SPIXIANA	13	1	9–24	München, 31. März 1990	ISSN 0341–8391

Diplopoda from the Nepal Himalayas. The first Paradoxosomatidae

(Polydesmida)*)

By **Sergei I. Golovatch**

Golovatch, S. I. (1989): Diplopoda from the Nepal Himalayas. The first Paradoxosomatidae (Polydesmida). – Spixiana 13/1: 9–24

The first representatives of the millipede family Paradoxosomatidae are being recorded in Nepal: *Orthomorpha coarctata* (de Saussure, 1860) (pantropical), *Oxidus gracilis* (C. Koch, 1847) (subcosmopolitan), *Paranedyopus cylindricus* (Carl, 1935) (hitherto known from Darjeeling District, India, only), *P. martensi*, spec. nov., *P. schawalleri*, spec. nov., *P. similis*, spec. nov., *P. affinis*, spec. nov., and *Orophosoma fechteri*, spec. nov.

Sergei I. Golovatch, Institute of Evolutionary Morphology and Ecology of Animals, USSR Academy of Sciences, Moscow V-71, Leninsky prospekt 33, USSR.

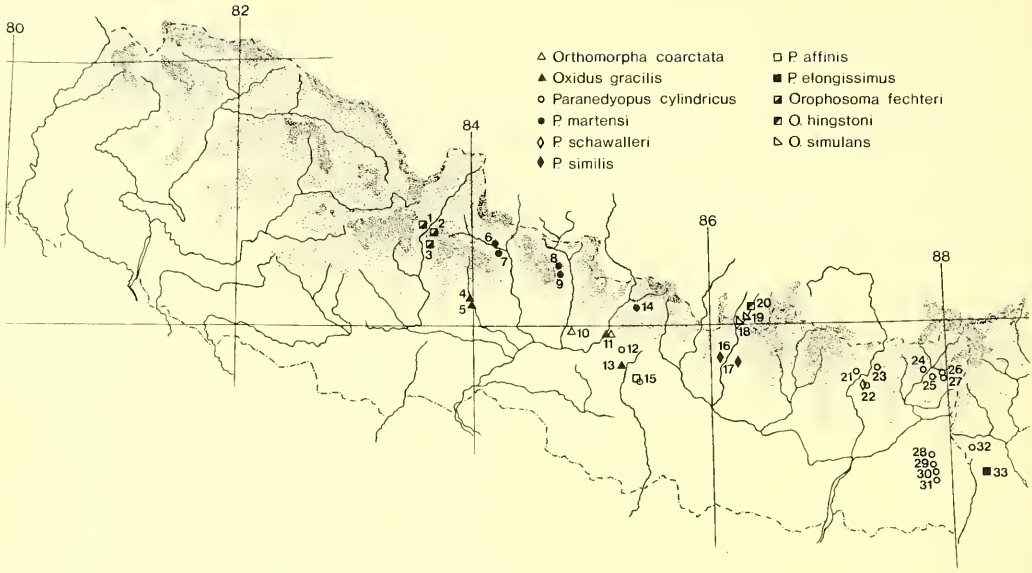
Introduction

This is certainly just a formal thing that members of the millipede family Paradoxosomatidae have almost never been reported from Nepal, as this group is known to be dominant in the diplopod faunas of both Indian and Farther Indian regions (Attems 1936). This statement is further proven by the magnificent collection of Diplopoda managed in Nepal since 1969 by Prof. Dr. Jochen Martens and his collaborators and now handed to me for taxonomic work: Paradoxosomatidae do constitute the bulk of the Nepalese fauna as well.

Formally, only *Orthomorpha (Orthomorpha) simulans* Carl, 1935 has hitherto been recorded in Nepal (Carl 1935), but one should be aware of the fact that this paradoxosomatid derived from Rongshar Valley (s. map) which lies at the very border with Tibet, and Tibet proper. At the present, this form together with *Orthomorpha (O.) hingstoni* Carl, 1935, another Tibetan species, constitute the genus *Orophosoma* Jeekel, 1980.

This contribution is limited to only a few members of the wealthy paradoxosomatid fauna of Nepal for several reasons. For one thing, I could not manage more during my short stay in Mainz in January-March 1989, as I had to deal also with other projects. Secondly, I am able to put on record practically all the more or less easily recognizable genera from the materials at hand, whereas the remaining forms seem to be very obscure, with a lot of new genera involved. Last but not least, we cannot avoid a careful, step-by-step treatment of a particularly species-rich material, which is the way I cope with Nepalese Polydesmida from the Martens Collection (Golovatch 1986, 1987a, b).

*) Results of the Himalaya Expeditions of J. Martens, No. 152. – For No. 151. see: Stuttgarter Beitr. Naturk., 441: 1–25, 1989. – J. M. sponsored by Deutscher Akademischer Austauschdienst and Deutsche Forschungsgemeinschaft.



Map. Distribution of some Nepalese Paradoxosomatidae and their immediate allies.

1. Purano Marpha, 2. ascent to Thaksang, 3. Chadziou Khola, 4. Hyangja/Mahendra Cave, 5. Pokhara, 6. Chame, 7. Thimang 8. Chuling Khola, 9. Tabruk Kharka, 10. Ankhu Sangu, 11. Trisuli, 12. Shepuri, 13. Kathmandu City, 14. Gosainkund, 15. Phulchoki Mt., 16. ascent to Ting Sang La, 17. Jiri and sourroundings, 18. Rongshar Valley, 19. Tropde, 20. Yatung, 21. Moyam, 22. Mure/Hurure, 23. Pahakhola, 24. Lungthung, 25. descent to Hellok, 26. Omje Kharka, 27. Yamputhin, 28. Dhorpar Kharka/Paniporua, 29. Gitang Khola, 30. Mai Majuwa Khola, 31. Mai Pokhari, 32. Ghum/Darjeeling, 33. Kurseong.

Both type and non-type materials treated below have been shared with and/or returned to the collections of the Senckenberg Museum, Frankfurt/M. (SMF), Zoologische Staatssammlung, München (ZSM), Zoological Museum of the State University of Moscow (ZMUM), and Zoologisk Museum, Copenhagen (ZMUC), as indicated hereinafter. All the holotypes are housed at the SMF. The scales of the figures are in mm.

Orthomorpha coarctata (de Saussure, 1860)

Polydesmus coarctatus de Saussure, 1860, Mém. Soc. Phys. Hist. nat. Genève **15**: 297; Figs.

Material. 1 ♂, 4 juv. (SMF), Nepal, Nuwakot Distr., Trisuli, cultivated land, forest remains, 600–650 m, 21.–22. VII. 1983; 1 ♂, 1 ♀, 4 juv. (SMF), Dhading Distr., Ankhu Khola Valley, Ankhu Sangu, 650 m, cultivated land, forest remains, 24.–25. VII. 1983; all leg. J. Martens & W. Schawaller.

Remarks. This species is known to be pantropical, with Southeast Asia being its presumable origin centre (Jeekel, 1968). New for the fauna of Nepal.

Oxidus gracilis (C. Koch, 1847)

Fontaria gracilis C. Koch, 1847, System der Myriapoden, etc.: 142.

Material. 27 juv. (SMF), Nepal, Kathmandu City, Ganabahal, 1350 m, 17.–22. III. 1980; 14 ♂, 8 ♀ (SMF), Kaski Distr., Pokhara town, 900 m, house walls, 11. V. 1980; 1 ♂ (ZSM), Kaski Distr., between Hyangja, Cave Mahendra

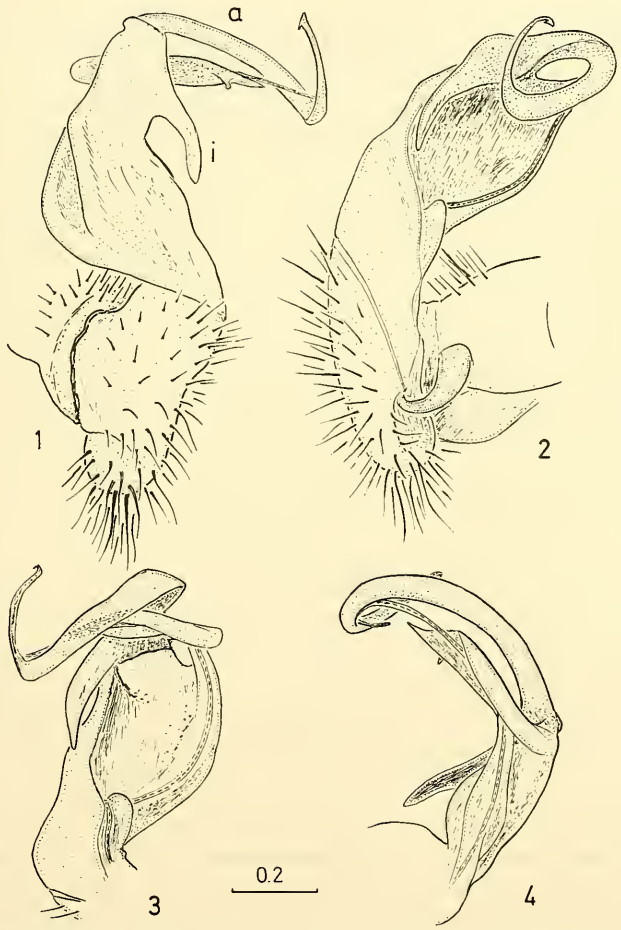
& Pokhara, 1000–1200 m, 11. V. 1980; all leg. J. Martens & A. Ausobsky; 2 ♂, 2 ♀ (SMF), Rasuwa Distr., Trisuli village, road, 570 m, 21. IV. 1973; leg. J. Martens.

Remarks. This subcosmopolitan species of (South)east Asian origin may obviously be considered as an anthropochorous element in the fauna of Nepal, as all the records are restricted to human settlements. Like the previous form, this one is new for the Nepalese fauna.

Paranedyopus martensi, spec. nov.

Figs 1–6

Holotype: ♂ (SMF), Nepal, Rasuwa Distr., Trisuli Valley, Gosainkund, Syng Gyang, 3200 m, *Abies* forest, 25. IV. 1973, leg. J. Martens. – Paratypes: 2 ♂, 2 ♀ (SMF), 2 ♂, 1 ♀ (ZMUM), same locality, together with holotype, 25. IV. 1973; 4 ♂ (SMF), same locality, Gosainkund, 2700–3000 m, *Quercus* forest, 23. IV. 1973, leg. J. Martens; 1 ♀, 2 juv. (SMF), Gorkha Distr., Chuling Khola, Djongshi Kharka, 3050–3400 m, mixed forest, 5. VIII. 1983; 1 ♂ (ZMUC), Chuling Khola, S of Kalo Pokhari, 3600 m, *Betula* stand on moraine, 7. VIII. 1983, leg. J. Mar-



Figs 1–4. Gonopods of *Paranedyopus martensi,* spec. nov.; ♂ paratype from Kalo Pokhari (ventral, mesal, fronto-mesal and dorsal views, respectively).

tens & W. Schawaller; 2♂ (ZMUM), Manang Distr., Marsyandi, 2550 m, between Thanjok & Chame, along stream, 17.IV. 1980; 2♂, 3♀ (ZSM), Marsyandi, Thimang above Bagarchap, 2250 m, *Tsuga-Acer-Rhododendron* forest, 14.–17.IV. 1980, leg. J. Martens & A. Ausobsky.

Other material. 1 juv. (SMF), Gorkha Distr., NW of Pass Rupina La between Kalo Pokhari & Tabruk, 3700 m, artificial meadow, 7.VIII. 1983; 2 juv. (SMF), Chuling Khola, Djinshi Kharka, 3400 m, *Abies* forest and subapline meadows, 4.–5.VIII. 1983, leg. J. Martens & W. Schawaller; 1 juv. (SMF), Chuling Khola, 3000–3400 m, *Abies-Quercus* forest, 3.VIII. 1983; 8 juv. (SMF), same locality, 2800 m, *Quercus semecarpifolia* forest, 2.–3.VIII. 1983, leg. J. Martens & B. Daams.

Derivatio nominis. This new species is gladly named after my good friend Prof. Dr. Jochen MARTENS, whose enthusiastic research in the Himalayas has yielded such important materials.

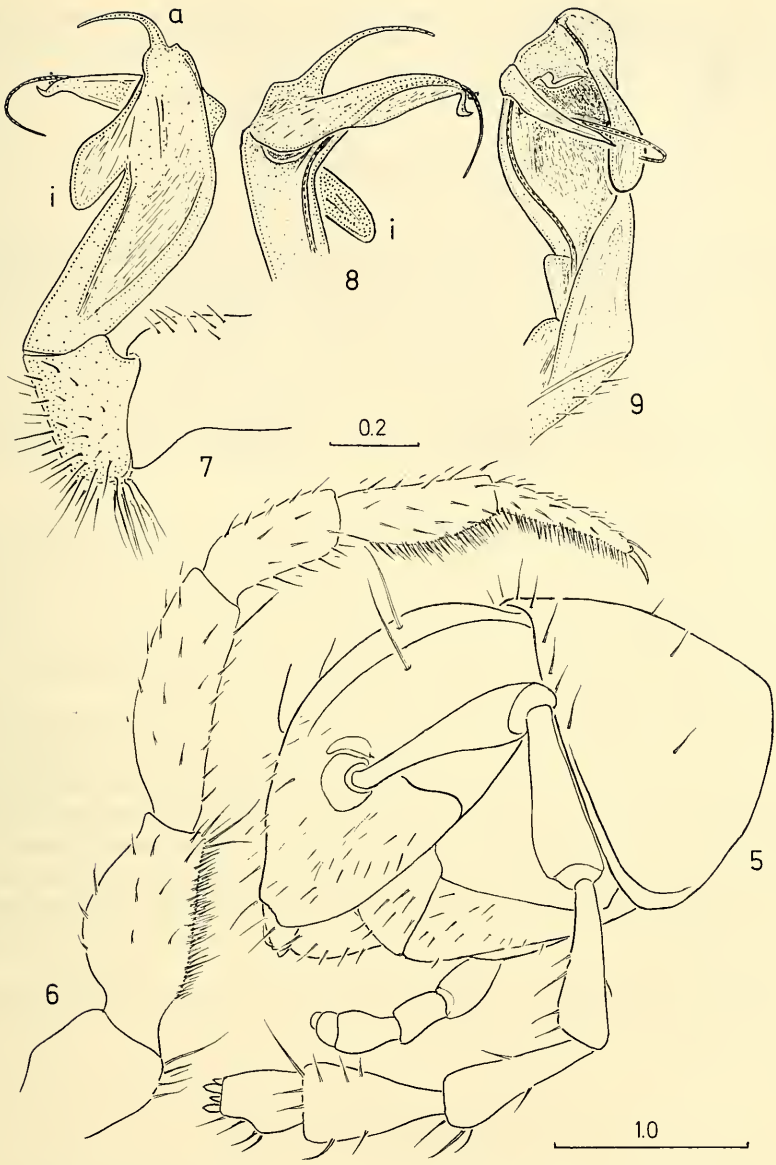
Diagnosis. Differs from other congeners by a combination of characters: body size relatively large (♂♂ over 15 mm long), pleural keels somewhat underdeveloped (projecting caudad beyond hind ring's contour as a tiny triangle or spine only till 7th somite), coloration rather dark, gonopod apical process *(a)* very long, slender, spiralling, whereas process *i* quite small and simple.

Description

Length ca. 16–17 mm in ♂♂ and 19–21 mm in ♀♀, width 1.7–1.8 mm in ♂♂ and 2.3–2.5 mm in ♀♀. Holotype ca. 17 mm long and 1.8 mm wide. Juveniles (19 segm.) 12–13 mm long. Colour greyish-brown to dark marble brown; a little paler, yellowish-brown are sutures between pro- and metazona, sometimes a more or less wide and uneven stripe along dorsal axis, sometimes also vague, marble, paramedian spots on both pro- and metazona, always sterna, ventrum and legs (usually only a few proximal joints); darker vertex, distal parts of antennomeres 3–6, basal part of antennomere 7.

Body subcylindrical, no traces of paraterga, appearance quite moniliform due to well-constricted rings, without even lateral swellings. Head usual (Fig. 5), antennae relatively long and slender, a little longer in ♂♂ (reaching to end of somite 3 or even almost to midlength of somite 4) than in ♀♀. Gnathochilarium beset with short setae. Collum semi-circular, lateral parts situated rather low (Fig. 5), with an inconspicuous lateral rim and two rows of 4 + 4 and 2 + 2 long setae. Similar setae in a single row of 2 + 2 on subsequent metaterga 2–19 not far behind deep suture between pro- and metazona, tending to gradually grow shorter toward telson. Ozopores lie at about 2/5ths off metatergal caudal margin laterally, closer to 1/3rd on rings 5 and 19, always little, very simple, rather vague. Metaterga with no traces of transverse sulci, surface generally finely shagreened (suture always shagreened somewhat rougher), laterally along hind limbus and more so ventro-laterally rather delicately rugose. Pleural keels relatively underdeveloped, moderate, poorer expressed in ♀♀ as compared to ♂♂, on anterior body half as real carinae of arched outline (even posteriorly), only on somites 2–7 caudal corner projecting somewhat angularly a bit beyond hind contour in the form of a more or less pointed spine. From ring 8 onward, the keels turn gradually smaller to remind rather an inconspicuous stria never projecting caudad beyond the contour on rings of hind body third. Collum subequal in width to 5th ring, either a little broader than 4th and more so than subequal segments 2 & 3; postcollar constriction well-developed. Body parallel-sided on rings 6–7 to rings 15–16 to become very gradually and gently tapering further on. Epiproct rather long, practically straight in lateral view, from above as a regular triangle with tip very narrowly rounded and lacking (sub)terminal papillae, with sides somewhat concave and devoid of any lateral incisions. Subanal scale roundly subtriangular, with a couple of very long paramedian setae on knobs at hind margin. Anal valves margined.

Legs distinctly incrassate in ♂♂, somewhat shorter and slenderer in ♀♀, in both sexes gradually growing in length toward telson, especially well due to femora and tarsi. Leg-pair 1 (Fig. 5) particularly reduced in size, with only minute claws. Other claws simple, rather long, slightly curved. All ♂ femora and (almost) all ♂ tibiae and ♂ tarsi (sometimes except for a few posteriormost legs) provided with distinct ventral brushes of stronger, simple setae beginning from leg-pair 1 (Fig. 6), the brushes tending to become reduced gradually, though never completely, toward telson. No adenostyles what-



Figs 5–9. *Paranedyopus martensi*, spec. nov. (5–6) & *P. similis*, spec. nov. (7–9); ♂ paratype from Gosainkund and Pass Ting Sang La, respectively. – 5. head and collum (fronto-lateral view); 6. midbody leg; 7–9. gonopod (ventro-lateral, mesal and fronto-mesal views, respectively).

ever. A very high, subquadrate, setose lamina between ♂ coxae 4, either of which is about twice as short as lamina. Sterna moderately setose; beginning from pre- (♀) or postgonopodial (♂) leg-pairs, each sternum with a paramedian pair of alternatively smaller (anterior) and bigger (posterior), more or less blunt, oblique spines directed caudad, like in *P. cylindricus* (Carl 1935, and below).

Gonopods (Figs. 1–4) quite complex, coxite rather long, setose disto-laterally. Prefemur large, setose densely, distally set off from acropodite by a well-developed oblique sulcus. Femoral portion

broadened at about midlength, tibiotarsus well demarcated from femorite and consists of a smaller inner finger *(i)*, a long, slender, spiralling, apical lamella *(a)*, and a shorter, lamellate, somewhat tortiled solenophore sheathing basal half of free solenomerite.

Paranedyopus similis, spec. nov.
Figs 7–9

Holotype: ♂ (SMF), Nepal, Sindhu Palchok Distr., ascent to Pass Ting Sang La from Bikuti, 2300–2600 m, 13.IV.1973, leg. J. Martens. – Paratypes: 2♂, 1♀ (SMF), 1♂ (ZMUM), same locality, together with holotype, 13.IV. 1973; 1♂, 1♀ (ZSM), same locality, 2330–2500 m, semi-cultivated land, I. 1970; 3♀ (SMF), 1♀ (ZMUM), same locality, Jiri, 2600–3000 m, degraded *Quercus-Abies* forest, 16.I. 1970; 1♀ (ZMUC), same locality, Mt. Chordung near Jiri, 2900 m, *Abies-Tsuga-Rhododendron* forest, 1.IV. 1973, all leg. J. Martens.

Diagnosis. Differs well from other congeners by the presence of ventral brushes on practically all the joints of the ♂ telopodite, short and flagelliform apical process *(a)* of the gonopod tibiotarsus, peculiar triangular tubercle between the ♂ coxae 5, etc.

Description

Length ca. 15–17 mm in ♂♂ and 17–18 mm in ♀♀, width 1.4–1.5 mm in ♂♂ and 1.8 mm in ♀♀. Holotype ca. 17 mm long and 1.5 mm wide. Colour rather pale brown; somewhat darker are vertex and distal thirds of antennomeres 4–6, as well as basal half of antennomere 7; somewhat paler, yellowish are rather vague, irregular, axial stripe, central parts of metaterga, sides of prozona (as marble spots), suture between pro- and metazona, legs, ventrum, proximal parts of antennomeres 1–6; tip of antennae whitish.

Body shape, structure, surface, head, ozopores, anal segment as in *P. martensi*, spec. nov. (see above), but antennae a little shorter (in ♂♂ reaching only up to end of somite 3); pleural keels even in ♂♂ developed worse (only on 7th ring visibly projecting angularly beyond hind ring's contour, onward increasingly reduced in size, being expressed rather as striae, also distinctly arched throughout); a low (about 1/3rd of coxal height), roundly-triangular, transverse tubercle between ♂ coxae 5 just behind usual, high, subquadrate, setose lamina directed obliquely forward between coxae 4 (otherwise sterna like in *P. martensi*, spec. nov.); ♂ legs carry ventral brushes practically on all telopodite joints, though on both femora and especially postfemora brushes tend to grow sparser, particularly toward hind body quarter.

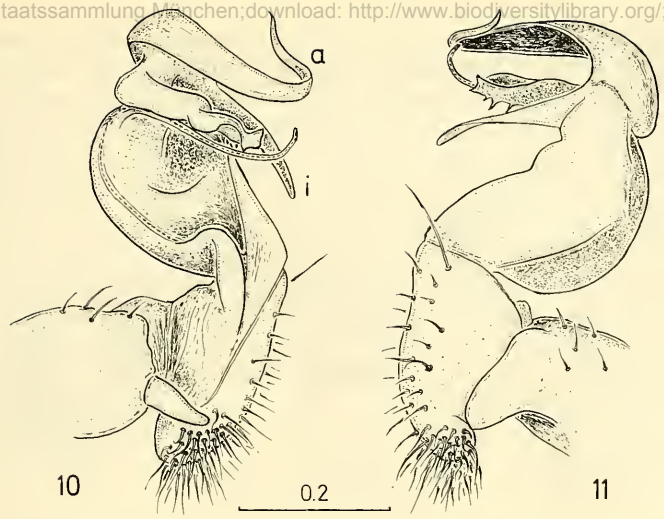
Gonopods (Figs. 7–9) more slender, tibiotarsal apical process *(a)* short and flagelliform, inner finger *(i)* broadly scapulate, massive and rather short.

Paranedyopus schawalleri, spec. nov.
Figs 10–11

Holotype: ♂ (SMF), Nepal, Sankhua Sabha Distr., Arun Valley between Mure & Hurure, 2050–2150 m, mixed broadleaved forest, 9.–17.VI. 1988, leg. J. Martens & W. Schawaller. – Paratypes: 19♂, 18♀, 10 juv. (SMF), 4♂, 4♀ (ZSM), 4♂, 4♀ (ZMUM), 3♂, 2♀ (ZMUC), same locality, together with holotype, 9.–17.VI. 1988, leg. J. Martens & W. Schawaller.

Derivatio nominis. This species honours Dr. Wolfgang Schawaller, Stuttgart, a good friend of mine, who also devotes a very considerable time for Himalayan contributions, both as collector and taxonomist.

Diagnosis. Differs from other congeners by the least body size of adults (especially in width), sabre-shaped gonopod process *i* combined with a lamellate and somewhat spiralling process *a*, etc.



Figs 10–11. Gonopods of *Paranedyopus schawalleri,* spec. nov.; ♂ paratype (mesal and lateral views, respectively).

Description

Length ca. 9.5–11.5 mm in ♂♂ and 10.5–13.5 mm in ♀♀, width 0.8–1.0 mm in ♂♂ and 1.0–1.2 mm in ♀♀. Holotype ca. 10 mm long and 0.9 mm wide. Juveniles (19 segm.) ca. 8 mm long. Colour generally uniformly brown, never dark brown, but sometimes pale yellow-whitish; particularly pale, whitish are suture between pro- and metazona, ventrum, antennomere 7, legs; neither striped pattern nor distinct spots, some marble tint at best.

Head a bit wider than collum which is subequal to ring 5 and in its turn a little wider than subequal rings 2 and 3; postcollar constriction poorly marked. Body parallel-sided on rings 6–16 to grow very gradually and gently attenuating toward telson onward, moniliform appearance better expressed in ♂♂. Surface smooth, somewhat shining, finely shagreened, rugose only hind halves of metazona well below rather vague pores. Epiproct quite long and straight in lateral view, from above triangular, with tip very narrowly rounded and provided with tiny setiferous paramedian knobs, and sides almost straight, only very slightly concave. Pleural keels moderately developed, a bit better in ♂♂ than in ♀♀, in both sexes till body midlength gradually turning from small carinae to striae, but at least until ring 17 invariably provided with a minute caudal projection in the form of a spine or triangle; caudal corner either subrectangular or a little rounded, whereas anterior corner always very broadly rounded. Tergal setae, ozopores, anal valves, subanal scale, sterna as in *P. martensi,* spec. nov., but legs with very long brushes in ♂♂ on prefemora, tibiae and tarsi until the posteriormost leg-pairs, while femora and postfemora rather densely setose. Nothing unusual behind usual, subquadrate, setose, high lamina between ♂ leg-pair 4.

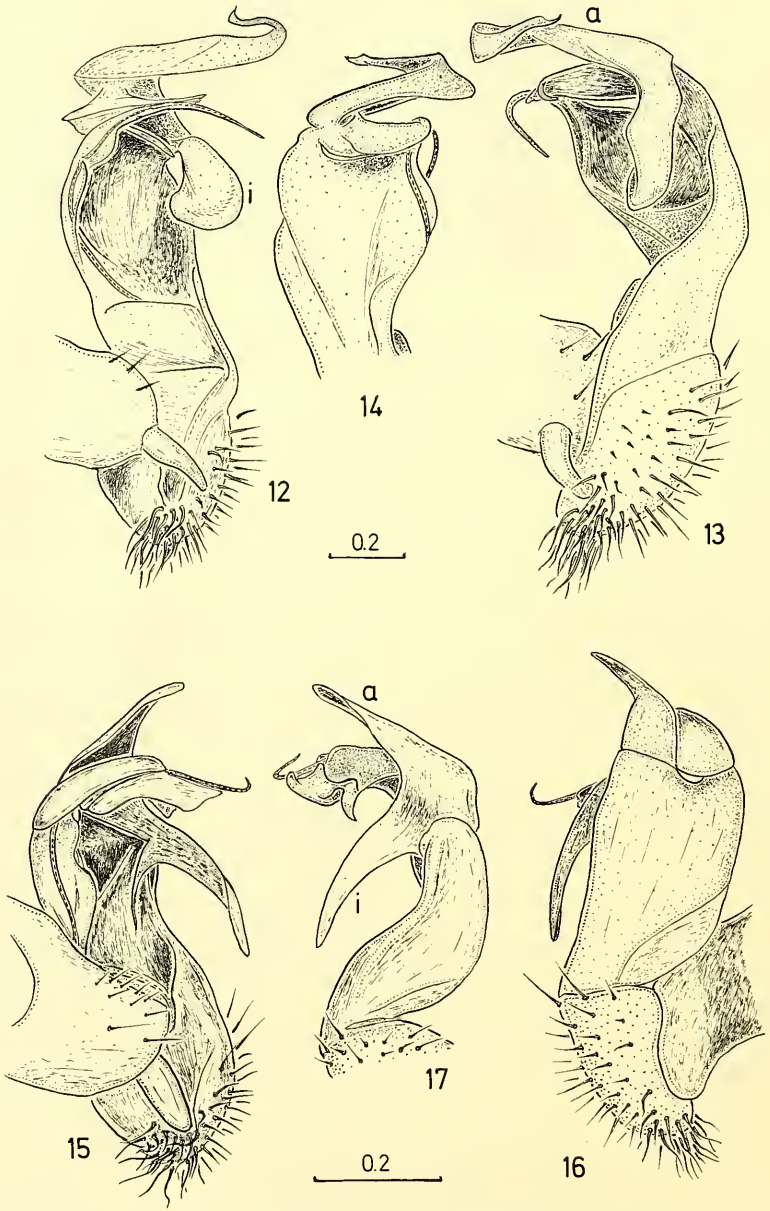
Gonopods (Figs 10–11) conspicuous in having long, sabre-shaped process *i* (similar to that in *P. cylindricus,* see below) combined with a lamellate, somewhat spiralling, long *a* (like in *P. affinis,* spec. nov., see below).

Paranedyopus affinis, spec. nov.

Figs 12–14

Holotype: ♂ (SMF), Nepal, Lalitpur Distr., Kathmandu Valley, Mt. Phulchoki, 2475–2700 m, *Quercus semecarpifolia* forest, 19.III. 1980, leg. J. Martens & A. Ausobsky.

Diagnosis. Differs from other congeners by the particularly poorly developed ventral brushes on ♂ legs and the gonopod process *a* being more like in *P. schawalleri,* spec. nov., combined with scapulate process *i,* which is more like in *P. similis,* spec. nov.



Figs 12–17. Gonopods of *Paranedyopus affinis,* spec. nov. (12–14) & *P. cylindricus* (Carl, 1935); holotype and ♂ from Moyam (= Moyang), respectively (dorso-mesal, mesal, lateral, fronto-mesal, lateral and ventral views, respectively).

Description

Length ca. 17 mm, width 1.6 mm. Colour marble brown; somewhat darker are vertex, frons, antennae (especially basal half of antennomere 7); paler, yellowish are a rather wide, irregular axial stripe, a stripe-like row of marble spots on each side of both pro- and metazona at level of ozopores, ventrum, a few proximal leg joints, suture between pro- and metazona; tip of antennae whitish.

Body shape and structure, head, surface, anal segment, etc., like in *P. martensi,* spec. nov., but antennae reaching in situ to end of somite 3 (like in, e. g., *P. similis,* spec. nov. or *P. schawalleri,* spec. nov.); pleural keels quite poorly developed, arched, a bit better expressed on somites 2–4 where they project caudad beyond rings' contour to become gradually reduced toward telson further on; constriction behind collum more feeble than in *P. martensi,* spec. nov., more like in *P. schawalleri,* spec. nov.; sterna more like in *P. similis,* spec. nov., with lamina between ♂ coxae 4 being likewise very high, subquadrate, setose, directed obliquely forward, about twice as high as coxa 4, with a roundly subtriangular tubercle between coxae 5.

Leg brushes closer to those of *P. martensi,* spec. nov. (s. Fig. 6), but still poorer expressed, displayed only on distal 1/2-2/3rds of both prefemora and tibiae, with their bases being completely free, and throughout all tarsi except for a few posteriormost ones (for all brushes, as usual, tend to grow sparser toward telson); prefemora disto-ventrally a little swollen.

Gonopods (Figs 12–14) with finger *i* even more scapulate than in *P. similis,* spec. nov., whereas process *a* very much like in *P. schawalleri,* spec. nov.

Paranedyopus cylindricus (Carl, 1935)

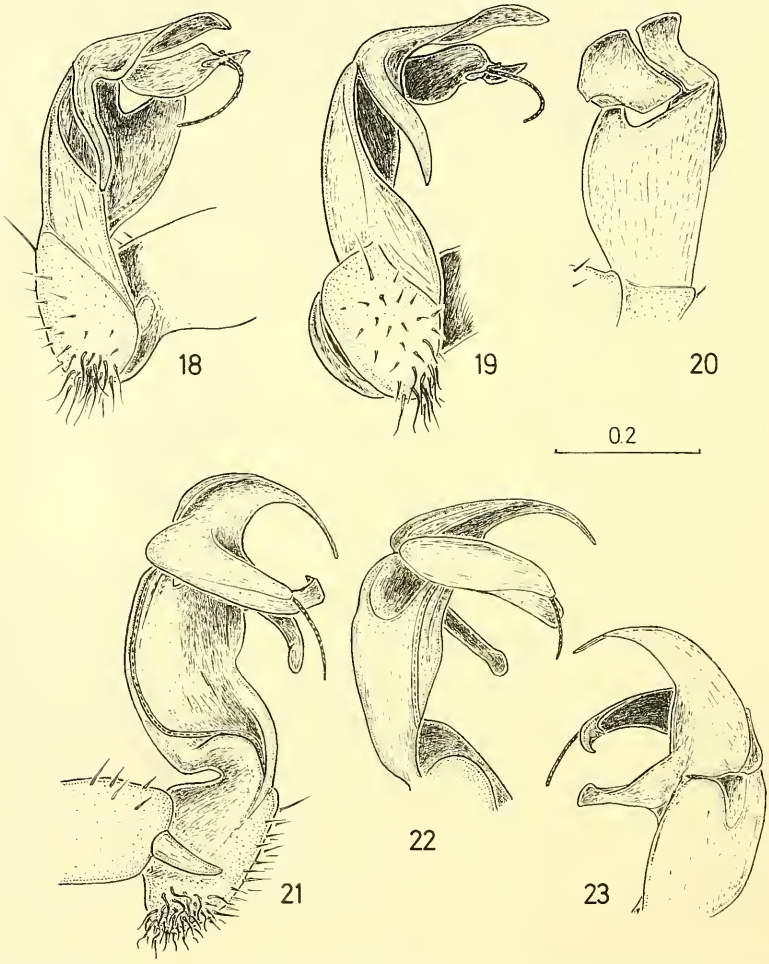
Figs 15–23

Akribosoma cylindrica Carl, 1935, Rev. suisse Zool. 42 (10): 334; Figs
Paranedyopus cylindricus Golovatch 1984, Acta zool. hung. 30(3/4): 350; Figs

Material. 1 ♂ (ZMUC), Nepal, Sankhua Sabha Distr., Moyam, 1870–2430 m, moss, 6.II.1959, leg. K. Becker-Larsen; 1 ♂, 1 ♀ (SMF), Lalitpur Distr., Kathmandu Valley, Mt. Phulchoki, 2600–2650 m, *Quercus semecarpifolia* forest, 14.V.1980; 2 ♀, 1 juv. (SMF), same locality, altitude and habitat, 21.–22.III.1980; 1 ♀ (SMF), Godawari at foot of Mt. Phulchoki, 1770 m, 19.III. 1980, leg. J. Martens & A. Ausobsky; 2 ♂, 12 ♀ (SMF), Kathmandu Distr., Mt. Sheopuri, 2100–2300 m, *Quercus semecarpifolia* forest, 25.VI. 1988, leg. J. Martens & W. Schawaller; 4 ♂, 2 ♀ (SMF), 1 ♂, 1 ♀ (ZMUM), Ilam Distr., Gitang Khola, 2550 m, Berlese extraction from litter, 28.–31.III. 1980; 3 ♂, 16 ♀ (SMF), 1 ♂, 1 ♀ (ZMUM), same locality, 2550 m, *Lithocarpus* forest, 28.–31.III. 1980; 1 ♂, 2 ♀ (SMF), Mai Pokhari, 2100–2200 m, mixed forest, 25.–27.III. 1980, leg. J. Martens & A. Ausobsky; 3 juv. (SMF), same locality, 2150–2250 m, 23.–25.VIII. 1983, leg. J. Martens & B. Daams; 1 ♀ (ZSM), same locality, 2100–2200 m, *Castanopsis* forest remains, 9.–10.IV. 1988; 1 ♀ (SMF), between Mai Pokhari & Gitang Khola Valley, 2100–1750 m, tree-rich cultivated land, 11.IV. 1988, leg. J. Martens & W. Schawaller; 1 juv. (SMF), Panchthar Distr., upper reaches of Mai Majuwa Khola, 2250–2500 m, mixed forest, 27.VIII. 1983; 4 juv. (SMF), between Deorali, Puspati & Sheldoti, 2500–2600 m, *Tsuga-Lithocarpus* forest, 28.VIII. 1983; 13 juv. (SMF), Grat between Sheldoti & Paniporua, 2200–2450 m, broadleaved forest, 29.VIII.1983, leg. J. Martens & B. Daams; 1 ♂, 4 ♀ (ZMUM), 3 ♂, 6 ♀ (SMF), Paniporua, 2300 m, mixed broadleaved forest, 16.–20.IV. 1988; 1 ♂ (SMF), between Pass Deorali & Puspati, 2850–2300 m, degraded forest with *Tsuga,* 16.IV. 1988; 6 ♂, 3 ♀ (SMF), 2 ♂, 4 ♀ (ZMUM), 2 ♂, 2 ♀ (ZMUC), Dhorpar Kharka, 2700 m, mature *Rhododendron-Lithocarpus* forest, 13.–16.IV.1988; 2 ♂ (SMF), Taplejung Distr., from SE of Yamputhin to Yamputhin, 2000–1650 m, forest mainly *Alnus,* 26. & 30.IV. 1988; 3 ♂, 11 ♀ (SMF), Yamputhin, cultivated land, 1650–1800 m, open forest, 26.IV.–1.V. 1988; 2 ♀ (SMF), above Yamputhin, left bank of Kabeli Khola, bushes, 1800–2000 m, open forest, 27.–29.IV. 1988; 1 ♀ (SMF), path to Omje Kharka in Omje Khola Valley NW of Yamputhin, 2400–2500 m, mixed *Quercus* forest, 1.V. 1988; 6 ♂, 7 ♀ (ZSM), Omje Kharka NW of Yamputhin, 2300–2500 m, mature mixed broadleaved forest, 1.–6.V. 1988; 1 ♂ (SMF), descent from Pass Deorali to Hellok, 2600–2000 m, forest with *bamboo,* 17.V. 1988; 1 ♀ (SMF), Hellok in Tamur Valley, 2000 m, forest remains, bushes, 17.V.1988; 3 ♂ (SMF), upper Tamur Valley, from Lungthung waterfalls to bamboo bridge, 1800–2150 m, open forest, bushes, 19.V. 1988; 2 ♂, 11 ♀

(SMF), Sankhua Sabha Distr., above Pahakhola, 2600–2800 m, *Quercus semecarpifolia-Rhododendron* forest, 31.V. 1988; 1♀ (SMF), Arun Valley, between Mure & Hurure, 2050–2150 m, mixed broadleaved forest, 9.–17.VI. 1988; all leg. J. Martens & W. Schawaller.

Remarks. This species has hitherto been known but from a few specimens deriving from Darjeeling Distr., North India (Carl 1935; Golovatch 1984), thus making the present records new for the fauna of Nepal.



Figs 18–23. Gonopods of *Paranedyopus cylindricus* (Carl, 1935); ♂♂ from Gitang Khola (18–20) and Mt. Phulchoki (21–23), respectively (ventromesal, ventral, lateral, mesal, dorsal and ventral views, respectively).

The rich material at hand in general agrees quite well with the species' diagnosis and allows to throw additional light on its variability and geographical range. Most of the specimens are very typical, as they have a relatively larger body size which varies significantly (length 11–14 mm in ♂♂ and 13–16 mm in ♀♀, width 1.1–1.3 mm in ♂♂ and 1.5–2.0 mm in ♀♀), a darker coloration which has a pattern of stripes/spots, pleural keels well-developed and spinose cuadally at least until rings 15–17

in both sexes, ventral brushes on ♂ legs present on the prefemora, tibiae and tarsi tend to practically disappear toward a few posteriormost leg-pairs, etc. The gonopods also display quite a marked range of individual variability. Mostly they are just the kind of the (topo)types (Carl 1935; Golovatch 1984), e. g., those of a ♂ from Moyam (Figs 15–17), with the very prominent processes *a* & *i*.. Only relatively seldom *a* is as long as *i*, e. g., in a ♂ from Gitang Khola (Figs 18–20). Normally the solenophore is massive, distinctly tortiled, at least bifid. However, in ♂♂ from the Kathmandu Valley, which externally are indisputable *P. cylindricus*, the gonopods appear to be a little more disjunct as compared to eastern Nepalese or Darjeeling samples: the solenophore is less massive, and *a* quicker attenuating toward tip (Figs 21–23). Seldom, as is the case with a ♂ from Mt. Phulchoki, the gonopod process *i* is not more or less sabre-shaped, but subscapulate (Figs 21–23), although prominent enough.

One ♂ from Mai Pokhari, eastern Nepal, deserves special attention, as it seems to represent an abnormality, in all probability an intersex. Indeed, along with having the gonopods fairly well developed, displaying exactly the somewhat deviating type shown in Figs 18–20, the ♂ is larger than average (ca. 14 mm long and 1.7 mm wide), has neither sternal lamina between leg-pair 4 nor ventral brushes on normal legs lacking any traces of enlargement.

Despite the rather marked variation range of *P. cylindricus* quite easily accounted for the species' relatively vast distribution not so often met with among Himalayan Diplopoda, all the material at hand seems to be conspecific. The characters making *P. cylindricus* easily recognizable are the pleural keels' spines extending, in both sexes, at least until body rings 15–17, postcollar constriction very poorly expressed (collum subequal in width to rings 6–7, usually being but a bit wider than the narrowest somites 3 & 4), ventral brushes present on most ♂ prefemora, tibiae and tarsi, tubercle between ♂ coxae 5 wanting, gonopods with a simple, more or less sabre-shaped *i* (sub)equal in length to lamina *a* which is also quite simple, broadest at base, never particularly flagelliform or spiralling.

Another important observation is that *P. cylindricus* manages to co-exist, perhaps even syntopically, with both *P. schawalleri*, spec. nov. in eastern Nepal and *P. affinis*, spec. nov. in the vicinity of Kathmandu, central Nepal, whereas all the other local forms appear to be strict vicariants (s. map). Such data alone are highly interesting for further ecological and chorological investigations, and some of them will be dealt with a little below.

Paranedyopus sp(p). indet.

Material. 1 ♀ (SMF), Nepal, Makwanpur Distr., Mahabarat Mts., Daman, 2500–2900 m, *Quercus* forest, 22.–25. II. 1970, leg. J. Martens; 9 juv. (SMF), Terhathum Distr., Tinjura Dara, 2450 m, species-rich mixed broadleaved forest, 17. IX. 1983, leg. J. Martens & B. Daams; 17 juv. (SMF), Mustang Distr., S of Lethe, 2450–2600 m, species-richmixed broadleaved forest, 30. IV.–1. V. 1980, leg. J. Martens & A. Ausobsky.

Remarks. Unfortunately, those samples could not be identified closer to species in the absence of either adult ♂♂ or reliable geographical record. The only adult ♀ referred to just above seems to represent one of the new species, more probably *P. affinis*, spec. nov. due to the arched outline of the pleural keels, but certainly not *P. cylindricus*. Only additional materials from the areas involved can obviously bring us to a solution of the identity problem faced at the moment.

The genus *Paranedyopus* Carl, 1932 comprises at the present *P. subcylindricus* Carl, 1932 (type-species), *P. rufocinctus* (Carl, 1932) and *P. ursula* (Attems, 1936) from southern India, *P. simplex* (Humbert, 1865) from Sri Lanka, *P. elongissimus* Golovatch, 1984 from Darjeeling District, northern India, *P. cylindricus* (Carl, 1935) from Darjeeling District and Nepal, as well as the Nepalese *P. martensi*, spec. nov., *P. schawalleri*, spec. nov., *P. similis*, spec. nov., and *P. affinis*, spec. nov. (Jeekel 1980b, Golovatch 1984, and above). The distribution pattern of the genus and also of its Himalayan species is highly interesting and deserves special attention. Before discussing it in more detail, it seems necessary to add that in general in the majority of *Paranedyopus* there are no traces of paraterga, at least

some ♂ legs carry ventral brushes of stronger setae at least on certain joints, a good lamina is present between the ♂ coxae 4, most of the sterna are invariably spinose (even in the juveniles of 16–19 body segments). Such characters, as well as the highly complex conformation of the gonopods seem to be derivative and make the Himalayan members particularly closely related to each other and to the generotype *P. subcylindricus,* perhaps representing a separate species swarm, the *subcylindricus*-group, as opposed to the remaining, relatively disjunct forms.

In the Himalayas, *Paranedyopus* spp. are mainly restricted to elevations ranging from 2000 to 3000 m, but sometimes occur as low as at 1000 m a. s. l. *(P. elongissimus)* or reach up to 3700 m a. s. l. *(P. martensi).* They all are more or less strictly confined to mixed or monodominant broadleaved, more seldom to coniferous-broadleaved forests, being obvious mesophiles. Clear enough, this genus is not a Palaearctic element in the Himalayan diplopod fauna, its affinities being perhaps better expressed with *Anoplodesmus* Pocock, 1895, a genus encompassing about 20 forms from Sri Lanka, southern India and tropical East Asia (Jeekel 1965, 1980b) and displaying a set of considerably less derived characters. Neither does it seem possible to attribute *Paranedyopus* to true Indian elements, because its pattern resembles the one known for certain arboreal plants too vividly just to be neglected. Thus, the Himalayan *Rhododendron arboreum* Smith (Ericaceae), the national flower of Nepal, occurs over a wide range of altitudes throughout the eastern part of the Himalayas, and in the mountains/hills of southern India and Sri Lanka likewise (Mani 1974, Polunin & Stainton 1985). A similar pattern is observed in other tropical Asian flora elements: *Pittosporum* (Pittosporaceae), *Saraca* (Leguminosae), etc. (Mani 1974). Dealing with various fauna groups of Nepal, Martens (1984) distingushed tropical Indian from (sub)tropical West Chinese Himalayan and (sub)tropical Indochinese Himalayan components, with lots of examples provided of regular violations by many species/genera of Oriental genesis of the otherwise manifest rule: tropical forms for tropical habitats only. Contrary to this rule, numerous taxa Oriental in origin, with *Paranedyopus* apparently among them, populate not only the "normal", lowland sites, but also quite montane ones known generally to be dominated by Palaearctic elements. The fact that, e. g., *P. martensi* or *P. cylindricus* have colonized the upper reaches of several well-isolated valleys (s. map) is clearly indicative of a young, Holocene age of such upward invasions, whereas intrageneric disjunctions of the *Paranedyopus* type (South India – Sri Lanka – East Himalayas) may soundly be ascribed to the effect of the Pleistocene (Mani 1974, Martens 1984), with southward spread from the (pre-)Himalayan region involved at least within the *subcylindricus*-group.

Perhaps the same logic is applicable for some other Himalayan Diplopoda, e. g., *Sholaphilus* Carl, 1932 (Fuhrmannodesmidae, Polydesmida) which also displays a similar disjunction (Golovatch 1986).

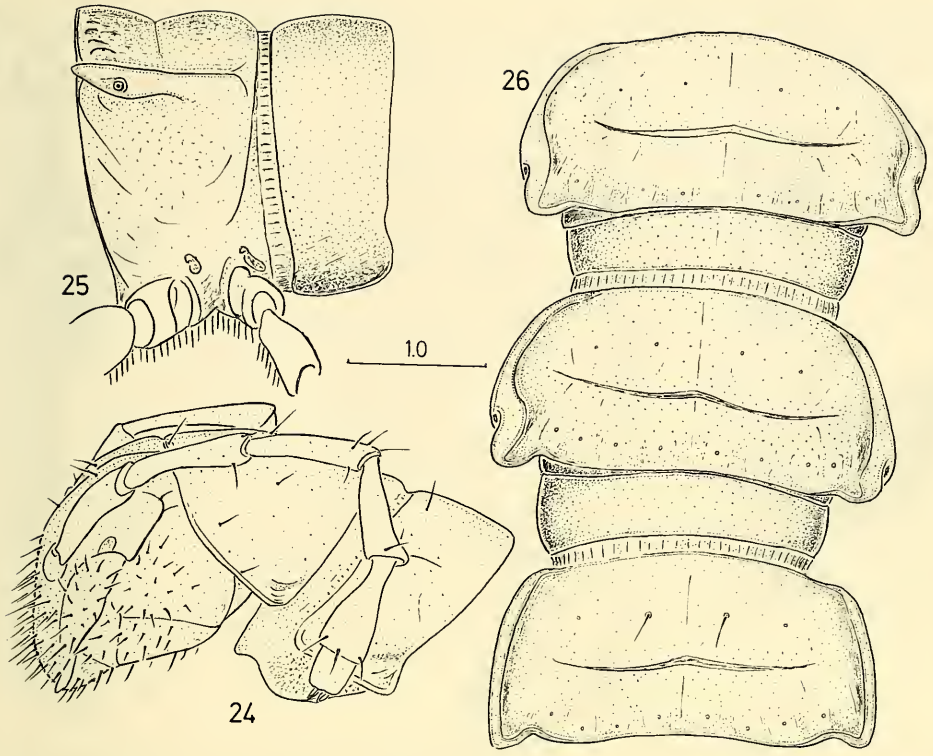
Orophosoma fechteri, spec. nov.

Figs 24–30

Holotype: ♂ (SMF), Nepal, Mustang Distr., Kali Gandaki Valley between Annapurna & Dhaulagiri Himal; Thaksang above Tukche, 3150 m, 2.–4. VII. 1973, leg. J. Martens. – Paratypes: 1 ♂, 1 ♀ (ZSM), 1 ♂, 1 ♀ (SMF), same locality, together with holotype, 2.–4. VII. 1973; 1 ♂ juv. (SMF), same locality, Chadziou Khola Valley, 2330–2600 m, X. 1969; 1 ♂ (SMF), 1 ♂ (ZMUC), same locality, Chadziou Khola, 2560 m, VI.–VII. 1970; 1 ♂, 1 ♀ (ZMUM), 1 ♂ (SMF), same locality, ascent to Thaksang, 2600–2900 m, 1. VII. 1973; 1 ♂ (SMF), same locality, Purano Marpha, 3100–3200 m, 6.–7. VII. 1973; all leg. J. Martens.

Derivatio nominis. This remarkable new species honours my good friend Dr. Hubert Fechter, keeper of Myriapoda at the ZSM, whose generous help and hospitality I enjoyed during my brief stays in Munich.

Diagnosis. Differs from both other known congeners by the considerably larger body size, better developed paraterga, presence of only a single larger emargination on the medial ridge behind ♀ legpair 2, absence of gonoprefemoral process, etc.

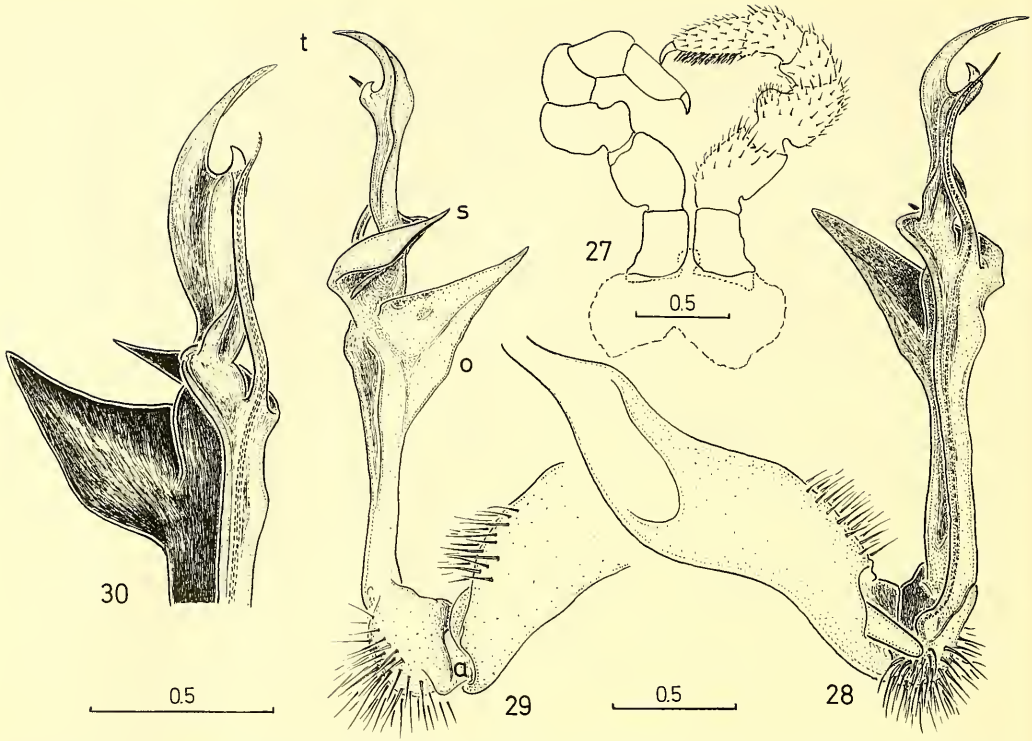


Figs 24–26. *Orophosoma fechteri*, spec. nov.; ♂ paratype from Chadziou Khola. – 24. anterior body end (lateral view); 25. somite 9 (lateral view); 26. somites 9–11 (dorsal view).

Description

Length ca. 26–32 mm in both sexes, width of pro- and metazona 2.0–2.5 and 2.8–3.3 in ♂♂, 2.7–2.8 and 3.3–3.5 mm in ♀♀, respectively. Holotype ca. 28 mm long, 2.0 and 2.8 mm wide on pro- and metazona, respectively. Juvenile (19 segm.) ca. 22 mm long, 1.9 and 2.5 mm wide on pro- and metazona, respectively. Colour quite uniformly brown to chocolate brown, somewhat paler brownish only legs, tip of antennae, juvenile, sometimes also paraterga.

Antennae in situ reaching to midlength of body segment 3 (♂) or 2 (♀), quite slender, slightly clavate (Fig. 24). Collum with small, well-rimmed lateral keels from both sides, above them slightly rugose, at least with two rows of rather short, simple setae, one (4 + 4 ?) along anterior margin and the other (2 + 2 ?) middorsally. Head subequal in width to collum, a bit narrower than somite 2, but a bit broader than or subequal to somites 3–4; postcollar constriction feeble, but evident. From ring 5, which is somewhat broader than collum, body parallel-sided till ring 15 whereupon gradually, but rather abruptly tapering toward telson. Surface generally poorly shining, more so only on metazona, very finely shagreened, slightly rugose on posterior halves of metaterga. Body rings well constricted due to deep suture between pro- and metazona. Paraterga moderately developed, set not so low, though dorsum evidently convex, on somite 2 well below collum (Fig. 24); caudal corners well rounded and lie more or less within hind tergal contour until ring 13 (Figs 25–26), onward increasingly pointed, beak-shaped, well projecting caudad beyond the contour until somite 18, on 19th again small, but pointed and exceeding the contour significantly. Metaterga with a deep, more or less bow-shaped medial transverse sulcus dividing two rows of simple tergal setae (mostly missing), 2 + 2 anteriorly and



Figs 27–30. *Orophosoma fechteri*, spec. nov.; ♂ paratype from Chadziou Khola. – 27. leg-pair 1; 28–29. left gonopod (mesal and lateral views, respectively); 30. tip of left gonopod (meso-dorsal view).

4 + 4 on very weak elevations posteriorly (Fig. 26). Pleural keels absent totally. Epiproct rather long, almost straight in lateral view, from above subtriangular, with tip narrowly emarginate due to a pair of apical papillae, sides feebly concave and carry a pair of good preapical lateral incisions. Anal valves well margined. Subanal scale subtrapeziform, with a paramedian pair of good setiferous knobs at hind margin.

Sterna simple, in ♀♀ wider, always densely setose, without particulars, only a moderate ridge gradually narrowing toward axis and broadly emarginate in the middle behind ♀ coxae 2, as well as normal, subquadrate, setose, somewhat higher lamina directed obliquely forward between ♂ leg-pair 4. Legs of ♂ well incrassate, gradually elongated toward telson, invariably slender in both ♀ and juvenile; claws simple, rather long, slightly curved. Leg-pair 1 of ♂ (Fig. 27) with good adenostyles on femora and tarsal brushes. Leg-pair 2 with good adenostyles on femora and tarsal brushes. Leg-pair 3 with brushes on both tarsi and tibiae (at least distally), whereas subsequent ♂ legs with increasingly poor tarsal brushes, but ventral sides of all other joints increasingly well setose, almost in a brush way. Coxa 2 of ♀ with a clear disto-ventral outgrowth and a smaller, midheight, conical, caudal process directed somewhat obliquely toward vulvae, fitting sternal ridge's emargination behind.

Gonopods very high, suberect, complex (Figs 28–30). Coxite very long, subcylindrical, disto-ventrally setose. Telopodite quite broad in ventral view, distinctly flattened till about midheight dorso-ventrally; prefemur densely setose, small, set off from acropodite by sulcus, laterally provided but with anlage *(a)* of a process; femorite distally with a larger *(o)* and a smaller *(s)* outer subtriangular outgrowth, without any demarcation between femorite and postfemoral portion; tibiotarsus with un-

equally bifid tip *(t)*, from inner side making a feeble solenophore to support a flagelliform, simple, moderately long, free solenomerite. Seminal groove runs entirely along inner side of telopodite which lacks any traces of torsion, near base of free solenomerite quite enlarged as a platform supporting acropodite.

Remarks. The above new species is certainly rather disjunct from both hitherto known congeners, *O. hingstoni* (Carl, 1935) (type-species) and *O. simulans* (Carl, 1935), as one can see from Carl's (1935) descriptions and Jeekel's (1980a) diagnosis of his *Orophosoma*. Indeed, *O. fechteri*, spec. nov. is peculiar not only in certain habitual features, but also in the conformation of the gonopods and even of the vulvar defensive structures. However, a close affinity is unquestioned, and at least for the time being it seems best to allocate the new form concerned within *Orophosoma*. Judging from the absence of a prefemoral process on the gonopods and presence of better developed paraterga, *O. fechteri*, spec. nov. is less derived as compared to both very closely related *O. hingstoni* and *O. simulans*.

Despite the fact that both latter species seem to be confined to an area lying within and/or very close to Tibet (s. map), the altitudes they were taken from (ca. 3 000–3 300 m a. s. l.) do not differ from those known for *O. fechteri* spec. nov. (2 330–3 200 m a. s. l.). As regards the new taxon, it occurs in various forest habitats ranging from pure broadleaved forests with bamboo (Chadziou Khola) within monsoon belt to solely coniferous stands (Purano Marpha) within rain shadow. Similar biotopic preferences may be expected for *O. hingstoni* and *O. simulans* as well. This seems particularly likely also because *Orophosoma* is a member of the tribe Alogolykini (Jeekel 1980b) restricted to southern China (incl. Tibet), Burma, Nepal, and India (Assam, Sikkim, Punjab). Being perhaps another (sub)tropical Oriental element in the Nepalese diplopod fauna, *Orophosoma* also violates the general principle: tropical creatures for tropical habitats only (Martens 1984, and above).

Acknowledgements

I take the opportunity to again appreciate the help and hospitality of Prof. Dr. J. Martens (Mainz), Prof. Dr. E. J. Fittkau, Dr. H. Fechter (both München), Dr. W. Schawaller (Stuttgart) experienced during my visit to West Germany in January-March 1989. I owe a lot, too, to all the keepers involved: Dr. H. Enghoff (ZMUC), Dr. H. Fechter (ZSM), Dr. M. Grasshoff (SMF), and Mr. K. Mikhailov (ZMUM). Prof. R. L. Hoffman (Radford University, Virginia) very generously shared with me his unpublished notes and sketches dealing with several Nepalese Paradoxosomatidae some of which have been used for the present study. Besides, Prof. Martens very kindly supplied me with certain literature sources on Himalayan ecology and biogeography relevant to the materials treated above and made useful suggestions. Technical assistance of Mrs. K. Rehbinder (Mainz) with preparing the map is also deeply appreciated.

References

Attems, C. 1936. Diplopoda of India. – Mem. Ind. Mus. 11(4): 133–323; Calcutta

Carl, J. 1935. Polydesmiden gesammelt von Major R. W. Hingston auf der III. Everest-Expedition, 1924. – Revue suisse Zool. 42(10): 325–340; Genève

Golovatch, S. I. 1984. Some new or less known Paradoxosomatidae (Diplopoda: Polydesmida) from India. – Acta zool. hung. 30(3/4): 327–352; Budapest

–– 1986. Diplopoda from the Nepal Himalayas. Polydesmidae, Fuhrmannodesmidae. – Senckenberg, biol. 63 (4/6): 345–369; Frankfurt/M.

–– 1987a. Diplopoda from the Nepal Himalayas. Opisotretidae, additional Polydesmidae and Fuhrmannodesmidae. – Courier Forsch.-Inst. Senckenberg 93: 203–217; Frankfurt/M.

–– 1987b. Diplopoda from the Nepal Himalayas. Glomeridae, additional Opisotretidae. – Courier Forsch.-Inst. Senckenberg 93: 219–228; Frankfurt/M.

Jeekel, C. A. W. 1965. A revision of the Burmese Paradoxosomatidae (Diplopoda, Polydesmida) in the Museo Civico di Storia Naturale at Genoa (Part 1). – Tijdschr. Ent. 108(5): 95–144; Leiden

—— 1968. On the classification and geographical distribution of the family Paradoxosomatidae (Diplopoda, Polydesmida). – Acad. Proefschr., Rotterdam: 1–168

—— 1980a. The generic allocation of some little-known Paradoxosomatidae from South-East Asia (Diplopoda, Polydesmida). – Revue suisse Zool. 87(3): 651–670; Genève

—— 1980b. On some little known Paradoxosomatidae from India and Ceylon, with the description of four new genera (Diplopoda, Polydesmida). – Beaufortia **30**(8): 163–178; Amsterdam

Mani, M. S. 1974. Chapter VI. The flora. – in: Mani, M. S. (Ed.): Ecology and Biogegraphy in India. Monographiae biologicae **23.** W. Junk Publ., The Hague: 159–177

Martens, J. 1984. Vertical distribution of Palaearctic and Oriental faunal components in the Nepal Himalayas. – Erdwissenschaftl. Forsch. **18:** 321–336; Stuttgart

Polunin, O. & Stainton, A. 1985. Flowers of the Himalaya. Oxford Univ. Press: 1–580