

PARASITES OF SIAMESE FISHES AND CRUSTACEANS.

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From May 14 to June 18, 1930, the writer studied certain of the fishes and crustaceans of Siam, principally at Bangkok and Paknam Chao Phya. Valuable aid was rendered by H. M. Smith, Gordon Alexander, Luang Choola, A. F. G. Kerr, E. D. Congdon, A. Marcan, and others. A number of parasites were discovered and some of these were referred to specialists. In this connection grateful acknowledgement is made to the following persons who examined specimens of the groups indicated: H. M. Smith and B. Eggert, fishes; H. W. Manter, trematodes; G. R. La Rue, trematodes and cestodes; G. W. Hunter III, carophyllaeids; J. P. Moore, leeches; C. B. Wilson, copepods; J. P. Visscher, barnacles; and Luang Choola and Mary J. Rathbun, decapods. The Rockefeller Foundation furnished funds to carry on the field work. Types of species described by the writer have been deposited in the United States National Museum. The figures which occur throughout the text refer to parasites, the first giving the percentage of hosts infested and the second the average number of parasites per host. For example (90:1.2) means that nine out of ten hosts were found to have the particular parasite and that twelve parasites were found among ten individual hosts. In most cases ten hosts were examined for parasites.

SPIROCHAETACEA.

Borrelia sp.

On May 17 at Bangkok spirochaetes were observed in a fresh blood preparation from the catfish *Clarias batrachus*. Two blood films were fixed and stained with Giemsa's stain, but no spirochaetes could be found.

PROTOZOA.

Mastigophora.

Intestinal flagellates were observed in a specimen of the climbing-perch *Anabas testudineus* at Bangkok on May 16 (10:) and

in three specimens of the goby *Boleophthalmus boddarti* on May 29 (30:).

Trypanosoma ophicephali, n. sp.

A serpent-head, *Ophicephalus striatus*, examined on May 16 at Bangkok contained trypanosomes (10:) in its blood. These trypanosomes (Fig. 1) have been treated with Giemsa's stain. They are slender, about 0.0336 mm. in length, and 0.0019 mm. wide. The flagellum is 0.0077 long. The vibratile membrane is narrow. The trophonucleus is ellipsoidal, at about the middle of the body, 0.0052 mm. long, 0.0018 mm. wide. The posterior end of the body is tapering and obtusely pointed. The parabasal body is about 0.001 mm. from the posterior end, length (0.002 mm.) one-third greater than width. Cat. No. 22072, U. S. National Museum.

Trypanosoma trichogasterae, n. sp.

On May 19 the blood of two specimens of the hair-fin *Trichogaster trichopterus* contained trypanosomes (Fig. 2; 20:). On blood films treated with Giemsa's stain these showed the following characteristics: Body rather plump, total length 0.042 mm., greatest width 0.0016 mm., just behind the trophonucleus. Flagellum 0.019 mm. long. Posterior end of body tapering, acutely pointed. Vibratile membrane narrow. Trophonucleus ellipsoidal, slightly anterior to the middle of the body, 0.0031 mm. long 0.0010 mm. wide. Parabasal body 0.001 long, 0.0006 mm. wide, 0.0014 mm. from posterior end of body. A small vacuole is present just anterior to the parabasal body. Cat. No. 22073, U. S. Nat. Mus.

SPOROZOA.

Gregarina ucae, n. sp.

On May 31 the intestines of three specimens of the crab *Uca dussumieri* (M. Edw.), examined at Paknam, contained gregarines (Fig. 3; 30:) which had the following characteristics: Individuals usually occur in pairs; the primate being always slightly larger than the satellite. Body length 0.0516–0.0576 mm., width 0.023–0.026 mm. Protomerite wider than long, discoidal, slightly narrower at anterior end, length 0.0144 mm., width 0.016 mm. Deutomerite

0.0432 mm. long, rounded posteriorly. Nucleus nearly spherical, situated about at the junction of the anterior and middle thirds of the deutomerite, diameter 0.0064 mm. Cat. No. 22074, U. S. Nat. Mus.

Agarella sp.

Ten specimens of *Anabas testudineus* were examined at Bangkok on May 16 and two had cysts on the gills. These contained spores which were slender and pyriform. There were two tapering processes at the small end of the spores and two sporozoites within (Fig. 4). This parasite is tentatively assigned to the genus *Agarella*.

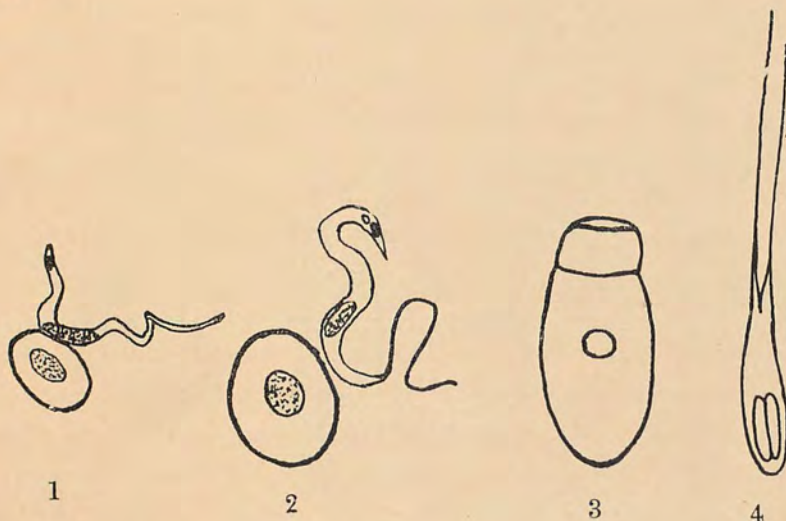


Fig. 1. *Trypanosoma ophicephali* and red blood corpuscle.

Fig. 2. *Trypanosoma trichogasterae* and red blood corpuscle.

Fig. 3. *Gregarina ucae*. Fig. 4. *Agarella* sp., spore.

PLATODA.

TREMATODA.

***Clinostomum piscidium* Southwell and Prashad.**

On May 19 ten specimens of each of two species of the fish genus *Trichogaster* were examined. *T. pectoralis* contained one *Clinostomum* (10:0.1) encysted in its liver. *T. trichopterus* was infested to a greater degree (60:6.2).

A single specimen of another species of trematode was found on the gills of the goby *Glossogobius giurus* at Paknam on June 2 (13:0.13), but was accidentally destroyed. Metacercariae were found in great numbers encysted on the gills of the little fish *Olenops vittatus* at Bangkok, May 20 (80:154.7).

CESTOIDEA.

An acarophyllaeid was quite common (80:2.4) in the air-breathing silurid *Clarias batrachus* at Bangkok on May 17. This was referred to George W. Hunter III, who reports that it belongs to a new genus and species in the sub-family Capingentinae.

Unidentifiable tapeworm cysts were found in *Boleophthalmus boddarti* (15:02) and *Periophthalmodon schlosseri* at Paknam (100:23.9) on May 29. Tetracampos cysts were found in *Ophicephalus striatus* in the liver and peritoneum (90:95.1); Bangkok, May 16. Proteocephalid cysts occurred in *Clarias batrachus* (70:3.2), *Trichogaster pectoralis* (67:1.3) and *T. trichopterus* (40:0.4). Cysts which resemble those of the genus *Echneiobothrium* (13:0.5) and tetraphyllid tapeworms (25:6.4) occurred in *Glossogobius giurus* (13:0.5).

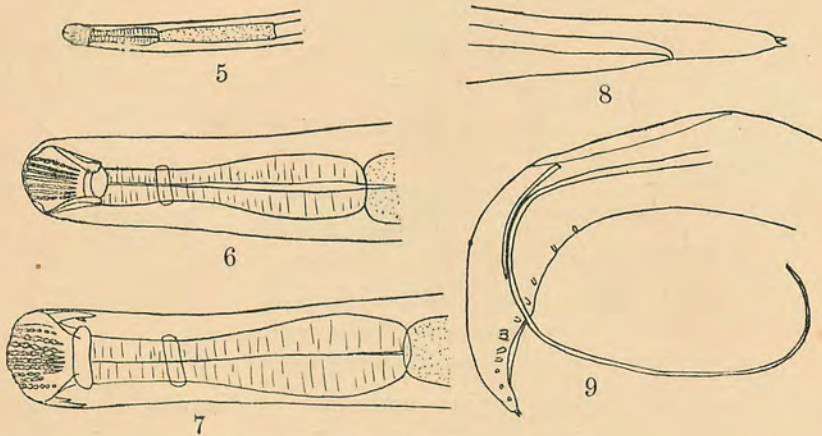
NEMATOIDEA.

NEMATODA.

Camallanus anabantis, n. sp.

In specimens of the climbing-perch (*Anabas testudineus*) examined May 16 at Bangkok, representatives of this worm were found in the intestine (90:18.3), usually near its anterior end. Both sexes are marked with cross striations throughout the length of the body. The largest male is 6.7 mm. in length and 0.1 mm. wide; the largest female 4.1 mm. long and 0.09 mm. wide. The buccal capsule in both sexes (Figs. 5-7) is enclosed by a pair of jaws each of which bears 7 to 10 beaded ridges. The males have the usual tridents above and below the jaws, but these structures cannot be seen in the females. Length of chitinous buccal apparatus in largest male 0.09 mm., muscular esophagus 0.33 mm.; glandular esophagus 0.54 mm.

Nerve ring is 0.07–0.09 mm. posterior to the buccal apparatus. Tail of male (Fig. 9) 0.063 mm. long, conical, curved ventrally, acute; two small spines at tip; four pairs of preanal papillae; 5 pairs of postanal papillae, and three pairs of discoidal elevations near the tip. Right spicule 0.59 mm. long, left spicule 0.14 mm. long. A depression occurs on the dorsal surface of each male in front of the anus. Tail of female (Fig. 8) 0.12 mm. long, conical, ending in 2 or 3 small spines. The vulva is situated slightly posterior to the middle of the body. The uteri of some of the females contain young worms. Cat. No. 8597, U. S. Nat. Mus.

Figs. 5-9. *Camallanus anabantis*.

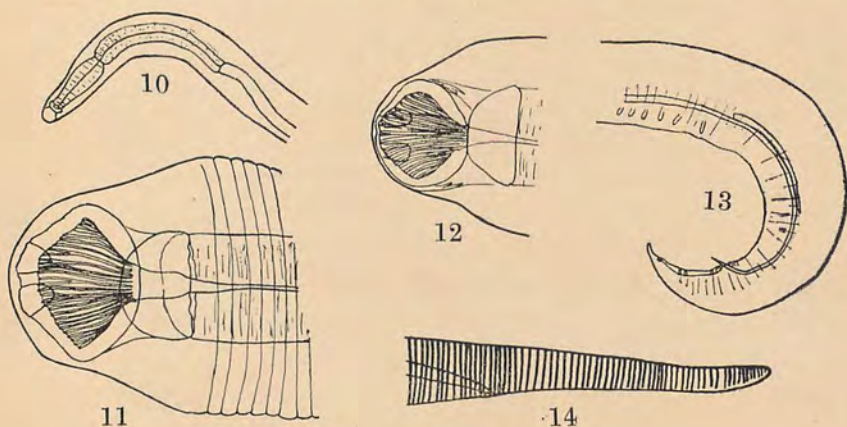
5, 6, female, anterior end; 7, male, anterior end;
8, female, posterior end; 9, male, posterior end.

One female of this species was found in *Clarias batrachus* (10:0.1) on May 17 at Bangkok.

***Camallanus ophicephali*, n. sp.**

Ten serpent-heads (*Ophicephalus striatus*) examined at Bangkok on May 16 contained in their intestines 37 worms of this species (80:3.7). The characteristics of these camallanids were as follows: Body of both sexes striated throughout. Length of body: largest female 11.9 mm., largest male 4.7 mm.; diameter: female 0.8 mm.; male 0.5 mm. Length of chitinous buccal apparatus of female (Figs. 10, 11) 0.06 mm., muscular esophagus 0.3 mm., glandular esophagus 0.7 mm. The chitinous jaws bear 18 to 26 ridges. The chitinous

pharynx behind them is hemispherical and half as long as they are. In the male (Fig. 12) small tridents extend to the posterior margin of the jaws, but such structures are not apparent in the females. Tail of female (Fig. 14) 0.28 mm. long, straight, tapering, obtusely rounded at tip; vulva a little in front of middle of body. Tail of male (Fig. 13) 0.09 mm. long; acute, tapering, curved ventrally. There



Figs. 10-14. *Camallanus ophicephali*.

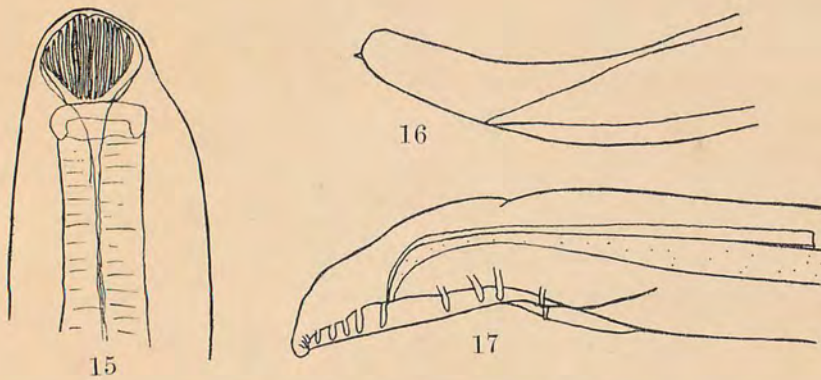
10, 11, female, anterior end; 12, 13, male, anterior and posterior ends; 14, female, posterior end with striations.

are four pairs of postanal papillae and a pair of discoidal elevations near the tip of the tail; two pairs of papillae are situated immediately in front of the anus, and six pairs some distance in front of these. Right spicule 0.35 mm. long; left spicule 0.13 mm. Cross ridges occur throughout the curved, ventral, posterior region of the male. Cat. No. 8598, U. S. Nat. Mus.

Camallanus trichogasterae, n. sp.

At Bangkok on May 19 ten specimens of *Trichogaster trichopterus* were examined. In the intestines of four of these camallanids (40:0.6) which have the following characteristics were found:

All specimens are dark yellowish brown in color, rather opaque, marked with fine cross striations. Length of body: female 7.2 mm., male 3.55 mm. Length of regions of enteron, female: buccal chitinous apparatus 0.09 mm., muscular esophagus 0.4 mm., glandular esophagus 0.68 mm. The chitinous jaws bear 14 to 20

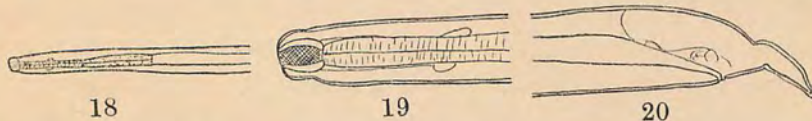
Figs. 15-17. *Camallanus trichogasterae*.

15, 16, female, anterior and posterior ends; 17, posterior end of male.

ridges. The chitinous pharynx behind the jaws (0.06 mm. long) is rather short (0.03 mm.). The tail of the female is short (0.12 mm.), obtuse, and terminates in a pair of minute spines. Vulva at junction of anterior and middle thirds of body. The tail of the male is short (0.07 mm.), obtuse, and bent ventrally. There are five pairs of large postanal papillae and two small pairs near the tip. There are four pairs of preanal papillae, none close to the anus. The right spicule is 0.36 mm. long. Cat. No. 8596, U. S. Nat. Mus.

Procamallanus kerri, n. sp.

On June 1 at Paknam a single female camallanid was found in the intestine of *Glossobobius giurus*. This is apparently a new species. Length of body 5.45 mm., buccal capsule 0.04 mm., muscular esophagus 0.29 mm., glandular esophagus 0.32 mm., tail 0.1 mm., diameter of body 0.08 mm. The chitinous buccal capsule is barrel-shaped, thick-walled, and strongly striated on its inner surface (Fig.

Figs. 18-20. *Procamallanus kerri*, female; 18, 19, anterior end; 20, posterior end.

19). The tail (Fig. 20) is constricted near its middle, curved ventrally, somewhat acute, and bears two small spines at its tip. The vulva is at the junction of the first and second thirds of the body.

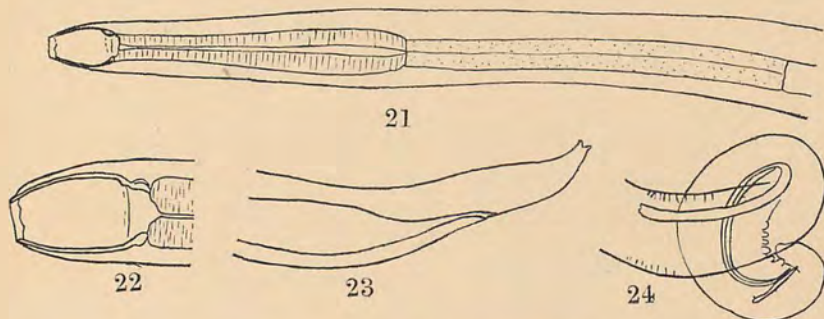
Named for Dr. A. F. G. Kerr, who has done much for Siamese natural history. Cat. No. 8603, U. S. Nat. Mus.

THELAZO, n. gen.

Spiruroidea; Thelaziidae. Buccal capsule is a chitinous, barrel-shaped cavity, without valves or lips. The posterior end of the male is coiled; gubernaculum present; spicules unequal; no caudal alae. Vulva near anterior end. Type: *Thelazo glossogobii* Pearse.

Thelazo glossogobii, n. sp.

On June 1 and 2 at Paknam in examining eight specimens of *Glossogobius giurus* four spiruroids, 2 males and 2 females, were found in the intestine of one of the fishes (13:052). These worms apparently constitute the type for a new genus and species.



Figs. 21-24. *Thelazo glossogobii*.

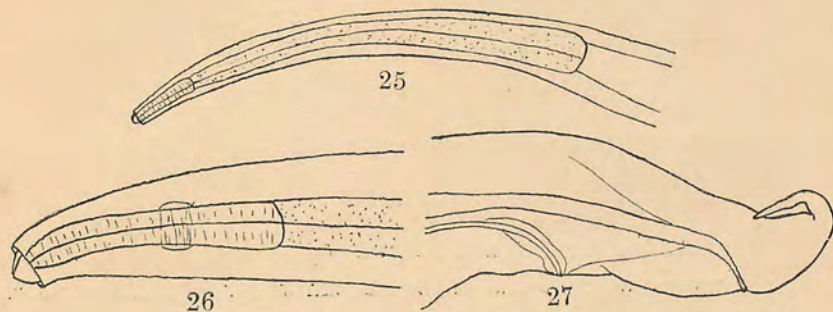
21, 22, anterior end of female; 23, posterior end of female; 24, posterior end of male.

Length of female 3.1 mm., male 2.9 mm., width of female 0.1 mm., male 0.08 mm. Length of female buccal capsule (Figs. 21, 22) 0.07 mm., muscular esophagus 0.275 mm., glandular esophagus 0.37 mm. Cuticle thin and transparent. Buccal capsule brown, barrel-shaped, the anterior border thin and widely open, posteriorly thicker, especially near the base. Muscular esophagus slightly expanded posteriorly, glandular esophagus cylindrical. Male: posterior end (Fig. 24) coiled into two loops; tail, 0.04 mm. long, conical, obtusely rounded at tip; gubernaculum 0.06 mm. long, nearly straight, spicules coiled, right spicule 0.45 mm. long, left spicule 0.17 mm. long; six sessile, pre-anal papillae, which are close together; no alae. Fe-

male: vulva at end of anterior fifth of body; eggs and larvae arranged in a single row in the uterus; tail (Fig. 23) 0.13 long, conical, ending in two short, divergent spines. Cat. No. 8601, U. S. Nat. Mus.

***Proleptus anabantis*, n. sp.**

On May 16 ten specimens of *Anabas testudineus* were examined, and one intestinal female physalopterid (Fig. 25-27; 10:0.1), which appears to be a new species, was found. Its characteristics are as follows: Body length 5.90 mm., width 0.22 mm. Cuticle smooth. Anterior end with two simple lips and a small collarette. Muscular esophagus short, 0.21 mm. long, glandular esophagus 1.36 mm. long. Vulva 1.4 mm. anterior to anus. Tail 0.18 mm. long, the posterior three-fifths slender, pointed, and flexible. Cat. No. 8592, U. S. Nat. Mus.



Figs. 25-27. *Proleptus anabantis*, female. 25, 26, anterior end; 27, posterior end.

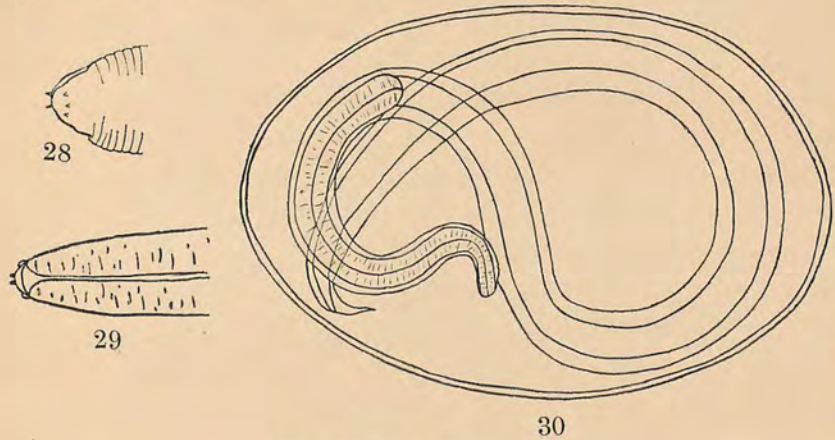
***Spinitectus* sp.**

On June 2 at Paknam a single immature *Spinitectus* was found encysted on the peritoneum of *Glossogobius giurus*. The body is 0.96 mm. long and 0.08 mm. wide. It bears about 165 rings of denticles.

***Agamofilaria* sp.**

Encysted filaroid worms were found in several fishes: *Ophicephalus striatus*, cysts in peritoneum, especially on intestine, Bangkok, May 16 (70:4.2); *Clarias batrachus*, mesenteric cysts, Bangkok, May 17 (90:5.8); *Periophthalmus koelreuteri*, peritoneal cysts, Paknam, May 29 (100:22.7); *Periophthalmodon schlosseri*, peritoneal cysts, Paknam, May 30 (20:0.2). All these worms may not belong to

the same species, and all may not be filaroids. They cannot be described satisfactorily until adults are known, but some of them are figured (Figs. 28-30). Cat. No. 8593, U. S. Nat. Mus.



Figs. 28-30 *Agamofilaria* sp.

28, anterior end of worm from *Periophthalmus koelreuteri*.

29, 30, anterior end and cyst of worm from *Periophthalmodon schlosseri*;
cyst: length 2.6 mm.; width, 1.72 mm.; worm: length, 7.47 mm.; width, 0.27 mm.

ACANTHOCEPHALA.

Farzandia ophiocephali Thapar.

This worm was found in the caecum of *Ophicephalus striatus* at Bangkok on May 16 (10:01). At Bangkok on May 19 cysts were found in *Trichogaster trichopterus* (40:1.1).

Farzandia sp.

Cysts which were referred to this genus by Dr. Van Cleave were found in *Ctenops vittatus* at Bangkok, May 20 (20:0.2).

Unidentifiable acanthocephalan cysts were also collected from *Anabas testudineus*, Bangkok, May 16 (20:0.2); *Periophthalmus koelreuteri*, Paknam, May 29 (57:2.9); and *Glossogobius giurus*, Paknam, June 2 (13:0.13).

ANNELIDA.

Paracheopsis vulnifera Harding.

Specimens of this leech were taken from the branchial cavities of a river crab (*Parathelphusa* sp.) at Bangkok.

Haemadipsa interrupta Moore.

This land leech was quite common along the damp mountain trails on Koh Chang, Southeast Siam, June 9. The leeches lurked among fallen leaves and, when a person walked along a trail, looped rapidly toward the traveller and if possible attached themselves to one of his feet.

CRUSTACEA.

Dichelaspis apeita Aurivillius.

On May 31 and June 2 at Paknam ten specimens each of the crabs *Portunus pelagicus* (L.) and *Scylla serrata* (Forsk.) were examined. The branchial cavities of nine of the first (90:59.0) and of all of the last (100:271.3) contained barnacles. Ten other somewhat smaller crabs, *Charybdis affinis* (Dana), were examined on May 31 and contained no barnacles or other parasites.

Ergasilis mugilis Vogt.

Two of eight specimens of *Glossogobius giurus* examined at Paknam on June 2 had copepods of this species on their gills (25:1.4)

Argulus sp.

Immature argulids were taken from *Trichogaster leeri*, Bangkok, May 19.

Gnathia sp.

Parasitic isopods were frequently encountered on the gills of fishes examined at Paknam, May 29–June 2: *Boleophthalmus boddarti* (100:50.9; 70:2.9); *Periophthalmus schlosseri* (30:0.7); *Glossobius giurus* (63:8.3). These parasites were all in the praniza stage and without adults a more accurate identification is not possible. Most of the little parasites were swollen through the middle of the body and often bright red from imbibed blood.

Palaegyge butendijki Horst.

A specimen was given to the writer by Dr. H. M. Smith. It was taken from the branchial cavity of a prawn, *Macrobrachium carcinus* (Fabricius), bought in the Bangkok market March 22, 1929.

MISCELLANEOUS.

Unidentifiable cysts (20:0.43) were found in the peritoneum

of *Periophthalmodon schlosseri*, Paknam, May 30. A pathological condition was found in the liver of *Periophthalmus koelreuteri*, Paknam, May 29. The abnormal portion had a white, granular, cheesy appearance. Sections of this were submitted to a pathologist, Dr. Wiley D. Forbus, who expressed the opinion that the growth was a haemangioma.

DISCUSSION.

The parasites which occur in air-breathing fishes in Siam are much like those which are found in other fresh-water and estuarine fishes. Evidence from other sources than parasites indicates that air-breathing and land fishes and land crabs took up residence on land largely on account of stagnant water, enemies, available foods, interspecific competition, and periodic aridity. The only crab which was found to contain gregarines was an intertidal zone species, *Uca dussumieri* (M. Edw.). Barnacles were abundant in the gill cavities of two large species of crabs, *Portunus pelagicus* (average diameter of 10, 119 mm.) and *Scylla serrata* (average diameter of 10, 118 mm.), but were wholly absent from another smaller species (38.4 mm.), *Charybdis affinis* (Dana), at the same locality on the same date. Whether such differences are due to host specificity, size, or other causes is unknown.

There is an excellent opportunity in Siam to study parasites. The adults of parasites which occur as immature stages in fishes will doubtless be found in piscivorous mammals, birds, and other animals. It is to be hoped that someone will be able to take up the study of the ecology and life histories of parasites and carry it on for many years. Such a field offers unusual scientific opportunities.

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