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REPORT ON A COLLECTION OF CLADOCERA AND COPEPODA FROM NEPAL*

Henri J. DUMONT & Isabella VAN DE VELDE

Zoological Institute, University of Gent, 35, Ledeganckstraat, Gent-Belgium

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Abstract

22 species of Cladocera and 14 species of Copepoda are reported, mainly from Kathmandu valley, Central Nepal and some from high-altitude lakes in the Khumbu area, East Nepal. Two species are new to science; neither can, however, be named due to inadequate material. The relation between *Macrothrix laticornis* (Jurine, 1820), *M. spinosa* King, 1853 and *M. goeldii* Richard, 1897 is discussed; *M. goeldii* is set as synonym to *M. spinosa*; new morphological criteria, permitting a separation to *M. laticornis* and *M. spinosa*, are given. Some biogeographical aspects of the fauna encountered are: 1) among Copepoda two calanoids of oriental origin and one of supposed palaeartic origin reach Kathmandu valley; all other Copepoda are circumtropical or cosmopolite species; no oriental Cyclopoidea were found; 2) at higher altitudes, no Cyclopoidea were found, and the Calanoidea were endemic species of the palaeartic genus *Arctodiaptomus*; 3) no oriental Cladocera were found in Kathmandu valley; the majority of species were cosmopolitan, the remainder circumtropical; 4) at high altitudes, endemic species of palaeartic genera exist next to a set of cosmopolitans.

Much remains to be learned about the Entomostraca of Nepal. Ueno (1966) comments upon a single sample from Yangma, 4600 m, N.-E. Nepal; Löffler (1968a, b; 1969) studied high-altitude lakes in the Khumbu area, paying special attention to the Copepoda Harpacticoida. Hickel (1973a, b) studied lakes and ponds in the valleys of Kathmandu and Pokhara. Although her work was mainly dealing with general limnology and algology, some Cladocera and Copepoda were also identified. During a visit by the senior author to Nepal in May 1973, a number of plankton samples were collected in eight localities. A

locality map is given in Daems & Dumont (1974).

The localities are:

1. Three closely apposed high-mountain lakes in the Khumbu area: Gokyo tsho (alt. 4750 m), Longponga tsho (alt. 4700 m) and a small unnamed third lakelet, Tsho III (alt. 4700 m). They lie along the side-morene of the Ngozumpa glacier, are connected by a streamlet and were still largely frozen on 5-5-1973.
2. Dolé (alt. 4100 m): shallow swamp with a thick rusty sediment, Khumbu area, 2-5-1973.
3. Tau Daha, Kathmandu valley (alt. ca. 1400 m): a eutrophic lakelet, rich in aquatic macrophytes. Data on phytoplankton and basic chemistry are given by Hickel (1973b). A series of zooplankton samples were here collected on 10-5-1973.
4. Hypertrophic village pond outside Patan, Kathmandu valley, 15-5-1973. A water bloom of blue-green algae present at the time of sampling.
5. Pool at Godavari, Kathmandu valley, 15-5-1973: small, standing water, probably astatic, near the entrance of the royal botanical gardens.
6. Rice paddy, Patan, 15-5-1973.
7. Chauni, Kathmandu, 15-5-1973, a near-standing section of a rivulet.
8. Phewa Tal, Pokhara valley, S.-W. Nepal (alt. ca. 800 m), 13-5-1973. A eutrophic lake near the city of Pokhara. Previously studied by Hickel (1973a).

List of species

Numbers behind the species refer to the localities given above; relative abundance: R, rare; C, common; D, dominant.

Cladocera			
Sididae			
1. <i>Diaphanosoma excisum</i> Sars, 1886	8		D
2. <i>Diaphanosoma sarsi</i> Richard, 1894	3		R
Daphniidae			
3. <i>Daphnia longispina</i> O. F. Müller, 1785	8		C
4. <i>Daphnia lumholtzi</i> Sars, 1886	8		R
5. <i>Ceriodaphnia cornuta</i> Sars, 1885	3, 8		C
6. <i>Ceriodaphnia reticulata</i> (Jurine, 1820)	8		R
7. <i>Simocephalus vetulus elisabethae</i> (King, 1853)	8		C
Moinidae			
8. <i>Moina micrura</i> Kurz, 1874	4, 5		D
Bosminidae			
9. <i>Eubosmina coregoni</i> (Baird, 1857)	8		R
Chydoridae			
10. <i>Eurycercus</i> sp.	1		R
11. <i>Alona rectangula rectangula</i> Sars, 1862	3		R
12. <i>Alona guttata guttata</i> Sars, 1862	3, 5		R
13. <i>Alona quadrangularis</i> (O. F. Müller, 1785)	5		R
14. <i>Biapertura karua</i> (King, 1853)	3		D
15. <i>Biapertura pseudoverrucosa verrucosa</i> (Sars, 1901)	3		C
16. <i>Dunhevedia crassa</i> King, 1853			
17. <i>Graptoleberis testudinaria testudinaria</i> (Fischer, 1851)	3		R
18. <i>Pleuroxus aduncus aduncus</i> (Jurine, 1820)	3		D
19. <i>Pleuroxus laevis</i> Sars, 1862	3		R
20. <i>Chydorus sphaericus</i> (O. F. Müller, 1785)			
	1, 2, 3, 5, 6, 7		C
Macrothricidae			
21. <i>Macrothrix laticornis</i> (Jurine, 1820)	3, 5, 7		C
22. <i>Macrothrix triserialis</i> Brady, 1886	3		R
Copepoda			
Calanoida			
1. <i>Eudiaptomus</i> sp.	3		R
2. <i>Arctodiaptomus jurisowitchi</i> Löffler, 1968	1		D
3. <i>Neodiaptomus strigilipes</i> (Gurney, 1907)	3		C
4. <i>Phyllodiaptomus blanci</i> (de Guerne & Richard, 1896)	8		D

Cyclopoïda

5. <i>Cryptocyclops linjanticus</i> Kiefer, 1928	3		R
6. <i>Microcyclops varicans</i> (Sars, 1863)	3		R
7. <i>Paracyclops affinis</i> (Sars, 1863)	3		R
8. <i>Macrocyclops distinctus</i> (Richard, 1887)	3		R
9. <i>Ectocyclops rubescens</i> Brady, 1904	3		R
10. <i>Tropocyclops confinis</i> (Kiefer, 1930)	5		C
11. <i>Eucyclops euacanthus</i> (Sars, 1909)	3		C
12. <i>Eucyclops serrulatus</i> (Fischer, 1851)	3, 5, 6, 7		C
13. <i>Mesocyclops leuckarti</i> (Claus, 1857)	3, 6, 8		C
14. <i>Thermocyclops hyalinus</i> (Rehberg, 1880)	3, 6, 8		C

Remarks on selected species

Cladocera

1. *Diaphanosoma excisum* Sars, 1886 (Fig. 1, A-C)
The limnetic population of *Diaphanosoma* from Phewa Tal showed some points of agreement with Brehm's (1933) *D. paucispinosum* from the Sunda Islands; there was however considerable overlap with typical *excisum* in the essential character, i.e. the number of teeth along the postero-ventral rim of the valves. This should be less than 10 in *paucispinosum*, but varied between 4 and 15 in our material. The transition between the spines and spinules also varied greatly: it was sometimes abrupt (Fig. 1, A), sometimes almost continuous (Fig. 1, B) and both types occasionally occurred together, on the left and right valve of the same animal. *D. paucispinosum* is therefore considered a doubtful taxon here. The inward fold of the ventral valve area, frequently called 'duplication', is moderately abrupt in *excisum* (Fig. 1, A). In fact, on evidence of this character, it may be hard to tell *excisum* apart from the European *brachyurum*.

2. *Diaphanosoma sarsi* Richard, 1894 (Fig. 1, D-E)

This species, rare in the plankton of Tau Daha, was easily differentiated from the preceding one by its enormous eye, which fills up the head almost completely. In this feature, and also in the armature of the posterior rim of the valves (Fig. 1, E), Nepalese animals agree with typical *sarsi* from Sumatra (Richards, 1894). The species, however, is not homogeneous throughout the world. In specimens from Guatemala we have found other types of armatures on the posterior margin of the valves (Van de Velde, Dumont & Grootaert, in preparation).

A further good diagnostic character is that the ventral fold of the valves is very abrupt and sinuous along its

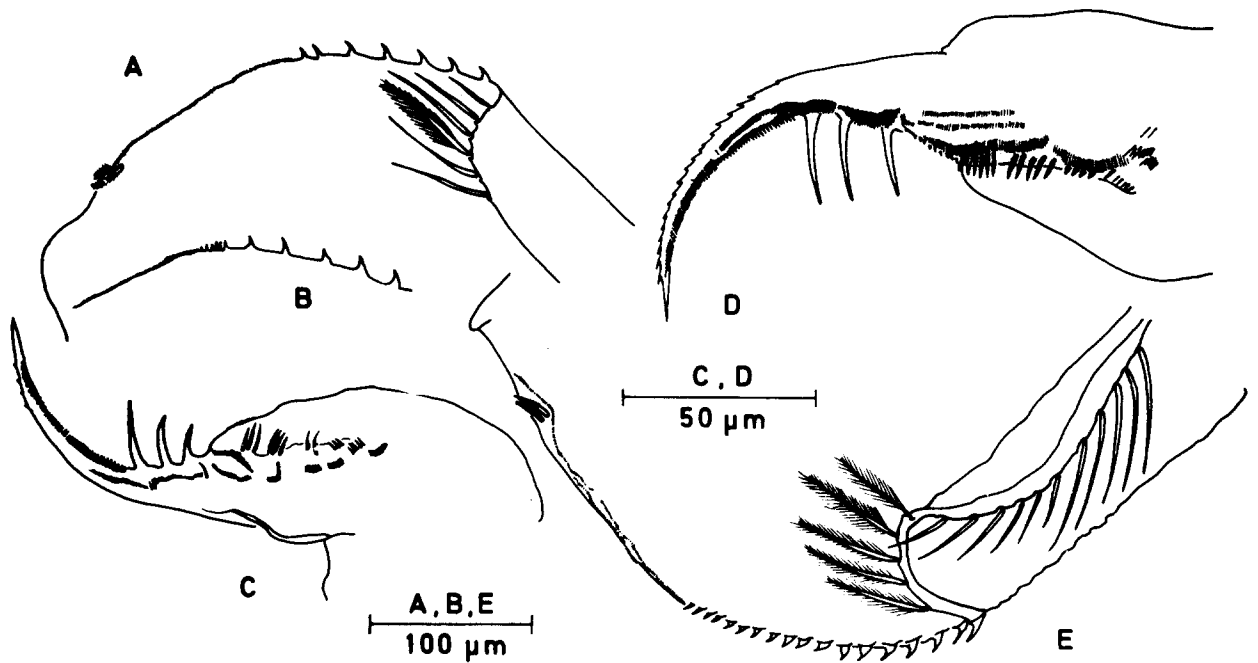


Fig. 1. *Diaphanosoma excisum* Sars, 1886 A: postero-ventral rim of left valve; B: postero-ventral rim of right valve of same specimen; C: postabdomen, *Diaphanosoma sarsi* Richard, 1894 D: postabdomen; E: postero-ventral rim of valve.

margins. The ciliated hairs along the margin of the fold are long at first, then, at the level of the sinuosity, suddenly become shorter, to return to their original length further on the course of the fold. In *excisum* (and all other species that we have seen), the hairs along the fold are shortest at the beginning of the fold, and then progressively reach a length which is maintained over the whole of the fold.

3. *Daphnia longispina* O. F. Müller, 1785 (Fig. 2, C-D) Parthenogenetic females were well represented in the plankton of Tau Daha. In general appearance (Fig. 2, D), as well as in the structure of the postabdomen, they look exactly like Central-European animals.

4. *Daphnia lumholtzi* Sars, 1886 (Fig. 2, A-B) Rare in the plankton of Phewa Tal. The helmets and fornices were enormously developed in the specimens seen. *D. lumholtzi*, originally described from Australia, is a circumtropical species occurring in subtropical lakes as well, e.g. Lake Tiberias (Barrois, 1893).

It is, however, a rather rare species, especially in the subtropics, and has e.g. not been found back in Lake Tiberias (Yam Kinneret, Israel) since 1953 (F. D. Por, personal communication).

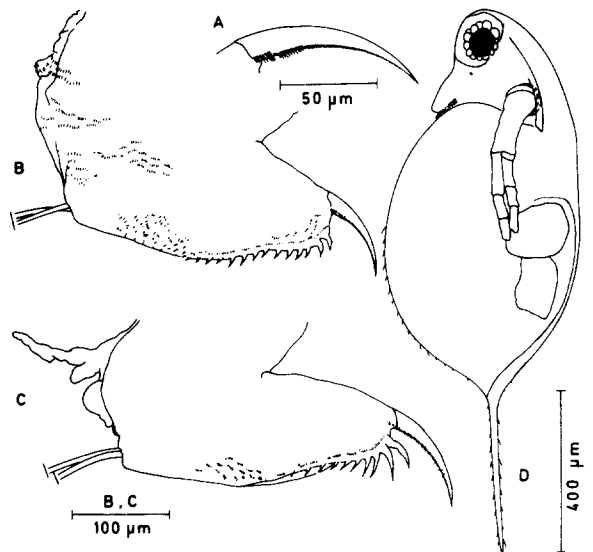


Fig. 2. *Daphnia lumholtzi* Sars, 1886 A: detail of postabdominal claw; B: postabdomen, *Daphnia longispina* O. F. Müller, 1785 C: postabdomen; D: parthenogenetic female, total.

5. *Simocephalus vetulus elisabethae* (King, 1853) (Fig. 3, A-C)

Syn. *Simocephalus vetuloides* Sars, 1916

The relation between *S. vetulus* (O. F. Müller), *S. elisabethae* (King) and *S. vetuloides* Sars is still a matter for discussion. The shape of the posterior margin of the shell has decisive importance for the separation of these taxa. Since in this respect *elisabethae* and *vetuloides* cannot be separated, *elisabethae* is the valid name.

Harding (1961) compared the shape of the valves in series of animals from different locations in Africa with animals from various parts of England. In a few cases, English specimens showed a tendency towards the development of a posterior protuberance, characteristic of *elisabethae*, while, rarely, some African *elisabethae* did not develop this protuberance. In the vast majority of cases both could be told apart without difficulty. The tendency towards overlap, however, justly throws doubt upon a specific difference between *vetulus* and *elisabethae*. Still we feel that the occurrence of forms with a posterior protuberance in tropical and subtropical areas of the world, and the absence of such forms (or their rarity) in moderate and cold climatic belts, is sufficiently regular to justify the maintenance of at least two distinct subspecies. The correct name for the tropical-subtropical

geographic subspecies is *S. vetulus elisabethae* (King, 1853), as redefined by Henry (1922).

Attempts at discovering other criteria for distinguishing between other poorly defined *Simocephalus* have so far led to frustrating results. The morphology of the trunk limbs is much like *Daphnia* and only some very subtle differences exist in the structure of P₁ and P₂ (Dumont, unpublished).

The presence of head-pores and their possible taxonomic significance has also been investigated. Frey (1959) states that he could find only two small pores near the tip of the head-shield. These are indeed very difficultly seen but there is a group of three large, connected pores in the cervical area (Fig. 3, B). Here again an identical pattern was found in all species we have been able to investigate so far.

The population found in Tau Daha was interesting in that it proved possible to construct an ontogenetic series, illustrating the evolution in the development of the valves. In very young instars, a small spinulated protuberance is seen at the dorso-caudal corner of the valves. As the animals grow, the protuberance becomes more expressed, and, through a dorsal swelling of the valves, apparently moves ventrad. (Fig. 3, A). At higher altitudes in Nepal (e.g. Yangma, 4600 m), typical *S. vetulus* (O.F.M.) have been found (Ueno, 1966).

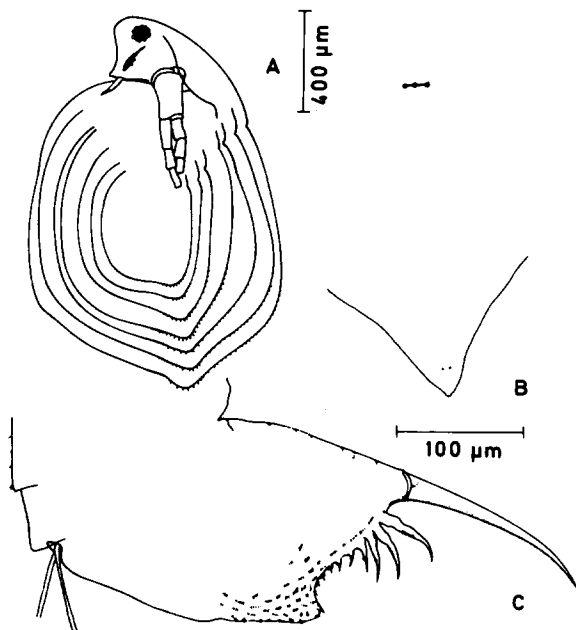


Fig. 3. *Simocephalus vetulus elisabethae* (King, 1853) A: evolution in the development of the posterior protuberance at the posterior margin of the valves; B: head-pores; C: postabdomen.

5. *Eurycercus* sp.

A number of specimens, collected in Tsho III, loc. 1, were sent to Dr. D. G. Frey (Bloomington, Indiana, U.S.A.) for further study. According to Frey, they pertain to an undescribed species but, as no adults were present in our collection, the description should wait until more material becomes available. This high-mountain form could well be the same as that cited from Tibet under the name *E. lamellatus* O.F.M. (Shen & Sung, 1964).

6. *Biapertura pseudoverrucosa verrucosa* (Sars, 1901) (Fig. 4, A-C)

We follow here Smirnov's (1970) nomenclature. A circumtropical species, known from India (*vide* Smirnov, 1970), extremely common in Tau Daha, where it outnumbered all other Aloninae except *B. karua*.

7. *Pleuroxus laevis* Sars, 1862 (Fig. 4, D)

Widely distributed in Europe, Central Asia and also known from Ceylon (*vide* distribution map in Smirnov, 1970), but apparently not recorded from the Indian subcontinent.

8. *Chydorus sphaericus* (O. F. Müller, 1785)

This was the most widespread Cladoceran found in Nepal, where it occurred in very different types of biotopes. The high-mountain population showed a typical dark-brown pigmentation, as already reported by Ueno (1966) and Löffler (1969), but they could not be separated from lowland forms on morphological grounds.

9. *Macrothrix laticornis* (Jurine, 1820) (Fig. 5; Fig. 6, A-F; Fig. 7; 8; 9)

It has been known for some time that the genus *Macrothrix* is in need of revision. Among other things, the *M. laticornis*-group is in a state of confusion. Jurine's species was taken near Geneva, in a subalpine environment; this represents the 'European form' as it became known from a series of descriptions (Baird, 1850; Lilljeborg, 1900; Stingelin, 1908; Keilhack, 1909; Wagler, 1937; etc.). From two localities in New South Wales, Australia, King (1853) described *M. spinosa*. The description was short and irrelevant, but the figures permit to recognize the species. It was recently redescribed on more or less topotypical material by Petkovski (1973).

From Lunache, Chile, South-America, Richard (1897) described *M. goeldii*. Its close relationship with both *M. laticornis* and *M. spinosa* (as redefined, with

some erroneous interpretations, by Sars, 1888) was recognized. The description is quite detailed and precise, but the name *goeldii* is not used again until Gauthier (1939) considered some *Macrothrix* found by him in Tchad, Africa, as a new subspecies to that species. Recently Rey & St-Jean (1968) figure a *Macrothrix* from Tchad lake, again under the name *goeldii*. Petkovski (1973) preserves both species' names and claims that *M. goeldii* is distributed from South America to Southern Asia and Africa, and that it differs from *M. spinosa* mainly by its smaller size, *M. spinosa* being larger than 0.77 mm, *M. goeldii* smaller than 0.53 mm. Animals from Victoria, Australia, kindly made available by Dr. B. V. Timms have a total length between 0.37 and 0.41 mm. Therefore, unless there would be two very closely allied species occurring together in Australia, the size gap between *goeldii* and *spinosa* should be considered not existent.

Our Nepalese animals were sufficiently puzzling to induce us to compare them with populations, not only from Australia (supposedly typical *spinosa*), but also from Belgium (supposedly typical *laticornis*) and from Hula, Lake Kinneret area, Israel (whence Petkovski, 1973 states to have obtained typical *goeldii*). We found that, in size and habitus, all series tend to show overlap. A habitus as in Fig. 5, A, with only the postcervical half of the valvae serrated, is met in all, as well as a type in which the serration (in fact, the degree to which the scales of the valves happen to be visible) extends over the dorsum of the head. A study of the antenna shows a variation from a rather long and slender type, with a bunch of ventrally implanted, distinctly subapical long spines, two tufts of

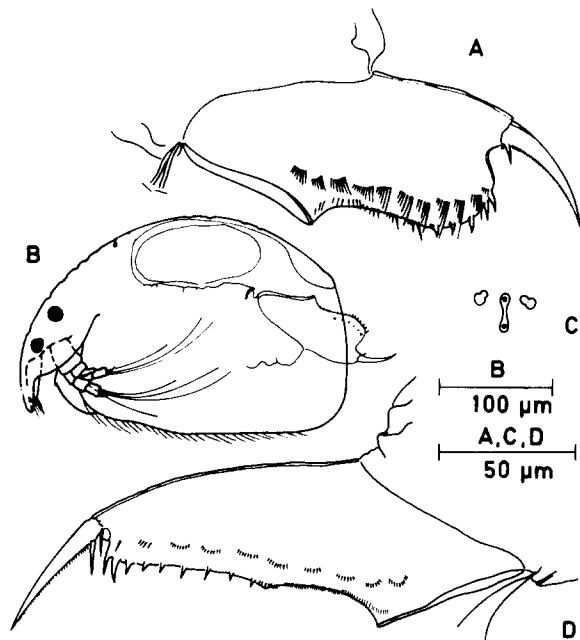


Fig. 4. *Biapertura pseudoverrucosa verrucosa* (Sars, 1901) A: postabdomen; B: parthenogenetic female, total; C: head-pores, *Pleuroxus laevis* Sars, 1862 D: postabdomen.

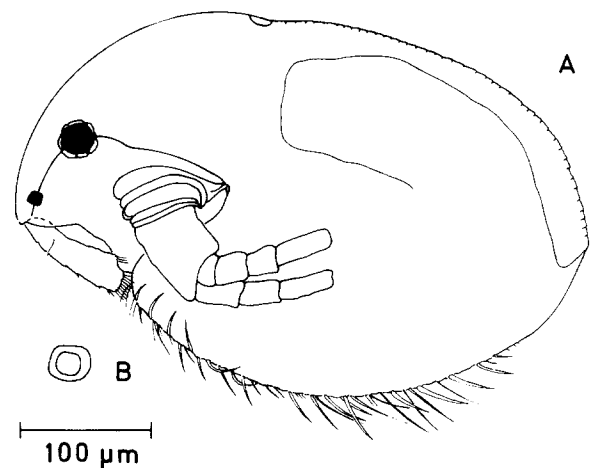


Fig. 5. *Macrothrix laticornis* (Jurine, 1820) Chauni, Nepal A: parthenogenetic female, total; B: head-pore.

dorsal spines and 4 rows of dorsal spinules (River Sambre, Belgium: Fig. 6, E-F) towards a more robust type, in which the ventral apical angulation of the antenna is, although undoubtedly present, less distinct, the bunches of spines somewhat shorter, and the rows of spinules (4 or 5) still visible as rows, not as a serration (Chauni, Nepal: Fig. 6, C-D).

In a third type of antenna (Australia, Israel: Fig. 6, A-B), the antenna appears more widened at its tip, without a distinct ventral angulation, and with the rows of spinules not visible, but marked as a step-like serration along the dorsal margin of the antenna. Although the separation of the antennae in species-specific groups therefore appears difficult, Nepalese specimens tend to be more of the *laticornis* type (Fig. 6, C-D) than of the *spinosa-goeldii* type. The antennal structure alone is certainly insufficient evidence for unraveling this species-group.

The structure of the head-shield, which has never been studied in detail, proved to lead to more consistent results. In the *spinosa-goeldii* group, the head-shield widens

abruptly at the level of the compound eye (Fig. 7); in lateral view, a strong ridge departs from the compound eye, is convexly arched at the level of the base of the second antenna, and runs further down towards the ventral edge of the head-shield; in typical *laticornis*, including Nepalese animals, the head-shield widens gently from the tip of the rostrum onwards. In lateral view, a ridge is seen to depart from the tip of the rostrum, distal to the level of the ocellus and runs towards the base of the head shield in a continuous concave arch (Fig. 5; Fig. 6, C-D). A further important difference is in the shape of the head-pore (Fig. 5; 7) which is very small in the *spinosa-goeldii* group (Australia, Israel) and large in *laticornis* (Belgium, Nepal).

An examination of the postabdomen revealed some further differences (Fig. 8; 9). It should be stated, at the outset, that much of the variation seen in published figs. of postabdomina of *Macrothricids* is due to pressure-induced artifacts. Contrary to *Daphniids* and *Chydorids*, where the postabdomen is a relatively flat structure, the postabdomen in *Macrothricids* is a thick, swollen organ, which may suffer heavy deformation under coverglass pressure. It is therefore rather essential to examine it, not only from the side, but also from above (Fig. 9). As far as we know, Gauthier (1939, 1951) and Petkovski (1973) are the only ones to have attempted this. If then, postabdomina of animals from Belgium, Nepal, Israel and Australia are compared (Fig. 8) it appears that in the former two there is a terminal single bunch of strong spines, with a few very thin spinules between them and the base of the end-claws (group A). In the latter two (group B), bunches of spines, almost equal in size, occur in the same area. In dorsal view, these spines appear to flank the anal opening; in group A the small spines are above the anal opening, the bunch of three or four strong spines is at the anterior half of the anus, two (sometimes three) rows of small spinules flank the posterior part of the anus.

In group B, between four to six groups of subequal spines line both sides of the anal opening. No particular pattern was found in the tufts of fine hairs that stand along the flanks of the postabdomen in both groups.

As to the rows of spines posterior to the anus: their number varies. Still, in group B there were always more rows and the spines were smaller than in group A.

It is therefore concluded that a distinction between *M. spinosa* and *M. goeldii* is untenable and that *M. spinosa* is the only valid name. The populations in the Kathmandu valley should, however, be named *M. laticornis* (Jurine).

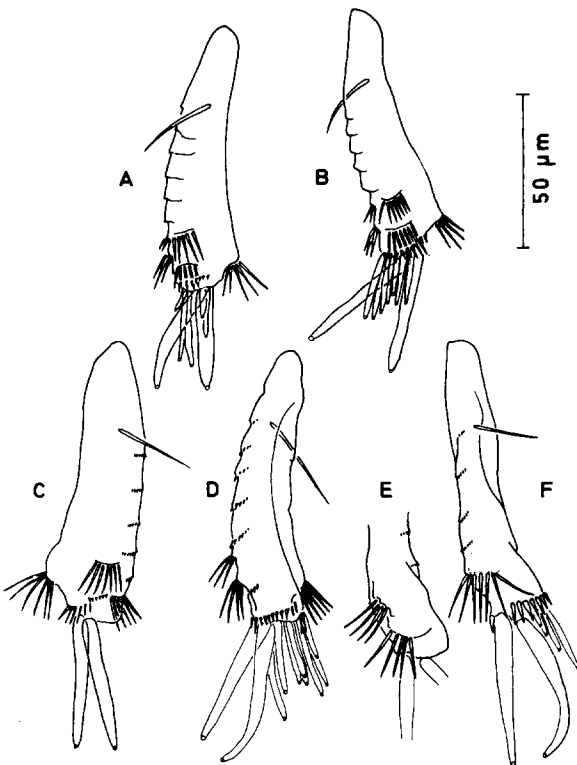


Fig. 6. First antenna: *Macrothrix spinosa* King, 1853 A: Louisa Lake, Australia; B: Hula, Israel *Macrothrix laticornis* (Jurine, 1820); C, D: Chauni, Nepal; E, F: River Sambre, Belgium.

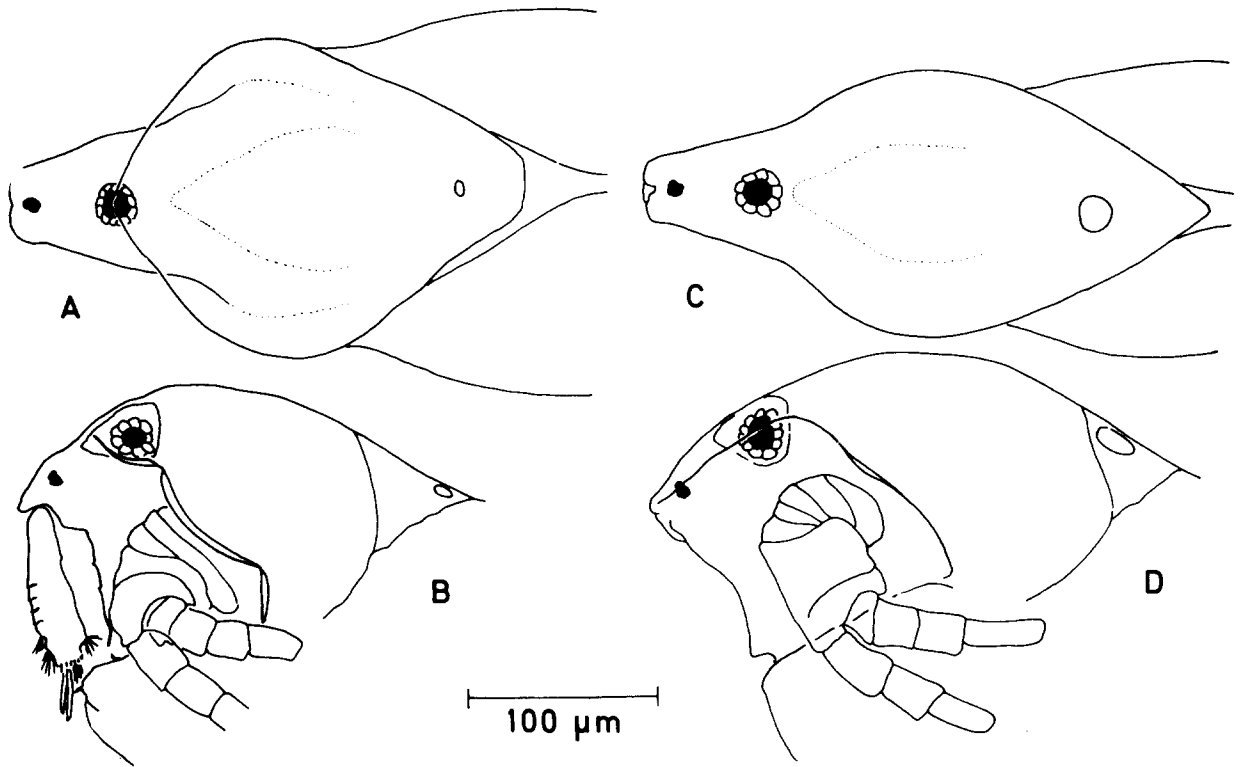


Fig. 7. *Macrothrix spinosa* King, 1853 Louisa Lake, Australia A: head-shield, dorsal view; B: head, lateral view, *Macrothrix laticornis* (Jurine, 1820) Chauni, Nepal C: head-shield, dorsal view; D: head, lateral view.

From tropical India, Stingelin (1905) has reported *M. spinosa* and populations from Iran (Löffler, 1961), according to the structure of their postabdomen, seem to pertain to *spinosa* as well. In a number of other cases, however, confusion with *M. laticornis* may have occurred, as it is by no means certain that *M. spinosa* and *M. laticornis* may not co-exist in the same area, nor that *M. laticornis* might not occur in tropical environments.

Copepoda

1. *Eudiaptomus* sp. (Fig. 10, E-F)

The plankton of Tau Daha contained a number of females of a calanoid that belongs to this genus. It has also been recorded by Hickel (1973b). Most curiously, no males could be found, and in their absence, a reliable identification is not possible. The structure of the genital segment is more or less like in *E. graciloides* and *E. drieschi* (vide Kiefer, 1968), but the two strong spines on the endopodites of the P₅ suggest it may be an unde-

scribed species. While the majority of the representatives of *Eudiaptomus* are restricted to Europe and to North Africa, one should note that *E. graciloides* (Lilljeborg) occurs as far east as Iran (Löffler, 1961) and *E. drieschi* (Poppe & Mrazek) is known from Anatolia, Iraq and, disjunctly, from Ceylon. The presence of an *Eudiaptomus* that comes nearest to these species at the foot of the Nepalese Himalaya contributes at narrowing the distributional gap in Asia. In fact, the Himalaya's may have been the pathway for the Eastern extension of a group of *Eudiaptomus* species which appear to be rather nearly related (female genital segment only slightly expanded, with weakly developed spines) and is now seen to consist of at least three species.

2. *Arctodiaptomus jurisowitchi* Löffler, 1968

The lakes in which we found this species are situated in a valley just West of the Khumbu glacier valley, which is the type locality of this species.

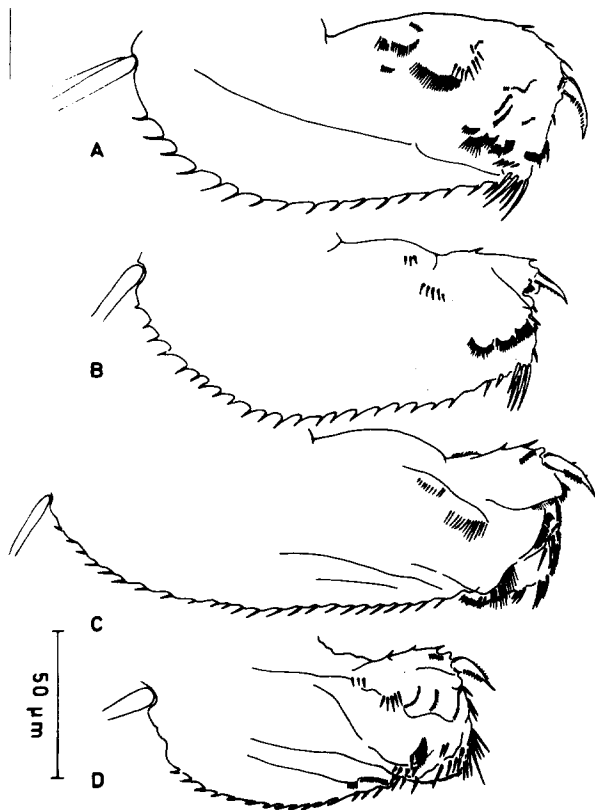


Fig. 8. Postabdomen: *Macrothrix laticornis* (Jurine, 1820) A: River Sambre, Belgium; B: Chauni, Nepal; *Macrothrix spinosa* King, 1853 C: Louisa Lake, Australia; D: Hula, Israel.

3. *Neodiaptomus strigilipes* (Gurney, 1907) (Fig. 10, G-K)

Previously recorded from Tau Daha by Hickel (1973b). Originally described from Chakradharpur, India (Gurney, 1907). It is a widely distributed endemic of the Indian subcontinent.

4. *Phyllodiaptomus blanci* (de Guerne & Richard, 1896) (Fig. 10, A-D)

Common in the plankton of Phewa Tal. Young copepodites (c_{1-3}) here appear to be the major source of food for adult *Mesocyclops leuckarti*. In the samples, many examples of this form of predation, in which the cyclopoïd sucks out the contents of the calanoïd, were rather well preserved.

5. *Tropocyclops confinis* (Kiefer, 1930) (Fig. 11, A-C)

Typical forms of this species were rather abundant at Godavari. *Tropocyclops confinis* is also widespread in India (Lindberg, 1939).

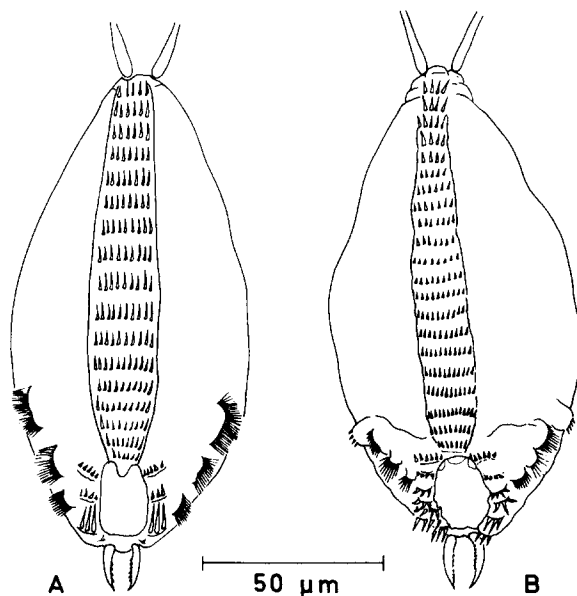


Fig. 9. Postabdomen, dorsal view: A: *Macrothrix laticornis* (Jurine, 1820) Chauni, Nepal; B: *Macrothrix spinosa* King, 1853 Louisa Lake, Australia.

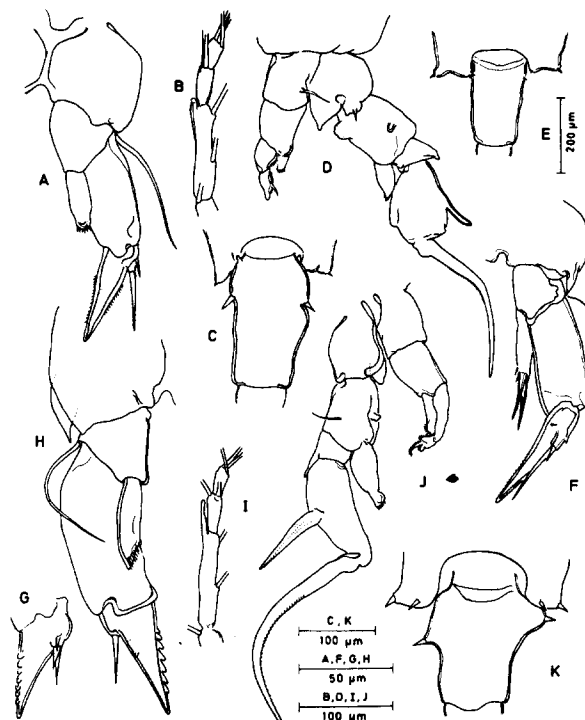


Fig. 10. *Phyllodiaptomus blanci* (de Guerne & Richard, 1896) A: P₃, ♀; B: antenna, ♂, last three segments; C: genital segment, ♀, dorsal view; D: P₃, ♂; *Eudiaptomus* sp. E: genital segment, ♀, dorsal view; F: P₃, ♀, *Neodiaptomus strigilipes* (Gurney, 1907) G: distal part of P₃, ♀, enlarged; H: P₃, ♀; I: antenna, ♂, last three segments; J: P₃, ♂; K: genital segment, ♀, dorsal view.

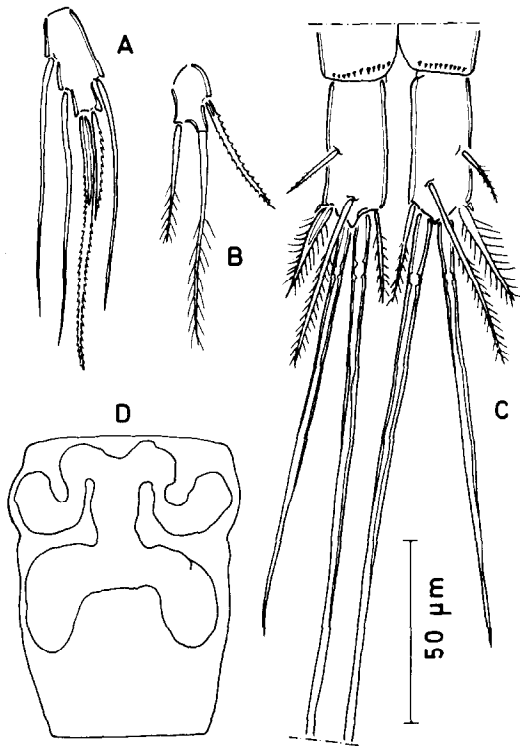


Fig. 11. *Tropocyclops confinis* (Kiefer, 1930) female A: endopodite III P₄; B: P₅; C: furca; D: receptaculum seminis.

6. *Eucyclops euacanthus* (Sars, 1909) (Fig. 12, A-E)

An *Eucyclops* which, although rare, might be of circum-tropical occurrence. Originally described from Lake Tanganyika (Sars, 1909), it was subsequently found back in South-East Asia (Kiefer, 1933) and in India (Lindberg, 1942). Its presence in a subtropical lakelet (Tau Daha), where it co-occurs with *E. serrulatus* (Fischer), is noteworthy. This is a relatively well characterized *Eucyclops*; the serra is variable, and may at times be reduced to about half the length of the form in Fig. 11, A. A very typical feature of this species is the seta terminalis interna of the furca which is naked. Further, the spines on the thoracopods are conspicuously spatulate (Fig. 11, B-C), the terminal hair on the third joint of the exopodite of P₄ is modified and shortened, the precoxal plate of P₄ bears three rows of spines and the spine on P₅ is particularly short (Fig. 11, B-E).

Biogeographical notes

We certainly do not know enough about the Entomostraca of Nepal to attempt a proper biogeographical

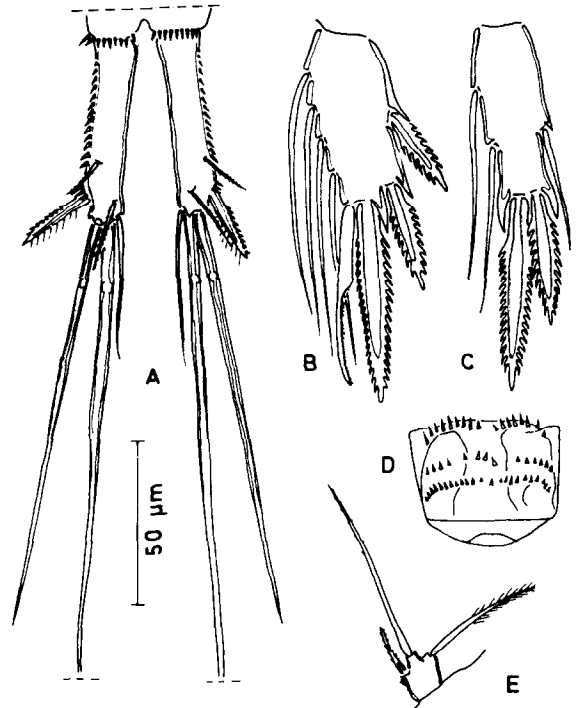


Fig. 12. *Eucyclops euacanthus* (Sars, 1909) female A: furca; B: exopodite III P₄; C: endopodite III P₄; D: precoxal plate of P₄; E: P₅.

analysis of its fauna, especially as the climate of this country is so deeply influenced by altitude, and this, in turn, may change by an order of magnitude over a linear distance of not more than a few kilometers, a unique situation in the world. Yet, if one considers only the 'middle sector', of which the Kathmandu valley is a good example, a few interesting facts appear. The number of true palaeartic Entomostraca is extremely low, and in fact, except for *Eudiaptomus* sp., no unambiguous example could be found. Indeed, the indicative value of *Macrothrix laticornis* and *Daphnia longispina* is doubtful. In more general terms, one might even throw doubt upon the existence of cladocerans typical of temperate climates. The number of cosmopolitan species, conversely, is impressive (Cladocera: nrs. 6, 8, 9, 11, 12, 13, 16, 17, 18, 19, 20; Copepoda: nrs. 6, 7, 8, 11, 13, 14). The remainder are circumtropical with a wide distribution. Only the calanoids *Neodiaptomus strigilipes* and *Phyllo-diaptomus blanci* may be considered as oriental. No typical oriental Cladocera were found (although some representatives of *Indialona* are true oriental endemics: vide Petkovski, 1966 and Smirnov, 1970).

At higher altitudes (say, above 3500 m), the number of

species drops dramatically. Among the Calanoida, endemic species appear, pertaining to the palaeartic genus *Arctodiaptomus* (*A. nepalensis* Ueno, *A. jurisowitchi* Löffler).

Among the Cladocera, cosmopolitan species remain relatively dominant, but some endemic high-altitude Himalaya-species exist here, although again, endemic genera are not found (*Daphnia tibetana* Sars; Brehm & Woltereck, 1939; Löffler, 1969; *Eurycercus* sp.). These are however exceptions: the rule seems to be, among Cladocera and most Cyclopoida, that circumtropical species, in more elevated locations are replaced by cosmopolitan species (e.g. *S. v. vetulus* taking the place of *S. v. elisabethae*).

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Résumé

22 espèces de Cladocères et 14 espèces de Copépodes ont été trouvées au Nepal; la plupart proviennent de la vallée de Kathmandu, quelques-unes de lacs de haute altitude dans la région du Khumbu, Nepal de l'Est. Deux espèces sont nouvelles pour la science, mais ne peuvent être décrites, faute de matériel adéquat. La relation entre *Macrothrix laticornis*, *M. spinosa* et *M. goeldii* est discutée; *M. goeldii* est synonymisé avec *M. spinosa*; des critères morphologiques nouveaux, qui permettent de faire la distinction entre *M. laticornis* et *M. spinosa* sont présentés. Quelques aspects biogéographiques de la faune trouvée au Nepal sont: 1) parmi les Copépodes de la vallée de Kathmandu, deux calanoïdes sont d'origine orientale, un seul est supposé être d'origine palaeartic; les autres Copépodes sont cosmopolites ou circum-tropicaux; aucun cyclopidé oriental ne fut rencontré; 2) à des altitudes plus élevées, les cyclopidés manquent et les calanoïdes étaient représentés par des espèces endémiques du genre palaeartic *Arctodiaptomus*; 3) aucun Cladocère oriental ne fut trouvé dans la vallée de Kathmandu; la majorité des espèces était des cosmopolites, le reste, des espèces à répartition circum-tropicale; 4) à des

altitudes plus élevées, des espèces endémiques appartenant à des genres palaeartiques existent, accompagnées d'une série d'espèces cosmopolites.

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