

On Turbellaria

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(Received December 10, 1956)

The present paper contains the results of Dr. WOLFGANG K. WEYRAUCH's continued collecting of Tricladida Terricola in Peru, and five marine Turbellaria: 1) the dividing *Convoluta* from the south-eastern coast of southern Africa (MARCUS & MACNAE 1954), 2) a new *Hofstenia* from the coast of São Paulo, 3) the well known *Notoplana chierchiai* (Plehn) from Peru, 4) a new form of *Itannia ornata* Marc., and 5) a new *Cestoplana*, the last two from the littoral of São Paulo.

NOTES ON PERUVIAN TERRICOLA

At the time GRAFF published his fundamental monograph of the Terricola (1899), no species of this Section was known from Peru. The first terrestrial flatworm described from this country was the big *Geoplana rosenbergi* A. Meixner (1906, p. 665) found at Santo Domingo (2000 m.) in South Eastern Peru. Only the exterior of this species was registered. It is quite different from that of the second Peruvian species, the small *Geoplana crawfordi* Beauchamp (1939, p. 75), taken at Capachica, Lake Titicaca, not far from the first locality.

The further 26 species of terrestrial Triclads from Peru were all published since 1951 (DU BOIS-REYMOND MARCUS 1951; 1953; and the present paper; HYMAN 1955). Five of them were collected by North American expeditions, the rest by Dr. WOLFGANG K. WEYRAUCH — Lima.

Dr. LIBBIE H. HYMAN (1955, p. 19) classified one of her specimens as *Geoplana bogotensis* Graff (1899, p. 324). She sectioned it, while GRAFF had described the external characters only and had returned the single worm to the Museum of Berlin (l.c., p. 568). As the exterior of HYMAN's animal agrees perfectly with that of GRAFF's, she based her identification on it.

Some years after his description of *G. bogotensis* GRAFF received new material from Bogotá and surroundings. This was studied under the auspices of GRAFF by his scholar BUSSON (1903, p. 404). It was sectioned and considered as complement of *bogotensis* with regard to the anatomy. The size of BUSSON's worms and their eyes differ from GRAFF's description, also

body shape and colour are not quite the same. But as GRAFF had recognized only the eyes of the anterior end, and mature individuals of a species of *Geoplana* can differ considerably in size, the differences between GRAFF's and BUSSON's worms do not appear significant.

FUHRMANN (1914, p. 750) collected 38 specimens of a *Geoplana* near Bogotá. He counted the eyes in clarified worms and found them much more numerous than BUSSON had indicated. Nevertheless FUHRMANN classified his material as *G. bogotensis*, because the general exterior and specially the copulatory organs agreed with BUSSON's statements.

The copulatory apparatus of HYMAN's specimen, however, differs widely from that described by BUSSON and FUHRMANN. Therefore the distinguished North American author thinks that her animal is the true *bogotensis* of GRAFF, while BUSSON's and FUHRMANN's are not. I doubt whether the external characters deserve so much consideration, and am inclined to unite BUSSON's and FUHRMANN's worms with *bogotensis* Graff and to consider HYMAN's species as new, in spite of its external agreement with *bogotensis* Graff.

Dolichoplana vircata, spec. nov.

(Fig. 1-6)

The preserved worm is 95 mm. long, almost 3 mm. broad and 1 mm. high. The back is convex, the belly flat, the sides are round. Head and tail are evenly rounded, the sides nearly parallel, diverging slightly from the head towards the region of the copulatory organs and converging from the gonopore backwards.

The back is yellowish and the belly light; in its anterior half the middle is a little darker. The head (Fig. 1) is quite dark so that the black eyes are not set off from the adjacent ground colour. The latter becomes lighter backwards, first in the middle, farther behind also on the sides. Two pairs of dark stripes of nearly equal breadth go out from the pigmented cephalic region. The inner, so-called lateral stripes are darker than the outer, marginal ones (Fig. 2). In the posterior part the marginal stripes become paler. At the rear the lateral and marginal stripe of either side unite. Two weak median stripes extend from the anterior to the posterior third. On the whole, colour and pattern of the present species are very similar to those of *D. carvalhoi* Corrêa (1947, p. 63-64). As the pigment lies in the perenchyma, the stripes are interrupted by the pigment-free longitudinal muscles; the inner border of the marginal ones is further indented by the diverticula of the intestine.

The mouth lies 27,5 mm., the gonopore 51 mm., behind the tip. The nuclei of the epidermis are normal. The basilar membrane is distinct. The rhabditogenous glands are located entally to the dermal musculature and occur also above the creeping sole. The epidermal glands are all cyanophi-

lous. The annular and diagonal muscles are thin, the longitudinal bundles very strong, measuring about 30 microns on the back, 60 microns on the sides, and 80 microns on the belly. Over the ventral longitudinal bundles a dense nerve plexus is followed by a parenchymal layer, rich in gland cells, and a plate of chiefly longitudinal muscles. Entally to the latter lies the ventral nerve plate (n) with distinct cords and a network of commissures. The next layer is parenchymatous with glands and dorso-ventral muscles. The dorsal layers are much thinner.

The pharynx is 6 mm. long, the mouth lies 2 mm. behind its basis, thus farther in front than in *D. feildeni* Graff (1899, p. 534). Dorsally and ventrally the pharynx inserts on the same transverse level. The outer (1), middle (2), and inner (3) layer of the pharynx are: 1) Cilia, epithelium with abundant cyanophilous strands (v), outer longitudinal muscles (z), and outer annular muscles (y) in two or three layers. 2) Middle longitudinal muscles (z), which are very thin ectally, rather thick entally, parenchyma with red (r) and blue (v) glands and radial muscles (w), and few longitudinal fibres (z). 3) Many annular fibres (y), which are in part intermingled with the preceding muscles, few longitudinal fibres (z) and ciliated epithelium (h) with normal nuclei. The latter are insunk in *D. carvalhoi* (CORRÊA 1947, p. 65).

The inner pharyngeal epithelium and that of the ectal part of the gut are sharply separated without transition. The anterior intestinal limb begins with a wide lumen and numerous club-shaped cells of Minot. The lateral diverticula of the unpaired and the paired limbs are disposed with regular intervals of 0,2 mm., so that either side of the body contains about 475 diverticula. Most but not all of them bifurcate twice. The anterior part of the unpaired trunk and the paired limbs are thin. The latter bear short pouches also on their inner side and are united by seven anastomoses, once in front of the copulatory organs, thrice short behind it, and thrice short in front of the caudal end.

The testes begin about 20 mm. behind the tip of the head and extend backwards nearly to the gonopore. They are ventral to the longitudinal muscle plate, lateral to the nerve cords, and form a single, not quite regular row. The dilated parts of the male ducts (d), the so-called spermiducal bulbs, begin about 35 mm. from the head. Their muscles are distinct. The right and left bulb are united by a transverse canal (e), that runs exactly under the first intestinal anastomosis. The muscular copulatory bulb (b) begins about 43 mm. from the head. The dilated male ducts enter it from both sides without forming backward loops to the gonopore and unite within the seminal vesicle (s). The latter winds through a dense septum of muscles and passes to the granule vesicle (q), which is characterized by erythrophil glands (r) and their secretion stored in its epithelium. The narrow outlet of the granule vesicle into the male atrium (a) lies 1 mm. behind the tip of the copulatory bulb. The thick wall of the male atrium consists of inner annular (y) and outer longitudinal muscle fibers; all their nuclei (k) form a peripheral mantle.

The copulatory bulb is composed of two layers, an inner parenchymal one with glands and numerous crossed muscle fibers, and an outer tunic of principally longitudinal muscles. The bulb ends on the level of the gonopore (g). The epithelium of the male atrium (a) is cylindrical with scarcely preserved cilia, backwards it increases in height gradually. The annular muscles (m) of the common atrium (c), which begins 5,25 mm. behind the outlet of the granule vesicle, are accompanied by their nuclei and form a much thicker layer than that around the male atrium. Cyanophil strands of secretion open into the common atrium, which is 1 mm. long. The epithelia of male and common atrium are not as strongly delimited against one another as in *D. carvalhoi* (CORRÊA 1947, t. 1 f. 10).

The almost spherical ovaries lie within the nerve cords, 6-7 mm. behind the tip of the body, i.e., much farther in front than in *D. carvalhoi* (l.c., p. 67). As in this species the germ-zone is anterior, the funnel of the oviduct posterior, and parovaria are not developed. Also the vitellaria correspond to those of *D. carvalhoi*, as they begin on the level of the ovaries with inconspicuous follicles. Backwards they become thicker, surrounding the intestinal pouches dorsally and ventrally, and extend beyond the gonopore. At intervals of 80-200 microns vitelline funnels lead the yolk to the ovo-vitelline ducts, which run embedded into the ventral nerve cords. Behind the gonopore (g) the ducts (o) bend towards the middle and one of them forms three branches (j) which unite again. Such "Inselbildung" of one of the ovo-vitelline ducts was also observed in *D. carvalhoi* and others (l.c., p. 68). The union of the ducts (p) is rather ventral. The common ovo-vitelline duct rises and runs to the antrum as glandular duct (t). It is much dilated and receives the pink shell glands (x). The female part of the atrium is not separated from the common atrium (c). The glandular pouch (u), the uterus of Graff's terminology, is small, about 0,3 mm. deep, 0,15 mm. high and 0,15 mm. broad, lined with a very high epithelium and surrounded by few muscle fibers.

OCCURRENCE: Peru, Chanchamayo Valley, 800 m. Dr. WOLFGANG K. WEYRAUCH leg.

DISCUSSION OF *Dolichoplana vircata*

Colour and pattern, if possible of the living and preserved worm, should be mentioned in every description of a species of *Dolichoplana*, but these characters are not decisive for distinguishing the species. For taxonomic purposes the copulatory organs are indispensable, and as these are seldom found in the species of *Dolichoplana*, which generally reproduce by fragmentation, one should treat such asexual material as "*Dolichoplana* spec."

The copulatory organs are only known for *D. feildeni* Graff 1896 and *D. carvalhoi* Corrêa 1947. The modern and complete exposition of the latter makes it easy to distinguish *vircata* from *carvalhoi*. The Brazilian species has different epithelia in the male and the common atrium, and only the

common atrium has a wide lumen. The posterior male ducts of *carvalhoi* (CORRÊA 1947, t. 1 f. 10, dp) are not developed in *vircata*, the posterior testes of which evidently discharge their contents by inconspicuous ductules. The female apparatus of *carvalhoi* differs from that of *vircata* by the tubular glandular duct, which opens into the atrium by a papilla (f. 13, d). Also the glandular pouch is different in both species. The unlikeness concerning the male ducts, the extra-bulbar seminal vesicles, the dilated inner and the narrow glandular outer part of the male genital canal are probably functional and without systematic significance. The ovaries lie much farther backwards in *carvalhoi*.

GRAFF's diagram of the copulatory organs of *D. feildeni*, which he repeated several times, for the last time in "Bronn" (GRAFF 1912-17, textfig. 133), is accompanied by a short description (id. 1899, p. 199). BEAUCHAMP (1930, p. 74, note 1) confirmed GRAFF's statements. Nevertheless the copulatory organs of *D. feildeni* are known only in outlines. Therefore all characters of the corresponding organs of *vircata* that go beyond GRAFF's sketchy information can not be valued as distinguishing features. Only details mentioned for *feildeni* but absent in *vircata* can be considered as specific. Such occur in the male as well as in the female part. The anterior male ducts of *feildeni* extend backwards to the level of the gonopore, where they bend and run forwards to the anterior end of the copulatory bulb (GRAFF 1899, p. 160, note 5). This loop is frequent among the Terricola, but not developed in *D. vircata* nor in *D. carvalhoi*. The eggs of *D. feildeni* pass to the atrium through a terminal duct without glands, the vagina. In *vircata* as in *carvalhoi* a vagina does not exist, and the glandular duct opens direct into the atrium.

The characters that distinguish *feildeni* from *vircata* are less conspicuous than those that separate *vircata* from *carvalhoi*. This is evidently due to the very different state of the descriptions of *feildeni* and *carvalhoi* and can not suggest a nearer relation between *feildeni* and *vircata*. The occurrence of *feildeni* in the Neotropical Region is uncertain. The mature specimen of GRAFF was from Java (1899, p. 533), from where also BEAUCHAMP's material came, the copulatory organs of which were said to agree with *feildeni* Graff. The fragments from Barbados GRAFF called *feildeni* only according to their colour pattern (1899, p. 534), which is very similar in several species (HYMAN 1954, p. 15).

Microplana yaravi, spec. nov.

(Fig. 7-9)

The present worm is about 20 mm. long, 3 mm. broad, and 1,3 mm. high. The breadth of the creeping sole is 0,6 mm. The body is dorsally more convex than ventrally and evenly rounded on the sides. Fore and hind end are obtuse.

The back is dark with two black, 0,7 mm. broad, longitudinal stripes. The brown area between them is 1 mm. broad, the 0,3 mm. broad sides are darker brown and sharply limited against the bluish black belly. The white creeping sole is distinctly set off from the black sides. The eyes were not seen in the preserved worm, not even in oil of cloves.

The animal is opacous, so that the simple, not ramified diverticula of the intestine are only visible in the sections. There are about 250 pouches on either side. The limit between pharynx and intestine is abrupt and marked by a diaphragm, the anterior side of which is covered with 100 microns high intestinal cells, the posterior one with 10 microns high pharyngeal cells. The tubular pharynx is about 2 mm. long. The mouth lies 12 mm. behind the anterior end, nearer to the root of the pharynx than to the tip. The gonopore is located 16 mm. behind the fore end.

The epidermal nuclei are basal, intra-epithelial, the cells about 50 microns high on the back, up to 70 microns on the sides and 20 microns on the belly. Only the 14-20 microns high cells of the creeping sole are provided with 4 microns long cilia. Abundant cyanophil and erythrophil glands and rhabdites occur on the entire surface, also in the area of the sole. The annular and longitudinal dermal muscles are thin and simple. The cutaneous nerve plexus is well developed, also on the back. The longitudinal muscles in the parenchyma form bundles, the dorsal ones of which are thinner than the ventral ones.

The strong nerve cords are united by commissures with one another and with the cutaneous plexus on the sides. Over the nerve cords a plate of transverse muscles is developed, dorsally to which the testes lie in two rows on each side in the pre-pharyngeal region. The cutaneous glands penetrate deeply into the parenchyma, mainly in the ventro-median region, where they even extend between the transverse muscle plate and the intestine.

The layers of the pharynx are from the outer to the inner side: 3 microns long cilia, 3 microns high epithelium without nuclei, longitudinal muscles (7 microns), annular muscles (4 microns), parenchyma containing the epidermal nuclei, blue glands which open on the outer surface, diffuse bundles of longitudinal muscles, nerve plexus, many long radial muscle fibers, strands of red and more numerous blue glands which open principally on the pharyngeal border, and annular fibers. The parenchyma is underlain by longitudinal muscles, which also mingle with the following thick inner annular muscle layer. The latter fibers form series due to uncommonly numerous radial muscles. Also the innermost longitudinal layer coalesces with the preceding about 60 microns thick annular stratum. The inner epithelium is 10-15 microns high and not ciliated. Its nuclei are intra-epithelial near the root, deeply depressed near the border.

The testes lie in two rows and form a compact mass ventral to the intestine. They begin 4 mm. behind the tip and end 0,4 mm. in front of the root of the pharynx. The male ducts are dorsal to the nerve cords, medial

to the oovitelline ducts. About 0,5 mm. behind the pharynx the male ducts (d) dilate and form successive pouches that can hardly be termed spermiducal "bulbs". Backwards the male ducts extend with a short (0,1 mm.) loop beyond the ental margin of the copulatory bulb (b). The right and left (v) duct enter the bulb from the sides and meet where they open into the bulbar lumen, the ental part of which is sometimes called a seminal vesicle (s). The granule glands (q) lie, at least in part, outside the bulb. The epithelium of the bulbar lumen forms high folds and is ciliated in its outer part (r). The bulb is 1,2 mm., the penial papilla 0,4 mm. long. A strong annular musculature, which begins in the ectal fourth of the bulb, surrounds the narrow ejaculatory duct (m). Here the folded epithelium of the bulbar lumen becomes smooth. The outer layers of the papilla are: a low epithelium, a thicker annular and a thinner longitudinal muscle layer, which continue around the entire atrium. The papilla nearly attains the gonopore (g). The atrial epithelium is high and villous.

The ovaries lie 1,8 mm. behind the tip. The vitellaria, which begin behind the ovaries, are fully developed and nearly wrap the intestinal pouches. The oovitelline ducts (o) are lateral to the nerve cords, their vitelline funnels are composed of very small cells. Immediately behind the pharynx the oovitelline ducts begin to receive red shell glands (x) and so they continue till they meet behind the gonopore. By their union a common oovitelline duct (e) is formed, which runs forward and is very short. It differs from the following vagina (t) by lower epithelium and weaker musculature. The epithelium of the vagina resembles that of the atrium, and also the atrial annular muscles continue in the corresponding vaginal layer. Where the common oovitelline duct enters the vagina, the bursa canal (k) rises to the back. Its ectal part is irregularly dilated and histologically similar to the vagina. Farther inwards it is a straight narrow duct, the ciliated epithelium of which is 13 microns high. The bursa canal enters a true bursa ampulla (u) through the ventral wall of the latter. The vacuolated epithelium of the ampulla is about 60 microns high and underlain by a thin layer of annular muscles. On both sides a diverticulum of the ampulla touches the posterior limbs of the intestine (i), and its high, blue staining bursal cells (j) project into the lumen of the intestine.

OCCURRENCE: Peru, Cordillera Azul, 1600 m. Dr. WOLFGANG K. WEYRAUCH leg.

DISCUSSION OF *Microplana yaravi*

HYMAN (1954, p. 11) introduced the Genus *Orthodemus* for *Rhynchodemus terrestris* (O.F. Müller, 1774), i. e. for the Microplaninae with a bursa and, in contrast to *Othelosoma*, only one duct that connects it with the gonopore through the female genital canal. So the species of MARCUS' first group of *Microplana* (1953, p. 50) would become *Orthodemus*, and those

of the third group (p. 53) remain *Microplana*. Unfortunately the type-species of *Orthodemus*, as well as that of *Microplana*, *M. humicola* Vejdovsky, 1890, belong to MARCUS' second group (p. 51).

The species of this group have a genito-intestinal communication. The connection is generally established by a duct, that corresponds to a bursa canal, and opens with a dilatation into the intestine. Less frequently the dilated part communicates with the intestine by one or more canals or pores. Only in the last cases one can speak of a bursa with canal ("Bursastiel") and ampulla ("Endblase"). The literature (MEIXNER 1921; 1928, p. 591-92; STEINBOCK 1924, p. 484 ff.; HEINZEL 1929; FREISLING 1935, and others) shows that the genito-intestinal communication is not only sometimes difficult to verify, but also individually present or not. Therefore species described as provided with a true closed bursa may be later on recognized as also provided with an intestinal communication. Then the former bursa canal must be called "ductus genito-intestinalis", and the former ampulla an ental dilatation of the duct, or it reveals itself as an anastomosis of the posterior intestinal limbs with an epithelium of mixed bursal and intestinal character. The extension of the bursa varies very much in "*Rhynchodemus*" *terrestris* (HYMAN 1939, f. 50 C; 1954, f. 6). FREISLING (1935, p. 5) even denies the existence of a true bursa in this species by histological reasons. The bursa ampulla of the Microplaninae, specially in *Microplana* and *Othelosoma* (MARCUS 1953, p. 53), varies too much, as that it could define a genus. Evidently it is a historical residuum in the sense of REMANE'S genial theory (1951).

In the following I compare my material with the species of Marcus' group 1 and the two species of group 2 that seem to have a bursa, *terrestris* and *decennii*. Perhaps also *scharffi* belongs to this group (HEINZEL 1929, p. 446). Two further species, *attemsi* (Bendl, 1909) and *monacensis* (Heinzl, 1929), that one might expect to find here, are neither "*Orthodemus*" nor *Microplana*, but *Diporodemus* Hyman, 1938, though the bursal-cutaneous connection has only been verified for the first of them (BEAUCHAMP 1937, p. 365).

- 1) *aberana* (Mell, 1904). Ectal opening of bursa canal lies at the point where the ovo-vitelline ducts unite.
- 2) *cherangani* (Beauchamp, 1935). Vagina with special sphincter near its atrial opening.
- 3) *costaricensis* (Beauchamp, 1913). Bursa canal like in 1); copulatory bulb half as long as penial papilla.
- 4) *decennii* (Battalgazi, 1945). Has *Othelosoma*-like sphincter at entrance of female genital canal into atrium.
- 5) *howesi* (Scharff, 1900). Copulatory organ consists entirely of bulb; free penial papilla not developed. Shell glands open in part also in front of bursa canal.

- 6) *natalensis* (Jameson, 1907). Bursa canal opens like in 1); female atrium with dorsal glandular diverticulum.
- 7) *neumanni* (Mell, 1904). Male ducts open into bulbar lumen ectally to fundus of bulb. Length of penial papilla about one tenth of that of bulb.
- 8) *scharffi* (Graff, 1899). Penial papilla much longer than copulatory bulb.
- 9) *striata* (Freisling, 1935). With dark brown back and light belly. Creeping sole half the breadth of the body. Different aspect of penial papilla, caused by narrow lumen, probably without systematic significance.
- 10) *terrestris* (O. F. Müller, 1774). Shell glands open into glandular duct between union of ovo-vitelline ducts and atrium.
- 11) *viridis* (Jameson, 1907). Vagina opens into gonopore; union of ovo-vitelline ducts extremely far behind the ectal opening of bursa canal.

Incapora weyrauchi du Bois-Reymond Marcus, 1953

(Fig. 10)

The original description (1953, p. 75-77) was based on one not quite mature specimen (preserved 12 mm.), while now three further worms are available. These are 23 (A), 18 (B), and 14 mm. (C) long, and the two first are completely mature. Animal A was evidently preserved in greatly extended condition, hence it is narrower (2,5 mm.) than the others (B: 4 mm., C: 3 mm.). Also its creeping sole is the narrowest of the three. In worm A the mouth lies 10 mm., the gonopore 12,5 mm. behind the anterior end. For animal B the corresponding measurements are 12 and 14 mm., for C 11 and 12,5 mm. Thus the part behind the gonopore has different length: A 10,5 mm., B 4,0 mm., and C 15 mm. Like the type-specimen the worms are black with a narrow light dorso-median stripe and a white creeping sole.

The shape of the transverse section shows its dependence on the degree of muscle contraction, and does not deserve the importance that GRAFF attributed to it in his Monograph of the Terricola (1899). Worm A is broadly oval; B dorsally convex and ventrally nearly concave and rounded on the sides; C uniformly convex on back and belly and has sharp borders. Worm B was sectioned. Its head shows a thick mass of cyanophilous glands between the nerve cords and dorsally to them. These glands open at the fore end in a ventro-median area, which is not concentrated in one spot.

The testes of B begin 2 mm. behind the tip and extend to 12,4 mm., i. e., beyond the mouth. The penial papilla (z) corresponds to my former drawing (1953, f. 10), but it is bigger and more stretched in the present specimen. The granules that are stored in the epithelium of the common vesicle are blue in the inner (s), pink in the outer part (r).

The voluminous spherical ovaries, which were not studied in the type-specimen, lie about 1,4 mm. behind the anterior end of the body dorsal

to the nerve cords. The funnel of the oovitelline duct bends from the outer side to the germarium; the funnel is full of sperms, the heads of which are all directed towards the ovary. The vitellaria begin in front of the ovaries and are dorsal to them, and the vitellarian mass surrounds the outer side of each ovary. The vitellaria reach the hind end. The posterior vitellarian follicles are coalesced and attain the hindmost point of the oovitelline ducts (o) at 2,6 mm. from the hind end (0,35 mm. in the worm described 1953, not 0,035 mm., p. 77). The previously mentioned (l. c.) nuclei around the oovitelline ducts evidently belong to young shell glands, which are fully developed in the present worm. The cells of the duct contain the red granular secretion of the shell glands, and sperms are in the lumen of the duct. The common oovitelline duct (Fig. 10, g) has no glands. Its epithelium is a little higher than that of the ectal part of the female canal, which may be called vagina (q). The genito-intestinal canal (d) is ciliated and muscular.

This canal opens into the previously described anastomosis (a) between the posterior limbs (i) of the intestine. Also the anterior pair of intestinal-cutaneous ducts (w) corresponds to the original description, but the two posterior ones, which connect the right and left intestinal branch with the skin behind the loops of the oovitelline ducts, are new. They do not occur in worms A and C. Around the inner opening of the genito-intestinal canal, and around the exits of all four intestinal-cutaneous ducts the epithelium of the intestine is free from alimentary inclusions.

OCCURRENCE: Peru. Worm A: Santa Rosa on the River Chinchipe, a northern affluent of the River Marañon, 1600 m. July 1947. Worm B: River Casaracra, near Oroya, under a stone in grassland, 3900 m. January 5, 1955. Worm C: Quebrada Casaracra, near Oroya, 3800 m. January 5, 1955. Dr. WOLFGANG K. WEYRAUCH leg.

Geoplana quichua du Bois-Reymond Marcus, 1951

Four small specimens, the biggest of which, 17 mm. long and 3 mm. broad, is in the phase of beginning sexual maturity. Sections of it show the characteristic tea cup-shaped male copulatory organ. As in two worms of my first description (1951, p. 222) there is a white dorsal mid line, which fades away in front of the pharynx. The characters of the alimentary tract are identical with those of the previously described material.

The testes form only two transverse rows in the present young animal. Shell glands are not developed; even in a 40 mm. long worm they are still wanting (l. c.). The oovitelline ducts unite a little farther distant from the atrium than in my first material, so that a short common oovitelline duct, which curves downwards, enters the atrium in the middle of its hind wall.

OCCURRENCE: Peru, Cajabamba (S.E. of Cajamarca), 2800 m. September 25, 1955. Dr. WOLFGANG K. WEYRAUCH leg.

Geoplana weyrauchi du Bois-Raymond Marcus, 1951

(Fig. 11-13)

The present single worm is 28 mm. long and 3 mm. broad. It is mature. The light dorso-median stripe is reduced to a minute line (Fig. 13). The two marginal light stripes attain the hind end as in one of the three worms of the first description, and are broad bands in the new specimen. Therefore the colour pattern (Fig. 11) appears considerably different from that figured in my previous paper (1951, t. 8 f. 76). It consists of the following elements: black border 0,3 mm. broad, greyish brown 0,75 mm. broad stripes, black 0,9 mm. broad median band, that is divided by a quite narrow light mid line. The tip of the head is lighter than the rest of the body.

Eyes (Fig. 12), pharynx, intestine, and copulatory organs agree perfectly with the original material. The common oovitelline duct, which is straight in one of the first described worms (1951, t. 3 f. 24), and slightly bent downwards from the point where the oovitelline ducts unite in a second animal (l. c., f. 25), is curved still farther in the present specimen.

The slit-like opening of the penial papilla is latero-ventral; it is directed to one side in the new as well as in the previously studied material. The same peculiar character occurs in *Geoplana carrièrei* Graff, 1899 (MARCUS 1951, p. 62).

OCCURRENCE: Peru, Vale Chanchamayo, 800 m. August, 1951. Dr. WOLFGANG K. WEYRAUCH leg.

Geoplana aymara du Bois-Reymond Marcus, 1951

A smaller, but also mature animal of this species confirms the characters, which I previously described (1951, p. 228 f. 36-39, 77). The length is 33 mm., the breadth 6,5 mm., the mouth lies 21 mm., the gonopore 29 mm. behind the anterior tip. The eyes are not recognizable even in oil of cloves. The colour pattern differs somewhat from that of the original material, the black median stripe of which was 0,8 mm. broad and the yellow ones 0,4 mm. each. The corresponding measurements of the present worm are 0,3 and 0,9 mm. Over the pharynx and the copulatory organs the black stripe is a little broader.

The testes of the new material were in a regressive phase. The restriction of the shell glands to the separate oovitelline ducts, an uncommon feature, agrees with the first described worm.

OCCURRENCE: Peru, Campanillaya near Palca on River Tarma, under a stone, 2600 m. January 6, 1955. Dr. WOLFGANG K. WEYRAUCH leg.

Geoplana lama, spec. nov.

(Fig. 14-15)

The preserved worm is 80 mm. long, 12 mm. broad, and 2 mm. high. The fore end is pointed gradually, the hind end narrowed more suddenly. The back is slaty grey in alcohol, black in oil, the belly light yellow with dark fore end. The mouth (m) lies 50 mm. behind the latter, the gonopore (p) 63 mm. The anterior tip is bordered with a light sensory margin and, ventrally to it, with a glandular furrow full of secretion.

The eyes begin a little behind the fore end. At first they form a single row, and from about 15 mm. behind the anterior tip of the body they extend over 2 mm. on either side of the back. They are rare and minute, nearly without halos.

The mouth lies at the beginning of the hindmost third of the 12 mm. long ruffled pharynx. The latter belongs to the collar-shaped type (GRAFF 1899, p. 99 f. 5 B). Its dorsal insertion lies about one third of the length of the pharynx in front of the hind end of the pharyngeal pouch, the ventral insertion at the fore end. The outer and inner surface are provided with numerous cyanophil and erythrophil glands; the wide border is richly frilled. The oesophagus is surrounded by a thick layer of annular muscles, and hence its epithelium is folded. There are 60-80 intestinal diverticula on either side, to judge from 25 pre-pharyngeal ones, which were counted, and those of the hind-body computed from sagittal sections. The diverticula are much ramified and anastomosing.

Transverse sections show tufts of red-staining glands opening on the sides. The cutaneous longitudinal muscles form distinct bundles. The nerve-plate attains the lateral borders without differentiated cords. The testes lie from 1,5 — 4 mm. to the sides of the mid line, up to 3 or more in a transverse section. The male ducts accompany the oovitelline ducts that run 4 mm. apart from each other above the nerve-plate.

The spermiducal bulbs (d) end with muscular ducts. These unite and form a tubular seminal vesicle (s) which rises in front of the copulatory bulb (6). It contains sperm, is lined with a flat epithelium and surrounded by muscles. This vesicle continues within the bulb as ejaculatory duct (e), which runs excentrically, near the ventral side. The duct has its own musculature and begins wide with a rather high, folded epithelium, which stores pink granular secretion. The opening of the duct is a broad slit in the penial papilla (p), which in the present specimen projects through the gonopore (g). The mighty penial musculature continues around the female atrium (f). The epithelium (c) of the penial papilla is wrinkled and pierced by strongly cyanophilous glands at the root, while that of the blunt cone is lower. The epithelium of the male atrium is cylindrical and ciliated.

The oovitelline ducts (o, r) are wrapped in thick muscles in their rising stretches in the region of the gonopore. In their following loops these

muscles are weaker, and shell glands (x) enter the female ducts before they unite. The short glandular duct, which also receives shell glands, runs forwards and passes to a posterior prolongation of the female atrium (f). As the muscles of this diverticulum are atrial ones, one can not call it vagina. The female atrium of the present specimen is completely separated from the male atrium and somewhat everted (see Fig. 15, f). It has a small dorso-lateral pouch on either side, a thick layer of loose muscles, and a 0,1 mm. high epithelium with strands of erythrophil secretion.

OCCURRENCE: Peru, Tschaidicancha between Huanuco and Tinga Maria, 2500 m. October 3, 1946. Dr. WOLFGANG K. WEYRAUCH leg.

DISCUSSION OF *Geoplana lama*

The excentrical course of the male genital canal as well as the wrinkled and glandular epithelium at the base of the penial papilla are the most characteristic features of the new species and isolate it among the known Peruvian representatives of *Geoplana*. *G. chalona* du Bois-Reymond Marcus (1951, p. 218) has some characters in common with *G. lama*, but differs not only in the mentioned particularities but also in the structure of the seminal vesicle and the backwards directed glandular duct.

Geoplana vicuna, spec. nov.

(Fig. 16-18)

The present worm is 23 mm. long, 4,5 mm. broad, and its greatest breadth lies between the first and second quarter, an uncommon feature. It is flat and has a sharply pointed fore end (Fig. 16). The back is dark, nearly black, the quite black mid line becomes specially conspicuous, because it is flanked by somewhat lighter stripes. The pigment granules are very coarse. The belly is white and so transparent that the spermiducal bulbs between mouth and gonopore appeared in the clarified worm. The eyes are disposed in a single series all around the body; due to the pigment they are hardly recognizable in the hind region.

The pharynx (Fig. 17) is bell-shaped, its root is narrow, the border wide and folded. Its glands are distributed like in many species of *Geoplana*, those with erythrophil secretion open on the border of the pharynx and into the pharyngeal lumen, those with cyanophil secretion on the outer surface. The inner annular muscle layer forms a thick sphincter (h) around the ental part of the pharynx.

There are about 60 intestinal diverticula on either side which bifurcate once each. The clubs of Minot extend into the posterior limbs of the intestine backwards to the level of the copulatory apparatus. The nerve cords are distinct from the ventral plexus. The oovitelline ducts are dorsal to the cords, and the male ducts run immediately over the female ducts.

The testes are dorsal and begin 6 mm. behind the anterior tip; there are up to three on one side of a transverse section. Behind the pharynx the male ducts become spermiducal bulbs (d), the windings of which are filled with sperm. The bulbs enter the extra-bulbar seminal vesicle (s) about 0,2 mm. distant from one another. Their hindmost and narrow stretch with its epithelium containing big blue nuclei contrasts with the vacuolized, pink, 10-30 microns high lining of the seminal vesicle, which bears long cilia. The vesicle is muscular and has few pink glands. The ejaculatory duct (e) within the copulatory bulb (b) is narrow, has no glands and a 40-50 microns high epithelium. The ectal part of the bulbar lumen is widened and folded; its broad opening is subterminal.

The oovitelline ducts (o) rise immediately behind the gonopore (g) and unite above the latter. They receive shell glands (x), which open also into the glandular duct. This duct leads backwards to a pouch of the female atrium (f), which is lined by an 80-100 microns high epithelium and ensurrounded by a distinct though not very thick muscle layer, composed principally of annular fibers.

OCCURRENCE: Peru, between Cerro de Pasco and Rafael, 3800 m. October, 1946. Dr. WOLFGANG K. WEYRAUCH leg.

DISCUSSION OF *Geoplana vicuna*

The form of the body is very similar to *Geoplana idaia* du Bois-Reymond Marcus (1951, p. 232), and also the extra-bulbar seminal vesicle is comparable. The enormous penial papilla with its numerous glandular warts, however, and the ventral union of the oovitelline ducts show clearly, that *G. idaia* is a different species. The pharyngeal sphincter and the female organs of *G. vicuna* and *G. pichuna* (l. c., p. 225) are not unlike, but neither the form and the colour pattern, nor the male apparatus suggest a near relation of the two species.

Geoplana shapra, spec. nov.

(Fig. 19-21)

The worm is 36 mm. long, up to 4 mm. broad and has rather sharp borders. Its anterior end is damaged. The greatest breadth lies behind the middle of the body, approximately at the beginning of its last fourth.

The back is black, the belly white. A dorso-median yellow stripe is 0,8 mm. broad and somewhat dilated over pharynx and copulatory apparatus. The yellow stripe is sparsely dotted with black. The eyes occupy nearly half of the black lateral parts of the back and are surrounded by small light halos.

The mouth lies 18, the gonopore 28 mm. behind the anterior tip. The pharynx is ruffled and inserts a little farther in front on the ventral than on the dorsal side. The numerous pharyngeal glands are thick red and thin blue ones. The first open principally into the lumen and on the border, the latter on the outer surface of the pharynx. The principal trunk of the gut contains clubs of Minot. The intestinal diverticula bifurcate at least once; about 5-6 of them originate on a 2 mm. long stretch, and there are 10-12 near the border. The nerve plate forms a plexus without thickened lateral cords.

The big testes are dorsal, mostly uniserial, but sometimes also two of them lie side by side. The testicular tunic is very distinct, and so are the ciliated funnels at the beginning of the ductules which are perpendicular to the male ducts. The latter lie exactly over the oovitelline ducts. The spermiducal bulbs (d) are lined with a 20 microns high epithelium and continue as thin canals into the T-shaped seminal vesicle. The ciliated epithelium of the vesicle is 30 microns high, the muscle mantle rather weak. The vesicle is extra-bulbar, though the copulatory bulb (b) is not distinctly limited in front. Only farther back the bulbar longitudinal and transverse muscles become stronger. The bulbar lumen begins tubular and widens within the penial papilla, that is defined by its annular muscles (m) and the surrounding atrium (a). The high epithelium (40 microns) of the ejaculatory duct (e) is folded. The outer epithelium of the papilla is 30 microns high, that of the atrium 50-60 microns, but rather villous. The atrial epithelium is pierced by blue staining glands (y).

The oovitelline ducts (o) rise behind the gonopore (p) and unite (v) dorsally. Shell glands (z) open into the separate oovitelline ducts as well as into the short glandular duct (q). This latter runs backwards and opens with a short gland-free stretch from the dorsal side into the wide and folded female atrium, the epithelium of which is 70 microns high and like the male atrium provided with cyanophilous glands (y).

OCCURRENCE: Peru, Cajabamba (S.E. of Cajamarca), 2800 m. September 25, 1955. Together with a small specimen of *Bipalium kewense* Moiseley, 1878, a species widely distributed in tropical and temperate-warm countries. Dr. WOLFGANG K. WEYRAUCH leg.

DISCUSSION OF *Geoplana shapra*

The species most similar to *G. shapra* is *G. aymara* du Bois-Reymond Marcus (1951, p. 228). It differs by a black stripe along the middle of the yellow dorsal band, its eyes occupy much less than half the breadth of the black lateral zones, the intestinal diverticula, 45 on either side, are about half the number of those in *shapra* (about 90), up to 5 testicular follicles were seen in one transverse section, and the shell glands are restricted to the separate oovitelline ducts. The colour pattern of *G. aymara* may vary,

and the number of testes depends on the state of male reproductive activity. The remaining properties however, eyes, intestinal diverticula, and topography of the shell glands, which are repeated in the second specimen of *G. aymara*, are good specific characters.

Convoluta macnaei, spec. nov.

(Fig. 22-25)

The preserved worms are up to 5 mm. long and 0,48 mm. broad. The proportion between breadth and length is generally 1 : 6 to 1 : 10. The fore end is blunt, the hind end pointed, the back is convex and the belly concave. The mouth lies 0,19 to 0,27 mm. behind the anterior end in a more or less distinct groove brought about by the curling of the anterior borders.

The dorsal and ventral cilia are about 5 microns long, while the epicytium (p) is higher on the back (4 microns) than on the belly (3 microns). The slender epidermal nuclei are depressed. The annular muscle fibers (v), are thinner but more densely disposed than the longitudinal bundles (m). As single fibers of the latter occasionally pass from one bundle to the other, these assume the aspect of diagonal muscles. True diagonal muscles, however, do not exist; also WESTBLAD (1948, p. 20) did not find them in any Acoel. Dorso-ventral muscles (u) are numerous.

The cyanophilous glands (c) on the back and on the sides have preserved their contents, the ventral ones are for the most part empty. The cells of the frontal gland (f) extend backwards beyond the mouth and open with a common pore. In the region of the female opening dorsal and ventral sagittocysts (s) are numerous. They are up to 30, in *roscoffensis* up to 45, microns long and 3 microns in diameter, pointed at both ends, and contain a refractive rod in their axis. The sagittocysts develop in eosinophilous cells (r), but the aspect of these stages (Fig. 24) is somewhat different from that in *roscoffensis* (GRAFF 1905, t. 2 f. 6).

The algae (a) fill the entire ectocytium (k) forming about three layers. The epidermal nuclei are outside of, the cytosomes of the cutaneous glands generally inwards to the symbionts. Though only 5-10 microns in diameter, the algae agree perfectly with those of *C. henseni* (MARCUS 1949, p. 12 t. 1 f. 4).

The brain (w) which lies in the ectocytium is rather conspicuous and consists of two anterior and two posterior lobes, between which the statocyst (z) is located in the middle. The statolith contains two nuclei.

The mouth (i) is generally marked by an adjoining empty space in the endocytium. There are a few very thin annular and longitudinal fibers around the oral end of the endocytium. A narrow endocytial strand (e) with no nuclei extends through the whole body; it contains up to 85 microns long Diatoms (h).

On either side of the mouth the gonocytes begin in two rows, the male cells are lateral, the female (o) medial. Farther back the latter coalesce in the middle forming an unpaired band which reaches to the nozzle (n) of the bursa. The testes extend farther backwards. The groups of male germ cells are followed by two tracts of spermatozoa (d) converging to the male pore (q). The position of the latter varies from 300 to 30 microns in front of the caudal end. There are no efferent (penial) or auxiliary male organs.

The ovocytes (o) are lobate and have big nuclei. The cuticularized nozzle (n) of the bursa is about 0,1 mm. long and slightly curved. Ectally to it lies the bursa (b), generally of about the same length, or when fully extended by sperm, a little longer than the nozzle. Though distinctly separated from the surrounding tissue, the bursa has no wall of its own, but is merely a space in the endocytium (e). A bunch of peculiar cells lies between bursa nozzle as in *C. henseni* (MARCUS 1949, p. 10 t. 2 f. 6). The female pore (g) is located 0,7 mm behind the bursa. No vagina or special muscles around the female opening are developed. Hence the copulatory apparatus is equally reduced in both sexes.

The species is named for Dr. WILLIAM MACNAE (Grahamstown) who re-discovered this dividing *Convoluta*.

DISCUSSION OF *Convoluta macnaei*

The only species that must be compared with the present one is *C. roscoffensis* Gr., the morphology of which is not well known. In any case a bell-shaped penis is indicated for *roscoffensis* and absent in *macnaei*. GRAFF (1905a, p. 23) separated *C. schultzii* O. Schm. and *roscoffensis* and attributed DELAGE's material (1886) to *roscoffensis*. According to DELAGE's figure 1 (1886, t. 5) the position of the bursa immediately in front of the female pore in *roscoffensis* differs from *macnaei*. Finally the bursa of *roscoffensis* is said to be several times as long as the nozzle, while it is nearly as long or only a little longer in all examined mature specimens of *macnaei*.

OCCURRENCE OF *Convoluta macnaei* AND BIOLOGICAL NOTES

According to a letter of June 13, 1956 from Dr. WILLIAM MACNAE the species has been collected at Cape Padrone, Port Alfred (23.III.51; 18.I.56), Port Natal (Durham), and the island of Inhaca (Inyak) at the entrance to Delagoa Bay (3. & 4. V. 53; 16. & 17. XII. 55). The localities of WARREN (1908), Scottsburg (IX. 04; V. 05), and WAGER (1913), Umkomas, lie on the coast of Natal, hence within the area indicated by MACNAE. The latter has "never seen any specimens near Port Elizabeth." As the Algoa Bay is the limit between the East African and the specifically South African fauna in several marine groups (EKMAN 1935, p. 273), MACNAE is right to "assume that this sand dwelling species is an Indian Ocean component of the South African fauna."

MACNAE informs that the worms "always occur on sandy beaches in the close vicinity of rocky outcrops, at the level of high water of neap tides, and always in places where there is a flow of water out of the sand. This water is usually of reduced salinity, and at a lower level one finds *Enteromorpha* in the pools through which the water flows to lower levels. These Acoela are very sensitive to vibrations in their vicinity and disappear into the sand if disturbed. Often large numbers clump together and form a flocculent green tangle of worms in the streamlets where they occur. On open ocean beaches I have never seen the worms occupying bands . . . , however on the sheltered western shore of Inhaca the worms are spread out along just such lines, in areas where there is some seepage of water through the sand." Hence the ecological conditions of *Convoluta macnaei* are similar to those of *C. roscoffensis* (GAMBLE & KEEBLE 1903, p. 408 t. 30 f. 1, 2).

It is strange WAGER (1913, p. 223) stressed that his material, contrary to European *C. roscoffensis* (KEEBLE 1910, p. 11, 14-16) is not sensitive to vibrations. He also affirmed that the animals do not take any solid food particles in, while WARREN (1908, p. 106) mentioned that they feed on Diatoms. The latter observation agrees with my finding of Diatoms in the endocytium even of mature worms.

The two pairs of samples from Inhaca Island are very different with regard to the size of the animals, e. g. the sample of May 3 averages the largest, that of May 4 the smallest animals.

WARREN (1908) found reproductive organs in September and May. They were extremely rare among the many thousands of worms sent by MACNAE. Only in the sample of January from Port Alfred and in that of May 4 from the island of Inhaca about 50 animals with reproductive organs were found. The bulk of the present material was immature and in part regenerating after architomy (MARCUS & MACNAE 1954).

Hofstenia tinga, spec. nov.

(Fig. 26-29, 31-32)

The only specimen was about 3 mm. long alive, rather flat, and 1 mm. broad, with a 0,4 mm. long narrowed tail. It was quite white, more or less transparent; the big ovocytes (o) were visible. It has no eyes or traces of pigmentation. The anterior end is broadly triangular; its dorsal pit (p) unites the outlets of the enormous cephalic gland (c). Ventrally, 0,1 mm. behind the tip, the small mouth (m) is located, which leads into a pyriform pharynx (f). Under the hind border of the latter, 0,32 mm. from the tip of the body, the male atrium (a) opens.

The ventral surface is concave in the anterior half, plane in the posterior, without prominent edges. Belly and back are ciliated with 4 micra long cilia. Their basal granules are disposed as in *H. atroviridis* Bock (1923,

p. 17 f. 3 b). The epidermis is higher (18 micra) on the back than on the belly (12 micra). It has normal, intra-epithelial nuclei. Neither the intra-epithelial muscle fibers nor the subepidermal nervous plexus of Bock's species were seen; only four dorsal nerves (n) run at the base of the epidermis.

The back and the sides contain many glands (g) with a big vacuole, the contents of which do not stain with haematoxylin-eosine; they leave the ventral surface free. All over the ventral surface, not only on its borders (BOCK 1923, p. 5), there are many cyanophilous glands (h), in part with sub-epidermal bodies. Scarce glands (k) with coarse, eosinophilous secretion are scattered over the whole surface. As in *H. atroviridis* there are no rhabdites. The cyanophilous cephalic gland (c) spreads dorsally and to the sides of the pharynx (f) about 0,25 mm. backwards. It seems to be much more conspicuous than it appears in Bock's figures 4 and 8 (t. 1). The secretion stains lighter in the peripheral bigger cells and quite dark blue in the central smaller ones.

The basal surface of the epidermis is accompanied by fine annular muscle fibers which obscure the presence or absence (BOCK, p. 7) of a basement membrane. A single layer of longitudinal muscles, 3 micra in diameter on the back (l), much thinner on the ventral side, separates the integument from the intestine. Inwards of these fibers lie the bodies of part of the glands (h) of the ventral surface and a few parenchymal cells. There are also infrequent muscles that suspend the pharynx and the reproductive organs. They pass through the digestive syncytium (d) and are in connection with the follicle cells (e) of the ovocytes (o). These parenchymal muscle fibers are much richer developed in *H. atroviridis* (BOCK, p. 11).

The mouth (m) leads directly into the pharyngeal cavity with a sudden change of the aspect of the epithelium over the sphincter (x) that closes the mouth. The pharynx simplex (f) is lined with a folded, densely ciliated epithelium, the nuclei of which are all insunk under a layer of annular and longitudinal muscle fibers. In *H. atroviridis* the nuclei are intra-epitelial and the muscles very thick. Different from Bock's species is also the rich development of glands in *H. tinga*. These are clustered in front around the dorsal, farther backwards (w) on the lateral and ventral walls of the pharynx. At its hind end the pharynx constricts to form a pore through which it opens into a dorsal pouch. The anterior wall of this pouch seems to be covered by bundles of cilia. The hind wall of the pouch (oesophagus) dissolves gradually into the intestinal syncytium (d). Only a loose net of muscle fibers suggests the wall of the intestine and is connected with the body wall by radiate fibers. All spaces that are free from cephalic gland, brain, pharynx, and reproductive organs are filled with a vacuolated plasma (d) that includes few nuclei and very numerous nematocysts (t), about 20 micra long, 7 micra in diameter, with a fine coiled thread inside. The foremost occur on the level of the cephalic pit, and they are also in the digestive syncytium that fills the tail. The syncytium encloses several larger vacuoles in the hinder part of the body, but in no place a defined intestinal cavity as the two other species of *Hofstenia* have.

The nervous system consists of a ganglionic concentration around the outlets of the cephalic gland and an irregular plate (b) to the sides and over it. Numerous nervous strands go from the brain directly to the cephalic epidermis. Besides four dorsal and two ventral nerve cords (n) can be traced backwards. The dorsal ones run in the basal part of the epidermis, outside the dermic muscles, like in some Acoela, f. ex. *Convoluta thauma* Marcus 1952 (p. 16 t. 3 f. 16), the ventral cords and the brain are submuscular. The statocyst (s) lies embedded in the centre of the cephalic gland (c).

There are no traces of a male gonad in the present specimen, probably due to its advanced female phase. The male efferent apparatus (Fig. 31) begins with a cuticular vesicle (r) lying on the ventral side between some female follicles. Outside the cuticle there are some cells which might have produced it. The vesicle is filled with reddish, finely granulated mass. In front it is connected with a muscular bulb (q) lined with epithelium and with some sperms in the lumen. The bulb bears a bundle of about 50 cuticular spines and projects into the ciliated atrium (a). The latter receives a few glands and is separated from the skin by a sphincter (x). This male organ is similar to that of *H. atroviridis*, the atrium of which is much longer.

Very young female cells are found adhering to the parenchymal muscles. They are spread over the whole body from the level of the male vesicle (r) to the precaudal region. Hence the distribution of the growing ovocytes is quite irregular. They occur on both sides, in the mid-line, and ventrally or dorsally to the biggest eggs, not seriated as in BOCK's figures (t. 2). Growing ovocytes (Fig. 32) are enclosed in follicular cells (e) that form a rather regular epithelium as in *H. atroviridis* (BOCK 1923, p. 38 f. 8). Its cells produce vitelline granules which are given off into the rapidly growing ovocyte (o). When the latter has attained a certain size, about 0,25 mm. in diameter, it appears that the follicle cells are exhausted and become irregular. None of the biggest ovocytes shows any signs of shell formation as BOCK (p. 41) has observed it. Apparently the ripe eggs are freed by rupture of the body wall; I mean to see some scars. The follicle cells collapse to a small lump which is probably absorbed later on.

A superficial vacuole of the digestive syncytium contains some coiled elements which might possibly be injected sperms (i), as such were observed by BOCK (p. 46).

OCCURRENCE: Ilhabela on the Island of São Sebastião. One specimen among a'gae on a boulder in the upper littoral, July 1955.

DISCUSSION OF *Hofstenia tinga*

The present worm fits into the diagnosis of the Hofsteniida (KARLING 1940, p. 230; WESTBLAD 1948, p. 65). Its nervous system, voluminous brain, six pairs of cords, no subepidermal plexus, differs, it is true, widely from *Hofstenia atroviridis* Bock from Japan. But as I have only a single specimen

in female mature phase, so that the male gonad can not be settled, I prefer to place it in the genus *Hofstenia* provisionally.

I can hardly expect to obtain more material soon, because the present worm was caught on a boulder, from which my husband and I have been collecting. Turbellaria regularly during 16 stays of several weeks each at Ilhabela in the course of eight years. The neighbourhood of the same stone has yielded one specimen of the aberrant Nudibranch *Rhodope veranyi* in the same space of time, and it was hunting for more of these slugs that we came upon the Turbellarian. Size and colour of both animals are similar.

The description of *Hofstenia minuta* Palombi 1928 from the Suez Canal mentions the absence of a cephalic gland, and an intestine with diverticula. The nature of the everted pharynx is not defined. A female efferent duct is present, and no spicules on the penial papilla. The systematic position of this species remains uncertain.

From *H. atroviridis* the new species differs by smaller size, ventral mouth, less muscular and more glandular pharynx, less defined but farther extended intestine that has no lumen, details of the dermic muscle tube, nervous system, and high degree of proterandry.

The pharynx of *H. tinga* is a typical pharynx simplex resembling that of the Catenulida, f. ex. *Stenostomum amphotum* (MARCUS 1945, t. 3 f. 11), and Macrostomida, f. ex. *Microstomum breviceps* (MARCUS 1951, t. 2 f. 10). Though it is much less muscular than that of *H. atroviridis* (BOCK 1923, textfig. 2, t. 1 f. 3-4, 8), it is more developed than the acelan pharynx (WESTBLAD 1948, p. 18: RIEDL 1954, p. 167 ff.)

Differences in the position of the nerves corresponding to those in *H. atroviridis* and *H. tinga* occur in *Convoluta* and other Acoela (WESTBLAD 1948, p. 22). In *Mecynostomum evelinae* Marcus 1948 (p. 113) and *M. pellicatum* (id. 1951, p. 7) the brain lies outside the ectocytium, while it surrounds the statocyst (MARCUS 1950, p. 12) in *Mecynostomum tenuissimum* like in most Acoela.

I agree with KARLING (1940) and WESTBLAD (1948) as to the position of the Hofsteniida among the Archoophora. The Lecithoepitheliata, of which WESTBLAD recently described a new genus (1952, p. 4; 1954, p. 10), differ by their pharynx and female gonads.

Notoplana chierchiai (Plehn)

Three specimens from Callao-La Punta, near Lima (Peru), collected by Dr. WOLFGANG K. WEYRAUCH under stones in the tidal zone.

This together with Ancon, about 30 km. farther north, is the original locality (PLEHN 1896, p. 1955). The species is further known from Iquique, Antofagasta, Coquimbo, and Valparaiso. It belongs to the Peruvian-Northern Chilean temperate warm water-fauna and extends southward to the Bay of Reloncavi (MARCUS 1954, p. 63: St. M 22), a northern inlet of Gulf of Ancud,

between the Island of Chiloé and the continent. This is a region of transition, comparable to the western part of the English Channel, where the temperate warm passes to the temperate cold water (l. c., p. 75).

Itannia ornata forma murna, f. nov.

(Fig. 30)

Among hundreds of specimens of *Itannia ornata* Marcus 1947 (p. 135; 1952, p. 88) of all sizes and ages, which came to the surface in jars with algae and Bryozoa, several worms called our attention by their different colour pattern which consists of transverse black stripes over the white flesh, with the ripening ova appearing as pinkish dots. The slightly irregular stripes are generally broader towards the border and thinner in the middle of the body. Size, anatomical features, eyes, reproductive organs, and the two suckers beside the female opening are perfectly consistent with the typical form.

OCCURRENCE: Five specimens among algae in the upper littoral of the coast of São Paulo, near Ubatuba, about 180 km. northeast of Santos; September 1956.

Cestoplana Lang, 1884

This genus represents the Section Emprosthommata Bock 1913 of the Polycladida Acotylea and is known to occur in warm and temperate warm water of the Atlantic and Indo-West-Pacific. The species described in the following is the third one from American coasts. It was only recently found at a locality where we have frequently collected Turbellaria for many years in all seasons.

Cestoplana techia, spec. nov.

(Fig. 33-35)

Our living worms attained a length of 60 mm. and a breadth of 8 mm. The head is more pointed than the hind end; the edges of the body are ruffled. The colour is ivory on back and belly with three vermillion stripes on the back. The median stripe is a little broader than the lateral ones which run at some distance from the margin. The three stripes seem to join at the anterior and posterior end, but in the preserved, somewhat contracted worms they appear slightly separate.

The cilia are weaker on the dorsal, strong on the ventral side, except on a circular ventro-terminal pad (a), the high cells of which have no cilia. These cells are filled with eosinophil granules produced by glands located in the surrounding parenchyma. As the usually applied term "sucker" is not an appropriate denomination for the glandulo-muscular adhesive organ of the

Cotylea (HYMAN 1953, p. 271), it can even less be used for the adhesive pad of *Cestoplana* (KATO 1937, p. 227), as the cutaneous musculature around it is only little stronger than on the rest of the belly.

The area occupied by the frontal eyes (Fig. 34) corresponds to less than one fifth of the body length. As in all species of *Cestoplana* there is a marginal eyeless zone, but it is narrow. Eyes are also absent under the red stripes. The eyes outward to the lateral stripes are up to 25 micra in diameter, and form a dense band. Their pigment cups open to the right and left side. The scattered eyes between either lateral and the median stripe are smaller, up to 16 micra in diameter; they grow denser towards the mid line. Most of their cups open forward and outward, a few obliquely backwards. All eyes are dorsal to the brain (b) and not grouped around it. The brain lies approximately in the centre of the eye-bearing area.

The mouth which lies 4,5 mm. from the caudal end of a preserved 35 mm. long worm is located at the posterior third of the ruffled, 2,5 mm. long pharynx (f).

The male gonopore (m) is situated 2,2 mm. in front of the hind end; the female pore (q) lies 0,7 mm. behind the male one. The sectioned worm was in full male phase and had all male germ cells transformed into spermatozoa which enlarge the seminal canals (spermiducal vesicles, e).

The ducts unite and form a slightly dilated common male duct (d) which opens into the seminal vesicle (x). The vesicle is 0,3 mm. long and measures about 0,2 mm. in height and thickness. The nuclei of the muscle fibers that surround the seminal vesicle lie all on the periphery of the muscle mantle. A thin and curling ejaculatory duct (j) leads from the seminal vesicle to the hind end of the granule vesicle (r). This cucumber-shaped organ is 0,25 mm. long and 0,1 mm. in diameter. The male canal is directed vertically to the ventral side and projects into the penis pocket (y) with a 85 micra long penial papilla (p). The papilla is weakly cuticularized, not horny yellow, but not nucleated. The same seems to be the case in *C. microps* (Verr.), to judge from HYMAN's drawing (1939a, t. 6 f. 21). The penis sheath (z) is small, but the male atrium (k) 0,3 mm. long, folded and thickly muscular.

The ovaries (o) are dorsal to the testes (t) and like these attain nearly the rear end of the body. They are disposed as a network, and their germ zones lie on the dorsal or on the ventral side. In the sectioned specimen the uteri do not contain eggs. The uterine ducts (u) begin in front of the pharynx and extend behind the female gonopore. They unite in the dilated inner vagina (w) which does not continue to a Lang's vesicle. The further organs of the female efferent system, the large cement chamber (c) and the short, vertical external vagina (female antrum, v) are like those in the other species of the genus.

OCCURRENCE: Island of São Sebastião, under stones in the upper littoral of Ilhabela, 3 mature worms in November 1955.

DISCUSSION OF *Cestoplana techa*

Since the publication of a key for the determination of 9 species of *Cestoplana* (MARCUS 1949, p. 80-81) no new species has been described. Therefore the key can be used in order to differentiate *techa*. It has its mouth in the posterior third of the body (against *raffaeli*), simple male efferent organs (against *lactea*), one female aperture (against *polypora*), no Lang's vesicle (against *microps*), and no separate group of cerebral eyes (against *feraglionensis* and *marina*). The further items refer to the extension of the area containing eyes in front of the brain and behind it. As the anterior and posterior areae are of nearly equal size in *techa*, this character can hardly be used for separating *techa* from the three last species of the key, *rubrocincta*, *ceylanica* and *salar*. The dense border of big marginal eyes set off from the eyes of the inner area is the most particular feature of *techa*. Moreover *C. rubrocincta* and *C. ceylanica* do not show an eyeless mid line, and *ceylanica* and *salar* have no pigmented median stripe.

RESUMO

Das 28 espécies dos Tricladida Terricola atualmente conhecidas do Perú 21 foram colecionadas pelo Dr. WOLFGANG K. WEYRAUCH — Lima.

Dolichoplana vircata, sp. n., distingue-se pelo aparêlho reprodutivo das duas outras espécies do gênero conhecidas a este respeito, *D. feildeni* Graff e *D. carvalhoi* Corrêa. *Microplana yaravi*, sp. n., tem uma bursa, cujos dois divertículos laterais se projetam para dentro do lume do intestino. A descrição original de *Incapora weyrauchi*, baseada em um espécime não completamente maduro, pode ser completada por 3 outros, dos quais 2 totalmente maduros. Além do duto gênito-intestinal e das comunicações entre a anastomose intestinal e o integumento, ocorre, em um exemplar, um par de dutos cutâneo-intestinais atrás da anastomose. As diagnoses anteriores de *Geoplana quichua*, *G. weyrauchi* e *G. aymara* foram confirmadas e completadas, com novo material. *G. lama*, sp. n., caracteriza-se, principalmente, pelo curso excêntrico do canal genital masculino e pelo epitélio rugoso e glandular na base da papila penial. *G. vicuna*, sp. n., é semelhante a, mas, claramente diferente de *G. idaia*. *G. shapra*, sp. n., separa-se de *G. aymara* pelos olhos, os divertículos intestinais e pela topografia das glândulas da casca. As espécies mencionadas provêm do Perú.

Dá-se o mesmo com *Notoplana chierchiai* (Plehn) de Callao-La Punta, uma das lides do material original. Da África do Sul, Dr. W. MACNAE — Grahamstown enviou-me milhares de espécimes de uma *Convoluta*, *C. macnæi*, sp. n., morfológica e ecológicamente semelhante a *C. roscoffensis* Gr. As diferenças mais importantes residem no aparêlho masculino. *C. macnæi* reproduz-se, principalmente, por arquitomia. As espécies seguintes são do litoral superior do Estado de São Paulo. *Hofstenia tinga*, sp. n., é representada por um exemplar em plena maturidade feminina. O cérebro volumoso e 6 cordões nervosos diferem bastante de *Hofstenia atroviridis* Bock. Sómente os 4 cordões dorsais correm na base da epiderme; os outros elementos nervosos são sub-musculares. *H. minuta* Palombi difere pelos divertículos intestinais e pela ausência da glândula céfala. O intestino de

H. tinga é sincicial. Uma forma, *murna*, f. n., distingue-se de *Itannia ornata* Marc. pelas suas listras pretas. *Cestoplana techa*, sp. n., é de cór de marfim com 3 estrias de cór de cinábrio. Portanto, é semelhante a *C. rubrocincta* (Grube). Distingue-se, porém, desta e das 8 outras espécies do gênero pelos grandes olhos laterais, densamente dispostos e nitidamente separados dos olhos internos.

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Plate 1

Dolichoplana vircata, sp. n.

Fig. 1 — Fore end.

Fig. 2 — Colour pattern short in front of pharynx.

Fig. 3 — Sagittal section of pharynx.

Fig. 4 — Diagram of copulatory organs; a 4,5 mm. long stretch of the male atrium omitted.

Fig. 5 — Horizontal reconstruction of male organs.

Fig. 6 — Same of female organs.

a — male atrium. b — copulatory bulb. c — common atrium. d — male ducts.
e — anastomosis of e. g — gonopore. h — inner pharyngeal epithelium. i — anastomosis of
intestinal limbs. j — ramification of one of the ovovitelline ducts. k — nuclei of muscles
of male atrium m — annular muscles of common atrium with their nuclei. n — ventral
nerve plate. o — ovovitelline ducts. p — union of o. q — granule vesicle. r — granule
glands. s — seminal vesicle. t — glandular duct. u — glandular pouch. v — cyanophilous
strands in pharynx. w — radial muscles in pharynx. x — shell glands. y — Annular muscles.
z — longitudinal muscles.

On Turbellaria

E. DU BOYS-REYMOND MARCUS

PLATE 1

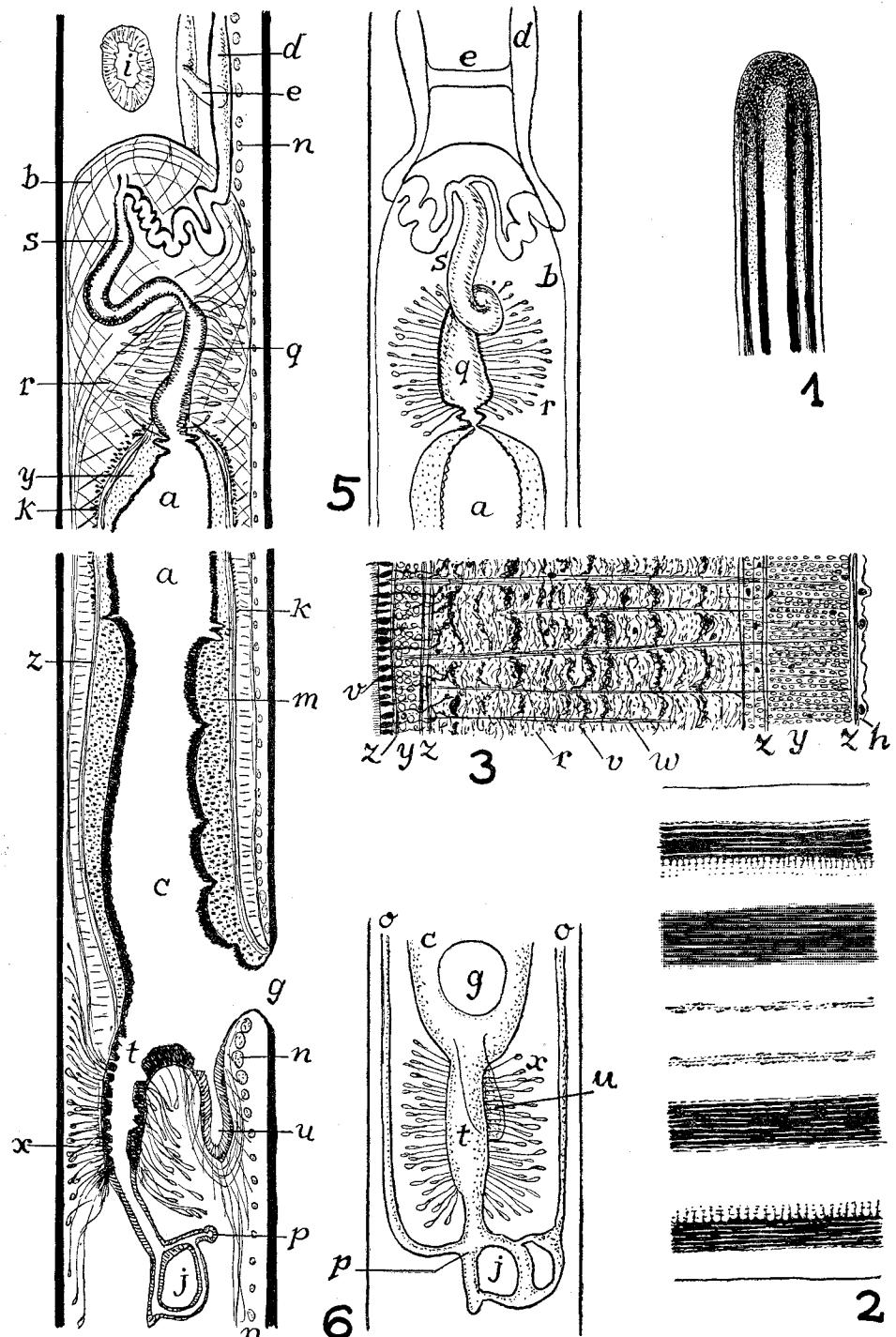


Plate 2

Micoplana yaravi, sp. n.

Fig. 7 — Dorsal view of preserved worm.

Fig. 8 — Ventral view of fore end.

Fig. 9 — Reconstruction of copulatory organs.

b — copulatory bulb. d — right male duct. e — common oovitelline duct. g — gonopore. i — left posterior limb of intestine. j — bursal-intestinal duct. k — bursa canal. m — ejaculatory duct. o — oovitelline duct of right side. p — penial papilla. q — granule glands. r — ectal part of bulbar lumen. s — ental part of bulbar lumen (seminal vesicle). t — vagina. u — ampula of bursa. v — left male duct. x — shell glands.

Incapora weyrauchi d. B.-R. Marc.

Fig. 10 — Diagram of reproductive organs.

a — anastomosis of hind intestinal limbs. b — copulatory bulb. — d — genito-intestinal canal. e — right male duct. g — common oovitelline duct. i — posterior intestinal limbs. j — sphincter of ejaculatory duct. o — oovitelline ducts. p — gonopore. r — outer part of common vesicle (bulbar lumen). s — inner part of same. u — cutaneous pores of w. w — intestinal-cutaneous ducts. z — penial papilla.

On Turbellaria

E. DU BOYS-REYMOND MARCUS

PLATE 2

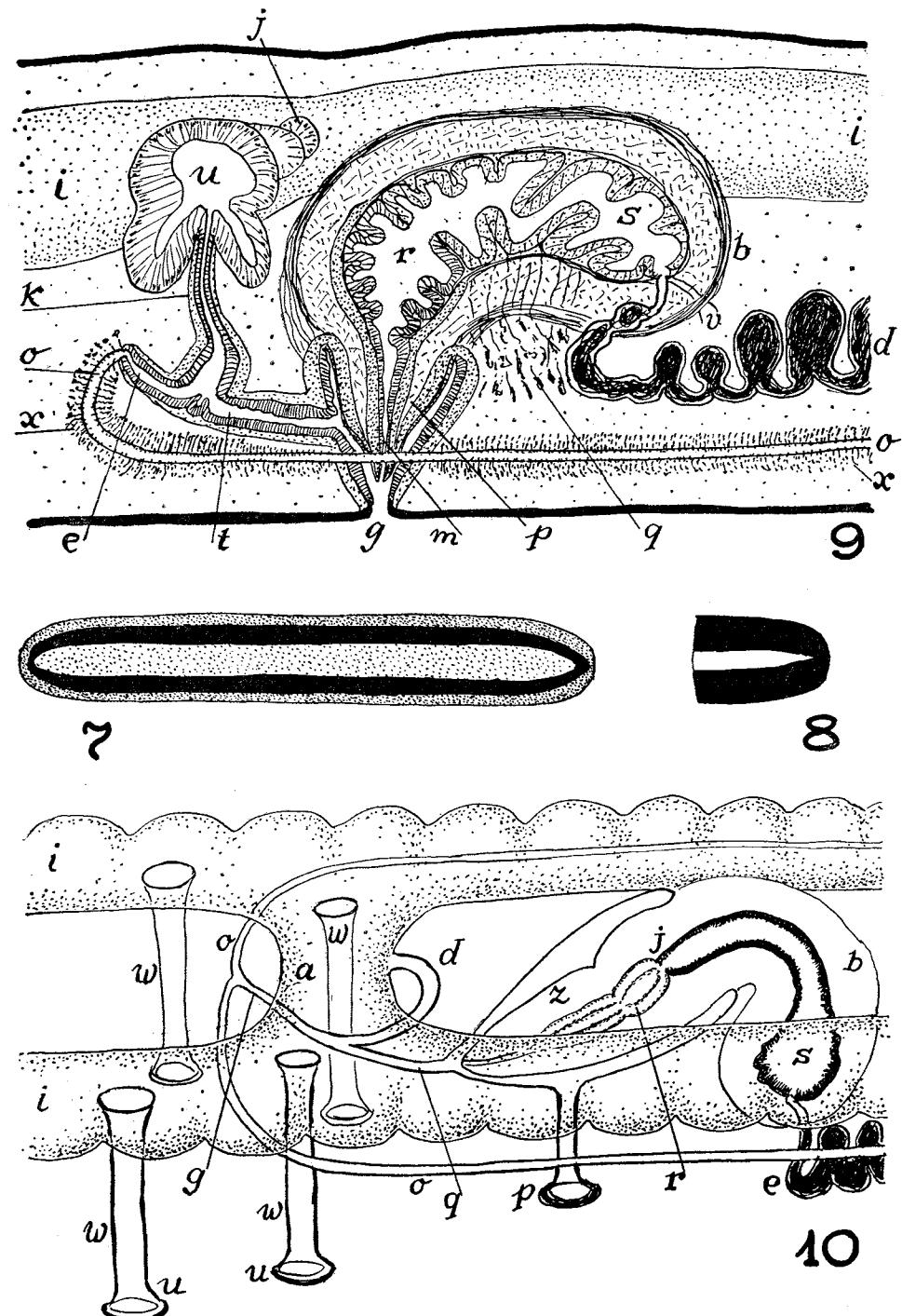


Plate 3

Geoplana weyrauchi d. R.-R. Marc.

- fig. 11 — Dorsal aspect of preserved worm.
 fig. 12 — Latero-ventral view of fore end.
 fig. 13 — Colour pattern of back.

Geoplana lama, sp. n.

- fig. 14 — Ventral view of preserved worm.
 fig. 15 — Diagram of reproductive organs.

a — male atrium. b — copulatory bulb. c — folded epithelium at root of penis.
 — spermiducal bulbs. e — ejaculatory duct. f — female atrium. g — gonopore. m —
 mouth. o — left oovitelline duct. p — penis papilla. r — right oovitelline duct.
 — seminal vesicle. x — shell glands.

Geoplana vicuna, sp. n.

- fig. 16 — Outline of preserved worm.
 fig. 17 — Median section of pharynx.
 fig. 18 — Diagram of copulatory organs.

a — mouth. b — copulatory bulb. d — spermiducal bulb. e — ejaculatory duct.
 — female antrium. g — gonopore. h — sphincter of pharynx. i — intestine. m — male
 atrium. o — left oovitelline duct. s — seminal vesicle. x — shell glands.

On Turbellaria

E. DU BOYS-REYMOND MARCUS

PLATE 3

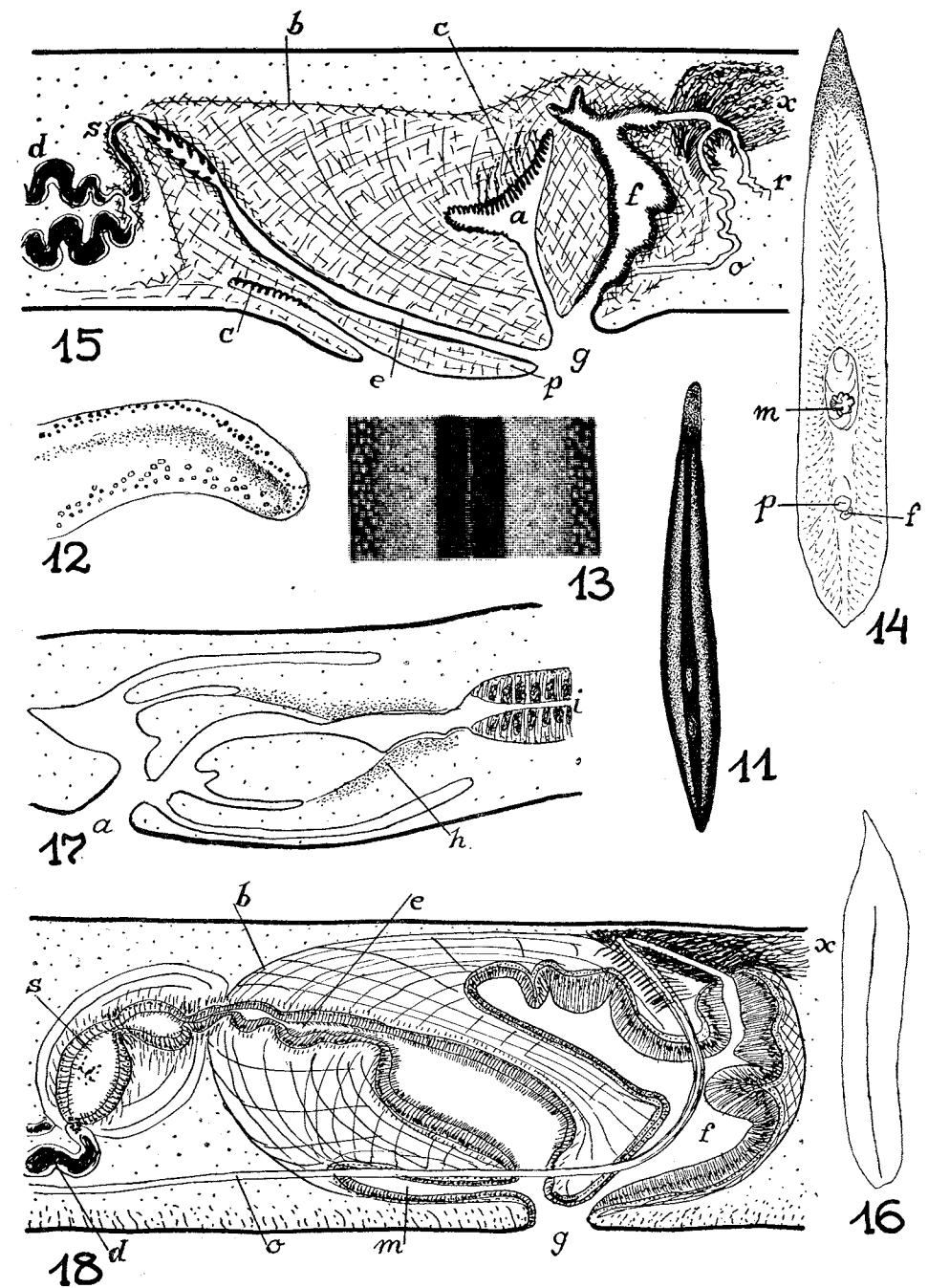


Plate 4

Geoplana shapra, sp. n.

Fig. 19 — Dorsal view of preserved worm.

Fig. 20 — Colour pattern.

Fig. 21 — Diagram of copulatory organs.

a — male atrium. b — copulatory bulb. d — spermiducal bulbs. e — ejaculatory duct. m — annular muscles of penis papilla. o — ovovitelline duct of left side. p — gonopore. q — glandular duct. s — seminal vesicle. v — union of ovovitelline ducts. y — cyanophilous glands of antrum. z — shell glands.

Convoluta macnaei, sp. n.

Fig. 22 — Bursa and nozzle.

Fig. 23 — Section of hind end with male pore.

Fig. 24 — Sagittal section through region of sagittocysts.

a — alga. b — bursa. c — cyanophilous gland. d — sperm tract. e — endocytium. f — frontal gland. g — female pore. h — Diatom. i — mouth. k — ectocytium. m — longitudinal muscle. n — nozzle. o — ovocyte. p — epicytium. q — male pore. r — sagittocystoblast. s — sagittocyst. u — dorso-ventral muscle. v — annular muscle. w — brain. z — statocyst.

On Turbellaria

E. DU BOIS-REYMOND MARCUS

PLATE 4

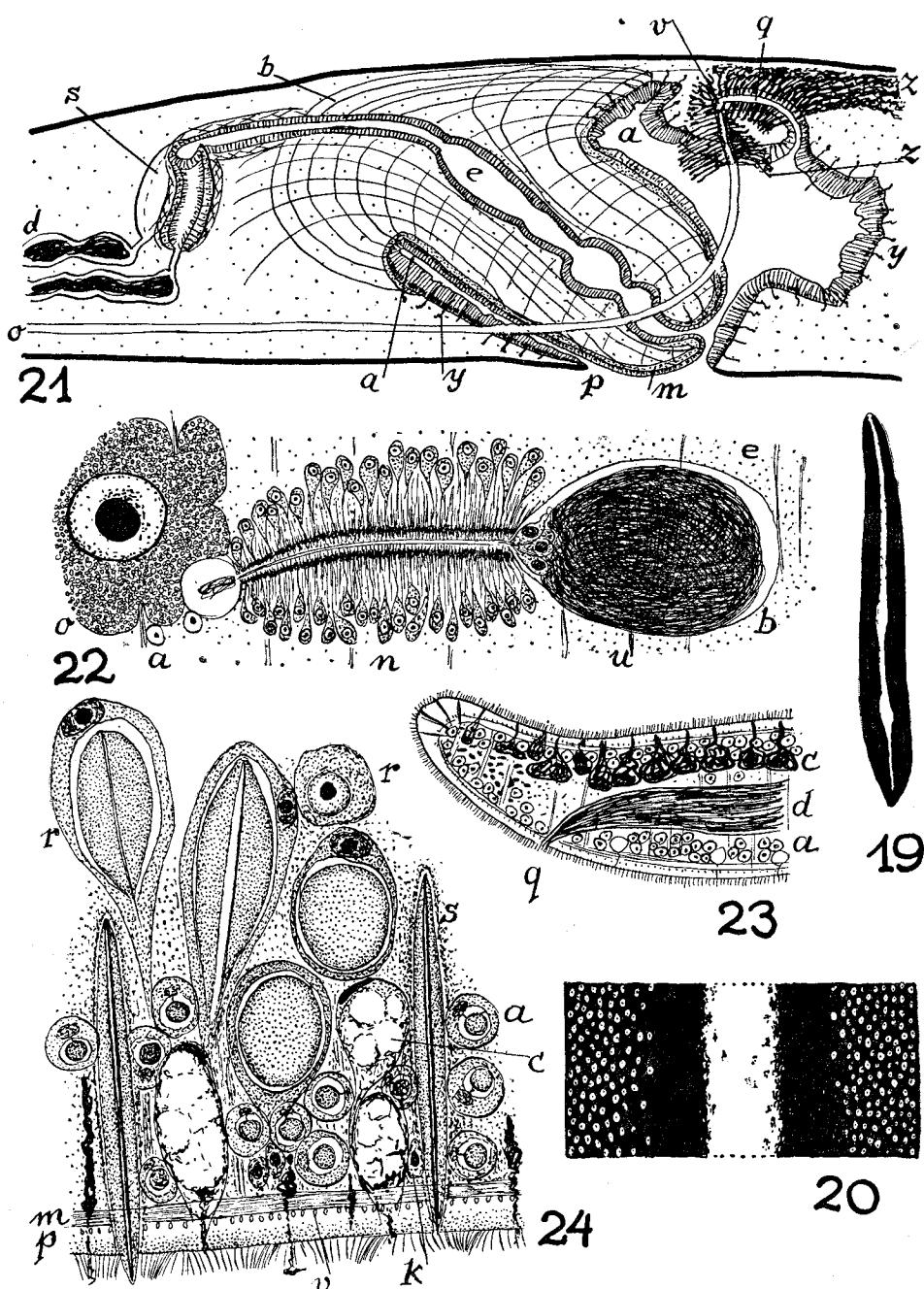


Plate 5

Convoluta macnæi, sp. n.

Fig. 25 — Combined sagittal section.

For lettering see Plate 4.

Holstenia tinga, sp. n.

Fig. 26 — Dorsal view of clarified worm.

Fig. 27 — Lateral aspect of same.

Fig. 28 — Transverse section on level of statocyst.

Fig. 29 — Transverse section at hind end of pharynx.

a — male atrium. b — brain. c — cephalic gland. d — digestive syncytium. e — follicle cells. f — pharynx. g — vacuolated epidermal glands. h — cyanophilous epidermal glands. i — possibly injected sperm. k — eosinophilous epidermal glands. l — longitudinal dorsal muscles. m — mouth. n — nerves. o — ovocytes. p — cephalic pit. q — male bulb. r — vesicle containing granules. s — statocyst. t — nematocysts. w — pharyngeal glands. x — sphincteres.

Itannia ornata forma murna, f. n.

Fig. 30 — Dorsal aspect of living specimen.

On Turbellaria

E. DU BOIS-REYMOND MARCUS

PLATE 5

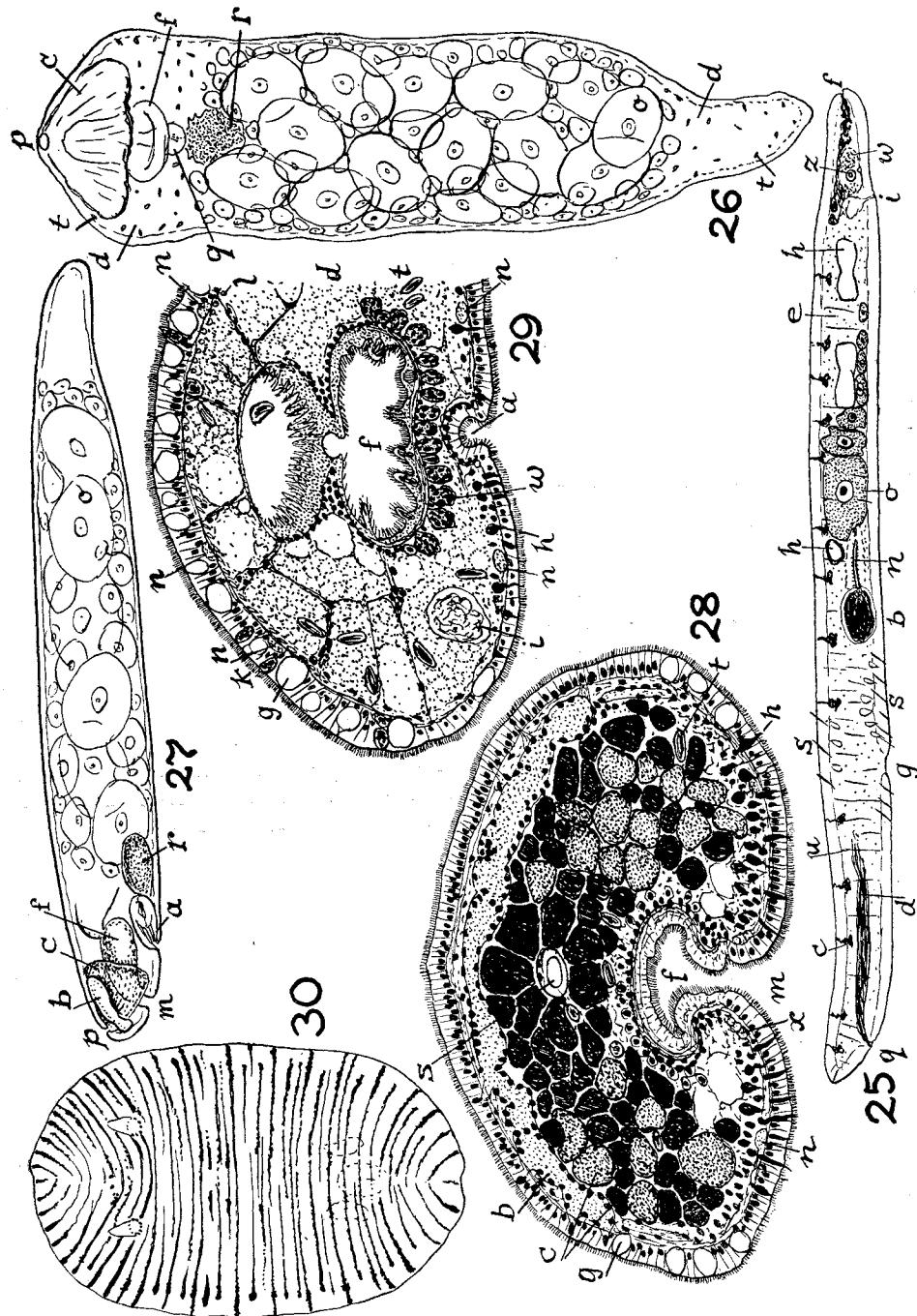


Plate 6

Hofstenia tinga, sp. n.

Fig. 31 — Median reconstruction of male organ.

Fig. 32 — Section of growing ovocytes.

For lettering see Plate 5.

Cestoplana techa, sp. n.

Fig. 33 — Living worm, dorsal view.

Fig. 34 — Head of preserved worm in oil of cloves.

Fig. 35 — Combined sagittal section of reproductive organs.

a — adhesive pad. b — brain. c — cement chamber. d — common male duct. e — enlarged seminal duct. f — pharynx. j — ejaculatory duct. k — male atrium. m — male gonopore. o — ovary. p — penial papilla. q — female gonopore. r — granule vesicle. s — cement glands. t — testes. u — uterine duct. v — external vagina. w — internal vagina. x — seminal vesicle. y — penial pocket. z — penial sheath.

On Turbellaria

E. DU BOYS-REYMOND MARCUS

PLATE 6

