

The genus *Humbertium* gen. nov., a new taxon of the land planarian family Bipaliidae (Tricladida, Terricola)

Robert E. Ogren¹ and Ronald Sluys²

¹ 88 Lathrop Street, Kingston, Pennsylvania 18704, U. S. A.

² Institute for Biodiversity and Ecosystem Dynamics, Zoological Museum, University of Amsterdam,
P.O. Box 94766, 1090 GT Amsterdam, The Netherlands

ABSTRACT. A new generic name is proposed for a group of 23 bipaliid species that share a unique feature of the female copulatory organ: the ovovitelline ducts turn dorsally before reaching the gonopore, and enter the female organ from an antero-dorsal aspect. They are distributed in Madagascar, India, Sri Lanka, China, Sarawak, and West Malaysia.

KEY WORDS: Platyhelminthes, Terricola, land planarian, copulatory apparatus, *Humbertium* n.g., geographic distribution

INTRODUCTION

The land planarian family Bipaliidae Stimpson, 1857 exhibits species with a diverse morphology, which is prominent in their copulatory organs. VON GRAFF (1899) used the diversity of head form as a basis for the new genera *Placocephalus* and *Perocephalus*, but did not use copulatory organs in his taxon definitions. More recently, OGREN & SLUYS (1998) have used copulatory organ morphology to unravel phylogenetic relationships in the family Bipaliidae. By examining a number of characters related to the copulatory organ, and presumed to be of phylogenetic importance, they constructed a phylogenetic tree for five major, *a priori* groups. Their Group A, comprising species with a pseudophallus (an elongate penis sheath), has been recently named as the new genus *Novibipalium* Kawakatsu, Ogren, & Froehlich, 1998. This paper proposes a new generic name for Group B1 + Group B2, which is characterized by the proflex condition of the ovovitelline ducts. In this paper the same basic characters, definitions and symbols are used as in the former paper (OGREN & SLUYS, 1998).

RESULTS

The 23 species falling within the groups B1 and B2 recognized by OGREN & SLUYS (1998), clearly belong to the family Bipaliidae in that they possess its defining characters: semilunar head, narrow creeping sole, continuous sensory groove, collared pharynx, and penis papilla. Moreover, the 23 species that will constitute the new genus are part of a selected group in Bipaliidae because they share the vertical position of the female organ (FCA-1), with genera *Bipalium* and *Novibipalium* (OGREN & SLUYS, 1998: fig. 7). These species of the new genus are considered to be a natural group or monophylum because they possess the same derived character, viz., the antero-dorsal entrance of the ovovitelline ducts into the female organ (character OVD-1). This suggests common ancestry. Therefore, we do here propose to recognize this group of proflex bipaliid species as a separate taxon, for which we provide the following new generic name and diagnosis:

Humbertium gen. nov.

Diagnosis: Bipaliidae with ovovitelline ducts turning dorsally before reaching the genital pore and having an antero-dorsal entrance to the female organ. Type species: *Perocephalus ravenalae* von Graff, 1899. [Copulatory apparatus described by MELL (1903)].

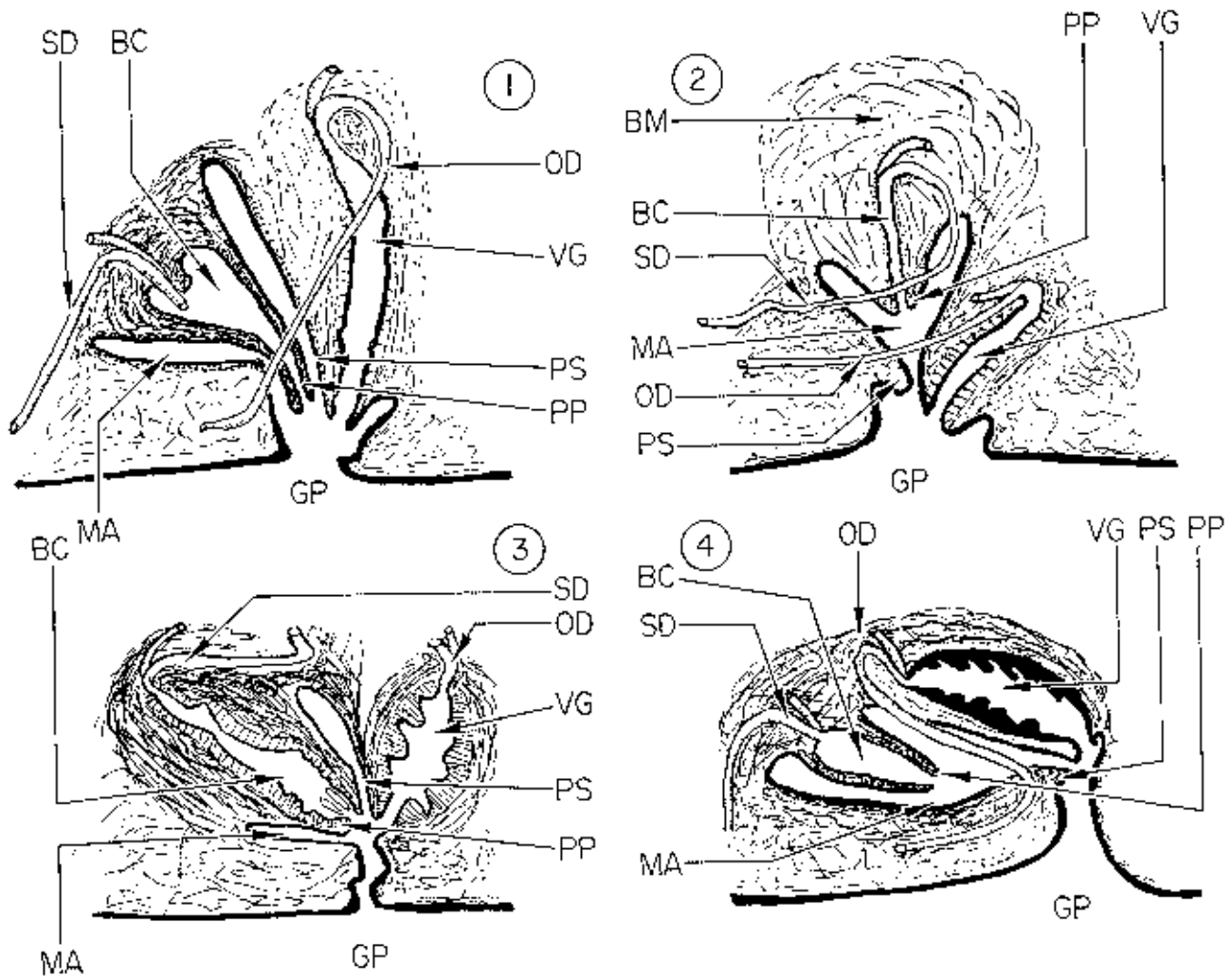
Etymology: the genus is named for Aloïs Humbert whose early paper (HUMBERT & CLAPARÈDE, 1862), describes several bipaliid species from Sri Lanka, now included in the new genus.

In our previous paper (OGREN & SLUYS, 1998) schematic profiles of the copulatory apparatus were provided for the *Humbertium* species *H. ravenalae* (von Graff, 1899) and *H. proserpina* (Humbert & Claparède, 1862). Repetition of these diagrams is not considered necessary to the present paper. Nevertheless, for the purpose of the current discussion, additional examples of copulatory apparatus are provided for *H. kelleri* (von Graff, 1899), *H. umbrinum* (Geba, 1909), *H. dodabettae* (De Beauchamp, 1930), and *H. woodworthi* (von Graff, 1899) (Figs 1-4). In the new genus *Humbertium* the male copulatory organ has essentially those features found in the genus *Bipalium*: large rounded

muscular bulbus, cone-shaped penis papilla and well-developed penis sheath. The female organ is vertical with the vagina opening into the common antrum. However, in *Humbertium* the ovovitelline ducts approach from the anterior, turn dorsally near the gonopore, and enter the female organ from an anterior-dorsal aspect (Figs 1-2).

The species that we consider to belong to the new genus *Humbertium* are listed in Table 1. For bibliographic information on the species we refer to OGREN & KAWAKATSU (1987, 1988).

As pointed out previously, within *Humbertium* there is a group (Group B2 of OGREN & SLUYS, 1998) consisting of three species with a prolapsed condition of the female organ (character FCA-2, organ tilted anteriorly); viz., *H. ceres*, *H. proserpina*, & *H. woodworthi*. They appear to



Figs 1-2. – Copulatory apparatus profiles showing location of ovovitelline ducts. Fig. 1. *Humbertium kelleri* (von Graff, 1899) (olim *Bipalium*) profile after MELL (1903, pl. 32, fig. 6); Fig. 2. *H. umbrinum* (Geba, 1909) (olim *Placocephalus*), profile after GEB (1909, pl. 20, fig. 5). Figures represent schematic sagittal views, modified and simplified; anterior is to the left, ventral is bottom; male organ on the left. BC, bulbus cavity; BM, bulbus muscle; GP, genital pore (=gonopore); MA, male genital antrum; OD, ovovitelline duct; PP, penis papilla; PS, penis sheath; SD, sperm duct; VG, vagina (= female canal).

Figs 3-4. – Copulatory apparatus profiles showing location of ovovitelline ducts. Fig. 3. *Humbertium dodabettae* (de Beauchamp, 1930) (olim *Bipalium*), profile after de BEAUCHAMP (1930: 687, fig. 8); Fig. 4. *Humbertium woodworthi* (von Graff, 1899) (olim *Bipalium*), profile after MELL (1903, pl. 31, fig. 4). Abbreviations as in Figs 1-2.

constitute a distinctive phylogenetic sister group to the other members of *Humbertium*, represented in Group B1 (cf. OGREN & SLUYS, 1998) of which the monophyletic status remains to be supported by apomorphic characters.

Table 1 shows that the greatest external variation occurs in Madagascar. External dorsal appearance of species shows no clear pattern and varies between species from one stripe, to two, three, four and four-five stripes. There is also reported intraspecific variation in number of stripes. There are three species with transverse banding known from Sarawak and West Malaysia. Two species with prolapsed female organ (*H. ceres* and *H. proserpina*) occur on Sri Lanka; Another prolapsed species (*H. woodworthi*) is found only on Madagascar.

DISCUSSION

Taxonomy

The general characters of the male organ in *Humbertium* are shared with species of the genus *Bipalium* as shown in the character matrix of OGREN & SLUYS (1998). *Humbertium* species are different from the genus *Novibipalium* because in *Humbertium* species the male antrum wall (character MAW) does not generally form a pseudophallus. However, one species, *Humbertium pseudophallicum* (de Beauchamp, 1925) has an elongated, moderately muscular pseudophallus (without an inner, thick layer of circular fibers) formed by the male antrum wall (MAW). This is considered an unusual feature for a species of this genus. The several characters employed in this study were not considered the result of distortion from fixation or preservation.

The present generic definition is based on the single apomorphic condition (OVD-1) that can be learned only after histological sections have been made and examined. External body characters are readily observed, but do not correlate with the presence of the proflex (OVD-1) condition. For example, head form is regularly placoid, with a few species having a head with prominent recurved auricles. Great variability exists for dorsal body patterns. Some species are plain dorsally; or have longitudinal stripes; or show transverse banding. Because these features are not unique to *Humbertium*, and do not correlate with the proflex condition, they are not useful as reliable features to supplement the generic definition.

Biogeography

In the map published by OGREN et al. (1992: p. 99, Plate I) the distribution of Bipaliidae is shown (see also KAWAKATSU & OGREN, 1998: 8, fig. 11); their distributional records are also registered in a biogeographic database of all nominal species of terrestrial planarian (SLUYS, 1998, 1999). Species of *Humbertium* occur primarily in Madagascar, India, Sri Lanka and Sarawak. How can this disjunct distribution of *Humbertium* species be

TABLE 1

Species of *Humbertium*, with an indication of their external appearance and geographic distribution.

Ψ: This symbol indicates the species has the prolapsed condition (FCA-2) of female organ.

*: The asterisk indicates assignment is probable but not certain because the OVD-1 character is not clearly shown in diagram or text. Although these were reported as part of 23 species in Group B1 + B2 (OGREN & SLUYS, 1998), it is clear that we must await new knowledge of their copulatory organs before their present temporary inclusion within *Humbertium* can be supported. (Since in Madagascar all Bipaliidae species, where the copulatory organ is known, have the OVD-1 character, it is expected that this feature will be confirmed in the three marked species).

Madagascar
<i>Humbertium ferrugineoideum</i> (Sabussowa, 1925) comb. nov. (plain black)*
<i>Humbertium ferrugineum</i> (von Graff, 1899) comb. nov. (3 stripes)
<i>Humbertium girardi</i> (von Graff, 1899) comb. nov. (5 stripes)
<i>Humbertium kelleri</i> (von Graff, 1899) comb. nov. (3 stripes)
<i>Humbertium ravenalae</i> (von Graff, 1899) comb. nov. (2-4 stripes)
<i>Humbertium sikorai</i> (von Graff, 1899) comb. nov. (1-3 stripes)*
<i>Humbertium umbrinum</i> (Geba, 1909) comb. nov. (plain brown, paler medially)
<i>Humbertium voigti</i> (von Graff, 1899) comb. nov. (2 medial stripes)
<i>Humbertium woodworthi</i> (von Graff, 1899) comb. nov. (4 stripes) Ψ
India, Sri Lanka, China
<i>Humbertium core</i> (de Beauchamp, 1930) comb. nov. (3 stripes, India)
<i>Humbertium depressum</i> (Ritter-Záhony, 1905) comb. nov. (3 stripes, India & Sri Lanka)
<i>Humbertium dodabettiae</i> (de Beauchamp, 1930) comb. nov. (plain, India)
<i>Humbertium negritorum palnisium</i> (de Beauchamp, 1930) comb. nov. (India)*
<i>Humbertium ceres</i> (Moseley, 1875) comb. nov. (2 medial stripes, Sri Lanka) Ψ
<i>Humbertium diana</i> (Humbert, 1862) comb. nov. (2 medial stripes, Sri Lanka)
<i>Humbertium longicanale</i> (Sabussowa, 1925) comb. nov. (1 stripe, China)
<i>Humbertium phoebe</i> (Humbert, 1862) comb. nov. (2 marginal stripes, Sri Lanka)
<i>Humbertium proserpina</i> (Humbert, 1862) comb. nov. (4 stripes, Sri Lanka) Ψ
<i>Humbertium univittatum subboreale</i> (Sabussowa, 1925) comb. nov. (plain, China)
Sarawak and West Malaysia
<i>Humbertium penrissenense</i> (de Beauchamp, 1925) comb. nov. (transverse band, Sarawak; cf. KAWAKATSU et al., 1998)
<i>Humbertium pseudophallicum</i> (de Beauchamp, 1925) comb. nov. (transverse band, Sarawak)
<i>Humbertium penangense</i> (Kawakatsu, 1986) comb. nov. (transverse band, W. Malaysia)

explained? It is possible that human migrations accidentally introduced species, for example from Madagascar to India. However, Continental Drift may provide an alternative explanation for the distribution pattern. Before major continental drifting these regions (Madagascar, India, Sri Lanka) were nearly adjacent land masses, being parts of Gondwanaland in the early Jurassic Period (HALLAM, 1994). Bipaliidae presumably had evolved before the time of the Cretaceous Period and populated part of Gondwanaland. By the late Cretaceous the landmasses had become separated, thus enabling speciation in the various land planarian populations. According to this viewpoint, *Humbertium* species of Madagascar would represent the result of speciation. Under this scenario, *Humbertium* species may have dispersed into West-central China, West Malaysia, and Sarawak after India had collided with the Asian land mass between 10 and 20 million years ago. This scenario therefore implies that Asian *Humbertium* species are more closely related to Indian species than to species from Madagascar. Future and more in-depth phylogenetic analyses of the genus may be able to test this prediction.

Humbertium species are the primary Bipaliidae on Madagascar. There are 23 bipaliids known from Madagascar (See the list of species for Madagascar in OGREN et al., 1997; those marked + have known copulatory apparatus). There are 11 species with copulatory apparatus known and all except one belong to *Humbertium*. The one exception is *Bipalium kewense* Moseley, 1878, which does not have the proflex (OVD-1) character. This species is known to be a cosmopolitan migrant with human activities (WINSOR, 1983), and is not considered part of the indigenous fauna of Madagascar. *Humbertium* species on Madagascar display the widest variety of longitudinal stripe patterns for the genus.

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