

ON THE NAME OF THE GROUND FLUKE *FASCIOLA TERRESTRIS* O. F.Müller, ON *OTHELOSOMA SYMONDSI* Gray, AND ON THE GENUS*AMBLYPLANA* von Graff. By C. F. A. PANTIN, from the Departments of General and Animal Physiology and of Zoology, of the University, Sao Paulo, Brazil, and the Zoological Laboratory, Cambridge, England.

(PLATES 41-43 and 1 text-figure.)

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The common terrestrial planarian *Fasciola terrestris* O. F. Müller is well known in Europe under the name of *Rhynchodemus terrestris* (O. F. Müller), in accordance with the monograph of von Graff (1899). Recently Hyman (1943) brought forward evidence that the type species of the genus is not *terrestris* as many supposed but *Rhynchodemus sylvaticus* (Leidy), and that the difference between *terrestris* and *sylvaticus* is of at least generic magnitude. The chief points of difference concern the organization of the musculature and of the genitalia.

Hyman's work shows that *terrestris* can no longer be a *Rhynchodemus*. To supply a new generic name for it she concludes from a paper of von Kennel (1882) that *terrestris* generically resembles another species, *Geodesmus bilineatus* Meczniow. She therefore names it *Geodesmus terrestris* (O. F. Müller) and makes far-reaching changes in the nomenclature of the Rhynchodemidae on this basis.

But in a recent paper (Pantin, 1950) I have shown that animals which correspond to Meczniow's *Geodesmus bilineatus* are in fact congeneric with *Rhynchodemus sylvaticus*, the very genus from which *terrestris* must be separated. *Geodesmus* thus becomes a synonym for *Rhynchodemus*; and since *terrestris* is not a *Rhynchodemus* it cannot be a *Geodesmus* either. The species *terrestris* is thus left without a generic name. It is the primary object of this paper to try to supply this deficiency.

Let us first examine the species of the family Rhynchodemidae. If there are any species which can be shown to be generically related to *terrestris*, and which were at some time given some generic name other than *Rhynchodemus*, then that other name may become a possible candidate for the generic name of *terrestris*. The work of von Graff (1899), Heinzel (1929), Hyman (1943), Corrêa (1947), Prudhoe (1949) and others shows that the majority of species of the Rhynchodemidae are generically distinct from *terrestris*, except for those which have always been called *Rhynchodemus*. There are certain species which fall outside this category; their descriptions are too meagre to enable their relationship to be determined with certainty. This is true of the genus *Nematodemus* founded by von Graff (1896) to include the sole species of *N. lumbricoides* von Graff, 1896. But even here, von Graff gives one important character, the absence of a creeping sole, which surely distinguishes this animal from *terrestris*. Moreover, he later (von Graff, 1899, p. 85) considered this genus to be possibly related to his ' *Rhynchodemus*, group B', which included *R. sylvaticus*, rather than to his 'group A', which included *terrestris*. Sections of this specimen by my friend Mr. S. Prudhoe, of the British Museum (Natural History), confirmed a suspicion that *Nematodemus lumbricoides* is not a planarian at all but is a nemertine. It is, in fact, a heteronemertine. Mr. Prudhoe writes to me: "it seems that in 1874 a certain Mr. Holdsworth presented to the Museum a collection of polychaetes, among which was a specimen identified (by Dr. Edward Grube) as '*Geoplana* sp.'. Von Graff, who reclassified our collection of triclads, assumed this specimen to be a land planarian, but not, however, a *Geoplana*, hence his description and designation of *Nematodemus lumbricoides*. It does not seem possible to discover more precise

information on where the specimen was actually found. But it is reasonable to suppose that, in view of its systematic relationship, it was collected with the polychaetes from the littoral regions of Ceylon."

Excluding this genus *Nematodemus*, there are within the Rhynchodemidae three generic names which must be considered seriously in relation to *terrestris*: *Othelosoma*, *Amblyplana*, and *Microplana*.

OTHELOSOMA.

Of *Othelosoma symondsi* Gray, 1869, the sole species of its genus, von Graff's (1869, 1899) examination of the type specimen was able to add little to Gray's uninformative account. Heinzl (1929) and Bresslau (1933) rightly concluded that, as with *Nematodemus*, too little was then known to determine its systematic position. Mr. Prudhoe has kindly enabled me to examine the type specimens of *O. symondsi* from the British Museum (69.2.20.1). Von Graff defined the genus *Othelosoma* as "Rhynchodemids in which the anterior end bearing the eyes is separated from the body by a furrow, and with a narrow creeping sole". This distinctiveness of the head is probably not a permanent feature but is due to excessive contraction of the specimen caused by a powerful retractor muscle to be presently described.

The sections of *O. symondsi* at once reveal some affinity with *terrestris* and its allies. There is the same weak dermal muscular layer (Pl. 41, fig. C), and the strong superficial longitudinal muscle bundles characteristic of *Rhynchodemus sylvaticus* and members of von Graff's 'group B' are absent. Like the *terrestris* group, there is a large penis with a large papilla.

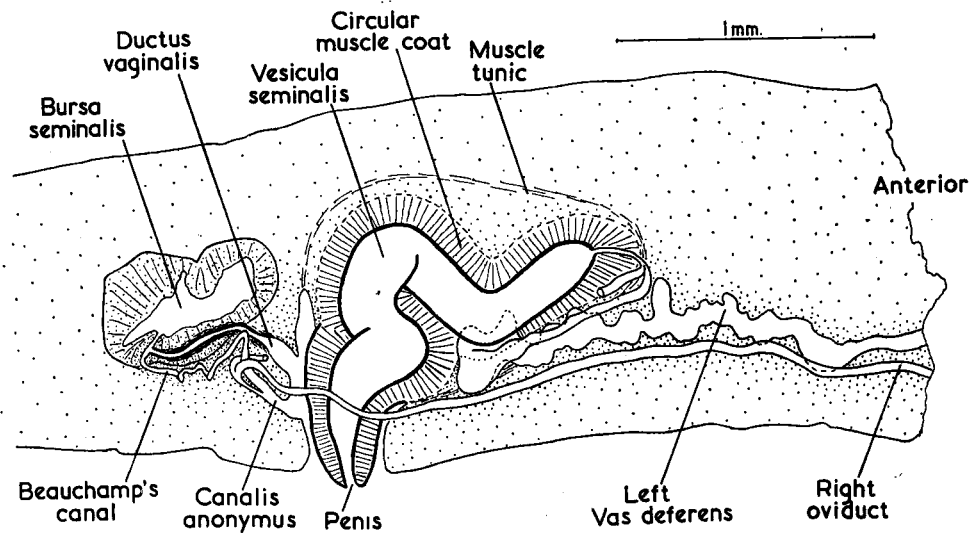
On the other hand, the genitalia of *O. symondsi* show no ductus genito-intestinalis, though one, or even two, of these ducts commonly occur in *terrestris* when sexually mature (von Graff, 1899; Bendl, 1908, 1909). Further, *O. symondsi* has a seminal bursa connected with the genital atrium by two separate exits (text-fig. 1). One of these corresponds to a ductus vaginalis, the other to Beauchamp's canal which, after junction with the united duct of the oviducts, continues as the *canalis anonymus* to the atrium. These features are those given by Heinzl (1929) and Hyman (1943) as characteristic of the genus *Artiocotylus*, and distinguish it generically from *terrestris*. If, as seems reasonable, we accept the conclusions of these authors, we must conclude that the difference between *terrestris* and *Othelosoma* is of generic magnitude and that we cannot therefore call *terrestris* an *Othelosoma*.

Othelosoma not only resembles *Artiocotylus* in the peculiar plan of the genitalia, but also in the general characters of the musculature. The weak *terrestris*-type of dermal musculature is to be found in both. Moreover, in both, the deep longitudinal musculature of the dorsal anterior region is much more strongly developed than in *terrestris* (Pl. 42, fig. A). No differences of generic magnitude are apparent between *Othelosoma symondsi* and *Artiocotylus speciosus*. It is true that von Graff (1899) describes 'suckers' in *Artiocotylus*. But as Heinzl (1929) showed, the double suckers of *A. speciosus* on which von Graff originally named this genus are not well-differentiated structures and consist simply of two areas of secretory ectoderm. In *Othelosoma*, similar areas are in fact also to be seen similarly situated on each side of the anterior part of the creeping sole (Pl. 42, fig. A), though they are less developed than in *Artiocotylus*. When we consider the musculature, the genitalia, and these other features, it is evident that *Othelosoma symondsi* corresponds completely with the whole of Heinzl's (1929) definition of the genus *Artiocotylus*. And since *Othelosoma* Gray, 1869 has temporal priority over *Artiocotylus* von Graff, 1896, *Artiocotylus* now becomes a synonym for the generic name *Othelosoma*.

The single original species *Othelosoma symondsi* Gray is the type species of its genus. Its adequate description is therefore important. It was found in Gaboon, West Africa. The other species of *Othelosoma* placed by Heinzl in the genus *Artiocotylus* are also African. *O. symondsi* was necessarily defined by von Graff (1899) on superficial characters: the small retracted head with two small eyes, apparently separated from the body by a furrow; the narrow creeping sole; the fusiform

sub-cylindrical body; the three broad black lines, a median and two lateral, on the upper surface of the red-brown body. We may augment this description by comparing the structure of *O. symondsi* with other well-described species: notably *Othelosoma* [= *Artiocotylus*] *speciosum* (von Graff) from the Cape of Good Hope, *Othelosoma* [= *Artiocotylus*, = *Amblyplana*] *notabilis* (von Graff) from the Cameroons, re-described by Heinzl, and *Othelosoma* [= *Artiocotylus*, = *Amblyplana*] *cylindricum* (de Beauchamp) from Kenya.

O. symondsi shows specific differences from these. In the male genitalia of *symondsi* each of the swollen vasa deferentia turns sharply back near the penis towards the anterior end of the animal. They then run forward as a pair of rather narrow ducts as far as the anterior end of the wide ductus ejaculatorius or vesicula seminalis, as it may here be called. Here they unite to form a narrow common duct which pierces the thick intrinsic musculature of the ductus (text-fig. 1) and enters its cavity.



Von Graff's account and figure of *O. notabilis* show that its similarly swollen vasa join and enter the vesicula, in this species apparently without any narrow recurrent duct or final common duct. In von Graff's figure of *O. speciosum* the vasa are also swollen as in the other species. But here each opens independently into the vesicula. The same is true of *O. cylindricum* (de Beauchamp, 1913).

In all four species the cavity of the penis is continued anteriorly as a long contorted extension of the vesicula seminalis and is surrounded by an intrinsic muscle layer. This whole system is embedded in a loose mass of muscular tissue which is in turn enclosed within an outer muscle tunic (Pl. 42, fig. B and text-fig. 1). The intrinsic musculature of the penis and vesicula shows specific variation. In *O. symondsi* it is evenly developed as a continuous thick layer chiefly of circular muscle. In *O. notabilis* the intrinsic musculature of the penis is divisible into an inner and middle layer, of which only the middle layer continues into the vesicula. The intrinsic musculature of the vesicula is thus weaker than that of the penis (von Graff, 1899). In *O. speciosum* there is a similar differentiation of the intrinsic musculature into an inner and outer region. But in this case the inner layer is four times as thick over the vesicula as in the penis, and the middle layer loses itself in the sparse surrounding musculature enclosed by the outer tunic (von Graff, 1899). In these three species the

vesicula is lined with abundant glandular epithelium, with similar granular cells. Sections of *O. symondsi* show these to be arranged in longitudinal ridges, apparently with a core of branching fibres of muscle. On the other hand, whereas in *O. notabilis* and *O. speciosum* the penis itself is lined with simple ciliated epithelium (von Graff, 1899), in *O. symondsi* the penis-lining consists of longitudinal ridges of glandular tissue like that of the vesicula, though with cells of a different cytology and more deeply staining (Pl. 42, fig. B). How far this distinction is real, and how far it may be due to histological differences consequent on different states of sexual maturity in the described specimens, is not known.

O. cylindricum differs somewhat from the other species. At the entrance of the vasa deferentia the ductus ejaculatorius is enlarged as in the other species to form a vesicula seminalis which is surrounded by a thick intrinsic musculature. But at the base of the penis the vesicula of *cylindricum* becomes a narrow convoluted canal, with a thinner muscular coat, the ductus ejaculatorius proper. This narrow canal finally becomes straight and runs to the tip of the penis through the powerful extrinsic musculature of that organ (de Beauchamp, 1913).

There are similar specific differences in the female genitalia. All four species have the generic character of a large 'uterus' or 'bursa seminalis' lined with vacuolated glandular cells. But whereas in *O. symondsi* and *O. cylindricum* (see de Beauchamp's fig. 2) the bursa is some 0.8 mm. long in an animal some 2 to 3 mm. in thickness, in the other two species the bursa becomes enormous, reaching 2.3 mm. in *O. notabilis* (Heinzel, 1929) and of similar size in *O. speciosum* (von Graff, 1899).

The generic characters of ductus vaginalis, canalis anonymus, and Beauchamp's canal are common to all the species, but here too their relations differ in detail. In *O. symondsi*, as in *O. cylindricum* (de Beauchamp, 1913) and *O. notabilis* (Heinzel, 1929), the ductus vaginalis opens into the female genital atrium above the entrance of the canalis anonymus; whilst von Graff (1899) shows (his text-fig. 59) that in *O. speciosum* the ducts cross over, so that the entrance of the canalis anonymus is the more ventral. On the other hand, in *O. symondsi*, and by von Graff's (1899) account in *O. speciosum* also, the ductus vaginalis and Beauchamp's canal unite before opening into the cavity of the bursa seminalis; whereas Heinzel (1929) figures these two canals opening separately into the bursa in *O. notabilis*. And in *O. cylindricum* the separation is extreme, the very large ductus vaginalis sweeping backwards and upwards to enter the dorsal side of the bursa seminalis, whilst Beauchamp's canal opens on the ventral side.

In addition to the species we have discussed, Heinzel places three others in the genus *Artiocotylus*, namely *caffer* (Jameson), *flavescens* (Jameson), and *hepaticarum* (Jameson). Jameson (1906) originally assigned these to the genus *Amblyplana* but his description and figures of their genitalia leave no doubt that Heinzel was right to transfer them to *Artiocotylus*, and they accordingly now become *Othelosoma* [= *Artiocotylus*, = *Amblyplana*] *caffer* (Jameson), *Othelosoma* [= *Artiocotylus*, = *Amblyplana*] *flavescens* (Jameson), and *Othelosoma* [= *Artiocotylus*, = *Amblyplana*] *hepaticarum* (Jameson). Jameson's description of their genitalia also leaves no doubt that these species are specifically distinct from *O. symondsi*.

Jameson did not describe the musculature in these three species. But in those species to which we have here directed special attention the musculature of the body shows an interesting series of increasing specialization. In *O. speciosum* von Graff (1899) notes the exceptionally powerful longitudinal muscle of the parenchyma on the dorsal side. In *O. notabilis* his description and figures show this muscle to be differentiated into a definite retractor attached to the anterior end of the worm. In *O. symondsi* this retractor is differentiated as a powerful discrete muscle of circular cross-section. It takes origin just posterior to the ovary, about three-quarters of the distance from the pharynx towards the head, and is inserted on to the anterior end of the animal (Pl. 43, fig. E). As the figure shows, this muscle not only possesses freedom of movement by virtue of its position over the flattened anterior branch of the gut, but the parenchyma surrounding it is transformed into a specialized sheath of loose

fibrous tissue. Indeed, a transverse section of the anterior end of this worm presents as remarkable an appearance as any to be found in the Turbellaria.

O. cylindricum also possesses a powerful and highly differentiated retractor. De Beauchamp (1913, p. 12) described it thus: "Cette rétraction est effectuée par un muscle longitudinal très différencié, semblable à celui qu'a décrit von GRAFF dans d'autres espèces du genre, mais beaucoup plus développé. Il s'étend (Pl. 41, fig. 4, *ml*) sur le quart de la longueur du corps, et ses fibres s'incurvent vers la face ventrale en s'étaillant en éventail. Le caecum supérieur de l'intestin est dorsal par rapport à lui, mais ses ramifications l'entourent de chaque côté et reviennent ventralement à lui (*i*). On remarquera la raréfaction du parenchyme autour de lui l'isole du reste du corps et donne libre jeu à sa contraction."

Except for one curious point, this description precisely fits the retractor of *O. symondsi* and the peculiar anatomical differentiation of the structures in relation to it. De Beauchamp's figure in sagittal section also precisely resembles the comparable sections of *O. symondsi* (cf. Pl. 43, fig. E). But he speaks of the anterior gut caecum lying *dorsal* to the retractor, and of the insertion of this muscle on to the *ventral* surface: compared with the condition in *O. symondsi*, with all its special features, the condition in *O. cylindricum* would seem precisely the same, but upside down. It seems likely that there has been a slip here in de Beauchamp's description: for in the species described by von Graff, to which he compares *cylindricum*, the retractor is unquestionably dorsal. Unfortunately, the sagittal section of which de Beauchamp gives an excellent figure is precisely median and thus misses the nerve cords, which would at once show the correct orientation. But the detail of the section he figures is almost an inverted image of what can be seen in a corresponding section of *symondsi*.

We can conclude that *Othelosoma symondsi* shows clear specific distinction from those other species included in the genus *Artiocotylus* by Heinzl. But all of them share significant characters of generic magnitude not only in the organization of the genitalia but also in the differentiation of the retractor muscle and structures in anatomical relationship to it. All these species, of what must now be named the genus *Othelosoma*, share with *Fasciola terrestris* characters which are possibly of subfamilial significance, such as the simple dermal musculature and the well-developed penis. Nevertheless important features of the genitalia and of the parenchymal musculature separate *terrestris* generically from *Othelosoma*.

AMBLYPLANA.

This genus was created by von Graff (1896) for two species *flava* and *fusca* named by Moseley (1877) and originally placed by him in the genus *Rhynchodemus*. Many of the species of *Amblyplana* were subsequently divided by Heinzl (1929) between the genus *Artiocotylus* on the one hand and '*Rhynchodemus*' on the other. By '*Rhynchodemus*' Heinzl intended to convey generic relationship with *terrestris*. Unfortunately Heinzl did not mention either of Moseley's species *flava* and *fusca*, on which von Graff founded the genus *Amblyplana*. Moseley's original account does not allow us to decide whether *flava* and *fusca* are generically related to *terrestris* or not. Nor do von Graff's (1899) additional notes help us to do this except on one important point; he remarks (p. 76) that the musculature of yet another species, *Amblyplana teres*, resembles that of his '*Rhynchodemus* group A', which includes *terrestris*, and that the same holds true for *A. fusca*, and his figure of a section of *fusca* supports this. Heinzl (1929) places *A. teres* in the same genus as *terrestris* (which he called *Rhynchodemus terrestris*); and, since among other things, it is on this very point of the organization of the musculature that we separate *terrestris* from *Rhynchodemus sylvaticus* and its congeners (Hyman, 1943), *Amblyplana* might possibly become the generic name of *terrestris*.

Owing to the inadequate description of the first described species of *Amblyplana* the position is far from satisfactory. To determine the relationships of *flava* and *fusca* it is essential to add to the superficial generic characters, which were all that could be specified by von Graff, such as the plump sub-cylindrical body and the narrow

creeping sole. We must be able to compare a number of unequivocally defined structural characters with those in well-known species. At present, the most satisfactory characters of this sort in the Turbellaria are those of the genitalia. Von Graff could only study the external features of Moseley's specimens and could see no sign of the external genital opening. He also examined sections of a specimen collected by Professor Weber, and identified as *fusca*. But this also was immature and showed no trace of genitalia.

Through the kindness of Mr. S. Prudhoe I have been able to section one of Moseley's cotypes of each of the species. The specimen of *flava* was immature. There were small ovaries (Pl. 43, fig. B) from whence led oviducts, which, however, were only differentiated for the first half millimetre behind the ovary. There were also partly differentiated testes and vasa deferentia. But none of these structures had become connected with a genital atrium, which was only represented by a small undifferentiated cavity with no external opening. These rudiments are quite insufficient to enable us to make any comparison with other species.

On the other hand, transverse sections of the head end showed at once a powerful dorsal retractor muscle with just the same essential structure and relationships as that of *Othelosoma symondsi*. There was the same circular cross-section, the same outer sheath of spongy parenchyma, and the same relation to the anterior diverticulum of the gut (Pl. 43, fig. A). There are some small differences. The retractor takes origin just in front of the ovary instead of just behind, and the median anterior gut diverticulum is more normal in appearance and has not developed into the flat canal of *symondsi*.

From this retractor muscle and its peculiar relations we can safely infer that *Amblyplana flava* is closely related to *Othelosoma symondsi*. Indeed the differentiated structure of the retractor system of *flava* approaches that in *symondsi* and *cylindricum* more closely than the retractor systems of *O. notabilis* and *O. speciosum* seem to do. We may conclude that *flava* is generically related to *symondsi*; and since *Othelosoma* Gray, 1869 has priority over *Amblyplana* von Graff, 1896, we may refer to it as *Othelosoma* [= *Amblyplana* von Graff, = *Rhynchodemus* Moseley] *flavum*.

On the other hand, the sections of *Amblyplana fusca* were disappointing. Careful search failed to reveal any trace of genitalia except for immature ovaries without ducts. Sections at and anterior to the ovary, which reveal the retractor system of *symondsi* and *flavum*, disclose no specialized retractor in *fusca* (Pl. 43, fig. C).

Like *flavum*, *symondsi*, and *terrestris*, the outer dermal muscular layer of *fusca* is simple (Pl. 41). But beyond this all we can say is that the parenchymal musculature is much more powerfully developed than that of *terrestris*. In view of the sexual immaturity of the known specimens we cannot tell whether *fusca* is generically related to *terrestris*. We cannot tell therefore whether *Amblyplana* could under any circumstances become a candidate for the generic name of *terrestris*. There is considerable probability that we should never be able to do so, since, even if sexually mature worms were taken from the same locality, the lack of features in Moseley's own specimens would make it difficult to prove beyond all doubt that their species was the same as his.

Thus, the specimens which Weber collected and which were identified by von Graff as *fusca* were more recently examined by Freisling (1935). He found a sexually mature specimen, and its genitalia show beyond all doubt that it is an *Othelosoma*. The parenchymal musculature is powerful, but a dorsal retractor is not differentiated (pp. 10 and 13). In this it is unlike *symondsi* and might be considered to stand below *speciosum* in the series of species showing increasing differentiation of the retractor.

But the difficulty is to prove that Weber's specimens belong to the same species as Moseley's. Both come from the same geographical region (Cape of Good Hope), but from rather widely separated localities. The external features of Moseley's specimens are not of a kind to allow us to make a clear specific diagnosis. And though some weight must be given to the fact that both Moseley's and Weber's specimens possess a powerful parenchymal musculature, and both lack a dorsal

retractor, the evidence cannot be considered to be yet sufficient to warrant their specific identity. Our one hope is that one of the remaining specimens of Moseley may still be found to contain mature genitalia.

We cannot therefore ascertain simply by examination of *Amblyplana fusca* whether *Amblyplana* could possibly become the generic name of *Fasciola terrestris*. This impasse can however be avoided if it becomes apparent that *terrestris* is generically related to *Microplana* Vejdovsky, 1890, since this has temporal priority over *Amblyplana* von Graff 1896. We shall conclude that this is so.

MICROPLANA.

The most serious candidate for the generic title of *Fasciola terrestris* is *Microplana humicola* Vejdovsky, 1890. His account is based on examination of living specimens only, and he expresses regret that he could not preserve them. His clear description therefore necessarily lacked some information of importance, and Heinzl (1929) could truly say that we knew too little to place this animal in its correct systematic position. Bresslau (1933), whose opinion in such matters must command the greatest respect, states in Kükenthal & Krumbach's *Handbuch der Zoologie* (p. 283) that *Microplana* is in fact a '*Rhynchodemus*', implying by that (in Heinzl's sense of the name) that it is generically related to *terrestris*. But he gives no evidence. Subsequently, one of his students (Schneider, 1935) gave an excellent account of the anatomy of an animal he identifies as *M. humicola*. The well-developed penis, the rest of the special features of the male and female genital system, the undifferentiated dermal muscular layer, and the posterior fusion of the hindgut diverticula, are among the many characters in which this animal resembles *terrestris* and certain related genera. It is by the use of such characters as these that Heinzl and Hyman establish a subfamilial distinction between *terrestris*-like genera and the other section of the Rhynchodemidae, which includes the familial type of *Rhynchodemus sylvaticus* Leidy.

Schneider's organism resembles *terrestris* not only in these supposedly subfamilial characters but also in generic features, such as the absence of Beauchamp's canal which characterizes the other adequately known related genera, *Othelosoma* [= *Artiocotylus*] and *Diporodemus*. Like *terrestris* also, it possesses a ductus genito-intestinalis, and the ciliation is absent from the dorsal surface (cf. von Graff (1899), p. 50).

On the other hand, the organism shows specific differences from *terrestris*, in the white colour, the small size at sexual maturity, the restricted number of testes (two pairs), the minuteness and the position of the eyes, and the character of the ductus genito-intestinalis, which is single.

We thus arrive at the conclusion that Schneider's organism, which he considers to be identical with Vejdovsky's *Microplana humicola*, is beyond reasonable doubt congeneric with *Fasciola terrestris* O. F. Müller. If it can be established that Schneider is right in supposing that his and Vejdovsky's organisms are the same species, our problem is solved. If we cannot so do *Microplana* must fail us as a generic name for *terrestris*, since the only other organism so named is *M. ruteocephala* Kaburaki, 1922, the inadequate description of which gives no evidence as to why that species was placed in a genus from which it would seem excluded by the absence of a creeping sole.

Schneider does not review the evidence that his and Vejdovsky's species are the same, though he makes certain comparisons, and his very full description admits of a comparison with Vejdovsky's limited one. The descriptions include many observations in common: the small size at sexual maturity; the absence of pigment; the absence of dorsal ciliation, and of auricular appendages; the dense armature of rhabdites over the head; the minute paired eyes (perhaps the smallest known in Triclads) deeply situated close to the cerebral ganglia; the comparatively simple gut diverticula, of which Schneider's formula 2(12-15), 4-5, fits Vejdovsky's figure and description; the restriction of the testes to two pairs; the well-developed penis; the two vasa deferentia which unite where they open into a vesicula seminalis. Vejdovsky believed that longitudinal muscle was absent from the penis, and that

because of this it could not be everted. In searching for an alternative copulatory organ he suggests that this function is undertaken by a projection of the body wall which he figures by the genital opening. It would seem that observations on living material, such as he made, would not permit detection of restricted longitudinal musculature such as that figured by Schneider from his sections. And in any case, Vejdosky's contention that longitudinal muscle in such a system is necessary for exertion is mechanically unsound. It is difficult not to suppose that the penis figured by Vejdosky is an intromittent organ, and difficult to disagree with Schneider that Vejdosky's figured projection from the body wall is merely an everted part of the atrium. Such would be particularly liable to be seen in compressed living specimens.

Schneider's description of the female genitalia shows some points of agreement with Vejdosky's observations, but there is a difference. Schneider traced the two oviducts from the ovaries, posteriorly, till they met in a common duct which also received the ductus genito-intestinalis at the same point. The junction of the oviducts and the common duct is densely embedded in gland cells. The common duct then passes into the vagina which opens into the posteriorly directed atrium femininum, which arises from the atrium commune above and behind the genital aperture.

Vejdosky in his living specimens was unable to see the ovaries or the course of the oviducts. He detected the final portion of a duct running down towards the posterior side of the genital aperture. This duct became embedded in a mass of gland cells. He guessed that this duct was the oviduct. It might be interpreted as the common duct or one of the oviducts, or even the ductus genito-intestinalis. The glandular mass may be allowed to correspond to the similar structure which Schneider found. But according to Vejdosky the glandular region of this duct opened direct into the genital atrium. It did not open into a vagina and atrium femininum; though a blind posteriorly directed sac which he describes arising from the genital atrium occupies the same position as the atrium femininum and vagina of Schneider. If Vejdosky's account is accepted literally, we have here a significant difference between his and Schneider's specimens in the manner of entry of the oviduct into the genital atrium, and in the existence of a posterior blind sac, which Vejdosky refers to as 'uterus'—comparable with the bursa copulatrix of paludicolous genera like *Dendrocoelum*, whose comparison with *Microplana* Vejdosky had constantly in mind. Schneider suggests that Vejdosky's description is based on a confused interpretation of the *atrium masculinum* and the vagina; though perhaps the confusion is even more likely to concern the *atrium femininum*. Anyone who has attempted carefully to trace the complex genital system of living Turbellaria in specimens distorted by compression will be aware of the great ease of misinterpretation of detail and may well conclude that Schneider's suggestion is right. If we accept this and bear in mind the lack of other differences together with the quality of the numerous points of resemblance between Vejdosky's and Schneider's organisms, we may conclude with the latter that *Microplana humicola* is indeed congeneric with *terrestris*; a judgment that agrees with Bresslau's.

This conclusion has a high probability, but it is not a certainty. However, we cannot reject it on that account, for all systematic judgments of this sort ultimately rest on inductive inference. Indeed, in cases involving early descriptions of invertebrate species in which the type specimens have not survived, we must often be content with no more than a fair probability that the original superficially described organism is identical with that which was later subjected to detailed anatomical description. This indeed is true of the type species of the whole family, *Rhynchodemus sylvaticus* Leidy. Leidy's (1851 a, b) and Girard's (1893) descriptions of the original animals from gardens at Philadelphia are meagre and superficial. The original specimens are lost. Hyman's (1943) important systematical description of the anatomy is based on material collected by Walton (1907, 1912) from places distant from the original site, which could not be compared with Leidy's specimens. So that even here the validity of the identification must ultimately depend on the original meagre and superficial

description. Taking all the evidence, there is a fair probability that Hyman is right and that the animal she describes is Leidy's *Rhynchodemus sylvaticus*. It would be perverse to reject the identification because it does not reach certainty. To apply such a principle generally would create far more confusion in systematics than it would allay. By the same argument it would be perverse to reject the identification of Schneider's organism with Vejdovsky's *Microplana humicola* because it rests on a probability which is short of certainty. I therefore propose to accept Schneider's identification.

Schneider concludes his work on *M. humicola* by renaming it '*Rhynchodemus*' *humicola*, congeneric with '*Rhynchodemus*' *terrestris*. Since *terrestris* is not a *Rhynchodemus*, his work makes it legitimate to reverse his procedure and to apply the generic name *Microplana* to *terrestris*, provided that it has priority over *Amblyplana*. Fortunately this is the case, since Vejdovsky's (1890) name preceded that of von Graff's (1896) genus of *Amblyplana*.

We thus reach the conclusion that *Fasciola terrestris* O. F. Müller should be named *Microplana terrestris* (O. F. Müller); a conclusion which can give some satisfaction in view of Schneider's excellent description of *M. humicola* on which it is based. And while one can only regret that an animal so long familiar to zoologists as '*Rhynchodemus*' *terrestris* must change its name, we can at least feel that in contrast with great tropical forms like *Geoplana* and *Bipalium* the name of *Microplana* for the relatives of *terrestris* is no aesthetic misnomer.

CLASSIFICATION.

Corrêa (1947), and after her Prudhoe (1949), divided the family Rhynchodemidae into two subfamilies: the Rhynchodeminae Corrêa (1947), to which the genus *Rhynchodemus* is assigned, and a second subfamily named by Hyman (1943) the Geodesminae. But I have shown elsewhere (Pantin, 1950) that *Geodesmus* is a synonym for *Rhynchodemus*. Consequently the subfamily Geodesminae Hyman can no longer receive this name with propriety. This subfamily, which includes those genera related to *Microplana terrestris*, thus requires a new name.

If *Microplana* becomes the genus to which *terrestris* and related species are assigned, it follows from the International Rules of Zoological Nomenclature (Art. 30, I, c) that the single original species, *Microplana humicola* Vejdovsky, 1890, becomes the type of the genus.

The other genera placed in the Geodesminae of Hyman are:

Artiocotylus v. Graff, 1896;
Pseudartiocotylus Ikeda, 1911;
Diporodemus Hyman, 1938.

For reasons already given *Artiocotylus* must now be replaced by *Othelosoma* Gray, 1869.

The genus *Microplana* Vejdovsky, 1890 now includes the oldest described species, *terrestris*. Its generic characters are less specialized than those of the other genera. We may with propriety denominate the subfamily Microplaninae [=Geodesminae Hyman, 1943 =Rhynchodeminae Heinzl, 1929].

We may thus classify the family as follows:

Family **Rhynchodemidae**.

Of Hyman, 1943; Prudhoe, 1949; and others.

1. Subfamily **RHYNCHODEMINAE**.

Of Corrêa, 1947; not of Heinzl, 1929,
 =DOLICHOPLANINAE Hyman, 1943,
 =DESMORHYNCHINAE Heinzl, 1929,
 not RHYNCHODEMINAE of Heinzl, 1929.

Genus RHYNCHODEMUS Leidy, 1851 b.

Type species *Planaria sylvatica* Leidy, 1851 a,= *Geodesmus* Mecznirow, 1866.Type species *Geodesmus bilineatus* Mecznirow, 1866,= *Desmorhynchus* Heinzel, 1929.

The inclusion of *Geodesmus* follows Pantin (1950), otherwise this is in agreement with the nomenclature of Hyman (1943) as modified by Corrêa (1947) and Prudhoe (1949).

Genus DOLICHOPLANA Moseley, 1877 (*sensu* Hyman, 1943).Genus PLATYDEMUS v. Graff, 1896 (*sensu* Hyman, 1943).

2. Subfamily MICROPLANINAE, nom. nov.

= GEODESMINAE Hyman, 1943,

= RHYNCHODEMINAE Heinzel, 1929.

Definition: as given by Hyman (1943) for her subfamily Geodesminae. "Rhynchodemidae with weak subepidermal musculature of which the longitudinal fibers are inconspicuously developed and are not aggregated into bundles. Mostly of short, plump, cylindroid form; eyes may be small or retrogressed. Copulatory apparatus often complicated; male apparatus with a well-developed, often large penis papilla; female apparatus with or without seminal bursa, may have genito-intestinal connection, bursa may have more than one exit."

Genus MICROPLANA Vejdovsky, 1890.

= *Rhynchodemus* of Heinzel, 1929.Type species *Microplana humicola* Vejdovsky, 1890,(= *Rhynchodemus humicola* (Vejdovsky) of Schneider, 1935).

Definition: with or without seminal bursa; when present, this bursa has only one exit.

Genus OTHELOSOMA Gray, 1869.

Definition: the seminal bursa is very large and communicates by two openings or by a common opening with two canals, a ductus vaginalis and a Beauchamp's canal, leading into the genital atrium. The dorsal anterior parenchymal musculature is very highly developed and may be differentiated as a discrete retractor muscle.

= *Artiocotylus* v. Graff, 1896 (*sensu* Hyman, 1929),= *Amblyplana* v. Graff, 1896, in part (*sensu* Heinzel, 1929).Type species *Othelosoma symondsi* Gray, 1869.

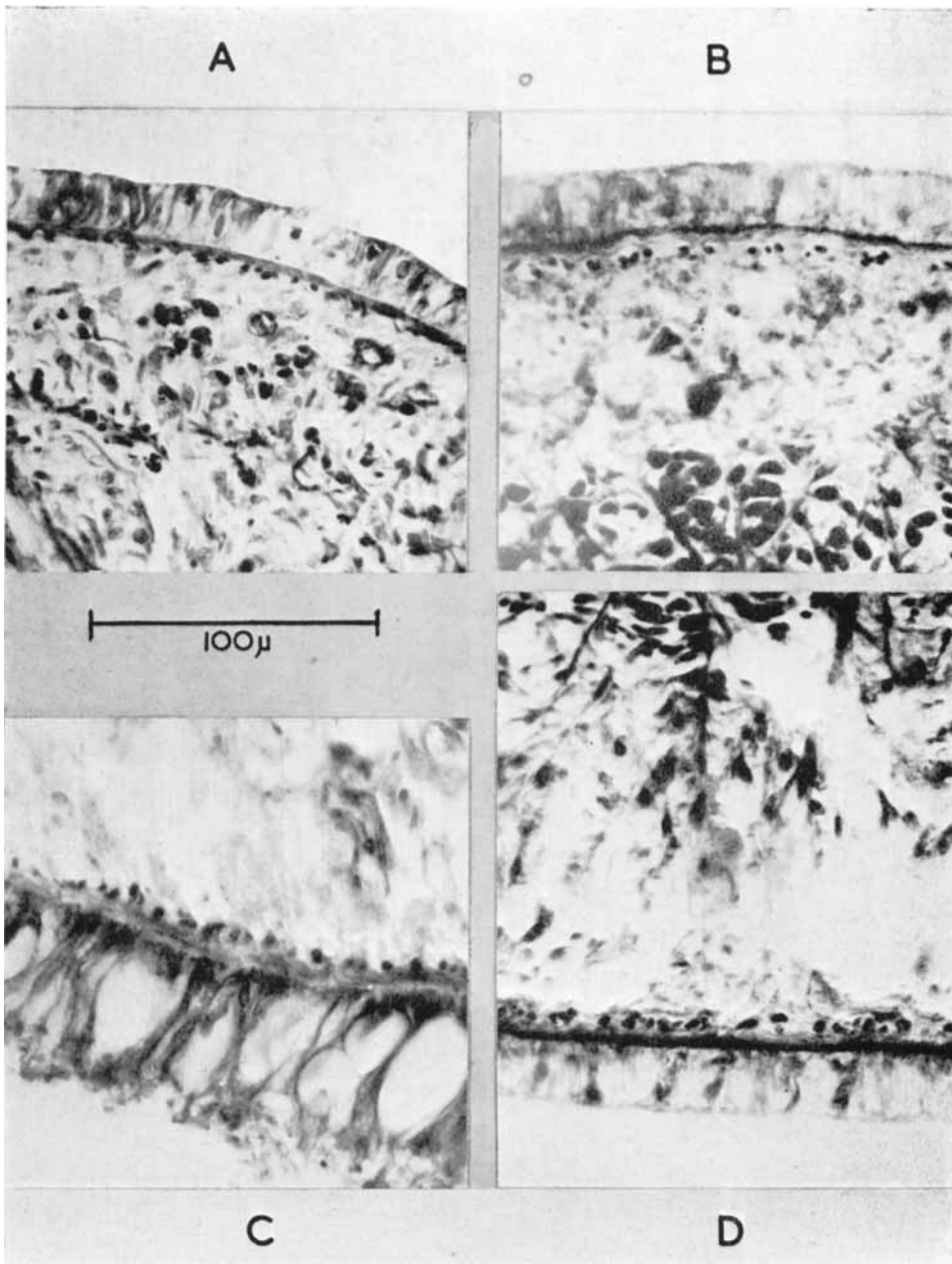
Definition: as given in this paper.

The genus includes *Amblyplana flava* (Moseley, 1896).Genus PSEUDARTIOCOTYLUS Ikeda, 1911 (*sensu* Hyman, 1943).Genus DIPORODEMUS Hyman, 1938 (*sensu* Hyman, 1943).*Incertae sedis*Genus *Amblyplana* v. Graff, 1896.

Two species were originally placed by von Graff in this genus. The transference of *flava* to the genus *Othelosoma* leaves only the species *fusca*. Accordingly the type species of the genus *Amblyplana* becomes

Rhynchodemus fuscus Moseley, 1877,[= *Amblyplana fusca* (Moseley) of v. Graff, 1896].

The musculature of the body wall in this species resembles that in the Microplaninae. But in the absence of other discovered characters there is not yet enough evidence to assign it with certainty to that subfamily.



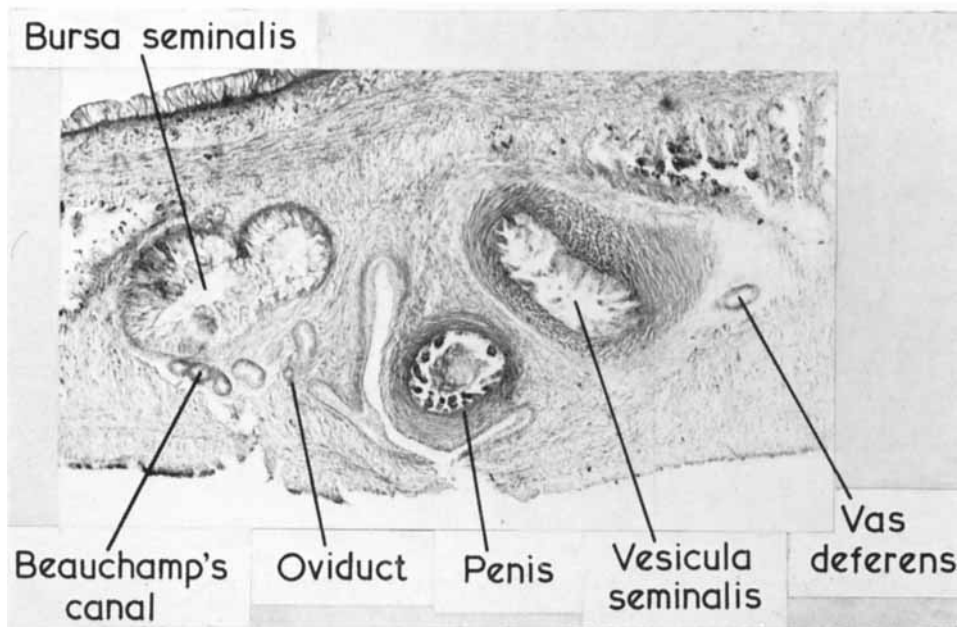
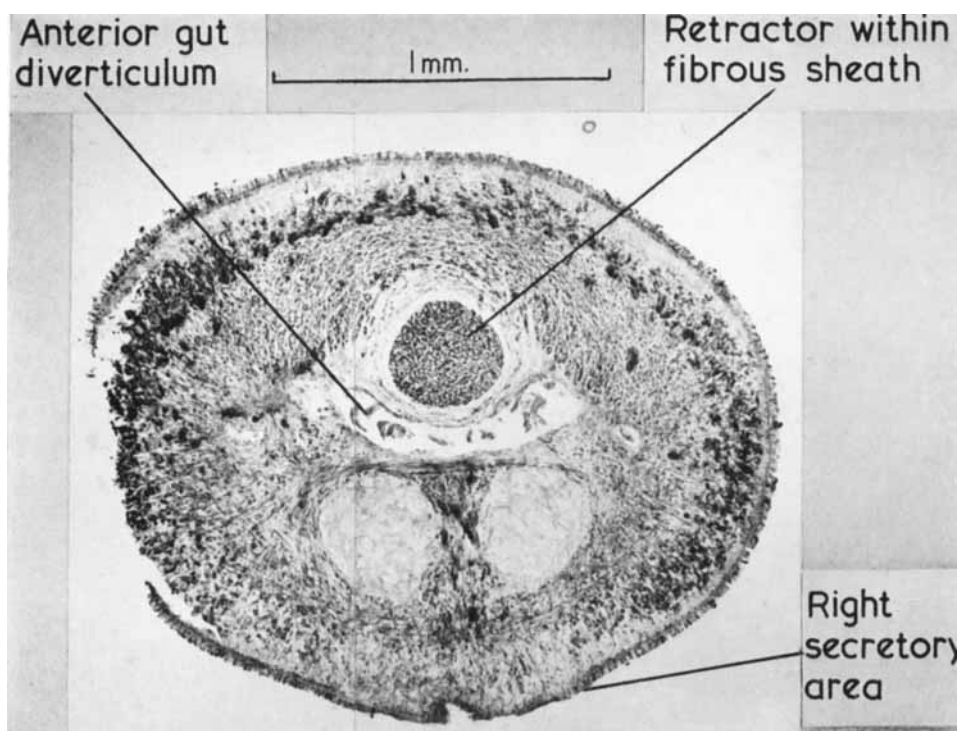
T.S. lateral body wall showing simple dermal longitudinal musculature.

FIG. A.—*Microplana* (= *Rhynchodemus*) *terrestris*.

FIG. B.—*Amblyplana fusca*. Note powerful parenchymal muscle fibres.

FIG. C.—*Othelosoma symondsi*.

FIG. D.—*Othelosoma* (= *Amblyplana*) *flavum*.



Othelosoma symondsii.

FIG. A.—T.S. just behind brain showing retractor muscle and associated structures.

FIG. B.—Sagittal section of genital region.

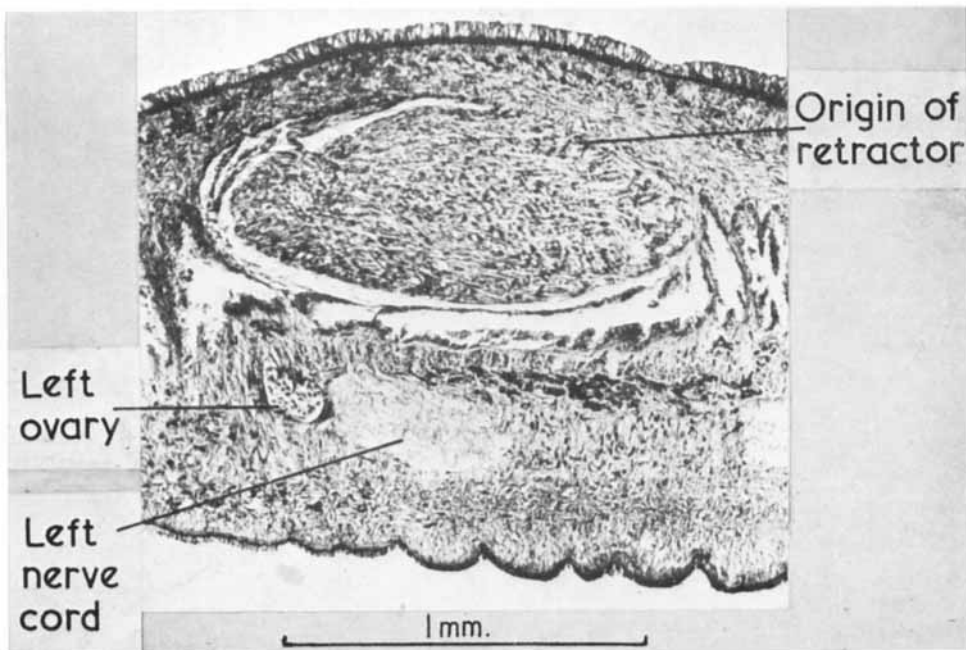
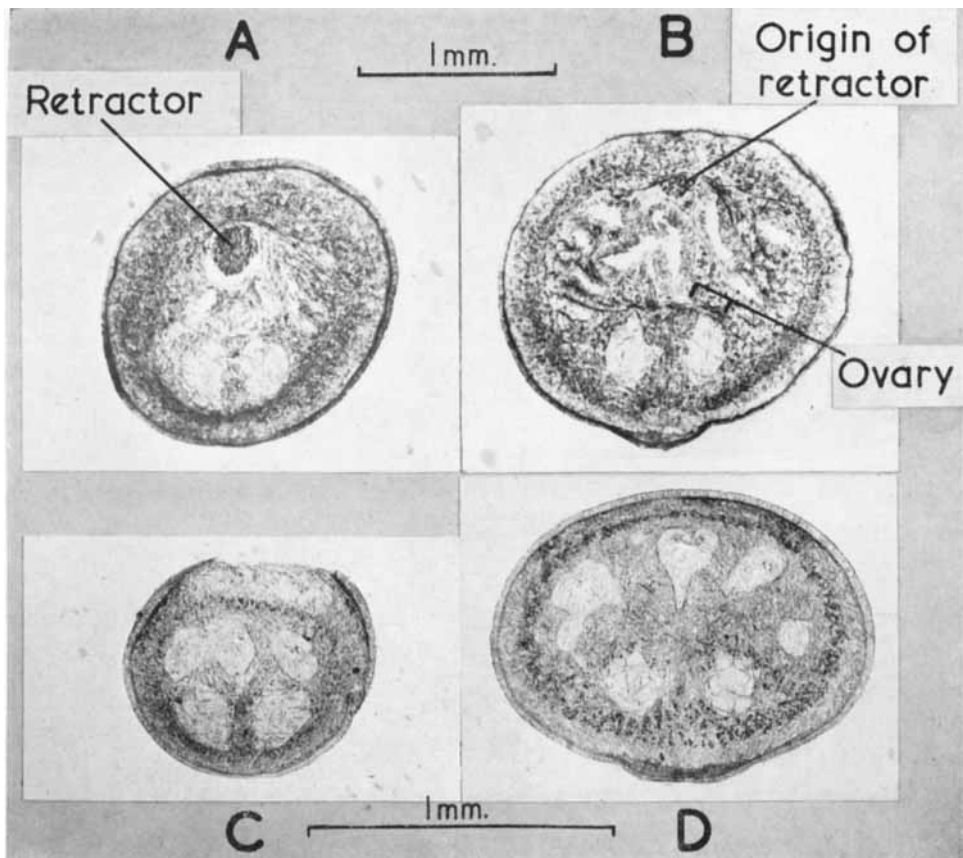


FIG. A.—*Othelosoma flavum*. T.S. just behind brain, to show retractor muscle.
 FIG. B.—*Othelosoma flavum*. T.S. at level of ovary to show origin of retractor.
 FIG. C.—*Amblyplana fusca*. T.S. just behind brain.
 FIG. D.—*Amblyplana fusca*. T.S. just in front of ovary. Note well-developed parenchymal musculature, but no retractor.
 FIG. E.—*Othelosoma symondsii*. Oblique section at level of ovary showing origin of retractor and relation to nerve cord.

It is a very great pleasure to express my gratitude to Professor E. Marcus of the Departamento de Zoologia at the University of Sao Paulo for many interesting discussions and for his most valuable criticism. I should also like to thank Mr. S. Prudhoe and Dr. J. Smart very much for their valuable help and criticism.

SUMMARY.

1. It is shown that the well-known European terrestrial flatworm, *Fasciola terrestris* O. F. Müller, commonly known as *Rhynchodemus terrestris* (O. F. Müller), must be named *Microplana terrestris* (O. F. Müller). The type species of the genus *Microplana* is *M. humicola* Vejdovsky, 1890. The effects of this on the classification of the Rhynchodemidae are discussed. The subfamily which includes *M. humicola* is renamed the Microplaninae.

2. The imperfectly described species *Othelosoma symondsi* has been examined. It agrees generically with species of *Artiocotylus*. The generic name *Othelosoma* has priority over that of *Artiocotylus*, which now becomes a synonym for *Othelosoma*.

3. Specimens of the two original species of the genus *Amblyplana* von Graff, 1896 have been examined. *A. flava* proves to be an *Othelosoma* and takes that generic name. *A. fusca* is not evidently an *Othelosoma* but immaturity of the specimens prevents assignation of relationship.

4. *Nematodemus lumbricoides* von Graff is not a planarian but a heteronemertine.

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