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MORPHOLOGICAL, KARYOLOGICAL AND TAXONOMIC STUDIES OF FRESHWATER PLANARIANS FROM SOUTH BRAZIL VI. *DUGESIA SCHUBARTI* (MARCUS, 1946) FROM THE VICINITY OF SÃO LEOPOLDO, ESTADO DE RIO GRANDE DO SUL (Turbellaria, Tricladida, Paludicola)

by

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INTRODUCTION

According to the authors' preliminary data, *Dugesia schubarti* (MARCUS, 1946) is a prominent species in the vicinity of São Leopoldo, Estado de Rio Grande do Sul (cf. KAWAKATSU, OKI, TAMURA, YAMAYOSHI, HAUSER & FRIEDRICH, 1980; OKI, TAMURA, YAMAYOSHI, KAWAKATSU, HAUSER & FRIEDRICH, 1980; see also KAWAKATSU, HAUSER & FRIEDRICH, 1976, 1980). This species, widely distributed in the southeastern area of Brazil, shows some local variation not only in its general appearance but also in its genital anatomy (cf. KAWAKATSU, HAUSER & FRIEDRICH, 1976, 1983; KAWAKATSU, HAUSER, FRIEDRICH & SOUZA LIMA, 1982).

The degree of muscular contraction of planarians upon killing is affected by the differences in chemical composition of the fixatives used (cf. KAWAKATSU & MIYAZAKI, 1972). When discussing the local variation of the copulatory apparatus of widely distributed species, this phenomenon should be considered carefully. The authors have many samples of preserved specimens of *Dugesia schubarti* fixed with Bouin's fluid and Susa fluid. In the present paper, the genital anatomy of this species from 3 localities in the vicinity of São Leopoldo fixed with Susa fluid is given, together with some data on the external morphology of live specimens. Results of karyological studies on this species are also given.

MATERIALS AND METHODS

The animals used for morphological, anatomical and histological studies were collected from the following localities by HAUSER and some other staff members of his laboratory.

1) Specimen Lot No. 1314. A single specimen collected from a mountain stream near the Moinho on the northeastern hillside of Morro Reuter (Doïs Irmãos), the upper tributary of the Rio Cadeia, about 18 km NE of Nôvo Hamburgo. Alt. 400 m. Collected in May, 1976. The slides deposited in the Department of Zoology, National Science Museum, Tôkyô (No. 1314-c, NSMT-Pl 2944), were used (cf. KAWAKATSU, HAUSER & FRIEDRICH, 1976). See the Station No. 24 in the sketch map on page 138 of the previous paper (KAWAKATSU, HAUSER & FRIEDRICH, 1980).

2) Specimen Lot No. 1418. Five specimens collected from a narrow mountain stream at Linha Júlio de Castilho, the upper stream of the Rio Caí, near Harmonia, about 12 km SE of São Salvador do Sul. Alt. 200 m. Collected on June 27-29, 1978. See the Station No. 7 in the sketch map on page 138 of the previous paper (KAWAKATSU, HAUSER & FRIEDRICH, 1980).

3) Specimen Lot No. 1440. Ten specimens collected from a narrow mountain stream of the Arroio Tupandí, the upper tributary of the Rio Caí, near Harmonia, about 16 km SE of São Salvador do Sul. Alt. 100 m. Collected on June 27-29, 1978. See the Station No. 3 in the sketch map on page 138 of the previous paper (KAWAKATSU, HAUSER & FRIEDRICH, 1980).

For chromosomal observations, animals collected from 5 localities were used (the collection in the winter of 1979 by HAUSER, FRIEDRICH, KAWAKATSU, and other members of HAUSER's laboratory). All of these localities are listed in the previous paper by KAWAKATSU, HAUSER & FRIEDRICH (1980, pp. 137-142). Station Nos. and the name of each stock are as follows; No. 3 (the Arrio Tupandí), No. 7 (Linha Júlio de Castilho), No. 12 (Linha Olinda, the Arrio Paixão), No. 24 (Morro Reuter), and No. 36 (Picada Verão, Morro Reuter).

Serial sections (7-8 micrometers) were stained with Delafield's hematoxylin and erythrosin in KAWAKATSU's laboratory. Chromosomes were observed according to the technique described in the previous papers (cf. OKI, TAMURA & KAWAKATSU, 1976; OKI, TAMURA, YAMAYOSHI & KAWAKATSU, 1980, p. 4, fig. 4). The slides used for chromosomal analyses were prepared both in the laboratories of the UNISINOS by KAWAKATSU, HAUSER and FRIEDRICH and of the home institution of OKI, TAMURA and YAMAYOSHI in Ôsaka (live specimens were brought by KAWAKATSU to their laboratory).

SPECIES DESCRIPTION

Order TRICLADIDA
Suborder PALUDICOLA or PROBURSALIA
Family Dugesiidae BALL, 1974
Genus *Dugesia* GIRARD, 1850

Dugesia schubarti (MARCUS, 1946)

External features. —— *Dugesia schubarti* has a head of markedly triangular shape with a pair of well-developed, long and pointed auricles. In the normally gliding animal, the anterior end of the head is highly pointed as a thorn (cf. KAWAKATSU, HAUSER & FRIEDRICH, 1976, p. 207, fig. 1 A-C; HAUSER & FRIEDRICH, 1982, pp. 65-69, figs. 1-3, 5; HAUSER, DA SILVEIRA & FRIEDRICH, 1979, pp. 13-14, figs. 1-35). Each of two eyes is enclosed in a reniform, pigment-free ocular area; this character is clearly shown in the enlarged photographs of heads of live specimens in the papers by HAUSER (1979, p. 243, pl. 1, pp. 247-259, pls. 3-9) and HAUSER & FRIEDRICH (1982, pp. 65-69, figs. 1-3, 5). The non-pigmented auricular sense organ of a boomerang-shape is large and conspicuous on each postero-lateral side of the auricles.

The coloration of *Dugesia schubarti* varies considerably according to locality. In the laboratory of HAUSER and FRIEDRICH, names are given to each stock of animal as a means of designating experimental lots. Stocks are classified according to differences in ground color and in macroscopic pigment patterns of the animals. The following 4 types of forms are distinguished (cf. DE HENSEL, 1980).

1. The Tupandí type (Figs. 1 A, 2 A). The ground color of the dorsal surface of the body

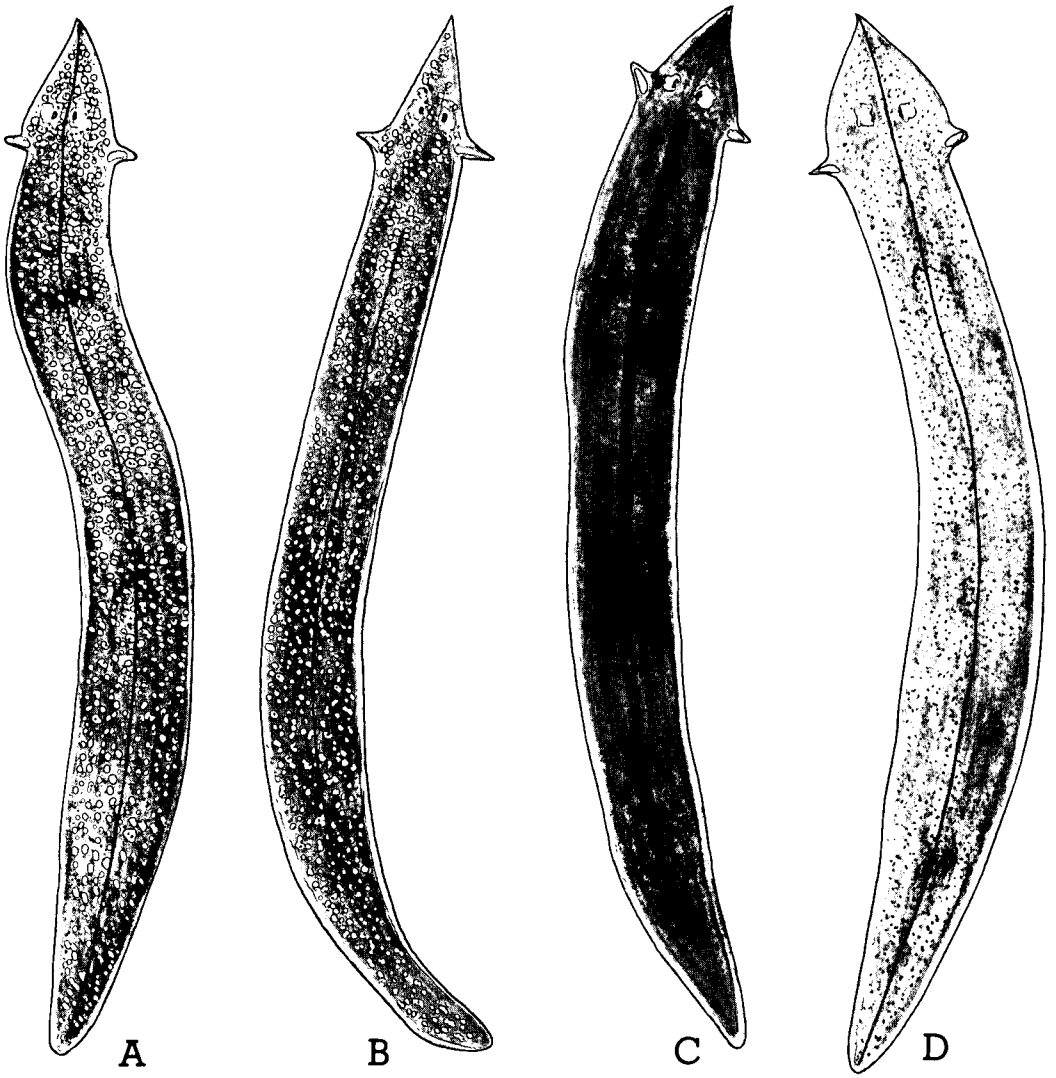

Fig. 1. Sketches of live specimens of *Dugesia schubarti* (MARCUS, 1946). A : the Tupandí type ; B : the Cascata type ; C : the Black type ; D : the Brown type. Reproduced from color drawings by KAWAKATSU.

is very blackish brown with numerous, small, black pigments. It is also mottled with numerous, small, indistinct white-yellowish brown spots. The midline is striped with a clear, thin, longitudinal black band throughout the body. The ventral side is a uniform dark grayish brown with numerous blackish brown pigments.

2. The Cascata type (Figs. 1 B, 2 B). The coloration and pigment patterns of the animal are very similar to those of the Tupandí type, but the middorsal longitudinal band is not conspicuous (sometimes the band can be seen only at the central part of the body).

3. The black type (Figs. 1 C, 2 C). The ground color of the dorsal surface is a uniform black with numerous, small, very black pigments. It is usually without spotted patterns. The middorsal, thin, longitudinal band is usually only partially evident, but sometimes it appears as a somewhat widened black band. The ventral side is black.

4. The Brown type (Figs. 1 D, 2 D). The ground color of the dorsal surface is a uniform dark brown with numerous, small, blackish brown pigments. It is usually without spotted patterns. The mid-

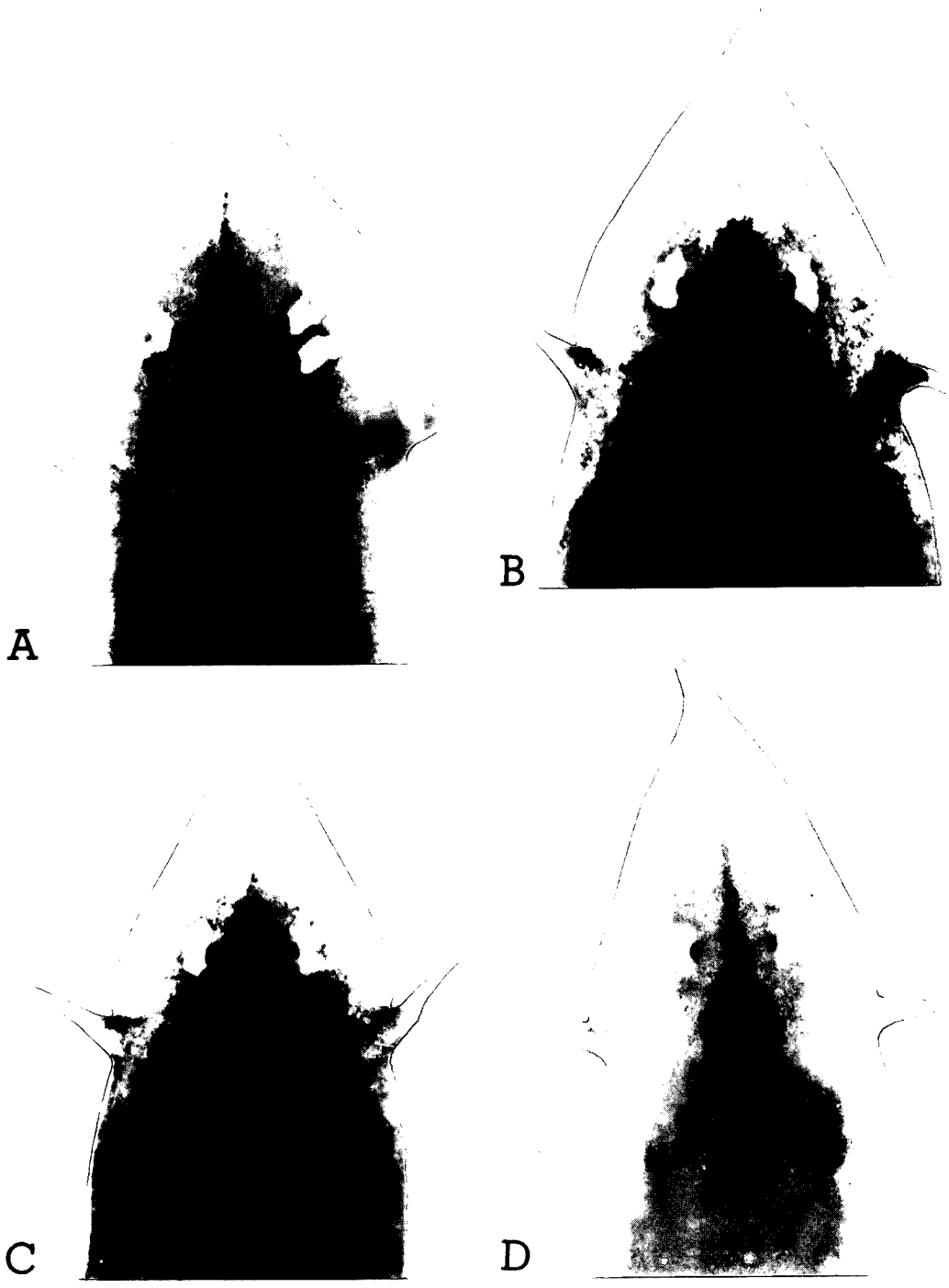

Fig. 2. Photographs of the heads of live specimens of *Dugesia schubarti* (MARCUS, 1946). A : the Tupandi type ; B : the Cascata type ; C : the Black type ; D : the Brown type. Reproduced from monocolor films by HAUSER.

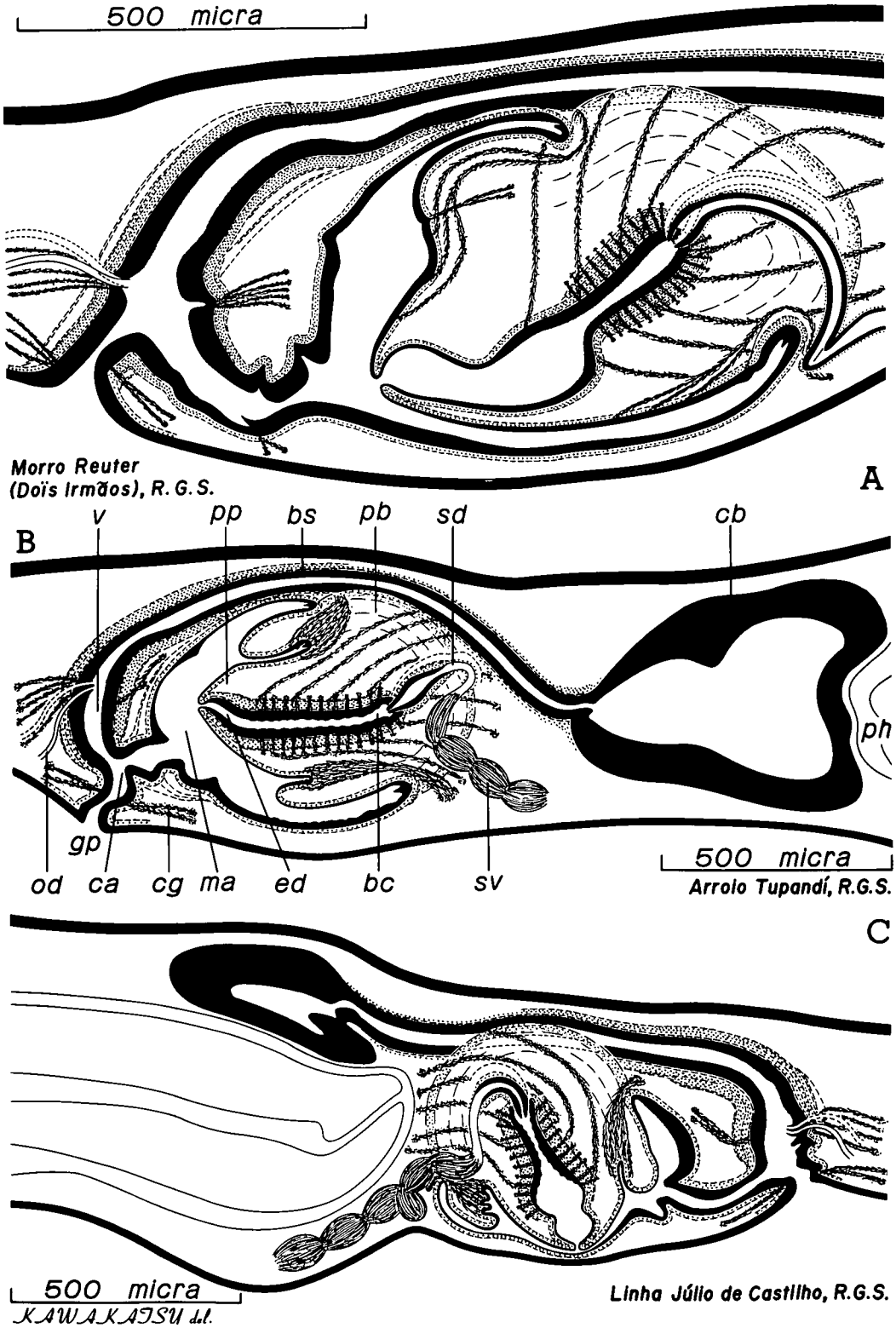

Fig. 3. For explanation see page 50.

dorsal, thin, longitudinal, dark colored band is conspicuous throughout the body. The ventral side is pale brown.

The sketches shown in Fig. 1 (A-D) are redrawn from KAWAKATSU 's pencil sketches of living animals prepared in the UNISINOS in 1979. In addition to animals classified into these 4 typical groupes, some intermediate forms are also seen.

The animal of Specimen Lot No. 1314 is the Black type ; the animals from Specimen Lot Nos. 1418 and 1440 are the Tupandí type. Sexually mature specimens are 20 to 30 mm long and 3 to 4 mm broad.

Internal features. —— There are no anatomical nor histological peculiarities in the muscle layers of the pharynx, the arrangement of dorsal testes, the position of paired ovaries, and the distribution of yolk glands. Only a brief description of the anatomy and histology of the copulatory apparatus of the animals examined is given in the present paper.

Fig. 3 (A) is a sagittal view of the copulatory apparatus of the Morro Reuter (Doïs Ilmãos) specimen (No. 1314-b) redrawn from the original sections used in the previous paper (KAWAKATSU, HAUSER & FRIEDRICH, 1976, p. 211, fig. 4 A). Sagittal views of the copulatory apparatus of 2 specimens from the other 2 localities are also shown in Fig. 3 (B, No. 1440-a from the Arroio Tupandí; C, No. 1418-c from Linha Júlio de Castilho). Photomicrographs of the parts of the copulatory apparatus of several specimens are also shown in Fig. 4 (A-I).

Several anatomical and histological features described in the previous paper (KAWAKATSU, HAUSER & FRIEDRICH, 1976, pp. 211-214, fig. 4 A) should be corrected as follows (see Fig. 3 A).

1) A weak constriction or fold is found at the middle part of the dorsal lip of the penis papilla; it is also found at the near-basal part of the ventral lip. 2) The terminal section of each sperm duct forms a slightly widened, thick-walled tube as shown in Fig. 3(A) and is surrounded by an inner layer of circular muscle fibers and an outer, thin layer of longitudinal fibers. 3) The surrounding muscle coat of the tubular cavity consists of an inner, thin layer of longitudinal fibers, a middle, thick layer of circular fibers with a few longitudinal ones intermingled, and an outer, thin layer of longitudinal fibers. Besides the erythrophilic penis glands, numerous ducts filled with granules weakly stained with hematoxylin are found around here.

The penis of both specimens from the localities of the Arroio Tupandí and Linha Julio de Castiho shown in Fig. 3 (B and C) are contracted. The penis consists of a large, hemiglobose bulb and a well-developed, rather short, turbinate papilla. The bulbar cavity is narrow and tubular in both specimens. The ejaculatory duct is narrow and tubular in the specimen from the Arroio Tupandí (Figs. 3 B, 4.D-G).The specimen from Linha Júlio de Castilho has a widened ejaculatory duct (Fig. 3 C); a large mass of sperms was found here in this specimen (Fig. 4 B and C).

The most peculiar feature in the penial anatomy of the specimens from the Arroio Tupandí and Linha Júlio de Castilho is a presence of a well-developed constriction or fold at the middle part of the penis papilla (Fig. 3 B and C). Numerous, heavily erythrophilic gland ducts are found around this region. A well-developed fold of the penis papilla is observed in the serial sections of the remaining 5 specimens from the Arroio Tupandí (No. 1440-b, -c, and -d, sagittal sections; No. 1440-e, horizontal

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Fig. 3. *Dugesia schubarti*, semidiagrammatic sagittal views of the copulatory apparatus of 3 specimens from the vicinity of São Leopoldo. A : Morro Reuter (No. 1314-b). B : Arroio Tupandí (No. 1440-a). C : Linha Júlio de Castilho (No. 1418-c). **bc**, bulbar cavity ; **bs**, bursal stalk ; **ca**, common genital antrum; **cb**, copulatory bursa ; **cg**, cement gland ; **ed**, ejaculatory duct ; **gp**, genital pore ; **ma**, male genital antrum ; **od**, ovovitelline duct ; **pb**, penis bulb ; **ph**, pharynx; **pp**, penis papilla ; **sd**, sperm duct ; **sv**, spermiducal vesicle ; **v**, vagina.

sections; No. 1440-f, transverse sections). In Specimen No. 1440-c, however, the fold of the dorsal lip of the papilla is small. Photomicrographs in Fig. 4 (A-I) show the penes of these 5 specimens. Except for Speciman No. 1418-c, no other sexual specimens were found in the sectioned material from Linha Júlio de Castilho.

In the specimens from these 2 localities, the muscle coat surrounding the bulbar cavity (and the anterior part of the ejaculatory duct) is well-developed. Histologically, it is essentially similar to that of the specimen from Morro Reuter. However, the middle, thick layer of the muscle coat seems to

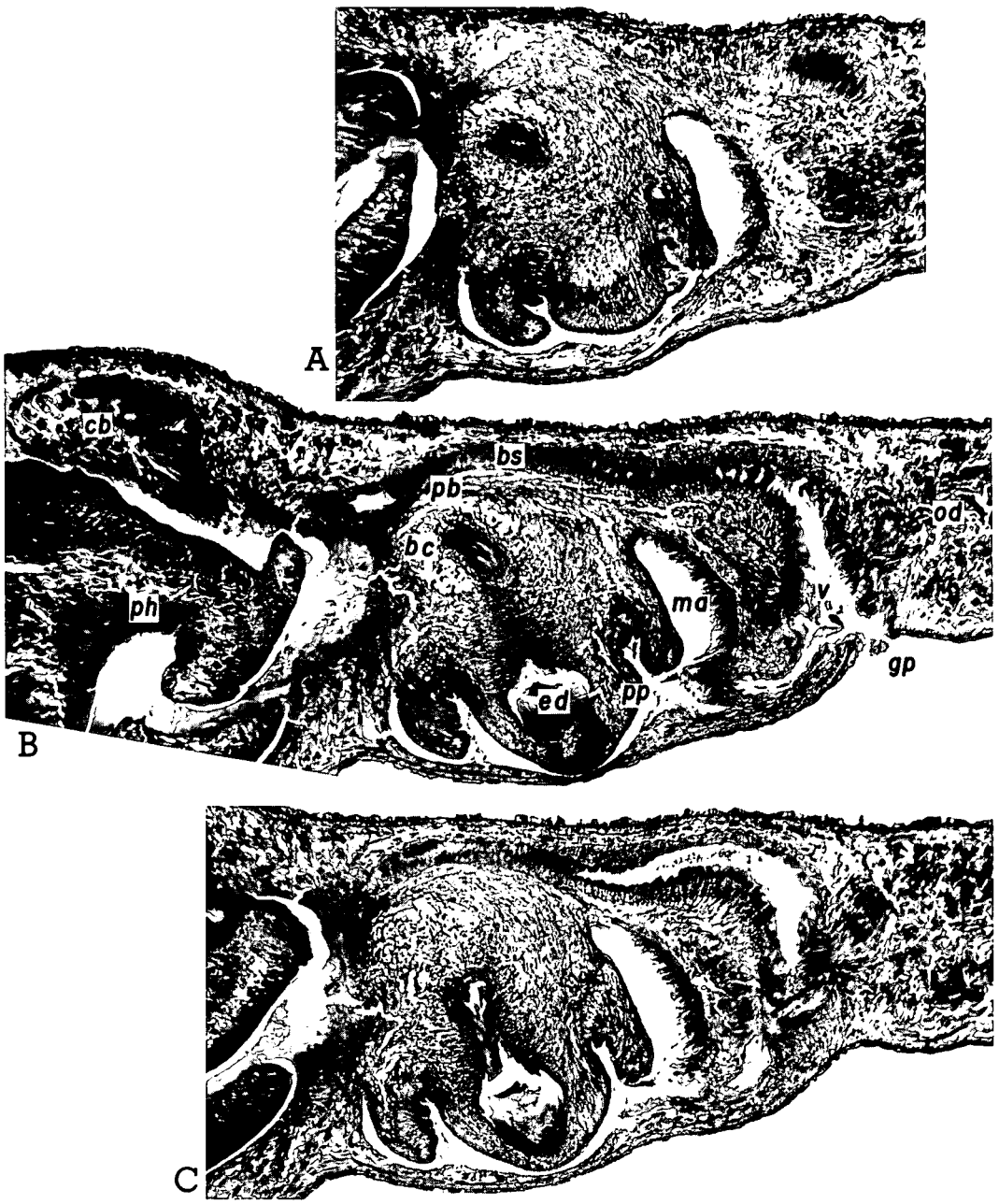

Fig. 4. For explanation see page 53.

Fig. 4. For explanation see page 53.

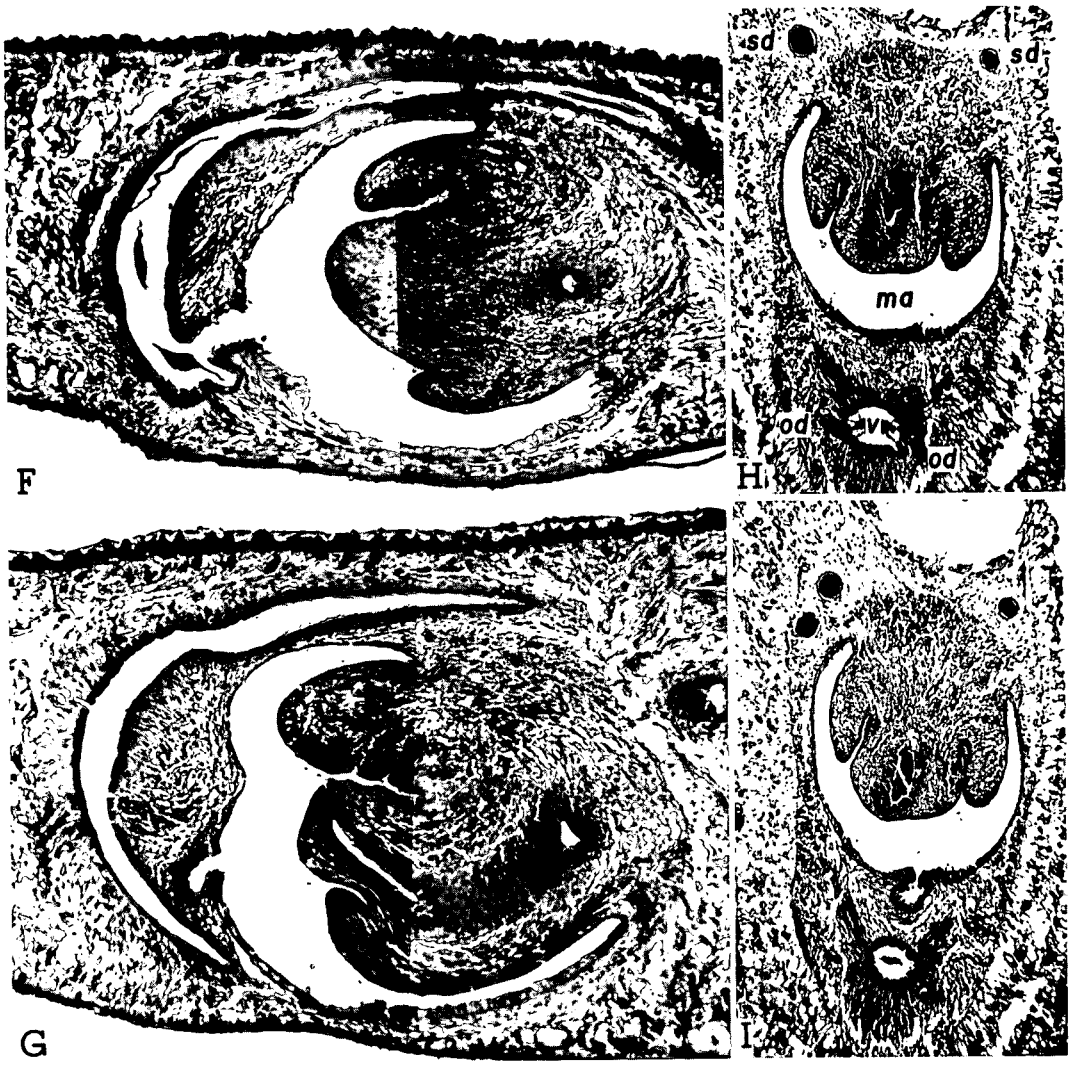

Fig. 4. *Dugesia schubarti*, sections of the coulatory apparatus. A, B and C : Near midsagittal sections (No. 1418-c). D and E : Near midsagittal sections (No. 1440-a). F and G : Near midsagittal sections (No. 1440-b). H and I : horizontal sections (No. 1440-e). **bc**, bulbar cavity ; **bs**, bursal stalk ; **cb**, copulatory bursa ; **ed**, ejaculatory duct ; **gp**, genital pore ; **ma**, male genital antrum ; **od**, ovovitelline duct ; **pb**, penis bulb ; **ph**, pharynx ; **pp**, penis papilla ; **sd**, sperm duct ; **v**, vagina.

consist only circular fibers. Numerous cyanophilous gland ducts are found in the region of the bulbar cavity.

In the female part of the copulatory apparatus of the specimens from the Arroio Tupandí and Linha Júlio de Castilho, it was observed that the muscle coat surrounding the terminal section of the bursal stalk (vagina) is more developed than that of the specimen from Morro Reuter. The middle, thick layer of circular muscle fibers is accompanied by a few intermingled longitudinal fibers.

The authors have a large number of specimens of *Dugesia schubarti* fixed with Bouin's fluid collected from many localities in the vicinity of São Leopoldo (the collection in 1979 ; cf. KAWAKATSU,

HAUSER & FRIEDRICH, 1980). Thus, a discussion on the local variation of the copulatory apparatus of this species will be given in a future paper of this series.

Material. —— Seven sets of serial sections (Specimen Lot Nos. 1418 and 1440) and preserved specimens in alcohol from the vicinity of São Leopoldo, Estado de Rio Grande do Sul, are retained in KAWAKATSU's laboratoy at Fuji Women's College, Sapporo, Japan. The slides of a Morro Reuter speci-men deposited in the National Science Museum, Tôkyô, were also used as comparative material.

KARYOLOGICAL OBSERVATIONS AND REMARKS

The results of the cytological studies of 18 sexually mature and 17 immature specimens of *Dugesia schubarti* from 5 localities is shown in Table 1. The idiograms of 7 specimens are shown in Fig. 5. Photomicrographs of the chromosomes of 8 specimens are also shown in Fig. 6 (A-J).

The chromosome number of the diploid cells of this species is $2x=8$ (Figs. 5, 6 B-D). During meiosis 4 bivalents are observed (Figs. 5, 6 A). The karyotype consists of 3 pairs of metacentric chromosomes (one pair of them is slightly larger than the other 2 pairs) and one pair of small, submetacentric chromosomes. Animals having the karyotype of $2x=8$ were found at the localities of the Arroio Tupandí, Linha Júlio de Castilho, Linha Olinda, Morro Reuter, and Picada Verão.

The following mixokaryotypes were also found in several specimens of this species. An orthoploidic mixoploid karyotype of diploid & triploid ($2x=8$ & $3x=12$) was rather common in the animals

Table 1. Karyotypes of *Dugesia schubarti* from 5 localities in the vicinity of São Leopoldo. Each locality number in this table corresponds to the number listed in the previous paper by KAWAKATSU, HAUSER & FRIEDRICH (1980, pp. 137-142).

Species & Localities	No. of specimens examined cytologically			Chromosome nos., karyotypes & the no. of cells studied in parentheses	
	Total	Sexual specimens	Asexual specimens	Male line (meiosis)	Somatic line (mitosis)
No. 3. Arroio Tupandí, 16 km SE of São Salvador do Sul	12	2	6	n=4 (8)	2x=8 (355)
		-	3	-	2x=8 (158) & 3x=12 (57)
		-	1	-	2x=8 (7) & 3x=12 (60) & 4x=16 (47)
	3*	3	-	-	4x=16 (29)
No. 7. Linha Júlio de Castilho, 12 km SE of São Salvador do Sul	3*	3	-	-	2x=8 (38)
No. 12. Linha Olinda, the Arroio Paixão, Nova Petrópolis, 25 km S of Caxias do Sul	3*	3	-	n=4 (38)	2x=8 (63)
No. 24. Morro Reuter, near Father's Villa, 18 km NE of Nôvo Hamburgo	11	2	2	n=4 (38)	2x=8 (160)
		1	4	-	2x=8 (182) & 3x=12 (152)
		1	1	-	2x=8 (24) & 4x=16 (40)
No. 36. Picada Verão, Morro Reuter, 18 km NE of Nôvo Hamburgo	3	3	-	n=4 (33)	2x=8 (95)

*Samples for the chromosomal examination were prepared in the laboratory of the UNISINOS. The other samples were prepared in the laboratory of OKI, TAMURA & YAMAYOSHI in Ôsaka.

from the localities of the Arroio Tupandí and Morro Reuter (Figs. 5, 6 E-G). A tetraploid karyotype (4x = 16) was found in only 3 sexual specimens from the Arroio Tupandí locality (Figs. 5, 6 H). An orthoploidic mixoploid karyotype of diploid & tetraploid (2x = 8 & 4x = 16) was found in only 2 (one sexual and one asexual) specimens from the Morro Reuter locality (Figs. 5, 6 I and J). An orthoploidic mixoploid karyotype of diploid, triploid & tetraploid (2x = 8 & 3x = 12 & 4x = 16) was found in only one asexual specimen from the Arroio Tupandí locality.

Some brief remarks on the karyotypes of *Dugesia schubarti* were given in the previous papers (cf. OKI, TAMURA, YAMAYOSHI & KAWAKATSU, 1980, p. 17, fig. 15 C, 1981, p. 65; OKI, TAMURA, YAMAYOSHI, KAWAKATSU, HAUSER & FRIEDRICH, 1980). PEREIRA (1970), who first studied the karyotype of *"Curtisia schubarti" (= Dugesia schubarti)* from the vicinity of the Estação Biológica de Boracéia,

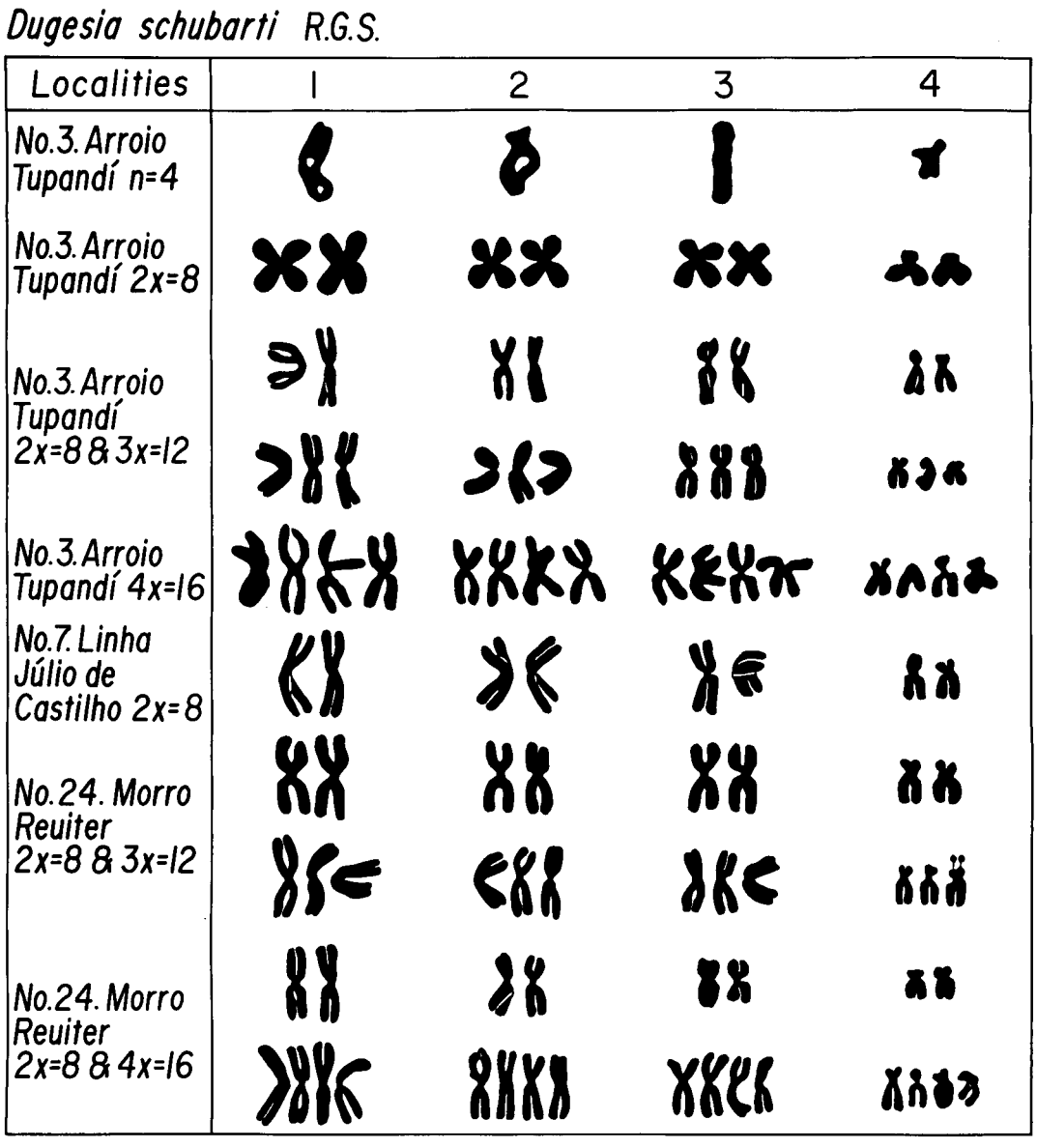

Fig. 5. Idiograms of *Dugesia schubarti*. For explanation see text.

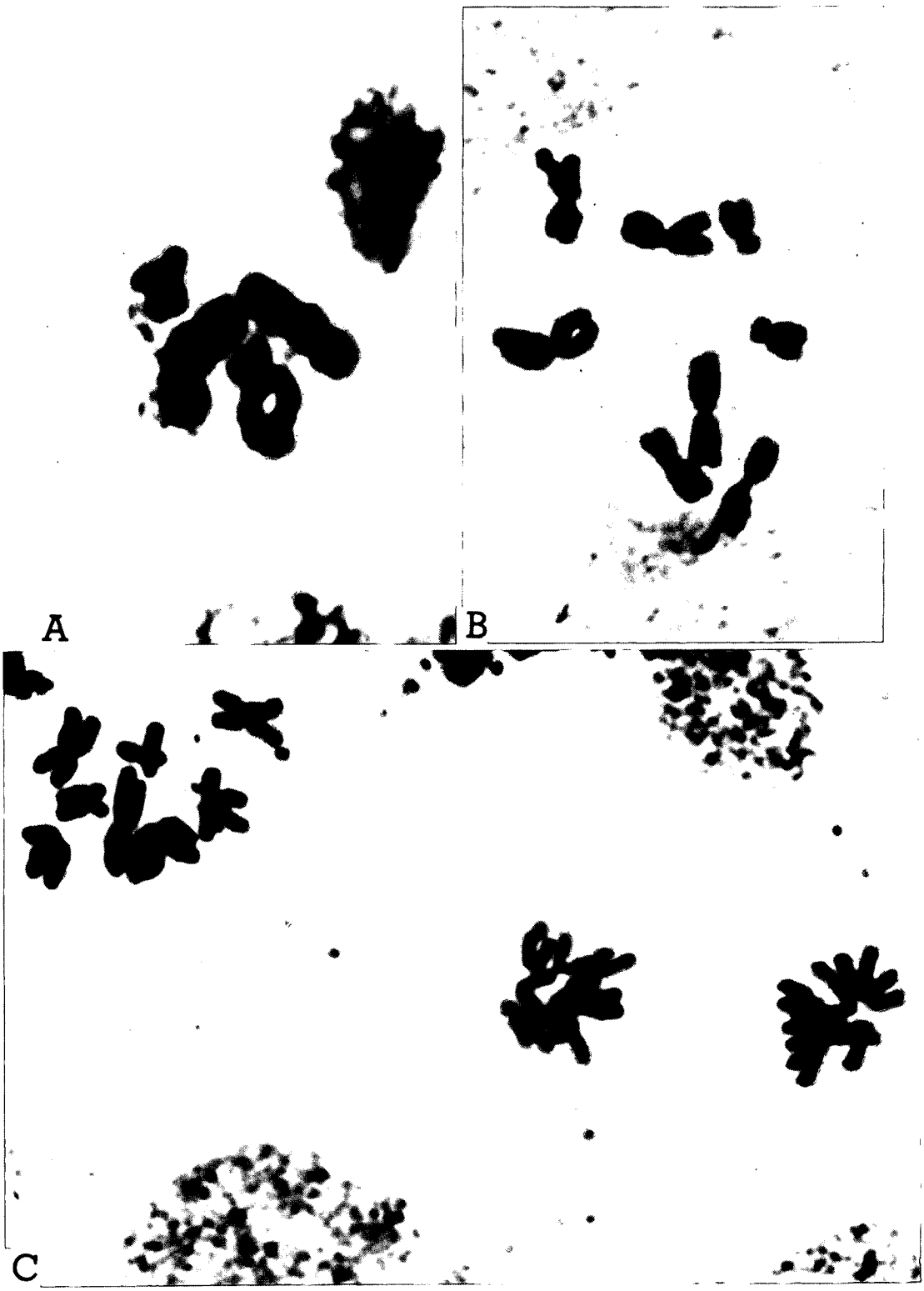

Fig. 6. For explanation see page 59.

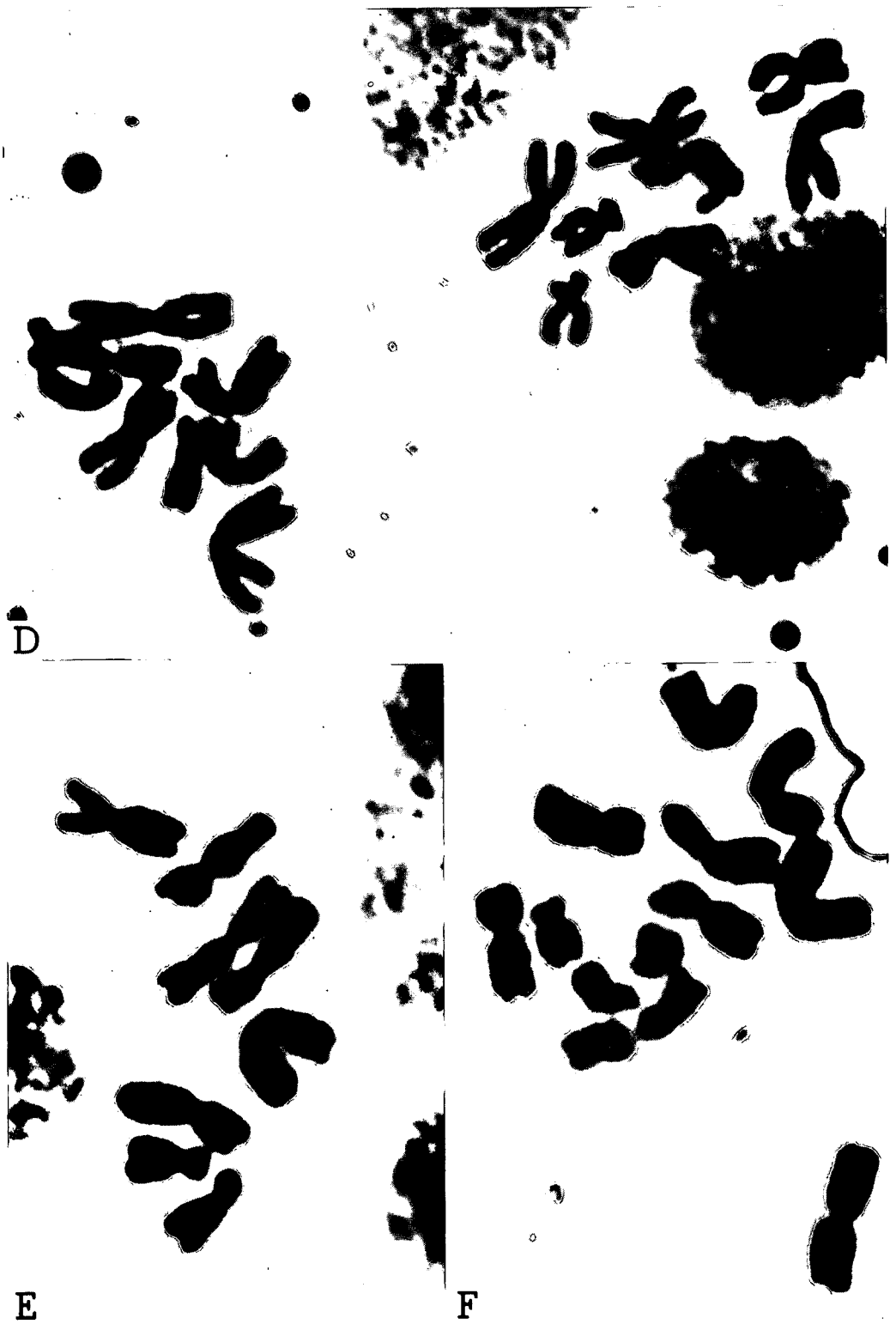

Fig. 6. For explanation see page 59.

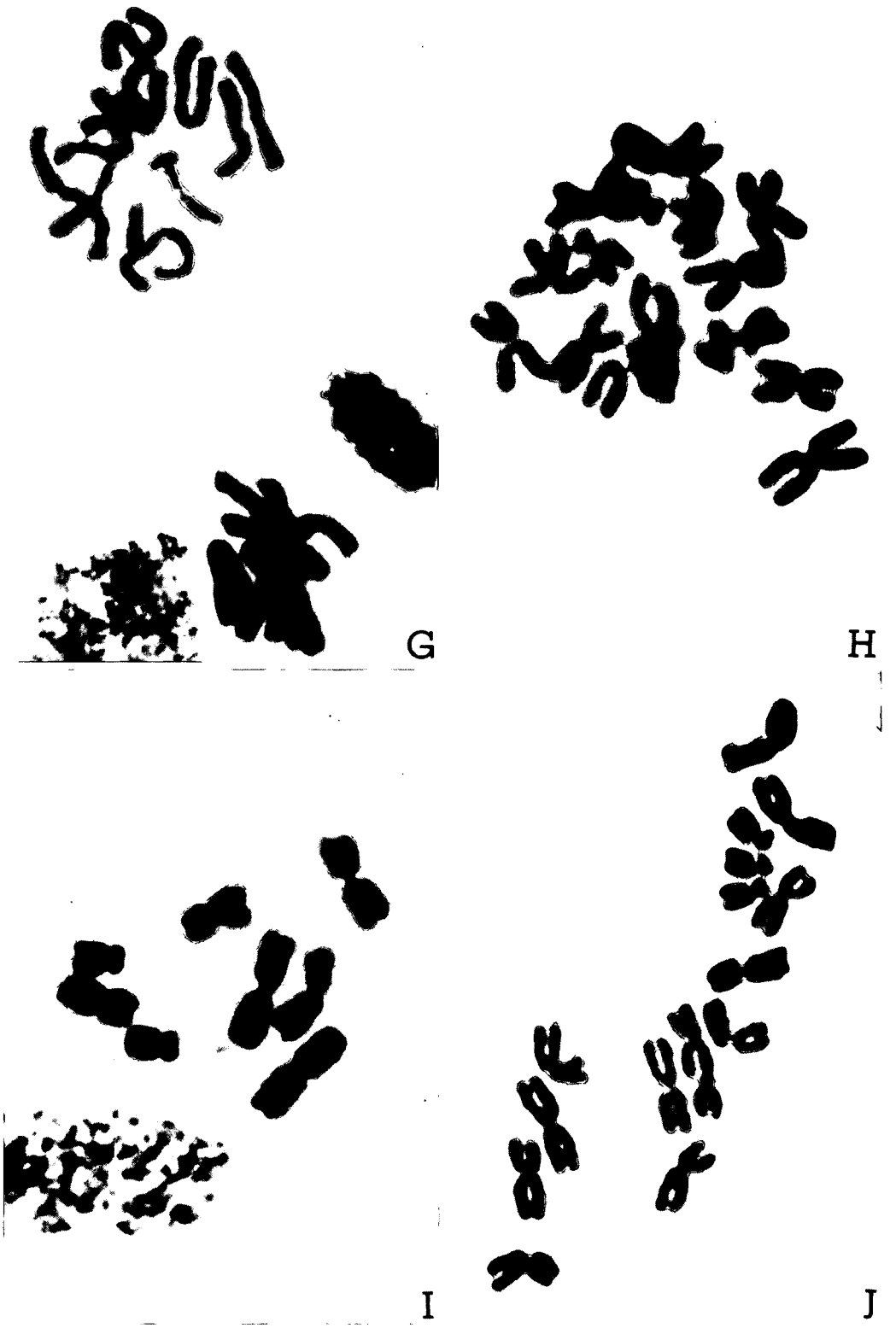

Fig. 6. For explanation see page 59.

Municipio Salesópolis, São Paulo, illustrated 3 figures of diploid chromosomes (on p. 212, fig. 1; see also KAWAKATSU, HAUSER & FRIEDRICH, 1980, p. 136, fig. 5). The idiogram of the diploid chromosomes of *Dugesia schubarti* reported in the present paper is coincides with that of PEREIRA's (1970) figures.

ACKNOWLEDGEMENTS

The authors wish to express their thanks to Professor Dr. Robert W. MITCHELL of the Department of Biological Sciences, Texas Tech University, Lubbock, Texas, U. S. A., for his careful reading of this manuscript.

SUMMARY

In a series of publications on the freshwater planarian fauna of South Brazil, of which this is the sixth, the authors have described the anatomy and histology of the copulatory apparatus of *Dugesia schubarti* (MARCUS, 1946) collected from 3 localities in the vicinity of São Leopoldo, Estado de Rio Grande do Sul.

Animals fixed with Susa fluid from the Arroio Tupandí and Linha Júlio de Castilho show a conspicuous constriction or fold at the middle part of the penis papilla. Reexamination of the serial sagittal sections of a specimen from Morro Reuter used in a previous paper (KAWAKATSU, HAUSER & FRIEDRICH, 1976) proved that a weak constriction is found in its penis papilla. Some minor local variations in the anatomy and histology of the copulatory apparatus are found in the animals from these 3 localities.

Chromosomal analyses of this species from 5 localities in the vicinity of São Leopoldo (the Arroio Tupandí, Linha Júlio de Castilho, Linha Olinda, Morro Reuter, and Picada Verão) confirmed that the chromosome number is $2x = 8$ and $n = 4$. The karyotype consists of 3 pairs of metacentric chromosomes and one pair of submetacentric chromosomes. Animals having the following mixoploidic and tetraploidic karyotypes were also found at some localities. They are: 2x & 3x, 2x & 4x, 2x & 3x & 4x, and 4x.

RESUMO

De uma série de publicações sôbre a fauna de planárias de água doce do sul do Brasil, da qual esta é a sexta, os autores descreveram a anatomia e a histologia do aparelho copulador de *Dugesia schubarti* (MARCUS, 1946), coletadas de 3 localidades nas vizinhanças de São Leopoldo, Estado do Rio Grande do Sul.

Animais de Arroio Tupandí e Linha Júlio de Castilho, fixados com Susa, mostram uma constricção conspícua ou prega na parte mediana da papila peniana. O reexame de cortes sagitais seriados

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Fig. 6. Photomicrographs of the chromosomes of *Dugesia schubarti*. A: $n = 4$ (Arroio Tupandí). B: $2x = 8$ (Arroio Tupandí). C: $2x = 8$ and a figure of anaphase (Linha Olinda). D: $2x = 8$ and $2x = 8$ (Linha Olinda). E and F: $2x = 8$ & $3x = 12$ (Arroio Tupandí). These figures were found in one body of a mixoploidic specimen. G: $2x = 8$ & $3x = 12$ (Arroio Tupandí). H: $4x = 16$ (Arroio Tupandí). I and J: $2x = 8$ & $4x = 16$ (Morro Reuter). These figures were found in one body of a mixoploidic specimen.

de um espécimen de Morro Reuter, usado em um trabalho prévio (KAWAKATSU, HAUSER & FRIEDRICH, 1976) provou que uma constricção fraca é encontrada nesta papila peniana, Algumas variações locais menores na anatomia e histologia do aparelho copulador são encontrados em animais destas 3 localidades.

Do resultado da análise cromossomal destas espécies de 5 localidades nas vizinhanças de São Leopoldo (Arroio Tupandí, Linha Júlio de Castilho, Linha Olinda, Morro Reuter e Picada Verão), foi cofirmado que o número cromossômico é $2x = 8$ e $n = 4$. O cariótipo consiste de 3 pares de cromossomas metacêntricos e um par de cromossomas submetacêntricos. Animais com os seguintes cariotipos mixoploidicos e tetraploidicos também foram encontrados em algumas localidades. Eles são 2x & 3x, 2x & 4x, 2x & 3x & 4x e 4x.

RÉSUMÉ

D'une série de publications sur la faune de planaires d'eau douce du sud du Brésil, dont celle-ci est la sixième, les auteurs décrivent l'anatomie et l'histologie des organes génitaux du *Dugesia schubarti* (MARCUS, 1946), cueillis de 3 localités dans les alentours de São Leopoldo, état du Rio Grande do Sul.

Des animaux de Arroio Tupandí et de Linha Júlio de Castilho, fixés à Susa, présentent une constriction remarquable ou pli dans la partie médiane de la papille du pénis. L'examen supplémentaire de coupes sagittales sériées d'un spécimen de Morro Reuter, utilise dans un travail antérieur (KAWAKATSU, HAUSER & FRIEDRICH, en 1976) ont prouvé qu'une faible constriction se trouve dans cette papille du pénis. Quelques variations moindres locales dans l'anatomie et l'histologie de l'organe génital se trouvent dans des animaux de ces 3 localités.

Du résultat de l'analyse chromosomique de ces espèces de 5 localités dans les alentours de São Leopoldo (Arroio Tupandí, Linha Júlio de Castilho, Linha Olinda, Morro Reuter et Picada Verão) il fut confirmé que le nombre chromosomique est de $2x = 8$ et $n = 4$.

Le "cariotype" consiste de trois paires de chromosomes "métacentriques" et d'une paire de chromosomes "submétacentriques". On a aussi rencontré dans certaines localités des animaux avec les "cariotypes" mixoploïdiques et tetraploïdiques suivants : 2x & 3x, 2x & 4x, 2x & 3x & 4x et 4x.

ZUSAMMENFASSUNG

Diese Arbeit ist der sechte Teil in einer Serie der Veröffentlichungen über Süsswasserplanarien vom Rio Grande do Sul, Brasilien.

Die Autoren beschreiben den Kopulationsapparat von *Dugesia schubarti* (MARCUS,1946). Die Tiere wurden gesammelt in drei Ortschaften in der Nähe von São Leopoldo, im Bundesstaat von Rio Grande do Sul.

Die Tiere vom Tupandí-bach und von Linha Júlio de Castilhos, wurden in Susa fixiert und zeigen eine klar sichtbare Konstriktion und bilden eine Falte in der Medianregion der Penispapille.

Die Revision der sagittalen Schnittserie von einem Exemplar von Morro Reuter, schon behandelt in einer vorhergegangenen Arbeit (KAWAKATSU, HAUSER & FRIEDRICH, 1976), bestätigte die leichte Konstriktion, die die jetzigen Tiere an der Penispapille aufweisen.

An den Tieren von den drei verschiedenen Ortschaften konnte man kleine anatomisch-histologische Abweichungen des Kopulationsapparates beobachten.

Das Ergebniss der Analyse der Chromosomen von dieser Art, gesammelt von fünf verschiedenen Ortschaften, alle in der Nähe von São Leopoldo (Tupandí-bach, Linha Júlio de Castilhos, Linha

Olinda, Morro Reuter, Picada Verão), bestätigte, dass die Chromosomenzahl 2x=8 und n=4 ist. Der Karyotyp besteht aus drei Chromosomenpaare von metacentrischen Chromosomen und aus einem Paar von submetacentrischen. Man hat auch Tiere in verschiedenen Orten von mixoploidischem und tetraploidischem Karyotyp gefunden. Diese sind : 2x & 3x, 2x & 4x, 2x & 3x & 4x, und 4x.

REFERENCES

BALL, I. R., 1974. A contribution to the phylogeny and biogeography of the freshwater triclads (Platyhelminthes : Turbellaria). In : N. W. RISER & M. P. MORSE (eds.), *The HYMAN Memorial Volume —— Biology of the Turbellaria,* pp. 339-401. McGraw-Hill Book Co., New York, etc.

GIRARD, C., 1850. A brief account of the fresh water species of planariae inhabiting the United States. Proc. Boston Soc. Nat. Hist., 3 : 251-252.

HAUSER, J., 1979. Modificacões morfológicas nos olhos de *Dugesia schubarti* (MARCUS, 1946) durante a formação da nova cabeça. Acta Biol. Leopoldensia (UNISINOS), 1 (2) : 237-262 (+ pls.1-9).

HAUSER, J. & FRIEDRICH, S. M. G., 1982. Morphogenesis of regenerating fragments of *Dugesia schubarti* (Turbellaria Tricladida). Exper. Cell. Biol., 50 : 61-71.

DE HENSEL, M. L., 1980. Dados mophomêtricos de quatro populações de *Dugesia schubarti* (MARCUS, 1946). Acta Biol. Leopoldensia (UNISINOS), 2 (2) : 167-174.

HAUSER, J., DA SILVEIRA, S. M. O. & FRIEDRICH, S. M. G., 1979. Études preliminaires sur les modifications morphologiques des regenerants de *Dugesia schubarti* (MARCUS, 1946) (Turbellaria, Tricladida). Acta. Biol. Leopoldensia (UNISINOS), 1 (1) : 5-15.

KAWAKATSU, M., HAUSER, J. & FRIEDRICH, S. M. G., 1976. The freshwater planaria from South Brazil. Bull. Natn. Sci. Mus., Tôkyô, Ser. A (Zool.), 2 : 205-223. **1980.** Morphological, karyological and taxonomic studies of freshwater planarians from South Brazil. I. A history of those studies and a list of localities in the vicinities of São Leopoldo. Bull Fuji Women's College, (18), Ser. II : 129-151. **1983.** Morphological, etc. V. *Dugesia tigrina* (GIRARD, 1850) from Municipio Botucatu, Estado de São Paulo, and *Dugesia schubarti* (MARCUS, 1946) from the vicinity of São Paulo (Turbellaria, Tricladida, Paludicola). Bull. Fuji Women's College, (21), Ser. II : 147-163.

KAWAKATSU, M., HAUSER, J., FRIEDRICH, S. M. G. & SOUZA LIMA, O., 1982. Morphological, etc.III. *Dugesia tigrina* (GIRARD, 1850) and *Dugesia schubarti* (MARCUS,1946) from the vicinities of São Carlos, Estado de São Paulo (Turbellaria, Tricladida, Paludicola). Bull. Fuji Women's College, (20), Ser. II : 73-90.

KAWAKATSU, M. & MIYAZAI, T., 1972. Effect of different fixatives on a common Japanese freshwater planarian, *Dugesia japonica* ICHIKAWA et KAWAKATSU. Bull. Fuji Women's College, (10), Ser. II : 81-117 (+ pls. Ⅶ-XXXII).

KAWAKATSU, M., OKI, I., TAMURA, S., YAMAYOSHI, T., HAUSER, J. & FRIEDRICH, S. M. G., 1980. Karyological and taxonomic studies of freshwater planarians in Brazil. I . Review of the previous studies. Zool. Mag., Tôkyô, 89 : 628. (In Japanese.)

MARCUS, E., 1946. Sôbre Turbellaria Brasileiros. Zoologia, Fac. Filos., Ciênc. e Letras Univ. São Paulo, (11) : 5-250 (+ pls. I-XXX) + pl. XXXI

OKI, I., TAMURA, S. & KAWAKATSU, M., 1976. A technique for the study of planarian chromosomes. The Heredity (Iden), Tôkyô, 30 (12) : 32-40. (In Japanese.)

OKI, I., TAMURA, S.,YAMAYOSHI,T. & KAWAKATSU, M., 1980. Karyological and taxonomic studies of *Dugesia japonica* ICHIKAWA et KAWAKATSU in the Far East. Preprint of a paper given at the Third International Symposium —— The Biology of the Turbellaria in Honour of Prof. Tor G. KAR-

LING. Occ. Publ., Biol. Lab. Fuji Women's College, (2): 1-23.

OKI, I., TAMURA, S., YAMAYOSHI, T., KAWAKATSU, M., HAUSER, J. & FRIEDRICH, S. M. G., 1980. Karyological and taxonomic studies of freshwater planarians in Brazil. II. Chromosomes of *Dugesia* species in South Brazil. Zool. Mag., Tôkyô, 89: 628. (In Japanese.)

PEREIRA, M. E. Q., 1970. Metodo para estudo chromossomos em planárias. Ciên. Cult., São Paulo, 22: 211-212.

* *

Additional Literature

HAUSER. J., 1983. II Teil: Neuere Untersuchungen an Regenerations-prozessen von Teilstücken von *Dugesia gonocephala*. Acta Biol. Leopoldensia (UNISINOS), 5 (1): 31-36.

HAUSER, J. & FRIEDRICH, S. M. G., 1982. Morphogenesis of regenerating fragments of *Dugesia schubarti* (Turbellaria, Tricladida). Exper. Cell Biol., 50: 61-71.

HAUSER, J. & HELLER, Z., 1983. Augenmorphologie von *Crenobia alpina* (DANA, 1976)—— (Turbellaria, Tricladida). Acta Biol. Leopoldensia (UNISINOS), 5 (2): 209-219 (+ pls. I-II).

FRIEDRICH, S. M. G., DANIEL, A., WIRTH, Q. J., PONS, L. R. & FIORENTIN, G. L., 1983. Levantamento biogeográfico de Dugesiidae e vegetação marginal de águas correntes do Rio Grande do Sul —— 1983. Acta Biol. Leopoldensia (UNISINOS), 5 (2): 251-264.

PALMA, I. A. D., 1983. Comportamento e regeneração em planárias *Dugesia tigrina* (GIRARD, 1850). Acta Biol. Leopoldensia (UNISINOS), 5 (1): 81-118.

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