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An overview of Anthelmintics in Helminthic Infections of Domestic Animals

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The control of parasitic helminthes in domestic animals relies largely on the use of anthelmintic drugs. Although anthelmintic are used in all domestic species, the largest market is undoubtedly the ruminant market, especially cattle, where thousands of rupees are spent annually in an effort to reduce the effect of parasitism.

Since the introduction in the early 1960s of the first broad-spectrum anthelmintic, thiabendazole, followed shortly afterwards by tetramisole, there has been a virtual procession of new highly effective broad-spectrum anthelmintics and considerable confusion reigns as to the merits of the different drugs.

Stages in the development of a typical anthelmintic proceed approximately as follow: First, as mentioned earlier, many thousands of compounds must usually be screened before one is found that shows promise. The screening procedure, in the case of an anthelmintic, could require the demonstration of *in vivo* activity against some convenient parasite e.g.; *Nippostrongylus brasiliensis, Hymenolepis nana* of laboratory rodents; *Ascaridia galli* or *Heterakis gallinarum* of chickens. A preliminary estimate of mammalian toxicity, the LD50 (median lethal dose), is also obtained from experiments on rats or mice. The activity screening tests and preliminary toxicity studies greatly reduce the list of suitable candidates but are of little value in predicting the effect of a particular drug either on a particular species of domestic animal or on its customary assemblage of parasites. Thus, ascarids are very sensitive to piparazines, whereas hookworms are quite refractory. The necessary information can be obtained only through experiments on domestic animals and the parasites for which the anthelmintic is intended.

When a manufacturing firm produces a new drug, it should pass through following steps:

1. It must submit specimens of the product and all chemicals used in it manufacture along with complete information on its chemistry, process of manufacture, and quantitative assay methods.
2. Protocols and results of all experiments conducted on the pharmacological activity and mammalian toxicity of the compound and copies of all relevant published reports must also be submitted.
3. Drugs intended for animals that are used for human food must be accompanied by data on tissue residues and the route and rate of excretion of the parent compound and its metabolites.
4. The amount and the structure of the longest residing tissue residues must also be determined and, if the substance has similarities to know carcinogenic chemicals, a two-year toxicity experiment is then required in rats and mice.
5. Phytotoxicity and the effects of the drug on fish and other lower animals must also be vigorously studied.
6. Before a new anthelmintic can be approved, well-controlled experiments must be carried out involving slaughter of the test animals' determinations of residual worm burdens after treatment.
7. Several independent laboratories must conduct confirmation experiments as a series of field-tests in different geographic regions.
8. The package label is required by law to bear all the necessary cautions and to notify the user about all adverse reactions that have been discovered.
9. Six months after a product enters the market and at regular intervals thereafter, the manufacturer is required to report to Food and Drug Administration (FDA) any adverse reactions that have come to light and to add appropriate notices to the label or withdraw the product from the market place.

Properties of Ideal Anthelmintic

It should be efficient against all parasitic stages of a particular species.

1. It should be non-toxic to the host.
2. It should be rapidly metabolized and excreted by the host.
3. It should be easily administered.
4. The cost of an anthelmintic should be reasonable.

Use Of Anthelmintic

Anthelmintic are generally used in two ways, *viz;*

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1. Therapeutically- to treat existing infections or clinical outbreaks.
2. Prophylactically- in which the timing of treatment is based on knowledge of the epidemiology.
3. Clearly prophylactic use is preferable where administration of a drug at selected intervals or continuously over a period can prevent the occurrence of disease.

Therapeutic Usages

When used therapeutically, the following factors should be considered.

1. If the drug is not active against all stages it must be effective against the pathogenic stage of the parasite. e.g.; the larval stages of *F.hepatica* may cause acute disease, but some drugs are active only against adult flukes.
2. The use of the anthelmintic should, by successfully removing parasites, result in cessation of clinical signs of infection such as diarrhoea and respiratory distress; in other word s, there should be a marked clinical improvement and rapid recovery after treatment.

Prophylectic Usage

Where anthelmintics are used Prophylectically, the following points should be considered.

1. The cost of prophylactic treatment should be justifiable economically.
2. The cost-benefit of anthelmintic prophylaxis should stand comparison with other Control methods.
3. It is desirable that the use of anthelmintics should not interfere with the
4. development of an acquired immunity, since there are reports of outbreaks of disease in older stock, which have been overprotected by control measures during their earlier years.

Major Groups of Anthelmintics

The drugs in current use can be classified as either broad spectrum or narrow spectrum. Broad-spectrum drugs include the benzimidazoles, imidothiazoles, tetrahydropyrimidines, organophosphorus compounds, ivermectins, and nitroscanate. Narrow spectrum anthelmintics include piparazines and compounds such as disophenol and cIosantel, which are occasionally used to treat specific gastrointestinal nematodes.

The major groups of anthelmintics currently in use against nematodes, trematodes, and cestodes are shown in table-l

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Nematodes

Chemical Groups	Drugs	Dose & rout
Piparazines	Piparazines salts Diethylcarbamazine	110-220 mg./Kg. -Oral Poultry - 0.2-0.4 % in feed - 0.1-0.2 % in water Over few hours - 50 - 100 mg./bird - 55- 110 mg./Kg. – Oral
Imidazothiazoles	Levamisole & Tetramisole	8 mg./Kg. In all animal -Oral 6 mg./Kg. *Sic* inj.in cattle (13.15 % soul. @ 2 ml./45 Kg.)
T etrahydropyrimidines	Pyrantel & Morantel	10 mg./Kg. –Oral 13.5 g. fteebase to release 90 mg./Kg./day for at least 60 days.
Benzimidazoles	Albendazole Cambendazole Fenbendazole F ebental Mebendazole Oxibendazole Oxfendazole Parbendazole Thiabendazole	5 - 7.5 mg./Kg. -Oral 20 -25 mg./Kg. -Oral 5 - 7.5 mg./Kg. - Oral 5 - 7.5 mg/Kg. - Oral 15 mg./Kg. - Oral 10 mg./Kg. - Oral 5 mg./Kg. - Oral 20 -30 mg./Kg. --Oral 66 -110 mg./Kg. --Oral
Pro-benzimidazoles	F ebental Netobimin Thiophanate	6 -20 mg./Kg. -Oral 7.5 mg./Kg. -Oral 50 mg./Kg. -- Oral
Macrolides	Ivermectins & Doramectin Milbemycin D Moxidectin Milbemycin Oxim	0.2 mg./Kg. - *SIC* For aJI animal Dogs 0.006 mg./Kg.(monthly for heartworm) 1 mg./Kg. Once monthly-Oral 0.2 mg./Kg. - *SIC* 0.5 mg/Kg. - once monthly For heartworm and hookworms in dogs.
Organophosphates	Diclorvos Haloxan Trichlorphon (Metriphonate)	20-40 mg./Kg. – Oral 60 mg./Kg.—Oral 40 mg./Kg. -- Oral
Salicylanides	Closantel	*5 mg./Kg.-S/C* 10 mg./Kg. -- Oral
Substituted Phenol	Nitroscanate	50 mg./Kg. in dog- Oral

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TREMATODS

Salicylanides	Closantel	5 mg./Kg. – *SIC* 10 mg./Kg. – Oral
	Oxyclosanide	10 -15 mg./Kg. -Oral
	Rafoxanide	7.5 mg./Kg. - Oral 3.5 mg./Kg. - *SIC*
Substituted Phenols	Diamphenethide Nitroxynil	100 mg./Kg.Sheep-Oral 10 m ./K .-*S/C*
Sulphonamides	Clorsulon	7 mg./Kg. -Oral 4 mg./Kg -*SIC*
Benzimidazoles	Albendazole	7.5 mg./Kg.Sheep Oral 10 mg./Kg. Cattle Oral
	Luxabendazole	110 mg./Kg. Sheep Oral
	Triclabendazole	10 mg./Kg. Sheep Oral 12 mg/Kg. Cattle Oral

CESTODES

Salicylanides	Niclosamide	150 mg./Kg. Dog -Oral
Substituted Phenols	Nitroscanate	50 mg./Kg. Dog-Oral

Sulphonamides	Clorsulon	7 mg./Kg. –Oral 4 mg./Kg. -*SIC*
Pyrazinoisoquinolines And Benzazepines	Praziquantel	5 mg./Kg. Dog- Oral 5.5 mg./Kg. *Dog-SIC* or I/M

Routes Of Administration

Anthelmintics for treatment of helminthes infections may be given parenterally (e.g. Ivermectins) topically (e.g. Levamisole), orally (e.g. Benzimidazoles) or by intraruminal injection (e.g. Oxfendazole). Oral administration is common by drenching with liquids or suspension or by the administration of tablets to small animals and by the incorporation of the drug in the feed or water for farm animals. Oral formulations are also available in the form of gels, pastes and granules. Paste (e.g., Ivermectins) formulation have been introduced especially for horses. Pour-on or spot-on formulations have systemic action when applied to the skin. Injection of compounds directly in to the rumen of cattle and sustained release devices (slow-release Morantel tart rate bolus) being designed to remain in the rumen/reticulum and release anthelmintics over a period, this prevents the establishment of parasite populations and thus limits the contamination and the occurrence of disease.

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