

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

by

MASAHARU KAWAKATSU, JOSEF HAUSER and  
SIRLAI MALVINA GEHRKE FRIEDRICH

**INTRODUCTION**

*Dugesia schubarti* (MARCUS, 1946), widely distributed in the southeastern area of Brazil, shows some local variations not only in its general appearance but also in its genital anatomy (cf. KAWAKATSU, HAUSER & FRIEDRICH, 1976, 1983; KAWAKATSU, HAUSER, FRIEDRICH & SOUZA-LIMA, 1982; KAWAKATSU, OKI, TAMURA, YAMAYOSHI, HAUSER & FRIEDRICH, 1984). The coloration and macroscopic pigment patterns of the animals of this species vary considerably according to locality. Anatomically, 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. In the specimens from the Arroio Tupandí and Linha Júlio de de Castilho in the vicinity of São Leopoldo, a well-developed constriction or fold at the middle part of the penis papilla is observed (cf. KAWAKATSU, OKI, TAMURA, YAMAYOSHI, HAUSER & FRIEDRICH, 1984).

In the present paper, further observations with the variation of the genital anatomy of this species from 20 localities in the vicinity of São Leopoldo are given, based on the material of our 1979 winter collections.

**MATERIALS AND METHODS**

The animals used for the study were collected from the following 20 localities listed in our previous paper (cf. KAWAKATSU, HAUSER & FRIEDRICH, 1980, pp. 137-141; see also fig. 6 on page 138). Their Specimen Lot Numbers are as follows:

Nos. 1585, 1586, 1588, 1591, 1593, 1594, 1595, 1597, 1598, 1599, 1601, 1602, 1603, 1605, 1606, 1607, 1611, 1614, 1615, and 1616.

All the localities of these samples are distributed within the limits of approximately 50 square kilometers. The animals of the Specimen Lot No. 1585 were killed by Sugino's method and fixed with Nozawa's fluid (cf. KAWAKATSU & MIYAZAKI, 1972); the animals from the other 19 localities were fixed with Bouin's fluid.

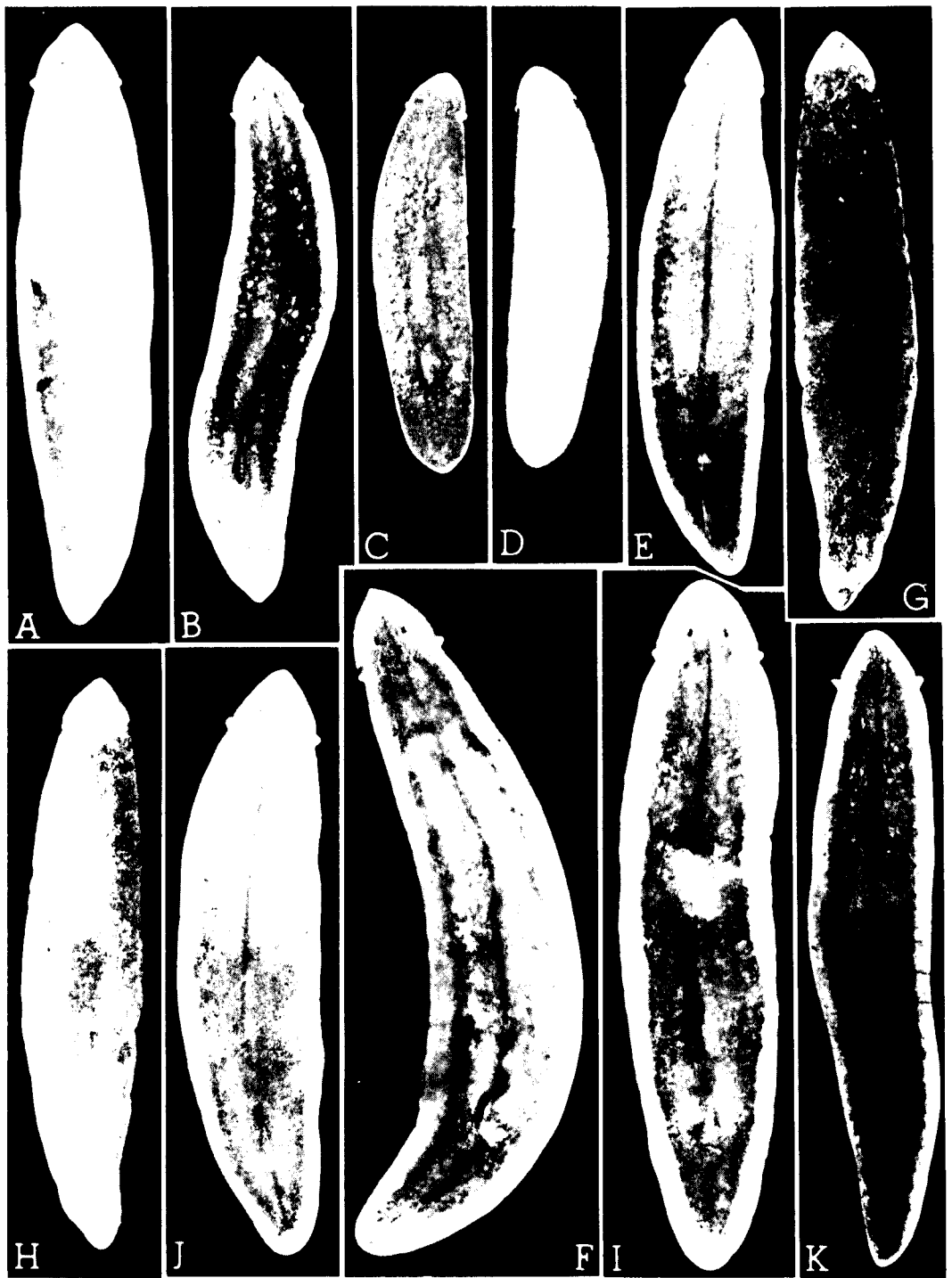
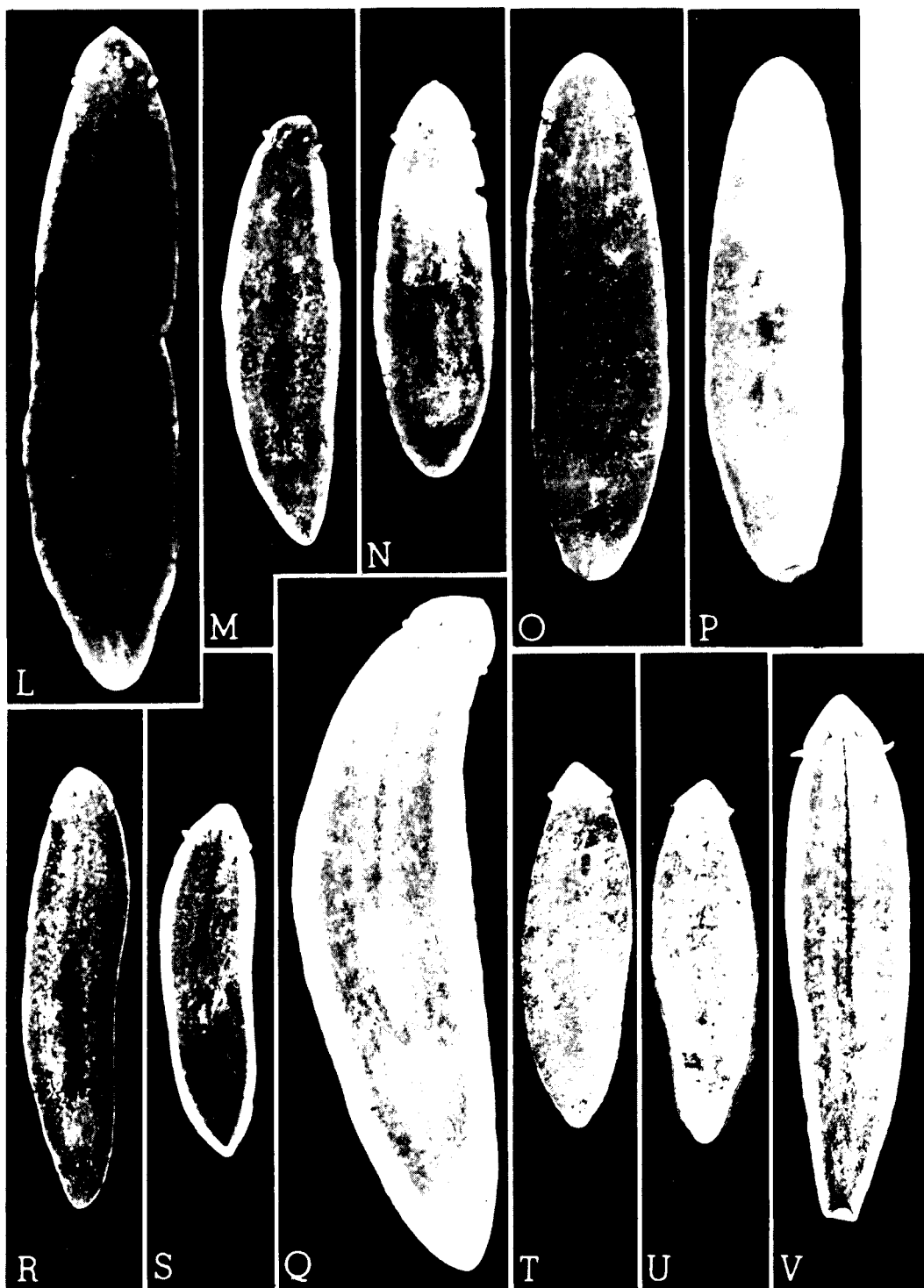
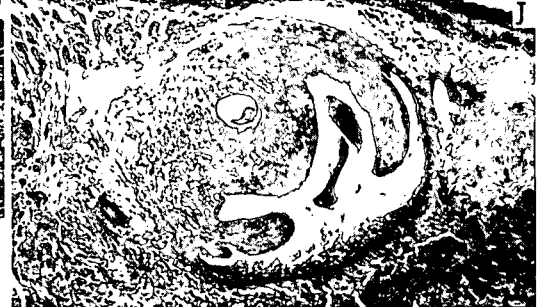
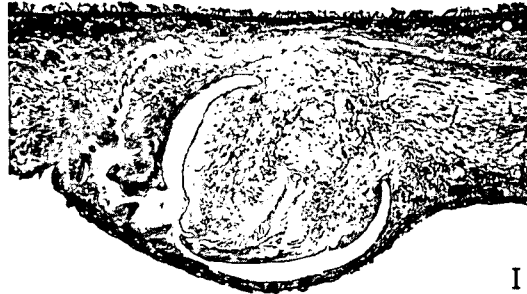
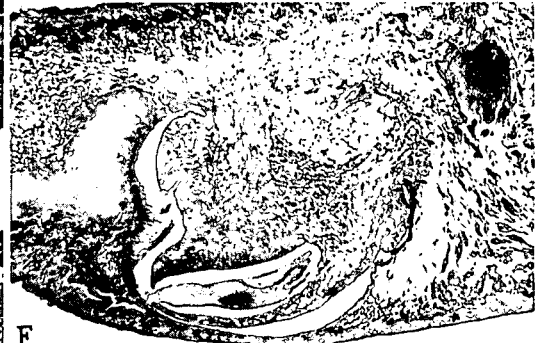
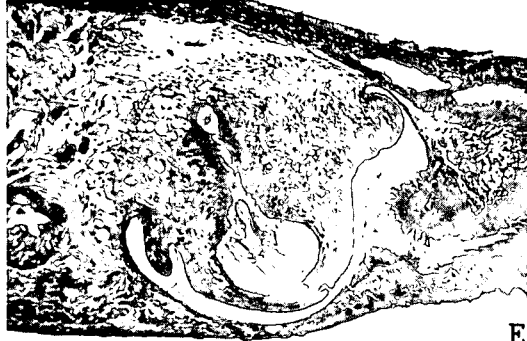
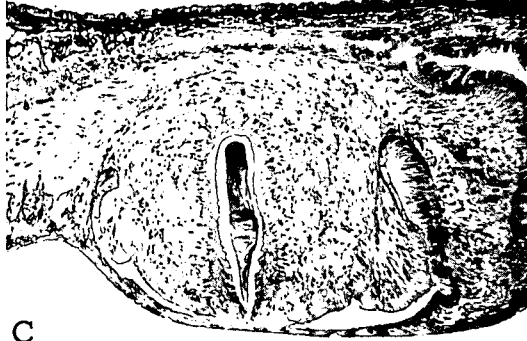
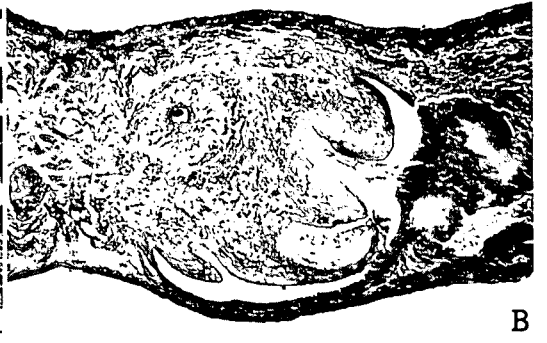
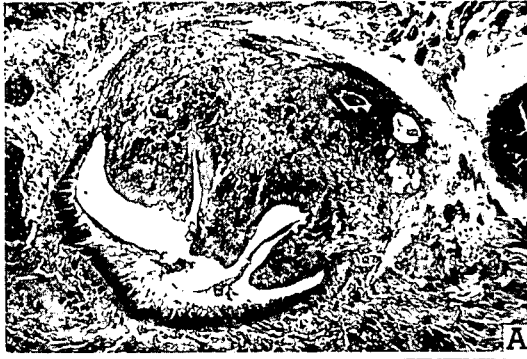
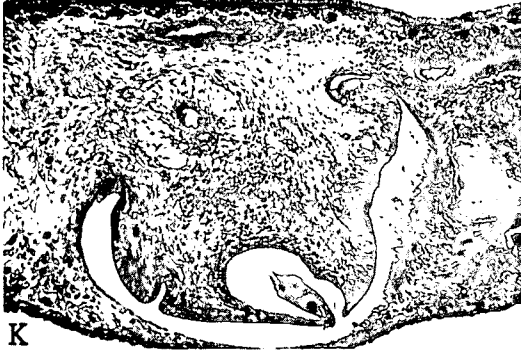


Fig. 1 (on pages 102-103). *Dugesia schubarti* (MARCUS, 1946), photographs of preserved sexually mature specimens from the vicinity of São Leopoldo, Rio Grande do Sul, Brazil. The same magnifications. A : Specimen Lot No. 1585 ; B, No. 1586 ; C and D ; No. 1588 (D, ventral view) ; E : No. 1591 ; F : No. 1594 ; G and H : No. 1595 (H, ventral view) ; I : No. 1597 ; J : No. 1598 ; K : No. 1601 ; L : No. 1602 ; M : No. 1603 ; N : No. 1605 ; O and P : No. 1606 (P, ventral view) ; Q : No. 1607 ; R : No. 1611 ; S : No. 1614 ; T and U : No. 1615 (U, ventral view) ; V : No. 1616.



Serial sections (7-8 micrometers) were stained with Delafield's hematoxylin and erythrosin in KAWAKATSU's laboratory.

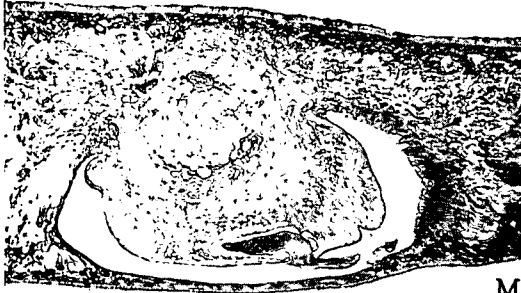




K



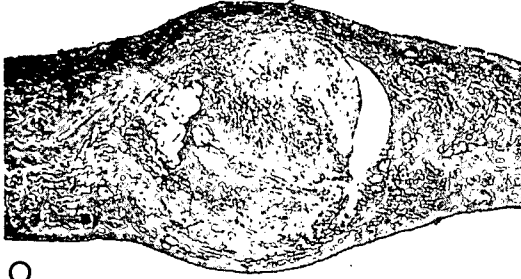
L



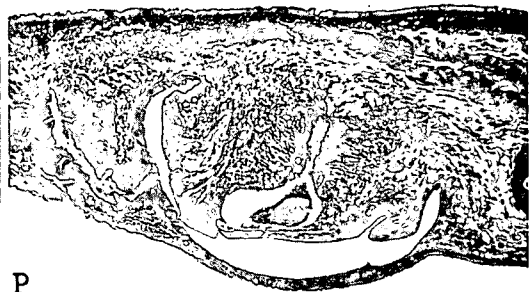
M



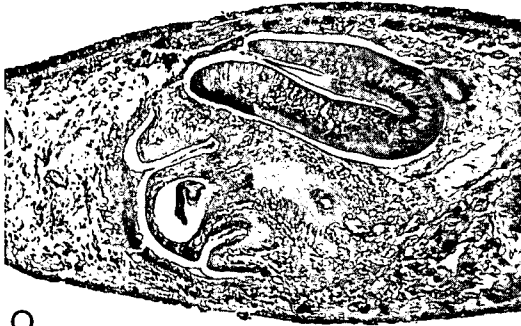
N



O



P



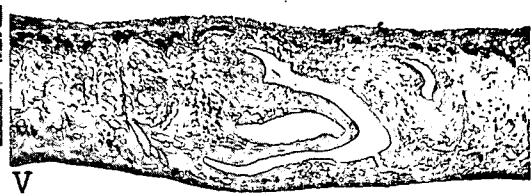
Q



R



U



V

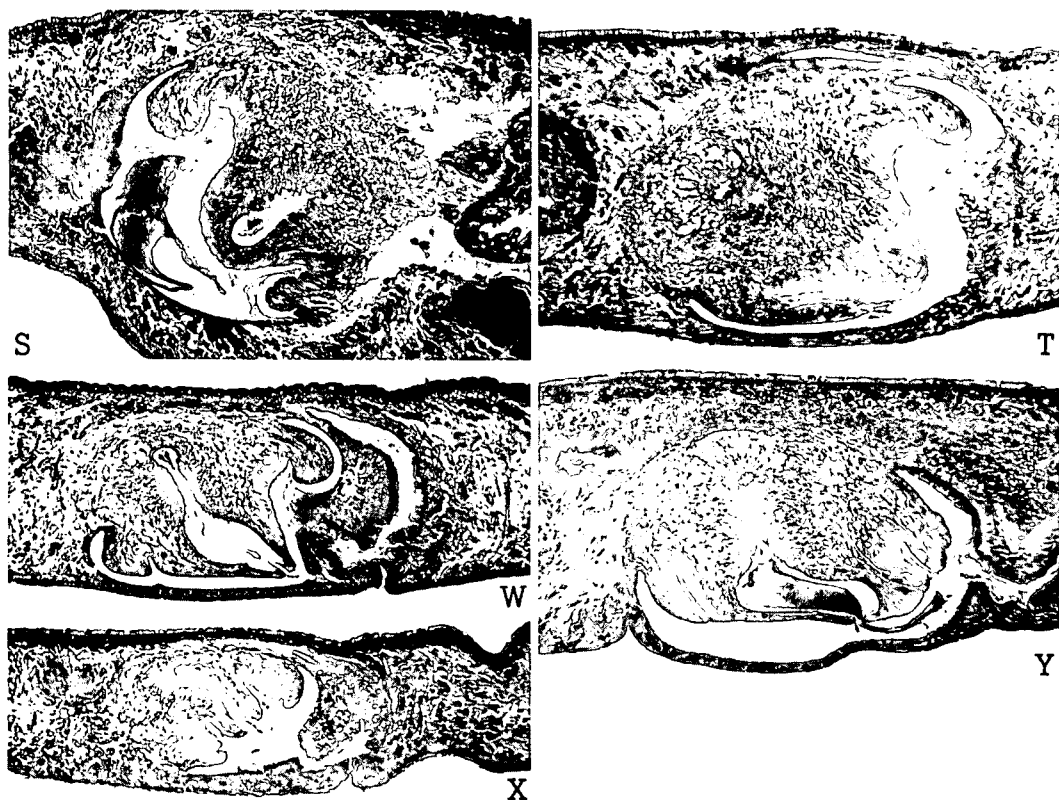


Fig. 2 (on pages 104-106). *Dugesia schubarti*, near midsagittal sections of the copulatory apparatus.

The same magnifications. A: No. 1585 a; B: No. 1585 b; C: No. 1586 a; D: No. 1588 a; E: No. 1591 a; F: No. 1591 b; G: No. 1593 a; H: No. 1594 a; I: No. 1595 a; J: No. 1597 a; K: No. 1598 a; L: No. 1599 a; M: No. 1601 a; N: No. 1602 a; O: No. 1602 b; P: No. 1603 a; Q: No. 1605 a; R: No. 1606 a; S: No. 1606 b; T: No. 1607 a; U: No. 1611 a; V: No. 1611 b; W: No. 1614 a; X: No. 1615 a; Y: No. 1616 a.

## OBSERVATIONS AND CONCLUSIONS

### Order TRICLADIDA

### Suborder PALUDICOLA or PROBURSALIA

### Family *Dugesiidae* BALL, 1974

### Genus *Dugesia* GIRARD, 1850

### *Dugesia schubarti* (MARCUS, 1946)

The animals in life were sketched in HAUSER's laboratory when they were collected. Although the coloration varies considerably, the animals have a typical body form of *Dugesia schubarti*. Some of the photographs of preserved specimens from 18 localities are shown in Figure 1 (A-V).

Only a brief description of the comparative penial anatomy of the samples examined is given here. Photomicrographs of the parts of the copulatory apparatus of 25 specimens from 20 localities are

shown in Figure 2 (A-X).

In most of the specimens from 20 localities in the vicinity of São Leopoldo, their penial anatomy is very similar to that of the specimens from the Arroio Tupandí and Linha Júlio de Castilho reported in the previous paper (cf. KAWAKATSU, OKI, TAMURA, YAMAYOSHI, HAUSER & FRIEDRICH, 1984, pp. 49-54, figs. 3 B and C, 4 A-I). Namely, a well-developed constriction or fold at the middle part of the penis papilla is observed. Numerous, heavily erythrophilic gland ducts are found around this region.

The samples of the Specimen Lot Nos. 1585 and 1586 collected from the same locality (the Arroio Tupandí) were fixed with Nozawa's fluid and Bouin's fluid, respectively. The locality of the samples of the Specimen Lot No. 1440 reported in the previous paper (cf. KAWAKATSU, OKI, TAMURA, YAMAYOSHI, HAUSER & FRIEDRICH, 1984) is also in the same region; they were fixed with Susa fluid. In comparison of the samples fixed with these three different fixatives, the presence of a well-developed constriction at the penis papilla is conspicuous. In conclusion, this character may be due to the muscular constriction of the penis when the animal was killed. In the case of *Dugesia japonica* ICHIKAWA et KAWAKATSU, 1964, the penis is preserved in a moderately contracted form when fixed with these three kinds of fixatives (cf. KAWAKATSU & MIYAZAKI, 1972).

The known geographical distribution of *Dugesia schubarti* ranges approximately over 1200 kilometers in the southeastern area of Brazil: the Serra de Mantiqueira, the Serra da Cantareira, the Serra do Mar, and Rio Grande do Sul. Judging from the results of the taxonomic study of this species by the authors (cf. KAWAKATSU, HAUSER & FRIEDRICH, 1976, 1983, and the present paper; KAWAKATSU, HAUSER, FRIEDRICH & SOUZA-LIMA, 1982; KAWAKATSU, OKI, TAMURA, YAMAYOSHI, HAUSER & FRIEDRICH, 1984), it must be pointed out that the degree of the local variation is minor.

*Material.* — Twenty-five sets of serial sections and preserved specimens in alcohol from 20 localities in the vicinity of São Leopoldo, Estado de Rio Grande do Sul, are retained in KAWAKATSU's laboratory at Fuji Women's College, Sapporo, Japan.

### SUMMARY

In a series of publications on the freshwater planarian fauna of South Brazil, of which this is the seventh, the authors have described the penial anatomy of *Dugesia schubarti* (MARCUS, 1946) collected from 20 localities in the vicinity of São Leopoldo, Estado de Rio Grande do Sul.

Animals fixed with Nozawa's fluid and Bouin's fluid show a conspicuous constriction or fold at the middle part of the penis papilla. This character is also found in the animals fixed with Susa fluid (cf. KAWAKATSU, OKI, TAMURA, YAMAYOSHI, HAUSER & FRIEDRICH, 1984). This may be due to the muscular constriction of the penis when the animals were killed.

The known geographical distribution of *Dugesia schubarti* ranges over 1200 kilometers in the southeastern area of Brazil. Although the animals from different localities show a slight variation in their morphology, anatomy and histology, the degree of the local variation of this species is minor.

### RESUMO

Em uma série de publicações sobre a fauna de planárias de água doce do sul do Brasil, da qual esta é a sétima, os autores descreveram a anatomia peniana de *Dugesia schubarti* (MARCUS, 1946), coletados de 20 localidades nas vizinhanças de São Leopoldo, Estado do Rio Grande do Sul.

Animais fixados com solução de Nozawa e Bouin mostraram uma evidente constrição ou dobra na porção mediana da papila peniana. Esta característica também foi encontrada em animais fixados com

solução de Susa (cf. KAWAKATSU, OKI, TAMURA, YAMAYOSHI, HAUSER & FRIEDRICH, 1984), isto talvez seja devido à constrição muscular do pênis quando o animal foi morto.

A distribuição geográfica conhecida de *Dugesia schubarti* alcança mais de 1200 quilômetros em extensão, na área sudeste do Brasil. Animais de diferentes localidades mostram ligeira variação em sua morfologia, anatomia e histologia, mas o grau de variação local destas espécies é menor.

## RÉSUMÉ

Dans une série de publications sur la fauna de planaires d'eau douce du sud du Brésil, dont celle-ci constitue la septième, les auteurs ont décrit l'anatomie pénienne de la *Dugesia schubarti* (MARCUS, 1946), étudiée sur des exemplaires recueillis dans une vingtaine de localités des environs de São Leopoldo, dans l'état du Rio Grande do Sul.

Chez les animaux fixés avec une solution de Nozawa et de Bouin on a constaté une évidente constriction ou pli dans la portion médiane de la papille pénienne. Cette caractéristique a été trouvée également chez des animaux fixés avec une solution de Susa (cf. KAWAKATSU, OKI, TAMURA, YAMAYOSHI, HAUSER & FRIEDRICH, 1984), ce qui est peut-être dû à la constriction musculaire du pênis à l'occasion de la mort de l'animal.

La distribution géographique connue de la *Dugesia schubarti* atteint plus de 1200 km d'extension dans la région sud-est du Brésil. Les animaux des différentes localités présentent une légère variation dans leur morphologie, leur anatomie et leur histologie, mais le degré de variation locale de ces espèces est moins important.

## ZUSAMMENFASSUNG

Zu einer Reihe von Veröffentlichungen über die Planarienfauna des Süßwassere vom Süden Brasiliens gehört diese siebte. Die Verfasser beschreiben die Anatomie des Penis von *Dugesia schubarti* (MARCUS, 1946), die eingesammelt wurde in 20 Orten in der Nähe von São Leopoldo, des Staates Rio Grande do Sul.

Fixierte Tiere mit der Lösung Nozawa und Bouin zeigten eine deutliche Konstriktion oder eine Falte am medianen Teil des Penis Papille, dasselbe wurde auch durch die Anwendung der Lösung Susa festgestellt (cf. KAWAKATSU, OKI, TAMURA, YAMAYOSHI, HAUSER & FRIEDRICH, 1984). Dies kann vielleicht durch die muskulare Konstriktion des Penis hervorgerufen sein, als das Tier getötet wurde.

Die bekannte geographische Verbreitung von *Dugesia schubarti* erstreckt sich über 1200 km. im Südwesten Brasiliens. Tiere aus verschiedenen Fundorten zeigen kleine Variationen in ihrer Morphologie, Anatomie und Histologie auf, aber die lokale Variation dieser Art ist geringer.

## REFERENCES

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. & MIYAZAKI, 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 : 73-90 (+ pls. VIII-XXXII).

KAWAKATSU, M., OKI, I., TAMURA, S., YAMAYOSHI, T., HAUSER, J. & FRIEDRICH, S. M. G., 1984. Morphological, etc. VI. *Dugesia schubarti* (MARCUS, 1946) from the vicinity of São Leopoldo, Estado de Rio Grande do Sul (Turbellaria, Tricladida, Paludicola). Bull. Fuji Women's College, (22), Ser. II : 45-62.

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

\*\*\*\*\*

#### Additional Literature

FIOLENTIN, G. L. & FRIEDRICH, S. M. G., 1985. Contribuição para o estado histológico do integumento auricular de *Dugesia schubarti* (MARCUS, 1946). Acta Biol. Leopoldensia (UNISINOS), 7 (1) : 119-130.

HAUSER, J., 1984. The fundamental problem of the cell changes during the regeneration. Acta. Biol. Leopoldensia, 6 (1) : 115-120.

HELLER, Z., 1985 a. Study of the type and morphological characters of the eyes of the *Dugesia tigrina* (GIRARD, 1850). Acta Biol. Leopoldensia, 7 (1) : 77-89. 1985 b. Study of the external morphology of the eyes of the *Dugesia anderlani* (KAWAKATSU, HAUSER, 1983). Acta Biol. Leopoldensia, 7 (1) : 109-118.

SANTOS, W. H. & HAUSER, J., 1984. Irregular formations in the *Dugesia schubarti* (MARCUS, 1946) regenerating process. A contribution to the problem of the axial gradient theory. Acta Biol. Leopoldensia, 6 (2) : 231-238.

SOUZA, T. M. DE & HAUSER, J., 1984. The growing of the regenerating heads of *Dugesia schubarti*. Acta Biol. Leopoldensia, 6 (1) : 97-113.

STEIGLEDER, A. K. & HAUSER, J., 1984. Alimentação e crescimento de regenerantes de *Dugesia schubarti* (MARCUS, 1946). Acta Biol. Leopoldensia, 6 (1) : 35-45.

\*\*\*\*\*

#### Addresses of the Authors :

Dr. Masaharu KAWAKATSU, Professor of Biology, Biological Laboratory, Fuji Women's College, Kita-16, Nishi-2, Kita-ku, Sapporo (Hokkaidō) 001, Japan.

Dr. Josef HAUSER, S. J. and Dra. Sirlai Malvina Gehrke FRIEDRICH, Professors of Biology, Instituto de Pesquisas de Planárias, Universidade de Vale do Rio dos Sinos, UNISINOS, Praça Tira-dentes, 35, Caixa Postal, 275, 93000 São Leopoldo, Rio Grande do Sul, Brasil.

December 25, 1985.