

ON GEOPLANIDS FROM BRAZIL

by Claudio G. Froehlich
(with 11 plates)

In June-July, 1953 my wife and I made an excursion to the southern states of Brazil to collect land planarians and, especially, to try to find again some of the species of **Geoplana** described by Fritz Müller, 1856, and by Graff, 1899. As regards the latter aim, our success was mediocre, for at Blumenau and nearby localities we found only five (**G. mülleri**, **G. schultzei**, **G. atra**, **G. marmorata**, and **G. pulchella**) of Müller's 13 species, and two (**G. ladislavii** and **G. polyophthalma**) of Graff's. In Taquara, State of Rio Grande do Sul, where Hermann von Ihering collected several species he sent to Graff, the land planarian fauna was very scarce, perhaps on account of the very cold winter of that year, and we succeeded in collecting only 3 specimens of **G. ladislavii** Graff. In this paper are also included land planarians collected at Blumenau by Lic. Natalia Gabrusewycz and her father, Mr. Oleh Gabrusewycz, and in the State of Rio Grande do Sul by Prof. Dr. J. Hauser, S. J., and Prof. Dr. R. Gliesch, to all of whom we are grateful. The last species described in this paper was collected by Mr. Johann Becker in the environs of Salvador, State of Bahia. It is the second species known from that State, the first being **G. flava** Moseley. At the end of the systematic part are found some remarks on the status of Fritz Müller's species of **Geoplana**.

To the National Research Council (Conselho Nacional de Pesquisas) we are specially thankful, for its grants have made possible our excursion.

List of the species appearing in this paper:

1. **Geoplana marmorata** Fritz Müller
2. **G. mülleri** Diesing
3. **G. abundans** Graff

4. *G. carrièrei* Graff
5. *G. ladislavii* Graff
6. *G. pseudorhynchodemus* Riestel
7. *G. quagga* Marcus
8. *G. tapetilla* Marcus
9. *G. velina* C. G. Froehlich
10. *G. apeva*, n. sp.
11. *G. assu*, n. sp.
12. *G. fita*, n. sp.
13. *G. gaucha*, n. sp.
14. *G. glieschi*, n. sp.
15. *G. hauseri*, n. sp.
16. *G. nataliae*, n. sp.
17. *G. suva*, n. sp.
18. *Chœradoplana iheringi* Graff
19. *Geoplana beckeri*, n. sp.

The types of the new species are deposited at the Departamento de Zoologia da Faculdade de Filosofia, Ciências e Letras da Universidade de São Paulo.

GEOPLANA MARMORATA Fritz Müller

Geoplana marmorata Fritz Müller, 1856, p. 25 [Blumenau, S. C., Brazil].

Geoplana rufiventris, Graff, 1899, p. 294 (part.).

Localities: Rio do Teste, 2 specimens, June 28, 1953.
Blumenau, 3 specimens, July 2, 1953.

Measures, in mm., of three sectioned worms:

Length	Width	Mouth	Gonopore
84	9.5	61	73
50	9	35.5	42
50	7	35.0	43

Our larger specimens attained, creeping (Fig. 1), a length of 100 mm. by a width of 7 mm. A smaller specimen was 60 mm. long by 5 mm. broad. At rest (Fig. 2) they are shorter and broader, with wavy margins.

In the creeping worms, the body broadens gradually from the rounded anterior tip backwards, attaining its maximal width shortly in front of the pharynx. From this point, the margins are almost parallel down to the abrupt posterior narrowing.

The dorsal ground is light brown with a pinkish tint; this tint increases towards the cephalic end, which is reddish, both dorsally and ventrally. On the ground there are numerous dark brown spots, aggregated into irregular strips, which give the worms a marbled appearance (Fig. 3). At the cephalic region the strips are prevailingly longitudinal, on the rest of the back they are more or less oblique. The more mesial spots are commonly smaller but more crowded, especially in the region of the pharynx and copulatory apparatus. A spot-free median line may be present or not. The ventral side is light grey with pinkish-brown borders.

In the largest worm, the small eyes are marginal and crowded in the first 20 mm. (Fig. 8); backwards (Fig. 9) they spread on the dorsal side to a maximum of 1/4 of the body width on each side but commonly less; from about 60 mm. from the anterior tip backwards they get gradually more thinly scattered.

The pharynx (Fig. 4) is cylindrical, with the ventral insertion more anteriorly placed than the dorsal, and with richly folded border.

The copulatory apparatus of the three measured specimens were sectioned (Figs. 5-7). The two smaller worms present both the male and the female genital organs mature; in the longest, however, the female organs are fully mature, but the male are not: the testes, e. g., present almost only the first stages of spermatogenesis, and there are only a few ripe sperms in the ectal part of the efferent ducts.

The seminal vesicle (s) has the form of an inverted U with the anterior arm longer and forked entally. Each branch of the fork receives one of the efferent ducts (d). The larger part of the vesicle is situated outside the main muscle coat of the penis bulb (b) but it is, nevertheless, encircled by some

fibres from the latter. The vesicle is not much dilated; it receives eosinophilous glands, and is lined by an epithelium provided with long cilia. The lining of the narrow ejaculatory duct (e) is similar. The penis papilla (p) is large, asymmetrical, irregular, and variable. In all the three sectioned specimens it is bent to the left in such a way that the atrium forms a depression or recess that extends from the left to the right. In two specimens (Figs. 5, 7) the ejaculatory duct opens into this recess; in the third (Fig. 6) it opens into the outer part of the atrium.

The oviducts (o) rise behind the gonopore (g). Shell glands (z) open into the ectal ascending and into the transverse portions of the oviducts, and into the common glandular duct (q). The latter is directed backwards and downwards and opens into a short vagina. The female atrium (f) is ample, with folded lateral walls. The whole genital atrium receives eosinophilous and cyanophilous glands, and is lined by a non-ciliated epithelium that is higher, pluriserial to pluristratified, in the female part.

Remarks: Our specimens of *Geoplana marmorata* are in part from the original locality and fit perfectly to the short description given by Fritz Müller. Graff (1899, p. 294) considered *G. marmorata* to be a synonym of *G. rufiventris* Fr. Müll. but his opinion cannot be held, because the two species present different colour patterns, *G. rufiventris* presenting a dark brown dorsal side and a brick red ventral side. By its external features, *G. marmorata* stands near the group of the large, broad and flat species, but it cannot be included in that group because of the irregular and asymmetrical form of the penis.

GEOPLANA MÜLLERI Diesing

Geoplana elegans Fritz Müller, 1856, p. 23 (non Darwin, 1844, p. 244) [Blumenau, S. C., Brazil].

Geoplana pallida Fritz Müller, 1856, p. 24 (non Darwin, 1844, p. 245) [Blumenau, S. C., Brazil].

Geoplana mülleri Diesing, 1862, p. 511; Graff, 1899, p. 333.

Geoplana schultzei Diesing, 1862, p. 512; Graff, 1899, p. 327.

Localities: Paranapiacaba, 40 km. SE from the city of São Paulo: 1 young specimen, possibly of the present species, Nov. 1, 1954.

Blumenau (type locality): 24 specimens, collected between June 23 and July 2, 1953.

Rio do Testo (formerly Pommerode), ca. 35 km. NNW from Blumenau: 1 specimen June 28, and one July 1, 1953.

Itajaí: 6 specimens, June 25, 1953.

Brusque: 5 specimens, June 26, 1953.

The specimens were found under fallen logs and in the leaf rosettes of fallen epiphytic Bromeliaceae.

Measures, in mm., of three preserved worms:

Locality	Length	Width	Mouth	Gonopore
Blumenau	51.0	2.3	30.0	38.2
Itajaí	53	2.5	30	38
Brusque	53.0	2.5	30.0	38.7

This is a lively species, presenting quick reactions when stimulated. Creeping (Figs. 11, 12), the body is long and slender, narrowing gently to both ends, more so to the anterior. The dorsal ground colour is light-yellow; the cephalic end, and commonly also the posterior, although to a lesser extent, are darker, orange to ferruginous. The ventral side is white bordered by the dorsal colour. The specimens from Blumenau and Rio do Testo (Figs. 12, 14) present on the back a black median longitudinal stripe and, on each side, a ferruginous one. At the cephalic end all the stripes merge into the ground colour; at the posterior, the stripes unite shortly before the tip. The specimens from the remaining localities lack the lateral reddish stripes. The worms from Itajaí (Figs. 11, 13) present a narrow median black line, those from Brusque (Fig. 10) a median stripe, broader than that of the worms from Blumenau. The young worm from Paranapiacaba is similar to the specimens from Brusque, but the stripe is relatively even broader.

Around the anterior end the eyes are uniserial; backward they spread on the dorsal side to about a third of the body width (Fig. 13). At about 2 cm. from the tip they get sparser, and from ca. 3 cm. on they are restricted to a marginal row (Fig. 14).

The pharynx (Fig. 15) is bell-shaped (glockenförmig).

The three sectioned specimens are mature. The efferent ducts (Figs. 16-18, d) are full of spermatozoa. Their final portions bend forward, upward and mesially to enter separately into the ental, upturned end of the large seminal vesicle (s). The walls of the approximately S-shaped vesicle are folded; the lining is a columnar epithelium provided with long cilia and traversed by numerous ducts of granular eosinophilous glands. On entering the muscle coat of the male atrium, the vesicle narrows to the short ejaculatory duct (e), which is lined by a ciliated cubical epithelium. The ejaculatory duct opens directly into the male atrium (a), a penis being absent. The male atrium presents a small number of large folds. Both its subepithelial muscles (muscularis) and the outer muscle coat are strong. The male atrium is lined by a low columnar, non-ciliated epithelium. At its ental half (or less) the epithelium is irregular, presenting small projections into the atrial lumen; in this region open fine-grained eosinophilous glands. At the ectal half, where the epithelium is more regular, open more intensely staining eosinophilous glands together with some cyanophilous ones. In the specimen from Brusque (Fig. 18) the male atrium presents a ventral protuberance to which a large cluster of spermatozoa is attached. The epithelium has disappeared at the place of attachment, and the sperms, oriented at right angles to the surface, are in direct contact with a mass of eosinophilous secretion; the same secretion also covers partially the whole cluster. The same phenomenon has already been observed in *G. sexstriata* Graff (C. G. Froehlich, 1956, p. 317 fig. 7, p. 319, and p. 341), another species in which a penis is lacking. The mass of sperms should be considered a spermatophore, for it probably is deposited as a packet into the fe-

male atrium or vagina of the other individual during copulation.

The vitellaria are mature in the three sectioned worms. The oviducts (o) begin to rise in front of the gonopore, ascend slanting backwards, and bend mesially to unite into the common oviduct (q). Shell glands open into the final portions of the paired oviducts and, excepting a very short ectal portion, into the common oviduct (common glandular duct). The common oviduct is directed backward and downward; ectally it is continuous with the slightly wider, nonciliated vagina. The vagina bends forward to open into the small female atrium (f). The vagina and female atrium are lined by an epithelium similar to that of the ectal part of the male atrium but both, the vagina chiefly, receive a greater number of cyanophilous glands. The male and female atria are not sharply delimited, the gonopore canal, which presents much folded walls, issuing between the two.

Remarks: Fritz Müller (1856) described as different species the specimens with a median black stripe and a pair of lateral ferruginous ones (***Geoplana elegans***), and those provided with a narrow median stripe and lacking the lateral ones (***G. pallida***). These species became homonyms of ***Planaria elegans*** and ***P. pallida*** Darwin, 1844. Diesing, 1862, renamed them ***G. mülleri*** and ***G. schultzei***, respectively. Our specimens from Blumenau and Rio do Testo fit perfectly to Müller's description of ***G. elegans***, while those from the environs of the harbour of Itajaí fit to ***G. pallida***. The specimens from Brusque are similar to those from Itajaí, but the median stripe is much broader. The anatomical uniformity of the three forms led us to consider them a single species, ***G. mülleri***, which has priority over ***G. schultzei*** because it preceded the latter in the same paper. To ascertain whether the different forms represent subspecies or varieties would require an intensive investigation of the region where they occur, not possible during our brief stay there. As regards the young worm from Paranapiacaba, its definitive identification must await the finding of mature specimens.

G. mülleri, concerning the general topography of the copulatory apparatus, stands near **G. marginata**, Graff (not Fr. Müll.), but none of our specimens showed the formation of an atrial copulatory papilla as in the latter. The shape of the body and of the pharynx are also similar in both; the coloration, however, is different.

GEOPLANA ABUNDANS Graff

Geoplana marginata, var. **abundans** Graff, 1899, p. 306 ["Taguara do mundo novo, Prov. Rio Grande do Sul", Brazil].

Locality: São Leopoldo, R. G. S.: 2 specimens; Prof. Dr. J. Hauser, S. J., col.

What Graff called **G. marginata** cannot be Fritz Müller's species, as will be discussed later. Among the specimens H. von Ihering sent him, however, there was one with seven stripes, which Graff named **G. marginata**, var. **abundans**. Through the kindness of Prof. Hauser we received two specimens of a seven-striped species which agree very well with Graff's variety. This species should, therefore, be called **G. abundans** Graff. Its anatomy, as well as its relations to the species Graff, and after him several authors, called **G. marginata**, will be presented and discussed in a future paper.

GEOPLANA CARRIÈREI Graff

Geoplana carrièrei Graff, 1897, p. 2; 1899, p. 315 [Misión d'Aguairenda, Chaco Boliviano].

Geoplana carrièrei Marcus, 1951, p. 62.

Locality: São Leopoldo, State of Rio Grande do Sul, 5 specimens; Prof. Dr. J. Hauser, S. J., col.

Measures, in mm., of three sectioned specimens:

Specimen	Length	Width	Mouth	Gonopore
a	53.7	5.0	37.1	45.1
b	57.7	6.6	37.6	45.9
c	54.6	7.0	34.5	42.5

Only specimen **a** presents the typical coloration: reddish cephalic region and dark brown dorsal side. In the remaining worms, the anterior end, although usually lighter than the brown, olive-brown, or brownish-black dorsal side, lacks the conspicuous reddish hue. The ventral side is grey or brownish-grey.

The distribution of the eyes agrees with the description of Marcus, 1951. In specimen **a**, however, the maximum spread of the eyes is only about one tenth of the width of the body on each side, whereas usually the eyes spread to one third or one fourth. The diameter of the larger pigment cups varies from 50 to 60 μ in different specimens.

The anatomy of the pharynx and of the copulatory apparatus are also in agreement with Marcus's (1951, p. 62) description. The penis is asymmetrical, the insertion of the papilla being displaced to the right, a condition easily seen in the cleared worms. The degree of the asymmetry varies in the three examined specimens. Specimen **b**, which presents spermatozoa in the efferent ducts, but in which vitellaria are still undeveloped, is the most strongly asymmetrical, the penis papilla being almost transverse. Specimens **a** and **c**, of which **a** is younger than **b**, and **c** is fully mature, are much less asymmetrical, an indication that the degree of asymmetry is not related to age. In both these specimens the ejaculatory duct opens into a bowl-shaped depression on the ventral surface of the penis papilla.

GEOPLANA LADISLAVII Graff

Geoplana ladislavii Graff, 1899, p. 300 ["Taguara do Mundo nuovo, Prov. Rio Grande do Sul", Brazil].

Localities: Blumenau, S. C.: 6 specimens between June 23 and July 2, 1953.

1 specimen, Oct. 3, 1955; Gabrusewycz col.

Taquara, R. G. S. (Type locality): 3 specimens, July 7, 1953.

São Leopoldo, R. G. S.: 1 specimen, Sept. 1955; Prof. Dr. J. Hauser, S. J., col.

Creeping, medium-sized worms are 50 mm. long by 5 mm. broad. The measures, in mm., of four preserved worms are:

Length	Width	Mouth	Gonopore
50	8	33.5	41
39	9	21.5	27.5
38	8	25	31
36	7.5	20	26

The specimens from Blumenau presented an olive-green dorsal side with darker spots over the testes and pharynx (Fig. 19). The broad creeping sole was translucent white, through which could be seen the gut diverticula and the efferent ducts. The dorsal side of the worms from Taquara was brownish-green.

Distribution of the eyes according to Graff's description.

The copulatory apparatus of two worms were sectioned (Figs. 24-25). The efferent ducts (d) open into paired portions of the seminal vesicle (s). These are directed upward and mesially, and unite into the common vesicle, which shortly on turn backwards, and penetrate into the penis bulb (b). The extrabulbar portion of the vesicle has a relatively weak muscular coat, independent from the bulb musculature. Within the bulb, the vesicle changes gradually into the ejaculatory duct, which presents a narrower lumen. Both vesicle and ejaculatory duct receive eosinophilous glands and are lined by an epithelium provided with long cilia. The penis papilla (p) is muscular, massive, and traversed centrally by the ejaculatory duct, which opens at its tip. Both papilla and genital atrium are lined by a columnar nonciliated glandular epithelium, especially high in the female atrium, where it may attain 200 μ . The male atrium presents a small dorsal fold which partly separates it from the female.

Vitellaria mature in both specimens. The oviducts (o) rise caudally to the gonopore (g), and unite into a short common oviduct (q) directed ventrally, which opens into the vagina. Shell glands (z) open into paired ectal portions and into common portion of oviducts. The female atrium (f) is ampler

in one specimen (Fig. 24) than in the other (Fig. 25); the vagina turns dorsally in both. The gonopore canal issues from the anterior part of the female atrium.

Remarks: This species, easily recognized by its uncommon green colour, is one of the best studied by Graff, 1899. Our specimens were collected at the same localities as Graff's. Graff had larger specimens than we did, some reaching 100 mm. when creeping, and being up to 65 by 7 mm., preserved. On the whole Graff's description applies well to our material, the chief differences following:

The numerous granules, 1-2 μ . in size, which Graff (l. c., p. 21, footnote) observed on the epidermis, in the peripheral parenchyma, and some also inside the epidermal cells, and which he suggested could be symbiotic green algae, were not present in our material. Only some secretion granules of the size indicated by Graff are present in the peripheral parenchyma; no algal cells could be seen. Graff's suggestion should, on these grounds, be dismissed. The granules he saw are probably only secretion granules. The nature of the pigments which produce the green colour remain unknown.

In Graff's drawing of the copulatory apparatus, the seminal vesicle is shown as being totally intrabulbar, and the efferent ducts as having a longer ascending portion. The female atrium is smaller than in our sectioned specimens, but in one of ours it is also smaller than in the other.

G. ladislavii belongs to group B of Brazilian Geoplanas (E. M. Froehlich, 1955, p. 328), distinguishing itself from the other species of the group by its green colour.

GEOPLANA PSEUDORHYNCHODEMUS **Riester**

Geoplana pseudorhynchodemus Riester, 1938, p. 32 [Teresópolis, R. J., Brazil].

Geoplana pseudorhynchodemus, Marcus, 1951, p. 76.

Locality: Blumenau, S. C.: 8 specimens, June 23 — July 2, 1953.

GEOPLANA QUAGGA Marcus

Geoplana quagga Marcus, 1951, p. 97 [São Paulo, S. P., Brazil].

Locality: Blumenau, common in vacant lots in the town. We collected several specimens in June, 1953; N. Gabrusewycz, 2 specimens in July, 1955.

GEOPLANA TAPETILLA Marcus

Geoplana tapetilla Marcus, 1951, p. 98 [Piraçununga, S. P., Brazil].

Localities: Blumenau and Itajaí, S. C.: a common species in vacant lots, under bricks, boards, etc.

GEOPLANA VELINA C. G. Froehlich

Geoplana pulchella, du Bois-Reymond Marcus, 1951, p. 234 (non Fritz Müller, 1856, p. 25) [Brusque, S. C., Brazil].

Geoplana velina C. G. Froehlich, 1955b, p. 190.

Locality: Blumenau, S. C.: one immature specimen, July 22, 1955; N. Gabrusewycz col.

GEOPLANA APEVA, n. sp.

Localities: Blumenau, S. C. (type locality): 2 specimens, June 24, 1953.

1 specimen, Oct. 3, and 1, Dec. 1, 1955; Gabrusewycz col.

Brusque, S. C.: 1 specimen, June 26, 1953.

Measures, in mm., of three specimens:

Specimen	Locality	Length	Width	Mouth	Gonopore
a	Blumenau (1953)	53.5	10	36.5	43.5
b	Blumenau (1955)	77	9.5	50	61
c	Brusque	67	7.5	47	54.5

Creeping, specimen **a** was 75 mm. long by 9 mm. broad; specimen **c**, 85 mm. by 6 mm., respectively.

Creeping (Figs. 26, 30), the worms present a slightly carinate dorsal side, and the body tapers very gradually to the anterior end, less so to the posterior; both ends are sharp. At rest, the body may be kept as in Fig. 28 or much shortened (Fig. 30).

The dorsal side varies from brown to black in different specimens, and is provided with a light longitudinal stripe. The dark colour is darker at the limit with the median stripe, lighter at the margins of the body. The median stripe varies from a deep yellow to a dirty white. The youngest specimen is lighter, umber in colour, what could be an indication that the worm darkens with age. The ventral side (Fig. 27) is light orange to brick red with bluish-grey margins. The anterior end, and, in some specimens, a zone around the orifices of the body are also grey.

In the cephalic region (Fig. 31) the eyes lie crowded at the margins; at ca. 2 cm. from the tip they spread, in one specimen, to ca. one ninth of the body width on each side (Fig. 33); in the other specimens, to about a fourth or a fifth (Fig. 32). The eyes are surrounded by small light halos. The diameter of the larger pigment cups is 55μ .

The pharynx (Fig. 34) is collar-shaped, with a small number of primary folds.

All the three sectioned worms are incipiently mature. Only specimen *c* has some spermatozoa inside the efferent ducts (Fig. 36, d). These ducts open into a pair of short lateral processes of the extrabulbar seminal vesicle. The vesicle (*s*) is tubular; in specimens *a* and *c* it presents a loop directed dorsally, in specimen *b* (Fig. 35) it is straighter. The ejaculatory duct (*e*) is somewhat narrower than the vesicle. The penis has a strong musculature, the bulb (*b*) is sharply delimited, and the papilla (*p*) is conical, rather long, filling up the greater part of the genital atrium. The length of the papilla in the sectioned specimens is, respectively: *a*, 0.7 mm.; *b*, ca. 2 mm.; *c*, ca. 1.2 mm.. The gonopore (*g*) lies before the middle of the atrium.

Vitellaria still absent in all specimens. The oviducts (*o*) rise behind the gonopore and unite into a short common oviduct

(q) that opens into the short vagina (v). Shell glands, present in an incipient stage only in specimen **b**, open into the final portions of the paired, and into the common oviducts. The vagina, located at the ental part of the female portion of the genital atrium, is directed upwards.

Remarks: The colour pattern of the ventral surface of the specimen of **Geoplana apeva** from Brusque is identical to one of Graff's figures of **G. rufiventris** (Graff, 1899, pl. 1 fig. 22; also, 1913, pl. 33 fig. 3). **G. rufiventris** Fr. Müll. is a uniformly brown species which occurs in the same region. **G. rufiventris**, Graff, is an heterogeneous assortment of worms from various localities. **G. apeva** distinguishes itself from all of them by its longitudinal light stripe on the back.

Within the group of the large, broad and flat species, the colour pattern of the dorsal surface of **G. apeva** is similar to those of **G. maximiliani** Fr. Müll. and **G. catharina** Hyman. The former was described by Müll. as presenting, among other characters, a yellowish longitudinal stripe ("Längsbinde"), and a nearly spherical penis. The colour pattern alone would indicate the identification of our material to Müller's species, but as the penis in **G. apeva** is an elongated cone and, besides, as **G. apeva** seems to be a broader species than is indicated by Müller, we think it wiser to consider **G. apeva** distinct from **G. maximiliani**. The copulatory apparatus of **G. apeva** is not inconsistent with that of **G. catharina** Hyman but the pharynx of the latter was described as "simple tubular", whereas that of **G. apeva** is collar-shaped.

GEOPLANA ASSU, n. sp.

Localities: Blumenau, S. C. (type locality): 4 specimens, June 23 — July 2, 1953.

Rio do Testo, S. C.: 1 specimen, July 1, 1953.

Measures, in mm., of three sectioned worms:

Specimen	Length	Width	Mouth	Gonopore	Penis Papilla:	
					Length	Diameter
a	104	9	66	80	7.3	1.2
b	100	10	60	75	1.5	1.8
c	84	10	56	69	4.6	1.2

Specimen **b** had an egg capsule inside the genital atrium (Fig. 49). The larger specimens were 110 mm. long by 9 mm. broad, creeping (Fig. 38).

A large, flat and broad species. Creeping, there appears along the middle of the back a low keel, the margins of the body are subparallel, and the body tapers gradually to the anterior end, more abruptly to the posterior end. At rest, the body becomes much shorter and broader (Fig. 37). To the naked eye, the dorsal side is dark grey with lighter margins and with a darker line along the median keel; the ventral side is brown with dark grey border. Magnified (Fig. 41), the dorsal colour pattern appears as numerous close-set small dark grey spots on a light brown ground; the ventral, as fine dark brown pigment dots evenly distributed.

The eyes circle the anterior tip in an irregular row (Fig. 40). Backwards they increase in number and spread progressively on each side to about one fourth of the dorsal surface (Fig. 41). Shortly in front of the pharynx they begin to get sparser. The eyes are surrounded by small light halos.

The pharynx (Fig. 42) is collar-shaped but the pharynx pocket extends well beyond the caudal insertion of the pharynx.

A pair of ventrolateral processes of the seminal vesicle receive each an efferent duct (Figs. 43, 44, and 49, d). The ental part of the seminal vesicle is slightly dilated and vertical. The ectal, tubular and bent, enters the penis bulb (b) and continues as the ejaculatory duct (e). Both the seminal vesicle and the penis bulb are small in relation to the size of the penis papilla (p). The vesicle, as well as the ejaculatory duct, receive eosinophilous glands. The penis papilla is long, filling up the genital atrium (a), and is traversed by the sinuous ejaculatory duct. In specimen **a** (Fig. 43) the papilla is much

extended, pushing before it the posterior wall of the genital atrium, and displacing the vagina (v), which normally issues from the posterior end of the atrium, to a dorsal position. In specimen **b** (Fig. 49), due to the presence of an egg capsule inside the greatly enlarged genital atrium, the papilla is strongly contracted. The penis is highly muscular, the muscularis of the seminal vesicle, of the ejaculatory duct, and of the papilla being particularly well developed. The epithelium of the penis papilla is nonciliated, irregular, and traversed by numerous ducts of weakly eosinophilous glands and of some cyanophilous ones; around the root of the papilla open more strongly eosinophilous glands. The atrial epithelium is also nonciliated, higher and more irregular on the female side; both eosinophilous and cyanophilous glands, not numerous, discharge into the atrium. The gonopore is located approximately at the end of the first third of the atrium.

Under a fallen log, near one of the collected specimens, we found an egg capsule 7-8 mm. in diameter. Nine days later hatched from it 5 young worms (Fig. 39), almost certainly of the present species. Creeping, the largest was 18 by 3 mm., the smallest, 12 by 2.5 mm. Along the middle of the back ran a deep yellow stripe; the rest of the back was pink to wine-coloured, with dark grey margins in some specimens.

The vitellaria are mature in specimens **b** and **c**, spent in specimen **a**. The oviducts (o) rise obliquely well beyond the gonopore, at the sides of the last third of the genital atrium, then run mesially to unite into the common glandular duct (q). Shell glands (z) open also at the ectal ascending and at the transverse portions of the oviducts. The common glandular duct is long, directed backwards and downwards, and is continuous with the vagina. The latter is a tubular extension of the genital atrium.

Remarks: *Geoplana assu* is similar, as regards the size, shape, and colour pattern, to *G. carinata* Riester and *G. livae* Marcus. It differs from these two species in its more homogeneous coloration, especially of the ventral side (it is true, however, that in some rare specimens of *G. carinata* the ventral

side is not spotted). Also, the young of *G. carinata* are more drab coloured (those of *G. divae* are still unknown). As regards the copulatory apparatus, *G. assu* must be distinguished from the two named species because the penis papilla is, normally, two to more than three times longer than in both *G. carinata* or *G. divae*.

G. catharina Hyman, 1955, also from the State of Santa Catarina, agrees well in the distribution of the eyes, the colour pattern (except the light median line), and in other external characters with *G. assu*. The copulatory organs are also similar. However, the pharynx, examined by Hyman only in the cleared worm, is described as simple tubular, whereas that of *G. assu* is collar-shaped.

G. catharina, *G. apeva*, and *G. assu*, as regards size and shape of the body, belong undoubtedly to the group of the large, broad and flat species (Group B of E. M. Froehlich, 1955, p. 328). The copulatory apparatus also conforms to the general types of the group, excepting, particularly in *G. assu*, the large size of the penis papilla. The inclusion of these species in group B makes natural the inclusion of *G. burmeisteri* M. Schultze too, whose remaining characters agree with those of this group.

GEOPLANA FITA, n. sp.

Locality: Blumenau, S. C.: 5 specimens, June 23 — July 2, 1953.

Measures, in mm., of two sectioned specimens:

Length	Width	Mouth	Gonopore
100	2.3	64	80
64	1.6	40	50

A very long and slender species (Fig. 45), the bigger of our specimens being 110 mm. long by 2 mm. broad, creeping. The margins are parallel along the greater part of the body; the anterior tapering is gradual, the posterior more rapid; both ends are blunt. The dorsal ground colour is light straw-

yellow, a little darker at the margins; at the cephalic region it acquires a ferruginous tint, also darker at the margins, and at the anterior tip it darkens even more, becoming brownish. On the back, there are two pairs of narrow longitudinal ferruginous stripes, a darker mesial pair and a lighter submarginal one. At the cephalic region (Fig. 46) there is a fine median dark line. All the stripes end, without fusion with the others, near to the extremities of the body, except the submarginal, which, one specimen excepted, unite at the posterior end (Fig. 46). The ventral side is white.

The eyes (Fig. 47) are marginal, in one row. The pigment cups present commonly a diameter of 21-26 μ .

The pharynx (Fig. 48) approaches the campanuliform (glockenförmig) type of Graff. Its border is richly folded.

The efferent ducts (Figs. 50, 51, d) full of spermatozoa in both sectioned specimens, turn mesially near to the copulatory complex and open at the lateral walls of the seminal vesicle (s). The vesicle is very long, extending, in one specimen (Figs. 51-52) for 4.2 mm. in front of the openings of the efferent ducts. The lining epithelium of the vesicle is cubical, ciliated, and traversed by ducts of numerous eosinophilous and sparse cyanophilous glands. On entering the muscle coat of the male atrium, the seminal vesicle narrows to the ejaculatory duct. The ectal half of this duct is narrower, and more regular in form than the ental half. A penis papilla is absent, the ejaculatory duct opening dorsally into an atrial recess bounded by folds which take the shape of a copulatory papilla. Numerous cyanophilous glands (y), interspersed with eosinophilous ones, open on these atrial folds. The male atrium (am) is rather elongated, with folded walls, the more ectal dorsal fold (x) separating it from the common genital atrium. This fold runs diagonally, so that to one side the gonopore canal leads directly to the male, to the other side to the common atrium. The male atrium is lined by a nonciliated cubical to low columnar epithelium. Besides the special glands already referred to, it receives eosinophilous and, ectally, cyanophilous glands.

The yolk glands are mature in both specimens. The oviducts (o) rise at the sides of the gonopore (g), turn mesially, and unite into the common glandular duct (q). The transverse glandular duct is long, dorsally situated, and directed backwards; it opens dorso-posteriorly into the female atrium (f). The female atrium, separated from the common by one or by a pair of lateral slanting flaps (fl), is lined by an irregular pluristratified epithelium provided with lacunae into which accumulates the secretion of numerous subepithelial cyanophilous glands. The common atrium receives sparser cyanophilous glands and is lined by a simple, nonciliated epithelium with irregular border toward the female atrium.

Remarks: The species that stands closest to *Geoplana fita* is *G. caissara* E. M. Froehlich, but the former is much longer and more slender than *G. caissara*, and has four dorsal longitudinal dark stripes, against five on the latter. As regards the copulatory organs, the seminal vesicle of *G. caissara* is longer, provided with numerous irregular projections, and it forks at the anterior portion into two branches, which may lie at the sides of the pharynx pocket; in *G. fita* the vesicle presents no projections and its anterior end, not forked, stands at a distance from the pharynx pocket.

GEOPLANA GAUCHA, n. sp.

Locality: São Salvador, Montenegro municipality, R. G. S.: 2 specimens, Sept. 1955; Prof. Dr. J. Hauser, S. J., col. According to the collector, a common species at that locality, and also at Pôrto Alegre, capital of the State.

Measures, in mm., of the preserved specimens:

Length	Width	Mouth	Gonopore
26.0	4.0	16.5	20.5
22.5	3.2	15.3	18.2

The ventral side is flat; the dorsal arched, but not high. A broad light-grey band, bordered by black, runs along the back. The width of the band is ca. 1/4 to 1/3 of the width of

the body. Inside the band there is a pair of brownish-grey stripes. The black border fades laterally to the colour of the latero-marginal portions of the back, which in the larger specimen is dark violet-grey, in the smaller, brownish-grey with a violet tinge. The cephalic end (Fig. 54) is grey like the margins, the stripes merging into the grey at a distance from the tip. At the posterior end, the stripes fade out before the tip, but the light zone reaches it. A light spot is present over the pharynx. The ventral side is greyish-cream with a narrow border of the dorsal colour; the anterior end is grey.

The cephalic eyes (Fig. 54) are marginal, in one row. At 3.5 to 4 mm. from the tip the eyes begin to spread onto the dorsal side; the maximum spread (Fig. 55) is slightly over one fourth of the body width on each side. The dorsal eyes are located in the centre of small light halos, almost invisible to the naked eye. The larger eye-cups are ca. 40 μ across.

The pharynx (Fig. 56) is typically cylindrical. The pharynx pocket is relatively small, with the mouth at its posterior part.

In the larger specimen, which is more mature than the smaller, the male genital system is well developed, but the female is still unripe. Except for some minor differences due to age, the anatomy of the copulatory apparatus of both specimens agree entirely. The description is based on the more mature specimen.

The seminal vesicle forks anteriorly into two branches (Fig. 57, s_1), and each receives laterally the corresponding efferent duct (d). The branches extend anteriorly to the vicinity of the pharynx pocket (t). The vesicle (s_1 , s_2) receives eosinophilous and purple glands, is lined by a columnar nonciliated epithelium, and has a rather strong muscularis. On entering the weak penis bulb (b), the vesicle narrows to the ejaculatory duct (e), which has a weak muscularis, and which presents two portions. The ental one receives fine-grained purple glands and is lined by a nonciliated epithelium; the ectal one receives rare glands and its lining epithelium is ciliated. The ejaculatory duct

traverses the penis in a simple course, slightly bent downwards, and opens at the tip of the papilla (p). The penis papilla is small, cylindroid, and weakly muscular; it almost fills up the male atrium (a). The epithelium of the apical half of the papilla is low and insunk; toward the base it becomes normal, columnar, similar to that of the atrium. On the surface of the papilla open numerous eosinophilous glands of two kinds, one of coarser granulation and bright red, the other finer and with a bluish tint. At the base, chiefly dorsally, there are also cyanophilous glands. The male atrium narrows ectally and is distinct from the female atrium. It is lined by a nonciliated columnar epithelium and receives eosinophilous glands.

Vitellaria are still absent. The oviducts (o) rise at the level of the gonopore (g), turn mesially, and unite into the common glandular duct (q). Shell glands (z), still in early stages of development, open into the oviducts from the middle of the ascending portion on, and into the common glandular duct. This duct curves gently backward and downward, and opens into the female atrium (f). The lumen of the female atrium is restricted to a central narrow passage, all the rest of the atrium being filled by a compact mass of small cells (r). Some eosinophilous and cyanophilous glands traverse this mass of cells to open into the lumen. The gonopore canal issues between the two atria. It is asymmetrical, one side leading to the male atrium, the other to the female, the median part being common.

Remarks: The colour pattern of *Geoplana gaucha* is distinctive. Only *G. doederleini* Schirch presents a similar pattern, but it is much lighter, the median light zone is broader, and the latero-marginal zone is spotted.

The copulatory apparatus is very similar to that of *G. multicolor* Graff as regards the female part, the asymmetry of the gonopore canal, and the shape and size of the penis. The long paired extensions of the seminal vesicle, into which open the efferent ducts, is, besides the colour pattern, a disjunctive character.

GEOPLANA GLIESCHI, n. sp.

Locality: Iraí, R. G. S.: 1 specimen, Oct. 1953; Prof. Dr. Rudolf Gliesch col.

The preserved worm (Fig. 60) is 120 mm. long and ca. 10 mm. broad. The body is broad and flat, tapering at both ends; the margins are subparallel, and, along the greater part of the length of the body, they have rolled to the ventral side. The anterior tip is damaged. The mouth is located at 70 mm., the gonopore at 88 mm. from the anterior end.

The dorsal surface is black. In front of the pharynx the pigment had been rubbed off along two bands (Fig. 58), and in the cleared worm the testes could be seen in these regions as light spherules. The ventral side is light brownish-orange with dark borders.

The small eyes (Fig. 58) are located in the centre of small light halos. The eyes spread on the dorsal surface to a maximum of one seventh of the body width, on each side.

The pharynx (Fig. 59) is cylindrical, with caudally displaced dorsal insertion and folded border. The pharynx pocket is long, extending to the vicinity of the seminal vesicle.

The seminal vesicle (Fig. 61, s) is irregular, not much dilated, and lined by an epithelium provided with long cilia; it receives lightly stained purple glands. The ental part of the seminal vesicle extends each side as short transverse processes that receive the efferent ducts (d). Inside this transverse portion of the vesicle is found a mass of spermatozoa. On entering the small, muscular penis bulb (b), the diameter of the vesicle decreases as it becomes the ejaculatory duct (e). This duct, histologically similar to the vesicle but with few glands, traverses longitudinally the penis papilla, following the curve of the latter. The penis papilla (p) is rather long, muscular, and is bent to the ventral side; its covering epithelium is non-ciliated, columnar, and is traversed by ducts of cyanophilous and of slightly stained glands, the latter occurring chiefly near the tip. The genital atrium (a) is lined by a nonciliated co-

lumnar epithelium higher in its female part, and it receives cyanophilous glands.

Vitellaria wholly mature. Shell glands (z) open into the ectal transverse portion of the oviducts (o) and into the common glandular duct (q); the latter is dorsal, directed backwards and downwards, and opens into the vagina, a narrow upturned portion of the female atrium (f). The strong muscle coat of the female atrium is independent from that of the male.

Remarks: *Geoplana glieschi* belongs to the group of the large, broad and flat species of *Geoplana* (Group B, E. M. Froehlich, 1955, p. 328). It presents, like the heterogeneous material classified as *G. rufiventris* by Graff, a rufous ventral side and a dark dorsal side. In *G. glieschi*, however, the dorsal coloration is a homogeneous deep black, against a spotted, marbled or brown one in Graff's *G. rufiventris*. The topography of the copulatory apparatus of *G. glieschi* conforms to that of Graff's description and figure of *G. rufiventris*, but the pharynges are different, cylindrical in *G. glieschi* and collar-shaped in *G. rufiventris*.

G. burmeisteri M. Sch., *G. applanata* Graff, *G. dictyonota* Riest., *G. itatiayana* Schirch, *G. apeva*, n. sp., and, in part, *G. assu*, n. sp. are species with a reddish ventral side and belong to the same group as *G. glieschi*. None of them has, however, a uniform black back. Besides, *G. burmeisteri* has a shorter and more cylindrical pharynx, *G. applanata* and *G. itatiayana* shorter and more massive penis papillae, *G. dictyonota* intrabulbar seminal vesicle, and *G. apeva* and *G. assu* collar-shaped pharynges.

GEOPLANA HAUSERI, n. sp.

Locality: São Leopoldo, R. G. S.: 1 specimen, Jan. 1955; 3 specimens, Oct. 1956; Prof. Dr. J. Hauser, S. J., col.

Measures, in mm., of the preserved specimens:

Specimen	Length	Width	Mouth	Gonopore
a	73	4	49	62
b	84.4	4.0	54.4	71.8
c	42.6	3.4	27.6	36.0
d	61.3	3.5	46.4	56.0

Specimen **a** collected Jan. 1955; specimens **a**, **b**, and **c** were sectioned. Creeping, specimen **c** was 80 mm. long by 5 mm. broad; the body was flattened, with almost parallel margins, narrowing rather abruptly at both ends.

The dorsal surface (Fig. 67) presents a greyish-brown pigment on a light yellow ground. Along the back runs a lighter stripe, ca. 1 mm. broad, due to a thinning of the dark pigment. At the borders of the light stripe the pigment is darker than on the rest of the back. The ventral side is ivory.

Beginning at the anterior end, the small and numerous eyes (Fig. 68) spread onto the dorsal surface, leaving free only the median stripe.

The pharynx (Fig. 69) is long, collar-shaped, with richly folded border.

The efferent ducts (Fig. 70, d), full of spermatozoa in all specimens, enter the common muscular coat (mc) of the copulatory apparatus and turn forward before opening into the ental paired portions of the seminal vesicle. These portions run forward and unite (at x) into the interrogation mark- or S-shaped common part (s). The paired portions and the ental part of the common receive fine-grained eosinophilous glands; the glands of the ectal are separated by a short narrow portion with rare glands. The lining of the vesicle is folded and ciliated. The rather short ejaculatory duct (e) presents a narrow lumen, is lined by a regular ciliated epithelium, and receives sparse fine-grained eosinophilous glands. A penis is absent. The male atrium (a), separated from the female by oblique folds, is ample, with folded walls. Near its ental end there are two conspicuous glandular rings, of which the first (ys) is made up of heavily stained eosinophilous glands, the second (yw), of lightly-stained eosinophilous glands interspersed with

sparse cyanophilous ones. Ectally to these rings, the male atrium receives both eosinophilous and cyanophilous glands. The male atrium is lined by a low columnar epithelium, ciliated in its ental part to a different extent in the various specimens, nonciliated in the rest. The muscle coat of the male copulatory complex is strong.

The vitellaria are fully mature in the two bigger specimens. The oviducts (o) turn mesially ca. 2 mm. behind the gonopore without rising and unite into the ascending common glandular duct (q), which is continuous with the horizontal vagina. Shell glands (z) open also into the transverse portions of the oviducts. The vagina is lined by a pluriserial ciliated epithelium, and receives eosinophilous and sparse cyanophilous glands. The female atrium (f) is simple, rather long, and is lined by an epithelium similar to that of the vagina. The muscle coat of the female atrium and vagina is much weaker than that of the male.

Remarks: *Geoplana hauseri* belongs to Group A (E. M. Froehlich, 1955, p. 327), a very homogeneous group of species of *Geoplana*. Within the group, *G. hauseri* stands very near to *G. rosea* E. M. Froehlich. Externally, the chief difference is the broader median stripe, a character that may be subject to individual variation and, therefore, not of much weight. Some differences in the copulatory apparatus of these two species, however, force their separation. The principal are: 1. *G. rosea* presents two seminal vesicles connected by a narrow canal, and the ental vesicle is not forked, whereas *G. hauseri* presents one vesicle forked entally; 2. in *G. rosea* does not occur the glandular rings in the ental part of the male atrium; 3. the lining of the vesicle is folded in *G. hauseri*, smooth in *G. rosea*; and 4. the muscularis of the male atrium is much stronger in *G. hauseri*.

The worms Graff (1899, p. 299) classified as *G. maximiliani* present a great external similarity to *G. hauseri*, but in Graff's species the pharynx is cylindrical with caudally displaced dorsal insertion (l. c., p. 101).

GEOPLANA NATALIAE, n. sp.

Locality: Blumenau, S. C.: 1 specimen, July 31, 1955; Natalia Gabrusewycz col.

The preserved worm (Fig. 62) is 52 mm. long by 6 mm. broad; the mouth is at 30 mm., the gonopore at 40 mm. from the anterior end. The body is rather thick with rounded borders. It tapers more gently to the anterior end than to the posterior. The anterior third is coiled up. The dorsal side is deep black. The ventral is brownish-grey, darker toward the margins and at the extremities. Ventro-marginally runs a light line, light-grey to orange, that corresponds to the sensory border.

The eyes are marginal and located at the centre of small light halos. In the cephalic region (Fig. 63) they are pluriserial and closely set, backwards they get progressively sparser.

The pharynx (Fig. 64) is short and broad, of the cylindrical type with caudally displaced dorsal insertion, approaching the bell-type of Graff.

The efferent ducts (Fig. 65, d), full of spermatozoa, bend mesially and forward before entering each into a branch of the entally forked seminal vesicle (s). The paired and the ental common portions of the seminal vesicle are outside the penis bulb (b) proper but are enclosed by some muscle fibres derived from the latter. The seminal vesicle receives abundant secretion from extrabulbar eosinophilous and cyanophilous glands. It is lined by a columnar epithelium, much folded in the bulbar portion; cilia were not ascertained. The bulbar portion is much dilated and its lumen is nearly filled up with secretion (se). The muscularis of the vesicle is rather weak. The vesicle opens into the ejaculatory duct by a narrow passage located at a small papilla-like projection into that cavity. The penis bulb is strongly muscular. The penis papilla (p) is short and broad. The ejaculatory duct is very ample, forming an ejaculatory cavity (ce); it opens into the male atrium by a vertical slit. Both the ejaculatory cavity (except the small dorsal recess, n) and the penis papilla are covered by a

low columnar, nonciliated epithelium whose cells store the secretion of eosinophilous subepithelial glands; cyanophilous glands are also present. The basement membrane (Figs. 65, 66, mb) is very thick (ca. 30 μ , locally), thicker even than the epithelium. It is also thick in the ental part of the male atrium (Fig. 65, a), but ectally thins out progressively to a tenuous layer before the middle of the atrium. The muscularis of the ejaculatory cavity and of the papilla are strong. The dorsal recess is connected to the ejaculatory cavity by a narrow horizontal slit. The principal histological peculiarities of the recess are: 1. it receives only cyanophilous glands, 2. its lining epithelium is more irregular, 3. the basement membrane is thin, and 4. the muscularis is weak.

The male atrium is long and ample. It is lined by a high, irregular, nonciliated epithelium, except in the immediate neighbourhood of the papilla, where its epithelium is similar to that of the latter. The epithelial cells of the ental half store cyanophilous and some eosinophilous secretion from subepithelial glands at its apical half. The ectal, narrower half of the atrium receives numerous eosinophilous and some cyanophilous glands. The apical ends of the epithelial cells release secretion-containing globules. The musculature (mc) of the male atrium is strong.

The vitellaria are fully mature. The oviducts (o) begin to rise shortly in front of the gonopore (g). Shell glands (z) open into the final part of the oviducts, and into the common glandular duct (q); this duct is short, directed downward and backward, and is continuous with the rather short vagina. A female atrium is lacking, the vagina opening directly into the male atrium close to the wide open gonopore. The vagina is lined by a high columnar, irregular epithelium, and receives the same glands as the adjacent atrium, but it does not produce the secretion globules. The whole copulatory apparatus is enveloped by a common muscular coat.

Remarks: The homogeneous black dorsal surface is shared by *Geoplana nataliae* with several other species of the genus: *G. atra* Fr. Müll., *G. preta* Riest., *G. astraea* Marc., *G. plumbea*

C. G. Froeh., and *G. glieschi*, n. sp., from Brazil; *G. talpa* du B.-R. Marc. and *G. idaia* du B.-R. Marc. from Peru; and *G. eugeniae* Graff from Paraguay. The first four are small species, *G. glieschi* is very large, *G. talpa* and *G. idaia* are shorter and relatively much broader, and *G. eugeniae* has a similar shape but is much smaller. As regards the anatomy of the copulatory organs, *G. nataliae* readily distinguishes itself from all the referred species and presents an isolated position within the genus.

GEOPLANA SUVA, n. sp.

Locality: Blumenau, S. C.: 3 ripe specimens, June 22 — July 2, 1953.

Measures, in mm., of two sectioned specimens:

Length	Width	Mouth	Gonopore
20.5	2.5	14.7	17.7
16.0	2.7	12.0	13.8

This is a small species. The body (Fig. 71) tapers gradually to the blunt anterior end, more abruptly to the pointed posterior one.

The margins excepted, there are on the back, over a milky ground, irregular black strips which may fork or anastomose (Fig. 73). The borders of the strips are not sharp, fading to the ground colour. Toward the margins, the strips are shorter, even reduced to small rounded spots. The margins of the body are orange, turning to grey at the cephalic end. The broad creeping sole is light-grey, acquiring a dark tint at the anterior end.

The small eyes (Fig. 75) are restricted to the margins. The pigment cups are commonly 20-25 μ across, the largest attaining 32 μ .

The pharynx (Fig. 74) is a long tube; the ventral insertion is more anterior than the dorsal, and the border has few folds. The mouth opens near the posterior end of the pharynx pocket.

The efferent ducts (Figs. 76, 77, d) overpass the first seminal vesicle (s_1), then loop forward to enter into it. The first vesicle is connected to the second (s_2) by a narrow canal. Both vesicles are irregular and lined by a ciliated columnar epithelium; the first receives a homogeneous, weakly-stained secretion; the second, a granular secretion (y) that takes both eosin and haematoxylin in one specimen, almost only eosin in the other. The outer part of the muscular coat is common to both vesicles. The inner is separate. Both vesicles are extrabulbar. The ciliated ejaculatory duct (e) traverses almost straightly the small, slightly elongate to globular penis papilla (p). Both papilla and male atrium are lined by a low, irregular epithelium provided with a cyanophilous border. The male atrium is comparatively ample.

Vitellaria mature in both specimens. The oviducts (o) begin to rise shortly in front of the gonopore (g), and unite dorsally into the common glandular duct (q). The ectal part of the oviducts also receives shell glands (z). The common glandular duct, directed caudally, opens into the dorsal part of the female atrium (f). The ental portion of the female atrium is globular, the ectal tubular, between them occurring a small constriction. The globular and part of the tubular portions of the female atrium are lined by a high pluristratified mass of cells (r). In this mass, the cells are closely packed but leave between them small reticulate spaces. There are also some larger lacunae, commonly containing degenerating cells. In one specimen there are spermatozoa inside the female atrium, the common glandular duct, and the oviducts, what indicates recent copulation. Those sperms inside the female atrium are mixed in part with eosinophilous secretion and many of them are directed to the cell mass, some even penetrating into lacunae of the same. The reticulate spaces contain, in this worm, cyanophilous granules. The ciliated gonopore canal issues between the two atria; the female atrium is ciliated ectally and partially also where the lining is pluristratified.

Remarks: Among the species of *Geoplana* provided with a mass of cells in the female atrium, *G. multicolor* Graff, *G. phocaica* Marc., *G. preta* Riest., and *G. incognita* Riest. probably constitute a natural group (E. M. Froehlich, 1955, p. 329), and it is in this group that *G. suva* and, also *G. gaucha*, n. sp., should be placed. As regards the colour pattern, *G. suva* is quite distinct from the referred species, for only *G. phocaica* is spotted, but it has not the orange margins, and presents a spotted creeping sole and dorsal eyes. As regards the copulatory apparatus, *G. suva* stands closer to *G. preta*, but in the latter there is no canal separating two seminal vesicles; the seminal vesicle being simple or at most provided with a constriction (Riester, 1938, p. 37, fig. 38). *G. goettei* Schirch presents, like *G. suva*, a mass of cells in the female atrium, and two vesicles connected by a narrow canal, but *G. goettei* has a larger and more muscular penis papilla than *G. suva*, besides the differences in size, shape, and colour pattern.

CHOERADOPLANA IHERINGI Graff

Choeradoplana iheringi Graff, 1899, p. 395 ["Taguara do mundo novo, Prov. Rio Grande do Sul", Brazil].

Choeradoplana iheringi, Riester, 1938, p. 75.

Choeradoplana iheringi, Marcus, 1951, p. 103.

Locality: São Leopoldo, R. G. S.: one specimen, Prof. Dr. J. Hauser, S. J., col.

GEOPLANA BECKERI, n. sp.

Locality: Chapada, environs of Salvador, Bahia: 3 specimens, July 20, 1955; J. Becker col.. The worms were found under a gneiss stone lying on lateritic soil. The locality was relatively dry, with a cover of loose shrubby vegetation. The worms were preying on small snails.

Measures, in mm., of the preserved worms:

Specimen	Length	Width	Mouth-Gonopore	Gonopore-
				Posterior tip
a	22	3.8	3.7	7.0
b	26	3.2	3.5	8.2
c	20	3.0	3.8	6.7

Specimen **b** had lost the tip of the fore end; specimen **c**, a larger piece, probably 2-3 mm. long, of the same end. The mouth lies, therefore, at the beginning of the second half of the body, and the genital opening at the beginning of the last third of the body.

The body (Fig. 78) is flattened. The colour of the live worms was described as presenting orange margins and a pair of stripes of the same colour along the middle of the body, the rest of the back being bright yellow. The worms were fixed in hot formalin in a tin can, and an ensuing reaction turned the colour of the worms to black. Fortunately the histology was in good condition.

The eyes spread onto the whole dorsal surface, beginning at the anterior end (Fig. 79). The diameter of the larger eye cups is about 35 μ .

The pharynx (Fig. 80) is a long tube, 2.1 mm. long in a sectioned worm. The dorsal insertion is more posteriorly located than the ventral. The lumen of the pharynx presents longitudinal folds. The mouth lies shortly in front of the middle of the pharynx pocket.

Two worms were sectioned. Both are mature, and agree perfectly in the structure of the copulatory apparatus. The efferent ducts (Fig. 81, d), full of spermatozoa, curve mesially and forwards to enter into the short paired ental portions of the seminal vesicle. The final portions of the efferent ducts have few or no spermatozoa. The tubular vesicle (s) lies outside the penis bulb (b), but is surrounded by sparse fibres derived from the latter. The ental part of the common portion of the vesicle loops forward and dorsally; the ectal part is contorted. The epithelium of the vesicle is columnar ciliated and is traversed by ducts of strongly eosinophilous granular glands and of weakly stained glands. The ducts of the latter

form a mass of alveolar appearance between the epithelium and the weak muscularis; its cell bodies lie nearby. The musculature of the penis bulb is not strong, and the bulb is not sharply delimited against the surrounding parenchyma. The ectal part of the vesicle narrows gradually, but on entering the penis bulb it narrows more abruptly to become the ejaculatory duct. The epithelium of the latter is nonciliated; in the ental half of the duct (e_1) it is irregular and cubical to low columnar, in the ectal half (e_2), flattened, what is probably due to stretching resulting from a great accumulation of glandular secretion (u) at the tip of the penis papilla. The alveolar coat of gland ducts of the vesicle continues around the ejaculatory duct but decreases progressively in thickness, disappearing where the epithelium becomes flattened. The ejaculatory duct is nearly straight and opens at the tip of the penis papilla. The latter (p) is conical, but its apical part is dilated by the accumulation of secretion referred above. This secretion is strongly eosinophilous and is produced by extrabulbar glands. The male atrium (a) is simple, lined by a columnar epithelium higher ectally, and receives the secretion of eosinophilous glands; dorsally open the ducts of numerous fine-grained neutrophilous (purple) glands (w).

The yolk glands are mature in both specimens. The oviducts (o) rise approximately at the level of the gonopore (g). Shell glands (z) open into the transverse portions of the oviducts and into the common glandular duct (q). The latter runs backward and opens dorsally into the ental, globular half of the female atrium (f). The ectal half of the same is more tubular, and is separated from the ental by a constriction. The lining epithelium of the female atrium is high, pluriserial in the ectal half to pluristratified in the ental. The female atrium receives sparse eosinophilous glands. Its muscularis is relatively strong, chiefly at the globular portion. Male and female atria are not sharply separated from each other, the gonopore canal issuing between the two.

Remarks: *Geoplana beckeri* cannot be identified with the previously known species from Bahia, *G. flava* Mcs., 1877, for

it lacks the glistening white longitudinal stripes on the back present in the latter. Moreover, in *G. beckeri* the eyes spread onto the whole of the dorsal surface, whereas in *G. flava* they spread but little from the margins (Moseley, 1877, p. 283; Graff, 1899, p. 345, pl. 3 fig. 31). The copulatory apparatus of *G. flava* has not been described.

G. beckeri distinguishes itself also from the other species of the genus by the colour pattern and by the anatomy of the copulatory organs.

REMARKS ON THE STATUS OF FRITZ MÜLLER'S SPECIES OF LAND PLANARIANS

Fritz Müller, in a letter to Max Schultze published together with observations by the latter in 1857, described 13 species of *Geoplana*. This letter seems to be the first scientific paper Müller got published about the Brazilian fauna, and it is his only contribution on land planarians. His descriptions are very short, and commonly insufficient to define clearly a species, but in general also clear enough to show what worms cannot be of any of his species. Graff (1894, 1899) tried to make good use of Müller's species but he was on the whole very unfortunate in his identifications, as we shall see presently. Seven of Müller's species remain obscure. They are *G. tristriata*, *G. octostriata*, *G. marginata*, *G. rufiventris*, *G. olivacea*, *G. nephelis*, and *G. maximiliani*. A clear redescription of them will only be possible by a thorough field work at the type locality (Blumenau, State of Santa Catarina).

1. *GEOPLANA TRISTRIATA* Fritz Müller

In Müller's time this was a common species at Blumenau, but we couldn't find any during our two-week stay at that locality in the winter of 1953.

Hermann v. Ihering sent to Graff a three-striped worm he collected at Taquara, State of Rio Grande do Sul, and suggested it could be *G. tristriata*, a suggestion Graff accepted. There are,

however, several differences that make this identity improbable: a) the shape of the body is different, Müller's species being broader; b) in Müller's species the greatest width of the body, and there also the mouth, are situated behind the second third of the body; in Graff's, the mouth is at about three fifths of the length of the body; c) Müller's species presents three longitudinal narrow dark lines; in Graff's, at least the lateral stripes are much broader. However, as neither Müller's, nor Graff's species have been found again, both remain obscure.

2. *GEOPLANA OCTOSTRIATA* Fritz Müller

Geoplana sexstriata Graff could be a synonym of this species, but only the study of eight-striped specimens from the type locality can settle this problem. The eight-striped worm Graff had from Rödersburg, State of Rio Grande do Sul, probably was correctly identified. Schirch's *G. octolineata* is a synonym of *G. sexstriata* (du B.-R. Marcus, 1951, p. 236), and the same may be the case with his *G. octostriata*.

GEOPLANA ELEGANS Fritz Müller

A homonym of *G. elegans* (Darwin), Diesing, 1862, renamed it *G. mülleri*. During our stay in Blumenau this was a common species, and we collected a rich material. We have analysed it in this paper.

GEOPLANA PALLIDA Fritz Müller

Diesing, 1862, renamed this species *G. schultzei*, because it was a homonym of *G. pallida* (Darwin). We have had several specimens of this form, and its study led us to consider it a synonym of the preceding species.

GEOPLANA ATRA Fritz Müller

In a former paper (C. G. Froehlich, 1957) we described a small black species, of which we had specimens from the State

of Paraná, and from Blumenau and nearby localities. As it differed in its internal anatomy from the worm Graff considered to be *G. atra*, we named it *G. nana*. As our species, however, agrees perfectly with Müller's description and occurs in the type locality, we conclude it to be a synonym of *G. atra* Fr. Müll., and Graff's *G. atra* from Taquara, Rio Grande do Sul, to be another species. We rename it *G. nigra*, nom. nov.

6. *GEOPLANA MARGINATA* Fritz Müller

It is clear from Müller's description that *G. marginata* is a dark ("Rücken und Bauch dunkelschwarzbraun glänzend"), large ("3-4 Zoll lang") and broad ("einige Linien breite") species provided with one pair of mesial and one of marginal yellow stripes. Graff (1894, 1899) considered an elongate, light-coloured, five-striped species to belong to *G. marginata*, and he even employs the term "typical" to the five-striped worms. Graff's identification is surely mistaken, but unfortunately it has been accepted by several authors, the present writer included. In a future paper we shall discuss Graff's species, which evidently cannot stay under Müller's name. As regards *G. marginata* var. *abundans* Graff, which we have raised to specific status, see above.

G. marginata, Schirch, 1929, and *G. marginata*, Riester, 1938, are synonyms of *G. caissara* E. M. Froeh. (E. M. Froehlich, 1955, p. 295). In Riester's paper, where he refers to the external features of *G. marginata* (l. c., p. 30), the remarks he attributes to Müller are really H. von Ihering's (cf. Graff, 1899, p. 306).

7. *GEOPLANA RUFIVENTRIS* Fritz Müller

Fr. Müller's *G. rufiventris* presented a dark brown back and a brick-red ventral side. Several "large, broad, and flat" species of *Geoplana* have a dark back and a reddish ventral side, and Graff, misguided by these characters, lumped a heteroge-

nous material into **G. rufiventris** (cf., e. g., Riester, 1938, p. 53). Only one of Graff's specimens can, with reasonable certainty, be considered as **G. rufiventris**: it is the worm collected at Blumenau by G. W. Müller, for both the locality and the colour are the same as those of Fr. Müller's specimen (Graff, 1899, p. 296, pl. I figs. 26-27). Graff's anatomical analysis of **G. rufiventris** is also impaired by the fact that he doesn't indicate which specimens he studied.

G. rufiventris, Schirch, 1929, is a synonym of **G. applanata** Graff (C. G. Froehlich, 1955b, p. 192).

8. GEOPLANA OLIVACEA Fritz Müller

G. olivacea is a long and slender species, as can be inferred by comparison with the description of **G. nephelis**. Here Graff lumped also at least two species, one represented by some fragments collected at Blumenau by G. W. Müller, the other (or others) by several specimens from Argentina and Chile. The fragments from Blumenau present a slender shape and the same colour pattern as Fr. Müller's, the difference in hue being probably due to the preservation. The specimens from the other localities are much broader and flatter, despite the similarity in colour pattern. These should be removed from **G. olivacea**, but as their status is obscure, it is better not to rename them as yet. The name **G. olivacea** must be restricted, therefore, to the fragments from Blumenau.

G. olivacea, Busson, from Colombia, is also a large, broad and flat species, and must also be removed from **G. olivacea** Fr. Müll.. At it is well analyzed anatomically, we rename it **Geoplana bussoni**, nom. nov..

9. GEOPLANA NEPHELIS Fritz Müller

G. nephelis is also an elongate species, with uniform brown back and a lighter ventral side. In colour and shape it reminds one of a **Nephelis**, says Müller. Graff (1899, p. 337) put into this species a material from the Berlin Museum that had no

data about its provenance, and a material collected by Michael- sen in Chile. The material from the Berlin Museum was analysed anatomically by Graff. It presents ventral testes, part of the male efferent system ventral to the nerve plate, and longitudinal parenchymal muscles in the peripheral parenchyma (Graff, l. c., pl. 26 figs. 1-2). Besides, the copulatory apparatus presents a general resemblance to that of ?*Coenoplana munda* (Graff, l. c., p. 191 fig. 41 and 42). As we have already indicated (C. G. Froehlich, 1955a, p. 200), the provenance of the material from the Berlin Museum must be sought in the Indo-Pacific region, and it cannot be *G. nephelis* Fr. Müll. because it isn't even a *Geoplana*. It may be put tentatively into the genus *Coenoplana* Moseley, 1877 (cf. C. G. Froehlich, l. c., pp. 200, 246), and we rename it ?*Coenoplana graffi*, nom. nov.. As regards the material from Chile, without an anatomical study it cannot be called *G. nephelis* with any certainty, for the land planarian fauna of Chile differs considerably from that of Brazil. *G. nephelis*, Graff is, in conclusion, heterogeneous, and the possibility that at least the Chilean material could remain in Müller's species is remote.

10. GEOPLANA MAXIMILIANI Fritz Müller

Almost as the preceding, says Müller, with a lighter yellowish longitudinal stripe. The penis is nearly spherical, the pharynx deeply 5-lobed. Being similar to *G. nephelis*, *G. maximiliani* must also be elongate, but less so than *G. olivacea*. Graff (1899, p. 299) classified as *G. maximiliani* some specimens H. von Ihering sent him from Taquara, but his justification for doing so is not stated with much conviction (l. c.). We cannot agree with Graff's identification, for his specimens belong to a very elongate species, the colour has a violet shade not referred to by Müller, and, chiefly, because the unripe copulatory apparatus (similar to that of his "*G. burmeisteri*") lacks a penis. In those species that possess one, the penis differentiates very early in the development of the copulatory apparatus, long before the gonopore is open. If the young copu-

latory apparatus had already an ejaculatory duct and a vesicle, as Graff (l. c., p. 16 fig. 15, p. 167, and p. 187) indicates, it should present also a penis, which Müller's species has. Graff (l. c., p. 299) states also that the distribution of the eyes of his specimens agrees with that of Müller's, but Müller says nothing about the eyes of **G. maximiliani**. Graff's species agrees very well with **G. hauseri**, the pharynx excepted, being collar-shaped in the latter, and cylindrical (type c) in Graff's material.

The shape and colour pattern of **G. maximiliani**, Schirch (1929, p. 2 fig. 10) from Teresópolis, State of Rio de Janeiro, seem to be compatible with Müller's data, but as its anatomy is unknown, and as it is from a locality far from Blumenau, nothing can be advanced about its real identity.

There is a possibility that **G. apeva**, n. sp., is a synonym of **G. maximiliani** Fr. Müll.. The reasons we considered them distinct are given in the remarks on **G. apeva**.

11. GEOPLANA MARMORATA **Fritz Müller**

We have had material from the original locality (Blumenau) and environs coinciding with Müller's description. We have redescribed it in detail, and also removed it from the synonym of **G. rufiventris** into which Graff had put it.

12. GEOPLANA PULCHELLA **Fritz Müller**

We collected an immature specimen of this species at the original locality. Although we could not describe its copulatory apparatus, the colour pattern is distinctive enough to avoid any misidentification (C. G. Froehlich, 1955b, pp. 189-90, pã 191 fig. 1).

13. GEOPLANA SUBTERRANEA **Fritz Müller**

Diesing, 1862, transferred it to a new genus, **Geobia**.

Although we had no material from the original locality, we think there can be no doubt as regards the identity of the worms classified by Riestler (1938, p. 28) and Marcus (1951, p.

106). The reasons why we have kept the genus **Geobia** are given in a former paper (C. G. Froehlich, 1955a, p. 216).

RESUMO

O trabalho presente refere-se principalmente a planárias terrestres coligidas nos Estados de Santa Catarina e do Rio Grande do Sul. Entre as espécies já conhecidas são estudadas anatomicamente **Geoplana marmorata** Fr. Müll., **G. mülleri** Dies., **G. carrièrei** Graff e **G. ladislavii** Graff. **G. marginata** var. **abundans** Graff é considerada como espécie distinta, **G. abundans**. A ocorrência de **G. pseudorhynchodemus** Riest, de **G. quagga** Marc. e de **G. tapetilla** Marc. no Estado de Santa Catarina, e novos achados de **G. velina** C. G. Froeh. em Santa Catarina e de **Choeradoplana iheringi** no Rio Grande do Sul são registrados. São descritas as seguintes espécies novas: **Geoplana apeva**, **G. assu**, **G. fita**, **G. gaucha**, **G. glieschi**, **G. hauseri**, **G. nataliae** e **G. suva**. Do Estado da Bahia é descrita **G. beckeri**, a segunda espécie descrita desse Estado.

Na parte final é discutido o status taxonômico das espécies de **Geoplana** descritas por Fritz Müller, 1856, cujas conclusões seguem:

G. tristriata, que Müller diz ter sido comum em Blumenau, não foi mais reencontrada. Graff considerou como pertencentes a esta espécie alguns vermes tristriados coligidos por H. v. Ihering em Taquara, mas provavelmente não o são. A situação de ambas é obscura.

G. octostriata também permanece obscura. **G. sexstriata** Graff poderia ser sinônimo dela.

G. elegans e **G. pallida**, por serem homônimas de espécies de Darwin, foram redenominadas **G. mülleri** e **G. schultzei**, respectivamente, por Diesing. O estudo anatômico de ambas levou-nos a considerá-las sinônimas.

G. atra. Por coincidir com a descrição de Müller e por ocorrer na mesma localidade, consideramos **G. nana** C. G. Froeh.

como sinônimo de **G. atra** e redenominamos a espécie chamada de **G. atra** por Graff **G. nigra**, nom. nov., pois esta não pertence à espécie por nós reencontrada.

G. marginata permanece obscura. A espécie que Graff e, seguindo-o, outros autores chamaram de **G. marginata**, seguramente não o é.

G. rufiventris também permanece obscura. Do material de Graff, apenas o verme de dorso castanho escuro coligido em Blumenau pode ser **G. rufiventris**, o resto é material heterogêneo.

Com **G. olivacea** acontece caso semelhante, pois, do material de Graff, só o verme de Blumenau é compatível com a descrição de Müller. **G. olivacea**, Busson, da Colômbia, é outra espécie e redenominamo-la **G. bussoni**, nom. nov.

O que Graff considerou como **G. nephelis** é material heterogêneo e mesmo a possibilidade de que parte pertença à espécie de Müller é remota. O material sem proveniência do Museu de Berlim colocamos tentativamente no gênero **Coenoplana** Mos. e redenominamos **Coenoplana graffi**, nom. nov.. **G. nephelis** também permanece obscura.

G. maximiliani. A identificação de Graff é também aqui impossível. Quanto ao verme de Schirch, nada se pode adiantar, pois é de região diferente e de anatomia desconhecida. **G. apeva** C. G. Froeh. poderia ser sinônimo de **G. maximiliani**, o que ainda não pode ser resolvido com os dados em mãos.

G. marmorata não é sinônimo de **G. rufiventris**, como pensou Graff. Foi reencontrada e redescrita por nós.

De **G. pulchella** encontramos um exemplar imaturo. O colorido da espécie é invulgar e permite determinação segura.

G. subterranea, transferida por Diesing para o gênero **Geobia**, é espécie bem conhecida.

REFERENCES

- du BOIS-REYMOND MARCUS, E., 1951: On South American Geoplanids. Bol. Fac. Fil., Ci. Letr. Zoologia n. 16, pp. 217-255, pls. 1-8. São Paulo.

- BUSSON, B., 1903: Über einige Landplanarien. S. Ber. Akad. Wiss. Naturw. Kl. v. 112 pt. 1, pp. 375-429, 2 pls. Wien.
- DARWIN, Ch., 1844: Brief Descriptions of several Terrestrial Planaria and of some remarkable Marine Species, etc. Ann. Mag. Nat. Hist. v. 14, pp. 241-251, pl. 5 figs. 1-4. London.
- DIESING, K. M., 1862: Revision der Turbellarien. Abtheilung: Dendrocoelen. S. Ber. math.-naturwiss. Cl. Akad. wiss. Wien, v. 44, pp. 485-578.
- FROEHLICH, C. G., 1955a: Sobre morfologia e taxonomia das Geoplanidae. Bol. Fac. Fil., Ci. Letr. Zoologia n. 19, pp. 195-279, 14 pls. São Paulo.
- 1955b: Notas sobre geoplanas brasileiras: Pap. Av. Dep. Zool. Secr. Agric. São Paulo, v. 12 n. 7, pp. 189-198, 6 figs. S. Paulo.
- 1956: Tricladida Terricola das regiões de Teresópolis e Ubaituba. Pap. Av. Dep. Zool. Secr. Agric. São Paulo, v. 12 n. 16, pp. 313-343, 56 figs. São Paulo.
- 1957: Planárias Terrestres do Paraná. Dusenya v. 7 n. 4, pp. 173-191, pls. 4-8. Curitiba.
- FROEHLICH, E. M., 1955: Sobre espécies brasileiras do gênero **Geoplana**. Bol. Fac. Fil., Ci. Letr. Zoologia n. 19, pp. 289-369, 16 pls. São Paulo.
- GRAFF, L. von, 1894: Viaggio del Dott. Alfredo Borelli nella Repubblica Argentina e nel Paraguay. V. Landplanarien. Boll. Mus. Zool. Anat. Comp. Univ. Torino v. 9 n. 182, pp. 1-4. Torino.
- 1897: Neue Landplanarien (Viaggio Borelli IX). Boll. Mus. Zool. Anat. Comp. Torino v. 12 n. 288, 4 pp., 1 fig. Torino.
- 1899: Monographie der Turbellarien II. Tricladida Terricola. v. 1, xiii + 574 pp.; v. 2, 58 pls. Leipzig (Engelmann). — 1912-1917: Turbellaria. II. Tricladida. H. G. Bronn, Klass. Ordn. Tier-Reichs v. 4 Abt. Ic, xxxviii + pp. 2601-3370, pls. 31-64. Leipzig.
- HYMAN, L. H., 1955: Miscellaneous Marine and Terrestrial Flatworms from South America. Am. Mus. Novitates n. 1742, 33 pp., 42 figs. New York.
- 1957: A Few Turbellarians from Trinidad and the Canal Zone, with Corrective Remarks. Am. Mus. Novitates n. 1862, 8 pp., 6 figs. New York.
- MARCUS, E., 1951: Turbellaria Brasileiros (IX). Bol. Fac. Fil., Ci. Letr. Zoologia n. 16, pp. 5-215, 40 pls. São Paulo.
- MOSELEY, H. N., 1877: Notes on the Structure of Several Forms of Land Planarians, with a Description of Two New Genera and several New Species, etc. Quart. J. Micr. Sci. v. 117 N. S., pp. 273-292, pl. 20.

- MÜLLER, Fr. — see Schultze, Max, and Fritz Müller.
- RIESTER, A., 1938: Beiträge zur Geoplaniden-Fauna Brasiliens. Abh. Senckenb. Naturf. Ges. Abh. 441, 88 pp., 2 pls. Frankfurt a.M.
- SCHIRCH, P., 1929: Sôbre as planárias terrestres do Brasil. Bol. Mus. Nacional v. 5, pp. 27-38, pls. 1-4. Rio de Janeiro.
- SCHULTZE, Max, and Fritz Müller, 1856: Beiträge zur Kenntnis der Landplanarien, etc. Abh. Naturf. Ges. Halle v. 4, pp. 19-38 Halle a. S.

PLATES

PLATE 1 (Figs. 1-7)

***Geoplana marmorata* Fritz Müller**
(also Plate 2, Figs. 8-9)

- Fig. 1 — Creeping worm, dorsal side.
Fig. 2 — Resting worm, dorsal side.
Fig. 3 — Magnified portion of the dorsal side.
Fig. 4 — Pharynx, median section.
Fig. 5-7 — Copulatory apparatus, combined sagittal sections
of three specimens.

a, male atrium; b, penis bulb; c, mouth; d, efferent ducts; e, ejaculatory duct; f, female atrium; g, gonopore; i, intestine; k, subepithelial muscles (muscularis) of pharynx; mc, common muscle coat of copulatory apparatus; o, oviduct; p, penis papilla; q, common glandular duct; s, seminal vesicle; z, shell glands.

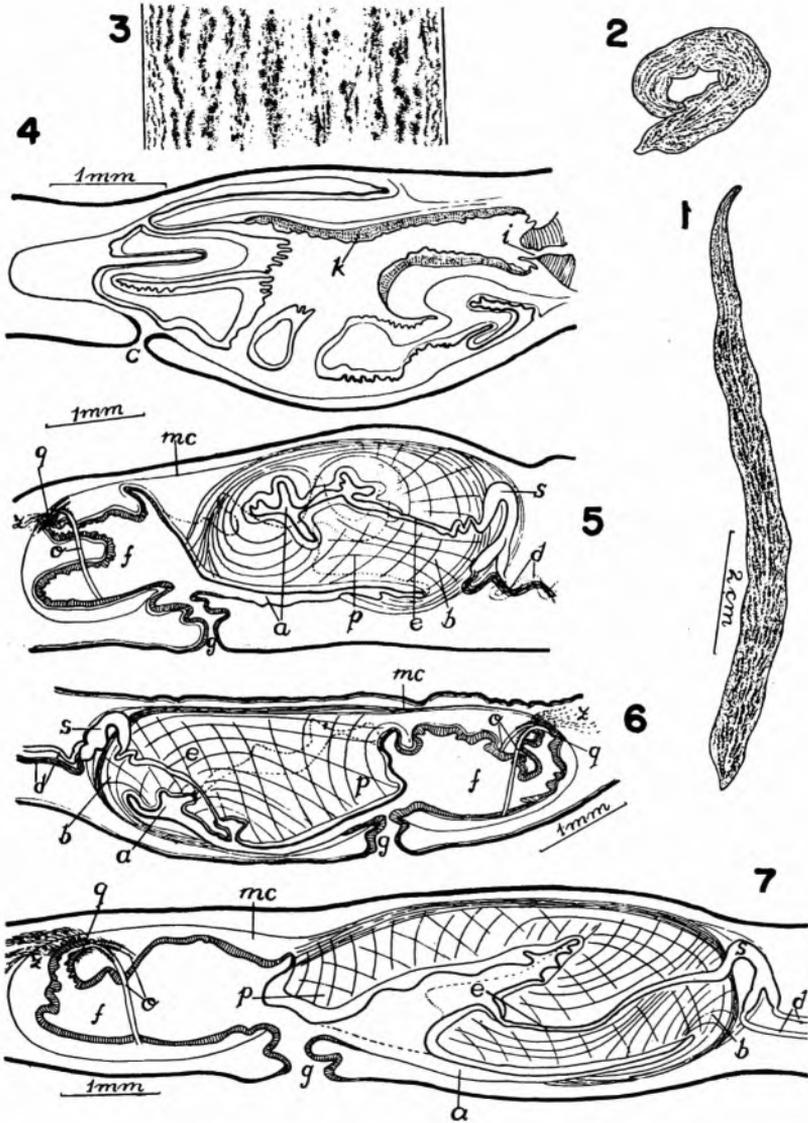


PLATE 2 (Figs. 8-16)

Geoplana marmorata Fritz Müller
(also Plate 1, Figs. 1-7)

Fig. 8 — Cephalic region, distribution of the eyes.

Fig. 9 — Maximum spread of the eyes.

Geoplana mülleri Diesing
(also Plate 3, Figs. 17-18)

Fig. 10 — Specimen from Brusque, resting position.

Fig. 11 — Specimen from Itajaí, creeping.

Fig. 12 — Specimen from Blumenau, creeping.

Fig. 13 — Distribution of the eyes in the cephalic region.

Fig. 14 — Distribution of the eyes in front of the pharynx.

Fig. 15 — Pharynx, median section.

Fig. 16 — Copulatory apparatus, combined sagittal sections;
Specimen from Itajaí.

a, male atrium; c, mouth; d, efferent ducts; e, ejaculatory duct;
f, female atrium; g, gonopore; i, intestine; m, muscularis of
male atrium; mc, muscle coat of male atrium; o, oviducts; q,
common glandular duct; s, seminal vesicle; w, glands of pha-
rynix; y, eosinophilous glands; z, shell glands.

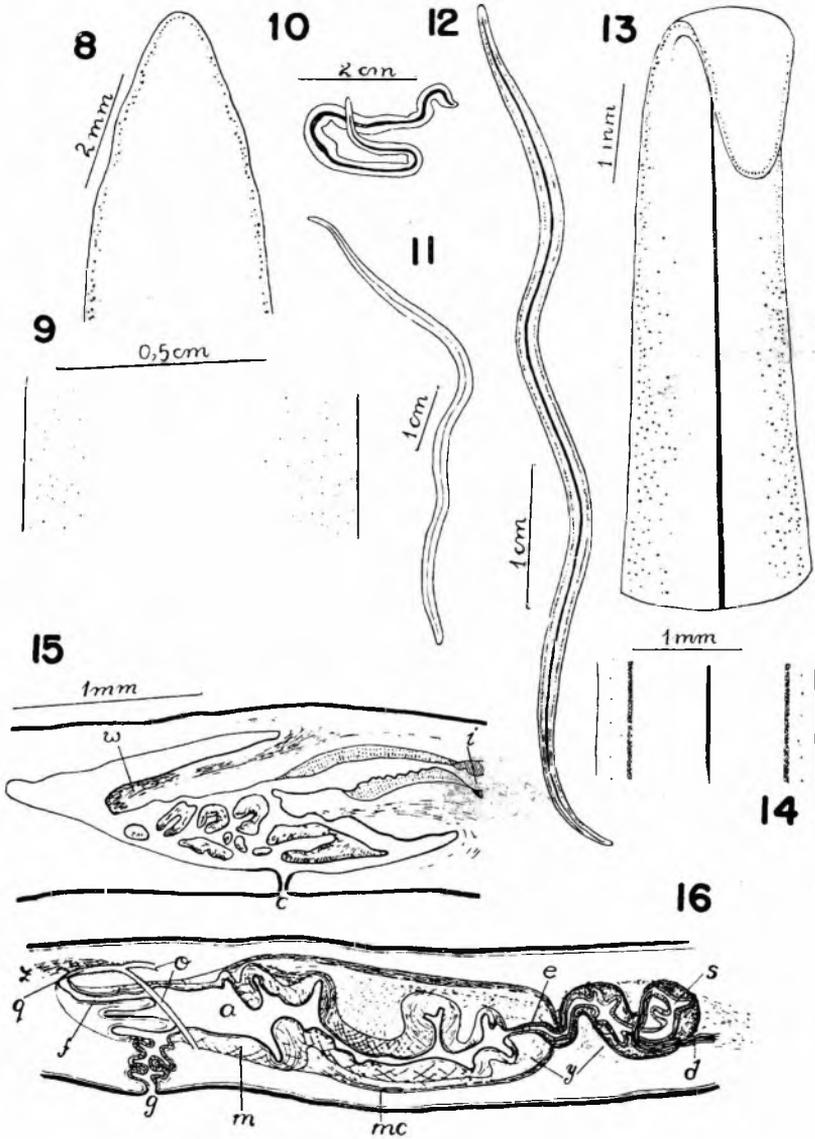


PLATE 3 (Figs. 17-23)

Geoplana mülleri Diesing
(also Plate 2, Figs. 10-16)

- Fig. 17 — Copulatory apparatus, combined sagittal sections; specimen from Blumenau.
Fig. 18 — Copulatory apparatus, combined sagittal sections; specimen from Brusque.

Geoplana ladislavii Graff
(also Plate 4, Figs. 24-25)

- Fig. 19 — Creeping worm, specimen from Blumenau.
Fig. 20 — Outline of a resting worm.
Fig. 21 — Distribution of the eyes in the cephalic region.
Fig. 22 — Maximum spread of the eyes.
Fig. 23 — Pharynx, median section.

a, male atrium; c, mouth; d, efferent ducts; e, ejaculatory duct; f, female atrium; g, gonopore; i, intestine; k, muscularis of pharynx; mc, muscle coat of male atrium; o, oviducts; q, common glandular duct; s, seminal vesicle; sp, cluster of spermatozoa attached to wall of male atrium; t, pharynx pocket; z, shell glands.

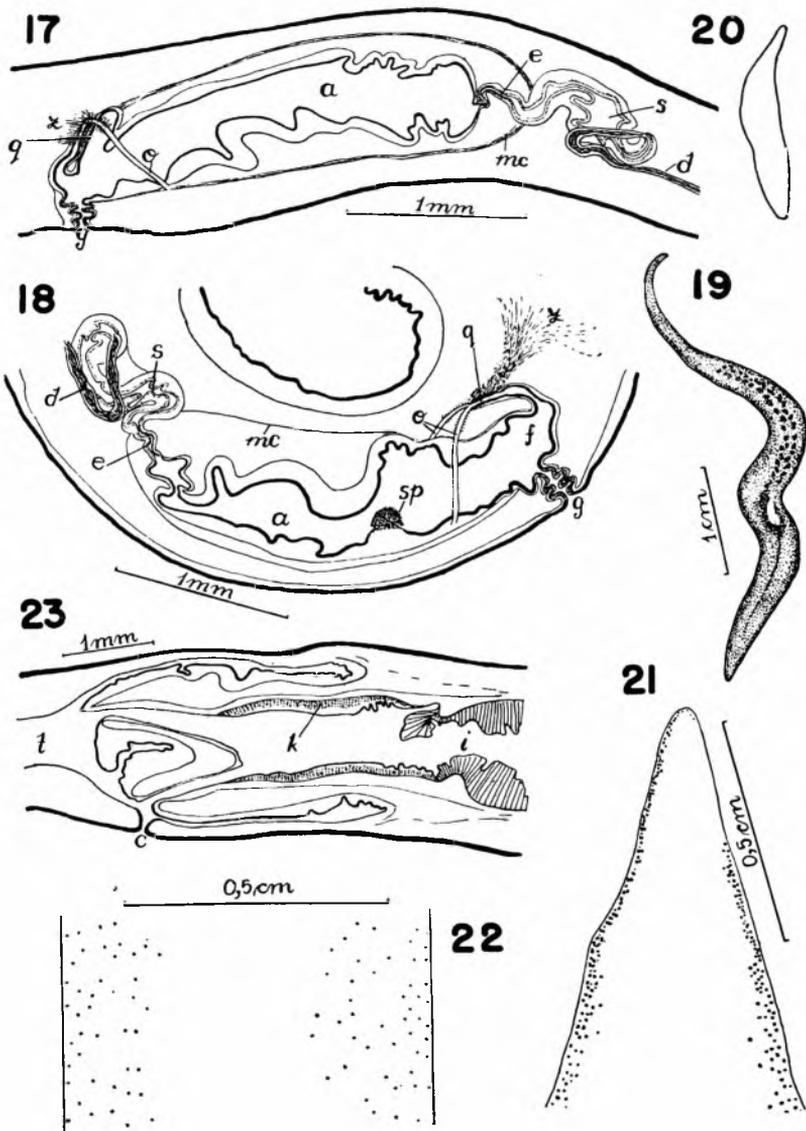


PLATE 4 (Figs. 24-34)

Geoplana ladislavii Graff
(also Plate 3, Figs. 19-23)

Figs. 24-25 — Copulatory apparatus, combined sagittal sections.

Geoplana apeva, n. sp.
(also Plate 5, Figs. 35-36)

Fig. 26 — Specimen from Brusque, creeping.

Fig. 27 — The same, ventral side.

Fig. 28 — The same, resting.

Fig. 29 — Specimen from Blumenau, creeping.

Fig. 30 — The same, resting.

Fig. 31 — Distribution of the eyes at the anterior end.

Figs. 32-33 — Maximum spread of the eyes in two specimens.

Fig. 34 — Pharynx, median section.

a, male atrium; b, penis bulb; c, mouth; d, efferent ducts; e, ejaculatory duct; f, female atrium; g, gonopore; i, intestine; k, muscularis of pharynx; o, oviduct; p, penis papilla; q, common glandular duct; s, seminal vesicle; z, shell glands.

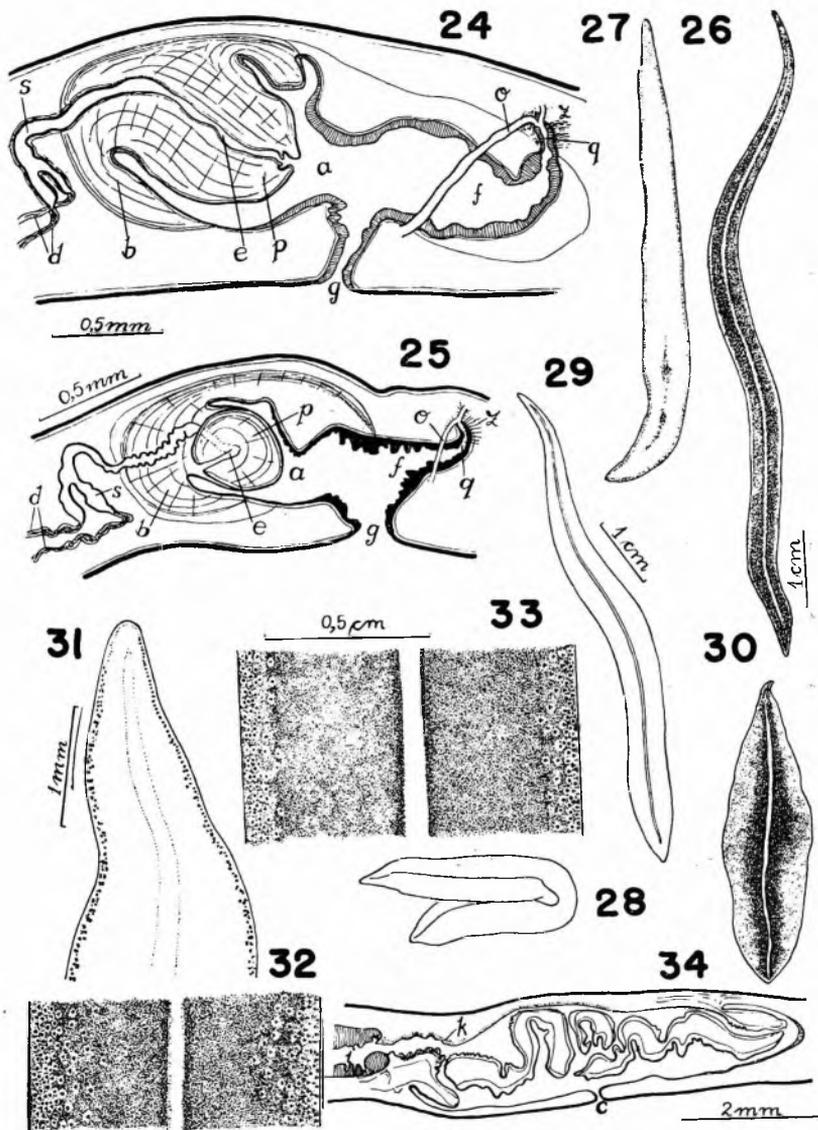


PLATE 5 (Figs. 35-42)

Geoplana apeva, n. sp.
(also Plate 4, Figs. 26-34)

Figs. 35-36 — Copulatory apparatus, combined sagittal sections of two specimens.

Geoplana assu, n. sp.
(also Plate 6, Figs. 43-44; Plate 7, Fig. 49)

- Fig. 37 — Resting worm, showing dorsal colour pattern.
Fig. 38 — Creeping worm, dorsal view.
Fig. 39 — Newly hatched young, dorsal view.
Fig. 40 — Distribution of the eyes at the anterior end.
Fig. 41 — Colour pattern of the back and maximum spread of the eyes.
Fig. 42 — Pharynx, median section.

ac, genital atrium; b, penis bulb; c, mouth; d, efferent ducts; e, ejaculatory duct; g, gonopore; p, penis papilla; q, common glandular duct; s, seminal vesicle; t, posterior extension of pharynx pocket; v, vagina; y, glands of pharynx; z, shell glands.

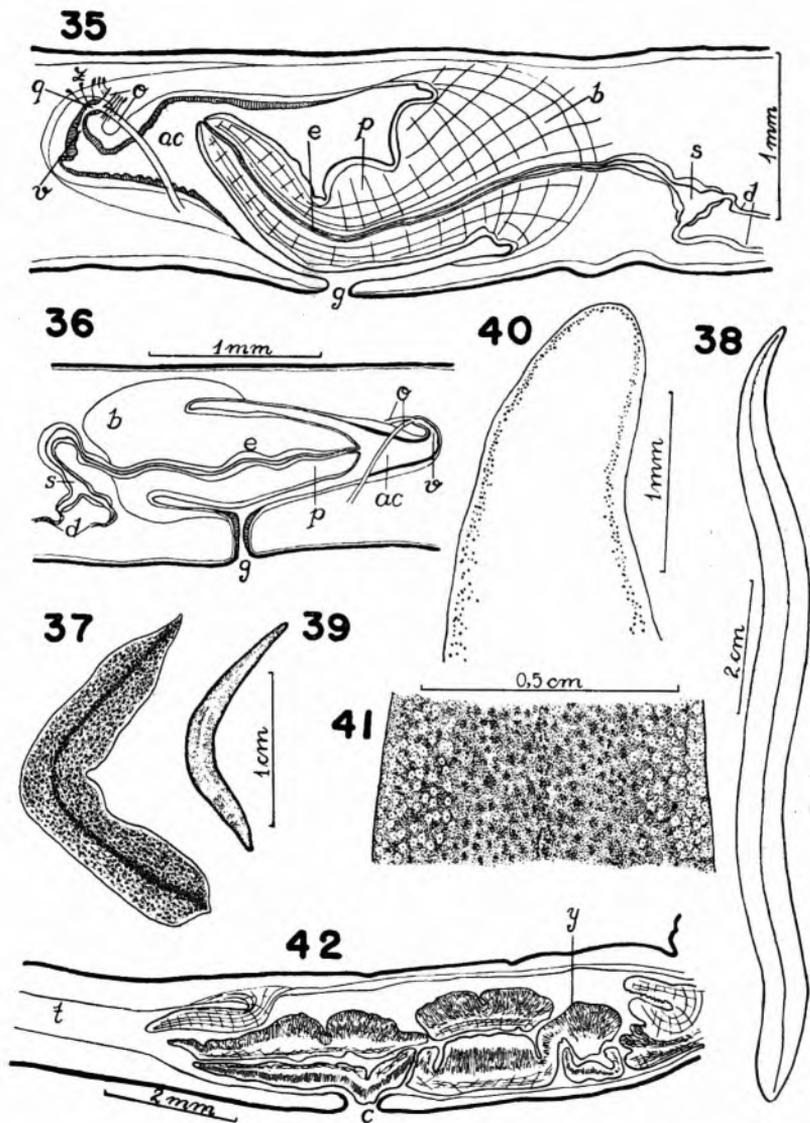


PLATE 6 (Figs. 43-48)

Geoplana assu, n. sp.

- Fig. 43 — Copulatory apparatus of specimen **a**, combined sagittal sections.
Fig. 44 — Copulatory apparatus of specimen **c**, combined sagittal sections.

Geoplana fita, n. sp.

(also Plate 7, Figs. 50-52)

- Fig. 45 — Outline of a worm.
Fig. 46 — Colour pattern of the back, various regions.
Fig. 47 — Distribution of the eyes, anterior end.
Fig. 48 — Pharynx, median section.

a, genital atrium; b, penis bulb; c, mouth; d, efferent ducts; e, ejaculatory duct; g, gonopore; i, intestine; k, muscularis of pharynx; m, muscularis of penis papilla; o, oviducts; p, penis papilla; q, common glandular duct; s, seminal vesicle; v, vagina; z, shell glands.

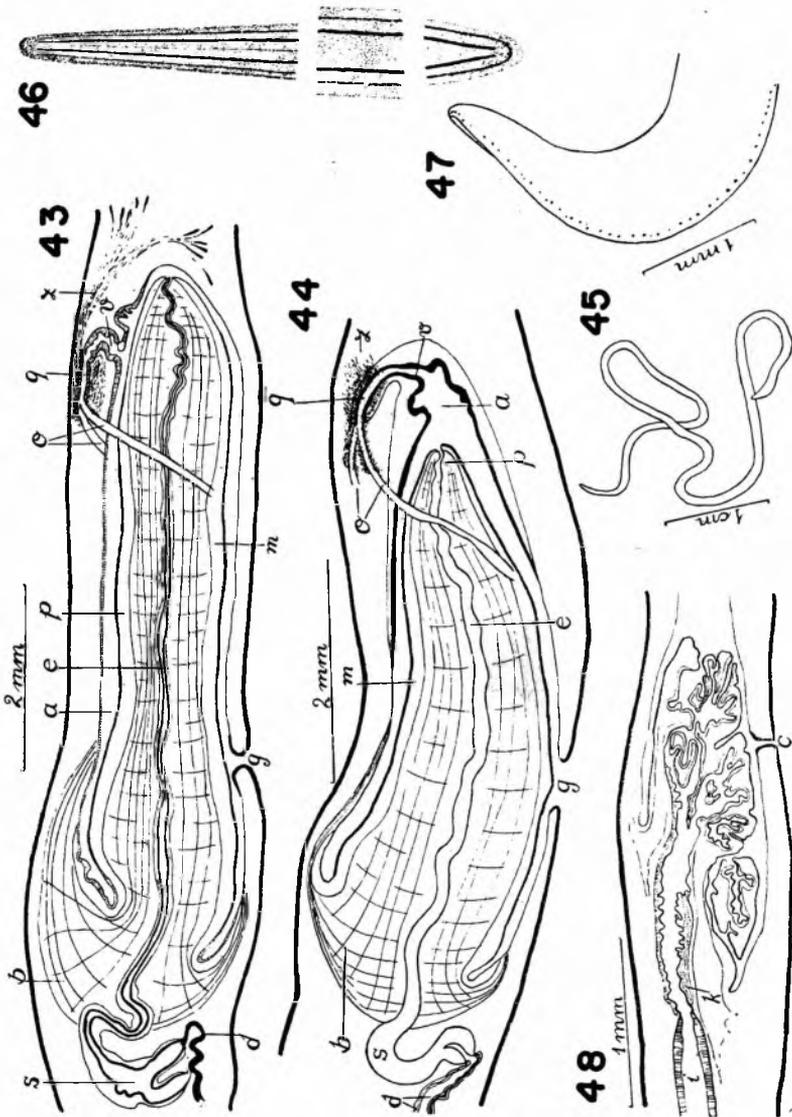


PLATE 7 (Figs. 49-52)

Geoplana assu, n. sp.

(also Plate 5, Figs. 37-42; Plate 6, Figs. 43, 44)

Fig. 49 — Copulatory apparatus of specimen **b**, with egg capsule inside genital atrium; combined sagittal sections.

Geoplana fita, n. sp.

(also Plate 6, Figs. 45-48)

Fig. 50 — Copulatory apparatus of one specimen, combined sagittal sections.

Figs. 51-52 — Copulatory apparatus of another specimen, showing the extension of the seminal vesicle; combined sagittal sections.

a, genital atrium; am, male atrium; b, penis bulb; d, efferent ducts; e, ejaculatory duct; eg, egg capsule; f, female atrium; fl, flap separating female from common atrium; g, gonopore; m, muscularis of penis papilla; o, oviducts; p, penis papilla; q, common glandular duct; r, pluristratified epithelium of female atrium; s, seminal vesicle; x, dorsal fold separating male from common atrium; y, cyanophilous and eosinophilous glands; z, shell glands.

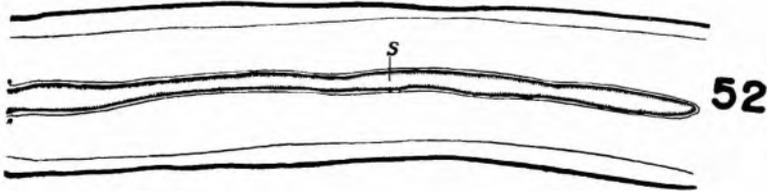
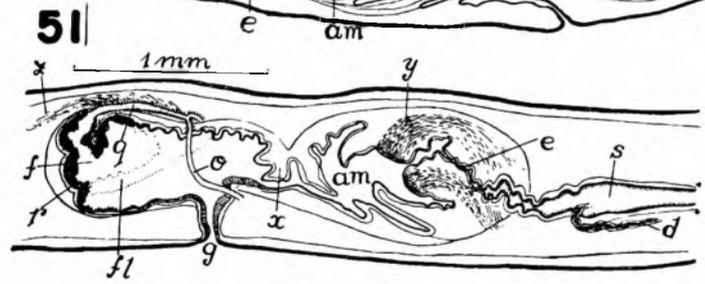
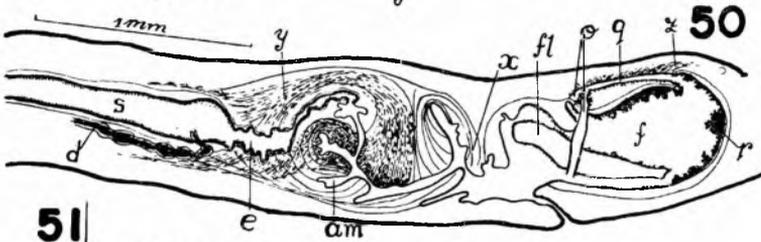
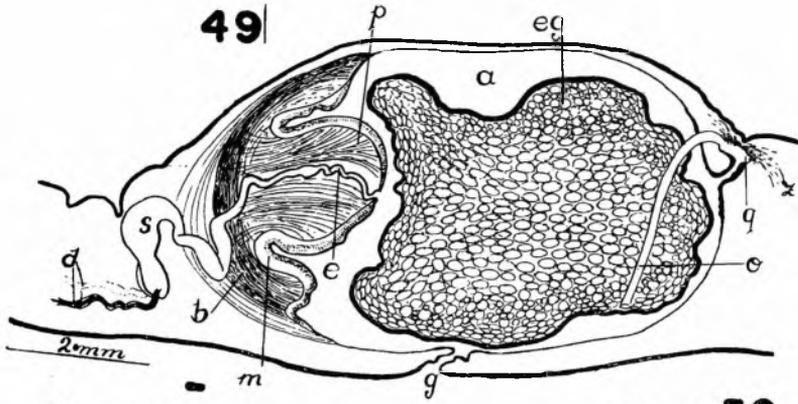


PLATE 8 (Figs. 53-59)

Geoplana gaucha, n. sp.

- Fig. 53 — Colour pattern of the back.
Fig. 54 — Cephalic region: colour pattern and distribution of the eyes. Pigment not drawn in margins to show eyes.
Fig. 55 — Maximum spread of the eyes.
Fig. 56 — Pharynx, median section.
Fig. 57 — Copulatory apparatus, combined sagittal sections.

Geoplana glieschi, n. sp.

(also Plate 9, Figs. 60-61)

- Fig. 58 — Portion of dorsal side in front of the pharynx, showing the eyes and, where the pigment has been rubbed off, testes follicles.
Fig. 59 — Pharynx, median section.

a, male atrium; b, penis bulb; c, mouth; d, efferent ducts; e, ejaculatory duct; f, female atrium; g, gonopore; i, intestine; o, oviducts; p, penis papilla; q, common glandular duct; r, mass of cells of female atrium; s₁, paired portions of seminal vesicle; s₂, common portion of seminal vesicle; t, caudal extension of pharynx pocket; y, eosinophilous glands; z, shell glands.

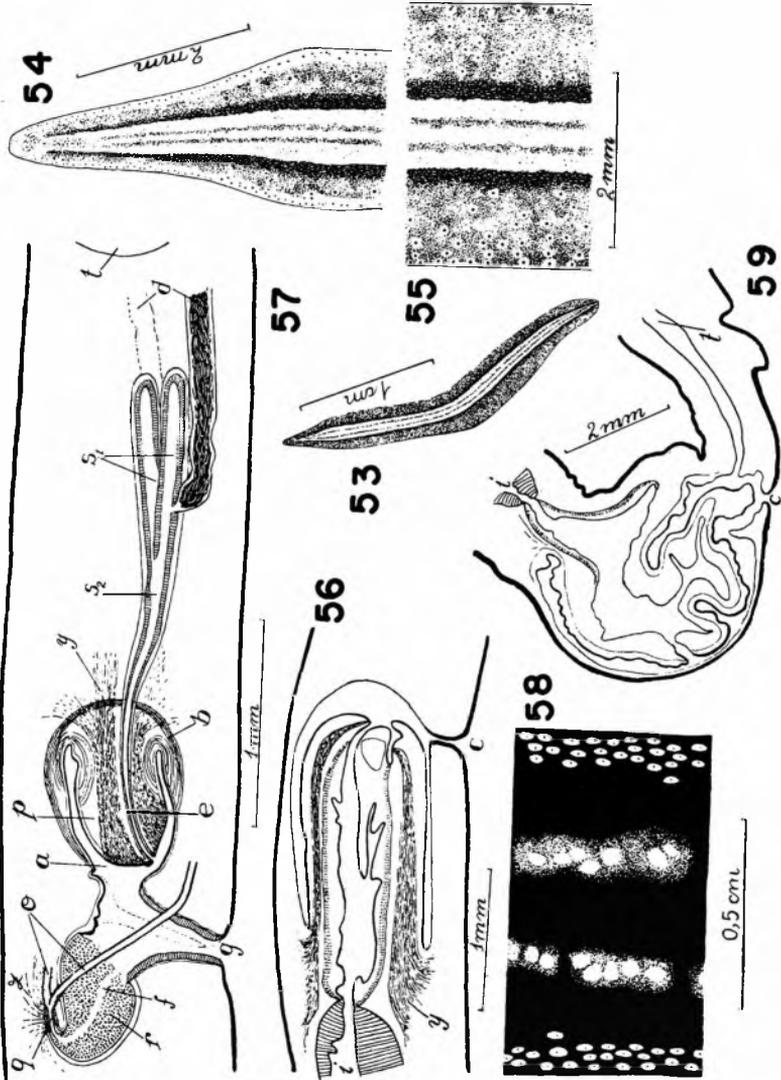


PLATE 9 (Figs. 60-66)

***Geoplana glieschi*, n. sp.**
(also Plate 8, Figs. 58-59)

Fig. 60 — Ventral view of the preserved worm, showing rolled sides.

Fig. 61 — Copulatory apparatus, combined sagittal sections.

***Geoplana nataliae*, n. sp.**

Fig. 62 — Dorsal view of preserved worm, anterior end rolled up.

Fig. 63 — Lateral view of the body, showing distribution of eyes.

Fig. 64 — Pharynx, median section.

Fig. 65 — Copulatory apparatus, combined sagittal section.

Fig. 66 — Magnified view of wall of ejaculatory cavity (at 1).

a, male atrium; b, penis bulb; c, mouth; ce, ejaculatory cavity; d, efferent ducts; e, ejaculatory duct; f, female atrium; g, gonopore; i, intestine; m, muscularis of penis papilla; mb, basement membrane; mc, musculature of male atrium; n, dorsal recess of ejaculatory cavity; o, oviducts; p, penis papilla; q, common glandular duct; s, seminal vesicle; se, secretion inside seminal vesicle; v, vagina; ve, ventral side; y, eosinophilous glands; z, shell glands.

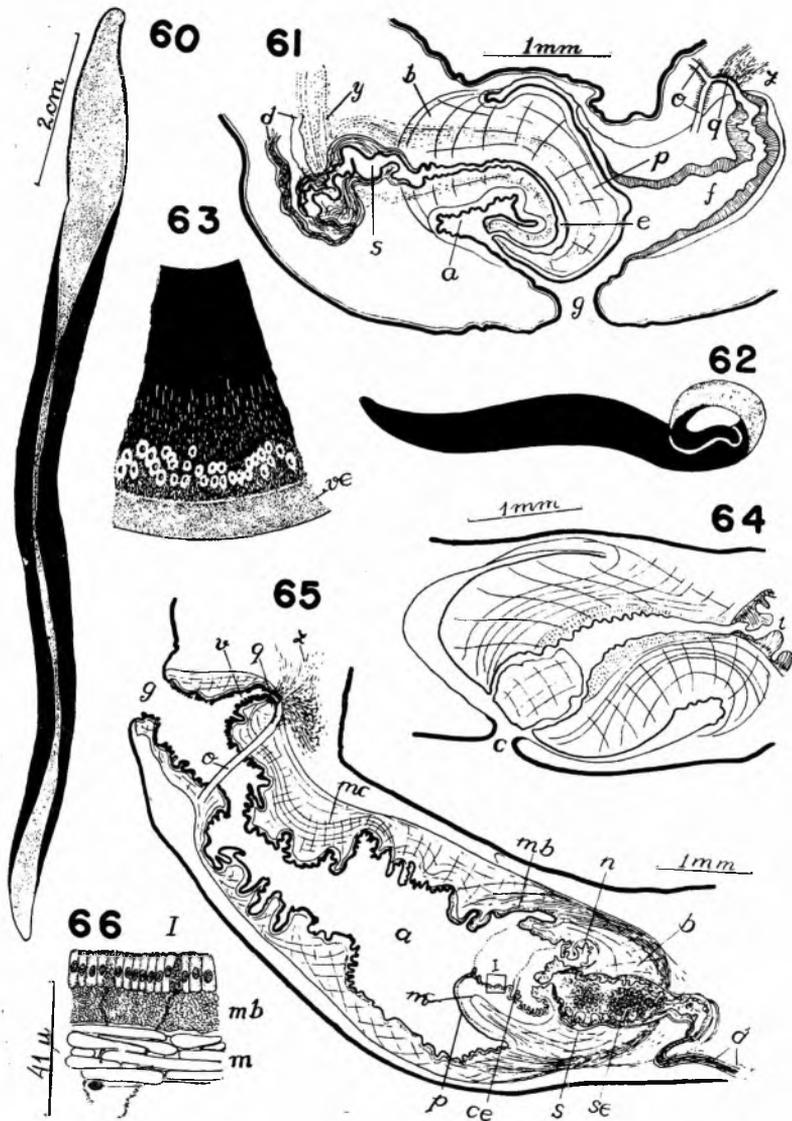


Plate 10 (Figs. 67-74)

Geoplana hauseri, n. sp.

- Fig. 67 — Dorsal view, colour pattern.
Fig. 68 — Maximum spread of the eyes.
Fig. 69 — Pharynx, median section.
Fig. 70 — Copulatory apparatus, combined sagittal sections.

Geoplana suva

(also Plate 11, Figs. 75-77)

- Fig. 71 — Dorsal view, colour pattern, creeping worm.
Fig. 72 — Dorsal view, resting worm.
Fig. 73 — Magnified portion of dorsal side, colour pattern.
Fig. 74 — Pharynx, median section.

a, male atrium; c, mouth; d, efferent ducts; e, ejaculatory duct; f, female atrium; g, gonopore; i, intestine; k, muscularis of pharynx; mc, common muscle coat of copulatory apparatus; o, oviducts; q, common glandular duct; s, seminal vesicle; w, glands of pharynx; x, point of union of the two ental rami of seminal vesicle; ys, heavily stained eosinophilous glands, yw, lightly stained eosinophilous and some cyanophilous glands; z, shell glands.

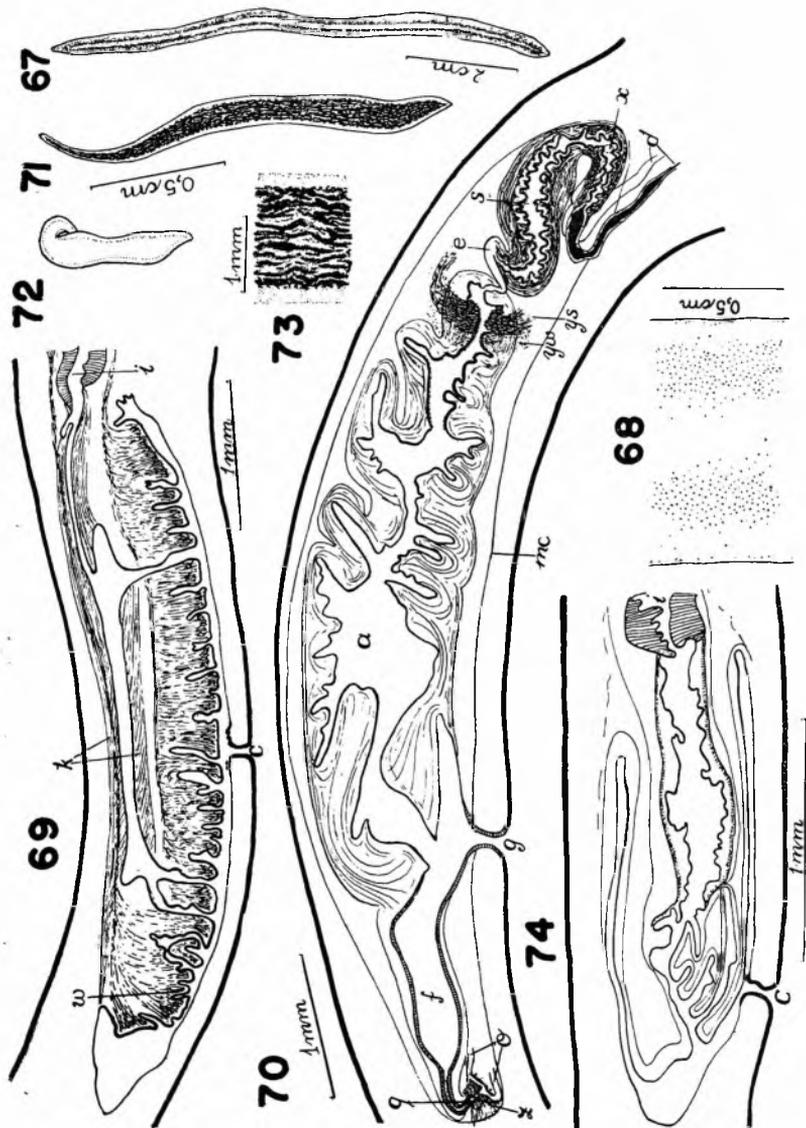


PLATE 11 (Figs. 75-81)

Geoplana suva, n. sp.
(also Plate 10, Figs. 71-74)

Fig. 75 — Anterior end, distribution of the eyes.

Figs. 76-77 — Copulatory apparatus of two specimens, combined sagittal sections.

Geoplana beckeri, n. sp.

Fig. 78 — Outline of a preserved worm.

Fig. 79 — Anterior end, distribution of the eyes.

Fig. 80 — Pharynx, median section.

Fig. 81 — Copulatory apparatus, combined sagittal sections.

a, male atrium; b, penis bulb; c, mouth; d, efferent duct; e, ejaculatory duct; e₁, ental part of ejaculatory duct; e₂, ectal part of ejaculatory duct; f, female atrium; g, gonopore; i, intestine; o, oviducts; p, penis papilla; q, common glandular duct; r, pluristratified lining of female atrium; s, seminal vesicle; s₁, first seminal vesicle; s₂, second seminal vesicle; u, accumulation of eosinophilous secretion; w, purple glands of male atrium; x, spermatozoa inside female atrium; y, granular glands of seminal vesicle; z, shell glands.

