

# Review of the Sunda *weberi*-group of *Orthomorpha* Bollman, 1893, with the description of two new species (Diplopoda, Polydesmida, Paradoxosomatidae)

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*Review of the Sunda weberi-group of Orthomorpha Bollman, 1893, with the description of two new species (Diplopoda, Polydesmida, Paradoxosomatidae).*— The *weberi*-group of *Orthomorpha* Bollman, only located in Sunda, comprises eight species. *Orthomorpha beroni*, n. sp., from Java, and *O. melischi*, n. sp., from West Sumatra, are diagnosed, and *O. weberi* (Pocock, 1894) and *O. conspicua* (Pocock, 1894), both from Java, are redescribed. A key is provided to distinguish the eight species of the group. All of them, including both new forms, appear to be unusually uniform in gonopod structure. The main species-specific differences lie in the position and outlines of the paraterga, the sculpture of the metaterga, arrangement of both pleurosternal keels and ♂ tarsal brushes. Hence the fact that *O. beaumontii* (Le Guillou, 1841), the type species of *Orthomorpha*, which is known only from a ♀ holotype (supposedly from Borneo), does not preclude the taxon's formal incorporation both into the *weberi*-group and into the key. Both new species differ from congeners and each other mainly in a peculiar combination of size, development of the paraterga, sculpture of the metaterga and shape of the epiproct.

Key words: Diplopoda, *Orthomorpha*, *weberi*-group, Taxonomy, Identification key, Indonesia.

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## Introduction

The genus *Orthomorpha* Bollman, 1893, seems to be one of the most prolific Oriental paradoxosomatid millipedes, currently encompassing 18 species. In the latest review of *Orthomorpha*, HOFFMAN (1977) split the genus into three groups and briefly discussed their distribution. Group 1 is composed of four species from Burma, Indochina and Java, and is characterized by the lack of median processes/lobes between the ♂ coxae 4. Group 2 consists of only two species from Indochina and the Malay peninsula. These species have a single paramedian sternal process between the ♂ coxae 4 which is its distinguishing feature. Group 3 is by far the largest, covering the entire generic range from Indochina and Burma to Bali and Lombok. It is defined by the presence of two paramedian cones between the ♂ coxae 4.

Within Group 3, HOFFMAN (1977) outlined a smaller aggregate of four purely Sunda species further characterized by a particularly strongly reduced median lobe at the tip of the gonopod tibiotarsus. According to JEEKEL (1964), this highly homogeneous subunit is preferably treated as the *weberi*-group. At present it includes *O. weberi* (Pocock, 1894), *O. conspicua* (Pocock, 1894) and *O. flaviventer* (Attems, 1898), all from Java, *O. baliorum* Golovatch, 1994, from Bali, *O. francisca* Attems, 1930, from Lombok, and probably also *O. beaumontii* (Le Guillou, 1841), from Borneo. The latter taxon is the type species of *Orthomorpha* and is known only from a beautifully re-described ♀ holotype (see JEEKEL, 1963). Since the gonopod structure within the *weberi*-group appears unusually uniform (the strongest argument testifying to its homogeneity), the main emphasis in species discrimination must be put on peripheral characters (see JEEKEL, 1963, 1964; HOFFMAN, 1977). Hence the formal incorporation of *O. beaumontii* into the group.

The aim of this work is to review some material of the Sunda *weberi*-group, which leads to the description of two new species and the redescription of two older species based on their type materials. A key to the constituent members of the group, using all available literature sources

(POCOCK, 1894; ATTEMS, 1898, 1930, 1937; JEEKEL, 1963; GOLOVATCH, 1994) is also presented. Zoogeographically, one of the new congeners contributes to making the distribution pattern of both the group and the genus more natural, because no indigenous form of *Orthomorpha* has been recorded in Sumatra (cf. HOFFMAN, 1977). The *weberi*-group seems purely Sunda, ranging from West Sumatra to Lombok (and possibly Borneo).

## Material and methods

Materials serving as the basis for this contribution have been returned to or shared with the collections of the following institutions as indicated herein: The Natural History Museum, London (NHML), National Natural History Museum, Sofia (NHMS), Senckenberg Museum, Frankfurt (SMF), Zoologisk Museum of the University of Copenhagen (ZMUC), Naturhistorisches Museum Wien, Vienna (NHMW), and Zoological Museum, Moscow State University (ZMUM).

## Results

*Orthomorpha conspicua* (Pocock, 1894) (figs. 1-2)

*Strongylosoma conspicuum*-Pocock, 1894: 368, fig. 9.

*Orthomorpha conspicu*-Attems, 1898: 339.

*Strongylosoma conspicuum*-Attems, 1937: 280.

*Orthomorpha conspicua*-Jeekel, 1963: 265.

*Orthomorpha conspicua*-Jeekel, 1964: 360, fig. 9.

*Orthomorpha conspicua*-Jeekel, 1968: 45.

*Orthomorpha conspicua*-Hoffman, 1977: 700.

### Material studied

♂ cotype (NHML), Buitenzorg (Indonesia, Java, currently Bogor), without date, leg. Max Weber.

### Diagnosis

It differs from the apparently very closely related *O. weberi* by a number of minor peripheral and gonopodal characters. See key below.

### Redescription

Length ca. 33 mm, width of midbody pro-

and metazona 2.5 and 3.6 mm, respectively. Coloration pale brownish (must have faded, stated to have been black in the original description), paraterga yellow. Legs and ventrum somewhat paler brown to yellowish.

Head considerably narrower than somite 2; collum and somite 3 subequal in width, both narrowest, either only a little narrower than both subequal somites 2 and 4, latter a bit narrower than somite 5. Body broadest and parallel-sided on somites 5-17, onward rather rapidly tapering.

Antennae moderately long, in situ reaching the end of somite 3 dorsally. Paraterga very strongly developed (fig. 1), beginning as big lateral flaps from collum, set very high, level to or slightly above dorsum, somewhat elevated, very strongly bordered both ventrally and, especially, dorsally; fore angle always broadly rounded, lateral edge on postcollar somites with a distinct incision at about anterior third, caudal corner subrectangular and pointed on collum, invariably protruding backward beyond rear tergal contour and pointed on subsequent somites, in lateral view very thick and oblique (pore-bearing) or thinner and straighter (poreless) ridges. Ozopores lateral, evident, lying inside a shallow, ovoid groove. Surface generally smooth, at most faintly rugulose, metaterga polished, shining almost throughout, prozona very delicately and metazona below paraterga somewhat more coarsely shagreened. Axial line virtually untraceable. Tergal setae medium-sized, pattern 2+2 and 3+3 in two transverse rows; setae mostly broken off, rarely preserved only in fore rows, traceable only as insertion points in fore rows and as very little but evident, often flattened (especially paramedian pair) knobs in rear rows. Somites moderately strongly constricted, suture dividing pro- and metazona rather shallow, thin, evidently but not too conspicuously beaded. Transverse metatergal sulcus developed on somites 5-18, lineiform, often very poorly beaded at bottom, rather shallow, not reaching the bases of paraterga, missing on somite 19. Pleurosternal carinae present, moderately well-developed, gradually disappearing toward somite 5, as small but evident, sometimes sharp teeth at best only slightly protruding caudally beyond rear metazonal

contour. Epiproct very long, digitiform, almost entirely and evenly truncated, subapical papillae barely traceable, very close to tip. Subanal scale semi-circular, caudal margin rounded, with a pair of small, well separated, setigerous paramedian knobs at caudal margin.

Sternites moderately densely setose, without modifications, except for a pair of setose cones between  $\sigma^7$  coxae 4. Legs long, probably somewhat incrassate in  $\sigma^7$ , densely setose ventrally, without adenostyles; tarsal brushes present until about somite 12, onward thinning out.

Gonopods as in figure 2, dorso-parabasal groove on femorite quite conspicuous.

*Orthomorpha weberi* (Pocock, 1894) (figs. 3-4)

*Strongylosoma weberi*-Pocock, 1894: 367, fig. 4.

*Orthomorpha weberi*-Attems, 1898: 339.

*Orthomorpha weberi*-Attems, 1937: 69.

*Orthomorpha weberi*-Jeekel, 1963: 265.

*Orthomorpha weberi*-Jeekel, 1964: 360.

*Orthomorpha weberi*-Jeekel, 1968: 45.

*Orthomorpha weberi*-Hoffman, 1977: 700.

#### Material studied

$\sigma^7$  cotype (NHML), Buitenzorg (Indonesia, Java, currently Bogor), with neither date nor collector, but obviously also taken by Max Weber.

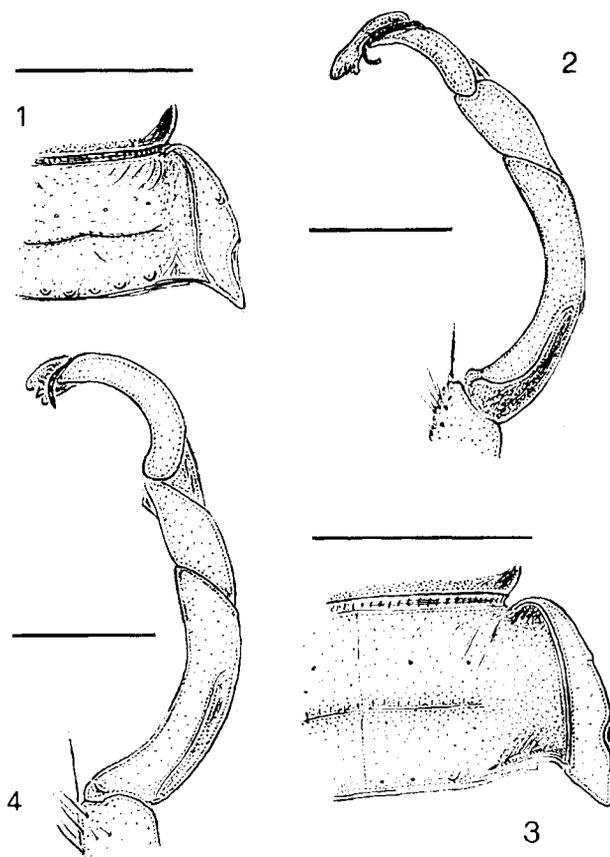
#### Diagnosis

See the diagnosis of *O. conspicua* above and the key below.

#### Redescription

Length ca. 35 mm, width of midbody pro- and metazona 2.95 and 4.7 mm, respectively. Coloration brown (must have faded, stated to have been pitch black in the original description), bases of paraterga marble brown, peritremata (calluses) and adjacent parts of paraterga paler, yellowish.

Other main characters like in *O. conspicua*, but paraterga somewhat narrower, a little more strongly elevated, their lateral calluses more distinctly bordered dorsally (fig. 3); setigerous knobs in rear row on metaterga very small, indistinct; axial line present, though poorly devel-



Figs. 1-4. 1, 2. *Orthomorpha conspicua* (Pocock, 1894), ♂ cotype: 1. Paratergum 10, dorsal view; 2. Left gonopod, lateral view. 3, 4. *Orthomorpha weberi* (Pocock, 1894), ♂ cotype: 3. Paratergum 10, dorsal view; 4. Left gonopod, lateral view. (Scales: 1, 3 2.0 mm; 2, 4 0.5 mm.)

1, 2. *Orthomorpha conspicua* (Pocock, 1894), ♂ cotipo: 1. Paratergo 10, vista dorsal; 2. Gonopodo izquierdo, vista lateral. 3, 4. *Orthomorpha weberi* (Pocock, 1894), ♂ cotipo: 3. Paratergo 10, vista dorsal; 4. Gonopodo izquierdo, vista lateral. (Escala: 1, 3 2.0 mm; 2, 4 0.5 mm.)

oped; pleurosternal carinae as little caudal teeth present until somite 16, onward missing; epiproct broadly truncated, preapical papillae prominent, also quite close to tip; tarsal brushes present only until somite 10, onward thinning out.

Gonopods (fig. 4) typical for the group, yet with a somewhat less conspicuous dorso-parabasal groove on femorite.

*Orthomorpha beroni* n. sp. (figs. 5-7)

Material studied

Holotype: ♂ (NHMS), Indonesia, Java, Pass Puncak, 34 km from Bogor, 1500-1600 m, 6 VII 1994; leg. P. Beron & V. Beshkov. Paratypes: 2 ♂♂, 1 ♀ (NHMS), 1 ♂, 1 ♀ (ZMUM), 1 ♂ (SMF), 1 ♂ (ZMUC), same locality, together with holotype.

**Name**

In honour of my good friend Dr. Petar Beron, collector of this species.

**Diagnosis**

It differs from other members of the *weberi*-group by a peculiar combination of peripheral characters, namely size, development of paraterga, epiproct, etc. (see key below).

**Description**

Length ca. 34-38 mm (♂, ♀), width of midbody pro- and metazona 2.45-2.7 and 3.8-4.0 mm (♂), 3.0-3.1 and 4.5-4.6 mm (♀), respectively. Holotype ca. 36 mm long, 2.7 and 4.0 mm wide on midbody pro- and metazona, respectively. Background coloration blackish-brown dorsally, strongly contrasting with yellow to yellow-brownish calluses on paraterga and rather narrow marbled transition zones both dorsally and ventrally on paraterga; tip of antennae whitish; head, sides and legs dark brown; antennae brown too, especially distally, up to blackish; ventrum pale brown to brown, often same colour as lighter patches both on pleurosternal areas and epiproct.

Antennae moderately long, in situ almost reaching the end of somite 3 (♂) or only scarcely surpassing somite 2 dorsally (♀). Other main characters like in *O. conspiciua*, but paraterga somewhat narrower, in ♂ a little more strongly elevated than in ♀, their lateral calluses also more distinctly bordered dorsally than ventrally and more strongly ventrally on pore-bearing somites; setigerous knobs in rear row varying from similar to *O. weberi* to rather considerably better developed, especially so due to lateralmost knobs (fig. 5); caudal corner of paraterga considerably less strongly surpassing rear tergal contour (figs. 5, 6); transverse sulcus on metaterga from almost unbeaded to delicately incised; suture dividing pro- and metazona rather shallow, thin, from rather indistinctly to rather evidently but not too conspicuously beaded; axial line missing; pleurosternal carinae as little caudal teeth gradually reduced in size until somite 16, traceable as minute denticles even on somites 17-18; epiproct broadly truncate, preapical papillae hardly traceable, placed quite close to tip (fig. 7); tarsal brushes present only until somites 10-11, onward thinning out.

Gonopods typical for the group, as in figure 4 or 10, but with an especially conspicuous dorso-parabasal groove on femorite extending almost up to lateral demarcation sulcus between femorite and post femoral part.

*Orthomorpha melischi* n. sp. (figs. 8-10)

**Material studied**

Holotype: ♂ (NHMW, ded. Dr. R. Melisch and Dr. J. Spelda), Indonesia, Sumatra, Lampung Prov., Way Kambas, forest road, 10 m, 26 XII 1993; leg. R. Melisch.

**Name**

In honour of Dr. R. Melisch, collector of this species.

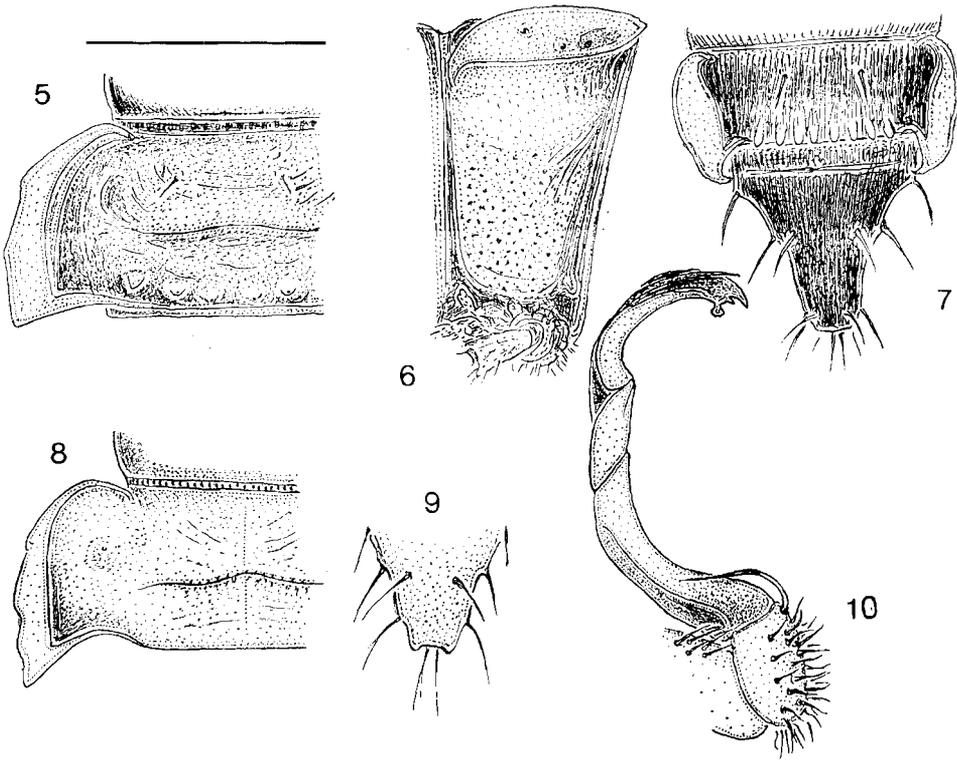
**Diagnosis**

This new species is especially related to *O. francisca* Attems, 1930, but differs in certain characters given in the key below.

**Description**

Length ca. 32 mm, width of midbody pro- and metazona 2.5 and 3.9 mm, respectively. Coloration dark brown to castaneous, paratergal calluses paler brownish-red, not obviously contrasting to a darker background. Legs (except proximal 2/3-3/4 coxae and femora) somewhat paler brown to yellowish; ventrum, calluses on paraterga 19, tip of both epiproct and antenna, and most coxae and femora whitish; antennomere 7 blackish-brown.

All main characters as in *O. conspiciua*, but head considerably narrower than collum, somites 1-4 subequal in width, each considerably narrower than somite 5. Body broadest on somites 5-17, onward rapidly tapering. Paraterga (fig. 8) set lower, subhorizontal, never reaching the level of a more strongly convex dorsum, very strongly bordered both ventrally and, especially, dorsally; fore angle always broadly rounded, lateral edge on postcollar somites with a distinct incision at about anterior 1/3, with one incision on collum and two on somites 2-4, caudal corner acutangular (ca. 65-70°), pointed and within rear tergal contour on collum, invariably protruding backward beyond rear tergal contour and also pointed on subsequent somites, in lateral view as very thick and oblique (pore-



Figs. 5-10. 5-7. *Orthomorpha beroni* n. sp., ♂ paratype: 5. Paratergum 10, dorsal view; 6. Somite 10, lateral view; 7. Caudal end of body, dorsal view. 8-10. *Orthomorpha melischi* n. sp., ♂ holotype: 8. Paratergum 10, dorsal view; 9. Epiproct, dorsal view; 10. Right gonopod, lateral view. (Scales: 5-9 2.0 mm; 10 1.0 mm.)

5-7. *Orthomorpha beroni* n. sp., ♂ paratipo: 5. Paratergo 10, vista dorsal; 6. Somito 10, vista lateral; 7. Zona caudal del cuerpo, vista dorsal. 8-10. *Orthomorpha melischi* sp. n., ♂ holotipo: 8. Paratergo 10, vista dorsal; 9. Epiprocto, vista dorsal; 10. Gonopodo derecho, vista lateral. (Escala: 5-9 2,0 mm; 10 1,0 mm.)

bearing) or thinner and straighter (poreless) ridges. Ozopores lateral, evident, lying inside a shallow, ovoid groove strongly sinuate in dorsal view. Surface generally smooth, at most very faintly rugulose, metaterga polished, shining almost throughout, prozona very delicately and metazona below paraterga somewhat more coarsely shagreened, regions close to pleurotergal carinae particularly strongly microgranulate on a few anteriormost somites. Axial line scarcely traceable. Tergal setae relatively long, a lit-

tle longer than in *O. beroni*, pattern 2+2 and probably 3+3 in two transverse rows; setae mostly broken off, rarely preserved in fore rows, traceable only as insertion points in fore rows, almost untraceable in rear rows due to completely missing supporting knobs. Somites moderately strongly constricted, suture dividing pro- and metazona rather shallow, thin, rather evidently but not too conspicuously beaded. Transverse metatergal sulcus traceable on somites 3-4, fully developed on somites 5-18, lineiform,

Key to species of the *weberi*-group of *Orthomorpha*.Clave de las especies del grupo *weberi* de *Orthomorpha*.

1. Adult body particularly small, only ca. 2.6 mm in width (♂). Bali.	<i>O. baliorum</i> Golovatch, 1994
Adult body larger, at least 3.5 mm in width. Other Sunda islands.	2
2. Paraterga mostly level to or even above dorsum (fig. 6). Coloration of metaterga contrasting as very pale calluses against a very dark remaining background.	3
All paraterga below dorsum. Colour pattern not so striking, calluses only being inconspicuously paler than a dark remaining background	6
3. Rear row of tergal setae barely traceable even as insertion points due to lack of knobs (figs. 3, 8), knobs occasionally traceable only from somite 10 onward.	4
Rear row of tergal setae rather easily traceable as 3+3 knobs evident even in front of somite 10 (figs. 1, 5). Java.	5
4. ♂ tarsal brushes entirely wanting. Epiproct with very distinct apical papillae. Lombok.	<i>O. francisca</i> Attems, 1930
♂ tarsal brushes present until midbody legs. Epiproct broadly truncated, without evident apical papillae. Java.	<i>O. weberi</i> (Pocock, 1894)
5. Paraterga relatively strongly produced caudally, paratergal calluses in dorsal view rather strongly sinuate near ozopores (fig. 1).	<i>O. conspicua</i> (Pocock, 1894)
Paraterga relatively slightly produced caudally, paratergal calluses in dorsal view rather poorly sinuate near ozopores (fig. 5).	<i>O. beroni</i> n. sp.
6. Pleurosternal carinae only on a few anterior-most somites. Poorly developed knobs of rear tergal row traceable only from somite 10 onward. Java.	<i>O. flaviventer</i> (Attems, 1898)
Pleurosternal carinae traceable at least until somite 15. Virtually no knobs of rear tergal row	7
7. Paratergal calluses with neither anterolateral incision nor conspicuous sinuosity near ozopore in dorsal view. Sulcus present only from metatergum 5 onward. Axial line wanting. Epiproct without apical papillae.	<i>O. beaumontii</i> (Le Guillou, 1841)
Paratergal calluses with both an anterolateral incision and a conspicuous sinuosity near ozopore (fig. 8). Sulcus present already from metatergum 3 onward. Axial line traceable. Epiproct without apical papillae (fig. 9). Sumatra.	<i>O. melischi</i> n. sp.

often poorly incised, rather shallow, not reaching the bases of paraterga, missing on somite 19. Pleurosternal carinae present, mostly as a well-developed caudal tooth only slightly protruding caudally beyond rear metazonital contour and gradually coming to naught toward somite 16, already missing from 17th.

Epiproct (fig. 9) very long, digitiform, both apical and subapical papillae very little, the latter more strongly removed from tip than in *O. beroni*. Subanal scale semi-circular, caudal margin rounded, with a pair of large, well separated, setigerous paramedian knobs at caudal margin.

Tarsal brushes present only on pregonopodal legs, barely visible already on legpair 6, onward thinning out.

Gonopods as in figure 10, dorsoparabasal groove on femorite conspicuous.

### Acknowledgements

My deepest gratitude to Dr. Petar Beron (NHMS) for making his highly important collections available for study, to Dr. Paul Hillyard (NHML), Dr. Manfred Grasshoff (SMF), and Dr. Jürgen Gruber (NHMW) for the loan of some older type materials under their care, and to Dr. Jörg Spelda (Stuttgart) who brought my attention to and allowed me to describe the Sumatran material.

### Resumen

*Revisión del grupo weberi de Orthomorpha Bollman, 1893 de Sunda, con la descripción de dos nuevas especies (Diplopoda, Polydesmida, Paradoxosomatidae)*

El grupo *weberi* de *Orthomorpha* Bollman, localizado únicamente en Sunda, comprende ocho especies. En este trabajo se diagnostican *Orthomorpha beroni*, sp. n. de Java y *O. melischi* sp. n. del oeste de Sumatra y se redescubren *O. weberi* (Pocock, 1894) y *O. conspicua* (Pocock, 1894), ambas de Java. Se incluye una clave para distinguir las ocho especies del grupo. Todas ellas, incluidas las

dos nuevas son inusualmente uniformes en la estructura de los gonopodos. Las principales diferencias específicas son la posición y bordes del paratergo, el relieve del metatergo y la disposición de las quillas pleurosternales y de los cepillos tarsales del ♂. De ahí que *O. beaumontii* (Le Guillou, 1841), la especie tipo de *Orthomorpha* de la cual sólo se conoce el holotipo ♀ (supuestamente de Borneo), no excluye la incorporación del taxón en el grupo *weberi* o en la clave de identificación. Las dos especies nuevas difieren de sus congéneres y entre sí, principalmente, en una peculiar combinación del tamaño, desarrollo del paratergo, relieve del metatergo y forma del epiprocto.

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