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ON SOUTH AMERICAN GEOPLANIDS

by Eveline du Bois-Reymond Marcus

(with 8 plates)

The present paper contains the descriptions of 17 species of Geoplanidæ. These proceed from various regions of Peru, between Lat. 15° 50' and 7° S., and from southern Brazil, Sta. Catharina. The peruvian collection that was gathered by Dr. WOLFGANG K. WEYRAUCH (Lima) in altitudes from 800 to 4000 m. consists of 14 species. They are all new to science, as was to be expected due to the isolating factor offered by ranges of high mountains. Moreover the peruvian terrestrial Tricladæ are nearly unknown; only one valid species was hitherto reported from the extreme South of Peru (altitude: 3850 m., Beauchamp 1939, p. 75).

The brazilian material collected in Bromelias by Dr. FIRMINO T. CASTRO (Rio de Janeiro) comes from Brusque, 25 km. south of Blumenau, the original locality of Fritz Müller's species (1857), and a relatively short distance from H. v. Ihering's collecting area in Rio Grande do Sul (Taquara do Mundo Novo). Therefore I dare to identify the three species from Brusque with previously described ones.

Geoplana garua, n. sp. (Fig. 1-6)

Even the biggest of the 3 present worms is not wholly mature. It is 30 mm. long, 4,5 mm. broad, and 1,1 mm. high. The anterior end is pointed, the tail round, and the borders are sharp.

The back is dark gray with a narrow black median line between light gray bands, that confine with black stripes of equal breadth. Towards the borders the gray ground becomes lighter and is dotted with the white halos of the eyes. The ventral side is light gray.

The anterior eyes are disposed in a single series and spread on to the back some millimeters behind the fore end. They are numerous and fill the sides of the dorsal surface with their halos; in the posterior region of the body they become rare. The ventral nerves are developed as a plexus.

In a 25 mm. long worm the pharynx lies between mm.s 13 and 16,5; the mouth (m) at 16 mm., the gonopore (p) at 20,5 mm. The pharynx (Fig. 4) is a richly folded cylindrical organ, the dorsal and ventral insertions of which lie nearly on the same level. The nuclei of the outer and inner pharyngeal epithelium are depressed as those in the ectal part of the oesophagus (c); in the ental part of the latter they are normal. Cyanophilous glands open into the lumen of the pharynx and on its outer surface; erythrophilous

ones only between the inner epithelium. The anterior trunk of the gut has 35 branches on each side. Each posterior intestinal division has 35 outer diverticles and some on the inner side in the region of the mouth and behind the copulatory apparatus.

Up to 7 dorsal testicular follicles one beside the other may occur on one side of a transverse section. The copulatory apparatuses in two worms (30 and 19 mm.) are of the same length (2,1 mm.). The efferent ducts bend forward along the musculature that surrounds the copulatory organs. Then they enter an anterior vesicle-shaped antral diverticle separately, that is divided from the central lumen only by an annular fold. Tufts of glands open between the epithelial cells in the middle part of the antrum. Their gland cells (h) lie among the nuclei (y) of the sub-epithelial antral muscles, and their openings (g) project as small papillae. The antral epithelium is 0,02 mm. high, that of the canal leading to the gonopore (p) 0,05-0,08 mm. The latter lies at the hind end of the antrum, the female part of which is very short and narrow. As shell glands are not yet developed, the limit between the common ovovitelloduct (glandular duct) and the female genital canal (q) can not be fixed.

Occurrence: Peru, Contumazá, 35 km. S. W. of Cajamarca, 2850 m. Three worms, february 1942.

Discussion of *Geoplana garua*

The glands of the antrum of the present species are similar to those occurring on the penis of *G. picadoi* Beauchamp (1912, p. III), *G. vungunteni* Fuhrmann (1914, p. 760), *G. sandersoni* Prudhoe (1949, p. 425), and *G. idaia*, n. sp. (Fig. 54,55), all for the rest quite different from *G. garua*. *G. multipunctata* Fuhrmann (1914, p. 776) has such glands in the dorsal wall of the antrum, but is distinguished from *garua* by the penis papilla, the gonopore before the hind end of the antrum, the female diverticle of which is wide, and white spots on the sides of the back, only in part related with the eyes.

G. becki Fuhrmann (1914, p. 770) and *G. amagensis* (ibid., p. 773) are species from Colombia without a penis papilla. Both have other colour pattern, female antrum, and position of the gonopore, and in both the male antrum is folded. *G. ortizi* (ibid., p. 779) is also provided with a folded antrum and has a small penis papilla.

Geoplana chalona, n. sp. (Fig. 7-9)

The broad, flat worm is 85 mm. long, 10 mm. broad, and 1,5 mm. high. The borders are sharp, the anterior end is gradually, the posterior one broadly cuspidate.

The colour of the back is black, denser along mid-line. The ventral side is light gray with white pharyngeal region.

The eyes begin short behind the tip in a single file, then form several rows and at the level of ca. 20 mm. pass on to the back, occupying at most one fourth of the dorsal breadth, and become rare a little farther behind. The ventral nerves constitute a very thick plexus.

The collar-shaped, low pharynx (Fig. 8) extends between mm.s 48 and 62. The mouth (m) lies at 55 mm., the gonopore (p) at 70 mm. from the fore end. The anterior intestinal trunk has 69 branches on each side, each posterior gut-limb 60.

The testes lie dorsally, and one transverse section may contain up to 6 follicles beside one another. The efferent ducts (d) enter two broadly separate diverticles of the seminal vesicle (s) that receives the pink secretion of surrounding glands (k). The vesicle lies before the penial bulb (b), and its musculature is separate. The broad cup-shaped penis as well as the walls of the whole antrum are provided with strong circular muscles. The epithelium of the penis is 0,05 mm. high and has the nuclei on a single level; that of the antrum, especially in the female part (f), attains 0,18 mm., and the nuclei occupy different heights in the basal half of the cells.

The ovovitelloducts (o) direct themselves towards the back in the region of the gonopore (p) and receive the secretion of the shell glands (z) before and behind their union (v). A short female genital canal (q) descends into the hind part of the extense female antrum, into which erythrophil and cyanophil (y) glands open.

Occurrence: Peru, Contumazá, 35 km. S. W. of Cajamarca, 2850 m. One specimen, february 1942.

Discussion of *Geoplana chalona*

The penis of *G. cantuta* (Fig. 12) is similar to that of *G. chalona*, and both have a collar-shaped pharynx. But the quite different colour as well as the side-branches of the intestine, 30 on each side of the anterior and 35 on each posterior division in *cantuta*, separate the two species.

The dorsal side of *G. olivacea* Fr. Müller (1857, p. 24) in one of Graff's figures (1899, t. 4, f. 29) likens that of *chalona*. The copulatory organs of *olivacea* (Busson 1903, f. 5 on p. 425) differ widely from those of *chalona*.

G. andicola (Schmarda 1859, p. 15; Graff 1899, p. 312) has a short pharynx, and the details of the colour do not suit to the present species.

The blackish gray *G. gonzalezi* Fuhrmann (1914, p. 781) is much smaller than *chalona*, its borders are darker than the middle, and the testes extend backwards 4 mm. beyond the copulatory apparatus. *G. nigrocephala* (ibid., p. 766) has olivaceous brown margins, very numerous eyes, and a small pharynx.

Geoplana cantuta, n. sp. (Fig. 10-12, 70)

The bigger of the two present specimens is nearly mature and 70 mm. long and 7 mm. broad on the level of the pharynx. The second quite immature worm measures 42 and 4 mm. In both animals the body tapers from the middle towards the anterior end, and is more suddenly and bluntly pointed at the hind end. The borders are round; the height is one third of the maximum breadth.

The tip of the head is brick red. The anterior third of the back shows 3 light yellow and 4 black stripes. The former are one broad median and two narrow lateral ones. Broad black bands separate the light zones, and narrow black stripes run outside the light marginal ones. In a distance of about 20

mm. from the anterior end the melanophores strengthen, and the yellowish back becomes sprinkled with fine black dots all over. The ventral side is light with a very narrow black border in the anterior part that ends at the level of 30 mm. Some black ventral spots occur in the region that corresponds to the dotted dorsal one.

The eyes form a single file on the red anterior end, then become pluriserial within the black borders and only expand a little more over the dorso-lateral parts, where these borders are extinguished in the general dotting. Here the eyes have trilobate pigment cups and light halos. The ventral nerves form a plexus.

The pharynx is collar-shaped with a long ruff; it extends from mm.s 43 to 48. The mouth (m) lies at the hind end of the pharynx pocket. The cyanophilous glands are scattered over the whole outer and inner surface of the pharynx, most concentrated on the border, while the eosinophilous glands only open on the inner side from the border upwards to half the height of the ruff one beside the other. Thus in the sections the folds of the pharynx show red glands turned towards each other at one interval and blue ones along the next, conform to the inner or outer surface (Fig. 20). The anterior branch of the gut has ca. 30 lateral diverticles on each side, each posterior branch 35.

The testes are dorsal, and up to 4 follicles may lie on each side on the same level. The efferent ducts (d) bend to the middle and open into the small seminal vesicle (s). As the worm is not yet fully mature, the narrow lumen of the vesicle is perhaps not a specific character. The muscle mantle of the vesicle is independent from the penial bulb (b). The ejaculatory duct (e) opens on the ventral surface of the flat, cupola-shaped penis, the retractors (r) of which originate in the cutaneous muscle layer. The epithelium of the male antrum is very low and has small cilia. In the female part (f) the cells are 0,02-0,025 mm. high and have extremely long (0,05-0,06 mm.) cilia.

The gonopore (p) is still closed by the skin and is entally lined by probably caducous cells. Later on these are possibly substituted by such of the ventral epidermis. The muscles of the female antrum are separate from those of the male organs. Only the unpaired ectal part of the female efferent ducts is recognizable (q). From the point where the ovovitelloducts unite (v) the female genital canal descends to enter the female antrum.

Occurrence: Peru, Cordillera Azul, Fundo Sinchono, 1600 m. Two animals, June 1947.

Discussion of *Geoplana cantuta*

The 4 black stripes of the Chilean *G. nobilis* Graff (1899, p. 334) extend over the whole back, whereas those of *G. perspicillata* (ibid., p. 335) disappear in the anterior region. *G. gigantea* Gr. is "rich flesh pink with two brown stripes in the anterior region" (Prudhoe 1949, p. 420).

Geoplana gabriellæ, n. sp. (Fig. 13-17, 71-73)

One specimen, 85 mm. long, 8,5 mm. broad, moderately flat with rounded borders, gradually tapering anterior and suddenly pointed hind end.

The back has 3 bright yellowish orange bands, one in the middle (breadth 2 mm.) and 2 on the borders (each 1 mm. broad), separated by black stripes (each 2,5 mm. broad). The tip of the head is quite black, the median yellow band begins short behind and the marginal ones at 4 mm. from the anterior end. Until 14 mm. they are bordered by a narrow black rim that also appears on the ventral side. At the hind end the 3 yellow stripes unite behind the ends of the black ones. Over the pharynx the median band shows a deeper yellow shade. The ventral side is cream-coloured.

The eyes (Fig. 14) begin in a single file and have white halos in the black rim. Where this ends they spread over the yellow marginal bands. The ventral nerves form a plexus.

The collar-shaped pharynx (Fig. 15) has ca. 12 folds on each side and extends from mm.s 43 to 54. The mouth (m) lies at 50 mm. There are 45-46 diverticles on each side of the anterior division of the intestine and ca. 30 on each posterior limb. The latter have also some small pouches on their inner sides (Fig. 16) between the pharynx and the copulatory apparatus and behind the gonopore (p) that lies at 66 mm.

The testes are dorsal. Up to 5 follicles may occur on each side in one transverse section. The efferent ducts (d) open from the ventral side into two diverticles of the ample seminal vesicle (s) that lies outside the penial bulb (b) and has its own muscles. It is a common vesicle, that contains not only sperms, but also small balls of granular erythrophil secretion. These are stored in the high (0,05-0,15 mm.) epithelium of the vesicle, from where they pass into the lumen. Similar secretion occurs also in the middle region of the ejaculatory duct (e) where the folded epithelium is 0,08 mm. high. That of the ectal part of the duct is still more folded. The nearly semi-globular penis is invested with a columnar epithelium (0,1 mm.) with normal nuclei all on one level, very strong annular, and thinner longitudinal muscles. Radial and longitudinal fibres in the parenchyma are scarce.

The ovovitelloducts (o) rise behind the gonopore (p); their ascending courses dilate suddenly (w) and unite (v) in the mid-line. From there the straight common ovovitelloduct (q) runs backwards and enters a dorsal diverticle of the female antrum (f). Shell glands (z) open entally and ectally to the union of the ovovitelloducts; a gland-free female genital canal does not exist. In the high epithelium (0,09-0,18 mm.) of the female antrum the nuclei lie on different levels, and it is covered with the secretion of cyanophilous glands.

Occurrence: Peru, Cordillera Cumulca, between Cajamarca and Cuzco, 3600 m. One specimen, February 1942.

The species is named in the memory of our dear Dra. GABRIELLA P. ZUCCARI.

Discussion of *Geoplana gabriellæ*

G. bilineata Fuhrmann (1914, p. 766) that is only known by its external characters has a similar colour pattern, but its eyes enter the dark zones, whereas they do not in *G. gabriellæ*.

Geoplana quichua, n. sp. (Fig. 18-21, 74-75)

Three specimens, 30-43 mm. long and 6,5 mm. broad, 1,4 mm. thick in the middle, with round borders. The greatest breadth lies in the region of the mouth, at 27 mm. in the biggest worm. The fore end is pointed, the hind end rounded.

The back is mottled black on a grayish yellow ground. The biggest worm (Fig. 18) has an antero-posterior black median line, the two others a light one that contains black spots (Fig. 74) and fades away before the pharynx. The ventral side has a pale yellow ground colour that is mottled with black except near the borders, where the brighter yellow of the back is continued.

The eyes begin uniserial and then increase in number and extend over one fourth of the dorsal surface, where they are surrounded by light halos and have trilobate pigment cups. The ventral nerves form a plexus.

The mouth (m) lies at the hind end of the pharynx pocket that contains a bell-shaped pharynx with folded margin (Fig. 20). The cyanophilous glands (g) open on the outer border and the erythrophilous ones (h) on the inner, so that the two sides of each fold appear differently coloured in all sections. More cyanophil glands open through the outer and inner epithelium of the pharynx. The latter is united with the intestine (i) by an oesophagus (c) with strong circular muscles. The anterior canal of the gut has 25 diverticles on each side, of which the 5 posterior ones anastomose (Fig. 19, a). Each posterior intestinal limb gives off ca. 22 side branches.

The testes are dorsal. At least 4 follicles beside one another occur on each side. The efferent ducts (d) enter two small ventro-lateral pouches of the seminal vesicle (s) that lies outside the penial bulb (b). As shell glands are not developed even in the biggest worm, the narrowness of the vesicle may be a juvenile character. The ejaculatory duct (e) shows two successive dilatations. The broad, cup-shaped penis and the female antrum are dorsally involved by a common muscle mantle.

The ovovitelloducts (o) rise behind the gonopore (p) and unite at their entrance into a dorso-caudal diverticle of the female antrum. The epithelium of the latter is 0,06 mm. high, and its nuclei lie on somewhat different levels, whereas the cells of the male antrum are lower (0,03 mm.) and have their nuclei in a row.

Occurrence: Peru, Contumazá, 35 km. S. W. of Cajamarca, 2850 m. Three worms, february 1942.

Discussion of *Geoplana quichua*

The net- or web-like black pigment on a yellow ochre ground described in various colombian species (Fuhrmann 1914) suits to *G. quichua*. *G. camelix* (l. c., p. 756) is different by its not mottled ventral side, cylindrical pharynx, 32 side branches of the anterior limb of the intestine, and a volumous, very long penis. The female genital canal of *camelix*, although described as very short, is longer than in *quichua*.

G. colombiana (l. c., p. 765) that was not sectioned has two dark brown lines near the dorsal margins, and its ventral surface is yellowish in the anterior third, whitish in the rest, without spots or stipples.

The head of *G. becki* (l. c., p. 770) is bordered by a black line dorsally and ventrally, its ventral side is not spotted, the eyes extend to 2,3 mm. from the borders, the mouth lies in the middle of the small pharynx or a little backward, and the anterior division of the intestine gives off 40 diverticles. The copulatory organs of *G. becki* differ from those of *G. quichua* by the absence of a penis and the presence of a though short female genital canal.

G. amagensis (l. c., p. 773) is a big species (up to 112 mm. long, 12 mm. broad, preserved); its head is bordered with black on the dorsal and ventral surface; the latter is yellowish, in various individuals speckled with white. The ample folded male antrum with a very small penis papilla as well as the considerably long common ovovitelloduct distinguish *amagensis* clearly from *quichua*.

G. bogotensis Graff (1899, p. 324) differs from *quichua* by the more ribbon-like shape of the body, distinct mid-dorsal and marginal light bands, and absence of a penis papilla. The copulatory organs were described by Busson (1903, p. 421-424) and confirmed by Fuhrmann (1914, p. 751), so that Riester's "*bogotensis*" (1938, f. 68) cannot belong to this species. Also the eyes of his material (ibid., p. 60) do not agree with Fuhrmann's description of those of *bogotensis*.

Geoplana weyrauchi, n. sp. (Fig. 22-25, 76)

The three worms are 35-45 mm. long, 4-5,5 mm. broad, and 1,3-1,8 mm. high. The borders are distinct. The maximum breadth lies in the posterior third; the shape of the body is narrowed and prolonged towards the fore end, shortly acuminate behind. The mouth lies at 23 mm. in two specimens (45 and 36 mm. long), the gonopore at 28 mm.

The dorsal side is black with a yellow median band of different width (0,3-1,2 mm.) in the 3 worms, that is widened over the pharynx and the copulatory organs. Some fine black streaks occur in the yellow band. Two thin, antero-marginal yellow stripes run near the borders and fade away before the middle of the body or continue nearly to the hind end. The head of one worm is black, so that the yellow pattern begins 2 mm. behind the tip (Fig. 76). The ventral surface is brownish gray, its speckled borders are anteriorly darker, posteriorly lighter than the one-coloured central part.

The eyes surround the anterior tip in a single row that soon becomes irregular and forms a band 2-3 eyes deep. Then a few big eyes appear in the latero-median black zone, and at about 12 mm. from the tip the area taken by the eyes increases to 1 mm. width. They lie in small white halos and turn scarce behind the anterior third. The ventral nerves are plexus-like.

The mouth (m) lies at the rear of the pharynx pocket. The pharynx (Fig. 23) is cylindrical with folded borders, and the dorsal insertion is farther caudal than the ventral one. The anterior main branch of the intestine has ca. 30 secondary branches on each side, and each posterior division ca. 31.

Of the testes up to 4 dorsal follicles may occur one beside the other in a transverse section. The efferent ducts (d) unite where they enter the ventral end of the extra-bulbar seminal vesicle (s). The wall of the vesicle is muscular, its epithelium contains pellets of erythrophil secretion. Such also occurs in the cells lining the ejaculatory duct (e) that meanders within the strong muscle mass of the penial bulb (b). The latter is separated from the

surrounding parenchyma by a thick muscular lamella. The ejaculatory duct opens into a dilatation (k) with yellowish red secretion in its cells and lumen. The epithelium of the dilatation is 0,04 mm. high, and its nuclei are scarce. Cyanophilous glands (g) occur in the caudal part of the copulatory organ and all round its communication with the male antrum (a), that is a long slit. The male antral epithelium is quite flat.

The ovovitelloducts (o) ascend behind the gonopore (p). Shell glands (z) are developed around the ends of the paired ovovitelloducts as well as ectally to their union (v). The common ovovitelloduct and the female genital canal (q) run forward in a straight line, the latter already in the muscle coat of the female antrum (f). The epithelium of this is high (0,09 mm.) with an irregular surface and nuclei at very different levels. The muscle mantles of the male and female antrum are separate; a strong dorsal bundle of transverse muscle fibres (w) lies over the limit of the two antra.

Occurrence: Peru, Huacapistana on river Tarma, 1800 m. Three animals, June 1943.

The species is named in honour of the collector Dr. WOLFGANG K. WEY-RAUCH (Lima), our work-fellow many years ago at the Zoological Institute of the University of Berlin.

Discussion of *Geoplane weyrauchi*

A ventral, not terminal, opening of the ejaculatory duct is rare (*picadoi* Beauch., *vonguntini* Fuhrm.). The general aspect of *G. mayori* Fuhrmann (1914, t. 5 f. 8, 9) is similar to that of *weyrauchi*, but it is much bigger (92 mm. preserved), the details of the colour pattern are different, and the broad communication of male and female antrum, both indistinctly separated from the parenchyma, is not compatible with *weyrauchi*.

Geoplane takia, n. sp. (Fig. 26-28)

The worm is 45 mm. long and attains its maximum breadth, 6,5 mm., at the end of the second third. The borders are round; the height is 1,2 mm. in the mid-line, 1,5 mm. over the pharynx. The general shape with a narrowed anterior and a broad, only terminally pointed posterior end is the usual of the genus.

The back is grayish yellow with small black spots and a light median line; the ventral side is grayish white without spots.

The eyes form a single file around the fore end and spread over the borders of the back at 7 mm. distance from the tip. They are not numerous in front and soon become quite rare.

The mouth (m) lies at 30 mm., the gonopore (p) at 38 mm. The pharynx (Fig. 27) belongs to the cylindrical type with the dorsal insertion considerably farther backward than the ventral one. The border of the pharynx is folded, and cyanophil glands open here as well as in the lumen. The erythrophilous ones (h) are restricted to the border. The number of intestinal diverticles could not be verified because they were empty; it seems that they anastomose as in *G. quichua*, and that also the posterior limbs are connected. A ball of vegetable matter, certainly the intestinal contents of an animal eaten by the *Geoplane*, was seen in the sections.

The testes are dorsal. The efferent ducts (d) attain the penial bulb (b) and enter it with ascending, slightly curved and muscular end tubes (u). These open into the right (k) and left (x) diverticle of the seminal vesicle. The diverticles are involved in the penial muscle layer and contain sperm (r) as well as fine granular erythrophil secretion (k) produced by extra-bulbar glands (g). In their dorsal regions the diverticles join to form a common seminal vesicle. The erythrophilous secretion stored in the latter consists of coarser granules than that in the diverticles. The dorsal wall of the whole seminal vesicle has a high epithelium (0,06 mm.), the ventral one is quite flat. The conical penis papilla is pierced by the ejaculatory duct (e) that is dilated ectally and has a 0,02 mm. high epithelium.

The epithelium of the antrum is up to 0,06 mm. high, and its nuclei are disposed nearly in a row. Only erythrophil antral glands occur in the present worm. The ovovitelloducts (o) pass to the dorsal side approximately on the level of the gonopore (p) and receive shell glands (z) before and behind the point of their union (v). The short female genital canal (q) is not distinguished from the tubular caudal diverticle of the antrum into which it opens. The whole copulatory apparatus is involved in a common muscle mantle.

Occurrence: Peru, Huacapistana on river Tarma, 1800 m. One individual, June 1943.

Discussion of *Geoplane takia*

A species with male ducts uniting within the penial bulb is *G. crawfordi* Beauchamp (1939, p. 75) from southern Peru. Its colour is darker than that of *takia*, the male ducts unite at the basis of the long, peg-like penis, and the ovovitelloducts meet quite near the female antrum, the structure of which, examined in two worms, differs very much from that of *takia*.

G. cameliae Fuhrmann (1914, p. 756; Hyman 1941, p. 5) likens *takia* in shape, colour, cylindrical pharynx, and general aspect of the female antrum. The seminal vesicle however is simple and extra-bulbar in *cameliae*, and the epithelium of the penis forms small papillae, absent in *takia*.

Dr. Hyman (1939, p. 430) is quite right to stress the importance of the colour pattern in *Geoplane*, the copulatory organs of which offer little variation. On the other hand of course differences in these organs of similarly coloured forms separate them more emphatically than the pattern unites them. The present species would have been determined as *G. cameliae*, if the sections had not revealed different male organs. Therefore the identity (Hyman 1941, p. 6; Beauchamp 1947, p. 5) of *G. plana* Schirch (1929, p. 33; Riester 1938, p. 84) from the mountains near Rio de Janeiro with *cameliae* cannot be accepted as long as the copulatory organs of *plana* are unknown. *G. plana* is more than twice as long (110 mm.) as *cameliae* (50 mm.).

Geoplane pichuna, n. sp. (Fig. 29-32)

The bigger of the two specimens is 33 mm., the other 25 mm. long. The breadth of both is 2,5 mm., the height 1,2 mm. The shape of the body is characterized by parallel sides, little difference between the form of the two ends, and rounded borders.

The dorsal side is black with a whitish mid-line, that is broader over pharynx and copulatory organs. The black colour is produced by small, densely disposed dots. These become scarce towards the borders, where the skin is reddish brown. The reddish brown pigment passes to the ventral side except in the anterior region, where it is cut short by the white sensory margin ("Sinneskante"). The ventral surface is whitish with small dark dots. As these are rarer in the middle, this appears lighter.

The eyes are surrounded by halos and confined to the margin, although some of them lie inwards, near the borders. The ventral nerves constitute a plexus.

The mouth (m) lies at the rear of the pharynx pocket and 20 mm. from the tip of the 30 mm. long worm. The gonopore (p) lies at 25 mm. The pharynx is cylindrical with insignificant caudal dislocation of the dorsal insertion. The thick annular inner muscles of the pharynx have nuclei (c) situated outside the fibres.

One row of 20-24 dorsal testes occurs on each side. Every follicle is involved in dark pigment. The efferent ducts (d) open into the seminal vesicle (s) from the ventral side. The vesicle has its own strong muscle coat (t) that is not only morphologically separated from the penial bulb (b), but even stains differently in the present slides. The seminal vesicle with its many quite irregular pouches and diverticles is simplified in the drawing (Fig. 31). The short cone-shaped penis fills the whole male antrum. Erythrophilous glands (g) open around the orifice of the ejaculatory duct (e), the cells of which lie much farther forward, outside the bulb (b).

Male and female (f) antrum are separate. Longitudinal fibres prevail in the muscle mantle of the first, whereas the latter has a strong layer of nearly exclusively annular fibres (Fig. 31, a). The ovovitelloducts (o) rise in the region of the gonopore and unite (v) a little dorsal to the female antrum. Therefore the common ovovitelloduct and the female genital canal descend to the antrum. Shell glands (z) are developed entally and ectally to the uniting point of the ovovitelloducts. The epithelium of the male antrum is 0,025 mm. high. By some glands and the indistinctness or absence of cilia the epithelium of the innermost part of the female antrum can be discerned from the female genital canal. The columnar epithelium of the rest of the female antrum is 0,1 mm. high (Fig. 32).

Occurrence: Peru, Hacienda Chaquil near Cajamarca, 3150 m. Two specimens, march 1942.

Discussion of *Geoplana pichuna*

The aspect of *G. pichuna* resembles that of *G. saima* (Fig. 45-48) closely, but there are some differences in the dorsal and ventral colour pattern. The slightly farther caudal position of the dorsal pharyngeal insertion in the present species cannot be emphasized as a separating character, because the whole pharynx of Fig. 30 seems to be stretched and that of Fig. 47 contracted. However comparison of the seminal vesicles and the lining of the female antra shows true morphological diversities, and the penial glands of *pichuna*, its female genital canal (q), and the much thicker muscles around the female antrum have no parallel in *saima*.

The structure of the female antrum and penial glands approach the present species more than *saima* to *crawfordi* Beauchamp (1939, p. 75), although *saima* was found near the original locality of *crawfordi*. The shape of the male copulatory organ and the uniting of the paired seminal vesicles within the penis characterize *crawfordi* and separate it from *pichuna*.

Geoplana chulpa, n. sp. (Fig. 33-35)

The only worm is 65 mm. long, 10 mm. broad, and rather flat. The borders are rounded. The anterior end tapers a little more than the posterior one.

A yellow border separates the black dorsal from the yellowish white ventral side. Cleared in oil the back showed that the black colour consists of a fine dark granulation on a slightly lighter ground. At the anterior end the ventral side has dark spots, especially on the borders. These ventral melanophores extend over ca. 6 mm.

Already around the fore end the eyes form a band 5-6 eyes deep. The foremost have excentric white halos; the following eyes lie in the yellow border and spread into the margins of the black region without halos. They are few in number and some of them have trilobate pigment cups.

The pharynx (Fig. 34) extends from mm.s 33 to 40 where the mouth (m) lies, and belongs to the cylindrical type with the dorsal insertion farther backward than the ventral one and a broad, richly folded border. The anterior part of the intestine has 23 side branches on each side and each posterior limb ca. 25.

The testes are dorsal and two follicles can lie on each side in one transverse section. The seminal vesicle (s) is contiguous with the penial bulb (b) and receives the efferent ducts (d) in two ventro-lateral diverticles widely distant from each other. The conical penis extends beyond the level of the gonopore (p). Cyanophilous glands (y) occur on the ventral wall of the male and in great number around the female antrum (f). The lumen of the latter contains the secretion of these glands. The antral epithelium is 0,035 mm. high and has basilar nuclei all in one level.

The two ovovitelloducts (o) unite a very small distance from their entrance into the female antrum, so that only a very short female genital canal results. Shell glands are not developed yet.

Occurrence: Peru, Ollantaytambo (Urubamba valley). One worm, december 1947.

Discussion of *Geoplana chulpa*

The little known black *G. andicola* (Schmarda 1859, p. 15) from Ecuador has a light brown ventral side with bluish white mid-line, and a short cylindrical pharynx (Graff 1899, p. 313). *G. multipunctata* Fuhrmann (1914, p. 776) is somewhat similar to *chulpa*, but its ventral side is dark grayish brown with black borders, and the dorso-lateral parts of the body are garnished with 460 white spots on each side.

Geoplana aymara, n. sp. (Fig. 36-39, 77)

The broad and flat worm is 45 mm. long, 10 mm. broad. The anterior end of the present animal is damaged, the hind end is blunt.

The back has a mid-dorsal black band (0,8 mm. broad) bordered by two yellowish orange lines (breadth : ca. 0,4 mm. each) to the sides sharply set off against a black pigment that becomes lighter towards the margins. The ventral side is of a transparent light gray.

The eyes are disposed in a single file only a little way. Farther backwards they form various loose series, that do not extend medially beyond the outer zones of the sides, even between mm.s 10 and 12, where they attain their maximum of spreading over the back. The ventral nerves are plexus-like.

The pharynx (Fig. 38) is a richly folded cylinder with the dorsal insertion a little farther back than the ventral one, and erythrophilous glands that open in the whole caudal half of the inner epithelium. The mouth (m) lies at 27 mm., the gonopore (p) at 37 mm. from the anterior tip. The intestine shows ca. 21 branches on each side of the anterior limb and ca. 24 on each posterior division. Behind the gonopore the paired canals of the intestine anastomose twice and continue backwards near each other (Fig. 37).

Up to 5 dorsal testicular follicles can occur on each side in one transverse section. The efferent ducts (d) open from the sides into two lateral pouches of the seminal vesicle (s) that lies outside the penial bulb (b) with its whole length and has its own muscle coat. The ejaculatory duct (e) of the present specimen is dilated ectally. The volumous, truncated conical penis nearly fills the antrum. The epithelium of the latter is ventrally 0,04-0,045, dorsally and caudally up to 0,1 mm. high, and its nuclei are disposed on one level.

Cyanophilous glands (y) occur in all walls of the antrum. The ovovitelloducts (o) rise steeply at the level of the gonopore and receive shell glands (z) in the ectal third of their ascending course. Behind the point where the ducts meet (v) there are no more shell gland openings. The female genital canal (q) enters the antrum from above at some distance from the caudal antral wall.

Occurrence : Peru, Tarmatambo near Tarma, 3400 m. One specimen, June 1943, under a stone on the bank of a brook.

Discussion of *Geoplana aymara*

A mid-dorsal dark stripe bordered by light bands occurs in the Brazilian *G. olivacea* Fr. Müll. that was also recorded from western South America (Graff 1899, p. 298 ; Busson 1903, p. 407). In this species however the limit between the lateral zones and the paramedian yellowish bands is indistinct, and the zones are lighter than the median stripe. The copulatory organs of *G. olivacea* (Busson, f. 5 on p. 425) differ from those of *G. aymara* by the absence of seminal vesicle, penis, and female genital canal ("vaginal part" Busson). The colour of the back of *G. mexicana* Hyman (1939, p. 425 ; 1943, p. 1) is similar to *aymara*, but the ventral side of *mexicana* is medium brown or has a faint banded appearance. Moreover *G. mexicana* has ventral testes.

Geoplana caya, n. sp. (Fig. 40-44)

Of the two present worms the bigger one, 110 mm. long and 12 mm. broad, is immature, the smaller, 100 mm. and 10 mm., is mature. The latter is 2,5 mm. high in the region of the pharynx and 1,8 mm. over the gonopore. The anterior end tapers gently, the posterior one suddenly ; the borders are high and round.

The dorsal side is black with white mottles and a thin white mid-line in the anterior part. Over the pharynx (m) and gonopore (p) as well as at the anterior end and on the borders of the back the white specks are scarce or absent. The yellowish white ventral side becomes gray towards the fore end.

The eyes begin with a marginal irregular row and lie in small excentric halos. Farther backwards they become rarer on the margin and spread over the sides of the back no more than 0,5 mm. The ventral nerves are developed as a plexus.

The mouth lies at 68 mm., the gonopore at 81 mm. from the tip of the mature worm. The pharynx pocket extends backwards beyond the mouth and contains a cylindrical pharynx with a folded border (Fig. 43) and the dorsal insertion farther caudal than the ventral one. The outer and inner pharyngeal epithelium has normal nuclei. The erythrophil glands open on the inner side of the border and the cyanophilous ones on the outer surface and the ectal part of the inner side. About 40 branches occur on each side of the anterior trunk of the intestine ; those of the posterior limbs could not be counted, as they run parallel to the posterior limbs for a great extension. A snail of ca. 3 mm. length, nearly digested and ready for evacuation, was seen in the gut near the orifice.

The testes are dorsal ; there is only one row of follicles on each side. The efferent ducts (d) enter 1,1 mm. distant from each other into the ventral pouches of the seminal vesicle (s). This organ is T-shaped, accompanies the penial bulb (b) and has a thin musculature. The ejaculatory duct (e) proceeds with many sinuosities through the bulb and the conical penis papilla that extends beyond the level of the gonopore (p). Glands with pink secretion (g) open into small crypts of the dorsal wall of the male antrum.

The ovovitelloducts (o) begin to ascend in front of the gonopore. The ends of their separate parts as well as the beginning of the common ovovitelloduct receive the secretion of shell glands (z). A female genital canal is wanting, as the short tube between the uniting point of the ovovitelloducts (v) and the female antrum is a glandular duct. Numerous cyanophil glands open through the wall of the spacious female antrum (f) that is lined with a 0,06 mm. high epithelium with nuclei at different heights.

Occurrence : Peru, Sahuayaco in the Urubamba valley, 800 m. Two worms, December 1947.

Discussion of *Geoplana caya*

From the so-called forest region of Chile (Lat. 37°-45° S.) we know *Geoplana maculata* (Darwin 1844, p. 246) and some other species, perhaps allied to *maculata* (Goetsch 1933, p. 250-256, f. 2 on p. 254), whose colour pat-

tern is similar to that of *caya*. In these medium-sized flat chilean species the white or light yellowish spots are disposed in a more or less distinct longitudinal pattern that does not exist in *caya*, except a quite black streak over the pharynx. The maximum length among the various species united by Goetsch as "*maculata*-Formenkreis" is 50 mm.; black borders are not mentioned. As long as the anatomy of all members of the "*maculata*-Formenkreis" continues unknown, one cannot judge whether these "species" are related to one another or not (Corrêa 1947, p. 69) and still less identify worms collected 24 degrees farther North with one of them.

The spotted, mottled, or reticulate ventral side of the *maculata*-group contrasts with the uniform colour of *G. caya*. A similar, though darker, ventral side occurs in *G. multipunctata* Fuhrmann (1914, p. 776) that has a black border around the whole ventral surface and eyes extending nearly to the middle of the back. Moreover the white stipples of *multipunctata* are developed only in the lateral parts of the back, and its testes are 2-3 on each side on the same level. The peculiar glands in the dorsal wall of the male antrum and the very undulate course of the ejaculatory duct agree in *multipunctata* and *caya*, but the penis of the colombian species is much smaller.

Geoplana saima, n. sp. (Fig. 45-48)

The ribbon-like worms are up to 25 mm. long, 3 mm. broad, and 1,3 mm. high. As the borders are round, the middle of the back is only little arched. The sides are parallel over most of the body-length, and the round fore end does not taper much more than the broad hind end.

The colour of the back is a velvety grayish black with a light mid-dorsal line. The ventral side varies from nearly white to darker gray with fine brown stipples, especially towards the fore end.

The eyes are all marginal and begin in a single row. Farther back some of them are placed a little more inwards, but they do not spread over the back. The ventral nerves form a plexus.

The mouth (m) lies 17 mm. behind the anterior tip at the hind end of the pharynx pocket. The pharynx (Fig. 47) is cylindrical with the dorsal and ventral insertion at almost the same level. The inner pharyngeal epithelium has long cilia and normal nuclei. Its passage to the intestine (i) is folded, and the nuclei (a) of the inner annular muscles form a layer between the fibres and the parenchyma. The nuclei of the outer epithelium are depressed. Erythrophilous glands open on the border, cyanophilous ones on the whole outer surface.

The dorsal testes are disposed in a single series of ca. 60 follicles on each side. The efferent ducts (d) enter the seminal vesicle (s) at a distance of 0,4 mm. from each other. The volumous and long muscular vesicle lies outside the penial bulb (b). The ejaculatory duct begins wide and sinuous and then becomes straight and narrow (e). The cylindrical, bulky penis occupies nearly the whole male antrum, the dorsal wall of which is closely beset with the openings of pink glands (x).

The ovovitelloducts (o) bend dorsally in the region of the gonopore (p) and unite (v) before attaining the upmost level of the female antrum. Therefore the common ovovitelloduct continues ascending. Shell glands (z) occur

entally and ectally to the union of the ovovitelloducts. The spherical female antrum that is separate from the male one has its own muscular coat (c), the nuclei of which surround the fibres. Around a capillar central lumen the female antrum is filled with a mass of small cells (r) that do not form an epithelium and have no regular common surface. A thick layer of these cells also covers the caudal wall of the tube that connects the female antrum with the gonopore.

Occurrence : Peru, Puno on lake Titicaca, 3900 m. Seven animals under stones in a garden ; december 1940.

Discussion of *Geoplana saima*

G. crawfordi Beauchamp (1939, p. 75) from the neighbourhood of Puno, Capachica, is similar in measurements, colour, and eyes. But the insertion of the pharynx, and the male and female copulatory organs are different. The pharynx of *crawfordi* belongs to the type of *Cheradoplana langi* (Graff 1899, t. 29 f. 11), that is cylindrical with a dorsal insertion removed backwards. The male ducts of *crawfordi* meet far ectally, so that the seminal vesicles and the following ducts are paired. The female antrum of *crawfordi* that is not separated from the male one, is lined with a single layer of high glandular cells, and not filled with the mass of small cells that occur in *saima* and constitute a good systematic character of mature specimens, as I know from the analysis of various brazilian species of *Geoplana*. In *crawfordi* the point where the ovovitelloducts unite lies very near the female antrum.

The brazilian *G. preta* Riester (1938, p. 35 ; Marcus 1951, f. 194-196) is smaller ; has cyanophil glands opening also into the lumen of the pharynx ; depressed nuclei in the ectal part of the inner pharyngeal epithelium ; 20 testicular follicles on each side ; a penis that does not fill the long and folded male antrum ; and a gland-free continuation of the common ovovitelloduct, the female genital canal, that is absent in *saima*.

Geoplana talpa, n. sp. (Fig. 49-51)

The biggest of the 3 specimens is 35 mm. long, 7,5 mm. broad, and 2,4 mm. high. Its anterior end tapers gradually, the posterior one is round. The borders are quite round.

The dorsal side is black with two light yellow paramedian lines (ca. 5 mm. long) short before the hind end. These lines are absent in one of the 3 worms. The ventral side is a transparent grayish white in all three animals.

The eyes lie in white halos ; they form an irregular file around the anterior region, and 8-10 mm. behind the tip scatter over the lateral zones of the back, where they occupy the eighth to sixth part of the breadth. The halos of the anterior eyes are small, those of the latero-dorsal ones medium-sized. The eyes become very scarce 20 mm. from the tip. The ventral nerves constitute a plexus.

The mouth (m) lies at 23 mm. in the biggest specimen, the gonopore (p) at 29 mm. The pharynx (Fig. 50) belongs to the cylindrical type with backward removed dorsal insertion and depressed nuclei of the outer and inner epithelium. The erythrophilous glands open inside the folded border, the

cyanophilous ones occur on the inner and outer surface. The nuclei of the annular internal muscles accompany their fibres. Each side of the anterior intestinal limb has ca. 23 secondary branches and each posterior trunk ca. 18.

In the intestine of one worm a stage of a Trematode was found, probably a tailless Cercaria (Cercariaeum), as f. ex. Wesenberg-Lund (1934, t. 32-34) has excellently figured them. As *Geoplana*-species eat slugs and snails, the occurrence of a Cercariaeum in the intestine of the present Triclad is not strange. It is not known, whether Trematodes can reach maturity in Terricoles as they evidently can in Polyelads (Graff 1892, p. 204).

The testes are dorsal; 2-3 follicles close together form a group on each side of the transverse sections. Even the largest of the three worms is only at the onset of sexuality, so that most of the glands of the copulatory apparatus are not yet developed. The efferent ducts (d) enter the seminal vesicle (s) separately at a distance of 0,3 mm. from each other. The vesicle lies outside the penial bulb and is revested by strong muscles. The ejaculatory duct opens at the tip of the acuminate bulbiform penis that occupies nearly the whole antrum.

The antral epithelium has the considerable height of 0,08-0,12 mm. with nuclei all on one level. In the ventral wall of the antrum there are some cyanophilous glands. The ovovitelloducts (o) rise behind the gonopore (p), and from the point of their union (v) the female genital canal (q) bends vertically downwards.

Occurrence: Peru, Huailah uichán on river Tarma, near Palca, 2900 m. Three worms on a moist meadow, may 1943.

Discussion of *Geoplana talpa*

Black or nearly black, one-coloured, not mottled, species of *Geoplana* are not numerous. Graff (1899, p. 543) mentioned *G. eugeniae* (p. 313) without penis papilla (p. 183); *G. férussaci* (p. 314), the eyes of which are very numerous and spread nearly over the whole dorsal side (Riester 1938, f. 67; Marcus 1951, f. 170); and *G. atra* Fr. Müller (1857, p. 24; Graff 1899, p. 307) with large testes that descend between the intestinal diverticles (p. 159) and distinctly separated antra (p. 185). The female antrum of *G. preta* Riester (1938, f. 38; Marcus 1951, f. 196) differs widely from that of *G. talpa*. *G. idaia* (Fig. 52-55) has a dark gray ventral side and a peculiar penis.

Geoplana idaia, n. sp. (Fig. 52-55)

The material consists of three specimens. Two of 27 and 28 mm. are mature, the third, 19 mm. long, is young. The breadth is 6-7 mm., the height only 1,5 mm. The anterior end is pointed suddenly and the hind end rounded broadly. The borders are sharp.

The colour of the dorsal side is black. The ventral side is dark gray, a little lighter around the mouth and the gonopore, and the black dorsal colour passes onto the ventral side where it is cut short by the broad creeping sole. The anterior tip is rimmed with a white sensory margin.

The eyes are recognizable only in the tip. They form a single row and have no halos. Farther back the black pigment hides the eyes completely even in cleared worms. The ventral nerves are plexus-like.

The mouth lies at the rear of the pharynx and 17 mm. behind the tip, the gonopore at 21 mm. The nearly smooth pharynx (Fig. 53) is 2,1 mm. long, cylindrical, and its dorsal insertion lies 0,5 mm. farther back than the ventral one. The outer epithelium has depressed nuclei, the inner normal ones. Many cyanophil glands open on the outer and few on the inner surface. The erythrophil glands are restricted to the pharynx border.

The testes are dorsal. Up to 3 follicles lie beside one another on the same side of a transverse section. The dilated efferent ducts (d) or spermiducal bulbs enter the seminal vesicle from below, 0,32 mm. distant from each other. The wide vesicle (s) is extra-bulbar, revested with a strong muscle coat, and lined by a high epithelium. The ejaculatory duct (e) runs in the middle of the oblique penis papilla and opens on its truncate apex. The male organ extends beyond the gonopore (p) into the female antrum (f).

The penial papilla is beset with numerous glandular papillae (g), each about 0,12 mm. broad and 0,11 mm. high. Their centre is pierced by a canal of 0,025 mm. in diameter, the wall of which is constituted by lamellar cytoplasm (l). The nuclei (n) that belong to this wall lie at the base of the canal as a bud-like group. This is penetrated by the cyanophilous strands (c) of extra-bulbar glands. Erythrophil glands (h) are situated around the central canal and open on the surface of the papilla. Each papilla is surrounded by a very strong layer of annular muscles as such also covers the whole penis papilla.

The ovovitelloducts (o) bend upwards behind the gonopore (p) and unite below the female antrum (f). Shell glands (z) involve the ascending parts of the ovovitelloducts and also open ectally from their uniting point (v). The glandular duct and the female genital canal (q) continue backwards an upwards. The latter turns forwards to enter the female antrum. In the present specimens the secretion of the shell glands is cyanophilous. The epithelium of the female antrum is folded and 0,04-0,08 mm. high, with basal nuclei.

Occurrence: Peru, in the Puna over Abancay, 4000 m. Three worms, december 1947.

Discussion of *Geoplana idaia*

There is a group of in a wide sense andean species with papillae on the penis, viz. *Geoplana vunguenti* Fuhrmann (1914, p. 760) from Medellín-Colombia (about 1500 m.); *G. picadoi* Beauchamp (1912, p. III) from Costa Rica; *G. montana* Hyman (1939, p. 426) also from Costa Rica (1160-2800 m.); and *G. sandersoni* Prudhoe (1949, p. 424) from Trinidad (Mount Aripo).

Especially *vunguenti* is very similar to *idaia*, and it is a question whether the peruvian specimens should not be regarded as a geographical subspecies of the colombian ones. The back of *vunguenti* has a black median line, broad bistre or ochre paramedian zones, lateral gray bands, and narrow ochre borders. A seminal vesicle is not figured nor mentioned in the text, though glands are described and sketched (l. c., f. 7, gl) around the entrance of the

efferent duct into the penial bulb. The papillae are less numerous and proportionally bigger in *vongunteni* than in *idaia*, and the ejaculatory duct of *vongunteni* opens on the ventral side of the penis.

In all the above mentioned species with papillae on the penis the female duct enters the antrum from below, but this character can be valued for taxonomic purposes at most combined with the papillae. The structural details of the papillae in *montana* and *sandersoni* comprise more muscular elements than in *vongunteni* and specially *idaia*. *G. sandersoni* has ventral testes behind the pharynx and therewith differs widely from the majority of the neotropical *Geoplana*-species. The position of the testes in *G. picadoi* and *G. montana* is not mentioned, but as the latter is said to be closely related to *G. cameliae* Fuhrmann (1914, p. 756), they can be supposed to be dorsal.

Geoplana pulchella Fr. Müller (Fig. 56-59, 78)

Geoplana pulchella Fr. Müller 1857, p. 25

Geoplana pulchella Graff 1899, p. 330

The only worm is 50 mm. long, 4 mm. broad, and 1,5 mm. high. The borders are for the most part nearly parallel, so that there is only little difference between the somewhat more acuminate fore and the blunter hind end. The transverse section is crescent-shaped, as the back is evenly arched over the plane ventral side. The borders are round.

The ventral side is whitish, the back dark grayish brown with a lighter middle region. A yellow median band occurs in the fore and hind part of the body. Approximately 5 mm. of the tip are brick-red. With exception of this part the body-sides are provided with large oval or irregularly shaped white spots that are halos around the eyes. They are up to 0,6 mm. in diameter, sometimes two of them coalesce, and they grow scarcer towards the hind end.

Anteriorly the eyes form a heap on each side rather near the tip that is crossed by a single file of eyes. The ventral nerves form a plexus.

The mouth (m) lies 31 mm. behind the fore end, the gonopore (p) 38 mm. The pharynx (Fig. 58) is cylindrical; its dorsal insertion is slightly (0,32 mm.) more caudal than the ventral one. Erythrophil glands open on the much folded border and between the inner epithelium, the nuclei of which are normal. All the cyanophil glands pass their secretion to the lumen of the pharynx. The nuclei of the outer epithelium are depressed. The inner circular muscles (c) of the pharynx are strong. The longitudinal cutaneous muscles are remarkably thick (0,07 mm.). The erythrophil marginal glands of the skin are developed as in most *Geoplana*-species.

The testes are dorsal, two or three follicles lying together. The efferent ducts (d) are dilated in their ectal parts forming what Dr. Hyman calls spermiducal bulbs. These enter the seminal vesicle (s) from below and considerably distant (0,32 mm.) from each other. The vesicle has its own muscular coat and contains sperms and erythrophil secretion. The curved ejaculatory duct (e) connects the seminal vesicle with the male antrum (a), that is involved by muscles (b) and lined with a high epithelium. This is folded irregularly near the entrance of the ejaculatory duct and pierced by erythrophil glands. There is no penis papilla.

The ovovitelloducts (o) rise behind the gonopore (p) and unite (v) below the entrance of the common ovovitelloduct into the female antrum (f). Therefore the common ovovitelloduct continues ascending. The glands that have furnished the erythrophil secretion in the epithelia of the common ovovitelloduct and the female antrum did not stain.

Occurrence: Brazil, Brusque (Sta. Catharina), one worm.

Further distribution: Blumenau (Sta. Catharina).

Discussion of *Geoplana pulchella*

Fritz Müller observed *G. pulchella* only once, and Graff merely copied his description. Although the present specimen is twice as long and broad as Fr. Müller's, the proportions are the same. An only moderate tapering of the fore end, a brownish brick-coloured anterior third, oval whitish spots, and rather dense eyes near the fore end are mentioned in the brief original description. Neither the occurrence of the brick tinge nor the large light spots are common elements in Brazilian species of *Geoplana*. Therefore it seems justified to describe a worm found near Blumenau that suits approximately to the essentials of the first diagnosis, under the old name. As the type-specimen of *G. pulchella* was not preserved, and the occurrence of another species that agrees still better with Müller's description than the present worm is not probable, the risk of a confusion is very insignificant.

Geoplana sexstriata Graff (Fig. 60-63, 79-81)

Geoplana sexstriata Graff 1899, p. 329 t. 7 f. 10-11

Geoplana octolineata Schirch 1929, t. 2 f. 13 (explanation p. 36)

Geoplana sexlineata Riester 1938, p. 5 f. 1-3, t. 1 f. 1

The biggest of the 5 present animals is 80 mm. long and 2,5 mm. high. Its greatest breadth is 5 mm. and lies in the pharyngeal region. In transverse section the worms are dorsally very convex and ventrally concave, with sharp borders. The fore end is less pointed than the hind end. Thus the shape resembles the above mentioned figure of Schirch. Graff's and Bresslau's drawings (Riester, l. c.) however show that the shape varies corresponding to the preservation and has no specific value.

The colour varies: the lightest of the present specimens has bluish black paramedian stripes separated by a very narrow light mid-line, yellow lateral zones, and grayish green borders; the darkest is nearly black with only vestigial yellow stripes on the anterior end and a grayish green tinge on the borders. An intermediate type shows the black median stripes close together and widely separated from the lateral black stripes by yellow zones. The lateral stripes are accompanied by marginal ones, and the latter are bordered by a narrow yellow line. The paramedian stripes are always blackest; the greatest intensity of black in the other stripes can once belong to the lateral, another time to the marginal ones. The hind part of the body is always darker than the anterior. The ventral side is whitish gray without spots.

The eyes lie in a sometimes irregular row in the outermost yellow marginal line and have no halos. The ventral nerves form a plexus.

In a 75 mm. long worm the mouth (m) lies 40 mm. behind the tip, the gonopore (p) 48 mm. The smooth pharynx (Fig. 62) is 5 mm. long and typically cylindrical with dorsal and ventral insertion on the same level. The mouth is situated in the middle of the pharynx pocket. The nuclei of the inner epithelium are normal, those of the outer for the most part depressed. Erythrophil and cyanophil glands open on the border of the pharynx and on its outer surface, where those with pink secretion are restricted to the ectal part. The layer of inner annular muscles (r) is especially thick in the region near the pharyngeal mouth. Erythrophil marginal skin-glands are scarce.

One row of testicular follicles occurs on each side. These are dorsal but extend far downwards between the intestinal branches. The efferent ducts (d) open 0,3 mm. distant from each other into the folded male antrum (c). Glands (g) that lie outside the musculature (b) of the copulatory organs enter the anterior cavities of the antral lumen, which correspond to a bipartite common vesicle. Cyanophil glands open into the middle region of the male antrum. There is no penis papilla.

The muscles around the female antrum are continuous with those of the male part. The ovovitelloducts ascend behind the gonopore (p). Shell glands (z) occur around their ectal parts as well as beyond their uniting point (v). The glandular duct is connected with the female antrum by a short gland-free female genital canal (q).

Occurrence : Brazil, Brusque (Sta. Catharina), 5 animals. Two specimens under logs in a wood near the city of São Paulo.

Further distribution : Rio Grande do Sul, Taquara do Mundo Novo ; State of Rio de Janeiro, Therezopolis.

Discussion of *Geoplana sexstriata*

The considerable distance between the paramedian and lateral stripes in the present material agrees better with *sexlineata* than with *sexstriata*. The very convex dorsal side, that is sharply set off against the ventral side, suits better to *sexstriata*. This difference may be due to different fixation. A great variability of the colour, both of the ground and of the black stripes results from Bresslau's notes (Riester 1938, p. 5-6) ; Graff had only two small worms (25 and 9 mm.) available. Riester was right to emphasize the near relations between *sexlineata* and *sexstriata*, recommending their separation as long as the copulatory organs of *sexstriata* were unknown. In reproductive organs and pharynx the present worms agree perfectly with *sexlineata*, and as the distance between Brusque and Taquara do Mundo Novo (original locality of *sexstriata*) is 360 km. against 800 km. between Brusque and Therezopolis, where *sexlineata* was collected, I assume that also the specimens from Rio Grande do Sul have the same anatomical characters.

Schirch (1929, p. 30) reported *G. octostriata* Fr. Müll. from Therezopolis and figured the colour pattern of this species (t. 2 f. 3). He considered his figure 13 (t. 2) as a greenish variety of *octostriata*, but called it *octolineata*. This animal is certainly *sexstriata* Gr. (= *sexlineata* Riest.), and Schirch's denomination has probably occasioned Bresslau's preliminar classification of his material as *octostriata* that puzzled Riester.

Choeradoplana langi (Graff) (Fig. 64-69, 82-83)

Geoplana langi Graff 1894, p. 3

Choeradoplana langi Graff 1897, p. 2

Choeradoplana langi Graff 1899, p. 396 t. 7 f. 6-9, etc., f. 46 on p. 195

The maximum length of the worms in the present material is 25 mm., the breadth 2 mm., and the height 1,5 mm. The head is blunt or pointed at the tip, dilated over the ventro-lateral gland-masses and set off from the body by a neck-like constriction. The body is elongated and tapers gradually towards the hind end. The back is convex, the ventral side flattened, the transverse section almost circular.

The colour of the ground is yellow on the back, whitish or grayish on the ventral side. There is a wide range of variation in the pattern of the dark brown or black pigment, though it always begins a little behind the tip, on the constriction. The head is of the light ground colour ; this indicates that the head is borne curled up as in *Ch. iheringi*. Generally a median light zone is present. Its borders, the medial stripes of Graff's terminology (1899, p. 25 f. 2), have sharp inner and indistinct outer limits. The following zone is the most variable. Once it is dark with two black stripes, the lateral and the marginal stripe, in other cases only the latter is present. The outer marginal zone is light and its yellow tinge passes to the ventral side.

The eyes are confined to the light marginal border, where they form an irregular row. A small increase of eyes occurs in the region in which the dark stripes of pigment begin. The ventral nerves form a thick plate-like plexus.

The mouth (m) lies in the middle of the pharynx pocket and 14 mm. behind the anterior end ; the gonopore (p) 17 mm. The pharynx (Fig. 68) is a cylindrical organ, the dorsal insertion of which lies a little farther caudal than the ventral one. The nuclei of the pharyngeal epithelia are depressed on the outer surface and in the ectal part of the inner side. In the ental part of the latter they are normal. The cyanophil glands open on the outer surface, a few erythrophil ones on the border of the pharynx. The greater part of the pink glands (g) is situated in the wall of the pharynx pocket, and their secretion passes directly into the lumen of the latter.

Up to 3 dorsal testicular follicles lie beside one another on one side of the same transverse section. They descend between the intestinal branches beyond the middle of the body. The efferent ducts (d) enter the penial bulb (b) and open into the seminal vesicle (s) at a distance of 0,1 mm. from each other. The epithelium of the seminal vesicle contains granular secretion as does that of the ejaculatory duct (e). There is no penis papilla, but the strong muscles around the male antrum (a) and the deep folds of the latter indicate that it can be partially evaginated for copulation.

The ovovitelloducts (o) rise behind the gonopore (p). Their ectal parts and the glandular duct that results from the union (v) of the ovovitelloducts receive shell glands (z). The following narrow tube corresponds to the female genital canal and the female antrum (f), but it is impossible to discern between these parts. The copulatory organs of the present material agree entirely with Graff's wood-cut.

Occurrence : Brazil, Brusque (Sta. Catharina), 5 specimens.

Further distribution : Blumenau (Sta. Catharina) ; Rio Grande do Sul ; Paraguay ; Argentine, near Buenos Ayres.

Resumo

O trabalho presente contém a descrição de 17 espécies das Geoplanidae. Registrando a fauna das Bromeliáceas, Dr. FIRMINO DE CASTRO (Rio de Janeiro) colecionou em Brusque (Sta. Catarina), perto de Blumenau, *Geoplana pulchella* Fr. Müller, *G. sexstriata* Graff, e *Charadoplana langi* Graff. O material da última concorda com a descrição original em todos os pormenores. O exame dos órgãos reprodutivos de *G. sexstriata* possibilitou incluir, na sinonímia, *G. sexlineata* Riester, de Terezópolis. Tal procedimento já foi preparado por Riester (1938, p. 6). O espécime de "*G. octolineata*" de Schirch (1929, t. 2 f. 13) pertence à mesma espécie, não porém o de *G. octostriata* (ibid., f. 3). *G. sexstriata* ocorre também nos arredores da cidade de São Paulo. A revalidação do nome de *G. pulchella*, observada somente uma vez por Fritz Müller, justifica-se pelo colorido bastante invulgar descrito na diagnose original e encontrado semelhante em um verme de Brusque.

As outras 14 espécies proveem de várias partes do Perú, entre Lat. 15°50' e 7° S., onde foram colecionados por Dr. WOLFGANG K. WEYRAUCH (Lima) em altitudes entre 800 e 4000 m. Relações com espécies do Chile e mais ainda da Colômbia não faltam, mas em nenhum caso foi possível identificar uma das espécies do Perú com outra, anteriormente descrita. Revela-se, nisso, o conhecido fator isolador das montanhas. Acrescenta o fato de ter sido descrita, até agora, apenas uma espécie dos Tricladida Terricola do Perú, *G. crawfordi* Beauchamp (1939, p. 75) da península de Capachica, no lago Titicaca. A espécie mais interessante é *G. idaia* (Fig. 54) com papilas no órgão copulador masculino, semelhantes às de *G. vungunteni* Fuhrmann (1914, p. 760) de Medellín na Colômbia. A maioria das espécies peruanas de *Geoplana*, aqui reunidas, apresenta cores escuras.

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PLATE I

Geoplana garua, n. sp.

Fig. 1 — Ventral view.

Fig. 2 — Colour pattern of back.

Fig. 3 — View of intestine in pharynx-region.

Fig. 4 — Median section of pharynx.

Fig. 5 — Median section of copulatory organs.

Fig. 6 — Median section of dorsal antral glands.

a, annular sub-epithelial muscles of antrum. c, oesophagus. d, efferent ducts. g, opening of antral gland. h, gland-cells of antrum. i, intestine. m, mouth. o, ovovitelloduct. p, gonopore. q, female genital canal. r, longitudinal sub-epithelial muscles of antrum. v, uniting point of ovovitelloducts. y, nuclei of sub-epithelial antral musculature.

Geoplana chalona, n. sp.

Fig. 7 — Ventral view.

Fig. 8 — Pharynx in clove oil.

Fig. 9 — Median section of copulatory organs.

b, penial bulb. d, efferent ducts. e, ejaculatory duct. f, female antrum. k, pink glands of seminal vesicle. m, mouth. o, ovovitelloduct. p, gonopore. q, female genital canal. s, seminal vesicle. v, uniting point of ovovitelloducts. y, cyanophilous antral glands. z, shell glands.

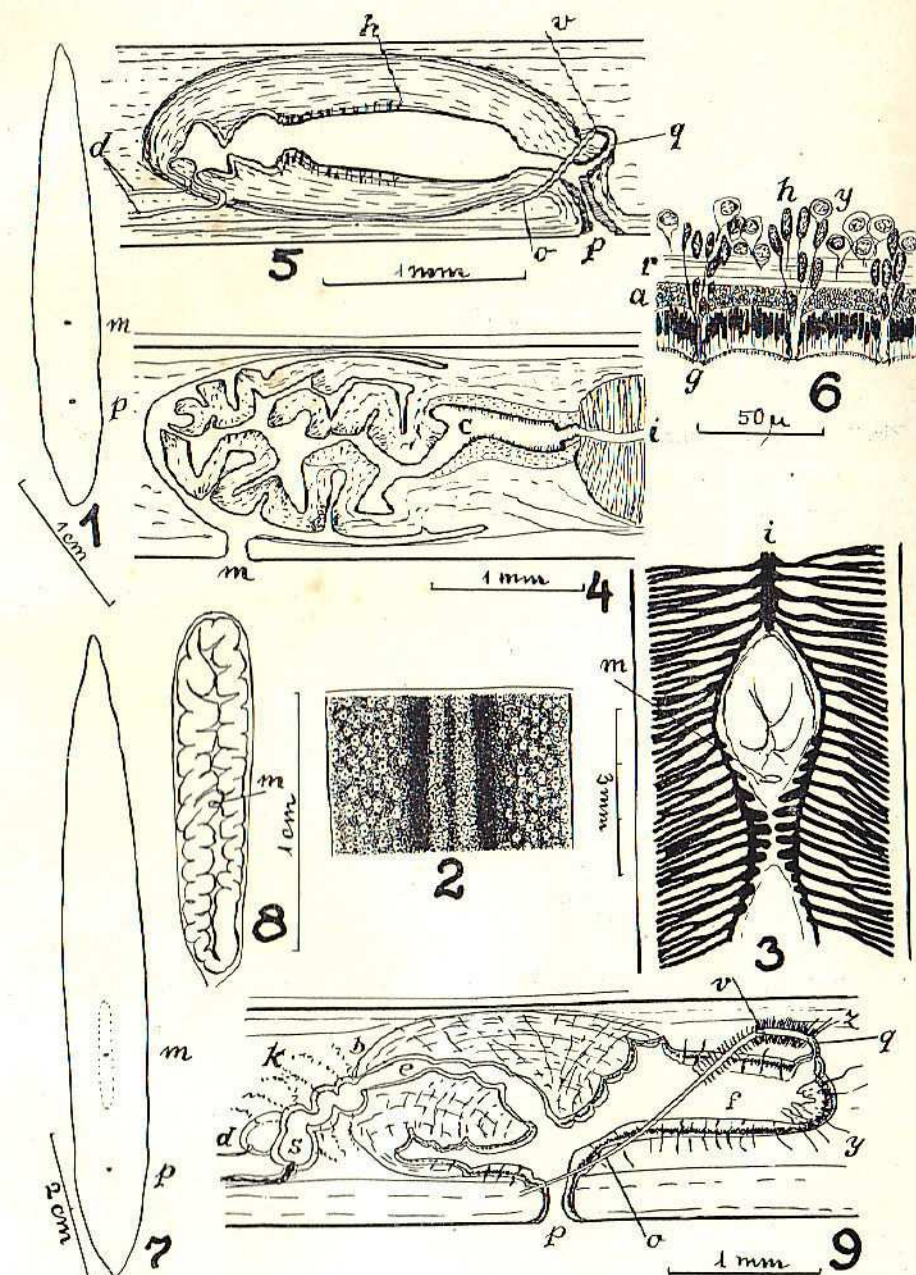


PLATE II

Geoplana cantula, n. sp.

Fig. 10 — Dorsal view.

Fig. 11 — Median section of pharynx.

Fig. 12 — Median section of copulatory organs.

Fig. 70 — on plate VIII.

b, penial bulb. d, efferent ducts. e, ejaculatory duct. f, female antrum. i, intestine. m, mouth. p, gonopore. q, female genital canal. r, retractors of penis. s, seminal vesicle. v, uniting point of ovovitelloducts.

Geoplana gabriellae, n. sp.

Fig. 13 — Dorsal view.

Fig. 14 — Anterior end showing distribution of eyes.

Fig. 15 — Ventral view of pharynx.

Fig. 16 — Ventral view of copulatory region.

Fig. 17 — Median section of copulatory organs.

Fig. 71-73 on plate VIII.

b, penial bulb. d, efferent ducts. e, ejaculatory duct. f, female antrum. i, intestine. m, mouth. o, ovovitelloducts. p, gonopore. q, common ovovitelloduct (glandular duct). s, seminal vesicle. v, uniting point of ovovitelloducts. w, widened part of ovovitelloducts. y, cyanophilous glands. z, shell glands.

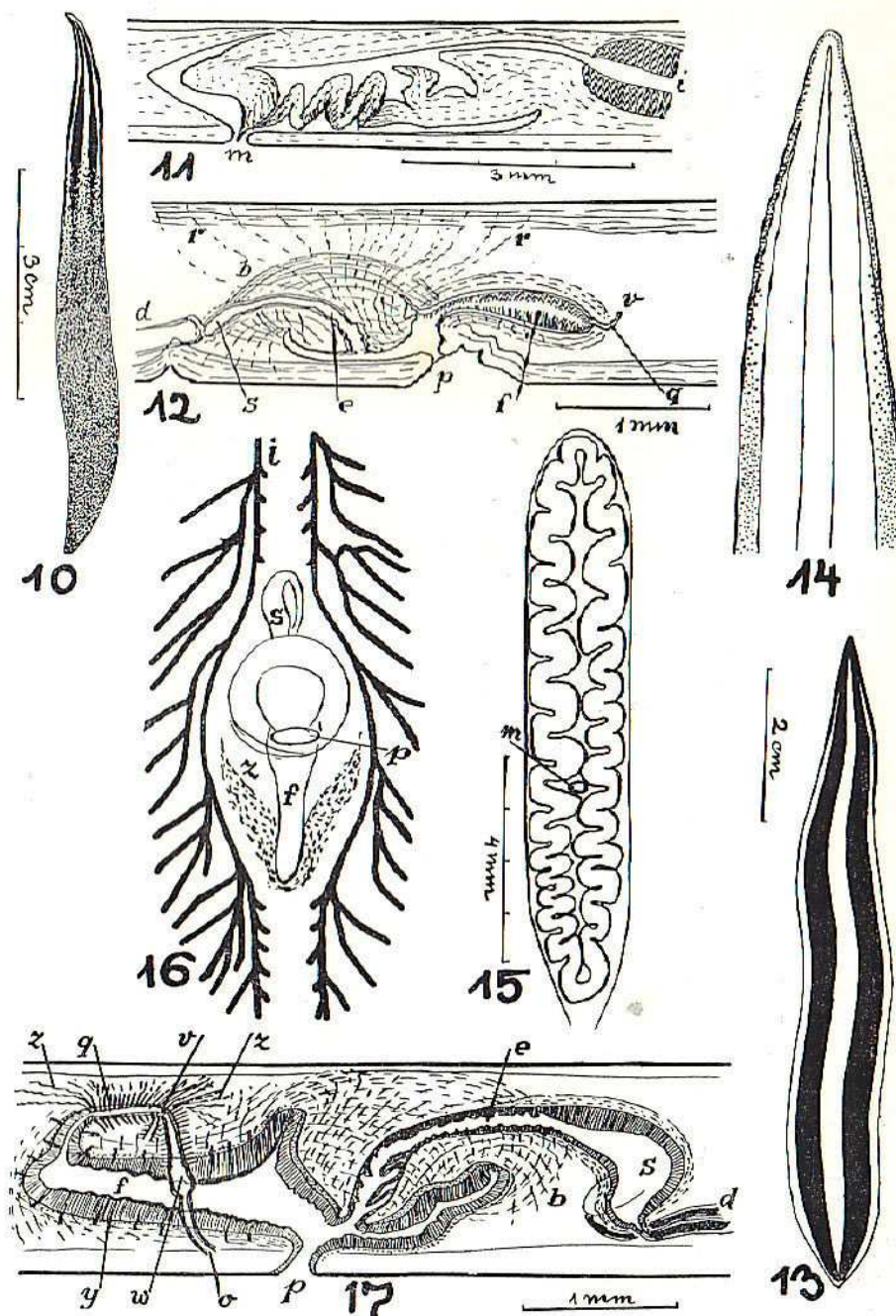


PLATE III

Geoplana quichua, n. sp.

- Fig. 18 — Dorsal view of biggest worm.
 Fig. 19 — Ventral view of hind end in clove oil.
 Fig. 20 — Median section of pharynx.
 Fig. 21 — Median section of copulatory organs.
 Fig. 74-75 on plate VIII.

a, anastomoses between side branches of anterior intestine. b, penial bulb. c, oesophagus. d, efferent ducts. e, ejaculatory duct. f, female antrum. g, cyanophilous glands of pharynx. h, erythrophilous glands of pharynx. i, intestine. m, mouth. o, ovovitelloducts. p, gonopore. s, seminal vesicle.

Geoplana weyrauchi, n. sp.

- Fig. 22 — Dorsal view.
 Fig. 23 — Median section of pharynx.
 Fig. 24 — Median section of copulatory organs.
 Fig. 25 — Median section of copulatory organs of a second worm.
 Fig. 76 — on plate VIII.

a, male antrum. b, penial bulb. d, efferent ducts. e, ejaculatory duct. f, female antrum. g, cyanophilous glands and secretion. i, intestine. k, dilatation of ejaculatory duct. m, mouth. o, ovovitelloducts. p, gonopore. q, female genital canal. s, seminal vesicle. v, uniting point of ovovitelloducts. w, dorsal transverse muscle. z, shell glands.

Geoplana lakia, n. sp.

- Fig. 26 — Ventral view in clove oil.
 Fig. 27 — Median section of pharynx.
 Fig. 28 — Median section of copulatory organs.

b, penial bulb. d, efferent ducts. e, ejaculatory duct. g, erythrophil penial glands. h, erythrophil pharyngeal glands. i, intestine. k, fine granular secretion in right diverticle of seminal vesicle. m, mouth. o, ovovitelloduct. p, gonopore. q, female genital canal. r, sperms in right diverticle of seminal vesicle. s, coarse granular secretion in seminal vesicle. u, end tube of left efferent duct. v, uniting point of ovovitelloducts. x, left diverticle of seminal vesicle. z, shell glands.

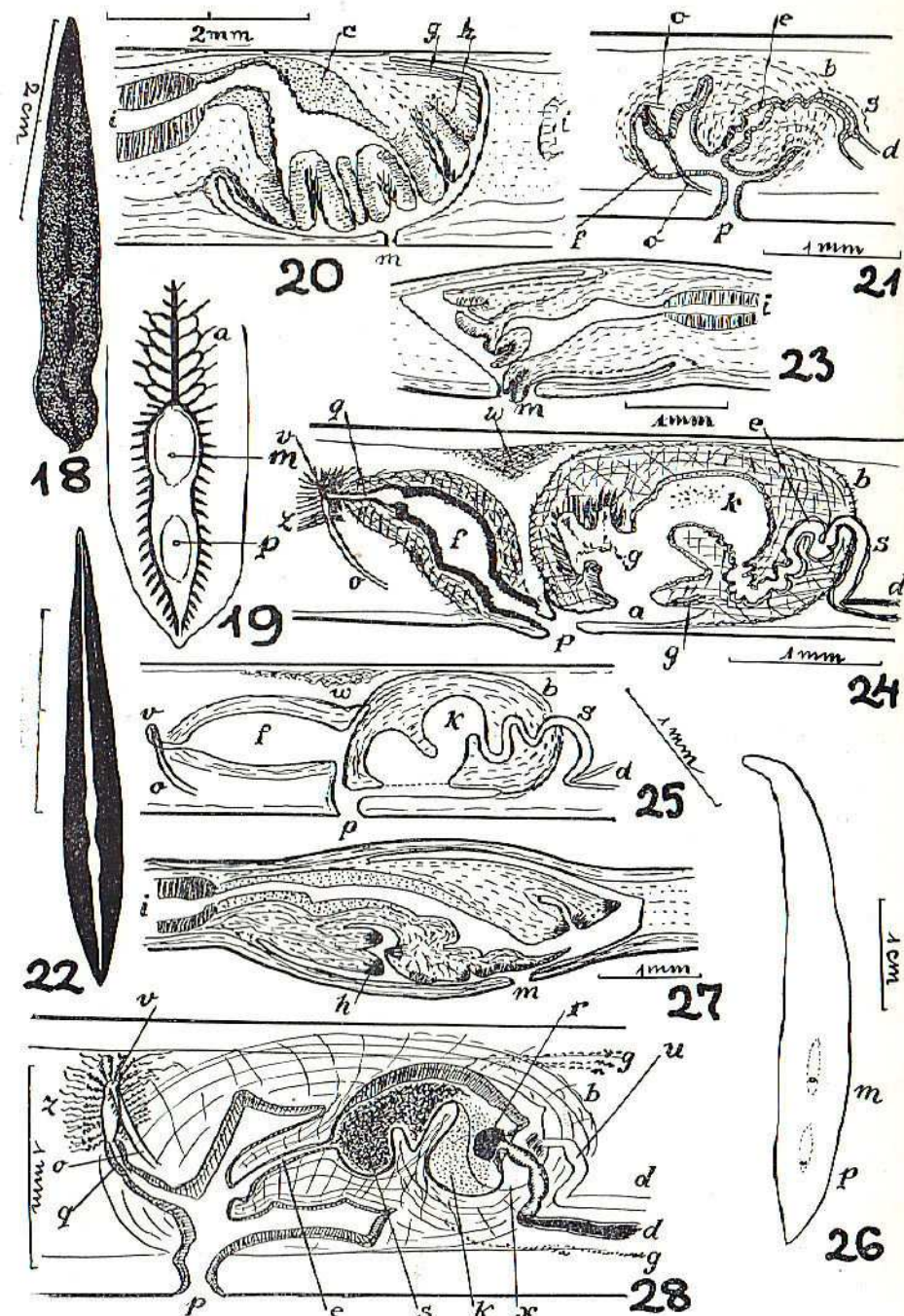


PLATE IV

Geoplana pichuna, n. sp.

Fig. 29 — Dorsal view.

Fig. 30 — Median section of pharynx.

Fig. 31 — Median section of copulatory organs.

Fig. 32 — Section of epithelium of female antrum.

a, annular muscles of female antrum. b, penial bulb. c, nuclei of inner annular pharyngeal muscles. d, efferent ducts. e, ejaculatory duct. f, female antrum. g, erythrophil penial glands. i, intestine. m, mouth. o, ovovitelloduct. p, gonopore. q, female genital canal. s, seminal vesicle. t, muscles of seminal vesicle. v, uniting point of ovovitelloducts. y, cyanophil glands of female antrum. z, shell glands.

Geoplana chulpa, n. sp.

Fig. 33 — Ventral view of worm cleared in clove oil.

Fig. 34 — Median section of pharynx.

Fig. 35 — Median section of copulatory organs.

b, penial bulb. d, efferent ducts. e, ejaculatory duct. f, female antrum. h, pharynx pocket. i, intestine. m, mouth. o, ovovitelloducts. p, gonopore. s, seminal vesicle. y, cyanophilous glands.

Geoplana aymara, n. sp.

Fig. 36 — Dorsal view; anterior tip completed.

Fig. 37 — Ventral view of hind end in clove oil.

Fig. 38 — Median section of pharynx.

Fig. 39 — see plate V.

Fig. 77 — on plate VIII.

i, intestine. m, mouth. p, gonopore.

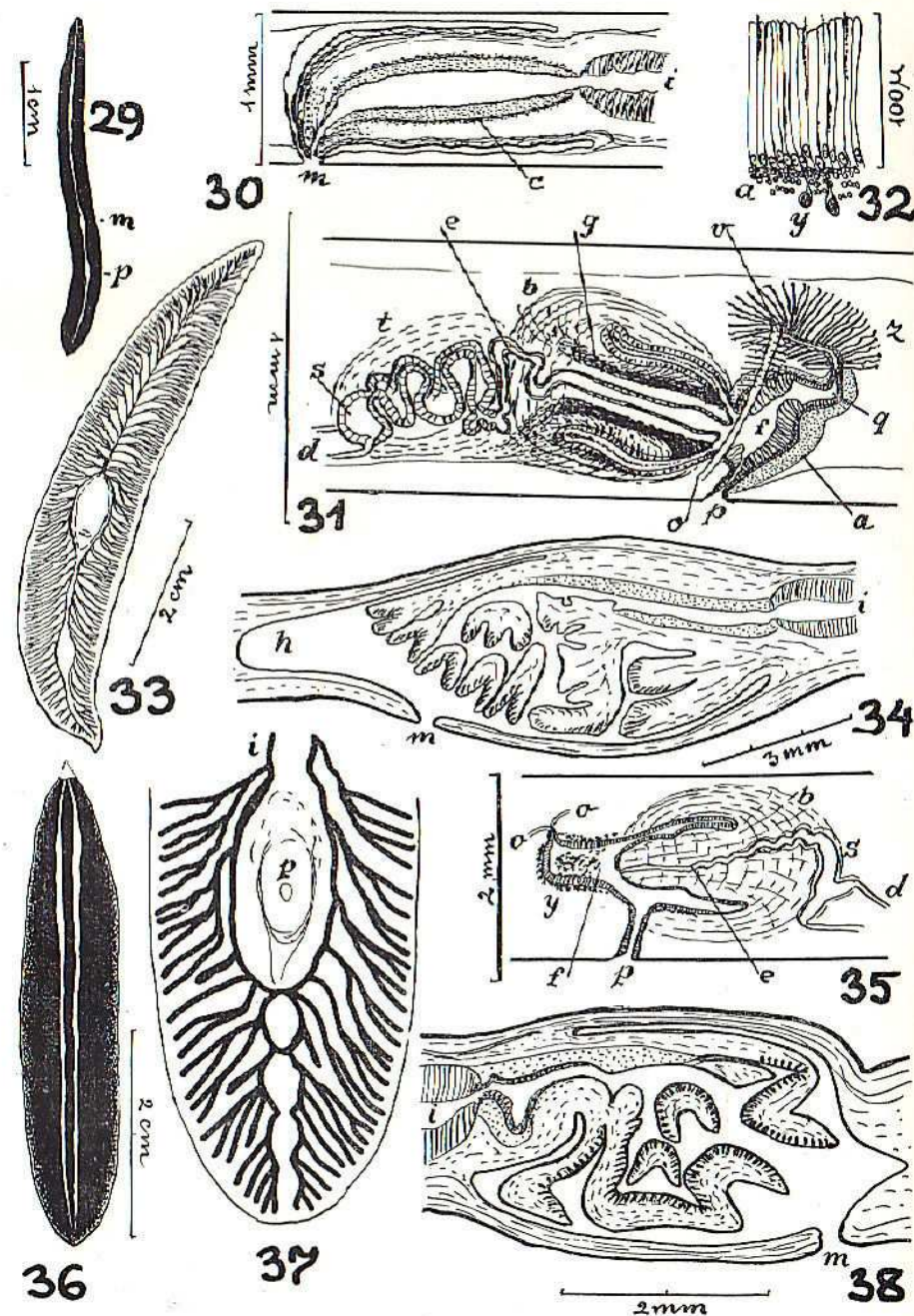


PLATE V

Geoplana aymara, n. sp.

Fig. 36-38 see plate IV.

Fig. 39 — Median section of copulatory organs.

b, penial bulb. d, efferent ducts. e, ejaculatory duct. o, ovovitelloduct. p, gonopore. q, female genital canal. s, seminal vesicle. v, uniting point of ovovitelloducts. y, cyanophil glands. z, shell glands.

Geoplana caya, n. sp.

Fig. 40 — Dorsal view.

Fig. 41 — Ventral view.

Fig. 42 — Colour pattern of back over the pharynx.

Fig. 43 — Median section of pharynx.

Fig. 44 — Median section of copulatory organs.

b, penial bulb. d, efferent ducts. e, ejaculatory duct. f, female antrum. g, penial glands of male antrum. h, pharynx pocket. i, intestine. m, mouth. o, ovovitelloduct. p, gonopore. s, seminal vesicle. v, uniting point of ovovitelloducts. y, cyanophil glands of female antrum. z, shell glands.

Geoplana saima, n. sp.

Fig. 45 — Colour pattern of back.

Fig. 46 — Dorsal view.

Fig. 47 — Median section of pharynx.

Fig. 48 — Median section of copulatory organs.

a, nuclei of inner annular pharyngeal muscles. b, penial bulb. c, nuclei of muscles of female antrum. d, efferent ducts. e, ejaculatory duct. i, intestine. m, mouth. o, ovovitelloduct. p, gonopore. r, small cells in female antrum. s, seminal vesicle. v, uniting point of ovovitelloducts. x, penial glands of male antrum. z, shell glands.

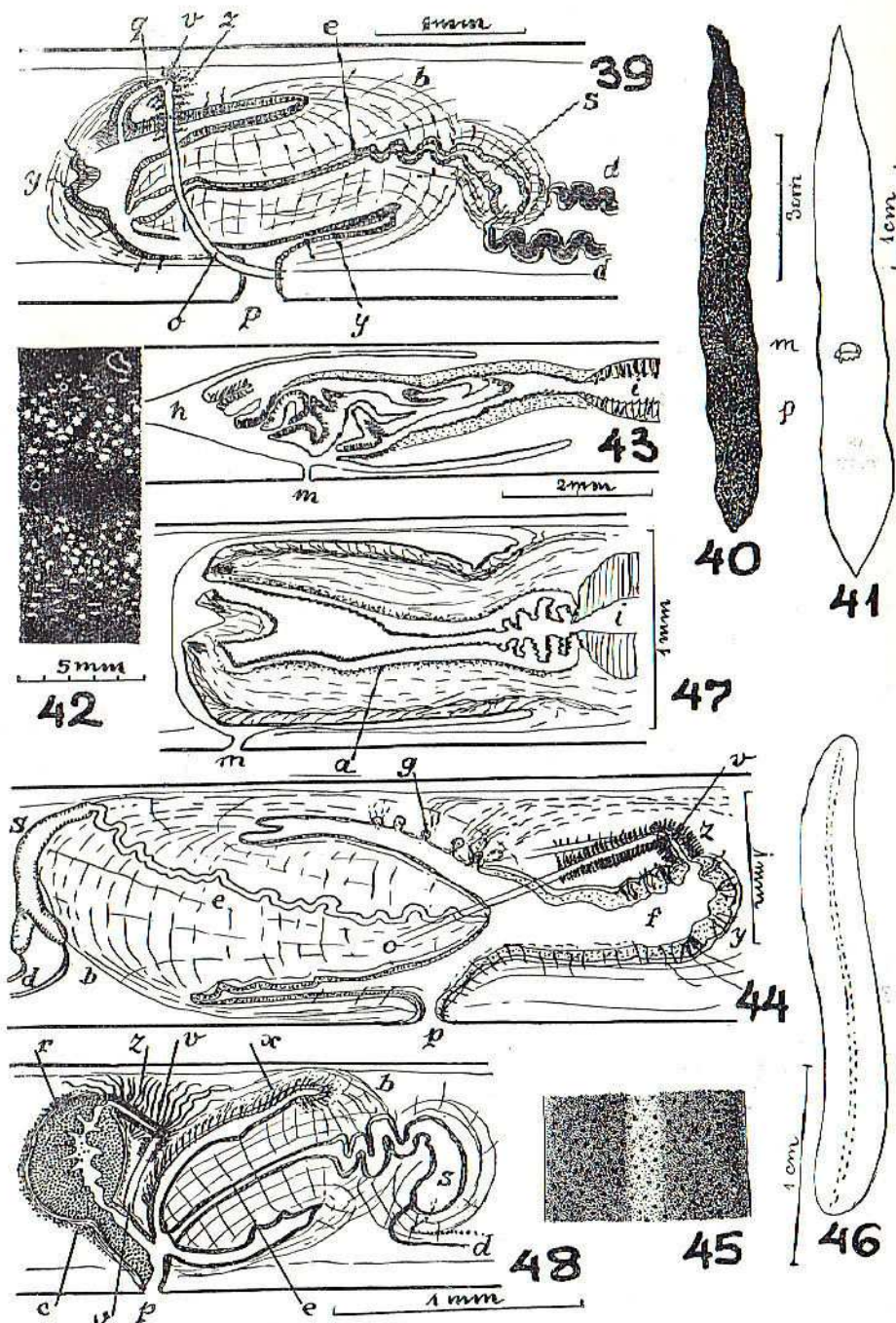


PLATE VI

Geoplana talpa, n. sp.

Fig. 49 — Dorsal view.

Fig. 50 — Median section of pharynx.

Fig. 51 — Median section of copulatory organs.

b, penial bulb. d, efferent ducts. e, ejaculatory duct. i, intestine. m, mouth. o, ovovitelloduct. p, gonopore. q, female genital canal. s, seminal vesicle. v, uniting point of ovovitelloducts.

Geoplana idaia, n. sp.

Fig. 52 — Ventral view.

Fig. 53 — Median section of pharynx.

Fig. 54 — Median section of copulatory organs.

Fig. 55 — Sagittal section of glandular papilla on penis.

a, annular muscles of penis. b, penial bulb. c, cyanophilous strands of secretion in papilla. d, efferent ducts. e, ejaculatory duct. f, female antrum. g, glandular papilla on penis. h, erythrophilous gland of papilla. i, intestine. k, epithelium of papilla. l, lamellar cytoplasm of papillar canal. m, mouth. n, nuclei of lamellar cytoplasm. o, ovovitelloduct. p, gonopore. q, female genital canal. s, seminal vesicle. v, uniting point of ovovitelloducts. z, shell glands.

Geoplana pulchella Fr. Müller

Fig. 56 — Colour pattern.

Fig. 57 — Dorsal view.

Fig. 58 — Median section of pharynx.

Fig. 59 — see plate VII.

Fig. 78 — on plate VIII.

c, inner annular muscles of pharynx. i, intestine. m, mouth. p, gonopore.

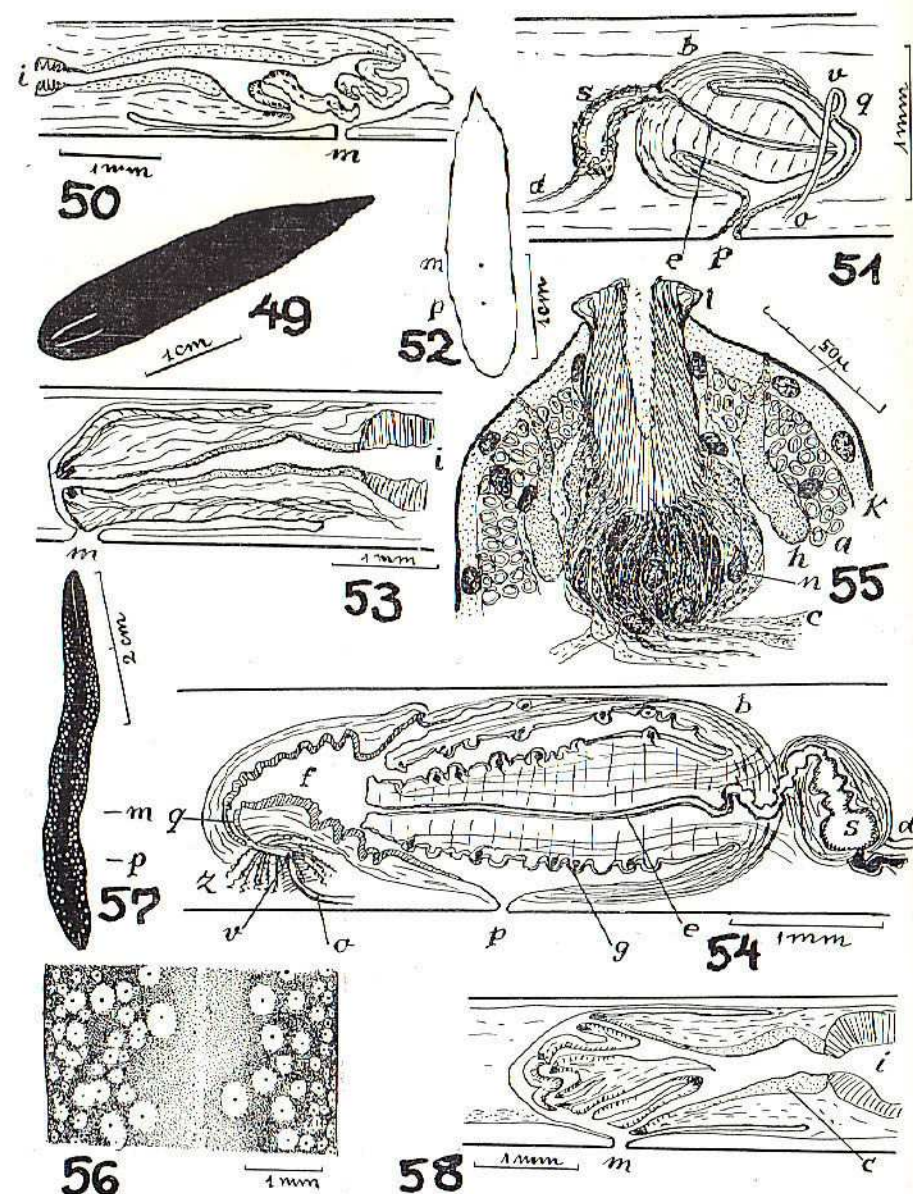


PLATE VII

Geoplana pulchella Fr. Müller

Fig. 56-58 on plate VI.

Fig. 59 — Median section of copulatory organs.

a, male antrum. b, musculature of male antrum. d, efferent ducts. e, ejaculatory duct. f, female antrum. o, ovovitello-duct. p, gonopore. s, seminal vesicle. v, uniting point of ovovitello-ducts.

Geoplana scerstiata Graff

Fig. 60 — Dorsal view.

Fig. 61 — Colour pattern of back.

Fig. 62 — Median section of pharynx.

Fig. 63 — Median section of copulatory organs.

Fig. 79-81 on plate VIII.

b, muscles around copulatory organs. c, male antrum. d, efferent ducts. f, female antrum. g, granule glands. i, intestine. m, mouth. o, ovovitello-duct. p, gonopore. q, female genital canal. r, inner annular muscles of pharynx. v, uniting point of ovovitello-ducts.

Chæradoplana langi (Graff)

Fig. 64 — Dorsal view.

Fig. 65 — Colour pattern of a specimen with medial stripes, bistriate lateral zones, and marginal stripes.

Fig. 66 — Ventral view of fore end.

Fig. 67 — Lateral view of fore end.

Fig. 68 — Median section of partly protruded pharynx.

Fig. 69 — Median section of copulatory organs.

Fig. 82-83 on plate VIII.

a, male antrum. b, muscles around copulatory organs. d, efferent ducts. e, ejaculatory duct. f, female antrum. g, erythrophil glands of pharynx pocket. i, intestine. m, mouth. o, ovovitello-duct. p, gonopore. s, seminal vesicle. v, uniting point of ovovitello-ducts. z, shell glands.

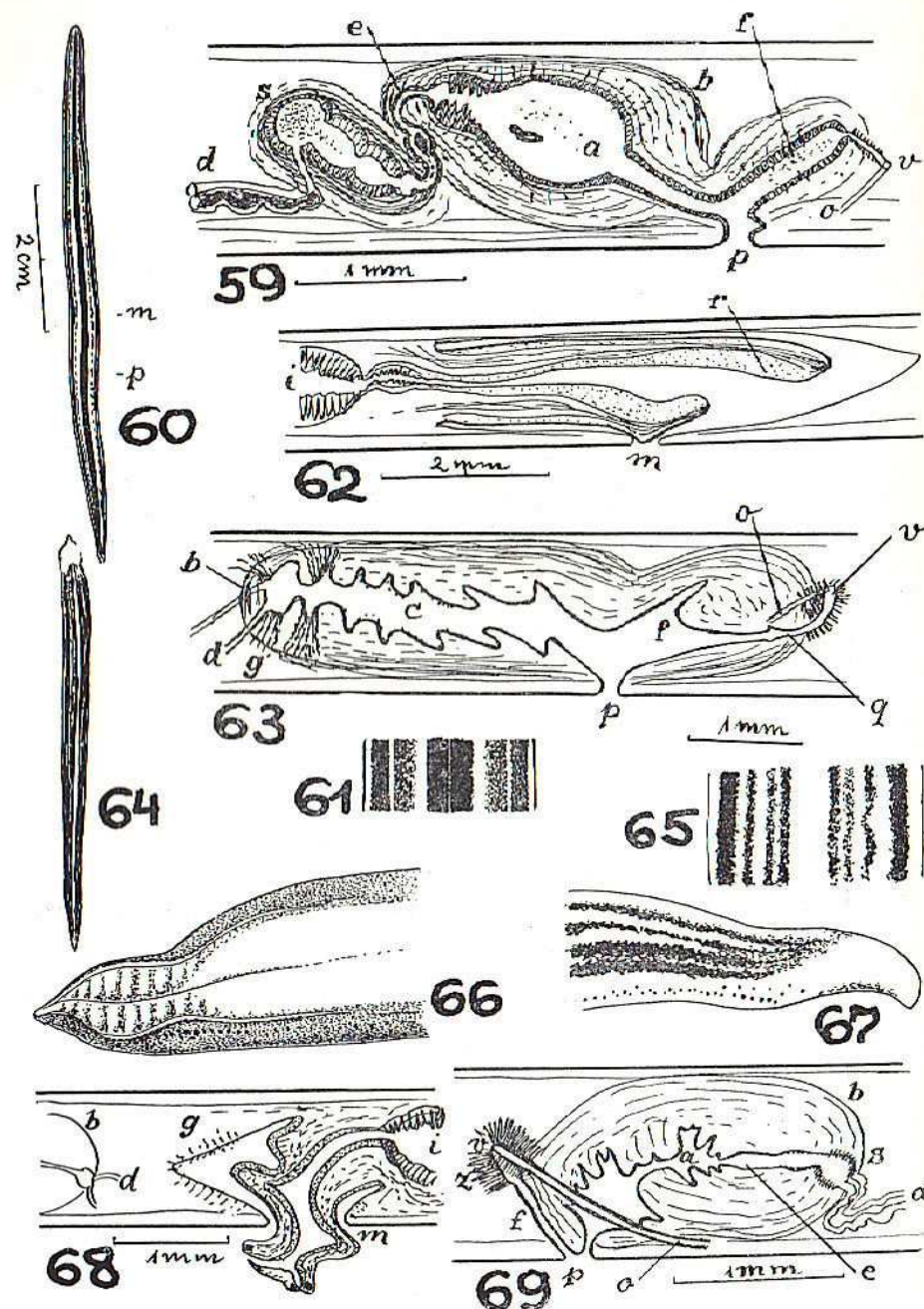


PLATE VIII

- Fig. 70 — *Geoplana cantuta*, colour pattern of anterior region.
 Fig. 71 — *G. gabriellæ*, colour pattern of fore end.
 Fig. 72 — The same, middle part.
 Fig. 73 — The same, hind end.
 Fig. 74 — *G. quichua*, dorsal side of middle-sized worm.
 Fig. 75 — Ventral side of the same.
 Fig. 76 — *G. weyrauchi*, dorsal view of fore end.
 Fig. 77 — *G. aymara*, dorsal view.
 Fig. 78 — *G. pulchella* Fr. Müller, colour pattern of fore end.
 Fig. 79 — *G. sexstriata* Graff, colour pattern of fore end.
 Fig. 80 — Colour pattern of the same before the middle.
 Fig. 81 — Colour pattern of the same behind the middle.
 Fig. 82-83 — *Cheradoplana langi* (Graff), colour pattern in different regions of one worm.

