THE SCIENCE WORLD

A Monthly e Magazine

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Vol.3 Issue 10 October, 2023

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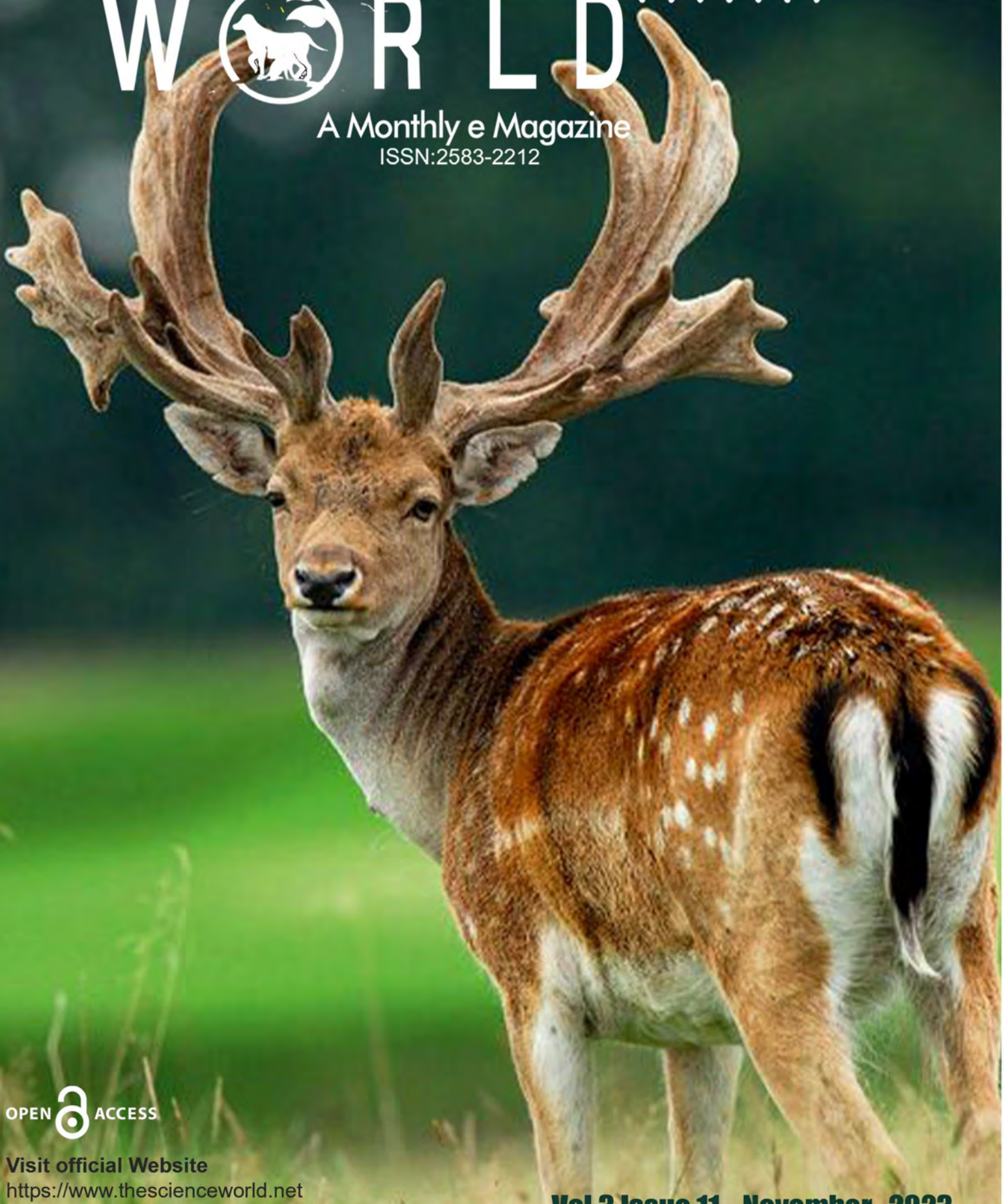

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As a beacon of intellectual exchange in the realm of scientific discourse, we are grateful for the support and collaboration that have illuminated our path since our inauguration.

This Diwali, we celebrate not only the triumph of light over darkness but also the pursuit of excellence and innovation that drives our community. Just as Diwali brings light to our lives, your dedication to scholarly standards and unwavering commitment to peer-reviewed rigor bring enlightenment to the world of science.

We wish you a Diwali filled with the brilliance of new insights, the warmth of knowledge sharing, and the joy of discovering the marvels that shape our world. May this festival of lights kindle your spirit and lead you to new horizons of discovery .

"The Science World" is not just a herald of scientific breakthroughs; it is a sanctuary for the art of scientific prose. May your Diwali celebrations be as eloquent and captivating as the narratives within our pages.

Wishing you a Diwali filled with the radiance of knowledge and the joy of scientific exploration.

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"The Science World" emerges as a beacon of intellectual exchange within the realm of scientific discourse. This distinguished open-access e-magazine (ISSN: 2583-2212), inaugurated in May 2021, serves as a hallowed platform for the convergence of erudite minds, inviting researchers, scholars, and scientists of myriad disciplines to partake in a symphony of innovation and insight.

Distinguished by its commitment to uncompromising scholarly standards, "The Science World" beckons those who are driven by a pursuit of excellence. With an unswerving dedication to peer-reviewed rigor, each article submitted undergoes an incisive evaluation process, orchestrated by subject matter luminaries, principal scientists, and revered research scholars from esteemed institutions. This discerning curation ensures that the intellectual tapestry woven within these virtual pages remains a tapestry of unwavering authenticity and insight.

Globally, within the expansive fields of Veterinary, Agriculture, Life Sciences, and Natural sciences, this e-magazine unfurls a canvas of innovation. It is a herald of the avant-garde, a chronicle of the vanguard technologies that shape our world. By facilitating the dissemination of these breakthroughs, "The Science World" transcends conventional boundaries, uniting scientific and non-scientific communities in awe of the marvels unfolding within laboratories and research corridors.

Yet, "The Science World" is not just a herald; it is a sanctuary for the art of scientific prose. Its pages resound with the eloquence of well-constructed narratives, each article an embodiment of refined scientific writing. Here, researchers and academicians from diverse spheres refine their craft, their insights not only enlightening but also captivating. Through its carefully curated selection of popular articles, this e-magazine cultivates a cadre of proficient scientific communicators, empowering them to resonate with broader audiences and transcend disciplinary confines.

THE LEADING EDITORS

"The Science World" emerges as a bastion of diverse intellectual prowess. Established in May 2021, this open-access peer-reviewed e-magazine (ISSN: 2583-2212) proudly boasts an accomplished editorial panel representing an array of academic domains. Distinguished by their respective backgrounds, these editors contribute their wealth of expertise to cultivate a rich blend of insights.

Dr RS Sethi
Editor In Chief

Dr. N.Rajanna
Add. Editor In Chief

Dr. Vikas Jaiswal
Add. Editor In Chief

Dr Nasrul I Shaikh
Add. Editor In Chief

Within the sphere of veterinary sciences, the magazine benefits from the discerning perspectives of an esteemed expert. Their oversight ensures the accuracy and precision of discussions on animal health and well-being.

Dr Amit Sehgal
Editor In Chief

Dr. Mude R. Naik
Editor

In the expansive landscape of life sciences, the editorial cadre welcomes the guidance of adept professionals. Hailing from institutions that hold significance in the scientific community, their insights enrich the e-magazine's coverage of cutting-edge developments in the biological realm.

Dr V Kasthuri Thilagam
Editor

Dr. Mohd. Arif
Editor

The vitality of agricultural sciences finds an ardent advocate in the e-magazine's editorial leadership. Contributors with backgrounds in this domain lend their discernment to content that catalyzes innovations in sustainable agriculture and rural advancement.

These editors, united by their commitment to intellectual excellence, constitute a symposium of perspectives. Their collective influence elevates "The Science World" into a beacon of knowledge dissemination, fostering a bridge between pioneering research and the seekers of deeper understanding.

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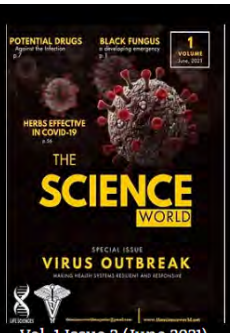

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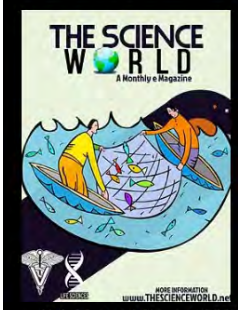

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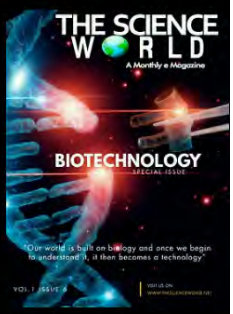

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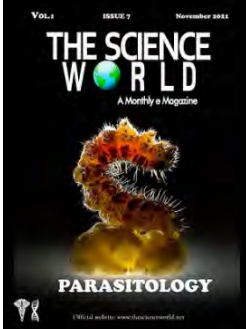

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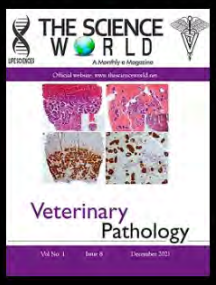

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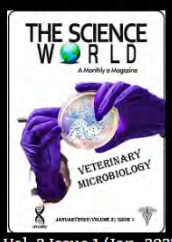

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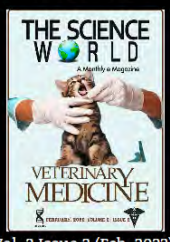

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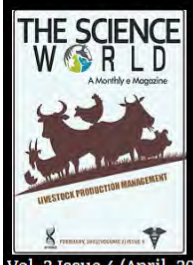

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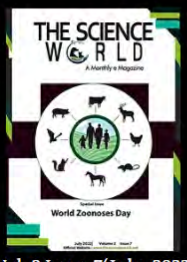

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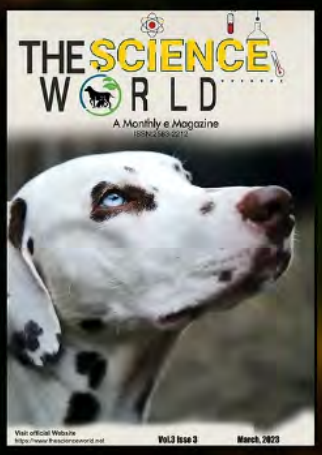

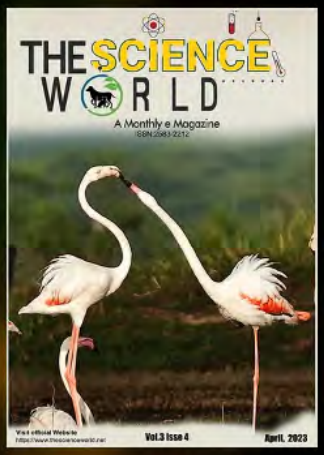

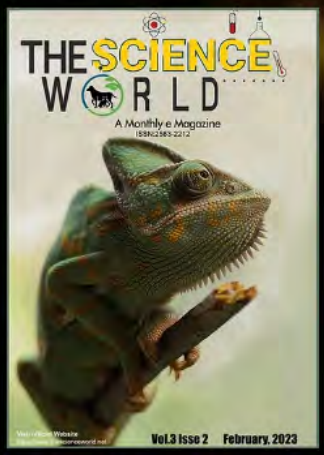

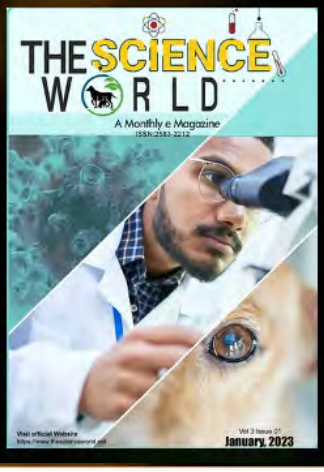

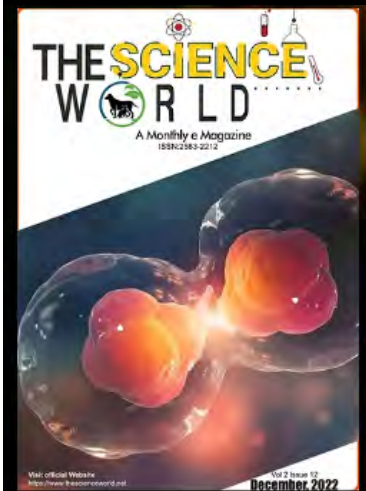

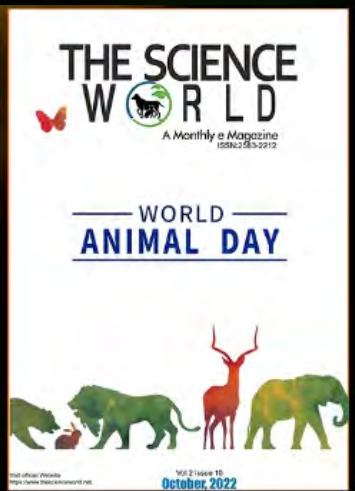

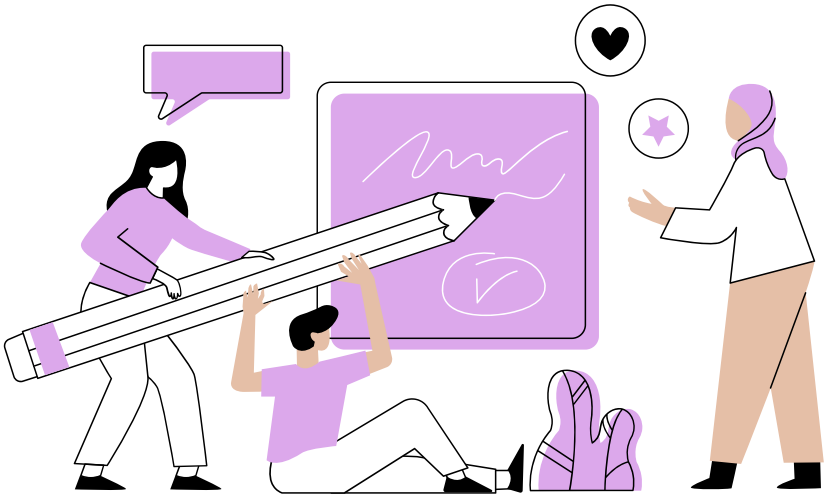

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Gomathi and Arisekar
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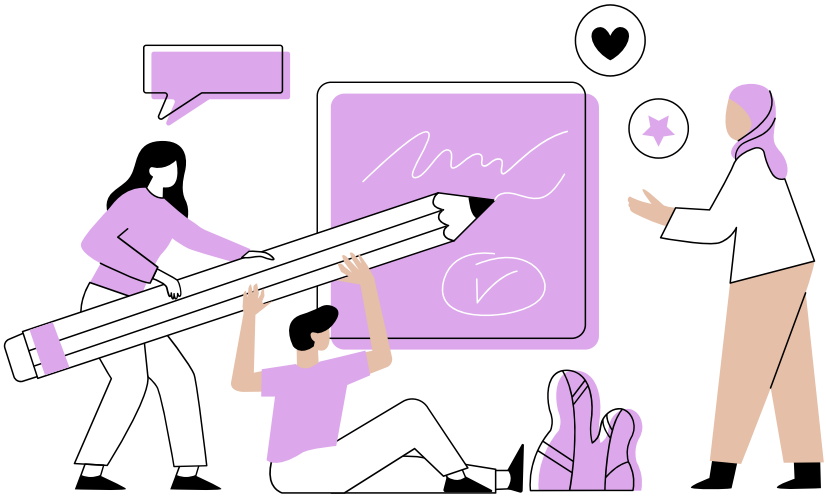

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Tapas Goswami
Why cats decline sweet dish but incline to grab fish? Is it due to killer instinct or inherent gene distinct

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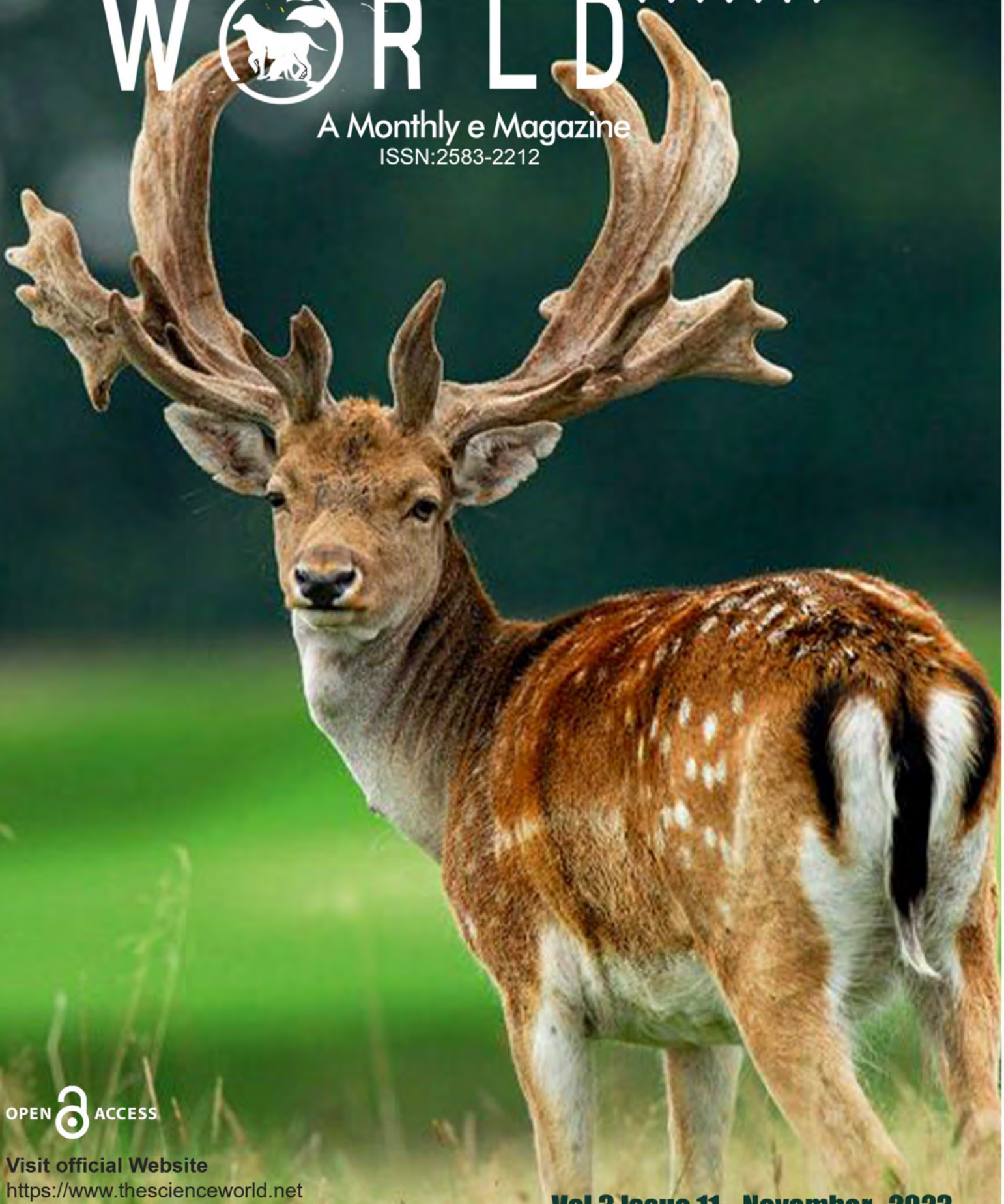

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Popular Article

Hybrid Seed Production of horticultural crops in Koppal district of Karnataka

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https://doi.org/10.5281/zenodo.8415800

Introduction

Seed is the first and foremost vital resource for successful crop cultivation, which is also a crucial input for the creation of sustainable crop production. The quality of the seeds is thought to account for 20-25% of productivity. Mankind has long understood the significance of high-quality seed. In the Rigveda of ancient India, the requirement for a good viable seed for the prosperity of the human race is mentioned. Seed production sector has a favourable impact on the Indian economy in terms of generating income and employment, as well as in earning foreign exchange on the global market. Seed production in India has enormous potential due to factors such as expanding horticultural area, diverse agro-climatic conditions and the availability of abundant and affordable human resource. The Indian seed industry is constrained by a variety of problems, such as high manufacturing costs, technical issues and stringent legal restrictions.

Current status:

Over the past fifty years, the Indian seed sector has seen tremendous growth both in quality and value. High-quality seed production is being actively pursued by both public and private sector corporations. The Indian seed industry is currently the fifth-largest seed market in the world, contributing about 4.4% of the worldwide seed market after US, China, France and Brazil. Both private and public sector companies are involved with the production of seed. The National Seed Corporation (NSC), State Farm Corporation of India (SFCI), and 13 State Seed Corporations constitute the public sector component. Recognising the significance of seeds, currently production of seed surplus its requirement (Table 1). Indian seed market projected to grow at a CAGR of 6.8% during 2022-2027. India's share in world's vegetables production is 14 per cent.Today Indian seed industry has a turnover of ₹ 16,000 to ₹ 18,000 crores. It is globally sixth largest seed industry in terms of size (Indian seed congress, 2017).

The commercial seed production in vegetables not only meets domestic demand but also earns foreign exchange for the country, and thus adds substantially to improve the economic status of the farm families (Sudha et al. 2006). Indian seed industry is strong, vibrant and is showing rapid growth. Current turnover of Indian seed industry is around ₹ 900 crores and it is growing at a rate of 12-15 per cent annually *(*https://www.indiastatagri.com/(link is external*)*

			(Quantity in Lakh Quintals)
Year	**Requirement**	**Production/Availability**	**Surplus**
2014-2015	343.56	351.77	-
2015-2016	337.09	343.52	-
2016-2017	353.49	380.30	-
2017-2018	371.38	419.41	-
2018-2019	353.54	398.88	-
2019-2020	387.31	431.01	43.70
2020-2021	443.16	483.66	40.50
2021-2022	465.36	498.83	33.47

Which season is suitable for seed production?

- For quality seed production there should not be heavyrains during the flowering stage of the seed crop
- Maturity of the seed should coincide with the summerseason
- Seeds harvested during dry season are always better inquality

How climate affects the seed production?

- High temperature is likely to shorten the growing cycle ofmany crop species
- During some developmental stages such as the reproductivephase most of the crops are only able to tolerate narrowtemperature changes which if exceed can reduce the seedset and thus yield
- Uncertainty of weather was a major problem in hybrid seedproduction

Why Koppal region is suitable for Seed Production?

Considering the above-mentioned condition, Koppal District of Karnataka are prevalent for seed production as, it have

- ✓ Rainfall :- 500-550mm
- ✓ Temperature :- 29-37
- ✓ Soil :-Red Sandy loam
- ✓ Altitude :- 500-600m

In Koppal the summers are short, Sweltering, dry and partlycloudy and the winters are long, warm muggy, windy and mostlycloudy.

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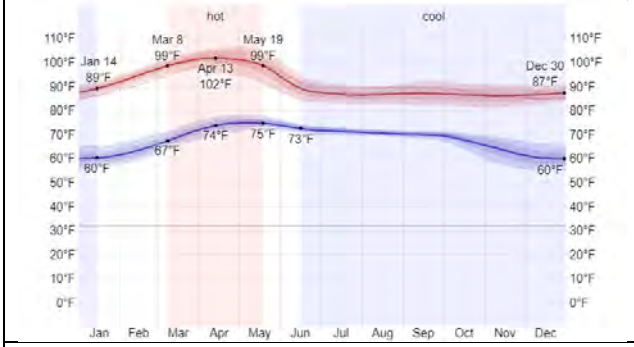
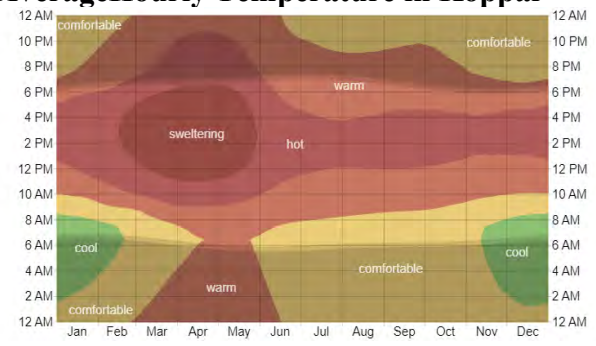
Average High and Low Temperature inKoppal



AverageHourly Temperature in Koppal



Daily Chance of Precipitation in Koppal

Methods followed in hybrid seed production?

Commercial hybrid seed production is gaining popularity with the farmers and private seed companies due to its higher profitability. To produce hybrid seeds, a pollination control system is required to prevent unwanted self-pollination.

During hybrid seed production, many methods can be used to prevent self-pollination of the female line: mechanical removal of anthers or male flowers, application of male-specific gametocides, or use of genetic cytoplasmic or nuclear-encoded male sterility. Cytoplasmic male-sterile (CMS) lines have a mutation in their mitochondrial genome.

Crops which are growing for hybrid seed production in Koppal District

Watermelon, Chilli, Tomato, Cucumber, Bitter gourd, Bottle gourd, Okra, Marigold

Conclusion

The commercial seed production is not only meets domestic demand but also earns a sizeable foreign exchange, and thus substantially improves the economic status of the farmers. **T**here is a need to create awareness by imparting training among the seed producing farmers about proper method for quality seed production as per scientific recommendation which in turn helps them to reduction in the cost of cultivation, good quality seeds and augment in output levels.

References

Anonymous. 2017. Indian seed congress, Kolkatta. National Seed Association, India, 13-February.

Koundinya, A. V. V., & Kumar, P. P. (2014). Indian vegetable seeds industry: status and challenges. *International Journal of plant, animal and environmental sciences*, *4*(4), 63-69.

Paled, M., & Guledagudda, S. S. (2018). Resource Use Efficiency in Hybrid Vegetable Seed

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Production in Northern Karnataka. *Research Journal of Agricultural Sciences*, *9*(6), 1311-1316.

Poonia T C. 2013. History of seed production and its key issues. *International Journal of Food, Agriculture and Veterinary Sciences* 3(1): 148-154.

Sudha M, Gajanana T M and Shinivasmurthy D. 2006. Economic impact of commercial hybrid seed production in vegetables on farm income, employment and farm welfare – a case of tomato and okra in Karnataka. *Agricultural Economics Research Review* 19: 251-268.

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Popular Article

Seasonal Cultivation of Mushrooms: Growing Fungi in Tune with Nature Rhythms

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Mushrooms have become well-known globally for their nutritional and therapeutic values. Cultivating them is a beneficial bioconversion method transforming waste materials into potentially valuable resources. Mushrooms grow under a wide range of temperatures (10-35ºC) and pH 6.0 to 8.0, secretes a wide range of enzymes that are capable of degrading lignocellulosic biomass of substrates thus utilizing agro-solid wastes for valuable and nutritive rich food. Mushroom farming, a practice that has been around, for centuries has evolved into a thriving industry due to its versatility, nutritional value and delicious flavour. Over time we have gained knowledge and advanced techniques that enable us to cultivate mushrooms throughout the year. By adapting our cultivation methods based on the seasons we can optimize their growth. Ensure yields and quality. This article explores approaches and important factors for cultivating mushrooms in seasons providing a comprehensive guide, for both mushroom enthusiasts and cultivators. Mushrooms hold significant importance in future generations for several compelling reasons. First and foremost, mushrooms are a sustainable and eco-friendly food source. They can be grown using various waste materials, including agricultural byproducts, making them a potential solution for reducing food waste and promoting a circular economy. With the growing concern about food security and sustainable agriculture, mushrooms present a viable option to address these issues.

Mushrooms are highly nutritious and rich in essential vitamins, minerals and proteins [1]. As global populations continue to increase, finding alternative protein sources that are both nutritious and sustainable becomes crucial. Mushrooms can supplement or even replace traditional protein sources, offering a healthier and more sustainable dietary option. In addition, mushrooms possess medicinal

properties and have been used in traditional medicine for centuries. They contain bioactive compounds with potential health benefits, including anti-inflammatory, antioxidant and immune-boosting properties [2]. Research into the medical potential of mushrooms is ongoing and they could play a significant role in the development of new pharmaceuticals and healthcare solutions [1,2]. Furthermore, mushrooms play a critical role in ecological sustainability. They have a symbiotic relationship with plants, promoting healthy soil and aiding plant growth. Some mushrooms also help remediate contaminated environments by breaking down pollutants and converting them into less harmful substances. Incorporating mushrooms into agriculture and environmental restoration practices can create a more sustainable and healthier planet. However, cultivating gourmet and exotic mushrooms has gained popularity in the culinary world, offering unique flavours and textures to various dishes. As culinary appreciation grows globally, the demand for these specialty mushrooms will likely increase, providing economic opportunities for farmers and entrepreneurs [3]. Therefore, mushrooms have immense potential to address future challenges related to food security, nutrition, health, sustainability and economic development [4-6]. Harnessing this potential through research, innovation and sustainable cultivation practices is essential for a brighter and more sustainable future for coming generations [7-10].

Key advantages of mushroom cultivation

1. A good source of protein, mushrooms are rich in minerals and vitamins. Some varieties have medicinal properties as well.
2. Very cheap source of vitamin D.
3. Potential of utilizing agro-solid wastes without causing pollution and health hazards.
4. Indoor crop growth independent of the fertility status of land and vagaries of weather.
5. Demand increasing at a rapid rate for immune-boosting activities.
6. Cultivation is labour-intensive and provides employment in rural areas [3].
7. Cost-benefit ratio is appreciable, hence a potential profit-earning crop.
8. Zero-waste industry cashes in on crop residues.
9. Good scope of export, so a source of earnings foreign exchange.
10. Mushrooms are a beautiful gift of nature, unique, interesting to look and bring a sense of visual excitement to any home or garden.
11. Eco-friendly and production per unit is high.

Climate-wise availability of mushroom species

Generally, there are about 3,000 prime edible mushroom species and around 100 species have been cultivated so far. In India, five varieties *viz*., *Agaricus* (Button), *Pleurotus* (Oyster), *Volvariella* (Paddy straw), *Calocybe* (Milky) and *Lentinula* (Shiitake) are commonly commercially cultivated [11,12]. The climate of our country is suitable for cultivating different mushrooms because hot, humid,

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temperate, tropical, sub-tropical etc. is available in different regions of the country. Therefore, it is possible to grow different types of mushrooms in sequence in our country because they require different temperatures to grow. In the plains, white button mushroom is grown in autumn from November to February, summer white button mushroom from September to November and February to April, oyster or dhingri mushroom from September to May, paddy straw or parali mushroom from July to September and milky mushroom can be grown from February to April and from July to September. In hilly areas at medium altitude, the white button mushroom is grown from September to March, the summer white button mushroom from July to August and March to May, the shiitake mushroom from October to February, oyster or dhingri mushroom throughout the year and milky mushroom can be grown from April to June. In high-altitude areas, white button mushrooms can be grown from March to November, oyster or dhingri mushrooms from May to August and shiitake mushrooms from December to April. In this way, farmers can get employment by growing different mushrooms throughout the year in different types of climates [13].

Commonly cultivated mushroom species

Mushroom species	Scientific Name	Common Name	Optimum Temperature (°C)		Cultivation Months
			Spawn Run	Sporocarps Production	
	*Agaricus bisporus*	White Button mushroom	22-25	14-18	November-February
	*Agaricus bitorquis*	Pavement mushroom	28-30	24-26	February-April September-November
	*Pleurotus spp.*	Oyster or Dhingri mushroom	15-25	14-26	Whole year except June and July
	*Calocybe indica*	Milky mushroom	25-30	30-35	June-August
	*Volvariella volvacea*	Paddy straw mushroom	32-34	28-32	June-August
	*Lentinula edodes*	Shiitake mushroom	22-26	15-20	November-April
	*Auricularia spp.*	Black ear mushroom	20-34	12-30	February-April

(Source: DMR Solan, 2010), [13]

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Seasonal cultivation of mushrooms

1. **Spring cultivation:** Spring is a favorable season for cultivating mushrooms like morel (*Morchella* spp.) and oyster mushrooms (*Pleurotus* spp.). Spring temperatures and humidity levels are conducive to their growth. Morel mushrooms are particularly sought after and can be cultivated by mimicking their natural habitat, typically consisting of forested areas with specific soil compositions [14].
2. **Summer cultivation:** While summer is not traditionally considered ideal for mushroom cultivation due to high temperatures and lower humidity, certain species like the wine cap mushroom (*Stropharia rugosoannulata*) thrive during this season in foreign countries. Wine cap mushrooms are relatively resilient and prefer warmer temperatures, making them suitable for summer cultivation. In India milky mushroom (*Calocybe indica*) is generally cultivated because this species of mushroom requires high temperatures (30-35ºC) for its growth and development [14].
3. **Autumn cultivation:** Autumn is often called the mushroom season. The cooling temperatures and increased humidity provide an excellent environment for various mushroom species, including shiitake (*Lentinula edodes)*, maitake (*Grifola frondosa*) and different species of oyster mushrooms (*Pleurotus* spp.). These mushrooms can be cultivated using logs or substrate bags in a controlled environment [14].
4. **Winter cultivation:** Winter presents a unique challenge for mushroom cultivation due to lower temperatures and reduced natural light. However, certain cold-loving species like the lion's mane mushroom (*Hericium erinaceus*) and snow mushroom (*Tremella fuciformis*) can be cultivated during this season. Indoor cultivation with appropriate temperature and lighting control is essential for successful winter mushroom cultivation. Different species of oyster mushrooms are also cultivated during winter months [15].

Key considerations for seasonal cultivation

1. **Indoor cultivation:** Regardless of the outdoor season, indoor cultivation provides the flexibility to grow mushrooms year-round. Utilizing controlled environments such as mushroom grow rooms or greenhouses allows growers to maintain optimal conditions for mushroom growth, regardless of external weather.
2. **Temperature and humidity:** Understanding the temperature and humidity requirements of specific mushroom species is crucial for successful cultivation. Maintaining the right conditions is essential for the different growth stages, including mycelial colonization and fruiting.
3. **Substrate selection:** The appropriate substrate for the specific mushroom species is vital. Common substrates include straw, wood logs, sawdust and grain, depending on the cultivated mushroom.

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4. **Lighting and ventilation:** Providing adequate lighting and ventilation, especially for indoor cultivation, is essential to support the healthy growth and development of mushrooms.
5. **Hygiene and sterilization:** Maintaining a clean and sterile environment is critical to prevent contamination and ensure a successful harvest.

Conclusion

Seasonal cultivation of mushrooms is a pivotal strategy, enabling growers to fine-tune growth conditions for diverse mushroom species, thereby ensuring successful harvests year-round. By comprehending the distinct requirements of each mushroom and employing appropriate cultivation techniques, growers can foster a flourishing mushroom cultivation enterprise. Be it the revitalizing aura of spring, the warmth of summer, the bountiful autumn, or the serene winter, meticulous planning and catering to the unique needs of each season empower cultivators to achieve a consistent and fruitful mushroom harvest, showcasing the adaptability and potential of this fascinating fungal realm. Therefore, seasonal cultivation of mushrooms holds significant importance for various reasons. Different mushroom species have specific growth requirements related to temperature, humidity and light, among other factors. Adapting cultivation practices to suit the natural seasonal variations optimizes these conditions, enhancing overall yield and quality. With a population of more than 140 crore, India is a huge mushroom market. However, due to a lack of awareness, consumption is quite low in India (about 20-25 grams per capita per annum). Hence, there is an urgent and utmost need to generate awareness among the people about the mushroom's multifarious benefits to increase their demand in the country. Mushroom farming is likely to poise for a phenomenal rise in production and consumption in the coming years. The farmers of India therefore have the opportunity to develop mushroom production as a remunerative subsidiary occupation for sustainable livelihoods and development by valorisation of agro-solid wastes.

References:

1. Aditya, Jarial RS, Jarial K (2022) Commercial cultivation of the elm oyster mushroom *Hypsizygus ulmarius* (Agricomycetes) on different substrates and its medicinal benefits. Int J Med Mushrooms 24(12):87-93. https://doi.org/10.1615/IntJMedMushrooms.2022045380
2. Aditya, Jarial RS, Bhatia JN (2023) Performance of various agroforestry wastes for the cultivation of elm oyster mushroom *Hypsizygus ulmarius* (Agaricomycetes) in India and its biochemical constituents. Int J Med Mushrooms 25(08):55-62. https://doi.org/10.1615/IntJMedMushrooms.2023049037
3. Aditya, Bhatia JN (2020) Economic empowerment of rural women through mushroom farming. Int J Curr Microbiol App Sci 9(06):1081-1089. https://doi.org/10.20546/ijcmas.2020.906.134
4. Aditya, Jarial RS (2023) Utilization of agro-industrial wastes and organic supplements for cultivation of blue oyster mushroom. Bangladesh J Bot 52(01):179-185. https://doi.org/10.3329/bjb.v52i1.65249
5. Tiwari H, Naresh RK, Bhatt R, Aditya, Kumar Y, Manisha, Das D, Kataria SK (2023) Underutilized nutrient rich millets: Challenges and solutions for India's food and nutritional security: A review. Int J Pl Soil Sci 35(02), 45-56. http://dx.doi.org/10.9734/IJPSS/2023/V35i22758

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6. Aditya, Jarial RS, Jarial K (2022) Evaluation of different grain substrates for spawn production and yield performance of blue oyster mushroom [*Hypsizygus ulmarius* (Bull.: Fr.) Red Head] through bio-conversion of agri/industrial wastes. Indian J Ecol 49(06):2389-2394. https://doi.org/10.55362/IJE/2022/3838
7. Aditya, Jarial RS, Jarial K (2022) Laboratory screening of different nutrient media for mycelial growth and cultural characteristics of blue oyster mushroom [*Hypsizygus ulmarius* (Bull.: Fr.) Redhead. Indian J Ecol 49(03):826-830. https://doi.org/10.55362/IJE/2022/3602
8. Aditya, Jarial RS, Jarial K (2023) Influence of physiological parameters on mycelial growth and cultural characteristics of blue oyster mushroom [*Hypsizygus ulmarius* (Bull.: Fr.) Redhead]. Indian J Ecol 50(01):151-156. https://doi.org/10.55362/IJE/2023/3869
9. Aditya, Jarial RS, Jarial K (2022) Performance evaluation of substrates for cultivation of blue oyster mushroom. Indian J Hort 79(03):323-329. https://doi.org/10.5958/0974-0112.2022.00044.5
10. Aditya, Jarial RS, Jarial K (2022) Evaluation of spawn quality and doses on yield and biological efficiency of blue oyster mushroom [*Hypsizygus ulmarius* (Bull.: Fr.) Redhead]. J Eco-friendly Agri 17(02):393-398. https://doi.org/10.5958/2582-2683.2022.00076.4
11. Aditya, Neeraj, Bhatia JN (2023) Mushrooms: Immunity booster and nutritive food for human health. Sci World 3(07):1595-1601. https://doi.org/10.5281/zenodo.8187259
12. Aditya, Neeraj, Jarial RS, Jarial K, Bhatia JN (2023) Oyster Mushrooms: Versatile Mushrooms with Potential Health Benefits. Sci World 3(08): 2128-2133. http://dx.doi.org/10.5281/zenodo.8290368
13. Directorate of Mushroom Research, Solan, Himachal Pradesh, India. Accessed from: https://dmrsolan.icar.gov.in/Folder_Seasonal.pdf
14. Indian Council of Agricultural Research (ICAR), New Delhi. Accessed from: http://agridaksh.iasri.res.in/temp/18%20Round%20the%20year%20cultivation.pdf
15. Aditya, Jarial RS, Jarial K (2021) Scientific cultivation of blue oyster mushroom. Indian Hort 66(6):15-17. https://epubs.icar.org.in/index.php/IndHort/article/view/119904

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Popular Article

Unlocking Insights: The significance of *in vitro* cultivation for haemoprotozoan parasites of veterinary importance

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Abstract

Haemoprotozoan parasites are microscopic organisms that invade the blood of animals, leading to severe health issues in veterinary medicine. Understanding their biology, life cycle and interactions with the host is paramount for developing effective control and treatment strategies. *In vitro* cultivation, the controlled growth and maintenance of these parasites in a laboratory environment, plays a pivotal role in advancing our knowledge and capabilities. This article explores the key significance of *in vitro* cultivation for haemoprotozoan parasites, encompassing research, drug development, vaccine creation and insights into disease pathogenesis and host-parasite interactions. By leveraging in vitro cultivation, we can enhance our understanding of haemoprotozoan parasites, ultimately contributing to improved veterinary healthcare and management practices.

1. Introduction

In vitro cultivation refers to the process of growing and maintaining haemoprotozoan parasites in a controlled laboratory environment outside their natural host. This technique has revolutionized the study of these parasites, enabling researchers to investigate their lifecycle, pathogenesis, drug sensitivity and host-parasite interactions in a controlled setting. Cultivation is an important method for diagnosis of many clinically important parasites for example *Entamoeba histolytica*, *Trichomonas vaginalis*, *Leishmania* spp., *Strongyloides stercoralis* and free-living amoebae (Ahmed, 2014). RPMI-PY medium can be used for *Trypanosoma cruzi*, *Leishmania amazonensis*, *Leishmania major*, *and Leishmania tropica* species since in all the species except *Leishmania braziliensis*, the exponential growth of the parasite was observed, in many cases higher than conventional media (Castelli *et al*., 2023).

1.1 Enhanced Replication and Life Cycle Studies

In vitro cultivation allows for the controlled replication of haemoprotozoan parasites, providing researchers with a limitless supply of parasites for experimentation. By studying their life cycles in vitro, researchers can uncover critical stages of development, host-specific factors, and

environmental cues that influence parasite growth and transmission. The ethical concerns of using laboratory animals and the difficulty of readily obtaining parasite life stages highlight the need for in vitro models as viable alternatives for cultivating and maintaining protozoan parasites. In vivo models may offer insights into host-parasite interaction (Sutrave and Richter, 2021).

1.2 Accessibility for Experimental Manipulation

In vitro cultivation offers a unique advantage by providing accessibility and ease of manipulation compared to in vivo studies. Researchers can modify environmental conditions, such as temperature, pH and nutrient availability, to mimic specific host environments and study the effects on parasite growth and behaviour. This flexibility enables the investigation of intricate cellular processes that may be challenging to study within the complex host environment.

1.3 Drug Screening and Anti-parasitic Discovery

One of the most significant contributions of in vitro cultivation is its role in drug screening and antiparasitic discovery. By exposing in vitro-cultivated parasites to a variety of drugs, researchers can assess their efficacy and determine drug resistance patterns. This information is invaluable for developing effective treatment strategies and identifying new drug targets to combat haemoprotozoan infections in veterinary medicine.

1.4 Immune Response Studies

In vitro cultivation also allows for the investigation of host-parasite interactions and immune responses during infection. By culturing parasites with host immune cells, researchers can simulate the immune environment and study the mechanisms of immune evasion employed by haemoprotozoan parasites. These studies aid in understanding the complex dynamics between the host immune system and the parasites, leading to the development of targeted immunotherapeutic interventions.

1.5 Genetic Manipulation and Molecular Studies

Advancements in molecular biology techniques have facilitated genetic manipulation of haemoprotozoan parasites *in vitro*. Researchers can introduce genetic modifications, knockdown or knockout specific genes and study the resulting phenotypic changes. These molecular studies provide insights into essential parasite proteins, gene function, and their role in pathogenicity, further expanding our understanding of these parasites.

2. Techniques and Methodologies

Culturing *Trypanosoma evansi in vitro* involves maintaining the parasite in a controlled laboratory environment outside of the host. Materials and reagents required are *T. evansi* culture flask, culture medium (e.g., Hirumi-9 or similar medium), Fetal bovine serum (FBS), Penicillin-streptomycin antibiotics, CO_2 incubator, Microscope and cell counting chamber. **Steps for in vitro culture of *T. evansi* are:**

1. Preparation of Culture Medium: Prepare a suitable culture medium for *T. evansi*. Hirumi-9

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medium is commonly used and can be supplemented with 10% FBS and penicillin-streptomycin antibiotics.

1. Inoculation of Culture Flask: Start with a culture flask containing the appropriate volume of culture medium. The flask should be sterile. Add a small amount of *T. evansi* culture (usually a few drops or a small volume of previously cultured parasites) to the medium.
2. Incubation: Place the culture flask in a suitable incubator. *T. evansi* can be cultured at 37°C in a CO_2 incubator, but it can also grow at room temperature.
3. Monitoring and Feeding: Regularly monitor the culture under a microscope to check for parasite growth. *T. evansi* typically multiplies by binary fission. Periodically feed the culture by adding fresh culture medium to replenish nutrients and remove waste products.
4. Subculturing (Passaging): When the parasite density becomes too high or the culture medium becomes depleted, it's time to subculture the parasites. This involves transferring a portion of the culture to a new flask containing fresh medium. Sub-culturing prevents overgrowth and maintains the health of the culture.
5. Parasite Counting: Use a microscope and a cell counting chamber to estimate the parasite density in the culture. This helps determine when to subculture and how much culture to transfer.
6. Maintaining Sterility: Ensure all procedures are performed using aseptic techniques to prevent contamination of the culture.
7. Experimental Manipulations (if necessary): If you are conducting experiments with *T. evansi*, you can introduce specific conditions or treatments into the culture to study their effects on the parasites.
8. Record Keeping: Maintain accurate records of the culture's age, density, subculture dates, and any experimental data.
9. Storage (if necessary): If you need to store *T. evansi* for a longer duration, consider cryopreservation using suitable cryo-protectants, as mentioned in a previous response.

In vitro culture of *Babesia equi*, a protozoan parasite responsible for causing equine piroplasmosis, requires specialized techniques and culture conditions. The variety of media and sera from various host species is employed and the composition of the medium ingredients relies on the Babesia sp. that has to be cultivated (Schuster, 2002). Materials and Reagents required are *B. equi*-infected horse blood, culture medium (e.g., RPMI 1640), fetal bovine serum (FBS), antibiotics (e.g., penicillin-streptomycin), gas mixture (5% CO_2, 5% O_2, and 90% N_2), microscope and cell counting chamber, culture flasks or plates, CO_2 incubator.

Steps for in vitro culture of *B. equi* are:

1. Collection of Infected Blood: Collect blood from a *Babesia equi*-infected horse. This blood

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will serve as the source of parasites.

2. Processing of Blood Sample: Centrifuge the blood to separate the red blood cells (RBCs) from the plasma and buffy coat. The parasites are typically found within the RBCs.
3. Washing RBCs: Wash the RBCs multiple times with a suitable buffer (e.g., phosphate-buffered saline or PBS) to remove plasma and residual contaminants.
4. Preparation of Culture Medium: Prepare a culture medium, such as RPMI 1640, supplemented with 10-20% FBS and antibiotics (e.g., penicillin-streptomycin). The medium should be warmed to 37°C.
5. Inoculation of RBCs: Mix the *Babesia equi*-infected RBCs with the prepared culture medium in a culture flask or plate. The initial parasite concentration should be determined based on previous knowledge or microscopic examination.
6. Incubation: Place the culture flask or plate in a CO_2 incubator with a controlled gas mixture (5% CO_2, 5% O_2, and 90% N_2) and maintain it at 37°C.
7. Monitoring: Regularly monitor the culture under a microscope to check for the presence of *Babesia equi* parasites. They will be observed within the RBCs.
8. Feeding and Maintenance: Periodically replenish the culture medium with fresh medium to provide nutrients and remove waste products. This can be done every 1-2 days or as needed.
9. Subculturing (Passaging): As the parasite density increases, perform subculturing by transferring a portion of the culture to a new flask with fresh medium. This prevents overcrowding and maintains parasite health.
10. Parasite Counting: Use a microscope and a cell counting chamber to estimate the parasite density in the culture. This helps determine when to subculture and the appropriate parasite-to-RBC ratio.
11. Storage (if necessary): If you need to store *B. equi* cultures for an extended period, consider cryopreservation using suitable cryoprotectants and protocols.
12. Record Keeping: Maintain detailed records of the culture's age, density, subculture dates, and any experimental data.

Culturing *B. equi* in vitro can be challenging due to the parasite's specific requirements and sensitivity to environmental conditions.

In vitro culture of *Theileria annulata*, a protozoan parasite responsible for causing tropical theileriosis in cattle, requires specialized techniques and culture conditions. The reduction of virulence during in vitro maintenance is a significant characteristic of some Babesia and Theileria spp. in vitro cultures, but not all of them. As a result, *T. parva* and *Babesia* spp., among other possible sources of attenuated parasites, might be employed for vaccine purposes (Shkap and Pipano, 2000). Materials and Reagents are *Theileria annulata*-infected blood, culture medium (e.g., RPMI 1640), fetal bovine

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serum (FBS), penicillin-streptomycin antibiotics, CO_2 incubator, microscope and cell counting chamber, culture flasks or plates and cryoprotectant (e.g., glycerol or DMSO, if long-term storage is needed).

Steps for *in vitro* culture of *Theileria annulata* are as follows:

1. Collection of Infected Blood: Collect blood from a *T. annulata*-infected cow. This blood will serve as the source of parasites.
2. Processing of Blood Sample: Centrifuge the blood to separate the red blood cells (RBCs) from the plasma and buffy coat. The parasites are typically found within the leukocytes and RBCs.
3. Isolation of Leukocytes: Carefully collect the buffy coat layer, which contains leukocytes and infected cells, and transfer it to a separate sterile container.
4. Washing Leukocytes: Wash the isolated leukocytes several times with a suitable buffer (e.g., phosphate-buffered saline or PBS) to remove plasma and residual contaminants.
5. Preparation of Culture Medium: Prepare a culture medium, such as RPMI 1640, supplemented with 10-20% FBS and antibiotics (e.g., penicillin-streptomycin). Warm the medium to 37°C.
6. Inoculation of Leukocytes: Mix the washed *T. annulata*-infected leukocytes with the prepared culture medium in a culture flask or plate. The initial parasite concentration should be determined based on previous knowledge or microscopic examination.
7. Incubation: Place the culture flask or plate in a CO_2 incubator and maintain it at 37°C with a controlled atmosphere (5% CO_2) to simulate the physiological conditions of the host.
8. Monitoring: Regularly monitor the culture under a microscope to check for the presence of *T. annulata* parasites within the leukocytes. Parasite morphology and division can be observed.
9. Feeding and Maintenance: Periodically replenish the culture medium with fresh medium to provide nutrients and remove waste products. This can be done every 1-2 days or as needed.
10. Subculturing (Passaging): As the parasite density increases, perform subculturing by transferring a portion of the culture to a new flask with fresh medium. This prevents overcrowding and maintains parasite health.
11. Parasite Counting: Use a microscope and a cell counting chamber to estimate the parasite density in the culture. This helps determine when to subculture and the appropriate parasite-to-leukocyte ratio.
12. Storage (if necessary): If you need to store *T. annulata* cultures for an extended period, consider cryopreservation using suitable cryoprotectants and protocols.
13. Record Keeping: Maintain detailed records of the culture's age, density, subculture dates, and any experimental data.

3. Challenges and Future Directions

Despite the numerous advantages, in vitro cultivation also presents challenges. This section

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explores limitations such as the inability to replicate the complete host environment, difficulties in mimicking the immune response accurately, and potential variations among different parasite strains. Moreover, it highlights ongoing research efforts and future directions, including the integration of in vitro and in vivo studies, the application of three-dimensional (3D) cell culture models, and the use of microfluidic systems for more accurate replication of the host environment.

4. Conclusion

In vitro cultivation has proved to be an invaluable tool for understanding haemoprotozoan parasites of veterinary importance. Its contributions to the field have enhanced our knowledge of parasite biology, pathogenesis, drug sensitivity, and immune interactions. Continued advancements in in vitro techniques hold promise for addressing veterinary challenges related to these parasites, ultimately leading to improved diagnostics, therapeutics and disease management strategies.

5. References

Ahmed NH. Cultivation of parasites. Tropical parasitol. 2014; 4(2): 80.

Castelli G, Eugenia O, Viviana V, Susanna G, Flavia F, Francesco LR, Fabrizio V, Federica B. Cultivation of Protozoa Parasites In Vitro: Growth Potential in Conventional Culture Media versus RPMI-PY Medium. Vet Sci. 2023; 10 (4): 252.

Sutrave S, Richter M H. The Truman Show for protozoan parasites: A review of in vitro cultivation platforms. PLoS Neglected Tropical Dis. 2021; 15(8): e0009668.

Shkap V, Pipano E. Culture-derived parasites in vaccination of cattle against tick-borne diseases. Ann. NY Acad. Sci., 2000; 154–17.

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Popular Article

Understanding Livestock Behavior: A Key to Successful Farming

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Animal behavior encompasses the actions and reactions displayed by animals in reaction to internal or external stimuli. These actions include various activities like feeding, mating, communication, movement, and social interactions. The behavior of animals can be shaped by genetic factors, environmental circumstances and the learning experiences they encounter.

Behavior acts as the intermediate step between recognizing a need and fulfilling it. The behavior displayed at any given time results from a variety of motivations, some of which may conflict with each other (e.g., motivations to feed and to avoid predators). The expression of behavior can be intricate and ever-changing, particularly when behavior governs interactions between individuals. It serves as an external manifestation of internal regulatory processes and plays a fundamental role in animal interactions and communication via visual, auditory, chemical, and tactile cues.

Natural behavior criterion

The standard for assessing animal welfare is the observation of natural, species-specific behaviors. The absence of such behaviors can negatively impact welfare. Natural behavior is considered crucial for ensuring animal well-being in various husbandry practices, including the management of animals in zoos. Normal and natural behaviors are synonymous, indicating that they refer to the behaviors exhibited by individuals or populations in the wild. Any deviation from these natural behaviors can be considered abnormal. Abnormal behaviors, such as heightened and prolonged fighting among unfamiliar pigs, which may be natural in wild conditions, can have adverse effects on humans and may be considered harmful.

Mistaken reliance on natural behaviour

The tigers' behavior is driven by their natural survival instincts, leading them to engage in activities like predator avoidance and fighting. In their natural habitat, tigers usually lead solitary lives, and this tendency

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is also evident in most zoos. However, when kept in captivity, tigers appear to fare better when housed in pairs rather than being solitary, as they willingly display prosocial behaviors.

Abnormal behaviour

An atypical behavior, which either strays from its natural expression or does not occur in the wild, and is considered problematic.

Savaging

In captive settings, mother pigs (sows) exhibit aggressive behavior towards their own piglets shortly after giving birth. This behavior is not observed in the wild and could be associated with the absence of certain natural behaviors, like nest building, which would normally occur before birth in their natural environment. The limited opportunities to perform these natural behaviors in captivity might contribute to the occurrence of this unusual aggression towards the newborn piglets.

Concept of behavioural needs

For laying hens, nest-building behavior is an essential requirement that satisfies their innate urge to create a secure and cozy space for laying eggs. Nevertheless, in barren environments where appropriate materials for nest building are absent, the hens' behavioral needs are not properly fulfilled. Consequently, they may resort to alternative behaviors such as feather pecking.

Types of Abnormal Behaviour

Redirected behaviour: Stereotypical behaviour; Sham behaviour; Self-directed harmful behaviour and Learned helplessness behaviour.

Redirected behaviour

Behaviour that is redirected towards a group member rather than a more appropriate target. Feather pecking and cannibalism (hens); fin chewing (farmed fish); tail and ear biting (pigs); belly nosing (pigs) and cross sucking (calves).

Stereotypical behaviour

Apparently functionless and repetitive behaviour seen in many species in unstimulating environments. Pacing in zoo and performing animals; biting of fittings in stabled horses; biting of bars in sows in gestation crates.

Sham behaviour

Behaviour performed despite the absence of substrates to allow its proper execution. Dust bathing movements in poultry in cages that are devoid of substrate; nest building movements in sows in environments lacking litter; courtship responses and displays directed at inanimate objects.

Self-directed harmful behaviour

Self-mutilation in response to severe stress. Excessive grooming, licking and biting at limbs in dogs, laboratory rodents and other species; feather plucking in parrots.

Learned helplessness

Failure to show a behavioural reaction to on-going physical injury because of a prolonged inability to control the environment. Pigs that are the victims of severe tail biting; hens that are the victims of severe feather pecking.

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Behavioural expressions and animal management:

Pigs should be provided with sufficient materials to exhibit basic nest-building behavior before giving birth. Additionally, they should have enough substrate to engage in rooting and exploring activities to fulfill their natural instincts.

Handling

Reducing fear during the handling process can lower the chances of harm to both humans and animals, enhance handling efficiency, and lead to improved livestock productivity and reproductive performance. Cattle handling serves as an illustrative example, as cattle exhibit fear of unfamiliar situations or locations and dislike being socially isolated.

Fear in cattle is demonstrated through vocalizations, defecation, becoming physically immobile and rigid, kicking at perceived threats, and attempting to escape through running and jumping. These behaviours become particularly noticeable when a human enters the animal's "flight zone." The flight zone refers to a protected space around the animal, and when a person enters this area, the animal will withdraw or move away in response, with associated risk of injury. In addition to human behaviour, it is also critical that the physical handling systems themselves are designed using knowledge of how animals have evolved behaviourally to respond to threats.

Species that have historically been preyed to exhibit heightened vigilance even in domesticated settings and will react by withdrawing from sudden stimuli like unexpected noises or movements. Therefore, handling systems should be designed to be quiet and free of objects that might be moved by the wind. The orientation of the handling system should facilitate livestock's tendency to return towards their point of entry, rather than working against it. During health treatment, the animals should be offered a clear view of systems exit and path back to their familiar environment. Herbivores show less fear when handled together with other animals rather than in isolation. Moving two animals that have a calming influence on each other is often quicker, easier, and safer than handling a single animal. These principles are increasingly being adopted in progressive farms and abattoirs.

Conclusion

Behaviour is the way animals interact with and communicate in their environment. Alterations in behaviour can be influenced by the availability of food and the presence of predators. Abnormal behaviour can result in harm to humans, the animal itself, or other members of its group. Such abnormal behaviour arises from a disconnect between the animal's needs and the resources provided by the environment or the animal's inability to control its surroundings. Knowing what causes fear in animals and how they naturally respond to threats can aid in reducing stress during handling, leading to a smoother and safer process. Skilled animal handlers apply their knowledge of animal behaviour effectively.

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Popular Article

Porcine Circovirus (PCV) in pigs

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Abstract

In India, pig farming is one of the most viable and lucrative animal industries, and the pork sector plays a significant role in ensuring food security. Pig diseases are frequently complicated and can result in multifactorial situations, particularly when they are respiratory illnesses brought on by the porcine circovirus. Porcine circovirus (PCV) infection in pigs develop wide variety of diseases. This is responsible for significant economic loss to the swine industry. The virus is categorised under the family *Circoviridae* of the genera *Circovirus*.The virus can cause substantial mortality which may reach up-to 50%. Keeping in view the severity of the disease and the economic losses caused by it, the article was written on the infection of Porcine Circovirus in swine population.

Introduction

A wide variety of disorders in pigs are brought on by PCV, which also has a significant economic impact. It covers a number of illnesses that affect pigs between the ages of 3 and 26 weeks, including Proliferative and Necrotizing Pneumonia (PNP), Porcine Respiratory Disease Complex (PRDC) and Porcine Dermatitis and Nephropathy Syndrome (PDNS), and (Oliver *et al.,* 2016). Symptoms of this illness include diarrhoea, slowed growth, spontaneous abortion, breathing problems and edoema of the appendages (Segales *et al.,* 2012).

Structure

The respiratory virus which is a DNA virus included in genus *Circovirus* of *Circoviridae* family. With a diameter of 17–22 nm and the ability to replicate on its own, PCV is a tiny animal virus (Tischer *et al*., 1982). They are single chained circular DNA pathogen with symmetry of an octahedron and capable of performing autonomous replication in cells of mammals (Mankertz *et al.,* 1997). Replication of virus takes place in the nucleus of cycling cells and produce large intracellular inclusion bodies. The DNA of virus is encapsulated in single viral capsid protein which has 60 subunits (Mankertz *et al.,* 1997). Three different strains of the virus have been recognised, designated as porcine circovirus class1 (PCV1), 2 (PCV2), and 3 (PCV3). Later in 2020 Zhang and his co-workers discovered new strain of PCV named PCV type 4. The genotypes of PCV2—PCV2a, PCV2b, PCV2c, PCV2d, and PCV2e—have been further discoveredon the basis of phylogenetic study of the cap gene and the entire genome.

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Epidemiology

PCV is considered ubiquitous, highly prevalent in worldwide pig population. Porcine circovirus, now named as PCV1 was initially extracted as a source of contamination from the kidney cell line of porcine origin (PK-15) (Tischer *et al.,* 1974). The serological prevalence of PCV1 was reported in domestic pigs of North America and Europe but the virus did not show any correlation with other swine diseases. In the year 2016, PCV3 virus was identified in the sows of USA showing PDNS like physical symptoms or inflammation in multiple organs and the heart. Since that time, reports of the virus from numerous nations have been ongoing such as Brazil, China, Denmark, Japan, Italy, Russia, Spain, South Korea, Sweden and Thailand, indicating worldwide distribution of the disease (Hayashi *et al.,* 2018).

In 2006, India reported the first instance of PCV2 systemic disease (PCV2-SD) in pigs exhibiting Post-Weaning Multisystemic Wasting Syndrome (PMWS) symptoms. Diverse genotypes, such as PCV2a-2D, PCV2b-1C, and PCV2d, were discovered in the country through heterogenetic analysis of the PCV2genome. Recombination was also confirmed (Rajkhowa *et al.,* 2021). In 2015, Bhattacharjee *et al*. revealed the whole genomic sequence of the Indian porcine circovirus types 2a and 2b (north eastern states). Prior to this, the only virus known to cause common illnesses in pigs was PCV type 2, however later on, pigs were also found to have contaminationof 3rd strain of PCV (PCV3) (Phan *et al.,* 2016). In North eastern part of India, the positivity rate for mean PCV2 antibody was reported as 31.27% from 2011 to 2017, however in 2019, samples taken from all states of northern India, such asAssam, Manipur, Mizoram, Meghalaya, Nagaland, Tripura, and Sikkim, showed a positive rate of 49.35% (Barman *et al.,* 2018). Seropositivity of 6.28% was observed by Deka and co-workers in the pigs of north eastern states which were not vaccinated, however in Punjab, 34.07% seroprevalence was discovered (Deka *et al.,* 2021). Additionally, it has been discovered that the PCV2 is linked to 88.46% neonatal mortality and 20.00% stillbirth in a private pig farm in Tamil Nadu, India's Poosaripalayam village (Kumar *et al.,* 2014).

Pathogenesis

In the world's pig population, PCV is extremely common. A retrospective serological study indicates that PCV2 infection in pigs' dates back more than 50 years and phylogenetic studies indicate that virus is circulating in pigs since 100 years (Rose *et al.,* 2012). PCV has a high level of environmental resistance and persistent shedding in respiratory and oral secretions. It's difficult to achieve absolute inactivation of the virus and extended exposure time is required for disinfection (Rose *et al.,* 2012). This virus can spread through faeces, urine, direct contact, through colostrum, through seminal fluid and through placental contact (Gillespie *et al.,* 2009). Pathogenesis of the PCV depends on the type of virus strain infecting the pig. Out of three strains of PCV type 1 is considered non-infectious causing no disease in swine while type 2 and 3 are considered highly pathogenic (Mettenleiter & Sobrino, 2008). PCV2 causes PMWS (post weaning multisystemic syndrome) which results into lymphocyte depletion and enlargement of lymph nodes. Impairment of immune system is the main characteristic of PCV2 directly infecting macrophages and endothelial cells leading to acquired immunodeficiency in infected pigs. Endothelial cell infection causes vascular thrombi, perivascular and intramural edoema, fibrinoid necrosis, the activation of the phenotypic, and endothelial cell degeneration.Infected animals' thymus, bone marrow, and thymic lymphocyte macrophages exhibit PCV2 positivity. Pigs infected with PCV3 show characteristic lesions of PDNS such as destructive inflammation of

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blood vessels, bronchointerstitial pneumonia, glomerulonephritis and granulomatous lymphadenitis.

Diagnosis

Diagnosis of PCV infection in pigs involves 3 main criteria i.e. accordant clinical symptoms, distinctmicroscopic lesions and presence of virus specific antigens or DNA in the lesions (Rosell *et al.,* 2000). The disease is difficult to diagnose since PCV2 is linked to so many disorders and because an infected animal may not exhibit any clinical symptoms. A conclusive detection of the disease related to PCV infection were made on the basis of the identification of pathogenic antigen and/or genomic content connected to injuriesin sick animals. When determining whether a virus is present in the pig population, histopathological studies are extremely helpful (Sharma *et al.,* 2010). Localized death of the living cells in growing organs, such as kidneys, liver, heart, brain, spleens, lymph nodes, as well as organs of respiratory system and hepatic system, accounted for the majority of the histological changes observed in aborted foetuses. The enzyme-linked immune sorbent assay (ELISA), which detects serum antigen and antibody, have been quite helpful in determining the seroprevalence of the virus in the nation (Rajkhowa *et al.,* 2021; Deka *et al.,* 2021). In the country's north-eastern region, the PCV2 was amplified with the help of PCR targeting ORF2 gene to identify the disease (Mukherjee *et al.,* 2018). A variety of real-time PCR assays such as Taq-man-based and SYBR Green-based have been described globally for the identificationof PCV2 (Ouyang *et al.,* 2019). Recently, isothermal assays such as Loop-mediated isothermal amplification (LAMP), and Recombinase polymerase amplification (RPA) and indirect enzyme-linked immunosorbent assays (ELISAs) are a few of the diagnostic tests that have been developed to detect PCV3 infection in pigs (Chen *et al.,* 2018).

References

1. Barman, N. N., Nath, B., Kumar, V., Sen, A., Dutta, T. K., Dutta, B., Rahman, T. & Kumar, S. (2018) The emergence of porcine circovirus 2 infections in the Northeastern part of India: A retrospective study from 2011 to 2017. Transboundary and Emerging D iseases, 65(6), 1959- 1967.
2. Bhattacharjee, U., Ahuja, A., Sharma, I., Karam, A., Chakraborty, A. K., Ghatak, S., Puro, K., Das, S., Shakuntala, I., Giri, S. & Sen, A. (2015). Complete genome sequence of emerging porcine circovirus types 2a and 2b from India. Genome Announcements, 3(2), 00087-15
3. Chen, G. H., Tang, X. Y., Sun, Y., Zhou, L., Li, D., Bai, Y., Mai, K.J., Li, Y.Y., Wu, Q.W. & Ma, J. Y. (2018) Development of a SYBR green-based real-time quantitative PCR assay to detect PCV3 in pigs. Journal of Virological Methods, 251, 129-132.
4. Deka, D., Barman, N. N., Deka, N., Batth, B. K., Singh, G., Singh, S., Agrawal, R.K. &Mukhopadhyay, C. S. (2021). Sero-epidemiology of porcine parvovirus, circovirus, and classical swine fever virus infections in India. Tropical Animal Health and Production, 53, 1-12
5. Gillespie, J., Opriessnig, T., Meng, X. J., Pelzer, K., &Buechner-Maxwell, V. (2009) Porcine circovirus type 2 and porcine circovirus-associated disease. Journal of Veterinary Internal Medicine, 23(6), 1151-1163.
6. Hayashi, S., Ohshima, Y., Furuya, Y., Nagao, A., Oroku, K., Tsutsumi, N., Sasakawa, C. & Sato, T. (2018) First detection of porcine circovirus type 3 in Japan. Journal of Veterinary Medical Science, 80(9), 1468-1472.
7. Kumar, S. K., Selvaraj, R., Hariharan, T., Chanrahassan, C., & Reddy, Y. K. M. (2014). Porcine Circovirus-2 an emerging disease of crossbred pigs in Tamil Nadu, India. International Journal of Science, Environment and Technology, 3(3), 1268-1272.
8. Mankertz, A., Persson, F., Mankertz, J., Blaess, G., Buhk, H.-J. (1997) Mapping and characterization of the origin of DNA replication of porcine circovirus. Journal of Virology, 71, 2562–2566
9. Mettenleiter, T. C., &Sobrino, F. (Eds.). (2008) Animal viruses: molecular biology. Vol. 1, Norfolk: Caister Academic Press.
10. Mukherjee, P., Karam, A., Barkalita, L., Borah, P., Chakraborty, A. K., Das, S., Puro, K., Sanjukta, R., Ghatak, S., Shakuntala, I. & Sharma, I. (2018) Porcine circovirus 2 in the North Eastern region of India:

Official Website
www.thescienceworld.net
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Disease prevalence and genetic variation among the isolates from areas of intensive pig rearing. ActaTropica, 182, 166-172.
11. Ouyang, T., Niu, G., Liu, X., Zhang, X., Zhang, Y., & Ren, L. (2019) Recent progress on porcine circovirus type 3. Infection, Genetics and Evolution, 73, 227-233.
12. Phan, T. G., Giannitti, F., Rossow, S., Marthaler, D., Knutson, T. P., Li, L., Deng, X., Resende, T., Vannucci, F. &Delwart, E. (2016) Detection of a novel circovirus PCV3 in pigs with cardiac and multi-systemic inflammation. Virology Journal, 13(1), 1-8
13. Rajkhowa, T. K., Lalnunthanga, P., Rao, P. L., Subbiah, M., &Lalrohlua, B. (2021) Emergence of porcine circovirus 2g (PCV2g) and evidence for recombination between genotypes 2g, 2b and 2d among field isolates from non-vaccinated pigs in Mizoram, India. Infection, Genetics and Evolution, 90, 104775.
14. Rose, N., Opriessnig, T., Grasland, B., &Jestin, A. (2012) Epidemiology and transmission of porcine circovirus type 2 (PCV2). Virus Research, 164(1-2), 78-89.
15. Rosell, C., Segalés, J., & Domingo, M. (2000) Hepatitis and staging of hepatic damage in pigs naturally infected with porcine circovirus type 2. Veterinary Pathology, 37(6), 687-692.
16. Segalés, J. (2012) Porcine circovirus type 2 (PCV2) infections: clinical signs, pathology and laboratory diagnosis. Virus Research, 164(1-2), 10-19.
17. Sharma, R., &Saikumar, G. (2010) Porcine parvovirus-and porcine circovirus 2-associated reproductive failure and neonatal mortality in crossbred Indian pigs. Tropical Animal Health and Production, 42, 515-522
18. Tischer, I., Gelderblom, H., Vettermann, W., & Koch, M. A. (1982) A very small porcine virus with circular single-stranded DNA. Nature, 295(5844), 64-66.
19. Tischer, I., Rasch, R., &Tochtermann, G. J. Z. B. (1974) Characterization of papovavirus and picornavirus-like particles in permanent pig kidney cell lines. Zenibl. Bukt., 226(2), 153-67.
20. Zhang, H. H., Hu, W. Q., Li, J. Y., Liu, T. N., Zhou, J. Y., Opriessnig, T., & Xiao, C. T. (2020) Novel circovirus species identified in farmed pigs designated as Porcine circovirus 4, Hunan province, China. Transboundary and Emerging Diseases, 67(3), 1057-1061

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Popular Article

Antibiotic Resistance and MRSA: A Challenge to Human and Pet Medicine

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Abstract

Antibiotic resistance occurs when bacteria change its response to the use of antibiotics. When such bacteria infect human and animals, the management of infection become a difficult task as it poorly responds to antibiotics. Antibiotic resistance is exacerbated by the exorbitant mass use of antibiotics in necessary and unnecessary situations. *Staphylococcus aureus* is one of the bacteria identified with resistance mechanism against antibiotics. Even though it was identified in human beings in the beginning, later reports started coming from animals too. In this writing we are describing about its origin, symptoms and control in a brief way.

Key word: Antibiotic resistance, Bacteria, Canine, MRSA, Veterinary

Staphylococcus aureus, gram-positive bacteria in the Stpohylococccceae family with a diameter of about 1 µm, produces grape-like collections. *S. aureus* is a bacterium that lives commensally or often symptomless in healthy individuals' skin and skin glands, nasal epithelial cells. The most common human pathogen is *Staphylococcus aureus* found in mucous membranes, and gut. In dogs and cats *S. aureus* is less common than *S. pseudintermedius* and *S. hyicus*. *Staphylococcus aureus* is commonly found in the skin, nose, armpit, groin, and other areas. These organisms are not always harmful but they can cause infection under certain circumstances. *S. aureus* is the leading cause of skin and soft tissue infections.

Staphylococcus bacteria are very adaptable, and many varieties have become resistant to one or more antibiotics. Treatment with penicillin was very much effective against many of bacteria and virus. But after few years of its introduction, an enzyme produced from *Staphylococcus aureus* that inactivate the antimicrobial properties of penicillin. This enzyme known as beta-lactamase which can hydrolyse the beta lactam ring structure of penicillin. Due to excessive use of penicillin, *S. aureus* increases their resistance power against these antibiotics which results to produce Methicillin-Resistant *Staphylococcus aureus* (MRSA). MRSA has become a pathogen of animals in due course of time. Management of this bacterium is difficult not only because of its resistance to many

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antibiotics but also because it possesses many virulence factors that increase its ability to damage body tissue and interrupt the body's host defenses. Fortunately, MRSA is not found as often in dogs and cats as it is in humans. Dogs could be source of zoonotic MRSA.

There is a sudden emergence of MRSA in dogs and cats mainly due to clonal spread. Due to the multi resistant characteristics of these bacteria they constitute a new prominent risk to animal health. MRSA mainly transmitted by direct contact of healthy animal and infected animal. MRSA in dogs can infect person through licking, kissing, bathing or direct contact. MRSA can be spread in kennels and Veterinary hospitals. Dogs can carry MRSA without showing any clinical symptom. Clinical symptoms are easily found in immunocompromised and unhealthy dogs. Symptoms in MRSA in dogs might include erythema, pustules, hair loss, inflammation in the ear, crusts and scaling.

Diagnosis should be done by isolation of bacteria from samples. Samples from infected lesion were collected with sterile swab under aseptic precaution. Swab samples can be collected from skin lesion like pus, abscess, ulcer, burn area, boils, furuncles and blood in cases of bacteremia. *Staphylococcus* bacteria can be easily grown on special laboratory media. The sample from the patient is placed onto a culture media which could be a liquid for providing nutrition, energy, nitrogen carbon for the bacteria to grow.

Baird Parker Agar (BPA) media can be used as a selective media for *Staphylococcus* bacteria. These media are placed on petri dishes and swabbed with the sample. The dishes are then incubated overnight at 37°C. After a period of time the typical black colonies of *S. aureus* are seen. *Staphylococcus* bacteria can be identified by Gram staining and catalase test from the culture. On gram staining *Staphylococcus* bacteria are small round gram-positive cocci which stain purple or blue under microscope. The catalase test was significant for isolation of *Streptococci* which were catalase negative and staphylococcus bacteria which were showing positive reaction for catalase test. For catalase test 3% hydrogen peroxide was required on culture. In case of positive catalase test cultures bubble produced at once. Presence of *S. aureus* was confirmed by coagulase test on tube test. Methicillin susceptibility of *S. aureus* can be done by disc diffusion, Minimum Inhibitory Concentration (MIC) measurements (in broth or by E test), chromogenic agar, latex agglutination, automated methods, rapid screening methods and molecular approaches. Antibiotic Sensitivity test is used for isolation of MRSA and MSSA.

MRSA in clinical practice was the most significant problem observed now a days and the incidences of MRSA infections were increasing day by day. Methicillin resistance in *staphylococci* involved the *mecA* gene, which encodes for the penicillin-binding protein 2a and results in reduced affinity for all β-lactam antimicrobial drugs. Thus, medical management of MRSA cases can become complicated and can result in the administration of various classes of antimicrobial drugs.

MRSA bacterial infection responds quickly to a modern class of antibiotics and develops a

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resistance mechanism. Treatment of methicillin-resistant strains, vancomycin, teicoplanin and mupirocin are used after antibiotic sensitivity test. Vancomycin has remained the medication of choice in treating MRSA infection conditions. In clinical management, *S. aureus* is a multidrug-resistant condition known as a potentially life-threatening superbug. In small animal medicine, fluoroquinolones are commonly used because of their activity against a wide range of bacteria and their ability to be given orally.

If we think about antibiotic resistance and its prevention and control, certain things can be done from our side too. Use antibiotics when it is prescribed by a qualified health professional or veterinarian. Demanding antibiotics from medicine shops should be discouraged. Don't use the antibiotics from old prescriptions and offer to others. Let's follow hygienic measures in tackling infections and a healthy lifestyle in our day-to-day routine.

References

Abdullahi, I. N., Zarazaga, M., Campaña-Burguet, A., Eguizábal, P., Lozano, C., & Torres, C. (2022). Nasal *Staphylococcus aureus* and *S. pseudintermedius* carriage in healthy dogs and cats: a systematic review of their antibiotic resistance, virulence and genetic lineages of zoonotic relevance. *Journal of Applied Microbiology*, *133*(6), 3368-3390.

Boost, M. V., O'donoghue, M. M., & James, A. (2008). Prevalence of Staphylococcus aureus carriage among dogs and their owners. *Epidemiology & Infection*, *136*(7), 953-964.

Burstiner, L. C., Faires, M., & Weese, J. S. (2010). Methicillin-resistant Staphylococcus aureus colonization in personnel attending a veterinary surgery conference. *Veterinary Surgery*, *39*(2), 150-157.

Enoch, D. A., Karas, J. A., Slater, J. D., Emery, M. M., Kearns, A. M., & Farrington, M. (2005). MRSA carriage in a pet therapy dog. *Journal of Hospital Infection*, *60*(2), 186-188.

Rutland, B. E., Weese, J. S., Bolin, C., Au, J., & Malani, A. N. (2009). Human-to-dog transmission of methicillin-resistant Staphylococcus aureus. *Emerging infectious diseases*, *15*(8), 1328.

Magalhães, R. J. S., Loeffler, A., Lindsay, J., Rich, M., Roberts, L., Smith, H., & Pfeiffer, D. U. (2010). Risk factors for methicillin-resistant Staphylococcus aureus (MRSA) infection in dogs and cats: a case-control study. *Veterinary research*, *41*(5).

Silva, V., Caniça, M., Manageiro, V., Vieira-Pinto, M., Pereira, J. E., Maltez, L., & Igrejas, G. (2022). Antimicrobial resistance and molecular epidemiology of *Staphylococcus aureus* from hunters and hunting dogs. *Pathogens*, *11*(5), 548.

Yamauchi, T., & Santorelli, F. (2005). Recovery of methicillin-resistant Staphylococcus aureus (MRSA) from dogs and cats. *American Journal of Infection Control*, *33*(5), e175

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Popular Article

Bacteriocins and its application in food preservation

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Introduction

Biopreservation is a method of food preservation that employs natural antimicrobials (biopreservatives) and microbiota to extend food storage life. Consumers are increasingly seeking chemical-free foods due to their reported negative effects. Bacteriocins are bactericidal proteins or peptides that can inhibit the development of food- spoiling bacteria. These substances are made by various gram-positive and gram-negative microorganisms, each of which has its own molecular weight, biochemical makeup, and mode of operation. The majority of bacteriocins target an individual bacterial strain or species without disturbing other microbial populations. One solution to solve this issue is the use of bacteriocin (Raichurkar, and Athawale, 2015). Modern food-processing technologies and microbiological food-safety standards have reduced, but not entirely eliminated, the likelihood of food-related illness and product spoilage in industrialised countries. The increasing consumption of precooked food, which is susceptible to temperature abuse, and the continual importation of raw foods from developing countries are two of the primary causes of this situation (Ananou *et al.,* 2007). Food spoilage is the loss of the food's original nutritional value, texture, and flavour, which ultimately makes it unsafe for humans to consume (Nath *et al.,*2014). *Salmonella, Campylobacter jejuni, Escherichia coli 0157:H7, Listeria monocytogenes, Staphylococcus aureus, and Clostridium botulinum* have all been linked to such outbreaks. Food preservation is a never-ending battle against microorganisms that spoil or make food unsafe (Raichurkar, and Athawale, 2015).

Microorganisms and their metabolic by-products have been used for food preservation since prehistory. Lactic Acid Bacteria (LAB) are generally regarded as safe for this application (Hammam *et al.,* 2019). Furthermore, as an alternative to chemical preservatives, natural antimicrobials may be an effective way to prevent or minimise food spoilage and/or foodborne outbreaks. Bacteriocins are a large family of proteinaceous toxins produced by bacteria and Archaea that have antimicrobial activity

against bacteria closely related to the producer strain (Hols *et al.,* 2019). Only a few bacteriocins, in addition to their antibacterial properties, also have antiviral and antifungal properties (Vieco-Saiz, 2019).

Source and analysis of bacteriocins

Bacteriocins derived from Gram-positive bacteria, particularly Lactic Acid Bacteria (LAB), have received extensive research due to their high biosafety and wide range of industrial applications. Bacteriocins are produced by many Gram-positive, Gram-negative, and Archaea bacteria in the bacterial community (Juturu and Wu, 2018). Furthermore, the majority of bacteriocin producers are Lactic Acid Bacteria (LAB), a group which exists naturally in foods and has an extended history of safe use in the dairy industry. Bacterial cells that generate bacteriocins are resistant to their antimicrobial peptides, which are regulated by the host cells' specific immunity proteins. Bacteriocins, whether purified or excreted by bacteriocin-producing strains, are a great alternative to the inclusion of chemical preservatives in dairy products because they pose no health risks (Silva *et al.,* 2018). Bacteriocins, such as nisin, are considered safe for use as a preservation agent for food in vegetables, dairy, meats, and other food products because they inhibit microorganism contamination during the manufacturing process (Owusu-Kwarteng *et al.,* 2020). Bacteriocins generated by one bacterium that are inhibitory to other bacteria of the same species are referred to as narrow-spectrum bacteriocins (Parada *et al.,* 2007).

Effectiveness of bacteriocins in food systems

Bacteriocins inhibit target organisms in broth systems, but further research is needed to confirm their efficacy in food. The chemical formula and food's physical conditions can have substantial effects on the bacteriocin's activity. For example, Nisin at pH 2 is 228 times more soluble than at pH 8. Because lactic acid bacteria are frequently utilised as food starter cultures. Researchers have investigated the use of fermentations. Bacteriocin producers can be used as starter cultures (Ghosh *et al.,* 2021).

Food applications of bacteriocins

Applications in dairy industry: Bacteriocins are widely used in the dairy industry, particularly during product fermentation. Many studies have been conducted to demonstrate the efficacy of nisin and/or nisin-producing strains against pathogenic bacteria like *Clostridium* difficile butylated hydroxyanisole (Raichurkar and Athawale, 2015). Bacteriocins with lytic properties, such as nisin and lacticin 3147, could be used to speed up the ripening of cheddar cheese. Cell lysis of the beginning culture is beneficial for flavour development (Guinane *et al.,* 2005).

Applications in meat products: One must keep in mind that meat and meat products are complex systems with a variety of factors influencing microbial growth and metabolite production when assessing a bacteriocin-producing culture for banger fermentation and/or biopreservation. As a result,

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it is necessary to evaluate how formula and technology for fermentation affect the effectiveness of bacteriocin-producing cultures. The most extensively researched bacteriocins found in meat and meat products are nisin, enterocin AS-48, enterocins A and B, sakacin, leucocin A, and particularly pediocin PA-l/AcH, used alone or in combination with a variety of physicochemical processes, modified atmosphere packaging, high hydrostatic pressure (HHP), heat, and chemical preservatives as an additional barrier to control *L. monocytogenes and other pathogens* (Cleveland *et al.,* 2001; Nielsen *et al*., 1990; Garriga *et al.,* 2002; Ananou *et al.,* 2005a; Ananou *et al.,* 2005b).

Applications in fish

Gram-negative microorganisms are typically responsible for the degradation of fresh fish, but pathogenic organisms like *Clostridium botulinum and L. monocytogenes* can also cause issues in vacuum-packed fresh fish and seafood. Nisin and Microgard together increased the shelf-life and decreased the growth of *L. monocytogenes* inoculated frozen thawed salmon. Nisin also decreased the total aerobic bacteria numbers of fresh chilled salmon (Zuckerman and Ben Avraham, 2002).

Canned food products (alcoholic beverages)

Yeast is insensitive to nisin and it can be used to control LAB spoilage in beer or wine. It can maintain its activity during fermentation without affecting the growth or fermentative performance of brewing yeast strains, and it has no negative impact on taste. As a result, it can be used to reduce pasteurization time-temperature combination and increase the duration of storage of beers (Bali *et al.,* 2012). To control bacterial spoilage, nisin may also be employed to reduce the amount of sulphur dioxide used in wine production (Todorov *et al*., 2003).

Conclusion

Bacteriocins are one of the most well-studied microbial defence systems. Foods preserved with bio-preservatives are becoming more popular as a result of increased consumer awareness and concern about synthetic chemical additives. This has led scientists to isolate new bacteriocins from food products and various fermented products such as milk products, vegetables, fruits, cereals, and meat, to name a few examples. There is a need to investigate more microorganisms that produce novel bacteriocins with unique preservation properties, bacteriocin modifications with protein engineering, construction of food grade vectors, regulation and expression of heterologous proteins, and modification and control of organoleptic properties of food items.

References

Ananou, S. Garriga, M., Hugas, M., Maqueda, M., Martinez-Bueno, M., Galvez, A. and Valdivia, E. 2005a. Control of Listeria monocytogenes in model sausages by enterocin.AS-48. *Internat. J. Food Microbiol,* **103**:179-190.

Ananou, S. Garriga, M., Hugas, M., Maqueda, M., Martinez-Bueno, M., Galvez, A. and Valdivia, E. 2005b.Control of *Staphylococcus aureus* in sausages by enterocin AS-48. *Meat Sci.,* 71: 549-556.

Ananou, S., Maqueda, M., Martinez-Bueno, M. and Valdivia, E. 2007. Biopreservation, an ecological approach to the safety and shelf-life of foods. *Communicating Current Research and*

Educational Topics and Trends in Applied Microbiology. A. Mendez- Vilas (Ed.): 475.

Bali, V., Panesar, P.S. and Bera, M.B. 2012. Biopreservation: an emerging technique in Food processing industry. *Beverage & Food World*, **8**:0-53.

Cleveland, J., Montville, T.J., Nes, I.F. and Chikindas, M.L. 2001. Bacteriocins: safe, natural antimicrobials for food preservation. *Internat. Journal of Food Microbiology,* **71**:1-20

Garriga, M., Aymerich, M.T., Costa, S., Monfort, J.M. and Hugas, M. 2002. Bactericidal synergism through bacteriocins and high pressure in meat model system during storage. *Food Microbiol,* 19*:* 509-518

Ghosh, T., Purkait, A., Garai, B. and Banerjee, A., 2021. Microbial production of bacteriocins and its applications in food preservation: A review. *Journal of Food Process Preservation*, **5:** 1-2.

Guinane, C.M., Cotter, P.D., Hill, C. and Ross, R.P. 2005. Microbial solutions to microbial problems; lactococcalbacteriocins for the control of undesirable biota in food. *Journal of Applied Microbiol*ogy, 8 :1316-1323.

Hammami R, Fliss I, Corsetti A. Editorial: Application of protective cultures and bacteriocins for food biopreservation. Frontiers in Microbiology, 2019:1-2

Hols P, Ledesma-García L, Gabant P. 2019. Mobilization of microbiota commensals and their bacteriocins for therapeutics. *Trends in Microbiology,* 27:690-702.

Juturu V. and Wu, J.C. Microbial production of bacteriocins: Latest research development and applications. Biotechnol Adv.2018; 36:2187-2200.

Nath, Swarnadyuti., Chowdhury, S., Dora, K.C. and Sarkar, S. 2014. Role of biopreservation in improving food safety and storage. *Journal of Engg. Research & Applications,* **4**(1) : 26-32.

Nielsen, J.W., Dickson, J.S. and Crouse, J.D. 1990. Use of a bacteriocin produced by pediococcusacidilactici to inhibit listeria monocytogenes associated with fresh meat. *Appl. & Environ. Microbiol.,* 56 : 2142-2145.

Owusu-Kwarteng J., Akabanda F., Agyei, D. 2020. Microbial safety of milk production and fermented dairy products in Africa. *Microorganisms,* 8:752.

Parada J L, Caron C.R, Medeiros, A.B.P. 2007. Bacteriocins from lactic acid bacteria: Purification, properties and use as bio preservatives. *Brazilian Archives of Biology and Technology,* 512–542.

Raichurkar, S.J. and Athawale, G.H., 2015. Biopreservative: bacteriocin its classification and applications in food. *Food Science Research journal,* **6**(2): 363-374.

Silva, C.C.G, Silva, S.P.M. and Ribeiro, S.C. Application of bacteriocins and protective cultures in dairy food preservation. Frontiers in Microbiology, 2018.

Vieco-Saiz N, Belguesmia Y, Raspoet R. Benefits and inputs from lactic acid bacteria and their bacteriocins as alternatives to antibiotic growth promoters during food animal production. Frontiers in Microbiology, 2019.

Todorov, S.D., Vaz-Velho, M. and Dicks, L.M.T. 2003. Isolation and partial characterization of bacteriocins produced by four lactic acid bacteria isolated from traditional South African beer. *Electronic J. Environ., Agric. & Food Chem,* **2***:*(4): 1-6.

Zuckerman, H. and Ben Avraham, R. 2002. Control of growth of L-monocytogenes in fresh salmon using Microgard (TM) and Nisin.*Lebensmittel-Wissenschaft und-Technologie,* **35**:543-548.

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Popular Article

Importance of clean milk production for farmers and consumers

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Abstract

Milk is a complete food and nature's most wonderful gift to mankind. The high nutritional content of milk makes it a perfect growth medium for innumerable microorganisms including pathogenic ones and the spoilage microbes cause deterioration of milk quality thereby causing great economic loss to farmers. Over and above this contaminated milk may cause milk-borne infections like typhoid, food poisoning, tuberculosis etc. which negatively impacts public health. The unprecedented use of chemical contaminants such as antibiotics and pesticides in agriculture food system has made milk chain vulnerable. India is the largest milk producer in the world holding first rank, but the quality of milk produced in India is questionable. The export of milk and milk products from India to the international market is far behind than that of developed countries, hence farmers don't get better price. In order to get high quality milk, certain hygienic practices such as appropriate sanitation and disinfections of the animal shed, utensils and equipment, properly good quality feed and water are must to be implemented. The mastitis control measures are essentially required at dairy farms to produce clean milk. The ultimate quality of milk and their products is determined by the complete process starting from animal production till the utilization of milk by consumers.

Introduction

In India, dairying occupies a special niche and contributes substantially to the national economy as well as in socio-economic development of millions of rural and urban households. India ranks first in the world in milk production with annual milk production of 155.50 million tonnes and contribute about 16% to the world milk production (DAHF, 2017). Although, India ranks first in milk production, quality of milk produced is not satisfactory due to lack of technical knowledge to the farmer. Milk quality is utmost important factor in dairying today due to consumer's awareness regarding quality. To achieve quality standards clean milk production (CMP) practices at the farmers' level needs to be considered. Clean milk can be defined as milk coming from healthy milch animal possessing normal flavour, devoid of dirt and filth, containing permissible limit of bacteria and essentially free from adulterants, pathogens, various toxins, abnormal residues, pollutants and metabolites. CMP also involves a set of preventative practices that helps in keeping the animal healthy

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and free from diseases like mastitis, proper care and monitoring of individual animal to get the best quality milk without compromising with animal's productivity (Ogale, 1999). The most important step in clean milk production is the practice of hygienic milking, yielding milk safe for human consumption, free from disease-producing microorganisms, with high keeping quality, high commercial value and high-quality base suitable for processing, resulting in high-quality finished products. It is necessary to protect milk from all possible sources of microbial contamination liked dung, water, utensils, soil, feed, air, milking equipment, animal and the milker. To achieve these milking should be conducted gently, quietly, quickly, cleanly and completely and also farmers should adopt important operations such as cleanliness of animal shed, cleanliness of animals, cleanliness of milkers and milking pails, milking methods, proper transportation of milk from dairy farm to processing units. Clean milk production involves cleanliness at all phases of handling and stringent quality control and hygienic measures have to be adopted at farm level. The adoption of clean milk production practices has great potential for increasing the quality of milk production (Rathod, 2014).

Contaminated milk deteriorates quickly and is a cause of health concerns. Zoonosis constitutes 61% of all known infectious diseases. It may also be noted that out of the 175 diseases considered to be emerging, 75% are zoonotic (Alexander *et al*., 2015). There are some 45 zoonotic diseases reported to be transmitted from cattle. Dairy farmers are always at risk of acquiring infections from animals, being in close contact with their animals. Therefore, the maintenance of healthy milking animals will subsequently reduce the likelihood of introducing such zoonotic pathogens into the milk through the mammary gland or from the feces (FAO/WHO, 2011). Some of the zoonotic diseases that spread through milk are brucellosis, tuberculosis, salmonellosis, etc. (Pelzer and Currin, 2009). Clean milk production (CMP) involves cleanliness at different phases of handling animals, processing, and transporting of milk and milk products. Stringent quality control and hygienic measures are required at the level of dairy farm to maintain the milk quality, which is determined by aspects of composition and hygiene of milk. There are mainly four factors to be considered in CMP practices viz., animal hygiene, milking hygiene, equipment hygiene, and processing hygiene (Singh and Gupta, 2013). Clean milk production practices also involve proper method of milking, practices for let-down of milk, washing of udder before milking, drying of udder after washing, cleanliness of milkman, removal of hairs near to udder and discarding first stream of milk from each teat (Abdessemed *et al*., 2016). The first step to clean milk production should be education and training of milk producers on hygiene, housekeeping, sanitation, milking methods and good animal husbandry practices.

Health management and hygiene of animal House

Good animal husbandry practices including regular monitoring of disease such as mastitis should be a part of the routine work. Sick animal shed should be kept away from the milking barn and separated from the healthy ones. The healthy animals must be milked first. Improper use of veterinary

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drugs should be avoided. Hygiene of animal house is an important component of clean milk production practices. Concrete floor with well drainage system in the animal shed is very important however if it is not possible bedding materials like sand or sawdust should be provided to the animals during cold weather or in damp or marshy floor. The shed should be comfortable and clean with suitable arrangement to dispose dung, urine, and feed and fodder residues. There should be proper supply of clean drinking water and electricity (Bafanda *et al*., 2018).

Handling of milking vessels

The milking vessel should be made of stainless steel or non-rusting and non-absorbent materials (*i.e.* aluminium or galvanized iron), having small mouth mouths to avoid external contamination. All the utensils should be free from dents, cracks and crevices so that washing and cleaning of utensils become easier. It should be scrubbed and cleaned before and after milking with hot water and certified detergents/chemicals and placed in inverted positions for the complete drainage of water, so as to avoid contamination from air, insects and rodents, etc. At farm, washing soda is used for cleaning of utensils followed with exposure to sunlight or use of disinfectants (iodophors) is recommended. The milker should wear clean clothes and maintain personal hygiene. He should wash his hands before milking and should not spit or smoke. Shaving the hair of the hind legs and tail of the cow should be carried out routinely. Also, the fore milk should be discarded in a proper place (Pal and Khadda, 2022).

Udder Hygiene

From an ethological perspective, the cow rests in a lying position, which inevitably leads to contact of the udder skin with filth on the bedding surface. As much as 1 x 1010 of total microorganisms can be found in one gram of filth from the udder surface. With unsuitable udder hygiene, the microorganisms present on the teat skin can contaminate the milk during milking or through the teat tip will penetrate the teat canal increasing the possibility of mastitis. Bulk milk SSC for all lactating animals should be less than 250000 cells/ml and for first calver, it is less than 100000 cells per ml of milk. The incidence of mastitis in dairy farm should be less 25 percent in a year and whereas the culling of animals due to udder health should be less than 5 percent in a year. Therefore, it is necessary to implement hygienic-prophylactic measures in maintaining cleanliness and udder health before and after milking. This can be achieved by washing of udder and teats, spraying and wiping of teats with a cloth immersed in warm disinfectant solution and drying with a dry cloth; immersing of teats in disinfectant solution and wiping with a paper cloth etc. This procedure removes the milk droplets that are left behind which can serve as a breeding ground for surrounding pathogenic microorganisms. Subsequent drying of the disinfectant creates a thin layer over the teat orifice, mechanically preventing the incursion of microorganisms through the teat canal (Singh, 2018).

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Milking methods

Milking is an art which requires experience and skill. Milking should be done gently, quickly, neatly and completely. Teat is the first line of defense against pathogens of mastitis. The milking process may affect teat's condition, increasing the risk of mastitis. For hygienic milk production milking clothes, buckets, udders and hands should be clean.

1. Hand milking is done using clean and dry hands. It is performed by massaging and pulling down the teats, squirting the milk into milking pail. Hand milking is also done by three methods: (i) stripping (generally for first calvers), (ii) knuckling (not advisable), (iii) full hand milking (best). Whatsoever method of hand milking is followed however at the end, stripping should be resorted to with a view to milk the animal completely; the last drawn milk is called stripping and is richer in fat.
2. Machine milking works on the principle of vacuum just like the calf sucking its mother. Important consideration has to be considered as any negligence can cause adverse effect on the animals' health and milk production. The operator has to check the milking vacuum, vacuum level, pulsation rate and pulsation ratio. Over-milking can damage teat ends and leads to mastitis (Aslam, 2014).

Post-milking care of teats

The appropriate use of teat disinfecting products reduces mastitis rates and the need for antibiotic use. As soon as milking is complete, the milking pail must be cleaned by an initial rinse in clean water, followed by scrubbing in a hot detergent/disinfectant solution and finally rinse with fresh water. All equipment must be drained and dry between milking intervals. Post milking disinfection of teat is the most effective way to prevent the spread of mastitis as the teat canals remain open and mastitis causing pathogens can easily enter through teat orifice. Teat dip must be always used after every milking. The animals must be kept in standing position at least 20-30 minutes after milking - by sending them to the feeding area/grazing to prevent the teats coming into contact with dirty floors (Singh, 2018).

Milk collection and transportation

Hygiene at all stages of milk collection and processing is very important for the quality and shelf life of dairy products. Hygiene at all stages of milk collection and processing is very important for the quality and shelf life of dairy products. Hygiene at all stages of milk collection and processing is very important for the quality and shelf life of dairy products. Hygiene at all stages of milk collection and processing are very important for the quality and shelf life of dairy products. Hygiene at all stages of milk collection and processing is very important for the quality and shelf life of milk and other dairy products. There should be a provision of bulk cooling tanks to reduce the bacteriological load in

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the milk immediately after collection. Introducing differential pricing system based on bacteriological quality of milk will help in overall improvement of milk quality reaching the dairy dock. Hygienic norms, good animal husbandry practices and proper handling, storage and transportation of milk are other prerequisites for clean milk production. The milk cans must have tight fitting lids to prevent entry of rain and dust. They should be stored in an inverted condition on stand. Group transport can be arranged for individual supplies of milk. However, it is better if transportation is done using small containers which will avoid mixing of poor-quality milk with good ones. During transportation agitation of milk should be avoided as milk fat is destabilized if agitated which becomes easily oxidized. The milk tanker should have proper insulation. The number of spoilage bacteria in raw milk depends on the level of hygiene during milking and the cleanliness of the vessels used for storing and transporting the milk. During the first 2-3 hours after milking, raw milk is protected from spoilage by inherent natural antibacterial substances that inhibit the growth of spoilage bacteria. However, if the milk is not cooled, these antibacterial substances break down causing bacteria to multiply rapidly. Cooling milk to less than 10°C may prevent spoilage for up to three days. High storage temperatures result in faster microbial growth and hence faster milk spoilage. Group transport can be arranged for individual supplies of milk. However, transport milk in small containers which will avoid mixing of poor-quality milk with good ones (Singh, 2018; Faraz, 2020).

Conclusion

Clean milk production is the first key step farmer of our country should look at to meet the challenges of globalization as high-quality milk fetches good price in market. Development of skills related to clean milk production, knowledge and application of the above standard procedures will help in reducing spoilage, production of high-quality milk kept for long time and ensuring health of the consumers, farming families and overall prosperity to our dairy farmers.

References

1. Annual Report (2017). Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture and Farmers Welfare, Govt. of India.
2. Ogale H. (1999). Clean milk production- the key to quality management in dairy industry. *Indian Dairyman*., **51**(6): 41-43.
3. Rathod P, Balraj S, Dhanraj G, Madhu R, Chennaveerappa and Ajith M. C. (2014). Knowledge level of dairy farmers about artificial insemination in Bidar district of Karnataka, India. *Veterinary Research International*., **2**(2): 46-50.
4. Alexander L K, Lopes B, Ricchetti-Masterson K, and Yeatts K B. (2015). Cross-Sectional Studies ERIC Note Book, Second Edition. United States: Department of Epidemiology, Gillings School of Global Public Health, pp. 1-5.
5. FAO/ WHO (2011). Milk and Milk Products. 2nd ed. Nutritional Division, pp. 181-231.
6. Pelzer K D, and Currin N. (2009). Zoonotic diseases of cattle. *Commun Mark Coll Agric Life Sci*., **5**:1-5.
7. Singh V, and Gupta J. (2013). Analysis of knowledge and adoption level of the dairy farmers Regarding Clean Milk Production (CMP) practices. *Indian Council Agric. Res.,* **3**:180-6.

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8. Abdessemed D, Avdeenko V S, and Avdeenko A V (2016). Diagnosis and therapy of subclinical mastitis in lactating dairy cows. *Journal of Animal. Health. Prod.,* **4**(3): pp. 95-100.
9. Bafanda R A, Nanda R, khandi S A, Choudhary F , Choudhary M S and Shehjar F (2018). Clean Milk Production Practices Adopted by the Dairy Farmers of R. S. Pura in Jammu District. AJAEES., **26**(3): 1-10.
10. Pal S and Khadda B S. (2022).) Clean and Quality Milk Production, Krishi Vigyan Kendra, S.A.S. Nagar, SR Publications.
11. Singh R K (2018). Protocols for clean milk production & milking techniques of dairy cattle in India. www.pashudhanpraharee.com
12. Aslam N, Abdullah M, Fiaz M, Bhatti JA, Iqbal ZM, Bangulzai N, Choi CW, Jo I H. (2014). Evaluation of different milking practices for optimum production performance in Sahiwal cows. *J Anim. Sci. Technol.,* **56**:13.
13. Faraz, A (2020). Milk collection and transportation. *Farmer Reformer*., **5**(8): 2519-7835.

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Popular Article

The livestock industry and veterinary science: A Must for Increase in Farmer's Income

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Abstract

Livestock sector plays a pivotal role in improving the socio-economic conditions of farmers, contributing indirectly to food security by increasing crop output through manure production. Restructuring livestock processes and policy interventions are crucial to increase the farmer's income which would be fulfilled by increasing the gross income, reducing the costs, and stabilizing the income. In India, 70% of livestock population is owned by landless and marginal farmers, providing livelihood to nearly two-third of rural households. So, livestock acts as cushion to the farmers in times of draught as the agricultural farming alone can be risky to farmers specifically in our country due to unpredictability of several factors like weather, crop failure and market availability. Therefore, the domestic animals in terms of generating the diverse economy and monetary benefits to farmers consequently become a dependable bank on hooves for them to fulfil their need of the hour.

Introduction

The goal of doubling farmer's income by 2022 was given by Honourable Prime Minister Shri Narendra Modi on February, 2016 in Bareilly, U.P. As per the latest census *i.e.*, 20th livestock census, the total cattle population in India is 193.46 million, out of which 142.11 million are indigenous or non-descript cattle and only 51.36 million are exotic or crossbred cattle. The livestock population has been increasing gradually over the years as it is observed as 4.6% increase in total livestock number in the current livestock census (Moyo and Swanepoel, 2010). Therefore, to utilize the nation's increasing livestock reserve for the maximum benefits and growth of the farmers, the focus should be shifted to increase the number of productive animals so the productivity would be achieved by regulating the livestock population specifically cattle and buffalo by adopting new and modifying the existing breeding policies.

As per the production statistics, in India, the average milk yield of indigenous cattle is 3.9 kg per day and that of crossbred and exotic cattle is 7.1 kg per day wherein the indigenous cattle contribute only 10% while exotic and crossbred cattle contribute 27% to the total annual milk

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production which is almost 2.5 times that of indigenous cattle (DAHDF, 2019). Low genetic potential of the indigenous breeds and poor nutrition due to unavailability of good quality feed or fodder, inferior farm management practices, inefficient execution of existing breeding programmes and inadequate extension services to farmers are the main causes of low productivity. New breeding initiatives like artificial insemination (A.I.) by using superior quality semen is required, however, the A.I. coverage in cattle and buffalo is hardly 35% due to lack of adequate number of trained staffs and lesser supply of good quality semen straws. To achieve adequate A.I. coverage, the required number of semen straws is 160 million whereas the availability is only 81 million, nearly half of the target (Chand, 2017). At present there are only 54 semen production centres and 235 frozen semen storage banks in the whole country which calls for an attention to open more such centres. Other breeding policies such as selective breeding, cross breeding and practical implementation of "Embryo Transfer Technology" (ETT) in field to produce genetically superior productive animals aided by the use of "Advanced reproductive technology" that involves the use of "Sex Sorted" semen will hasten the genetic progress with selective increase in the number of female or male calves as per their requirement. The process of A.I. of farm animals using sex sorted semen is approved by FAO to improve efficiency of farm animals and the famers. In India, it is standardized for indigenous breeds like Sahiwal, Gir, Haryana and Red Sindhi (DAHDF, 2019). All these aspects are associated to focus on increasing productivity specifically milk production drawing the attention for doubling farmer's income towards "Dairy sector development".

Dairy and poultry sector development

The annual milk production in the country is 187.75 million tonnes. Implementation of dairy entrepreneurship programme would enhance farmer's growth to help them learn to become entrepreneurs and establish their own start-ups to reap huge benefits thereby subsequently contributing in increasing the total production (DAHDF, 2019). The central government has approved a specific fund for "dairy processing and infrastructure development" that involves Rs. 10,881 crores for its utilization in creation, modernization or expansion of dairy processing infrastructure and building an efficient milk procurement system to generate employment opportunities which would benefit 95 lakh farmers in 50,000 villages (DAHDF, 2017). Poultry alone contributes 50% of total meat production in the country and still has a huge demand among consumers therefore; it is another area which farmers can adopt (meat and egg production). The total egg production is 103 billion annually while per capita availability is 79 eggs which is lesser than 182 eggs recommended by ICMR (DAHDF, 2019). The DADHF provides the farmers with feed and technical facilities like vaccination against deadly diseases of poultry to make their enterprise more profitable and reap great margins. Therefore, dairy and poultry sectors altogether hold a bright future for farmers to utilize maximum benefits and have their own start-ups for multiple benefits.

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Livestock-Fish integrated farming

Integration of livestock with fish farming is another profitable option which has already been adopted by various farmers and acts as one of the methods for doubling their profits e.g. chicken or duck along with fish farming or goat rearing with fish farming. It is also an economical method of recycling organic wastes or faecal wastes from poultry or other livestock to be utilized as feed for fish. This reduces the cost of separate supplementary feed for fishes and thus with the rearing cost of one, twin benefits can be obtained by the farmers.

Value addition

Value addition to milk, meat and eggs can actually multiply the farmer's income many folds, also the economic value of livestock products is increased by changing its current place, time and form which are more preferred in the market. Various innovative value-added livestock products from egg, meat and milk like egg jam, egg paneer, egg pickle, instant egg mixes, meat sausages, salamis, loaves, meat pickles, meat patties, mozzarella cheese and varieties of lassi have been developed at GADVASU, Ludhiana and are accepted well by the consumers.

Byproduct utilization

Another underutilized aspect of livestock which can be utilized to increase the profit of the farmers is the use of byproduct which are stated in details as below-

- The cow dung or animal waste can be converted to vermicompost by the action of earthworm and microorganisms for use as fertilizer or farm manure. This makes the farming more economical and subsequently increases the profit. Such byproduct utilization will promote organic farming leading to better returns and marketing options including international markets to the farmers. On an average, 400 Kg bovine dung can be converted to 800-1000 Kg vermicompost annually.
- Biogas, which can be used as a substitute for other non-renewable fuel is produced by anaerobic digestion of the organic waste generated from livestock.
- The dead livestock also never loses its value, if properly utilized it will generate twin benefits to generate some income too. Skin or hide from the dead animals can be sold for further processing and bones can be converted to bone powder which is a source of calcium and phosphorus for animal feed and fertilizer.

Government policies and initiatives

Several central schemes under the Dept. of Animal husbandry, Dairying and Fisheries are being sponsored by the government, of which some are cited below.

- **Animal Husbandry Infrastructure development fund:** In this central fund worth Rs. 15,000 crore, the government has given opportunities to farmers to develop their own enterprises

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under Atma Nirbhar Bharat Abhiyan, dividing it into three sectors *i.e*., a) Dairy Processing and value addition infrastructure, b) Meat Processing and value addition infrastructure, c) Animal feed plant.

- **Livestock health and disease control:** Under this programme, efforts are made to control the spread of deadly diseases and treat the animals from economic diseases.
- **National Animal Disease Control Programme for FMD and Brucellosis:** The Government has launched a new scheme with a financial outlay of Rs. 13,343 crore for five years (2019-20 to 2023-24) by vaccinating 100% cattle, buffalo, sheep, goat and pig population for FMD and 100% bovine female calves of 4-8 months of age for brucellosis to prevent losses of Rs. 50,000 crore. This programme is combined with providing unique PashuAadhar to 535 million animals (cattle, buffalo, sheep, goat, and pig).
- **Rashtriya Gokul Mission:** It aims to improve productivity and production of indigenous cattle breeds for which genetic improvement and designed nutritional approaches are introduced to the native breeds.
- **Pashu Sanjivani:** It is also one such programme run by the government for ensuring animal wellness.
- **Nationwide Artificial Insemination Programme (NAIP):** NAIP for 20,000 bovines per district for 600 districts in the country was launched by the government in September, 2019 to undertake breed improvement to achieve 70% A.I. coverage.
- **Kisan credit cards:** The central government launched this scheme under DAHDF with the aim to benefit all dairy farmers and provide "Kisan credit cards" to 1.5 crore dairy farmers by December, 2020.
- **Digitalization:** The government has initiated digitalization of various schemes to facilitate the farmers to access e-portal (e-Pashuhaat) which is an e-market to facilitate the traceability of high-quality bovine germplasm by connecting the farmers directly to breeders and related agencies.

Role of a veterinarian

Veterinarians play a leading role in creating a liaison between government's plan and policies and their actual implementation at the field level as all the attributes of livestock sector cannot be utilized by farmers to their utmost benefit in doubling their income. Their foremost role is to provide active guidance to farmers about all the diverse options related to livestock to draw the maximum benefits. Veterinarians working in fields are providing awareness about different government schemes and subsidies for the farmers by providing trainings to farmers for different entrepreneurship programmes related to dairy, poultry, piggery and goat units under government schemes through state

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animal husbandry department and veterinary universities. These schemes provide push to the farmers to start their own start-ups for better financial gains. Farmers are also given several extension services by organizing Kisan Melas/Divas, free vaccination and deworming camps and also, through print and electronic media. Taking all these facts into concern, it is no denial that a veterinarian plays a vital role in achieving the dream of doubling farmer's income with a focus on livestock sector.

Conclusion

The livestock sector is performing well in the manner of production, value addition, and export of dairy, fishery, wool, poultry, and other products. Apart from its performance, some threats do exist which need to be overcome to grab the global market opportunities. This approach to make agriculture and related activities more remunerative can be achieved if governments at the centre and the states, district and block officials commit to the purpose and work in tandem towards the goal of increasing farmer's income. Also, adopting scientific livestock farming systems, value addition technologies and establishment of marketing channels, encouraging entrepreneurship and utilization of the byproduct will also aid immensely to the goal wherein veterinarians contribute an important part.

Disclosure statement

The study's authors affirm that there were no financial or commercial ties that may be viewed as having a possible conflict of interest.

References

1. Moyo, S. and Swanepoel, F. J. C. (2010). Multifuncionality of livestock in developing communities. In: The Role of Livestock in Developing Communities: Enhancing Multifunctionality, edited by Frans Swanepoel, Aldo Stroebel and Siboniso Moyo, Co-published by The Technical Centre for Agricultural and Rural Cooperation (CTA) and University of the Free State, 2010.
2. DAHDF (2019). Dairy Entrepreneurship Development Scheme (Retrieved from www.nabard.org/content. (aspx.id. 591, dated 13.09.2019).
3. Chand R. (2017). Doubling of farmer's income, Rational, Strategy, Prospect and action plan. Niti Policy Paper: 5-19.
4. Basic Animal Husbandry & Fisheries Statistics (2019). Animal Husbandry Statistics Division, DAHDF, Ministry of Fisheries, Animal Husbandry & Dairying, GOl. DAHDF, 2017. www.transformingindia.in

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Millet prebiotics modulate gut microbiota and promote health

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Millet-based prebiotic functional food can provide a means to address the growing pressures on the health care system by augmenting health through prevention rather than treatment. Therefore, health-conscious consumers are significantly recommended to consume millet-based functional foods in an effort to boost their immunity and wellbeing.

Keywords: *Millet, probiotics, Functional food, SCFA*

Impact of diet on gut microbiota

The influence of diet and dietary constituents on human metabolism and health is a well-established fact. We can increasingly modify health through dietary habits and measure the effects through our microbes or metabolites. Gut microbiota (GM) are involved in a cascade of metabolic activities, and their dysbiosis is associated with the pathogenesis of both intestinal (inflammatory bowel disease, coeliac disease, and colorectal cancer) and extra-intestinal (metabolic syndrome, cardiovascular disease, neurological disease, and obesity) disorders. A favourable equilibrium of GM supplies several nutrients, regulates energy balance, modulates the immune response, and provides defence against pathogens, thus promoting host health. Functional foods are food products or food ingredients with valuable bioactive compounds that offer health benefits beyond their nutritional value and can provide further protection against chronic disease by promoting gut health. One type of functional food that has been receiving much attention is food rich in prebiotics. Therefore, there is a great interest in producing healthy prebiotic foods to improve gastrointestinal health by interacting closely with the GM.

Cereal-based prebiotic and probiotic functional food

In the nutrition sciences today, prebiotic and probiotic functional food development is one of the most active areas of research and has encouraged food scientists to study the feasibility of cereal

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ingredients for the development of innovative cereal-based functional foods. Cereals are one of the main components of the human diet and nutrition, and their bioactive ingredients can be used as an alternative (to dairy-based products) for the development of prebiotic functional foods. Dietary fibres of cereals, especially resistant oligosaccharides and arabinoxylan, are well-recognized as prebiotics. Besides dietary fibres and resistant starch, polyphenols present in cereals are also potential prebiotic candidates. The health benefits of prebiotics are mainly attributed to shaping an individual's microbial diversity, stimulating the growth of beneficial microorganisms (probiotics), and increasing the production of postbiotics such as short-chain fatty acids (SCFA). SCFA e.g. acetate, propionate, and butyrate, are the chief end-products of prebiotic fermentation; they play important roles in modulating the intestinal barrier, mucus production, and intestinal pH regulation. SCFA are also involved in appetite, blood sugar regulation, energy expenditure, and modulation of the immune response, thus promoting metabolic health. Anti-inflammatory SCFA exerts beneficial effects on intestinal and immune cells, being important compounds for cell proliferation, cell differentiation, and gene expression. They are also signalling molecules in immunological pathways. Butyrate is the primary energy source of colonocytes, and it has an epithelial barrier function. SCFA can also induce the expression of anti-inflammatory cytokines, inhibiting inflammatory responses through inhibition of the NF-B signalling pathway. Therefore, prebiotics seem to represent an effective non-pharmacological approach to re-establish gut symbiosis and promote well-being through several signalling mechanisms to regulate barrier functions, oxidative stress, and inflammation.

Prebiotic and Probiotic Potential of Millets

People are continuously searching for nutrients having prebiotic and probiotic potential. In this regard, millets are suddenly back in the limelight for many reasons; millets are more nutrition-rich than other major cereals (rice, wheat, maize). They are rich sources of calcium, iron, potassium, magnesium, and zinc, as well as essential molecules such as dietary fibres, proteins, minerals, vitamins, amino acids, fatty acids, antioxidants, polyphenols, and other nutraceutical compounds, making them a promising and highly functional food ingredient. Millet grains are considered a source of traditional medicines and have the potential to develop prebiotic functional foods with probable health benefits. Millet foods are characterised as potential prebiotics and can enhance the viability and functionality of probiotics with significant health benefits; these are good for people with celiac disease and are good sources of bioactive compounds. The processing methods, like fermentation, germination, and heating, have shown an increase in the concentration of these bioactive compounds. Researchers are progressively studying the prebiotic potential of millet components, their therapeutic effects, and immunomodulatory mechanisms. A number of dietary carbohydrates and phenolic substances can modulate the structure and activities of GMs. According to research on both animals and humans, changes in the proportion of healthy bacteria in the gut are most frequently linked to

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improvements in health. Little attention has been paid to prebiotics found in whole millet-based diets, despite the fact that the majority of research into their health effects has been on isolated compounds. Several studies revealed that supplementing with millet raised levels of *Bifidobacterium* and *Lactobacillus* and decreased levels of *Escherichia coli*, *Enterococcus,* and *Bacteroides.* The prebiotics (e.g., arabinoxylan, phenolic acid-bound arabinoxylan, polyphenols, etc.) in millets have high antioxidant activities, which is critical in scavenging nitric oxide (NO) and reactive oxygen species (ROS) and reducing oxidative damage. Cytokines and pro-inflammatory signalling pathways mediate the majority of metabolic disorders, and it has been documented that millet nutraceuticals prevent these disease markers. As our understanding of the relationship between GM and metabolism deepens, the significance of various probiotic bacterial species, their involvement in various immune responses and signalling pathways, and the role of prebiotic components in maintaining health will probably become clearer.

Conclusion and Way Forward

There will be more interest in learning about prebiotics as awareness and acceptability among consumers worldwide continue to rise. Obtaining a detailed description of how bioactive components of millets interact and modulate GM composition and functions and what the mechanism of their biotransformation is could be a key to understanding their prebiotic and probiotic properties. The discovery of their nutraceuticals for new prebiotics as well as their immunomodulatory signaling mechanism(s) required an interdisciplinary approach. In the recent past, prebiotics research has come a long way due to the maturation of omics technologies (metagenomics, transcriptomics, proteomics, and metabolomics), bioinformatics, and systems biology tools. We argue that by applying and integrating meta-omics with systems biology tools, it is possible to monitor the fate of millet nutraceuticals, assemble data collected from the microbiota profiling upon millet consumption to absorption, and, more health or disease status. Given the current gaps in the prebiotic potential of millet-based functional foods, detailed clinical evidence, ideally through randomized controlled studies, is urgently required.

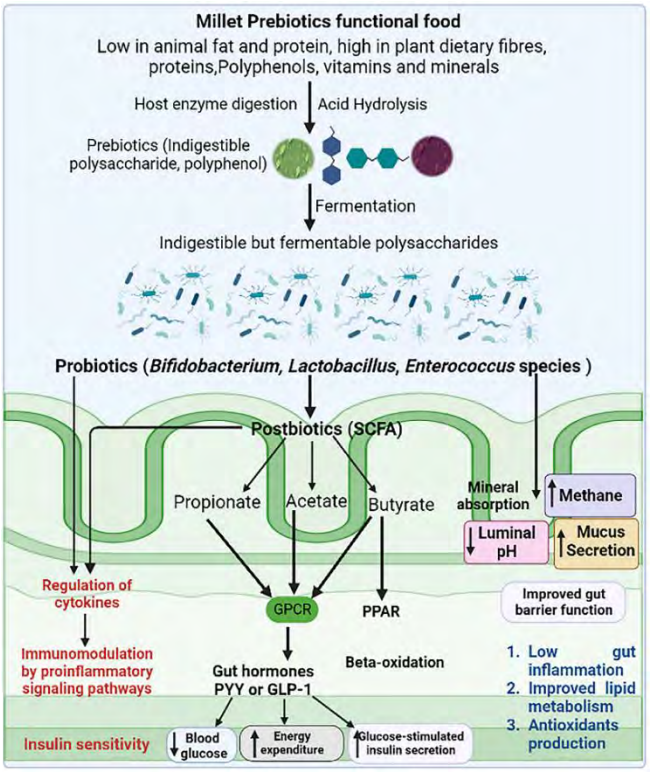

Figure 1. Mechanism(s) of action of millet prebiotics functional food. The health benefits of prebiotics on the host are attributed through; selectively stimulating the growth of beneficial probiotics production of postbiotics (SCFAs), which eventually regulate various cytokines and inhibit the pro-inflammatory signaling cascades.

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importantly, link the GM, host metabolome, and The outcome of these clinical trials can be translated into clinical practice to assess changes in GM composition and health outcomes.

Suggested reading:

1 Kumar, D., Lal, M.K., Dutt, S., Raigond, P., Changan, S.S., Tiwari, R.K., Chourasia, K.N., Mangal, V. and Singh, B., 2022. Functional Fermented Probiotics, Prebiotics, and Synbiotics from Non-Dairy Products: A Perspective from Nutraceutical. Molecular Nutrition & Food Research, 66(14), p.2101059.

2 Chen, Y., Zhang, R., Xu, J. and Ren, Q., 2022. Alteration of intestinal microflora by the intake of millet porridge improves gastrointestinal motility. Frontiers in Nutrition, 9, p.965687.

3 Li, X., Hui, Y., Leng, B., Ren, J., Song, Y., Che, L., Peng, X., Huang, B., Liu, S., Li, L. and Nielsen, D.S., 2021. Millet-based supplement restored gut microbial diversity of acute malnourished pigs. Plos one, 16(4), p.e0250423.

4 Stražar, M., Temba, G.S., Vlamakis, H., Kullaya, V.I., Lyamuya, F., Mmbaga, B.T., Joosten, L.A., van der Ven, A.J., Netea, M.G., de Mast, Q. and Xavier, R.J., 2021. Gut microbiome-mediated metabolism effects on immunity in rural and urban African populations. Nature communications, 12(1), p.4845.

5 Ren, X., Wang, L., Chen, Z., Hou, D., Xue, Y., Diao, X. and Shen, Q., 2021. Foxtail millet improves blood glucose metabolism in diabetic rats through pi3k/akt and nf-κb signaling pathways mediated by gut microbiota. Nutrients, 13(6), p.1837.

6 Babele, P.K., Kudapa, H., Singh, Y., Varshney, R.K. and Kumar, A., 2022. Mainstreaming orphan millets for advancing climate smart agriculture to secure nutrition and health. Frontiers in Plant Science, 13, p.902536.

7 Babele, P.K., Srivastava, A., Selim, K.A. and Kumar, A., 2023. Millet-inspired systems metabolic engineering of NUE in crops. Trends in Biotechnology, 41(5), pp.701-713.

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Popular Article

Harmful Algal Blooms: Counterbalancing Aquatic Ecosystem

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Cyanobacteria and phytoplankton are essential to the functioning of aquatic ecosystems. However, under extreme environmental conditions, they can proliferate rapidly and cause HABs. Toxins produced by HABs can cause severe injury to humans, fish, animals, and other aquatic ecosystem components. Urgent action and management policies are required to halt the epidemics.

What is harmful algal and/or cyanobacterial bloom?

Cyanobacteria (prokaryotes) and algae (eukaryotes) are an ancient group of photosynthetic organisms that occur in almost all habitats, including water (fresh and brackish water, oceans, and hot springs), terrestrial environments (soil, deserts, and glaciers), and symbioses (with plants, lichens, and primitive animals). They are important primary producers in aquatic environments and valuable indicators of ecosystem conditions because they respond quickly both in species composition and densities to a wide range of water conditions due to changes in water chemistry. However, excessive growth of certain cyanobacteria and algae results in harmful algal blooms (HABs). HABs affect our oceans and form in bodies of fresh water, making lakes, ponds, or your favorite swimming hole smelly and slimy. HABs are linked to 'overfeeding' of nutrients and an abundance of pollutants in water bodies. A cyanobacterial bloom can change the color of the water to blue, green, brown, yellow, orange and red. Some blooms are easy to spot, but others that present below the water's surface are hard to see. Depending on the type of cyanobacteria or algae that cause it, HABs may produce bad-smelling scum, foam, froth, or a paint like slick. HABs release cyanotoxins and are becoming more popular due to public safety concerns, adverse effects on coastal living resources, and economic losses from reduced tourism, recreation, or seafood industries.

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The Most Common Types of Freshwaters HABs

Several cyanobacterial or algal species can proliferate into a HAB under favorable conditions. Most freshwater HABs are produced by cyanobacteria. Cyanobacterial blooms are the most common type of HABs in lakes, ponds, and other freshwater systems. Some, though not all, types of cyanobacteria can produce dangerous cyanotoxins. The most frequently reported types of bloom-forming cyanobacteria are *Microcystis*, *Dolichospermum, Aphanizomenon, Nodularia* and *Planktothrix*. Cyanobacterial blooms can grow on rocks beneath the water. Common toxins made by cyanobacteria are microcystin, cylindrospermopsin, anatoxin, guanitoxin, nodularin and lyngbyatoxin. Golden algae blooms are most commonly found in oceans, however, golden algae (*Prymnesium parvum*) are an emerging problem in freshwater rivers, reservoirs, and lakes, particularly those with higher salinity due to higher mineral content. While a bloom of golden algae can cause massive fish kills, it has not been shown to pose a health threat to humans. Common toxins made by dinoflagellates brevetoxin, azaspiracid, ciguatoxins, okadic acid saxitoxin and dinophysistoxin.

What Causes Freshwater HABs?

HABs occur in more locations than ever, and new findings are reported regularly. Several researchers have argued that this trend is due to increasing eutrophication worldwide, and several classic examples connect HAB incidence to anthropogenic activities. Additionally, climate change, such as rising temperature and inorganic pollution, is massively increasing the frequency, prevalence, and toxicity of HABs. The following are some of the main freshwater algal bloom causes:

1. Nutrient runoff or nutrient pollution

HABs are mostly caused by large amounts of nitrogen (N) and phosphorus (P) in water. N and P are essential to plant growth and natural part of underwater ecosystems. These nutrients are excessively used in farms through synthetic fertilizers. Nevertheless, excessive amounts of these elements can create nutrient pollution when they run off urban and rural surfaces and flow into a river, lake, pond, or reservoir. They can enter waterways via agricultural runoff, particularly from animal manure and chemical fertilizers that are washed from farms by rain. Together with the N and P dead organic matter propagates the growth of cyanobacteria and algae leading to HABs.

2. Warm and stagnant water

Rise in earth's temperature due to greenhouse effect is one of the main reasons HABs are thriving at a fast rate. Conducive temperature is required for certain cyanobacteria to thrive both in and out of water. The exceedingly high temperatures experienced due to global warming have led to rapid decomposition of nutrients such as nitrates and ammonia, which are easier forms for cyanobacteria to use up and grow in quantity. Higher temperatures and warm water give cyanobacteria a competitive advantage over other benign algae. As blooms grow thicker, the dark surfaces of the

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algae mats absorb more sunlight, which leads to warmer water and more HAB growth. Similarly, slow-moving or stagnant water can cause low turbidity, allowing suspended particles to settle out of the water column. When turbidity is low, more light can penetrate the water column, creating optimal conditions for algal growth. Moreover, static water can also become thermally stratified, meaning that a layer of warm water, which favors cyanobacterial and algal blooms, floats on top of cooler water. In return, growing algae creates a turbid environment that contributes to decreased water flow.

3. Climate change

Climate change is both increasing the frequency and duration of droughts in many parts of the country and intensifying extreme storms. Periods of drought interspersed with strong precipitation increase runoff from agricultural lands, lawns, and other sources, leading to higher nitrogen levels in rivers and, therefore, HABs. Burning fossil fuels, deforestation, and land development are increasing the amount of carbon dioxide in the atmosphere. This fuels HABs because cyanobacteria can feed on the carbon dioxide not only present at the surface of a water body but also dissolved in the water. When algae die and sink to the bottom of a freshwater body, they decompose and release once sequestered carbon, providing more fuel for cyanobacteria growth. Climate change and more severe droughts also modify the flow regime in freshwater bodies and can increase competition for ever-scarcer freshwater supplies. Reduced flows in waterways mean the remaining water will be warmer and more stagnant, creating conditions ripe for algal blooms.

Effects of HABs on Aquatic Ecosystems

1. Endangerment to Human Health

People can be exposed to HAB toxins by swallowing or swimming in affected waters, eating poisoned fish or shellfish (even when food is cooked, algal toxins remain), or inhaling airborne droplets of affected water. Depending on the level of exposure and the type of algal toxin, health consequences may range from mild to severe to fatal. HABs produce toxins that reduce the suitability of water for human consumption. People often get sick by eating shellfish containing cyanotoxins. Their large presence in the water and their well propagating sequences lead to quick contamination of water, thus posing a health hazard to humans. Strong irritation, itching, and even skin diseases are experienced when such contaminated water encounters the human skin. Some cyanotoxins are known to cause acute illness in humans, such as allergic reactions, gastrointestinal upset, eye irritation, respiratory distress and flu like symptoms. Long-term effects after ingesting cyanotoxins include liver cirrhosis, neurogenerative diseases, etc. Pets and wildlife are also susceptible to cyanotoxins. Freshwater blooms have not only shut down local water sources but have also been blamed for the death of dogs that had been swimming in them.

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2. Death of Aquatic Life and disturbance in Food Chain

For any living organism to survive, they need oxygen for respiration. Fishes and other aquatic life depend on the oxygen dissolved in water. HABs consume oxygen and block sunlight from underwater plants. HABs can deplete oxygen in water and lead to low dissolved oxygen levels. When masses of algae die and decompose, the decaying process can deplete oxygen in the water, causing the water to become low in oxygen and when oxygen levels become too low, fish suffocate and die. More death of aquatic animals means more food for the algae, leading to faster propagation and, in the end, deterioration of aquatic life. Toxins produced by HABs are detrimental to fish and other animals. These toxins can be transferred through the food web, affecting and even killing the higher forms of life, such as zooplankton, shellfish, fish, birds and larger animals like sea lions, turtles, and dolphins. Even if algal blooms are not toxic, they can negatively impact aquatic life by blocking out sunlight and clogging fish gills. In 2015, a bloom of various dinoflagellates off the coast of South Africa led to low-oxygen conditions, known as eutrophication, killing 200 tons of rock lobster.

3. Strain on Industries and Economies

The presence of HABs makes transport on waterways cumbersome, leading to more expensive means of transport, such as air, resulting in economic losses. Since HABs lead to the death of aquatic life, there can be widespread losses to fishermen who depend on fishing as an income-generating activity. HABs badly affect fishing and shellfish industries, killing fish and contaminating shellfish. Annual losses to these industries from nutrient pollution are estimated to be in the tens of millions of dollars. Besides, some industries, for example, food-processing companies, only require clean water from water bodies to drive their production. This means that the presence of HABs will cause additional water treatment costs to get clean water, leading to increased overhead costs.

4. Losses in the Tourism Industry

With the dense growth of algal blooms on natural recreational water surfaces, the tourism industry suffers greatly as the resulting foul smell and dead zones mean there are no fishes to watch, no available ways to navigate the water, and no swimming or boating activities.

5. High Water Utility Bill for Domestic Consumers

With HABs contamination or not, people still need water for consumption. The municipality will have to invest in water treatment processes that eliminate the toxins caused by algal blooms. In some cases, extensive growth of algal blooms may lead to scarcity of fresh drinking water if the town or community depends on the contaminated source as the only one for distributing consumption water. All these increase the costs of treatment and the demand for water, which eventually dramatically raises the water utility bills for domestic consumers.

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Solutions to mitigate HABs

1. Proper Sewage Treatment

To decrease the amount of nitrogen and phosphorus in water, sewage water must be treated according to the standard waste treatment procedure. Implementing disinfection and tertiary treatment is important to mitigate the introduction of excessive nutrients into rivers, lakes, oceans, and streams. This involves the removal of nitrogen and phosphorus components through processes such as nitrification, followed by the appropriate treatment of resulting sludge. Also, effective water treatment procedures guarantee that people drink clean water and protect aquatic life.

2. Reduction of Pollution and Water Wastage on a Personal Level

In order to attain the global objectives of environmental conservation with a focus on reducing pollution, it is imperative to initiate individual efforts aimed at minimizing waste generation, promoting recycling practices, and embracing the concept of reusing resources as a means to preserve the natural environment. When individuals engage in this behavior at their residences, workplaces, or educational institutions, it has the potential to contribute to the reduction of the collective nutrient burden in water bodies, hence facilitating the water treatment process.

3. Better farming practices

Farmers use fertilizers to increase crop yields by supplementing deficient nutrients. Farmers are advised to consult with agricultural experts regarding the type and amount of fertilizer to use. Employing the most desirable practices and applying the proper quantities of fertilizers can ensure both optimal crop growth and a balanced level of soil toxicity or nutrient concentration. It would mean that only small quantities of chemicals are dispersed into waterways upon the onset of rain, thereby reducing the incidence of algal bloom. Do not apply fertilizer before gusty, rainy days or near waterways.

4. Green infrastructure

As mentioned above, it's not just farms that produce tainted runoff. Every year, gallons of untreated stormwater wash off paved surfaces into waterways. This runoff can contain high levels of nutrients and inorganic pollutants that can trigger HABs. The solution is to use greener infrastructure in cities. Adding green roofs, planting trees, and building gardens of rain absorbing plants all capture rainwater before it flows into waterways.

5. Ultrasound Bloom Treatment

This technology utilizes ultrasonic sound vibrations in water bodies to detect algal blooms and if found, to control their growth by up to 90 percent. This treatment monitors vast bodies of water and can determine whether algal blooms pose a threat based on the prevailing conditions. These waves are sent across the surface of water bodies to counter their buoyancy, causing them to descend and inhibiting photosynthesis. The absence of light inevitably leads to the demise of HABs.

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6. Smart water policies and conservation

Smart water management practices, which comprise planning, developing, distributing and managing the use of water resources using an array of technologies, should be designed for better monitoring and more reasonable and sustainable usage of water resources. Government agencies, local communities, and businesses should develop practical strategies for reducing excessive nutrients and pollutants from water bodies while providing alternative, sustainable water supplies for growing populations and economies.

7. Monitoring, mitigation, and collaboration

Improved monitoring and increased research into HABs are also much needed. There is no nationwide system for collecting data on and responding to HABs, and the type of information available on HABs in individual states varies greatly. Improved methods of communication to the public, across organizations, and among states could speed up emergency response to HABs, reducing harm to the environment, wildlife, and people. Knowing where HABs are occurring and whether the government is responding is a critical first step to keeping our waterways, ecosystems and population safe.

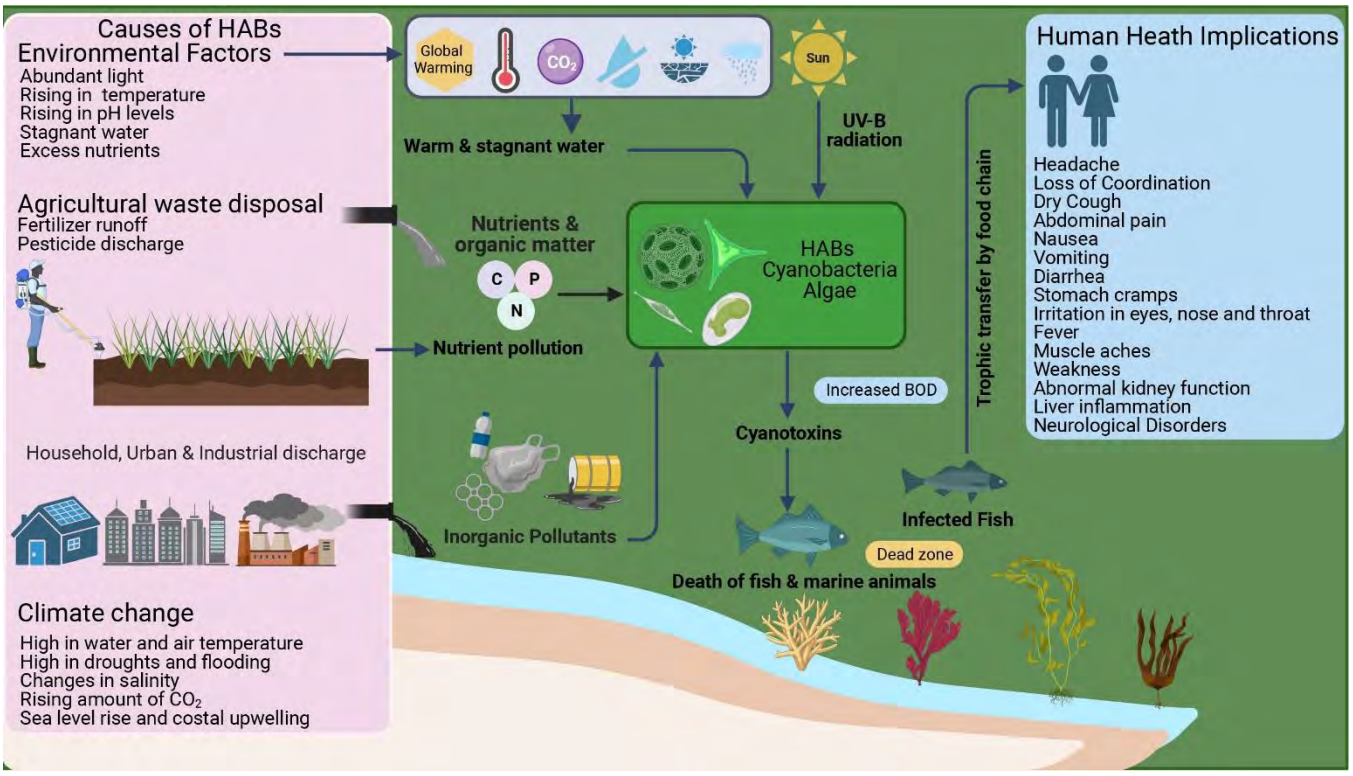

Figure: Overview of causes of HABs, ecological impacts on aquatic systems and associated human health implications.

References

Singh, A. and Babele, P.K., 2020. Dynamics of harmful cyanobacterial blooms and their toxins: environmental and human health perspectives and management strategies. In Advances in Cyanobacterial Biology (301-317). Academic Press.

Cressey, D., 2017. Climate change is making algal blooms worse. Nature.

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Published: 9.10.2023

Carmichael, W.W. and Boyer, G.L., 2016. Health impacts from cyanobacteria harmful algae blooms: Implications for the North American Great Lakes. Harmful algae, 54, 194-212.

Hallegraeff, G.M., Anderson, D.M., Belin, C., Bottein, M.Y.D., Bresnan, E., Chinain, M., Enevoldsen, H., Iwataki, M., Karlson, B., McKenzie, C.H. and Sunesen, I., 2021. Perceived global increase in algal blooms is attributable to intensified monitoring and emerging bloom impacts. Communications Earth & Environment, 2(1), p.117.

Griffith, A.W. and Gobler, C.J., 2020. Harmful algal blooms: A climate change co-stressor in marine and freshwater ecosystems. Harmful Algae, 91, p.101590.

Chislock, M.F., Doster, E., Zitomer, R.A. and Wilson, A.E., 2013. Eutrophication: causes, consequences, and controls in aquatic ecosystems. Nature Education Knowledge, 4(4), p.10.

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Popular Article

Enhancing the durability of wood using heat treatment

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Heat treatment is an effective method to improve the durability of wood against biodegradation as well as dimensional stability. Heat treatment of wood at different temperatures is targeted to improve the dimensional stability, hygroscopic properties and biological resistance of wood by modifying the chemistry of its cell components. These chemical changes can be expressed as increased dimensional stability, decreased hygroscopicity and ultimately increased durability of the wood.

Wood is a sustainable, renewable, aesthetical, technologically diverse and energy-efficient raw material for indoor and outdoor applications due to its multiple uses and unique properties. It has been the versatile and valuable material for many decades and is therefore considered as one of the best renewable constructional materials. As an easily accessible natural substance, wood has diverse applications in different fields due to its excellent characteristics, such as texture, colour, density, good strength to weight ratio and aesthetic appearance. Anatomically, wood is secondary xylem whereas, chemically it is composed of cellulose, hemicelluloses, lignin and extractives like; resins, fats, waxes, terpenes *etc*. Among these, two major chemical components *viz.,* lignin (18-35%) and carbohydrates (65-75%) are complex polymeric materials and are present mostly in the form of organic extractives and inorganic substances (ash). Each of these components has an impact on ultimate strength properties of wood. Hence, the fitness and ability of wood to resist the applied and external forces such as tension, compression, bending, shear, cleavage *etc*. are governed by both chemical as well as physical properties of wood.

Due to rise in human population, the pressure on high quality timber forests has also increased. This ultimately has resulted in unavailability of quality and durable timber from the forests. Hence, one way to neutralize this pressure on the forests is to modify the other non-durable wood species having undesirable properties like hygroscopicity, anisotropy, dimensional instability and biodegradability. Wood modification could be either active modification (change in chemical nature

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of wood) or passive modification (change without affecting chemical parameters which includes use of wood preservatives). Although, use of preservatives is an effective chemical treatment and extends the service life of wood but is hazardous to environment and involves high cost. Therefore, as a solution to these problems, many advance technologies have been evolved to improve the durability of wood without causing ecological hazards, and among these one of the methods is heat treatment, also known as thermal modification of wood.

This involves treatment of wood at high temperature in the absence of oxygen that affects the wood properties by modifying their constituents and altering the chemical composition of wood cells by decomposing their cell wall components (chiefly hemicelluloses and cellulose) and extractives so as to improve the quality, increase in durability, enhancement of dimensional stability and decrease in hygroscopicity as well as equilibrium moisture content of wood Research on heat-treated wood has contributed significantly for improving wood properties in various countries, for several decades. The improved characteristics of heat-treated timber offer the furniture industries new scopes and opportunities, because of its good weather and decay resistance and therefore, the modified timber can be put into its worth market value. Heat-treated wood has a promising market in applications like; panelling, home interiors and decors, garden and kitchen furnishing, ceilings, doors and windows, musical instruments *etc.* The method of heat treatment of wood is considered very effective so as to produce sustainable building material having less toxicity as all the improvements in wood properties are achieved only by heat treating the wood at different temperatures without adding any chemical. Hence, thermally modified wood has also been designed as an ecological alternative material to impregnated wood. Heat-treated wood has been commercialized and produced on a large scale during the last decade. Finland currently has the highest production of thermally modified wood.

Thermally modified wood is, therefore, applicable for higher value end-uses such as surfacing, flooring, making windows and doors, musical instruments, boats, and other general outdoor uses. Many tree species that have no commercial value can be used for specific purposes and put into the better utilization by using heat treatment.

Within the last several years five different types of heat treatments have gained industrial significance. Some of the products developed by thermal treatment include thermowood in Finland, ratification process and bois perdure in France, oil-heat treatment in Germany and plato-wood in The Netherlands. The temperature and duration for heat treatment generally vary from 180 to 280 ºC and 15 min to 24 h depending on the heat treatment process, wood species, sample size, moisture content of the sample, and the desired mechanical properties, resistance to biological attack, and dimensional stability of the final product. Temperature has a greater influence than time on many properties. Treatment at lower temperatures for longer periods, however, does not give similar results compared to treatments at higher temperatures.

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The Sweet Delight: Exploring the Irresistible World of Gummy Candies

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In the vast and colourful universe of candies, there is a type that stands out for its unique texture, mouth-watering flavours, vibrant colour, appealing shapes and endless variety – Gummy candies. When it comes to sweet treats that evoke nostalgia and bring joy to both young and old, gummy candies take the lead. Enjoyed by people of all ages, these chewy treats have captured the heart and taste buds of candy enthusiast around the globe. From playful gummy bears to tangy gummy worms, these versatile confections have a fascinating history and continue to reign as one of the most loved treats. Let's delve into the enticing world of gummy candies and discover why they hold such universal appeal.

A Chewy Journey

The origin of gummy candies can be traced back to early 20th century in Germany. In the 1920s, inspired by the texture of Turkish delight, a confectioner named Hans Riegel Sr. from Bonn, Germany, created the first gummy bear and eventually gave a mass market appeal to the fruit based gummy with gelatine as the main ingredient. The chewy, gelatin- based candy was an instant hit, and in 1922, Riegel founded a company called Haribo. Haribo's gummybear, the iconic gummy bears, quickly gained popularity and since then gummy candies have evolved into global phenomenon encompassing a vast array of shapes and sizes with countless variations and flavours to suit every palate. These delightful treats are made using a combination of gelatin or pectin, corn syrup and various flavourings and colourings.

Endless Variety

One of the reasons for enduring popularity of gummy candies is the broad range of shapes, sizes and flavours they come in. From classic gummy bear to worms, andbottles to more imaginative creations like fruits, dinosaurs and even emojis, gummy candy never fail to spark joy and curiosity.

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The vibrant hues and playful shapes of gummy candy make it visually appealing, while the burst of flavours, including, fruity, sour and tangy variations, provide a tantalizing taste experience. The flavours of gummy candy span a wide spectrum, from basic flavours like strawberry and orange to exotic tastes such as passionfruit and mango, these cater to all taste preferences. With each bite, gumm candy embarks on a taste adventure, exploring a multitude of flavour combination.

A Feast for the Senses

What sets gummy apart is its unique texture. The soft and chewy consistency offers a satisfying mouthfeel that appeal to many candy lovers. Unlike hard candies that require immediate crunching or chocolates that melt away, gummy candies provide a longer-lasting chewing experience, allowing the flavours to slowly unfold and linger on the palate. Their delightful texture combines with different flavours, creating a sensory symphony that keeps people coming back for more.

Gummy Candies for all Occasions

The most remarkable aspects of gummy candies are their universal fascination across generations. From children who are attracted by their bright colours and playful shapes to adults who savour their nostalgia and indulge in their favourite childhood treats, gummy candies have a way of bringing joy to people of all ages. They are equally at home as a quick snack, pick me up during a work break or as a delectable addition to a party or festive celebration. The versatility and accessibility of gummy candies make them a perennial favourite treat.

Healthier Alternative

While gummy candies are undeniably delicious, it's essential to consume them in moderation due to their high sugar content. As consumers are becoming more health- conscious, the demand for healthier candy option has prompted the development of gummy candies with reduced sugar content, natural fruit flavours and other organic ingredients. Some manufacturers have even embraced vegetarian and vegan alternatives, replacing gelatin with plant- based substitutes like agar or pectin. These adaptations allow individuals with dietary restrictions or ethical preferences to still the chewy delight of gummy candies.

Gourmet Gummies

Gummies have transcended their traditional form and have their way into various culinary creations. Chefs and home cooks have embraced the versatility of gummies, incorporating them into desserts, cocktails and even savoury dishes. From gummy- infused ice cream to cocktails adorned with gummy garnishes, they have become a canvas for culinary creativity, adding a fanciful touch to the culinary world. This adaptability has broadened the horizons of gummies, firmly establishing their importance beyond the confines of candy aisle.

Functional gummies

The versatility of gummies extends beyond mere indulgence. With an increasing focus on

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health wellness, gummies have a popular vehicle for delivering functional benefits. Gummies provide a convenient and enjoyable way to incorporate essential nutrients and supplements into daily routines, ranging from vitamins and supplements to probiotics and herbal extracts. The chewy texture and irresistible flavours make taking vitamins and supplements a more pleasant experience, especially for those who struggle with traditional pill forms.

Nutritional Supplements:

Nutritional supplements are a booming market, with people increasingly recognizing the importance of supporting their well-being with additional nutrients. Manufacturers have cleverly combined this growing demand with the nostalgic appeal of gummy candies, creating a unique product that satisfies both taste buds and nutritional needs.

1. Nutrient Fortification: Gummy treats have evolved beyond being mere sources of sugary delight. Many gummy products are now fortified with essential vitamins and minerals, making them a convenient and enjoyable way to supplement our nutrient intake. Gummies can be found enriched with nutrients such as vitamin C, vitamin D, calcium, omega-3 fatty acids, and more. These fortifications offer a simple solution for those who struggle to meet their daily nutritional requirements, especially for individuals with specific dietary needs or preferences.
2. Digestive Aid: Some gummy treats, particularly those containing gelatin, can support digestive health. Gelatin is derived from animal collagen and is known to help strengthen the gut lining, promoting healthy digestion. It can aid in improving gut integrity, reducing intestinal inflammation, and supporting the overall balance of the digestive system. Additionally, the soft and chewy texture of gummies can stimulate saliva production, which plays a crucial role in the initial stages of digestion.
3. Collagen Boost: Collagen, a vital protein in our bodies, is responsible for maintaining the health and elasticity of our skin, hair, nails, and joints. Certain gummy products have started incorporating collagen as an ingredient, offering a convenient way to support collagen production and promote skin elasticity. Regular consumption of collagen gummies may contribute to the reduction of wrinkles and fine lines, improved skin hydration, and stronger hair and nails.
4. Stress Relief: Believe it or not, gummy treats can also provide a sense of stress relief. The act of chewing gummies can help release tension and provide a momentary distraction from daily stressors. Additionally, some gummies contain ingredients such as L-theanine, chamomile, or other calming herbs that have been linked to relaxation and stress reduction. However, it's important to note that moderation is key, as excessive consumption of sugary gummies may have adverse effects on overall well-being.
5. Cognitive Support: Certain gummy products are formulated with brain-boosting ingredients to support cognitive function. These may include nutrients like omega-3 fatty acids, B vitamins, or herbal extracts known for their cognitive-enhancing properties. While the effects may vary, incorporating

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these gummies into a balanced diet and healthy lifestyle may potentially contribute to improved memory, focus, and overall brain health.

Creative Confections

The gummy goes beyond the realm of candy and culinary delights. They have inspired a wave of imaginative creations that blend gummies with other confections. Gummy filled with chocolates. Gummy filled with cookies and gummy studded cakes are just a few examples of imaginative combinations that have emerged. They have also found their place in education and novelty items. Educational gummies shaped like letters, numbers, and animals can make learning more engaging for young children.

Conclusion

Gummy candies have become an integral part of the confectionery landscape, being confections to potentially offering surprising health benefits. From nutrient fortification to digestive support, collagen enhancement to stress relief and cognitive support, gummy treats have diversified their roles in promoting overall well-being. However, it's important to remember that not all these treats are created equally; reading labels, choosing high quality products and consuming them in moderation are crucial factors for reaping their potential benefits. So, the next time you reach for a gummy treat, you can savour not only its delicious taste but also the boost it may provide for your health.

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Review Article

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Biological Control of Parasites In Livestock : An Update

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Parasites are a major cause of diseases in livestock, man and crops, leading to poor yield and great economic loss Livestock parasites account for **13%** of livestock mortality leading to reduction in productivity, degrading its quality and quantity, hampering reproduction and after all food insecurity (Santos & Rebello, 2022). It has been estimated that about **$93.1** million is lost due to parasite infestation in sake of treatment costs and production. But still we are aiming to control this kind of parasites mainly through three processes: a) Mechanical b) Chemical and c) Biological method. Mechanical method mainly means removal of parasite population manually which is next to impossible and impractical. Chemical methods had already been in use for ages. Over 200 classes of chemical compounds are currently in use for the treatment of livestock parasites but now-a-days there are some limitations in chemical control eg- there is high resistance rising in drugs, some drugs are posing threat to the environment, some drugs are even acting on the non-target organisms, some are lasting long in animal products leading to health issue in human population. In context to that biological control method has been found to be a successful and sustainable method in controlling pest which has also been included in the Integrated Parasite Management strategies. Biological control methods have included human manipulation or labouratories manipulated procedures where one group of living organisms will be used to suppress the target organisms. The organism that suppresses the pest population is generally referred to as a biological control agent (BCA). DeBach, 1964 stated that the action of parasites, predators and pathogens in maintaining another organism's population density at a longer average than would occur in their absence or Alston, 2011 stated that "any activity of one species that reduces the adverse effect of another".

History:

In 1701, Van Leeuwenhoek was probably the first to describe insect parasitism, which he illustrated in his publication. In 1870, Charles V. Riley was the first person to conduct the successful movement of parasitoids for biological control and therefore he is considered as the "Father of Modern Biological Control".

Biological/ Bio- control Agents:

- **Pathogens:** Viruses, Bacteria, Fungi, Protozoa, Rickettsiae, Nematodes
- **Parasites:** Parasitoids
- **Predators:** Vertebrate, Invertebrate

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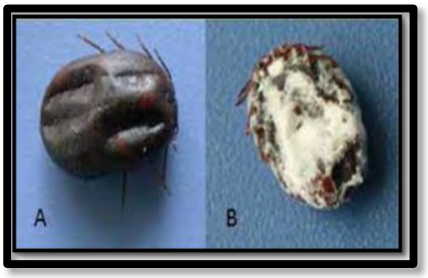
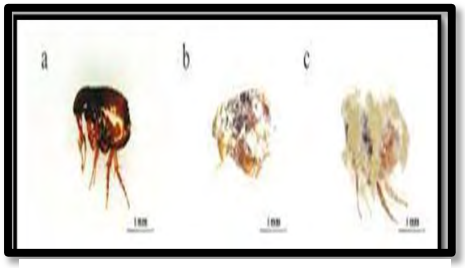


***Boophilus* spp.**



Dog flea

Examples: *Metarhizium anisopliae* and *Beauveria bassiana* are effective in the control of ***Culex pepiens*** and ***Rhiphicephalus sanguineus*** where the fungal spores can be applied in outdoor attracting odour traps, on indoor house surfaces and on cotton pieces hanging from ceilings, bed nets and curtains to control adult mosquitoes.

Fungi that infect and kill nematodes (worms) are referred to as nematopathogenic fungi. Over 150 species of fungi are known to invade nematodes which can be grouped into three: Nematode-trapping fungi, Endoparasitic fungi and root-knot nematodes. Most nematopathogenic fungi of veterinary importance fall in the group of **nematode trapping fungi.** They use **constricting (non-adhesive) or non-constricting (adhesive) rings**, sticky hyphae, sticky knobs, sticky branches to trap and kill nematodes by penetration and growth of hyphal elements within the host.

Examples: ***Arthrobotrys musiformis*** has been found to be effective against *Haemonchus contortus* infective larvae (Trichostronylidae) through its predatory activity and its fungal culture filtrates. (Pérez-Anzúrez *et al.,* 2022). ***Monacrosporium thaumasium*** has also shown promising results in reduction of *Cooperia punctata*, *Oesophagostomum* sp., *Trichostrongylus* sp. and *Bunostomum* sp. (Araujo *et al.,* 2004). ***Duddingtonia flagrans*** is found to be an effective feed additives can reduce number of parasitic nematodes on pasture to the benefit of grazing animals when used at the recommended application rate (Bampidis *et al.,* 2020).

Fig: *Arthrobotrys musiformis* trapping *Haemonchus contortus* infective larvae

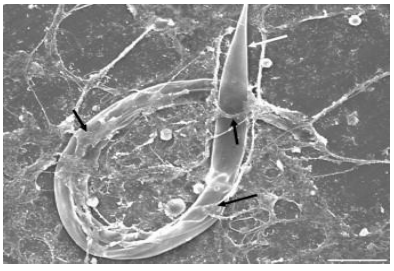


Fig: *Monacrosporium thaumasium* trapping GI nematodes

Fig: *Duddingtonia flagrans* trapping worms

Bacteria:

The most important entomopathogenic bacteria belong to the genus ***Bacillus*** of which ***B. thuringiensis*** (Bt) is the most widely used agent in the biological control of insects. Within Bt, there are a number of serovars (including *israelensis, jega thesan, darmstadiensis, kyushensis, medellin, fukuokaensis, higo*), each containing proteins with parasicidal activity and ***Bt* ser. *israelensis*** (Bti) was the first to be found toxic against **dipteran larvae.**

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Examples: ***B. sphaericus*** is effective in killing larvae of *Culex* spp., *Anopheles* spp and certain species of sand fly (vector for *Leishmania* spp.), ***Paenibacillus glabratella***, a recently discovered biocontrol agent showed positive results in controlling snails. ***Streptomyces avermitilis*****,** produces toxins collectively called "avermectins" which are highly effective against classes Insecta, Arachnida and Nematodes.

An updated list of Bt genes encoding proteins with demonstrated anti-dipteran activity encompasses cry1, cry2, cry4, cry10, cry11, cry19, cry20, cry24, cry27, cry30, cry39, cry44, cry47, cry50, cry54, cry56. Several products of *Bacillus thuringiensis* are available in the market- **Dipel 2x** (*B. thuringiensis* var *kurstaki*), **VectoBac** (*B. thuringiensis* var. *israeliensis*) and **HD 703** (*B. thuringiensis* var *thuringiensis*) (Valtierra-de-Luis *et al.,* 2020)

Viruses and virus-like particles:

Viruses belonging to the families **Entomopoxviridae, Reoviridae and Baculoviridae** have shown successful result in controlling pest population of which **Baculovirus** is the most widely exploited virus group for biocontrol. At present, there are approximately **16 biopesticides** based on baculoviruses available for use or are under development.VLPs are self-assembled with viral protein and devoid of genetic material, making them non- infectious and safe to use.

Protozoa:

Some protozoa such as *Haemogregarina, Babesia* and *Theileria* are pathogenic to some arthropods like ticks. Predatory soil amoeba *Theratromyxa weberi* is capable of ingesting nematodes

Nematodes:

Nematodes belonging to the genera ***Steinernema*** and ***Heterorhabditis*** have been proven as effective BCAs to control insect pests like houseflies, fleas and other non-biting flies.

Others:

Rickettsia, a diverse group of bacteria, mostly transmitted by arthropods such as ticks, fleas and so on. During their stay, rickettsial organisms lead to alterations in tick behavior, interfere with their development and cause pathological changes in salivary glands and ovarian tissues leading to their death.

Earthworm consume a large volume of soil along with animal faeces containing nematodes present in the soil and faeces which acts as a dominating role in removal of cattle dung from pastures, reducing infective larvae of trichostrongyle nematodes on the pasture.

Predators: feeds on other animal (i.e., prey) for their development, sustenance, and reproduction and generally larger than their prey.

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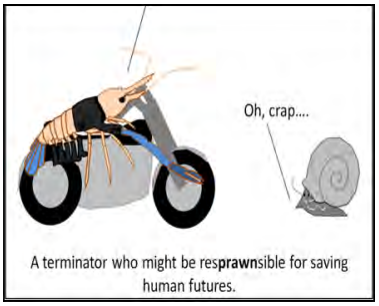
Invertebrates:



Spiders: Spiders trap their prey by making typical web and sometimes they will use larva silk to make "capture nets" and are capable of consuming *Ascaris* ova in the soil. River prawns have been observed to prey on snails.

Mites: Some mites are nematode predators, for example, *Phytoseiid* spp. are capable of consuming *Ascaris* ova in the soil. They are also voracious predators of eggs and larvae of houseflies and other flies that develop in manure and faeces of livestock. ***Macrocheles muscae domesticae*** can eat up to 10 housefly eggs per day.

Macrocheles muscae domesticae

Flies: Predatory fly, ***Hydrotaea (Ophyra) aenescens***, presents a breakthrough in the indoor control of the housefly, *Musca domestica*. Small flies such as ***Mutilla glossinae*** are promising BCAs against the tsetse fly.

Hydrotaea aenescens

Insect herbivores: Insect herbivores like the cell-content feeder ***Liothrips ludwigi*** (Thysanoptera), the stem borers ***Merocnemus binotatus*** (Boheman) and ***Tyloderma* spp**. have shown promising results in the control of weeds. ***Scolothrips sexmaculatus*** prefers spider mite eggs but adult females will consume various mites of animals.

Solenopsis spp

Ants: Around 27 species of ants from 16 genera mainly *Aphaenogaster, Iridomyrmex, Monomorium, Pheidol* , *Solenopsis* etc. are known to prey on ticks, horn flies and different other pests. Application of the fire ant, ***Solenopsis*** spp.in the USA markedly reduced the population of ticks, *Ixodes* spp. transmitting anaplasmosis in cattle.

Dragonflies and water bugs: They are known to feed on mosquitoes larva, thus acting a promising agent in malaria control.

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Beetles: Dung beetles of the family Scarabaeidae are useful in the control of pasture livestock flies since they breed primarily in cow pats. ***Onthophagus ganelle*** and ***Euniticellus intermedius*** when introduced from Africa to Australia, showed reduction of ***Musca*** spp. upto 80–100% and the buffalo fly ***Haematobia exigua*** by 95%. It can also play a role in the biocontrol of bovine gastrointestinal nematodes (Trichostrongylidae).

Dung beetles

Vertebrates:

Amphibians and fishes:

Water tortoise ***Pelomedusa subrufa*** has been reported to be able to remove ticks from black rhinos. Edible fishes such as ***Gambusia affinis, Guppy poecilia*** and carp fishes have tremendous potential as a larvivorous predator of mosquito and showed 98% reduction in the larval density of ***Anopheles*** spp. when introduced into water wells. ***Cyprinus carpio, Aplocheilus blocki, Tilapia spp, Catla catla, Labeo rohita*** and ***Cirrhinus mrigala*** have also shown promise in the control of mosquitoes.

A study showed that ***Gambusia affinis*** preferred live larvae than commercial food and consumes about **100- 150** larvae per fish per day. They prefer **live larvae over dead larval** stuff and prefers to eat larva in the **presence of light.** (Noreen *et al.,* 2017)

Reptilians: Australian gecko ***Gehydra dubia*** and the exotic Asian house gecko ***Hemidactylus frenatus*** have been observed to prey on mosquitoes and is therefore a promising tool for the biocontrol of malaria.

Avian and domestic fowls: Birds are natural predators of insects. Some bird species are known to pick off ticks from the host during flight or collect them from the ground and also eat the larvae of dung flies. Domestic fowls and birds are good predators of snails i.e., intermediate host of trematodes.

Parasites (parasitoids):

It is an organism that lives in close association with its host which sooner or later kills the host and is stenoxenous. The parasiotid wasp**, *Ixodiphagus hookeri*** (Hymenoptera) is the natural enemy of a many hard and soft tick species but shows promising result in control of the American dog tick ***Dermacentor variabilis (***Buczek *et al*., 2021). Braconid wasps have shown control over caterpillars other insects including greenfly.

Fig: ***Ixodiphagus hookeri*** in close association with American dog tick ***Dermacentor variabilis.***

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Rearing Systems for Biocontrol Agents:

1) Natural rearing systems: It uses the natural or target prey for production of the parasitoids and predators.

2) Systems using factitious prey: Organism that is unlikely to be attacked by a natural enemy in its natural habitat, but that supports its development and/or reproduction. They donot occur in natural habitat but can sustain in laboratory condition.It is easier and less expensive to rear. Examples: Storage mites for predatory mites (Phytoseiidae, Laelapidae), Eggs of lepidopterans for insect predators, etc.

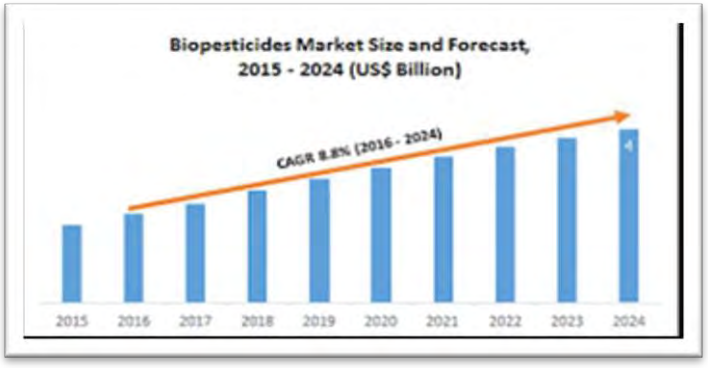
3) Artificial rearing systems: It uses artificial foods and preferably no plant materials. It may be tissues, haemolymph, protein, amino acids, cells etc.

IDEAL LOCATIONS FOR BIO-CONTROL UNITS:

- Care should be taken to set up biocontrol production units in areas which have **appropriate climatic conditions.**
- Location of biocontrol **production units** and **consumer market** (farming areas) should be close to each other
- Care should be taken so that the surrounding farming areas should not get any harmful effects from the biocontrol units.
- **Air pollution** can damage biocontrol agents, the production unit should be located away from industrial and urban areas

Present Status of BCA:

- The global market of bio agents is expected to reach $4 billion by 2024 from $2 billion in 2016, growing an increase with 8.8% from 2016 to 2024. The USA accounts for 40% of the global bio pesticide followed by Europe (20%) and Oceania (20%).
- In India, biopesticides industry shows a growth rate of 20.2 % since 2010 -2020.



At present there are total **361 biocontrol laboratories/un**its in India of which **141** are under the private sector laboratories, **98** nos. are under state biocontrol laboratories, **49** nos. are under ICAR/SAUs/DBT laboratories, **38** nos. are under private sector getting grant from Government of India., **35** nos. under Central

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Integrated Pest Management Centers (CIPMC). In **2022,** India has made its first announcement on 7th National Conference on Biological Control from **5-7** August in Bengaluru.

Approaches to Biocontrol:

1) **Importation:** It involves introduction, screening and release of natural enemies to permanently establish effective natural enemies in a new area which will target the native pest to control.

2) **Augmentation:** It typically involves the purchase and release of natural enemies that are already present in an area but not in quantity, enough to adequately keep in check the pest population in a particular location.

3) **Conservation:** This includes avoidance of measures that destroy natural enemies and the use of measures that increase their longevity and reproduction in an environment.

Challenges:

- If a BCA attack any native non-target species, its persistence and ability to spread to areas far from the site of release become a serious liability.
- Non-native BCA can carry non-native parasites and commensal species.
- BCA are easily influenced by environmental factors such as temperature, humidity and oxygen extremes, which determine the success of the biological control strategy.
- Distribution of BCAs product, especially those containing living organisms are not easy.
- Most industries producing BCA products are often situated a considerable distance away from where the BCA is to be used.
- There is no information available on the economic viability of those strategies; biological products must have competitive costs relative to chemicals to allow their use by farmers.
- Lukewarm attitude among who find it difficult to forego their fast-acting chemical pesticides over the sluggish BCA.

Conclusion

- Biological control approaches hold promise as the most suitable alternative to the chemical pesticides and are now a core component of IPM (Integrated Parasite Management).
- A good number of promising BCAs including predators, parasites (parasitoids) and patho- gens (fungi, bacteria, viruses and virus-like particles, protozoa and nematodes) have been identified and proven to be efficacious against many parasites of medical, veterinary and agri- cultural importance
- With the recent advances in biotechnology and the application of most recent technologies such as nanotechnology and microencapsulation, there are many opportunities for the continued use and expanded role of natural enemies in biological control.
- Newer BCAs are being identified and older ones are being genetically engineered to make them more efficacious in their antagonism of parasites.
- In the future, biological control will develop to overcome many of the challenges, and BCAs will become the mainstay for the control of parasites

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References:

1) Araújo, J. V. de, Guimarães, M. P., Campos, A. K., Sá, N. C. de, Sarti, P. & Assis, R. C. L. (2004). Control of bovine gastrointestinal nematode parasites using pellets of the nematode-trapping fungus *Monacrosporium thaumasium. Ciência Rural,* **34**(2), 457–463. DOI:10.1590/s0103-84782004000200019.

2) Bampidis, V., Azimonti, G., Bastos, M. L., Christensen, H., Dusemund, B., Durjava, M. K., Kouba, M., Puente, S. L., Marcon, F., Pechov, A., Petkova, M., Sanz,Y., Villa, R. E., Woutersen, R., Chesson, A., Brozzi, R. & Maria-Saarela, M. (2020) Safety and efficacy of BioWorma® (Duddingtonia flagrans) as a feed additive for all grazing animals. Scientific Opinion, **18**(7): 6208. DOI: 10.2903/j.efsa.2020.6208.

3) Buczek, A., Buczek, W., Bartosik, K., Kulisz, J. & Stanko, M. (2021) *Ixodiphagus hookeri* wasps (Hymenoptera: Encyrtidae) in two sympatric tick species *Ixodes ricinus* and *Haemaphysalis concinna* (Ixodida: Ixodidae) in the Slovak Karst (Slovakia): ecological and biological considerations. *Scientific Reports* **11**, 11310. DOI:10.1038/s41598-021-90871-7.

4) Noreen, M., Arijo, A. G., Ahmad, L., Sethar, A., Leghari, M. F., Bhutto, M B., Leghari, I. H., Memon, K. H., Shahani, S., Vistro, W. A., Sethar, G. H. & Khan, N.(2017). Biological control of mosquito larvae using edible fish. *International Journal of Innovative and Applied Research*, **5**(8): 2348 – 0319.

5) Pérez-Anzúrez, G., Olmedo-Juárez, A., von-Son de Fernex, E., Alonso-Díaz, M. Á., López-Arellano, M. E., González-Cortázar, M., Zamilpa, A., Paz-Silva, A. & Mendoza-de Gives, P. (2022). *Arthrobotrys musiformis* (Orbiliales) Kills *Haemonchus contortus* Infective Larvae (Trichostronylidae) through Its Predatory Activity and Its Fungal Culture Filtrates. *Pathogens*, **11**(10):1068. DOI: 10.3390/pathogens11101068.

6) Santos, H. L. C. & Rebello, K. M. (2022). An overview of Mucosa-Associated Protozoa: Challenges in Chemotherapy and Future Perspectives. Frontiers in Cellular and Infectious Microbiology, **12**: 860442. DOI: 10.3389/fcimb.2022.860442.

7) Valtierra-de-Luis, D., Villanueva, M., Berry, C. & Caballero, P. (2020). Potential for *Bacillus thuringiensis* and Other Bacterial Toxins as Biological Control Agents to Combat Dipteran Pests of Medical and Agronomic Importance. *Toxins*, **12**(12):773. DOI: 10.3390/toxins12120773

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Popular Article

Viral Vector: An emerging tool for gene therapy

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Abstract

The science of gene therapy has achieved huge success in the last few decades. The technique has given a new ray of hope to the patients who are suffering with lethal genetic diseases. The viral vector-based strategy of gene therapy has permitted scientists and doctors to create potent advanced therapeutic platforms. Past few years have revolutionized the field of gene therapy by the development of numerous drugs based on viral vectors that have gained regulatory approval for clinical applications. Presently, there are three major viral vector-based strategies, which are based on adeno, adeno-associated and lenti virus. However, there are certain challenges which silently limit the evolution of these approaches.

Keywords: Gene therapy; genetic diseases; viral vector

Introduction

Gene therapy is defined as a medical approach for the treatment of any genetic disease by the introduction of specific cell function-altering genetic material into a patient. There are four more popular strategies of gene therapy available: somatic cell gene therapy, germline gene therapy, In-vivo gene therapy and Ex-vivo gene therapy (5). The somatic cell gene therapy can be performed by replacement of therapeutic transgene in place of mutated gene. The changes that is being made through somatic cell gene therapy remains lifelong, but it cannot pass to forthcoming generations. However, in case of germline gene therapy, before splitting the embryo, target gene can be introduced in germ cells (sperm or egg cell), fertilized egg cell or embryo. Subsequently, the modifications made in the DNA of these cells can pass into the upcoming generations. Because of playing with live embryos, this technique has been termed as unethical. In-vivo gene therapy, includes insertion of the exogenous gene directly into defective cell. However, in case of Ex-vivo gene therapy, cells are collected from

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patients and modified in lab followed by re-introduction of altered cells inside the patients (Fig. 1). There are four basic approaches for gene therapy: gene replacement, gene editing, gene silencing and gene addition.

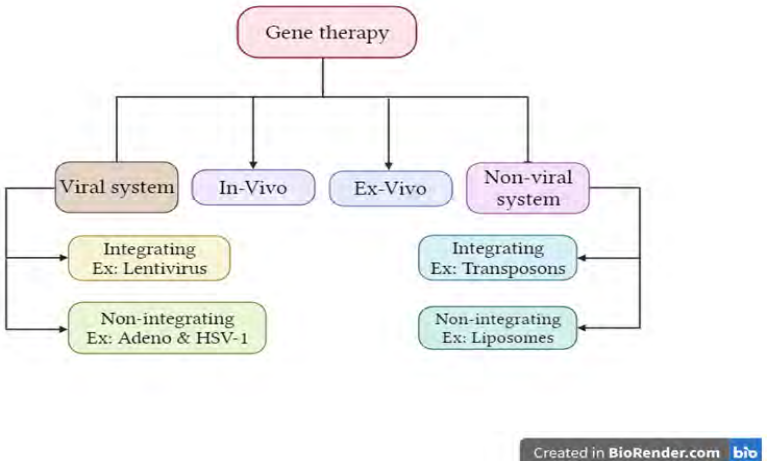

Figure 1. Overview of gene therapy strategies

History

Dr. S. Rogers has performed the first gene therapy trial, in 1973, who treated two blood relative sisters those were suffering from hyperargininaemia (4). The treatment was totally depended on his prior observations that patients with Shope papilloma virus had decreased serum arginine levels. However, before the 90s the viral vector-based gene therapy was less popular. F. Anderson has employed one clinical trial using Ex- vivo strategy for the treatment of a patient named Ashanthi DeSilva, who had adenosine deaminase deficiency-severe combined immunodeficiency disease (ADA-SCID). He has administered transformed T cells carrying recombinant retrovirus-ADA gene in that therapy. Moreover, Adeno-associated viral vector-based gene therapy has been used for the treatment of choroiderema disease during the year 2014. Therefore, so many viral vector drugs have been permitted by FDA to perform the gene therapy for various diseases.

Gene therapy vectors

The vehicle used to introduce the transgene is termed as vector. Currently, there are two types of vectors available: viral and non-viral. The utility of the vector depends on: size of the transgene, efficiency of the delivery, stability, longevity of the transgene and level of expression. These both type of vectors is again classified into two subcategories- integrating and non-integrating. Integrating vectors includes: Lenti virus, Retro virus and transposons while, non-integrating includes: Adeno virus, Adeno-associated virus, Herpes simplex virus-1, Baculo virus, liposomes and nanoparticles (3). Here, we will discuss regarding viral vectors which are most commonly used for gene therapy such as Adeno virus, Adeno-associated virus and Lenti virus-based vectors.

Adeno viral vectors

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Adeno virus is a non-enveloped, icosahedral protein capsid that accommodates a 26 to 45 kbp linear, double-stranded DNA genome and it has hairpin-like inverted terminal repeats (ITRs) that differ in length (30–369 bp). It is known to mostly cause infections of the upper respiratory tract but can also infect other organs such as the brain and bladder. It encodes ~35 proteins that are expressed in the early (E1a, E1b, E2, E3 & E4) and late phases (L1-L5) of viral gene transcription (2). Being used as a vector it has several qualities like: high transduction efficiency in both non-dividing and dividing cells; extra chromosomal persistence; vast tropism for various tissue; and large scale production system (1). So many generations of Adeno viral vectors are available based on number of genes deleted and insert size. The first-generation vector was engineered by replacement of the E1A/E1B gene with targeted transgene that can be up to 5.0 kb in length while E1/E3 double deletion freed up more space for the transgene cassettes. Due to certain drawbacks with first-generation vectors, researchers developed second generation by further deleting other early genes such as E2a, E2b, or E4. In 2003, Gendicine was approved as world's first commercialized gene therapy drug for the cancer treatment. Subsequently, ONYX-105 (dl1520) and H101(oncorine) have gained commercial approval in China during the year 2007.

Adeno-associated viral vector

Adeno-associated virus (AAV) was developed by B. Atchison in 1965 as a contaminant of Adeno virus preparations. As a depend parvovirus, AAV lacks the essential genes needed for replication and expression of its own genome. The AAV genome itself, is a single-stranded DNA that houses four known open reading frames (ORFs). The first cloned of the AAV genome into expression plasmids was done by Samulski. He found that transfer of these cloned plasmids into mammalian cells in the presence of Adeno virus could produce infectious viruses. Since the first demonstration, multiple vector designs have been reported. The first Adeno associated viral vector-based gene therapy was performed in human through delivery of cystic fibrosis transmembrane regulator gene. Till date, three AAV-based gene therapy drugs are available worldwide commercially. The first AAV-based gene therapy for the treatment of lipo-protein lipase deficiency was Glybera. It has gained regulatory approval for commercialization in 2012 (7). Subsequently, Luxturna and Zolgensma came in market during the year 2017.

Lenti viral vector

Lentivirus genus come under the *Retroviridae* family. Retroviruses are spherical, enveloped, ss-RNA viruses that are ~100 nm in diameter. It comprises of common essential core protein genes, such as gag, pol, and env. The lentiviral particle encapsidates two positive sense-strand RNAs that are bound by nucleocapsid proteins. Lentiviral vectors can integrate in genome and permit long-term gene expression. Additionally, they have a packaging space up to 9 kb. The first-generation vector contains entire viral genome within the therapeutic cassette, including the viral core, regulatory protein coding

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sequences and accessory regulatory genes. In the case of more than two plasmid based vector, the env gene is replaced by the vesicular stomatitis virus (VSV-G) glycoprotein that is separately provided by a second plasmid. To perform the large scale manufacturing of lentiviral vectors certain steps are needed such as intricate production, purification, and quality assessment. The first commercially available lenti viral vector based drug is Kymriah that can be used for the treatment of paediatric B-cell leukemia. The second chimeric T- cell based drug approved by the FDA for the treatment of refractory large B cell lymphoma is Yescarta (6).

Challenges

Currently, several types of viral vectors are available for multiple clinical and preclinical applications. However, an important challenge that it is facing remains regarding prevalence of pre-existing immunity. Additionally, this vector-based gene therapy has three major obstacles such as immunogenicity, cellular toxicity and risk of insertional mutagenesis.

Conclusions and future views

The future for viral-based vectors is extremely good and bright which has the ability to address numerous genetic diseases. In order to avoid the pre-existing immunity against adeno viral vector, several strategies can be employed such as serotype exchange or epitope masking. In addition to that, various adeno viral vector of animal importance can be used to limit cross-reactive immunity. Presently, advancement in CRISPR/Cas system and the associated pre-clinical successes has improved the potential of AAVs. Recently, evolution in the non-integrating lentiviral vectors development have greatly reduced the risk of insertional mutagenesis. To overcome the existing challenges, exploration into viral biology, as well as advanced and interdisciplinary approaches are needed.

References

1. Araujo, N.M., Rubio, I.G.S., Toneto, N.P.A., Morale, M.G. and Tamura, R.E., 2022. The use of adenoviral vectors in gene therapy and vaccine approaches. Genetics and Molecular Biology, 45.
2. Bates, E.A., Lovatt, C., Plein, A.R., Davies, J.A., Siebzehnrubl, F.A. and Parker, A.L., 2023. Engineering adenoviral vectors with improved GBM selectivity. Viruses, 15(5), p.1086.
3. Bulcha, J.T., Wang, Y., Ma, H., Tai, P.W. and Gao, G., 2021. Viral vector platforms within the gene therapy landscape. Signal transduction and targeted therapy, 6(1), p.53.
4. Grody, W.W., Kern, R.M., Klein, D., Dodson, A.E., Wissman, P.B., Barsky, S.H. and Cederbaum, S.D., 1993. Arginase deficiency manifesting delayed clinical sequelae and induction of a kidney arginase isozyme. Human genetics, 91, pp.1-5.
5. Gupta, K., Singh, S. and Garg, K.N., 2015. Gene therapy in dentistry: Tool of genetic engineering. Revisited. Archives of oral biology, 60(3), pp.439-446.
6. Kochenderfer, J.N., Feldman, S.A., Zhao, Y., Xu, H., Black, M.A., Morgan, R.A., Wilson, W.H. and Rosenberg, S.A., 2009. Construction and pre-clinical evaluation of an anti-CD19 chimeric antigen receptor. Journal of immunotherapy (Hagerstown, Md.: 1997), 32(7), p.689.
7. Yla-Herttuala, S., 2012. Endgame: glybera finally recommended for approval as the first gene therapy drug in the European union. Molecular Th

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Success Story

Shri Ram Kumar Singh: A Farmer of Natural Farming

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Introduction

Shri Ram Kumar Singh, age, 73 years, village & post office Vikrampur, Begusarai, is a well-known natural farming farmer in the Begusarai district. He decided to pursue natural farming after retiring as a reputed teacher to raise public awareness of soil health and environmental issues. To practise natural farming, he has owned three local cows and a 3-acre area of land. Besides maize and Berseem, which are planted for fodder, the pointed gourd, banana, onion, and potato vegetables are now grown by utilising natural farming techniques. Their Sources of Motivation are Bihar's Agriculture Department, KVK, Begusarai and other organisations that provide training on natural farming practices and extension activities.

Reason for adopting natural farming

Ram Kumar Singh is an educated farmer. After the retirement the teacher, he decided the natural farming for to following reasons:

- Natural farming is thought to be a profitable agricultural method with the potential to increase employment and rural development.
- Because natural farming does not utilize synthetic chemicals, there are no health risks or dangers. The food provides better health advantages because it has a higher nutritional density.
- Natural farming maximizes the quantity of "crop per drop" by using a variety of crops that support one another and cover the soil to reduce unnecessary water loss through evaporation.
- The biology of the soil, including the bacteria and other living things like earthworms, is where Natural Farming has the most direct effect. The health of the soil is largely dependent on its inhabitants.

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- Livestock integration into farming systems is crucial to natural farming and aids in ecosystem restoration. Eco-friendly bio-inputs, like Jivamrit and Beejamrit, are made from natural ingredients like cow dung and urine.
- Plant development is being aided by the changes in soil structure brought about by organic carbon, no/low tillage, and plant diversity, even in the face of harsh conditions like drought.

Technology and Innovation Adopted

For natural farming methods, he has consistently made Beejamrit, Bhanjeevamrit, Jeevamrit, Panchparni, Dashparni, Neemastra, and Brahmastra, among others. For the organic-based fertilisers, he has also created vermicompost and liquid-based dung decomposers.

Innovation developed

He has prepared microelements-based fertilizers for the nutrition of plants. For the preparation of microelements-based fertilizers, he used Besan of three different Pulses (2 kg of each), three types of Oilseeds (2 kg each), 2 kg Maize, 500 g Cu, 500g FeO, Zn, Bo, Al (250 g each), 2 kg Ashwagandha, 4 kg ripe Banana, 4 kg Bel, five types rock (each 1 kg) are ground well and mixes in 50 litres already prepared liquid decomposer. Rotate clockwise & properly mix this solution for 21 days. Filter this content after 21 days. Solution (5%) of this filtrate is used as a spray in the crop before and after the flowering. This solution can be used up to 60 days after the preparation.

Achievements of natural farming practices

Enterprises	Average change in Cost of production (%)	Average change in Yield (%)
Crops (Wheat, Paddy etc.)	(-) 12.51	(-) 20.47
Oilseeds (Mustard etc.)	(-) 17.48	(-) 10.29
Vegetables (Potato, onion etc.)	(-) 14.63	(-) 4.55
Fodder (Berseem, Maize etc.)	(-) 35.11	(+) 3.26
Milk production	(-) 35.71	(-) 4.26
Average change	**(-)19.93**	**(-)13.72**

Every cow's calved once a year with few health problems from the last three years.

Contributing Factors for the Success of the Enterprises

Mr. Singh has embraced natural farming and has thoughtfully produced several natural farming inputs. He has also taken training from Krishi Vigyan Kendra, Begusarai, and other organizations in natural farming, organic farming, and livestock husbandry.

Awards/ Recognitions Received

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Natural farming piqued Shri Ram Kumar Singh's interest. Additionally, he is raising awareness of the value of natural farming among various groups of people. As a result, Mr. Singh was honored by numerous institute bodies. Here is a list of some of the honors and accolades they have received.

- ✓ Certificate of appreciation from ATMA Begusarai
- ✓ Certificate of appreciation from Bhoosari Farms Pvt. limited
- ✓ First position for Potato in the Exhibition on Fruits, Flowers and Vegetables dated: 12-13 March 2021
- ✓ Best of India. Biz Award in the Mega Mumbai World Expo & Conference dated: 4-6 March, 2022
- ✓ C_1 certificate in Organic Farming
- ✓ Certificate of Appreciation for Organic Farming in Jal Jeevan- Hariyali Abhiyan By the Department of Agriculture, Bihar

Importance of Other Farmers

A hundred or so farmers in the area have opted for natural farming thanks to Shri Ram Kumar Singh's inspiration and his awareness campaign. He is the district of Begusarai's natural farming resource person.

Conclusions

Ram Kumar Singh is a progressive farmer who uses natural farming methods since they boost crop yield while also lowering input expenses. Farmers who practice natural farming have healthier soil and plants.

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Popular Article

Calcium, Electrolytes and Markers in Downer Cow Predictions and Monitoring

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Abstract

Blood tests play a crucial role in diagnosing and managing downer cows in dairy farming. This abstract summarizes key diagnostic markers and their significance in assessing the health and prognosis of downer cows. Creatine Phosphokinase (CPK) and Aspartate Transferase (AST) serve as specific indicators of muscle damage, while Non-Esterified Fatty Acid (NEFA) levels detect fatty liver. Serum electrolyte imbalances, particularly hypocalcemia and hypokalemia, are associated with prolonged recumbency. Serum magnesium and phosphorus levels are also considered. Ornithine Carbamoyltranferase (OCT) and Glutamate Dehydrogenase (GDH) values provide insights into the severity of fatty liver and hepatocellular damage. These blood tests aid in diagnosing underlying issues, guiding treatment, and improving the prognosis of downer cows in dairy herds.

Introduction

Blood tests from individual animals are routinely used to diagnose disease problems in dairy cattle. Veterinarians, producers and nutrition consultants alike seem to be interested in extracting pertinent information relative to herd nutrition and health status from blood tests. The term “downer cow” is generally used to describe a cow which is in sternal recumbency and unable to rise. There are a number of causes, including metabolic disease, toxic mastitis or metritis, exhaustion from calving, calving paralysis, hip joint luxation, and pelvic fracture. While in sternal recumbency, cows generally lie on one pelvic limb. Pressure damage resulting from this position is considered to cause local damage to muscle and nerve tissue. This tissue damage is generally held to be the cause of the pelvic limb dysfunction in downer cows. The treatment of downer cows can be expensive in terms of the time taken and the drugs used. Therefore, it would be helpful to have a prognostic test to determine which animals are unlikely to recover because of severe muscle damage.

Downer cows usually have reduced appetite which aggravates fatty liver, initiating a vicious cycle of worsening appetite. This may explain why moderate or severe fatty liver often leads to liver failure and death in downer cow. A panel of tests - which included creatine phosphokinase (CK), aspartate transferase (AST), glutamate dehydrogenase (GDH), calcium, magnesium, phosphorus and potassium is performed on the

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majority of the routine cases to predict and monitoring of "downer cow".

Utility of CK testing

CPK normally ranges between 105 to 409 IU/L. A value greater than 1000 IU/L indicates severe muscle damage from being down. Maximum CPK activity occurs first 48hrs of recumbency and > 48hrs its activity declines rapidly. Downer cows had significantly higher CK, AST and urea level and significantly lower cholesterol than healthy cows. For downer cow problems, consider CPK and AST in the blood test. Prolonged recumbency causes ischemic necrosis of muscles resulting in increased permeability of cell membrane allowing seepage of AST, ALT and CPK enzymes into circulation.

Creatine phosphokinase is considered as a specific marker of muscle damage and increase in CPK testified ischemic damage to the muscle causing its seepage into the circulation. The CPK levels need to be interpreted in relation to the days of recumbency when the sample is taken. Critical levels may be highest initially up to 50 times and may reduce to 10 times normal range at 7 days of recumbency.

Aspartate Transferase (AST)

Normal AST range for cow is 60-125 IU/L. In downer cows with increased AST activity, concurrent analysis of serum CK activity helps to identify the origin of AST (muscle or liver). Increases in AST were likely due to muscle damage, because the correlation between serum CK and AST activity was high. Consequently, as the liver-derived portion of serum AST activity cannot be distinguished, the diagnostic value of AST in downer cows suspected for liver dysfunction is diminished. AST levels over 200 IU/L flag a guarded prognosis and levels over 500 IU/L can indicate severe muscle damage. Serum AST activity may also have value in diagnosing fatty liver.

Non-Esterified Fatty Acid (NEFA)

Non-esterified fatty acids are considered useful for detection of fatty liver in downer cows, as a high NEFA concentration is indicative of extended lipid mobilization and is highly correlated with liver lipid content. Serum NEFA gradually increases during the last week before parturition and then acutely increases at calving, which triggers even more fatty liver infiltration. In downer cows this phenomenon is more intense because the appetite loss and the difficulties in accessing food lead to a higher negative energy balance, which in turn increases NEFA mobilization and blood concentration. The NEFA serum concentration is also stress-sensitive which increases NEFA release, resulting in more rapid lipid accumulation in the liver.

Serum cholesterol concentration was significantly decreased in cattle with moderate and severe fatty liver compared to the healthy cows and cows with mild fatty liver, and was inversely related to NEFA concentrations. These resulted in fatty liver infiltration was associated with decreased serum cholesterol, higher NEFA, and higher NEFA/cholesterol ratio. The NEFA/cholesterol ratios herein were about 3 times higher in cows with moderate fatty liver and more than 4 times higher in cows with severe fatty liver compared with the reference cows.

Normal values for cows in positive energy balance are than 200micromolar. During the close-up period, values increases slowly as the cow approaches calving and usually range from 200 to 300 micromolar. Values greater than about 700 µM beyond 7 days indicate severe negative energy balance.

Serum electrolyte imbalances

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Serum electrolyte imbalances or deficits may be associated with prolonged recumbency following treatment for parturient paresis

1. Calcium homeostasis

The regulation of serum Ca is controlled by three potent calcitropic hormones: associated parathyroid hormone (PTH) secreted from the parathyroid gland, 1,25-(OH) D_3 , a metabolite of vitamin D produced in the kidney and calcitonin, while calcitonin plays a valuable feedback relationship with hypercalcemia, or managing blood Ca concentrations after an intravenous calcium treatment, it has a lesser impact on fever calcium homeostasis. Normal blood Ca^{++} in the adult cows is maintained between 8.5 and 10mg/dl (2.0 -2.8mmol/L). Ionozed calcium level is most important than total calcium measurements. Maintenance of blood Ca^{++} within the acceptable range is a balancing act between the Ca^{++} demand of milk production and the cow's homeostatic mechanisms to maintanin blood calcium. During the dry period, the supply of calcium through the diet is usually not activated until parturition. Therefore, dry period is the phase most important in the development of milk fever and consequences of downer cow. During subclinical hypocalcemia, blood Ca concentration ranges between 5.5 and 8 mg/dl.

The downer cows had significantly lower ionized serum Ca concentration compared with the reference and healthy fresh cows. This was expected, because hypocalcemia is the most frequent cause of recumbency in fresh cows. Some of the downer cows suffered severe hypocalcemia (ionized Ca concentrations as low as 0.7 mmol/L).

2. Serum Potassium

All downer cows had significantly lower median serum K concentrations compared with reference and healthy fresh cows. K concentration was significantly lower in downer animals that died compared to animals that were cured. It is generally accepted that cows being off-feed for more than 3 d will finally result in hypokalemia. However, the cows were hypokalemic without being off-feed, as the sampling was performed within 6 h after their recumbency. The degree of hypokalemia may be partly attributed to the various degrees of inappetance that these cows had. Nevertheless, we cannot draw conclusions about the reason the downer cows were hypokalemic. Given that hypokalemia can lead to muscle weakness and degeneration and recumbency, K concentration should always be evaluated in downer cows and considered in the prognosis.

Hypokalaemia in recumbent cows occurs due to the fact that muscle ischaemia as a result of prolonged recumbency increases the cell membrane permeability of muscle fibres and allow loss of potassium from the cell causing myotonia which appears to be the basis of downer cow syndrome. Hypokalemia could also occurs due to rapid urinary excretion and diminished alimentary absorption of potassium associated with reduced feed intake. Diminished excitability of nerve and muscle cells, weakness and flaccid paralysis are the consequences of hypokalaemia Hypomagnesemia as well as normal magnesium level have been recorded in downer cows. The sodium concentration in downer cows was within normal range.

Normal ranges for bovine serum calcium, magnesium, phosphorus, and potassium

	Calcium	Magnesium	Potassium	Phosphorus
Normal range (mmol/L)	2.0-2.6	0.63-1.15	1.3-2.5	3.9-5.8

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3. Serum magnesium

Serum magnesium levels below 0.8mg/dL (0.33 mmollL) indicate severe hypomagnesemia and clinical signs occur with levels of 0.3-0.7 mg/dL (0. 12-0 .29 mmoIlL). Normal values are 2.2-2. 7mg/dL (0.9-1 .11 mmoI/L). Erythrocyte magnesium concentrations are also low, indicating a chronic deficiency. Serum calcium levels tend to fall when serum magnesium levels become very low and are below normal in most clinical cases. A long-term lowlevel hypomagnesemia has been associated with the downer cow especially when it accompanies hypocalcemia.

4. Serum phosphorous

Persistent hypophosphatemia has been regarded as a cause of downer cow syndrome associated with milk fever. Many veterinarians claim that these cows respond to treatment with phosphorus. However, persistent recumbency is associated with subnormal levels of serum phosphorus which increase to normal in the cow stands regardless of treatment with or without phosphorus. Mature dairy cows may become recumbent in early lactation and subnormal levels of serum phosphorus may be present.

Other indicators

Ornithine carbamoyltranferase (OCT

OCT is a reliable index of fatty liver severity, which, in turn, is an indicator of poor prognosis of downer cows. Although the relatively small number of downer cases did not enable sensitivity evaluation to verify a cut-off point, the data indicate that OCT values above 40 U/L suggest severe fatty liver and guarded prognosis for downer cows.

Glutamate dehydrogenase (GDH)

Detection of high activity in recently calved cows may be an important indicator of fatty liver and of the poor prognosis of downer cows. Increased GDH activity also indicates acute hepatocellular damage. GDH values > 16 U/L might indicate guarded prognosis for downer cows due to severe liver damage

We believe that the panel of tests applied to downer cows, especially in the first week of recumbency, helps to determine whether severe muscle damage is limiting recovery. It also provides information on other causes of recumbency and aids awareness of herd problems such as low concentration of calcium, phosphorus and potassium. However, significantly higher activities of serum enzymes of creatinine phosphokinase, aspartate and alanine amino transferase were observed in downer cows. Concluded that the downer cows should be treated with potassium in addition to calcium, phosphorus and magnesium.

References

Kachhawaha S, Tanwar RJ. Biochemical and enzymatic changes in downer cow syndrome. Indian J Anim Sci. 2010; 80: 338-339.

Blood DC, Henderson JA, Radostits OM. Veterinary Medicine. 5th ed. London: Bailliere Tindall; 1979.

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Success Story

The success story of Goat Farming for livelihood

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Md. Shahnawaz age, 23 years Village and Post, Malpur, Begusarai, comes from a well-educated and business-oriented family. He finished his secondary schooling with I.T.I. Md. Shahnawaz and his family used to work in the company for a living, but during the COVID crisis, they were unable to generate enough money to support their family, so they switched to goat farming for a living. He possessed twenty-one indigenous goats (Black Bengal and Desi) that were raised for meat purposes on a 0.40-hectare land. Their Sources of motivation were training on goat farming and extension activities of KVK, Begusarai.

Reason for adopting goat farming

Goat farming has numerous advantages, making it an attractive option for farmers. Here are some reasons for adopting goat farming:

1. **Versatility**: Goats are versatile animals that are raised for a variety of reasons. They can be used for milk, meat, fiber, and even as pack animals.
2. **Low Maintenance**: Goats require less attention and management. They are quite easy to look after, and even women and children may do so.
3. **Space Efficient**: Goats are small animals and require less space than certain other domestic animals[2].
4. **Feeding Needs**: Goats require less feed because they are smaller animals. In India, several goat varieties can thrive on low-quality feed as well.
5. **High Market Demand**: The main advantage of goat farming is the high market demand and the availability of a wide variety of goat breeds.

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6. **Multipurpose Usage**: Goats are raised for a variety of reasons. It's meat and milk for which goats are commonly farmed.
7. **Numerous Breeds Available**: Some goat breeds are popular for meat production, while others are suitable for milk production, and yet others are suitable for both meat and milk production.
8. **Clear Land**: Goats are great browsers and they love to eat weeds and blackberry brambles. Pasture them on whatever you want to clear out and let them act as living brush hogs.
9. **Use their dung as fuel**: Plenty of people all over the world use goat dung to fuel fires.
10. **Use their skin and hide**: Goat skins can be dried and tanned like leather and used in any number of products, including goatskin gloves.

Technology and Innovation Adopted

For goat farming, he has consistently adopted the following innovation and technology.

Technology/Innovation/Techniques adoption	Effect/improvement
Breed selection	Higher average daily gain of body weight, number of kids produced per kidding
Ration formulation	The higher average gain of body weight, low feed cost, and fewer health issues
Deworming and vaccination	Reduce the mortality and disease incidences
Care & management of kids	Low kid mortality with a higher growth rate

Achievements of goat farming

	Baseline period 2021-22				Year 2022-23				Change
Breed	No.	Production (No.)	Gross Income (Rs.)	Net Income (Rs.)	No.	Production (No.)	Gross Income (Rs.)	Net Income (Rs.)	Net Income (%)
Black Bengal	16	29	226200	113100	41	113	1084800	433920	(+)33.16
Desi	05	08	81600	40800	11	19	250800	100320	(+) 9.62
Total	21	37	307800	153900	52	132	1335600	534240	(+)27.98

Contributing Factors for the Success of the Enterprises

He obtained consultation and technical support from KVK scientists and visited their farm.

Importance of Other Farmers

Due to Md. Shahnawaz's success and income inspire the small and landless farmers of the village. Other farmers are now starting their goat farming businesses with few goats.

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Conclusions

Through proper vaccination and health management, he can reduce the mortality rate of kids as well as disease incidences. Through proper feeding and breed selection, he was able to achieve optimal goat growth. Goats' carcass weight rises as a result of all contributing factors.



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Popular Article

Integrated Pest Management of Diamondback moth, *Plutella xylostella* in cruciferous vegetables

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Introduction

Diamondback moth (DBM), *Plutella xylostella*, is destructive insect pest of cruciferous crops worldwide. The changing cropping pattern, monoculture, intensive cultivation of high yielding varieties, negligence of crop rotation, non-adoption of summer ploughing besides negation of other cultural practices and injudicious use of insecticides have aggravated this pest problem in cruciferous vegetables. Thus, the result is that DBM has developed resistance to most commonly used insecticides. Therefore, eco-friendly pest management (IPM) is now being considered to manage DBM in a more sustainable manner.

Host: Broccoli, brussels sprouts, cabbage, Chinese cabbage, cauliflower, collard, kale, mustard, radish, turnip etc.

Biology and Identification

Eggs are spherical and flattened minute yellow coloured and laid singly or in groups on the upper surface of leaves. Females may lay average 150 eggs. The egg hatch in 5-6 days. The diamondback moth has four instars. The larvae are pale yellowish green in colour**.** Pupation takes place on the foliage in a transparent cocoon and formed on the lower or outer leaves. The duration of the cocoon average about 5 to 15 days. Adults are small greyish brown moth. Adult folds the wings that appear with triangular markings, with diamond shape. Total development time from the egg to pupal stage average 25 to 30 days.

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Symptoms of damage

Feeding habit of young instar larva is leaf mining, thereafter grown larvae feed on the lower surface and upper surface of the leaf. Their chewing results in irregular patches of damage, scrapping of epidermal leaf tissues which produces typical whitish patches on leaves. Full-grown larvae bite holes in the leaves and feeds on curd and head.

Management

- ✓ Crop monitoring or crop scouting is the regular systematic checking of crops for pest activity.
- ✓ Crop rotation with non-host crop such as cucurbits, beans, peas, tomato and melon.
- ✓ Growing of mustard as a trap crop at the ratio of 2:1 (cabbage: mustard) at least 10 days ahead of planting of main crop to attract female adult moth for oviposition. Thereafter, spraying of mustard crop with Lufenuron 5.4 % EC 1.2 ml/lit to avoid dispersal of the larvae.
- ✓ Installation of the pheromone traps @12/ha to monitor the population of adult moth.
- ✓ Inter cropping of cabbage or cauliflower with marigold, garlic or onion also reduces the incidence of DBM population.
- ✓ Mass releasing of larval parasitoid, *Cotesia plutellae* at 20000/ha from 20 days after planting.
- ✓ Planting of clean and healthy seedlings in the field.
- ✓ Removal of all debris and stubbles after harvest of crop which harbour the overwintering stages of the pest.
- ✓ The predator green lacewings *Chrysoperla carnea*, also feeds on eggs and young larvae.
- ✓ Spraying of the any one insecticide with different mode of action and rotation of insecticide further at 15, 30 and 45 days after sowing at the economic threshold level such as spray of (Bt) *Bacillus thuringiensis var. kurstaki* @ 2 g/lit of water or Neem seed kernel extract 5% when pest pressure is low. Cartap hydrochloride 50% SP @ 0.5%, Lufenuron 5.4 % EC 1.2 ml/lit., Spinosad 2.5 % SC, 1.2 ml/lit or chlorfenapyr @ 200 g a.i./ha when pest pressure is high.

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Popular Article

Butterflies eyespot

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Introduction

Colour pattern in butterfly wings is a kind of mosaic pattern of dozens to hundreds of finely-tiled monochromatic scale cells. Colour pattern formation occurs in a single layer of the wing disc and it is essentially two-dimensional in space without cell movement. The eyespots, however, form in response to epidermal cell interactions that occurred much earlier in development. Butterfly wing patterns are not just unique arrangements of pigmentation rather they share relatively few pattern elements. That is, most butterflies have colour patterns composed of discrete pattern elements whose homology can be traced across genera and family. The system of homologies among pattern elements is now called the nymphalid ground plan (NGP). Thus, butterfly wing pattern evolution is based on nymphalid ground plan. Butterfly wing patterns comprise a series of symmetry systems showing several bands like basal and central bands, border ocelli (light red), parafocal elements, sub marginal and marginal bands. Monteiro (2015) defines eyespots as colourful, conspicuous and concentric circular markings on the margin of wings that butterflies mostly of the family Nymphalidae possess. Eyespots within a single individual can have different morphologies and vary between males and females. Species often differ in the location where these eyespots are displayed; in the total number of eyespots; and in their size, colour, and number of rings.

Eyespot development

Surveys for the expression of a few candidate genes during the larval stage of wing development in nymphalid species with eyespots found that at least two genes (spalt and Distal - less) were expressed in most eyespot centers (Oliver *et al*., 2012). So far, a variety of candidate genes with expression in the eyespot field have been identified, but only two genes have been tested at the functional level. One of the genes tested codes for the transcription factor *Distal-less* (Dll), and the other gene codes for the ligand *Hedgehog* (Hh). The *Distal-less* gene is present in almost all eyespot

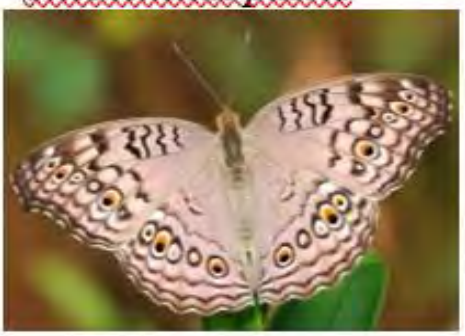
organizers, making it an ideal candidate to carry out major functions of eyespot formation. During the wing imaginal disc development Dll, has two expression domains separated by a temporal component. First Dll is expressed in a group of cells in the center of what will become the focus and eventually the eyespot. This expression starts during the middle of the fifth instar larvae and lasts until the pupal stage. The second domain starts around 20 hours after pupation around the original central cluster of cells, in an area in which a black ring of the eyespot will be formed. The wide distribution of Dll across eyespot forming butterflies suggest that this transcription factor is a central regulator for the correct patterning of the eyespots (Monteiro, 2015). Eyespots develop around a small central region, focus act as an organizer to specify eyespot (Nijhout, 1980). Focus is the discrete organizing centre. Organizing centres are specialized group of cells that occur at various locations on wing surface and wing margin (Nijhout, 1980). Surgical experiments, pioneered by Nijhout (1980), showed that the eyespot rings are specified on early pupal wings by signals coming from the central focus. Thus,

Butterflies with eyespots

Blue pansy

Oxeoschistus puerta

Clipper



Grey pansy

Elephant hawk moth

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removal of the focal cells eliminates the eyespot, while grafting them elsewhere on the wing epidermis produces a displaced eyespot pattern. Eyespot is specified by a signal from the focus. This signal is an unstable and diffusible molecule called morphogen. Focus is the source of a morphogen that is somehow able to induce synthesis of specific pigments.

References

Monteiro, A. 2015. Origin, Development and Evolution of Butterfly Eyespots. *Annual Review of Entomology,* **60**: 253 – 257.

Nijhout, H. F. 1980. Pattern formation on lepidopteran wings: determination of an eyespot. *Developmental Biology,* **80**: 267 – 274.

Oliver J C, Tong X L, Gall L F, Monteiro A. 2012. A single origin for Nymphalid Butterfly eyespots followed by widespread loss of associated gene expression. PLOS Genetics 8: e1002893.

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Popular Article

Intelligent micro-/nanorobots as smart vehicles for biomedical therapeutic applications.

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Abstract

Nanorobotics is an emerging science that has attracted tremendous interest among research groups. Nanoscale robotics have the ability to transform multiple energy sources into motion and strength. Micro/nanorobots, are regarded as superior delivery system by altering other forms of energy into propulsion and movements. Furthermore, it can be advantageous as it is directed to targeted sites beneath physiological environments and conditions. They have been validated to possess the capability to encapsulate, transport, and supply therapeutic contents directly to the disease sites, minimizing the dosage of drugs with enhancing efficiency of drugs and less side effects.

Introduction:

Nanotechnology is one of the most emerging and advanced science of today's world. Nanotechnology by definition, the science deals with extremely small structures having size of 1 to 100 nm. As the size increase or decrease, the properties of nanoparticles keep changing enabling various possible way of manipulation for different purposes. It has applications in various fields such as health and medicine, electronics, energy and environment, and also in biological science. This emerging research field has received ever-increasing attentions. One of the first mentions of nanotechnology as a concept emerged in 1867 when James Clerk Maxwell introduced his visionary theory about some submicroscopic entities called Maxwell's Demon, which would have the capacity to handle individual molecules and atoms (Aeran et al., 2015). Later, these tiny machines will be

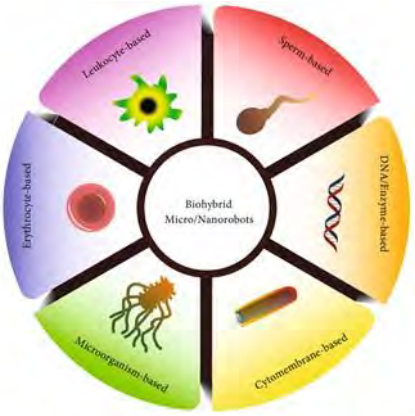

Figure.1. Summary of various biohybrid micro- and nanorobots.

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known as nanorobots. Nanorobotics is one of the most promising domains with many nanotechnological discoveries that deal with the design, assembly, and utilization of molecular devices with nanometer-scale dimensions. Developments in this field with a great impact in medicine. Nanorobots are typically controllable machines made of assemblies of nanometric components which, due to their small size, can interact and even penetrate the cellular membrane, providing a direct pathway to the cellular level. Due to numerous applications of nanorobots in medicine, their development imposes a series of challenges and limitations that derive mainly from various control and behavioral aspects in a dynamic work environment. To avoid the occurrence of rejection reactions from the host immune system, the outside surface of the nanostructures are covered with biomimetic material. Basically, nanorobots are comprise of biological components (e.g., DNA, enzyme, cytomembrane, and cells) and artificial components (e.g., inorganic or polymer particles). They can inherit the parental biological properties, onboard actuation, and sensing capabilities.

Design of Nanorobots

Nanorobots have to travel via narrow channels of only a few hundreds of nanometers in diameter against the body fluids and tissues. Therefore, for effective targeting to diseased sites the design of a nanorobotic propulsion mechanism should take into account the apparently increased viscosity and the low Reynold numbers as the main effects. The principal element used in the manufacture of nanorobot bodies is carbon in the form of diamond/fullerene nanocomposites due to their inert properties and strength for controlled delivery of the payload. For the active locomotion a propulsion tail of nanorobots is required as they sway against the blood flow in the body as shown in figure.2.

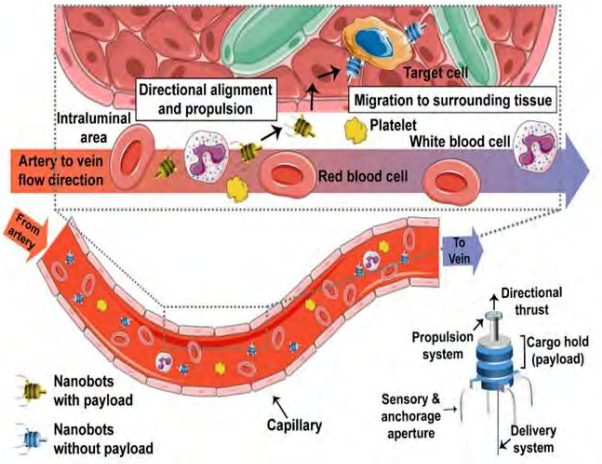

Figure.2. Micro-/nanorobot components for drug delivery: propulsion system, cargo hold of the payload, sensory and anchorage aperture, and delivery system.

Nanorobots for monitoring diabetes

It operates through computational techniques in which nanorobots are designed in such a way that it can sense the glucose levels in the body and provides clinical data in order to suggest patient's diet through 3D prototyping for prevention of diabetes. In vitro studies showed that level of insulin can be regulate in a pulsatile profile as a response to different glucose concentration. A single nanoparticle injection can enables stabilization of the glucose in the blood (<200 mg/dL) for up to 10 days. This platform can be invented for in vivo health monitoring in which the measured data is passed to the patient through mobile phones. If blood glucose level increases it warns the patients through

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alarming in mobile phones in emergency situations.

Nanorobots for kidneys stone disease

Nanorobots are employed for rupturing of kidney calculi through ultrasonic shocks. In this procedure, nanorobots disintegrating the stones in small parts which can easily be passed out during excretion in order to prevent excessive pair.

Nanorobots for Tooth repair

Different nanorobots are functioning simultaneously on dental field include genetic engineering, tissue regeneration and tissue engineering for repair in major tooth issues. The main functions include inducing anesthesia and osseointegration, blocking tooth hypersensitivity by obstructing dentinal tubes, orthodontic treatments by allowing painless tooth uprighting, vertical repositioning and rotating. Similarly, the nanorobots can be used for nanosolutions delivery which contain bonding agent, impression materials, nanofillers, bone replacement materials, for nanoencapsulation of therapeutic agents into polymeric nanocapsules, to form nanocomposites with antibacterial and whitening agents in order to improve polishability and tooth esthetics.

Nanorobots in treatment of gout

Gout is very serious disease in today's modern world mostly suffered in old age group. It is a disorder where the kidney fails to discard waste generated from lysis of fats in the blood. With these techniques it disintegrates the urate crystals at the joints which loses their ability to reverse the condition permanently. For this nanorobots are designed incorporating bone structure then made bone-like nanoparticles. When this particle reached fractured bones site they form a structure which becomes part of bone. The same technology can be applied Arthritis disease as well.

Nanorobots in Opthalmology:

The applications of nanorobots for ophthalmology is to design-sensitive robots to monitor, control, construct, repair, defend, and improve eye function. Employing nanorobots in ophthalmology benefits possibility of injecting them elsewhere in the body and delivering the drug to the target eye area. The other applications include management of oxidative stress, measurement of intraocular pressure, theragnostics, transport drugs for the treatment of choroidal new vessels, assisting in healing processes, and prevention of scar occurrence after glaucoma surgery, treatment of retinal degenerative disease using DNA genes, and ocular prosthetics.

Nanorobots in Gene therapy

With the rapid advancement of nanotechnology, nanorobotic technology is gaining more success not only in genetic engineering but markedly extended to genomics, proteomics, transcriptomics, gene chips, and artificial chromosomes where the nanorobots can be successfully used to detect genetic diseases by comparing the molecular structures of proteins and the DNA of the patient with a data reference. The defects DNA structures and proteins can be corrected or modified

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using the minimally invasive technique of innovative nanorobots. The nanocomponents for nanorobots must be assembled in a functional state to be able to work at the molecular level of patients. The nanomachines used in gene therapy might be assembled fully or partially from DNA structure. For instance, DNA nanorobots is one of new emerging therapeutic tools to promote gene therapy because using DNA to build nanoscale objects is related to the stiffness characteristic and its ability to interact with other intermolecular forces.

Nanorobots in drug delivery

So far, drug delivery by nano/micro machines rely on systemic circulation and the Brownian motion is the main obstacle to their movement in complex body fluids lacking the absence of force and navigation for localised delivery and tissue penetration. To obtain an accurate delivery of medicinal contents to the targeted site of diseases, the drug delivery vehicles are meant to have some distinctive abilities which include navigation, propulsive force, cargo transporting and delivery and tissue perforation. To overcome all these lacuna micro/nanorobots come up with latest solution which satisfy all these necessary characters because micro/nanorobots possess its own motors to deliver the therapeutic loads directly to disease sites thereby decrease the side effects of highly toxic drugs. In addition, an exogenous force such as magnetic field, light energy, and ultrasonic field can be employ as an external power sources to coordinate the behavior of micro/nanomotor drug delivery systems. For an example sperm can be developed as an excellent micro/nanomotor drug delivery system for the treatment of ovarian-related cancers. For that, a micromotor drug delivery system propelled by sperm cells has constructed and assisted by an external magnetic field (Fig.3). This system not only provided propulsion but also acted as the carrier. After internalization of Fe_2O_3 nanoparticles modified by the DOX into sperm cells, the micromotor drug delivery system showed a strong killing effect on human SKOV-3 ovarian cancer cells *in vitro*.

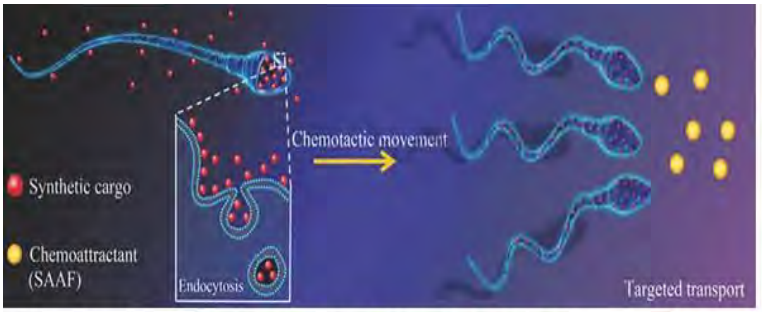

Figure:3. Schematic diagram of the loading and working mechanism of functionalized sperm micromotors. Reproduced with permission. Copyright 2017, John Wiley and Sons.

Conclusions

In today's world, nanorobotics has appeared as an unconventional and adaptable raised area to combine the benefits of micro technologies and robotic skills. Micro/nanorobots acquire unique and multipurpose functions which include rapid mobility in complex biological fluids, bulky cargo-transporting for reversing and extended distances and separation of targets objects. This immense evolution in the field of nano/microrobots from laboratories to a biological system and clinical conversion of micro/nanorobots was a significant step in in vivo researches. Furthermore,

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micro/nanorobots have the capability to detect the health-related issues at just the infancy stage as well.

References:

Sindhu, R.K., Kaur, H., Kumar, M., Sofat, M., Yapar, E.A., Esenturk, I., Kara, B.A., Kumar, P. and Keshavarzi, Z., 2021. The ameliorating approach of nanorobotics in the novel drug delivery systems: a mechanistic review. *Journal of drug targeting*, *29*(8), pp.822-833.

Nistor, M.T. and Rusu, A.G., 2019. Nanorobots with applications in medicine. In *Polymeric nanomaterials in nanotherapeutics* (pp. 123-149). Elsevier.

C. Chen, X. Chang, P. Angsantikul, J. Li, B. Esteban Fernández de Ávila, E. Karshalev, W. Liu, F. Mou, S. He, R. Castillo, Y. Liang, J. Guan, L. Zhang, J. Wang, Chemotactic guidance of synthetic organic/inorganic payloads functionalized sperm micromotors, Adv. Biosyst. 2 (2017) 1700160, doi:10.1002/adbi. 201700160.

Li, J., Dekanovsky, L., Khezri, B., Wu, B., Zhou, H. and Sofer, Z., 2022. Biohybrid micro-and nanorobots for intelligent drug delivery. *Cyborg and Bionic Systems*.

Agrahari, V., Agrahari, V., Chou, M.L., Chew, C.H., Noll, J. and Burnouf, T., 2020. Intelligent micro-/nanorobots as drug and cell carrier devices for biomedical therapeutic advancement: Promising development opportunities and translational challenges. *Biomaterials*, *260*, p.120163.

Aeran, H., Kumar, V., Uniyal, S., Tanwer, P., 2015. Nanodentistry: is just a fiction or future. J. Oral Biol. Craniofac. Res. 5 (3), 207_211.

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Popular Article

Concepts of Metagenomics in Rumen Manipulation

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Abstract

The genetic and biological variety of microbes is an important topic of scientific study. The ability of ruminants to convert locally available feedstock to animal products should be enhanced given the significance of ruminants in livestock strategy. The structure and function of rumen communities may now be studied more comprehensively as a result of recent developments in molecular biology and genomics. Today's rumen microbiologists face a significant difficulty in trying to comprehend how complex microbial communities' function and how organisms interact within their niches. In order to identify the complex community of bacteria, protozoa, archae, and fungi, among others, and to understand how they interact, metagenomics is helpful. Understanding how microbial communities function is one of the main objectives of rumen microbiology. It aids in both the immunomodulation of both animals and poultry as well as the formulation of feed ingredients containing probiotics.

INTRODUCTION

Microbial populations are essential to life on Earth and have huge practical implications in medicine, engineering, and agriculture (Sloan *et al*., 2006). Rumen microbial diversity is constituted of bacteria, archaea, fungus, protozoa, and virus in varying proportions depending on the rumen habitat. The rumen's stability and dynamics are critical in maintaining balance within the rumen ecosystem, where there is equilibrium between the microbial community and their metabolism. When new feed types or new organism enter the rumen ecosystem, the balance is disrupted. The change is possible only if the entering new microbes fit into the rumen environment, if not the microbes are eliminated. Rumen is anaerobic in nature, the feed particles in rumen trap small air pockets containing oxygen which are used by the facultative anaerobes ensuring perfect anaerobic condition. Rumen ecosystem diversity, anaerobiosis, pH and various other factors make it difficult to culture the

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organism. The synergetic and antagonistic effect on account of feeding different type of feeds makes it difficult to quantify the role played by any particular group of microbes among the consortia inside the rumen. The conventional technique of culture-dependent cloning gives a limited and biased knowledge about the prevailing rumen microbial population. The global microbial diversity presents an enormous, largely untapped genetic and biological pool that could be exploited for the recovery of novel genes, biomolecules for metabolic pathways and various valuable products (Cowan, 2000). However, current research indicates that more than 99% of microorganisms in the environment are not easily cultivable (Hanada, 2003; Kamagata and Tamaki, 2005; Sekiguchi, 2006). The knowledge about the prevailing organism in the rumen and an insight of the rumen microbial changes during different conditions can be studied with the help of next-generation sequencing (NGS) technique – metagenomics. Metagenomics has recently emerged as a highly strong approach for analysing microbial communities regardless of individual microbial culturing conditions. Metagenomics isolates DNA from the whole community, to sequence and to analyze the obtained data to provide intervention, microbial understanding, therapeutic and biotechnological applications.

The term ‘‘metagenomics’’ was first coined by Handelsman *et al*., 1998 to study the genomes from all microbes in a particular environment as opposed to the genome from one organism isolated from the environment and cultured in vitro. Metagenomics is a rapidly expending field of study that aims at studying uncultured organisms to understand the true diversity of microbes, their functions, cooperation and evolution, in environments such as soil, water, ancient remains of animals, or the digestive system of animals and humans (Huson *et al*., 2009).

Application of rumen metagenomics:

The invention and application of metagenomics has provided access to the uncultivated ecosystem as well as insight into the metabolic capacities of microbial communities that have yet to be grown. Here are some examples of metagenomics applications:

Rumen Lipolysis and Biohydrogenation:

The metagenomics in this field have to access the microbial ecology of lipolysis and biohydrogenation, as well as develop techniques to manipulate ruminal microbes to increase the flow of PUFA (Polyunsaturated Fatty Acids) and CLA (Conjugated Linoleic Acid) from the rumen into meat and milk. Because of the fatty acids that escape ruminal metabolism, the quantity and composition of dietary lipids have a significant impact. Fatty acids, on the other hand, may have a direct modifying effect by inhibiting biohydrogenation. Biohydrogenation is affected indirectly too when other activities are changed, because fatty acid metabolism is inextricably linked to other areas of ruminal metabolism, through a common reliance on H_2 metabolism or the microbial species that are involved in multiple metabolic processes (Lourenço *et al*. 2010).

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Identification of novel enzymes/microbes from rumen:

Metagenomics must be used to screen and detect novel microorganisms and biomolecules from the GI tracts of the livestock ruminants adapted to the forages or diets enriched with high fiber and an array of antinutritional Plant Secondary Metabolites (PSMs) such as tannin-polyphenols.

A metagenome expression library of bulk DNA extracted from the rumen content of a dairy cow was established in a phage lambda vector and activity-based screening was used to investigate the functional diversity of the microbial flora.

The investigations have shown that a metagenomic method can be used to obtain novel debranching enzymes, which are vital for the bread/food industries, from microbial habitats with a high rate of plant polymer turnover, such as the cow rumen.

In another study, RL5 (EMBL/DDBJ/GenBankTM accession number AM269758 [GenBank]), a gene coding for a novel Laccases (polyphenol oxidase) was found through activity screening of a metagenome expression library from the bovine rumen micro flora. Laccases in the rumen may be significant in ryegrass lignin breakdown, suggesting that the RL5 enzyme has biotechnological potential for use in pasture-fed animals and pasture grasses. Finally, the study highlights the ability and utility of activity-based metagenomics for exploring functional diversity space and discovering novel enzymes with laccase activity in a protein that has no relationship to any previously reported polyphenol oxidase (Beloqui *et al*., 2006).

Identification of uncultured methanogens:

Methanogens belong to the domain Archaea and are part of the kingdom Euyarchaeota. They are obligate anaerobes and produced methane as a major catabolic product (Bergey, 1994). Interest in ruminal methanogen is on account of the role of methane in global warming and from the fact that enteric methane emission is a key source of greenhouse gas in agriculture sector.

Molecular approaches have been used to identify methanogens in the rumen. A temporal Temperature Gradient Gel Electrophoresis (TGGE) method evaluated to determine the diversity of methanogens in cattle and sheep rumens showed that uncultured methanogens account for the majority of methanogenic archaea in the rumen (Nicholson *et al*., 2007).

Elaborating the molecular mechanisms of association patterns between archaea and rumen protozoa would be helpful in developing strategies to reduce methane emissions by dietary or genetic manipulation of the rumen ecosystem.

Determination and Quantification of rumen biomass:

The quantitative assessment of total rumen microbial biomass and the differentiation of bacterial and protozoal biomass are important applications of microbial metagenomics in animal nutrition. Rapid profiling techniques, such as the real-time PCR assay, can be used to infer likely variations in the community structure of bacteria and archaea present in animals and at different

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periods after feeding diets.

Rumen nitrogen metabolism:

A better understanding of mechanistic process altering the production and uptake of amino nitrogen will help the livestock nutritionists to improve the overall conversion of dietary nitrogen into microbial protein. It will give critical information for further improving the mechanistic models defining rumen function and analysing dietary circumstances that influence the efficiency of dietary nitrogen conversion into milk protein (Firkins *et al*. 2007).

CONCLUSION:

The use of metagenomic libraries derived from distinct rumen habitats as a strategy for successfully exploiting the mainly "untapped" resources found in varied rumen ecosystems. The rumen microbial community is distinguished by its high population density, vast diversity, and interaction complexity. These diverse ecosystems are potentially very useful sources for novel enzymes with distinct characteristics and great biotechnological potential. Only a small percentage of rumen microbial bioresources have been studied, and an even smaller portion has been used. The inability to culture the vast majority of microbes from this ecosystem the metagenomic approaches the sole method currently available to access these unique and useful bioresources. There is an ongoing need for a wide range of novel genes and enzymes which are required to improve fiber digestion, increasing digestibility of low quality forage, by the selected elite rumen flora and explore the nutrients-host tissue interaction. Rumen metagenomics, in conjunction with biotechnology, has the potential to contribute to all these pressing needs. These technologies have the potential to revolutionize the understanding of rumen function and will overcome the limitations of traditional techniques, including isolation and taxonomic identification of strains important to efficient rumen function and better understanding of the roles of microorganisms in relation to achieving high productivity and reducing environmental pollutants.

REFRENCES:

Beloqui, A., Pita, M., Polaina, J., Martínez-Arias, A., Golyshina, O. V., Zumárraga, M., and Golyshin, P. N. (2006). Novel polyphenol oxidase mined from a metagenome expression library of bovine rumen: biochemical properties, structural analysis, and phylogenetic relationships. *Journal of Biological Chemistry*, 281(32): 22933-22942.

Bergey, D. H. (1994). *Bergey's manual of determinative bacteriology*. Lippincott Williams and Wilkins.

Cowan, D. A. (2000). Microbial genomes–the untapped resource. *Trends in Biotechnology*, *18*(1): 14-16.

Firkins, J. L., Yu, Z., and Morrison, M. (2007). Ruminal nitrogen metabolism: perspectives for integration of microbiology and nutrition for dairy. *Journal of dairy science*, 90: E1-E16.

Hanada, S. (2003). Filamentous anoxygenic phototrophs in hot springs. *Microbes and environments*, *18*(2): 51-61.

Handelsman, J., Rondon, M. R., Brady, S. F., Clardy, J., and Goodman, R. M. (1998). Molecular biological access to the chemistry of unknown soil microbes: a new frontier for natural

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Published: 18.10.2023

products. *Chemistry & biology*, *5*(10): R245-R249.
Huson, D. H., Richter, D. C., Mitra, S., Auch, A. F., and Schuster, S. C. (2009). Methods for comparative metagenomics. *BMC bioinformatics*, *10*: 1-10.
Kamagata, Y., and Tamaki, H. (2005). Cultivation of uncultured fastidious microbes. *Microbes and environments*, *20*(2): 85-91.
Lourenço, M., Ramos-Morales, E., and Wallace, R. J. (2010). The role of microbes in rumen lipolysis and biohydrogenation and their manipulation. *Animal*, *4*(7): 1008-1023.
Nicholson, M. J., Evans, P. N., and Joblin, K. N. (2007). Analysis of methanogen diversity in the rumen using temporal temperature gradient gel electrophoresis: identification of uncultured methanogens. *Microbial ecology*, 54: 141-150.
Sekiguchi, Y. (2006). Yet-to-be cultured microorganisms relevant to methane fermentation processes. *Microbes and environments*, *21*(1):1-15.
Sloan, W. T., Lunn, M., Woodcock, S., Head, I. M., Nee, S., and Curtis, T. P. (2006). Quantifying the roles of immigration and chance in shaping prokaryote community structure. *Environmental microbiology*, *8*(4): 73

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Popular Article

Feline Zoonotic Diseases

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The term "Zoonoses" is derived from the Greek word "Zoon", which means animal, and "nosos", which means illness. According to the World Health Organization (WHO), any disease or infection that is naturally transmissible from vertebrate animals to humans or from humans to animals is classified as a zoonosis (1). Among the human pathogens, about 61% are zoonotic in nature (2). Zoonoses is a great public health concern and a direct human health hazard that may even lead to death.

This document provides information on various diseases that can be passed from cats to humans. Often these diseases do not make the animal appear sick but can cause serious illness in humans. Persons with specific medical conditions such as a chronic illness, immunodeficiency and pregnancy may be at higher risk of developing disease or complications from a zoonotic disease and should consult with their physician before working with animals.

The zoonotic diseases associated with cats include rabies, capnocytophagosis, pasteurellosis, cat scratch disease, ringworm, sporothrichosis, tularemia, plague, Q fever, and external parasites, campylobacterosis, salmonellosis, infections with pathogenic *E. coli*, cryptosporidiosis, giardiasis, toxoplasmosis, and MRSA.

Rabies is a viral disease that causes inflammation of the brain in humans and other mammals. Early symptoms can include fever and tingling at the site of exposure. These symptoms are followed by one or more of the following symptoms: nausea, vomiting, violent movements, uncontrolled excitement, fear of water, an inability to move parts of the body, confusion, and loss of consciousness. Once symptoms appear, the result is virtually always death, regardless of treatment. The time period between contracting the disease and the start of symptoms is usually one to three

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months but can vary from less than one week to more than one year. The time depends on the distance the virus must travel along peripheral nerves to reach the central nervous system(3)

Rabies is caused by lyssaviruses, including the rabies virus and Australian bat lyssavirus. It is spread when an infected animal bites or scratches a human or other animals. Saliva from an infected animal can also transmit rabies if the saliva comes into contact with the eyes, mouth, or nose. Globally, dogs are the most common animal involved. Cats are the most frequently reported domestic animal diagnosed with rabies in North America. Free roaming outdoor cats may acquire rabies from bats, raccoons, skunks and other wildlife. Infected animals often exhibit neurological symptoms and unusual behavior before death. There is an effective vaccine available for people and most domestic animals including cats. If a person is bitten or scratched by a suspect animal, they should report the incident and seek post-exposure rabies prophylaxis immediately from a medical professional. Persons who routinely work in high-risk activities should be vaccinated against rabies.

Free roaming cats and cats that hunt are at risk for developing tularemia and plague. Tularemia is a bacterial infection of wild rodents and rabbits that occasionally infects cats that hunt or drink contaminated water. Plague caused by *Yersinia pestis* is endemic in wild rodents in the Southwest America and some parts of India. Cats acquire the infection by flea bites and hunting infected rodents. Cats may develop septicemic and pneumonic plague (4) which can be transmitted to people by inhalation, contact with the mouth, tissues and body fluids of an infected cat as well as flea bites. Disease in people can be severe and requires prompt medical diagnosis and treatment. Symptoms can include high fever and chills, headache, malaise, and swollen lymph nodes.

Dermatophytosis is a fungal skin infection commonly known as “ringworm” and is seen in both animals and people as scaly round areas of hair loss but can affect the nails as well (5). Transmission of ringworm is by direct skin-to-skin contact with an infected cat or from the environment. Young cats and kittens are more likely to carry the disease and infect people.

Q fever caused by *Coxiella burnetti* can cause abortion & reproductive disease in pregnant cats. There is an especially high concentration at the time that an infected cat gives birth, so particular care needs to be used in handling newborn kittens, placental tissues, and other products of conception. These agents can be acquired by exposure to placental membranes and fetuses from infected cats and by aerosol. Immunocompromised persons are at higher risk of developing severe disease and complications from Q fever.

Salmonellosis, campylobacterosis, cryptosporidiosis, giardiasis and infections with pathogenic *E. coli* are acquired by contact and accidental ingestion of fecal material from infected cats. Animals infected with these bacterial and protozoal diseases often have diarrhea, but some animals may show no symptoms of disease. Any animal with diarrhea should be suspect of having a zoonotic disease. Symptoms in people include diarrhea, vomiting, and abdominal cramps.

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Toxoplasmosis is an intestinal protozoal infection in cats. Cats typically do not exhibit any disease symptoms but shed infectious oocysts in their feces. Humans are infected by accidental ingestion of oocysts in cat feces or ingestion of tissue cysts in undercooked meat. Toxoplasma infection during pregnancy can result in birth defects including mental retardation and blindness. Avoid direct contact with cat feces and urine and use gloves and handwashing to avoid accidental ingestion of animal waste.

Methicillin-resistant *Staphylococcus aureus* (MRSA) are bacteria that have acquired resistance to certain antibiotics. They can be found on the skin of healthy animals (6) and people, where they can opportunistically cause infections. Cats normally do not have signs of disease, but they can have infections in the skin, and respiratory and urinary tracts. People can get infected after direct contact with animals carrying these bacteria. If people are not treated, the infection can progress to septicemia and affect other organs including the lungs.

We can protect ourselves from most diseases by using the following procedures:

- Handle animals appropriately and safely to avoid bites and scratches.
- Thoroughly wash any bite or scratch wounds and report bite and scratch injuries.
- Do not eat, drink, apply cosmetics or use tobacco products while handling animals or in animal housing areas.
- Wear gloves when handling animals, animal tissues, body fluids and waste and wash hands after contact.
- Wear dedicated protective clothing such as a lab coat or coveralls when handling animals. Launder the soiled clothing separate from your personal clothes and preferably at the animal facility.
- Wear respiratory protection when appropriate.
- Keep animal areas clean and disinfect equipment after using it on animals or in animal areas.
- Report ill animals so that they can receive veterinary care.

Most importantly, familiarize yourself about the animals that you will be working with and the potential zoonotic diseases associated with each species. If at any time, you suspect that you have acquired a zoonotic disease, informed your supervisor and sought medical care.

References

1. World Health Organization WHO Health Topic Page: Zoonoses. [(accessed on 20 July 2020)]; Available online: https://www.who.int/topics/zoonoses/en/ [Ref list]
2. Taylor L.H., Latham S.M., Woolhouse M.E. Risk factors for human disease emergence. *Philos. Trans. R. Soc. Lond. B Biol. Sci.* 2001; 356:983–989.
3. Cotran RS, Kumar V, Fausto N (2005). *Robbins and Cotran Pathologic Basis of Disease* (7th ed.). Elsevier/Saunders. p. 1375. ISBN 978-0-7216-0187-8

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published: 18.10.2023

doi: 10.1098/rstb.2001.0888.

4. Gage, K. L.; Dennis, D. T.; Orloski, K. A.; Ettestad, P.; Brown, T. L.; Reynolds, P. J.; Pape, W. J.; Fritz, C. L.; Carter, L. G.; Stein, J. D. (2000). "Cases of Cat-Associated Human Plague in the Western US, 1977-1998". *Clinical Infectious Diseases*. **30** (6): 893–900. doi:10.1086/313804. ISSN 1058-4838. PMID 10852811.
5. McPhee, Stephen (2012). *Current medical diagnosis & treatment 2012*. New York: McGraw-Hill Medical. p. 110. ISBN 9780071763721.

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Popular Article

Per-Vaginal Delivery of a Congenital Arthrogryposis Foetus in A Graded Murrah Buffalo- A Case Report

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Introduction

Arthrogryposis is a congenital musculoskeletal defect characterized by the ankylosis of limbs, often accompanied by other growth deformities such as a cleft palate. When calves are born with arthrogryposis, their joints are fixed in abnormal positions, and they may also exhibit scoliosis, kyphosis, and other deformities. This condition is more commonly observed in the forelimbs than the hind limbs, and the hind limbs are typically unaffected unless the forelimbs are also involved. When arthrogryposis is accompanied by additional deformities like kyphosis, scoliosis, torticollis, or a cleft palate, it is often referred to as Crooked Calf Disease. Affected calves usually have difficulty standing and nursing, and muscle atrophy can also be observed. Arthrogryposis is a relatively rare condition and is more commonly seen in sheep, buffalo, and cattle. It has been reported in various cattle breeds, including Hereford, Angus, Charolais, Shorthorn, Holstein-Friesian, Guernsey, Jersey, Ayrshire, Brown Swiss, and mixed breeds. The overall incidence of congenital defects in calves is estimated to range from 2 to 3.5%, with musculoskeletal defects accounting for about 24% of these cases. The causes of arthrogryposis are multifactorial and include various genetic and environmental factors. In Charolais cattle, for instance, the syndrome is linked to an autosomal recessive gene with complete penetrance in the homozygous state. Teratogens, which are substances that can cause birth defects, have also been identified as contributors to arthrogryposis. In some cases, the ingestion of plants like lupines, with anagyrine as the toxic agent, by pregnant cows between gestational days 40 and 70 can lead to arthrogryposis. Additionally, prenatal viral infections with viruses such as Akabane or bluetongue can result in this condition. Congenital defects like arthrogryposis often lead to dystocia, which is a difficult or obstructed labor during the birthing process. This article discusses a specific case of arthrogryposis in a Murrah

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buffalo calf delivered vaginally, with the use of mutation and traction.

Case history and Clinical findings

An 8-year-old Graded Murrah buffalo in its third parity was presented to mobile ambulatory veterinary clinic, Tuni with the history of full-term gestation. The animal was straining since last 12 h and its water bag had ruptured with both fore limbs hanging from vulva. Per-vaginal examination revealed a male dead fetus in anterior longitudinal presentation and dorso-sacral position with the both fore limbs flexed at elbow, knee, fetlock and slight downward deviation of head is noticed.

Treatment

Following caudal epidural anesthesia (5 ml; 2% lignocaine hydrochloride), the birth canal was thoroughly lubricated with sodium carboxy methyl cellulose slurry. After correcting the position of head and fetal extremities three-point tractions were applied on both fore limbs and head leading to delivery of the fetus. A dead male fetus was born with the condition called arthrogryposis. Gross examination of the dead male fetus revealed ankylosis of both fore limbs and hind limbs. A close examination of one elbow joint in a calf showed that the positioning of the ulna against the articular surface of the distal humerus was incorrect. Post obstetrically the dam was administered with Inj. DNS-2lit, RL-2 lit, Mifex-250ml intravenously, Inj. Melonex-0.5 mg/kg b.wt, Inj.Intamox-4.5gm intra muscularly. The antibiotics and NSAIDS were continued for 3 more days. The dam showed appreciable recovery.

Figure 1: Congenital Arthrogryposis Fetus

Conclusion

Arthrogryposis is a relatively common congenital condition seen in cattle, primarily affecting the limbs due to joint fibrosis, which results in joint fixation. In this clinical case report,

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we present a unique and successful approach to managing dystocia in a buffalo calf that exhibited a slight head deviation associated with arthrogryposis. Our method involved a carefully planned strategy for delivering a small-sized fetus per-vaginally through controlled traction. This approach stands out as a valuable alternative to opting for a cesarean section or fetotomy. Notably, this method offers several advantages. It minimizes the risk of causing trauma to the dam, which is essential for ensuring the overall well-being of the animal. Moreover, it proves to be cost-effective for the farmer, making it a practical choice for managing dystocia related to arthrogryposis. By avoiding the use of excessive force and excessive traction, we prioritize the health and safety of both the dam and the calf, contributing to a successful and humane outcome.

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Popular Article

Role of Nutrient Supplements for Enhancing Milk Production

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Introduction

For dairy animals, increasing milk production is crucial, and supplementing with nutrients can help the impact of dietary supplements on milk production, including those containing lipids, carbohydrates, prolactin, oestrogen, amino acids, and peptides, as well as other substances. The functions of nutrients and associated pathways in enhancing the synthesis of milk protein and fat are outlined in this article which can aid in understanding how milk production and nutritional supplementation are related.

Keywords: Nutrients; Milk protein; Milk fat; Regulatory pathway

Introduction

One crucial aspect of dairy animals' economics is their ability to produce dairy products. Dairy products and milk are consumed worldwide. The world produced around 928 million tonnes of milk in 2021, but the need will only rise. Global milk output is expected to increase at a 1.7% yearly rate. By 2030, milk production is expected to surpass most other major agricultural products, with 1.020 billion tonnes produced. Providing high-quality feed and balanced nutrition is a promising and forthcoming technique for raising milk production and quality in poor nations (Tricarico *et al*., 2020). The strategy is supplementing the diet or cell culture medium with the right nutrients (lipids, peptides, and amino acids) to enhance milk output and quality.

The Enhancement of Milk Production by Amino Acids and Peptides

Amino acid: The mTOR pathway is the most basic mechanism via which amino acids can improve the production of milk. One important signaling component that is present in many mammalian cells is the mammalian target of rapamycin, or mTOR. It is necessary for the synthesis of proteins and cell development. The cytoplasm contains phosphatidylinositol-3 Kinase (PI3K),

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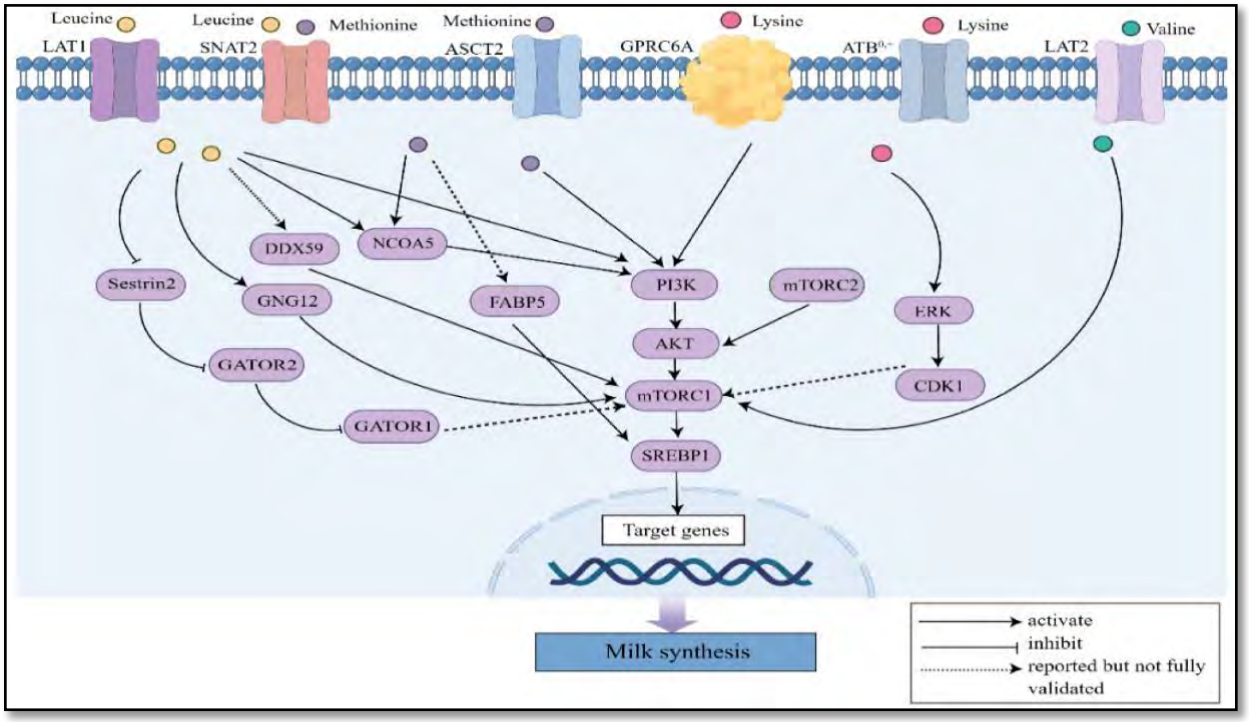
which is a dual-purpose protein kinase and phospholipid kinase. After activation, PI3K finally transforms into phosphatidylinositol 3,4,5-triphosphate (PIP3). According to reports, the addition of amino acids stimulates the mTORC1 pathway in dairy bovine mammary epithelial cells (BMECs) by means of the Septin6 factor, hence facilitating cell proliferation and the synthesis of milk proteins. Supplementing BMECs with amino acids can also activate mTOR signaling via Glycyl-tRNA synthetase (GlyRS) and Seryl-tRNA synthetase (SARS), which will benefit cell growth and casein synthesis. Furthermore, β-casein production can be stimulated by adding the right ratio of necessary amino acids to both BMECs and bovine mammary tissue explants (MTE). Methionine, leucine, valine, and lysine are among the amino acids on which researchers concentrate.



Peptides: When two or more amino acids dehydrate and condense, peptides are created. It has a major impact on biologically active processes and is implicated in hormones, neurons, cell growth, and reproduction. Peptides can influence a milk protein's possible signaling pathway and improve milk protein from mammals (goats, cows, etc.). Among these, mTOR continues to be significant. The promotion of mammalian milk fat synthesis has been shown to be greatly aided by ghrelin, kisspeptin-10, dipeptide (methionyl-methionine), and substrate (threonyl- phenylalanyl-phenylalanine). Peptides can influence a milk protein's possible signaling pathway and improve milk protein from mammals (goats, cows, etc.). Among these, mTOR continues to be significant. The promotion of mammalian milk fat synthesis has been shown to be greatly aided by ghrelin, kisspeptin-10, dipeptide (methionyl-methionine), and substrate (threonyl- phenylalanyl-phenylalanine). The peptide-promoted production of milk fat is also dependent on the JAK2-STAT5

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and mTOR signaling pathways. Related proteins like GPR54, ERK1/2, and AKT all influence the production of milk fat in these pathways. They will eventually achieve the impact

of boosting lactation by increasing the expression of PepT and β-casein in mammary epithelial cells via the route.

The enhancement of milk production by lipids

Triglycerides and lipoids (phospholipids, sterols) are examples of lipids. In addition to being a vital source of energy, fatty acids have an impact on tissue and cellular metabolism (Calder, 2019). Fatty acids stimulate the synthesis of milk fat, and this process is significantly aided by the mTOR pathway. Numerous fatty acid-related factors, including SREBP1, FABP3, PPARG (peroxisome proliferators-activated receptor gamma), and others, influence the production of milk fat. One important element controlling animal fat production is SREBPS. It controls fat production by regulating the gene transcription of lipogenesis-related enzymes, which in turn controls the activity of lipogenesis-related enzymes. FABP belongs to the class of intracellular lipid-binding proteins. It is important for intracellular absorption, transport, and metabolism of long-chain fatty acids. Additionally, a few C18 unsaturated fatty acids have been found, including oleic, linoleic, linolenic, palmitic, stearic, and palmitic. By altering the expression of FABP3, oleic acid, stearic acid, and palmitic acid can enhance the formation of lipid droplets in BMECs and upregulate SREBP1 and PPARG to stimulate milk fat production.

The enhancement of milk production by carbohydrates

Glucose is one of the most significant carbs, and energy metabolism is closely linked to carbohydrates. It is a necessary precursor for the lactating mammary gland to synthesize lactose, which powers the immune system and milk production in dairy cows. The production of lactose, nicotinamide adenine dinucleotide phosphate (NADPH), and milk fat are the three processes by which the mammary gland uses glucose. The uptake of glucose in the mammary gland of mammals is facilitated by two distinct transport mechanisms: sodium-dependent transport, which is mediated by the sodium+/glucose co-transporter, and facilitative transport, which is mediated by the glucose transporter family. The AMPK mTOR pathway is the most significant in milk protein synthesis that is stimulated by glucose. The AMPK and mTOR signaling pathways interact with one another. Closely linked to intracellular energy metabolism, adenosine monophosphate (AMP)-activated protein kinase (AMPK) is capable of preserving energy balance in the face of metabolic stress at the cellular and physiological levels. One of mTOR's upstream factors is AMPK. The mTOR signaling pathway is suppressed when AMPK is triggered by external stimuli, which lowers the number of related proteins synthesized.

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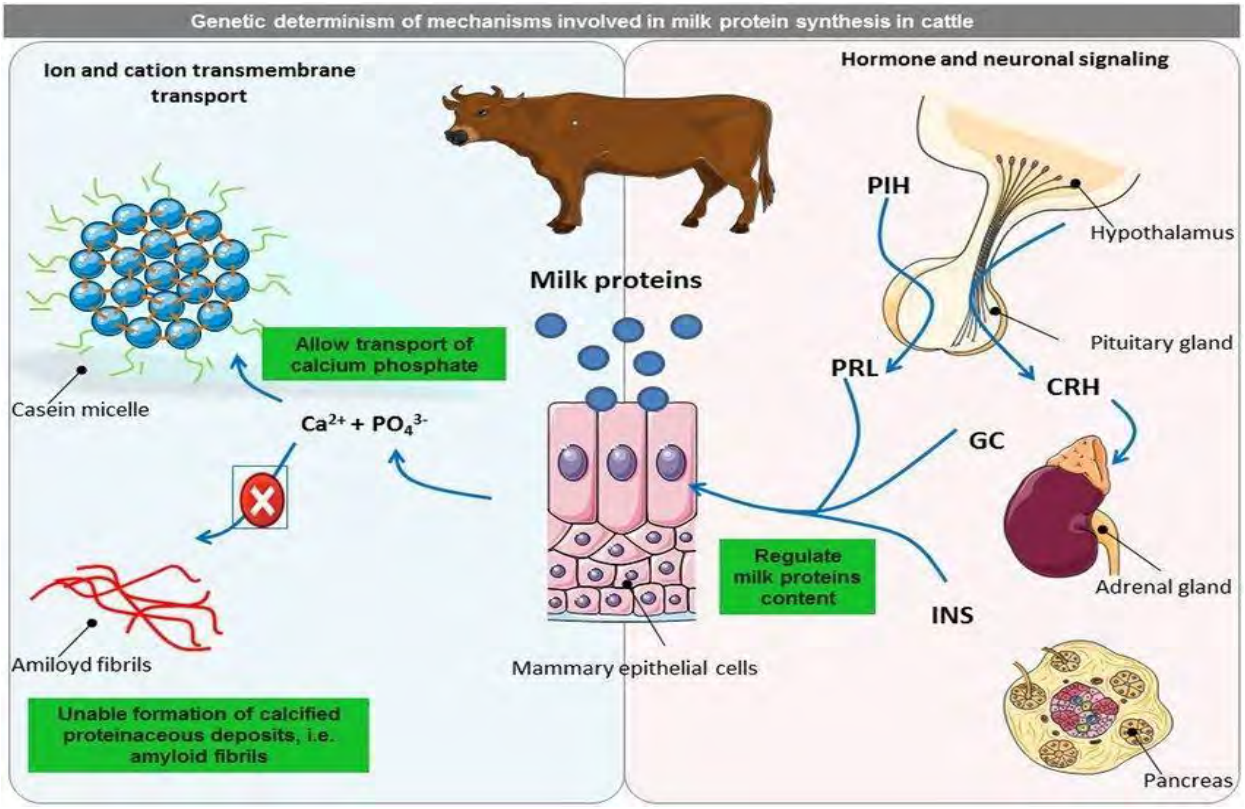

Conclusion

The improvement of milk production with vitamin supplements and associated processes are outlined in this article. Most research focuses on using lipids and amino acids to increase milk production. The mechanisms involved in protein synthesis, fat synthesis, and metabolism can all be impacted by nutrients. The transport systems that carry nutrients across membranes are also crucial for boosting the production of milk. Among all the pathways, JAK2-STAT5A, SREBP1, PPARG, and mTOR were the most often implicated. These pathways are crucial for encouraging the production of milk.

References

Calder, P.C. Functional Roles of Fatty Acids and Their Effects on Human Health. JPEN J. Parenter. Enteral Nutr. 2019, 39, 18s-32s

Tricarico, J.M., Kebreab, E. and Wattiaux, M.A. MILK Symposium review: Sustainability of dairy production and consumption in low-income countries with emphasis on productivity and environmental impact. J. Dairy Sci. 2020, 103, 9791-9802

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Popular Article

Medicinal And Nutritional Benefits of Chia (*Salvia Hispanica* L.)

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Abstract

Nitrogen takes part in many physiological and and biochemical plant processes and is a structural unit of amino acids, nucleic acids, enzymes and proteins, chlorophyll, and cell wall. Nitrogen is thus universally limiting factor in soil and most important for crops growth and yield, its management in the field level is necessary to obtain high seed yield. Efficient fertilization is necessary in both economic and environmental terms. This minimizes nutrient losses to the environment while producing optimum crop yields.

Keywords: Agronomic practices, Sowing, Irrigation, Insects & disease management, Health Benefits of Chia Seeds.

Introduction

Chia (*Salvia hispanica* L.) seed is a member of the Lamiaceae family and comes from Mexico. Chia seeds have previously been used to make seed oil, mucilage, flour, and entire seeds. Chia seeds are gaining popularity in Mexico as a whole in refreshing drinks, which is increasing their use as an ingredient in food products. As a result, during the past few years, there has been a sharp increase in the number of publications regarding chia seed that describe its usage as a food additive. Due to their outstanding nutritional qualities, including as their high fiber, polyphenol, and fat content, they have been highly regarded **(Zettel & Hitzmann, 2018).**

Chia, also known as *Salvia hispanica* L, is a multipurpose plant whose use as food dates back to 2500 B.C. Between 1500 and 900 B.C., it was a staple food in Mexico after being domesticated in Mesoamerica (Pozo Pozo, 2010). It is an annual herbaceous species in the Labiatae family, and in pre-Columbian times, its fruits were one of the four main traditional food sources. It was rediscovered recently (**Ayerza and Coates, 2009**).

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Nutritionally, chia seeds are rich in alpha-linolenic acid (ALA), a plant-based omega-3 fatty acid. The seed contains 25% to 40% oil with 60% of it comprising (omega) ω-3 alpha-linolenic acid and 20% of (omega) ω-6 linoleic acid. The human body badly need both essential fatty acids for healthy life, and they cannot be artificially synthesized. They are also high in dietary fibre, protein, calcium, iron, magnesium, zinc by (**Herman *et al*., 2016**).

Fig: - Data observation of respective research trial

Nitrogen takes part in many physiological and biochemical plant processes and is a structural unit of amino acids, nucleic acids, enzymes and proteins, chlorophyll, and cell wall. The main problem is the unequal ripening of the central inflorescence compared to the side shoots that stay green. However, waiting until all seeds are mature rises the risk of seed loss due to shattering problems, damage from birds, and abiotic factors like rain and wind. Chia is an interesting option, which has been illustrated as being drought resistant while maintaining high growth under reduced water availability. while in Mexico, 68 kg of nitrogen per hectare, however, recent crops already use quantities greater than 100 kg /ha of nitrogen. Chia (*Salvia hispanica* L.) is a plant of the *Lamiaceae* family native to Mexico and Guatemala. This crop was cultivated by pre-Columbian communities, and it was the third most important economic source only surpassed by corn (*Zea mays* L.) and beans (*Phaseolus vulgaris* L.). Chia seeds were valued for food, medicine and oil. With Spanish contact and colonization, however, cultivation of the species diminished sharp. **(Ixtaina *et al*., 2010).**

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Health Benefits of Chia Seeds

Magnesium and phosphorus are two elements found in chia seeds that are essential for maintaining healthy bones. Additionally, one ounce of the seeds has 18% of the daily recommended calcium intake, which is necessary for strong bones, muscles, and nerves. Chia seeds have more calcium than dairy products gram by gram.

1. **Rich in Nutrients:** Chia seeds are packed with essential nutrients, including fiber, protein, omega-3 fatty acids, antioxidants, vitamins (such as vitamin B, vitamin D, and vitamin E), and minerals (including calcium, magnesium, phosphorus, and potassium).
2. **High in Dietary Fiber:** Chia seeds are an excellent source of dietary fiber, which can aid digestion, promote a feeling of fullness, and help regulate blood sugar levels. The soluble fiber in chia seeds can also contribute to lower cholesterol levels.
3. **Heart Health:** The omega-3 fatty acids in chia seeds, particularly alpha-linolenic acid (ALA), can help reduce the risk of heart disease. They may lower blood pressure, reduce inflammation, and improve overall cardiovascular health.
4. **Weight Management:** Due to their high fiber content and ability to absorb water, chia seeds can help control appetite and contribute to weight loss or weight maintenance when incorporated into a balanced diet.
5. **Blood Sugar Control:** Chia seeds have a low glycemic index, which means they have a minimal impact on blood sugar levels. This can be beneficial for individuals with diabetes or those looking to manage their blood sugar.
6. **Bone Health:** Chia seeds are a good source of calcium, phosphorus, and magnesium, all of which are essential for maintaining strong and healthy bones.
7. **Digestive Health:** The fiber in chia seeds supports a healthy digestive system by promoting regular bowel movements and preventing constipation.
8. **Hydration:** Chia seeds can absorb up to 10 times their weight in water, making them a valuable addition to hydration strategies, especially for athletes. They can help maintain electrolyte balance and prolong hydration during physical activity.
9. **Antioxidant Properties:** Chia seeds contain antioxidants, such as quercetin, chlorogenic acid, and caffeic acid, which help protect cells from oxidative damage and reduce the risk of chronic diseases.
10. **Omega-3 Fatty Acids:** Chia seeds are one of the best plant-based sources of ALA omega-3 fatty acids. These fats are associated with brain health and may have anti-inflammatory effects.
11. **Skin Health:** The combination of antioxidants, omega-3s, and minerals in chia seeds can contribute to healthy skin by reducing inflammation and promoting tissue repair.

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Varity' CHIAmpion W-83' crop variety was manually sown during the second fortnight of July and harvested during the first fortnight of November, etc.

CLIMATE

Chia seeds are a popular superfood known for their nutritional benefits, and they can be grown in various climates. However, they have specific requirements for temperature, rainfall, and soil conditions. Here's an overview of the climate requirements for chia seed cultivation.

Temperature: Chia plants (*Salvia hispanica*) thrive in moderate to warm temperatures. They are typically grown in regions with average temperatures ranging from 60°F (15°C) to 95°F (35°C). Chia plants are sensitive to frost and cannot tolerate freezing temperatures.

Rainfall: Chia is a drought-tolerant crop and can grow in arid or semi-arid regions. It prefers well-distributed rainfall or irrigation during its growing season. However, chia can also adapt to regions with as little as 300 to 600 millimeters (12 to 24 inches) of annual rainfall.

Soil: Chia plants prefer well-draining soils. Sandy or loamy soils with good aeration and organic matter content are ideal. Soil pH should be in the range of 5.0 to 8.0 for optimal growth. Chia plants that are mature do not tolerate damp soils during growth, however chia seeds that have been sown need moisture for seedling establishment.

Growing Season: Chia seeds are typically sown in the spring or early summer when temperatures are warm and there's adequate sunlight. The growing season lasts for several months, depending on the local climate.

Land preparation: Choose a well-drained field with good soil fertility. Sandy or loamy soils with good organic matter content are ideal for chia cultivation. Ensure that the selected site receives adequate sunlight, as chia plants require plenty of sunlight to grow and produce seeds.

Soil Testing: Conduct a soil test to determine the pH and nutrient content of the soil. Chia plants thrive in soils with a pH between 5.0 and 8.0. Based on the soil test results, amend the soil as needed to ensure proper pH and nutrient levels. This may involve adding lime to raise pH or adding organic matter or fertilizers to address nutrient deficiencies.

TIME OF SOWING

Winter is the ideal time to plant and grow chia seeds and the very early spring, because it is considered as the short-day plant and cannot grow in long day season. But they cannot tolerate frost and snow.

Fertilization: Apply any necessary fertilizers based on soil test recommendations or the nutrient requirements of chia. Balanced fertilization can promote healthy plant growth and seed production.

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Insects & disease: It is possible for your chia seeds to become infested with bugs. This is because bugs and other pests tend to be attracted to cool dark places, such as your pantry. If you notice bugs, eggs, or any other type of pests have invaded your bag of chia seeds, throw them out immediately.

POPAGATION

Growing chia plants from seeds might be the best work; simply prepare the soil for crop, scatter the seeds over it, prick them gently, and then cover them with dirt. Chia seeds are propagated from both seeds and seedlings. Chia seeds should be watered often; they begin to sprout in 7 to 10 days. Thin the seedlings as they develop once they reach a height of 7 to 10 cm and have 5 to 6 pairs of genuine leaves.

SEED RATE

Typically, 2.5 to 3 kg per acre area sown.

IRRIGATION

Chia crop should be irrigated frequently for better yields, in chia plantation; the plan may need, from one to five irrigation per growing season, depending on climatic conditions and rainfall

HARVESTIN:

Plant starts yielding by 100-140 days after plantation. Harvesting is done during winter month as the plant become dormant.

Store the Chia Seeds: Once you have separated the seeds from the flower heads and any remaining debris, store the chia seeds in airtight containers. Store the containers in a cool, dry place away from direct sunlight. Proper storage helps maintain the freshness and quality of the seeds.

CONCLUSION

The findings of present study showed that application of treatment combination performed better of growth and economy which was found to be more productive and economically viable. Since the finding are based on the research done in one season. Further trials are needed to confirm more precise results.

References:

Freitas, J. H. E. S., de Santana, K. V., do Nascimento, A. C. C., de Paiva, S. C., de Moura, M. C., Coelho, L. C. B. B., & Napoleão, T. H. (2016). Evaluation of using aluminium sulphate and water-soluble Moringa oleifera seed lectin to reduce turbidity and toxicity of polluted stream water. *Chemosphere*, **163**: 133-141.

Herman, J. P., McKlveen, J. M., Ghosal, S., Kopp, B., Wolson, A., Makinson, R., & Myers, B. (2016). Regulation of the hypothalamic-pituitary-adrenocortical stress response. *Comprehensive physiology*, **6**(2): 603.

Inamullah, S. I., Ayub, M., Khan, A. A., Anwar, S., and Khan, S. A. (2012). Response of common buckwheat to nitrogen and phosphorus fertilization. *Sarhad J. Agric*., **28**(2): 172-178.

Ixtaina, V. Y., Vega, A., Nolasco, S. M., Tomás, M. C., Gimeno, M., Bárzana, E., & Tecante, A. (2010). Supercritical carbon dioxide extraction of oil from Mexican chia seed (*Salvia*

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hispanica L.): Characterization and process optimization. *The Journal of Supercritical Fluids*, **55**(1): 192-199.

Kirruti, J. S., Mburu, M. W., & Njoroge, D. M. (2021). The Effect of Drying Processes on the Nutritional and Phytochemical Levels of Chia Leaves (*Salvia hispanica* L.) at Different Stages of Growth. *European Journal of Agriculture and Food Sciences*, **3**(6): 68-75.

Maruti, Hulihalli, U. K., and Arvind K. B. N. (2018). Production potential of buckwheat (*Fagopyrum esculentum*) as influenced by genotypes and fertilizer levels in Northern transition zone of Karnataka, India. *International journal of current Microbiology and Applied Sciences*, **7**(9): 537-545.

Zettel, V., & Hitzmann, B. (2018). Applications of chia (*Salvia hispanica* L.) in food products. Trends in Food Science and Technology, 80, 43–50.

Ayerza R, Coates W, 2009. Influence of environment on growing period and yield, protein, oil and linolenic content of three chia (*Salvia hispanica* L.) selections. *Ind. Crops Prod.* 30:321-4

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Popular Article

Drones: Revolutionizing Indian Agriculture

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Abstract

India's economy is mostly based on agriculture. For the vast majority of rural households, agriculture continues to be their main source of income. A significant amount of India's exports are agricultural products, which are another important component of its economy. Despite the growing importance of agriculture, the industry is still lagging behind in terms of technical development. The main causes of this situation have been cropping failure owing to unfavorable weather and unmanaged pest problems. Researchers, farmers, and managers of natural resources must understand how plants, animals, and landscapes as a whole are impacted by shifting environmental conditions and other stresses in order to maximize resilience and productivity. A promising method for describing landscapes, specific plants and animals, and the numerous pressures they face is remote sensing with drones

There have been just too many advances in precision agriculture in recent years to not increase crop output. Over 70% of the rural population relies on agriculture, particularly in developing nations like India. The illnesses cause severe losses in the agricultural lands. Despite how heavily India depends on agriculture, it still falls far short of incorporating cutting-edge technologies to create high-quality farms. Precision agriculture monitoring is crucial for supplying essential ideas for improving agricultural productivity and food management. Precision agriculture is a crop management idea that is more beneficial for increased productivity and is field-specific. In order to make better decisions for increased productivity, precision agriculture uses real-time data from sensors and geospatial tools (remote sensing, geographic information systems). The most recent development is the use of drones or other unmanned aerial vehicles for precision agriculture. An aircraft that can fly without a human pilot and is controlled by radio channel is called a UAV or drone. Drones have a wide range of uses.

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The use of land vehicles to monitor various agricultural processes in conventional farming methods required a lot of human labor and time. Drones are a better option for agricultural operations than traditional techniques. Due to their most amazing qualities, using drones in agriculture has a significant positive impact on both time and money. Numerous studies conducted in recent years have shown that drones can cover an area that is nearly 10 to 15 times larger than what can be reached using conventional land-based methods. Computers can control drones based on their capabilities, allowing them to be automated over a wide region, locate remote areas, and even be semi-automated. Because of their effectiveness, drones can be utilized for a variety of agricultural tasks some of which are discussed in detail as under:

a) **Mid-Season Crop Health Monitoring:** The most common use of drones in farming is to use near-infrared (NIR) or normalized difference vegetation index (NDVI) sensors to scan crop growth from a height of roughly 100 metres. Traditionally, this job was carried out by often-reluctant college interns who entered the fields with a notepad. Modern drones enable the capture of data that cannot be seen by the human eye (such the NDVI or near-infrared), as well as the covering of a larger surface area in a shorter amount of time. Additionally, it greatly reduces human error in traditional inventory work, while it is still advised to physically verify a potential problem location after viewing the picture. Crops in production of agriculture can be damaged in a variety of ways that result in structural or spectral changes. Weather-related structural change can be brought on by things like wind and hail. Drone mapping can help to locate and quantify crop damage caused by weather-related events as well as a wide range of other factors, such as insects and illnesses. These adjustments can range from subtle, like a modest shift in the vegetation index, to drastic, like a complete change in colour, like when sooty mould covers the leaves of sorghum. The user may choose to do this kind of inspection. Drone inspection intervals are now being researched to complement current mapping assets like satellites and manned aircraft.

b) **Irrigation management:** One of the biggest issues facing agriculture today is the scarcity of water, and pressure on water resources is predicted to grow in the future. In order to protect crops from drought-related losses, water management systems that can adapt to shifting water demands almost instantly are needed. To do this, it is necessary to have reliable data that reflects emerging water deficits before those shortages result in loss of production. To measure the loss of soil moisture in the soil profile, soil moisture sensors are normally placed at a few carefully chosen sites around the field. To determine the amount of water needed, irrigation system managers used data from soil moisture sensors along with knowledge of the crop type,

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soil properties, and climatic factors including temperature, precipitation, and humidity. By improving the efficiency of data generation, drones can significantly contribute to the evolution of irrigation systems. Under a wide range of environmental circumstances and with unmatched levels of data generating efficiency, aerial sensing devices can give a reliable spatial and temporal assessment of crop water stress.

c) **Weed management:** Drones have advantages in this application because of the great degree of flexibility in spatial resolution. Weed mapping is a frequently utilized application of remote sensing in agriculture. In terms of how the aerial mapping phase is carried out and the imagery is analyzed, the difficulty of mapping weeds is identical to that of mapping seedling emergence. Farmers and their agronomists may readily distinguish between areas of high-intensity weed proliferation and healthy crop areas growing next to them using NDVI sensor data and post-flight image processing to build a weed map. Typically, multispectral photography is best suited for mapping weeds in crop fields. To ensure understanding of the morphology, phenology, and ways in which they differ from crop species, the agronomist must collaborate closely with the image analyst when mapping weeds.

d) **Nutrient management:** The use of drones to inspect the soil is one of their main applications. In the conventional method of farming, there are many steps involved in inspecting the soil, including physically visiting the site and inspecting the soil sample for various factors. In contrast, the drone is equipped with a variety of censors and highly developed equipment for precisely inspecting the soil and providing accurate reports. For the goal of improving Nitrogen, Phosphorus, and Potassium applications in agriculture, ground-based inspections combined with satellite imaging, together with a dedicated grid soil sample programme, are more viable.

e) **Agriculture spraying:** Since drones are flying devices, a spraying technique can be used to effectively deploy them in agriculture for smart farming. Drone sensors will gather data from agricultural areas, and depending on the need, fertilizers and pesticides will be sprayed on the necessary crops. These technologies are helpful in situations where human interaction is not possible, such as when there is a labor shortage. The drones can also detect the diseased crops and the severity of the illness. Based on the severity of the infection, certain crops will receive fertilizer applications while pesticides won't be applied to healthy crops. With the automation of currently manned aerial application aircraft, this small-scale application could potentially result in large-scale application. A specific application of solids is found in the large-scale planting of trees, where drones release biodegradable seed capsules into the soil.

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Conclusion

Farmers in the agricultural industry can profit from drones in a variety of ways, including higher productivity, better yields, and lower expenses. Farmers may be hesitant to accept this technology due to worries about job loss, a lack of expertise, and inadequate training. While drone technology acceptance in rural India is still in its infancy, initiatives are being made to overcome these issues and advance drone use in agriculture. It is crucial that farmers comprehend the potential advantages of this technology and get the support and training they need to use it successfully. It is crucial that farmers and policymakers collaborate to ensure that the advantages of drone technology in agriculture are realised while also addressing any worries or issues that may arise. By doing this, we can contribute to the development of an agriculture sector that is more productive and sustainable and that benefits both farmers and consumers.

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Popular Article

Defence Modulators for Enhancing Quality and Disease Resistance in Horticulture Crops

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Introduction

The world population is increasing at an alarming rate and is expected to reach about 10 billion by the end of 2050, but the productivity of food is decreasing due to the effect of various biotic and abiotic stresses and post-harvest losses of produce. In order to meet the world's rising food demand, reducing these losses is a major significant concern for all countries. However, in India losses through diseases are 20%, losses from insect pests are 25%, and abiotic stresses can reduce crop yields by up to 50% on average. There are numerous technical options available to combat this problem. Some options include development of resistant cultivars, biological control, crop rotation, tillage and agrochemicals. A complicated interconnection of biotic and abiotic stresses and post-harvest storage losses leads to enormous usage of agrochemicals. While, their use at commercial level is uneconomical, their application is time-consuming, and some have been shown to cause cancer. However, with rising consumer interest in food, attention has shifted more towards quality assurance with particular emphasis on the enhancement of health-promoting phytochemicals that promote health. Therefore, considerable efforts have been accomplished to devise environmental-friendly strategies for the check of plant diseases and thus to save mankind from health hazard. Keeping this back ground, post-harvest defence modulators/elicitor treatments may a viable option to elicit the desired effect and to ensure an efficient and consumer-oriented supply chain.

Why focus on Defence modulators/elicitors?

- **Chemical compounds** – Not only Contaminate soil, but it also contaminates the natural water resource and vegetation.

- In addition to killing insects and pest, it also **toxic to beneficial organisms** like honey bee and other pollinators in turn the biodiversity and sustainability of environment will be affected.
- The Chemical residues when added to the food chain it will cause health hazards and some chemicals are also proven to be carcinogenic nature.

➢ Whereas, **Defence modulators/ Elicitors** – In-turn induce defence responses by altering the physiology of the plant

- Even the low concentration is enough to provide the plants with long term protection to a wide range of pathogens
- Non – toxic and environmentally friendly in nature.

- **What is Defence modulators (Elicitors)?**

Elicitors are the bio-factors from various sources that can trigger physiological and morphological responses and also phytoalexin accumulation in the target living organisms.Originally the term elicitor was used for molecules capable of inducing the production of phytoalexins, but it is now commonly used for compounds stimulating any type of plant defense.This broader definition of elicitors includes both substances of pathogen origin (exogenous elicitors) and compounds released from plants by the action of the pathogen (endogenous elicitors)

CLASSIFICATION OF DEFENCE MODULATORS

✓ **Depending upon their origin,** they are classified as **biotic** and **abiotic** elicitors.

❖ **Biotic elicitors**: The biotic elicitors are such elicitors that are biological nature derived from plants or pathogens. Biotic elicitors are either pathogen (or) host origin that can stimulate defense responses (such as phytoalexin accumulation) in plant tissues.

❖ **Abiotic elicitors:** Abiotic elicitors have non biological nature and can be either physical agents or chemicals. Abiotic elicitors are of non-biological origin.

✓ Elicitor classification **based on their interaction** with the host plant.

❖ **General Elicitors:** They are able to trigger defense both in host and non-host plants. They do not significantly differ in their effect on different cultivars within a plant species and are involved in primary innate immunity.

❖ **Specific Elicitors (gene-gene):** They induce defense responses leading to disease resistance only in specific host cultivars. They are formed by specialized pathogens and function only in plant cultivars carrying the corresponding disease resistance gene. Effectors typically lead to the secondary innate immunity after an intracellular receptor mediated perception.

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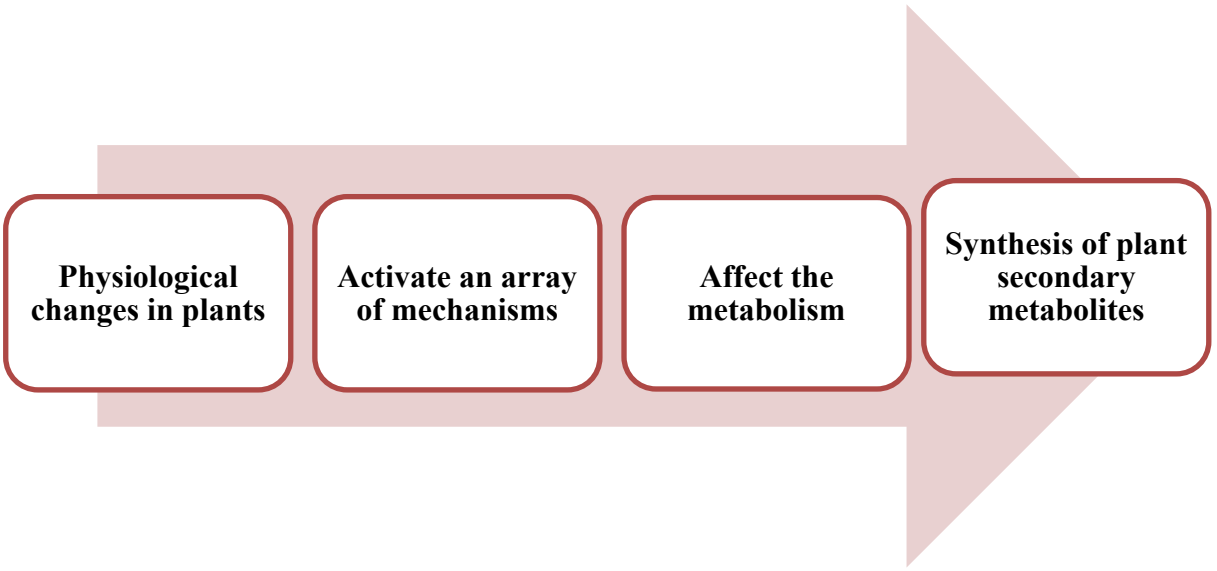
Molecular mechanism of elicitation

- When elicitor come into contact with the plant, the receptor presents in the plasma membrane recognize & bind with the elicitor
- This will initiate series of biochemical activities like – ion influx, etc.
- Initially K & Cl- efflux and ca2+ & H+ influx takes place
- The most important is Ca2+ influx, beacuse Ca2+ regulate ROS burst etc.
- Ca2+ promote secondary messengers' production like IP3 & diacylglycerol (DAG) through G- protein activation
- These 3 processes will mediate the MAP Kinase phosphorylation which will produce signals to hormone for defence & mediate gene expression through transcription & translation
- With the help enzyme reactions secondary metabolites will produce.

Main Functions of Defense modulators



Commonly used elicitors

- ✓ Salicylic Acid
- ✓ Methyl Jasmonate
- ✓ Ascorbic Acid
- ✓ Sea Weed Extract
- ✓ Chitosan

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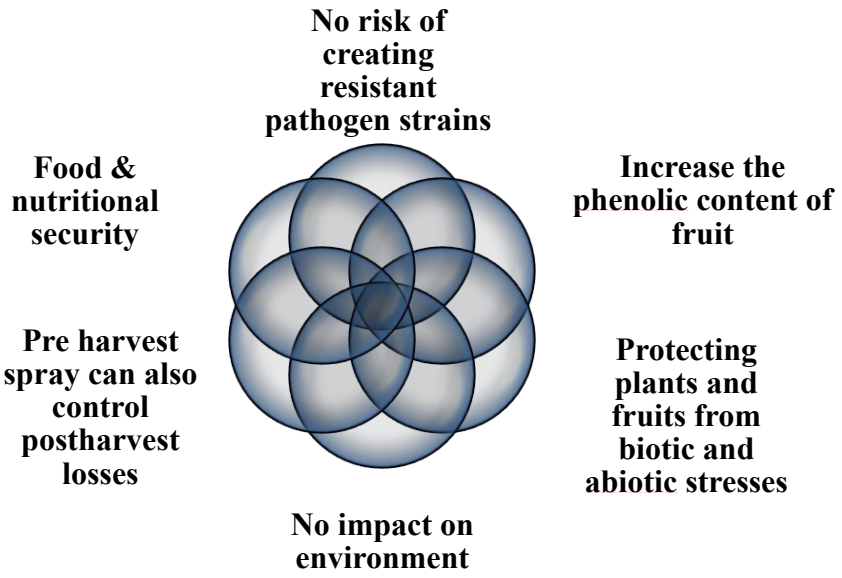
Advantages



Conclusion

- ✓ Defense modulators have the potential of increasing plant **productivity** and **quality** through influence on various metabolic processes.
- ✓ Reduced **environmental hazards** as elicitors affect directly the crop plants, and their **acute toxicity** to other organisms is lower than that of **pesticides**.
- ✓ Elicitors are compounds that play major role in **plant defence mechanism**.
- ✓ Improvement in quality, colour, appearance, shelf life, firmness and spot-free fruits will be of **great boon to farmers**.
- ✓ The use of elicitors in crop protection and pest management is a viable option for enhancement of growth, yield and quality

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Popular Article

Harnessing the Power of Nature: The Herbal Revolution in Livestock Productivity

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Abstract

Herbal supplementation in livestock production has gained considerable attention as a natural and sustainable approach to improve animal health, productivity, and overall well-being. Traditional herbal knowledge, passed down through generations, forms the basis for herbal supplementation practices in livestock farming. These ethnoveterinary practices leverage the healing properties of various herbs, plants, and botanical extracts to address a range of health challenges faced by livestock, including heat stress, digestive disorders, immune system support, and more. One of the primary benefits of herbal supplementation is its potential to enhance the immune system of livestock. Numerous herbs possess immunomodulatory properties, which can aid in disease resistance and reduce the need for antibiotics and synthetic drugs. Additionally, herbal supplements can contribute to the mitigation of heat stress, a growing concern in the context of climate change. The use of herbal supplements in livestock nutrition is gaining momentum as a means to optimize feed efficiency, reduce feed-related disorders, and improve overall production outcomes. Furthermore, the emphasis on natural and sustainable farming practices aligns with consumer preferences for food products free from synthetic chemicals and residues. This abstract highlight the need for further research and exploration of herbal supplementation in livestock production.

Key words: Ethnoveterinary practice, Herbal supplementation, immunomodulatory properties.

Introduction:

In the age-old quest to enhance livestock productivity, farmers have often turned to the wonders of nature for solutions. As we strive to produce more with less, sustainable and natural alternatives are gaining traction. One such promising frontier is the use of herbal mixtures to boost the health, well-being, and ultimately, the productivity of our livestock. In an era where sustainable and eco-friendly practices are gaining prominence, it's no wonder that the world of livestock farming is turning to nature's own remedies to enhance productivity. One such remarkable trend involves the use of herbal mixtures, a time-tested solution that is gaining popularity among farmers worldwide. These herbal concoctions, derived from various plants and herbs, are proving to be powerful allies in

boosting the health and productivity of livestock. In this article, we'll delve into the fascinating world of herbal mixtures and explore how they are making a positive impact on livestock farming.

The Power of Herbs in Livestock Health:

Herbal mixtures consist of a blend of herbs, leaves, roots, and other plant parts known for their medicinal and nutritional properties. These mixtures are meticulously crafted to provide a range of benefits to livestock, including:

1. **Improved Digestion:** Many herbal ingredients have digestive properties that aid in the breakdown of feed, leading to better nutrient absorption by animals. Many herbal blends contain ingredients that aid digestion and optimize nutrient absorption. This can lead to better feed conversion and more efficient growth.

2. **Enhanced Immunity:** Certain herbs are packed with antioxidants and immune-boosting compounds that help animals resist diseases and infections. Herbs like echinacea, garlic, and turmeric are known for their immune-boosting properties.

3. **Stress Reduction:** Herbal mixtures can have a calming effect on animals, reducing stress levels that often result from environmental factors or transportation. Certain herbs, such as adaptogens like ashwagandha, help animals cope with stressors more effectively.

4. **Natural Deworming:** Some herbs possess anthelmintic properties, which help in controlling internal parasites in animals. Some herbs possess natural antiparasitic properties, reducing the need for chemical dewormers and minimizing resistance issues.

5. **Weight Gain and Milk Production:** Herbs that stimulate appetite and improve metabolism can lead to increased weight gain in meat-producing animals and higher milk yields in dairy cattle.

6. **Improved Reproduction**: Certain herbal mixtures can support reproductive health in livestock, resulting in higher fertility rates and increased offspring.

Herbal Supplements:

Herbal products have gained popularity in livestock production as natural and sustainable alternatives to synthetic chemicals and antibiotics. These herbal products can serve various purposes, from improving animal health and performance to enhancing the overall well-being of livestock.

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- **Garlic and Onion**: These herbs are known for their antimicrobial properties and can help improve the immune system of livestock.
- **Turmeric**: Turmeric has anti-inflammatory and antioxidant properties and is often used to enhance overall health and immunity in animals.
- **Ginger**: Ginger can aid digestion and reduce the risk of bloat in ruminants.

Essential Oils:

- **Oregano Oil**: Oregano oil is used as a natural antibiotic and has been shown to improve growth rates and feed efficiency in livestock.
- **Cinnamon Oil**: Cinnamon oil is used to support digestive health and may have antiparasitic effects.

Herbal Teas and Extracts:

- **Peppermint Extract**: Peppermint can improve digestion and reduce the risk of bloat and digestive discomfort in ruminants.

Herbal Dewormers:

- **Neem**: Neem is used as a natural dewormer for livestock and has antiparasitic properties.
- **Wormwood**: Wormwood is another herb used to control internal parasites in animals.

Herbal Fly Repellents:

- **Citronella**: Citronella-based products can be used to repel flies and other insects in livestock housing areas.

Herbal Calming Remedies:

- **Valerian**: Valerian root is used to reduce stress and anxiety in livestock during transportation or other stressful events.

Herbal Immune Boosters:

- **Astragalus**: Astragalus is believed to enhance the immune system and improve overall health in animals.

Herbal Topical Treatments:

- **Aloe Vera**: Aloe vera gel is used topically to soothe and heal skin irritations and wounds in livestock.

The Eco-Friendly Advantage:

One of the most appealing aspects of herbal mixtures is their eco-friendliness. Unlike synthetic

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additives and antibiotics, herbal remedies pose minimal risks to the environment and food chain. They contribute to the development of more sustainable and organic livestock farming practices that align with the growing consumer demand for natural, chemical-free products.

Conclusion:

As the world continues to seek sustainable and ethical alternatives to traditional livestock farming practices, herbal mixtures are emerging as a compelling solution. Their ability to improve animal health, boost productivity, and promote environmentally conscious farming practices makes them a powerful tool in the hands of modern farmers. As herbal mixtures continue to prove their worth in livestock farming, they are set to play a pivotal role in shaping the future of the industry. In the world of modern agriculture, the resurgence of herbal mixtures offers a promising path towards healthier, more productive livestock. By harnessing the power of nature, we can create a brighter and more sustainable future for both livestock and those who depend on their contributions to our food systems.

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Popular Article

Consumer Behaviour Towards Aloe Vera Products

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1.1 Consumer behaviour- An introduction

For a firm or company to survive, grow and compete, it is very essential that marketer identifies the needs and wants of customers and offer products according to their needs more effectively and efficiently than other competitors. Though similar but consumers are unique in themselves due to having different needs and wants which are varied and diversified from one another; and even they have different consumption pattern and consumption behaviour. The marketer helps them in satisfying their needs and wants through offering different products and services. A comprehensive knowledge of consumers and their consumption behaviour is essential for a firm to fight and to succeed.

Definition-Consumer behaviour is defined as the decision process and physical activity individuals engage in when evaluating, acquiring, using, or disposing of goods and services.

1.2. Some consumer behaviour roles

Role	Description
Initiator	The individual who determines that some need or want is not being met and authorizes a purchase to rectify the situation.
Influencer	A person who buys by some intentional or unintentional word or action influences the purchase decision, the actual purchase, and/or the use of the product or service.
Buyer	The individual who actually makes the purchase transaction.
User	The person most directly involved in the consumption or use of the purchase.

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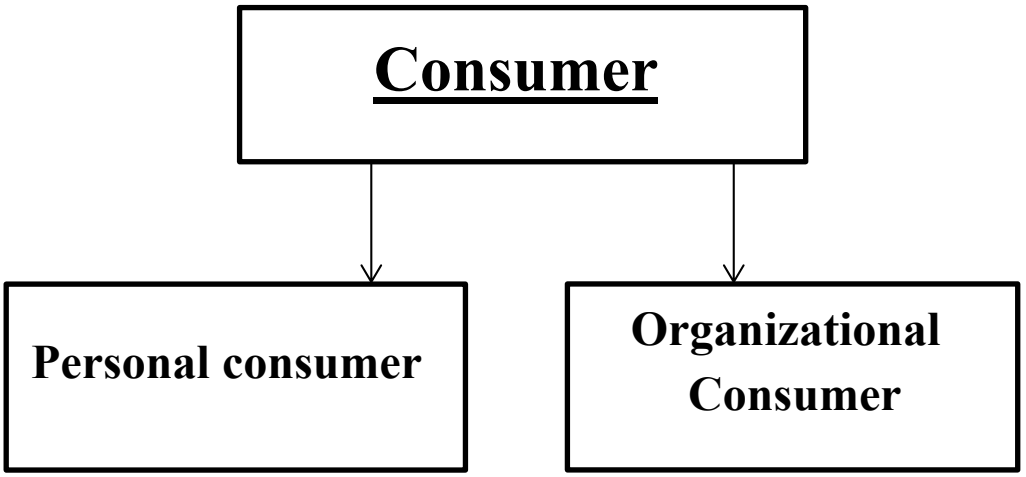
The "customer is king" philosophy has become one of the most important marketing strategies. The term consumer used to describe two different categories of consumers i.e., personal consumers and organizational consumer. Personal consumers are the consumers who purchases goods for the personal use and organizational consumers are the consumers who buys product and services in order to run their own business.

1.3. Consumer behaviour as a dynamic process-



Consumer behaviour involves understanding that acquisition, use and disposition can occur over time in a dynamic sequence. The American Marketing Association (AMA) defines consumer behaviour as "the dynamic interaction of cognition, behaviour and environmental events by which human beings conduct the exchange aspect of their lives. Consumer behaviour helps in the study of individuals, groups, or organizations and the processes they use to select, secure, use and dispose of products, services, experiences or ideas to satisfy needs and impact that these processes have on the consumer and society. Behaviour occurs either for the individual or in the context of a group (friend influence on the choice of purchasing clothes) or an organization (people on the job make decisions as to which products or services the firm should use).

1.4. Importance of consumer behaviour-

The marketing management tries to solve the basic problems of consumers in the area of consumption of product and services. To survive and to compete in the market, a firm has to be constantly innovating and understand the needs of customers, their tastes and preferences. It will extremely helpful for firm in exploiting marketing opportunities and for meeting the challenges that market offers. It is important for marketers to understand the consumer behaviour due to following reasons-

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- It can be used for the purpose of helping a firm or organization to accomplish its objectives. Advertising managers, product designers, and many others in profit oriented businesses prefers to study consumer behaviour in order to be more effective at their tasks.
- Understanding consumer behaviour from a macro perspective can provide insight into economic and social trends and can perhaps even predict such trends. It may also suggest ways to increase efficiency of the market system and improve the well-being of people in society.
- In today's time, consumers give more importance on environment friendly products. They are more concerned about health, hygiene, and fitness. They prefer natural products. Hence detailed study on upcoming groups of consumers is essential for any firm.
- Consumer behaviour helps firms to identify influencers and factors which influence the consumer purchase decisions.
- Consumer behaviour study helps marketer to understand psychology of customers regarding their products and services and can make efficient strategies for their product marketing.
- Consumer's tastes and preferences are changing continuously, so study of consumer behaviour provides information regarding the consumers' needs and can use it in making marketing strategies and for product development so that they can satisfy the need of customers.
- It helps in market opportunity analysis by examining trends and conditions in the marketplace to identify consumer's needs and wants that are not being fully satisfied.

The analysis begins with the study of general market trends, such as consumer's lifestyle and income levels.

- It helps in target market selection by identifying distinct groupings of consumers who have unique needs and wants. This can result in a decision to approach each market segment with a unique market offering.
- From the customer's point of view customers today are in tough spot as due to wide market and tough competition, the customers have a wide variety of products.

1.5. Aloe Vera Industry- An Introduction

- Aloe vera has been used for medicinal purposes in several cultures for millennia: Greece, Egypt, India, Mexico, Japan and China. Egyptian queens Nefertiti and Cleopatra used it as part of their regular beauty regimes. Alexander the Great, and Christopher Columbus used it

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to treat soldiers' wounds. The first reference to Aloe vera in English was a translation by John Goodyew in A.D. 1655 of Dioscorides' Medical treatise De Materia Medica. By the early 1800s, Aloe vera was in use as a laxative in the United States, but in the mid-1930s, a turning point occurred when it was successfully used to treat chronic and severe radiation dermatitis.

1.7 Varieties of Aloe Vera:

Gurguva aloe - Aloe vera(Aloe barbadensis)
Cape aloe - Aloe ferox
Sagotrin aloe - Aloe perryi

These are the three mainly cultivated types of aloe. Certain other types like Zanzibar, Uganda, Natal and Hyderabad aloe are having good quality of "aloe gel".Aloe vera belongs to the family Liliacae, and nearby there are about 150 species in Aloe vera. The common varieties are:

1. *Aloe barbadensis* Miller
2. *Aloe saponaria*
3. *Aloe chinesis*
4. *Aloe variegata*
5. *Aloe forex*
6. *Aloe lalifolia*

Of these the most popular is *Aloe barbadensis* Miller which has most therapeutic value and reffered to as 'True Aloe'. ICAR has released varieties like IC111271, IC111269, IC111280 etc. Central Institute of Medical science and Aromatic Plants, Lucknow, has also released the variety AL-1 for cultivation.

1.7 Consumer behaviour towards aloe vera products

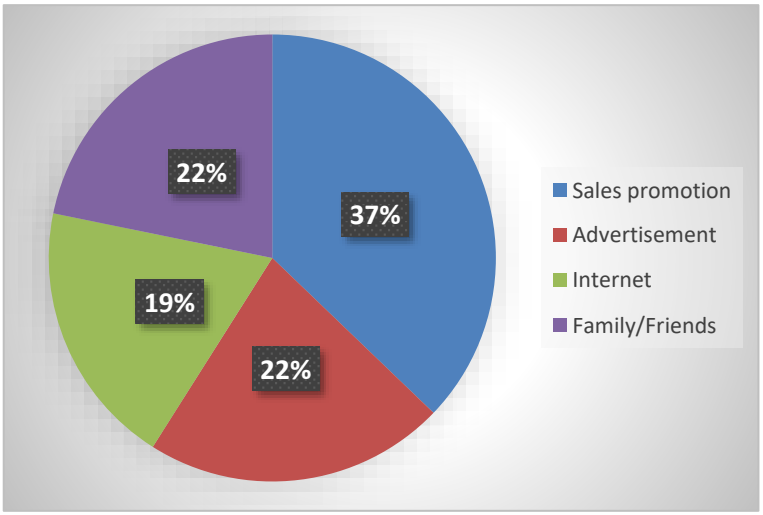

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Fig.1 showing from where the consumers get knowledge about Aloe Vera.

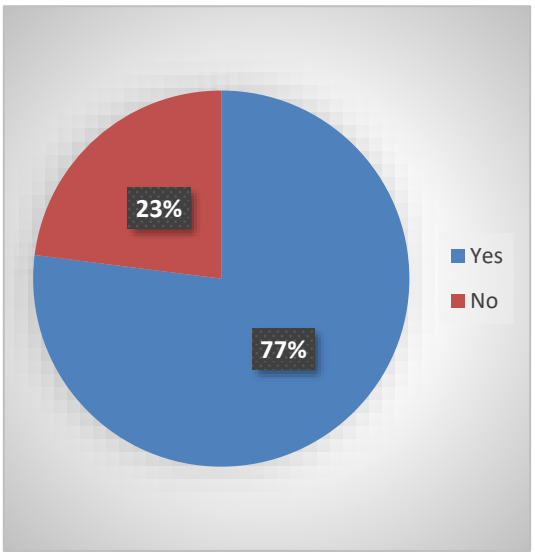

Fig.1 showing Aloe Vera use

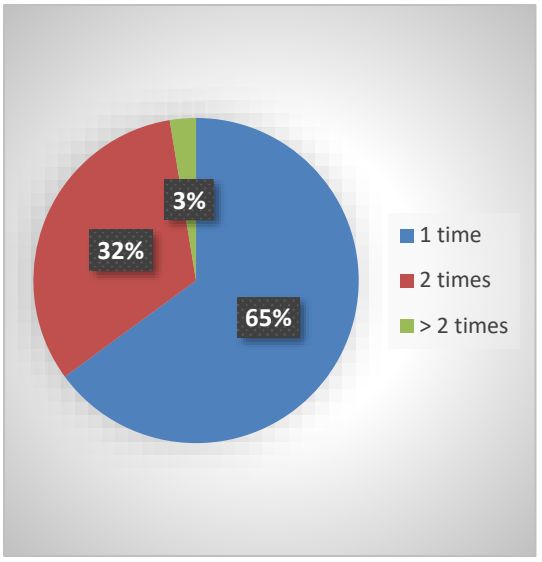

Fig. 3 showing usage of Aloe Vera products on daily basis

1.8 Conclusions

The Aloe Vera market is demand driven and facing cut throat competition from other brands also. The pull of consumers is so strong towards top brands that the stores are forced to keep the brand of consumer's choice. It has been found from study that most of the consumers are aware about the quality standards of aloe Vera and they just buy the brand name due to popularity of the brand and product itself as seen in advertisements. Most of the consumers get information about the product through advertisement and sales promotion. About 60% consumers use brands like Patanjali and Himalaya because they are the most popular brands in India and are available easily at any store. Decision maker in family regarding the purchase are elders and younger ones. 65% consumers choose brand and quality of the products over the price factor. Customers are not loyal to one brand and shifts easily to another brand. Gifts and offers are the factors of customer shifting to other brand followed by other factors like quality, schemes and quantity etc. Price mainly affects the sales of these products. The other factors which affect the sales are quality, quantity and offers etc.

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Abstract

Therapeutic management of Post Parturient Haemoglobinuria in Cattle

Yashoda Rathod, Mohammed Zaheer, Sandeep Halmandage
Department of Veterinary Clinical Complex, Veterinary College, KVAFSU, Bidar.
https://doi.org/10.5281/zenodo.10029511

Abstract

A Six-year H.F cross cattle was presented to the department of veterinary clinical complex, Veterinary College, Bidar with the history of reduced feed intake, sudden drop in milk yield, passing dark brown colored urine for three days. Clinical examination revealed dullness, pale conjunctival mucous membrane, 101.5ºF rectal temperature, tachycardia, coffee decoction-colored urine and jugular pulsation. Haematological examination showed Haemoglobin 5.4gm/dl, TEC $3.98x10^6$/µl, and PCV 20.00%. Biochemical analysis revealed decreased serum phosphorus level about 3mg/dl. Based on clinical findings and haemato-biochemical evaluation the case was diagnosed as Post Parturient Haemoglobinuria. The cattle were treated with inorganic buffered phosphorus solution-inj. Novizac@ 50ml I/V on the first day followed by 25ml I/V for the next four days. Supportive treatment included inj. Dextrose-20% 1000ml I/V, inj Tribivet 10ml I/M, inj Zeet 10 ml I/M and sodium bicarbonate @100gm P/O for 5 days. The animal was kept on oral Haematinics (Ferstron) @ 50ml P/O. The animal showed an uneventful recovery with improvement in clinical findigd 5 days post treatment.

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Popular Article

Biofertilizers: Reduces human & animal hazards

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Abstract

Biofertilizers are a type of fertilizer that contains living microorganisms, such as bacteria, fungi, and protozoa, that can improve soil health and crop nutrition. These organisms help in the supply of essential nutrients, such as nitrogen, phosphorus, and potassium, to the plants by converting inorganic compounds into organic matter. They also enhance the soil structure, increase water retention capacity, and improve soil fertility. Biofertilizers are eco-friendly and have minimal side effects, making them a preferred choice over chemical fertilizers. However, the effectiveness of biofertilizers depends on the type of microorganism used, the application method, and the environmental conditions. Therefore, the use of biofertilizers can help in sustainable agriculture and food production while reducing the negative impacts of chemical fertilizers on the environment. When the diazotrophic bacteria Pseudomonas fluorescens, *Azotobacter chroococcum, Azospirillum lipoferum*, and *Acetobacter* diazotrophicus were combined with the fungi *Trichoderma viride*, the plant height, dry weight, ear length, grain and stover yield, grain quality (58.9 percent protein and 17 percent carbohydrate), nitrogen uptake (grain 59.03 and stover 79.76 kg ha^{-1}) Phosphorus uptake (grain 9.21 and stover 8.73 kg/ha) and B: C ratio over control and single inoculation of pearl millet crop.

Keywords: Biofertilizer, Advantage, Importance, and classification of biofertilizer

Introduction

When applied to seeds, plant surfaces, or soil, biofertilizer—a material containing living microorganisms—promotes development by boosting the host plant's availability or supply of primary nutrients. Through the processes of nitrogen fixation, phosphorus solubilization, and growth-promoting chemical synthesis, it augments plant development with additional nutrients. A substance containing living microorganisms is called biofertilizer. By providing the host plant with more primary nutrients, they increase plant growth when applied to plant surfaces. Bio-fertilizers supplement soil with nutrients by means of organic processes such fixing nitrogen, phosphorus solubilization, and

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boosting plant development by inducing the production of chemicals that promote growth. Since bio-fertilizer is technically alive, it can work in tandem with plant roots to produce reciprocal benefits. Simpler chemicals that are easier for plants to ingest could be produced by the involved microbes from complicated organic material. It keeps the soil in its original state. Growth is increased by 20–30%, artificial nitrogen and phosphorus are substituted by 25%, and plant growth is improved **(Bhattacharjee and Dey, 2014).**

The foundation of biological fertilization is the availability of organic inputs, such as fungi, bacteria, animal dung, organic wastes, fertilizers, and domestic sewage. They improve rhizosphere nutrient fixation, generate growth-stimulating plants, aid in soil stability, provide biological control, break down materials, recycle nutrients, encourage mycorrhizal symbiosis, and advance bioremediation processes in soils tainted with toxic, xenobiotic, and resistant substances. In addition to improving yield per acre in a very short amount of time, bio-fertilizers also use less energy, decrease soil and water contamination, boost soil fertility, and promote biological control and antagonistic interactions with phytopathogenic organisms. Numerous advantages exist for the economy, society, and environment when using biofertilizer **(Carvajal-Muñoz and Carmona-Garcia, 2012).**

Agriculture plays a pivotal role in the growth and survival of nations; therefore, maintaining its quantity and quality is essential for feeding the population and economic exports. Over the years, agriculture has undergone various scientific innovations to make it more efficient **(Ajmal, 2018).** Modern agriculture involves the usage of pesticides and chemical fertilizers with the essence of increasing the world's food production, as these serve as a fast food for plants causing them to grow more rapidly and efficiently. Continuous application of chemical fertilization leads to the decay of soil quality and fertility and might lead to the collection of heavy metals in plant tissues, affecting the fruit's nutritional value and edibility **(Farnia and Hasanpoor, 2015).**

Biofertilizers are good sources for enhancing the nutrient availability in soil and plants. They are ready-to-use, live formulations of beneficial micro-organisms that are agriculturally useful in terms of N fixation, P solubilization, and nutrient mobilization by their biological metabolism to increase the productivity of soil and/or crop on application to seed, root, or soil treatment for mobilizing the availability of nutrients. In India, a systematic study on biofertilizers was started by N. V. Joshi in 1920. Rhizobium was the first isolated from various cultivated legumes, and this was followed by vast research by Gangulee, Sarkaria, and Madhok on the physiology of the nodule bacteria besides its inoculation for better crop production. Rhizobium and blue-green algae (BGA) are considered the traditional biofertilizers, while Azolla, Azospirillum, and Azotobacter are in the middle stage **(Rahimi *et al.*, 2014).**

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Advantages of biofertilizers

- It helps in maintaining environmental health by reducing the level of pollution.
- Reduces human & animal hazards by reducing the level of residue in the product.
- Increases the agricultural products and makes them sustainable.
- Ensures the optimum utilization of natural resources.
- Reduces the risk of crop failure.
- Improves the physical and chemical properties of soil.
- Biofertilizers are cost-effective when compared to synthetic fertilizers.
- Their use leads to soil enrichment and the quality of the soil improves with time.
- They are eco-friendly as well as cost-effective.
- They increase the phosphorous content of the soil by solubilizing and releasing unavailable phosphorous.
- Biofertilizers improve root proliferation due to the release of growth-promoting hormones.
- These fertilizers harness atmospheric nitrogen and make it directly available to the plants.
- Microorganism converts complex nutrients into simple nutrients for the availability of the plants.
- Biofertilizers can also protect plants from soil-borne diseases to a certain degree.

Importance of biofertilizers

- Biofertilizers improve soil texture and yield of plants.
- They do not allow pathogens to flourish.
- They are eco-friendly and cost-effective.
- Biofertilizers protect the environment from pollutants since they are natural fertilizers.
- They destroy many harmful substances present in the soil that can cause plant diseases.
- Biofertilizers are proven to be effective even under semi-arid conditions.

Classification of biofertilizers (Rakesh Kumar *et al.*, 2017)

S. No.	Types of biofertilizers	Examples
N_2 fixing biofertilizers		
1.	Free-living	*Azotobacter,* Beijerinkia, Clostridium, Klebsiella, Anabaena, Nostoc.
2.	Symbiotic	*Rhizobium*, Frankia, Anabaena azollae
3.	Associative Symbiotic	*Azospirillum*
P Solubilizing Biofertilizers		

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4.	Bacteria	*Bacillus* megaterium var. phosphaticum, *Bacillus* subtilis, *Bacillus* circulans.
5.	**Fungi**	*Penicillium spp*, Aspergillus awamori**.**
P Mobilizing Biofertilizers		
6.	Arbuscular mycorrhiza	Glomus spp, Gigaspora spp, Scutellospora spp &Sclerocystis
7.	Ectomycorrhiza	Laccaria spp, Pisolithus spp, Boletus spp, Amanita spp.
Biofertilizers for micronutrients		
8.	Silicate and Zinc solubilizers	*Bacillus spp.*
Plant Growth Promoting Rhizobacteria		
9.	Pseudomonas	Pseudomonas fluorescens

Several microorganisms and their association with crop plants are being exploited in producing biofertilizers. They can be grouped in different ways based on their nature and function.

Fig: Some images for available biofertilizers in powder and liquid form

Rhizobium: Legume roots are colonized by the soil-dwelling bacterium Rhizobium, which symbiotically fixes atmospheric nitrogen. Rhizobium can exist in a variety of environments, from free-living nodules to bactericide. In terms of the amount of fixed nitrogen involved, they are the most effective biofertilizers. Known as the cross-inoculation group, they belong to seven genera and are extremely specialized to produce nodules in legumes.

Azotobacter: Of the several species of Azotobacter, A. cerococcid happens to be the dominant inhabitant in arable soils capable of fixing N_2 (2-15 mg N_2 fixed /g of carbon source) in culture media. The bacterium produces abundant slime which helps in soil aggregation. The numbers of A. cerococcid in Indian soils rarely exceed 105/g soil due to lack of organic matter and the presence of antagonistic microorganisms in the soil.

Azospirillum: Gramineous plants' major residents of soil, the rhizosphere, and the intercellular spaces

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of the root cortex include A. linoleum and A. Brasiliense (*Spirillum lipomeria* older literature). With gramineous plants, they form associative symbiotic partnerships. In addition to nitrogen fixation, inoculation with Azospirillum also confers disease resistance and drought tolerance, as well as the production of growth-promoting substances (IAA).

Cyanobacteria: Both free-living as well as symbiotic cyanobacteria (blue-green algae) have been harnessed in rice cultivation in India. Once so much publicized as a biofertilizer for rice crops, it has not presently attracted the attention of rice growers all over India. The benefits due to alkalization could be to the extent of 20-30 kg N/ha under ideal conditions but the labor-oriented methodology for the preparation of BGA biofertilizer is a limitation.

Azolla: The nitrogen-fixing blue-green algae *Anabaena azollae* collaborate with the free-floating water fern Azolla to fix atmospheric nitrogen. Azolla can be added to commercial nitrogen fertilizers or used as a substitute for nitrogen. Azolla is known to contribute 40–60 kg N/ha per rice crop when used as a *biofertilizer* for wetland rice.

Phosphate solubilizing microorganisms (PSM): Several soil bacteria and fungi, notably species of Pseudomonas, Bacillus, Penicillium, Aspergillus, etc. secrete organic acids and lower the pH in their vicinity to bring about the dissolution of bound phosphates in soil. Increased yields of wheat and potato were demonstrated due to inoculation of peat-based cultures of *Bacillus polymyxin* and *Pseudomonas striata*.

Plant growth-promoting rhizobacteria: The group of bacteria that colonize roots or rhizosphere soil and are beneficial to crops are referred to as (PGPR). The PGPR inoculants promote growth through suppression of plant disease (termed Bioprotectants), improved nutrient acquisition (Biofertilizers), or phytohormone production (Biostimulants). Species of *Pseudomonas* and *Bacillus* can produce yet not well-characterized phytohormones or growth regulators that cause crops to have greater amounts of fine roots which have the effect of increasing the absorptive surface of plant roots for uptake of water and nutrients. These PGPRs are referred to as bio stimulants and the phytohormones they produce include indole-acetic acid, cytokinin's, gibberellins, and inhibitors of ethylene production.

Conclusions: Biofertilizers are an eco-friendly and sustainable alternative to chemical fertilizers. They help to improve soil health, increase crop yields, and reduce the need for synthetic fertilizers. Biofertilizers are made from natural sources, such as microorganisms, plant materials, and animal byproducts, and are rich in nutrients that are essential for plant growth. They also help to improve soil structure, nutrient cycling, and soil fertility.

References

Amirnia, R., Ghiyasi, M., Siavash Moghaddam, S., Rahimi, A., Damalas, C. A., & Heydarzadeh, S. (2019). Nitrogen-fixing soil bacteria plus mycorrhizal fungi improve seed yield and quality

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Published: 22.10.2023

traits of lentils (*Lens culinaris* Medik). *Journal of Soil Science and Plant Nutrition*, ***19***: 592-602.

Bhattacharjee, R., & Dey, U. (2014). Biofertilizer, a way towards organic agriculture: A review. *African Journal of Microbiology Research*, ***8***(24): 2332-2343.

Carvajal-Muñoz, J. S., & Carmona-Garcia, C. E. (2012). Benefits and limitations of biofertilization in agricultural practices. *Livestock Research for Rural Development*, ***24***(3): 1-8.

Farnia, A., & Hassanpour, K. (2015). Comparison between effect of chemical and biological fertilizers on yield and yield components of wheat (*Triticum aestivum* L.) Pishtaz cultivar. *Indian Journal of Natural Sciences*, ***5***: 7792-7808.

Kumar, R., Kumawat, N., & Sahu, Y. K. (2017). Role of biofertilizers in agriculture. *Popular kheti*, ***5***(4): 63-66.

Vishnu, P., Yasasvi, B., & Tarate, S. B. (2022). Influence of biofertilizers on millet production. *Pharma Innovation Journal*, ***11***: 950-953.

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Popular Article

Expansion Microscopy-Application and Advantages

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Introduction

In optical microscopy, fine structural details are resolved by using refraction to magnify images of a specimen. The development of super-resolution microscopy is one of the most revolutionary breakthroughs in molecular and cellular biology in the 21st century. Super-resolution microscopy has provided researchers with powerful new means to overcome the physical diffraction limit. Expansion microscopy (ExM) is an emerging technology initially developed in the Boyden Laboratory that overcomes limitations of optical super-resolution techniques by physically expanding tissue samples with a water-swellable polymer (Chen et al., 2015) by 4–5× linearly in each dimension. This allows super-resolution imaging of biological specimens with reagents and hardware that most biological laboratories already have access to. In addition, the fully expanded tissue-gel is more than 98% water by volume, thus rendering the specimen transparent and dramatically reducing optical aberrations even deep into tissue.

Definition

Expansion Microscopy is a method to magnify physically a specimen with preserved ultrastructure. OR Expansion microscopy (ExM) is a sample preparation tool for biological samples that allows investigators to identify small structures by expanding them using a polymer system. (Markoff, 2015). OR Expansion microscopy (ExM) is a recently invented technology that uses swellable charged polymers, synthesized densely and with appropriate

topology throughout a preserved biological specimen, to physically magnify the specimen 100-fold in volume, or more, in an isotropic fashion (Chen et al., 2015).

History

In 2015, Chen et al., all of MIT first described expansion microscopy as a method to enhance microscopy resolution by swelling a sample rather than using stronger microscopy equipment. Since then, the use of ExM has continued to grow. Due to the recency of development, there is limited information on applications. However, the most common modern use is in biological samples. In 2016, several papers were published detailing workarounds for ExM's traditional limitation of labeling probes. These changes proposed a way to use ExM with conventional microscopy probes, allowing it to be used more widely. In 2016, these new labeling methods were applied to allow fluorescence microscopy of RNA molecules, which in turn led to a new spatially precise in situ sequencing method, namely ExSeq (expansion sequencing), in 2021.ExM is a rapidly growing field, and there is hope that many biological mysteries will be elucidated using ExM techniques within coming years.

Purpose

Traditional light microscopy has limits of resolution that prevent it from reliably distinguishing small structures that are important to biological function and must instead be imaged by a higher-resolution technique, such as electron microscopy. For example, synaptic vesicles are 40- 50 nanometers in diameter, which is below the commonly quoted resolution limit of 200 nanometers for light microscopy. Expansion microscopy solves this problem by expanding the underlying tissue sample Fig 1 .

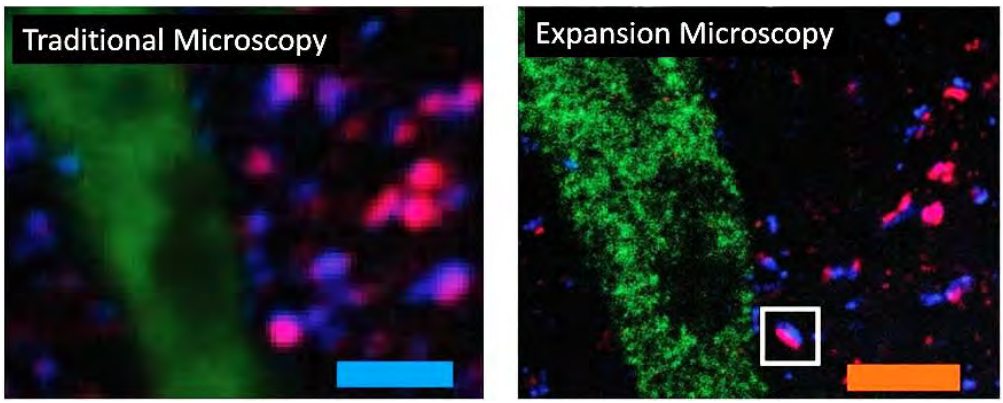

Figure 1 Traditional microscopy and Expansion microscopy

Principle

A swellable hydrogel is synthesized inside a tissue slice and then expanded. During the expansion, two biomolecules (red dots, Fig. 2) inside the tissue slice move apart. If the two biomolecules were 100-nm apart before the expansion, then conventional diffraction limited

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microscopy with a resolution of 250 nm cannot resolve these two biomolecules. However, the two biomolecules would be clearly resolved with the same microscopy after 3-fold expansion, which makes the distance between the two molecules 300 nm.

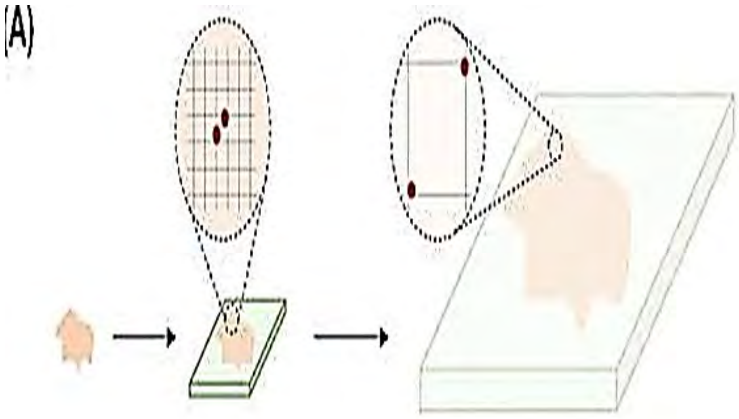
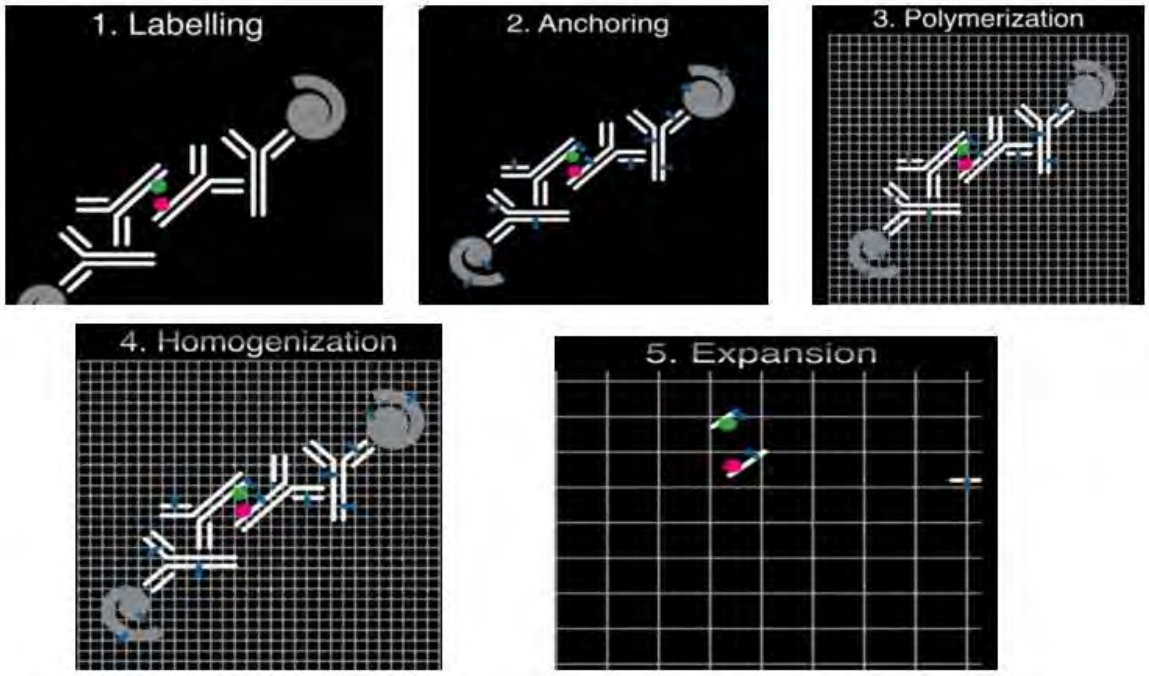


Figure 2 During the expansion, two biomolecules (red dots)

Expansion microscopy is a multistep process. The sequence of steps is:

1. Labelling
2. Anchoring
3. Gelation
4. Homogenization
5. Expansion



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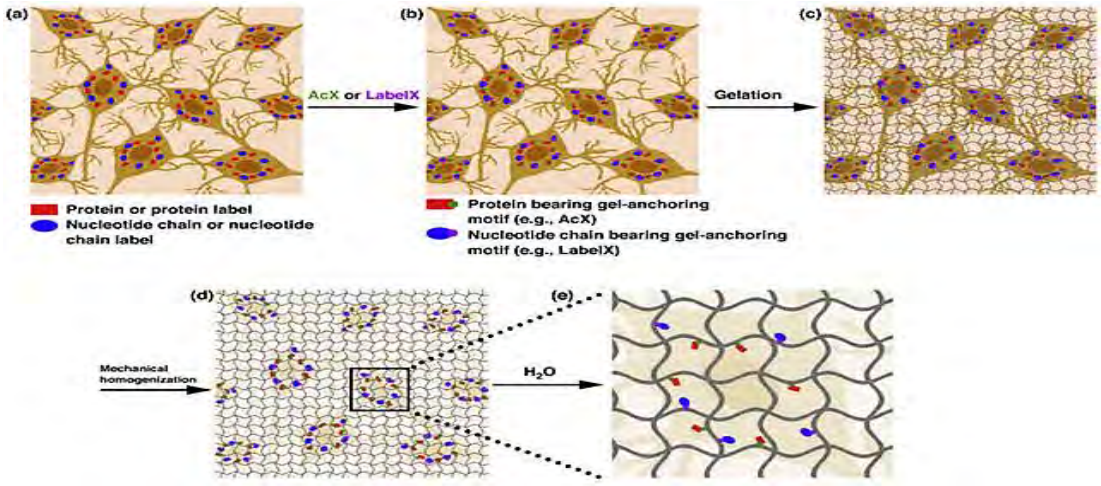
Fixed samples are first labeled with probes.

Next, the specimen is treated with compounds that bind to key biomolecules or labels (Ex: Acrydite , AcX , MA-NHS).It is done so they can be tethered to the hydrogel polymer chains synthesized in the next step.If this step fails, the gel will not expand uniformly because the cell will try together and prevent expansion. The digestion solution breaks down the proteins and allows expansion. A hydrogel made of closely spaced, densely cross-linked, highly charged monomers is then polymerized evenly throughout the cells or tissue, intercalating between and around the biomolecules or labels. Sodium acrylate, a monomer used to produce superabsorbent materials along with the comonomer acrylamide and the cross-linker N-N′-methylenebisacrylamide. After triggering free radical polymerization with ammonium persulfate (APS) initiator and tetramethylethylenediamine (TEMED) accelerator. Then the embedded specimen goes through a homogenization step involving denaturation and/or digestion of structural molecules. It can be done enzymatically (often with Proteinase K) or mechanically (i.e., softening the specimen by disrupting key protein-protein interactions that are not needed). If this step fails, the gel will not expand uniformly because the cell will try together and prevent expansion. The digestion solution breaks down the proteins and allows expansion. Following digestion, the sample is washed with low-salt buffer or pure water which pulls out all of the salt. This causes the sample to physically get bigger. Expansion causes the gel to be physically expanded in all directions, which causes the fluorophores that are attached to the gel to expand as well.

Variants of Expansion microscopy

1. **Protein retention Expansion microscopy (proExM)**
   - It is a simple, yet powerful, variant of ExM, in which proteins are anchored to the swellable polymer generated during the ExM process via a commercially available small molecule (which we call AcX for short).
   - AcX binds to amines on proteins and simultaneously to the polymer matrix.



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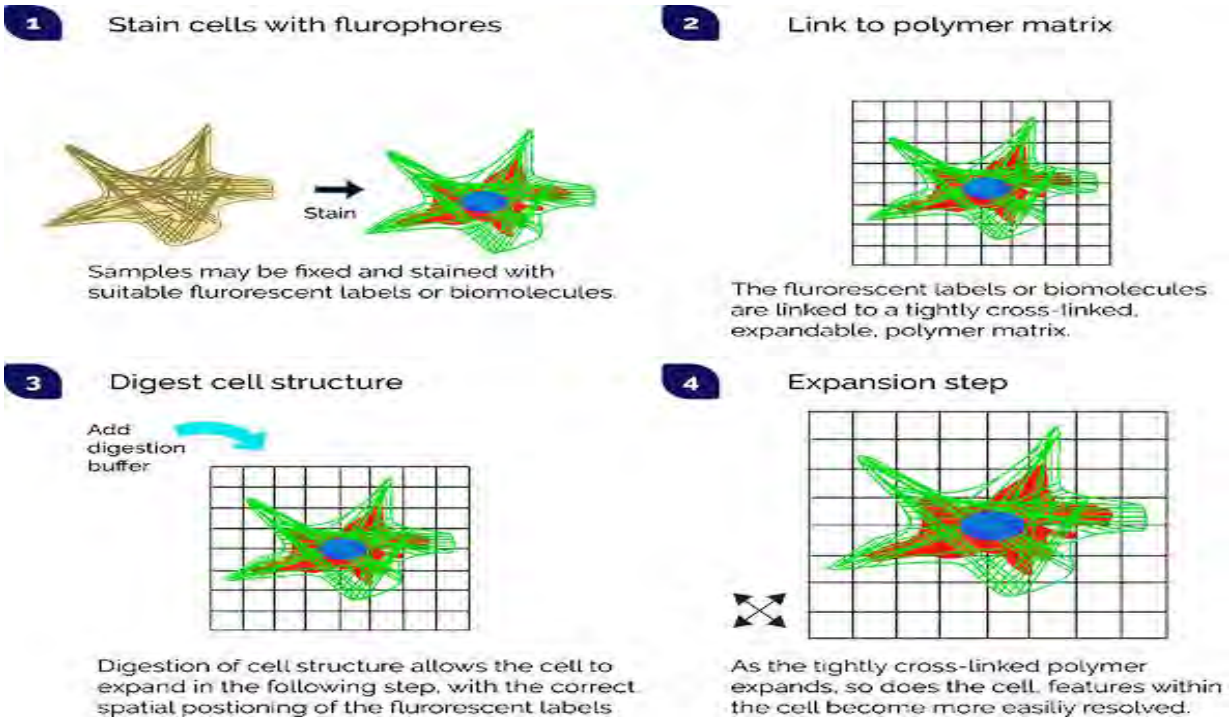
2. **Expansion Fluorescence in Situ Hybridization (ExFISH)**

- It is a version of ExM in which RNAs in a biological sample are retained during the ExM process.
- In ExFISH, RNAs are covalently anchored to the hydrogel with a small molecule that we call Label X (and which is made by mixing two commercially available reagents) that binds to guanine and also to the hydrogel.
- By applying the protein-anchoring reagent (AcX) simultaneously, you can anchor both RNAs and proteins to the hydrogel for dual protein/RNA visualization.
- For imaging, RNAs can be labeled with FISH probes after expansion.



3. **Iterative ExM (iExM)**

- It is a process where a biological specimen is first expanded by ExM, then a second swellable gel is formed in the space opened up by the first expansion, and then the sample is expanded a second time.
- This double expansion process results in a linear expansion factor of about ~4.5 × 4.5 = 20× and an effective resolution of ~25 nm after two rounds of expansion (larger than the expected ~300 nm/20 = 15 nm due to the size of the antibodies and DNA linkers).
- iExM is sufficient for resolving proteins within synapses in 3D, as well as very fine parts of neurons (such as dendritic spine necks).

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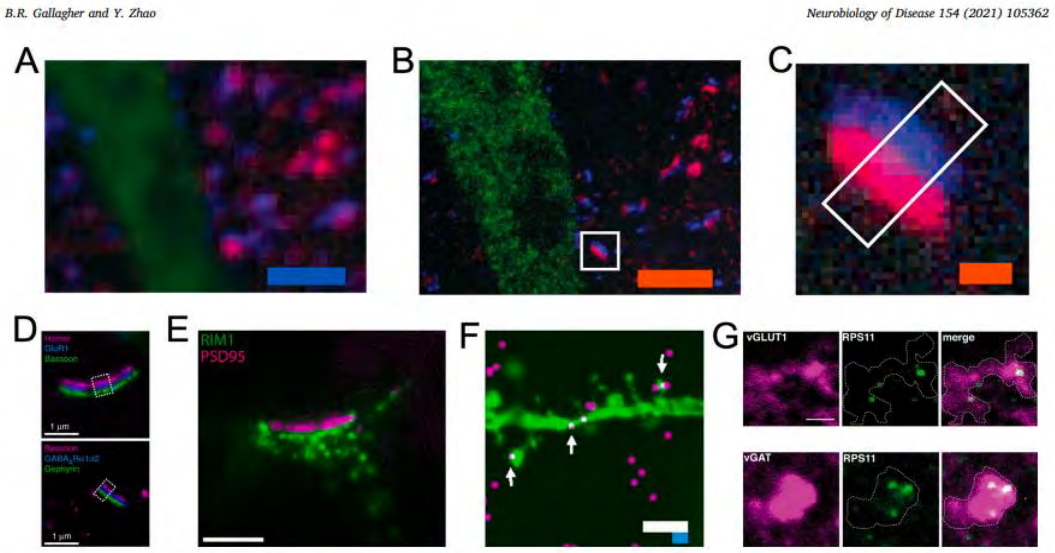
Applications

Disease diagnosis

- This process can be used for optical diagnosis of kidney minimal-change disease, early breast neoplastic lesions and to spot the difference of normal human tissue specimens to cancer tissue specimens, enabling a routine use of clinical research.
- This imaging reveals sub-diffraction limit sized features of the intermediate filament's keratin and vimentin, critical in the epithelial mesenchymal transition, cancer progression and initiation of metastasis.

Neuroscience

- ExM magnifies biological specimens such as brain circuits and allows them to be more easily mapped.
- Biomolecules, such as proteins and nucleic acids, are anchored to the polymer, which is then swelled in order to expand the biomolecules. Due to the increased distance between the biomolecules, ordinary microscopes can then perform nanoscale resolution imaging.
- Through the use of ExM technique, neuroscientists can more easily map images of synapses, cells, and neural circuits.



Advantages

One key advantage is that it also allows investigators to stain for and visualize particular molecules in the sample, such as specific proteins or RNA to identify their density and distribution in relation to the biological structures of interest. The most beneficial principle of expansion microscopy is that it requires no specialized equipment.

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Conclusions and future directions

Expansion microscopy is a unique approach to super resolution imaging, enabling rapid and easy nanoscale imaging of specimens in 3D. Samples are optically clear which reduces the effects of diffraction and scatter. This enables greater imaging depth with minimal introduction of optical aberrations. Multicolor applications of ExM are possible with minimal constraints on fluorophore choice. Recent innovation of this technique has extended the range of biomolecules and labelling approaches compatible with it. However, with all of these advances its incompatibility with live cell imaging, remains. It has been suggested that higher expansion factors and therefore resolution may be achieved and would supersede other super resolution techniques. If a unified protocol could be developed, imaging of DNA, RNA, proteins and lipids may be combined to reveal organization of heterogeneous complexes.

References

1. Chen F, Tillberg PW, Boyden ES (2015). Expansion microscopy: Science (80), 347:543-548 http://dx.doi.org/10.1126/ science.1260088 PMID: 25592419.
2. Markoff J (2015-01-19). "Expansion Microscopy Stretches Limits of Conventional Microscopes" (https://www.nytimes.com/2015/01/20/science/microscopy-stretches-limits-of-conventional-microscopes.html) . New York Times. Retrieved 21 October 2015.

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Review Article

in-vitro culture of Orchids through Seeds and other plant parts- where we stand now?

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Abstract

Orchids are blessed with spell bounding beauties, shape, size, colour and these features make orchid flowers tremendously attractive. Craze for these flowers is too high, people all over the world fantasize to have those in their flower vase and polyhouses. In nature orchid species are one of the most diverse flowering plant groups. Besides having astonishing beauty some of the orchids also possess therapeutic properties. They can be propagated through in-vitro culture of seeds and meristematic parts. Propagation through meristem parts is crucial for commercial purpose as only meristem culture can produce true to the type genotypic similarities in orchids. Tissue culture by means of seeds culture may derive progenies with heterogeneous genotypes and phenotypes as well as the plants take much longer time to flower as compared to the plants produced through meristem culture. Thus, propagation through meristem culture may be considered as the best way to produce best quality orchid planting materials as per the market demand. This review is a comprehensive synthesis of updated information pertains to orchid meristem culture aiming for quality produce which may be beneficial for all the stakeholders.

Keywords: Meristem culture, Commercial Orchid, PLBs, Basal media of orchid, explant.

Introduction

Orchid is a fascinating flower all over the world. Orchid was there even during the dinosaur's period. We human beings are social so along with food we need a beautiful mind for creating a happy environment for which Orchid is counted as an astonishing flower. Many hybrid, species and other varieties of orchid are in cultivation for export and in-situ selling as a cut flower as well as potted plant. In current scenarios, world's flower industry accounts for annual sales of more than US$4 billion. The family of Orchidaceae comprises of 736 genera with more than 28,000 species which are mostly available in the wet tropics worldwide except few isolated areas. In Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura total 159 genera and 870 species whereas in in J & K, Himachal Pradesh, Uttarakhand 75 genera

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and 288 species of orchid are present. Orchid family is most diverse amongst the flowering plants. They have capacity to grow on all kind of habitats, except some aquatic systems. Based on their growth habitat they are grouped as terrestrial, epiphytic or saprophytic. Generally, most of the orchids are epiphytic in nature however, some are terrestrial. Orchids are used mainly for ornamental purpose but some are utilized for therapeutic purpose (Nand Lal, 2020). The wild orchid population basically multiplied by sexual means i.e., by seed and asexually by way of vegetative propagation. However, the traditional vegetative propagation system is very slow whereas in natural ecosystem orchid cultivation by seed germination takes greater care as only few seeds germinate in spite millions seed produced in each capsule. Traditionally orchid is propagated through *kekies* or other means of clonal propagation for large scale multiplication, however this might enhance the disease dissemination (Kunagorn *et al*., 2017). Therefore, multiplication by meristem or other in-vitro culture are attaining a greater scope for expanding its market. Orchid species preferable for cut flower are *Cymbidium eburneum*, *Pahiopedillum fairrieanum*, *Paphiopedilum hirsutissimum*, *Paphiopedilum insigni*, *Paphiopedilum venustum*, *Vanda coerulea*, *Vanda tessellate*, Cattleya, Mokara, Aranda, Oncidium etc.

In orchid regeneration plant tissue culture techniques have been apply for rapid growth and development. Only few orchid species were multiplied during last several years either by using explant or protocorm like bodies (PLBs). Seed germination give rise to heterozygous plants, whereas micropropagation through various vegetative parts of the plants overcome this problem. Usually for meristem culture stem, bulb, leaves, leaf tips, flower stalk, young flower buds, internodes segments, root, root tips, stem portion, stamens, pistil etc., are used. Basic flow chart for plant tissue culture in orchid is given below

Take any plant part then wash and clean it under running tap water for 5 minutes.

⬇

Then prepare a 10% chlorine bleach solution and add 2-3 drops of Tween twenty (wait 5 minutes)

⬇

Wash with distil water five times

⬇

Dip with 0.1% $HgCl_2$ solution (2-3 min)

⬇

then wash with distil water

⬇

Take this plant parts in Laminar Air Flow Chamber

⬇

Then dip in 0.2 % $HgCl_2$ solution (2-3 min)

⬇

Again, wash with autoclave water

⬇

Make section with sterilized blade and inoculation in suitable culture media

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Basic requirements of *in-vitro* culture of orchid have been discussed under few sub headings below.

(i) **Aseptic conditions**: It means a pathogen free environment for maintaining good health of the callus, cell or protoplast cultures. It results into recovery of health plants. The explant and glassware should be properly sterilized before their entry into the tissue culture laboratory.

(ii) **Control of temperature**: Generally, 18 to 25^{0}C temperature is essential. High temperature adversely affects the growth of the callus.

(iii) **Proper culture medium**: There are various culture media developed by various workers but it should be modified as per Orchid species requirements. Orchid culture media are composed of macronutrients, micronutrients, vitamins and growth hormones. Plant growth hormone such as cytokinin [BAP (N6 –benzylaminopurine), IBA, Kinetin, 2-iP (2-isopentyladenine), TDZ (Thidiazuron)] either alone or in combination with auxin [IAA, 2,4-D (2,4 dichlorophenoxy acetic acid), NAA (a-naphthalene acetic acid)] have been used for production of shoot and PLBs formation. PLB formation is affected by various factors among which light is one crucial factor, for example in Phalaenopsis in absence of light PLB formation induce whereas for differentiation into plantlet light is mandatory. In Orchids a perusal of literature reveals that several hundred media compositions have been used but the most commonly used media for the propagation of orchids are MS, VW and KC. Subsequent to defining the medium, other aspects are developed such as suitable pH, addition of growth regulators, and exploration of the use of alternative carbon sources. Use of activated charcoal and antioxidants for minimizing browning effect etc. (Yam, *et al*., 1989; Jayarama Reddy, 2008) is crucial.

(iv) **Sub-culturing**: It is a method of transferring of tissue or callus from old tissue culture media to fresh culture media. It is crucial to maintain proper health of callus or tissues.

The *in-vitro* propagation method of Orchid under in-vitro is discussed as below-

A. Seed propagation

Orchid pod or capsule may consist of thousands of dusts like seed which are devoid of food reserve (endosperm). These seeds can be grown by Orchid flasking procedure since orchid seeds usually require a symbiotic mycorrhizal fungus to germinate. There are two different techniques for flasking: symbiotic germination and asymbiotic germination. Symbiotic germination requires the isolation of a mycorrhizal fungus which is added to the agar in which the seeds are grown. Asymbiotic germination just uses the nutrients that the seed requires to grow. First innovative method for orchid seed germination was developed by David Moore (Morel, 1974). Fifty years after Moore's discovery, Noel Bernard (Bernard,1909) made another quantum

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jump when he developed a method for the symbiotic germination of orchid seeds in vitro. This is the first method derived for the in vitro propagation of any plant. Seedlings grew well on a pH 4.5 culture containing 0.8% agar.

B. Meristem culture

Meristem culture refers to regeneration of whole plant from tissues of an actively dividing plant part such as stem tip, root tip, auxiliary bud, flower bud, flower petal etc. Mass multiplication of orchid is possible with meristem culture technique as it maintains its genotypic value as it is. Although soma clonal and gametoclonal variation do occur in tissue culture plants but their occurrence is low.

In the initial stage of research only solid media were used in recent past researchers started using a liquid medium either in static or in moving conditions. In the latter case, a shaker was used to provide aeration for growing tissues (Steward *et al*., 1958). A distinction was also made by some authors between the starting, standard maintenance and rooting media based on their suitability. For example, in one of experiments, meristems of Cymbidium were inoculated on a liquid medium, on which PLBs were formed. The PLBs were then transferred on to a solid medium to obtain plantlets (Wimber, 1965). The choice of liquid or solid medium may depend on the type of the explant and the objective of the culture. A solid medium was found economically viable, convenient as it produces consistent results. At present Suspension culture techniques are also using by some researcher which were developed by Singh and Prakash, 1985 for the micropropagation of *Epidendrum radicans*. Example, to produce plants using apical and axillary buds of Dendrobium Caesar Red Lip, VW liquid medium were used for initial culture and KC solid medium for producing plantlets from PLBs (Jayarama Reddy, 2008).

Photo 1: Subculture under Laminar Air

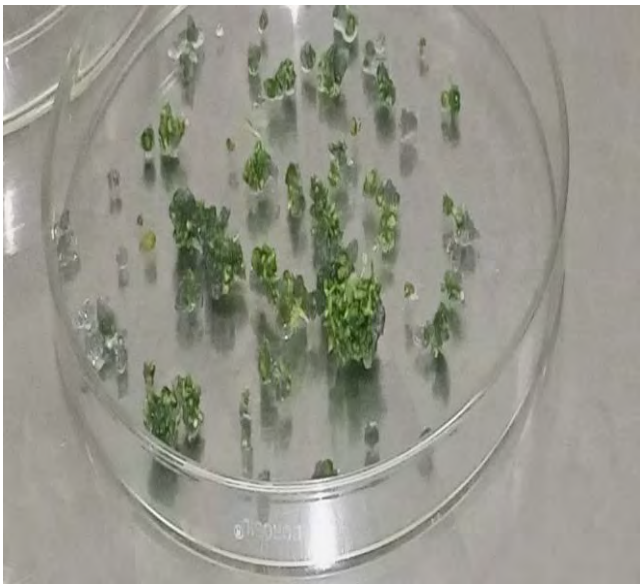

Photo 2: PLB culture of Cymbidium species.

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flow chamber

Photo 3: Meristem part for induction culture under Laminar Air flow chamber

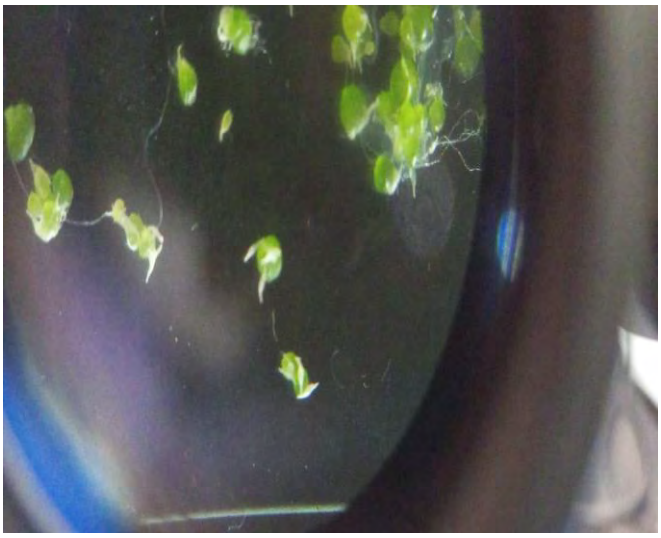

Photo 4: Protocorms Like Bodies (PLB)

References

Jayarama Reddy. 2008. Biotechnology of orchids; I.K. International Pvt Ltd. New Delhi.

Kunagorn, N., Roopkam, C., Aumroong, P. and Anukul, N. 2017. Meristem tip culture of Dendrobium orchid for boosting efficiency of hygienic large scale micropropagation. Acta Hortic., 1155: 419-424.

Morel GM. 1974. Clonal multiplication of orchids. In: Withner CL (ed.), The Orchids: Scientific Studies, Wiley, NY.

Nand Lal and Madhulika Singh. 2020. Prospects of Plant Tissue Culture in Orchid Propagation: A Review. Indian J Biol, 7(2):103–110.

Singh, F. and Prakash, D. 1982. In vitro propagation of Epidendrum through flower stalk cuttings. In: Proc. Natl. Syrup. Plant Propagation, 27--29 December 1982, Calcutta, West Bengal, India, 1:103--104.

Steward FC and Mapes MO. 1971. Morphogenesis in Aseptic Cell cultures of Cymbidium. Bot. Gaz, 132(1): 65-70.

Bernard N. 1909. L'évolution dans la symbiose. Les orchidées etleurs champignons commensaux. Ann Sci Nat Bot, 9:1-196.

Wimber DE. 1965. Additional observations on clonal multiplication of Cymbidiums through culture of shoot meristems. Cymbidium Soc. News, 20: 7-10.

Yam TW, Arditti J, Weatherhead MA. 1989. The use of darkening agents in seed germination and tissue culture media for orchid- a review. J. of the Orchid Society of India, 3: 35-39.

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Popular Article

Advantages of Herbal Supplementation in Livestock

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Introduction

It is estimated that there are 2,50,000 species of higher plants on earth, of which more than 80,000 are medicinal. Recent studies show that medicinal plants (their extracts) help achieve one or more beneficial impacts on ruminant performance. The extracts of leaves, fruits or roots of various plants are traditionally used as medicine. They also have galactagogue property. Recently these plants have been recognized as having antimicrobial and anti-methanogenic properties. An extensive grazing system for goats is being practised chiefly by the resource-poor farmers. Inaccessibility to timely veterinary health care and the cost of treatment are the main constraints, which affect the productivity and sometimes viability of the system. Under these conditions, it becomes essential to utilize the locally available resources as ethno-veterinary medicines to ensure the general well-being and welfare of the animals. WHO recognizes the importance of ancient medicinal practices and recommends their importance in developing livestock in third-world countries. Some herbal plants are reported to have beneficial effects on animal production, reproduction and health. Many herbs and plant extracts have antimicrobial activities against a wide range of bacteria, yeasts, and moulds.

Phytochemical constituents of herbs and their mechanism of action

Primary and secondary metabolites are the two classifications of phytochemical components of plants based on their function in fundamental metabolic processes. All live cells contain primary plant metabolites, which are somewhat similar because they are engaged in fundamental life processes. Secondary plant metabolites, on the other hand, are byproducts of subsidiary pathways.

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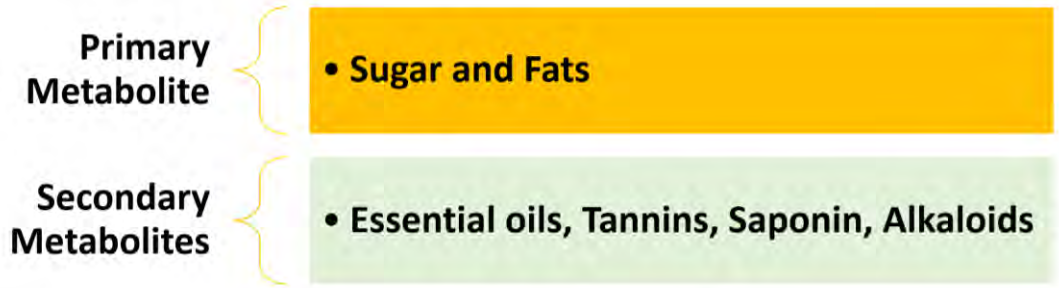
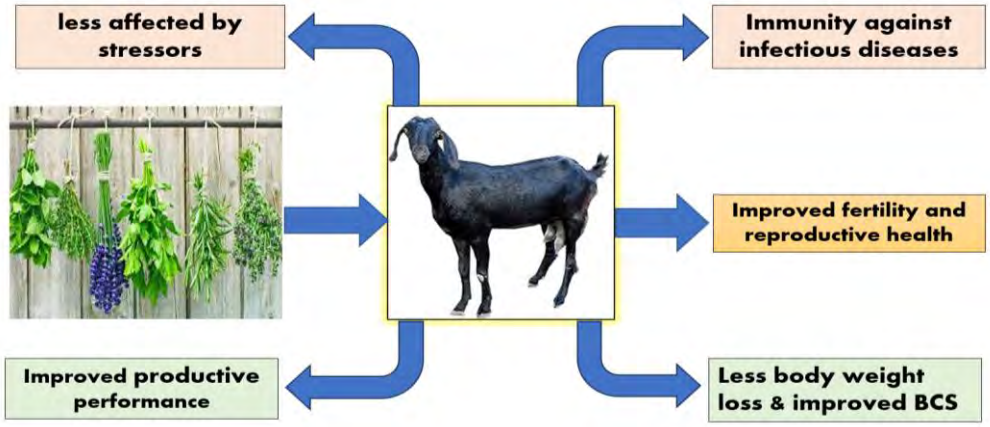


Tannic acid present in tannins inhibit the growth of gut microbes such as *E. coli, Clostridium perfringens, Bacteroides fragilis*. Saponin exhibits antimicrobial activity by forming complexes with sterols that are present in the membrane of micro-organisms. Essential oils show antimicrobial activity against bacteria *E. coli* and *Clostridium perfringens*. Flavonoids are polyphenolic phytochemicals having both bactericidal and bacteriostatic properties. So, there may be no specific mode of action for herbal supplementation; instead, herbs have multi- dimensional beneficial effects in ruminant's body.



Shatavari (*Asparagus racemosus*)

Classical Ayurvedic literature claims several therapeutic attributes for the root of *A. racemosus* (Sanskrit: - Shatavari). Specially recommended in cases of threatened abortion and as a galactagogue.

The genus Asparagus (with about 300 species) is a rich source of sapogenins and saponin. It also has growth promoter property. Satavari supplementation shows promising outcomes in terms of total body weight gain and feed conversion efficiency. It helps in enhancing humoral and cell-mediated immune responses in an efficient manner to increase infection resistance.

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Jivanti *(Leptadenia reticulata)*

stimulant properties in the Indian system of medicine. The main constituents reported are stigmasterol, flavonoids, pregnane glycosides and proteins. Aerial parts contain tocopherol & possess activities such as galactagogue, antimicrobial and anti-inflammatory activity. The lactogenic effect has been reported in both small and large ruminants. *L. reticulata* has been shown to increase milk production without affecting milk composition.

Jivanti and a cocktail of herbs namely Galog are known for their lactogenic properties since the times of Charak Samhita. Galog may be attributed to certain metabolic changes in the body tissues and the mammary gland, where the absorbed nutrients are utilized more effectively.

Fenugreek/Methi (*Trigonella foenum-graecum*)

Fenugreek is a leguminous herb that is cultivated in numerous parts of the world predominantly in India, the Middle East, North Africa and South Europe. Fenugreek supports the production of milk because it is a rich source of essential fatty acids. This herb has been shown to significant effect on the lactation performance in ruminants. Supplementation of dairy ration, with fenugreek seeds improves the composition of cow milk.

Kalajaji /Kalonji/ Black Cumin (*Nigella sativa L.*)

Kalonji has antipyretic, analgesic, anti-inflammatory, antimicrobial, and antineoplastic activity. Thymoquinone, an active constituent of Kalonji seeds, is a pharmacologically active quinone, which possesses several properties including analgesic and anti-inflammatory actions. Supplementation of Nigella seeds linearly improves growth performance, nutrient utilization, and metabolism of ruminants. Nigella seeds could also be considered immunomodulators as they can enhance the IgA and IgG of the animals without adversely affecting blood metabolite parameters.

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Turmeric (*Curcuma longa*)

This compound is believed to have a wide range of biological effects such as anti-inflammatory, antioxidant, antitumor, antibacterial, and antiviral activities. Turmeric contains properties, which make the digestive process of ruminant animals more efficient. Thereby, producing less waste and thus improves performance in terms of growth.

Ginger (*zingiber officinale*)

Ginger is usually found in grasslands of humid regions as a weedy and herbaceous perennial herb. Ginger roots contains Aryl alkanes that give ginger a pungent taste that enhances the appetite of animal and improve the nutrients palatability which ultimately causes increased feed intake. Ginger may also be attributed to the enhanced synthesis of bile acids in the liver and their excretion in bile, which beneficially increases the digestion and absorption of lipids. It also helps to increase the absorption of essential nutrients to increase the stability of feed and beneficially influence the gastrointestinal ecosystem through inhibition of pathogenic microorganism growth.

Conclusion

It can be concluded that various herbs such as Shatavari (*Asparagus racemosus*), Jivanti (*Leptadenia reticulata*) and Methi (*Trigonella foenum-graecum*) etc. and their preparations are effective herbal galactogogue and their use as feed additive in goats improves productive performance in general and milk production in particular. Increasing the demand of organic food and cost effectiveness in the livestock feed, the use of herbal feed additives has become the requirement of recent modalities. Utilization of herbal remedies will not only improve the productive efficiency but improve reproductive efficiency, general health and milk production.

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Review Article

Impact of Heat Stress on the Physiological Responses of Buffaloes

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Abstract

Thermal stress is a concern for all livestock production systems and its effects have been studied because of the negative impact on production, health and even mortality. Exposure to high ambient temperature is the major constraint on buffalo productivity in hot climatic areas due to the fact that it reduces feed intake and its utilization, disturbance in water metabolism, protein, energy, mineral balance, enzymatic reactions, hormonal secretions and blood metabolites. Such changes result in impairment of productive and reproductive performance of animals, particularly buffaloes. Most of the livestock species experience stress of varying degrees but are able to cope with these environmental stressors through behavioral measures such as sweating, panting, drinking water, shivering or by regulating their metabolic rates. Buffaloes are the most affected species due to their anatomical features and hence it is very important to understand the different physiological responses to thermal stress which can be considered as elementary markers of thermal stress. Therefore, this review focuses on the changes in physiological responses like respiratory rate, pulse rate and rectal temperature during thermal stress. These responses can also be easily monitored by the farmer and accordingly necessary precautionary and mitigation strategies could be adopted to prevent further adverse effects and even reverse the negative effects there by maintaining the optimum productivity and prevent any economic loss.

Keywords: Thermal stress, buffaloes, production, reproduction, physiological responses

1. Introduction

Climate is one of the major constraints that hinder the efficiency of livestock production, especially in sub-tropical and tropical areas (Li et al., 2021). Thermal stress is a major problem causing great economic losses to the dairy farmers. The word, “stress” is very common butreflects vast effective results (Suguna., 2020). Thermal stress reduces feed intake, milk yield and composition, growth rate and reproductive function in livestock (Kumar et al., 2018). The Buffalo population in India is 108.7 million which contributes around 21.23% to total livestock population in India (Basic Animal Husbandry Statistics, 2019). Buffaloes are homeotherms, but at the same time, they are less

tolerant to extremes of heat and cold conditions than various breeds of cattle (Aggarwal and Singh, 2010). They are insufficiently heat tolerant and the milk yield, growth and fertility are reduced during periods of high ambient temperature (AT) (Burgos et al., 2007). Buffaloes display amalgamation of thermoregulatory responses to overcome the changes occurring in micro and macro climatic conditions (Mishra., 2021). These thermoregulatory responses are behavioral, physiological, neuro-endocrine and molecular responses acting synergistically to counteract the deleterious effects of heat stress. During extreme hot humid conditions, the thermoregulatory capability of buffalo to dissipate heat by sweating is compromised and thermal stress occurs (Kumar et al., 2018). An increase in body temperature of around 1ºC may result in detectable, deleterious effects on metabolism, tissue integrity and a significant depression in production (Kadzere et al., 2002). Buffalo, an animal of hot and humid climate has a unique wallowing behavior that supports heat dissipation due to an increase in the blood volume and flow to the skin surface in hot conditions (Koga et al., 1999). Body temperature is a good measure of heat tolerance in animals. It represents the resultant of all heat gain and heat loss processes of the body (Ganaie et al., 2013). High AT and high RH are the primary factors that cause heat stress in dairy animals. Temperature humidity index (THI) range is used to indicate degree of heat stress i.e., mild, moderate, and severe (Umar et al., 2021). Rectal temperature (RT) is considered as a good index of body temperature even though there is considerable variation in different parts of the body core at different times of the day (Srikandakumar et al.,2003). Increased respiratory rate (RR) is the first reaction when animals are exposed to environmental temperature above the thermoneutral zone (TNZ). The physiological response to heat stress results in the reduction of heat production (Seif et al., 1979), which in turn cause a reduction in feed intake (Seif et al., 1979 and Lough et al., 1990), milk yield (Johnson, 1965; Lough et al., 1990 and Elvinger et al., 1992), and thyroid hormone secretion (Al-Haidary et al., 2012).

In order to maintain homeothermy during heat stress, respiratory rate increases to dissipate excessive heat as other physical heat loss mechanisms such as conduction, convection and radiation becomes inadequate (Hahn et al., 1997). The major stressor affecting RR is ambient temperature, which has much more influence on RR than humidity and increased RR is the first reaction of stress when animals are exposed to environmental temperature above the TNZ (Seath and Miller, 1946). Alteration in pulse rate is also one of the major indicators of stress. Badreldin and Ghany (1954) reported that buffaloes had a lower level of PR than cattle and exhibited noticeably more stress in summer. A rise of 1ºC or less in RT is enough to reduce performance in most livestock species (McDowell et al., 1976), which makes body temperature a sensitive indicator of physiological response to heat stress. The RT is an indicator of thermal balance and may be effective in quantifying the harshness of the thermal environment (Silanikove, 2000). Heat production in buffaloes is markedly influenced by diurnal changes in temperature (Koga et al., 1999).

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2. Materials and Methods

The rectal temperature (RT) has to be recorded with a digital clinical thermometer. The thermometer has to be inserted 3 inches in the rectum for about 2 minutes to ensure that the rectal mucosa is in contact with the bulb of thermometer. Respiration rate (RR) of the animals has to be recorded by flank method. One outward movement was counted as one respiration and the respiration rate was expressed as breaths per minute (bpm). Pulse rate (PR) has to be counted by observing pulsation of middle coccygeal artery at the base of tail and the results expressed as pulse rate per minute.

3. Results and Discussion

Respiratory rate

Wankar et al. (2014) observed that the RR increased in the adult buffaloes when exposed to varying temperatures in a controlled chamber. Younas et al., (2020) reported significantly increased respiratory in a study on NiliRavi buffaloes. Li et al. (2021) reported increased respiratory rate in summer when THI >80. Silanikove (2000) reported that measuring RR appears to be the most accessible and easiest approach for evaluating the degree of heat stress in farm animals (low: 40–60 bpm; medium high: 60–80; high: 80–120; and severe stress: above 150 bpm). All these findings imply that animals tried more to maintain their core body temperature through evaporative cooling during the hot dry season. The RR is the most sensitive index which reflects more response to the environmental conditions than the other physiological responses and is the first indicator of stress in animals (Fayza, 2008). McDowell (1972) stated that increased RR is the first outward indication that an animal is responding to increased thermal load. At higher temperature, the peripheral warm receptors in the skin become activated and send neural signals to the warm receptors located in the anterior hypothalamus in order to trigger the respiratory activity to increase the rate of heat loss from the body (Hafez, 1968). Wankar et al. (2014) opined that the increased RR in buffaloes was probably adopted to increase the evaporative cooling. Yousef (1985) stated that RR maybe a more appropriate indicator of heat stress than internal temperature, as RR increased more rapidly during heat exposure than other responses such as RT, skin temperature and changes in feed intake. RR increased as stressors caused an animal to maintain homeothermy by dissipating excess heat when other physical heat loss mechanisms (i.e., conduction, convection and radiation) become inadequate (Hahn et al., 1997). During heat stress, respiration is directed towards evaporation of moistures from the respiratory tract. This increase in RR associated with heat exposure involves an increase in ventilation of the dead space (Yousef, 1985). The rise in RR showed the attempt of the animals to increase pulmonary evaporative heat loss to attain thermal equilibrium.

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Pulse Rate (PR)

Alteration in pulse rate is also one of the major indicators of stress. Blackshaw and Blackshaw (1994) reported significantly increased HR and RR but insignificant rise in RT during heat stress in cattle.Younas et al. (2020) reported significantly increased pulse rate in a study on Niliravi buffaloes.The elevated heart rate (HR) and pulse rate (PR) during stress may be due to two reasons; one is the increased muscular activity controlling the rate of respiration, along with elevated RR and the second reason is the reduction in resistance of peripheral vascular beds and arteriovenous anastomoses. Arterial blood pressure decreases under mild heat stress as a consequence of the decrease in total peripheral resistance (Rubsamen& Hales, 1985) and this stimulates HR. Increase in pulsation rate increases blood flow from the core to the surface as a result of which more heat is lost by sensible and insensible means (Marai et al., 2007). The increase in cardiac output and cutaneous blood flow by heat stress, due to blood redistribution from deep splanchnic to more peripheral body regions, has been found in goat (Silanikove, 2000).The cardiovascular and respiratory adjustments to combat the increasing stress indicate the significance of physiological adaptations which are the first line of defense to prevent drastic metabolic alterations and maintain thermoregulation (Wankar et al., 2014).

Rectal Temperature (RT)

Das et al. (1997) recorded a riseinRTfrom38.70±0.21to40.00±0.10°C during the 24 h diurnal change and RR rise from 11.25±0.38 to 48.66±1.26 bpm in Murrah buffaloes during solar exposure in summer when the minimum and maximum AT were27.1and44.1°Crespectively. The heat stressed buffaloes in the study of Khongdee et al. (2011) exhibited a higher mean RT than that of non-heat stressed buffaloes reported in previous studies ((37.9°C (Bunyavejchewin et al., 1985) and 38.5°C (Chaiyabutr, 1993)). The RT increased from 38.5 to 39.7 °C when swamp buffalo and cows (340–375 kg, 4–7 years old) were subjected to acute heat exposure (41 °C; without wallow) for 5 hours (Chaiyabutr,1993). Younas et al., (2020) reported siginifcantly increased rectal temperature in a study on Niliravi buffaloes.

4. Conclusion

It can be therefore concluded that recording of physiological responses is of paramount importance; since their alterations are of physiological significance particularly with respect to effect of thermal stress on the animals. Since these parameters are easy to estimate, the farmers can use them as markers of heat stress at field level. Accordingly, necessary precautionary measures to alter the microclimatic and macroclimatic climatic conditions can be taken to prevent adverse effects of thermal stress on production and reproduction of animals.

Conflict of Interest

The authors declare that no conflict of interest exists.

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References

Aggarwal, A. and Singh, M. (2010). Hormonal changes in heat-stressed Murrah buffaloes under two different cooling systems. *Buffalo Bulletin*, 29(1) :1–6.

Al-Haidary, A.A., Aljumaah, R.S., Alshaikh, M.A., Abdoun, K.A., Samara, E.M., Okab, A.B., Alfuraiji, M.M. (2012). Thermoregulatory and physiological responses of Najdi sheep exposed to environmental heat load prevailing in Saudi Arabia. *Pakistan Veterinary Journal*, 32(4): 515–519.

Badreldin, A.L., Ghany, M.A. (1954). Species and breed differences in the thermal reaction mechanism. *The Journal of Agricultural Science*, 44(2): 160–164.

Basic Animal Husbandry Statistics. (2019).Government of India. Ministry of Fisheries, Animal Husbandry and Dairying, Department of Animal Husbandry and Dairying, KrishiBhavan, New Delhi,5.

Blackshaw, J.K., Blackshaw, A.W. (1994). Heat stress in cattle and the effect of shade on production and behaviour: a review. *Australian Journal of Experimental Agriculture*, 34(2): 285–295.

Bunyavejchewin, P., Veerasit, P., Chaidirek, P., Chantalakhana, C. (1985). Changes in body temperature and working efficiency of Thai swamp buffalo. In Draught animal power for production: proceedings of an international workshop held at James Cook University, Townsville, Queensland, Australia: 10 (46).

Burgos, R., Odens, L.J., Collier, R.J., Baumgard, L.H., VanBaale, M.J. (2007). Case study: Evaluation of different cooling systems in lactating heat-stressed dairy cows in a semi-arid environment. *The Professional Animal Scientist* 23(5): 546–555.

Chaiyabutr, N. (1993). Buffalo physiological responses to high environmental temperature and consequences for DAP. In: Proceedings of Workshop held in conjunction with 6th Asian-Australasian Association of Animal Production Society Congress. Bangkok, Thailand.

Das, S.K., Upadhyay, R.C., Madan, M.L. (1997). Changes in skin temperature and physiological reactions in Murrah buffalo during solar exposure in summer. *Asian- Australasian Journal of Animal Sciences*, 10(5): 478–483

Elvinger, F., Natzke, R.P., Hansen, P.J. (1992). Interactions of heat stress and bovine somatotropin affecting physiology and immunology of lactating cows. *Journal of Dairy Science*, 75(2): 449–462.

Ganaie, A.H., Ghasura, R.S., Mir, N.A., Bumla, N.A., Sankar, G., Wani, S.A. (2013). Biochemical and physiological changes during thermal stress in bovines: areview. *Iranian Journal of Applied Animal Science*, 3 (3): 423–430.

Hafez, E.S.E. (1968). Adaptation of Domestic Animals. Lea andFebiger, 415. ISBN 13: 9780702002731

Hahn, G.L., Parkhurst, A.M., Gaughan, J.B. (1997). Cattle respiration rate as a function of ambient temperature. ASAE Paper NMC 97, 121.

Johnson, H. D. (1965). Environmental temperature and lactation (with special reference to cattle). *International Journal of Biometeorology*, 9(2): 103–116.

Kadzere, C.T., Murphy, M.R., Silanikove, N., Maltz, E. (2002). Heat stress in lactating dairy cows: a review. *Livestock Production Science*, 77(1): 59–91.

Khongdee, T., Sripoon, S., Vajrabukka, C. (2011). The effects of high temperature and wallow on physiological responses of swamp buffaloes (Bubalusbubalis) during winter season in Thailand. *Journal of Thermal Biology*, 36(7) :417–421.

Koga, A., Kurata, K., Furukawa, R., Nakajima, M., Kanai, Y.,Chikamune, T. (1999). Thermoregulatory responses of swamp buffaloes and Friesian cows to diurnal changes in temperature. *Asian-Australasian Journal of Animal Sciences*, 12(8): 1273–1276.

Kumar, V.S., Kumar, R.P., Harikrishna, C.H., Rani, M.S. (2018). Effect of heat stress on production and reproduction performance of buffaloes: a review. *The Pharma Innovation Journal*, 7(4): 629–633.

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Published: 24.10.2023

Lough, D.S.,Beede, D.L., Wilcox, C.J. (1990). Effects of feed intake and thermal stress on mammary blood flow and other physiological measurements in lactating dairy cows. *Journal of Dairy Science*, 73(2): 325–332.

Li, M., Hassan, F.U., Tang, Z., Guo, Y., Liang, X., Peng, L., Yang, C. (2021). Physiological, oxidative and metabolic responses of lactating water buffaloes to tropical climate of South China. Veterinary Medicine and Science.

Marai, I. F. M., El-Darawany, A. A., Fadiel, A., and Abdel-Hafez., M. A. M. (2007). Physiological traits as affected by heat stress in sheep: a review. *Small Ruminant Research*, 71(1–3): 1–12.

McDowell, R.E. (1972). Improvement of Livestock Production In Warm Climates. W.H Freeman and Company.ISBN 0716708256.

Mishra, S. R. (2021). Thermoregulatory responses in buffaloes against heat stress: an updated review. *Journal of Thermal Biology*, 96(102844).

Rubsamen, K., Hales, J.R.S. (1985). Circulatory adjustment of heat-stressed livestock.In: Yousef, M.K. (Ed.), Stress Physiology in Livestock. Vol. 1: Basic Principles.CRC Press, 143–154.

Seath, D, M., Miller, G. D. (1946). The relative importance of high temperature and high humidity as factors influencing respiration rate, body temperature, and pulse rate of dairy cows. *Journal of Dairy Science*, 29(7):465–472.

Seif, I., Khoury, G., Dhar, R. (1979). The genome of human papovavirus BKV. Cell, 18(4): 963–977.

Silanikove, N. (2000). Effect of heat stress on the welfare of extensively managed domestic ruminants. *Livestock Science*, 84:671.

Srikandakumar, A., Johnson, E. H., Mahgoub, O. (2003). Effect of heat stress on respiratory rate, rectal temperature and blood chemistry in Omani and Australian Merino sheep. *Small Ruminant Research*, 49(2): 193–198.

Suguna. (2020). Management of stress in culture fish. *International Journal of Bio-resource and Stress Management*, 11(6): 607–612.

Upadhyay, R. C., Aggarwal, A. (1997). Pulmonary and skin evaporative heat loss during exercise in hot dry conditions in crossbreds. *Indian Journal of Animal Sciences*, 67(1): 51–53.

Umar, S.I.U., Konwar, D., Khan, A., Bhat, M.A., Javid, F.,Jeelani, R., Brahma, B. (2021). Delineation of temperature-humidity index (THI) as indicator of heat stress in riverine buffaloes (Bubalusbubalis) of a sub-tropical Indian region. *Cell Stress and Chaperones*, 1–13.

Wankar, A.K., Singh, G., Yadav, B. (2014).Thermoregulatory and adaptive responses of adult buffaloes (Bubalusbubalis) during hyperthermia: physiological, behavioral, and metabolic approach. *Veterinary world*, 7(10): 825–30.

Yousef, M.K., Johnson, H. D. (1985). Endocrine system and thermal environment.In: Stress Physiology in Livestock. Vol. 1,Basic Principles.CRC Press, 133–139.ISBN-13: 978-0849356674

Younas, U., Abdullah, M., Bhatti, J. A., Ahmed, N., Shahzad, F., Idris, M., Ahmed, S. (2020). Biochemical and physiological responses of Nili-Ravi buffalo (Bubalusbubalis) to heat stress. *Turkish Journal of Veterinary and Animal Sciences*, 44(6): 1196–1202.

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Review Article

100 Years of Horticultural Research in TNAU

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Introduction

The Tamil Nadu Agricultural University (TNAU) had its genesis from establishment of an Agricultural School at Saidapet, Madras, Tamil Nadu, as early as 1868 and it was later relocated at Coimbatore. In 1920 it was affiliated to Madras University. TNAU assumed full responsibilities of Agricultural Education and Research and supported the State Agricultural Department by delivering research products. Till 1946, the Agricultural College and Research Institute, Coimbatore, was the only Institute for Agricultural Education for the whole of South India. In 1958, it was recognized as a Post-graduate Centre leading to Masters and Doctoral degrees. The Agricultural College and Research Institute, Madurai was established in 1965. These two colleges formed the nucleus of the Tamil Nadu Agricultural University while it was established in 1971. The number of varieties released from TNAU in fruits, vegetables, flowers, plantation crops, medicinal and aromatic crops for the benefit of farming communities

Table 1. Horticultural College and Research Institute under TNAU

S.No.	College	Year of Establishment	Place
1.	Horticultural College and Research Institute	1971	Coimbatore
2.	Horticultural College and Research Institute	1990	Periyakulam
3,	Horticultural College and Research Institute (Women)	2011	Trichirapalli
4.	Horticultural College and Research Institute	2021	Zennur

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Horticultural College & Research Institute, Periyakulam

The Horticultural College & Research Institute (HC & RI), one of the constituent colleges of Tamil Nadu Agricultural University, is located at Periyakulam, on the Theni-Dindigul high way in Tamil Nadu State (NH). The famous upper Pulney hill ranges featuring nearby offer natural beauty and scenic frontage to this unique Institute. Geographically, the College campus is situated at 10'N latitude with an elevation of 300m above MSL. The climatic conditions are quite congenial for cultivation of a wide array of horticultural crops. This Institute provides both teaching and research opportunities of high order in an exceptionally pleasant environment. The College Campus encompasses over 100 hectares of farm lands to cater to the needs of teaching, research, training, seed production and plant propagation activities. This is the only full-fledged Institute providing horticulture education in Southern Peninsular India.

Genesis and Growth

A Fruit Research Station was set up in 1957 at Periyakulam, with a view to meet the needs and aspirations of the fruit growers of the erstwhile Madurai district. In the year 1971, Horticultural Research Station (HRS), Periyakulam, was developed which marked the expansion of the research mandate to all major horticultural crops. Commendable progress in fruit and vegetable research is achieved. The centre was upgraded in 1990 as a full-fledged teaching and research institute.

The Horticultural College and Research Institute for Women, Tiruchirappalli

The Horticultural college and Research Institute for Women (HC&RI (W)) a constituent college of Tamil Nadu Agricultural University was established during the year 2011 in the Srirangam constituency at Navalur kuttapattu, Tiruchirappalli. This institute is offering B.SC.,(Horticulture)/ B.Sc.,(Hons.) Horticulture programme exclusively for women to generate adequate women graduate in horticulture to meet the future demand for horticultural development. The undergraduate programmes in B.Sc (Hort.) and B.Sc. (Hons.) Horticulture is a four year degree programme. The curriculum is designed to develop candidates suitable for various sectors viz., agricultural extension, research, banking and private sector.

The institute provides comfortable learning environment by means of well-established academic block with scientific laboratories, modern digitalized class rooms, computer lab, exhibition hall, instructional farm, protected structures, ornamental garden, high density demonstration block in guava, modern library with huge volume of text books, e-resources, well established auditorium, students counselling and placement, student club, new ladies hostel for comfortable stay with all amenities, sports and games facilities etc., for holistic development of mind and body.

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Table 2. Horticultural Research Stations under TNAU

S.No.	Station	Mandate Crops	Year of establishment	Place
1.	Coconut Research Station	Coconut	1963	Aliyar Nagar
2.	Coconut Research Station	Coconut	1958	Veppankulam
3.	Horticultural Research Station	Temperate fruits and Vegetable crops	1988	Ooty
4.	Horticultural Research Station	Coffee,	1976	Yearcaud
5.	Vegetable Research Station	Jack and Vegetables	1981	Palur
6.	Information and Training Centre	Ornamental crops	2000	Chennai
7.	Turmeric Research Centre	Turmeric	2021	Bhavanisagar
8.	Floriculture Research Station	Flower crops	2008	Thovalai
9.	Grape Research Station	Grape	2014	Theni
10.	Horticultural Research Station	Temperate fruits and vegetable crops,	1971	Kodaikanal
11.	Horticultural Research Station	Pepper, Coffee, Mandarin Orange, Cinnamon, Avocado, Chow-chow, Vanilla and Hill banana.	1957	Thadiyankudisai
12.	Horticultural Research Station		1992	Pechiparai
13.	Citrus Research Station	Citrus	2015	Sankarankovil

Table 3.Horticultural Crops varieties released from different colleges and Research Station of TNAU

S.No.	Crop	Varieties	Year of Release	Special feature
I	Fruit Crops			
1.	Mango	**PKM 1**	**1981**	It is a clonal selection from Chinnaswarnarekha and Neelum. Yield of 336 fruits (102.7kg/tree/ha).
		PKM 2	**1990**	It is a hybrid between Neelum and Mulgoa.

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		PAIYUR 1	**1992**	This is a clonal selection from Neelum suitable for high density planting (400 trees/ha
2.	Banana	**CO 1**	**1984**	It is akin to hill banana Virupakshi (AAB). The mean bunch weight is 10.57kg
3.	Citrus Acid Lime	**PKM 1**	**1990**	It is a selection from Kadayam type Tree is vigorous. Fruits can be harvested throughout the year.
4.	Sapota	**CO.1**	**1972**	It is a hybrid clone of the cross between Cricket Ball and Oval. TSS 18°brix. yield of 175 to 200kg per tree
		CO.2	**1974**	It is a clonal selection from Baramasi. The yield is 175 kg per tree or 11.8 tonnes of fruits per hectare per year
		CO 3	**2000**	It is a hybrid between Cricket Ball and Vavilavalasa. yields up to 157kg of fruits
		PKM 1	**1981**	It is a clonal selection from Guthi. yield of 3547 fruits (236kg) per tree per year.
		PKM 2	**1992**	hybrid between Guthi and Kirtibarthi varieties. yield of 80kg of fruits/tree
		PKM.3	**1994**	It is a hybrid between Guthi x Cricket Ball. The variety is adaptable to tropical plains of Tami Nadu and yields 14t/ha.
		PKM (Sa) 4	**2003**	It is a open pollinated clone of PKM 1. It yields about 20.8 tonnes / hectare
		PKM (Sa) 5	**2007**	It is a selection from open pollinated seedlings yield potential of 18.70 t/ha
5.	Guava	**TRY (G) 1**	**2005**	It is Off season bearing, yield potential of 40.52 kg/tree (163.048 t/ha).
6.	Papaya	**CO.1**	**1972**	It is developed by sib mating Ranchi type The plants are dwarf in stature and dioecious.
		CO.2	**1979**	It is pureline selection from a local type. A dioecious type with good papain yield (4-6g per fruit). The papain yield is 250 to 300 kg per hectare.
		CO.3	**1983**	It is a hybrid derivative of the cross between CO.2 (female parent) and Sunrise Solo (male parent). It is a gynodioecious type
		CO.4	**1983**	Hybrid derivative of the cross between CO.1 (female parent) and Washington (male parent). It is a dioecious type
		CO.5	**1985**	It is a selection from Washington type. It is a dioecious type suitable exclusively for papain production
		CO.6	**1986**	It is a selection from a giant papaya. The

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				plants are dioecious.
		CO.7	**1997**	This variety (culture CP81) is gynodioecious in nature developed through multiple crosses
		CO8	**2000**	Dioecious, derived through improvement of CO.2. Yield - 200-230 t /ha
7	Pomegranate	**CO.1**	**1983**	It is a clonal selection. It yields 50fruits/tree, each weighing 340g
		YCD.1	**1985**	It is a clonal selection from Acc. No.455 suitable for mid elevation of Shevroys hills. average yield of 120 fruits/tree
8	Aonla	**BSR.1**	**1995**	It is a selection from Thimbam local A high yielder produces 155 kg of fruits per tree per year.
9	Custard Apple	**APK (Ca) 1**	**2003**	It is a clonal selection from a high yielding type. It yields about 7300 kg fruits / ha
10	Fig	**YCD.1 TIMLA FIG**	**1993**	It is an introduction Higher harvests are made from each tree, the maximum being 4000 fruits.
11	Jack	**PLR.1**	**1992**	Palur.1 Jack is a clonal selection from Panikkankuppam local. Tree yield is about 80 fruits weighing around 900kg.
		PPI.1	**1996**	It is a clonal selection from Mulagumoodu local near Pechiparai
		PLR (J) 2	**2007**	It is a clonal selection from Pathirakkotai Local. yields 95 – 110 fruits/tree/year
12	Manila Tamarind	**PKM (MT)1**	**2008**	It is a open pollinated seedling selection from Soolakkarai yield is 125 kg / tree / year (11.85 t/ha).
13	Aocado	**TKD.1**	**1997**	Selection from germplasm pool. tree yields 264 kg of fruits per tree per year (26.4t/ha).
14	**Apple**	**KKL.1**	**1987**	Kodaikanal-1 apple is a selection from Parlin's Beauty. Heavy yield of 22t/ha.
II	**Vegetable Crop**			
1	**Amaranthus**	**CO 1**	**1968**	It is a selection from a type collected from Tirunelveli (*Amaranthus dubius* Mart exThell
		CO 2	**1979**	It is a selection from a germplasm type of Thanjavur, *A. tricolor* L.(syn. *A gangeticus*), It yields 10.75 tonnes/ha of greens.
		CO 3	**1988**	It is a selection from the local type and yields 30.72 tonnes of greens per hectare
		CO4 Grain type	**1989**	It is a green cum grain type from *A. hypochondriacus* L., which is suitable for

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				growing in plains and hills. It yields 2,555kg/ha of grain in addition 8,200 kg/ha of leaves
		CO 5	**1998**	It is a single plant selection from germplasm (A 166-1). leaf yield of 40 t/ha,
2	**Annual moringa**	**PKM 1**	**1989**	It is a pureline selection. The estimated yield per hectare is 52.8 tonnes.
		PKM 2	**2000**	It is a hybrid derivative developed by cross between MP31 (Eppodumvendran local) X MP28. The average number of fruits is 220/ tree/year,
3	**Ash gourd**	**CO 1**	**1971**	It is a selection from a local type from Tamil Nadu with crop duration of 150 days. It yields 20-25 t/ha
		CO 2	**1982**	It is a selection from Coimbatore local
		Ash gourd Hybrid CO 1		Hybrid between PAG 3 x CO 2. Yield - 91.82 t/ha
4	**Beet root**	**Ooty 1**	**1992**	Selection from the local type. It yields on an average of 31.45t/ha of roots.
5	**Bhendi**	**CO 1**	**1976**	Pureline selection from the 'Red Wonder'. It yields 12 tonnes per hectare
		MDU 1	**1978**	It is an induced mutant from Pusa Sawani through gamma rays.
		CO 2	**1987**	F1 hybrid between A.E. 180 and Pusa Sawani. yields 16.51 t/ha,
		CO 3	**1991**	F1 hybrid between Parbhani Kranti x MDU.1 (Hy.8) yield potential of 16-18 t/ha
		COBhH1	**2007**	It is an VU Selection / PA 4 (T). yield potential of 22.1 t/ha
6	**Bitter gourd**	**CO 1**	**1978**	It is a selection from a local type collected from Thudiyalur (Long Green). It yields 14.4 t/ha
		MDU 1	**1984**	It is an induced mutant developed by gamma irradiation to local cultivar (MC 103). It yields 32.19 t/ha.
		COBgoH1	**2001**	It is a F1 hybrid developed by a crossing MC.84 x MDU.1 potential yield goes up to 51.29 tonnes/ha.
7	**Bottle gourd**	**CO 1**	**1981**	It is a selection from a germplasm type . yield of 36.0 t/ha.
		Bottle gourd Hybrid CO 1		crossing NDBG 121 x Arka Bahar. Yield - 79.03 t/ha
8	**Brinjal**	**CO 1**	**1978**	Pureline selection Yields on an average of 24.0 t/ha

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		MDU 1	**1979**	selection from Kallampati local type crop yield per hectare is 34 tonnes
		PKM1	**1984**	It is an induced mutant of a local type called 'Puzhuthi kathiri'. yields on an average of 34.75t/ha
		CO 2	**1988**	It is a pureline selection from the local variety 'Varikkathiri' yield is around 35 t/ha
		PLR 1	**1990**	It is a reselection from a Nagpur ecotype. It yields on an average of 25.1 t/ha
		KKM 1	**1995**	It is a pure line selection from Kulathur local
		PPI(B) 1		This is a single line selection (PPI (B) 1) from Karungal local type Vazhuthunangai and yields 50 t/ha
		COBH 1	**2001**	F1 hybrid between EP 45 x CO.2 yield of 56.40 tonnes /ha
		PLR(B) 2	**2008**	Single plant selection yield of 42t/ha
		COBH 2	**2009**	F1 hybrid developed by crossing EP65xPusa Uttam. Yield - 58-60 t/ha
		VRM1	**2010**	Pureline selection Yield - 40-45 t/ha
9	**Butter beans**	**KKL 1**	**1991**	Selection from a type collected from Vilpatti. yields 3.47 tonnes
10	**Carrot**	**Ooty 1**	**1997**	Selection from half-sib progeny of a local type It yields 49.1 t/ha with a seed yield of 700-1000 kg/ha.
11	**Cauliflower**	**Ooty 1**	**1998**	selection from OP progenies yields 46.4 t/ha in 120 days,
12	**Cerely**	**Ooty 1**		Selection from the six germplasm types Yield - Greens - 30.5 t/ha Seed - 1.40 t leaves /ha
13	**Chakravarthikkeerai**	**Ooty 1**	**2001**	Pureline selection green yield of 28.9 tonnes/ha
14	**Chilli**	**K 1**	**1964**	Pure line selection from local Sattur Samba yields 1.8 tonnes of dry pods/ha
		K 2	**1975**	Hybrid derivative of the cross between B.70 A (Assam type) x Sattur Samba. yields 1.9 tonnes of dry pods
		MDU 1	**1978**	Induced mutant from K.1 chillies dry pod yield of 1809 kg/ha
		CO 1	**1979**	Reselection from Sattur Samba [CA (p) 247]. yields 2110 kg of dry pods per hectare.
		CO 2	**1982**	Selection from Nambiyur local 'Gundu' type green pod yield is about 11 t/ha.
		PKM 1	**1990**	Cross between AC. No. 1797 x CO.1yields on an average of 3.08 t/ha
		CO 3	**1991**	Selection from an open pollinated

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				type15-18 tonnes of green chilli per hectare.
		PMK 1	**1993**	Cross Co.2 x Ramanathapuram gundu . yields on an average of 2.36 tonnes
		PLR 1	**1994**	Pureline selection yields 18.41 tonnes of green chillies/ha,
		CO 4	**2000**	Pureline selection yields 23 t/ha of green fruits as against 11.73 t/ha in PKM.1
		KKM(Ch) 1	**2006**	Hybrid derivative of Acc. 240 / CO-3 yields about 3.03 tonnes of dry pod / hectare
		CO CH 1	**2010**	Yield - Green fruit yield: 28.10 t/ha Dry fruit yield : 6.74 t/ha
15	**Coccinia**	**CO 1**		Clonal selection from Anaikatti type. Yield - 83.09 (t/year)
16	**Coleus**	**CO 1**	**1991**	Clonal selection from local type introduced from Tenkasi. It yields 31.93t/ha
17	**Colocasia**	**CO 1**	**1991**	It yields 24.3t/ha
18	**Cowpea**	**PKM -1**	**2011**	Selection from a local type Green pod yield - 25 t/ha
19	**Cucumber**	**CO 1**	**1989**	Selection from a local type It yields (25-28 t/ha) of ripe fruits
20	**Dolichos bean**	**CO 1**	**1993**	Pureline selection. It yields 18 tonnes of green pods per hectare.
21	**French beans**	**TKD 1**	**1988**	Pole type selected from germplasm population Dry seed yield is 2.78 t/ha.
		YCD 1	**1994**	Pure line selection from a local yield potential of 9.75 tonnes of green pods per hectare and grain yield of 6.3 t/ha.
		Ooty 1	**1999**	Pure line selection from accession PV-26 It yields 33.68 t/ha,
		Ooty 2		Yield of 14.30 t/ha of green fruits in 90 days
22	**Garlic**	**Ooty 1**	**1991**	Clonal selection from the germplasm potential yield of 17.1 t/ha
23	**Greater yam**	**CO 1**	**1991**	Clonal selection from the germplasm yields 44.8 tonnes of tubers/ha
24	**Moringa beans**	**KKL 1**	**1996**	Pureline selection from local type It yields 7t/ha
25	**Onion**	**CO 1**	**1965**	Clonal selection from a germplasm type CS 450 yields 10t/ha
		CO 2	**1975**	Selection from a germplasm type C.S. 911. yields 12t/ha
		CO 3	**1979**	Clonal selection from open pollinated progenies of C.S. 450 yields 15.8t/ha
		MDU 1	**1979**	Selection from the Sempatti local yield potential was 13,000 kg /ha.

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		CO 4	**1982**	Hybrid derivative of the cross AC863 x CO.3. yields 19.0t/ha
		COOn 5	**2001**	Mass pedigree method of selection. yield 18.9 t/ha
26	**Palak**	**Ooty 1**	**1995**	Yields 15t/ha of leaves. The carotene content is high.
27	**Peas**	**Ooty 1**	**2000**	Pureline selection (PS-33-1) crop yields 11.1 t/ha under rainfed conditions and 12.9 t/ha under irrigation
		Pole type Ooty 1		Pure line selection Yield - 33.7 t/ha
28	**Potato**	CO Simla potato	1970	Selection from the hybrids obtained from CPRI, yield is 12t/ha
29	**Pumpkin**	**CO 1**	**1971**	Selection from local type. yields 25-30 t/ha,
		CO 2	**1974**	Yield of 22.65 t/ha.
30	**Radish**	**CO 1**	**1981**	Selection from germplasm type (RS 44).
31	**Ribbed gourd**	**CO 1**	**1976**	It is a selection and yields 14t/ha.
		PKM 1	**1980**	Induced mutant from the type H.160. It yields 25-28 t/ha
		CO 2	**1984**	Selection from a germplasm type.
32	**Snake gourd**	**CO 1**	**1976**	Pureline selection yields 18.28 t/ha
		PKM 1	**1979**	Induced mutant from H.375 25.5 t/ha
		MDU1	**1981**	F1 hybrid between Panripudal and Selection-1 yield of 31.75 t/ha
		CO 2	**1986**	Pureline selection from a local type It yields on an average of 36 t/ha.
		PLR(SG) 1	**2007**	Pure line selection from white long type. yield potential of 35 – 40 t/ha
		PLR (SG) 2		Fruits are plumpy, fleshy with attractive white colour
33	**Newzealand spinach**	**OOTY (Sp) 1**	**2005**	Pure line selection from germplasm types. potential of 33.80 t/ha of greens
34	**Sweet potato**	**CO 1**	**1976**	Clonal selection (IB 3) yields on an average 28.33t/ha
		CO 2	**1980**	Clonal selection (IB 81) Yields on an average of 32t/ha.
		CO 3	**1982**	Seedling clone (IB 2837) tubers is 43.68t/ha
		COCIP 1	**(1999)**	Clonal progeny of IB 90-10-20 yields 31.76 t/ha (tubers),
35	**Tapioca**	**CO 1**	**(1977)**	Clonal selection from a local type (ME 7) yields of 29.97 tonnes of tubers per hectare
		CO 2	**(1984)**	Clonal selection (ME 167) yields 35-37 t/ha

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		MVD 1	**(1983)**	It yields 34.5t/ha in a crop duration of 9 months.
		CO 3	**(1993)**	Clonal selection (ME 120-1) yields on an average of 42.58 t/ha of tubers under irrigated and 27.31 t/ha of tubers
		CO 4	**(2002)**	CO (TP) 4 is a clonal selection tuber yield of 50.6 t/ha
		CO(Tp) 5	**(2007)**	exotic germplasm introduced from CIAT, Cali, Colombia (MNga-1). tuber yielder (38 t/ha).
36	**Tomato**	**CO 1**	**(1969)**	Pureline selection isolated from American variety "Pearl Harbour"yield potential of 35 tonnes of fruits per hectare.
		CO 2	**(1974)**	Selection from a Russian Introduction. yields to a maximum of 41.0 tonnes of fruits per hectare.
		PKM 1	**(1978)**	Induced mutant from a local variety called Annanji yields on an average, 32 t/ha
		CO3	**(1980)**	Induced mutation by treating the seed of CO.1 tomato (IM 39) with EMS. yielding as high as 45 tonnes of fruits per hectare
		Paiyur 1	**(1988)**	Hybrid derivative of a cross between Pusa Ruby and Co.3 (Marutham). yields about 30 tonnes per hectare
		COTH 1	**(1998)**	Crossing IHR 709 X LE.812 hybrid yields 95.9 t/ha
		COLCRH 3	**(2006)**	Hybrid developed from LCR 2 / CLN 2123 A yield potential of 90.20 t/ha
		COTH 3		Crossing HN2xCLN 2123AYield - 96.2 t/ha
37	**Watermelon**	**PKM 1**	**(1993)**	Selection from a local type.
III	**Flower crops**			
1	**Barleria**	**CO 1**	**(1984)**	Clonal selection from the local type. average 2.11 kg of flowers per plant in a year.
2	**Chrysanthemum**	**CO 1**	**(1985)**	Selection made form a bulk population Average yield on main crop is 16.7 t/ha.
		MDU 1	**(1985)**	Selection from the germplasm type. I It yields 30.59 tonnes per hectare per year in two crops
		CO 2	**(1989)**	Clonal selection
3	**Gerbera**	**YCD 1**	**(1992)**	Clonal selection from seedling from a mixed open pollinated seeds
		YCD 2	**(1995)**	Germplasm collection, 80 flowers / clump
4	**Gladiolus**	**KKL 1**	**(1993)**	Improved selection. The selection yields

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				on an average of 21.1 spikes and 19.5-corms/ sq.m.
5	**Hibiscus**	**CO 1**	**(Thilagam) (1981)**	Inter-generic hybrid between *Hibiscus rosasinensis* and *Malvaviscus arboreus.*
		CO 2 (Punnagai)	**(1981)**	Open pollinated seedlings of 'Chandrika' variety.
		CO 3	**(1984)**	Clonal hybrid between Bright Yellow and Red Gold
6	**Jathimalli**	**CO 1 (1980)**		Clonal selection from germplasm collection
		CO 2 (1991)		Induced mutant (I.M.3)
7	**Marigold**	**MDU 1**	**(1986)**	Selection from a germplasm type. yield of 41.54 t/ha.
8	**Mullai**	**PARIMULLAI**	**(1972)**	Clonal selection from a germplasm clone
		CO 1	**(1980)**	Clonal selection from a local type.
		CO 2	**(1988)**	Clonal selection, It yields on an average of 11,198 kg of fresh flower
IV	**Spice Crops**			
1	**Cinnamon**	**YCD 1**	**(1995)**	Selection from the germplasm High dry bark yield of 359.75 quills and 3800 kg of dried leaves /ha
		PPI (Ci) 1	**(2003)**	Selection from the germplasm It yields about 980 kg bark / ha (248.42 kg of quills and 731.58 kg of chips and dust)
2	**Coriander**	**CO 1**	**(1977)**	Selection from a germplasm type yields 500 kg grains per hectare.
		CO 2	**(1982)**	Reselection from a type P2 of Gujarat. yields 600 to 700kg of grains per hectare
		CO 3	**(1991)**	Reselection from accession 695 yield potential of 275.6 kg/ha in Kharif and 644 kg/ha in Rabi season.
		CO 4		Single line selection from Lam (Andhra Pradesh) type. high yielder (590 kg /ha in irrigated and 540 kg/ha under rainfed)
3	**Fennel**	**CO 1**	**(1985)**	selection from a local type It yields 566.8 kg/ha grain
4	**Fenugreek**	**CO 1**	**(1982)**	Reselection from a type TG 2336 yields 600 kg of grain/ha.
		CO 2	**(1999)**	Selection from germplasm collection (CP 390) It yields 481.8 kg/ha of grains,
5	**Tamarind**	**PKM 1**	**(1992)**	Clonal selection from a local type Endapuli. yields on an average 263.3 kg/tree
6	**Turmeric**	**CO 1**	**(1983)**	Vegetative mutant selection from Erode local turmeric
		BSR 1	**(1986)**	Mutant population irradiated with X-

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				ray. It yields 31 t /ha of fresh rhizomes and 6 tonnes of dried rhizomes.
		BSR 2	**(1994)**	Induced mutant from Erode local type yields 32 t/ha
		CO -2		Yield - 42 tonns fresh rhizome /ha
V	**Plantation Crops**			
1	**Betel vine**	**SGM 1**	**(1994)**	Clonal selection from a Palghat type. higher leaf yield of 109 lakh leaves per hectare
		SGM (BV) 2	**(2004)**	Pureline selection yields about 49 lakh leaves / ha / year
2	**Cashew nut**	**VRI 1**	**(1981)**	Clonal selection from germplasm accession average annual yield is 7.12 kg per tree in a year.
		VRI 2	**(1985)**	Selection from Kattupalli village in Chengalpattu district. yields 1750 kg of nuts/ha,
		VRI 3	**(1991)**	Sseedling progeny (M 26-2) of a high yielding treeyield of 14.19 kg per tree per year
		VRI 4	**(2000)**	Selection from Vazhisodanipalayam of Cuddalore crop yields 3320 kg of nuts per hectare.
		VRI (CW) H1	**(2009)**	Yield - 14.5 kg/tree, 2900 kg/ha
3	**Coconut**	**VHC 1**	**(1982)**	Hybrid between East Coast Tall and Malayan Dwarf Green. yield of 98 nuts/palm/year.
		VHC 2	**(1988)**	East Coast Tall and Malaysian Yellow 100 nuts per tree per year,
		VHC 3	**(2000)**	VHC 3 (East Coast Tall x Malaysian Orange Dwarf) yield of 156 nut/palm/year and copra yield of 25.2 kg/palm/year
		VPM 3	**(1994)**	Selection from material received from CPCRyields 72-92 nuts and 15 kg copra per palm per year
		ALR (CN) 1	**(2002)**	Selection from Arasampatti tall selection from Arasampatti tall
		ALR 2	**(2010)**	Selection from Tiptur Tall Yield - 140 nuts / palm / year
4	**Palmyrah**	**SVPR 1**	**(1992)**	Selection from Srivilliputhur local. 298 litres of padaneer/tree/year.
VI	**Medicinal and Aromatic Crops**			
1	**Geranium**	**KKL 1**	**(1987)**	Clonal selection from an Algerian variety yields 45.2 tonnes of green leaves per hectare

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2	**Rosemary**	**Ooty (RM) 1**		Selection from the seedling progenies of rosemary. crop yields an average of 12.4 tonnes / ha of green leaves / hectare
3	**Senna**	**KKM Se 1**	**(2001)**	Selection from Thenkalam local yield of dried leaves is 712 kg/ha with a pod yield of 266 kg/ha
4	**Thyme**	**OOTY (Tv 1)**	**(2006)**	Pureline selection from five germplasm types yield potential of about 10.70 tonnes of green leaves / year

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Popular Article

Exploring Insect Gut Microbial Diversity: A Scientific Inquiry

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Introduction

The gut microbiome, form intricate communities that coexist in a delicate balance with their insect hosts. This symbiotic relationship, often overlooked, has far-reaching implications, influencing not only the health and behaviour of the insects themselves but also their resurgence against applied pesticides (Siddiqui et al., 2022). Gut microbiome analysis delves deep into the heart of this complexity, aiming to unravel the secrets held within the diverse communities of microorganisms residing in the insect gut. By exploring their composition, interactions, and functions, entomologists have begun to decipher the profound impact of insect gut microbial diversity on ecological processes, agricultural practices, and even human health.

Importance of Studying Insect Gut Microbiota

I. Insects are vital components of ecosystems. Gut microbiota influence insect behaviour, which, in turn, affects plant pollination, seed dispersal, and nutrient cycling.

II. In agriculture, certain insects are pests that damage crops. Understanding their gut microbiomes can lead to innovative pest control strategies, reducing the reliance on chemical pesticides.

III. Insect gut microbiomes harbour a vast reservoir of enzymes and biochemical pathways. These can be harnessed for various biotechnological applications, such as biofuel production, waste degradation, and the development of novel enzymes for industrial processes (Krishnan et al., 2014).

IV. Understanding the gut microbiomes of disease-carrying insects like mosquitoes, which transmit illnesses such as malaria and dengue fever, can yield valuable insights into disease transmission patterns and facilitate the development of strategies to disrupt these transmissions.

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Methodologies Involved

The insects are left without food until they die before undergoing surface sterilization. After that, their digestive system is blended with sterile water. The resulting mixture is then diluted, and the necessary concentration is spread onto a nutrient agar medium. Bacterial and fungal colonies are recognized, sub-cultured, and purified before being progressed for research. 16S rRNA Gene Sequencing, Whole Metagenome Shotgun Sequencing, Quantitative PCR (qPCR), Metatranscriptomics, Metaproteomics, Metabolomics, 16S rRNA Gene Microarrays and Flow cytometry are the general techniques used to analyse and estimate gut microbiome.

Conclusion

From aiding in nutrient digestion and energy harvesting to influencing reproduction, development, and disease transmission, the significance of insect gut microbiomes reverberates across various fields. By deciphering the language of these microcosmic alliances, we not only enhance our understanding of insect biology but also pave the way for innovative solutions to some of humanity's most pressing challenges.

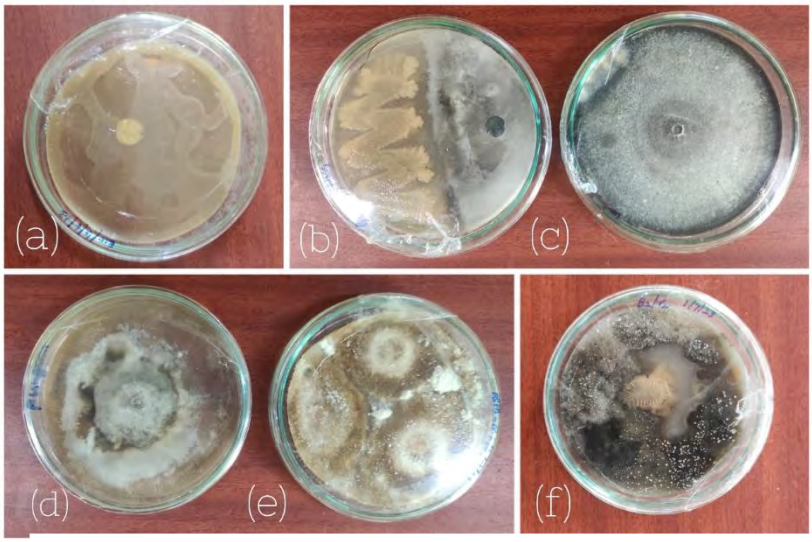

Figure: Estimation and analysis of gut microbiome population of **sugarcane internode borer** [*Chilo sacchariphagus indicus* (Bojer, 1856)], collected from Tiruvannamalai District, Tamil Nadu
(a) Unidentified bacterial culture **(b & c)** antagonist compatibility analysis **(d & e)** sub-cultured fungal colonies **(f)** Aspergillus isolated from the insect's gut

References

Siddiqui, J. A., Khan, M. M., Bamisile, B. S., Hafeez, M., Qasim, M., Rasheed, M. T., Rasheed, M. A., Ahmad, S., Shahid, M. I., & Xu, Y. (2022, May 3). Role of Insect Gut Microbiota in Pesticide Degradation: A Review. Frontiers in Microbiology, 13. https://doi.org/10.3389/fmicb.2022.870462

Krishnan, M., Bharathiraja, C., Pandiarajan, J., Prasanna, V. A., Rajendhran, J., & Gunasekaran, P. (2014). Insect gut microbiome - An unexploited reserve for biotechnological application. *Asian Pacific journal of tropical biomedicine*, *4*(Suppl 1), S16–S21. https://doi.org/10.12980/APJTB.4.2014C95

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Popular Article

Check points of kid's management to identify susceptible animals early and increase the survivability of kids.

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Introduction

The finest care should be given to kids and youngsters while they are still growing. In goat farms, the mortality rate for kids varies from 16 to 33%, depending on the management approach. Seasonal mortality rates may vary from 41.07% in the winter, 37.5% in the rainy season, and 21.43% in the summer. The biggest proportion of deaths were attributable to diarrhea (35.71%), followed by pneumonia (28.57%), and other causes (12.5%). In terms of fatalities, diarrhea was the leading cause (35.71%), followed by pneumonia (28.57%), and other causes (12.5%). So there is a clear checkpoint during the management from birth to till weaning, the following is described:

First three days after kidding

Colostrum Feeding

- Newborn goat kids are to ensure intake of adequate amounts of good-quality colostrum. Within 30 minutes, a doe will usually nurse a healthy goatling. Always keep in mind the three Qs of colostrum: quality, quantity, and quickly.
- As a general guideline, administer at least half of the recommended amount of colostrum within two hours after delivery and the remaining amount within six
- Up to 3 days of birth keep dam and young ones together for frequent access of colostrum at least 4-5 times a day.
- Orphaned kids may be placed along with foster mother to ensure colostrum, if that is not available goat milk or cow milk fortified with vitamin A (10,000 I.U feeding per litre) may be given.

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- **Birth Defects**: Atresi ani (no rectal opening).
- **Constipation:** Sometimes stressed newborns become constipated. Monitoring fecal production or the absence of feces can identify issues early. Enemas may be carried out in such case in relieve the kids from constipation.
- **Diarrhea:** In many ailments, diarrhea is a symptom rather than the primary cause of whatever is wrong. Take the required action after determining the cause of the diarrhea.
- **Thiamine deficiency**: If the kid's are not able to figure out where the teat is, then there may be thiamine deficiency. Such kid may be given Vitamin B1 injections.
- **Neonatal Diarrhea Complex:** Kids have (generally) grayish or whitish diarrhea with a very distinctive smell, all of these symptoms point neonatal diarrhea complex. Newborn kids tend to produce bright yellow feces, usually thought to be E. coli or Cryptosporidiosis, infections, commonly occurring in young kids in cold and/or wet weather.
- **Coccidiosis:** Blackish diarrhea can be one of the symptoms. These protozoan attacks the goat's intestinal lining and can cause so much damage quickly that the intestine will never be able to absorb nutrition effectively. Sulfa-based medications like Dimethox 12% oral solution or Albon must be used to treat such cases.
- **Pneumonia:** Pneumonia is the common term for a range of respiratory infections that kill goats, especially kids, so quickly that you don't have the luxury of time to determine its type. Prompt treatment is required.
- **Interstitial pneumonia** is the type of pneumonia most often seen in goats. it appears with rapid-onset high fever, no nasal discharge, and often foam comes out of the mouth as it quickly progresses. In less than 12 hours, interstitial pneumonia can quickly cause death. The goat seems to be well during the day but is dead in the morning. Dry and windy conditions can also cause pneumonia. Goats should not be moved through dry pens or lanes without first moistening the ground. Goats live close to the ground particularly kids. As compared to other mammal's ruminants have lungs smaller in relation to the overall size of their bodies than other mammals, making them susceptible to pneumonia.
- **Floppy Kid Syndrome:** Generally, occur due to overeating on milk, can occur when high-milking does and their young are confined in tight spaces.
- **Joint Ill**: occurs when bacteria travel up a newborn kid's infected navel cord and migrates to its (usually) leg joints. To avoid joint ill tie the umbilical cord about 3/4 inch away from the belly and cut it 2 cm below. Dip the naval cord the tying point in a strong iodine solution

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(7%) immediately after birth. Dip the naval cord the tiering point in a strong iodine solution (7%) immediately after birth and continue it twice a day for its complete healing falls after drying off.

- **Enterotoxemia:** This can happen when newborns and very young kids consume too much milk and it gets fermented in intestine to produce toxins.

From 4 day to weaning day

- After 3 days and up to weaning feed the kids with milk at least 2 to 3 times a day.
- The whole milk should be given at the rate of 1/6th of their body weight from 4th day to 30th days.
- From the 2nd week onwards a palatable and easily digestible concentrate mixture and good fodder may be offered to the kids.
- Kids from birth up to weaning should be housed along with their mothers.
- From birth to weaning, body weight of kids should be recorded every week.
- After weaning up to attaining maturity kids should be housed in sheds at the rate of 60-75 animals per shed.

- A deworming schedule should be followed at the age of 4 week to prevent the kids from coccidiosis and endo-parasitic infection.

Deworming Schedule

Age group	Dewormer to be used	First Doses	Another dose/ month
4-6 week of age	Benzimidazoles/ Fenbendazole (Panacur) (Against all worms)	1 or 2 months	3-4 months
>4 months, adult and breeders (2 weeks before breeding)	Albendazole/Fenbendazole/Mebendazole (Panacur)	5-10 mg/kg B.wt.	• Mid-February to March • June to mid-July • Mid-September to mid-October
	Ivermectin	1ml/50kg B.wt.	
	Piperazine salt	0.2-0.4g/kg B.wt.	
Other medicines are also used in severe case of diarrhea like.: Biotrem & Griptol-N			

A vaccination schedule should also be followed; primary vaccination for various infectious diseases like E.T., FMD, HS. Goat Pox and PPR should be done at 3-4 months of age.

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Vaccination Schedule for goats

Sr. No.	Disease	Type of vaccine	Dose and route	Age of vaccination	Revaccination	Month
1	Enterotoxaemia (E.T.)	Multicomponent clostridial vaccine	2.5 ml S/C (Repeat after 15 days)	4 months of age and above	Annually	February
2	Foot & Mouth Disease (FMD)	Polyvalent FMD vaccine (A, O, C, asia-1 strains)	2-3 ml S/C	6 months	Twice in a year (September & March)	June/July
3	Hemorrhagic Septicemia (H.S.)	Oil adjuvant vaccine	2 ml I/M	1 year	Once Annually Before monsoon	June/July (Before onset of monsoon)
4	Goat Pox	Live attenuated vaccine	1 ml	4 months of age and above	Annually	December
5	PPR Peste Des Petits Ruminanat	live-attenuated PPR vaccine	1 ml Subcutaneous route	At the age of 3 month for kid or lamb & above	Once in three years	late November to middle of December

Conclusion

If the farmer fallows the above points during early phase of kid's life, then they can prevent early mortality of kids in their flock and will be able to produce a good number of adult goats for breeding and marketing. This leads to improved overall performance of their goat flock and they may be able to earn a healthy profit from their goat farm.

Reference

1. Hundal, J. S., Udeybir Singh, Navdeep Singh, S. K. Kansal, and J. S. Bhatti. "Impact of training on knowledge level of goat farmers in Punjab." *Haryana Vet* 55, no. 1 (2016): 47-49.
2. Snyman, M. A. "Factors affecting pre-weaning kid mortality in South African Angora goats." *South African Journal of Animal Science* 40, no. 1 (2010).
3. Tizard, Ian R. "Sheep and goat vaccines." *Vaccines for Veterinarians* (2021): 215.

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Popular Article

Blue Tongue in Small Ruminants: An Overview

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Abstract

Blue tongue is now considered as important arthropod borne viral disease affecting multiple species, though sheep is acutely infected with high mortality. India is endemic to Blue tongue with nearly 15 serotypes already identified in India, so considered as an important emerging disease. Routine serosurvelliance as well as awareness among all stake holders related to animal husbandry sector is the need of the hour to investigate circulating strains in different parts of country, which will be helpful in designing effective vaccine as well as limiting the spread of this disease.

Introduction

Small ruminants play a key role in livelihood sustenance and nutritional security. In addition to their considerable contribution to the production of meat, milk, and wool as well as their capacity for rapid reproduction and growth, these small ruminants are valuable resources to be considered as a potential entrepreneurial activity among the rural youth. Many productions limiting viral diseases like PPR, Blue tongue and Pox cause a considerable setback to the small ruminant industry, with persistence in the susceptible population in spite of mass vaccination due to the influence of genetic mutations (Mishra *et al.,* 2020). Blue tongue (BT) is an arthropod borne viral disease occurring around the globe while majority of the states in India are endemic to this (Rupner *et al.,* 2020). Awareness about the disease aetiology, transmission and pathology is utmost important among the rural people to limit the spread as well as in curtailing unnecessary veterinary expenses. This literature will refresh the knowledge of field veterinarians and para veterinarians about the recent updates of the disease which will be helpful in disease diagnosis and treatment.

Blue tongue is an infectious viral non-contagious disease predominantly affecting sheep. It occasionally affects cattle, goats, and wild animals. There are several names for blue tongue

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disease such as: Catarrhal fever, Sore muzzle, Pseudo foot and mouth disease and Stiff lamb disease.

Aetiology and transmission

Blue tongue virus is an RNA virus belonging to the arthropod-borne Orbivirus of Reoviridae family. It has been determined that there are 26 antigenic strains of the virus, which vary in pathogenicity. The insect vector i.e. Culicoides mosquitoes, ticks like Argus, is the key to the transmission of virus between animals. After ingesting blood from infected animals, vectors become infected. Transmission can also occur through semen observed in the case of bulls. The virus is resistant against antiseptic and disinfectants and can persist in blood and meat for a long period of time. It can be destroyed by use of 3% sodium hydroxide solution. It is basically a disease of sheep but the severity of the infection varies in different age groups. Suckling lambs are resistant. Sheep around the age of one year are highly susceptible (Joardar, 2022). Epidemiological risk factors like age, sex, breeds, housing conditions, body weight of concerned animals as well as seasonal influence on vector population plays important role in disease outbreak in field conditions (Rath *et al*., 2020; Rao *et al*., 2016).

Clinical signs

The morbidity is around 50% whereas the mortality ranges from 10-90%. The incubation period can vary from 1-10 days. The disease has been occurring in several forms as described below -

Acute form, the most common form in field is characterized by

- High fever, Nasal discharge, Lacrimation, drooling of saliva, Ulceration of dental pad, gums, and lips, Burnt and dry appearance of the muzzle, Cyanotic/Bluish coloration of the tongue, Lameness due to inflammation in the hoof coronets, Arched back posture/ Torticollis and Death

(b) Subacute form: Observed in cattle, often goes unnoticed

(c) Abortive form: Abortion in pregnant ewes, Deformities such as congenital muscle stiffness, absence of mandible, and protrusion of lower mandible.

Characteristic post-mortem lesions

- Necropsy lesions are characterized by petechial, ecchymosis, or haemorrhages at the base of the pulmonary artery and focal necrosis of the papillary muscle of the left ventricle
- Congestion of lungs
- Swelling of pharyngeal, cervical, and thoracic lymph nodes
- Hyperaemia, petechiation, and ulceration of the mucosa of the stomach.
- Exanthematous eruptions on the non-hairy areas of skin.
- Nostrils occluded due to encrusted nasal discharge.

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- Oedema, petechial haemorrhage in pharynx and trachea.
- Enlarged spleen
- Lymphadenitis

Prevention and control

- Surveillance and monitoring in the endemic areas to check the presence of the virus
- Active surveillance in the endemic areas to check the vector population
- Vaccination
- Quarantine of the sick animals
- Restriction of movement during increased activity of vectors especially late summers and early autumn
- Use of insecticide sprays to curb the vector population
- Import of animals from the disease-prevalent areas should be strictly avoided.
- Educating the farmers

Conclusion

Active surveillance and seromonitoring needs to be done along with regular vaccination for curbing the menace of the blue tongue disease. Regular outbreak investigation with due emphasis given to identify the circulating viral isolates in different regions of country, which will be helpful in formulating the vaccine strategy and suitable vaccine strain for controlling the disease.

References

Mishra, A.R., Rath, P.K., Panda, S.K., Nayak, D. 2020. Influence of mutation in nucleoprotein of *Peste-des-petits-ruminant's virus* (PPRV) isolated from 2016 Indian outbreak. *Small Ruminant Research*. 184: 106048.

Rupner, R.N., VinodKumar O.R., Karthikeyan, R., Sinha, D.K., Singh, K.P., Dubal, Z.B., Tamta, S., Gupta, V.K., Singh, B.R., Malik, Y.S. and Dhama, K. (2020). Bluetongue in India: a systematic review and meta-analysis with emphasis on diagnosis and seroprevalence, *Veterinary Quarterly*, 40(1): 229-242.

Rao PP, Hegde NR, Reddy YN, Krishnajyothi Y, Reddy YV, Susmitha B, Gollapalli SR, Putty K, Reddy GH. 2016. Epidemiology of bluetongue in India. *Transbound Emerg Dis*. 63(2): e151–e164.

Rath, P.K., Panda, S.K., Mishra, B.P., Mishra, R. and Karna, D.K. 2022. Epidemiology, Haemato-biochemical and Pathological Changes Related to Field Outbreaks of PPR in Small Ruminants in Odisha. *Indian Journal of Animal Research*. 8: 1-7. 10.18805/IJAR.B-4563

Joardar, S.N. 2022. Prevalence and sero-epidemiology of bluetongue with special reference to eastern and north-eastern states of India. *The Journal of Basic and Applied Zoology*, 83(9): https://doi.org/10.1186/s41936-022-00271-0

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Popular Article

Plastic Peril: Threatening to Marine Life

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Abstract

Plastic, due to its affordability and convenience, has permeated every aspect of our daily lives. Unfortunately, our careless handling of this material has transformed it into a paramount environmental crisis during our lifetime. Annually, millions of tons of plastic waste are discarded, with a significant portion finding its way into the oceans, inflicting harm upon wildlife and ecosystems. Astonishingly, a mere 9% of all plastic ever produced is recycled.the world generates a staggering 400 million tonnes of plastic waste, with the United States leading the pack, producing 42 million metric tons annually. Over 8 million tonnes of plastic end up in our oceans each year, causing the death of approximately 100,000 animals entangled in ghost fishing nets. Human exposure to plastic reaches an alarming 5 grams per week. During the COVID-19 pandemic, an additional 25,900 tonnes of plastic pollution found its way into the ocean, largely due to the essential nature of single-use surgical face masks, Personal Protective Equipment (PPE), and plastic disinfectant bottles.

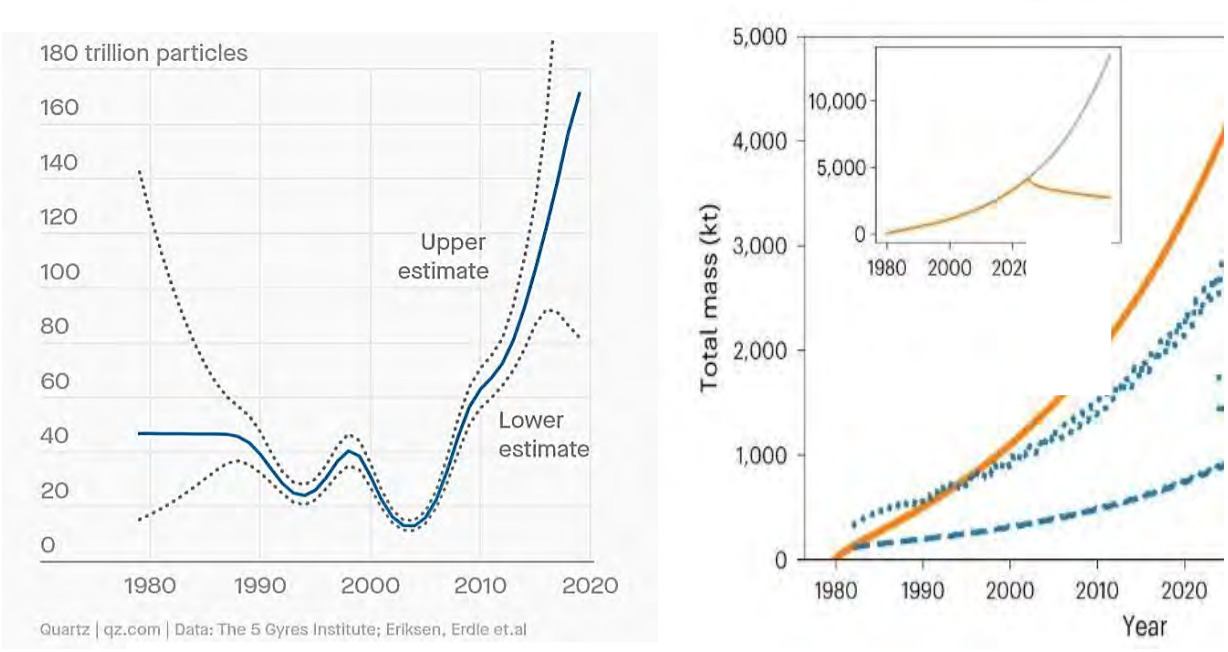

Fig 2 – Average no of particles in the World Ocean

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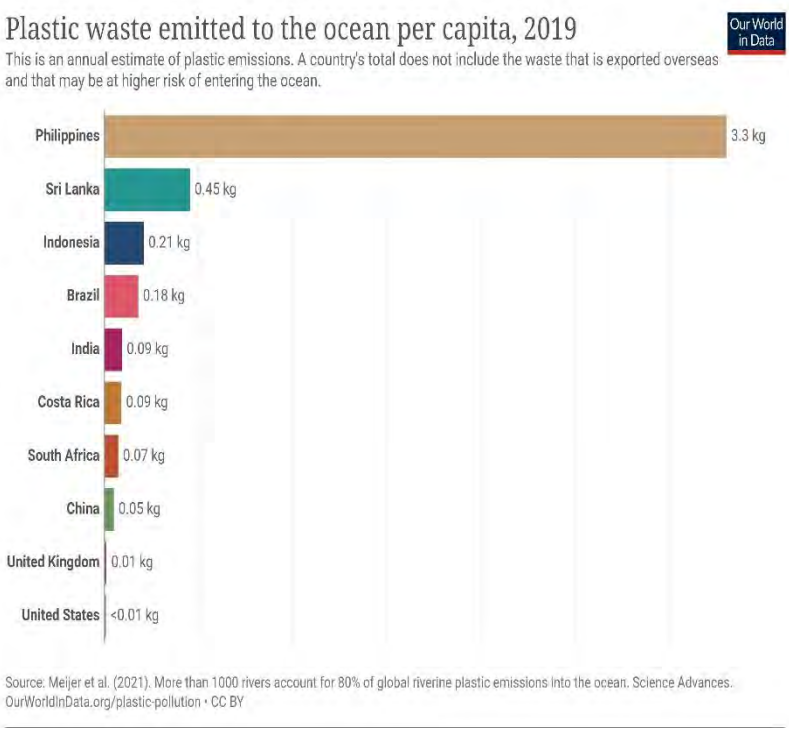
Plastic pollution on marine life is a significant threat to many marine species and their life. In this we discover the sources and types of plastic in oceans and their impact on marine life, marine flora and marine habitats, and the economic and social effects of plastic pollution and suggest steps for to reduce plastic pollution and save our oceans.

The most types of plastic pollution are microplastics. They are small particles that are less than 5mm in size. Microplastics have diverse sources, including agricultural products, cosmetics, and industrial waste. When they find their way into the ocean, they pose significant threats to marine life. They can be ingested by plankton and other small sea creatures, entering the marine food chain.



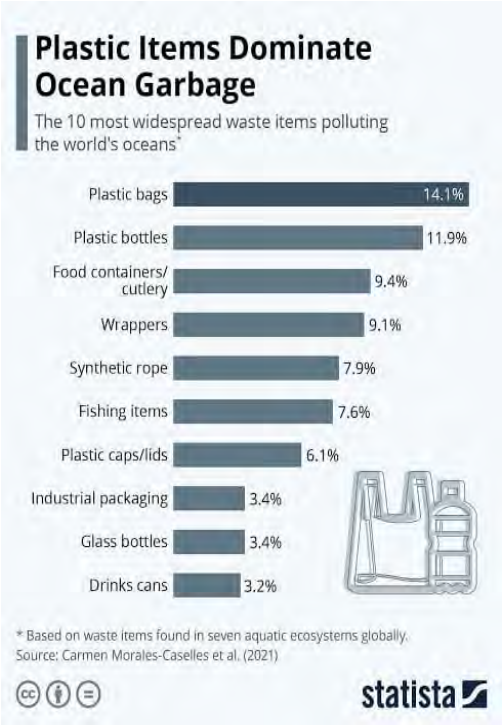


Fig 2 - Plastic waste Emmitt in Ocean per capita, 2019

Fig 3 – Plastic dominates ocean garbage

The ingestion of larger plastic pieces or entanglement in plastic can lead to asphyxiation or poisoning from toxic chemicals, which can have cascading effects on marine ecosystems. Addressing the sources and impacts of microplastics is crucial for the health of our oceans and the species that inhabit them.

Microplastics can enter the environment through various means, including the breakdown of larger plastic items due to sunlight and other factors. These tiny plastic particles can indeed have harmful effects on ecosystems, plant life, andwildlife when they accumulate in the environment. It's crucial to address this issue to protect our planet's ecosystems and biodiversity

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Plastic pollution is indeed a complex issue, but individual actions can make a difference. By adopting habits like using reusable bags, reducing plastic bottle usage, and avoiding littering, we can collectively work towards reducing the impact of plastic pollution on our environment. It's essential for individuals, communities, and industries to take steps in the right direction to tackle this global problem.

Sources of Plastic in Oceans

The various ways plastic waste finds its way into our oceans. Some of the major sources include improper waste disposal, industrial runoff, and plastic debris from fishing and shipping activities. To combat this issue, it's crucial to raise awareness, implement proper waste management systems, and promote sustainable practices to reduce plastic pollution in our oceans.

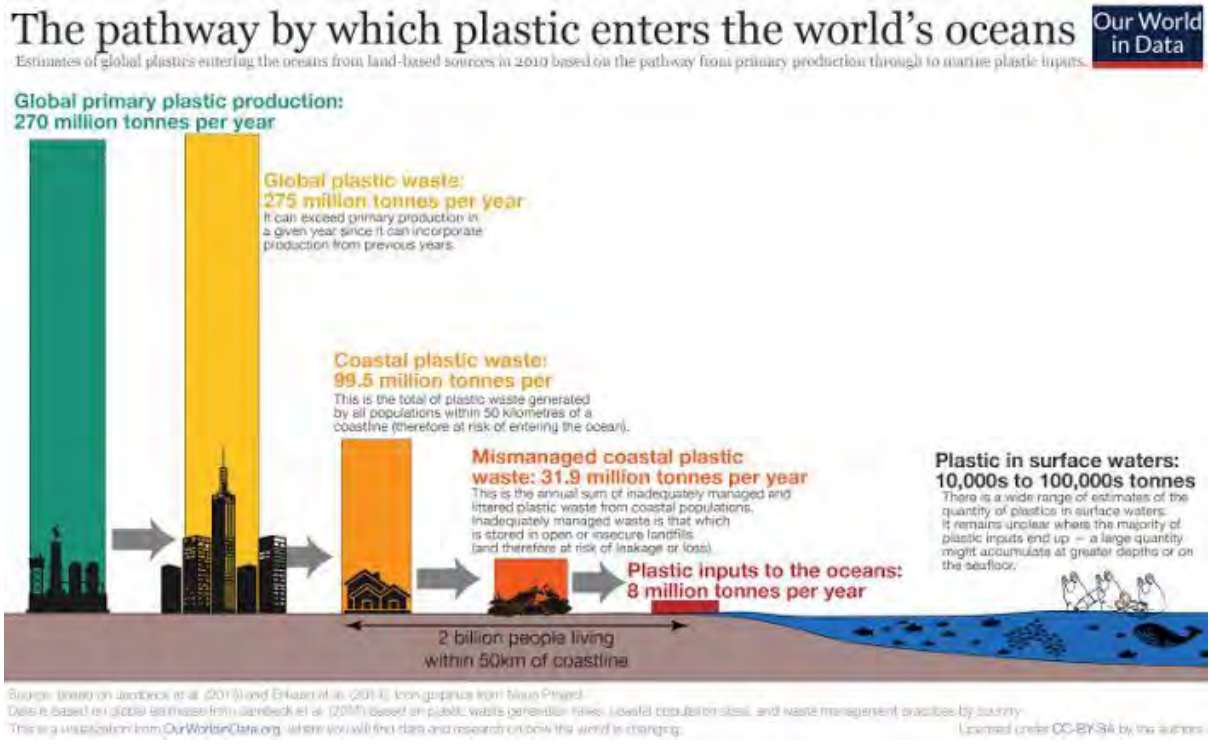

Fig 4 – Pathway by which plastic enter world ocean

Ghost nets and fishing gear: Ghost nets are abandoned, lost, or discarded fishing nets and gear that continue to float in the ocean and pose a serious threat to marine life and ecosystems. These nets can entangle and trap fish, marine mammals, seabirds, and other aquatic organisms, leading to injury or death. They damage also coral reefs and other habitats.

Addressing ghost nets and abandoned fishing gear is crucial for the health of our oceans and the preservation of marine ecosystems.

Land-based sources: Land-based sources of plastic waste are a major contributor to marine pollution. This includes plastic debris and microplastics that originate from various human activities on land, such as improper disposal of plastic waste, industrial processes, and even

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microplastics from personal care products like exfoliating scrubs. These pollutants can enter rivers, lakes, and eventually flow into the oceans, posing serious environmental and ecological threats. Efforts to reduce and properly manage plastic waste on land are crucial to mitigate this issue.

Marine transport: Marine transport can indeed contribute to pollution, especially through container spills and ships' waste. This pollution can lead to some areas having more ocean trash than fish, which poses significant environmental challenges. Efforts to reduce such pollution and promote sustainable shipping practices are essential to protect our oceans and marine ecosystems.

Changing Ecosystems:

How Plastic Pollution Alters the Marine Environment

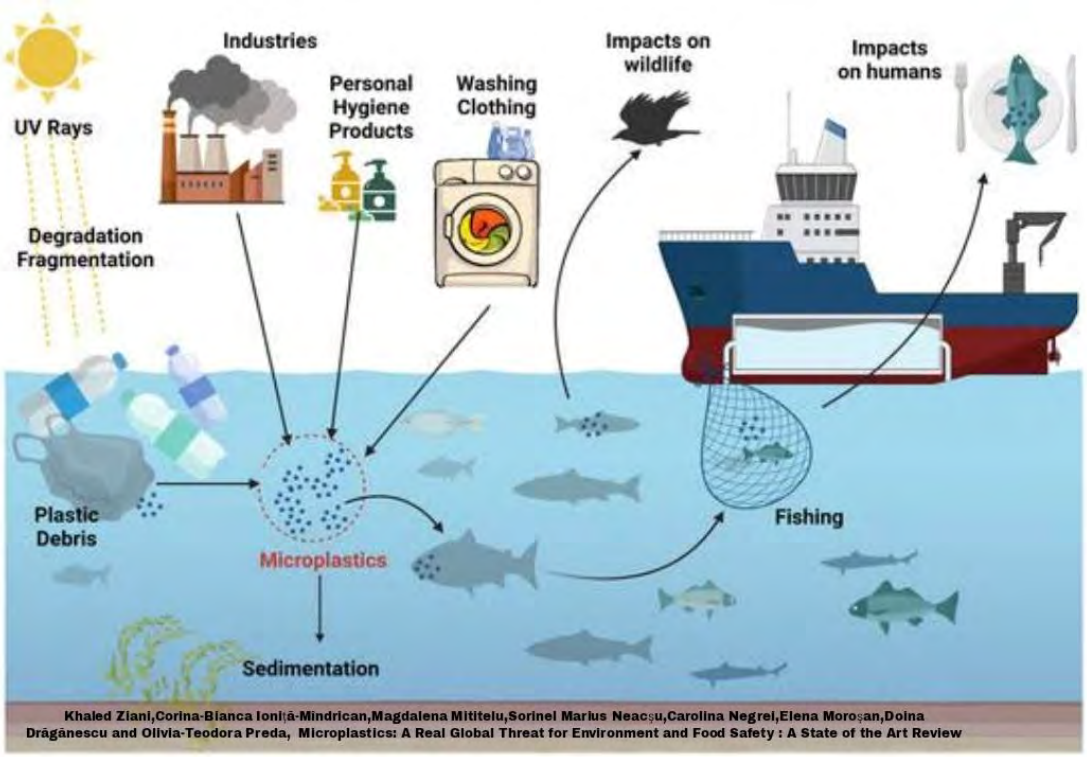

Fig 5 - Plastic Enter in marine ecosystems

Marine food chain: Plastic pollution in the ocean can be mistaken for food by marine organisms like phytoplankton, zooplankton, and fish. When these plastics are ingested, they can accumulate toxins and harm the health of these creatures. This can, in turn, affect the entire marine food chain and potentially impact human health when we consume contaminated seafood. It highlights the importance of addressing plastic pollution and its environmental consequences.

Beach inundation: Beach inundation by plastic debris is indeed a serious environmental issue. It not only affects the aesthetic beauty of beaches but also poses significant threats to wildlife, including sea turtles and horseshoe crabs. Plastic pollution can obstruct the path of turtle hatchlings

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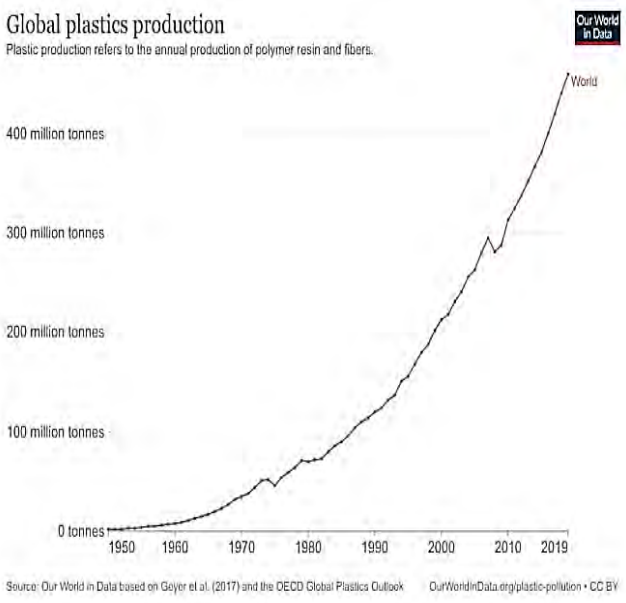
to the sea, reducing their chances of survival. Additionally, it disrupts the natural ecosystem and can have far-reaching consequences on marine life and coastal environments. Addressing plastic pollution is crucial for preserving these delicate ecosystems.

Microbial activity: Microbial activity in the ocean plays a vital role in breaking down organic matter and maintaining ecological balance. When plastic waste enters the ocean and leaches toxic chemicals, it can harm these microorganisms, disrupting their ability to perform their essential functions. This disruption can have cascading effects throughout the marine food chain and ecosystem, ultimately impacting the health of the oceans and the species that depend on them. Reducing plastic pollution is essential to mitigate these harmful effects on microbial life and marine ecosystems.



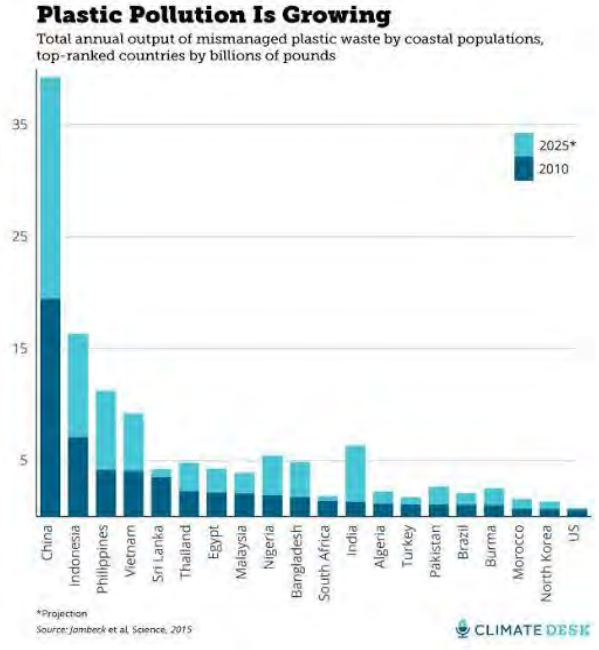


Fig.6 – Global plastic production **Fig 7 – Plastic pollution growing**

What We Can Do to Reduce Plastic Pollution in Oceans

Reducing sea plastic pollution requires a multi-faceted approach:

- Reduce Single-Use Plastics: Minimize the use of single-use plastics like plastic bags, straws, and bottles. Opt for reusable alternatives.
- Recycle Properly: Ensure proper disposal and recycling of plastics.
- Clean-Up Initiatives: Support or participate in beach clean-up events to remove existing plastic debris from coastal areas.

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- Prevent Littering: Educate and promote responsible waste disposal. Discourage littering and report illegal dumping.
- Plastic Alternatives: Advocate for and use alternatives to plastics, such as biodegradable or compostable materials.
- Support Legislation: Advocate for policies and regulations that reduce plastic production and encourage sustainable alternatives.
- Consumer Choices: Choose products with minimal plastic packaging and support businesses that prioritize sustainability.
- Raise Awareness: Educate yourself and others about the impact of plastic pollution on marine life and ecosystems.
- Innovation: Support research and innovation for new technologies to clean up plastics from oceans.
- Reduce Microplastics: Avoid personal care products with microbeads and support efforts to reduce microplastic pollution.
- Community Involvement: Get involved in local environmental groups and initiatives focused on plastic pollution.
- International Collaboration: Promote international cooperation to address the global issue of plastic pollution.
- Remember, reducing sea plastic pollution is a collective effort that involves individuals, communities, businesses, and governments working together to make a positive impact.

References

Khaled Ziani,Corina-Bianca Ioniță-Mîndrican,Magdalena Mititelu,Sorinel Marius Neacșu,Carolina Negrei,Elena Moroșan,Doina Drăgănescu and Olivia-Teodora Preda, Microplastics: A Real Global Threat for Environment and Food Safety : A State of the Art Review

Lusher, A.L.; Hollman, P.C.H.; Mendoza-Hill, J.J. (2017) Microplastics in fisheries and aquaculture: status of knowledge on their occurrence and Implications for aquatic organisms and food safety.FAO Fisheries and Aquaculture Technical Paper. No. 615. Rome, Italy.

Olivia lai[at]earth organization

Jemback at El science 2015, top rated country of total annual output of mis managed plastic waste bs coastal population.

Carmen moramen caselles al at 2021, plastic items dominant in oceans garbage to 10.

Hannah Ritchie and Max Roser (2018) Plastic Pollution *Our World in Data.*

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Popular Article

Animal Models for Wound Regeneration

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Abstract

Animal models provide a valuable tool for controlled environment to investigate the complex mechanisms involved in wound healing and evaluate potential therapeutic interventions. Mouse and pig models, among others, offer insights into the cellular and molecular processes of wound healing and allow for the testing of novel treatments. This article briefs about the dimensions of animal models for wound regeneration.

Wound healing is a complex process that involves a series of coordinated events to restore the integrity of damaged tissues. In order to better understand this process and develop effective therapies for wound regeneration, researchers often rely on animal models. Animal models provide a valuable tool for studying wound healing mechanisms, evaluating potential treatments, and predicting their efficacy in humans. In this article, we will explore the use of animal models in wound regeneration research.

Animal models play a crucial role in wound healing research due to their physiological and genetic similarities to humans. They allow researchers to investigate the various stages of wound healing, including inflammation, tissue formation, and remodeling, in a controlled environment. By studying wound healing in animals, researchers can gain insights into the underlying cellular and molecular mechanisms involved in the process (Masson-Meyers *et al.,* 2020).

Mouse model

Mice are widely used due to their genetic similarity to humans and the availability of various genetic tools for manipulation. Researchers can create wounds on the skin of mice and

study the healing process over time. This model allows for the evaluation of different wound healing parameters, such as wound closure rate, re-epithelialization, and collagen deposition. Additionally, the use of transgenic mice with specific genetic modifications enables researchers to investigate the role of specific genes or signaling pathways in wound healing.

Rat model

The rat model for wound regeneration is a widely used and valuable tool in scientific research. Rats, due to their genetic similarity to humans and ease of handling, provide an excellent platform for studying the wound healing process. Researchers can create standardized wounds on the skin of rats and monitor the healing process, allowing for the evaluation of wound closure rate, re-epithelialization, and the deposition of extracellular matrix components. Additionally, the larger size of rats enables the application of advanced wound healing techniques and the evaluation of potential therapeutic interventions, such as growth factors or stem cells.

Guinea pig

The guinea pig model for wound regeneration is a valuable and widely utilized tool in wound healing research. Guinea pigs share many physiological similarities with humans, making them an excellent model for studying wound healing processes. Researchers can create standardized wounds on the skin of guinea pigs and observe the healing progression over time. This model allows for the evaluation of wound closure rate, re-epithelialization, and the deposition of extracellular matrix components, such as collagen. Additionally, guinea pigs have a unique ability to develop hypertrophic scars, making them particularly useful for studying scar formation and potential therapeutic interventions. The guinea pig model also enables researchers to investigate the effects of various treatments, such as growth factors or novel wound dressings, on wound healing outcomes.

Rabbit

The rabbit model for wound regeneration is a widely employed and valuable tool in wound healing research. Rabbits share several physiological similarities with humans, making them an excellent model for studying the wound healing process. Researchers can create standardized wounds on the skin of rabbits and monitor the healing progression over time. This model allows for the evaluation of wound closure rate, re-epithelialization, and the deposition of extracellular matrix components, such as collagen. Additionally, rabbits have a relatively large size, which enables the application of advanced wound healing techniques and the evaluation of potential therapeutic interventions. The rabbit model also allows researchers to investigate the effects of various treatments, such as growth factors or tissue engineering approaches, on wound healing outcomes (Banu *et al.,* 2023).

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Pig model

Pigs have a similar skin structure and wound healing process to humans, making them an excellent model for studying wound healing in larger animals. The use of pigs allows researchers to evaluate wound healing outcomes, such as scar formation and tissue regeneration, in a more clinically relevant setting. Additionally, the larger size of pigs enables the application of advanced wound healing techniques, such as tissue engineering and regenerative medicine approaches, which may not be feasible in smaller animal models.

Types of wound healing models

Excisional Wound Mode: In this model, a defined area of skin is surgically removed, creating a wound. This model allows researchers to study the different phases of wound healing, including inflammation, granulation tissue formation, and re-epithelialization.

Incisional Wound Model: In this model, a controlled incision is made in the skin, simulating a surgical wound. This model is often used to study wound closure, tensile strength, and the effects of various interventions on wound healing (Banu *et al.,* 2023).

Ischemic Wound Model: This model involves the induction of ischemia, or reduced blood flow, to the wound area. Ischemic wounds mimic the conditions seen in chronic wounds, such as diabetic ulcers. Researchers can study the impact of impaired blood flow on wound healing and test potential therapies to improve healing in ischemic conditions.

Pressure Ulcer Model: Pressure ulcers, also known as bedsores, are a common type of chronic wound. Animal models can be used to simulate pressure ulcers by applying pressure to specific areas of the skin. This model allows researchers to investigate the underlying mechanisms of pressure ulcer formation and test interventions to prevent or treat these wounds.

Diabetic Wound Model: Diabetes can impair wound healing, leading to chronic wounds. Animal models with diabetes-like conditions, such as genetically modified mice or chemically induced diabetic animals, can be used to study the effects of diabetes on wound healing and test potential therapies for diabetic wounds.

Animal models also provide a platform for testing potential wound healing therapies. Researchers can administer various treatments, such as growth factors, stem cells, or biomaterials, to the wounds of animals and assess their effects on wound healing outcomes. These studies help identify promising therapeutic strategies and optimize their delivery methods before moving on to human clinical trials. Animal models also allow for the evaluation of potential adverse effects or complications associated with the treatments, ensuring their safety and efficacy (Grambow *et al.,*2021).

Despite their advantages, animal models also have limitations. The wound healing process in

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animals may differ from that in humans due to species-specific variations. Therefore, findings from animal studies should be interpreted with caution and validated in human clinical trials. Additionally, ethical considerations must be taken into account when using animal models, and efforts should be made to minimize animal suffering and use alternative methods whenever possible (Parnell and Volk, 2019)

In conclusion, animal models are invaluable tools for studying wound regeneration. However, it is important to acknowledge the limitations of animal models and ensure that findings are validated in human studies. By combining animal models with clinical research, we can advance our understanding of wound healing and develop effective strategies for promoting tissue regeneration in humans.

References

Banu, S. A., Pawde, A. M., Sharun, K., Kalaiselvan, E., Shivaramu, S., Mathesh, K., Chandra, V., Kumar, R., Maiti, S. K., Verma, M. R., Singh, K. P., & Amarpal (2023). Evaluation of bone marrow-derived mesenchymal stem cells with eggshell membrane for full-thickness wound healing in a rabbit model. Cell and tissue banking, 10.1007/s10561-023-10105-0. Advance online publication. https://doi.org/10.1007/s10561-023-10105-0

Grambow, E., Sorg, H., Sorg, C. G. G., & Strüder, D. (2021). Experimental Models to Study Skin Wound Healing with a Focus on Angiogenesis. Medical Sciences, 9(3), 55. MDPI AG. Retrieved from http://dx.doi.org/10.3390/medsci9030055

Masson-Meyers, D. S., Andrade, T. A. M., Caetano, G. F., Guimaraes, F. R., Leite, M. N., Leite, S. N., & Frade, M. A. C. (2020). Experimental models and methods for cutaneous wound healing assessment. International journal of experimental pathology, 101(1-2), 21–37. https://doi.org/10.1111/iep.12346

Parnell, L. K. S., & Volk, S. W. (2019). The Evolution of Animal Models in Wound Healing Research: 1993-2017. Advances in wound care, 8(12), 692–702. https://doi.org/10.1089/wound.2019.1098

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Popular Article

Delicious to Deadly Toxin: Uncovering a Global Culinary Crisis

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Abstract

India has vast species diversity and constitutes 10 % of the total fish species in the World. One of the most available species, pufferfish is poisonous to consume despite its nutritional advantage and delicacy worldwide. India is the third largest exporter of frozen pufferfish and China, Japan, and South Korea are the largest consumer for the same. However, these fishes are caught as by-catch due to a lack of domestic demand. Therefore, the development of organized supply and value chains in the domestic and export markets would help to utilize the available resources in India efficiently.

Introduction

India has a coastline of 8118 km with an Exclusive Economic Zone of 2.02 million km^2 (Vivekanandan,2022). It has diverse fishery resources with a record of 3200 native finfish species. Of these, 1555 are from marine, 931 are from freshwater, and 15 are from brackish water exclusively (NBFGR, 2023). India constitutes around 10 % of the total fish (33,059) species in the World. Of the total fish diversity from India, marine fishes constitute nearly 75 % whereas Andaman and Nicobar followed by the West Coast, shows the highest number of species (Gopi and Mishra, 2015). However, 70% of India's fish production comes from inland waters, and nearly 65% comes from aquaculture alone (NFDB, 2022). Nutritionally, Mohanty *et al. (*2016) found among the food fishes in India, shellfishes and marine fishes are good sources of sodium and potassium; small indigenous fishes provide calcium, iron, and manganese; cold-water fishes are selenium-rich food; and the brackish water fishes are an excellent source of phosphorous. However, one of the World's most delicious fish becomes deadly poisonous when it is not properly cooked which is none other than puffer fish/blowfish/globefish. It comes under the family

Tetraodontidae, comprises 200 species and is recognised as the second most poisonous vertebrate in the World after the "Golden Poison Frog" (Nath and Kundu, 2017).

Pufferfish trade and consumption

Puffer fishers are considered by-catch and non-commercial fish and are predominantly available in the Indo-West Pacific Ocean (Seetha *et al.*, 2023). It has the potential biomedical applications and is utilised for fish meal/poultry feed production, and the fleshy muscle is consumed as a delicacy food for human consumption (Kaleshkumar *et al.*, 2021).

According to the data source from TRIDGE (2023), during the year 2022, major buyers for frozen pufferfish globally were China, followed by South Korea, the United States and Japan. India was positioned third in exporting frozen puffer fish, with a share of 11 % after China (30 %) and the United States (13 %). Surprisingly, both import and export markets are dominated by the same countries such as China and the United States. However, the truth is China imported largely from India, Indonesia, Malaysia, Iran, Pakistan, Myanmar, New Zealand, Norway, and the United States and re-exported nearly 50 % of it to South Korea, Hong Kong, and the Philippines. Similarly, the United States imported largely from Brazil and re-exported completely to China, Japan, and South Korea. Japan has predominantly imported puffer fish from the United States and Russia. Thus, the ultimate and end consumers of pufferfish Worldwide are China, Japan, South Korea, Hong Kong, and the Philippines. India has exported about 147 million kg with a worth of 322 million USD to the World. The unit price of Indian puffer fish accounted for 2.2 USD/Kg.

Constraints in pufferfish utilisation

Although puffer fish is consumed as delicacy meat, it kills the consumer within 4 to 6 hours of consumption with its neurotoxin due to the presence of toxin-synthesizing bacteria viz., Pseudomonas and Actinomyces. It is 100 times more toxic than cyanide when it is consumed as a normal fish without detoxification. The liver, gonad, intestine, skin and occasionally the muscles of puffer fish have this toxin that leads to a 60% fatality in people who consume it (Seetha *et al.*, 2023). Thus, this meat is properly cooked by the trained Chefs and consumed in the name of fugu in Japan. Though many cases have been recorded globally, the first case of poisoning in humans due to pufferfish consumption was confirmed in India in 2020, and the victim was a 23-year-old man from Veraval, Gujarat, who had unknowingly eaten this poisonous species and was fortunate to be saved (Indian Express, 2021).

Women migrant labour in pufferfish processing

In India, pufferfishes are predominantly distributed on the South Indian coast, especially in Kerala, Southern Karnataka, and Tamil Nadu. According to the study by Swathi and Chaniyappa, 2013 migrant women labourers from Tamil Nadu were involved in puffer fish

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processing from October to December at Mangalore harbour where they removed the gut, ovary, and skin of the fish and earned Rs 250/day. The processed fish is segregated based on quality and transported to fish/poultry meal plants and export markets viz China and Malaysia due to the lack of domestic consumption demand. The price of puffer fish in the domestic market is less than Rs. 40/kg, whereas in the export market fetches nearly Rs.170 to Rs. 250 /kg.

Conclusion

Due to their low commercial value, pufferfish are primarily caught as by-catch in India. Additionally, these pufferfish bite other commercial fish and wreck fishing nets, and fishermen have trouble catching them alongside their main catch. However, the urge to catch these fish has recently intensified due to rising international demand and Indian cities like Mumbai. In order to effectively use the available resources to meet the Worldwide demand, the study indicated a need for proper supply and value chain mechanisms, particularly in the dry fish, fish meal, and export markets. Additionally, this would support the livelihood of migrant women labourers in the fish processing sector.

Reference

Gopi, K.C. and Mishra, S.S., 2015. Diversity of marine fish of India. In *Marine faunal diversity in India*. Academic Press. pp. 171-193.

Indian Express. 2021. https://indianexpress.com/article/cities/ahmedabad/cift-migrant-worker-from-bihar-first-confirmed-case-of-puffer-fish-poisoning-7470927/

Kaleshkumar, K., Rajaram, R., Vinothkumar, S. and Vinothkannan, A., 2021. Distribution of Marine Puffer and Porcupinefishes (Order: Tetraodontiformes) from Tamil Nadu Coast, Southern India. Proceedings of the National Academy of Sciences, India Section B: *Biological Sciences*, 91, pp.153-162

Mohanty, B.P., Sankar, T.V., Ganguly, S., Mahanty, A., Anandan, R., Chakraborty, K., Paul, B.N., Sarma, D., Dayal, J.S., Mathew, S. and Asha, K.K., 2016. Micronutrient composition of 35 food fishes from India and their significance in human nutrition. *Biological Trace Element Research,* 174, pp.448-458.

Nath, R.P. and Kundu, J.K., 2017. Seasonal Toxicological Profile of Three Puffer Fishes Collected Along Digha Coastal Belt, West Bengal, India. *International Journal of Current Research.* 9 (08). pp.55487-55491.

NBFGR, 2023. Aquatic Genetic Information System of India (AqGRISI), ICAR-National Bureau of Fish Genetic Resources. Lucknow. India.

NFDB, 2022. Introduction to fish and fisheries. National Fisheries Development Board, Hyderabad, India.

Seetha, P.K., Balachandran, R. and Zacharia, P.U., 2023. Pufferfish fishery along the Kerala coast and biology of the smooth-backed puffer, *Lagocephalus inermis* (Temminck & Schlegel 1850). *Journal of the Marine Biological Association of India*, 65(1), pp.97-101.

Swathi Lekshmi, P.S. and Chaniyappa, M., 2013. Migrant women labourers in Puffer fish processing. Marine Fisheries Information Service; Technical and Extension Series, (217), pp.8-9.

TRIDGE. 2023.https://www.tridge.com/intelligences/pufferfish/import

Vivekanandan, E (2022) Marine Fisheries in India: Outlook and Challenges ahead. In: ICAR-CMFRI -Winter School on Recent Development in Taxonomic Techniques of Marine Fishes for Conservation and Sustainable Fisheries Management. ICAR-Central Marine Fisheries Research Institute, Kochi, pp. 1-14.

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Popular Article

Health Management of Swine

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"Good hygiene keeps disease away."

Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (WHO). Maintaining good health and farm hygiene will not only help in gaining better body weight but also provide satisfactory return to the farmers and safeguarding health of the consumers. Providing clean and hygienic environment to the pigs housed must be the first and foremost priority of the owner of the farm. There should not be any water-logged areas near the farm. Floor hygiene specially floor cleaning and sanitization must be practiced twice daily. At the entry of the farm provision of foot bath is to be provided containing 2% potassium permanganate solution and every person entering the farm should dip their feet in that foot bath. Washing body of the animals with clean water at regular intervals reduces the incidences of infectious diseases and also provide comfort to the pigs.

Piglet anemia: piglet anemia is a condition of the piglets which occurs usually within 2-4weeks of birth, more common in suckling piglets, thereby making them prone to infectious diseases. Sow's milk is a poor source of iron thereby leading to low reserve of iron in piglets. Piglets usually reared under natural soil conditions are very much resistant to the condition as they take up iron from the soil. Vitamin K deficiency also causes this condition which leads to excessive naval bleeding. Treatment includes oral supplementation of iron, pasting of ferrous sulphate salt on the udder of the sow and Iron Dextran injection.

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Some of the most common diseases found in pigs are transmissible gastroenteritis virus (TGE) and Porcine epidemic diarrhea virus (PED) are porcine coronavirus. Both virus cause diarrhea in pigs with similar clinical symptoms. Disease severity is inversely related to the age of the animals. While TGE infections are currently under control, recent emergence of virulent PED virus strain results in significant mortality. No effective treatment is available.

Prevention measures include enhanced biosecurity and vaccination with the later, being the most effective approach. Commercial vaccines are available for both the viruses. (3)

Vaccines For TGE AND PED Viruses

Virus region/country	Vaccines in development	Commercial vaccines
1. Asia	Recombinant proteins expressed in Baculovirus, yeast, and plants; live attenuated vaccine	Inactivated vaccines (mono, bi-, and trivalent for TGE, PED), live attenuated trivalent for TGE and PED.
2. Asia	Recombinant vaccine expressed in Baculovirus, yeast plants, Lactobaccilus casei, Salmonella typhimurium and others.	Inactivated bivalent TGE and PED vaccine; Live attenuated trivalent TGE and PED vaccine.

Biosecurity Protocols to Be Followed

1. Replacement stock should be quarantined, and it should be ensured that their health status is compatible with the existing herd.
2. Entry to farm should be restricted only to essential personnel and their entry should be recorded.
3. Boots and coveralls should be provided for staff and visitors for each pig shed.
4. Staff should use dedicated boots and coveralls upon entering each different shed. Clean footbaths may be appropriate at the entry point.
5. Vaccination should be followed regularly.
6. Entry of equipment and other materials to the farm should be minimized and appropriate precautionary measures such as disinfection, removal from shipping boxes etc. should be strictly followed.
7. Entry of wild animals or pets to the farm should be prevented.
8. Semen should be used from a known source, which routinely tests against major infectious agents that can be transmitted through semen.
9. It should be ensured that feed and water sources are free from infectious agent.
10. Biosecurity plan and herd health program, including vaccination protocols should be reviewed on regular basis.

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Schedule For Vaccination in Pigs

Name of disease	Vaccine	Age of vaccination			Source of vaccination
		First	Booster	Subsequent	
Swine fever	F. D Lapinized Swine Fever vaccine	25-30 days	One month after	6-months interval	Institute of Veterinary Biologicals, Khanapara Guwahati.
Foot and mouth disease	Cell culture vaccine (Raksha-Ovac)	42 days	One month after	6-month interval	Produced by Indian Immunologicals & MSD Company.
Hemorrhagic septicemia	Raksha-H.S. Vaccine	2 months	One month after	Annually	Institute of Veterinary Biologicals, khanapara, Guwahati.

(4. Government of Assam Animal Husbandry & Veterinary Assam Livestock & Poultry Corporation)

General Herd Health Management

1. Employ veterinary services to help implement herd health programs.
2. Immediately report any unusual signs of illness to your veterinarian.
3. As recommended by veterinarian, vaccinate pigs against certain diseases.
4. The health of all pigs should be monitored daily.
5. All sick animals should be treated immediately.
6. It is inevitable that in every swine production system, animals will become ill or injured and euthanasia will be necessary. Euthanasia should be performed only when
   A) The animal has an inadequate or minimal prospect for improvement after two days of intensive care and treatment.
   B) The animal is severely injured, non-ambulatory, and unable to recover.
   C) Any animal that is immobilized with a body condition score of one on a scale of 1-5 (Karriker et al., 2006).

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Popular Article

Empowering women in livestock sector: Revolutionising livestock rearing

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https://doi.org/10.5281/zenodo.10051559

Abstract

Women's participation in the livestock sector is indispensable for agricultural and economic growth, food security, and rural development. Livestock farming is a cornerstone of many rural economies worldwide, and women play a pivotal role in this sector. Empowering women in livestock agriculture not only contributes to gender equality but also enhances the well-being of communities. These abstract highlights key strategies to promote women's empowerment in livestock, with a focus on education and training, resource access, technology adoption, financial inclusion, market access, networking, capacity building, advocacy, and healthcare. The role of women in providing nutritional sustenance through livestock products is also emphasized. To ensure the success of these initiatives, it is imperative to address gender-specific challenges and promote gender-sensitive policies. Ongoing research and data collection are essential to understanding the nuanced needs and roles of women in the livestock sector, while monitoring and evaluation mechanisms enable the continuous improvement of empowerment programs. Empowering women in livestock farming is a critical step toward achieving sustainable rural development and a more equitable society.

Key words: Women, cornerstone, rural development, education, empowering.

Introduction

The role of women in the livestock sector is pivotal not only for the prosperity of rural communities but also for global food security and economic development. Livestock farming stands as one of the cornerstones of agriculture, providing essential resources like meat, milk, and wool. Women, often serving as custodians of traditional farming practices, play a significant part in this sector, contributing to household incomes and nutrition. Empowering women in livestock agriculture is not just a matter of gender equality; it is an essential step toward achieving sustainable and inclusive rural development. Empowering women in the livestock sector is essential for economic development, food security, and gender equality. Livestock farming plays

a crucial role in many rural economies worldwide, and women often form a significant portion of the workforce in this sector. Empowering women in livestock can lead to increased agricultural productivity, income, and overall well-being for rural communities.

Ways to promote women's empowerment in the livestock sector

1. **Education and Training**: Providing women with access to education and training in livestock management and husbandry is crucial. This can include technical training on animal health, nutrition, and breeding.
2. **Access to Resources**: Ensure women have equal access to resources such as land, credit, and inputs like animal feed and veterinary services. Addressing gender-specific land rights issues is important.
3. **Technology Adoption**: Encourage women to adopt modern farming technologies and practices, which can improve productivity and reduce their workload. This includes promoting the use of mechanized equipment, better animal breeds, and efficient feeding methods.
4. **Financial Inclusion**: Facilitate access to financial services, including microloans and savings mechanisms, to empower women to invest in their livestock enterprises and manage their finances.
5. **Market Access**: Create opportunities for women to access markets and value chains. This can involve supporting women's participation in cooperatives and ensuring they receive fair prices for their livestock and livestock products.
6. **Networking and Support Groups**: Encourage the formation of women's self-help groups or cooperatives where they can share knowledge, resources, and support each other in livestock farming.
7. **Capacity Building**: Provide training in business management and entrepreneurship skills to help women develop successful livestock enterprises.
8. **Advocacy and Policy Support**: Advocate for gender-sensitive policies and programs at the government level to promote women's rights and empowerment in the livestock sector.
9. **Health and Nutrition**: Ensure that women are aware of the nutritional benefits of livestock products and support their efforts to provide their families with healthy and balanced diets.
10. **Childcare and Time Management**: Recognize the multiple roles women often play as caregivers, and provide support in the form of childcare services and time-saving technologies to help them balance their responsibilities effectively.

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11. **Research and Data Collection**: Collect data and conduct research on the role of women in the livestock sector and the specific challenges they face. This can inform targeted interventions and policies.
12. **Monitoring and Evaluation**: Implement systems to monitor and evaluate the impact of programs and policies aimed at women's empowerment in the livestock sector, and make necessary adjustments as needed.

Conclusion

Empowering women in the livestock sector is not merely an aspiration for gender equality; it is a necessity for rural development, food security, and sustainable agriculture. Women's contributions to livestock farming go beyond economic measures; they are intricately tied to the very fabric of rural life, culture, and sustainability. Nonetheless, challenges persist, and women in the livestock sector often face limited access to resources, technology, and markets. Societal norms and biases can further compound these challenges. Recognizing and addressing these hurdles is not only a matter of justice but a strategic imperative for agricultural progress. As we look to the future, it is crucial that research, data collection, and monitoring and evaluation mechanisms remain integral to our efforts. By understanding the nuanced needs and roles of women in the livestock industry, we can tailor interventions and policies that are effective and sustainable.

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Popular Article

Why cats decline sweet dish but incline to grab fish? Is it due to killer instinct or inherent gene distinct

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Domestication of cat, wild to mild

The domestic cat is one of the most popular companion animals of human being. As per archaeological evidence, the domestication of the cat took place nearly 10000 years in ago in the Near East region on this earth (Vigne *et al*., 2004). Domestic cat and Near Eastern wildcat are about the same size and shape with too much phenotypic resemblance. House cats exhibit enough similarity to their wild felid ancestors (Felis silvestris subspp), yet Felis silvestris is aggressive and feral, whereas the house cat, is quite tamed as pet animal. From biological perspective domestic dog (Canis lupus) and house cats are classified under the Order Carnivora. In classical sense the modern cat is not fully domesticated rather considered as a semidomesticated species. We have observed cats are keen towards fish; it is not just a killer instinct of this feline. Whether it is in their gene or their intense wish to prefer fish meal is still perplexing. Scientific evidence suggest ancestors of domestic cat were desert dwellers, therefore to expect fish on their dish is unimaginable. Humans' intervention does not influence their food habit and mating choice (Driscoll *et al*., 2009). Species like carnivores, or herbivores have selective choice for their food. Mammalian tongues are studded with several copies of taste receptors that act as sensor to receive the signals from food elements consequently the signal is transmitted to brain either to accept it as appetizing or to refute those as nonpalatable. Critical difference in the amino acid sequence of their taste receptor decides the preference of binding with certain chemical substances like amino acids and nucleotide available in their food (Toda *et al*., 2021). Obviously, question arise how and why cat has been domesticated: most of the domestic species like cattle, sheep, goat and pig, horse

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donkeys were domesticated either for food or transport but cat never comes in this category. Archaeological evidence and anthropological clues suggest once ancient nomadic human ceased hunting practice and preferred to settle with farming for growing grains as their food, association of cat with humans was the beginning as a commensal, feeding on the rodent pests that infested their grain stores (Clutton-Brock 1999). At present situation traditional role of cat as a rodent controller is not in practice. Domestic cats' descendants were transported across the world by human assistance. According to Cat Fanciers' Association total 41 breeds has been recognized as natural breeds (Wastlhuber 1991). All the available breeds of domestic animals on the earth are generated by selective breeding with a purpose for food, hunting, or security whereas cat breeds are due to selective breeding for aesthetic reason. Now scientists are involved in tracing the genetic changes that drove this remarkable transformation in their behaviour.

Not to eat sweet

A recent study of genomic analysis reveals that dogs and humans walked similar evolutionary paths however domestication shaped the diet of the dog therefore dog has evolved to eat more varied diet than their wolf ancestors. Genome sequencing data derived from 22 domestic cats from different location when compared with two Near Eastern and two Near European wild cats revealed alteration of 13 gene made the cat from feral to friendly. Surprisingly 30 copies of gene for amylase an enzyme that can break down starch has been detected in the intestine of dog and only two in wolves (Axelsson *et al*., 2013). Cats are obligately carnivorous and only mammalian species unable to synthesize arachidonic acid, due to lack of Delta-6-desaturase (D6D) activity in their intestine, however it can use an alternate yet unknow pathway to synthesize these essential fatty acids to support normal health and reproduction (Bauer 2006). Despite long association of dog and cat with human population there is marked contrast towards the avidity for sweet taste. Mammalian sweet-taste receptor is formed by the dimerization of two proteins. Tas1r receptors that can sense the sweet and umami taste in human and other mammalian species comprises of three members of receptor proteins, those are Tas1r1, Tas1r2 and Tas1r3. To be functional these protein receptors act in a heterodimeric combination; for umami taste Tas1r1 and Tas1r3 act as heterodimer whereas mammalian sweet receptor is a heterodimeric combination of Tas1r2 and Tas1r3 (Li *et al*., 2002). Respective genes for these proteins are written in italic *Tas1r2* and *Tas1r3*. Most recently during August 2023 scientific group from Monell Chemical Senses Center, Philadelphia along with Waltham Centre for Pet Nutrition, UK has reported that taste receptors of cat can detect umami; the savoury or meaty taste, but reluctant and refractile towards sweet because felines have very low levels of the enzymes that break down sugars (McGrane *et al.,* 2023). Unlike dog which prefer natural sugars e.g., sucrose, glucose, fructose, and lactose, but

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not maltose, domestic cats (Felis silvestris catus) although having functional sense of taste, they are uninterested toward, sweet sugars and sweeteners (Ferrell 1984). Contrast to this behaviour, cats exhibit normal taste modalities for other compounds as well as preference for selected amino acids (White and Boudreau 1975). Scientists are still blind to find the exact reason of sweet blindness however amino acids substitution in taste receptors in cat may be the possible reason. Possibility of deletion of gene coding for sweet receptor can't be ruled out as sweet ''*taster*'' and ''*nontaster*'' strains of mice has been reported earlier (Max *et al*., 2001). To explore the reason behind deficit character, researchers have claimed to blame few genes which they have not seen in felines. In 2005 scientific groups from Monell Chemical Senses Center in Philadelphia, Pennsylvania headed by biophysicist Joseph Brand, while initiated screening the DNA sequences of the two known genes *Tas1r2 and Tas1r3* encode for the sweet receptor heteromeric protein Tas1r2 and Tas1r3 (also written as T1R2/T1R3) in dogs, humans, mice, and rats, surprisingly a stretch of 240 base pair of nucleotides in *Tas1r2* gene was found to be missing only in feline but not in any other species. Simply due to missing nucleotide in *Tas1r2* gene the functional sweet receptor in taste papillae of cat is not expressed. Nucleotide depleted gene (a pseudogene) of feline does not code for a functional receptor protein thereby prevents cats from tasting sweets. Practically cat family never regain the sweet receptor gene in its life time due to permanent deletion of a chunk of nucleotide in sweet receptor gene (Li *et al.,* 2005). Sweet receptor is also not expressed in tiger and cheetah due to nucleotide deletion in *Tas1r2* gene in these species. It is undefined why and when such deletion has occurred during evolution process in animal species. Possible explanation is that the cats being strict carnivorous they never get a chance to encounter sweet diet, whereas the presence of proteins and amino acids enriched food in their prey has made their sensory taste buds to be exposed more frequently to meaty diet in their life (Lei *et al.,* 2015). As compare to human, cats have less bitter taste receptors, similarly lack of sodium appetite has been observed and null effect was recorded with sodium-repleted or depleted diet in cat (Lei *et al*., 2015). Screening the gene pool of cat, it has been established that certain genes are responsible for umami taste perception with an obligate craving for meat. Once given a choice cat are too selective for high protein and high fat with umami taste but not carbohydrate in their diet (Salaun *et al*., 2017). Taste of foods are perceived under five categories those are *sweet, sour, bitter, salty and umami,* each of these is recognised by specific receptor. Additionally, few other "secondary" tastes such as fat taste, metallic taste, astringency and kokumi are also recognised by sensory taste receptors (Laffitte *et al*., 2021). In 1908 Professor Kikunae Ikeda from Imperial University of Tokyo described the term umami a delicious savoury taste derived from glutamic acid. The time line of discovery of umami taste receptors goes back to 1856 (Fig-1). Primarily glutamic acids and

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its salt, nucleotide such as inosine-5'-monophosphate (IMP), and guanylo-5'- monophosphate (GMP) is found to be of umami taste (Stańska and Krzeski 2016). The taste buds of cats have several copies of umami receptors; the umami receptor respond to nearly 11 amino acids in combination with nucleotide.

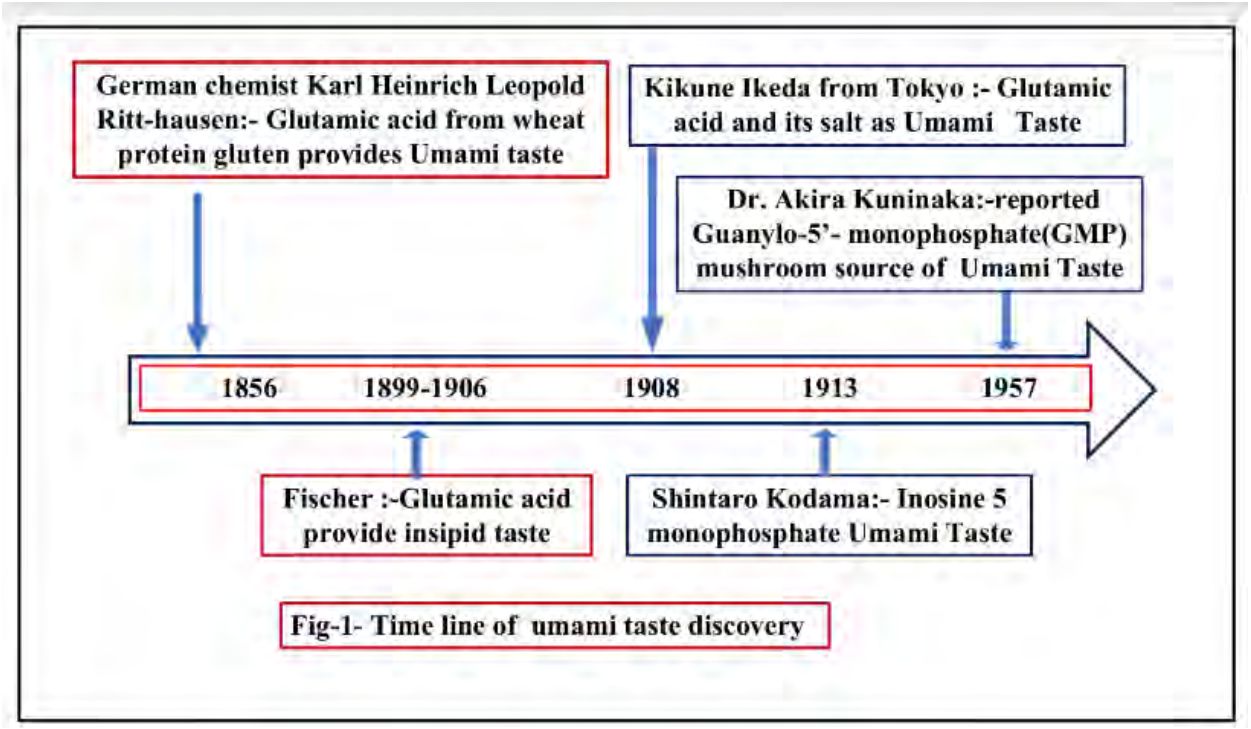

Fig-1- Time line of umami taste discovery

Keen for fish: gene or wish.

Cat shows intense affinity for fish and specifically tuna is the best choice in their dish. Among salt water fish Tuna is grouped under family Thunnini, genus *Thunnus* comprised of fifteen species. These are the only partially warm-blooded fish on earth. Any isolated or individual amino acids alone never exhibit preferential binding with umami receptor of cat, however, L-amino acids in combination with a nucleotide act as enhancers. Within nucleotides purine nucleotide is superior in binding with umami receptor of cats. It is now clear enough that L-Glutamic acid and L-Aspartic acid having umami taste not act as inducer (agonist) for the umami receptor in cat as there is subtle change of amino acids at 170-302 position the key binding site for ligand (McGrane *et al*., 2023). Response variability of umami receptor of mammalian species is not uncommon; sharp response towards glutamic acid and feeble response for aspartic acid is normally observed in human (Li *et al.,* 2002), whereas acidic amino acids have shown blunt response towards mice, contrary to it mice respond well to numerous other amino acids (Nelson *et al*., 2002). Recently during 2021 functional expression study has confirmed that purine nucleotide inosine 5'-monophosphate (IMP) and guanosine 5'-monophosphate (GMP) can

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strongly induce umami receptor of cat but L glutamic acid has shown inertia (Toda *et al*., 2021). Interestingly the functionality of umami taste receptor in man and cat although exhibit similarity but there is a whirling: in human the amino acid activates the receptor and nucleotide escalate the activity but in cat it is just opposite. Further investigation has pointed out the preference of cat towards food rich in histidine amino acids and inosine monophosphate nucleotide (IMP); the tuna is one such fish having plenty of these two, is an appetiser for cat. Using synthetic peptide approach to create artificial taste receptor of cat, the degree of binding affinity of taste receptors towards amino acids and nucleotide revealed the high intensity of binding by four amino acids (L-Alanine, L-Arginine, L-Histidine, and L-Isoleucine, (Fig-2) but cysteine failed to bind. Role of nucleotide inosine 5′-monophosphate (IMP) as a potentiator of L-amino acid binding has been confirmed. While screening individual nucleotides the purine nucleotides were found to be agonist for binding with taste receptor but pyrimidine nucleotides (CMP and UMP) were dull in this aspect. Among amino acids L-histidine acts as an enhancer of the cat umami receptor in combination with IMP (McGrane *et al*., 2023).

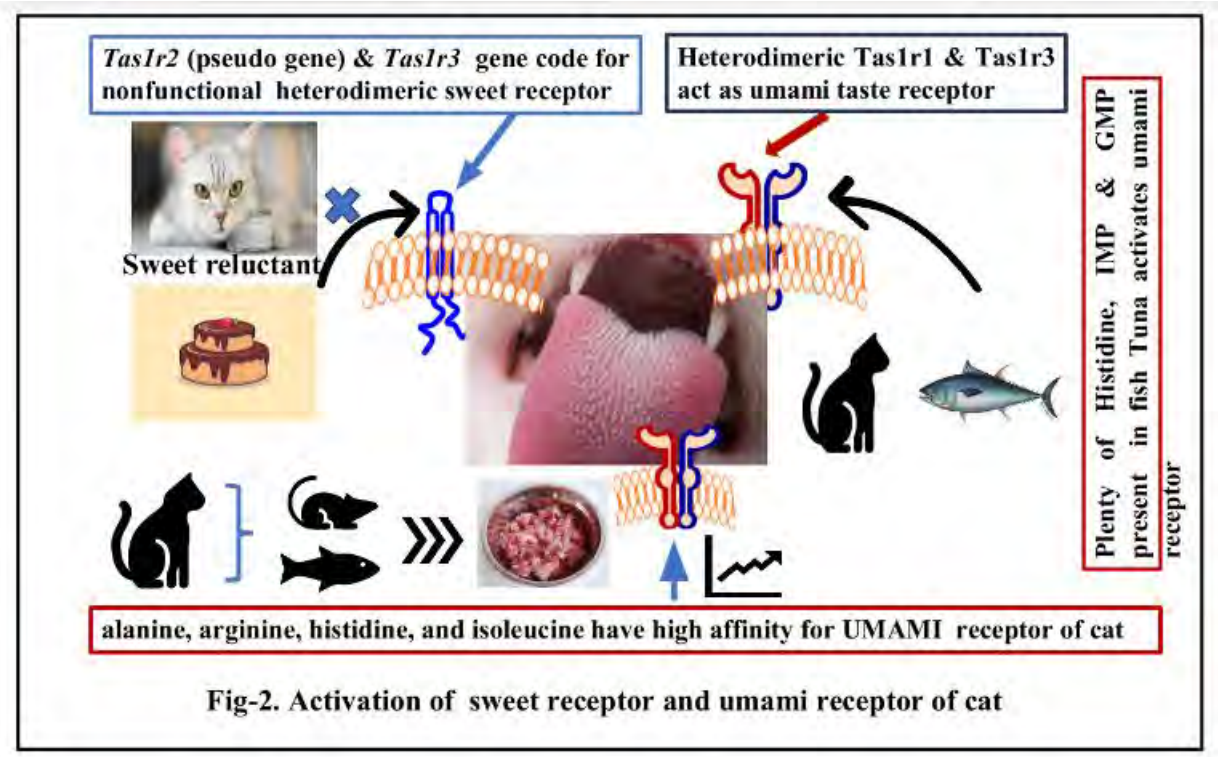

Fig-2. Activation of sweet receptor and umami receptor of cat

Conclusion

Now question arise is there any significant output from this finding? To summarize the research reports, it has shown insight of sensory world of cat for its taste receptors. To be realistic the findings will narrow down the preference of cat for selective diets having protein and fat contents rather than carbohydrate in pet food. Even though we know cats are unable to adjust sugar yet several ready to use marketable cat food contain rice or other grains as source of

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carbohydrate to an extent of 20% in their composition, that may be the reason of more diabetes in domestic cats. The present information can be used by pet food manufacturer for scientific formulation of palatable diets for cats. Similarly, adding umami taste in oral medicine for feline can be easily administered without much brawl. It is an added advantages for veterinarian to manage the feline species in captivity.

References

Axelsson E, Ratnakumar A, Arendt M L, Maqbool K, Webster M T, Perloski M *et al*., (2013). The genomic signature of dog domestication reveals adaptation to a starch-rich diet. *Nature.* 495(7441): 360–364.

Bauer J E (2006), Metabolic basis for the essential nature of fatty acids and the unique dietary fatty acid requirements of cats. *J Am Vet Med Assoc*. 229(11) 1729–1732.

Clutton-Brock J. A (1999) Natural History of Domesticated Mammals. 2nd ed. Cambridge University Press, Cambridge. 238 pp. ISBN 0-521-63495-4

Driscoll C A, Macdonald D W, O'Brien, S J (2009). "From wild animals to domestic pets, an evolutionary view of domestication. *Proc Natl Acad Sci USA*" 106 Suppl.1(Suppl.1): 9971-8. doi: 10.1073/pnas.0901586106

Ferrell F. (1984) "Preference for sugars and nonnutritive sweeteners in young beagles." *Neurosci Biobehav Rev.* 8(2): 199-203. doi:10.1016/0149-7634(84)90041-1

Laffitte A, Gibbs M, Hernangomez de Alvaro C. et al. (2021). Kokumi taste perception is functional in a model carnivore, the domestic cat (Felis catus). *Sci Rep* (11): 10527. doi:10.1038/s41598-021-89558-w

Lei W, Ravoninjohary A, Li X, Margolskee R F., Reed, D.R., Beauchamp, G.K., and Jiang, P.(2015). Functional analyses of bitter taste receptors in domestic cats (Felis catus). *PLoS One*. 10: 10 e0139670. doi: 10.1371/journal.pone.0139670

Li X, Li W, Wang H, Cao J, Maehashi K, Huang L, Bachmanov A A, Reed D R, Legrand-Defretin V, Beauchamp G K, Brand J G (2005)."Pseudogenization of a sweet-receptor gene accounts for cats' indifference toward sugar." *PLoS genetics* 1(1):27-35. doi: 10.1371/journal.pgen.0010003.

Li X, Staszewski L, Xu H, Durick K, Zoller M, Adler E (2002). Human receptors for sweet and umami taste. *Proc Natl Acad Sci* USA. 99(7):4692–4696. doi: 10.1073/pnas.072090199.

Max M, Shanker YG, Huang L, Rong M, Liu Z, et al. (2001) Tas1r3, encoding a new candidate taste receptor, is allelic to the sweet responsiveness locus Sac. *Nat Genet* 28(1): 58–63. doi: 10.1038/ng0501-58.

McGrane S J, Gibbs M, de Alvaro C H, Dunlop N, Winnig M, Klebansky B, Waller D (2023). Umami taste perception and preferences of the domestic cat (Felis catus), an obligate carnivore, *Chemical. Senses*, 48,1-17. doi: 10.1093/chemse/bjad026

Nelson G, Chandrashekar J, Hoon MA, Feng L, Zhao G, Ryba NJP, Zuker CS (2002). An amino-acid taste receptor. *Nature*. 416(6877):199-202. doi: 10.1038/nature726.

Salaun F, Blanchard G, Le Paih L, Roberti F, Niceron C (2017). Impact of macronutrient composition and palatability in wet diets on food selection in cats. *J Anim Physiol Anim Nutr* (Berl). 101(2):320-328. doi: 10.1111/jpn.12542.

Stańska K, and Krzeski A. (2016) "The umami taste: from discovery to clinical use." Otolaryngol Pol. The Polish otolaryngology 70(4): F0-5. doi:10.5604/00306657.1199991

Toda Y, Hayakawa T, Itoigawa A, Kurihara Y, Nakagita T, Hayashi M, Ashino R, Melin AD, Ishimaru Y, Kawamura S, et al(2021). Evolution of the primate glutamate taste sensor from a nucleotide sensor. *Curr Biol*. 31(20):4675-4676. doi: 10.1016/j.cub.2021.09.079

Vigne J D, Guilaine J, Debue K , Haye L , Gerard P (2004). Early taming of the cat in Cyprus.

Science, 304(5668):259. doi: 10.1126/science.1095335

Wastlhuber J (1991). In: History of domestic cats and cat breeds. Pedersen NC, editor. Feline Husbandry, *American Veterinary Publications*, Inc.; Goleta, CA, USA:. pp. 1–59

White TD, Boudreau JC (1975) Taste preferences of the cat for neurophysiologically active compounds. *Physiological Psychology.* 3(4): 405–410

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Popular Article

Ecological and environmental benefits of Dhaincha for sustainable Agriculture

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The dhaincha is a green manure crops; which improves soil productivity as well as supplies nutrients too for economic agricultural crops. This mainly includes legumes that can fix nitrogen by rhizobia. This is a major crop for green manuring in India.

The role of Dhaincha during green manuring: -

- Dhaincha releases Carbonic acid release during the rotting; which decomposes the soil minerals and do available for plants.
- During the decomposition several organic acids formed; which enhance the availability of certain plant nutrients like phosphorus, calcium, potassium, magnesium and iron.
- It improves the soil structure, moisture holding capacity and infiltration of water, thus decreasing the runoff and erosion.
- Fix atmospheric nitrogen to the soil that becomes available to the succeeding crop.
- Dhaincha also improve soil permeability and soil pH of acidic soil after 4-5 season cultivation.
- Dhaincha fix Nitrogen @ 134 Kg/ha through their nodules in root. In this way soil fertility level increases without adding any chemical fertilizer which is a great role of dhaincha for environmental concern.

The increasing level of greenhouse gases in the atmosphere is the serious causes of global warming, among which the contribution rates of CO_2, N_2O, and CH_4 to the greenhouse effect are 76.7%, 7.9%, and 14.3%, respectively. The Paddy soil is the main source of greenhouse gas emissions, accounting for approximately 10–12% of the total global

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agricultural emissions sources. The dhaincha improves the soil carbon upto the content of 20-30 % of its total value.




The dhaincha planting has many advantages in rice tillage. Its planting as green manure in paddy fields can reduce soil erosion and improvesoil properties, such as soil bulk density, water conductivity, soil porosity, water-holding capacity, enzyme activity, water-stable aggregates, and pH. Different fertilizer application methods and different tillage practices have different effects on soil nutrient availability and mixed fertilizer application methods and no-till rotations are more likely to improve agro-ecosystem. It also has a significant effect on the emissions of the three main greenhouse gases. The application of dhaincha in combination with fertilizer in the form of mulch to the field reduces CO_2 emissions, whereas the C/N ratio of green manure had a significant effect on CH_4 and N_2O emissions, with a low C/N ratio reducing CH_4 emissions but increasing N_2O emissions, and reducing N_2O emissions from paddy fields during flooding. The planting of dhaincha reduces herbicide residues and suppresses weeds in paddy fields and enriches and transfers specific heavy metals, such as Cd, Pb, and Zn, thereby remediating the soil. During the growth of dhaincha crop, the improvement in soil properties and nutrient supply varies with the growth stage.

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In reference to these findings, The Krishi Vigyan Kendra, Tirap conducted the Front-Line Demonstrations during 2016- 2022 at farmers field to popularize the Dhaincha cultivation and its benefits at farmers' field.

The Krishi Vigyan Kendra- Tirap demonstrated the technology of green manuring (Dhaincha) at farmer's field. The seeds of dhaincha @ 60 Kg/ha were free distributed among farmers and sown by them accordingly. The dhaincha crops were incorporated in field after 40 days. During first year (2016) total five demonstration were demonstrated at farmers field in an area of 1.40 ha. The increase in paddy was reported 30.76 %. Similarly, 26.67 %, 37.02 %, 28.06 %, 32.26 %, and 22.47 % respectively were reported from 2017 to 2022. The average impact of paddy yield through Dhaincha was 26.09 %; which is very impressive, eco-friendly and sustainable for future point of view.

Table :1 Demonstration details

S.N.	Year	Nos of demonstration of Dhaincha at farmers field	Area of Demonstrations **(ha)**	Average Paddy yield **(Q/ha)**		Increase in Paddy yield at farmers field **(%)**
				Without Dhaincha	With dhaincha	
1.	2016	05	01.40	18.56	24.27	30.76
2.	2017	08	02.60	19.90	25.21	26.67
3.	2018	14	05.80	18.37	25.86	37.02
4.	2019	19	08.50	20.45	26.19	28.06
5.	2020	27	12.40	21.99	28.34	28.77
6.	2021	32	16.80	17.60	24.62	32.26
7.	2022	38	19.44	23.54	28.83	22.47
			66.94 ha	**20.84 ha**	**26.19 ha**	**26.09 %**

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Popular Article

Growing Beyond Ground: Unravelling the potential of Dutch Bucket Hydroponics

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Abstract

Protected cultivation, such as greenhouse farming, has emerged as a critical tool in addressing the global demand for fresh produce while prioritizing sustainability. It provides a controlled environment that shield crops from external factors like harsh weather, pests and diseases, resulting in improved crop quality, increased yields and reduced resource consumption. Soilless growing techniques, like Dutch Bucket technology, have played a transformative role in this paradigm shift. Dutch Bucket hydroponics, originating in the Netherlands during the 1960s, offers a space-efficient and highly efficient method for cultivating high-value crops, particularly indeterminate vine crops such as tomatoes, cucumbers and peppers. This system utilizes individual containers filled with inert growing mediums like clay balls, ensuring stability and aeration. Drip irrigation delivers precise amounts of water and nutrient solutions directly to plant roots, with excess solutions being re-circulated to minimize waste. Regular monitoring of nutrient solutions, pH and electrical conductivity helps maintain optimal plant growth. The article underscores the significance of water quality, sanitation, and temperature control within the Dutch Bucket system, along with the need for proper training for operators and growers. Dutch Bucket hydroponics represents a promising solution in addressing the world's agricultural challenges and advancing sustainable food production.

Key words: Protected cultivation, Soilless growing, Dutch bucket, Hydroponics

Introduction

Protected cultivation technology, commonly known as greenhouse farming, has heralded a remarkable shift in modern agriculture. In an era where the sustainability of food production is of paramount concern, protected cultivation techniques have emerged as a crucial component in meeting the world's growing demand for fresh produce. This method facilitates optimal growth conditions, leading to improved crop quality, higher yields, and reduced resource consumption.

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One pivotal facet of protected cultivation is the integration of soilless growing techniques. Traditional soil-based farming, while time-tested, has its limitations, including susceptibility to soil-borne diseases and the inability to fully control nutrient delivery. Soilless growing techniques, like hydroponics and aeroponics, overcome these challenges by cultivating plants without soil, instead, relying on nutrient-rich water solutions to provide essential elements for plant growth. In contrast to field farming, protected soilless cultivation can achieve yields that are 2 to 5 times greater, consume 10 times less water, allow for year-round harvesting, result in improved flavour, and offer enhanced nutritional value **(Asaduzzaman et al., 2015; Chu and Brown, 2021).**

Among these innovative soilless growing techniques, Dutch Bucket technology has emerged as a highly efficient and space-saving method. The Dutch Bucket system consists of a series of individual containers, usually square or rectangular. It operates as a hydroponic system, utilizing containers typically loaded with perlite as the growing medium **(Yang et al., 2023).** These buckets are connected in a recirculating system, ensuring that no water or nutrients go to waste. An advantage of this system is its ability to maintain optimal root humidity since the roots are consistently submerged in the water contained within the bucket **(Helmy et al., 2023).**

Genesis of Dutch bucket

The genesis of Dutch Bucket technology is a testament to human ingenuity and the on-going quest to improve crop cultivation methods. The origin of the Dutch Bucket system can be traced back to the 20th century when the Netherlands, sought innovative ways to maximize crop production in limited space. Dutch farmers faced the challenge of cultivating high-value crops in a region with unpredictable weather and limited arable land. This droves them to experiment with various hydroponic and soilless growing techniques. The Dutch Bucket system itself was developed in the 1960s and gained widespread adoption in the Netherlands during the following decades.

Technical Design and Operation:

Dutch Buckets

The core of the Dutch Bucket system consists of individual containers or buckets made from materials like plastic or PVC (food grade). These buckets are typically square or rectangular in shape as show in **Fig.1.**

Fig 1. Bucket

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Growing medium: The growing medium supports the plant and provides stability and aeration. Common materials are clay balls, rockwool, perlite, coconut coir, or a mixture of both. It leads to the increased water retention and organic content of media. Numerous research studies have demonstrated that high-wire crops exhibit superior yields in peat and coir compared to perlite **(Ayipio et al., 2021).** Clay balls as media is shown in **Fig. 2.**

Fig 2. Growing media

Drip Irrigation: Each Dutch Bucket is equipped with a drip irrigation system as shown in **Fig. 3.** This system supplies a carefully measured amount of water and nutrient solution directly to the plant's root zone. Excess nutrient solution and runoff are collected and re-circulated, minimizing water and nutrient waste.

Fig 3. Micro tube

Nutrient Reservoir: The nutrient solution, typically including essential macro- and micro-nutrients, is prepared in a separate reservoir. The pH and electrical conductivity (EC) of the solution are regularly monitored and adjusted to ensure optimal nutrient uptake by the plants. A typical reservoir is shown in **Fig. 4.**

Fig 4. Reservoir

Common Nutrient Recipes: Several nutrient recipes are commonly used worldwide in Dutch Bucket systems. These recipes are adjusted based on the specific needs of the crop being grown and the stage of growth. Common nutrient components include Nitrogen (N), Phosphorus (P), Potassium (K), Calcium (Ca), Magnesium (Mg) and trace Elements like Iron (Fe), manganese (Mn), copper (Cu), zinc (Zn), boron (B), and molybdenum (Mo).

Crops suitable: The Dutch Bucket technology is well-suited for a range of high-value crops, particularly indeterminate vine crops like tomatoes, cucumbers, and peppers. Cucumber crop grown in such system is shown in the **Fig. 5.**

Fig 5. Cucumber grown in Dutch bucket system

Precautions:

1. **Monitor Nutrient Levels:** Regularly test and adjust the nutrient solution's pH and EC to maintain optimal nutrient uptake by the plants. The commonly used

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EC range is 0.8 to 1.5 dS/m and pH range of 5.5 to 6.5. The decrease in EC value indicates the uptake of nutrients by plants. The optimum range of pH value ensue better nutrient uptake.

2. **Water Quality:** Use good quality water to prepare the nutrient solution. Toxicity of water should be evaluated by measuring elements like Na and solution should be replaced if the value crosses 50 ppm. Contaminated water can lead to nutrient imbalances.
3. **Sanitation:** Maintain cleanliness within the system to prevent the growth of algae, fungi, and harmful microorganisms. Chemigation with chemicals like H_2O_2 (100 ppm) after each growing cycle is recommended.
4. **Temperature Control:** Ensure that the root zone temperature is within the optimal range for the specific crop. Root zone heating or cooling may be necessary.
5. **Plant Health Monitoring:** Keep a close eye on plant health and look for signs of nutrient deficiencies, pests, or diseases. Address any issues promptly.
6. **Reservoir Management:** Regularly clean and sanitize the nutrient reservoir to prevent the build-up of salts and contaminants.
7. **Proper Training:** Ensure that operators and growers are adequately trained in the operation of Dutch Bucket systems and hydroponic crop management.

Conclusion

Dutch Bucket technology is a key component of protected cultivation, offering efficient soilless cultivation of high value crops. It employs individual containers filled with materials like clay balls, providing stability and aeration. Drip irrigation delivers water and nutrients to plant roots, with excess solution being re-circulated. This technology offers opportunities for customization of nutrient recipes, along with monitoring of pH and EC levels. Maintenance, water quality, and sanitation is crucial. This system maximizes crop production, making it suitable for limited spaces, while maintaining high yields and quality produce.

References

Asaduzzaman, M. (Ed.). (2015). *Soilless Culture: Use of Substrates for the Production of Quality Horticultural Crops*. BoD–Books on Demand.

Ayipio, E., Wells, D. E., Smith, M., & Blanchard, C. (2021). Performance of Greenhouse-Grown Beit Alpha Cucumber in Pine Bark and Perlite Substrates Fertigated with Biofloc Aquaculture Effluent. *Horticulturae*, *7*(6), 144.

Chu, Y. T., & Brown, P. B. (2021). Sustainable Marine Aquaponics: Effects of Shrimp to Plant Ratios and C/N Ratios. *Frontiers in Marine Science*, *8*, 771630.

Nugroho, A. S., Novitasari, M., Pramono, S. & Wardihani, E. (2023). Performance of Acidity Nutrient Automation Using MQTT Protocol in Dutch Bucket System Hydroponic. *Journal of Engineering Science and Technology*, 18(4), 214 – 228.

Yang, T., Altland, J. E., & Samarakoon, U. C. (2023). Evaluation of substrates for cucumber production in the Dutch bucket hydroponic system. *Scientia Horticulturae*, *308*, 111578.

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Popular Article

One World, One Health- A Veterinary perspective

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One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems at the local, regional, national, and global levels. It recognizes that the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent.

The approach mobilizes multiple sectors, disciplines, and communities at varying levels of society to work together to foster well-being and tackle threats to health and ecosystems, while addressing the collective need for healthy food, water, energy, and air, taking action on climate change and contributing to sustainable development. So, key underlying principles are:

- **Equity** between sectors and disciplines;
- Sociopolitical and multicultural **parity** (the doctrine that all people are equal and deserve equal rights and opportunities) and inclusion and engagement of communities and marginalized voices;
- Socioecological **equilibrium** that seeks a harmonious balance between human–animal–environment interaction and acknowledging the importance of biodiversity, access to sufficient natural space and resources, and the intrinsic value of all living things within the ecosystem;
- **Stewardship** and the responsibility of humans to change behavior and adopt sustainable solutions that recognize the importance of animal welfare and the integrity of the whole ecosystem, thus securing the well-being of current and future generations; and

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- **Trans disciplinarity** and multisectoral collaboration, which includes all relevant disciplines, both modern and traditional forms of knowledge and a broad representative array of perspectives.

History

One Medicine has now morphed into One Health, but the concept has yet to be wholeheartedly embraced by the medical profession. In 2008, a Commentary in the American Journal of Medicine noted that medical schools, unlike veterinary schools, typically do not emphasize the ecology of zoonotic pathogens despite the estimated 60% of human diseases (and 75% of emerging diseases) originating in animals. The situation may be changing. The American Medical Association approved a "one health" resolution promoting the importance of a partnership between human and veterinary medicine in 2007. Nevertheless, it took another ten-plus years and a global pandemic before the World Health Organization added 'One Health' to its main website's list of health topics. Presently, India and every country in the world recognizes this as a tool to study the disease transmission mechanism.

Relevance

One Health is not new, but it has become more important in recent years. This is because many factors have changed interactions between people, animals, plants, and our environment.

- Human populations are growing and expanding into new geographic areas. As a result, more people live in close contact with wild and domestic animals, both livestock and pets. Animals play an important role in our lives, whether for food, fiber, livelihoods, travel, sport, education, or companionship. Close contact with animals and their environments provides more opportunities for diseases to pass between animals and people.
- The earth has experienced changes in climate and land use, such as deforestation and intensive farming practices. Disruptions in environmental conditions and habitats can provide new opportunities for diseases to pass to animals.
- The change of global ecosystem and climate change in particular lead to an expansion in pathogen and vector-friendly habitats and therefore increase in the incidence of many vector-borne diseases among dogs and humans.
- The movement of people, animals, and animal products has increased from international travel and trade. As a result, diseases can spread quickly across borders and around the globe.

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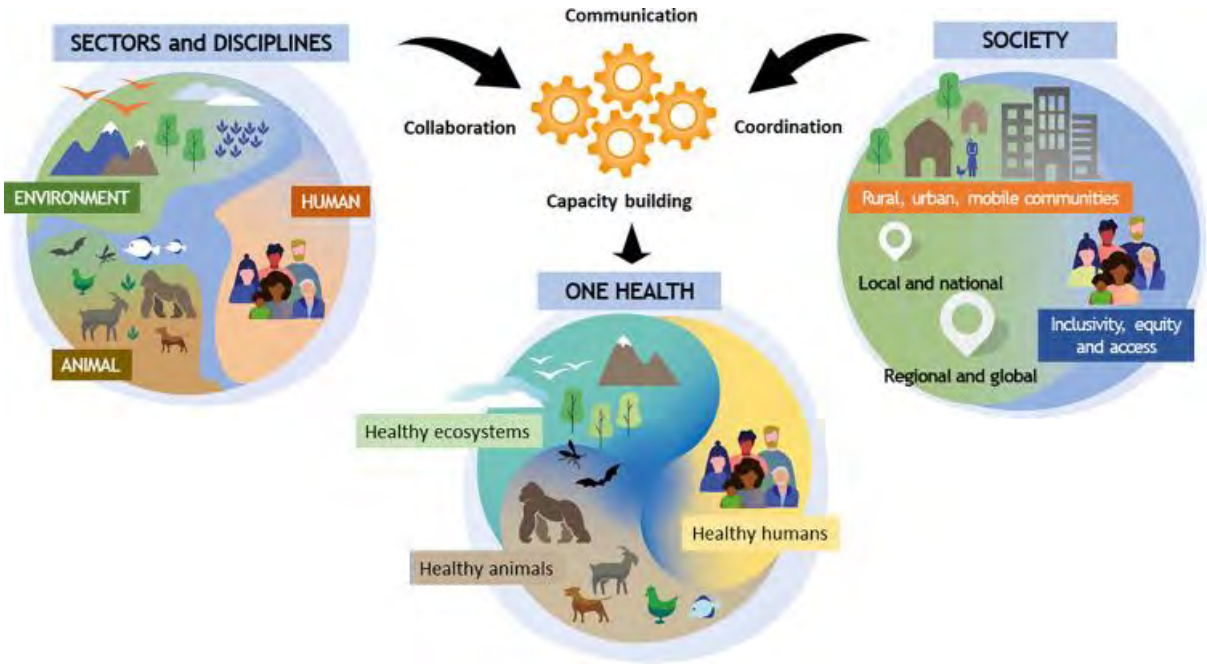

Common One Health issues:

One Health issues include emerging, re-emerging, and endemic zoonotic diseases, neglected tropical diseases, vector-borne diseases, antimicrobial resistance, food safety and food security, environmental contamination, climate change and other health threats shared by people, animals, and the environment. For example:

- Antimicrobial-resistant germs can quickly spread through communities, the food supply, healthcare facilities, and the environment (soil, water), making it harder to treat certain infections in animals and people.
- Vector-borne diseases are on the rise with warmer temperatures and expanded mosquito and tick habitats.
- Diseases in food animals can threaten supplies, livelihoods, and economies.
- The human-animal bond can help improve mental well-being.
- Contamination of water used for drinking, recreation, and more can make people and animals sick.
- Even the fields of chronic disease, mental health, injury, occupational health, and noncommunicable diseases can benefit from a One Health approach involving collaboration across disciplines and sectors.

Every year, millions of people and animals around the world are affected by zoonotic diseases like

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- Rabies
- Salmonella infection
- West Nile virus infection
- Q Fever (*Coxiella burnetii*)
- Anthrax
- Brucellosis
- Lyme disease
- Ringworm
- Ebola

Operation Methodology

The newly formed operational One Health High-Level Expert Panel (OHHLEP) aims to be comprehensive, to promote a clear understanding across sectors and areas of expertise, and to support the Partners and their Member States in framing their One Health strategies, programs, and implementation plans. This includes the Joint Plan of Action for One Health (2022 to 2026). The key strategic framework that will guide the cross-sectoral collaborative activities of FAO, OIE, UNEP, and WHO.

One Health is gaining recognition globally as an effective way to fight health issues at the human-animal-environment interface, including zoonotic diseases. It involves the public health, veterinary public health and environmental sectors. Government officials, researchers and workers across these sectors at the local, national, regional and global levels should implement joint responses to health threats. This includes developing shared databases and surveillance across different sectors, and identifying new solutions that address the root causes and links between risks and impacts. Community engagement is also critical to promote risk-reducing habits and attitudes, and to support early detection and containment of disease threats. Successful public health interventions require the cooperation of human, animal, and environmental health partners. Professionals in human health (doctors, nurses, public health practitioners, epidemiologists), animal health (veterinarians, paraprofessionals, agricultural workers), environment (ecologists, wildlife experts), and other areas of expertise need to communicate, collaborate on, and coordinate activities. Other relevant players in a One Health approach could include law enforcement, policymakers, agriculture, communities, and even pet owners. No one person, organization, or sector can address issues at the animal-human-environment interface alone.

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The One Health approach can potentially:

- Prevent outbreaks of zoonotic disease in animals and people.
- Improve food safety and security.
- Reduce antimicrobial-resistant infections and improve human and animal health.
- Protect global health security.
- Protect biodiversity and conservation.
- By promoting collaboration across all sectors, a One Health approach can achieve the best health outcomes for people, animals, and plants in a shared environment.

References

Centers for Disease Control and Prevention, National Center for Emerging and Zoonotic Infectious Diseases (NCEZID). Accessed: August 4, 2023.

American Veterinary Medical Association. One Health: A New Professional Imperative. One Health Initiative Task Force: Final Report. 2008. Available online: https://www.avma.org/sites/default/files/resources/onehealth_final.pdf (accessed on 7 January 2022).

Adisasmito WB, Almuhairi S, Behravesh CB, Bilivogui P, Bukachi SA, Casas N, Cediel Becerra N, Charron DF, Chaudhary A, Ciacci Zanella JR, Cunningham AA, Dar O, Debnath N, Dungu B, Farag E, Gao GF, Hayman DTS, Khaitsa M, Koopmans MPG, Machalaba C, Mackenzie JS, Markotter W, Mettenleiter TC, Morand S, Smolenskiy V, Zhou L. One Health: A new definition for a sustainable and healthy future. 2022. *Public Library of Science.* 23;18(6):e1010537.

https://www.who.int/news-room/questions-and-answers/item/one-health; Accessed: August 4, 2023.

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Popular Article

Strategies For Conservation of Animal Genetic Resources

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Biological diversity is a global asset of paramount importance for the food security and socio-economic development of mankind. The present pattern of diversity of AnGR is the result of a long and complicated history that started with animal domestication. Depending upon the species, domestication occurred 10,000 to 1000 years ago. Since then, domestic livestock have spread with human migration and trading to all inhabited continents. Local adaptation, artificial selection, mutation and genetic drift turned the genetic diversity captured with domestication into a vast array of differences in appearance, physiology and agricultural traits.

India is blessed with immense genetic resources of both agricultural and animal sector. The farm animal genetic resources in India are represented by a broad spectrum of native breeds of cattle, buffaloes, goat, sheep, swine, equine, camel and poultry. These breeds have developed during millions of years of evolution within specific ecological niche, forming and stabilizing to tropical environment besides developing genetic resistance to many diseases and adapting to native feed and fodder.

Increasing gap of demand and supply is creating immense pressure on researchers to go for intensive livestock development programmes which are promoting the universal use of very few improved breeds resulting in reduction of population of indigenous breeds as well as the genetic variability within a species. The Global Databank for Animal Genetic Resources data from 182 countries, for 38 species, the total number of mammalian national breed populations recorded in March 2018 was 11 371. The total number of avian national breed populations recorded in 2018 was 3689. With the challenges posed by climate change and emerging diseases we are now

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compelled to take immediate action for systemic conservation, genetic improvement and sustainable utilization of indigenous livestock breeds.

Erosion of genetic diversity

As per the 2018 data by FAO, 59 percent are classed as being of unknown risk status, 10 percent as not at risk, 24 percent as at risk and 7 percent as extinct. There are several factors responsible for decrease in Animal genetic resources, particularly in developing countries like India, but many of these reasons apply to developed countries as well.

- Lack of appreciation of the value of indigenous breeds and their importance. More stress is given to introduce exotic and crossbreeds by AI.
- The introduction of exotic germplasm of non adapted breeds followed by rapid spread through indiscriminate cross breeding.
- Change in traditional mixed farming system and introduction of modern techniques.
- Preferential shifting to farming of other breeds because of short term social and economic influences. These may arise from agricultural policies promoting rapid solutions that are not sustainable in long term.
- Mechanization of agriculture.
- Natural disasters such as drought and diseases, and wars and other forms of political unrest and instability reducing livestock numbers.

Status of Breeds

In the analysis of the Global Databank for Farm Animal Genetic Resources, breeds are classified into one of seven categories:

- Extinct
- Critical
- Critical-maintained
- Endangered
- Endangered-maintained
- Not at risk
- Unknown

This categorization is based on overall population size, number of breeding females, the number of breeding males, the percentage of females bred to males of the same breed and the trend in population size. Further consideration is given to whether active conservation programmes are in place for critical or endangered populations. For Domestic Animals following classification has been suggested:

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Status	Population Size	No. of Breeding Females and Males
Normal	The population size is greater than 1200 and overall population size is increasing.	F: >1000 M: > 20
Endangered	greater than 1000 and less than or equal to 1200 decreasing and the percentage of females being bred to males of the same breed is below 80 %.	F: >100 & ≤1000 M: > 5 & ≤ 20
Critical	less than or equal to 120 and decreasing and the percentage of females being bred to males of the same breed is below 80 %.	F: ≤100 M: ≤ 5
Extinct	no longer possible to recreate the breed population.	F: Zero M: Zero

As per NBAGR guidelines for India:

Status	Population Size	No. of Breeding Females and Males
Not at Risk	More than 20,000 for cattle, buffalo, sheep, goat, horse and camel, yak and mithun.	F: >10000 M: > 40
	More than 10,000 for Pig and poultry.	F: >5000 M: > 40
Vulnerable	20,000 or less but more than 10,000 for cattle, buffalo, sheep, goat, horse and camel, yak and mithun.	F: >5000 & <10000 M: > 20 & < 40
	20,000 or less but more than 10,000 for Pig and poultry.	F: >2500 & < 5000 M: > 20 & < 40
Endangered	10,000 or less, but more than 1,000 for cattle, buffalo, sheep, goat, horse and camel, yak and mithun.	F: >5000 & <500 M: > 5 & < 20
	5,000 or less but more than 500 for Pig and poultry.	F: >250 & < 2500 M: > 5 & < 20
Critical	1,000 or less in cattle, buffalo, sheep, goat, horse and camel, yak and mithun.	F: < 500 M: < 5
	5,00 or less in pig and poultry	F: ≤250

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		M: ≤ 5
Extinct	There is no breeding males (or stored semen) or no breeding females (or oocytes) or no embryos remaining.	F: Zero M: Zero

For their wild relatives following definitions has been suggested:

Status	**Definitions**
Commercially threatened	Taxa not currently threatened with extinction, but most or all of whose populations are threatened as a sustainable commercial resource, or will become so, unless their exploitation is regulated.
Threatened	Denote species that are endangered, vulnerable, rare, indeterminate, or insufficiently known.
Insufficiently known	Taxa that are suspected, but not definitely known, to belong to any of the above categories because of lack of information.
Indeterminate	Taxa known to be endangered, vulnerable, or rare but where there is not enough information to say which of the three categories is appropriate.
Rare	Taxa with small world populations that are not at present endangered or vulnerable, but are at risk.
Vulnerable	Taxa believed likely to move into the endangered category in the near future if the causal factors continue operating. Included are taxa of which most of all the populations are decreasing because of over-exploitation, extensive destruction of habitat or other environmental disturbance
Endangered	Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included are taxa whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction
Extinct	Species not definitely located in the wild during the last 50 years.

Current scenario of conservation and sustainable use of AnGR in India:

Livestock and poultry population:

According to 2019 census data (20th Livestock census), the country had 536.76 million livestock population and 851.81 million poultry population. During the last seven years (2012-2019), cattle and buffalo population has increased by 1.34% and 1.06% respectively. while sheep population showed handsome increase of 14.13%, Goat population showed increase of 10.14%

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and total poultry population increased by 16.81% during this period. Population of pig, yak, horse, mule, donkey and camel showed a decreasing trend.

Livestock population (*20th Livestock census, 2019*)

Sl. No	Species	Number (in millions)	Ranking in the world population
01	Cattle	192.49	**Second**
02	Buffaloes	109.85	**First**
	Total (including Mithun and Yak)	**302.79**	**First**
03	Sheep	74.26	**Third**
04	Goats	148.88	**Second**
05	Pigs	9.06	-
06	Others	0.91	-
	Total livestock	**536.76**	
	Total poultry	**851.81**	**Seventh**
07	Duck	-	
08	Chicken	-	Fifth
09	Camel	0.25	Tenth

Source: Annual Report 2018-19, Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture and Farmers Welfare, Govt. of India.

Breed-wise Population:

The Government has conducted the 20th Livestock Census in 2019. It covers 184 breeds of total 16 animal species like Cattle, Buffalo, Mithun, Yak, Sheep, Goat, Pig, Horse, Pony, Mule, Donkey Camel, Dog, Rabbit and Elephant and poultry birds (Fowl, Duck, Turkeys and other poultry birds) possessed by the households, household enterprises/non-household enterprises and institutions at their site. The Department is also initiating the next Livestock Census scheduled for Year 2024. There are 38 indigenous breeds out of 184 breeds of different livestock and poultry species that are 'at risk'. (As per the Press information Bureau, GOI; posted on 28 MAR 2023 5:51PM by PIB Delhi). Breed-wise livestock census carried out at timely intervals gives information which is of paramount importance for assessing the degree of crossbreeding, preparing breed watch lists, accreditation of breeds and planning for breed conservation and genetic improvement programmes.

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Livestock and Poultry Breeds:

Domesticated animals constitute an important genetic resource in the country that lends strength to the food and livelihood security in agriculture-based system. Despite contribution to the society, a large part of Animal Genetic Resources (AnGR) distributed all over the country is yet to be characterized, documented and evaluated scientifically. There are 212 registered breeds of livestock and poultry in India, which includes 53 breeds of Cattle, 20 of buffalo, 44 of sheep, 37 of goat, 7 of horses and ponies, 9 of camel, 13 of Pig, 3 of Dog, 3 of Donkey, 2 of Duck, 1 of Geese, 1 of Yak and 19 of Poultry in addition to many more not characterized and accredited so far.

Identification, characterization and documentation of AnGR

- Technical standards and protocols for breed survey and characterization is present.
- Both phenotypic and genetic characterization of more than 90% of the registered indigenous breeds.
- Molecular genotyping for diversity analysis in different livestock and chicken breeds and establishment of their phylogeny (More than 60% of the breeds have been documented).
- Information system on AnGR of India has been developed to inventorize and monitor trends.

Accreditation of Farm AnGR

- Registration of animal breeds to protect and check the bio-piracy of indigenous AnGR
- Accession numbers are given to each of extant breeds of various species of livestock and poultry.
- Publishing of Breed discriptors of extant breeds.

Conservation

Conservation of AnGR is generally defined as management of biosphere for the benefit of mankind of present generation while maintaining its potential to meet the future needs. It also refers to all human activities including strategies, plans, policies and actions undertaken to ensure that the diversity of animal genetic resources being maintained to contribute to food and agricultural production and productivity, or to maintain other values of these resources (ecological, cultural) now and in future. Three major strategies are normally followed in conservation of farm animal genetic resources. The first two i.e. *in situ* conservation as well as *ex situ* in vivo involves conservation of living population. The third, *ex situ* in vitro encompasses conservation of living

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ova, embryo, semen, somatic cell or other animal tissue, DNA etc. stored cryogenically in liquid nitrogen.

As a best preferred method of conservation, *In situ* conservation of livestock through involving livestock keepers in the production system should be adopted to maintain a breed in a dynamic state. *Ex situ* in vitro (cryopreservation) should complement in- situ conservation.

In-situ Conservation

In situ conservation is the maintenance of live populations of animals in their adaptive environment or as close to it as is practically possible. For domestic species the conservation of live animals is normally taken to be synonymous with *in situ* conservation

In-situ conservation requires information on following points

1. Setting and regular review of conservation priorities and goals. Establishment of institutional structures and policies including specific measures to conserve breed at risk of extinction and to prevent breeds from becoming at risk.
2. Factors leading to erosion of animal genetic resources should be assessed for formulation of policies for breed(s) under risk.
3. Population status of the breeds in its native traits and outside the native tract. The basic population status may include the data on the year of data collection, total population size (range or exact), reliability of population data, population trend-increasing/decreasing/stable. Population basis census/estimate/survey whereas, advanced population statistics will include number of breeding males/females, percent of females bred to males of the same breed percent of males used for breeding, number of females registered in herd book/ register. AI usage and storage of semen/embryos, number of herd and average herd size.
4. The communities responsible for maintaining the breed in its natural habitat along with socio-economic status of them.
5. The breeding management of breed and the programme of government/NGOs in breeding of the animals for the genetic improvement.
6. Economic importance of the breed vis-à-vis all kind of expenditure on the maintenance of the breed.

Models for *in-situ* conservation in India:

1. Linking of genetic improvement programme for the breed with its conservation. The success of breeding programmes depends upon the responses of the animal keepers. It is better to run the genetic improvement programmes for the breeds under production so that animal keepers may get benefit by their utilization.

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1. At farmer's herd/flock

Active participation of livestock owners and stakeholders is the best way to conserve the resources within their native breeding tracts. The native breeds especially those which are less productive can only be maintained as long as their minimum feed/fodder requirements are met under zero-low input system. So, the owners of the animals of the breed under risk may be give suitable incentives to save the breeds.

2. At organized government farms in their native breeding tract

In India, a large number of livestock farms under government and others are available who are concentrating on few selected breeds of livestock whereas not even a single farm are available for majority of the breeds. There is a need to earmark at least one livestock farm to each of the breeds of the livestock with fixed herd/flock strength.

The total number of government and other livestock farms in India are as follows:

SN	**Species**	**Livestock Farms**		
		Government	**Others**	**Total**
1.	Cattle	127 (+870 Gaushalas)	39 (+2215 Gaushalas)	166 (+3085 Gaushalas)
2.	Buffalo	26	2	28
3.	Goat	52	-	52
4.	Sheep	49	10	59
5.	Pig	150	-	150
6.	Camel	26	-	26
7.	Horse	17	-	17
8.	Rabbit	36	-	36
9.	Poultry	214	4355	4569
10.	Duck	57	2	59
	Total	**1343**	**6623**	**8247**

3. Research and development organizations

Many Research and development organizations like NBAGR (Karnal), specific specific ICAR institutes, SAUs, SVUs, State government Breeding units' area also maintaining the indigenous genetic resources and motivating the farmers for their adoption. The network project

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on AnGR (ICAR) has already covered in-situ conservation programmes for Tharparker cattle, Nilgiri and Kilakersal sheep, Beetal and Surti goats and Spiti horse.

4. **Breeders' association and breeders' societies**

The animal keepers should be supported financially and technically for establishing breed societies so as to provide better marketing facilities. These societies should be in hands of the animal keepers under a democratic way without any political or government interventions but they should support them as and when needed. Breed societies are already running in the country for Chetak horse, Chilika buffaloes, Malaimadu, Ongole and Deoni cattle and many more.

5. **Participation of NGOs in *in-situ* conservation programmes**

The non-government institutes such as NGOs, Gaushala etc. may also play significant role in in-situ conservation of AnGR. Good NGOs involved in the conservation programmes may be invited for MOUs with the government. In rural conditions, some of the NGOs are doing commendable work like ANTHRA for Deccani sheep, SURE for Tharparkar cattle, LPPS for camels in Rajasthan and SEVA for Pullikulam cattle etc such organizations needs to be financially supported after developing a technical programme and targets to be achieved under the programme.

Ex-situ Conservation

Ex situ preservation involves the conservation of plants or animals in a situation removed from their normal habitat. It is used to refer to the collection and freezing in liquid nitrogen of animal genetic resources in the form of living semen, ova or embryos. It may also be the preservation of DNA segments in frozen blood or other tissues. Finally, it may refer to captive breeding of wild plants or animals in zoos or other situations far removed from their indigenous environment. Conservation strategies benefit from advances made in cryopreservation and reproductive technologies. Choice of types of genetic material to be preserved for different species highly depends on objectives, technical feasibility (e.g. collection, cryo-preservation), costs and practical circumstances.

Ex-situ conservation can be practiced by two ways:

In Vivo ex-situ conservation:

It requires colony relocation. The endangered AnGR are kept and bred in nucleus herds at public or private institutions or zoos, all of which house whole, protected specimens for breeding and reintroduction into wild when necessary and possible. Apart from housing, these also provide an aesthetic and educational value they inform the public of the threatened status of the species and of those factors which cause the threat, with the hope of creating public interest in stopping and reversing those factors which jeopardize a species survival.

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Some special care has to be taken while allocating the animals at new place as the population becomes even more vulnerable to diseases as the animals are concentrated in only a few locations.

Ex-situ Conservation:

In Vitro ex-situ conservation:

Cryobiological principals:

Cryopreservation can involve gametes, embryos, somatic cells or primordial germ cells. The technologies for cryopreservation of different cells and tissues are at varying levels of development, cost and ease of application for different species. An assessment of the role of *in vitro* conservation in varying situations, is summarized in Table below. This assessment applies to the major mammalian livestock species. In poultry, cryopreservation of embryos and oocytes is not yet possible and somatic cell cloning has not yet been demonstrated.

Assessment of relevance and feasibility of cryopreservation for various purposes

Purpose	Semen	Embryos	Oocytes	Somatic cells	Primordial germ cells
Support breeding of small population	+++ ***	++ *	+ 0	0 0	0 0
Emergency (disease, war, natural disaster)	+++ ***	+ 0	+ 0	+ *	0 0
Breeding programmes	+++ ***	++ **	+ 0	+ 0	0 0
Backup of population in use	+++ ***	+++ **	0 0	++ *	+ 0
Trait selection	+++ ***	+++ **	+ 0	+ 0	0 0
Germplasm exchange	+++ ***	+++ ***	+ 0	0 0	+ 0
Breed reconstruction	+++ **	+++ ***	+ 0	+++ *	+ 0

+ = potential relevance of technology; * = current feasibility. A larger number of + and * indicates greater relevance or feasibility; 0 = no foreseeable relevance or not currently feasible.

Semen for Artificial Insemination:

Semen of most livestock species can be frozen adequately. Also, for a large number of birds and mammalian livestock species, dedicated freezing media and equipment for collection, packing, freezing and inseminating semen have been developed and are available commercially. Sperm cells are the endpoint of male spermatogenesis and have particular anatomic and metabolic features. Sperm cryopreservation and storage currently require liquid nitrogen or ultralow

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refrigeration methods for long- or short-term storage, which requires routine maintenance and extensive space requirements. Conserving sperms have several purposes apart from species conservation such as artificial reproductive technologies (ART) and clinical medicine. The present network of semen banks in India is essentially based on production, processing, storage and distribution of germplasm for those indigenous breeds which are included in breed improvement programme for milk production.

Oocyte for embryo transfer

It is done by preservation of ovarian tissue or entire ovary for transplantation, followed by oocyte harvesting or natural fertilization. The collected oocytes can be at any level of maturation including oocytes found in primordial, preantral, or antral follicles, each presenting its own special requirements and sensitivities. Remarkable progress has been made in last 20 years regarding cryopreservation of oocytes. Live born young ones from embryos produced from cryo-preserved oocytes have been reported in cattle, mouse rat, horse and human. However, the present efficiency and reliability of using frozen thawed oocytes for generating offspring is still much lower as compared to cryo preserved embroys.

Embroys or embryonic cells

In cattle, the cryo preservatin of embryos is highly successful. Both slow freezing and vitrification protocols are effective. The success of cryo preservation is dependent on the stage of the embryo; that is especially good results are obtained with blastocysts. Cryo-preservation of embryos resulting in live offspring has been reported in all important mammalian livestock species. Cryo-preservation of pig embryos is problematic, due to high lipid content of the pig embryos.

Somatic cell for reproductive cloning

In this, the nucleus of a somatic cell is removed and kept, and the host's egg cell is kept and nucleus removed and discarded. Now we have a lone nucleus and an empty (or deprogrammed) egg cell. The lone nucleus is then fused with the 'deprogrammed' egg cell. After being inserted into the egg, the lone (somatic-cell) nucleus is reprogrammed by the host egg cell. The egg, now containing the somatic cell's nucleus, is stimulated with a shock and will begin to divide. This technique is currently the basis for cloning animals (such as the famous Dolly the sheep), and in theory could be used to clone any animals. The use of nuclear transfer means that the original mitochondrial genotype of the nucleus is lost. In mammals, live offspring have been obtained from embroys generated from somatic cells in number of species, i.e. sheep, cattle, mice, pigs, goats, horse, rabbits and cats.

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Cryo-preservation of important or unique genes:

Globally, the genes bank of complete genome sequence of many mammalian species is available. As per future demand the gene of interest may be introgressed in animal lacking the same using reproductive biotechnology.

Genomic DNA library

The genomic library contains DNA fragments representing entire genome of an organism. It contains large fragments of DNA in either bacteriophages or bacterial or P1-derived artificial chromosomes (BACs and PACs). The evolutionary studies can be performed using the genomic DNA library since it contains both coding and non-coding regions of DNA.

cDNA library:

cDNA libraries are made with cloned, reverse-transcribed mRNA, and therefore lack DNA sequences corresponding to genomic regions that are not expressed, such as introns and 5′ and 3′ noncoding regions. cDNA libraries generally contain much smaller fragments than genomic DNA libraries, and are usually cloned into plasmid vectors. So, the advantage is that it contains only the coding regions of DNA.

Ex situ and *in situ* conservation are not mutually exclusive. Frozen animal genetic resources or captive live zoo populations can play an important role in the support of *in situ* programmes. *In situ* conservation approaches are to be preferred as a method of conservation where maintenance and management of the AnGR is the best available livelihood option for the farmers involved. *In situ* conservation should be established as a preventive measure to protect against loss of the AnGR. The relative advantages and disadvantages of the major systems are therefore reviewed here with a view to identifying the relative strengths and areas of mutual support.

		Ex Situ	***In Situ***
i.	COST - initial set up cost	rel high	low-high
	- maintenance cost	low	rel low-high
ii.	GENETIC DRIFT - initial	rel high	low
	- annual	none	moderate-high
iii.	Applied to all species	no	yes
iv.	Safety/reliability	good-bad	moderate

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v.	Local access	mod-poor	mod-good
vi.	International access	good	not good
vii.	Population Monitoring	none	good
viii.	Environmental adaptation	none	good
ix.	Selection for use	none	good

Selected Readings

Alderson L., 2009. Breeds at risk: Definition and measurement of the factors which determine endangerment. Livestock Science, 123, 23-27.

Designation of repositories under the biological diversity act, 2002. Order no.26-15/2007-csc dated 28 Aug, 2008, Ministry of environment and forests, Govt. of India.

FAO. 2021. Status and trends of animal genetic resources – 2020. Commission on Genetic Resources for Food and Agriculture. Eighteenth Regular Session, 27 September to 1 October 2021. CGRFA-18/21/10.2/Inf.6. Cited 10 October 2021. www.fao.org/3/ng620en/ ng620en.pdf

Gandini G.C:, Ollivier L., Danell B., Distl O., Georgudis A., Groeneveld E., Martiniuk E., Van Arendonk J,. Woolliams J. 2004. Criteria to assess the degree of endangerment of livestock breeds in Europe. Livestock production science 91: 173-182.

ICAR-NBAGR (2016) Guidelines for Management of Animal Genetic Resources of India. National Bureau of Animal Genetic Resources (Indian Council of Agricultural Research), Karnal (Haryana), India, 163 p.

Santiago, E. & Caballero, A. (1995). Effective size of populations under selection. genetics 139: 1013 1030.

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Popular Article

Laminitis in Dairy Animals

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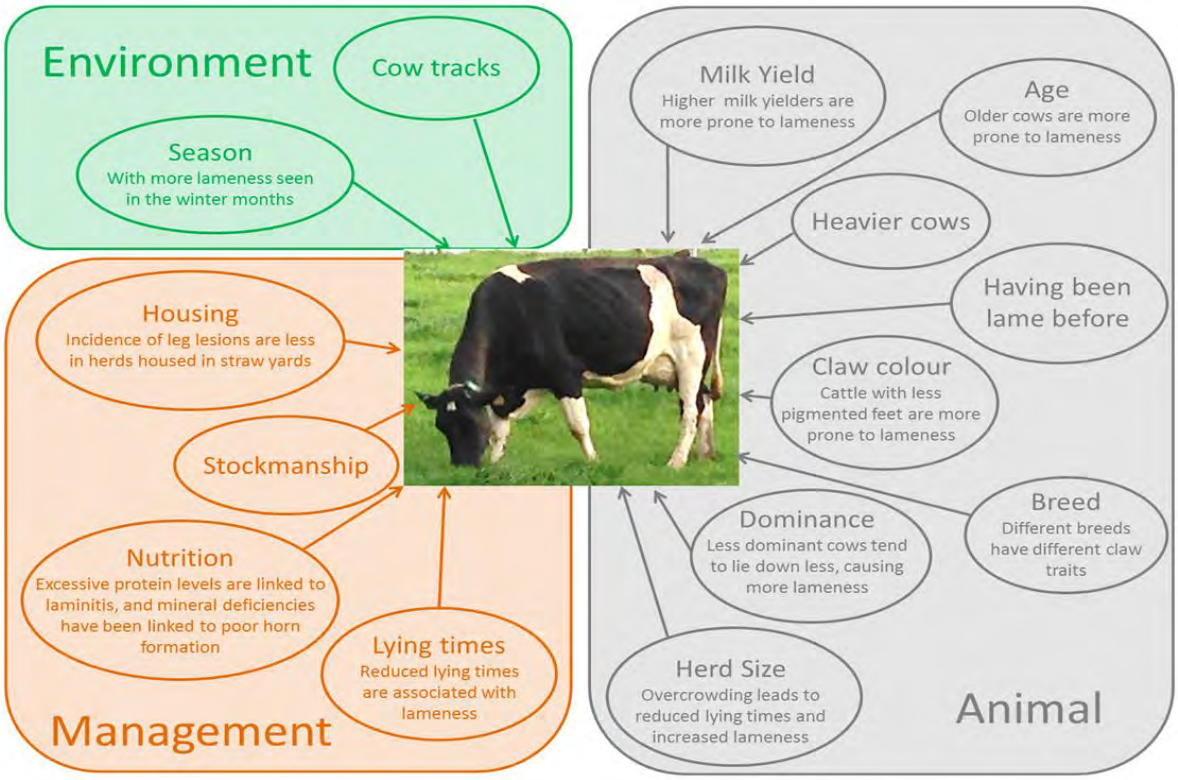
Lameness is when a cow struggles to walk, often because they have a foot or leg condition or injury. Lameness causes severe pain and prolonged suffering for cows, and can prevent them from walking or even standing up. Lameness is when a cow struggles to walk, often because they have a foot or leg condition or injury. The problem of lameness is widespread. Lameness is one of the greatest constraints to productivity, health and welfare of dairy cattle. Also, it causes significant financial losses to animal breeders. It is a clinical manifestation of a vast spectrum of diseases



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specified in a total of 43 causes and more than 80 potential hazards. Hazards to claw health and cow mobility can take many different forms. For instance, many aspects of the cow environment such as housing type, flooring quality and cubicle design can put claw health at risk. Management decisions such as claw trimming

routine or over-crowding are also considered to have an impact on claw health. Foot and leg problems are a major health concern for many dairy farmers. Cow lameness results in poor performance and substantial economic loss. Nutrition and feeding, housing and environment, concurrent disease, genetic influences, and management factors all predispose a cow to problems. The greatest incidence (90 percent) of lameness involves the foot, and of these, 90 percent involve the rear feet.

Synonym: Coriosis, *Pododermatitis aseptica diffusa*, coriosis, 'founder.'

Etiology

The major etiology behind the problem is diffuse acute, subacute, subclinical or chronic inflammation of pododerm, usually in several digits. Chronic cases without acute stage (subclinical) are often seen.

Incidence

Sporadic acute cases, widespread subacute, sub-clinical and chronic cases commonly in dairy units, high incidence in recently calved heifers and younger cows around parturition. Acute form occasionally pre- sents as outbreak in barley beef units. Common in beef feedlots.

Predisposition

- Inherited factors: Parturition (proven in Jersey)
- Feeding stress (ruminal lactic acidosis, subacute ruminal acidosis or SARA) from change of dry cow concentrate diet to high production rations
- Potentially dangerous reduction of roughage intake and exacerbation by trauma (overburdening)
- Excessive standing due to reluctance to use cubicles (inexperience, bullying by herdmates) and improper shed make.

Signs

- Acute stage: painful hot digit, digital arterial pulsation, general depression, severe lameness, abnormal stance, possibly recumbent (LS 2–3) subacute: less painful but persistent stiffness, stilted gait, solear and white line haemorrhages (LS 1)
- Chronic: stiff gait or not lame (LS 0–1), 'slipper foot' malformation with horizontal

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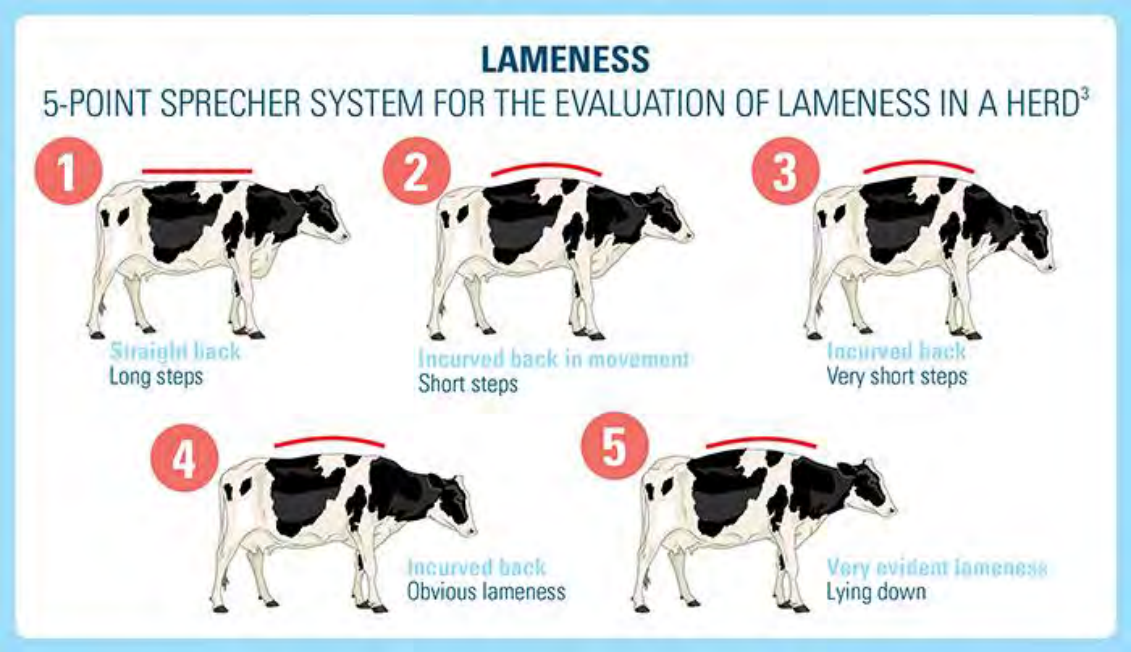
lines on sole wall, concave dorsal wall, widened white line and evidence of old solear and white line haemorrhages.



Pathology

- Blood and serum exudation in acute stage, later (chronic) grooves on hoof wall, concave profile, widened white line and flat sole.
- Significant sinking of distal phalax due to peripartum slackening of the connective tissue support structures; thin sole or ulceration near tip of distal phalanx ('toe ulcer') is evident as haemorrhage ('bruising') as toe tip has no fat layer in its corium.
- White line lesions may develop into white line disease; sole lesions at sole-heel junction may develop into solear ulceration.

Histopathology

Oedema, haemorrhages and thrombosis in acute stage, fibrosis and chronic thrombosis in later stages.

Differential diagnosis:

Bruised sole, white line disease, punctured sole, solear ulceration all of which may be present.

Treatment

- Acute stage: give systemic NSAIDs (flunixine meglumine or meloxicam) or possibly corticosteroids (only if non-pregnant) and diuretics
- Ensure exercise (to improve local circulation and further reduce developing oedema), preferably by turning on to soft ground, e.g., field

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- Feed no concentrates until acute phase is over in recumbent case consider digital nerve block to get heifer or cow to stand, then forced exercise
- subacute stage: as in acute case
- chronic case: hoof trimming

Prophylaxis

- Avoid large amounts of prepartum concentrates ('steaming up' 'lead feeding'), which should not exceed 2 kg daily
- Avoid high intake of concentrate in early lactation, and aim at peak yield about six weeks postpartum ensure ready access to roughage immediately before and after concentrate intake, or consider change to complete diet feeding (TMR, total mixed rations)
- If problem persists improve buffering capacity of rumen fluid (avoid lactic acidosis or SARA) by increasing saliva production: give iodide or rock salt, grass or lucerne nuts in concentrate
- Consider adding 1% sodium bicarbonate to concentrate ration, which should be fed as three to four daily portions
- Accustom down-calving heifers gradually to concrete yards and cubicles several weeks beforehand, but ensure plenty of exercise in both pre- and post-partum weeks
- Avoid exposure to excessive sole wear from long stony tracks, rough concrete
- High fibre diets should be used in rearing dairy heifers in long term planning
- Ensure regular claw examination and trimming

Discussion

Excess lactic acid production alters rumenal bacterial flora, and causes release of bacterial endotoxins involving histamine release and stagnation of blood in laminae of digital horn, with consequent hypoxia and functional ischaemia. Ischaemic necrosis of the corium and laminae heals by fibrosis. These tissues then inevitably produce defective (soft, poor quality) horn in aberrant manner, resulting in signs seen in subacute and chronic stages. Toxic conditions (mastitis, metritis) may also contribute to development of laminitis in some dairy cattle

Economic Loss

Economically, the results of foot disease are much greater than the treatment costs. Reduced milk yields, lower reproductive performance, increased involuntary cull rates, discarded milk, and the additional labor costs to manage these cows accounts for

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the largest monetary loses.

References

Clarkson, M.J., D.Y. Downham, W.B. Faull, J.W. Hughes, F.J. Manson, J.B. Merritt, R.D. Murray, W.B. Russell, J.E. Sutherst and W.R. Ward, 1996. Incidence and prevalence of lameness in dairy cattle. Veterinary Record, 138: 563-567.

Blowey, R.W., L.E. Green, V.J. Collis and A.J. Packington, 2004. The effects of season and stages of lactation on lameness in 900 dairy cows. In the proceedings of the 13th international symposium on diseases of the ruminant digit, Maribor, Slovenia, pp: 43-45.

Bell, N.J., M.J. Bell, T.G. Knowles, H.R. Whay, D.J. Main and A.J.F. Webster, 2008. The development, implementation and testing of a lameness control programme based on HACCP principles and designed for heifers on dairy farms. Veterinary J., 180: 178-188.

Haskell, M.J., L.J. Rennie, V.A. Bowell, M.J. Bell and A.B. Lawrence, 2006. Housing system, milk production and zerograzing effects on lameness and leg injury in dairy cows. J. Dairy Sci., 89: 4259-4266.

Espejo, L.A. and M.I. Endres, 2007. Herd-Level Risk Factors for Lameness in High-Producing Holstein Cows Housed in Freestall Barns. J. Dairy Sci., 90: 306-314.

Leonard, F.C., J.M. O'Connelland K.J. O'Farrell, 1996. Effect of overcrowding on claw health in first-calved Friesian heifers. British Veterinary J., 152: 459-472. Holstein Cows Housed in Freestall Barns. J. Dairy Sci., 90: 306-314.

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Popular Article

Pandemic Preparedness: Navigating Emerging Infectious Diseases for A Safer World

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Abstract

The present era has seen a series of significant infectious diseases outbreaks, including the devastating impact of the global pandemic like COVID-19. Additionally, there were outbreaks in the past such as the SARS coronavirus in 2003, the swine flu pandemic in 2009, the MERS coronavirus outbreak in 2012, the Ebola virus disease epidemic in West Africa from 2013 to 2016, and the Zika virus disease epidemic in 2015. These events led to substantial illness and death and crossed international borders, thus affecting the lives and livelihoods of many people across the globe. Simultaneously, recent decades have marked an extraordinary period characterized by remarkable advancements in technology, shifts in demographics, and evolving climate conditions. The ongoing developments in our current era are rendering humanity susceptible to future pandemics, anticipated to result from the melting of glaciers and polar ice caps. This thawing process could potentially unleash previously preserved viruses and bacteria from glacial ice and permafrost. Additionally, the warming climate is creating conditions where the habitats of these ancient viral pathogens increasingly overlap with those of humans, posing a significant threat to human well-being and safety. Thus, pandemic preparedness is not optional but rather an imperative in our interconnected global landscape.

Introduction

The term "emerging infectious diseases" (EIDs) refers to infectious ailments that have either manifested in a community or that have long existed but are now seeing a significant rise in incidence or geographic spread. As the causative agents of these ailments are novel or have undergone modifications that make them more virulent, transmissible, or otherwise challenging to control, these diseases frequently pose a serious risk to the public's health (Lederberg *et al*., 1992). In the past 20 years, there has been a rising trend in the occurrence and magnitude of EIDs that could potentially lead to pandemics. The COVID-

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19 pandemic has demonstrated that events where diseases jump from animals to humans (zoonotic spill-over) pose a growing risk to global public health.

Starting in 2007, the WHO has officially declared six instances as Public Health Emergencies of International Concern (PHEIC). These include the swine flu pandemic in 2009, the Ebola virus disease outbreaks in West Africa from 2013 to 2015 and in the Democratic Republic of Congo from 2018 to 2020, the ongoing situation with poliomyelitis since 2014, the Zika virus outbreak in 2016, and the continuing COVID-19 pandemic, which began in 2020 and is still ongoing (WHO, 2019). Significant research efforts have been dedicated to these PHEICs, particularly in the context of COVID-19. However, the majority of this research has primarily focused on aspects such as disease origin, symptom identification, transmission chains, case rates, mortality, as well as preventive measures and treatments. There has been comparatively limited emphasis on addressing issues related to health disparity and exploring the connections between pre-existing socioeconomic disparities and the emergence, magnitude, and management of pandemics caused by EIDs (Farmer, 2016). Therefore, the complex interplay between socioeconomic disparities and EIDs, where existing inequalities interact with and worsen factors such as case rates, symptom severity, illness, and death, has not received sufficient attention or investigation (Bambra *et al*., 2020) (Figure 1).

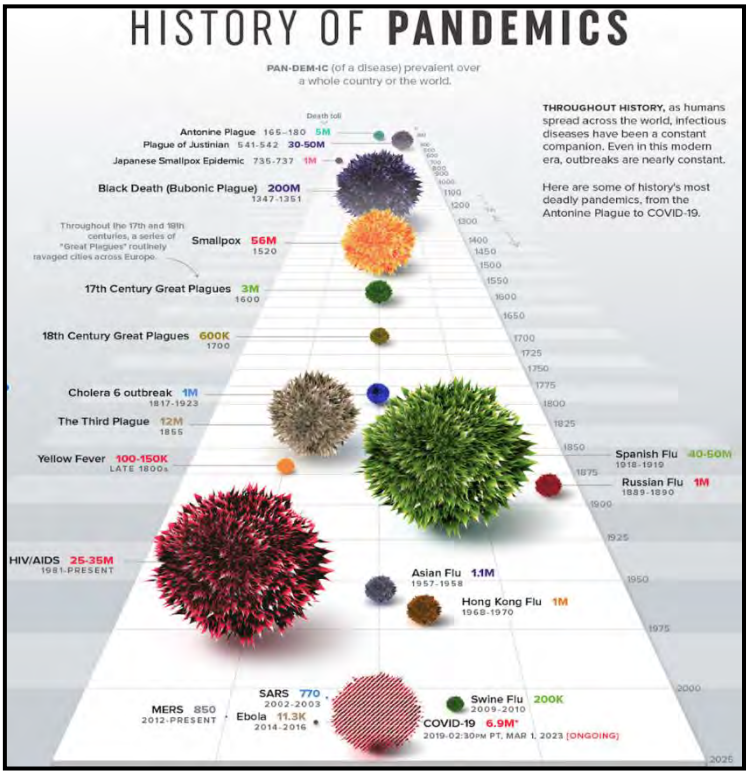

Figure-: 1 Timeline of Pandemics (https://www.visualcapitalist.com/history-of-pandemics-deadliest/).

Epidemiological Determinants Contributing to EIDs

1. Zoonotic Spillover: Many EIDs arise in animals and spread to people, including HIV, Ebola, and COVID-19.

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2. Environmental Alterations: Deforestation, urbanization, and climate change are examples of environmental changes that could ruin ecosystems and increase human contact with disease vectors or reservoirs.
3. Globalization: Global trade and increased international travel can hasten the transmission of communicable ailments, posing a threat to the globe as a whole from small epidemics.
4. Antimicrobial Resistance: It is more challenging to combat and manage ailments as drug-resistant varieties of bacteria, viruses, and parasites arise.
5. Societal and Behavioral Impact: The genesis and transmission of infectious diseases can be attributed to societal habits such as inadequate hygiene, little emphasis on immunization, and reckless behaviors.
6. Microbial Evolution: Over time, pathogens can alter in terms of virulence, transmission, or susceptibility to treatments (Van Doorn, 2014).

EIDs and inequality

The three case studies highlighting Ebola virus disease (2015-16, 2018-20), Zika virus disease (2016), and COVID-19 (2020 to the present) have exhibited distinct reservoir hosts and vectors (including mosquitoes and bats), different primary methods of transmission (such as blood, contact, and airborne), and have affected a wide array of regions and countries (ranging from West Africa to the Americas to a global scale). Despite these differences, they all share a common outcome in terms of generating substantial disparities in terms of ailments and death rates across different social groups (Bambra, 2022).

The epidemiological study highlighted notable disparities in EIDs. To proactively address these variations, it's crucial to adopt a more comprehensive perspective. Drawing from several past case studies, it becomes evident that four major interlinked factors play a pivotal role in shaping these disparities: differing levels of exposure, variations in disease transmission, disparities in susceptibility, and inequalities in the provision of healthcare. Figure- 2

Pathways to inequality

1. Differing levels of exposure: - Due to disparities in their living and working circumstances, individuals with lower socioeconomic status are at a higher risk of being exposed to infections from EIDs. For instance, regarding Ebola, the poorest communities' dependence on consumption of bush meat may have raised their risk of exposure to the virus, just as increased deforestation and encroachment into forests did. With respect to COVID-19, individuals in lower-paying jobs faced a significantly greater likelihood of exposure, such as having to continue working even during lockdowns (Houéto, 2019).

2. Variations in disease transmission:- Community transmission, defined as the uneven diffusion of a pathogen within a community, is notably shaped by the social factors that determine health. For example, during the Zika epidemic, densely populated urban slums saw considerably higher infection rates due to extreme overcrowding. Likewise, the transmission of COVID-19 virus was more pronounced in economically disadvantaged areas marked by a higher prevalence of multi-occupancy housing, smaller living spaces, greater urbanization, and increased population densities (Souza *et al*., 2018).

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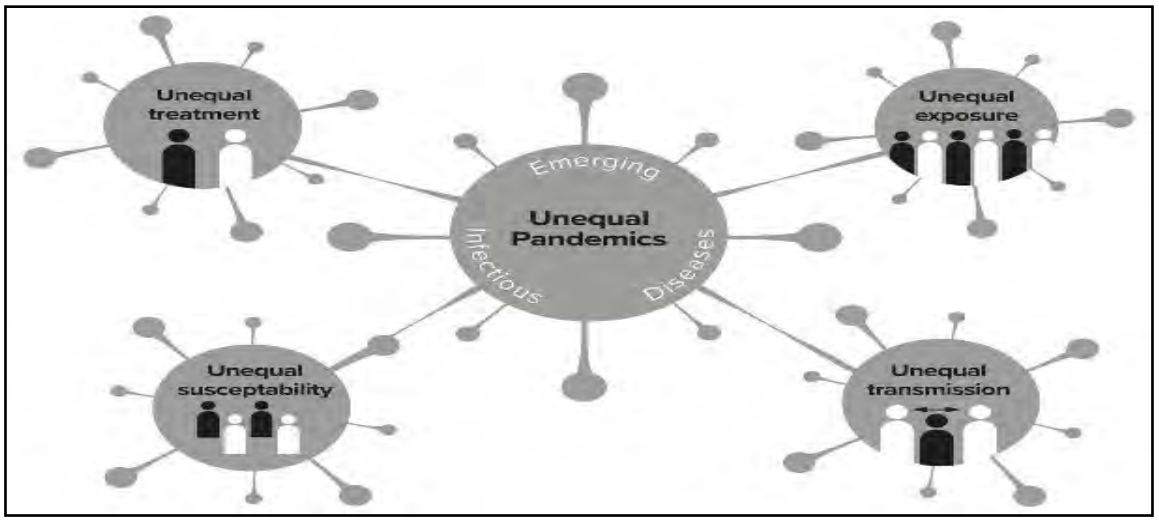

Figure-: 2 Pathways to Inequalities in Emerging Infectious Diseases Pandemics (Bambra, 2022) (Figure 2).

3. Disparities in susceptibility-: This factor presents a dual facet. First, susceptibility to EIDs is heightened by pre-existing medical conditions such as diabetes, heart disease, obesity, tuberculosis, and HIV. Additionally, individuals from lower income brackets are more prone to EIDs due to factors like malnutrition and chronic stress stemming from psychological conditions. Previous research has shown that economically disadvantaged groups with pre-existing health issues and limited access to healthcare facilities are at a higher risk of contracting diseases like Zika and Ebola (Fallah *et al*., 2015).

4. Inequalities in the provision of healthcare-: A key element contributing to disparities in EIDs lies in the accessibility of healthcare treatment and preventive services. This issue was particularly pronounced during the Ebola outbreak, as the intentionally neglected healthcare infrastructure in West Africa, stemming from historical colonial legacies and persistent healthcare system deficiencies, led to limited access to healthcare facilities. In the case of COVID-19, there's growing evidence that even in developed countries with universal healthcare, disparities exist in the availability vaccines. The pandemic has also revealed inequalities in access to personal protective equipment and disparities in testing for the disease (Todd and Bambra, 2021)**.**

Future Pandemics

Numerous research findings have highlighted the potential for future pandemics to be linked to climate change, as rising temperatures result in the thawing of glaciers and polar ice caps. This thawing process, in turn, may contribute to the resurgence of viruses and bacteria that have been preserved in glacial ice and permafrost. The revival of these microorganisms poses a risk of infecting local wildlife, particularly as these animals migrate toward polar regions in response to the increasing temperatures. A study involving genetic analysis of soil and sediment samples from Lake Hazen, the world's largest high Arctic freshwater lake, has revealed that the risk of viral spill over, where a virus infects a host species for the first time, could be elevated in proximity to melting glaciers (Lemieux *et al*., 2022) (Figure 3).

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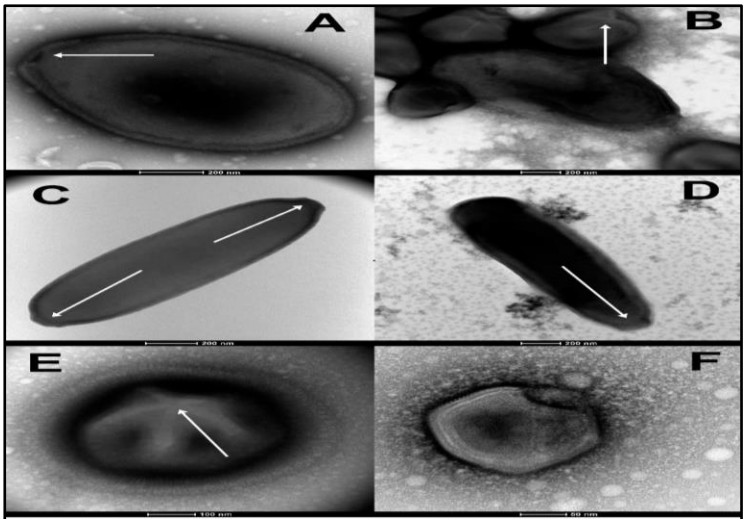

Figure-:3 Morphological features guiding the preliminary identification of newly isolated viruses (negative staining, TEM) (Alempic *et al*., 2023).

Similarly, a study conducted by a research group has revealed that increasing temperatures could release ancient pathogens previously trapped in polar regions. They identified thirteen viral strains from seven different Siberian permafrost samples (Alempic *et al*., 2023), with one of them being nearly 50,000 years old and still capable of causing infections. The warming climate is promoting the overlap of habitats between these ancient viral pathogens and humans, thereby presenting a risk to human health and safety (Carslon *et al*., 2022).

Conclusion and Future perspectives

Pandemic preparedness is not optional but rather an imperative in our interconnected global landscape. While the COVID-19 pandemic revealed vulnerabilities in our global response, it also highlighted the potential of human innovation and collaboration. To ensure a safer world for present and future generations, we must allocate resources towards enhancing surveillance, research, healthcare infrastructure, public health education, and global cooperation. The insights gained from this pandemic should lead us to adopt a more proactive and robust strategy for addressing EIDs. We must take action promptly because the next pandemic may loom on the horizon.

On April 23, 2023, the WHO introduced a new program called the "Preparedness and Resilience for Emerging Threats Initiative," abbreviated as PRET. This initiative builds on the lessons and methods developed during the COVID-19 pandemic and other recent health crises, with the goal of enhancing global readiness for pandemics. Using a transmission-based approach, WHO will provide guidance to nations in their pandemic planning efforts, recognizing that many skills and resources can be applied across various infectious agents. PRET responds to the need for technical assistance and support in advancing and reinforcing comprehensive preparedness and response, in line with resolutions from the World Health Assembly.

References

Alempic, J. M., Lartigue, A., Goncharov, A. E., Grosse, G., Strauss, J., Tikhonov, A. N., ... & Claverie, J. M. (2023). An update on eukaryotic viruses revived from ancient permafrost. *Viruses*, *15*(2), 564.

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Published: **30.10.2023**

Bambra, C. (2022). Pandemic inequalities: emerging infectious diseases and health equity. *International Journal for Equity in Health*, *21*(1), 6.

Bambra, C., Riordan, R., Ford, J., & Matthews, F. (2020). The COVID-19 pandemic and health inequalities. *J Epidemiol Community Health*, *74*(11), 964-968.

Carlson, C. J., Albery, G. F., Merow, C., Trisos, C. H., Zipfel, C. M., Eskew, E. A., ... & Bansal, S. (2022). Climate change increases cross-species viral transmission risk. *Nature*, *607*(7919), 555-562.

Fallah, M. P., Skrip, L. A., Gertler, S., Yamin, D., & Galvani, A. P. (2015). Quantifying poverty as a driver of Ebola transmission. *PLoS neglected tropical diseases*, *9*(12), e0004260.

Farmer, P. (2016). Social inequalities and emerging infectious diseases. *Understanding and applying medical anthropology*, 118-126.

Houéto, D. (2019). The social determinants of emerging infectious diseases in Africa. *MOJ Public Health*, *8*(2), 57-63.

https://www.who.int/news-room/questions-and-answers/item/emergencies-international-health-regulations-and-emergency-committees

https://www.who.int/news/item/26-04-2023-who-launches-new-initiative-to-improve-pandemic-preparedness

Lederberg, J., Shope, R. E., & Oaks Jr, S. C. (1992). Emerging infections: microbial threats to health in the United States.

Lemieux, A., Colby, G. A., Poulain, A. J., & Aris-Brosou, S. (2022). Viral spillover risk increases with climate change in High Arctic Lake sediments. *Proceedings of the Royal Society B*, *289*(1985), 20221073.

Souza, W. V. D., Albuquerque, M. D. F. P. M. D., Vazquez, E., Bezerra, L. C. A., Mendes, A. D. C. G., Lyra, T. M., ... & Martelli, C. M. T. (2018). Microcephaly epidemic related to the Zika virus and living conditions in Recife, Northeast Brazil. *BMC public health*, *18*, 1-7

Todd, A., & Bambra, C. (2021). Learning from past mistakes? The COVID-19 vaccine and the inverse equity hypothesis. *European journal of public health*, *31*(1), 2-2.

Van Doorn, H. R. (2014). Emerging infectious diseases. *Medicine*, *42*(1), 60-63.

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Popular Article

De Novo Domestication: An Accelerated Plant Breeding Approach Towards New Crop For Food Security

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Abstract

De novo domestication is a novel approach to crop breeding that involves introducing domestication genes into semi-domesticated and non-domesticated plants. This method preserves the intrinsic favourable phenotypes of crop wild relatives or semi-wild plants, such as their resistance to biotic and abiotic stresses, while enabling them to gain desirable domestication features. While the conventional approach to domesticating wild plants remains a viable means of producing new crops, the latest advancements in CRISPR-Cas technology allow for the quick de novo domestication of wild plants. The *de novo* domestication strategy, its prerequisites, and its impact on the development of orphan crops, perennials, and polyploids are covered in this section.

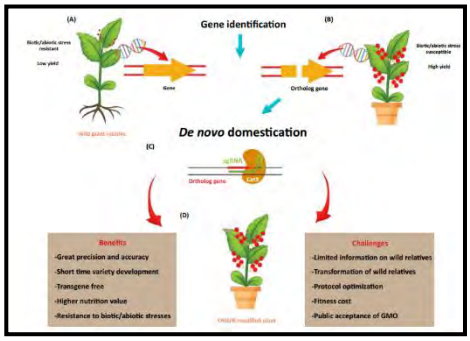
Introduction

Major crops were first domesticated about 12,000 years ago. Over 2500 plant species are thought to have been domesticated or semi-domesticated for food. Three primary crops—rice, wheat, and maize—provide 60% of the calories consumed by humans today, although only 20 plant species account for 90% of the world's calories. Other minor or orphan crops that have the potential to address food security challenges have lost ground to the big three as a result of the attention paid to them, both commercially and agriculturally. Therefore, de novo domestication of wild or semi-wild plants through genetic manipulation of the homologous domestication genes represents a second route for future crop design, in addition to the sluggish development of currently well-cultivated crops through conventional breeding. *De novo* domestication, which involves introducing domestication genes into non-domesticated and semi-domesticated plants, is a novel breeding technique for new crop species.

Pre-requistes of *de novo* domestication

- Prior knowledge of domestication traits and gene loci

- Genome sequencing of the target minor or wild crop
- Orthologous genes for *de novo* crop domestication
- Reference genome sequence of related species
- Efficient transformation protocol



(*Source*: Khan *et al*., 2019)

Fig. 1. Schematic representation of *de novo* domestication and its challenges and benefits

De novo domestication and crop improvement

De novo domestication of orphan crops

Wild plants that are not well-known to the general public and have not undergone extensive artificial selection are known as orphan crops. Local populations have been using orphan crops for millennia due to their superior nutritional qualities and environmental adaptability. However, because to their lower production, narrower range, and modest resistance to pests and diseases, they are unable to compete with important crops. Although it can be difficult to improve the quality of orphan crops through conventional breeding, guided nuclease genetic alteration provides an excellent platform. Recently, *de novo* domestication using genome editing has been shown for the orphan Solanaceae crop *Physalis pruinosa*, sometimes known as "groundcherry" (Lemmon *et al*., 2018). They altered tomato domestication and improvement orthologues that regulate fruit size, flowering time, and plant architecture, thereby improved these major productivity traits.

De novo domestication of perennials

A perennial grain crop, which does not need to be grown every year, would produce a long-lived deep root system capable of sequestering carbon while efficiently absorbing nutrients and water. Perennial legumes and this crop could be interplanted to provide extra ecosystem services like nitrogen fixing. Moreover, in a perennial grain domestication programme, the extensive root systems, vast storage reserves, and stress tolerance of perpetual forebears would offer plenty of mechanisms for creating new crops adaptable to a broad range of challenges. More species with desired features are being bred with the purpose of adding them to the list of domesticated plants. Numerous underutilized, nitrogen-fixing legumes may be grown as crops on low-input, low-nutrient soils, and frequently have high nutritive value. Perennial plants generally

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have more developed root systems than modern annual crops, which helps to maintain soil quality while also enabling them to be less reliant on water and fertiliser. Therefore, efforts to domesticate perennials and turn annuals into perennials are currently underway in the breeding process.

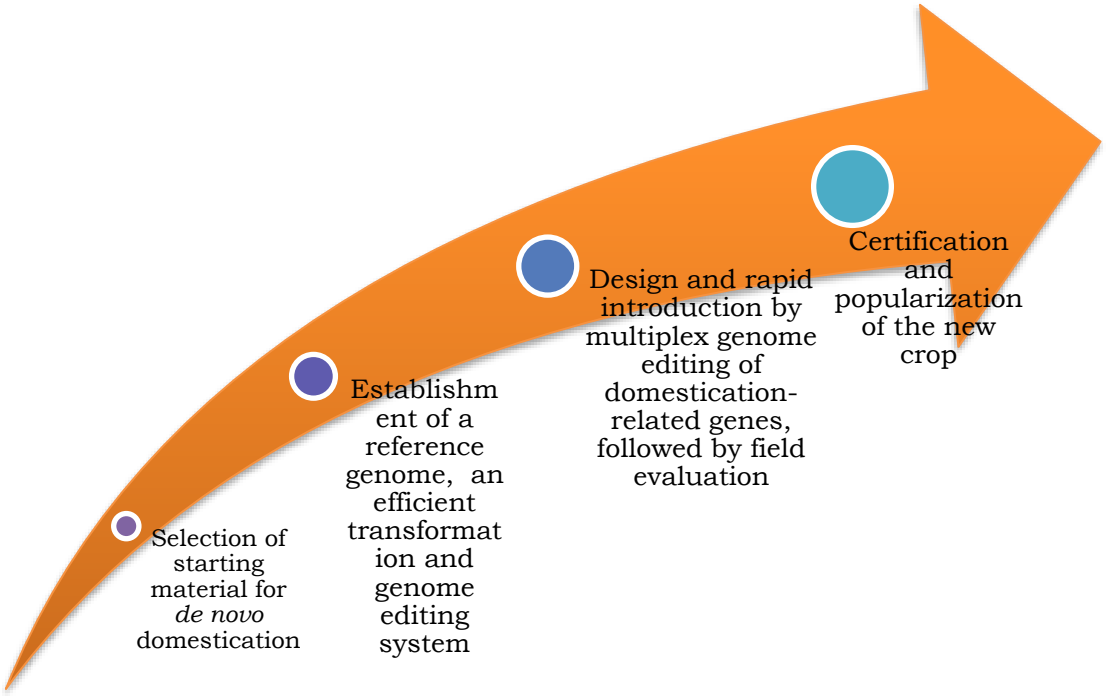

Fig. 2. Road map of *de novo* domestication

***De novo* domestication of polyploids**

In flowering plants, polyploidy is a prevalent method of evolution that arises largely via whole genome duplications or interspecific hybridizations. Polyploid plants offer substantial advantagesin biomass, vigorousness, and powerful response to environmental changes. More advantageous genetic variations, such as disease resistance, environmental adaptability, and enhanced local environment adaptation, can be found in polyploids. When it comes to certain features, such bigger seeds or grains, some polyploids display "gigantism." It is well known that polyploid plants offer advantages in terms of growth vigour and environmental adaptation. Consequently, crop polyploidization might be crucial to the development of next-generation crops that are meant to address issues related to food security.

A *de novo* domestication method for *Oryza alta*, an allotetraploid rice, has been published recently (Yu *et al*., 2021). It is the first instance of a polyploid plant and wild cereal being domesticated from scratch. In order to produce the desired features, the authors of this study used CRISPR-Cas9 tools to delete homologs of the genes regulating heading dates, plant height, awn length, grain size, and seed shattering from the *O. alta* genome. Finally, by combining the benefits of polyploidy, functional genomics knowledge of cultivated crops, desirable attributes of wild species, and rapid genetic modification(s) through genome editing *de novo* domestication of *O.*

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alta, a wild allotetraploid rice, the strategy shows a clear path for creating novel crops in the future.

Conclusion

De novo domestication, as demonstrated by recent works, represents a paradigm shift in utilising the natural genetic diversity of plants by introducing traits related to domestication and improvement into wild plants with unique traits through genome editing, even though there is still much work to be done. This is in contrast to the prevailing strategy, which makes use of natural genetic variety to introduce desirable traits—like high grain nutritional content and favoured architectural features—into already-existing crops via genome editing or hybridization. Recent developments in CRISPR-Cas technologies in plants, such as base editing, prime editing, and gene targeting, along with novel genetic transformation methods, are expected to trigger an exciting wave of *de novo* domestication of wild plants to produce products that are suited to specific needs.

References

Khan, M. Z., Zaidi, S. S. E. A., Amin, I., and Mansoor, S. (2019). A CRISPR way for fast-forward crop domestication. *Trends Plant Sci.*, *24*(4), 293-296.

Lemmon, Z. H., Reem, N. T., Dalrymple, J., Soyk, S., Swartwood, K. E., Rodriguez-Leal, D., ... & Lippman, Z. B. (2018). Rapid improvement of domestication traits in an orphan crop by genome editing. *Nat. Plants*, *4*(10), 766-770.

Yu, H., Lin, T., Meng, X., Du, H., Zhang, J., Liu, G. *et al*. (2021). A route to *de novo* domestication of wild allotetraploid rice. *Cell*, *184*(5), 1156-1170.

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Popular Article

"Harnessing Ancient Wisdom: Ethnoveterinary Practices for Immunity Enhancement in Livestock to Beat the Heat"

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Abstract

As global temperatures continue to rise, heat stress poses a significant threat to livestock health and productivity. Traditional and indigenous knowledge of ethnoveterinary practices offers valuable insights into mitigating the adverse effects of heat stress while enhancing the overall immunity of livestock. Ethnoveterinary practices encompass a wide range of traditional and culturally rooted methods employed by livestock keepers. These practices, often passed down through generations, are cost-effective and environmentally sustainable alternatives to conventional veterinary treatments. In the context of climate change and increased heat stress events, their significance is growing. The practices covered in this abstract include dietary interventions, herbal remedies, and management strategies. Local herbs and plant extracts are often administered to livestock to improve their resilience to high temperatures and to strengthen their immune systems. Dietary adjustments that focus on providing the right nutrients can also play a crucial role in preventing heat stress-related issues. Furthermore, the management of livestock housing and access to shade and water are vital considerations in combating heat stress. Understanding these ethnoveterinary practices and integrating them into livestock management not only enhances the animals' immunity but also supports sustainable agriculture by reducing the reliance on synthetic drugs and energy-intensive cooling systems.

Key words: Temperature, livestock, ethnoveterinary, heat stress.

Introduction:

As our world faces the harsh realities of climate change, extreme heat stress is becoming a major concern for livestock farmers. Rising temperatures can have a detrimental impact on animal health and productivity. In the quest for sustainable and effective solutions, we find ourselves turning to age-old practices rooted in the wisdom of our ancestors. Ethnoveterinary medicine, a holistic approach to animal health, is emerging as a beacon of hope for mitigating heat stress and bolstering immunity in our cherished livestock.

Understanding Ethnoveterinary Practices

Ethnoveterinary practices are traditional and indigenous methods of animal healthcare that

have been passed down through generations. They rely on a deep understanding of local ecosystems, plants, and animals. The use of ethnoveterinary remedies is often based on the belief that nature provides all the answers we need to maintain the health and well-being of our livestock.

Immunity Enhancement in the Face of Heat Stress:

As temperatures soar, livestock face increased risks of heat stress, which can lead to reduced feed intake, decreased milk and meat production, and even mortality. Ethnoveterinary practices offer a holistic approach to improving the resilience of animals to heat stress, primarily by boosting their immunity:

1. **Herbal Elixirs and Tonics**
   - Many indigenous communities have harnessed the power of local herbs and plants to create herbal elixirs and tonics that strengthen the immune system of livestock. Ingredients like neem, aloe vera, and ashwagandha are known to have immunomodulatory properties.
2. **Natural Supplements**:
   - Ethnoveterinary practices often emphasize the use of natural supplements, such as mineral-rich clay or seaweed, which can help replenish vital nutrients lost during periods of heat stress.
3. **Traditional Diets**:
   - Local knowledge often guides the formulation of diets that include specific plants or ingredients known for their cooling and immunity-boosting properties.
4. **Body Cooling Techniques**:
   - Traditional practices may also include methods for cooling animals during heatwaves, such as applying herbal pastes or bathing them in water infused with medicinal herbs.
5. **Stress Reduction**:
   - Ethnoveterinary practices recognize the interconnectedness of mental and physical health in animals. Methods for reducing stress, such as aromatherapy or calming herbal infusions, are employed to enhance overall well-being.

The Wisdom of Local Communities

One of the remarkable aspects of ethnoveterinary practices is their adaptability to local ecosystems and cultural contexts. They offer a valuable resource for sustainable agriculture, often relying on readily available plants and materials. Indigenous knowledge is an essential part of preserving these practices, and efforts are being made to document and share these invaluable traditions with the wider world.

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Conclusion

As the world grapples with the challenges of climate change and heat stress, we are rediscovering the wisdom of our ancestors. Ethnoveterinary practices, deeply rooted in local knowledge and nature's bounty, provide us with effective tools to enhance the immunity of our livestock and help them weather the heat. By integrating traditional wisdom with modern science, we can create a more sustainable and resilient future for both our animals and the farmers who depend on them.

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Popular Article

Vaccinia Viral Vectors and Its applications

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Abstract

Vaccinia virus has been constructed to express foreign genes and used as powerful vectors for production of recombinant proteins. Originating from highly efficacious vaccines securing world-wide eradication of smallpox, vaccinia vectors can be used as delivery system for heterologous genes encoding enzymes, antigens and hormones. Concerns about the safety of vaccinia virus have been addressed by the development of vectors based on attenuated viruses. Amongst them, modified vaccinia virus Ankara (MVA) can be considered as current choice for clinical investigation. As compared to replication competent vaccinia viruses, MVA and NYVAC provides similar levels of recombinant gene expression even in non-permissive cells. However, there are still some concerns regarding the safety and efficacy of vaccinia virus. In this article we have briefly discussed the essential information about vaccinia viral vector including its applications.

Keywords: Vaccinia virus, MVA, NYVAC

Introduction

Vectors are defined as the agents that carry selected genes encoding foreign antigens. The vaccinia virus is antigenically similar to smallpox, both viruses being presumably derived from a common ancestor, that led to its extensive use as a vaccine candidate against smallpox. Nowadays, large number of poxviruses are being used as vector such as fowlpox, raccoonpox and canarypox but vaccinia is one of the most extensively used virus amongst them for the development of vector system (3). It is a large DNA virus that replicates within cytoplasm of

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susceptible host cells. The virion comprises of a biconcave core, two lateral bodies and the entire structure is enclosed within lipid envelope.

Replication cycle

In order to replicate inside the host body, initially the vaccinia virus has to adsorb into susceptible host cells for making its way inside by either direct penetration or viropexis. Following the entry, virus particles are uncoated in a two-step process. During the transcription process, early genes are transcribed first followed by intermediate and late genes. Intermediate genes encode the transcription factors required for transcription of late genes. However, late genes encode virion proteins and early transcription factors that are packaged in virions and used in subsequent rounds of infection. Viral genome replication, transcription and assembly occur at juxtanuclear sites. Finally, the virions are released by budding or exocytosis (5).

Types of vaccinia viral vectors

1) **Modified Vaccinia Ankara Vector (MVA):** The MVA vector was developed by serial passage of vaccinia virus in chicken fibroblast tissue culture during the WHO smallpox eradication campaign. It was thought to be derived from ancestral vaccinia virus Ankara strain which was propagated on the skin of calves and donkeys at the Turkish vaccine institute. Herrlich and Mayr have cultivated this virus on the chorioallantois membrane (CAM) of embryonated chicken eggs and thus, it was named as Chorioallantois Vaccinia virus Ankara (CVA). Because of the high safety associated with attenuated phenotype, MVA is being frequently used for clinical research. Additionally, it has the ability to deliver foreign antigens in a highly immunogenic way, which makes it a suitable vaccine vector (4).
2) **NYVAC Vector:** This is a highly attenuated strain of vaccinia virus. It was derived from a plaque-cloned isolate of the Copenhagen vaccinia strain with the deletion of 18 ORFs that contain virulence factors and human host range replication proteins (6). The ORFs were deleted in a manner that prevent the synthesis of unwanted novel gene products.

Insertion sites and advantages

A number of non-essential loci are available within the genome of vaccinia virus for the insertion of foreign DNA. It includes insertion sites such as thymidine kinase (TK) gene and the BamHI site (2). As a vector it confers many advantages such as cytoplasmic replication, broad host range, large viral genome size, well defined gene architecture, economical, high stability and easy administration.

Applications: It has broad range of applications in various fields such as vaccine production, cell

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biology exploration, immunology and enzymology. Here, we have briefly described them as follows.

1) **Prophylactic vaccine production:** Vaccinia viral vector is the most commonly vector in the formation of potential recombinant vaccine. The premise is to insert a gene encoding an antigen from a heterologous pathogen into Vaccinia. Then, the recombinant virus was used as a live infectious vaccine that can induce an antigen-specific immune response in recipient animals (7). Most of the Vaccinia recombinants used to immunize animals are highly effective at inducing both humoral and cellular immunity (Fig.1).
2) **Cell Biology:** The field of cell biology is one of the most rewarding and promising area for the use of Vaccinia vectors. It has been widely used to express various neuropeptides, growth factors, and receptor proteins. The prime advantage associated with this approach is expression of appreciable (microgram) quantities of protein in biologically active form. Recently, the gene encoding yeast mating-factor protease (KEX2) was recombined in a fully functional form into vaccinia (8).
3) **Immunology:** Vaccinia has provided a new dimension to study the immunological interactions between pathogen and target host organism due to its infectious nature and broad host range. Pathogens such as viruses are complex structures that present an antigenic mosaic to the host immune system; thus, it is often difficult to determine which antigen is relevant to the induction of immunity. This problem can be greatly simplified by use of Vaccinia vectors. For example, in the case of acquired immunodeficiency syndrome (ACID), recombinant Vaccinia strains have been constructed which individually express each of the individual type 1 human immunodeficiency virus (HIV-1) proteins, gpl60, gpl20, tat, and reverse transcriptase (1). These recombinants are being used to determine whether the viral proteins are immunogenic or not.
4) **Basic research:** Vaccinia vectors can be used to express and manipulate any DNA sequence of interest, whether they encode antigens, enzymes, or structural proteins. The cloned sequences within the recombinant vectors work as suitable substrates for site-directed mutagenesis procedure. It is a relatively straightforward procedure to prepare a collection of Vaccinia recombinants expressing different genetically engineered forms of the same protein to address structure-function relationships.

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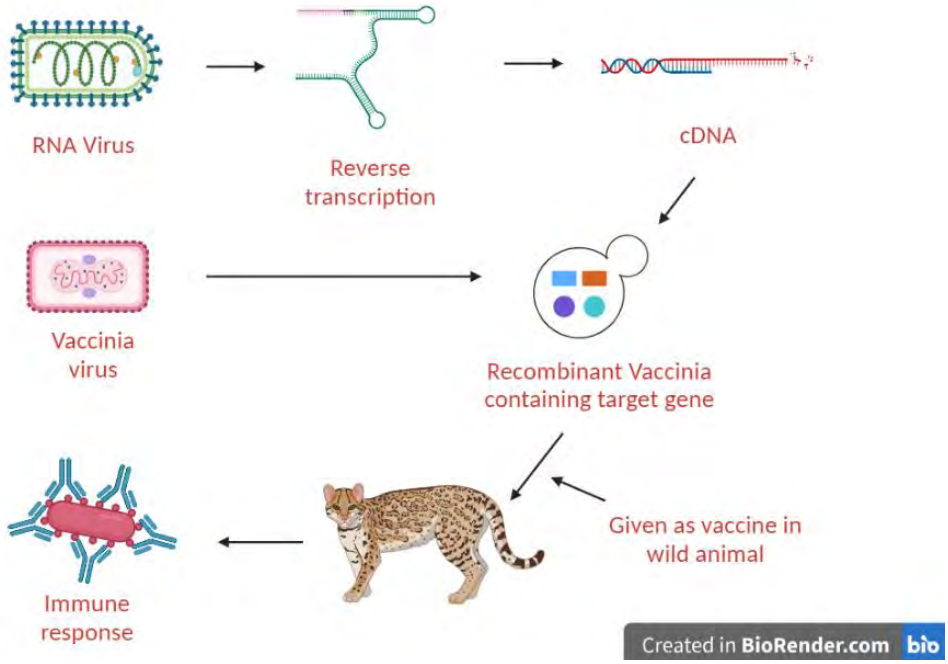

Figure 1. Diagram of Vaccinia viral vector-based vaccine construction

Limitations

Despite having multiple advantages of the Vaccinia viral vectors, the system also has some limitations. It includes lack of large scale and long-term expression capability and additionally, it is of little use to engineer nuclear gene replacements. The use in human population may be less beneficial due to the presence of pre-existing neutralizing antibodies due to its earlier administration as smallpox vaccine.

Conclusions

It is a remarkably powerful experimental vector system. We can easily insert and express any foreign DNA to make recombinants for various studies. Additional information regarding the structure, function and regulation of poxviruses have been widely studied. It is highly likeable that new generations of vaccinia viral vector systems will be developed in near future.

References

Chapman, R., van Diepen, M., Douglass, N., Hermanus, T., Moore, P.L. and Williamson, A.L., 2023. Needle-Free Devices and CpG-Adjuvanted DNA Improve Anti-HIV Antibody Responses of Both DNA and Modified Vaccinia Ankara-Vectored Candidate Vaccines. Vaccines, 11(2), p.376.

Faqih, L., Vallely, P. and Klapper, P., 2023. Genetic stability of SIV Gag/Tat gene inserted into Del-II in modified vaccinia virus ankara after serial passage of recombinant vector in pCEFs cells. Journal of Virological Methods, 312, p.114651.

Kaynarcalidan, O., Moreno Mascaraque, S. and Drexler, I., 2021. Vaccinia virus: from crude smallpox vaccines to elaborate viral vector vaccine design. Biomedicines, 9(12), p.1780.

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Published: 30.10.2023

Nave, L., Margalit, I., Tau, N., Cohen, I., Yelin, D., Lienert, F. and Yahav, D., 2023. Immunogenicity and Safety of Modified Vaccinia Ankara (MVA) Vaccine—A Systematic Review and Meta-Analysis of Randomized Controlled Trials. Vaccines, 11(9), p.1410.

O'Connell, C.M., Jasperse, B., Hagen, C.J., Titong, A. and Verardi, P.H., 2020. Replication-inducible vaccinia virus vectors with enhanced safety in vivo. PLoS One, 15(4), p.e0230711.

Perdiguero, B., Perez, P., Marcos-Villar, L., Albericio, G., Astorgano, D., Álvarez, E., Sin, L., Gómez, C.E., García-Arriaza, J. and Esteban, M., 2023. Highly attenuated poxvirus-based vaccines against emerging viral diseases. Journal of Molecular Biology, p.168173.

Rocke, T., Streicker, D. and Leon, A., 2023. Management of Vampire Bats and Rabies: Past, Present, and Future. In History of Rabies in the Americas: From the Pre-Columbian to the Present, Volume I: Insights to Specific Cross-Cutting Aspects of the Disease in the Americas (pp. 199-222). Cham: Springer International Publishing.

Vogt, E., Sonderegger, L., Chen, Y.Y., Segessemann, T. and Kunzler, M., 2022. Structural and functional analysis of peptides derived from KEX2-processed repeat proteins in agaricomycetes using reverse genetics and peptidomics. Microbiology Spectrum, 10(6), pp.e02021-22.