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Some Land Planarians of the United States and Europe, with Remarks on Nomenclature

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In 1943 I published an account of land planarians in the United States on the basis of material then available to me. I am now able to make some additions to our knowledge of these relatively rare forms through a generous gift of 28 vials collected by Dr. Leslie Hubricht in the eastern United States in the course of searching for other small invertebrates. Dr. Hubricht writes that land planarians are so rare one may hope to find them only accidentally in the course of other collecting. I also take this occasion to alter some of the nomenclatorial conclusions reached in the 1943 article. These have met with objections from other specialists on the Turbellaria, and no doubt I was mistaken on certain points.

All the forms dealt with in this article belong to the Suborder Terricola of the turbellarian Order Tricladida. The Terricola are commonly known as land planarians and live in humid secluded places, under logs, boards, leaf accumulations, and so on, mostly coming out to feed only at night or at times of dim light.

ABBREVIATIONS FOR ALL FIGURES

1, Sperm ducts; 2, common sperm duct; 3, sperm vesicle; 4, glandular vesicles; 5, male antrum; 6, common antrum; 7, gonopore; 8, female antrum; 9, glandular duct; 10, cement glands; 11, entrance of ovovitelline ducts; 12, eye; 13, pharynx; 14, penis bulb; 15, bulbar cavity; 16, penis papilla; 17, genito-intestinal connection; 18, vagina; 19, seminal bursa.

FAMILY RHYNCHODEMIDAE GRAFF, 1896

DEFINITION: Land planarians of elongate cylindroid form with simple rounded anterior end bearing a pair of eyes; with well-defined creeping sole occupying only the central part of the ventral surface.

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SUBFAMILY RHYNCHODEMINAE CORREA, 1947

Desmorhynchinae HEINZEL, 1929.

Dolichoplaninae HYMAN, 1943.

DEFINITION: Rhynchodemidae in which the longitudinal muscle fibers of the subepidermal muscle layer are aggregated into more or less definite bundles, obvious in transverse sections.

GENUS *RHYNCHODEMUS* LEIDY, 1851*Geodesmus* METSCHNIKOFF, 1866.*Desmorhynchus* HEINZEL, 1929.

DEFINITION: Rhynchodeminae in which the male copulatory apparatus lacks a penis papilla, consisting of antrum only, and the female copulatory apparatus is equally simple, consisting of antrum and glandular duct without bursa or genito-intestinal connection.

TYPE SPECIES: *Planaria sylvatica* Leidy, 1851.

Rhynchodemus sylvaticus (Leidy), 1851*Planaria sylvatica* LEIDY, 1851a.*Rhynchodemus sylvaticus* LEIDY, 1851b.

In my 1943 article I gave a sufficient description of this species, including the copulatory apparatus, and showed that it is the type of the genus *Rhynchodemus*, which therefore can include only rhynchodemines with the same sort of simple copulatory apparatus. I have now to record the finding of the species outdoors in the vicinity of the University of Illinois by Dr. R. E. Ogren (in press), apparently the first finding in nature in many years. Dr. Ogren has stated in letters that the worms may reach lengths of 12 to 15 mm., although they are usually around 10 mm. long, and that the ground color is dark brown or grayish brown, with a pair of darker brown to black stripes extending longitudinally in dorsolateral regions and united by a dark spot over the pharynx. The worms move about rapidly, with the anterior end raised and swinging from side to side. Two different sets of sagittal sections sent by Ogren for examination were puzzling in that the female system was completely developed, but the male system was represented only by traces of the copulatory apparatus as testes and sperm were totally wanting.

Rhynchodemus bilineatus (Metschnikoff), 1866

Figure 1

Geodesmus bilineatus METSCHNIKOFF, 1866.*Rhynchodemus bilineatus* MOSELEY, 1874.

In 1866 Metschnikoff (spelled Mecznirow in that article) described a small land planarian that was found on top of the soil of potted plants in a botanical garden at Giessen in Hesse, Germany. He gave the worm the name of *Geodesmus bilineatus*, thus creating a new genus. Metschnikoff presented good figures of the external appearance of the worm, which is seen to resemble closely *R. sylvaticus*, but unfortunately failed to give the information necessary to establish its taxonomic position. The subepidermal longitudinal muscle fibers are said by him to be external to the circular fibers, an erroneous statement as the circular fibers are always external, and nothing is said as to their being arranged in bundles or not. Metschnikoff thought his specimens were immature, although it is probable that they were ripe. He figured what he called the penis as an oval body with what he called a thick muscular wall. This figure is interpretable as a male antrum lined by a tall epithelium. Secretion granules were seen at the end of the antrum entered by the sperm duct.

In subsequent years many reports were published on the natural history of what was called *bilineatus*, found in various localities in Germany and in Austria. These findings are listed by von Graff (1899, p. 490) and Arndt (1934, 1935), and it appears unnecessary to repeat them here. The species was almost invariably found in greenhouses, terraria, around potted plants, and so on. In 1941 Adam and Leloup reported the discovery of what they identified as *bilineatus* in moist woods in Belgium. In these many reports there is unfortunately no information of taxonomic value except the one statement by von Graff (1899, p. 76), based on his own investigations, that *bilineatus* has little bundles of longitudinal fibers. In 1944 Pantin announced the finding in woods in Britain of a small land planarian closely resembling *Rhynchodemus sylvaticus*, and in 1950 he identified this worm as *bilineatus* and verified the presence of longitudinal muscle bundles. He also gave a sketch of a sagittal view of the copulatory apparatus that shows his specimens to belong to the genus *Rhynchodemus*.

In view of the fact that Metschnikoff failed to give the characters necessary for a specific identification it does not appear that anyone can be certain of having refound Metschnikoff's species. The foregoing identifications were based on external appearance, form, and color pattern, although Pantin (1950) admits that the color is subject to much variation and the identifying pair of stripes may be absent. It is further apparent that the species cannot be distinguished externally from *Rhynchodemus sylvaticus*, and in fact I was for a long time of the opinion that *bilineatus* is a synonym of *sylvaticus*.

Dr. Pantin some time ago kindly sent me several specimens of the

worms he identifies as *bilineatus*, and I have now sectioned two of these sagittally and am able to describe the reproductive system. My findings show that Pantin's figure (1950) of the copulatory apparatus is inaccurate in some details, but these are not sufficient to affect the taxonomic position of the worm.

Both of the sectioned specimens appear spent, and testes were located only with difficulty. According to the original description there are six pairs of brown rings connected by longitudinal brown streaks visible in ventral view about the middle of the animal. These were identified by Pantin (1950) as marking the location of the testes and sperm ducts, and are shown in one of his photographs. However, the two larger and most anterior spots on this photograph are almost certainly the ovaries. My sections show that not only the testes but also the ovaries, the oovitelline ducts, at least in their more anterior courses, and the anterior part of the male copulatory apparatus are surrounded with conspicuous yellowish brown granulations, apparently located in gland cells. The pair of ovaries is situated somewhat more than half of the distance from the anterior tip to the pharynx root, that is, behind the narrowed anterior beak-like region or hood, in Pantin's terminology. They and the oovitelline ducts leading away from them are densely surrounded by the yellowish brown pigment just mentioned. The testes should be easily identified in sections by the pigment ring around them, and the fact that only two or three could be found in each set of sections after prolonged search indicates that the testes dedifferentiate greatly and the pigment disappears when the animals are spent. Apparently breeding is seasonal. From what was observed in the sections, combined with the statements of Metschnikoff and Pantin, it would appear that there are three or four pairs of prepharyngeal testes, situated between the ovaries and the pharynx, and two pairs of postpharyngeal testes between the pharynx and the copulatory apparatus. The testes have a ventral location below the intestinal diverticula. All spaces between the intestinal diverticula are crowded with yolk glands.

The copulatory apparatus is located well behind the pharynx; it is shown in sagittal view in figure 1. In one set of sections, the two collapsed sperm ducts empty of sperm were found approaching the male copulatory apparatus from in front. They unite to a narrow channel that ascends and enters an expanded thin-walled vesicle containing a ball of sperm. These parts are surrounded by the yellowish brown pigment. From the vesicle a narrow duct enters the proximal end of the male copulatory apparatus. This shows two successive expansions of a highly glandular nature, especially the more distal of the two expansions. Both

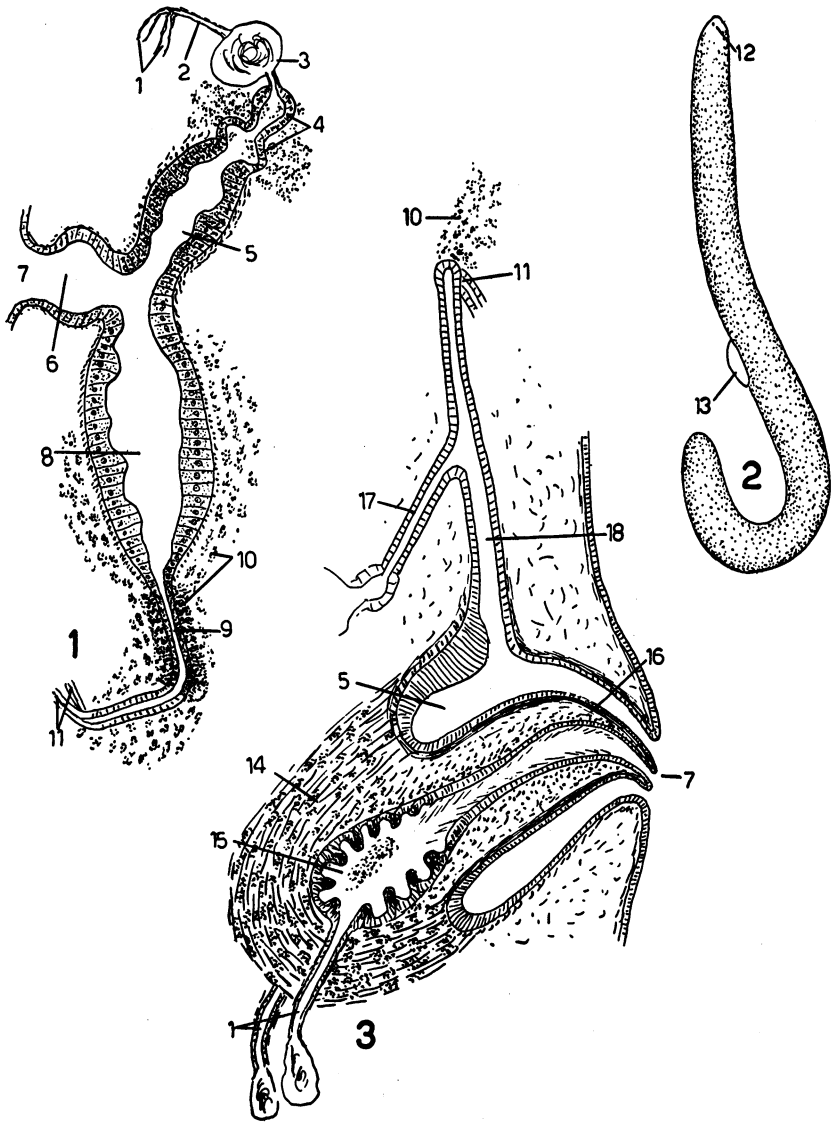


FIG. 1. Sagittal view of the copulatory apparatus of *Rhynchodemus bilineatus*, Pantin specimen.

FIG. 2. Habit sketch of *Microplana atrocyanus*, preserved.

FIG. 3. Sagittal view of the copulatory apparatus of *Microplana atrocyanus*.

are surrounded by eosinophilous granulations and thus seem to be of a prostatic nature. The second expansion or vesicle opens into an oval chamber, the male antrum, lined by a tall epithelium, also seemingly of glandular nature. A thin musculature invests the male antrum, which after joining the female antrum opens into the common antrum leading ventrally to the gonopore. The female antrum is decidedly larger than the male antrum, not smaller as shown in Pantin's figure (1950). It is an elongated oval chamber, lined by a tall but not glandular epithelium and invested with a thin musculature. At its posterior end it narrows into a glandular duct, heavily entered by eosinophilous glands that form a cloud around it and also extend in both directions from it. This glandular duct continues as a non-glandular duct that descends and receives the two ovovitelline ducts coming from in front.

From this study of the copulatory apparatus it is clear that Pantin's specimens are distinct from *R. sylvaticus*, although the two species probably cannot be distinguished externally. In *sylvaticus*, the male antrum is larger than the female antrum, is not lined by a glandular epithelium, and is not preceded by two glandular vesicles. Pantin reported a mid-ventral glandular strip at the anterior end of the creeping sole of his specimens; this appears absent in *R. sylvaticus*, although suitable sections for determining the point are not at hand.

In 1944, Dr. W. Adam of Brussels generously sent a specimen of the land planarians found in woods in Belgium that he had identified as *R. bilineatus* (Adam and Leloup, 1941). Sections of this worm unfortunately proved unsatisfactory, so that I am not able to establish its identity with Pantin's specimens.

SUBFAMILY MICROPLANINAE PANTIN, 1953

Rhynchodeminae HEINZEL, 1929.

Geodesminae HYMAN, 1943.

DEFINITION: Rhynchodemidae in which the longitudinal fibers of the subepidermal musculature are not aggregated into bundles; penis papilla present.

GENUS *MICROPLANA* VEJDOVSKY, 1890

DEFINITION: Microplaninae with a well-developed penis, consisting of bulb and papilla; female canal (antrum or vagina) simple, without bursa but generally with a genito-intestinal communication.

TYPE SPECIES: *Microplana humicola* Vejdovsky, 1890.

Microplana atrocyaneus (Walton), 1912, new combination

Figures 2, 3

Rhynchodemus atrocyaneus WALTON, 1912.*Geodesmus atrocyaneus* HYMAN, 1943.

Four of the vials sent by Hubricht were identified by him on the basis of color as Walton's species *atrocyaneus*. He states that the young of this species are dark purple and the adults are black with a bluish sheen in sunlight. Preserved, the specimens appear uniformly black above, lighter on the creeping sole. The two largest specimens were sectioned and found in full sexual maturity, with a copulatory apparatus typical of the genus *Microplana* as here defined. Cross sections showed an absence of subepidermal longitudinal muscle bundles. As Walton's specimens were not sexual, there is no way of establishing with certainty that the present specimens are *atrocyaneus*. I proceed on the assumption that color and size are sufficient identification, especially as no other specimens conforming to Walton's description have been found in the eastern United States during the 40 years that have elapsed since the original description.

This species has a cylindroid shape, reaching a length of 25 mm. when fully extended (fig. 2). The cross section is broadly oval, with the creeping sole forming a midventral ridge. There are the usual two small eyes near the anterior tip.

The testes occur in a ventral row on each side just above the ovovitel-line ducts; they were found only in the prepharyngeal region of the worm. The sperm ducts, expanded, as usual in triclads, into tubular, thin-walled spermiducal vesicles packed with sperm, course alongside the pharynx to the copulatory apparatus, narrowing to short slender ducts as they enter separately the penis bulb. The copulatory apparatus, situated some little distance behind the posterior end of the pharyngeal cavity, is shown in median sagittal section in figure 3. The male apparatus consists of a large and well-developed penis, composed as usual of muscular bulb and conical papilla. The penis bulb is of rounded form and composed of muscle fibers paralleling its contour and interspersed abundantly with eosinophilous glands. The sperm ducts pass separately through the muscular wall of the penis bulb and open into its cavity, usually called seminal vesicle but preferably designated bulbar cavity as it plays no role in sperm storage. The lining epithelium of the bulbar cavity is highly glandular, presumably receiving the secretion of the glands of the penis bulb, and is thrown into folds whose crests are filled with secretion granules. The bulbar cavity is continuous with the lumen

of the elongated conical penis papilla, housed in a male antrum of corresponding shape. The penis papilla has but slightly muscular walls, being provided with a muscular layer beneath both its surface and lining epithelia.

From the posterior wall of the male antrum the female canal or vagina proceeds straight posteriorly, lined by a cuboidal epithelium, scarcely underlain by muscle fibers. At about the middle of its course, the vagina gives off from its dorsal wall a diverticulum that slants forward and opens into the intestine, thus showing itself to be a genito-intestinal canal. At its posterior end the vagina receives the two ovovitelline ducts and is here surrounded by the usual eosinophilous cement glands. In reaching the vagina the ovovitelline ducts pass as usual to either side of the male copulatory apparatus.

The sexual anatomy of this species resembles in essential points that of *Microplana humicola* as described and figured by Schneider (1935) and consequently fits into *Microplana* on the basis of Schneider's description. It may be remarked, however, that there is poor agreement between Schneider's description and the original account of Vejdovsky as concerns the copulatory apparatus, but this may perhaps be ascribed to the fact that Vejdovsky was forced to limit his study to compressed preparations.

The localities of the four vials are as follows: under leaves near Bachelor's Hall, Pittsylvania County, Virginia, February 26, 1949; at 6100 feet elevation, Black Mountains, Yancey County, North Carolina, June 26, 1950; woods near Bat Cave, Henderson County, North Carolina, June 25, 1950; and at 3000 feet elevation, Roaring Gap, Allegheny County, North Carolina, September 17, 1940. The first and fourth specimens were those sectioned, hence sexual maturity appears unrelated to season. As the original specimens came from Ohio and as specimens previously recorded (Hyman, 1943) were collected by Hubricht from Illinois, Missouri, Kentucky, Tennessee, and Arkansas, the species would seem to be widely distributed in the central and eastern states in a belt extending from Illinois to Arkansas and eastward into Virginia and North Carolina.

Specimens will be deposited in the American Museum of Natural History.

Microplana rufocephalata, new species

Figures 4, 5

Two specimens taken by Hubricht on May 25, 1952, at 2600 feet elevation on Pine Mountain, near Harlan, Harlan County, Kentucky, were

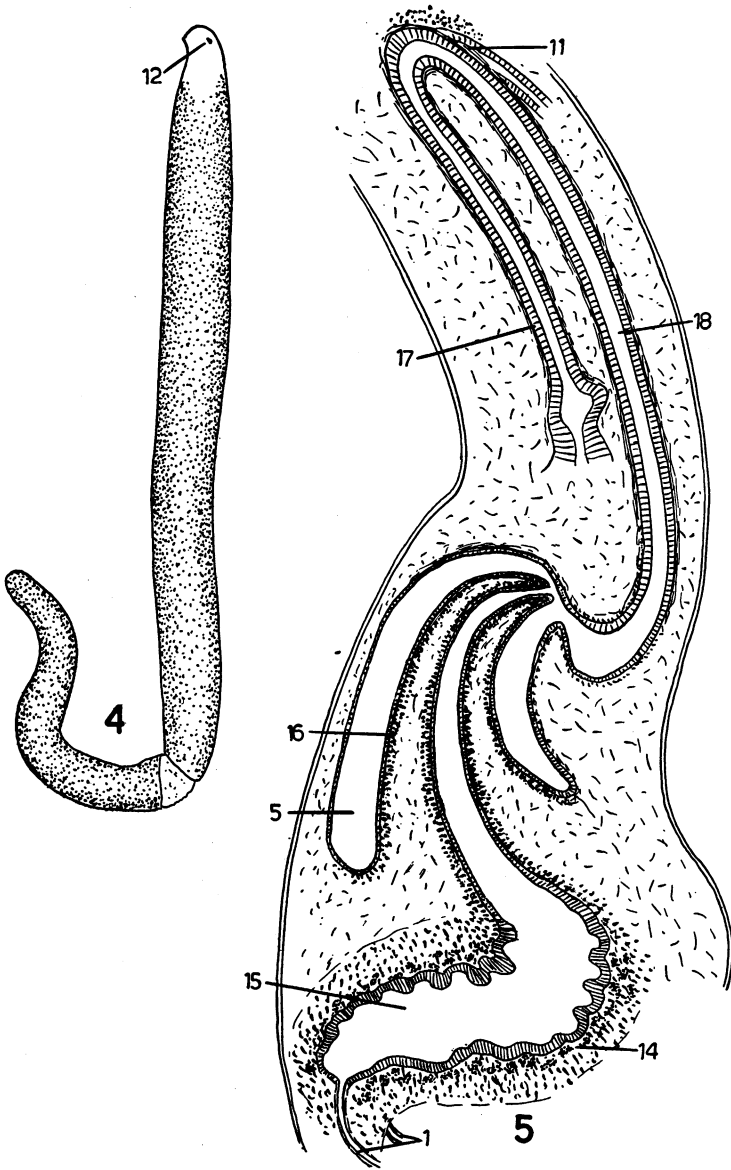


FIG. 4. Habit sketch of *Microplana rufoccephalata*, preserved; the specimen is broken near the rear end.

FIG. 5. Sagittal view of the copulatory apparatus of *Microplana rufoccephalata*.

suspected by him of being a new species. Both specimens were found to be sexually mature, and sections of one of them have proved his suspicion correct.

The two worms are of elongated cylindroid shape (fig. 4), measuring about 35 mm. in length in the preserved state, hence presumably of greater extension in life. The worms are black, with a lighter creeping sole and a reddish brown anterior tip. This colored anterior tip was still detectable in the preserved worms and furnishes a distinguishing field character of the species. The usual two small eyes near the anterior tip were detectable in the cleared specimens.

One specimen has been retained whole; a short anterior region 4 or 5 mm. long was cut off from the other specimen and sectioned transversely and the remainder was sectioned longitudinally. The transverse sections are of broadly oval shape, with the creeping sole appearing as a midventral ridge; they show an absence of longitudinal muscle bundles in the subepidermal musculature. The longitudinal sections contain both the pharynx and the copulatory apparatus but because of the curvature of the worm could not be successfully cut in the sagittal plane. It turned out that the prepharyngeal part was cut frontally and the postpharyngeal part somewhat diagonally, but the copulatory apparatus could be worked out without difficulty.

The well-developed pair of ovaries was found in the second slide of the transverse series, hence close to the anterior tip. Each ovary is in continuity with a large, darkly staining parovarium. The oovitelline ducts could be traced throughout the sections to the vagina. Testes could not be discovered, although the spermiducal vesicles are distended with sperm and appear conspicuously between the pharynx and the copulatory apparatus. Yolk glands are present everywhere between the intestinal diverticula.

A sagittal view of the copulatory apparatus is given in figure 5. The spermiducal vesicles reach a point to the sides of the ventral part of the penis bulb, then ascend alongside the bulb to its proximal end, where they narrow to slender tubes that penetrate the muscular wall of the bulb separately and unite just at their entrance into the bulbar lumen. The penis is very large and massive in this species, with a long muscular bulb and an equally long conical papilla. The muscular wall of the penis bulb consists chiefly of circular fibers, interspersed with gland cells. The bulb is lined with a tall epithelium. The penis papilla is provided mostly with circular fibers beneath both the external and lining epithelia. The gonopore was not located with certainty, no doubt because of the unfavorable slant of the sections.

From the male antrum an excessively long tubular female canal or vagina extends backward for a distance about equal to the length of the male copulatory apparatus. It then receives the two ovovitelline ducts accompanied by cement glands and turns forward as a long genito-intestinal canal. This parallels the vagina for about two-thirds of its length and then opens into the intestine.

Microplana rufoccephalata is distinguished from other species of the genus by the extremely long vagina and almost equally long genito-intestinal canal.

The set of sections has been deposited in the American Museum of Natural History as type and the whole specimen as paratype.

GENUS *ORTHODEMUS*, NEW GENUS

DEFINITION: Microplaninae in which the vagina gives off a blind sac or bursa; bursa may have genito-intestinal connections but is not directly connected with the antrum.

TYPE SPECIES: *Fasciola terrestris* O. F. Müller, 1774.

Orthodemus terrestris (O. F. Müller), 1774, new combination

Figure 6

Fasciola terrestris O. F. MÜLLER, 1774.

Rhynchodemus terrestris LEIDY, 1851b.

Rhynchodemus terrestris GRAFF, 1899.

Geodesmus terrestris HYMAN, 1943.

Microplana terrestris PANTIN, 1953.

Several specimens of the European land planarian commonly known as *Rhynchodemus terrestris* were generously presented to me by Dr. Adam and Dr. Pantin. Some of these have been sectioned, and the sections have shown that the Belgian and British specimens are identical. The copulatory apparatus, shown in sagittal view in figure 6, corresponds with various published figures for this species. The figure published by Pantin in his 1950 article is, however, erroneous as it altogether omits the bursa. On the basis of this figure, *R. terrestris* would in fact belong in *Microplana*, where Pantin later placed it although by that time he had become aware of the existence of the bursa.

Although the literature contains figures of the copulatory apparatus of this species, of which the figure of Bendl (1908) is the best, it does not appear superfluous to present a figure here for comparison with the copulatory apparatus of *Microplana*, as both Pantin and Marcus place *terrestris* in *Microplana*. Comparison of figure 6 with figures 3 and 5 shows that in both *Microplana* and *Orthodemus* there is a strongly de-

veloped penis with a highly glandular bulb, entered separately by the two sperm ducts. The difference concerns the female tract. In *Microplana* the vagina proceeds posteriorly from the common antrum and receives the two ovovitelline ducts with the accompaniment of cement glands. Either before or after this union, the vagina gives off a genito-intestinal canal that opens into the intestine. In *Orthodemus terrestris* the vagina receives cement glands throughout its course and gives off a large blind sac, the seminal bursa, also called by some authors seminal receptacle. This is entirely non-glandular in *O. terrestris*, although highly glandular in some other microplanines. It is stated in the literature that this bursa is connected to the intestine by one or even two genito-intestinal canals, but in the three specimens that I sectioned I am not able to find any such connections.

It is my opinion that the presence of a bursal appendage to the vagina precludes the inclusion of *terrestris* in *Microplana*. The genus *Microplana* should be limited to forms with a simple type of female apparatus, as in the type species *humicola*, and not confused by including in it forms like *terrestris* with a bursal appendage to the female tract.

GENUS *DIPORODEMUS* HYMAN, 1938

DEFINITION: Microplaninae with a large seminal bursa connected to the vagina by a canal (Beauchamp's canal) and also opening asymmetrically to the exterior by a bursal canal and pore situated behind the common gonopore; with or without a genito-intestinal connection.

TYPE SPECIES: *Diporodemus yucatanii* Hyman, 1938.

Diporodemus indigenus Hyman, 1943

Fourteen of the vials presented by Dr. Hubricht had been identified by him from external characters as *Diporodemus indigenus*. Three of the larger individuals were sectioned, and the identification proved correct. There were also in the material four other vials not identified by Hubricht. The largest of these four specimens was sectioned and also shown to be *D. indigenus*; very probably the other three are also this species, but were not sectioned as they are rather small and probably immature.

This wealth of material shows that *D. indigenus* is not the short, plump animal previously supposed but is a long, slender worm, reaching lengths when fully extended of 60 to 70 mm., and even of 30 to 40 mm. when preserved. In all specimens sectioned the seminal bursa was packed with eosinophilous secretion and the bursal pore was evident, as were also the two cephalic sensory tracts. However, the glandular cleft mentioned in the original description was not found in any of the series of sections and possibly has no real existence. The two cephalic sensory

tracts serve to distinguish this species from other North American rhyndodemids in the absence of sexually mature material. The color in life of *D. indigenus* is stated by Dr. Hubricht in letters to be a dark slaty gray rather than black.

The localities of the 15 vials, each of which contains a single worm unless otherwise stated, are as follows: bluff along the Staunton River, near Motley, Pittsylvania County, Virginia, February 24, 1951; near Cascade Creek, near West Fork, Pittsylvania County, Virginia, October 23, 1949; bluff along Staunton River, near Brights, Pittsylvania County, Virginia, January 28, 1951; near Danville, Pittsylvania County, Virginia, December 3, 1949; side of White Oak Mountain, near Spring

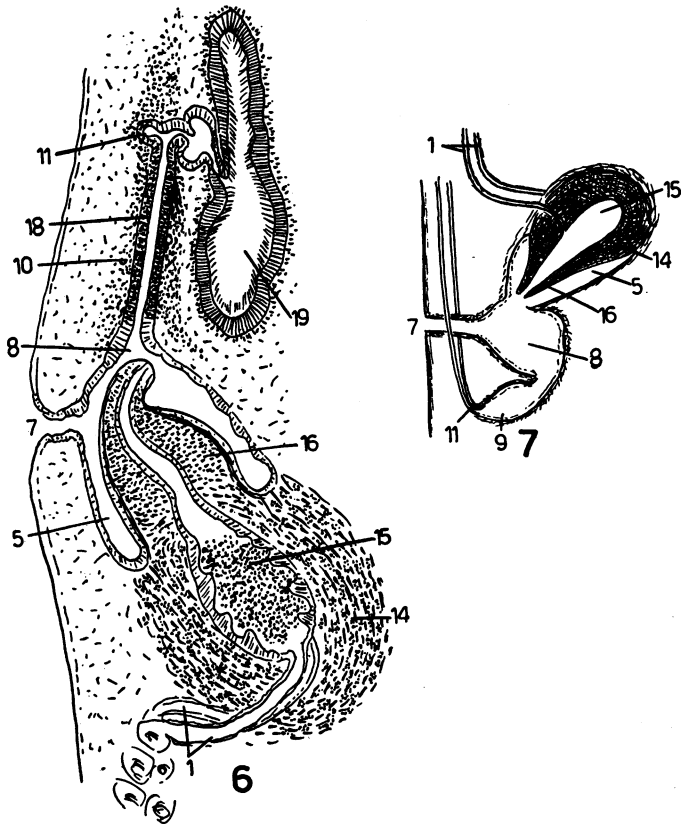


FIG. 6. Sagittal view of the copulatory apparatus of *Orthodemus terrestris*, British specimen.

FIG. 7. Kennel's figure, redrawn, of the copulatory apparatus of what he called *Geodesmus bilineatus*; compare with figure 1.

Garden, Pittsylvania County, Virginia, March 5, 1949, two specimens; Thunder Ridge, Blue Ridge Parkway, Rockbridge County, Virginia, July 21, 1951; bluff along Laurel Creek, Damascus, Washington County, Virginia, April 28, 1951; near mouth of Laurel River, Whitley County, Kentucky, September 23, 1949; at 5500 feet on Mt. Rogers, Grayson County, Virginia, June 4, 1949; at 5000 feet, Newfound Gap, Swain County, North Carolina, May 3, 1951; at 6600 feet, Clingmans Dome, Swain County, North Carolina, September 21, 1949; on Tyler Ridge, Radford, Montgomery County, Virginia, April 9, 1949; near Glen Ayre, Mitchell County, North Carolina, September 23, 1950; mountain side near Bryson City, Swain County, North Carolina, May 6, 1951; bluff along Staunton River, near Altavista, Pittsylvania County, Virginia, February 19, 1949. The three other vials mentioned above believed also to be *D. indigenus* have the following localities: woods near Schoolfield, Pittsylvania County, Virginia, November 7, 1948; Crab Orchard Mountain, Crab Orchard, Cumberland County, Tennessee, May 9, 1951; and Wallace Gap, Nantahala Mountains, Slagle, Macon County, North Carolina, May 6, 1951. These findings confirm the previous impression that the species is characteristic of the Appalachian region. However, on April 7, 1946, Hubricht collected two small black land planarians in woods near Dearborn, Wayne County, Michigan. Sections of these showed that they were juveniles, but traces of a bursa filled with eosinophilous secretion indicate that they, too, are *D. indigenus*. Finally a specimen taken by Hubricht near the Mohawk River, Ilion, Herkimer County, New York, March 28, 1943, appears to be *D. indigenus*, but the sections are indecisive because of the coiled state of the worm.

NOTES ON INTRODUCED LAND PLANARIANS

A living specimen of *Geoplana vaga* Hyman, 1943, was kindly sent by W. D. Hartman, of the University of California at Berkeley, who had collected it locally. Alive the specimen was about 60 mm. long when fully extended, of a dark blue color dorsally, with a whitish anterior tip, pale ventral surface, and very narrow middorsal yellow line. The gonopore was seen about 10 mm. behind the mouth. The specimen was preserved and is on deposit in the American Museum of Natural History. On preservation the middorsal yellow line disappeared, but the blue color, somewhat brightened, is well preserved in formalin.

Dolichoplana striata is a very common tropical land planarian hitherto known only from greenhouses in the United States. However, in September, 1948, I received specimens of this species that had been

taken out of doors at Bradenton, Florida, where it had become a nuisance in earthworm rearing beds operated by a dealer in earthworms, through feeding on the earthworms. This species may be expected to spread eventually throughout the warmer parts of the United States. Although the material sent included a fine, large worm, it showed no signs of sexuality. This species is also established out of doors on Puerto Rico, for two specimens were sent by Dr. G. E. Potter of the University of Puerto Rico at Mayaguez who had collected them in October, 1944, in crevices in a stone wall near a house and among rocks along a creek. The copulatory apparatus of *D. striata* has never been described, and it is probable that several species having the same striped pattern are covered by this name and cannot be distinguished until sexual material becomes available. The species of *Dolichoplana* reproduce asexually by fragmentation and are seldom found in the sexual state. The genus has recently been discussed by Correa (1947).

As previously reported (Hyman, 1943) another tropical land planarian, *Bipalium kewense*, has become established out of doors in the warmer parts of the United States, California, Louisiana, and Florida. Since that report I have received information from zoologists of the University of Georgia of its occurrence in that state, and a specimen was sent collected in September, 1943, from a palmetto stump at Biloxi, Mississippi. Hubricht has taken this species in nature in the Carolinas as follows: under boards in waste ground, Georgetown, Georgetown County, South Carolina, December 24, 1950; waste ground, Lumberton, Robeson County, North Carolina; waste ground, Wilmington, Hanover County, North Carolina, March 18, 1951; and in Florence, Florence County, South Carolina, March 24, 1951. Hubricht wrote that the Georgetown specimens had been found after three weeks of below freezing weather. Thus *Bipalium kewense* not only occurs in the Gulf states but is spreading northward up the Atlantic coast and is able to endure freezing when in protected sites as under boards.

I have now to record the astonishing finding of an exotic land planarian in the garden of my former country home at Millwood, Westchester County, New York, about 35 miles directly north of New York City. The village of Millwood lies in an exceedingly humid valley, probably one of the most humid areas of the northeastern United States, as shown by the abundance there of several kinds of slugs, wanting or infrequent within relatively short distances of this valley. I first saw the land planarian in my garden in the spring of 1947. I was completely astonished at the sight and at first incredulous, but I recognized the specimen as *Bipalium adventitium* Hyman, 1943, hitherto known only from Cali-

foria. During that spring a total of about 10 specimens were seen on different occasions, presumably some the same individuals. They were found under rocks, often feeding on earthworms and slugs. They were seen each succeeding spring but often only one or two during the entire season and also were twice found in a neighbor's garden. They were never seen at any time of the year except during the spring. Twice a worm was found resting adjacent to a batch of egg capsules under a stone, possibly an indication of parental care. The batch consisted of about 15 to 20 adherent, soft, light gray capsules, each containing a single embryo. The presence of the parent worm with the batch of capsules cannot be ascribed to its just having laid the capsules, because in one case development was so far advanced that the young worms could be seen in the capsules. On one occasion a worm that was being shown to some one divided transversely in what seemed to be a natural process of fission, that is, by pulling out into a thin strand that parted. Both halves were kept in a jar of moist earth and after a few weeks were seen to have regenerated perfectly.

How this worm came into my garden can only be surmised. Presumably it was introduced with purchased plants, but plants were purchased from nurseries no farther west than Indiana, and this species is known only from California. Possibly this worm by now has been introduced into a number of nurseries with plants obtained from California nurseries. It will not be surprising to find it turning up in various humid localities. The winters at Millwood are fairly severe, although less so in recent years; but temperatures invariably fall at least to 15°F. at times during the winter and are well below freezing much of the time. This presumably tropical land planarian (its original habitat is not known) therefore must have become adjusted to cold weather, no doubt by hibernating in well-protected situations, and has retained its power of sexual reproduction in the temperate zone.

NOMENCLATORIAL DISCUSSION OF THE RHYNCHODEMIDAE

The nomenclature of the Rhyrchodemidae has given constant trouble to specialists on land planarians, and it does not appear possible at the present time to arrive at definite solutions. The trouble began with Metschnikoff's description (1866) of *Geodesmus bilineatus*, which does not contain essential taxonomic information, and was greatly worsened by Kennel's description (1882) of what he identified as *Geodesmus bilineatus*. Kennel's material came from around potted plants in a propagation house in a garden at Würzburg, a place not very far from the type locality at Giessen, and, as far as external characters go, his speci-

mens seem to belong to *Rhynchodemus*, as here defined. They had the large eyes and narrowed or proboscidiform anterior region crescentic in cross section; they further showed in ventral view the six pairs of brown rings characteristic of *bilineatus*, correctly identified by Kennel as marking the location of the ovaries and testes. However, Kennel gave no satisfactory account of the subepidermal musculature, and his figure of a sagittal view of the copulatory apparatus shows a well-developed penis foreign to the genus *Rhynchodemus*. As the journal in which Kennel's article was published is not widely available, I have thought it desirable to reproduce Kennel's figure of the copulatory apparatus of what he called *Geodesmus bilineatus*. By comparison of this with my figure 1, it is self evident that what Kennel called *Geodesmus bilineatus* cannot be the same species or even the same genus as what Pantin considers to be *bilineatus*. It would appear in fact that Kennel's species must belong to *Microplana*, but this is contradicted by the fact that his specimens had the proboscidiform anterior region known only for the genus *Rhynchodemus*.

Graff, in his great monograph of the land planarians (1899), accepted Kennel's description of the copulatory apparatus as valid for *bilineatus*, and I also accepted it as valid in my 1943 article. This acceptance leads to the nomenclatorial conclusions that I reached in that article, namely, that *Geodesmus* is a valid genus; *Microplana* then becomes a synonym of *Geodesmus*. On the other hand if Kennel did not have Metschnikoff's species, then the nomenclatorial conclusions I reached are erroneous. In his 1950 article, Pantin attempts to explain away the differences between Kennel's *bilineatus* and his own. I do not find Pantin's explanations acceptable. Kennel's figures of the copulatory apparatuses of two other triclads are entirely accurate, in fact his figure of *O. terrestris* is more accurate than Pantin's figure of the same species, and consequently I cannot doubt the worth of Kennel's figure of what he called *Geodesmus bilineatus*. In his 1953 article, Pantin ignores Kennel's work, claiming to have shown that *Geodesmus* is a synonym of *Rhynchodemus*.

Did Kennel have *Geodesmus bilineatus*? It is absolutely necessary to decide this question before any further nomenclatorial conclusions can be reached. There is only one solid fact on which to hang a decision. Metschnikoff's description and figures indicate that his species did not have a penis, whereas Kennel's specimens were provided with a well-developed penis. On this ground one may suppose that Kennel's specimens were not *Geodesmus bilineatus*; what they were certainly remains a mystery, as the external characters are contradicted by the type of copulatory apparatus.

If Pantin's specimens are the true *Geodesmus bilineatus*, then the

nomenclatorial conclusions reached by Pantin in his 1953 article are correct, and I am prepared to accept them except that I cannot agree on the inclusion of *terrestris* or other microplanine species with a bursa in *Microplana*, as the type species of *Microplana* lacks a bursa.

In the nomenclatorial discussion in my 1943 article I had an unfortunate mental slip. I was of course perfectly aware of the fact that one of the subfamilies of a family must be named after the same root as the family, in short, one of the subfamilies of the Rhynchodemidae must be named Rhynchodeminae. However, Heinzel (1929) had used the name Rhynchodeminae in an erroneous sense and in my desire to avoid confusion by using this name in another sense, I temporarily forgot the rules and created the name Dolichoplaninae. I soon realized my mistake and corrected it on the separates sent out. Correa (1947) has graciously acknowledged my handwritten correction, but this correction of course does not constitute publication and I am glad to ascribe the correct usage of Rhynchodeminae to Correa.

The Rhynchodemidae are then divided into two subfamilies on the basis of the subepidermal musculature: Rhynchodeminae and Microplaninae. The former includes the genera *Rhynchodemus* (as here defined), *Dolichoplana*, and *Platydemus*, although the last is not on a very firm basis. Graff (1899, p. 204) gave a figure of the copulatory apparatus of the type species, *Platydemus grandis* (Spencer), 1892, from which it would appear that *Platydemus* may be a valid depository for rhynchodemines with a penis papilla. The subfamily Microplaninae includes the genera *Microplana* (as here defined), *Orthodemus* (as here defined), *Othelosoma* (= *Artiocotylus*), *Pseudartiocotylus* (poorly known), and *Diporodemus*. Pantin (1953) has done a service in showing that *Artiocotylus* is a synonym of *Othelosoma*. He has ably discussed the status of *Amblyplana*, but I cannot agree that Graff (1896) created this genus for Moseley's species (1877) *Rhynchodemus flavus* and *fuscus*, or that one or the other of these two species must be the type of *Amblyplana*. Graff created the genus for a number of new species that he had (and that were described in the 1899 monograph) and transferred to it Moseley's two species. Graff did not declare a type for *Amblyplana*, although it would seem as if he meant *teres* to be the type; nor to my knowledge have any later workers declared a type for *Amblyplana*. The sexual anatomy is known for only one of the 13 species placed by Graff in *Amblyplana* in his 1899 monograph, namely, *A. notabilis*. Heinzel (1929) reexamined Graff's slides and showed that Graff's figure of the copulatory apparatus of *A. notabilis* is inaccurate. His own figure from Graff's slides proves that *A. notabilis* belongs to *Othelosoma*. It would

be valid for someone to make *A. notabilis* the type of *Amblyplana*, whereupon *Amblyplana* would become a synonym of *Othelosoma*, as suspected by Pantin. Freisling (1935) described the sexual anatomy of a South African microplanine that he considered identical with Moseley's *Rhynchodemus fuscus* and showed that it belongs to *Othelosoma*, but as Pantin remarks one cannot be certain of the accuracy of the identification.

A large number of species have been assigned to *Rhynchodemus* in the past. It is now possible to allocate some of these to the proper genus, but for others the necessary anatomical information is wanting. It would be a very laborious proceeding to read all of the available literature on every species assigned to *Rhynchodemus* with a view of allocating it properly if possible. I have refrained from this undertaking, part of which was done by Prudhoe (1949), because Marcus (1953) has dealt with great erudition with this matter of allocating the *Rhynchodemus* species. I regret my inability to agree with some of Marcus's decisions, especially his inclusion in *Microplana* of species like *terrestris* that are provided with a bursal appendage to the vagina. I feel that nothing is gained by making of *Microplana* the same "hodgepodge" that was formerly made by *Rhynchodemus*. I consider that the genus *Microplana* should be limited to species with a simple female tract without appendages. The genus would then include, besides *humicola*, *atrocyaneus*, and *rufocephalata* discussed in the present article, such species as *cockerelli* (Graff), 1899, and *haitiensis* (Prudhoe), 1949. Species with a bursa attached to the vagina and having but one exit canal for the bursa I would place in *Orthodemus*. It further appears to me that it will be necessary to create other new genera to provide for the wealth of forms previously placed in *Rhynchodemus*.

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