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THE HELMINTH FAUNA OF NORTH THAILAND. II PARASITES OF AVES AND CHIROPTERA.

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ABSTRACT

Between November, 1972 and February, 1973. 19 genera of helminth parasites were recovered from 82 birds (18 species) and 40 bats (2 species) from different areas in Chiang Mai province. The following helminth are described : 4 species of Trematoda; **Prosthodendium** sp., **Philophthalmus** sp., **Anchitrema sanguineum**, **Plagiorchis vespertilionis**, 8 species of Nematoda; **Molinostrongylus** sp., **Heterakis isolonche**, **Heterakis gallinarum**, **Ascaridia perspicillus**, **Capillaria** sp., **Microtetrameres** sp., **Diplotriaena (Euryanisospiculum)** sp., **Diplotriaena (Sternoanisospiculum) nochti**, 6 species of Cestode; **Vampirolepis** sp., **Raillietina totragona**, **Raillietina echinobathrida**, **Raillietina cesticillus**, **Diskrjabininiella** sp., **Paricterotaenia** sp., and 1 species of Acantho cephala; **Sphaerirostris** sp. Public health implications and effect on commercial and domestic fowl are discussed. (13 figures; 10 tables).

In conjunction with on going helminthological surveys being conducted by the Department of Parasitology (Ratanasritong and Kliks, 1972), the authors examind birds and bats trapped, purchased, or otherwise collected in Chiang Mai province, during the period of November 1972 through February, 1973.

The importance of having a thorough understanding of enzootic and epizootic helminth diseases derives from the fact that, in his intimate sharing of the environment with wild and domestic animals, man frequently becomes a host for their parasites as well. Such infection are termed zoonosis and a wide variety have been recorded in Asia (Swellengrebel and Sterman, 1961 ; Faust and Russel,

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1964). Among the avian helminths occasionally found in man are included the cestode species **Mesocestoides** (Chandler, 1942), and **Raillietina** (Bear and Sandars, 1956; Kouri and Basnuevo, 1949). The latter genus has been found in both children and adults in Thailand (Leuckart, 1891; Chandler and Pradatsundarasar, 1957) Certain species of cestode genus **Hymenolepis** are comon parasites of man in many parts of the word (Faust and Russel, 1964) and more than a dozen species are known to occur in both birds and bate (Yamaguti, 1959). Recently, Maning **et al** (1970) have reported finding the trematode **Prosthodendrium molenkampi** in 6 of 15 autopsies perfromed in Udorn Province of Thailand. Later they recovered the same parasite from bats (Manning et al 1971). Doubtlessly more carefull examination of both human and animals will reveal further zoonotic helminthosis.

All of the host genera included in this surveys are common in the area, being frequently found around homes and farms, and are therefore of interest as potential reservoir hosts of human zoonotic infection. Furthermore, domestic fowl raised casually around homes, or in large commercial flocks, are an important source of animal protein and cash income necessary for optimum economic develepment in the region. The findings of this survey indicate that enzootic helminthosis are doubtlessly responsible for considerable mortality, morbidity, and stunting in domestic fowl. Helminth parasites are know to be a source of significant economic losses due to be a source of significant economic losses due to unproductive outlays of feed and labor (Wehr, 1969).

MATERIALS AND METHODS

Examined during the survey were 82 birds, comprising 15 families and 18 genera, including common domestic food species of commercial importance, and 40 bats representing 2 families and 2 genera (TABLE I). Generally specimens were returned to the laboratory alive and kept in cages until examined. External surfaces were carefully examined for ectoparasites, and both blood and stool specimens were collected (ectoparasites and protozoan parasites will be reported at a later date). Efforts were made to accurately record worm burden, habitat in the host and source of host material. Bird identifications were based on Dr. B Legakul's book and bats were identified by the staff of the Center for Thai National Reference Collection of the Applied Scientific Research Corporation of Thailand in Bangkok. All data were recorded on standard accession cards of the Department of Parasito-

logy, Faculty of Medicine, Chaing Mai University.

Standard methods of fixation, preservation and staining were used (Ratanasritong and Kilks, 1972).

RESULTS AND DISCUSSION

Holminth parasites belonging to 19 genera (Trematode 5 genera, Nematode 7 genera, Cestoda 6 genera and Acanthocephala 1 genera) were recovered during the survey, most of which have been previously reported from the same or related hosts in Asia (TABLE 2-10). Three genera found are of potential public health importance, i.e. **Vampirolopis** sp., **Prosthodendium** sp. and **Raillietina** sp. All of the others helminths encountered in domestic fowl may be presumed to be of some importance to the commercial and poultry industry althrough no obvious pathology other than stunding was noted in the hosts examined. Measurements are in microns, unless otherwise noted.

Nematoda

Order Strongylidea

Molinostrongylus sp.

(Figure 13)

Host : Hipposideras larvatus

Habitat : Small intestine

Locality : Cave at kilometer 90, Ampoer Chiang Dao, Chiang Mai province

Description : based on 5 male and 7 female specimens

Trichostrongylidae: Strongylacanthinae: Cuticle with fine transverse striations resembling sets of paired bars (1.6 wide by 6.4 long), interupted by longitudinal grooves or ridges; about 40 such bars around the circumferance at mid body. Very fine longitudinal striations also present. Lateral alae marrow, 10 wide, extending from immediately behind cephalic vesical to base of bursa copulatrix in male. Month cavity simple, unarmed, no distinct buccal capsule. Cephalic cuticular expansion of usual form, 36 long by 47 wide, finely striated; well defined at base by annular fold with posteriorly directed projections, remembling epaulettes. Nerve ring 180-241 (200) from head end; excretory pore 198-306 (250). Cervical papillae not observed.

MALE : Body 9.9 - 12 (11.3) mm.; long by 150 wide. Esophagus 360 to 450 (410) long. Bursa trilobate, dorsal lobe marrow, elongate. Numerous minute cuticular spines on inner surface of bursa, two prebursal papillae present. Ventroventral ray widely separated from lateroventral; latter approximating externolaterol, just as long and directed forward; mediolateral and posternolateral with common trunk, convergent toward each other at extremities, so that externolateral and the

medialoteral are somewhat divergent one from the other. Externodorsal arising near mid way from base of dorsal, long, reaching bursal margin; dorsal bifurcated distally into short bifid terminal branches. Spicules similar, equal, filiform, 210 - 290 (270) long, with one or more distal points or processes. Gubernaculum 108-110 (109) long by 14-15 (14.4) in maximum width; shield-shaped with sharp elongate barbs at anterior and posterior ends, separated from main body by definite shoulders.

FEMALE : Body 14 to 19.5 (17) mm. long by 140-190 (170) in maximum width. Esophagus 360-450 (410) long. Vulua 72-74 (73%) from anterior extremity, Eggs 61-72 (65) by 25-36 (30), as measured near vulva. Tail, bluntly rounded, 72 long; with a pointed spike 21.6 long, and ter ninating in three minute protuberances.

Discussion : **Molinostrongylus** sp. were recovered (average 4), from 5 of 16 specimens of **Hipposideros larvatus** examind. They conform to the family diagnosis in having a buccal capsule which is feebly developed and lacking in special structures, and to the subfamily, Strongylacanthinae, in being oviparous and by the female tail having a terminal spike. The worms are assigned to the genus **Molinostrongylus**, Skarbilovitch, 1934 on the basis of the weak buccal capsule, and the bursa copullatrix which has large lateral lobes and mumerous cuticular spines on the inner surface (Yamaguti, 1961). Skrjabin **et al**, (1954) have assigned this genus to the subfamily, Citellinomatinae, together with the very similar genera **Allitoshius** and **Parallin toshius**, while Barus and Rysavy (1971) recommend that these three genera, together with **Nycteridostrongylus** and several others form bats, all be included in the subfamily **Anoplostrongylinae.** All of these chiropteran genera are fairly specific as to host family, and appear to be closely related; transitional and intermediate forms do exist (Barus and Rysavy, 1971).

The genus **Molinostrongylus** contains 10 speciea and one subspecies of which several were originally referred to the genus **Anoplostrongylus.** Barus and Rysavy (1971) state that in the palearctic region, members of this genus show a host specificity to the chiroteran family Vespertilionidae, with some indications of transitions to the family Rhinolophidea. One species, **M. rhinolophi** has been reported from the bats genus **Rhinolophus** of the latter family, and the present report of an unknown and probably new species, from another rhinolophid bat, **Hipposideris larvatus**, thus extends the host specificity of this nematode genus, as well as being the first report of its occurance in South East Asia. Investigations of vespertilionid

bats common to the Chiang Mai area will probably product furture strongylacanthine genera.

The specimens herein descrlbed are readily distinguished from from all other members of the subfamily and genus by being three to four times longer than the largest of those for which data are available to the author. Males and famales of **M. rhinolophi**, Yamaguti, 1941, range in length from 3.65 to 5.3 mm; those of **M. tipula** (Beneden, 1872) Travassos 1936 (as reported by Soltys, 1659) range from 2.0 to 2.3 mm; and **M. pseudornatus**, Yeh, 1957 range from 2.3 to 3.1 mm. Similarly the spicules of **M.** sp. are near y twice as long (210-290) as thoso **M. rhinolophi** (153-156) and **M. pseudornatus** (124) and moro than three times those of **M. tipula** (75). The shield-shaped guberaculum with shaply pointed extremities is unique to the present material. The location of the vulva relective to the anterior extremity in female specimens(72-74%) is midway between that of **M. tipula** (66%) and **M. rhinolophi** (73%) and **M. psuedornatus** (80%). Eggs measured **in utero** near the vulva of **M.** sp. were considerably smaller (60-65 by 25-36 microns) than those of the above three species, which were 96 by 45, 75-87 by 45-54 and 47-50 by 84-92, respectively. Based on the above morphological distinctions and on the host and geographical evidence, the auther is inclined to consider these specimens of representing a new species. However, until such time as type specimens of previously described species and the key of Skrjabin et al, (1954) are available, no such designation can be male.

Order Filariidea

Diplotriaena (Stenoanisospiculum) sp.

(Figure 4,5)

Host : Plocous philippinas

Habitat : Body cavity.

Locality : Market, Ampoer Chiang Mai

Description : Based on 3 male and 9 female specimens.

Diplotriaenidao; Diplotriaeninae: Mouth simple, without lips, surrounded by two lateral and four submedian papillae. Cuticle smooth, raised lateral to oral opening into 2 cuticular finger like projections or tridents 110 - 119 (115) long, which are heavily chitinizad. Esophagus long, consisting for two parts, a short muscular and much longer grandular section, flanked by the three-forked chitinous tridents on each side of its anterior end.

MALE : Body 23-25 (24) mm. long by 352 - 413 (382) in muximum width. Esophagus long, consisting of two parts, a short muscular and much longer grandular. Spicules unequal, dissimilar; left spicule narrow, 689-765 (739) long, right spicule, thick, heavily cuticularized, alate

455-459 (456) long. Anus near posterior extremity, tail short bluntly rounded with number of small sessile papillae surrounding anus.

FEMALE : Body length 40-50 (45) mm. by 413-612 (479) in maximum width. Vulva in region of grandular esophagus 306 to 360 (336) from anterior extremity; vagina straight, very long, with thick muscular wall; loop of ovary passing anterior to vulva. Eggs thick shelled, embryonated at depostition.

Diplotrtaena (Euryanisospiculum) nochti, Hoeppli et Hsu, 1929.

(Figure 1, 2)

Host : Sturnus javanicus

Habitat : Body cavity

Locality : Doi Saket, Chiang Mai province.

Description : based on 1 female and 4 male specimens.

Diplotriaenidae ; Diplotriaeninae : As above. Tridents 119-126 (122) long.

MALE : Body 35-45 (38) mm. long by 383 - 459 (408) in maximum width. Muscular esophagus 152-183 (173) long, glandular esophagus 5.3-6.1 (5.7) mm. long, Spicules unequal; left spicule narrow 2.75 -3.06 (2.91) mm. long, right spicul thick, cuticularized 612-689 (665) long. Tail short, plain, bluntly rounded with a number of small sessile papillae.

FEMALE : Body 160 mm. by 530 in maximum width. Muscular esophagus 459 long, glandular esophagus 4.59 mm. long. Vulva in region of glandular esophagus 396 from anterior. Eggs thick-shelled, 50 by 29 wide, embryonated at deposition.

(Figure 3)

MICROFILARIA : Based on 10 specimens in Giensa stained thin blood films : unsheathed, cuticle unstriated body 250-270 (260) long by 3.2-4.3 (4) wide at mid body. cephalic space 4.8-6.4 (5.6) wide, excretory space 150-170 (160) from anterior anal space 12-13 (11) from anterior, 2.4-3.2 (2.7) wide. Tail 8-11 (9.6) from anal space to tip.

Discussion :

Members of the genus **Diplotriaena** are parasitic exclusively in the body cavity of birds. Lopez - Neyra (1956) divided this genus into two groups, **D. (Euryanisospiculum)** and **D. (Stenoanisospiculum)** according to differences in spicular ratio and total length of the female. In **Euryanisospiculum** the female is 8-10 c.m. and the spicules are very unequal, one being twice as long as the other or longer ; in **Stenoanisospiculum** the female is less than 10 c.m. and the spicules are not very unequal, one being less than twice as long as the other. Yamaguti (1961) list 18 species of **Diplotriaena** from avian host in Asia, of these 4 belong to the former and 16 to the latter group.

Five different species have been previously reported from **Sturnus vulgaris** of which only **D. (E) nochti**, Hoeppli et Hsu, 1926, from this host in Cairo Zoo (and several other host in China, Tonkin, and Pakistan) is of the **Euryanisospiculum** type. The specimens recovered from **Sturnas vulgoris** in this survey are therefore tentitively assigned to this species.

None of the 16 species of **D. (Stenoanisospiculum)** reported from Asia were found in **Ploceus** nor in other ploecid birds and specific identification must await the availability of associated reprints and type material.

Order Trichuridea

Capillaria sp.

Host : Hipposideras larvatus

Habitat : Small intestine

Locality : Cave at kilometer 90, Ampoer Chiang Dao, Chiang Mai province.

Description : based on 1 complete and 2 incomplete female specimens.

Trichuridae : Capilliariinae : Body small, elongate; complete specimen 12.24 mm. long by 60 in maximum width. Nerve ring 324 from anterior end. Esophagus 3.97 mm. long, consisting of 160-170(165) stichocytes which are 36-54 (45) in diameter. Vulva located just posterior to esophagus, 404 mm. from anterior, or 67% of total body length from anterior end; valvar appendage prominent, 32.4-36 (34) a long, Eggs thick shelled, 36-43.2 (38) long by 18-21.6 (19) wide measured **in utero** near vulva.

Discussion :

This Genus **Capillaria** contains 14 species found in bats in Europe and South America, 4 of which were found in rhinolophid bats. Only one species **C. pipistielli** from Japan, has been recorded **fron Asia.**

Order Oxyuridea

Hetarakis isolonche, Linstow, 1906 syn., **H. putaustralis**, Lane, 1914; **H. neoplastica**, Wassint, 1926; **H. hastata**, Chandler, **H. variablis**, Chandler, 1926.

Host : Gallus gallus

Habitat : Small intestine

Locality : Slaughter house, Chiang Mai city.

Description : based on male and 5 femaled specimens.

Heterakidae : Heterakinae; mouth surrounded by 3 well defined lips; esophagus with short pharynx, and a distinct posterior bulb containing a valvular apparatus, Lateral alae present; labial and phayngeal teeth absent.

MALE : Body 5.2-5.97 (5.57) mm long by 144-183 (161) in maximum width. Pharynx 25 40 (31) long; esophagus 525-725 (611) long, by 87-97 (91) wide across bulb. Caudal also alae supported by

pedinculate papipllae ; round pre-cloacal sucker prominent with thick chitinous rim ; pairs of pedunculate caudal papillae, 2 precloacal, near suckers ; 2 small paracloacal and 4 large adcloadal ; 1 long solitary and a group of three small postcloacal. Spicules subequal, slightly dissimilar ; right 288-360 (324), narrow, alate ; left 252-324 (286), broader, heavier, with angular tip armed with a low barb. Tail, narrow, pointed, 288-450 (371) long.

FEMALE : Body 5.5-7.2 (6.6) mm long by 198-230 (223) in maximum width, Parynx 36-43 (39) esophagus 652-742 (676) long by 122-138 (125) wide across bulb. Vulva opening slightly posterior to middle of body, 50-54 (52%). Egg ; thick, smooth shelled 29-36 (32) by 54 measured in utero near vulva. Tail, narrow, 581-688 (630) long.

Heterakis gallinarum (Schrank, 1788) syn. **H. galli** Omelin, 1790; **H. longicaudata** Linstow, 1879; **H. parisi** Blance, 1913

Host : Gallus gallus

Habitat : Small intestine

Locality : Slaughter house in Chiang Mai city.

Description : based on 4 male and 4 female specimens.

Heteakidae; Heterakinae : as above

MALE : body 6.9-8.1 (7.3) mm. long by 180 - 214 (198) in maximum width. Pharynx 36-46 (43) long; esophagus 719-760 (730) long by 108-115 (111) wide across bulb. Caudal alae large, supported by pedunculate papillae; round pre-cloacal sucker prominent, with thick chitinous rim ; 12 pairs of caudal papillae : 2 long precloacal pedundulate near sucker ; 2 small paracloacal sessile and 4 large adcloacal pedunculate ; one long postcloacal pedunculate, and 3 small postcloacal grouped on tail. Spicules unequal, similar ; right, slender 1300 - 2600 (1810) long ; left with broad alae, 760-1070 (908) long. Tail narrow, pointed 415-535 (480) long.

FEMALE : Body 6.6 - 8.4 (75) long by 198 - 275 (235) in maximum width. Pharynx 36-50 (46) long ; esophagus 652-1050 (806) long by 107-168 (137) wide across bulb. Vulva opening slightly anterior to middle of body, 42 - 49 (46%). Eggs thick shelled, smooth, 28 - 36 (33) by 54 - 68 (59) measured in utero near vulva. Tail very long, narrow, 704 - 918 (805).

Discussion :

The genus **Heterakis** is a large and rather poorly differentiated one that probably contains a great deal of synonymy among its members. They are a very old and well adapted group of parasites being widely distributed throughout the world in many classes of animal hosts apparently causing but little pathology themselves.

Heterekis gallinarum, however, has been associated with the spread among

birds of the hightly pathological flagellate protozoan disease agent, **Histomonas meleagridis**. This disease has not been reported in Thailand, but may have been overlooked due to ignorance. As infection with **Heterekis** is very common in this area, it is highly probable that outbreaks of **Histomonas** infection have occured. The life cycle of both species is direct with the eggs undergoing a period of 2 weeks development to the infective stage in the soil; earthworms have also been identified as harboring the infective stages and transmitting infection when eaten.

Some two dozen species have been recorded from avian hosts in Asia, (Yamaguti, 1961) of which 13 were from domestic fowl. In the present study, 4 of 20 chickens from a local slaughter house were infected with worms belong to the species **H. gallinarum** and **4** of **20** werer infected with 60 to 100 **H. isolinche**; 10% harbored mixed infections.

Prevention and control of **Heterekis** require the raising of poultry above the ground in wire screened cages and the periodic removal of collected feces; a practive which is uncommon in Thailand.

The female of both species are remarkably similar, differing only in the position of the vulva, it being slightly anterior to the middle of the body (42-49%) in the former and slightly posterior to the middle of the body (50 - 54%) in the latter species. The tail in both males and females of **H. gallinarum** is considerably longer than that of **H. isolaonche**.

The males of these two species are easily distinguished on the basis of the size and shape of the spicules, being very long (right average 1810 left average 908) with a ratio of 1 : 2 in H. **gallinarum** and short (right average 324 left average 286) without and subequal with a ratio of 1:1.1 in **H. isoloanche.**

H. gallinarum is cosmopolitan in domestic fowl and more than thirty species of wild birds. **H. isolonche** has a somewhat more limited distribution having been reported previously in Asia from India, Singapore and China, as **H. putaustialis.** The present report is the first record of both species from Thailand.

Order Spiruridea

Microtetrameres sp.

Host : Passer montanus

Habitat : Proventriculus

Locality : Tamboon Kwang Sing, Ampoer Chiang Mai

Description : based on 2 female specimens.

Tropisuridae : Tropisurinae : Body tightly coiled 2.6-3.4 (3) mm. long by 153 - 216 (184) in maximum width. Mouth with 3 small lips, buccul capusle barrel shaped, heavily cuticularized. Cuticle ruffled, with

well defined transverse striations. Esophagus divided into muscular esophagus 54 long and glandular esophagus 108 long. Vulva opening close to posterior extremity (95%). Uterus enormously developed occupying the greater part of the body, filled with thin shelled, embryonated eggs (14.4×28.8).

Discussion :

The genus **Microtetrameres** consistes of 16 species all parasitic in the proventriculus of birds; 2 species, have been reported from Asia, both in India. The present specimens are the first record of **Microtetrameres** from **Passer montanus** and the first report from Thailand. Several authors have noted considerable pathology in birds infected with **Microtetrameres** (Wehr, 1969). Grasshoppers and Cockroaches act as intermediate hosts.

Order Ascarididea

Ascaridia perspicillum

syn ; **A. inflexa** Zeder, 1800 : **A. galli** Schrank, (1788) Baylis, (1932)

Host : Gallus gallus

Habitat : Large intestine

Locality : Slaughter house, Ampoer Chiang Mai

Description : based on 3 male and 2 female specimens

Ascarididae : Ascaridinae : large, thick, yellowish-white worms. Head with 3 large lips esophagus without vestibule or bulb. Lateral cuticular flanges and alae present.

MALE : 30 - 35 (32) mm. long by 459-535 (509) in maximum width. Esophagus club shaped 230-260 (240) mm. long. Spicules equal, narrow, bluntly rounded at lips, 792-900 (864) long. Precloacal sucker chitinous, well developed. Caudal alae narrow, supported by pedunculate papillae. Ten pairs, caudal papilae: 3 precloacal pedunculate, one anterior to, one at leval of, and one posterior to sucker; 3 paracloacal pedunculate surrounding opening of cloaca; 4 postcloacal, 1 laege pedunculate just posterior to paracloacals and three smaller ones grouped midway between the cloaca and the tip of the tail. Tail moderolely long, 382 - 459 (420), without pointed processes or extensions.

FEMALE : 27-60 (43) mm. long by 490-918 (704) wide. Esophagus club-shaped, eggs 190-350 (170) long. Vulva opening in anterior part of body 50-55 (52) % from anterior ; eggs elleptical, thick - shelled unembryonated.

Discussion :

Four species of **Ascaridia** have been described from chickens in Asia, three of which have been regarded by one or another authers as being synonymous with the fourth species, **A. galli** (Schrank, 1788), which is found all over the world. **A. lineata** (Schneider, 1866) reported in India, Malaya, and China, and **A. sinensis** Wu and Kung, 1944, from China were

assigned to **A. galli** by Baylis, 1932 and Kung, 1949, respectively. Similarly, **A. perspicillum** (Rudolfi, 1902) found in India, Indonesia, Malaya, and Japan, was regarded as synonymous with **A. galli** by Baylis 1932. However, drawings of the latter species which appear in Olson, (1969) clearly indicate a different arrangment of the male caudal papillae than in the present material which more closely resembles the drawing of **A. perspicillum** as shown in York and Maplestone (1926). Furthermone - specimens, examined in the current study average 32-43 mm., whereas **A. galli** is reported to average 50 to 70 mm. in length. Though a certain amount of variation in the distribution of papillae might be expected, the specimens herein described are considered as being a separate species, **A. perspicillum**, until more evidence is available.

In the present study **A. perspicillum** was recovered in moderate numbers (1-10, average 5) from 4 of 20 chickens examined from a local slaughterhouse. Heavy infections are known to cause loss of blood, diarrhea, retarded growth, increased mortality, and emaciation (Wehr. 1969). Prevention is as discussed above for **Heterokis.** Treatment with piperazine admistered as a 0.2 - 0.4% solution in drinking water is very effective in removing **Ascaridia** (Wehr; 1969).

Trematoda

Prosthodendrim sp.

(Figure 6)

Host : Hipposideros larvatus

Habitat : Large intestine

Locality : Cave at kilometer 90, Ampoer Chiang Dao.

Description : Based on 6 fixed and stained specimens.

Lecithodendriidae : Lecithodenriinae : Body small, pyriform, unspined, 459-560 (506) long by 413-490 (459) inmaximum width. Oral sucker elliptical, 72-107 (88) long by 90-97 (91) wide; prepharynx not seen; esophagus short 16-18 (17); pharynx, 38-40 (39); ceca short, terminating anterior to testis, 112-120 (115) long. Acetabulum inmiddle third of body, 72-90 (78) in diameter, displaced slighly to one side. Testis, symetrical, opposite, rounded, slighly anterior to acetabulum, 90-108 (105) long by 90-108 (96) wide. Cirrus pouch round, preacetabular, 90 long by 72 wide, enclosing winding cirrus, seminal vesicle, and prostatic complex and bound by a distinct membrane ; genital atrium opening just in front of acetabulum. Ovary lobed, variable in shape and size submedian to median, anterior dorsal to, and usually overlapping circus pouch and right testis. Vitellaria forming symetrical, grapelike clusters 17-22 (20) anterior to ceca and between testis. Uterine coils occupying all of

hind body. Eggs slightly thickened at the abopercular end but without a distict, knob, 19.2 - 22.4 (20.8) x 8.8 - 9.6 (9.4), as measured **in utero**.

Discussion :

The genus **Prosthodendrium** is a large one with more than 70 species having been described almost exclusively from insectivourous bats and reptiles : 29 species from bats in Asia (Yamaguti, 1958), but none reported from the present host. In present study 8 of 16 **Hipposideras larvatus** examined were heavily infected with an average of several hundred being recovered from each host.

These specimens closely resemble a number of species of which descriptions and drawings are available, especially **P. molenkampi** (Lie Kian; 1951) and **P. glandulosum** (Looss, 1896).

The former species, first reported from man in Java and later from both bats and man in Northeastern Thailand (Manning **et al**, 1971), differs only in being larger in overall size (559-720 microns) with reletively smaller, less crowded, internal organs and in its more avoid shape com pared to the distinctly and consistently pyriform shape of the present specimens Eggs measured **in utero**, besides being smaller (15-20%) also apparently lacked ths characteristic abopercular knob of **P. molenkampi.**

Heyneman and Macy (1962) have provided a key to the species of **Prosthodendrium** in the bats of Egypt which indicates that the present specimens would be assigned to the species **P. glandulosum,** which again, is reported as being twice as large. Until additional specimens and reprints are available for comparison no specific identification will be attempted.

The life cycles of the few species of **Prosthodendrium** which are known, have been shown to involve second intermediate hosts which are the larvae and adults of acquatic insects. Recent examinations of mosquitoes, mayflies (**Ephemerata**) and other insects in Chiang Mai have yielded several types of typical lecithodendrid metacercaria (Kliks, 1973). Man undoubtedly becomes infected by accidentally ingesting these insect vectors with food and water.

Philophthalmus sp.

(Figure 8)

Host : Passer montanus

Habitat : Eye

Locality : Tamboon, Kwang Sing, Ampoer Chiang Mai

Description : Based on 2 fixed and stained specimens.

Philophthalmidae, Philophthalminae : Body elongate, fusiform, 1.37 mm. long by 380 in maximum width, not constricted in acetabular zone. Acetabulum at about one-third of body length from enterior

extremity, 144 in diameter. Oral sucker 129 in diameter. Esophagus very short; pharynx prominent, 64.8 wide by 36 long; ceca terminating at posterior extremity. Testes round 137.7 in diameter, oblique (entirely in posterior half of body but not at posterior extremity); cirrus pouch very long, 540, extending back of acetabulum, enclosing seminal vesicle; genital pore lateral, just anterior to acetabulum. Ovary submedian just posterior to acetabulum in middle third of body, 107 in diameter. Uterus extending from posterior extremity, winding between testis, and forward between overy and seminal receptical. Vitellaria extracecal in lateral field extending from level of acetabulum to posterior extremity where they nearly meet. Eggs 25 long by 18 wide.

Discussion :

The specimens have been assigned to the family and genus on the basis of Yamaguti's key (1958) in which the habitat of the flukes in the conjunctival sac is the primary taxonomic factor. While these specimens generally conform to the generic diagnosis, they differ in that the testis are oblique (not tandem) and are located at some distance anterior to the posterior extremity; the ovary is in the middle third of the body, not in the posterior third as in other **Philophthalmus** species; and the genital pore opens laterally, not medially. Aside from the fact that these flukes were recovered from the eye of the host, they resemble the genus **Plagiorchis** more than **Philophthalmus**, but the former genus has never been reported from that location in the host.

Yamaguti lists nine species of **Philophthalmus** reported from Asia, of which **P. occularae** (Wu, 1938) was recovered from the same host, **Passer montanus**, in Canton, China. Until type specimens of further material is available it is not possible to determine the specific identity of this fluke.

Anchitrema sanguineum (Sonsino, 1895) Looss, 1899

(Figure 7)

Host : Hipposederas larvatus

Habitat : Large intestine

Locality : Cave at kilometer 90, Ampoer Chiang Dao, Chiang Mai Province.

Description : based one 1 specimen.

Dicrocoeliidae, Anchitrematinae : Body tongue-shaped, 3.74 mm. by 0.77 mm. in maximum width, anterior one-third spined. Oral sucker terminal, 0.22 mm. in diameter; esophagus very short; ceca long, narrow, reaching to posterior extremity. Testes symmetrical, 505 by 245 wide, just behind acetabulum, extracecal. Ventral sucker 0.22 mm. in diameter. Cirrus pouch occupied by convoluted seminal

vesicle, immediately preacetabular. Genital pore median, pre-acetabular. Ovary nearly median, 245 long by 214 wide, immediately posttesticular. Seminal receptical formed by dilatation of basal portion of Laurer's canal. Vitellaria extending in extracecal field from immediately behind testes to some distance short of posterior extremity. Uterus filling up entire posttesticular intercecal field, descending on one side and then ascending on the other side; eggs small, 18 by 14.4, numerous. Excretory vesical Y-shaped.

Discussion :

The specimens herein described conform to the description of the genotype, **A. sanguineum**, which was recovered from the bats **Nycticejus kuhli** and **N. dormori** in India (Pande, 1935). Two other species have been recorded from bats : **A. phillipinorum** (Tubangui, 1928) from **Scotophilus temminckii**, the Phillipines, and **A. congolense** (Sandground, 1931) from **Myotis bocagecupreolus**, Belgian Congo.

A. sanguineum has been previously reported from several species of bats callocted in Malaysia by Rhode, (1966). Infected bats were found only during the months of March to September and only specimen of **A. sanguineum** was collected from the tomb bat, **Taphazous melanopogon**.

Heyneman and Macy (1962) have recorded **A. sanguineum** from eleven additional species of bats representing four families from Egypt and discussed the ability of bat trematodes to parasitize a wide variety of chiropteran hosts.

Recent studies conducted near Nongkhai, Thailand (102.46 E, 17.13 N) recorded two adult **A. sanguineum** from one of twenty-eight **T. melanopagon** and one adult from one of 10 **Scotophilus kuhlii** (Manning and Viyanant, 1971). The study site is located approximately 800 miles north of Kodiang, Malaysia, the northern most region previously reported for the fluke. The authors note that it is therefore quite possible that **A. sanguineum** ranges over much of Thailand, Laos, and perhaps Vietnam and Combodia. The recovery of **A. sanguineum** from the Chiang Dao region (99° E, 19.30 N) confirms this supposition and constitutes an extension of the range of this fluke, with **Hipposideros larvatus** as the sixteenth bat host reported.

Plagiarchis vespertilionis parorchis, Macy 1960

(Figure 9)

Host : Hipposideros larvatus

Habitat : Large intestine

Locality : Cave at kilometer 90, Ampoer Chiang Dao

Description : Based on 1 fixed and stained specimen

Plagiorchiidae : Plagiorchiinnae : Body flattened, 1.28 mm. long by 610 in maximum width. Oral sucker subterminal, 300 in diameter, acetabulum slightly smaller, 290. Pharynx rounded, 122 in diameter, esophagus very short, followed immediately by well-developed ceca entending to near posterior extremity. Testis 260 long by 152 wide, nearly opposite in posterior of middle third of body. Overy 120 long by 90 wide, on left side of acetabulum. Vitellaria in compact follicles, extracecal, extending from just posterior to tests to midway between the two suckers; not confluent in the region of acetabulum. Cirrus sac well developed, elongate, curved around anterior margin of acetabulum (but not extending posterior to it in this specimen); containing seminal vesicle and a long conveluted ejaculatory duct leading to the submedian genital pore, 100 microns anterior to acetabulum Cirrus long, without obvious spines. Uterine eggs 19.2-22.4 (22 1) by 10.8 - 16.0 (16.5).

Discussion :

Plagiorchis vespertilionis has been previously recorded from one other rhinolophid bats, **Rhinolophus ferurum-equenum** from Korea (Soganderes-Bernal, 1959) and from bats of 9 other genera from Europe, Canada and Mexico, (Yamaguti, 1958). At least 7 other species of **Plagiorchis** have been recorded from bats in Asia, many of which are probably synonymous with **P. vespertilionis.**

Macy, (1960) examined specimens of **P. vespertilionis** from both the U.S. and Korea and errected a new subgenus **P. v. parorchis** on the basis of the variation in testicular angle ; Asiatic and European populations tend to have the testis more obliguely situated. The present specimen, with testis situated opposite, would thus fall into Macy's subgenus.

The specimen described above differs only slighly from Macy's (1960) description: i. e., the anterior extremity does not appear to be spined, the currus sac does not extend posterior to the acetabulum and the vitelaria are not as profuse. **Hipposideros larvatus** is a new host record and Thailand an extension of the previously known range of the parasite in Japan, Korea, and China.

Cestoda

Vampirolepis sp.

(Figure 12)

Host : Hipposideros larvatus

Habitat : Large intestine

Locality : Cave at kilometer 97, Ampoer Chiang Dao.

Description : Based on 10 fixed and stained specimens.

Hymenolepidae : Hymenolepidinae: strobila serrate, 12.35 (21) mm. by 688-918 (765) in maximum width. Scolex 144-198 (169) long by 144-162 (152) wide; rostellum armed 126-144 (133) long by 54-72 (65) wide, with 17-26 (20) "Y" shaped hooks, 10.8-21.6 (19.4) long; sucker unarmed, oval, weakly developed, 46.8 to 72 (53) in greatest diameter. Proglottides numerous, transversly elongated. Testis, 3 arranged in a transverse row, 1 poral 2 antiporal, 54-72 (65.5) in diameter. Genital pore unilateral, cirrus pouch inconspicuous; external seminal vesicle 72-108 (90) long by 32-54 (41) wide, extending medially beyond the excretory canal; internal seminal vesicle anterior to poral testes, 90-108 (102) long by 36-54 (43) wide. Ovary rounded, 90-108 (98) by 45-54 (47) between poral and first antiporal testis, overlying compact vitelline gland 36-43 (38) by 29; seminal recepticle prominent, variable in size according to maturily of proglottid, 108-169 (173) long by 54-115 (11) wide in mature proglottids. Onchosperes filling gravid progottids, 22-29 by 32-36, measured **in utero**; seminal recepticle persists in middle of gravid progottids.

Discussion :

Spassky (1954) created the genus **Vampirolepis** to include these species of **Hymenolepis** which possessed and armed rostellum. Included in this genus is **Vampirolepis (Hymenlepis) nana** the world-wide parasite of man and rats. Of the 10 species reported from bats (Macy and Rausch, 1949) all can be distinguished from the specimens describe in this paper on the basis of the distribution of the testis and on the number and size of rostellar hooks (less than 30 and more than 20; less than 20 micron long). The present material most closely resembles **V. (H) nana** of man, which is known to occur in man in Thailand (Chirasak, 1973) but which has never been found in bats. One of the known species of **Vampirolepis**, **V. kerivoulae** (Hubscher, 1937) was reported in Asia (Java); none have been previously deseribed from Thailand nor from the host, **Hipposiderus larvatus.**

Diskrjabiniella sp.

(Figure 11)

Host : Callus gallus

Habitat : large intestine

Locaiity : Chiang Mai

Descreiption : based on 2 fixed and stained specimens.

Davainidae : Dipylidiinae : Strobila about 85 mm long by 2.98 mm in maximum width. Scolex well developed 765 in diameter; rostellum with a single row of 200 - 240 minute hooks, each about 10 long, attached in such a manner that they appear to be of two sizes; suckers

muscular, rounded, 290 in diameter. Testes numerous, round, distributed mostly within the boundaries of the excretory canals. Genital organs double, bilateral. Cirrus pouch prominent, 1224 long; genital pore opening anterior to middle of segment. Female pore opening posterior to male; vagina narrow, 324 long; joining seminal vesicle, 54 long by 39 wide surrounded by ovary and vitelline gland. Ovary, 198 in diameter, consisting of a number of discrete follicles clustered around the seminal vesicle anterior to the lobed vitelline gland which is 108-126 (114) long by 54-72 (64) wide. Gravid proglottids filled with many onchospheres, 53, to 55 in diameter

Discussion :

This little known genus consists of a single species, **D. avicola** (Fuhrman, 1906) Materosian, 1954 from a bird in South Africa. As no description of this specimen is available, no specific diagnosis can be made at this time. Despite the fact that mony chickens have been examined for intestinal parasites throughout the world, the genus has not yet been reported in that host.

Paricterotania sp.

(Figure 10)

Host : Zoothera dioni

Habitat : Large intestine

Locality : Cave at kilometer 90, Ampoer Chiang Dao.

Description : based on 1 incomplete fixed and stained specimen. Dilepididae : Dilepidinae : Strobila broken, 459 in maximum width. Scolex 260 in diameter; rostellum conical, armed with a single crown of 8-10 minute hooks, 72 in diameter by 150 long; suckers muscular, rounded 94 in diameter. Mature proglottid : testis intracecal, 15 - 20, distributed in posterior part of segment; cirrus pouch 90 long by 22 wide, overlapping excretory duct; genital pores alternating regularly, opening at anterior of segment margin. Ovary asymetrically biloped, larger lobe aporal. Vitelline gland small, compact posterior to ovary. Vaginal canal prominent, 150 long; opening posterior to male aperture; dilated proximaly near ovary to form large seminal receptical, 50 long by 36 wide. Gravid proglottid 796 wide by 459 long, containing 100-150 eggs in much expanded uterus; eggs 12.8 by 14.4.

Discussion :

In Asia eleven species of **Paricterotaenia** have been described from birds, mostly from India and Barma, but none from the current host nor from other members of the family Muscicapidae (fly-catchers).

Raillietina echinobothrida

(Megnin, 1881)

Host : Gallus gallus

Habitat : Large intestine

Locality : Slaughter house, Ampoer Chiang Mai.

Description : base on 3 fixed and stained specimens.

Davaineidae : Davaineinae : Strobila, 40-55 (45) mm. by 0.8-11.4 (1.0) mm. maximum width. Scolex 214-260 (234) in diameter; rostellum, 54-79 (68) in diameter by 43-58 (48) deep, armed with 2 rows of 180-200 (196) hammer-shaped hooks, 8-16 (11.5) long; suckers round, 47-54 (52) in diameter by 72-97 (74) deep, armed with 5 to 8 rows of minute hooks (1.6) long. Neck very short 610 - 765 (715) long. Cirrus pouch, oval elongate, directed anteriorly 94-90 (92) long by 54 wide. Genetal pore unilateral, located posterior to middle of segment margin. Testis 20 to 30 : antiporal 12 to 20, poral 5 to 10, distributed throughout the segment on either side of the ovary. Uterus ultimately forming eggs capsules; each capsule usually contain 6-8 onchosperes.

Raillietina cesticillus

(Molin, 1858)

Host : Gallus gallus

Hahitat : Large intestine

Locality : Slaughterhouse, Ampoer Chiang Mai.

Description : Based on 2 fixed and stained specimens.

Davaineidae : Davaineinae : Strobila 17-45 (31) mm. long by 380-850 (610) in maximum width. Scolex, 198-232 (215) in diameter; rostellum 72-190 (131) in diameter, by 29-55 (42) deep, armed with two eows of minute hammer-shaped hooks, about 350-360 in number, 919 long; sucker oval, unarmed, 82-109 (95) in diameter by 64-80 (72) deep Neck very long 2.14-3.53 (2.83) mm. Cirrus pouch oval directed posteriorly 65-72 (69) long by 54-58 (56) wide. Genital pore unilateral opening in the posterior third of segment margin. Testis 24 to 28 in number : 10-14 poral and 12-14 antiporal, in posterior part of segmont. Uterus divided into egg capsules, each capsule containing a single onchospere.

Raillictina tetragona Molin, 1858

Host : Gallus gallus

Habitat : Large intestine

Locality: Slaughterhouse, Ampoer Chiang Mai

Description : base on 3 fixed and stained specimens.

Davaineidae : Davaineinae : Strobila 25-55 (46) mm. by 0.5 - 1.8 (1.4 mm) in maximum width. Scolex, 168 - 229 (204) in diameter; rostellum 54 - 72 (62) in diameter by 40 - 58 (52) deep; armed with a double crown of 180 - 200 (190) hooks,

each 6.4 - 10.8 (9) long; suckers oval, 40 - 58 (51) in diameter by 61 - 83 (72) deep, armed with several rows of small hooks, 3.6 - 6.4 (5) long. Neck 360-1998 (1012). Cirrus pouch oval. directed posterior, 79 long by 58 wide. Genital pores unilateral, located just anterior to middle of segment morgin. Testis 16 to 25; antiporal 11 to 15, poral 5 to 10, distributed primarily in posterior half of proglottid with a few anterior to the ovary. In gravid proglottids uterus breaks up in to egg capsules each containing 6 to 12 onchospheres.

Discussion :

The genus **Raillietina** is one of the largest cestode genera known, with some 225 species having been described (Hugles and Schultz, 1942), many of which are doubtlessly synonymous. At least 20 species have been reported from domestic fowl and wild birds in Asia, (Yamaguti 1959). The genus has been divided into four subgenera on the basis of the position of the position of the genital appertures and the number of onchosperes per parenchymatous capsule.

The three species reported herein are all cosmopolitan and quite common in domestic fowl and conform, with minor variations, to previous descriptions (Wardle and McLeod, 1969). **R. cesticilus** with one onchospere per capsule in the gravid proglottic belongs to the subgenus (**skrjabinia**); however the present material differs from the usual descriptions in that the genital pore is consistently unitateral, and the rostellum is not nearly so broad and diffuse as is usually figured.

The life cycles of all three species involve a cysticercoid stage which becomes infective after a period of development in insects, usually beetles of the families Tenebrionidae, Scarabaenidae and Carabidae and several genera of ants. As these insects are quite commonly found in and around homes, they are occassionally ingested by man with food. Several **Raillietina** species generally considered to be of rat origin. have been reported in man in Asia and elseqhere (Faust and Russell, 1964). Baer and Sandars (1956) describe gravid proglottids from an infant in Australia which they assigned to the species **R. celebensis** of rats. The proglottids are similar in size and shape to **R. tetragona** which also possess genital pores which open in the anterior portion of the proglottid and which contains several onchospheres in each uterine capsule.

Similarly, entire worms recovered from a child in Bangkok (Chandler and Pradatsundarasar; 1957) resemble **R. tetragona** in the position of the genital pore, distribution of onchospheres in gravid proglottids, and other features. These

worms, assigned to the speeies **R. siriraji** are considerably larger (250-260 mm) than **R. tetragona** and have fewer rostellar hooks (80 - 82). In light of the many genera in birds, and the fact that **Raillietina** have not been recovered from rats in some areas where they do occur in man, it would seem likely that at least some of the human infections are derived from avian species of **Raillietina**.

The economic importance of **Raillietina** infections in domestic fowl greatly over shadows the portential public health danger to man. All three genera reported from chickens in Chiang Mai are known to cause degeneration and inflamption of the intestinal villae, the formation of intestinal tubercle, diarrhea, and convulsions, with up to 50 per cent mortality resulting (Wehr 1967). Fifteen of twenty chickens examined in the present study harbored one or more types of **Raillietina** in farly large numbers (average worm burden, 50); they are, without a doubt, a cause of enormous losses in term of increased mortality and unproductivness in local flocks.

Prevention of these infection requires control of the insect intermediate hosts by application of insecticide (chlordone, parathione), the periodic removal or sterilization of poultry feces, and the raising of fewl in wire cages above the around (Wehr ibid). Threatment with hexachlorophene is both cheap and effective in a single dose (Soulesby, 1968).

Acanthocephala

Sphaerirostris, sp.

Host : Glaucidium cuculoides

Habitat : Large intestine

Locality : Doi Sutep, Ampoer Chiang Mai.

Description : based on 1 male specimen

Paleoacanthcephala : Centrorhynchidae ; Controrhynchinae : Body slender, unspined, 13 mm. by 300 in maximum width. Proboscis cylindrical, 765 long by 245 wide divided by insertion of receptacle into two regions, of which the anterior is subglobose and entirely armed with rooted hooks, and the posterior armed with smaller spines; arrainged in 23-25 longitudinal rows of 24-26 (13 hooks 16-18 spines). Neck absent. Testis, tanden, rectangular, elongate 918-1071 (994) long by 230-306(268) wide. Cement gland 4-5, very long and slender. Bursa, 842 long by 612 wide.

Discussion :

The genus **Centrorhynchus**, Luhe, 1911, was divided by Golvan (1956) into the subgenera **Sphaerirostris** and **Lengirostris** on the basis of the shape of the proboscis. Of the 10 reported species, 4 have been found in Asia. Of these, **S. turdi** (Yamaguti, 1939) **n. comb.** Golvan, 1956, from **Turdus** in Japan is most

similar to this specimen in size (9.8 mm.) and in the number of proboscis hooks and pines (26-34 rows of 11-14 hooks or spines). When type specimens become available specific diagnosis will be made. This is the first record of a centrorhynchid acanthocephalan from **Glaucidium cuculoides**.

CONCLUSIONS

Three helminth species recovered in the survey are of potential public health importance, and six are definitely a factor in causing increased mortalily and unproductiveness in commercial poultry flocks. The remaining parasites may be presumed to be responsible for occasional morbidity in wild birds.

The as yet unknown **Prosthodendrium** recovered in large numbers from 50% of the bat **Hippsideros larvatus** resembles very closely **P. molenkampi** which was reported by Manning **et al** (1970) from a sinificant proportion of the human population in Northeastern Thailand. The author has often noticed local farmers gathering nymphs of various dragon-flies which are eaten raw, crushed in salads. Other potential intermediate host insects are frequently ingested by accident in food or water. As yet no careful fecal surveys have been conducted in the Chiang Mai area to determine if human **Prosthodendrium** cases exist.

The three species of the tapeworm **Raillietina** recovered are all of great importance to local poultry producers and in light of their common occurence, and the previous known human infections with members of this genus, it is highly recommended that knowledge of adequate control and prevention proceedures be distributed in the area.

The **Vampirolepis** species, found in 31% of **H. larvatus** examined, closely resemble **V.** (**= Hymenolepis**) **nana** of man; there is a possibility that the bat may be a resevoir host for this common human tapeworm. More comparative morphological studies and laboratory confirmation of the life cycle is required.

Although 45% of the specimens in the survey harbord at least one helminth, and **Hipposideros lavatus**, and **Gallus gallus** were found to be infected with four or more species simultaneously, the parasites appeared to be well tolearated (other than **Raillietina** sp.) and there was no evidence of gross pathology noted. Infections of **Gallus gallus**, an economically important food source, with **Heteragis gallinarum H. isoloncha** and **A. perspicillum** were generally very heavy and could potentially be a cause of morbidity in this

host. Again, information concerning treatment, control and prevention should be made available to local farmers.

Summary

During a survey on birds and bats in Chiang Mai province 19 genera of parasites were recovered, including 7 Nematode; 5 Trematode, 6 Cestode and 1 Acanthocephala.

Three are of importance assouces of possible human infection ; **Prosthodendium** sp., **Raillietina** sp., and **Vampirolepis** sp.

TABLE I ANIMALS SURVEYED

1. AVES

Family	Scientific name	Common name	No. of examined
Ploceidae	Passer montanus	Nok krajok Barn	11
	Ploceus phillippinus	Nok krajarb	21
	Erythruro prasina	Nok katid kheo	1
Anatidae	Anas sp.	Duck (Ped.)	10
Phasianidae	Gallus gallus	Chicken (kai)	20
Muscicapidae	Zoothera dixoni	Nok Dern dong Lung Seephrai	2
Sturnidae	Sturnus javanicus	Nok Iang Dum	4
Chloropreidae	Aigithina tiphia	Nok Kamin nai	3
	Chloropsis sonnerati	Nok kheo	1
Turnicidae	Turnix tanki	Nok koom ok lai	1
Calumbidae	Streptopelia chinensis	Nok khao yai	1
Strigidae	Gilaucielium cuculoides	Nok kao Moeng	1
Accipitridae	Milvus migrans	Nok Yeaw Dum Lek	1
Alcedinidae	Nalcyon smyrnensis	Nok Katen ok khai	1
Turdinae	Sonicola caprata	Nok Yod yah See dum	1
Bittacidae	Bittacula finschii	Nak Kaling	1
Scolopacidae	Capella wemarico a	Nok parg Som pong	1
Laniidae	Lanius cristatus	Nok Ee Seua See Namtal	1

2. CHIROPTERA

Pteropidae	Cynopterus sphinx	Bat	24
Rhinolophidae	Hipposideros larvatus	Bat	16

TABLE 2

Host Gallus gallus

No. examined : 20

Parasites species	f - infection	Total No. recovered	Range	Mean
Ascaridia perspicilum	0.2	22	1–10	3.25
Heterakis gallinarum	0.2	–	–	–
Heterakis isolonche	0.2	–	–	–
Raillietina sp. (I)	0.15	–	–	–
Raillietina sp. (II)	0.1	–	–	–
Raillietina ochinobothrida	0.15	–	–	–
Raillietina tetragona	0.2	–	–	–
Raillietina cesticillus	0.4	–	–	–
Diskrjabniella sp.	0.05	–	–	–
Hymenolepis sp.	0.2	–	–	–

TABLE 3

Host Zootheradixoni

No. examined 2

Parasites species	f - infection	Total No. recovered	Range	Mean
Paricterotania sp.	2	9	4–5	0.5

TABLE 4

Host Ploceus philippinus

No. examined 21

Parasites species	f - infection	Total No. recovered	Range	Mean
Diplotriaena (Stenoanisospiculum)	0.2	12	2–10	4

TABLE 5

Host Anas ap.

No. examined 10

Parasites species	f - infection	Total No. recovered	Range	Mean
Trichostrongylus tenus	0.1	5	5	5
Prosthogonimus cuneatus	0.1	2	2	2

TABLE 6

Host Sturnus javanicus

No : examined 4

Parasites species	f - infection	Total No. recovered	Range	Mean
Spaganum-like cestode lavae	0.5	15	6-9	1.5
Diplotriaena (Euryaniso-spiculum) nochti	0.5	6	2-4	1

TABLE 7

Host Passer montanus

No. examined 11

Parasites species	f - infection	Total No. recovered	Range	Mean
Philophthamus sp.	0.1	2	2	2
Microtatrameres sp.	0.2	5	2-3	5

TABLE 8

Host Capella nemorcola

No. examined 1

Parasites species	f - infection	Total No. recovered	Range	Mean
Paricterotania sp.	1	1	1	1

TABLE 9

Host Hipposideros larvatus,

No. examined : 16

Parasites species	f - infection	Total No. recovered	Range	Mean
Prosthodendrium sp.	0.5	2700	100–1000	237.75
Molinostrongylus sp.	0.31	16	1–5	1.3
Anchitrema sanguineum	0.06	1	1	1
Plagiorchis vespertilionis	0.06	1	1	1
Capillaria sp.	0.13	3	1–2	0.5
Vampirolepis sp.	0.31	62	1–31	9.4

TABLE 10

Host Cynopteros sphinx

No. examined 24

Positive Malaria 17 %.

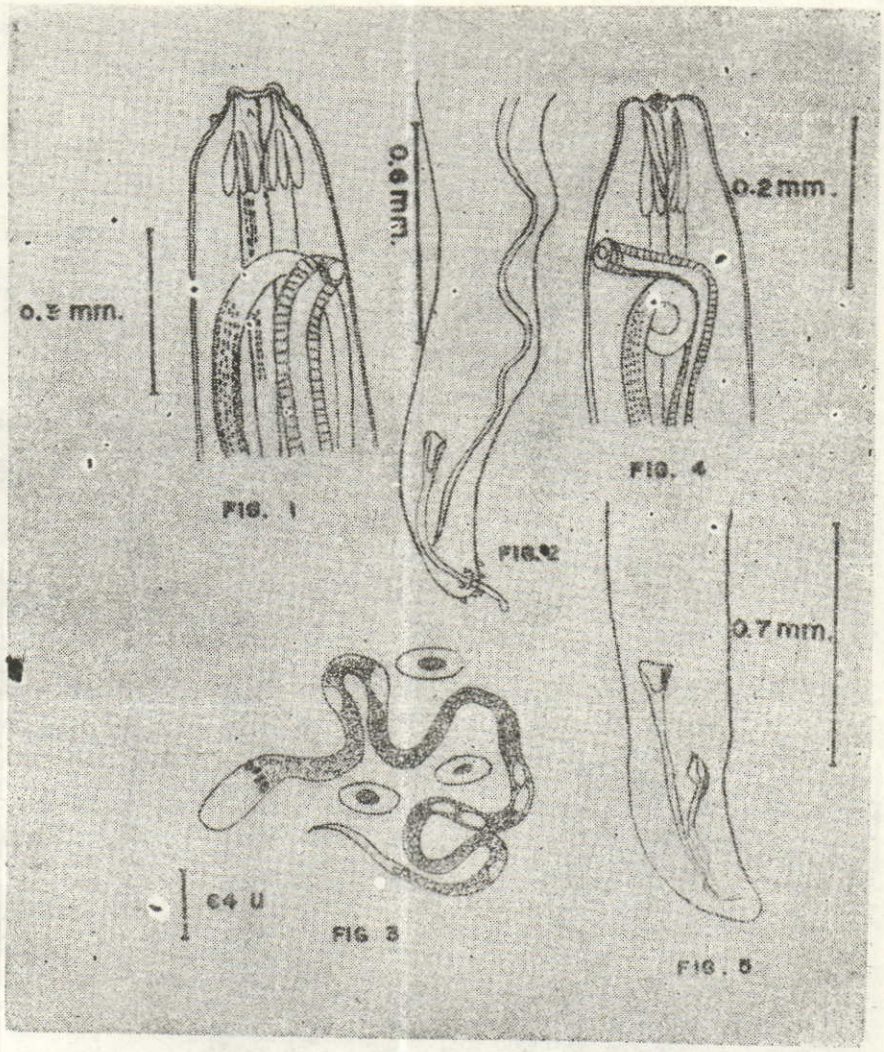

Figure 1 : Head of **Diplotriaena** (**Euryanisospiculum**) **nochti** × 70

Figure 2 : Tail of **Diplotriaena** (**Euryanisospiculum**) **nochti** × 50

Figure 3 : Microfilaria of **Diplotriaena** (**Euryanisospiculum**) **nochti** × 200

Figure 4 : Head of **Diplotriaena** (**Stenoanisospiculum**) × 110

Figure 5 : Tail of **Diplotriaena** (**Stenoanisospiculum**) × 45

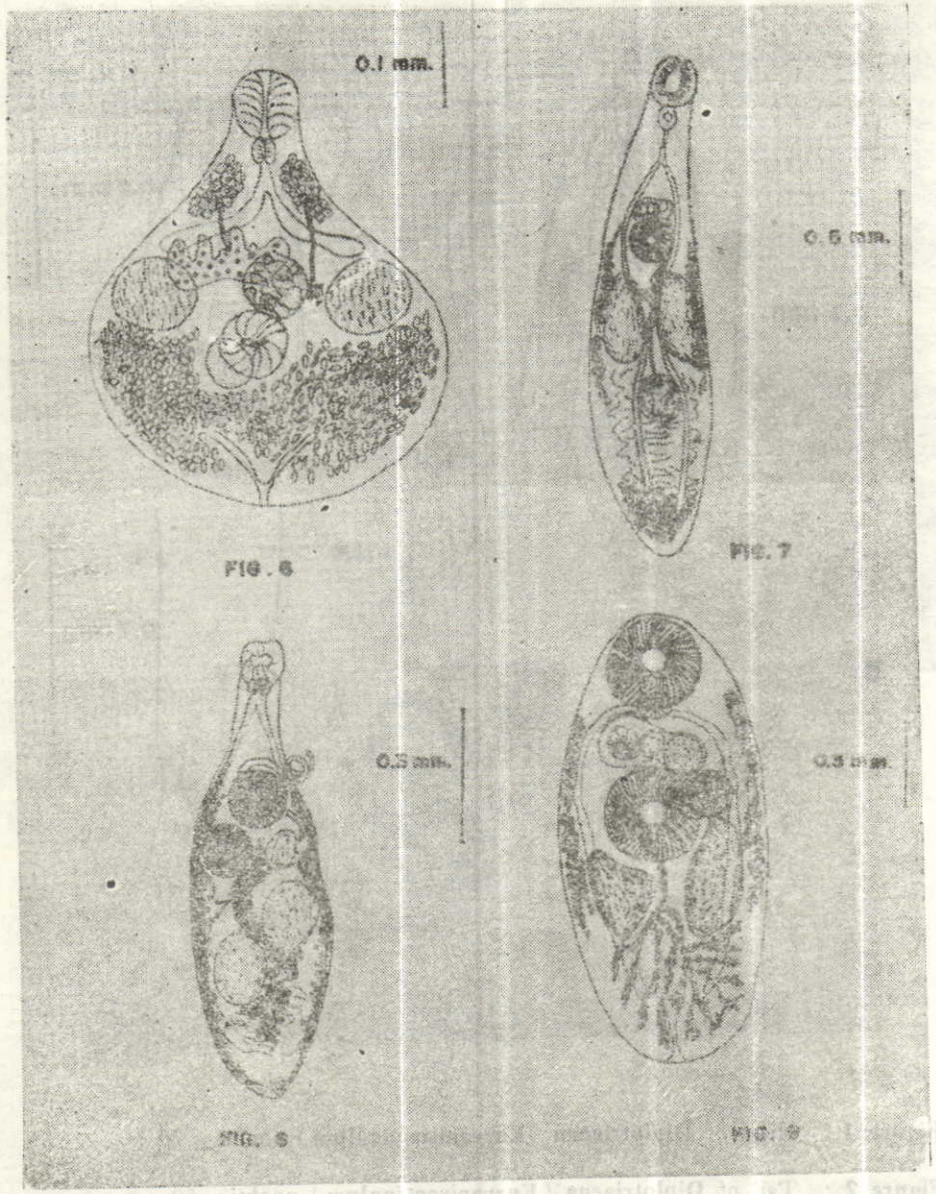

Figure 6 : Adult **Prosthodendrium** sp. from fixed and stained specimens × 110

Figure 7 : Adult **Anchitrema sanguineum** from fixed and stained specimens × 25

Figure 8 : Adult **Philophthalmus** sp. from fixed and stained specimens × 60

Figure 9 : Adult **Plagiarchis vespertilionis** from fixed and stained specimens × 40

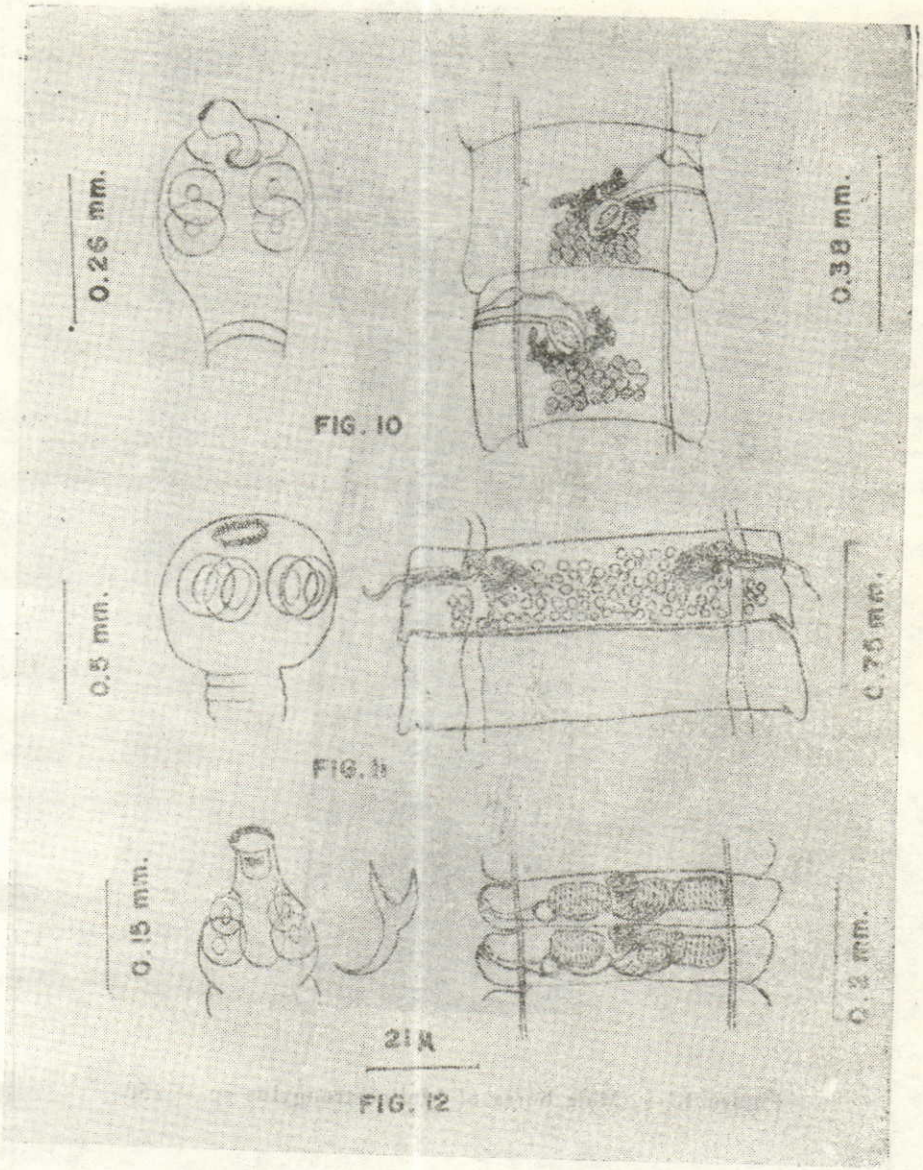

Figure 10 : Scolex of **Paricterotania** sp. × 80

Mature proglottides of **Paricterotania** sp. × 60

Figure 11 : Scolex of **Diskrjabiniella** sp. × 30

Mature proglottides of **Diskrjabiniella** × 20

Figure 12 : Scolex of **vampirolepis** sp. × 100

Hook of **vampizolepis** sp. × 750

Mature proglottides of **vampizolepis** × 100

Figure 13 : Male bursa of **Malinostrongylus** sp. × 250

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