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Some oxyurids from a Galapagos tortoise.[1] A. C. WALTON, Knox College, Galesburg, Illinois.

Through the courtesy of the Zoological Division, Bureau of Animal Industry, United States Department of Agriculture, a collection of nematodes taken from the caecum of a Galapagos land tortoise (*Testudo* sp.?) was placed at the writer's disposal for study. The worms were all oxyurids and fall into four genera and six species. Five of the species are new, and it becomes necessary to establish a new genus to accommodate three of these.

"Oxyuris" (sensu latu) *loveridgei* Baylis, 1920 (Fig. 1, A)

By far the most abundant species in the collection is one represented only by females, with all stages represented from the newly hatched larvae up to mature adults. The very short esophagus and the general body measurements fall well within the range of those given by Baylis (1920) for *"Oxyuris" loveridgei* from *Macroscincus coctaei* (from the Cape Verde Islands). Although from a different host from a different geographical locality, there are no recognizable differences between the materials studied by Baylis and the present specimens. It seems best, therefore, to refer the Galapagos material to the species *"Oxyuris" loveridgei* of Baylis, 1920. As Baylis has suggested, this form may either belong to a parthenogenetic generation or else it represents a case of such extreme dimorphism that as yet no males have been recognized as belonging with these particular females as members of the same species.

The worms are thick-bodied, and show considerable variation in the length of the tail. The eggs, varying in number from 4 to 18, may contain well-developed embryos at the time they are ready to leave the vagina. This structure is quite short and is heavily cuticularized. The vulva lips are only very slightly raised above the surface of the body.

The following measurements are based on 1 lot of 15 mature worms:—Length, 3.7–4.8 mm; width at vulva, 0.37–0.41 mm; esophagus (corpus) length, 0.55–0.61 mm; isthmus length, 0.07–0.08 mm; bulb dimensions, 0.14×0.14 mm; head-nerve ring distance, 0.18–0.19 mm; head-excretory pore distance, 0.92–1.11 mm (postbulbar); vulva-tail distance, 2.0–2.35 mm (vulva approximately median); anus-tail distance, 0.37–0.7 mm; egg size, 0.074×0.148 mm (larvae measure 0.031×0.325 mm); youngest hatched larvae in the collection measured 0.07×1.025 mm. No evidence of viviparity was noted.

Specimens.—U.S.N.M. Helm. Coll. No. 31958.

Thaparia contortospicula, n. sp. (Fig. 1, B & C)

In the material from the same tortoise are a number of specimens of both sexes of an oxyurid that belongs to the genus *Thaparia* Ortlepp, 1933, and to an hitherto undescribed species. The worms are medium sized oxyurids, lacking lateral alae,

[1] Contribution from the Biological Laboratories of Knox College, No. 78.

and with the two-parted esophagus (corpus and elongated isthmus) characteristic of the genus. The males have a distinctly spike-like and greatly narrowed tail, and show definite alae. There are 4 pairs of caudal papillae, 3 of which are cloacal in position and the fourth at the posterior end of the alae. The spicule is very long, reaching almost to the level of the esophageal bulb. The vulva is in the posterior half of the body, but is not as close to the anus as it is in the type species. The vagina is very long and extends far forward before turning back to give rise to the long ovejector. The lips of both sexes are flattened and the dorsal lip appears to have a cuticular flap that is everted in some specimens.

Male.—Length, 3.25–3.3 mm; greatest width, 0.13–0.15 mm; length of corpus, 0.22–0.26 mm; length of isthmus and its posterior bulbar swelling, 0.31–0.36 mm; head-nerve ring distance, 0.175–0.19 mm (around posterior third of the corpus); head-excretory pore distance, 0.58–0.64 mm (postbulbar); cloaca-tail distance, 0.13–0.17 mm; spicule length, 1.29–1.36 mm; accessory piece length, 0.035–0.042 mm. The spicule shows 3 to 5 long spiral twists. The undivided tip of the spicule is flattened and blunt. The accessory piece is Y-shaped, with the tip hooked laterally and with the arms curving and reaching far dorsally. Two pairs of fleshy-based papillae are precloacal in position, one pair is paracloacal in position, and the fourth pair is opposite the ends of the caudal alae, but some distance from the end of the spike-like tail. A pair of cuticular plates project posteriorly from the bases of the precloacal papillae and a second pair of similar structure is parallel to the projecting tip of the accessory piece. A single pair of phasmidial organs opens through the alae at about the level of the base of the posterior pair of papillae.

Female.—Length, 3.6–3.9 mm; width at vulva, 0.23–0.28 mm; length of corpus, 0.18–0.19 mm; length of isthmus and bulb, 0.4–0.425 mm; head-nerve ring distance, 0.145–0.152 mm (around posterior third of the corpus); head-excretory pore distance, 0.6–0.68 mm (opposite bulb); vulva-tail distance, 1.65–1.85 mm; anus-tail distance, 0.3–0.35 mm; embryonated eggs measure 0.067×0.130 mm. The lips of the vulva are level with the body surface. The ovaries and oviducts lie mainly anterior to the level of the vulva.

This species may be separated from the type species, *Thaparia macrospiculum* Ortlepp, 1933, by the generally smaller size, the shorter relative length of the spicule, the twisted nature of the spicule, the pattern of the arrangement of the cloacal papillae and cuticular projections, the spike-like (not truncated) tail form, and the more anterior position of the vulvar opening.

The new species is named *Thaparia contortospicula* because of the twisted nature of the spicule.

Specimens (including types).—U.S.N.M. Helm. Coll. No. 31958.

On the basis of the addition of a second species, the diagnosis of the genus *Thaparia* is emended to read as follows: Medium sized worms possessing 3 lips and a relatively short esophagus consisting of an anterior muscular corpus and a glandular isthmus which gives rise to a valvulated bulb without any constriction before the bulb; an excretory pore bulbar to post-bulbar in position; lateral alae absent. Vulva in the posterior half of the body, sometimes closely approximating the anus in position; vagina very long; ovejector present; uteri 2; ovaries 2. Caudal extremity of male cut and narrowed ventrally and continued backward to form a truncated or spiked tail; caudal alae present; phasmids distinct; spicule very long, extending to the level of the isthmus in some forms; accessory piece present. Four pairs of caudal papillae on fleshy bases, 3 pairs circumcloacal in position and 1 pair toward the tip of the tail; cuticular projections in addition to papillae around the cloaca in some forms.

Type species.—*Thaparia macrospiculum* Ortlepp, 1933, from *Testudo verreauxi* —S. Africa.

Other species.—*T. contortospicula,* n. sp., from Galapagos land tortoise—Galapagos Islands.

Tachygonetria testudinis, n. sp. (Fig. 1, D & E)

Among the specimens from the Galapagos tortoise were a number of males and females of a species of *Tachygonetria* Wedl, 1862. They are oxyurids of small size with 3 slightly bilobed lips and a very short pharynx, and they lack both lateral and caudal alae. The female has the vulva near the middle of the body and has both an ovejector and an egg reservoir. The male has a single spicule, and possesses an accessory piece.

Male.—Length, 1.98–2.1 mm; greatest width, 0.12–0.135 mm; corpus length, 0.58–0.61 mm; isthmus length, 0.037 mm; bulb dimensions, 0.074×0.074 mm; head-nerve ring distance, 0.18–0.19 mm; head-excretory pore distance, 0.85–0.92 mm (postbulbar); anus-tail length, 0.085–0.095 mm; spicule length, 0.09–0.11 mm; accessory piece length, 0.038–0.041 mm (poorly cuticularized and with a terminal knob); caudal papillae, 4 pairs (a double precloacal pair, a postcloacal pair, and a terminal pair); tip of tail mucronate; a small pair of cuticularized projections on the anterior cloacal lip.

Female.—Length, 3.5–3.7 mm; width at vulva, 0.26–0.29 mm; corpus length, 0.93–0.98 mm; isthmus length, 0.035 mm; bulb dimensions, 0.11×0.11 mm; head-nerve ring distance, 0.22–0.24 mm; head-excretory pore distance, 1.11–1.13 mm (usually postbulbar); vulva-tail distance, 1.57–1.61 mm (vulva in a depression and covered by a flap from the anterior lip of the opening); vagina short, ovarian coils all anterior to the vulva; anus-tail distance, 0.61–0.64 mm (tail long and pointed); egg size, 0.063×0.137 mm (embryonated).

This form can be separated from the other described species of the genus on the basis of the arrangement of the cloacal papillae and the shape of the accessory piece. In several species the paracloacal papillae are absent, but only in *T. pusilla* Surat, 1918, are the precloacal and paracloacal pairs coalesced. The tip of the spicule in *T. pusilla* is barbed, however, and in this form the spicule is barbless.

Specimens (including types).—U.S.N.M. Helm. Coll. No. 31958.

Ortlepp, 1933, described two species, *T. poweri* and *T. quadrilabiata,* which have definite caudal alae, and which were placed in the genus on the basis of spicule form and type of the caudal papillae, regardless of the presence or absence of caudal alae. Careful examination of examples of the original type material of the genus, and of several other species referred to this genus does not support the validity of the diagnosis as given by Seurat, 1918, which stated that narrow caudal alae may be present in the males. Later observers have been guided to a large extent by the statements of Seurat. The alae referred to by Seurat are probably due to improper fixation and consequent shriveling; a condition frequently found among the delicate forms such as the oxyurids. Examination of the cross sections of the tails of the males of several species of *Tachygonetria* has shown that the so-called alae are only artifacts. On the basis of this observation, the diagnosis of the genus should be emended to state that neither lateral or caudal alae are present in either sex. Since the presence or absence of the various types of alae is of use in the proper placing of species in genera, care should be taken to determine whether the apparent alate condition is natural or merely an artifact. On the basis of the emended generic diagnosis the two species described by Ortlepp, 1933, cannot be retained in the genus *Tachygonetria* Wedl, but must be placed elsewhere (*vide infra*).

Pseudoalaeuris macroptera, n. gen., n. sp. (Fig. 1, F & G)

A large number of males and females of a new species of a new genus are present in the collection. They are slender oxyurids of medium size, having 3 well-

developed lips, each of which is provided with evertible cuticularized flaps. The esophagus, which consists of a long corpus, a short and somewhat narrower isthmus, and a distinct bulb, follows a well-defined pharynx. The excretory pore is opposite the bulbar region. There are no lateral alae or ridges. The tail of the male is provided with very broad and longitudinally striated alae, and ends in a spike-like projection of variable length. There is a single pair of large mammillary precoacal projections, each tipped wth a small papilla, and at their bases giving rise to a posterior blade-like process of cuticular nature. A smaller pair of papilla-tipped processes lie in a postcloacal position on either side of the narrow projecting accessory piece. A small pair of caudal papillae is at the level of the posterior end of the caudal alae. The spicule is short and very thin, being difficult to find in many specimens. In the female the tail is conical and sharply pointed. The vulva opens into a small depression on the surface of the posterior half of the body. The vagina is quite short. The smooth-shelled eggs contain well-developed larvae when they leave the ovejector.

Th specific name of this species refers to the large size of the alae in the tail region.

Male.—Length, 3.15–3.26 mm; greatest width, 0.26–0.3 mm; pharynx length, 0.023–0.024 mm; corpus length, 1.03–1.045 mm; isthmus length, 0.03 mm; bulb dimensions, 0.11×0.11 mm; head-nerve ring distance, 0.22–0.25 mm; head-excretory pore distance, 1.19–1.22 mm; cloaca-tail distance, 0.157–0.162 mm; spicule length, 0.1–0.13 mm; accessory piece length, 0.045–0.05 mm.

Female.—Length, 4.05–4.11 mm; width at vulva, 0.35–0.39 mm; pharynx length, 0.026 mm; corpus length, 1.21–1.3 mm; isthmus length, 0.36–0.38 mm; bulb dimensions, 0.11×0.11 mm; head-nerve ring distance, 0.25–0.29 mm; head-excretory pore distance, 1.38–1.41 mm; vulva-tail distance, 1.22–1.27 mm; anus-tail distance, 0.18–0.19 mm; egg size, 0.055×0.148 mm; eggs containing formed larvae, 2–8 in number.

Specimens (including types).—U.S.N.M. Helm. Coll. No. 31958.

Pseudoalaeuris auricularis, n. sp. (Fig. 1, H & I)

A few specimens of both sexes of a species closely related to *Pseudoalaeuris macroptera* were present in the collection. They are small forms having 3 indistinct lips, each with a protrusible flap. The oral papillae are quite distinct. Lateral alae are absent. The esophagus shows an isthmus greater in diameter than the corpus, a condition exactly reversed in *P. macroptera.* The excretory pore is prebulbar in position. The tail in both sexes is elongated; that of the male extending considerably beyond the posterior tips of the alae which are distinctly auriculate in outline. The caudal papillae in the male consist of 1 precloacal pair and 1 pair opposite the posterior end of the alae. The prominences at the sides of the well-developed accessory piece do not appear to be tipped by papillae. The dorsal lip of the cloaca has 2 small cuticularized projections. The spicule is longer in proportion than is the case in *P. macroptera,* and is well cuticularized. It has a definite dorsal curve near its middle. The vulva has the anterior lip distinctly overlapping the posterior one but is not elevated above the general body surface. The vagina is short. The eggs are few in number and have completed segmentation when ready for ovipositing.

The specific name refers to the shape of the caudal alae.

Male.—Length, 2.35–2.42 mm; greatest width, 0.15–0.165 mm; pharynx length, 0.017–0.019 mm; corpus length, 0.83–0.89 mm; isthmus length, 0.04 mm; bulb dimensions, 0.09×0.09 mm; head-nerve ring distance, 0.175–0.185 mm; head-excretory pore distance, 0.87–0.94 mm; cloaca-tail distance, 0.148–0.152 mm; spicule length, 0.15–0.159 mm; accessory piece length, 0.056 mm.

Female.—Length, 3.65–3.8 mm; width at vulva, 0.27–0.32 mm; pharynx length, 0.018 mm; corpus length, 1.11–1.17 mm; isthmus length, 0.04 mm; bulb dimensions, 0.11 × 0.11 mm; head-nerve ring distance, 0.17–0.2 mm; head-excretory pore distance, 1.01–1.09 mm; vulva-tail distance, 1.5–1.69 mm; anus-tail distance, 0.54–0.58 mm; egg size, 0.072 × 0.120 mm.

Specimens (including types).—U.S.N.M. Helm. Coll. No. 31958.

This form can be distinguished from *P. macroptera* on the basis of the general contour of the body, the form of the caudal alae in the male, the size and form of the spicule, the arrangement of the cloacal papillae, the position of the excretory pore, the structure of the vulva, and the structure of the esophageal isthmus.

Pseudoalaeuris pharyngodentata, n. sp. (Fig. 1, J, K, L & M)

The third species of *Pseudoalaeuris* from the collection is also represented by both sexes. These are medium sized oxyurids with the characteristic caudal alae in the male, and with no lateral alae in either sex. They can be identified by the very long spicule in the male, by the very prominent prevulvar swelling in addition to the overlapping structure of the anterior lip of the vulva in the female, and by the structure of the head parts. The caudal alae of the male are long and fairly narrow. The lips are well developed and the cephalic papillae and the amphidial openings are prominent. Each lip has a terminal cuticular flap. At the base of the buccal cavity and attached to the tips of the heavy cuticular rods supporting the wall of the pharynx are 3 tooth-like cutting plates. The excretory pore is at the level of the isthmus. There are 3 pairs of finger-like processes surrounding the cloacal opening of the male. The precloacal pair and the paracloacal pair are tipped by papillae. No papillae were recognized on the tips of the postcloacal pair of processes. This latter pair of structure lies to either side of the swelling containing the accessory piece. The terminal caudal papillae are located at the level of the junction of the alae and the tail spike. The vulvar opening is in the posterior third of the body. The body of the female is bent sharply ventrad just behind the level of the vulva. The vagina is very long. The eggs are few in number and contain embryos when oviposited.

The specific name refers to the tooth-like structures at the anterior end of the pharynx.

Male.—Length, 3.6–3.7 mm; greatest width, 0.18–0.19 mm; pharynx length, 0.055 mm; corpus length, 1.1–1.15 mm; isthmus length, 0.055 mm; dimensions of the bulb, 0.11 × 0.11 mm; head-nerve ring distance, 0.18–0.192 mm; head-excretory pore distance, 1.22–1.3 mm; cloaca-tail distance, 0.18–0.19 mm; spicule length, 0.6–0.65 mm; accessory piece length, 0.08 mm.

Female.—Length, 4.1–4.9 mm; width at vulva, 0.25–0.3 mm; pharynx length, 0.055 mm; corpus length, 1.6–1.72 mm; isthmus length, 0.037 mm; dimensions of bulb, 0.103 × 0.103 mm; head-nerve ring distance, 0.185 mm; head-excretory pore distance, 1.7–1.81 mm; vulva-tail distance, 1.1–1.2 mm; anus-tail distance, 0.29–0.3 mm; egg size, 0.075–0.136 mm.

Specimens (including types).—U.S.N.M. Helm. Coll. No. 31958.

This form may be distinguished from the two other species of the genus by the size of the spicule and by the length of the vagina, as well as by the peculiar armed condition of the pharynx and the heavily cuticularized prevulvar structure found in the female.

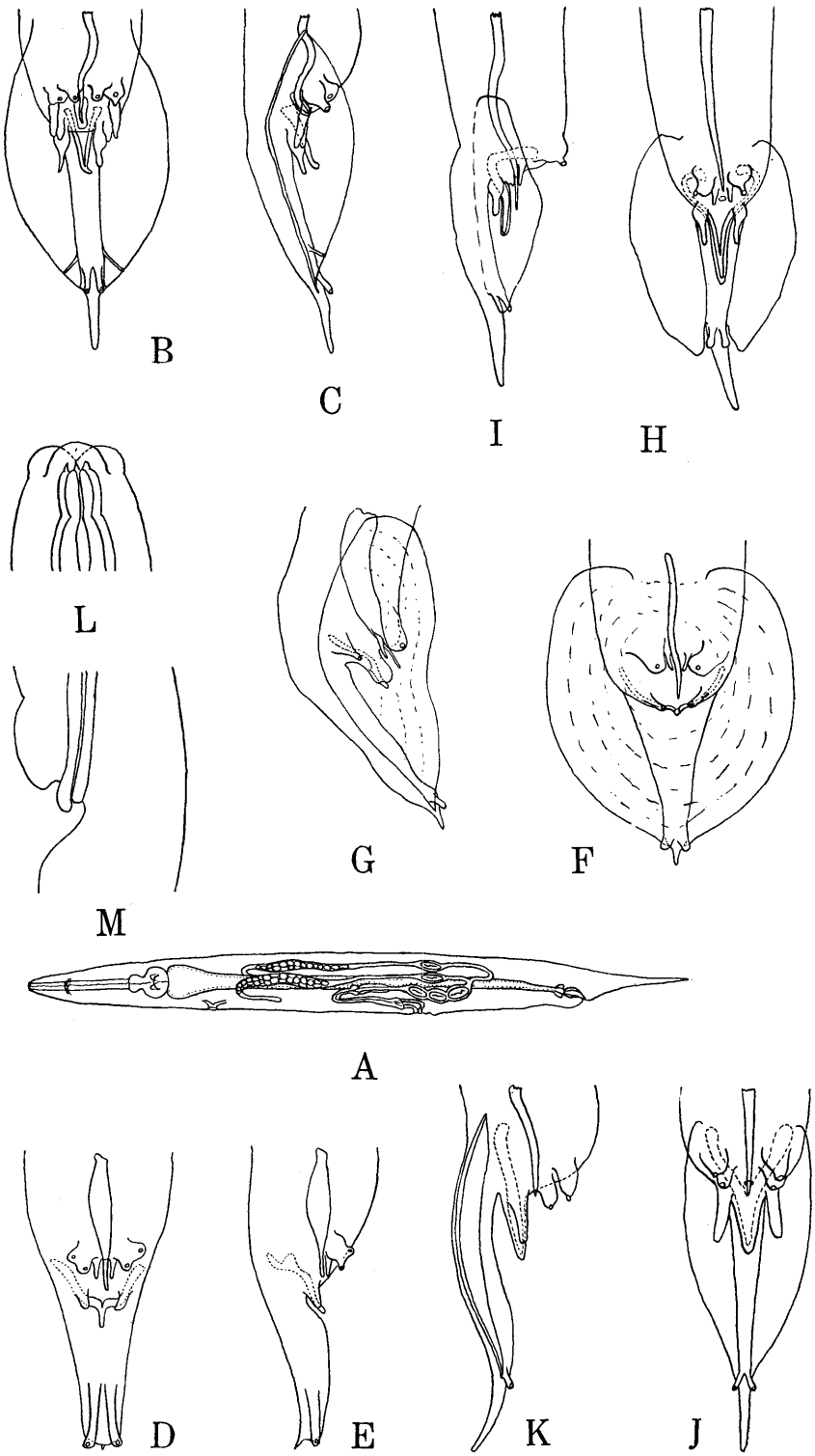
Discussion.—Thapar, 1925, established the genus *Alaeuris*, as distinct from the genus *Tachygonetria*, for those oxyurids of reptiles which possessed 3 lips, an elongated esophagus with a posterior valvulated bulb, and which showed lateral flanges or alae in both sexes. The males had a single long spicule, possessed distinct caudal

alae on the conical, ventrally cut tail, showed 4 pairs of caudal processes (usually tipped by papillae), and developed a V- or Y-shaped accessory piece. The females had a short, conical tail, a vulva located in the posterior half of the body, a long ovejector, and, apparently, were oviparous. Thapar also pointed out that the typical tachygonetrid lacked true caudal alae, a point missed by a number of subsequent workers. Two species, *Alaeuris alaeuris* (from a tortoise) and *A. iguanae* (from an iguana) were placed in the new genus. Ortlepp, 1933, added a third species, *A. conspicua* (from a tortoise). Sandground, 1929, described a species, *A. hirsutus* (from an iguana), placing it tentatively in *Alaeuris* although stating that it definitely lacked lateral alae. Cuckler, 1938, added 4 new species—*conolophi, galapagensis, labicula,* and *longispicula* (from the Galapagos land iguana)—to the genus *Alaeuris;* again in spite of the absence of lateral alae. He followed Thapar in separating them from *Tachygonetria* because of the presence of caudal alae in the males.

Careful study of materials from the original host species (*Testudo graeca* and *Iguana tuberculata*) substantiates Thapar's statement as to the presence of more or less well-defined lateral alae or flanges in both sexes of what he named *Alaeuris alaeuris* and *A. iguanae.* Examination of Cuckler's type material and of several batches of material from various iguanids (including *I. rhinolopha*—the source of Sandground's material) shows the consistent absence of any structures possible of interpretation as lateral flanges or alae. All of these forms, together with the three species of *Pseudoalaeuris* described above, agree in general body shape and structure to such a degree that they form a natural group. If the matter of alae is ignored, *Alaeuris* (original definition), as well as the above-mentioned group of species cannot be differentiated from *Tachygonetria.* Inasmuch as the presence or absence of lateral and caudal alae seems to be so consistent within groups of species and has been used as one of the criteria for generic differentiation, it simplifies identification of the various related groups to recognize the difference more widely and to establish generic concepts where possible on the basis of alar presence or absence, other conditions being equal. Under such circumstances, we find that the oxyurids (of reptiles) possessing three lips, an elongated corpus and a short isthmus opening into a posterior valvulated bulb, a single spicule, an accessory piece, and a cut-away male cloacal region having a group of papillae not involved in the support of the caudal alae, naturally falling into the following groups of the *Syphaciinae* Railliet, 1916: (1) *Tachygonetria* Wedl, 1862—a genus having neither lateral or caudal alae in either sex, (2) *Alaeuris* Thapar, 1925—a genus having both lateral and caudal alae, (3) *Veversia* Thapar, 1925—a genus having only lateral alae, and (4) a group of species having caudal alae present in the males but lacking any trace of lateral alae in either sex. It is to this latter group that the three new species just described belong, together with a number of other species to be transferred from their original generic positions. Due to the superficial resemblance of the species of this group—particularly in the case of the males—to the genus *Alaeuris,* the name *Pseudoalaeuris,* n. gen. is proposed with the following diagnosis:

Pseudoalaeuris, n. gen. Syphaciinae. Oxyurids of medium size. Lips 3. Pharynx present. Esophagus usually long, with a definite isthmus and a posterior bulb. Lateral alae absent. Lateral fields distinct and composed of large cells.

FIG. 1. A—*"Oxyuris" loveridgei,* lateral view of female. B—*Thaparia contortospicula,* tail of male, ventral. C—*T. contortospicula,* tail of male, lateral. D—*Tachygonetria testudinis,* tail of male, ventral. E—*T. testudinis,* tail of male, lateral. F—*Pseudoalaeuris macroptera,* tail of male, ventral. G—*P. macroptera,* tail of male, lateral. H—*P. auricularis,* tail of male, ventral. I—*P. auricularis,* tail of male, lateral. J—*P. pharyngodentata,* tail of male, ventral. K—*P. pharyngodentata,* tail of male, lateral. L—*P. pharyngodentata,* head of female, dorsal. M—*P. pharyngodentata,* vulva region of female, lateral.



Tail of male suddenly constricted at the level of the cloaca to form a dorsal conical process which may or may not end in a terminal spike. Consistent caudal alae present in the male, never subtended by papillae. Caudal papillae basically 4 pairs, of which 3 pairs are cloacal and 1 pair located opposite the posterior tip of the alae (the cloacal pairs may be fused or may be reduced in number in some species, but the processes upon which they normally appear are still present). Additional cuticular processes usually present in the cloacal region. Posterior lip of the cloaca projecting, and supported by the tip of the V- or Y-shaped accessory piece. Spicule single and of various lengths. Vulva usually behind the mid-region, and may be covered by a conspicuous prevulvar flap in some species. Vagina length varies from very long to very short. Eggs are large and few in number at any one time; usually being beyond the gastrula stage when deposited—in some cases containing coiled larvae. Parasites of the caecum of herbivorous reptiles.

Type species.—Pseudoalaeuris macroptera, n. sp.

Other species.—P. auricularis, n. sp., and *P. pharyngodentata*, n. sp.

As pointed out above, Cuckler's species—*conolophi, galapagensis, labicula*, and *longispicula*—, and Sandground's species—*hirsutus*—cannot be retained in the genus *Alaeuris* as originally placed since they lack all evidences of the presence of lateral alae. They therefore must be transferred to the new genus—*Psaudoalaeuris* —and become *Pseudoalaeuris conolophi* (Cuckler), *P. galapagensis* (Cuckler), *P. labicula* (Cuckler), *P. longispicula* (Cuckler), and *P. hirsuta* (Sandground); all new combinations.

The two species described by Ortlepp, 1933—*Tachygonetria poweri* and *T. quadrilabiata*—have been shown not to meet the specifications for the genus *Tachygonetria* (no alae), but do fit into *Pseudoalaeuris* (caudal alae in the male). Therefore they become *Pseudoalaeuris poweri* (Ortlepp) and *P. quadrilabiata* (Ortlepp), n. combs., respectively.

Rees, 1935, in describing *Tachygonetria expansa*, from *Testudo horsfieldii*, points out that the presence of caudal alae in the male makes the generic position of this form uncertain, but hesitates to establish a new genus on this basis—then represented by only one species. *T. expansa* is undoubtedly an example of *Pseudoalaeuris* and should be designated as *P. expansa* (Rees), n. comb.

Akhtar, 1937, in describing *Tachygonetria inflatocervix*, from *Testudo graeca* (= *ibera*), indicates the presence of caudal alae in the male. This form must likewise be transferred to the genus *Pseudoalaeuris* and therefore becomes *P. inflatocervix* (Akhtar), n. comb. In the same paper Akhtar emends the generic diagnosis of *Tachygonetria* by the addition of the following phrase—"a pair of voluminous papillae on the middle or posterior third of the tail"—to the description of the male. With the removal from the genus *Tachygonetria* of all of those forms in which the male possesses caudal alae, this emendation is no longer valid and should be dropped. The posterior pair of caudal papillae in *Tachygonetria* are not necessarily large and they are found only on the posterior third of the tail; usually in a terminal or subterminal position.

Dosse, 1939, has shown that the genus *Travassozolaimus* Vigueras, 1938, possesses an accessory piece and must be transferred to the Syphaciinae from the Oxyurinae, as originally placed. This genus, together with *Paralaeuris* Cuckler, 1938, shows relationships with *Pseudoalaeuris* in that the only evidence of alae is in the caudal structures of the male. *Travassozolaimus* has only one pair of caudal papillae, and these are located on the anterior cloacal lip. No evidences of the posterior pairs of caudal papillae, or even of their possible former existence, is present. *Paralaeuris* is differentiated by the fact that the posterior pair of caudal papillae are much elongated and aid in the support of the alae. In this form the isthmus is reduced to a mere constriction separating the corpus from the bulb.

Thaparia Ortlepp, 1933, with the same alar plan as *Pseudoalaeuris*, can be differentiated readily inasmuch as the isthmus is as long as, or longer, than, the corpus.

Mammillomacracis Dosse, 1939, has cervical alae in both sexes in addition to the caudal alae of the male. Since it has an accessory piece, it must be transferred to the Syphaciinae from the Oxyurinae. It can be separated from the related genus *Alaeuris*—with the same alar pattern—because of the possession of a median swelling on the esophagus.

Of the other genera falling in the subfamily Syphaciinae, *Veversia* Thapar, 1925, has lateral alae only, and a single uterus; while *Ozolaimus* Dujardin, 1845, and *Macracis* Gedoelst, 1916, have only two instead of three lips. In addition, *Ozolaimus* has a median swelling on the long esophagus.

Paracis Railliet, 1916, and *Mehdiella* Seurat, 1918, are accepted as synonyms of *Tachygonetria* Wedl, 1862.

A key has been constructed for convenience in the recognition of the following oxyurid genera that commonly occur in reptilian hosts: *Alaeuris, Atractis, Cyrtosomum, Ibrahimia, Labiduris, Macracis, Mammillomacracis, Monhysterides, Ozolaimus, Paraleuris, Parathelandros, Pharyngodon, Pseudoalaeuris, Tachygonetria, Thaparia, Thelandros, Travassozolaimus, Typhlonema,* and *Veversia.*

Key for the determination of some of the oxyurid genera found in reptiles
("Oxyuris" as a genus has not been included in this key)

OXYUROIDEA—esophagus with posterior bulb.

1. a. Females with 1 ovary ..... ATRACTIDAE (A)
   b. Females with 2 ovaries ..... OXYURIDAE (B)

(A) ATRACTIDAE—1 ovary, 2 spicules.

1. a. Male with 2 equal spicules, no accessory piece. LABIDURINAE (a)
   b. Male with 2 equal spicules, accessory piece present. IBRAHIMIINAE (b)
   c. Male with 2 unequal spicules, accessory piece present. ATRACTINAE (c)

(a) LABIDURINAE—esophagus in 2 regions, isthmus elongated.

1. a. Isthmus followed by 2 bulbs ..... *Labiduris*
   b. Isthmus followed by 1 bulb ..... *Cyrtosomum*

(b) IBRAHIMIINAE—esophagus in 2 regions, isthmus elongated.

1. a. Lips 3; caudal papillae, 10 pairs; vulva near anus. *Ibrahimia*

(c) ATRACTINAE—esophagus in 2 regions of about equal length.

1. a. Corpus of esophagus strongly chitinized ..... *Atractis*
   b. Corpus of esophagus not chitinized ..... *Monhysterides*

(B) OXYURIDAE—2 ovaries; 1 or 0 spicules.

1. a. Male lacking accessory piece ..... OXYURINAE (a)
   b. Male possessing accessory piece ..... SYPHACIINAE (b)

(a) OXYURINAE—1 or 0 spicules, accessory piece absent.

1. a. Lateral alae, no caudal alae, 1 spicule, vulva posterior to mid-region ..... *Thelandros*
   b. Lateral alae, no caudal alae, 1 spicule, vulva anterior to mid-region ..... *Parathelandros*
   c. Lateral and caudal alae present, 1 or 0 spicules, vulva anterior to mid-region ..... *Pharyngodon*

(b) SYPHACIINAE—1 spicule, accessory piece present.

1. a. Lips apparently 2 (3rd lip rudimentary) 2
   b. Lips 3–6 (all about of equal size) 3
2. a. Esophagus with median swelling and posterior bulb, caudal alae in male ..... *Ozolaimus*
   b. Esophagus lacking median swelling, caudal alae in male ..... *Macracis*
3. a. Both lateral and caudal alae present, 2 uteri 4
   b. Caudal alae only (only in male), 2 uteri 5
   c. Lateral alae only, 1 uterus ..... *Veversia*
   d. Lateral and caudal alae both absent, 2 uteri. *Tachygonetria*
4. a. Esophagus with median swelling. *Mammillomacracis*
   b. Esophagus without median swelling ..... *Alaeuris*
5. a. Isthmus and corpus of equal length ..... *Thaparia*
   b. Isthmus much shorter than corpus 6
6. a. Cloacal papillae only 1 pair ..... *Travassozolaimus*
   b. Cloacal papillae 2 or more pairs 7
7. a. Posterior cloacal papillae supporting alae. *Paralaeuris*
   b. Posterior cloacal papillae not supporting alae. *Pseudoalaeuris*

(C) OXYURIDAE?—2 ovaries, male not known.

1. a. 3 lips; isthmus elongated; vulva prebulbar; anus absent. *Typhlonema*[2]

Periera, 1935, established the family Ozolaimidae for *Ozolaimus* and *Macracis;* Thapar, 1925, established the family Labiduridae for *Labiduris;* and Travassos, 1920, the family Pharyngodonidae for *Pharyngodon, Thelandros,* and *Tachygonetria.* These family designations are of questionable validity and have not been adopted in this paper. Certain subfamily groupings have also been suggested in the literature for many of the above genera, but again their validity has been in question and they have not been mentioned in the key. The division of the Oxyuridae into the two subfamilies of the Oxyurinae and the Syphaciinae is admittedly one of convenience for the purpose of rapid separation of the genera involved. Their actual relationships are probably better represented by a division into the subfamilies of the Oxyurinae and the Pharyngodoninae, with a different distribution of the various genera (*vide* Chitwood & Chitwood, 1937). The genus *Parapharyngodon* Chatterji, 1933, is here regarded as a synonym of *Thelandros* Wedl, 1862, and is so keyed.

The following list contains the species assigned to the genera keyed out above, and their recorded hosts[3] (only species found in reptilian hosts are included).

Alaeuris alaeuris Thapar, 1925 ..... *Testudo graeca* (= *T. ibera*).
conspicua Ortlepp, 1933 ..... *Testudo verroxi* (= *T. verreauxi*).
iguanae Thapar, 1925 ..... *Iguana iguana* (= *I. tuberculata*).

[2] The combination of prebulbar vulva, *no anus,* ovoviviparous habit, and the absence of male material, makes the placing of this genus difficult. It shows affinities to both the Atractidae and the Oxyuridae, but the paired ovaries seem to relate it more closely to the Oxyuridae.

[3] Host names have been checked through the courtesy of Dr. C. H. Pope of the Field Museum of Natural History, Chicago, Ill.

Atractis africana Ortlepp, 1933	*Testudo verroxi.*
carolinae Harwood, 1932	*Terrepene carolina triunguis.*
dactylura (Rud., 1819) Duj., 1845 (= *A. brevicollis* Schn., 1866)	*Bactrachemys nasuta;* (= *Rhinemys nasuta*); *Geoemyda nasuta; Podocnemis dumeriliana* (= *P. tracaxa*); *P. expansa; Testudo denticulata* (= *T. tabulata*); *T. elongata; T. graeca* (= *T. mauritanica*); *T. horsfieldii* (= *Homopus horsfieldii*); *T. marginata* (= *Chersus marginata*).
fasciolata Gendre, 1909	*Kinixys belliana.*
granulosa (Raill. & Henry, 1912) Thapar, 1925) (= *A. dactylura granulosa* R. & H., 1912; ? = *A. morinae* Baer, 1936)	*Testudo denticulata; T. elongata; T. emys; T. graeca; T. radiata.*
hystrix (Dies., 1851) Linstow, 1910	*Podocnemis dumeriliana* (= *P. erythrocephalus*).
opeatura Leidy, 1891 (= *A. subulata* of Stiles & Hassall, 1894; = *A. cruciata* Linstow, 1902[4])	*Cyclura baeolopha; C. cornuta* (= *Iguana* (*Metopoceros*) *cornutus*); *C. macleayi; Iguana iguana.*
ortleppi Thapar, 1925	*Podocnemis unifilis.*
perarmata Linstow, 1910	*Kinixys belliana.*
Cyrtosomum scelopori Gedoelst, 1919	*Sceloporus undulatus.*
Ibrahimia ibrahimi Khalil, 1932	Liberian land tortoise.
Labiduris africana Gedoelst, 1916	*Kinixys erosa.*
gulosa (Rud., 1819) Schn., 1866	*Chalcides ocellatus* (= *Gongylus ocellatus*); *Geoemyda nasuta; Testudo denticulata; T. graeca.*
zschokkei Linstow, 1899	*Testudo denticulata.*
Macracis ctenosauri (Caballero, 1938) Dosse, 1939 (= *Ozolaimus ctenosauri* Cab., 1938)	*Crotalus polystictus; Ctenosaura acanthura.*
microtyphlon (Smith, Fox, & White, 1908) Dosse, 1939 (= *Ozolaimus microtyphlon* (S., F., & W., 1908) Vigueras, 1936; = *Oxyuris microtyphlon* S., F., & W., 1908)	*Cyclura carinata* (= *C. nubila*); *C. maclaeyi.*
monhystera (Linstow, 1902) Gedoelst, 1916 (= *Oxyuris monhystera* Linstow, 1902)	*Cyclura carinata; C. cornuta.*
Mammillomacracis cyclurae Dosse, 1939	*Cyclura carinata.*
Monhysterides testudinicola Baylis, 1933	*Trionyx cartilagineus.*
Ozolaimus cirratus (Linstow, 1906) Railliet & Henry, 1912 (= *Oxyuris cirratus* Linstow, 1906)	*Iguana iguana.*
megatyphlon (Rud., 1819) Dujardin, 1845) (= *Oxyuris megatyphlon* Rud., 1819)	*Iguana iguana; I. i. rhinolopha.*
Paralaeuris cuckleri Walton, 1942 (in press)	*Iguana iguana.*
dorochila Cuckler, 1938	*Conolophus subcristatus.*
Parathelandros anolis Chitwood, 1934[5]	*Anolis cristalellus.*
scelopori Caballero, 1938	*Sceloporus ferrariperezi* (= *S. torquatus*).
Pharyngodon acanthura (Dies., 1851) Dies., 1861 (= *P. extenuata* (Rud., 1819) Seurat, 1917, *e.p.*; = *P. spinicauda* (Duj., 1845) Seurat, 1917, *e.p.*)	*Lacerta lepida* (= *L. ocellata*); *L.* (*Podarcis*) *muralis; Tupinambis nigropunctata; T. teguixin.*

[4] Vigueras, 1935, defends the validity of *A. cruciata* Linstow, 1902, as a species definitely distinct from *A. opeatura* Leidy, 1891, but the writer is not convinced of the constancy of the criteria used in making the differentiation.

[5] Chitwood placed this form in the Thelastomatidae on the basis of the number of cephalic papillae.

apapillosus Koo, 1938[6]	*Gekko gecko.*
auziensis Seurat, 1917	*Cerastes vipera; Chalcides ocellatus; Scincus scincus* (= *S. officinalis*); *Testudo graeca.*
caesarpintoi Pereira, 1935	*Cnemidophorus lemniscatus.*
extenuata (Rud., 1819) Seurat, 1917 (= *P. acanthura* (Dies., 1851) Dies., 1861, *e.p.*; = *Ascaris extenuata* Rud., 1819)	*Lacerta lepida* (= *L. margaritacea*; = *Chrysolamprus ocellatus*).
hindlei Thapar, 1925	*Tiliqua scincoides.*
inermicauda Baylis, 1923	*Ptyodactylus lobatus; Tarentola annularis.*
laevicauda (Seurat, 1914) Seurat, 1917 (= *Oxyuris laevicauda* Seurat, 1914)	*Acanthodactylus blanchi* (? = *A. blanfordi*); *A. pardalis; Hemidactylus bowringii; Scincus scincus.*
mabuiensis Malan, 1939	*Mabuya trivittata.*
mabuyae Sandground, 1936 (? = *Oxyuris costata* Linstow, 1907)	*Mabuya multifaciata; M. varia varia.*
mamillata (Linstow, 1897) Seurat, 1917 (= *Oxyuris mamillata* Linstow, 1897)	*Eumeces* (*Plestiodon*) *aldrovandi* (= *E. schneideri, e.p.*).
megalocerca (Skrj., 1916) Seurat, 1917 (= *Oxyuris megalocerca* Skrj., 1916)	Gecko.
oxkutzcabiensis Chitwood, 1938	*Thecadactylus rapicaudus.*
spinicauda (Duj., 1845) Seurat, 1917 (= *Oxyuris spinicauda* Duj., 1845; = *Ascaris spinicauda* of Dies., 1851; ? = *P. acanthura e.p.* & *P. extenuata e.p.*)	*Ameiva ameiva; Lacerta agilis; L. lepida; L. muralis; Ptyodactylus lobatus* (= *P. oudrii*); *Tarentola mauritanica.*
tarentolae Spaul, 1926	*Tarentola delalandii.*
tectipenis Gedoelst, 1919	Lizard.
tiliquae Baylis, 1930	*Tiliqua scincoides.*
travassosi Pereira, 1935	*Ameiva ameiva.*
warneri Harwood, 1932	*Cnemidophorus sexlineatus.*
yucatanensis Chitwood, 1938	*Coleonyx elegans.*
Pseudoalaeuris auricularis, n. sp.	Galapagos land tortoise.
conolophi (Cuckler, 1938), n. comb. (= *Alaeuris conolophi* Cuckler, 1938)	*Conolophus subcristatus.*
expansa (Rees, 1935), n. comb. (= *Tachygonetria expansa* Rees, 1935)	*Testudo horsfieldii.*
galapagensis (Cuckler, 1938), n. comb. (= *Alaeuris galapagensis* Cuckler, 1938)	*Conolophus subcristatus.*
hirsuta (Sandground, 1929), n. comb. (= *Alaeuris hirsutus* Sandground, 1929)	*Iguana iguana rhinolopha.*
inflatocervix (Akhtar, 1937), n. comb. (= *Tachygonetria inflatocervix* Akhtar, 1937)	*Testudo graeca.*
labicula (Cuckler, 1938), n. comb. (= *Alaeuris labicula* Cuckler, 1938)	*Conolophus subcristatus.*

[6] This form lacks caudal alae and caudal papillae; therefore it seems to be more nearly related to *Parathelandros* than to *Pharyngodon*.

longispicula (Cuckler, 1938), n. comb. — *Conolophus subcristatus.*
(= *Alaeuris longispicula* Cuckler, 1938)
macroptera, n. sp. — Galapagos land tortoise.
pharyngodentata, n. sp. — Galapagos land tortoise.
poweri (Ortlepp, 1933), n. comb. — *Testudo verroxi.*
(= *Tachygonetria poweri* Ortlepp, 1933)
quadrilabiata (Ortlepp, 1933), n. comb. — *Testudo verroxi.*
(= *Tachygonetria quadrilabiata* Ortlepp, 1933)

Tachygonetria conica (Drasche, 1884) Seurat, 1918 — *Testudo graeca.*
(= *Oxyuris conica* Drasche, 1884)
dentata (Drasche, 1884) Seurat, 1918 — *Testudo graeca.*
(= *Oxyuris dentata* Drasche, 1884)
lambiensis Seurat, 1918 (? Nom. nud.) — *Testudo graeca.*
longicollis (Schn., 1866) Seurat, 1918 — *Testudo graeca; T. horsfieldii; T. leithi* (= *T. kleinmanni*).
(= *Oxyuris longicollis* Schn., 1866; = *Paracis longicollis* (Schn., 1866) Raill. & Henry, 1916; = *Tachygonetria massinissae* Surat, 1918; = *T. setosa* Seurat, 1918)
macrolaimus (Linstow, 1899) Seurat, 1918 — *Testudo graeca; T. pardalis.*
(= *Oxyuris macrolaimus* Linstow, 1899)
microlaimus (Linstow, 1899) Seurat, 1918 — *Testudo graeca; T. pardalis.*
(= *Oxyuris microlaimus* Linstow, 1899)
microstoma (Drasche, 1884), Baylis, 1923 — *Testudo graeca.*
(= *Oxyuris microstoma* Drasche, 1884; = *O. draschei* Stoss., 1898; = *O. robusta* Drasche, 1884; = *Tachygonetria weissi* Seurat, 1918; = *Mehdiella microstoma* (Drasche, 1884) Seurat, 1918)
nicollei Seurat, 1918 — *Testudo graeca.*
numidica Seurat, 1918 — *Testudo graeca.*
paronai (Linstow, 1893) Baylis, 1923 — *Macroscincus coctaei.*
(= *Oxyuris paronai* Linstow, 1893; = *Paracis paronai* (Linstow, 1893; Baylis, 1920)
pusilla Seurat, 1918 — *Testudo graeca.*
(= *Oxyuris longicollis* Schn., of Drasche, 1884)
stylosa Thapar, 1925 — *Testudo graeca.*
testudinis, n. sp. — Galapagos land tortoise.
torticollis Rees, 1935 — *Testudo horsfieldii.*
uncinata (Drasche, 1884) Thapar, 1925 — *Testudo graeca; T. horsfieldii.*
(= *Oxyuris uncinata* Drasche, 1884; = *O. inflata* Drasche, 1884; = *O. albanica* Stoss., 1898; = *Mehdiella uncinata* (Drasche, 1884) Seurat, 1918)

vivipara Wedl, 1862 (= *Oxyuris vivipara* (Wedl, 1862) Seurat, 1912; = *Tachygonetria jugurthae* Seurat, 1918)	*Iguana iguana; Testudo graeca; T. leithi; Uromastix* spp.
Thaparia contortospicula, n. sp.	Galapagos land tortoise.
macrospiculum Ortlepp, 1933	*Testudo verroxi.*
Thelandros alatus Wedl, 1862 (= *Oxyuris uromasticola* Galeb. 1889)	*Acontias percivali; Agama agama; A. a. caudospina; A. bibroni; A. hispida; A. lionotus; Anniella nigra; A. pulchra; Testudo leithi; Trachysaurus rugosus; Tropidurus spinulosus; Uromastix acanthinurus; U. hardwickii; U. spinipes.*
baylisi Chatterji, 1935	*Uromastix hardwickii.*
bulbosus (Linstow, 1899) Seurat, 1917 (= *Oxyuris bulbosa* Linstow, 1899)	*Chalcides ocellatus; Scincus* spp.
bulbosus annulatus (Linstow, 1899) Seurat, 1917 (= *Oxyuris annulata* Linstow, 1899)	*Agama agama; Chalcides ocellatus.*
cinctus (Linstow, 1897) Baylis, 1923 (= *Oxyuris cincta* Linstow, 1897)	*Agama caucasica; A. stellio* (= *Stellio vulgaris*).
echinatus (Rud., 1819) Seurat, 1917 (= *Ascaris echinata* Rud., 1819)	*Agama stellio* (= *Lacerta stellio*); *Chalcides ocellatus; Pachydactylus bibroni* (= *Platydactylus guttatus*); *Tarentola mauritanica.*
hemidactylus Patwardhan, 1935 (? = *Oxyuris megaloon* Linstow, 1906)	*Hemidactylus flaviviridis; H. leschenaulti.*
kasauli Chatterji, 1935	*Uromastix hardwickii.*
maplestoni (Chatterji, 1933) Baylis, 1936 (= *Oxyuris acanthura* of Linstow, 1904, *e.p.*; = *Parapharyngodon maplestoni* Chatterji, 1933; ? = *Thelandros hemidactylus* Patwardhan, 1935)	*Calotes versicolor; Hemidactylus flaviviridis.*
micipsae Seurat, 1917 (= *Oxyuris acanthura* of Linstow, 1904, *e.p.*; = *O. brevicaudata* Duj., 1845, *e.p.*)	*Acanthodactylus scutellatus; Calotes versicolor; Cerastes cerastes* (= *C. cornutus*); *Chalcides micipsae; C. tridactylus; Coluber algirus* (= *Zamenis algirus*); *Lacerta lepida; Scincus scincus; Tarentola mauritanica.*
micruris Rauther, 1918 (= *T. alatus* of Thapar, 1925)	*Uromastix hardwickii.*
numidicus Seurat, 1918	*Testudo graeca.*
rotundus Malan, 1939	*Agama atra; Pseudocordylus microlepidotus.*
sahariensis Baylis, 1930	*Uromastix* spp.
scleratus Travassos, 1923	*Tapinurus scutipunctatus; Tropidurus torquatus.*
seurati Sandground, 1936	*Acontias percivali.*
sexlabiata Ortlepp, 1933	*Testudo verroxi.*
taylori Chatterji, 1935	*Uromastix hardwickii.*
Typhlonema salomonis Kreis, 1938	*Gekko vittatus; Tropidurus spinulosus.*
Travassozolaimus travassosi Vigueras, 1938	*Chamaeleolis chamaeleontides; Cyclura carinata.*
Veversia tuberculata (Linstow, 1904) Thapar, 1925 (= *Oxyuris tuberculata* Linstow, 1904)	*Trachysaurus rugosus* (= *Trachydosaurus rugosus*).

There are a number of named species of oxyurids (*sensu latu*) taken from various reptiles and described only on the basis of the females: viz., "*Oxyuris*" *loveridigei* Baylis, 1920, *et alii*. These forms cannot be placed in their proper genera until the corresponding male forms have been identified and studied, and therefore have been omitted from the above list.

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The viability of *Trichomonas foetus* (Protozoa) in the house fly (*Musca domestica*).[1] BANNER BILL MORGAN, Department of Veterinary Science, University of Wisconsin.

Trichomonas foetus has long been known to be transmitted in nature by coitus, from the bull to the cow, or *vice versa*. Andrews and Miller (1936) reported nonvenereal transmission of trichomoniasis to virgin heifers and suggested the accidental contamination of the vagina with the infectious exudate from other cattle by tail-switching, jostling while being herded, lying on litter soaked in contaminated urine, or by other animals successively licking the external genitalia of infected and uninfected cattle. Grooming and handling by attendants was also suggested as a means of spreading the infection. According to Andrews and Miller (1936), 4 out of 34 virgin heifers were infected with *Trichomonas foetus* and suggested that the possibility of flies as disseminators of *T. foetus* should be investigated. The experiments presented in this paper were undertaken to determine the viability of *T. foetus* in the house fly (*Musca domestica*), and whether to incriminate the house fly as a possible nonvenereal transmitter of bovine trichomoniasis.

Wenyon and O'Connor (1917) demonstrated living motile trichomonads in the the feces of house flies 5 minutes after being fed on infected human fecal material. Root (1921) showed that the trophozoites of *Chilomastix mesnili* were viable for 20 minutes in house flies but they did not remain alive for more than 1 hour. Hegner (1926) summarized Root's work in a review article on the transmission of human protozoa. Hegner (1928–1929) fed 3 species of flies human feces containing motile *Trichomonas hominis*. Motile trichomonads were recovered from the intestine of

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Cynomyia cadaverina (hairy blow fly) from 25 minutes to 5½ hours after ingestion, from *Musca domestica* (house fly) within 1 and 2 hours, and from *Lucilia sericata* (green-bottle fly) within 2¾ hours. Flies of the above 3 species were also checked for viability of trichomonads in vomit and feces after being fed *T. hominis*. Living trichomonads were found at various intervals between 20 minutes to 4 hours after ingestion. Hegner's experiments were carried out on a total of 27 flies; 4 house flies, 2 green-bottle flies, and 21 hairy blow flies.

Allen (1931) and Cram (1932) concluded that flies were the cause of the spread of trichomoniasis in bobwhite quail (*Colinus v. virginiana*). Trichomonads, probably *T. gallinarum*, were found in the intestines of flies caught near the brooders, and the disease was probably spread by quails eating the infected flies. The species of fly was not mentioned in either paper.

Simitch and Kostitch (1937) found that *Trichomonas intestinalis* (= *T. hominis*) could be mechanically carried by the house fly (*Musca domestica*) from human or animal feces to moist food by feet or proboscis, provided that the interval between feedings did not exceed 10 minutes, and the organism may survive for 8 hours in the intestine of the fly.

Over 700 house flies (*Musca domestica*) were used in the following experiments. Pupae were obtained through the courtesy of Dr. T. C. Allen, Department of Entomology, University of Wisconsin. The pupae were kept in large Erlenmeyer flasks and as soon as hatching occurred the adult flies were transferred singly to small test tubes with the ends securely covered with cheese cloth held by rubber bands. The flies were starved 18 to 21 hours before the initial feeding. All of the experiments were conducted at room temperature.

In all of the experiments flies were fed on a mixture of equal parts of whole milk, distilled water, and the liquid portion of a bacteria-free culture of *Trichomonas foetus* with a count of approximately 2 million organisms per cc. About ¼ gram of carmine was added (enough to give the fluid a pinkish tinge). The fluid containing the trichomonads was composed of a buffered saline-citrate solution with 5 per cent bovine serum. When layered over a defibrinated blood and egg slant, this material is used in this laboratory for routine stock cultures of *T. foetus*. Control flies were fed the above material but without trichomonads. At the time of feeding each fly was given approximately one-tenth cc of the above mixture.

Experiment 1.—To ascertain the viability of *T. foetus* in the digestive tract of the house fly. Four hundred flies were used in the first experiment. Of these, 200 were fed *T. foetus* and 200 were used as controls. Flies started feeding immediately and became engorged in approximately 1 minute. The ventral surface of the abdomen of each fly appeared pinkish after feeding, due to distention of the crop. After feeding each fly was transferred to a clean test tube. Five flies were dissected at each half-hour interval until the termination of the experiment, and the motility of the trichomonads in the intestine was observed. Table 1 shows that *T. foetus* may live in the digestive tract of the house fly (*Musca domestica*) for a period from ½ hour to 17 hours after ingestion. The trichomonads in all positive cases were actively motile. Trichomonads were reisolated by the Glaser-Coria V tube method with the modifications of Andrews and Lyford (1940), thus indicating that the organism may still be capable of setting up an infection. All of the controls were negative.

Experiment 2.—To ascertain the viability of *T. foetus* in the vomit and feces of the house fly. One hundred flies were fed trichomonads and 100 were used for controls. As soon as the flies were fed, regurgitation often occurred. This usually lasted from 1 to 5 minutes. If vomit was deposited on the test tube, the fly usually retrieved most of the material, and the remainder of the drop dries very quickly. As soon as a fly deposied a vomit drop, the test tube was placed under the micro-

scope and the drop examined for motile trichomonads. All vomit drops examined from 1 to 5 minutes after feeding were positive for motile *T. foetus*. Only 3 flies were observed to regurgitate 5 minutes after feeding but the material was not deposited. Thus, it appears that a possibility exists in the transmission of bovine trichomoniasis, if flies after feeding on infected material, regurgitate on the proper biological environment, such as the moist vulva of a cow in heat or the sheath of bulls.

TABLE 1.—*Viability of Trichomonas foetus in the digestive tract of house fly (Musca domestica). Two hundred flies were used in the experiment, 5 flies dissected at each half-hour interval until negative motility was recorded*

Interval between ingestion and examination (hours)	Number of flies positive for motile trichomonads	Number of flies negative for motile trichomonads	Controls
½	5	0	0
1	5	0	0
1½	5	0	0
2	4	1	0
2½	5	0	0
3	3	2	0
3½	3	2	0
4	5	0	0
4½	3	2	0
5	5	0	0
5½	3	2	0
6	4	1	0
6½	4	1	0
7	2	3	0
7½	5	0	0
8	5	0	0
8½	4	1	0
9	5	0	0
9½	5	0	0
10	5	0	0
10½	3	2	0
11	5	0	0
11½	5	0	0
12	4	1	0
12½	4	1	0
13	5	0	0
13½	5	0	0
14	4	1	0
14½	3	2	0
15	4	1	0
15½	4	1	0
16	3	2	0
16½	1	4	0
17	0	5	0
17½	0	5	0
18	0	5	0
18½	0	5	0
19	0	15[a]	0

[a] Remaining flies were killed and examined after it was apparent they would be negative.

Flies starved for 18 to 21 hours and fed on the trichomonad carmine mixture usually started passing pink fecal material 2½ to 3½ hours after feeding. After carmine droppings were deposited on the test tubes they were examined under the microscope for motile trichomonads. Flies were able to pass motile trichomonads in their feces 2½ to 6 hours after ingestion. If the flies are fed milk about 3 hours

after the initial feeding of trichomonads, motile trichomonads may be found in the feces up to 8 hours after ingestion of the organism.

After motile trichomonads have stopped passing in the feces, examination of the intestine may reveal many motile *T. foetus*. Reisolation of *T. foetus* from the feces of house flies 2, 4, and 5½ hours after ingestion indicated that the organism may still be capable of setting up an infection. All of the controls were negative. Thus, it may be possible for the house fly (*Musca domestica*) to act as a disseminator of bovine trichomoniasis (*Trichomonas foetus*) by defecating on the genitalia of cattle after feeding on infectious exudate and start an infection under favorable biological conditions. Actual experiments with flies and cattle, of course, must be set up to ascertain definitely the role of the house fly in the transmission of bovine trichomoniasis.

SUMMARY

House flies (*Musca domestica*) were fed living *Trichomonas foetus*, which were recovered from the digestive tract from ½ hour to 17 hours after ingestion. Reisolation of *T. foetus* from the intestines of 2 house flies indicated that the organisms may still be capable of setting up an infection. There is a possibility that the deposition on the correct biological environment of infectious, regurgitated material (vomit) by house flies within 1 to 5 minutes after feeding may set up an infection. House flies were able to pass motile *T. foetus* in their feces for as long as 8 hours after ingestion.

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Unsuccessful attempts to transmit encephalomyelitis from horses to guinea pigs by endoparasites. A. O. FOSTER and M. S. SHAHAN, U. S. Bureau of Animal Industry.

This work was undertaken in search of a reservoir of the virus which might account for its inter-epizootic existence as well as clarify if possible some of the imperfectly understood aspects of the epizootiology and transmission of the disease. On *a priori* grounds, endoparasites seemed to satisfy the determinable prerequisites for service in this capacity. Furthermore, in the instance of swine influenza, also a

virus disease, Shope (Science 89(2315): 441–442, 1939 and ff.) has incriminated endoparasites as reservoirs of virus.

The experiments consisted chiefly in inoculations of guinea pigs with variously prepared "extracts" of endoparasites which had been collected at necropsy from horses that were killed when moribund with acute experimental encephalomyelitis or that had died of this disease. Parasites were obtained from 11 horses and tested by intracerebral or subcutaneous inoculations of 110 guinea pigs. Twelve more guinea pigs were given administrations *per os* of infective strongyle larvae which had been cultured 11 days in the manure from acutely ill horses. For purposes of brevity, the experiments are summarized below in tabular form according to the kinds of preparations which were made of the parasitic material from equines and the manner of their testing in guinea pigs:

Nature of "extract" or preparation	Number guinea pigs inoculated subcutaneously	Number guinea pigs inoculated intracerebrally	Number guinea pigs fed
1. Physiol. saline "washings" of *Strongylus vulgaris* adults (to test for virus on surface of worms. In some exps. *S. equinus* and *S. edentatus* were used also)	18	5	0
2. 21-hr. "washings" of living *S. vulgaris* in sterile *physiol.* saline (to test for virus in metabolic products and intestine)	5	2	0
3. Supernatant fluid from triturated *S. vulgaris* (to test for virus in bodies of worms)	13	8	0
4. Same as 1, using cylicostomes	5	2	0
5. Same as 2, using cylicostomes	5	2	0
6. Same as 3, using cylicostomes	5	2	0
7. Centrifuged supernatant fluid from triturated *S. vulgaris* passed through Whatman No. 1 paper filter	10	2	0
8. Filtrate of triturated *S. vulgaris* passed through Berkefeld (N) filter	0	8	0
9. "Bot" suspension filtrate (Berkefeld N)	0	4	0
10. "Bot" suspension unfiltered (supernatant fluid)	0	2	0
11. Supernatant fluid from macerated infective strongyle larvae	10	2	0
12. Living infective strongyle larvae	0	0	12

In all cases the parasites were collected into physiological saline solution from fresh autopsies of experimental cases of acute equine encephalomyelitis and, immediately thereafter, washed several times in saline solution before the above preparations were made. Every effort was made to reduce to a minimum the interval between the recovery of parasites and the test inoculations. In these experiments this interval varied from less than 3 hours to approximately 3 days.

Results.—In no case was success attained in transmitting equine encephalomyelitis to guinea pigs. Most of the guinea pigs remained normal for a sufficently long observational period after inoculation, although some died of shock and contaminating infections.

Conclusions.—It is believed that these experiments are sufficiently adequate to suggest that the parasites tested are probably incapable of harboring the virus of equine encephalomyelitis for a significantly long period of time to be of practical importance in the transmission of this disease.

Effectiveness of a method of raising experimental pigs free from worm parasites.

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In carrying out investigations on the transmission of helminth parasites of swine it is necessary to have parasite-free pigs in order properly to evaluate the results obtained. This is often difficult to accomplish. Under ordinary conditions, pigs may become infected with worms at an early age. The writer previously described (1933, Jour. Agr. Res. 46(6): 531–542) a method of handling naturally parasitized sows and their litters that proved effective in preventing extraneous infections of the pigs with various worm parasites, except *Strongyloides*. The pigs were farrowed and kept in a cement-floored outdoor pen that was cleaned and scrubbed with boiling water several times each day. In raising pigs at the Beltsville Research Center, Beltsville, Md., for use in parasite investigations an attempt was made to raise pigs worm-free by following the procedure outlined above. It was found, however, that because of the prevailing climatic conditions some change in the method of housing was necessary; it also became necessary to effect some changes in the method of handling the animals in question to lessen the amount of work involved so that several litters could be farrowed and maintained at once.

A type of farrowing house and a method of handling the sows and litters were devised that proved generally effective in preventing extraneous infections of the suckling pigs with worm parasites and coccidia. The method involves thorough cleaning and washing of pens to eliminate the majority of eggs passed in the feces of the sows; this is followed by a period of drying to destroy any of the organisms that may have escaped the cleaning and washing processes. The type of farrowing house construction and the technique of handling the sows and litters are herein described.

Description of farrowing house.—The farrowing house is of concrete construction and equipped with a heating plant and a hot-water system. There is a row of pens on each side with a passageway between. The pens are arranged in pairs connected by a short areaway. Each pen is approximately 7 feet wide by 9 feet long and is provided with suitable guard rails and with built-in concrete feed and water troughs, so located that it is unnecessary for the attendant to enter a pen to feed and water the animals. The pen walls are 3 feet or more high and constructed of smooth concrete; the corners are rounded to facilitate cleaning. The floor is of smooth concrete and slopes from all directions toward a drain located in the center of the pen. Each pen is connected by a door with an outside sloping runway, 11 feet long by 9 feet wide, and provided with a drain at the lowest point. The wall of the farrowing house forms one wall of the runway; the other three walls are of smooth concrete at least 1½ feet high topped by wire mesh 2½ feet high to prevent pigs escaping. By means of a rope and pulley arrangement the doors connecting the pens and runways can be opened or closed without entering either the pen or the runway. Each pen is provided with a door that opens into the passageway between the rows of pens and with a door that opens into the short areaway that connects with the adjoining pen. All doors are covered with sheet metal to facilitate cleaning.

Method of handling sows and litters.—A few days before farrowing, the sow is washed with soap and warm water to remove adhering dirt and fecal material, and is then brought into the farrowing house and placed in a clean pen. Twenty-four hours later the sow is transferred to the adjoining clean pen. Manure and bedding are then removed from the used pen, and the walls, floor, and the feed and water troughs are scrubbed and washed with hot water. Finally, the entire pen, including the walls, is again washed with hot water under pressure from a hose attached to the hot-water tank. This last washing is carried on from outside the pen, care being taken to play the stream of hot water over the entire floor and walls

in such a manner as to wash down the drain any material that might have escaped the first scrubbing and washing. If the outside runway was used, it is cleaned in the same manner; the pen and runway are then kept closed and allowed to dry for 24 hours. At the end of the drying period the sow is returned to the clean quarters and those previously occupied are cleaned in the manner described. The sows and litters are kept under these conditions until the pigs are weaned.

Summary of post-mortem examinations of pigs farrowed under the conditions described.—The equipment and procedure described above have been in use at the Beltsville Research Center for a period of 10 years. During this time approximately 900 pigs have been farrowed by sows infected with various worm and protozoan parasites. Of the pigs farrowed, 182 died from various causes or were killed during the suckling period and examined post mortem for worm parasites. Of these, 2 were found to be lightly infected with *Strongyloides* and 4 with one kidney worm each (liver infection). A total of approximately 750 pigs survived the suckling period and were later examined post mortem, with the following results: 14 harbored light infections with *Strongyloides;* 14 were lightly infected with nodular worms, the infections ranging from 1 to 3 worms each; 2 had acquired 1 ascarid each; the livers of 7 contained from 1 to 4 cirrhotic areas attributed to invasion by kidney worm larvae; and one animal harbored 2 whipworms.

In some cases the extraneous infections with *Strongyloides,* nodular worms, and kidney worms may have been due to occasional failure on the part of substitute attendants properly to clean the pens or from entering the pens while wearing dirty shoes. In certain other cases, the infections, notably those with ascarids, whipworms, nodular worms, and kidney worms were apparently acquired because substitute attendants, or visitors failed to close properly the pen doors and the pigs in question escaped from the farrowing house and came in contact with contaminated soil. Such extraneous infections are not considered to be due to failure of the washing and scrubbing processes to destroy eggs and larvae in the pens.

Reasons for an occasional failure to prevent infection with *Strongyloides* even though pens are carefully cleaned are not well understood. It is possible that infective and preinfective larvae may occasionally become caught in small cracks in the floor and thus escape destruction by the scrubbing, washing, and subsequent drying processes. Under conditions of high atmospheric humidity, pens sometimes do not dry readily. In such cases some infective larvae may survive and later serve as a potential source of infection of susceptible pigs.

Studies on oxyuriasis. XXVII. Notes on the survival of eggs of *Enterobius vermicularis* exposed to household fumigants. M. O. NOLAN and MYRNA F. JONES, National Institute of Health, U. S. Public Health Service, Bethesda, Maryland.

Hydrocyanic acid gas.—An experiment was conducted at a storage warehouse to determine the effect of hydrocyanic acid gas on infective (ring and a half stage) eggs of the human pinworm, *Enterobius vermicularis.* The eggs, recovered in the tadpole stage from worms and incubated at 37° C. until ring and a half embryos had developed, were placed in small Syracuse watch glasses (27 by 8 mm) at the laboratory and were transported to the storage warehouse. The experimental dishes were placed in a gas-tight vault with a capacity of approximately 23,000 cubic feet. In accordance with regular weekly practice at the warehouse during the spring and summer months, the contents of the vault were fumigated, using "Cyanegg" (Sodium Cyanide, 96 per cent min.) at the rate of 1 pound per 1,000 cubic feet; after an exposure of approximately 21 hours, the vault was ventilated and during the next 23 hours the gas slowly dissipated. The experimental dishes were placed approximately 20 feet from the center of gas generation. Control dishes were placed in a

large chamber near the fumigating vault under conditions of temperature and humidity approximating those in the fumigating vault. After 44 hours at the warehouse all of the dishes were returned to the laboratory. The viability of the eggs was then determined by their ability to hatch active larvae in artificial digestive juice at 37° C. within 4 hours.

Two separate tests were made at the warehouse. In both tests the number of eggs in each dish varied from 101 to 192, with an average of 140 per dish. In the first test, a total of 21 dishes was used, including 14 experimental and 7 control. In 13 of the dishes (9 experimental, 4 control), the eggs were on a dry base. In the remaining 8 dishes (5 experimental, 3 control), the eggs were floated on water, with the expectation that, owing to the ready solubility of HCN in water, these dishes would not only take up more of the HCN but that the HCN would be held longer and given off more slowly than would be the case with the experimental dry dishes. In the 9 experimental dishes containing eggs on a dry base, the rate of survival of the eggs ranged from 14 to 95 per cent, with an average of 78 per cent, whereas in the 4 control dishes, the rate of survival ranged from 68 to 97 per cent, with an average of 83 per cent. In the 5 experimental dishes containing eggs on water, the rate of survival was from 76 to 93 per cent, with an average of 87 per cent, and in the 3 control dishes, from 95 to 99 per cent, with an average of 96 per cent. The temperature in both the fumigation vault and in the adjoining chamber where the controls were placed varied from 48° to 55° F., with a relative humidity of 54 to 58 per cent.

In the second test, 14 dry dishes were used, 9 experimental and 5 control. The rate of survival of the eggs in the 9 experimental dishes varied from 69 to 86 per cent, with an average of 78 per cent, and in the 5 control dishes from 58 to 85 per cent, with an average of 75 per cent. The temperature varied from 59° to 62° F., with a relative humidity of 64 to 67 per cent.

These results indicate that, under conditions of the experiment, the hydrocyanic acid gas failed to kill the embryos in the eggs, since there was no significant difference in percentage of survival of the eggs exposed to HCN gas and those not exposed to the gas. There seems to be no satisfactory explanation for the low rate (14 per cent) of survival of the eggs in one experimental dry dish in the first test. It can reasonably be assumed that the high death rate of the eggs in this one instance was not due to exposure to HCN because the average rate of survival of the eggs in the remaining 8 dishes of this group was 86 per cent. In both tests conditions of temperature and humidity were favorable for survival of the eggs (Jones and Jacobs, 1941, Amer. Jour. Hyg. 33(3), Sec. D: 88–102). At high temperatures and low relative humidity pinworm eggs will not survive many hours.

These tests were carried out primarily as a result of inquiries received by the National Institute of Health as to the possible effectiveness of fumigation with HCN as a means of killing pinworm eggs scattered in the homes of infected persons. The procedure outlined above was selected as most likely to simulate the gas concentration that would prevail in the fumigation of private dwellings. It is apparent from the results obtained that fumigation with HCN gas would be ineffective.

Grateful acknowledgment is made to David B. Karrick, President, Fidelity Storage Company, for placing at our disposal the facilities of the warehouse and to C. K. Cadwallader, employee of the company, for his cooperation during the course of the experiment.

Paradichlorobenzene and naphthalene.—In controlled laboratory tests, an attempt was made to determine the lethal effect of the household fumigants, paradichlorobenzene and naphthalene. Pinworm eggs were exposed to each gas in 3-liter evacuated flasks in which crystals of the fumigant had been vaporized in quantities required to saturate the atmosphere. There was no significant difference in the

survival rate of the eggs exposed to the gases and the control eggs not exposed to the gases.

A precipitin reaction resulting from *Necator americanus* larvae in sera from hookworm-infected individuals. G. F. Otto, Naomi Jaffe Schugam, and M. E. Groover.

A precipitin reaction resulting from living infective nematode larvae in immune serum was described by Sarles in 1938 for *Nippostrongylus muris* larvae in the sera of immunized rats. Since that time the same phenomenon has been demonstrated with infective larvae of *Ancylostoma caninum* (Otto, 1940), *Strongyloides ratti* (Lawler, 1940), and *Trichinella spiralis* (Olivier-Gonzales, 1940, and Mauss, 1941) in sera of hosts immunized against these helminths. We report here the occurrence of that phenomenon with infective larvae, *Necator americanus*, in sera of individuals infected with that helminth.

"Immune" sera were obtained from *N. americanus* infected children and adults living in Georgia. All except one of these individuals were known to have undergone anthelmintic treatment; the one exception was the only adult negress in the group. Nonimmune sera were obtained from two individuals in Baltimore whose history precluded the likelihood of exposure to hookworm infection; in addition, three sera negative on test for syphilis were obtained from the Wassermann Laboratory of the Johns Hopkins Hospital and classified with the nonimmune sera.

In a drop of each of these sera were placed about a dozen living larvae of *N. americanus*, previously washed repeatedly in sterile saline. Each preparation was protected by a vaseline sealed cover glass and incubated at 37° C. In many cases duplicate preparations were made and maintained at room temperature. Similar preparations were made with living infective larvae of *Ancylostoma caninum*. Most of the preparations were examined after 5 hours, and all at 24 intervals for the appearance of precipitins in any of the physiological openings, viz., buccal cavity, anal pore, and excretory pore.

The results are summarized in table 1. While the data are too few to warrant

Table 1.—*Summarizing the precipitin reactions resulting from living hookworm larvae in human sera. The denominator indicates the number of different sera tested, and the numerator, the number giving positive reactions*

	"Immune" sera	Nonimmune sera
N. americanus larvae	7/10	0/5
A. caninum larvae	2/16	4/14

any more detailed analysis, there is one interesting feature. The only preparation in which the reaction was comparable to that seen in preparations with larvae of *A. caninum* in hyperimmune dog sera was that in which *N. americanus* larvae were incubated in serum obtained from the only adult negress in the series. In this preparation large easily discernible precipitins were seen at the oral openings of nearly all the larvae, whereas in the other positive preparations the precipitins were not as pronounced and involved relatively few larvae. It seems altogether possible that this negress was the only person in the series with a high grade immunity, but many more data are needed before this can be determined. Likwise, the signifi-

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We are indebted to Drs. Justin Andrews and Arthur W. Hill of the Division of Malaria and Hookworm Service of the Georgia State Department of Health for their active cooperation in obtaining sera and hookworms.

cance of the reactions between a few of the larvae of the dog hookworm, *A. caninum*, and some of the human sera, both "immune" and nonimmune, require further study. We may conclude then only that the same phenomenon occurs with human hookworm larvae, *Necator americanus*, in human "immune" sera as has already been demonstrated with a number of other nematode larvae and their respective immune sera. Further study is required to determine the significance of the reaction.

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An apparatus for the warm-air drying of a water suspension of ground trichina larvae for use as an antigen. JOHN L. AVERY, U. S. Bureau of Animal Industry.

In 1941, Spindler, Cross, and Avery (Proc. Helminth. Soc. Wash. 8(1): 1–5) described a method of preparing an antigen for the detection of trichina infections in swine. The preparation of this antigen involved rapid drying of a water suspension of ground trichina larvae, the drying being carried out by means of a stream of warm air at a temperature of 30° to 40° C. An apparatus for the rapid drying of 30 cc or more of the suspension at one time is herein described.

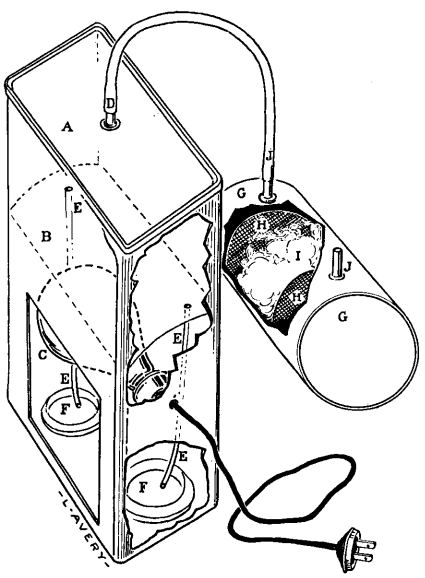

FIG. 1. An apparatus for the warm-air drying of a suspension of ground trichina larvae. A—Air-chamber. B—Reflector. C—Electric light bulb. D—Air inlet. E—Air ducts. F—Antigen. G—Air filter. H—Screens. I—Cotton. J—Air inlet and outlet tubes.

The apparatus, shown in figure 1, is contained in a rectangular metal receptacle, approximately 4 by 7 by 8 inches. Filtered compressed air first enters a warming chamber; the warmed air under pressure then comes down through two metal tubes and blows across the surface of the material to be dried. The material is contained in two watch-glasses or a Petri dish at the bottom of the apparatus.

The warming chamber (A) is built as a separate air-tight box with its lower surface concave to serve as a reflector (B) for the heat source, which is a 50-watt electric light bulb (C). A short metal tube (D) is soldered to the center of the top of the warming chamber as an air inlet and two other tubes (E) are attached to the lower surface of the reflector and serve as outlets for the warm air. These outlets lead to within an inch of the

watch-glasses or Petri dish (F) containing the material to be dried. The warming chamber is soldered in place inside the container; the electric light socket is put in place as shown in the figure. An opening is cut in the front of the apparatus to prevent overheating and to provide access to the material being dried.

An air filter (G) is placed in the compressed air line. This filter consists of a cylindrical metal container having a wire-mesh partition (H) soldered in place near each end, the space between the partitions being filled with absorbent cotton (I). Air inlet and outlet tubes (J) are provided as illustrated, so that the air must pass through the cotton filter before entering the warming chamber. The filter may be removed readily for autoclaving as it is attached to the drier by means of rubber tubing.

While in use, the electric bulb is lighted to warm the air and also to warm the material to be dried. The volume of compressed air entering the apparatus is adjusted to prevent splashing of the material and no further attention need be given to the apparatus until the drying is completed.

A hyperparasitic amoeba in *Peltogaster*. EDWARD G. REINHARD and THEODOR VON BRAND, Department of Biology, The Catholic University of America.

During studies upon the anatomy of the rhizocephalan *Peltogaster paguri* Rathke by one of the authors, a specimen was encountered that showed an abscess in the body wall. Despite the fact that for other reasons some thirty specimens had been serially sectioned during the past few years, this was the only individual that had such an abnormality. The rarity of this type of pathological condition warrants its publication, although the conclusions reached will necessarily be fragmentary.

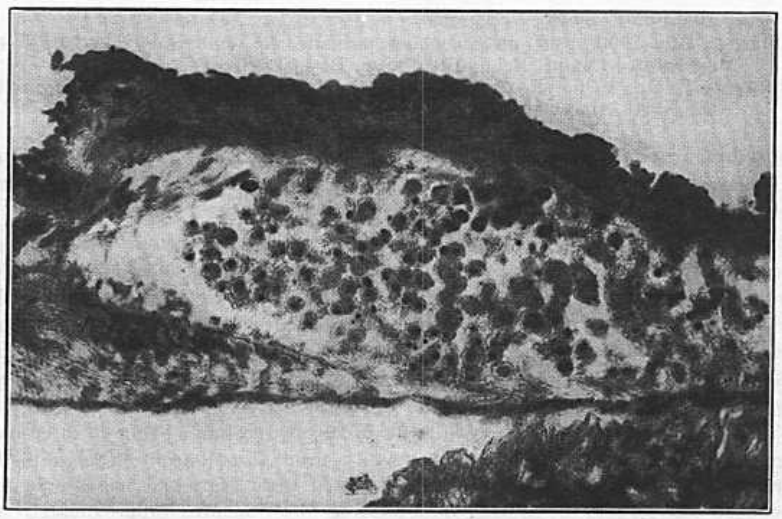

FIG. 1. Cross section of portion of mantle of a young *Peltogaster paguri* showing abscess filled with hyperparasitic amoebas; ×360.

The animal in question was very young, only 3.5 mm long, and had been collected, as were all the others examined, on the coast of Maine, in Frenchmans Bay, where these rhizocephala parasitize the hermit crab *Pagurus pubescens* Kröyer (Reinhard, 1939). The specimen had been fixed in formalin for a purpose unrelated to the present study and the sections stained with iron hematoxylin.

In the ventral body wall of this animal, near the anterior end, an irregularly formed abscess was found, the approximate size of which was $500 \times 50 \times 200\ \mu$.

Practically all the mantle tissues enclosed between the external and internal chitinous cuticle were entirely destroyed. These include outer and inner hypodermis and middle muscular layer of circular striated fibers with connective tissue cells and blood lacunae. The abscess was filled with rounded, in rare instances slightly elongated organisms varying in size from about 5 to 11 μ. The average size of 25 measured specimens was 7.5 μ. The organisms had a fairly large vesicular nucleus with a few irregularly distributed chromatin granules. The cytoplasm of most of them contained discs of various sizes that stained intensely black. These might be interpreted as ingested yolk granules in various stages of digestion. Identical bodies were found both in the detritus lying between the organisms and in the central visceral mass of *Peltogaster* which is, in the main, ovarian tissue. The great majority of the organisms were located inside the abscess, but some had penetrated into the normal mantle tissue, indicating that secondary abscesses or enlargement of the primary one might have occurred had not the host been fixed.

It seems likely that the organisms are amoebas. So far one hyperparasitic amoeba has been found in *Peltogaster*, the *Amoeba paedophthora* described by Caullery (1906). This amoeba, occurring in *Peltogaster curvatus* at Naples, resembled the organism described here in that it ingested yolk granules. It was, however, strictly localized to the eggs undergoing development in the mantle cavity, was apparently somewhat larger (15 μ *in vivo*), and its nucleus showed one large karyosome. These differences appear too great to allow an identification of both organisms under the same name, and positive determination must wait until more material is available which is fixed in a manner more suitable for demonstrating the cytology of these organisms.

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A preliminary note on the length of life of the stomach worm, *Haemonchus contortus* in the calf. ROY L. MAYHEW, Louisiana State University, Baton Rouge, Louisiana.

The animal used in this experiment was a purebred, Holstein male born on December 3, 1939, and kept under the conditions described in Mayhew, 1939,[1] for caring for the other animals in the series of experiments being carried out on bovine parasites at Louisiana State University. Daily fecal examinations were made between April 1, 1940, and June 30, 1941. He was given three small inoculations of infective larvae of *Haemonchus contortus* on March 21, 24, and 27, and the first eggs were recovered from the manure on April 15, 1940. The count increased to a maximum of 66 eggs per gram of sediment on May 1, the range being 20 to 66 during the first 15 days of May. There followed a gradual and steady decrease in the counts during the following 4 months correlated with a gradual increase in the amount of hay consumed. During the following 4 to 5 months (approximately the end of the ninth month) there was little decrease in the range of counts and a gradual increase of about ½ in the amount of hay consumed. Daily fecal examinations continued to the end of the experiment show a gradual decrease to a very low count by the end of the 14th month. No negative examinations were obtained; but counts as low as .02, .03, and .08 eggs per gram of sediment were obtained toward the end of the experiment. Eggs were recovered for a period of 14 months and 15 days.

[1] Mayhew, Roy L., 1939. Studies on bovine gastro-intestinal parasites I. The mode of infection of the hookworm and nodular worm. Cornell Vet. 29: 367.

***Eurytrema procyonis*, n. sp. (Trematoda: Dicrocoeliidae), from the raccoon, *Procyon lotor*.** J. FRED DENTON, The Rice Institute, Houston, Texas.

During the winter of 1940–41 Mr. Rollin H. Baker, Field Biologist with the Texas Game, Fish and Oyster Commission, sent to the writer for parasitological examination the carcasses of 10 raccoons collected near Lufkin, Angelina Co., Texas. Six of the 10 animals examined harbored in the interlobular ducts of the pancreas from 12 to more than 1000 specimens of an undescribed trematode belonging to the genus *Eurytrema* Looss, 1907.

Eurytrema procyonis, n. sp.

Description.—Body flat and foliaceous with entire margins, 1.70–2.54 mm long by 0.73–1.32 mm wide at middle of vitellaria. Cuticle without spines, smooth and very thin, and with small retractile sensory papillae, visible on lateral margins of anterior portion of body. Oral sucker, 0.150–0.210 mm long by 0.164–0.231 mm wide, subterminal, preceded dorsally by a short lip-like projection. Acetabulum weakly muscular, 0.245–0.325 mm in diameter, situated at junction of anterior and second body-fourths. Ratio of width of oral sucker to acetabulum 1: 1.3. Pharynx large, globular, 0.105–0.133 mm long by 0.126–0.164 mm wide. Esophagus usually slightly curved, 0.120–0.161 mm long, bifurcating about midway between the suckers. Ceca wide and voluminous, slightly wavy, passing lateral to margins of acetabulum and testes, medial to the vitellaria to terminate within posterior fifth of body.

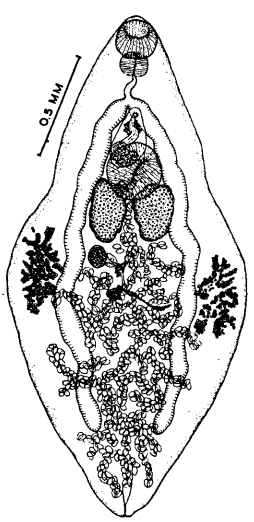

FIG. 1. *Eurytrema procyonis*, n. sp., ventral view.

Excretory pore terminal, excretory vesicle simple tubular, extending anteriorly for about $\frac{2}{3}$ of distance to Mehlis' gland to receive a common collecting tubule from each side of body. Each common collecting tubule passing antero-laterally to divide into an anterior and posterior main collecting tubule opposite anterior margins of testes. Remainder of excretory system not observed. Genital pore usually median at intestinal bifurcation. Testes elongated, irregular to slightly lobed in outline, 0.175–0.415 mm long by 0.147–0.235 mm wide, situated directly opposite with their fields close together and their zones partly overlapping that of acetabulum or immediately posterior to it. Vasa efferentia arising from dorso-medial margins of testes and passing anteriorly and medially to unite as they enter cirrus pouch. Cirrus sac large, enlongated oval, 0.210–0.390 mm long by 0.105–0.180 mm. wide, containing a coiled seminal vesicle, ductus ejaculatorius and eversible cirrus, extended usually posteriorly to equator of acetabulum. Ovary round to oval in shape, 0.065–0.122 mm in greatest diameter, situated submedially close behind the respective testis. Seminal receptacle globular, 0.045–0.085 mm in diameter, located anterior to, dorsal to, medial to or posterior to ovary. Mehlis' gland relatively large and diffuse, situated posterior to and on opposite side of body from ovary. Laurer's canal opening on mid-dorsal surface at posterior level of testes. Vitellaria composed of numerous small rounded follicles massed into grape-like bunches, mainly extra-cecal, situated immediately posterior to caudal level of tests. Uterus convoluted, but with relatively few loops, filling most of posttesticular region of body, then passing between testes and dorsal to acetabulum to genital pore by a slightly undulating course. Mature ova lemon yellow, 45–53 μ long by 29–36 μ wide.

Habitat.—Pancreas of *Procyon lotor*.

Locality.—Southeast Texas (Angelina Co.), U.S.A.

Specimens.—U.S.N.M. Helm. Coll. Nos. 36792 (type) and 36793.

Eurytrema procyonis is most closely related to *E. ten* Yamaguti, 1939 (Jap. Jour. Med. Sci., VI. Bact. and Parasitol., 1: 131–151), from which it differs in body shape, in having more voluminous and longer ceca, in having irregular or lobed testes and less extensive uterus anterior to the testes.

A new trematode of the family Psilostomidae from the lesser scaup duck, *Marila affinis*. EMMETT W. PRICE, U. S. Bureau of Animal Industry.

While investigating the deaths of lesser scaup ducks, *Marila affinis*, due to *Sphaeridotrema globulus* infestation, which occurred in 1928, 1929, and 1930 along the Potomac River between Washington, D. C., and Fort Washington, Md. (Price, 1929, Jour. Parasitol. 16: 103–104; Proc. Helminth. Soc. Wash. 1: 31–34), the writer encountered an additional trematode in all of the birds examined. This fluke, which is described here as a new species of *Psilostomum*, sometimes occurred in large numbers, but seemed to be in no way responsible for the deaths of the birds.

Psilostomum marilae, n. sp.

Description.—Body oval (Fig. 1), 510 to 630 μ long by 250 to 340 μ wide, with anterior end attenuated. Oral sucker slightly subterminal, about 60 μ in diameter; acetabulum 115 μ long by 150 μ wide, situated about one-third of body length from anterior end. Prepharynx very short; pharynx oval, about 45 μ long by 35 μ wide; esophagus about 20 μ long; intestinal ceca slender. Genital aperture median, at level of esophageal bifurcation. Cirrus pouch oval, 115 to 150 μ long by 65 to 75 μ wide, its posterior end almost reaching level of center of acetabulum. Testes globular, about 75 μ in diameter, situated diagonally in posterior half of body. Ovary globular or nearly so, about 55 μ in diameter, in zone of anterior testis. Seminal receptacle small, dorsal and medial to ovary; Laurer's canal not observed. Vitellaria consisting of large follicles extending in lateral fields from near level of genital aperture to posterior end of body; vitelline reservoir conspicuous, between ovary and posterior testis. Eggs oval, 85 to 90 μ long by 50 to 60 μ wide.

Host.—*Marila affinis.*

Location.—Small intestine.

Distribution.—United States (Maryland).

Specimens.—U.S.N.M. Helm. Coll. No. 45002 (type) and 45003 (paratypes).

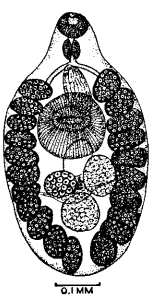

FIG. 1. *Psilostomum marilae*, n. sp. Complete worm, ventral view.

Psilostomum marilae most closely resembles *P. progeneticum* Wiśniewski because of the triangular arrangement of the gonads. It may be differentiated from that species, however by the distribution of the vitellaria which extend to the zone of the pharynx in *P. progeneticum* and only as far as the level of the genital aperture in *P. marillae.*

There are at present eight species included in the genus *Psilostomum*, as follows: *P. arvicolae* Shul'ts and Dobrova, 1933; *P. brevicolle* (Creplin, 1829), *P. cygnei* Southwell and Kirshner, 1937; *P. marilae*, n. sp.; *P. ondatrae* Price, 1931; *P. progeneticum* Wiśniewski, 1933; *P. reflexae* (Cort, 1914); and *P. varium* Linton, 1928. Of these, *P. ondatrae* Price obviously belongs to the genus *Ribeiroia* Travassos (1939, Bol. Biológico, 4: 301–304, and is probably identical with *R. insignis* Travassos; the correct name for *P. ondatrae* Price is, accordingly, *R. ondatrae* (Price) n. comb. *P. arvicolae* Shul'ts and Dobrova (1933, Vestnik Microbiol., Epidemiol. i Parazitol. 12: 229–331) probably does not belong to the genus *Psilostomum*, since its organization, particularly the relative size and dis-

tribution of the vitelline follicles and the length of the esophagus, suggests that it is an echisostome; the species was based on a single specimen from which the anterior end was missing. The inclusion by Feldman (1941, Jour. Parasitol. 27: 525–533) of *P. reflexae* (Cort) in the genus *Psilostomum* is likewise open to question. This species possesses two rows of spines at the anterior end of the body and has a long slender esophagus, both characters being at variance with those of the genotype *P. platyurum* (Mühling) (= *P. brevicolle* (Creplin)); these characters may be found on further study to be of generic value.

***Aequistoma*, nom. nov. for *Pseudechinostomum* Shchupakov, 1936, preoccupied by *Pseudechinostomum* Odhner, 1911.** PAUL C. BEAVER, Lawrence College, Appleton, Wisconsin.

Pseudechinostomum Shchupakov, 1936 (type *P. advena* Shchupakov, 1936) is a homonym of *Pseudechinostomum* Odhner, 1911 (type *P. incoronatum* Odhner, 1911). While the general morphology of the two forms is similar and echinostoma-like, and the absence of collar spines is a character common to both, other characters clearly place them in different genera. A new name, *Aequistoma*, is proposed for *Pseudechinostomum* Shchupakov (type *Aequistoma advena* (Shchupakov, 1936), n. comb.).

In *Aequistoma* there is no fleshy collar or spines, the vitellaria are post-testicular, and the cirrus sac is anterior to the middle of the acetabulum. In *Pseudechinostomum*, a fleshy collar is present though poorly developed and without spines, the vitellaria extend anteriorly almost to the acetabulum, and the cirrus sac extends far posterior to the acetabulum.

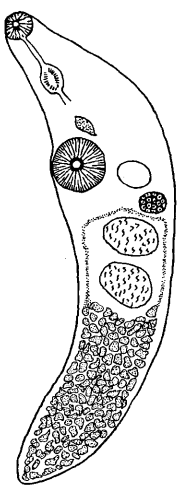

FIG. 1. *Aequistoma advena*. Shchupakov's drawing copied by projection.

The following diagnosis of *Aequistoma advena* is based on a translation of the original Russian description and its accompanying figure (Fig. 1).

Diagnosis. Body elongate, 0.88 to 1.14 mm long by 0.135 to 0.16 mm wide; greatest width at level of acetabulum. Cuticula without spines; collar and collar spines absent. Diameter of oral sucker, 58 to 66 μ; pharynx, 36 μ in length. Acetabulum between the first and second thirds of the body, 100 to 120 μ in diameter. Prepharynx and esophagus of about equal length, around 40 μ; intestinal bifurcation comparatively far ahead of the acetabulum, and the ceca follow the lateral edges of the body to its posterior third. Testes tandem, in anterior part of posterior half of body; oval in outline with regular borders; 80 to 96 μ by 120 to 140 μ. Cirrus sac small, mostly anterior to acetabulum. Vitellaria confined to post-testicular region, with the right and left fields confluent. Yolk ducts and yolk reservoir relatively large. Ovary round in outline, situated immediately anterior to the testes; 38 to 40 μ in diameter. Uterus short, with few coils, containing 1 to 3 eggs. Eggs of a muddy color, ovoid, measuring 60 by 76 μ.

Host.—*Phaco caspica* Gmelin (Caspian seal).

Location.—Small intestine.

Distribution.—Caspian Sea.

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Opuscula miscellanea nematologica. IX. G. STEINER, U. S. Bureau of Plant Industry.

(1) HOYA CARNOSA R. BR., THE COMMON WAXPLANT, AS HOST OF THE ROOT-KNOT NEMATODE AND OF A NEW RHABDITID, DIPLOSCAPTER PACHYS, N. SP.

Hoya carnosa R. Br. is here listed for the first time as a host of the root-knot nematode, *Heterodera marioni* (Cornu) Goodey. Hitherto the only member of the genus known to be attacked by this pest was *Hoya bella* Hook. The present material (submitted by M. L. Didlake of the Kentucky Agricultural Experiment Station, Lexington, Ky.) showed the roots to be heavily attacked, exhibiting considerable cracking and decay; knots were numerous, although of small size. Associated with the root-knot nematode and obviously restricted to its knots, numerous adults and larvae of a new *Diploscapter* species were also observed. An examination of the intestinal contents of these specimens suggests their feeding on cell contents of root cells. Access to the tissues of the plant is made possible by the cracking of the root cortex caused by the root-knot nematode.

Diploscapter pachys, n. sp. (Fig. 1, A–F)

There is no doubt that *Diploscapter coronata* (Cobb, 1893) Cobb, 1913 of various authors is an aggregation of different species resembling the type only in general structure. Unfortunately these species are all very small and therefore technically difficult objects of study, particularly regarding their head structures.

Description.—Of very small but remarkably plump form. Tail, compared with other *Diploscapter* species, rather short, although in length somewhat variable, tapering regularly to acute terminus; phasmids about anal body-width behind anus. Cuticle plainly annulated; annulation interrupted by lateral fields. In middle region of body these fields are 4 μ wide, with a corresponding body-width of 22.4 μ. As shown in cross section (Fig. 1, F), these lateral fields are edged on each side by protruding, peripherically rounded ridges. Lateral chords flat, almost $\frac{1}{6}$ of total body-circumference wide. Dorsal chord very narrow, ventral chord in cross section a rounded pad. Cervical papillae fine, located in lateral field at region between nerve ring and terminal oesophageal bulb. Head, in side view, with ovate lateral flaps (laciniae), their edges very faintly crenate (Fig. 1, A, B, D); these laciniae in medial view of somewhat triangular shape, anteriorly sharply pointed, their outer edges convex, faintly crenate, inner edges concave (Fig. 1, A). There is a fine, setose papilla, interpreted as homologous to the inner or anterior lateral papilla of other rhabditids, situated in the middle of these laciniae. A front view of head presented in figure 1, C. Laciniae unquestionably stiff and rigid structures, never seen bent or folded; their function not clear but obviously a mechanical as well as a perceptive one. Movements of the head end mainly in dorso-ventral plane, as already stated by Cobb, the two laciniae apparently preventing a sidewise escape of food material made loose or available through these motions. Function of these laciniae obviously one closely linked with that of hooks or hamuli. Latter as figured, appearing of very similar structure to that of other known species of *Diploscapter*, the various cuticular parts composing them, however, difficult to differentiate. Obviously the four submedial lips of other rhabditids correspond to these hamuli, the dorso-submedial lips to the dorsal, the ventro-submedial lips to the ventral hamulus, while the lateral lips correspond to the laciniae. Concerning the origin of the various cuticularized parts of the hamuli, no suggestions are available; however, it can be said that, during the moult they are shed. Compared with other species of *Diploscapter*, the points or endhooks of the hamuli in the present species in medial and in front view are rather small and tightly placed together. The location of the submedial cephalic papillae has not been

determined definitely; possibly some of these papillae are situated just in front of the basal cuticular apophyses of the hamuli as shown in figure 1, B, C; if this is correct, they are almost at the same latitude as the amphids and therefore obviously belong to the outer or posterior circle of cephalic papillae as seen in other Rhabditidae. There is an outer or posterior lateral papilla just in front of the amphid. In one instance rather distinct marks of submedial papillae were seen just back of the inner portion of the anterior cuticular arc of the hamuli. These

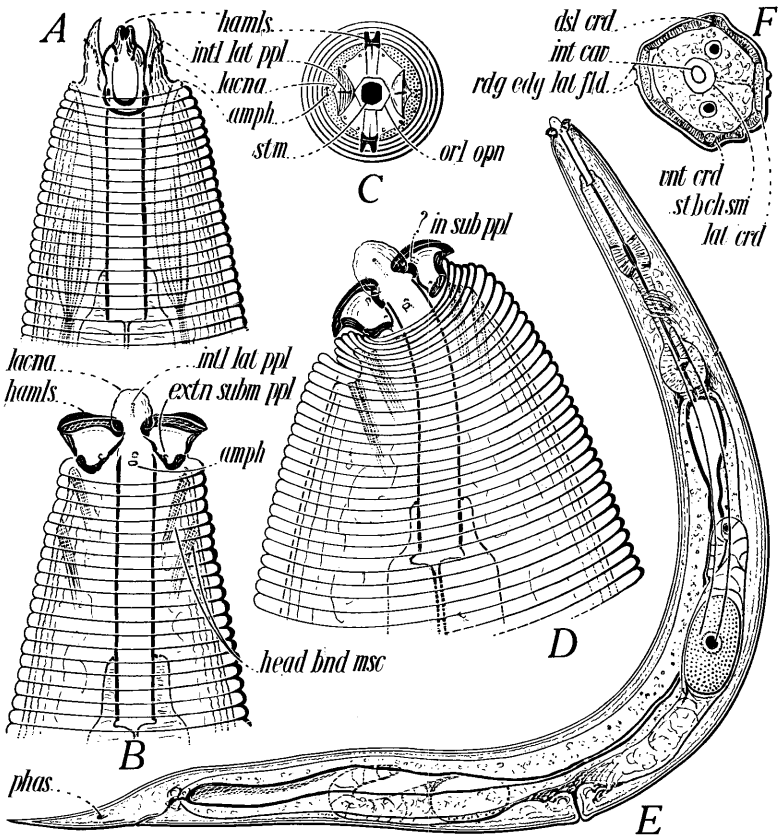

FIG. 1. *Diploscapter pachys*, n. sp. A—Head end, dorsal view; *amph*, amphid; *hamls*, hamulus or hook; *int lat ppl*, internal lateral papilla; *lacna*, lacinia or lateral flap; ×1200. B—Head end, side view; *amph*, amphid; *extn subm ppl*, external submedial papilla; *hamls*, hamulus; *head bnd msc*, bending muscle of head; *int lat ppl*, internal lateral papilla; *lacna*, lacinia; ×1200. C—Front view of head; *amph*, amphid; *hamls*, hamulus; *int lat ppl*, internal lateral papilla; *lacna*, lacinia; *orl opn*, oral opening; *stm*, stoma; ×1200. D—Head end in bent position, side view; *? in sub ppl*, internal submedial papilla?; ×1200. E—Female; *phas*, phasmid; ×266. F—Cross section through body in region of intestine; *dsl crd*, dorsal chord; *int cav*, intestinal cavity; *lat crd*, lateral chord; *rdg edg lat fld*, ridge forming edge of lateral field; *stbchsm*, "Stäbchensaum"; *vnt crd*, ventral chord; ×900.

might be interpreted as submedial papillae of the inner or anterior circle (Fig. 1, D). In the literature on the Diploscapterinae no reference to the pattern of cephalic papillae is found. Obviously earlier authors overlooked these structures; only in drawings by Cobb are the lateral papillae on the laciniae sketched, but they

were not recognized as such. In comparing and homologizing the pattern of cephalic papillae as here described for a *Diploscapter* with that of the more typical Rhabditidae, the anterior or inner circle is represented by the lateral papillae on the laciniae and the four anterior or inner submedial papillae; the posterior or outer circle is represented by a single papilla each in submedial and lateral position. Since in the diploscapters these structures are extremely difficult to see and to study, future work may still change the interpretation here presented. The amphids of the present species appear to be of the same general form as those of other rhabditids. The amphidial opening is located back of the base of the laciniae at about the latitude of the basal apophyses of the hamuli (Fig. 1, A, D). The amphids too were overlooked by all previous authors. The oral opening is hexagonal but the buccal cavity appears to be tetragonal in cross section. Cheilorhabdions amalgamated to protorhabdions, but often to be differentiated by their inwardly curved shape; their length as well as that of the cheilostom about 2 μ. In adults, the average length of the buccal cavity proper measures about 16 to 19 μ; its width 2 to 3 μ. At its base, it is surrounded by the oesophagus in the shape of a cuff, for about ¼ of its length. Corpus of oesophagus differentiated into a cylindrical, strongly muscular procorpus and a short, bulbous, well set-off metacorpus; latter also muscular and with longitudinal valves only slightly shorter than bulb itself. Isthmus well differentiated and also strongly muscular; terminal oesophageal bulb spherical, with set-off valves as in other rhabditids. Oesophagointestinal valve short, cylindrical, muscular. Intestine consisting of double series of cells. "Stäbchensaum" rather strong. Rectum about 14 μ long; rectal glands not definitely seen. Excretory pore ventrad to terminal oesophageal bulb. Female sexual apparatus amphidelphic, anterior branch to right, posterior to left of intestine. Ovaries short, their ends reflexed; vulva a transverse slit of about 10 to 11 μ length, that is, almost ½ body-width. Only females observed (over 60 specimens).

Measurements.— ♀ : total length = 0.31 to 0.41 mm; $\alpha = 12.4$ to 13.7; $\beta = 3.8$ to 4.5; $\gamma = 7.6$ to 9.2; $v = 55$ to 58%.

Diagnosis.—Diploscapter of very small size, with ovate, faintly crenate laciniae (= lateral flaps) in side view; hamuli (= dorsal and ventral hooks) with small and closely approached points; isthmus and terminal oesophageal bulb together longer than corpus; metacorpus short, well set off, of bulbous form, wider than corpus. Tail short, $\gamma = 7.6$ to 9.2; phasmids about anal body-width behind anus.

Type locality.—Lexington, Kentucky.

Type host.—In knots produced by the root-knot nematode in roots of *Hoya carnosa* R. Br., the common waxplant.

(2) NEW NEMATODES FROM THE MINES OF THE BARK BEETLE ALNIPHAGUS ASPERICOLLIS (LEC.), IN OREGON

On a June evening in 1939, while on a field trip, the writer visited the Entomological Field Laboratory of the Oregon Agricultural Experiment Station in Redmond, Deschutes County, Oregon. In discussing with Messrs. Joe Schuh and Roger Scott of that laboratory the interrelationships between nematodes and insects, particularly the extremely fascinating associations and often parasitic relations between certain bark beetles and nematodes, our attention was called to a small log of red alder or Oregon alder (*Alnus rubra* Bong.) in the laboratory. This trunk exhibited mines and contained living beetles of *Alniphagus aspericollis* (Lec.) [Scolytidae]. Three specimens of the beetle and a few small pieces of wood containing mines were chiseled out and later examined for the presence of nematodes. None were found in or on the beetles, but the mines contained the three following new species: *Aphelenchoides alni*, n. sp., *Aphelenchoides oregonen-*

sis, n. sp., and *Aphelenchus macrobolbus*, n. sp. The finding of these 3 species in the mines and frass only is not considered proof of their non-parasitic relationship to the bark beetle. Of the three forms, however, only *A. oregonensis* is suspected of being a true parasite, mainly because of its type of reproduction which appears to be based on the production of a large number of rather small eggs, each provided with a strong shell, and also because of the fact that no larval specimens of this species were observed in the mines.

Aphelenchoides alni, n. sp. (Fig. 2, A–F)

This is a well-defined, easily recognizable new species belonging to that group of *Aphelenchoides* where distinct basal knobs on the buccal stylet are absent. (6 ♀'s, 3 ♂'s and 8 larvae collected.)

Description.—*Aphelenchoides* somewhat resembling *A. demani* (Goodey, 1928) in the female but differing greatly in the male. Body in both sexes very slender; tail of female of elongated conical shape, slightly incurved ventrally, with acute (Fig. 2, D) or faintly obtuse (Fig. 2, E) but not set-off terminus. Male tail shorter and more incurved than that of female, terminus sharply acute, often somewhat set off yet not properly mucronate. Cuticle finely annulated; annulation about 0.8 μ apart. Structure of lateral fields not determined. Head set off by sharp constriction, almost spherical in shape, as wide or wider than the body, with 6 well-developed sectors. Cheilorhabdions fine but distinct. Buccal stylet rather obscure, about 9 to 12 μ long, without distinct basal knobs. Procorpus cylindrical, about thrice as long as metacorpus bulb; latter about 14 μ long and 8 μ wide, long-oval, with distinct valves. Isthmus short and slender, hardly swollen toward intestine, from which it is obscurely set off. Large oesophageal glands embedded in dorsal intestinal wall extending almost as far back from metacorpus bulb as distance from head end to isthmus. Rectum about twice as long as anal body diameter. Excretory pore ventrad of end portion of metacorpus bulb. Vulva at about 71% of total length, forming transverse slit, almost half as long as corresponding body-width; postvulvar uterus extending sometimes $\frac{3}{5}$ of distance vulva to anus. Ovary to right of intestine, outstretched forward, end not reflexed. Male with broad aphelenchoid spicula, proximally not capitate; ventral rib without ventrally directed apophysis at proximal end. Copulatory papillae as in figure 2, F: one in ventrosubmedial position about one anal body-width in front of anus, one at latitude of anus, two close together at about $\frac{3}{5}$ tail-length behind anus, and one on each side subdorsally at about same latitude. Presence of another very minute lateral papilla at base of tail point probable. Bursal muscles as in figure 2, F, about 7 pairs. A short distance in front of anus, medially, a small cuticular fold, possibly a copulatory structure. Testis not reflexed.

Measurements.— ♀: total length = 0.54 to 0.68 mm; $\alpha = 45$ to 52; $\beta = 19$; $\gamma = 16$ to 19; $v = 71$ to 72%. ♂: total length = 0.64 to 0.67 mm; $\alpha = 60$ to 61; $\beta = 7.5$ to 10; $\gamma = 30$ to 32.

Type location.—Redmond, Oregon.

Type association.—In mines produced by bark beetle *Alniphagus aspericollis* (Lec.) in Oregon alder, *Alnus rubra* Bong.

Aphelenchoides oregonensis, n. sp. (Fig. 2, G–J)

This new species (3 ♀'s and 4 ♂'s collected) belongs to that group of members of the genus *Aphelenchoides* where the female has a short obtuse tail. Of the species described from American bark beetles, *A. oregonensis* most closely approaches *A. acroposthion* Steiner, 1932, but differs from it in many essential points.

Description.—Body of both sexes filiform and tail end broadly obtuse with a terminal mucro in male only (Fig. 2, I, J). Cuticle finely annulated, lateral

fields not. Head high, broadly rounded, distinctly set off, not annulated and without distinct division into sectors; papillae obscure. Cheilorhabdions bacilliform, fine but distinct. Buccal stylet small, with faintly thickened basal walls but without proper knobs. Procorpus long, cylindrical, about three times as long as metacorpus bulb; latter about 16 μ long, ovoid with distinct valves and rather weak musculature. Isthmus connected with metacorpus bulb by very short collar-like section (Fig. 2, G) immediately followed by wide intestinal portion; nerve ring encircling latter. Oesophageal glands extending a distance back of the nerve ring greater than distance from head end to base of metacorpus bulb; these glands attached to the extremely thin dorsal wall of intestine. Excretory pore about twice body-width behind metacorpus bulb. Female sexual apparatus with long postvulvar vestigial uterus, reaching almost to rectum. Ovary not reflexed, reaching far forward but not to the oesophageal glands. Uterus containing a series of ovoid eggs; these about 22 μ long and 9 μ wide, each with a rather thick shell. Male with straight testis; spicula short, flat, close together, their ventral rib at proximal end with ventral projection or apophysis extending to body wall. Male tail shorter than that of female, ending in a strong, sharply pointed mucro; two sublateral male copulatory papillae on tail near base of mucro.

Measurements.— ♀ : total length = 0.820 to 0.870 mm; α = 52 to 57; β = ?(12)[1]; γ = 54; v = 86.8%. ♂ : total length = 0.800 to 0.802 mm; α = 72 to 80; β = ?(12)[1]; γ = 56 to 57.

Diagnosis.—*Aphelenchoides* resembling *A. acroposthion* Steiner but in the male with longer tail and different pattern of copulatory papillae; female also with a much longer tail; size in both sexes only about half that of *A. acroposthion*.

Type location.—Redmond, Deschutes County, Oregon.

Type association.—In mines produced by bark beetle, *Alniphagus aspericollis* Lec., in Oregon alder, *Alnus rubra* Bong.

Aphelenchus macrobolbus, n. sp. (Fig. 2, K–N)

A single female specimen was found. It is the first observation of a representative of this genus in a bark beetle mine, where possibly fungus hyphae furnish the food.

Considering the present confusion in regard to the status of the genus *Aphelenchus* it is pointed out that in our view this genus includes Aphelenchinae with broad, multistriated (4–16 striae) lateral fields, which in cross section more or less protrude from the body and, also in cross section, have a crenate outline (Fig. 2, N). Buccal stylet without basal knobs; posterior portion of oesophagus slender, without bulbous swelling, its junction with intestine often obscure; the oesophageal glands enlarged, protruding from the oesophagus proper and overlapping dorsal wall of intestine. Female tail short, obtusely rounded with phasmids at the terminus. Males, where known, with bursa and bursal ribs.

It is unfortunate that the structures of the lateral fields, the exact morphology of the posterior portion of the oesophagus, its mode of junction with the intestine, and the arrangement of the oesophageal glands were largely ignored in previous descriptions of members of this genus. Unquestionably a variety of species was recorded in the past under the name of *Aphelenchus avenae* Bastian, 1865 because these structures were not studied and differentiated properly.

The species here described as new under the name *Aphelenchus macrobolbus* closely resembles *Aphelenchus agricola* de Man of Maupas, 1900 (nec *A. agricola* de Man, 1881, nec *A. agricola* de Man, 1921) = *Paraphelenchus maupasi* Micoletzky,

[1] This number represents total length divided by length of distance, head end to beginning of isthmus.

1922. However, this species of Maupas, as renamed by Micoletzky, is not a *Paraphelenchus* because the terminal bulb of the oesophagus does not enclose the oesophageal glands as it does in the case of *Paraphelenchus pseudoparietinus* Micoletzky, 1922, the type of this genus. Maupas' species is here renamed *Aphelenchus maupasi* (Micoletzky), n. comb.

The present species differs from *A. maupasi* in the following characters: (1) Annulation of cuticle obscure; (2) lateral fields with maximal number of only 9 striae instead of 12; (3) tail shorter, more truncate and with phasmids (however, Maupas may have overlooked these); (4) rectum longer than tail, instead of shorter.

Description.—Body rather stout (Fig. 2, K, based on flattened specimen), tapering toward head more pronouncedly than toward tail. Annulation of cuticle obscure; lateral fields in middle region of body with 9, in anal region with 8, striae; contraction of fields in vulvar region as described for *Paraphelenchus micoletzky* Steiner, 1941 probably present. Phasmids at tail end as figured (Fig. 2, M). Cervical papillae not discerned. Head slightly set off, with six sectors.

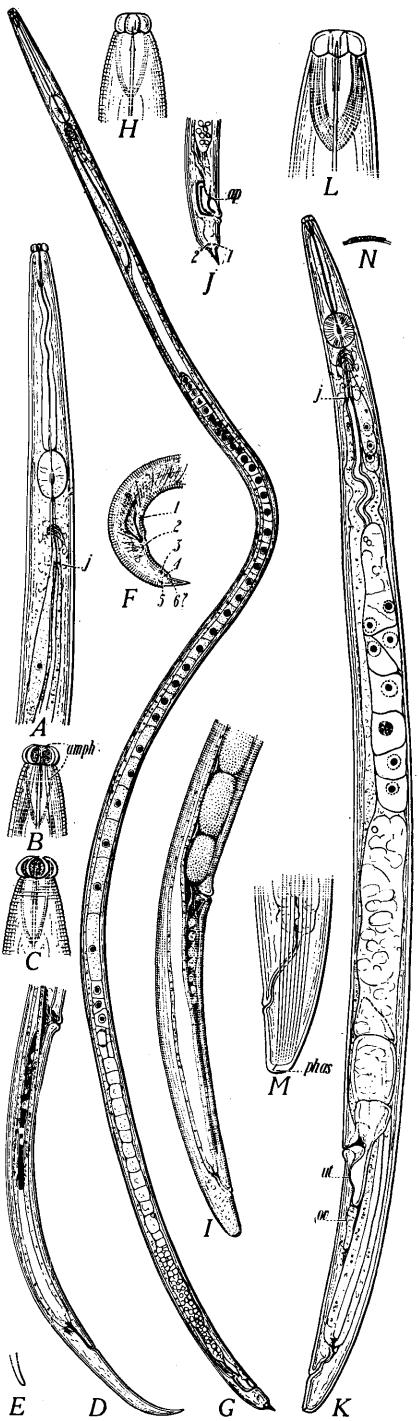

FIG. 2. A–F—*Aphelenchoides alni*, n. sp. A—Anterior end; *j*, junction of oesophagus and intestine; ×250. B—Head end in medial view; *amph*, amphid; ×562. C—Head end in side view; ×562. D—Tail end of female; ×187. E—Obtusely rounded tail end. F—Tail end of male; 1–6 copulatory papillae; ×187. G–J—*Aphelenchoides oregonensis*, n. sp. G—Male specimen; ×100. H—Head end; ×562. I—Tail end of female; ×187. J—Tail end of male; *ap*, apophysis on ventral rib of spiculum; 1–2 copulatory papillae; ×187. K–N—*Aphelenchus macrobolbus*, n. sp. K—Female specimen; *j*, junction of oesophagus and intestine; *ov*, vestigial posterior ovary; *ut*, vestigial posterior uterus; ×100. L—Head end; ×250. M—Tail end of female; *phas*, phasmid; ×250. N—Cross section through lateral field in anterior region of intestine, sketch.

Cheilorhabdions small; buccal stylet weak, about 16 μ long; no cuticularized guiding apparatus. Procorpus 48 μ long; metacorpus bulb almost spherical, 22 μ long and 20 μ wide, very muscular, with short valves. Isthmus very narrow, about 34 μ long, only slightly swollen toward end; junction with intestine quite obscure; oesophageal glands free in body cavity, overlapping dorsal wall of intestine, their posterior end almost 74 μ behind metacorpus bulb, a distance shorter than that from head end to isthmus (86 μ); arrangement of gland nuclei possibly as shown in figure 2, G. Intestine with rather wide lumen, and, in anterior portion with distinct "Stäbchensaum." Rectum measuring 24 μ, slightly longer than tail (22 μ). Excretory pore ventrad of and slightly behind nerve ring. Vulva at 77% leading inward and slightly forward. Posterior branch of female apparatus not quite reaching half distance vulva to anus, consisting of short uterus and an appendix interpreted as vestigial ovary (Fig. 2, G); anterior uterus and ovary to left of intestine; ovary not reflexed. Nuclei of oöcytes large; eggs not observed.

Measurements.—♀: total length = 0.768 mm; α = 21 (flattened); β = 6.4; γ = 35.

Diagnosis.—*Aphelenchus* with extremely large, almost spherical, and very muscular metacorpus bulb; oesophageal glands in close tandem arrangement, overlapping intestine for a distance of about 40 μ. Distance metacorpus bulb to intestine 34 μ; distance from metacorpus bulb to end of glands (74 μ) shorter than distance head end to isthmus (86 μ). Postvulvar branch of female apparatus slightly shorter than half distance vulva to anus and consisting of short uterus and attached vestigial ovary. Rectum slightly longer than tail. Lateral fields only slightly elevated, with 9 striae.

Type locality.—Redmond, Oregon.

Type association.—In mines produced by bark beetle, *Alniphagus aspericollis* (Lec.) in Oregon alder, *Alnus rubra* Bong.

Report of the Brayton H. Ransom Memorial Trust Fund

December 31, 1941

The status of the Fund, since the previous statement in the Proceedings of the Helminthological Society, January, 1941, is as follows:

ON LOAN	$1350.00
BALANCE ON HAND, December 31, 1940	66.19
RECEIPTS:	
Bank interest, Jan. 1, 1941	.96
Interest on loan, Jan. 12	27.00
Bank interest, June 30	.85
Interest on loan, July 12	27.00
Bank interest, December 31	1.13
TOTAL RECEIPTS	$ 123.13
DISBURSEMENTS:	
1941 rent, safe deposit box	3.89
BALANCE ON HAND, December 31, 1941	119.24
	$ 123.13

ELOISE B. CRAM,
Secretary-Treasurer

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