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SAPPORO, JAPAN

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In 1952, during an investigation of freshwater planarians in Hokkaidô conducted by the senior author, A. Ichikawa, several specimens of white planarian were collected in the brooklet running through the compound adjoining the Akkeshi Marine Biological Station attached to the Faculty of Science of Hokkaido University, Akkeshi-chô, in eastern Hokkaidô. An examination of the material revealed that the worms belonged to the genus *Polycelis*. But the presence of an extraordinarily thick muscle zone surrounding the male antrum differentiates it from *Polycelis sapporo* (Ijima et Kaburaki), a most common unpigmented *Polycelis* species in Hokkaidô. Unfortunately, in this material, none of the animals was fully mature (cf. Ichikawa 1954: Abstract of a lecture delivered before the 24th Annual Meeting of the Zoological Society of Japan held in Kyoto, on Nov. 1st-2nd, 1953).

Recently, the writers made several visits to the locality of those planarian specimens and a good number of planarians could be found in the hill streams near the Station. In laboratory cultures, the writers succeeded in obtaining many sexually mature specimens. In the summer of 1962 the junior author also took numerous sexually mature specimens of this planarian species in brooks and booklets in the vicinity of Mt. Apoi, Hidaka, in southern Hokkaidô and in the spring at Kaminayoro, Kamikawa, northern Hokkaidô.

After having re-examined a sufficient number of the worms the writers came to the conclusion that this freshwater planarian is a new species in the Japanese fauna. The taxonomic description of this form is here reported, together with some additional data.

The worms were killed by Sugino's method (pour 2% hydrochloric acid over living worm) and were fixed in Bouin's fluid. Serial sections were stained with haematoxylin and eosin. Some of them which were

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killed by Sugino's method were fixed in Nozawa's fluid (95% ethyl-alcohol 45 cc+formalin 10 cc+acetic acid glacial 2 cc), and were stained with borax-carmin as a whole mount. For the tracing of the digestive system, the following method was used: feed a bit of chicken spleen stained with a fluid of Chinese ink-stick to the hungry worms. After this treatment, the worms which were killed by Sugino's method were fixed in Nozawa's fluid, and were prepared as whole mounts without any staining (cf. Ichikawa & Kawakatsu 1961, pp. 14–18).

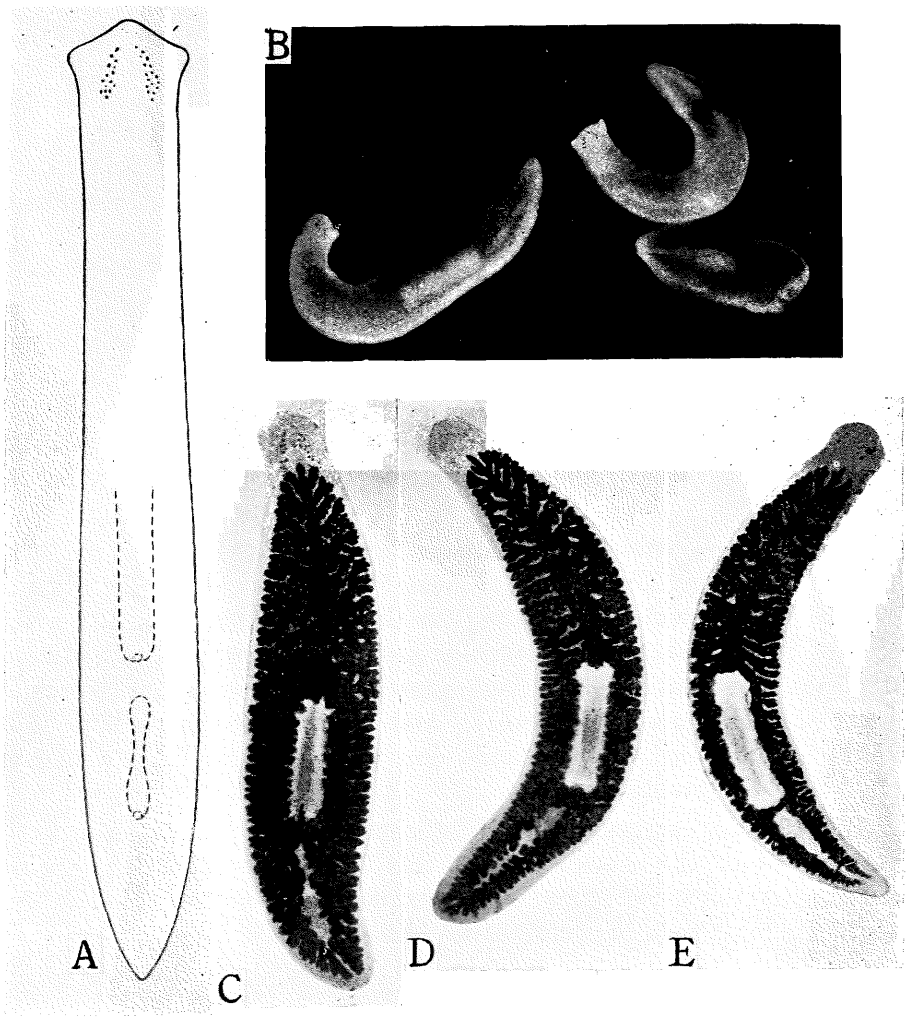

Fig. 1. *Polycelis akkeshi*, new species. A: sketch of living specimen from Akkeshi. Actual length, 15 mm. B: retouched photographs of living specimens from Mt. Apoi. Actual length, 12–15 mm. C, D and E: intestine variants from whole mounts (Mt. Apoi specimens, No. 344 group).

Order TRICLADIDA
Suborder PALUDICOLA or PROBURSALIA
Family PLANARIIDAE
Genus *POLYCELIS* Ehrenberg, 1831

Polycelis akkeshi, new species

Description. *Polycelis akkeshi* has great resemblance to *Polycelis sapporo* (Ijima et Kaburaki) in general appearance, viz., the shape of the

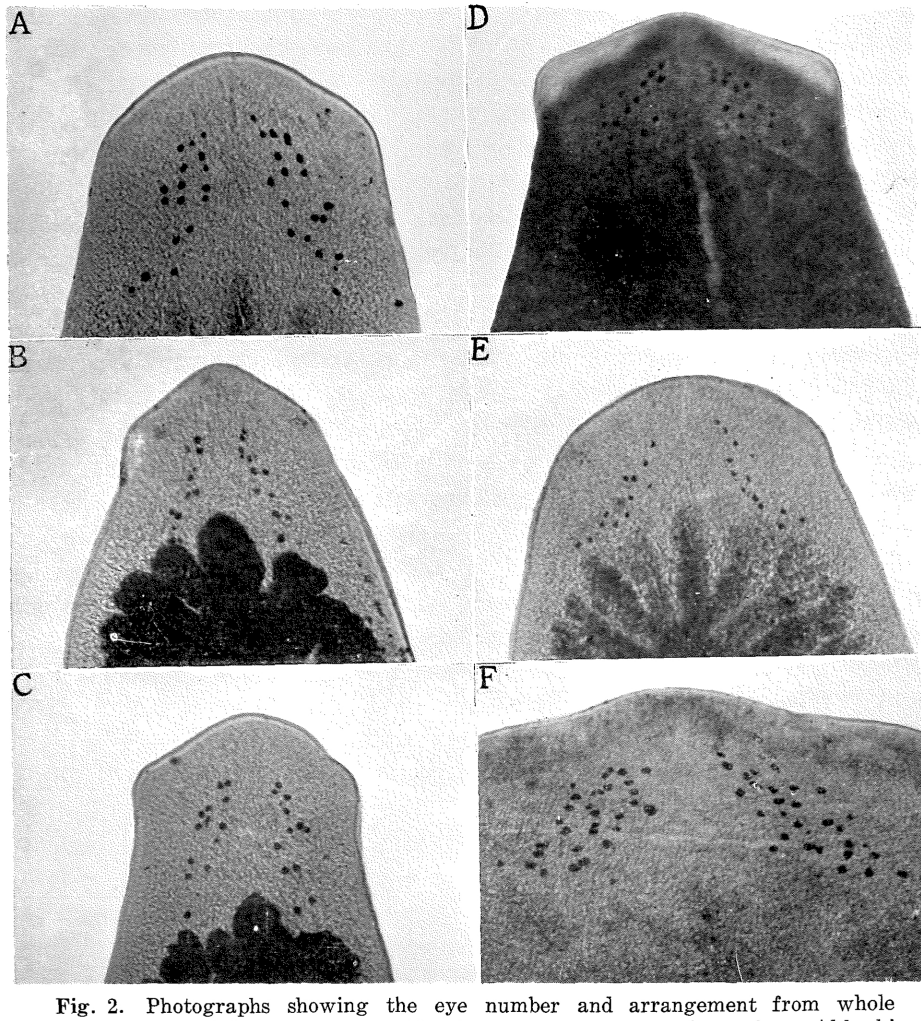

Fig. 2. Photographs showing the eye number and arrangement from whole mounts. All the same magnifications. **A**: mature specimen from Akkeshi (No. 342 group). **B** and **C**: immature specimens from Akkeshi, Chinese ink-stick stain (No. 342 group). **D**: mature specimen from Mt. Apoi (No. 344 group). **E**: mature specimen from Mt. Apoi, borax-carmin stain (No. 344 group). Notice the marginal zone of adhesive cells which in the preparation appears darkly stained. **F**: mature specimen from Kaminayoro (No. 321 1).

head, the number and arrangement of the eyes. But the body of the present form is more slender and more delicate in appearance than that of *Polycelis sapporo*. Anatomically, *Polycelis akkeshi* differs from *Polycelis sapporo* decidedly in the structure of the male copulatory apparatus.

The appearance of the species in life is shown in Figure 1 (A and B). Sexually mature worms are usually 12 to 15 mm long and 1 to 1.5 mm wide (largest specimen seen measured up to 18 mm in length). The body lacks pigment being white except for the contents of the intestine which may show through the body wall. The head region, the lateral margins of the body and the area above the pharynx are always white. In life, the copulatory apparatus, especially copulatory bursa and penis of the fully matured specimens are visible from the dorsal side. In color the organs are opaque milk-white.

The anterior margin is gently convex when the animal is gliding quietly. At the lateral corners of the head there is a pair of broad, rounded auricles which in life are kept in constant movement. Behind the level of the auricles, the body narrows slightly, then widens again; the moderately slender body remains of about the same width until the posterior body fourth where it tapers gradually to a rather pointed posterior end.

The species has many small eyes in the head region. They are arranged in two bands, one on each side of the median line, situated a considerable distance from the head margin both anteriorly and laterally, and fairly converging anteriorly. There are no eyes in the mid-dorsal part of head. The posterior end of the bands is at about the level of the anterior end of the anterior main intestinal ramus. Within each band the eyes are distributed irregularly. The photographs in Figure 2 (A-F) indicate the arrangement of the eyes in 6 specimens (4 sexual and 2 asexual) from three different localities.

Table 1

Group of specimens classified according to localities	No. of specimens examined, their sexual state in parentheses	Body length × width (mm)	Number of eyes*		
			Minimum on one side	Maximum on one side	Total no. of eyes
Akkeshi (No. 314 and No. 342)	18 (8, sexual / 10, asexual)	12~15×1.5 10~12×1.0	12 11	32 20	28~59 23~40
Mt. Apoi (No. 344)	17 (sexual)	10~15×1.5	10	32	21~62
Kaminayoro (No. 321 and No. 322)**	87 (sexual)	12~18×1.5	11	64	25~124

* The number of eyes was counted in the preserved specimens in alcohol and in the material of whole mounts.

** The count of the number of eyes of Kaminayoro specimens was made by Mr. Y. Yanagida.

The number of eyes varies considerably. In specimens of different size, both mature and immature, collected in three localities, the numbers were counted as in Table 1.

From the data given in Table 1, it can be seen that the Kaminayoro specimens possess rather many eyes compared with those of the specimens from the Akkeshi and Mt. Apoi localities. In general, a majority of the sexually mature worms possesses 30 to 70 eyes in the total number.[1] In one worm the number of eyes is substantially equal in each eye-band.

In the fully grown worms the pharynx is situated somewhat behind the middle of the body, and measures about one-fourth of the body in length. The pharynx is structurally typical of the genus *Polycelis* and of the family Planariidae. Namely, the internal muscle zone of the pharynx consists of two distinct layers, a thick circular layer adjoining the epithelium of the pharynx lumen and a thinner outer longitudinal one.

In mature worms the anterior trunk of the intestine bears 9 to 13 lateral branches; each posterior trunk bears 18 to 20 or more pairs of short lateral branches. Behind the level of the mouth, several branches of the medial sides of the posterior trunks extend inwardly but do not form the intestinal anastomoses. Figure 1 (C, D and E) shows photographs of the variation of intestine from whole mounts of 3 mature specimens from Mt. Apoi.

The general histology (i. e., epidermis, basement membrane, subepidermal musculature and rhabdite-forming cells) of the present material appeared to offer nothing of particular interest. There is a well-developed marginal zone of adhesive cells which widens at the ventral side of the head.

The general arrangement of the parts of the reproductive system is shown in Figure 3, drawn from several whole mounts. The testes are essentially ventral and prepharyngeal (Fig. 3). They occur in two longitudinal bands, on each side of the anterior ramus of the intestine, extending from the level of the ovaries to the base of the pharynx posteriorly. Of almost all specimens examined, in the central cavity of each testis a tangled mass of spermatozoa is found.

The paired ovaries, situated below the second lateral branches of the anterior trunk of the intestine, are of small size and simple (Fig. 3). Numerous mature ova were seen in the ovary of our ripe specimens. The two ovovitelline ducts (or oviduct) proceed posteriorly ventral; at about the level of the copulatory apparatus, they bend dorso-medially and form

1) According to our data, sexually mature specimens of *Polycelis sapporo* possess 60 to 100 eyes in total number (a specimen with 126 eyes, which may be considered the maximum number, has been seen).

a very long common ovovitelline duct. The yolk glands or vitellaria are clusters of large, darkly staining cells which are found embedded in dorsolateral parenchyma of both sides.

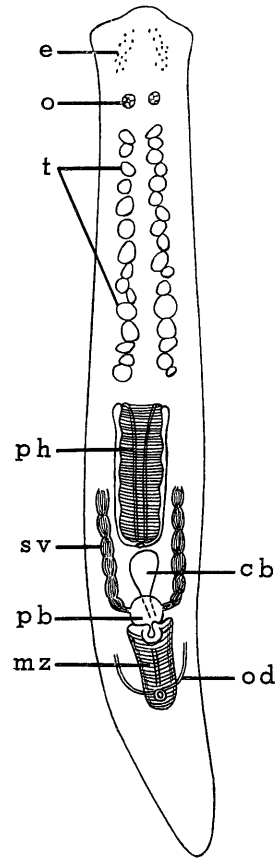

Fig. 3. General view of a mature specimen synthesized drawing from several whole mounts, borax-carmin stain (Mt. Apoi specimen).

cb: copulatory bursa; e: eye-band; mz: muscle zone surrounding the male antrum; o: ovary; od: ovovitelline duct; pb: penis bulb; ph: pharynx; sv: spermiducal vesicle; t: testis.

The copulatory organs occupy the anterior half of the post-pharyngeal region. Sagittal views of the copulatory apparatus, re-constructed from several sets of sections of animals from three different localities, Akkeshi, Mt. Apoi and Kaminayoro, are shown in Figure 5 (A, B and C). Figure 6 (A–I) shows photomicrographs of the copulatory apparatus of 9 different worms from the three different localities.

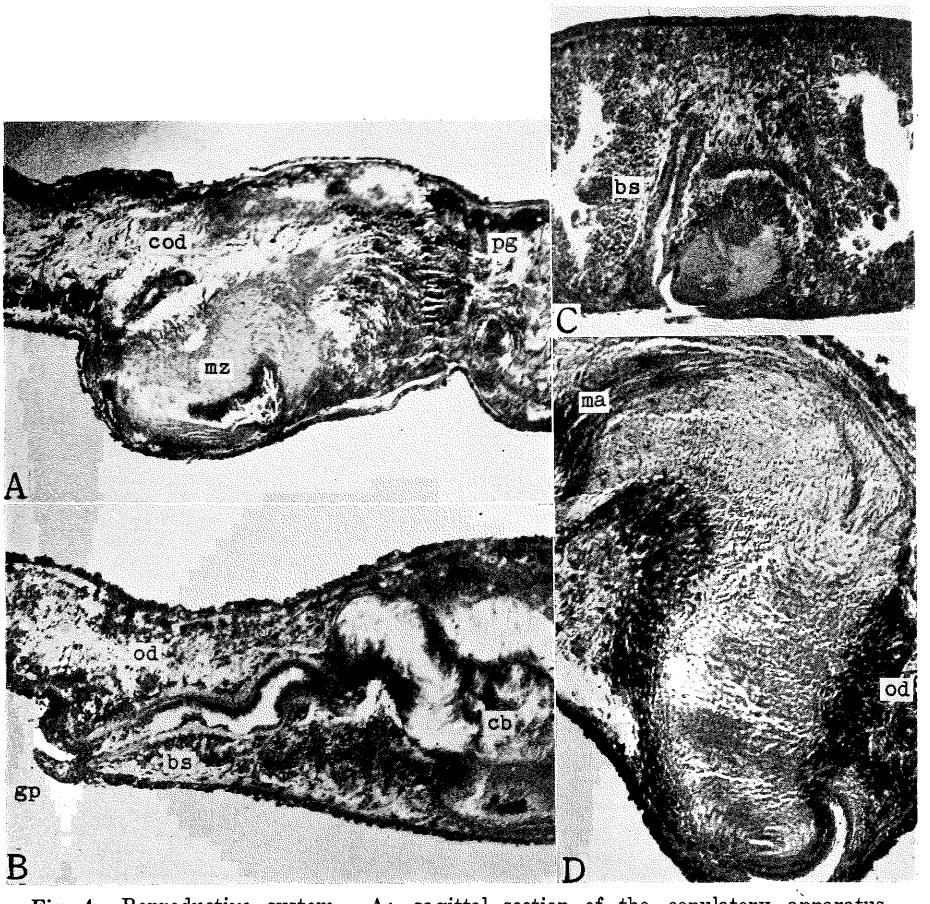

Fig. 4. Reproductive system. **A**: sagittal section of the copulatory apparatus, showing the situation of common ovovitelline duct, thick muscle zone surrounding the male antrum and penis glands (Akkeshi specimen, No. 314 a). **B**: sagittal section of the bursal canal (Kaminayoro specimen, No. 321 d). **C**: cross section through the bursal canal and the muscle zone surrounding the male antrum, at level of the genital pore (Akkeshi specimen, No. 341 g). **D**: sagittal section of the muscle zone surrounding the male antrum (Kaminayoro specimen, No. 321 f).

bs: bursa stalk; cb: copulatory bursa; cod: common ovovitelline duct; gp: genital pore; ma: male antrum; mz: muscle zone surrounding the male antrum; od: ovovitelline duct; pg: penis glands.

The genital pore leads immediately into two cavities, the tubular male antrum and, to the right and somewhat posteriorly, the duct of the copulatory bursa (Fig. 4 B and C; Fig. 6 A). No common antrum is found in this species. The common ovovitelline duct opens into the genital pore (or into the posterior terminal part of the male antrum) from the dorsal side (Fig. 4 A; Fig. 6 C; Fig. 7 F). The terminal section of the paired

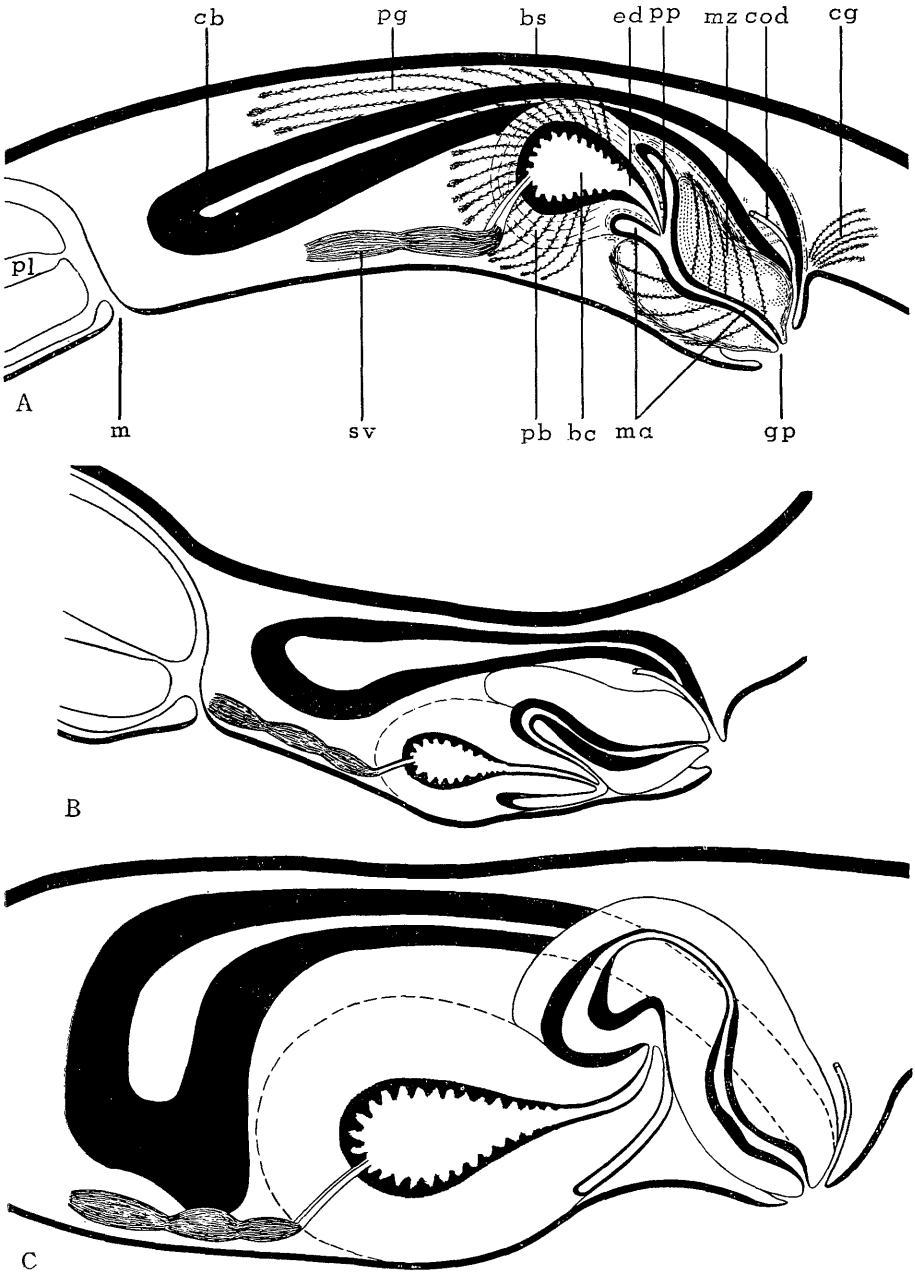

Fig. 5. Diagrams showing the sagittal view of the copulatory apparatus. All the same magnifications. **A**: Akkeshi specimen. **B**: Mt. Apoi specimen. Musculatures and glands simplified. **C**: Kaminayoro specimen. Musculatures and glands simplified.

bc: bulbar cavity; bs: bursa stalk; cb: copulatory bursa; cg: cement glands; cod: common ovovitelline duct; ed: ejaculatory duct; gp: genital pore; m: mouth; ma: male antrum; mz: muscle zone surrounding the male antrum; pb: penis bulb; pg: penis glands; pl: pharynx lumen; pp: penis papilla; sv: spermiducal vesicle.

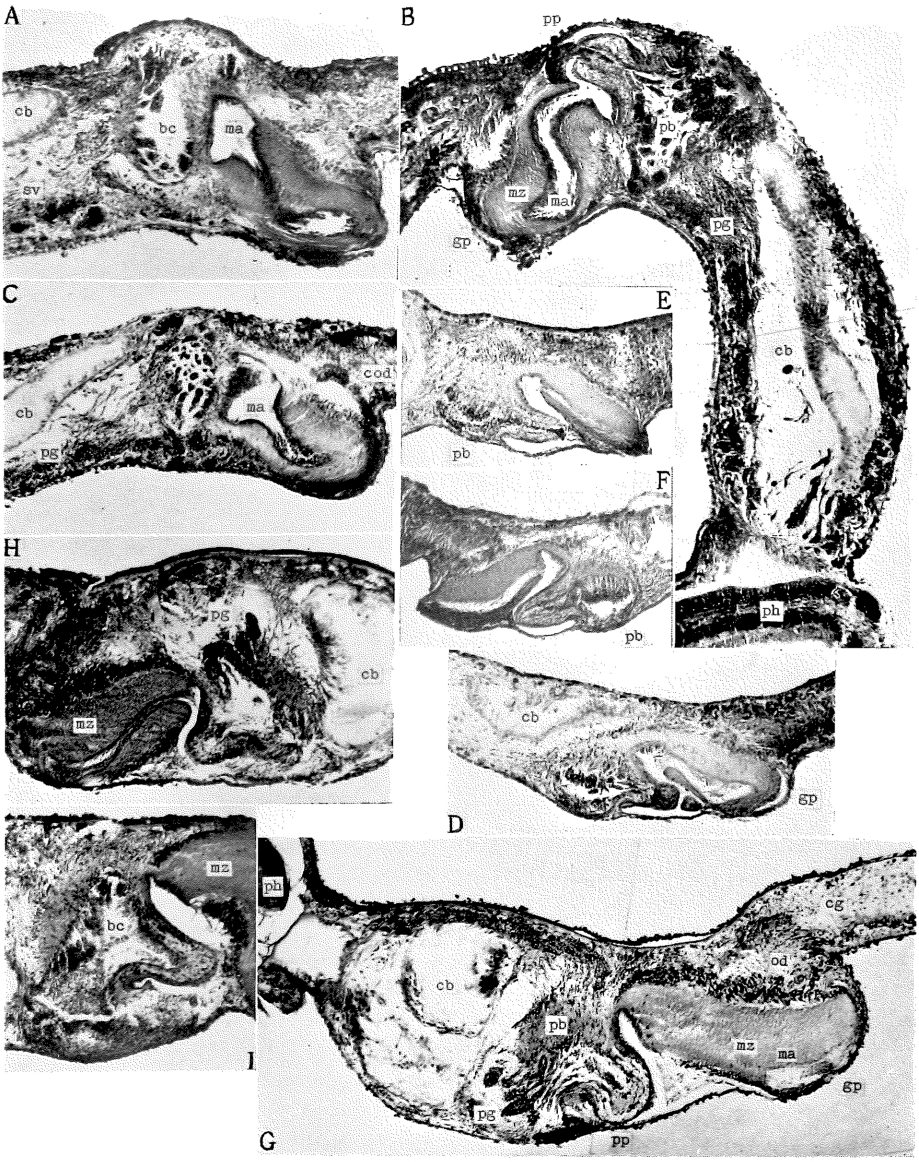

Fig. 6. Sagittal sections of the copulatory apparatus. All the same magnifications. **A**: penis bulb and male antrum (Akkeshi specimen, No. 314 d). **B**: copulatory apparatus (Akkeshi specimen, No. 314 e). **C**: copulatory apparatus (Akkeshi specimen, No. 314 f). **D**: copulatory apparatus (Mt. Apoi specimen, No. 344 f). **E**: penis (Mt. Apoi specimen, No. 344 h). **F**: penis (Mt. Apoi specimen, No. 344 l). **G**: copulatory apparatus (Kaminayoro specimen, No. 321 b). **H**: copulatory apparatus (Kaminayoro specimen, No. 321 c). **I**: penis (Kaminayoro specimen, No. 321 a).

bc: bulbar cavity; cb: copulatory bursa; cg: cement glands; cod: common ovovitelline duct; gp: genital pore; ma: male antrum; mz: muscle zone surrounding the male antrum; od: ovovitelline duct; pb: penis bulb; pg: penis glands; ph: pharynx; pp: penis papilla.

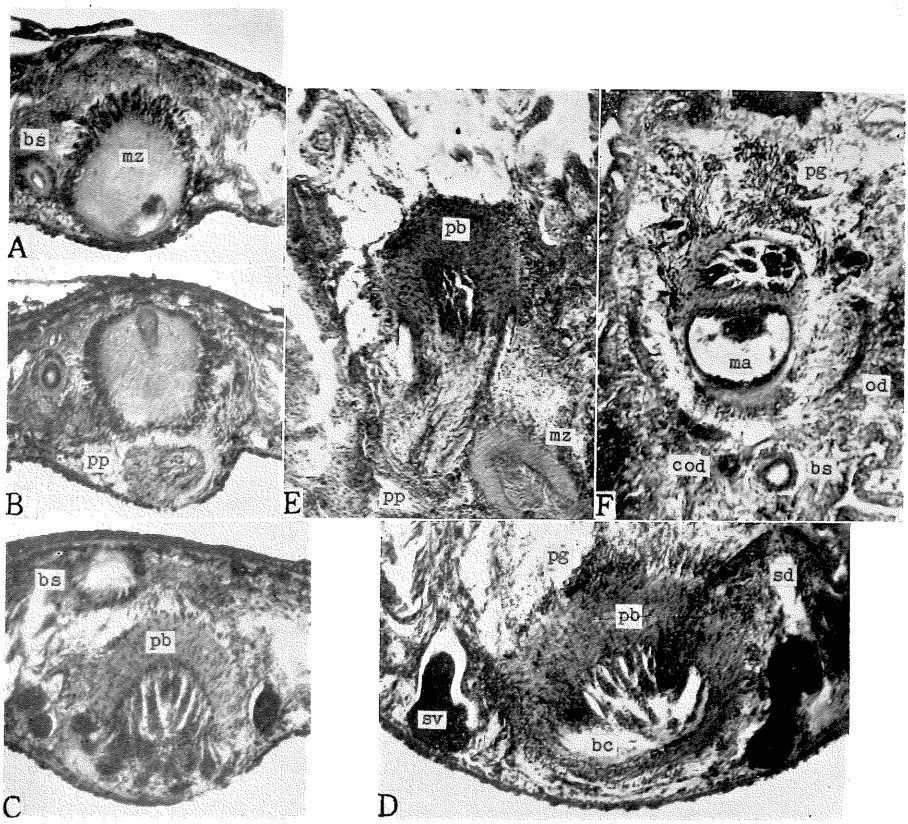

Fig. 7. Copulatory apparatus. **A, B** and **C**: cross sections showing the copulatory apparatus (Kaminayoro specimen, No. 321 g). **D**: cross section through the penis bulb, at level of entry of the sperm ducts (Kaminayoro specimen, No. 321 h). **E**: horizontal section of the penis (Kaminayoro specimen, No. 321 k). **F**: horizontal section of the copulatory apparatus (Akkeshi specimen, No. 314 g).

bc: bulbar cavity; bs: bursa stalk; cod: common ovovitelline duct; ma: male antrum; mz: muscle zone surrounding the male antrum; od: ovovitelline duct; pb: penis bulb; pg: penis glands; pp: penis papilla; sd: sperm duct; sv: spermiducal vesicle.

oviducts and a section of the common ovovitelline duct are equipped with numerous eosinophilic cement glands.

The most peculiar feature of the copulatory apparatus of this species is an extraordinarily thick muscle zone surrounding the male antrum; that zone appears cylindrical in shape. As shown in Figure 5 (A, B and C) its shape is subject to great variation due apparently to the state of the contraction of the musculature. The posterior end of this muscle zone is bluntly pointed or somewhat rounded; in many preserved samples examined, its distal end is protruded from the genital pore (Fig. 6 A, E

and F). Histologically, its musculature consists chiefly of a thick layer of circular muscle fibres; outside this layer there is a thin layer of longitudinal fibres (Fig. 4 D). The cavity, i. e., the male antrum is an elongated funnel-shaped cavity, wide anteriorly and very narrowing posteriorly and at the same time curving ventrally till it reaches the genital pore (Fig. 6 A, B, C, F and H). The anterior part of the cavity is lined with a thick cubical epithelium; the middle and posterior parts of the cavity are lined with a highly glandular epithelium respectively and its wall forms villus-like projections which in the preparations appears darkly stained (blue or violet after staining with haematoxylin and eosin). Numerous glands lie in the surrounding parenchyma and their outlets penetrate the muscular layers as well as the inner epithelium.

The penis consists of a large bulb embedded in the parenchyma and a rather small papilla projecting into the male antrum. Neither of the two parts is very muscular. In worms that were fixed in a well-extended condition, the bulb appears semispherical or ovoid in shape. The papilla has a symmetric conical shape. But the shape of it is very changeable as shown in Figures 6 (B–I) and 7 (E). The papilla is lined with a cubical covering epithelium. Under the epithelium it is provided with two rather feebly developed muscle layers: a layer of circular fibres adjoining the epithelium and a layer of longitudinal fibres.

The lumen of the bulb, or the bulbar cavity or the seminal vesicle, is a wide, irregularly lobed cavity lined by a very tall secretory epithelium. The bulbar cavity continues into the papilla as a tapering ejaculatory duct which opens at the tip of the papilla. The canal of the ejaculatory duct is lined with an epithelium of cubical cells, tapering in thickness towards the posterior. Figure 6 (A–I) shows photomicrographs of sagittal sections through the penis. The bulb is pierced by numerous ducts of the penis glands which open into the bulbar cavity. In the distal part of the papilla, the gland ducts are lacking (Fig. 6 B and G; Fig. 7 E). These ducts are filled with a granular, heavily eosinophilic secretion. In many specimens of the material at hand, it has been observed that the penis lumen was closely packed with this granular secretion (Fig. 6 B).

In the present species, a thin-walled tubular expansion of the sperm duct, the spermiducal vesicle, is found from the level of about middle of the pharynx to that of the penis bulb. In ripe specimens these spermiducal vesicles are packed with spermatozoa (Fig. 7 C and D). As the sperm ducts reach the penis bulb, each narrows to a rather slender duct. Then they bend upwardly and enter the bulbar cavity from the anterolateral sides of the penis bulb separately (Fig. 7 D). In living worms the spermiducal vesicles are recognizable with difficulty from the ventral side.

Concerning the penial anatomy of *Polycelis akkeshi* which was collected from the three localities, Akkeshi, Mt. Apoi and Kaminayoro, several morphological variations were observed. As seen in Figure 6 (D, E, F, G and H), in almost all slides of the specimens from Mt. Apoi and Kaminayoro, the anterior part of the male antrum is wide at the floor and narrow at the roof. On the contrary, in many slides of the Akkeshi specimens, the anterior part of the male antrum is narrow at the floor and wide at the roof (Fig. 6 B and C). These differences in appearance of the male genital organs are, of course, due to the different states of muscular contraction when the animals were fixed. But another reason may lie in the fact that the degree of the development of the muscle zone is different according to the worms' habitats. That is to say, in this species, it is seen that the thickness of the muscle zone surrounding the male antrum is thicker dorsally and somewhat thinner ventrally. In Mt. Apoi and Kaminayoro specimens, this character is more conspicuous than is that of the Akkeshi specimens.

The copulatory bursa is small to moderate in size and is situated at a dorsal portion between the posterior end of the pharyngeal chamber and the anterior end of the penis bulb. This organ varies markedly in shape according to the state at the time of fixation and to the different groups of the animals. Typically, it is of club-shape (Akkeshi specimens) or elongated oval shape (Mt. Apoi specimens) as shown in Figure 6 (A, B, C and D); but the organ of the Kaminayoro specimens is a rather large sac with a lobed outline (Fig. 6 G and H). The lumen of the copulatory bursa is lined with the usual tall glandular epithelium projecting into the lumen. From the bursa a wide stalk proceeds posteriorly to the right of the penis bulb, then turns ventrally and opens, from the dorsal side, into the terminal portion of the male antrum, immediately near the genital pore (Fig. 4 B and C; Fig. 7 A and B). In the slides of the Akkeshi and the Mt. Apoi specimens, the distal part of the bursa stalk becomes somewhat thick to form an under-developed vagina (Fig. 5 A and B). But in the Kaminayoro specimens it is of almost uniform diameter through the whole length (Fig. 5 C). The bursal canal is lined with a secretory epithelium similar to that of the bursa. Both bursa and stalk are coated externally with muscle fibres.

Feebly eosinophilous glands were observed around the distal part of the bursa stalk and the genital pore.

Remarks on Taxonomy and Differential Diagnosis. In 1930 R. Kenk (a. pp. 294–295) defined the genus *Polycelis* from a modern taxonomic viewpoint. According to the opinions of planarian taxonomists the genus *Polycelis* is primarily a Eurasian genus (cf. Kenk 1953, pp. 181–

184). The genus in its present extent has representatives in Europe, North Africa, Asia and North America.

Kenk (1930 a) proposed to divide the genus *Polycelis* into two subgenera, viz., *Polycelis* (without adenodactyls) and *Ijimia* (with adenodactyls). Later, he (1953, pp. 171–172) suggested that the genus *Polycelis* may be subdivided into three subgenera on the basis of the anatomical characters of the copulatory apparatus. Kenk's subgenera of the genus are as follows:

1. Subgenus *Polycelis* Ehrenberg, 1831 (including the genus *Sorocelides* Zabusova, 1929, p. 521 and the genus *Polycelidia* Zabusova, 1936, p. 152). Lacking adenodactyls and lacking any excessive development of the muscle coat of the male antrum.

2. Subgenus *Seidlia* Zabusov, 1911 (suppl., p. 7; including the genus *Rjabuschinskya* Zabusov, 1916, p. 273). Lacking adenodactyls but possessing an extraordinarily thick muscle zone surrounding the male antrum.

3. Subgenus *Ijimia* Bergendal, 1890 (p. 326). Possessing adenodactyls.

Up to the present, a good number of species of the genus *Polycelis* from the north-eastern part of the Far East and the North Pacific areas have been described. The indubitable species are: *Polycelis sapporo* (Ijima et Kaburaki, 1916), *Polycelis auriculata* Ijima et Kaburaki (1916) and *Polycelis schmidti* (Zabusov, 1916; including *Polycelis ijimai* Kaburaki, 1917) from Japan; *Polycelis sapporo*, *Polycelis schmidti*, *Polycelis elongata* (Zabusova, 1929) and *Polycelis karafuto* Ijima et Kaburaki (1916) from South Sakhalin; *Polycelis sapporo* from the South and the Middle Kuril Islands; *Polycelis schmidti* from the North Kuril Islands; *Polycelis schmidti*, *Polycelis elongata*, *Polycelis eudendrocoeloides* (Zabusova, 1929), *Polycelis polyopis* Zabusova (1936), *Polycelis eurantron* (Zabusova, 1936) and *Polycelis relicta* (Zabusova, 1929) from Kamchatka; *Polycelis schmidti* from East Siberia (vicinity of Okhotsk City); *Polycelis borealis* Kenk (1953) from Alaska. The reproductive system of *Polycelis karafuto* from South Sakhalin has not been well studied, because fully mature animals of this species had not been obtained in the original localities (vicinity of Vladimirofka and Korsakoff; cf. Ijima & Kaburaki 1916, pp. 169–171, Figs. 23 and 24; Kaburaki 1922, pp. 47–49, Plate-fig. 16).

From the central part of the Asiatic Continent, a good number of the *Polycelis* species have also been described. They are: *Polycelis koslowi* (Zabusov, 1911) from Tibet; *Polycelis tibetica* Hyman (1934) from Kashmir and Indian Tibet; *Polycelis pathan* Beauchamp (1959) and *Polycelis pamirensis* Beauchamp (1961) from Afghanistan; *Polycelis receptaculosa* (Livanow et Zabusova, 1940) from the vicinity of Lake Teletzkoë in the Altai Mountains; *Polycelis eburnea* (Muth, 1912) from the Aral Sea region;

Polycelis sabussowi (Seidl, 1911) from Turkestan, and *Polycelis kulsaika* Zabusova (1947) and *Polycelis alma-atina* (Zabusova, 1947) from Kazak, South-West Russia. The two undescribed Asian species, *Polycelis? tibetica* (Zabusov 1911, olim *Sorocelis*; pp. 349–350, Taf. II, Fig. 1) from Tibet and *Polycelis* sp. Kato (1950, p. 189, Fig. 3) from Sanshi in North China, may belong to the genus.

Polycelis akkeshi is clearly a member of Kenk's subgenus *Seidlia*. Amongst the 19 described species of the genus *Polycelis* mentioned above, the following 6 species also belong to this subgenus. They are: *Polycelis auriculata, Polycelis schmidti, Polycelis eurantron, Polycelis relicta, Polycelis sabussowi* and *Polycelis alma-atina.*

Polycelis auriculata and *Polycelis schmidti* are the pigmented forms. The general appearance of *Polycelis akkeshi* bears some resemblance to that of two Kamchatkan species, *Polycelis eurantron* and *Polycelis relicta*; both of the two Kamchatkan species are known only from the study of preserved specimens. However, our present form differs from these two Kamchatkan species mainly in the anatomical structures of the copulatory organs, especially in the shapes of the penis papilla, a muscle zone of the male antrum and the bursa stalk and in the site of opening of the common ovovitelline duct (cf. Zabusova 1929, p. 509, Text-fig. 5, 1936, p. 158, Fig. 5, p. 159, Fig. 6, p. 161, Fig. 7, p. 162, Fig. 8).

Polycelis sabussowi and *Polycelis alma-atina*,[2] reported from Central Asia, bears a striking resemblance to our present form not only in external appearance but also in the anatomical structure of the reproductive system. Judging from Seidl's sketches in color of the preserved specimens of *Polycelis sabussowi*[3] (cf. 1911, Taf. V, Figs. 1, 2 and 5), the external appearance of *Polycelis akkeshi* is very similar to that of *Polycelis sabussowi*. But a slight difference of the arrangement of the eye-bands has been seen between them. Seidl's sketches (op. cit.) show that the curved band of eyes narrows as it crosses the base of the auricles. Moreover, the eye-bands of *Polycelis sabussowi* are perhaps placed more laterally than those of *Polycelis akkeshi*. Figures of the head of *Polycelis alma-atina* (cf. Zabusova 1947, p. 153, Fig. 1, p. 154, Fig. 2) show the arrangement of the eye-bands of *Polycelis sabussowi* type.

Figures of the copulatory organ of *Polycelis sabussowi* (cf. Seidl 1911, Taf. VI, Figs. 11 and 12; Kenk 1936, p. 77, Fig. 1) show a penis bulb of

2) The reproductive system of *Polycelis alma-atina* is very similar to that of *Polycelis sabussowi*. And there is in fact some doubt whether *Polycelis alma-atina* is a really distinct species or a subspecies of *Polycelis sabussowi* (cf. Porfirjeva 1960, pp. 136–137).

3) Seidl's species, *Sorocelis lactea* and *Sorocelis stummeri*, are included in *Polycelis sabussowi* (cf. Kenk 1936, pp. 76–80, 1953, p. 172).

large size with very wide bulbar cavity, a short penis papilla, a well-developed but rather short muscle zone surrounding the male antrum, and the presence of a common genital antrum. Zabusova's figure of the copulatory complex of *Polycelis alma-atina* (cf. 1947, p. 156, Fig. 3) has great resemblance to the figures of our Japanese form. These three species are, undoubtedly, closely related but they differ in minute morphological details. On viewing the zoogeography of the probursalian faunae in the countries neighbouring Japan, it is an intensely interesting fact that our present form shows close relationship with the continental freshwater triclads inhabiting Central Asia.

Polycelis akkeshi differs from the other members of the genus in the following characters: living animals moderate, slender, and white; with thick and excessively long muscle zone surrounding the male antrum; penis bulb moderate or large and weak muscular with wide bulbar cavity which sperm ducts enter separately; penis papilla rather small and conical; penis glands well-developed; common ovovitelline duct long and entering roof of the posterior terminal part of the male antrum; copulatory bursa club-shaped or sacciform, with bursal canal of normal length; vagina opens into the genital pore.

Holotype. One set of sagittal serial sections of the Akkeshi specimen (Specimen No. 314 f, 3 slides) deposited in Professor Ichikawa's room of the Zoological Institute, Faculty of Science, Hokkaido University; also 13 sets of sections (No. 314 a–e, g–j and No. 341 a–d) and several whole mounts (No. 342 group). The following slides have also been deposited in the same room: 12 sets of sections (No. 344 a–l) and 15 whole mounts (No. 344 group) of the Mt. Apoi specimens; 11 sets of sections (No. 321 a–k) and 1 whole mount (No. 321 l) of the Kaminayoro specimens.

Locality. Collected by M. Kawakatsu and Y. Hirao in a spring-fed brooklet near the Akkeshi Marine Biological Station, Akkeshi-chô, eastern Hokkaidô; by M. Kawakatsu and Y. Hirao in mountain streams in the vicinity of Mt. Apoi, Hidaka, in northern Hokkaidô; and by M. Kawakatsu and T. Yamada in a spring, Kaminayoro-issenzawa, Kamikawa, in northern Hokkaidô.

Distribution and Ecology. The known habitats of *Polycelis akkeshi* in Hokkaidô are as follows.

1. Spring-fed brooklet near the Akkeshi Marine Biological Station (fountain-head of water-supply of the dormitory of the Station), Akkeshi-chô (altitude, 30 m). Slowly running, very clear water; bottom sandy with many stones. Aug. 20, 1961: about 20 sexually immature worms (14.8°C, pH 6.0; No. 321 group). July 20, 1962: a few, mature and immature, worms (about 14°C; Nos. 341 and 342 groups). *Polycelis akkeshi*

was also collected in another brooklet near the Station (Aug. 20, 1961: 16.2°C, pH 6.0). *Phagocata vivida* (Ijima et Kaburaki) occurred in these habitats.

2. Mountain streams in the vicinity of Mt. Apoi, Hidaka. *Polycelis akkeshi* was found in spring-fed brooklets and pools of swampy land in this district (Ponsanushibetsu River system). This species was found in stations below an altitude of about 580 metres (Aug. 19, 1962: 12.1–20.9°C, pH 6.2–6.4; No. 344 group). *Phagocata* sp., *Polycelis sapporo* (Ijima et Kaburaki) and *Dendrocoelopsis lacteus* Ichikawa et Okugawa also occurred.

3. Spring at Kaminayoro-issenzawa, near Nayoro City (altitude, 200 m; cf. Yamada 1962, Table 1, p. 46, st. 92). Shallow, almosl stagnant, clean, cold-water; bottom muddy with pebbles, here and there rich aquatic mosses. May 20, 1962: very numerous mature worms (7.9°C, pH 5.4; No. 321 group). Another white planarian, *Polycelis sapporo*, has been found in many localities near the habitat of the present new species.

According to Mr. T. Yamada's communication, seasonal change of the water temperature in this habitat ranges from 2 to 8°C. From December to April, the habitat is covered with snow.

Note on culture. From the data furnished by Mr. Yamada, the egg-laying season of the Kaminayoro specimens of this species is winter (November to December). Their cocoon is spherical in shape and about 1.5 mm in diameter. In the natural habitat and also in the room cultures the hatching of the cocoon was usually observed in April of the next year.

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Note:

Unpublished work of the authors, under the title of "Report on freshwater planaria from Afghanistan" (Contrib. No. 562 of the Zool. Inst., Fac. Sci., Hokkaido Univ.), bears on the remarks in the present article. It will be published near future [In *Flora and Fauna of Afghanistan and Adjacent Countries* (*Supplement*)]. Preliminary report of this article is to be found in Proceedings of the 14th Annual Meeting of the Hokkaido Branch of the Zoological Society of Japan, pp. 2-3 (1962). Sapporo. (Jap.)