Pacific Insects Vol. 22, no. 1–2: 162–170 29 August 1980

FOUR NEW SPECIES OF *DICRANOCENTRUS* FROM NORTHEAST INDIA AND NEPAL (COLLEMBOLA: ENTOMOBRYIDAE: ORCHESELLINAE)

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Abstract. Four new species of *Dicranocentrus* are described, 2 (*fraternus* and *singularis*) from the vicinity of Shillong, NE India and 2 (*nepalensis* and *pilosus*) from Nepal. *D. singularis* possesses a uniquely reduced head and body macrochaetotaxy. *D. pilosus* is unusual in several respects, including its claw structure, which is seemingly adapted to an aquatic habitat, and its head and body setal patterns, which make it the most polychaetotic *Dicranocentrus*. The 4 species occur at or near the northernmost limit of the distribution of the genus.

A series of leaf litter collections made by the junior author in the vicinity of Shillong, Meghalaya, NE India, produced a number of specimens which represent 2 new species of *Dicranocentrus*. Two collections from Nepal found by the senior author in the Field Museum of Natural History, Chicago, Illinois, USA (FMNH) contained the other 2 species described herein. This material is significant because it derives from an area which represents the northernmost limit of the distribution of the genus.

A revision of this genus has appeared recently (Mari Mutt 1979) and a detailed generic description is presented therein. However, for a better understanding of the species described here, the description of *D. fraternus* has been expanded to include generic characteristics. Such features (e.g., number of antennal segments, number of eyes, morphology and distribution of scales, morphology of mucro) are excluded from the descriptions of the other species.

Morphological abbreviations used in this paper are as follows: Ant. 1, Th. 1, Abd. 1, etc. = 1st antennal segment, 1st thoracic segment, 1st abdominal segment, etc.

Holotypes of the Indian species will be deposited in the Illinois Natural History Survey, Urbana, Illinois, USA (INHS) and holotypes of the Nepalese species in FMNH. Paratypes of the Indian species will be sent to the INHS, the Zoological Survey of India, Calcutta (ZSI), and to the collections of the senior author (JAMM) and junior author (RKB). Paratypes of the Nepalese species will be in the FMNH and the senior author's collection.

Dicranocentrus fraternus Mari Mutt & Bhattacharjee, **new species** FIG. 1–7, 31

Habitus typical of genus (e.g., FIG. 16, 22). Length excluding antennae and furcula up to 4.2 mm. Coloration variable (see remarks following this description). Head, body, collophore, all segments of legs, venter of furcula, and first 4 antennal segments (Ant. 1–4) covered with brown, strongly striated, apically rounded or truncated scales which are absent from Ant. 5–6. Antennae 6-segmented, Ant. 5–6 annulated,

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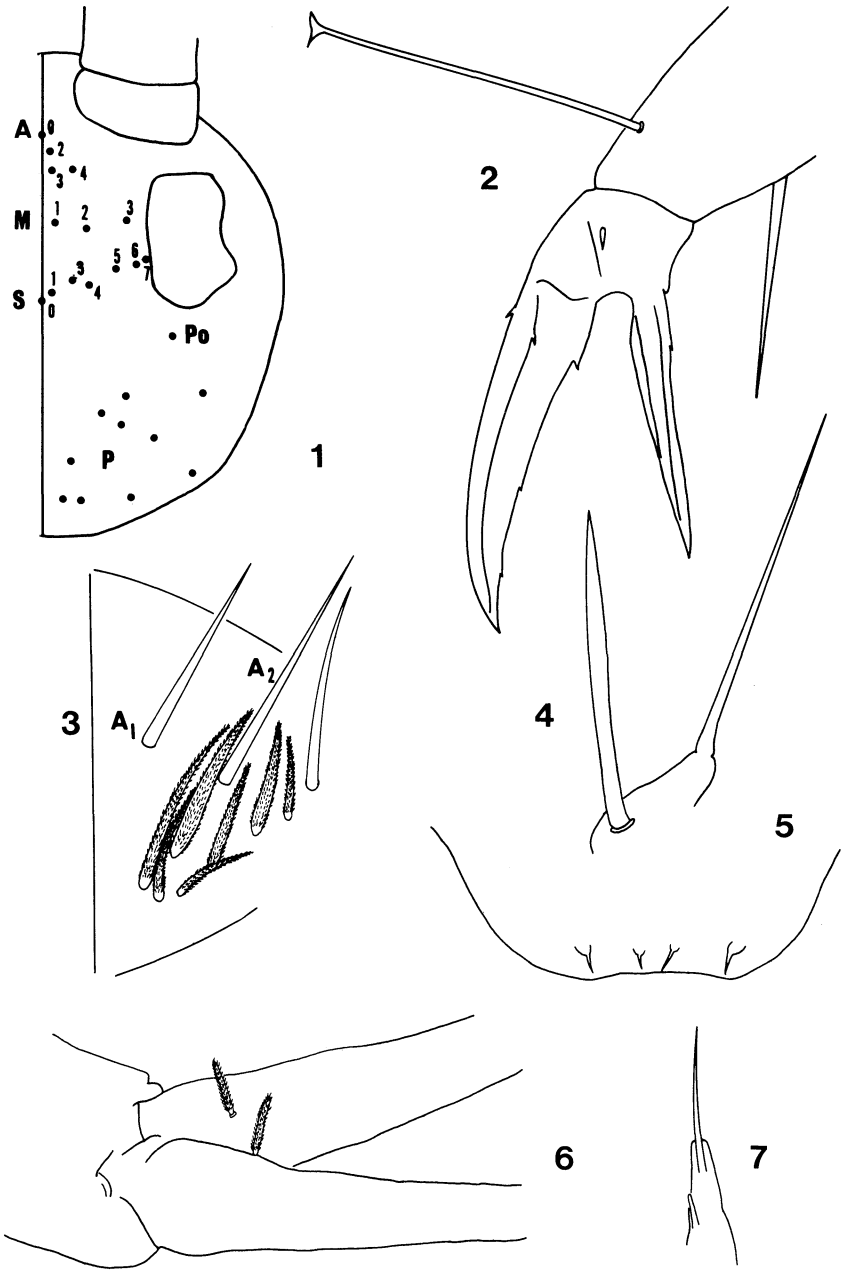

FIG. 1–7. *Dicranocentrus fraternus*. **1.** Head macrochaetotaxy (each dot represents a seta): A—anterior group, M—median group, S—sutural line, Po—postocellar macrochaeta, its presence and position are constant throughout the subfamily, P—posterior group. This system was proposed and explained by Mari Mutt (1979). **2.** Metathoracic claw. **3.** Chaetotaxy of labial triangle. **4.** Maxillary palp. **5.** Labral papillae (type I). **6.** Dorsolateral aspect of distal part of manubrium and proximal section of dentes showing plumose setae. **7.** Outer labial papilla and its differentiated seta.

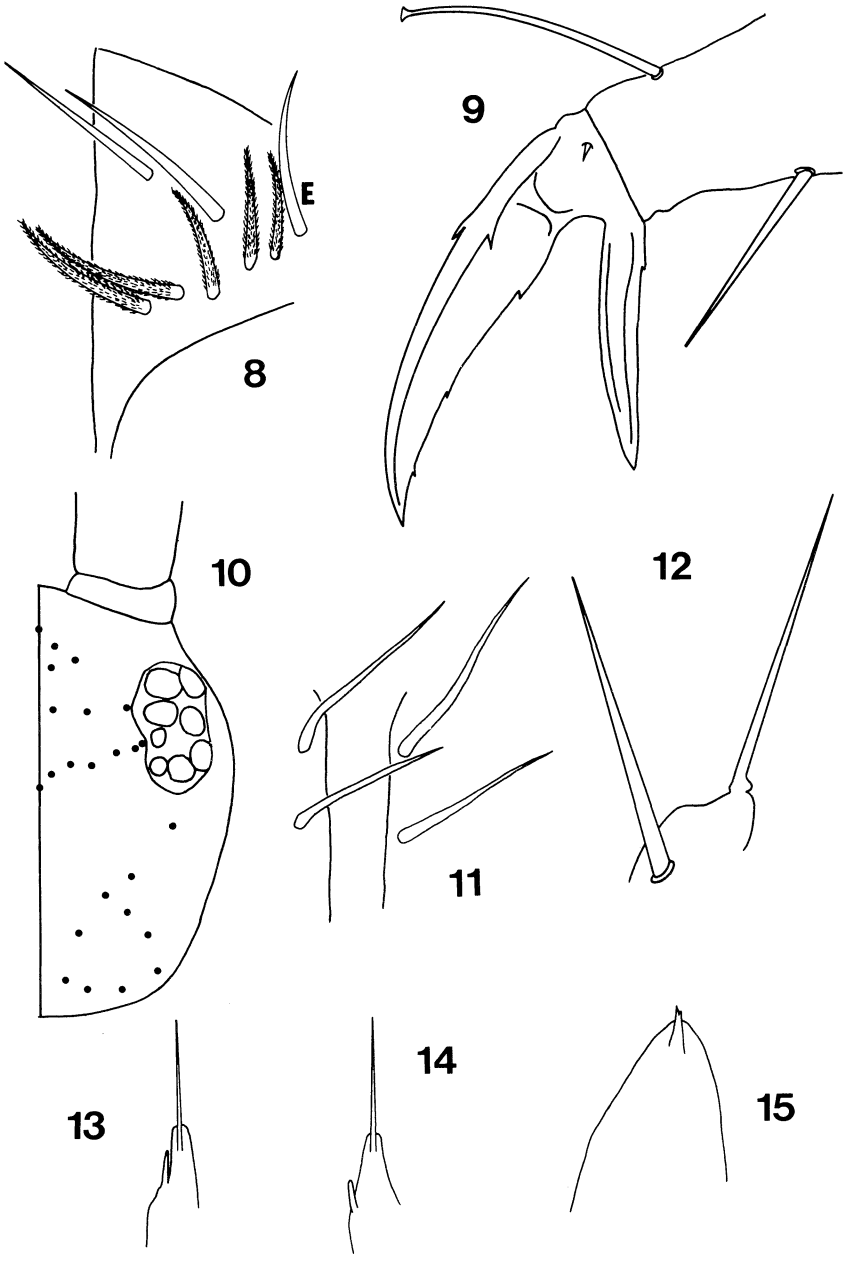

FIG. 8–15. **8–10, 12–13,** *D. nepalensis*; **11, 14, 15,** *D. singularis.* **8.** Labial triangle. **9.** Metathoracic claw. **10.** Head macrochaetotaxy (each dot represents a seta). **11.** Quadrangle of setae immediately behind labial triangle along ventral groove. **12.** Maxillary palp. **13.** Outer labial papilla and its differentiated seta. **14.** Same. **15.** Apex of Ant. 6 with pin seta.

with short verticillating setae only, subequal in length. Ratios of antennal segments 6:21:11:26:68:61. Antennae about ¾ length of head and body combined. Pin seta of Ant. 6 present.

Head macrochaetotaxy as in FIG. 1, S_2 absent. Eyes 8+8 on dark patches, eyes g and h reduced in diameter but with well-developed corneae. Four prelabral setae, all smooth, not bifurcated apically. Labral chaetotaxy follows formula 5,5,4; all setae smooth and not bifurcated. Labral papillae (FIG. 5) of type I, rounded, with a spinelike process. Chaetotaxy of labial triangle as in FIG. 3, setae of anterior row smooth, setae of posterior row ciliated; number of setae on latter row increases with size of individual. Maxillary palp as in FIG. 4, subapical seta distinctly thicker than apical one. Differentiated seta of outer labial papilla (FIG. 7) short, its apex falling far behind apex of its papilla. All setae of venter of head ciliated. *Tibiotarsi* without smooth setae with exception of seta opposite tenent hair present on metathoracic legs (of all species). Structure of claws as in FIG. 2. Unguis with a pair of lateral outer teeth, a pair of basal inner teeth and 2 distal unpaired teeth. Unguiculi with very small outer tooth. Pretarsal setae present. Tenent hair long, apically clavate. Body macrochaetotaxy as in FIG. 31, some specimens show irregularity in arrangement of Th. 2 and Abd. 4. Rami of tenaculum quadridentate, corpus with a median seta. Trochanteral organ with about 38 short and medium spinelike setae. Collophore multisetaceous, scaly; anterior distal 3+3 setae longer than rest, ciliated. Furcula without smooth setae. Proximal dorsal portion of dentes with a pair of long, conspicuous, ciliated (plumose) setae (FIG. 6). Dental spines absent. Smooth portion of dens about 3× length of mucro, which has 2 teeth and basal spine.

Holotype, INDIA: Shillong, Meghalaya, Crinoline Falls, 18.X.1974, soil and leaf litter, R.K. Bhattacharjee (INHS). Paratypes: INDIA: 30, same data as holotype; 41, Shillong Peak, 1960 m, 31.X.1974, forest broad leaf litter, Bhattacharjee; 54, same data except 28.I.1975; 60, same data except 3.II.1975; 40, same data except 4.II.1975; 19, Shillong, Boyce Rd, 29.I.1975, leaf litter and grasses in the slope of a hillock, Bhattacharjee (INHS, ZSI, JAMM, RKB).

Remarks. The specimens at hand can be sorted into 2 phena, one of individuals which are essentially dark blue throughout and the other of essentially pale individuals. Both forms occur sympatrically.

This species is most similar to the Nepalese *D. janetscheki* Yosii, 1971 and to *D. nepalensis,* n. sp. From the first it may be separated by the chaetotaxy of Th. 2 and Abd. 2. From *D. nepalensis,* n. sp. it may be readily distinguished by the color pattern and chaetotaxy of Th. 3 to Abd. 2. The name of this species points to the close similarity existing between it and the aforementioned species.

Dicranocentrus nepalensis Mari Mutt, **new species** FIG. 8–10, 12–13, 32

Habitus typical of genus. Length up to 2.2 mm. Antennae and anterior portion of head with some diffuse violet pigment; no pigment on rest of animal. Ant. 5 and Ant. 6 subequal in length. Pin seta of apex of Ant. 6 present.

Head macrochaetotaxy as in FIG. 10. Labral papillae as in *D. fraternus.* Labial triangle as in FIG. 8; all setae of posterior row ciliated, note similarity with pattern of preceding species. Maxillary palp as in FIG. 12. Differentiated seta of outer labial papilla short (FIG. 13) but not placed as far back as in most species (e.g., FIG. 14). Venter of head with smooth setae and ciliated setae; most setae, including those immediately behind labial triangle, along median cleft, ciliated. *Tibiotarsi* without smooth setae. Structure of claws as in FIG. 9; ungues with a pair of small basal inner teeth and 2 very small distal unpaired teeth. Unguiculus with a very small outer tooth. Tenent hair apically clavate. Body macrochaetotaxy as in FIG. 32. Furcula without smooth setae. Dental spines absent.

Holotype, NEPAL, Tomlingar Distr, about 9 km NNE of Chainpur, 2660 m, 29.III.1975, M. Marks (FMNH); 3 paratypes, same data as holotype (FMNH, JAMM).

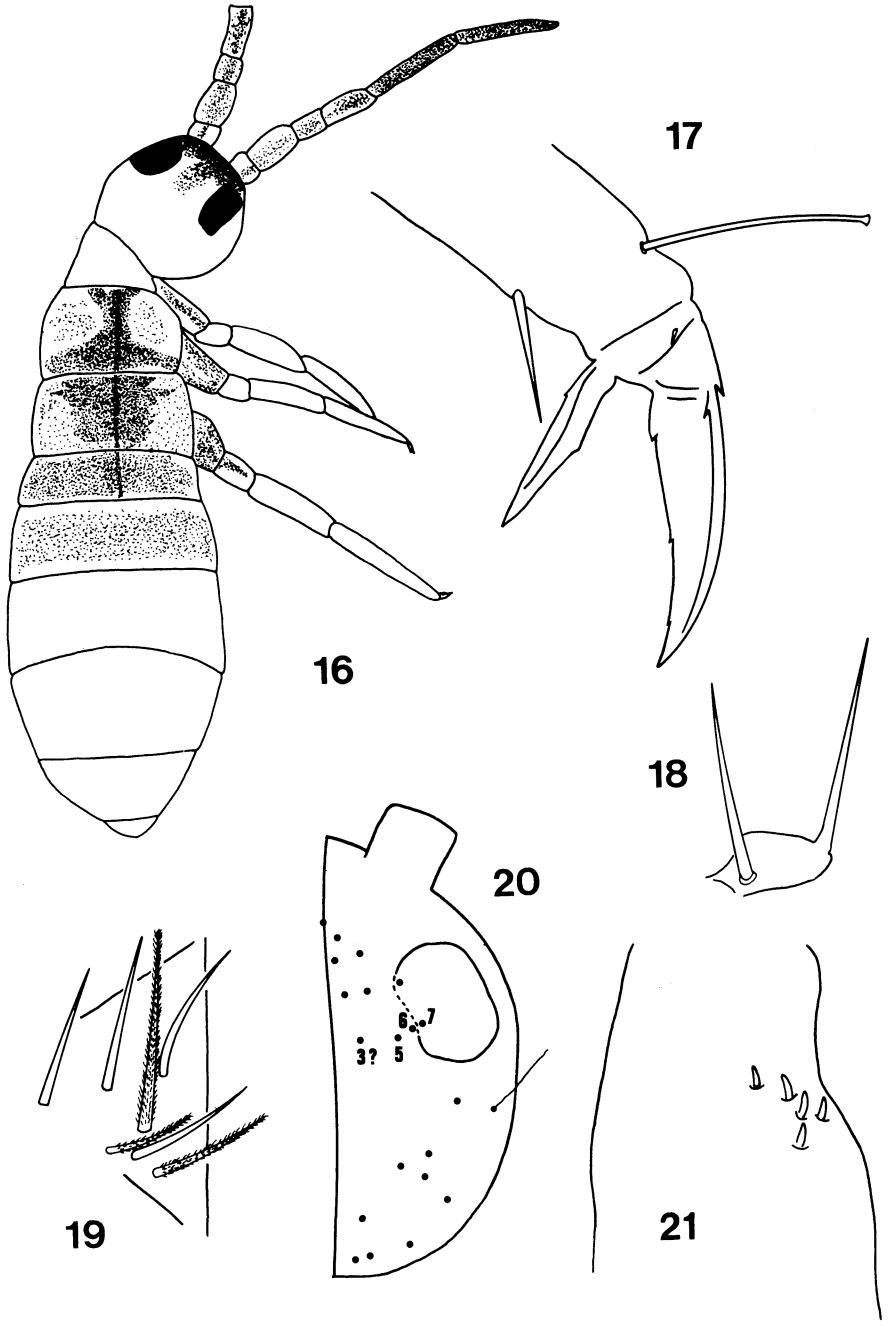

FIG. 16–21. *Dicranocentrus singularis*. **16.** Habitus and distribution of dark blue pigment. **17.** Mesothoracic claw. **18.** Maxillary palp. **19.** Labial triangle. **20.** Head macrochaetotaxy; note the absence of S_0–S_2 and S_4. **21.** Ant. 3 sense organ.

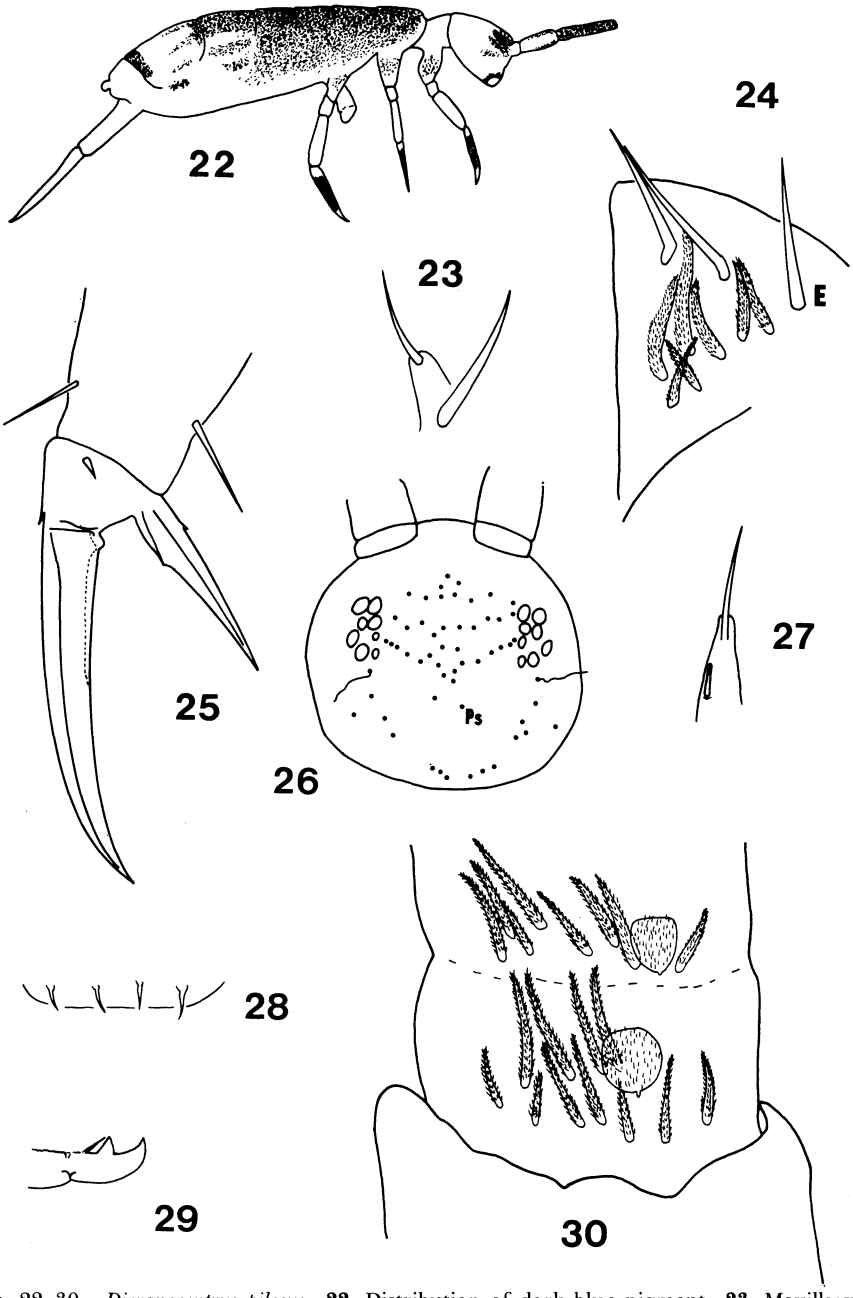

FIG. 22–30. *Dicranocentrus pilosus*. **22.** Distribution of dark blue pigment. **23.** Maxillary palp. **24.** Labial triangle. **25.** Metathoracic claw; note the long untoothed unguis and the much reduced tenent hair. **26.** Head macrochaetotaxy; note presence of 5 M setae, 8 S setae besides S_0, and Ps. **27.** Outer labial papilla with its differentiated seta. **28.** Labral papillae. **29.** Mucro. **30.** Region between Ant. 3–4, showing area devoid of setae and scales which marks the boundary between these segments.

Remarks. The species is most similar to *D. fraternus* from which it may be separated by the color pattern and by the chaetotaxy of Th. 3 to Abd. 2. From *D. janetscheki* the new species may be distinguished by the color pattern, relative lengths of Ant. 5–6, and by the chaetotaxy of Th. 2 to Abd. 1.

Dicranocentrus singularis Mari Mutt & Bhattacharjee, **new species**
FIG. 11, 14–21, 33

Habitus and distribution of pigment as in FIG. 16. Length up to 2.3 mm. Ant. 5 and Ant. 6 subequal in length. Ratios of antennal segments as 7:18:12:23:41:43. Pin seta of Ant. 6 present (FIG. 15). Ant. 3 sense organ as in FIG. 21.

Head macrochaetotaxy as in FIG. 20, note absence of S_0–S_2 and S_4. Labral papillae as in *D. fraternus* and *D. nepalensis*. Labial triangle as in FIG. 19, posterior row with 1 smooth and 3 ciliated setae. Maxillary palp and differentiated seta of outer labial papilla as in FIG. 18 and FIG. 14, respectively. Most setae of venter of head ciliated but those immediately posterior to labial triangle, along median cleft, smooth (FIG. 11). *Tibiotarsi* without smooth setae. Structure of claws as in FIG. 17. Ungues with a pair of small, very basal, inner teeth and with 2 very small distal unpaired teeth. Inner margin of unguiculus of pro- and mesothoracic legs characteristically notched midway along its length; unguiculus of metathoracic legs as in other species. Outer margin of all unguiculi with very small tooth. Tenent hair apically clavate. Body macrochaetotaxy as in FIG. 33; note reduction in number of setae as compared with preceding and next species. Ratio of furcal segments as 96:184:5. Dorsum of manubrium with a double row of conspicuous erect smooth setae. Dorsal proximal portion of dentes with a pair of similar setae but without plumose setae. Dental spines absent.

Holotype, INDIA, Shillong, Meghalaya, Ka Mari Rd, 30.X.1974, from moss over pillars in the side of a road on a hill, R.K. Bhattacharjee (INHS). Paratypes: INDIA: 34, same data as holotype; 18, Shillong, St. Edmund's College, steps nr B. T. Hostel, 12.XI.1974, moss over steps on the side of the hill, R.K. Bhattacharjee; 8, Shillong, Boyce Rd, 20.X.1974, from moss and fern roots on sides of a hill, Bhattacharjee (INHS, ZSI, JAMM, RKB).

Remarks. This species can be readily separated from all other *Dicranocentrus* by the indicated reduction in number of head macrochaetae, the absence of the upper inner pair of macrochaetae of Th. 2, the chaetotaxy of Abd. 4, the color pattern, and the shape of pro- and mesothoracic unguiculi.

Dicranocentrus pilosus Mari Mutt, **new species** FIG. 22–30, 34

Habitus typical of genus. Length 2.5 mm. Distribution of pigment as in FIG. 22. Ant. 6 missing (accidentally). Division between Ant. 3 and Ant. 4 inconspicuous, marked ventrally by slight indentation and area devoid of scales (FIG. 30).

Head macrochaetotaxy as in FIG. 26; note presence of 5 M setae, 8 S setae (besides S_0), and Ps. Labral papillae (FIG. 28) as in preceding species. Chaetotaxy of labial triangle as in FIG. 24; note similarity with patterns of *D. fraternus* and *D. nepalensis*. Maxillary palp as in FIG. 23. Differentiated seta of outer labial papilla short (FIG. 27), placed far back on its papilla. *Tibiotarsi* without smooth setae. Claw structure (FIG. 25) unique. Unguis very long and without inner teeth, 2 small proximal lobes seem to represent remains

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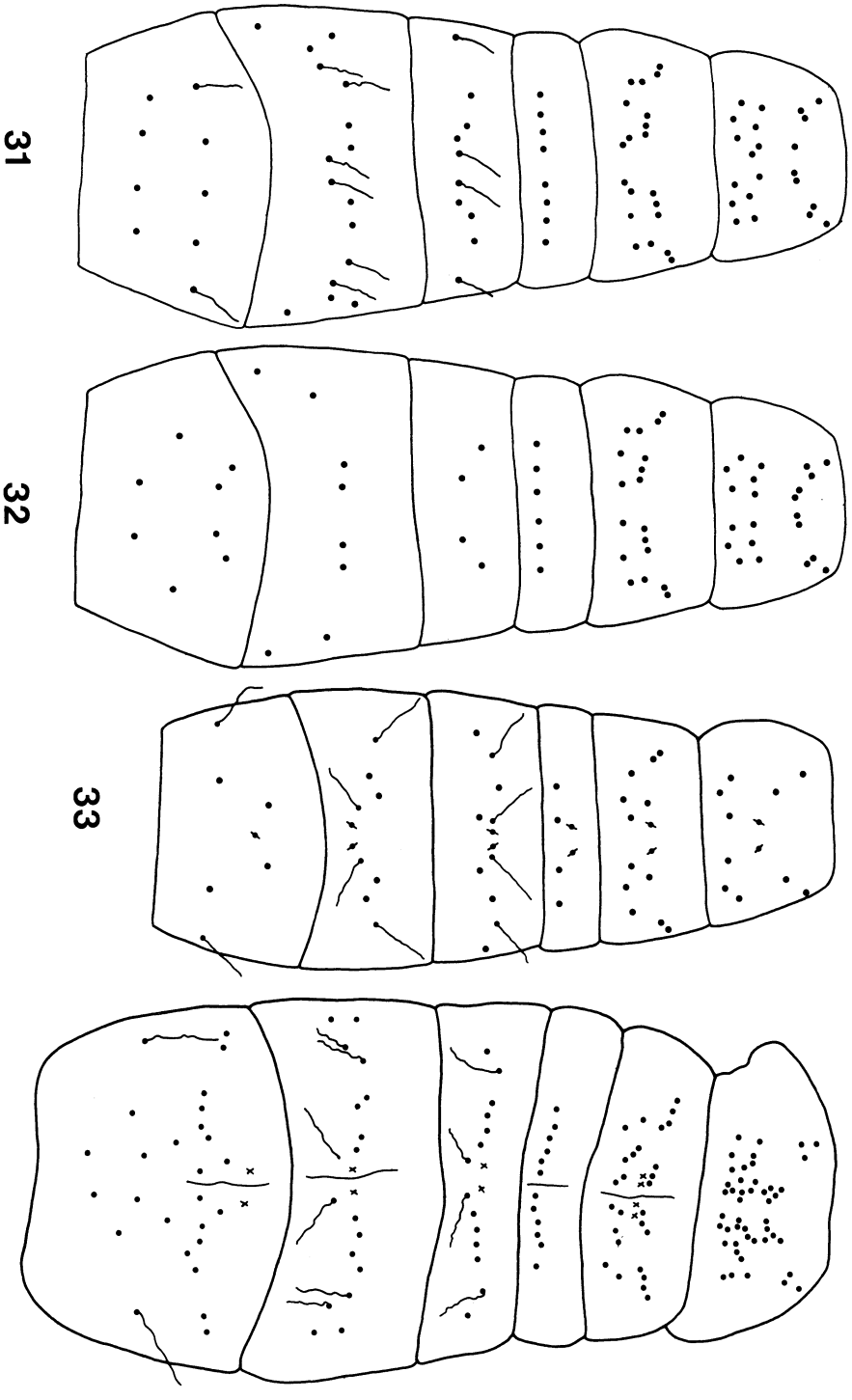
FIG. 31–34. Distribution of some lasiotrichia and body macrochaetotaxy; each dot represents a seta, each × and ϕ represent a pseudopore; **31,** *D. fraternus*; **32,** *D. nepalensis*; **33,** *D. singularis*; **34,** *D. pilosus*.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of proximal pair of teeth. Unguiculus fairly large, apically pointed, with very small outer tooth. Inner pair of unguicular lamellae unite proximally, originating a toothlike projection. Tenent hair very short. Body macrochaetotaxy as in FIG. 34; note abundance of setae, especially on Th. 2 and Abd. 4. Furcula without smooth setae, dorsum of manubrium with many ciliated setae and few scales. Base of dentes without plumose setae. Dental spines absent. Apical mucronal tooth large (FIG. 29) and more distal than usual.

Holotype, NEPAL, Nawatok and Sindhu districts, just N of Panghu Danda, 3303 m, 11.IX.1968, C. Wiens (FMNH).

Remarks. Several characters will instantly separate this species from all other *Dicranocentrus*. Most obvious of these is the structure of the claws, which is reminiscent of that of many troglobitic entomobryids. The macrochaetotaxy of Th. 2 and Abd. 4 plus some details of head macrochaetotaxy mentioned in the description are also unique to this species. *D. pilosus,* as its name implies, is the most polychaetotic *Dicranocentrus*.

The structure of the mucro is similar to that of some cavernicolous Entomobryidae in which claws and mucro are frequently adapted for walking on water. Perhaps *D. pilosus* is an aquatic species.

The division between Ant. 3 and Ant. 4 is very difficult to discern, a most unusual trait in the genus. This characteristic, coupled with those detailed in the preceding paragraphs, indicate that *D. pilosus* is phyletically somewhat removed from all other *Dicranocentrus,* although its closest affinities are with the Oriental species and, in particular, with those described in this paper.

Acknowledgments. The senior author wishes to express his sincere gratitude to Dr Phillip W. Smith, Head, Faunistics Section, Illinois Natural History Survey, and his staff for support and encouragement throughout this work, much of which was completed while the senior author was at that institution. The junior author is indebted to Dr N. R. Prabhoo, Reader in Zoology, Kerala University, for his various suggestions during the initial stages of this work. The authors wish to thank Mr Hank S. Dybas and Dr Eric Smith of the Field Museum of Natural History for the loan of the Nepalese specimens.

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