

THE TAXONOMIC REVISION OF SEVERAL HOMONYMS IN
THE GENUS *BIPALIUM*, FAMILY BIPALIIDAE
(TURBELLARIA, SERIATA, TRICLADIDA, TERRICOLA)¹⁾

by

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INTRODUCTION

Between 1987 and 1993, we have published the serial papers, "Indices to the Species of the Land Planarians (Turbellaria, Tricladida, Terricola)" (OGREN & KAWAKATSU, 1987, 1988a, b, 1989, 1990, 1991, 1992; OGREN, KAWAKATSU & FROEHLICH, 1992, 1993a, b). "Additions and Corrections" for this series were also published (OGREN, KAWAKATSU & FROEHLICH, 1994, 1995, 1996, 1997a, b, 1998). All known species of land planarian described and reported from the world are listed. For each species, all published records and known localities are listed chronologically.

Among these publications, every known bipaliid species and their taxonomic and chorological records are listed in the following articles: OGREN & KAWAKATSU (1987, pp. 79-111; 1988a, pp. 3-12; 1989, p. 91; 1991, pp. 96-97) and OGREN, KAWAKATSU & FROEHLICH (1992, pp. 62-75, 98-99, pl. I, top; 1993a, pp. 34-60; 1994, pp. 73-76; 1995, pp. 79-81; 1996, pp. 87-89; 1997a, pp. 55-56; 1997b, pp. 71-72, 81, 83-96; 1998, pp. 1-2).

The family Bipaliidae STIMPSON, 1857, now consists of only a single genus *Bipalium* STIMPSON, 1857 (cf. OGREN & KAWAKATSU, 1987). According to our latest data, the genus has 160 species (including 14 subspecies), of which well-described species (with a description of anatomy and histology of the copulatory apparatus based upon fully sexually mature specimens) amount to some 39 per cent. of the whole (cf. OGREN, KAWAKATSU & FROEHLICH, 1997b, p. 68, table 1, p. 70, table 4; see also KAWAKATSU & OGREN, 1998, pp. 2-3, table 1, fig. 2, top-left).

Land planarians with a head plate of a semicircular outline (including a form with the lateral auricles elongated, or a rudimentary form) are now classified as members of the non-homogeneous genus *Bipalium*. A tentative

identification only by external morphology of non-sexual specimens prevents classification from a modern taxonomic viewpoint. Due to the scanty anatomical knowledge of the various species in that genus, its subdivision based upon reliable taxonomic features has met with small success (cf. VON GRAFF, 1896, 1899, 1912-1917; OGREN & SLUYS, In press).

In the present paper, the taxonomic rearrangement of two Asian bipaliid species, *Bipalium fuscatum* STIMPSON, 1857, and *Bipalium penrissenense* DE BEAUCHAMP, 1925, will be given because several homonyms exist for each of them. For the clarification of their taxonomic confusion, a new bipaliid genus, *Novibipalium* gen. nov. will be proposed.

TAXONOMIC REVISION OF TWO BIPALIID SPECIES

Bipalium fuscatum and its Homonyms

Bipalium fuscatum STIMPSON, 1857, was described from Central Japan. Its original description is as follows: "BIPALIUM FUSCATUM. Grande, depressum, postice attenuatum acutum, supra nigro fuscum, margine frontali pallida. Ocelli in marginibus capitis sprasi. Long. 5; lat. 0.3 poll. Hab. prope urbem Japonicam "Simoda" sub follis putridis." (See OGREN, KAWAKATSU & FROEHLICH, 1997b:101, Appendix IV.)

The type locality of this rather large (in above measurements 1 pollex (poll.) means width of the thumb), uniformly black species common in the vicinity of Shimoda City (situated on the eastern coast at the southern tip of the Izu Peninsula), Shizuoka Prefecture, Chûbu Region, in southern coast of Honshû. It was reported that STIMPSON's (*op. cit.*) type specimen of *B. fuscatum* was lost by the

1). The present paper is the taxonomic part of the paper (KAWAKATSU & OGREN, 1998 c: The Asian land planarian fauna) which was presented at the OECD Workshop on Terrestrial Flatworms, Christchurch, New Zealand, on February 16-20, 1998) (see also KAWAKATSU & OGREN, 1998a, b; OGREN & KAWAKATSU, 1998 a, b). The Workshop papers are published in vol. 42 of 'Pedobiologia' (1998).

Great Chicago Fire in 1871.

The previous study publications on *B. fuscatum* reveal the synonymy (OGREN & KAWAKATSU, 1987: 87; see also OGREN, KAWAKATSU & FROELICH, 1992: 64-65; 1994: 74; 1995: 80; 1996: 88; 1997: 56). The following is an explanatory synopsis of the taxonomic history of this species.

VON GRAFF (1899) identified STIMPSON's (1857) old species under the name of "*Placocephalus fuscatus*". And, he also noted this species is distributed in Indonesia (Buitenzorg in Java and Natuna Island), India and Japan. He (*op. cit.*) gave the external appearance of an example in color (with additional figures of parts of the body: taf. VIII, figs. 8-13) and a schematic, sagittal view of the copulatory apparatus (fig. 66 on p. 222, and species redescription on pp. 461-462). A reproduction of the latter is also printed in VON GRAFF's later publication (1917, taf. LI, fig. 8). The correct locality of VON GRAFF's (*op. cit.*) animal used for the study of genital anatomy is not known (probably Buitenzorg).

KABURAKI (1922), who accepted VON GRAFF's (*op. cit.*) identification of Japanese material as "*Placocephalus fuscatus*", published a detailed redescription based on his own material (*op. cit.*: 34-38, figs. 17-19, pl. 1, figs. 8-9 in color). The correct locality of the specimens he used for study of the genital anatomy is uncertain (probably Central Japan).

The most recent redescription of *B. fuscatum* was published by MACK-FIRA[~] & KAWAKATSU (1972: 638, 641-644, fig. 2, pl. 2, figs. A-E) based upon the single, fully sexually mature specimen from the entrance of Dai'ichi-kazuhito-ana Cave, Motosu, Yamanashi Prefecture, Chūbu Region, in Honshū, Central Japan. A sufficient discussion about the comparative genital anatomy of *B. fuscatum* was not included in this paper.

Since the first description in 1857 by STIMPSON, the genus has been without a type species. However, it was clear that *Bipalium fuscatum* with the above history was the best known of the 4 species listed under *Bipalium* by STIMPSON (see OGREN, KAWAKATSU & FROELICH, 1997b, Appendix IV). Therefore, *B. fuscatum* was designated as type species by OGREN, KAWAKATSU & FROELICH, (1992: 63), even though the uncertainty of the copulatory apparatus was not settled. KAWAKATSU (1991) in a comparative review of *Bipalium trifuscostriatum* KABURAKI, 1992, from Kōbe in Central Japan and *B. fuscatum*, made the tentative conclusion that KABURAKI's (1922) material of "*Pl. fuscatus*", based on copulatory apparatus morphology, may consist of 2 different species with very similar external appearances but different male genital anatomies.

The issue was clarified by comparative study of the genital anatomy from existing schematic figures of the copulatory apparatus of *B. fuscatum* (and "*Pl. fuscatus*") reported by VON GRAFF (1899), KABURAKI (1922) and MACK-FIRA[~] & KAWAKATSU (1972). We have concluded that there are actually two types of copulatory apparatus

present.

The female organ in both cases has the vertical arrangement, whereas the male organs show differences considered to have taxonomic importance (OGREN & SLUYS, In press): 1) The primitive type (common male organ for the genus *Bipalium*) has a well-developed conical penis papilla, enclosed by the male genital antrum walls which form a thin penis sheath only moderately muscular (KABURAKI, 1922: 37, text-fig. 18; see Fig. 1 in the present paper). 2) The eversible type (derived) with papilla small or reduced, and the male antrum walls developed into a thick, highly muscular penis sheath that is extrusible to form a pseudophallus (KABURAKI, 1922: 37, text-fig. 19; see Fig. 4 in the present paper). It is suggested that species with this eversible male organ morphology should be placed in a new genus of the family Bipaliidae; *Bipalium venosum* KABURAKI, 1922, a species reported from Ōtsu in Central Japan (p. 11, text-fig. 3, pl. 1, fig. 12), should be included in it. 3) Until further studies can be made the following should be considered separate species: the specimen of VON GRAFF's (1899) "*Pl. fuscatus*" from Buitenzorg (?), along with additional specimens from Japan (*op. cit.*, taf. VIII, figs. 8-13) because they lack description of the copulatory apparatus.

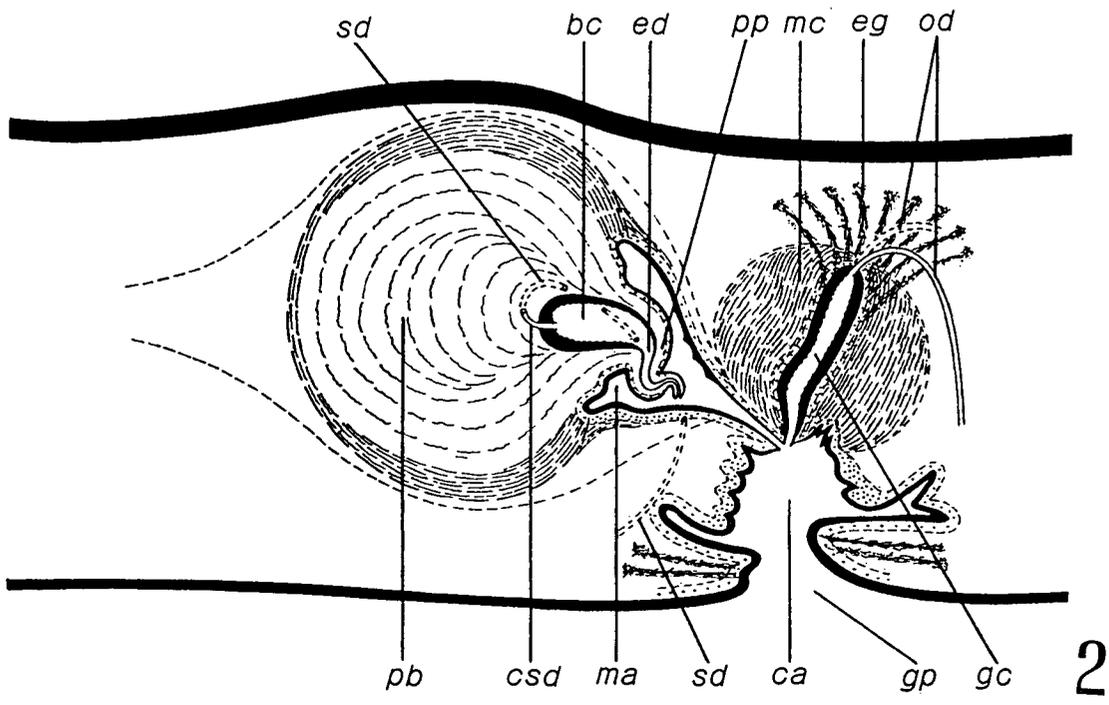
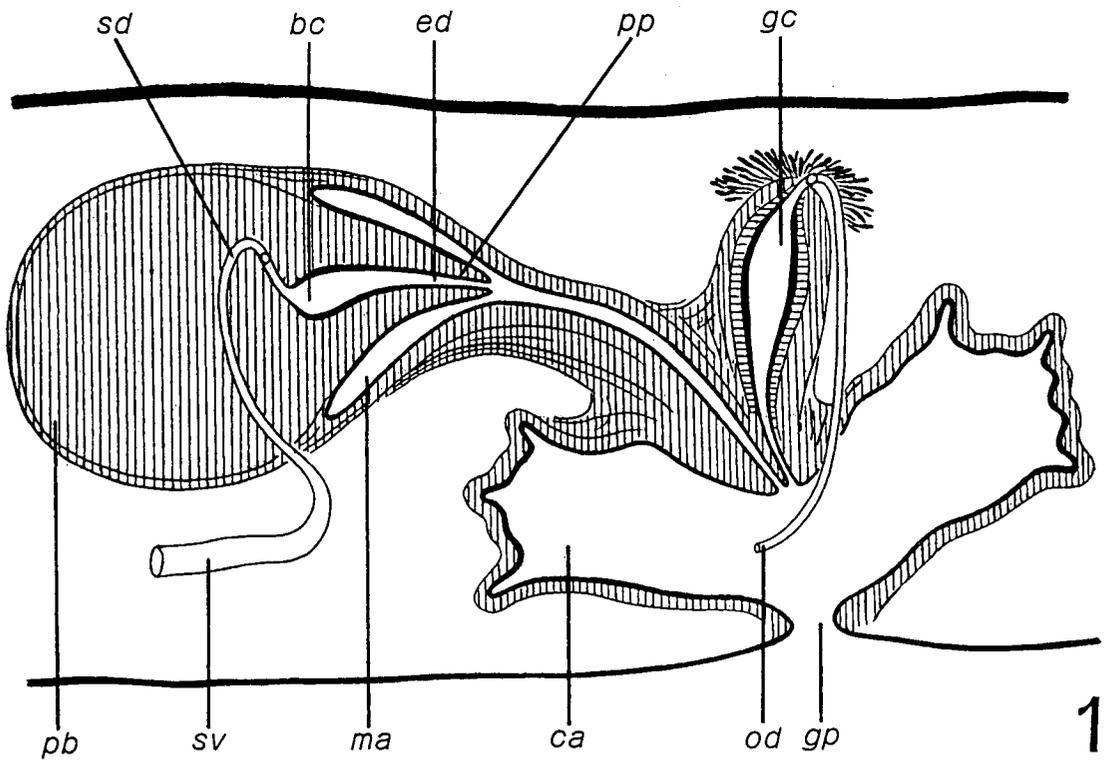
Descriptions

Bipalium fuscatum STIMPSON, 1857

This is a moderately large and broad species (80-120mm long and 7-8mm wide). The semilunar head plate is moderate in size with short, slightly recurved auricles (*i. e.*, lappets; cf. KABURAKI, 1922, p. 35, text-fig. 17, pl. 1, figs. 8 and 9). Both lateral sides of the body show a slightly serrulate form (when preserved). The dorsal surface is uniformly black; the ventral surface is dark gray with a narrow creeping sole. For a photograph of the preserved specimen consult: MACK-FIRA[~] & KAWAKATSU (1972, pl. 2, fig. A). For the morphology, histology and genital anatomy, with schematic figures of the copulatory apparatus, see KABURAKI (1922: in part of pp. 34-38, text-fig. 18) and MACK-FIRA[~] & KAWAKATSU (*op. cit.*: 641-644, pl. 2, figs. B-E). Schematic figures of the copulatory apparatus reproduced from these two papers are shown in Figs. 1 and 2.

B. fuscatum is distributed in Central Japan. The serial sections used by KABURAKI (1922) were lost; sections studied by KAWAKATSU (*i. e.*, MACK-FIRA[~] & KAWAKATSU, 1972) are deposited in the Department of Zoology, National Science Museum (Nat. Hist.), Tōkyō.

Note. The locality of the *B. fuscatum* specimen studied by KAWAKATSU in 1972 is approximately 90km NW of STIMPSON's (1857) type locality.



Figs. 1 (top) and 2 (bottom). *Bipatium fuscatum* STIMPSON, 1857, semidiagrammatic figures of the copulatory apparatus. Top (after KABURAKI, 1922); bottom (after MACK-FIRÁ & KAWAKATSU, 1972). Slightly retouched; abbreviations were changed. bc, bulbar cavity; ca, common genital antrum; csd, common sperm duct; ed, ejaculatory duct; eg, eosinophilous glands; gc, glandular chamber; gp, genital pore; ma, male genital antrum; od, ovovitelline duct; pb, penis bulb; pp, penis papilla; sd, sperm duct; sv, spermiducal vesical.

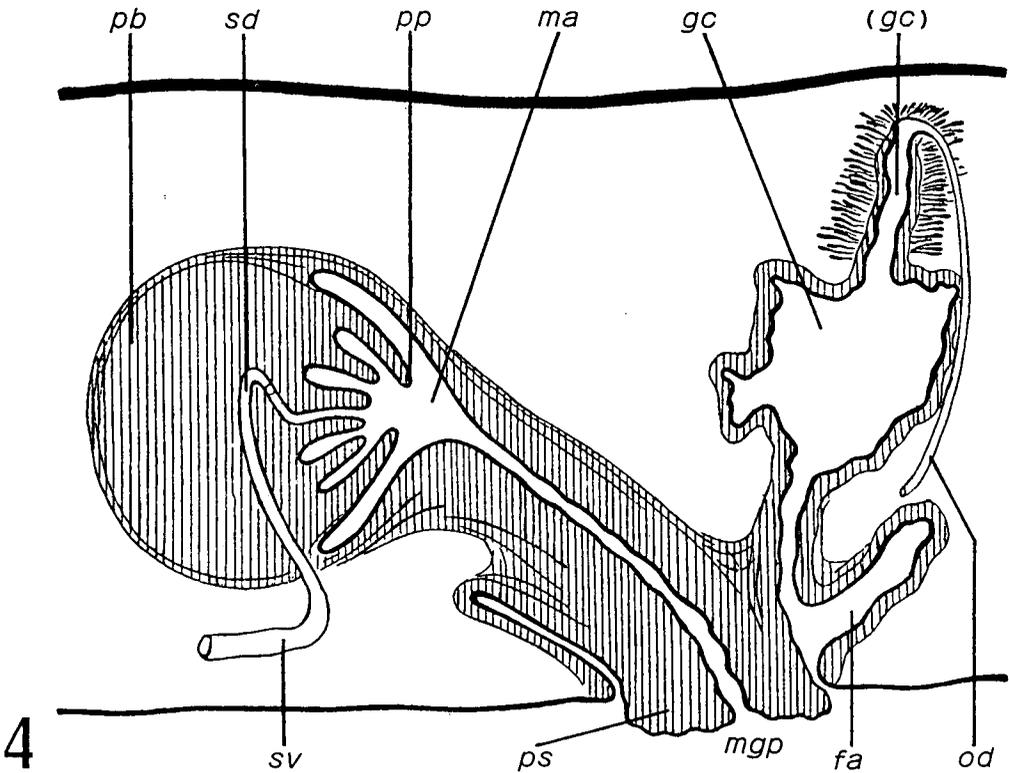
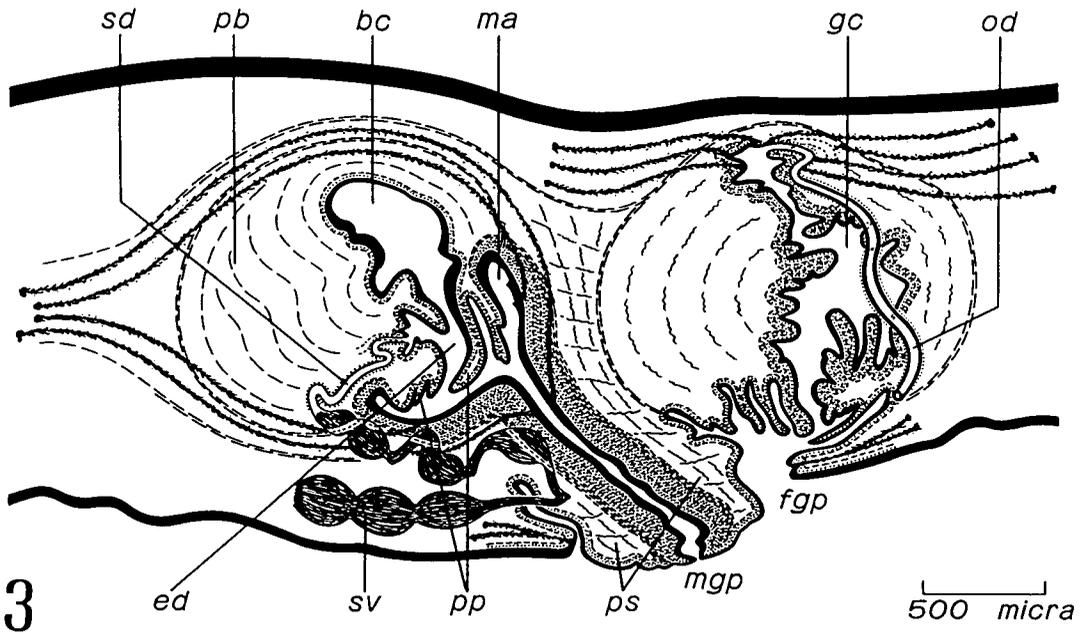


Fig. 3 (top). *Novibipalium trifuscostriatum* (KABURAKI, 1922). semidiagrammatic figure of the copulatory apparatus (after KAWAKATSU, 1991; the orientation in the original figure was reversed). Slightly retouched. bc, bulbar cavity; ed, ejaculatory duct; fgp, female genital pore; gc, glandular chamber; ma, male genital antrum; mgp, male genital vesicle; od, ovovitelline duct; pb, penis bulb; pp, penis papilla; ps, penis sheath; sd, sperm duct; sv, spermiducal vesicle.

Genus *Novibipalium* KAWAKATSU, OGREN et FROEHLICH,
gen. nov.

Definition: Bipaliidae sharing many features with *Bipalium*; male genital organ has the key character in the form of its highly muscular male antrum wall which can evert into an elongate penis sheath (pseudophallus), which provides a secondary or distal ejaculatory duct; reduction or absence of the penis papilla.

Type species: *Bipalium trifuscostriatum* KABURAKI, 1922; here designated.

Note. OGREN observes that the main difference between the new genus and *Bipalium* is the eversible muscular penis sheath of the male copulatory apparatus. In other anatomical details the two genera are similar and may represent only subgenera. There is some concern that future studies might show that the eversible muscular penis sheath is physiological, related to sexual maturation or developmental in origin, within a species population. In this case it would be negated as a generic character. However, with our present limited knowledge, this character of the male genital antrum wall as a muscular eversible organ, appears distinctly different from the condition of the primitive male organ of *Bipalium*. Thus, it is considered here as a new morphological feature and is recognized as a secondary (or derived) character.

KAWAKATSU emphasizes that in freshwater planarians the subgenus *Seidtia* ZABUSOV, 1911, characterized by an extraordinarily thick muscular zone surrounding the male genital antrum, is justifiably recognized at the rank of genus to which it was elevated by ZABUSOVA in 1936 (KAWAKATSU & MITCHELL, 1995, 1998; see also KAWAKATSU & TIMOSHKIN, In press; KENK, 1953). The anatomy of the male antrum of *Seidtia* is essentially similar to the new land planarian genus *Novibipalium*.

Novibipalium falsifuscatum KAWAKATSU, OGREN et
FROEHLICH, sp. nov.

External appearance and size of the body are very similar to *Bipalium fuscatum*; with a uniformly black coloration on the dorsal side; penis bulb large, spherical in shape, with a bulbar cavity consisting of an anterior, narrow tubular part (into which sperm ducts open separately) and a posterior, shallow lumen with many plicae that open into the male genital antrum (this part may function as an inconspicuous ejaculatory duct); penis papilla thin, conical and symmetrical in shape; male antrum consisting of an anterior, shallow, cup-shaped cavity and a posterior, long, tubular part that opens at the male genital pore; with a well-developed, muscular penis sheath of

a cylindrical form; female part of the copulatory apparatus forms a wide, vertical, glandular chamber of an irregular outline with a thin muscular coat; oovitellic ducts open separately into the beginning of the tubular part of the glandular chamber from its postero-dorsal side.

For the morphology, histology and genital anatomy, with a schematic figure of the copulatory apparatus, see KABURAKI (1922: in part of pp. 34–38, under the section of "*Pl. fuscatus*"). Schematic figure of the copulatory apparatus reproduced from KABURAKI's (*op. cit.*: 37, text-fig. 19) paper is shown in Fig. 4.

N. falsifuscatum is distributed probably in Central Japan. The serial sections used by KABURAKI (*op. cit.*) were lost. Although there are no new series of sections of this species, it is possible that preserved specimens will be found in "KAWAKATSU's Collection of Turbellarians".

Novibipalium alterifuscatum KAWAKATSU, OGREN et
FROEHLICH, sp. nov.

External appearance, size and coloration of the body are very similar to *Bipalium fuscatum*; penis bulb large, spherical in shape, into which sperm ducts open at posterior portion separately into the large bulbar cavity, with its epithelium folded into many plicae; without conspicuous ejaculatory duct; penis papilla thin, weakly muscular, conical and symmetrical in shape; male genital antrum consisting of an anterior cup-shaped cavity and a posterior, large, tubular part that opens at the male genital pore (the posterior one-third section is plicated); the outer wall of the penis papilla and the surface of the male antrum are covered with a thick, plicate, glandular epithelium; with a highly developed, thick, muscular penis sheath of an eversible, cylindrical form; female part of the copulatory apparatus ellipsoidal, and surrounded by a thin muscular coat; with a wide, vertical, glandular chamber covered with a thick and plicated epithelium.

For the morphology, histology and genital anatomy, with a schematic figure of the copulatory apparatus, see VON GRAFF (1899: 220–221, fig. 66, 461–462, taf. VIII, figs. 8–13, "*Pl. fuscatus*"). Schematic figure of the copulatory apparatus reproduced from VON GRAFF (*op. cit.*: 222, fig. 66) is shown in Fig. 5.

According to VON GRAFF's (*op. cit.*) description of "*Pl. fuscatus*", *N. alterifuscatum* is distributed in Buitenzorg, Java, in Indonesia, and India. The occurrence of the same species in Java and India is doubtful. The location of VON GRAFF's (*op. cit.*) serial sections of this species is not clarified.

Fig. 4 (bottom). *Novibipalium falsifuscatum* sp. nov. Semidiagrammatic figure of the copulatory apparatus (after KABURAKI, 1922). Slightly retouched; abbreviations were changed. fa, female genital antrum, gc, glandular chamber; ma, male genital antrum; mgp, male genital pore; od, oovitellic duct; pb, penis bulb; pp, penis papilla; ps, penis sheath; sd, sperm duct; sv, spermiducal vesicle.

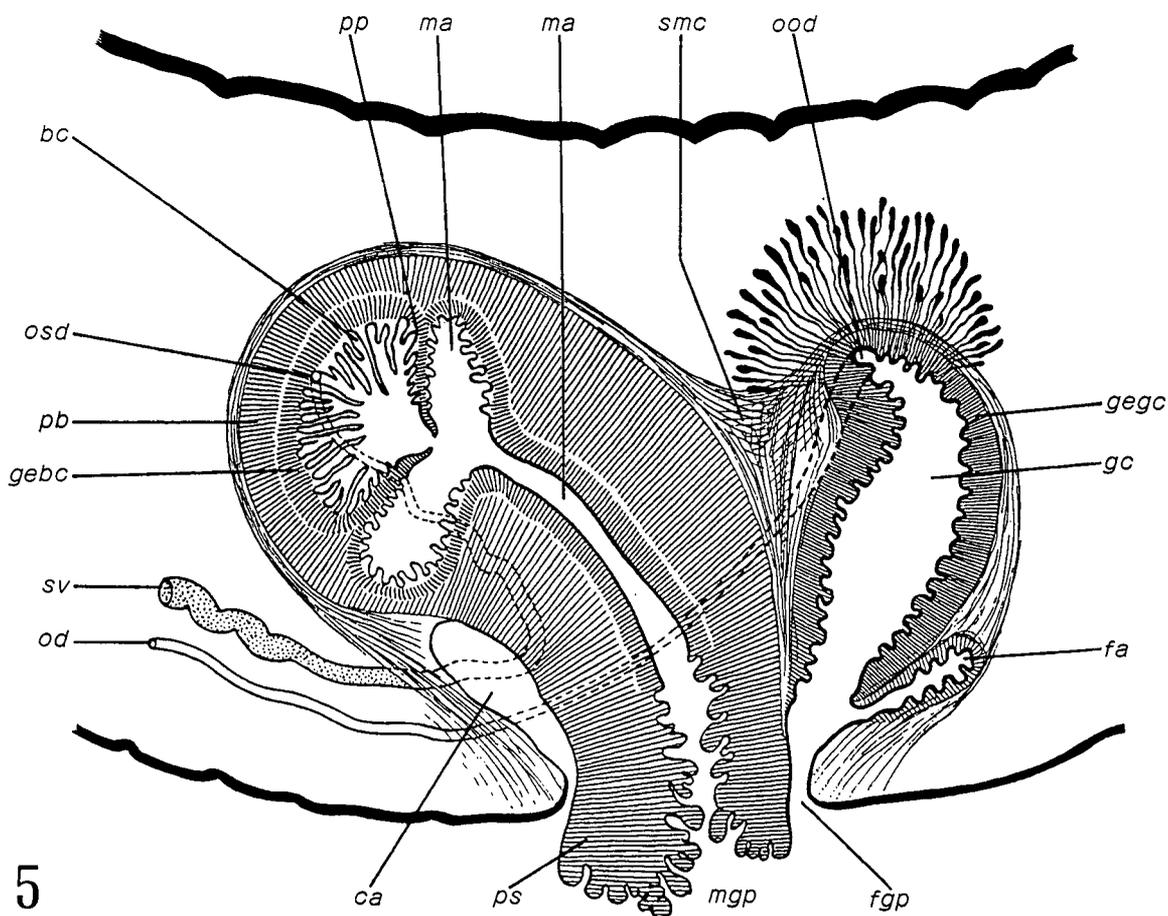


Fig. 5. *Novibipalium alterifuscatum* sp. nov. Semidiagrammatic figure of the copulatory apparatus (after VON GRAFF, 1899). Slightly retouched; abbreviations were changed. bc, bulbar cavity; ca, common genital antrum; fa, female genital antrum; fgp, female genital pore; gc, glandular chamber; gcb, glandular epithelium of the bulbar cavity; gegc, glandular epithelium of the glandular chamber; ma, male genital antrum; mgp, male genital pore; od, ovovitelline duct; ood, opening of the ovovitelline duct; osd, opening of the sperm duct; pb, penis bulb; pp, penis papilla; ps, penis sheath; smc, sparse muscle coat consisting of circular, longitudinal and diagonal fibers; sv, spermiducal vesicle.

Discussion of the Type Species for *Novibipalium* and Allied Species

Two of the species described and renamed herein, *i. e.*, *Novibipalium falsifuscatum* sp. nov. and *Novibipalium alterifuscatum* sp. nov., are not good candidates for type species of the genus. Their type specimens and original materials on which KABURAKI (1922) or VON GRAFF (1899) based their descriptions of the copulatory apparatus are not available.

The species *Bipalium venosum* KABURAKI, 1922, reported from Central Japan, has the male organ (KABURAKI, 1922: 11, text-fig. 3), with male antrum walls forming an eversible muscular organ indicating it belongs in the new genus (KABURAKI's sketch figure may show the organ

in a rather contracted state). However, type specimens no longer exist for this species. There is a possibility that this species is conspecific with *Novibipalium falsifuscatum* sp. nov., the taxonomic problem remains for future studies.

On the other hand, another better known species can be assigned to the new genus. In 1991, KAWAKATSU published a detailed redescription of *Bipalium trifuscostriatum* KABURAKI, 1922, from Central Japan. This dull brown species with 3 longitudinal stripes dorsally, has a well-developed, highly muscular eversible penis sheath in its copulatory apparatus. In that paper, the comparative penial anatomy and histology of *B. fuscum* were discussed (KAWAKATSU, 1991: 494–450). *B. trifuscostriatum* can be a suitable type species of the new genus *Novibipalium* be-

cause there is a recent detailed taxonomic description, specimens and slides used for studies are available, and specimen localities are known. The schematic figure of its copulatory apparatus (*op. cit.*: 45, fig. 3) is shown in Fig. 3 (reversed copy) of the present paper.

The new genus *Novibipalium* presently comprises 4 species, of which 2 new species (*N. falsifuscatum* from Central Japan and *N. alterifuscatum* from Jawa?, Indonesia) are described in the present paper. The other 2 species are as follows:

Novibipalium trifuscostriatum (KABURAKI, 1922) comb. nov.

Synonymy: See OGREN & KAWAKATSU (1987: 104); OGREN, KAWAKATSU & FROEHLICH (1992b: 73). See also KAWAKATSU (1991).

Localities: Ôtsu City (Mi-dera Temple) and its vicinity, Shiga Prefecture, Kinki Region, Honshû, Japan (old place names described in the original paper: Sakata, Prov. Ohmi; Mii Temple, Ôtsu); also obtained from a garden of Dr. OKI's residence, Suma-ku, Kôbe City, Hyôgo Prefecture, Kinki Region, Honshû. Cf. KAWAKATSU (1991).

Novibipalium venosum (KABURAKI, 1922) comb. nov.

Synonymy: See OGREN & KAWAKATSU (1987: 106); OGREN, KAWAKATSU & FROEHLICH (1992b: 73).

Locality: Ôtsu City (Mi-dera Temple), Shiga Prefecture, Kinki Region, Honshû, Japan (old place name: Mii Temple in Ôtsu).

Bipalium penrissenense and its Homonyms

Bipalium penrissenense DE BEAUCHAMP, 1925, was described from "Monts Penrissen et Poi", Sarawak in Borneo, East Malaysia. Its original description (DE BEAUCHAMP, 1925: 68-69) includes two figures, *i. e.*, a dorsal view of the animal (fig. 4 K on p. 68) and the schematic figure of the copulatory apparatus (fig. 4 J). The former was based on a single specimen from Mt. Poi (the largest of the 5 specimens he had, being provided with a genital pore — in spite of having been sectioned, a sketch of the copulatory apparatus was not published). The latter was drawn from serial sections of a small animal (only 8mm long!) from Mt. Penrissen. We can only obtain this information by reading DE BEAUCHAMP's 1926 paper.

In his 1926 paper, DE BEAUCHAMP gave the redescription of *B. penrissenense* with 6 figures (pp. 349-352, figs. 12 A-C, 13 D-F). Four of these figures show dorsal views of animals with different dorsal patterns (fig. 12 A and B, fig. 13 D and E) and two schematic figures of the copulatory apparatus (fig. 12 C and fig. 13 F). According to his explanation of figures, specimens diagrammed in fig. 12 (A and C) originated from Mt. Penrissen; specimens diagrammed in fig. 13 (D, E and F) also originated from Mt. Penrissen. However, the figure 12 (B)

(identical to fig. 4 K in his 1925 paper) of the dorsal side refers to an animal from Mt. Poi. Moreover, this figure is reproduced in DE BEAUCHAMP's 1961 publication (p. 115, fig. 58 G) as *Bipalium penrissenense*. A list of synonyms of this species is found in OGREN & KAWAKATSU (1987: 98).

From the result of our comparative examination of descriptions and figures of *B. penrissenense* published in 1925 and 1926, we conclude that 4 species are erroneously included in DE BEAUCHAMP's (*op. cit.*) descriptions under the name of a single species, *Bipalium penrissenense*. The patterns and stripes found on the dorsal (and ventral) surface of the body in bipaliid species have an important taxonomic value. The taxonomic confusion of *B. penrissenense* is corrected as follows.

Descriptions

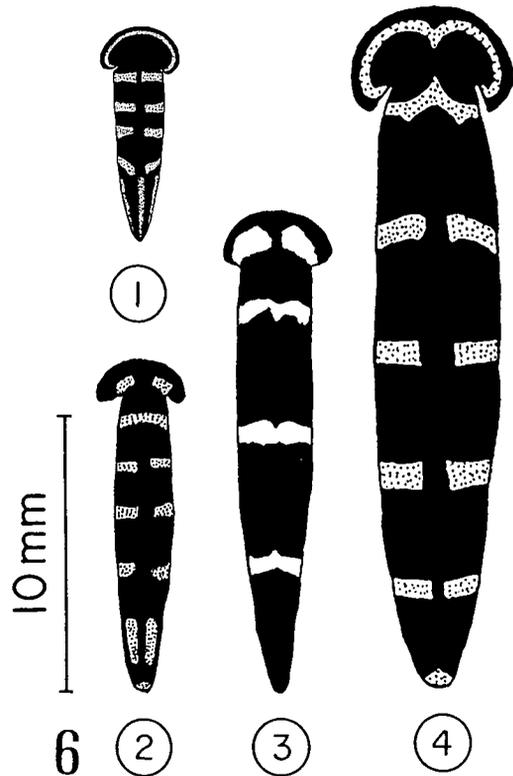


Fig. 6 (①-④). External appearances of 4 bipaliid species from Sarawak in East Malaysia (after DE BEAUCHAMP, 1925 and 1926; slightly retouched). Scale, 10mm. ①, *Bipalium penrissenense* DE BEAUCHAMP, 1925; ②, *Bipalium penrissenicum* sp. nov.; ③, *Bipalium* sp. of Mt. Penrissen; ④, *Bipalium* sp. of Mt. Poi.

Bipalium penrissenense DE BEAUCHAMP, 1925

The external appearance of this species is shown in Fig. 6 (①). This is an extremely small species (8mm long and 2.5mm wide in the preserved, sexual specimen). The ground color of the dorsal side is nearly black with 6 patterns: a submarginal, semicircular, head pattern, an interrupted transverse band at posterior level of the neck, 3 pairs of transverse bands those separated at the midline of the body, and a set of 3, indistinct, longitudinal markings on the tail region.

The sagittal view of the copulatory apparatus is shown in Fig. 7. Penis bulb large, ovoid, moderately muscular in nature, with a wide bulbar cavity consisting of an anterior, short, tubular part (into which sperm ducts open separately) and a middle and posterior wide lumen with many plicae; non-conspicuous ejaculatory duct present; penis papilla thin, weakly muscular, conical and symmetrical in shape; male genital antrum wine-glass shaped; female part of the copulatory apparatus elongate-ovoid, surrounded by a thin muscle layer; with a wide, vertical glandular chamber lined with a thick epithelium; ovovitelline ducts have an anterior dorsal approach rather than posterior (based on drawing of DE BEAUCHAMP, 1925, 1926); common genital antrum small cup-shaped, and receiving at its roof the openings of both male antrum antero-dorsally and glandular chamber postero-dorsally.

For the morphology, histology and genital anatomy, see DE BEAUCHAMP (1925: 69, fig. 4 J; 1926: in part of pp. 349-352, fig. 12 A, C). The anterior dorsal approach of the ovovitelline ducts is a new feature and suggests a new taxa (OGREN & SLUYS, In press).

Note. The type locality is Mt. Penrissen (alt. ca. 1310m; the correct position on the map is not clarified). The location of the type series is unknown.

Bipalium penrissenicum KAWAKATSU, OGREN et FROELICH, sp. nov.

The external appearance of this species is shown in Fig. 6 (②). This is a small species (13mm long and 2.5mm wide in the preserved sexual specimen). Colorations of the body and dorsal patterns are similar to *Bipa-*

lium penrissenense. The 7 patterns are: a pair of separated transverse bands at the frontal level of the neck, a prepharyngeal transverse band, 3 pairs of transverse bands separated at the midline of the body, a pair of short, longitudinal markings on the tail region, and a tail spot.

The sagittal view of the copulatory apparatus is shown in Fig. 8. Penis bulb large, ovoid, moderately muscular (subepithelial circular muscle layer well developed) with an extraordinarily wide bulbar cavity consisting of a anterior, short and narrow tubular part (into which sperm ducts open separately) and a middle and posterior wide lumen with many plicae; non-conspicuous ejaculatory duct present; penis papilla thin, non-muscular, conical and symmetrical in shape; male genital antrum shallow-bowled champagne-glass shaped, with a narrow, long, tubular section posteriorly; female part of the copulatory apparatus is somewhat reniform, with a wide, horizontal glandular chamber; ovovitelline ducts have a posterior terminal entrance; common genital antrum cup-shaped, and receiving the openings of tubular male antrum and glandular chamber at its expanded roof (many glandular ducts can be seen here).

For morphology, histology and genital anatomy, see DE BEAUCHAMP (1926: in part of pp. 349-352, fig. 13 D, F). *B. penrissenicum* is separated from *B. penrissenense* by the different body patterns and the details of the genital anatomy (especially the presence of an expanded roof of the common antrum, besides the arrival of the ovovitelline ducts from the posterior aspect).

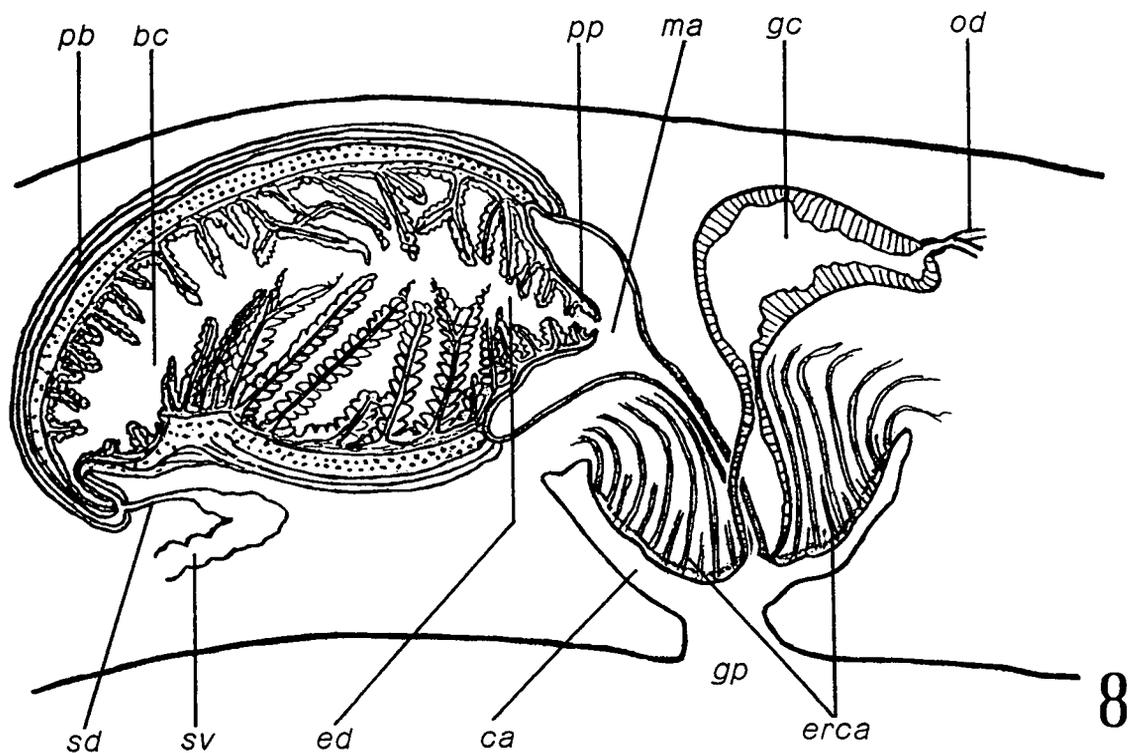
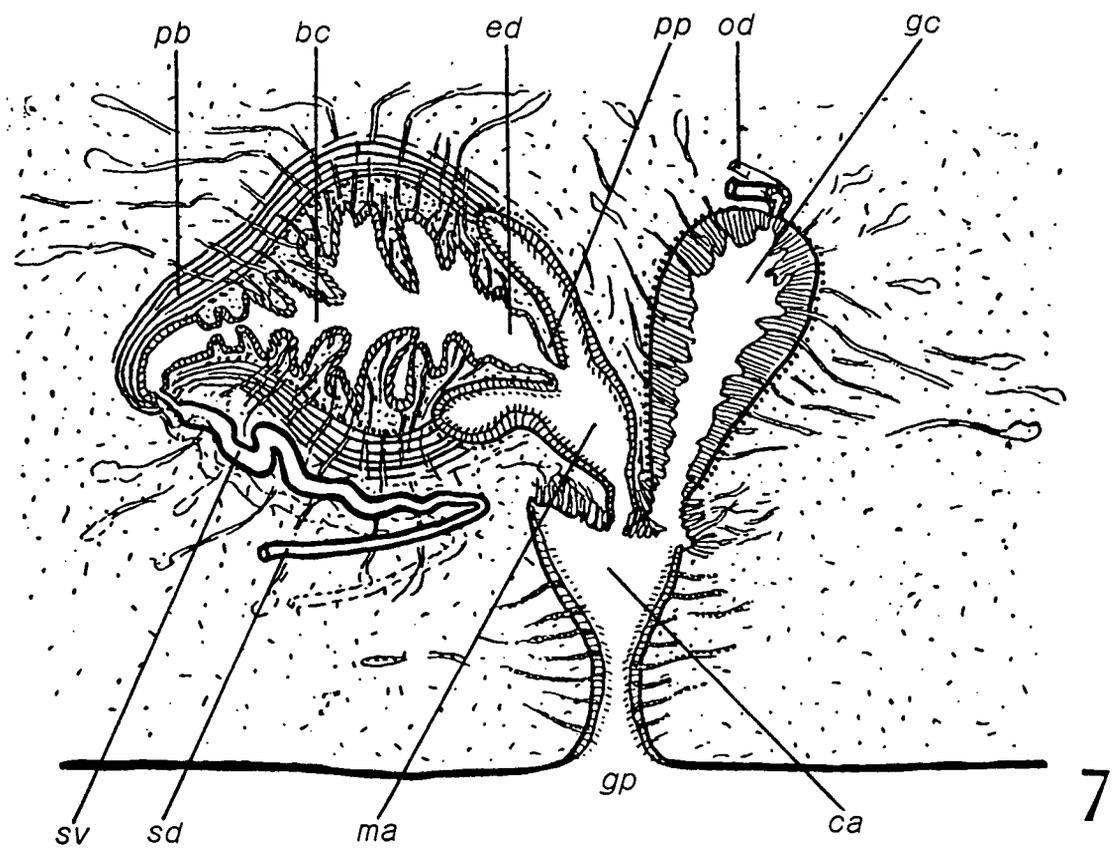
Note. The type locality is Mt. Penrissen (alt. ca. 984m). The location of serial sections used by DE BEAUCHAMP (1926) is not clarified.

Bipalium sp. of Mt. Penrissen

The external appearance of this sexually immature species is shown in Fig. 6 (③). This is a rather small species (19mm long and 3mm wide in the preserved specimen with a genital pore). Four patterns are: a pair of large, interrupted transverse bands on the neck (or the posterior portion of the head plate) and on the trunk 3 transverse bands of a retuse and mucronate form.

Fig. 7 (top). *Bipalium penrissenense* DE BEAUCHAMP, 1925, semidiagrammatic figure of the copulatory apparatus (after DE BEAUCHAMP, 1925). Slightly retouched; abbreviation were added. bc, bulbar cavity; ca, common genital antrum; ed, ejaculatory duct; gc, glandular chamber; gp, genital pore; ma, male genital antrum; od, ovovitelline duct; pb, penis bulb; pp, penis papilla; sd, sperm duct; sv, spermiducal vesicle.

Fig. 8 (bottom). *Bipalium penrissenicum* sp. nov., semidiagrammatic figure of the copulatory apparatus (after DE BEAUCHAMP, 1926). Slightly retouched; abbreviations were added. bc, bulbar cavity; ca, common genital antrum; ed, ejaculatory duct; erca, expanded roof of the common genital antrum; gc, glandular chamber; gp, genital pore; ma, male genital pore; od, ovovitelline duct; pb, penis bulb; pp, penis papilla; sd, sperm duct; sv, spermiducal vesicle.



Note. See DE BEAUCHAMP (1926: in part of pp. 350–351, fig. 13 E). The locality is Mt. Penrissen.

Bipalium sp. of Mt. Poi

The external appearance of this sexual, but undescribed species is shown in Fig. 6 (4). This is a rather small species (27mm long and 5mm wide in the preserved sexual specimen). The ground color of the dorsal side is a nearly black with 7 patterns of a light yellowish tint (a submarginal, retuse, head pattern, a cuspidate, transverse band on the neck, 4 pairs of transverse bands separated at the midline of the body, and a tail spot); a grayish coloration on the ventral side with transverse patterns prolonged from the dorsal side.

Note. See DE BEAUCHAMP (1925: 68, fig. 4 K; in part of pp. 349–350, fig. 12 B; 1961: 115, fig. 58 G). The genital anatomy is not known. The locality is Mt. Poi.

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SUMMARY

There are some taxonomic problems associated with the Bipaliidae. One has to do with the definition of the type species *Bipalium fuscatum* STIMPSON, 1857, from Central Japan (without a well-developed, cylindrical and muscular penis sheath). In Japan, Indonesia, and India, there are externally similar forms which have different types of copulatory apparatus (with a well-developed, cylindrical and muscular penis sheath). They are placed in a new genus *Novibipalium* gen. nov.: *N. falsifuscatum* sp. nov. from Central Japan and *N. alterifuscatum* sp. nov. from Java in Indonesia (or India).

Bipalium penrissenense DE BEAUCHAMP, 1925, from Sarawak (Borneo), East Malaysia, should be separated into 4 species; the other 3 species are: *B. penrissenicum* sp. nov., *Bipalium* sp. of Mt. Penrissen and *Bipalium* sp. of Mt. Poi.

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