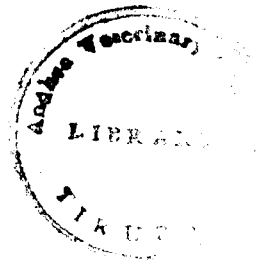


HELMINTH PARASITES OF DOGS IN ANDHRA PRADESH

THESIS SUBMITTED TO THE
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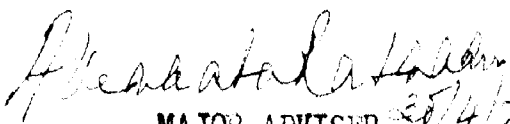
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TIRUPATI.

April, 1970

C E R T I F I C A T E.

THIS IS TO CERTIFY THAT this thesis/dissertation
entitled "Helminth Parasites of Dogs in Andhra Pradesh"
submitted for the degree of M.Sc. (in Veterinary
Science) in the Major subject Parasitology, of the
Andhra Pradesh Agricultural University is a result
of bonafide research work carried out by
Sri D. Ramalingeswara Sarma, under my supervision
and that the Thesis has not formed in whole or in
part, the basis of the award of any degree, diploma
or any other similar degree of distinction.

The assistance and help received during the
course of investigation have been fully acknowledged.


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30.4.70

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INTRODUCTION.

INTRODUCTION.

Dogs are reared by a number of people as pets and also for watch. Shepherds keep dogs to watch their flocks. So they enjoy intimacy with man and domestic animals.

Dogs are susceptible to a variety of Helminths which are transmissible to man and other animals. Their role as disseminators of Zoonotic Helminthic infections is of great public health importance. The fact that diseases like Hydatidosis, Ancylostomiasis etc., are mostly of Dog origin, makes the study of Helminth parasites of Dog, important which is second to none.

A large number of different types of Helminths, have been found in dogs in various parts of the world. Some of them are important in causing pathogenesis in dogs and others are important since they may be transferred in some stage of their development to man and other livestock.

The incidence of Helminths in dogs will also give us a pointer for similar infections in human beings in that particular area, as dogs and human beings have many Helminths in common.

Knowledge of dog helminths is specially important to those persons engaged in the breeding, maintenance and use of dogs as experimental animals.

With such studies efficient control programme can be devised to tackle parasitism in dogs and in such infections in man transmissible from dogs as well.

Though detailed surveys of Helminths in dogs were undertaken in different countries, not much adequate information is available in this vast country with different climatic conditions in different zones.

Such studies were not made in Andhra Pradesh. Hence the present study was undertaken.

1) to report the incidence of Helminth parasites of dogs in Andhra Pradesh.

2) to stress the incidence of these parasites as of zoonotic importance.

CHAPTER I

REVIEW OF LITERATURE

REVIEW OF LITERATURE.

Much work has been reported from various countries on Helminth parasites of dogs with reference to their morphology, Biology and Pathogenicity.

Dogs being closer to human beings, as pets and sentries, the parasitic diseases of dogs gained zoonotic importance. Hence, several countries reported the incidence and distribution of Helminth parasites of dogs stressing their zoonotic importance.

Apart from studies and reports on incidence of a single particular infection of Helminths in dogs, Recently, Jordon and Vaughn (1960), Turk (1962), Vaughan and Murphy (1962), Braun, John and Charles, B. Thayer (1963), Worly David (1964), William G. Lillis (1967) and Burrows (1968) from several states of United States of America; Jimenez (1959), Corsalini (1958), and Digivseppe, Di Matteo, Gramenzi and Restani (1960) from Italy; Lewis (1958), Cook (1964), Oldham (1965) and Pouplard (1967) from United Kingdom; Thomas Ralphs (1960) from Germany; Stankiewicz, Wadysaw, Markiewicz and Pietraszek (1962) from Warsaw area; Williams and Manning (1964) from Bermuda islands; Delyanova (1957) from various geographical zones of U.S.S.R.; Freitas (1957) from Brazil;

Styles (1967) from Mexico city; Fragade Azeredo, Dasneves and Palmeiro (1963) from Lisbon; Mimioglu, Mihri, Hevsatguralp and Fahri Sayin (1960) from Ankara; Sedighian (1969) from Iran; Daynes (1964) from Madagascar; Sto, Jird, Tongchi, Papsaratharn, Banchong and Tongkoong (1962) from Bangkok; Elsa, Mustapa and Soliman (1967) from Southern Sudan; Clarkson and Owen (1952) from Brahma Islands; Roudie (1962) and Liekian Joe (1963) from Malaya; Webster (1958), Gemmel (1958), and Sprent and Barrett (1964) from Australia, Watanabe, Noguchi, Mochise and Mackawa (1959) from Shisoka prefecture, Japan; Ash Lawrence (1962) from Hawaii, reported the incidence of Helminths of interest, in dogs.

Dissanayake (1961) recorded helminths of dogs in Colombo with a discription of new species Heterophyopsis yahi. He also gave a checklist of Helminth parasites of dogs. Senaviratna (1962) listed Helminth parasites of dogs from Ceylon. Apart from these surveys, Soulsby (1965) and Soulsby (1968) gave the list of helminths found in dogs along with description of type species. Yamaguti (1961) noted the Helminths of dogs in several families with descriptions of some

type species. Still the literature on Helminthic fauna of dogs is increasing round the globe.

The literature on Helminthic fauna of dogs in India, is far from adequate, considering the vastness of the country with different climatic conditions.

Sondai (1923) examined pariah dogs in Lahore and reported upon the parasitic worms, particularly the tape worms. He recorded nine species of Cestodes, Dioylidium walkeri, D. serrocoronatum, D. garleyi, Multiceps multiceps, M. serialis, M. gaikari, Taenia hydatigena, T. ovis and Echinococcus granulosus of which D. walkeri was a new species. Echinococcus granulosus was found to be occasional as it was recovered in one dog.

Pillai (1927) recorded Spiroseron sanguinolenta in the oesophagus of two dogs.

Rao and Ayyar (1932) recovered and studied Heterophyes heterophyes in three dogs in Madras and recorded Heterophyes pariscus, a new species in another.

Acharya (1933) examined 50 dogs and reported the incidence of Helminths in Lucknow. Among the Nematodes,

Ancylostoma caninum was found in 98%; Spirocerca sanguinolenta in 14% and Toxocara canis in 6%. Among the cestodes Dipylidium caninum was found in 22%, Taenia serrata in 16%, Taenia marginata in 14%, and Taenia oenuryus in 2% of dogs examined. The same author (1939) gave an account of the incidence of Helminths in 200 pariah dogs. It was reported that 175 (87.5%) dogs harboured Ancylostoma caninum; 71 (35.5%) were infected with Spirocerca sanguinolenta; 13 (6.5%) had Toxocara canis; 13 (6.5%) were found infected with young forms of Spirocerca sanguinolenta; 4 (2%) had Chlamydonema species; 27 (13.5%) harboured Opisthorchis nevera; 144 (72%) had Cestodes (Dipylidium caninum, Taenia pisiformis, T. hydatigena, Echinococcus granulosus and Multicapsa gaiseri). The record of the nematode worm of the genus Chlamydonema in the stomach of a dog was not recorded earlier.

Verma (1935) recorded a species of Echinochasmus, a heterophyid, and a third species under a new genus Eriothoschasmus (E. caninum), from dogs at Calcutta.

Rao (1935) recorded the Lung flukes, Paragonimus westermani in two dogs in Madras presidency and later

in 1937 recorded the eggs of Salistocoma aria in faeces.

Sami (1938) examined 156 pariah dogs and recorded Echinococcus granulosus in 45, Taenia hydatigena in 29, Trasacaria lumbata in 22, Onithorchis caninus in 14 and Dipylidium caninum in 6 of them.

Maplestone and Bhaduri (1940) studied parasites of dogs with the main intention to judge the incidence of Echinococcus granulosus. They provided a complete list of fifty worms known upto that time and recorded 21 helminths of which 6 trematodes, one cestode, two nematodes and one acanthocephalid which had not been recorded from dogs in India earlier. They emphasized that Heterophyes heterophyes and Onithorchis felinus were potential parasites of man and the incidence of Echinococcus granulosus was fairly high.

Bhat (1942) recorded Salistocoma aria in dogs in Bangalore.

Nadaliar (1943a) recorded Onithorchis parvus from the gall bladder of dog for the 1st time in South India. The same author (1943b) recorded a female specimen of Richaria Nichayri from intestine of a dog in Madras.

Krishnamurthy (1949) reported the incidence of Craticercus callulosus in myocardium, skeletal muscle and brain of a dog.

Rao (1952) reported schistosomiasis from dogs in Bombay State.

Chatterji (1954) recorded Echinostomum canis, a new species from the intestine of a dog at Allahabad.

Varma (1955) examined faecal material of a dog in Bihar and found eggs of Gnathostoma spinigerum.

In a survey of Helminth parasites of dogs in Uttar Pradesh, Bihar, Bengal, Assam and Orissa, Thapar (1956) reported Echinococcus granulosus, Dipylidium caninum, Taenia pisiformis, Ancylostoma caninum, Microfilaria immitis, Microfilaria species female, Spirocerca sanguinolenta and Toxocara canis.

Chandrasekharan, Sastry and Menon (1958) reported on the incidence and lesions of canine Spirosercosis in Madras. Spiroserca infection was found to be common in alsatian rather than other breeds. Majority of the cases were in age group of 1 to 7 years.

Rao (1958) while conducting a survey in Madras recorded Ancylostoma caninum (88%), Taxocara canis (28%), Dipylidium caninum (36%), Taenia hydatigena (8%), Taenia species (4%), Heterophyas heterophyas (24%), Stictodera manilensis (?) (12%), Galactosomum species (4%), Haplorobis yokokawai (4%), Heterophyid species (4%), Episthemium caninum (Episthocasmus caninum) (4%), of the 26 dogs examined. He gave the worm load of each parasite in the host and also gave the sex ratio of the nematodes. He also provided a consolidated list of helminths of dogs and cats in India.

Patnaik (1959) studied trematode parasites from 15 stray dogs in Orissa and recorded Onithophoris felina in livers of 11 dogs, Echinochasmus perfoliatus in intestines of 9 dogs, cysts of Paragonimus westermani in lungs of 3 dogs and Schistosoma suis in the liver of one dog.

Gupta and Pande (1962) reported pulmonary Spirocercoosis and mentioned that this parasite was encountered in the oesophagus and aortic tumour in 23 out of 77 postmortem examinations.

The same authors (1963) studied the genus Echinochasmus with remarks on the species occurring in

Indian carnivores. They stated that the genus Echinocasmus is represented in the Indian carnivores by 3 species viz., E. perfoliatus, E. corvus (Syn: E. caninum) and E. ganai.

The same authors (1963) reviewed the genus Opisthorchis and described Opisthorchis caninum.

Rao and Niphadkar (1962-63) described Echinostoma Nehmani, new species from dogs in Bombay.

Sharma and Chitakara (1963) recorded Echinococcus granulosus infection in 37 dogs out of 460 examined from Amritsar.

Patil and Lakshmi (1965) reported the incidence of spirocerosis in dogs and cats.

Sen (1965) recorded Heterophyes heterophyes from a dog from the Western part of India (Bombay).

Malaki (1966) made a survey of gastro intestinal parasites of 61 dogs belonging to four different breeds (11 Alsatians, 10 terriers, 3 golden retrievers, one pomeranian and 11 non-descript) in Bangalore). Ancylostoma caninum with an average of 57 worms per dog, was found in 45 dogs (73%); Spizoceros lund with an average of 11 per dog was found in 34 dogs (56%); Oestodes with an average

of 8 per animal, were found in 59 dogs (96%),. Multiple infections with a maximum of three species were recorded in 10 dogs. The combination of hook worms and ascarids, was found to be common in pups with prenatal infection, while hook worms and tape worms was common among adult dogs aged 2 years. *Spiraeocera* was recorded in unusual situation in the wall of rectum and lung tissue. The species recorded were *spirocerca lumi*, *Ancylostoma caninum*, *Trichoara canis*, *Dipylidium Caninum*, *Taenia hydatigena*, *T. ovis*, *Physalopora canis* and *Acanthocephala* species.

Deodhar, Patil Kulakarni and Karyakarte (1967) reported the occurrence of *Axyechinostomum Munshi* n.sp. in dogs in Bombay.

Patnaik (1967) reported the occurrence of *Echinocasmus japonicus* in dog in Orissa.

Sahasrabudhe and Shaw (1967) recorded the occurrence of *Exocorybium inermi* and *Echinocasmus cervus*, *Haploerchia taichui* in intestines and *Oniatharobia caninus* from the liver, gall bladder and pancreas in dogs at Jabalpur.

Ramakrishna Reddy (1967) examined 50 dogs on postmortem and reported *Oniatharobia felinus* in one

dog (2%), Heterophyes heterophyes in 2 dogs (4%), Echinochasmus perfoliatus in one dog (2%), Rabinostrongylus malayanus in one dog (2%), Stictodora species in 2 dogs (4%), Haplorhynchis kaichui (8) in one dog (2%), among trematodes; Dipylidium caninum in 10 dogs (20%), Taenia hydatigena in 6 dogs (12%), Rabinostrongylus granulosus in 4 dogs (8%) among Cestodes; Ancylostoma caninum in 47 dogs (94%), Spirocerca luni in 21 dogs (42%), Taxocara canis in 8 dogs (16%), Gnathostoma spinigerum in 4 dogs (8%) among nematodes. Opisthorchis felinus was found in the small intestine, an unusual situation. One dog was found to be parasitized with 8 species of Helminths. The sex ratio of nematodes was also given.

Rao and Anantaraman (1967) reported the incidence of trematodes of Heterophyidae from dogs and cats in Madras and recorded Heterophyes heterophyes, Haplorhynchis kaichui, H. yokogawai, Stictodora malayanensis from dogs.

Sahasrabudhe, Dubey and Srivastav (1969) examined 74 stray dogs at necropsy for Helminth parasites from two localities of Madhya Pradesh Bhow and Jabalpur. The species recorded were Encyrtosium incanum in 1.35%, Echinochasmus corvus in 13.51%, Haplorhynchis kaichui in 14.8%, Archytemonastomum antrodryfex in 1.35%.

Opisthorchis caninus in 31.08%, Spirometra ranarum in 1.35%, Spirometra arinacei auroral in 1.35%, Dioylidium caninum in 47.29%, Taenia hydatigena in 22.9%, Multicoeca raikeri in 2.70%, Echinococcus granulosus in 40.84%, Craticercus cellulosa in 1.35%, Toxocara canis in 2.70%, Ancylostoma caninum in 89.16%, Spireocerca lupi in 54.05% and Physaloptera pascuentialis in 1.35% of dogs. They stressed the incidence in relation to public health.

Sahai (1969) made a survey of helminth parasites of stray dogs in and around Bareilly (U.P) and reported the incidence of Opisthorchis poverca in 60.78%, Echinococcus perfoliatus in 41.17%, Haplorenchis tschui in 25.49%, Schistosoma incognitum in 7.84%, Dioylidium caninum in 39.21%, Taenia hydatigena in 31.37%, Echinococcus granulosus in 5.88%, Ancylostoma caninum in 70.58%, S. lupi in 19.60%, T. canis in 7.84%, Physaloptera canis in 1.96% (only one dog) of the dogs examined. One acanthocephalid was also recorded in one dog.

Ray (1969) reported Gnathostoma spinigerum infection in a dog in Orissa.

Fauna of British India including Ceylon and Burma was published with reference to cestodes by Southwell (1930) and a synopsis of the families and genera of the nematoda/ by Baylis and Daubney (1926).

Apart from these surveys, check-lists of helminths of dog were published, from time to time, by Gaiger(1915), Bhalerao (1935), Mudaliar and Alwar (1947a) and 1947 b), Ramanjachari and Alwar (1954), and Alwar and Lalitha(1961).

CHAPTER II

MATERIALS AND METHODS

MATERIALS AND METHODS.

MATERIALS:

Materials were collected from dogs on postmortem from various places. The places chosen were Tirupati (Chittoor District), Chittoor, Vijayawada (Krishna District), Narasapur (West Godavari District) and Hyderabad.

Unclaimed stray dogs which were caught and restrained by Municipalities of the above places for destruction, were obtained, for collection of Helminths on postmortem. So also dogs sent to Veterinary Hospitals for destruction were obtained for this study. These dogs were of ages varying from 4 months to 6 years. Particulars of the number of dogs from which materials was collected against the places were indicated in Table No. I.

METHODS:

Each carcass was examined in accordance with a definite procedure. Peripheral blood smears were taken, stained by Leishman and Giemsa stains and examined for blood parasites. Natural orifices were also examined for the presence of any parasites and other abnormalities.

TABLE No. I

Showing the number of Dogs from which the material
was collected against the places.

Place.	Total number of Dogs examined.
Tirupati	50
Chittoor	30
Vijayawada	30
Hyderabad	42
Narasapur	48

The body was opened from the ventral side and after ligating the different regions of the alimentary tract namely Oesophagus, Stomach, small intestines and large intestines, it was removed along with other organs. The ligated portions of the Alimentary tract were opened separately into trays, and parasites collected. The mucosa was scraped and the material diluted with water, screened and searched for any forms of parasites. Similarly the different organs namely lungs, liver, heart, spleen, pancreas, aorta, kidneys, and bladder were separately examined for parasites. Subcutaneous tissue, musculature and brain were also examined. All the parasites were removed and placed in a suitably labelled bottles containing physiological saline.

The trematodes and representative portions of tape worms were flattened, fixed in 5% warm formalin and preserved in the same fluid; small fragile trematodes were fixed in warm 70% alcohol and preserved in the same fluid with a few drops of glycerine. Nematodes were fixed in 5% warm formalin or 70% alcohol and preserved in the same fluid. The preserved Helminths were further processed for identification.

In the study of the morphology of Heterophyid trematodes, the armature of the genotype is of importance. It was found difficult to recognise it in stained mounts. Rao (1958) used "Berlese's Medium", commonly used for clearing arthropods, to make the specimens completely transparent. In such specimens the chitinous armature showed itself very distinctly. In the present study in addition to "Berlese's Medium", carbolic acid and lactophenol which were used as a clearing agent for nematodes, were also found to be satisfactory for the said purpose.

STAINING:

- 1) The trematodes (except the ones preserved in 70% alcohol, which were directly stained) and Cestodes preserved in 5% formalin, were washed in running tap water for 24 hours.
- 2) They were kept in staining solution; Grenacher's acetic alum carmalum for about 24 to 48 hours.
- 3) The specimens were preferably overstained and destained in 1% acid alcohol until the internal structures were clearly visible.
- 4) The specimens were thoroughly, washed in water and passed in ascending grades of alcohols i.e. 70, 90 and absolute. Each 20 minutes.

5) They were cleared in clove oil.

6) Permanent mounts were made in canada balsam.

For differential staining of various structures of trematodes including spines of echinostomes and Heterophyids , Horen's Trichrome stain was used and the method followed as described by Noble and Noble (1962) and Sundaram (1968) with a slight modification.

The nematodes preserved in formalin, were washed well under tap water for a few hours, dehydrated in ascending grades of alcohol (70%, 90% and absolute) and cleared in carbollic acid or lactophenol. The nematodes preserved in 70% alcohol were processed through 90% and absolute alcohols and cleared in lactophenol.

EXAMINATION:

The specimens were examined under Leitz microscope, under low and high power.

Photographs were taken and camera lucida drawings were made wherever necessary.

CHAPTER III

RESULTS.

RESULTS.

200 non-descript stray dogs, obtained at different places in Andhra Pradesh, were autopsied and the helminth parasites collected. All the helminths collected were identified and their number determined. In determining the number of cestodes, scolices were counted individually and no strobila without a scolex was taken into account. In case of nematodes, the number of males and females was also ascertained.

The following species were identified. Seven species of trematodes, four species of cestodes and four species of nematodes were recorded.

A. TREMATODES:

1. Opisthorchis caninus Lewis and Cunningham, 1872.
2. Opisthorchis felinus Revolta, 1884.
3. Haplorchis taichui Nishigori, 1924
4. Heterophyes heterophyes Siebold, 1852
5. Echinostomum perfoliatum Ratz, 1908
6. Echinostomum japonicum Tanabe, 1926
7. Stictodara species (Stictodara manilensis B) Leese, 189

B. CESTODES:

1. Taenia hydatigena Pallas, 1766
2. Taenia multiceps Leake, 1780
3. Dipylidium caninum Linnaeus, 1758
4. Echinococcus granulosus Batsch, 1786.

C. HEMATODES:

1. Ancylostoma caninum Ercolani, 1859
2. Ancylostoma brasiliense Gomes de Faria, 1910
3. Spirocerca lupi Rudolphi, 1809
4. Tomocera canis Verner, 1782.

The incidence of Helminth parasites in dogs has been tabulated against places in Table No. II. It is seen that a large percentage (89.5%) of dogs harbour one or the other helminth either singly or in combination. Only 21 dogs are free from any helminthic infection. Of the places Chittoor and Hyderabad had 100 percent incidence followed by Vijayawada, Tirupati and Narasapur with 96.6%, 84%, and 75% respectively.

The prevalence of specific helminth parasites in the infected dogs has been shown in Table No. III. Of the trematode infections Opiathorchis species - O. caninus and O. felinus appeared to occur in 5% and 4% of the dogs examined, being located mostly in bileducts and gall bladder. Of the Cestodes, T. hydatigena appeared to be the most common tapeworm in dogs, occurring in 15.5% of the dogs examined, being located in small intestines. Of the nematodes, the most common is A. caninum in 80.5% of the dogs examined, followed by

TABLE No. II

**Showing incidence of Helminth parasites in Dogs at
different places in Andhra Pradesh.**

Place	No. of dogs found positive.	Age of the Dogs.	Percentage of incidence.
Tirupati	42	4 months to 6 years.	84
Chittoor	30		100
Vijayawada	29		96.6
Hyderabad	42		100
Narasapur	36		75
Total:	179		89.5

TABLE No. III

Prevalence of specific Helminth parasites in infected Dogs.

Species of helminth parasites.	No. of animals positive	Percentage.
<u>TREMATODES:</u>		
1. <u><i>O. caninus</i></u>	10	5
2. <u><i>O. felinus</i></u>	8	4
3. <u><i>H. suichui</i></u>	3	1.5
4. <u><i>H. heterophros</i></u>	6	3
5. <u><i>E. parfoliatus</i></u>	2	1
6. <u><i>E. japonicus</i></u>	1	0.5
7. <u><i>Stictodara species</i></u> (<i>Stictodara maniliensis</i> B)	1	0.5
<u>CESTODES:</u>		
1. <u><i>T. hydatigena</i></u>	31	15.5
2. <u><i>T. multiceps</i></u>	2	1
3. <u><i>D. caninum</i></u>	23	11.5
4. <u><i>E. granulosus</i></u>	2	1
<u>NEMATODES:</u>		
1. <u><i>A. caninum</i></u>	161	80.5
2. <u><i>A. brasiliense</i></u>	1	0.5
3. <u><i>B. lupi</i></u>	62	31
4. <u><i>T. canis</i></u>	21	10.5

S. lupi in 34% and T. canis in 10.5%. The table also indicates that a variety of trematode parasites infect dogs perhaps due to the accessibility of fish in which the metacercariae of the majority of trematodes listed occur.

The intensity of the Helminthic infections is shown in Table No. IV. Species of Opiathorchis in gall bladder and bileducts among trematodes; T. hydatigena followed by D. caninum in small intestines among Cestodes; A. caninum in small intestine followed by S. lupi in oesophagus and aorta among nematodes were found in large numbers.

The sex ratio in the case of nematode infections in dogs has been tabulated in Table No. V.

Multiple infections with different species of helminths is quite common (Vide Table No. VI).

Toxocara canis with D. caninum in one dog, A. caninum with S. lupi in 44 dogs; A. caninum with Toxocara canis in 16 dogs; A. caninum with Taenia hydatigena in 11 dogs; A. caninum with Echinococcus granulosus in one dog; A. caninum with Dipylidium caninum in 5 dogs; A. caninum with D. caninum

TABLE NO. IV

Showing the intensity of Helminthic infection in Dogs.

Species of Helminths	No. of dogs infected.	Total number of parasites collected.	Average worm load per animal.	Location.	Remarks.
TRICHOCEPHALIDAE:					
1. <i>O. caninus</i>	10	155	15.50	Gall bladder and bile ducts.	
2. <i>O. felinus</i>	8	81	10.12	Bile ducts, liver and intestines.	Only one parasite collected from intestine.
3. <i>H. taichui</i>	3	22	7.33	Small intestine	
4. <i>H. heterophyes</i>	6	36	6.00	Small intestine	
5. <i>H. perfoliatus</i>	2	27	13.50	Small intestine	
6. <i>H. japonicus</i>	1	7	7.00	Small intestine	
7. <i>Sticodora species</i> 1 (<i>Sticodora manilensis</i> B)	3	3	3.00	Small intestine	
CYSTODONTIDAE:					
1. <i>T. hydatigena</i>	31	177	5.72	Small intestine	
2. <i>T. multiceps</i>	2	5	2.50	Small intestine	
3. <i>C. caninus</i>	23	78	3.39	Small intestine	
4. <i>C. granulosus</i>	2	327	163.50	Small intestine	
HELMINTHODONTIDAE:					
1. <i>A. caninus</i>	161	3582	22.25	Small intestine	
2. <i>A. brasiliensis</i>	1	19	19.00	Small intestine	
3. <i>B. lupi</i>	62	359	5.79	Oesophagus and Aorta.	
4. <i>A. canis</i>	21	67	3.19	Small intestine	

TABLE No. V

Table showing the sex ratio of nematodes infecting dogs.

Name of nematode.	No. of dogs infected.	<u>Worms collected</u>		Total	Sex Ratio
		Male	Female		
<u>A. caninum</u>	161	1093	2489	3582	1: 2.25
<u>A. braziliense</u>	1	5	14	19	1: 2.80
<u>S. lupi</u>	62	274	85	359	1: 3.22(F:M)
<u>T. canis</u>	21	25	41	67	1: 1.64

TABLE NO. VI

Prevalence of single and multiple infections with species
among Helminthic parasites in dogs.

Species		Number of animal	Percentage.
<u>One species:</u>			
<u>A. caninum</u>		33	
<u>T. hydatigena</u>		3	
<u>S. lupi</u>		1	
<u>H. heterophyes</u>		1	
<u>Stictodora species</u> (<u>Stictodora manilensis</u> B)		1	
Total:		39	19.5
<u>Two species:</u>			
<u>T. canis</u>	+ <u>O. caninus</u>	1	
<u>A. caninum</u>	+ <u>S. lupi</u>	44	
<u>A. caninum</u>	+ <u>T. canis</u>	16	
<u>A. caninum</u>	+ <u>T. hydatigena</u>	11	
<u>A. caninum</u>	+ <u>E. granulosus</u>	1	
<u>A. caninum</u>	+ <u>D. caninum</u>	5	
<u>A. caninum</u>	+ <u>O. caninus</u>	11	
<u>D. caninum</u>	+ <u>S. lupi</u>	1	
<u>T. multiceps</u>	+ <u>A. caninum</u>	1	
<u>A. caninum</u>	+ <u>H. taichui</u>	1	
<u>H. heterophyes</u>	+ <u>S. lupi</u>	1	
<u>H. heterophyes</u>	+ <u>H. taichui</u>	1	
<u>T. hydatigena</u>	+ <u>D. caninum</u>	1	
Total:		95	47.5

Contd

in 11 dogs; D. caninum with S. lupi in one dog; Taenia multiceps with A. caninum in one dog; A. caninum with Haplorchia taichui in one dog; Heterophyes heterophyes with H. taichui in one dog; T. hydatigena with D. caninum in one dog, were the multiple infection with two species, the percentage being 47.5.

A. caninum, S. lupi and Q. caninus in 3 dogs;
Q. caninum, Echinococcus perfoliatus and T. hydatigena in one dog; A. caninum, T. canis and S. lupi in 2 dogs;
A. caninum, D. caninum and T. hydatigena in 9 dogs;
S. lupi, D. caninum and T. hydatigena in two dogs.
A. caninum, E. japonicus and T. hydatigena in one dog;
A. caninum and T. hydatigena and E. granulosus in one dog;
A. vaninum, A. brasiliense and Q. felinus in one dog;
H. heterophyes, H. taichui and E. perfoliatus in one dog;
 were the multiple infection with three species, the percentage being 10.5

A. caninum, S. lupi, D. caninum and T. multiceps in 2 dogs, were found in multiple infection with 4 species, the percentage being → 1.0.

A. caninum in 35 dogs, T. hydatigena in 3 dogs and S. lupi and Stictodara species in one dog ^{each} were found as single infections, the percentage being 19.5.

DESCRIPTION OF HELMINTHSTREMATODESFAMILY OPISTHOCEPHALIDAE:1. Opisthorchis caninus:

This trematode was found in 10 dogs (5%) in different areas Tirupati, Vijayawada and Narasapur. Of the total 155 parasites collected, 154 were recovered from the gall bladder and bile ducts with intensity of infection being 15.5 and one from the small intestine. This parasite was found along with T. canis, A. caninum, S. ludi and E. perfoliatus.

DESCRIPTION:

The adult worms were broadly oval and measured on average 3 to 7.5 m.m. in length and 1.5 to 2.5 m.m. in width in the region of the testes. They were reddish-orange in colour and had very fine cuticular spines. Oral sucker was nearly twice as large as ventral. Oral sucker measured 0.25 m.m. and ventral sucker 0.12 m.m. The most significant feature was the presence of a pedicle, carrying at its summit the acetabulum, and genital sinus lying in a groove, close to the anterior margin of the acetabulum. The pedicular region could be seen as deeply stained mass around acetabulum in stained and mounted preparations. A prepharynx was visible in live specimens.

The testes, situated in the posterior third of the body, were mostly diagonal in position with their margins entire or slightly lobed. Testes measured 0.65×0.33 m.m. and 0.65×0.4 m.m. The coiled vesiculae seminalis continued into a weakly muscular ejaculatory duct proceeding directly to the genital sinus. The ovary, was median, just in front of anterior testis and lobed with three or four lobes. Vitellaria on each side had eight well defined acini but their number varied in different specimens. In extent, the vitellaria anteriorly reached as far as the base of the pedicle and posteriorly to the level of the anterior border of the ovary. In some specimens, however, vitellaria extend upto anterior testis.

The embryonated eggs are oval in shape, yellowish in colour, and with a distinct operculum, measuring 0.024 m.m. \times 0.016 m.m. in size.

The present description agreed in detail with that of Gupta and Pande (1963).

2. Oniathorobia felinus:

This trematode was found in 8 dogs (4%), and 81 parasites were recovered from bileducts and liver with intensity of infection being 10.12. This parasite was found along with A. caninum and A. brasiliense.

DESCRIPTION:

It was lancet shaped, thin and transparent, rounded posteriorly and attenuated anteriorly. It measured on average 7.21 m.m. in length and 2.35 m.m. in breadth. The living worm in the bileducts was bile coloured with reddish tinge. The integument was smooth, though the immature worms had delicate spines. The two suckers were nearly equal in diameter. In the present specimens the oral sucker measured 0.37 m.m. and the ventral sucker 0.34 m.m. in diameter. The oral sucker was subterminal, while the ventral sucker was situated about one fifth of the body from the anterior end. The excretory bladder was a long tube running in between two testes and opens at the posterior end.

The 2 testes were oval (not distinctly lobed) and were situated obliquely to each other in the posterior fourth of the body. The long, slightly coiled seminal vesicle terminated in a weakly muscular ejaculatory duct,

D.93

which opened through the genital pore immediately in front of the ventral sucker.

The small oval or pear shaped and lobed ovary was in median position, just in front of the testis. To the right was the ootype and the seminal receptacle. The vitellaria consisted of numerous transversely compressed follicles disposed in the lateral fields, and extending from the posterior border of ventral sucker to ovary.

The eggs were elongate ovoid in shape with an operculum which fits into a thickened rim of the shell proper. They were lightly yellowish brown in colour and measured 0.026 x 0.011 m.m. in size.

The present specimens agreed in description with that of Bhale Rao (1936), Lepage (1962), Faust and Russel (1964). This could be differentiated from Opisthorchis tenuicollis as per the differential characters given by Chakrabarty and Sinha (1960).

FAMILY ECHINOPOSTOMATIDAE:**1. Echinophasmus perfoliatus:**

This was found in two (1%) deegs along with all other trematodes and Taenia hydatigena. These were located in the small intestine, the intensity of infection being 13.5.

DESCRIPTION:

This was elongate, broader posteriorly from the level of ventral sucker. It measured on average 1.92 m.m. in length and 0.52 m.m. in breadth. The entire integument was spinose. The circum oral disc was incomplete on the ventral side and was surmounted with 24 spines which were discontinuous middorsally as well as midventrally. The ventral sucker was larger than oral sucker and situated at the posterior end of the anterior third of the body. It measured 0.15 m.m wide across and the oral sucker measured 0.08 m.m. The testes were large, entire, subglobose, bodies, at tandem and situated behind the middle of the body. They measured 0.23 x 0.09 m.m and 0.21 x 0.23 m.m in size. The retort shaped cirrus sac, was anterior to ventral sucker on the right of the midline. It was filled with a swollen seminal

vesicle, a short ejaculatory duct and a small cirrus which opens through the genital pore, just behind the bifurcation of the caeca. Some what in front of the anterior testis, to the right of the midline was the small entire, globose ovary. Ovary measured 0.18 m.m. in diameter. The 'Vitellaria' extended from the anterior margin of the ventral sucker to the posterior end of the body. Only few Mehlis glands surrounded the tubular ootype which was located in the middle of the body. The uterus was observed as a relatively short, slightly coiled tubule, containing only a few eggs. Eggs measured 0.1 x 0.05 m.m.

The present description agreed with that of Bhale Rao (1935), Gupta and Pande (1963), Faust and Russel (1964) and Soulsby (1968).

2. Echinostomus japonicus:

This was found in only one adult dog (0.5%). 9 specimens were recovered from the small intestine. It was found with other infections of Ancylostoma caninum and Taenia hydatigena.

DESCRIPTION:

This was very small, plumpy with spinose integument all over the body and measured 0.65 m.m. in length

and 0.4 m.m. in width. The head collar was kidney shaped and armed with 24 equal sized spines measuring 0.028 m.m. in length arranged in a single, dorsally and medially interrupted row. The oral sucker measured 0.06 m.m. and ventral sucker 0.122 m.m. situated just anterior to the midbody respectively. The short pharynx was 0.04 m.m. x 0.048 m.m. oesophagus was 0.08 m.m. long and was bifurcated at the preacetabular part into two caeca, which was glandular and extended beyond the post testicular part. The testes were transversely ellipsoidal, entire and placed at tandem in apposition to each other, measuring 0.137 x 0.05 m.m and 0.125 x 0.05 m.m. The oral cirrus sac was at the anterior margin of the acetabulum. The ovary was oval, anterior to testes, on the right of the median line and measured 0.027 m.m in diameter. The extra caecal vitellaria consisted of large compact follicles, extending from the mid-acetabular part to the post testicular region wherein they anastomosed. The preovarian small uterus contained only 2 eggs (in the present specimen).

The eggs measured 0.06 x 0.035 m.m. in size.

These parasites were similar in description to that of Patnaik (1967).

FAMILY HETEROPHYIDAE:**1. Heterophyes heterophyes:**

These species were collected from the small intestines of 6 dogs (3%) examined, the intensity of infection being 6. Only one dog was found to be infected with this species alone and others with this species along with S. lupi, H. taichui, and E. perfoliatus.

DESCRIPTION:

They were elongate, pyriform with a broadly rounded posterior and attenuated anterior ends. The body was covered with scales more in anterior than posterior region. They measured on average 1.38 m.m. in length, 0.52 m.m in breadth. Oral sucker measured 0.08 m.m. Ventral sucker was thick-walled, muscular, and was placed in the anterior part of the middle third of the body and measured 0.22 m.m. The gonostyle which was situated to the left of the posterior border of the ventral sucker, measured 0.15 m.m in diameter and was provided with 80 small multidigitate spines.

The two ovoid testes lie slightly in an oblique plane in the posterior region, and measured 0.25 x 0.15 m.m and 0.25 x 0.1 m.m in size. The retort shaped seminal

vesicle originated in the posterior part of the equatorial third of the body, proceeded obliquely anterior and continued as the muscular ejaculatory duct as it approached the genital sucker. The small, subglobular ovary, which measured 0.1 m.m in size, and the adjacent ootype were situated medially above the testes in the anterior portion of posterior third of the body. There were 10 to 14 large polygonal "Vitelline follicles" in each of the lateral fluids of this portion of the body. Seminal vesicle was present. The uterus coiled intricately through the intercaecal field and proceeded to genitalpore which lies next to the male genital opening in the genital atrium at the base of the genital sucker.

Eggs were ovoidal, operculated, light brown in colour and measured 0.028 m.m by 0.015 m.m.

The description of this species agreed with that of Bhale Rao (1935), Faust and Russel (1964) and Soulsby (1968).

2. Haplorchis taichui:

The species were collected from small intestine of 3 dogs (1.5%) examined, the intensity of infection

being 7.33. This species was found along with A. sanium, H. heterophyes, E. perfoliatum.

DESCRIPTION:

They were somewhat flattened, with a narrower anterior half and a broader almost cylindrical posterior half, with gradually rounded extremities. The general shape was ovoid and the body was covered with small spines all over, longer in the 1st third of the body and smaller towards the posterior extremity. It measured on average 0.725 to 1 m.m in length and 0.45 to 0.5 m.m in width in testicular region. Oral sucker was terminal, slightly broader and measured 0.05 x 0.067 to 0.065 x 0.08 m.m. Prepharynx was 0.005 m.m long. Muscular pharynx was 0.032 x 0.045 m.m long and oesophagus 0.13 to 2 m.m long. Intestinal caeca reached upto the hinder margin of the testés. Gonotyl was median, below the bifurcation of caeca, with apex directed antero-ventrally towards the left side. This was irregular in shape, with its anterior end armed with a fusiform group of anteriorly directed, 15 cone shaped hollow spines of 0.007 - 0.017 m.m in size, placed diagonally and arranged like a fan, and with another group of outwardly directed

small spines separately as a patch. Testis was nearly spherical, situated in the posterior half of the body and measured 0.197×0.175 m.m in size. Seminal vesicle was bilobed, and obliquely placed immediately behind the intestinal bifurcation to the left side. Ovary spherical, median and was placed in between testis and ventro genital sac which was 0.12 m.m in diameter. Receptaculum seminis was rounded, anterolateral to ovary and 0.13×0.14 m.m in size. Uterus extensively developed, with a large number of eggs filling up all the available space behind the ventrogenital sac. Vitelline follicles were small, lying scattered between anterior ovarian border and testis and beyond up to the posterior end. Eggs were yellowish and 0.031×0.11 m.m. in size.

The description of this species was similar with that of Sahasrabudhe and Shaw (1967) and Rao and Anantaraman (1967).

3. Stictodora panilensis:

This species was observed in one dog (0.5%) being located in the small intestine, and the intensity of infection being 3. This has been found along with none.

Stictodora manilensis was first described by Africa and Garcia (1935) from dogs in Philippines. The armature of gonotyl is the most characteristic feature of this species. Witenberg (1953) described gonostyle as having 12 to 15 hooks resembling those of *Taenia*. These specimens resembled those described by Rao (1958) and Rao and Anantaraman (1967) along with the character of gonotyl armature.

CESTODES.1. Dipylidium caninum:

This species was found in small intestine of 23 dogs (11.5%) and the intensity of infection being 3.39. The maximum number that was found was 9 and the minimum number was one. This was found along with S. lupi, A. caninum, T. hydatigena and T. multiceps.

2. Taenia hydatigena:

This species was found in the small intestine of 31 dogs (15.5%) and the intensity of the infection being 5.72. The maximum number that were found was 21, and the minimum number was 2. This was found along with A. caninum, S. lupi, D. caninum, E. granulosus, O. caninus, E. perfoliatus and E. japonicus.

3. Taenia multiceps:

This Cestode was found in the small intestine of 2 dogs (1%), the intensity of infection being 2.50. The maximum number that was found was 3 and the minimum number was 2. This was found along with A. caninum, S. lupi, ^{and} D. caninum and T. multiceps.

4. Rhinocephalus granulosus:

The number of dogs infected with this parasite were 2 (1%) and they were found in the small intestine. The number of parasites recovered were 325 and 2 at Chittoor and Vijayawada respectively, the intensity of infection being 163.5. The maximum number that were found was 325 and the minimum number was 2. It was found always with A. caninum infection.

These cestodes were identified based on the descriptions given by Hall (1947), Southwell (1930), Bhale Rao (1935), Soulsby (1968).

E. granulosus was differentiated from E. multilocularis by the characters given by Lepage (1962). The last gravid segment was more than half of the length of the worm with lateral uterine branches and the genital pore, opening laterally behind the middle of the proglottid.

NEMATODES.

1. Ancylostoma caninum:

This nematode was found in 161 dogs (80.5%), with the intensity of infection being 22.25. The minimum number of worms found was 4 and the maximum 91. Male and Female ratio, among the worms, was found to be 1: 2.20 and the total number of worms collected from 161 dogs were 1093 males and 2489 females. This was found to be the commonest of all the Helminths recovered, from the small intestine of dogs. This was found along with all trematodes and cestodes except with Stictodora species.

2. Ancylostoma brasiliense:

This hook worm was observed in only one male dog (0.5%), from small intestine, the intensity of infection being 19. This was found along with

A. caninum and O. felinus. Male and female ratio was found to be 1.28.

3. Spirocera lupi:

This nematode was found in 62 (34%) dogs and was the next commonest parasite found. Mostly this was seen in oesophageal tumours in maximum numbers upto 18. The minimum worms three in number were found in the nodule situated in the wall of Aorta. The

intensity of infection was 5.79. Males and females were found in the ratio of 1: 3.22 and the total worms collected were 274 females and 85 males. This was found always along with A. caninum, D. caninum, H. heterophyes, Q. caninum, T. canis and T. multiceps.

4. Toxocara canis:

This was found in the intestine of 21 (10.5%) dogs, the intensity of infection being 3.19. This occurred mostly in the young ones. The minimum number of worms found was 1 and the maximum 7. Male and female ratio was found to be 1: 1.64 and the total worms collected from 21 dogs were 25 males and 41 females. It was found along with Q. caninum, A. caninum, S. lupi, D. caninum and T. hydatigena.

The nematodes were identified as per descriptions given by Bhale Rao (1935), Morgan and Hawkins (1955), and Soulsby (1968).

CHAPTER IV

DISCUSSION.

DISCUSSION.

The incidence of parasites in dogs depends on their habits and the accessibility of various infective materials such as diseased offal, rawfish etc. The intensity of parasitism is directly proportional to the degree and frequency of exposure to such infective materials.

The present study demonstrates the incidence of common parasites of stray dogs in particular areas. It cannot be assumed that this pattern of distribution reflects the incidence of parasitism elsewhere. Rather it would indicate the types of parasites present in these areas which might endanger the host's health or human health in case such parasites are transmissible to human being.

The results of this survey and the pattern of incidence of parasites, when compared with those of other localities in this country, would reveal marked variations, dependent on climatic or living conditions of the people.

The results reveal the incidence of parasites in stray dogs habituated to take offal, discarded meat or raw fish etc.

The incidence shows that 89.5% of the 200 dogs examined, harbour one or the other kind of parasite, in the randomly selected places of Andhra Pradesh.

Comparatively the prevalence of Q. caninus, Q. felinus and E. heterophyes is more among trematodes having been found in 10, 8 and 6 dogs. The prevalence of T. hydatigena and D. granulosus is more among cestodes, having been found in 31 and 23 dogs examined. The prevalence of A. caninum is highest among nematodes having been found in 161 dogs. The prevalence of S. lupi and T. canis is also high having been found in 62 and 21 dogs.

With regard to intensity of infection, Q. caninus followed by E. perfoliatus and Q. felinus occurred in more numbers with an average worm load of 15.50, 13.50 and 10.12 per dog respectively among trematodes; E. granulosus occurred in largest number with an average worm load of 163.50 per dog among cestodes; A. caninum and A. braziliense occurred in larger numbers with an average worm load of 22.25 and 19.00 among nematodes.

Multiple infection with 4 species only has been recorded in 2 dogs.

The sex ratio seems to be nearer to each other with reference to nematodes.

TREMATODES

In general they were found in a few dogs only and in combination with other parasites except in the case of H. heterophyes and S. manilensis?

1. FAMILY OPISTHORCHIDAE:

Genus Opisthorchis was reviewed and revised by Bisseru (1957) and the species from dog, cat and man that have been recognised are O. felinus, O. poyarki and O. caninus; Watson (1960) believed that the cat liver fluke was O. tenuicollis and not O. felinus which thus becomes a synonym with former species. Chakrabarty and Sinha (1960) reviewed the characters of O. tenuicollis and differentiated this from O. felinus. Gupta and Pande (1963b) discussed the genus opisthorchis in the light of wide range of variation in the form of the gonads and the number of the vitelline acini and stressed the need for re-evaluation of the taxonomic significance that has been attached to these and other characters. They separated the species under the genus into two categories on the basis of the sucker ratio and further separation was made on the characters relating to branching of testes, extent of vitellaria and presence

or absence of pedunculated acetabulum. They have put Q. tenuicollis and Q. pseudofelineus in the category of suckers being equal and Q. pseudofelineus was separated on the basis of prominent vitelline break in ovarian zone. Q. sinensis, Q. novae and Q. caninus have been put in second category where oral sucker is larger than ventral. Q. sinensis has been differentiated on lobed character of testes at tandem. Q. caninus has been differentiated on the character of pedunculated acetabulum.

Q. felineus, Q. pseudofelineus and Q. novae, Q. novae var lobata and Q. novae var orbiculata are considered the liver flukes of Indian dog (Bhale Rao, 1936). Subsequently Q. caninus by Sami (1938); Q. felineus by Maplestone and Bhaduri (1940); Q. novae by Mudaliar (1943); Parapiathorchis caninus by Bhatia, Sood and Pande (1959); Q. felineus by Patnaik (1959); Q. tenuicollis from cat by Chakrabarty and Sinha (1960); Q. caninus by Gupta and Pande (1963b); Q. felineus by Ramakrishna Reddy (1967); Q. caninus by Sahasrabudhe and Shaw (1967); Q. caninus in 31.00% dogs by Sahasrabudhe, Dubey and Srivastav (1969); and Q. novae in 60.78% dogs by Sahai (1969), were recorded.

The Opisthorchids in the present survey are represented by Q. caninus and Q. felineus in 3% and 4% of the dogs examined.

2. FAMILY ECHINOSTOMATIDAE:

Varma (1935) recovered a species of Echinochasmus a heterophyid and a third species described by him under a new genus Epiathochasmus as E. caninus from dogs at Calcutta. Chatterji (1954) regarded Epiathochasmus as a synonym of Epiathimium. He regarded stephanopora, epithimium and Echinochasmus as subgenera Echinochasmus and described a n.sp. Epiathimium ganai. Rao (1958) recorded Epiathimium caninus. Gupta and Pande (1963a) reviewed the genus Echinochasmus with remarks on the species occurring the Indian carnivores. They considered that genera epithimium, Epiathochasmus and stephanopora were not maintainable as the species in these subgenera exhibit wide range of variability of characters such as form of gonads and anterior extent of vitalleria, on which these subgenera were built. And so they suggested their suppression as synonyms of Echinochasmus. They also discussed the characters of species in India and were of opinion that Echinochasmids were represented by E. porfoliatus, E. corvus (E. caninus) and E. ganai in Indian carnivores. E. janakiana was later added by Patnaik (1967) with characters that

differentiate E. parfoliatus and E. canai. It could also be differentiated from E. parvus by size, sucker ratio and extent of vitalleria anteriorly.

Echinochasmus parfoliatus was recorded previously by Chandler (1925), Bhale Rao (1935), Patnaik (1959), Ramakrishna Reddy (1967) in 2% of dogs and Sahai (1969) in 41.17% of dogs.

E. japonicus was recorded by Patnaik (1967).

The Echinochasmids in the present survey were represented by E. parfoliatus in 1% and E. japonicus in 0.5% of the dogs examined.

3. FAMILY HETEROPHYIDAE:

Faust and Nishigori (1926) and Witenberg (1929) made detailed studies on trematode family: Heterophyidae. Bhale Rao (1936) and Kuntz and Chandler (1956) studied Heterophyids in India and Egypt respectively. Chen (1936) and Pearson (1964) studied in particular the subfamily Haplorenchinae. Rao (1958) and Rao and Anantaraman (1967) reviewed the incidence of Heterophyids in dogs and cats in India and recorded Heterophyes heterophyes, H. haichui, H. yokogawai and H. manilensis. Sahasrabudhe and Shaw (1967) also reviewed the incidence of Haplorenchis species in dogs and cats and described in detail H. haichui.

Heterophyes heterophyes:

Rao and Ayyar (1932) described forms allied to H. naxiense from dogs at Madras which Bhale Rao (1947) designated as H. heterophyes because of synonymy proposed by Witenberg (1929), Maplestone and Bhaduri (1940) recorded H. heterophyes from dogs. Sen (1963) reported it from the dog. Rao (1958) recorded it in 24% dogs examined. Rao and Anantaraman (1967) reported this species from 6 dogs out of 24 from Madras. Ramakrishna Reddy (1967) recorded in 4% of 50 dogs.

Haplocheris taishui

Bhale Rao (1936) recorded this species in India for the first time in cat. Sahaarabudhe and Shaw (1967) recorded this species for the first time in dogs. 8 dogs out of 57 examined, harboured this species. Rao and Anantaraman (1967) reported this from one dog (4%) of the 24 dogs examined. Ramakrishna Reddy (1967) recorded this species in 2% of 50 dogs. Sahaarabudhe, Dubey and Srivastav (1969) recovered from 11 dogs (14.86%) from Mhow and Jabalpur. Sahai (1969) recorded this from 25.49% of 51 dogs examined.

Stictodora manilensis :

S. manilensis was reported from 3 dogs at Madras (Rao, 1958). Rao and Anantaraman (1967) reported this from 3 dogs (12%) from the same locality. Stictodora species were recorded in 2 dogs (4%) of 50 dogs examined (Ramakrishna Reddy, 1967).

The heterophyids in the present survey are represented by Heterophyes heterophyes in 3%; Haplorenchis taichui in 1.5%; Stictodora manilensis in 0.5% of the dogs examined.

CESTODES.

Cestodes in general were found in fairly large number of dogs and in combination with other parasites except in the case of Taenia hydatigena.

1. T. hydatigena:

This was the most common. The prevalence of this species reported in literature varied widely. A prevalence of 14% at Lucknow (Acharya 1933), 18.58% in Punjab (Semi 1938), 5% and 29% at Calcutta (Maplestone and Bhaduri 1940), 8% at Madras (Rao 1958), 14.75% at Bangalore (Malaki 1966), 12% at Madras

(Ramakrishna Reddy 1967), 22.9% in Madhya Pradesh (Sahasrabudhe, Dubey and Srivastav 1969) and 31.37% at Bareilly (Sahai 1969) was reported in dogs.

In the present survey, this was found in 15.5% of dogs examined with an average worm load of 5.72 per dog.

2. T. multiceps:

This species was of rare occurrence and was found only in 2 dogs (1%) in the present survey. Acharya (1925) found T. granulosus in 2% of the dogs at Lucknow.

3. T. caninum:

This was next common to T. hydatigena. A prevalence of 22% at Lucknow (Acharya 1933), 3.8% in Punjab (Semi 1938), 42% and 79% at Calcutta (Maplestone and Bhaduri 1940), 36% at Madras (Rao 1958), 47.4% at Bangalore (Malaki 1966), 20% at Madras (Ramakrishna Reddy 1967), 47.29% in Madhya Pradesh (Sahasrabudhe, Dubey and Srivastav 1969), and 39.21% at Bareilly (Sahai 1969) was reported in dogs.

In the present survey, this was found in 11.5% of dogs examined at various places.

4. E. granulosus:

A prevalence of 28.8% in Punjab (Sami 1938), 2% and 18% at Calcutta (Maplestone and Bhaduri 1940), 12.4% at Amritsar (Sharma and Chitakara 1965), 8% at Madras (Ramakrishna Reddy 1967), 10.81 in Madhya Pradesh (Sahasrabudhe, Dubey and Srivastav 1969) and 5.88% at Bareilly (Sahai 1969) was reported in dogs.

In this survey, this was found in only 1% dogs examined at various centres but with an average worm load of 163.50 per dog.

HEMATODES.

Nematodes were found in large number of dogs and in combination with other parasites except in the case of Ancylostoma caninum mostly.

1. A. caninum:

This is the most common nematode found in this survey. A prevalence of 98% and 87.5% at Lucknow (Acharya 1933 and 1939), 99 and 91% at Calcutta (Maplestone and Bhaduri 1940), 88% at Madras (Rao 1958), 73% at Bangalore (Malaki 1966), 94% at Madras (Ramakrishna Reddy 1967), 89.48% in Madhya Pradesh

(Sahasrabudhe, Dubey and Srivastav 1969) and 70.58% at Beirelley (Sahai 1969) was recorded.

In this survey it was recorded in 80.5% of dogs examined, which can favourably compared with the records in other regions.

2. A. brasiliensis

This species was of rare occurrence. Maplestone and Khaduri (1940) recorded the prevalence of this species in 53 and 69% of dogs at Calcutta. This nematode was not commonly found in several surveys done in this country, as reported in review of Indian literature.

In this survey this was recorded in one dog (0.5%).

3. S. lupi

This species is also common next only to A. caninum. A prevalence of 14% and 35.5% at Lucknow (Acharya 1933 and 1939), 23.5% at Madras (Chandrasekharan, Sastry and Menon 1958), 31.5% in Uttar Pradesh (Gupta and Pande 1962), 56% at Bangalore (Malaki 1966), 16% at Madras (Ramakrishna Reddy 1967), 54.05% in Madhya Pradesh (Sahasrabudhe, Dubey and Srivastav 1969) and 19.60% at Beirelley (Sahai 1969) was reported.

In this survey, this was recorded in 31% of the dogs examined.

4. T. Canis:

A prevalence of 6 and 6.5% at Lucknow (Acharya 1933 and 1939), 28% at Madras (Rao 1958), 26.23% at Bangalore (Malaki 1966), 16% at Madras (Ramakrishna Reddy 1967), 2.7% in Madhya Pradesh (Sahaarabudhe, Dubey and Srivastav 1969), and 7.84% at Beirelley (Sahai 1969) was reported previously.

In this survey, this was recorded in 10.5% of the dogs examined.

Species of Oniathorchis, Haplorchia, Heterophyes, D. caninum, A. caninum, A. brasiliense, T. canis have all been known to infect man (Watson 1960, Soulsby 1968 and Sahaarabudhe, Dubey and Srivastav 1969).

Precise information on the incidence of the above parasites, the incidence and extent of Hydatidosis, in human beings is lacking.

It is relevant to recognise the fact that of 15 helminths reported upon in this study, atleast 9 are of zoonotic importance and emphasizes the role of the dog as a potential reservoir of human infections.

CHAPTER V

SUMMARY AND CONCLUSIONS.

SUMMARY AND CONCLUSIONS

A survey of Helminth parasites in dogs and their prevalence in selected places in Andhra Pradesh was undertaken in these studies for the first time.

The literature on the subject with emphasis on the species of helminths of dogs recorded in different localities in India, has been reviewed.

179 dogs (89.5%) were found harbouring helminths of one species or other, out of 200 dogs examined.

7 species of trematodes viz., Onchoborhis sinensis, in 10 dogs (5%), O. felinus in 8 dogs (4%), Reinoborhis - parfoliatus in 2 dogs (1%), E. japonicus in one dog (0.5%), Heterophyes heterophyes in 6 dogs (3%), Haplocheilichis taichui, in 3 dogs (1.5%), Stichodora manilensis in 1 dog (0.5%); 4 species of Cestodes viz., Taenia hydatigena in 31 dogs (15.5%), T. multiceps in 2 dogs (1%), Dipylidium caninum in 23 dogs (11.5%), and Reinoborhis granulosus in 2 dogs (1%); 4 species of nematodes viz., Ancylostoma caninum in 161 dogs (80.5%), A. braziliense in 1 dog (0.5%), Spirocerca lupi in 62 dogs (31%) and Toxocara canis in 21 dogs (10.5%) were identified and recorded.

Opisthorchis caninus among trematodes; Taenia hydatigena among cestodes; Ankylostoma caninum among nematodes are more prevalent having occurred in 5%, 15.5%, 80.5% dogs than any other helminths.

The intensity of infection for each species of helminths recorded is given. So also the sex ratio for the nematodes recorded is given.

Out of 200 dogs examined, 39 dogs (19.5%) had single infections; 95 dogs (47.5%) had double infections; 21 dogs (10.5%) had triple infections and 2 dogs (1%) had quadruple infections.

Detailed descriptions of the trematodes recorded were given.

Opisthorchis caninus, O. felinus, Echinochasmus - perfoliatus, E. japonicus, Heterophyes heterophyes, Haplorenchis taichui, Stictodora manilensis have been recorded for the first time in Andhra Pradesh. And Echinochasmus japonicus is the second record in India.

Taenia multiceps has been recorded for the first time in Andhra Pradesh.

The investigation has brought to light that 9 of 15 helminths recorded are of economic importance.

The salient features of this survey, was discussed in relation to previous work done in India.

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CHAPTER VI

BIBLIOGRAPHY.

BIBLIOGRAPHY.

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N.Y.

Illustration.

- 1. Map showing the various places where material is collected in Andhra Pradesh.**

**MAP SHOWING THE VARIOUS
PLACES WHERE MATERIAL IS
COLLECTED IN ANDHRA PRADESH**

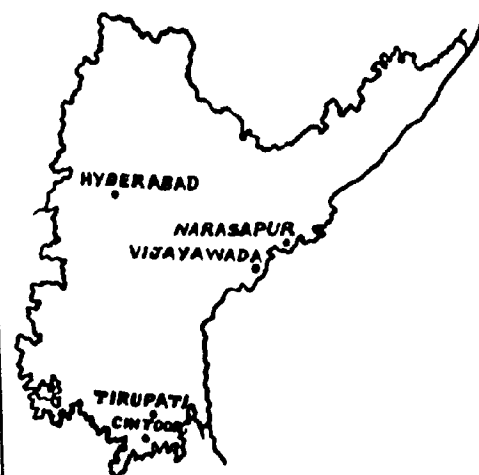


Illustration 1.

Illustration. 2. Photomicrograph of
Opisthorchis caninus. x 24

Illustration. 3a Photomicrograph of
Opisthorchis felinus
 (Anterior end) x 24

Illustration. 3b. Photomicrograph of
Opisthorchis felinus
 showing the position
 of gonads. x 24



Illustration 2.



Illustration 3a



Illustration 3b

Illustration.

**3e. Photomicrograph of
Opisthorchis Felinus. $\times 24$**

Illustration.

**4. Photomicrograph of
Heterophyes heterophyes. $\times 100$**

Illustration.

**5. Photomicrograph of
Heterophyes heterophyes -
Incomplete circle of spines
in the gonostyle. $\times 450$**



Illustration 3c



Illustration 4



Illustration 5

Illustration. 6a. Photomicrograph of
 Haplorehis taichui x 100

Illustration. 6b. Photomicrograph of
 Haplorehis taichui
 showing disposition of spines
 like a fan in
 Ventrogenital sac. x 450

Illustration. 7. Photomicrograph of
 Stictodora manilensis x 100

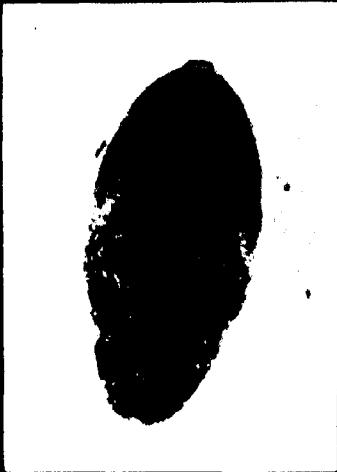


Illustration 6a



Illustration 6b



Illustration 7

Illustration.

8. Photomicrograph of
Rhinocactus perfoliatus. x 60

Illustration.

9. Photomicrograph of
Echinochasmus japonicus. x 60

Illustration.

70. Photomicrograph of *Behinoseocus granulosus* - Seeley - 3 segments; gravid segment showing genital pore behind the middle. $\times 100$



Illustration 8



Illustration 9



Illustration 10

Illustration.

- 11. Photomicrograph of
Taenia hydatigena -
Scolex to show characteristic
rostellum hooks. × 450**



Illustration 11