Notes on Cladocera and Copepoda from high altitude lakes in the Mount Everest Region (Nepal)

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Abstract

The paper deals with Cladocera and Copepoda species from eight high altitude lakes in the Khumbu area. In all lakes, an endemic known diaptomid of the palearctic genus Arctodiaptomus is found. The dark and large Daphnia tibetana occurs in five of the lakes sampled, characterized by the persistence of the spine in adults (parthenogenetic and ephippial females, males). Apparently, this is an unknown feature of this species. The literature on the diagnostic traits of the different morphs described is reviewed. In addition, a transparent and smaller-sized Daphnia species occurs in two lakes. This is a D. longispina characterized by the absence in adults of the carapace spine (var. aspina Weretschagin, 1911). The presence of these two species is discussed in relation to water transparency, colour, and vertical distribution. Two hypotheses on the evolution of cuticular pigmentation in Daphnia are examined. In addition to these mostly dominant species, a macrothricid also typical of high altitude lakes in the Alps was found (Macrothrix hirsuticornis) together with two cosmopolitan Chydroridae.

Reports on Entomostraca from high altitude lakes in Nepal have been published since the beginning of this century. After the studies by Hedin (1907) on central and west Tibet, where a dark Daphniopsis tibetana (Sars) swimming in the marginal region of Selling Tso was reported, came a series of papers from the Yale North India Expedition in 1932. As customary at that time, the papers were mainly concerned with taxonomy and zoogeography, with the aim of describing phylogenetic relationships among closely related species. Apart from the results on copepods (Kiefer, 1935 & 1936), and on Cladocera in general (Brehm, 1936), particular attention was given to Daphniidae (Brehm & Woltereck, 1939). Much confusion existed about their taxonomic position after reports of four Daphnia species from similar regions, and of different morphs within the same species. As a result, Wagler's treatise on the systematics of Daphnia (1936) reported all of them under the same name (D. tibetana).

From the samples collected during the Yale expedition, Hutchinson (1937) reported the presence in several lakes of Indian Tibet (Ladak and Rupshu), of the above mentioned 'dark' species, and also a 'pale' Daphnia, a longispina-like species (Woltereck, quoted in Hutchinson, 1937).

More recently, data on Cladocera and Copepoda from a shallow pond (Yangma) in northeastern Nepal at 4600 m a.s.l. have been reported by Uéno (1966), with the description of a new species (Arctodiaptomus nepalensis).
Another endemic species, *A. jurisovitchi*, was described by Löffler (1968) in lakes from the same region where our samples were collected. Some information can also be found in a report on Entomostraca from Nepal, including data from three high altitude lakes (4700–4750 m a.s.l.) in the lateral-moraine of the Ngozumpa glacier and from a swamp in the Khumbu region (Dumont & Van De Velde, 1977).

We report here some findings from a scientific expedition in the Khumbu Valley during September and October 1992 (C.N.R. Technical report n. 5, 1993), in the framework of the Ev-K²-C.N.R. Project on remote areas regarding the global circulation of micropollutants. Logistic and technical support was given by a laboratory (called Pyramid) located at 5050 m a.s.l. (Fig. 1).

Cladocera and Copepoda were collected from eight lakes between 4688 m a.s.l. and 5460 m a.s.l. (Table 1).

The main morphological and chemical characteristics of the lakes are reported by Tartari *et al.* (1993).

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**Fig. 1.** Map of lakes in the Khumbu region where zooplankton samples were collected. From Tartari *et al.* (1993), modified.