

The Larva of *Himalopsyche tibetana* (Insecta: Trichoptera, Rhyacophilidae) with Some Ecological Notes on the Genus *Himalopsyche* Banks, 1940 from Nepal

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Abstract

During two expeditions led by the University of Agriculture, Vienna, in 1993 and 1994, several pupae and numerous larvae of the genus *Himalopsyche* Banks 1940 could be obtained. Some of them turned out to belong to the species *H. tibetana* (Martynov 1936). Mature pupae with larval sclerites enabled us to describe the larva of this species for the first time.

Within the genus *Himalopsyche*, two distinct larval types are known (Flint 1961, Lepneva 1970), of which one is reported for the first time from the east. Both forms are described in detail.

Besides an altitudinal zonation, a description of the habitat and saprobic values of the genus are given.

Introduction

Trichopteran species are generally considered to be very sensitive to environmental changes such as pollution or control of river flow. Thus Trichoptera are used as indicator organisms in applied water quality assessment. However, the idea that Trichoptera are sensitive as a group is not true. As numerous detailed studies (Higler 1993, Moog 1995) show, the ecological requirements and pollution tolerance can vary within one genus considerably. In consequence, there is an urgent need for ecological studies to be carried out on the species' level. In order to characterise indicator organisms, information about the morphology and anatomy of invertebrates should be especially increased.

Unless proper taxonomic knowledge is available, no detailed ecological investigations are possible.

Recently, during two expeditions in November 1993 and March 1994 led by the University of Agriculture, Department of Hydrobiology, Vienna, larvae and pupae of *Himalopsyche* Banks 1940 was collected from two different river systems. The identification of the larva was made on the basis of mature male pupae, which show fully developed genitalia and cocoons that include larval sclerites.

The genus *Himalopsyche* Banks 1940 is mainly restricted to the Oriental region, the only species occurring in the Nearctic being *H. phryganea* (Ross 1956). Currently, 39 species are known worldwide (Malicky 1971, Higler 1992, Spuris 1991).

The following species are known in Nepal.

- H. alticola* Banks
- H. angnorbui* Schmid
- H. biansata* Kimmins
- H. digitata* (Martynov)
- H. dolmasampa* Schmid
- H. gyamo* Schmid
- H. malenada* Schmid
- H. phedongensis* Kimmins
- H. tibetana* (Martynov)

Although the spectacular larvae are, with a body length of more than 30mm, the largest within the family Rhyacophilidae and, along with the megalopteran family Corydalidae and the trichopteran family Stenopsychidae, are one of the most prominent members of the faunal assemblages of mountain rivers, nearly no taxonomic details are known on the species' level. Schmid and Botosaneanu (1966) described five different larvae from the Himalayan region, but it is still not clear which species they are. Since then, there has been no significant progress in larval taxonomy concerning the genus *Himalopsyche*.

Larval Features of the Genus *Himalopsyche* Banks 1940

The most distinct characteristics features for separating the genus *Himalopsyche* from the genus *Rhyacophila* are according to Lepneva (1970), Ross (1956), Flint (1961), Ulmer (1957) as follow. Different features are shown in Figures 1 to 9.

- The second segment of the maxillary palp is subequal to the first (arrow Fig. 2)
- The outer side of the mandibles has prominent tubercles (arrow Fig. 5)
- The anal leg with an additional basoventral sclerite in the form of a spine (arrows Fig. 3)

The genus appears to have at least two distinct types of larvae, both of which can be found in Nepal.

Type A is characterised by the following features.

- On abdominal segments there are very prominent conical processes on which numerous gill filaments are arranged (Fig. 1 a).
- It has femora, tibiae, and tarsi with a crest of setae on the dorsal side (Fig. 4a).
- It has straight and feather-shaped basodorsal setae on the femora.

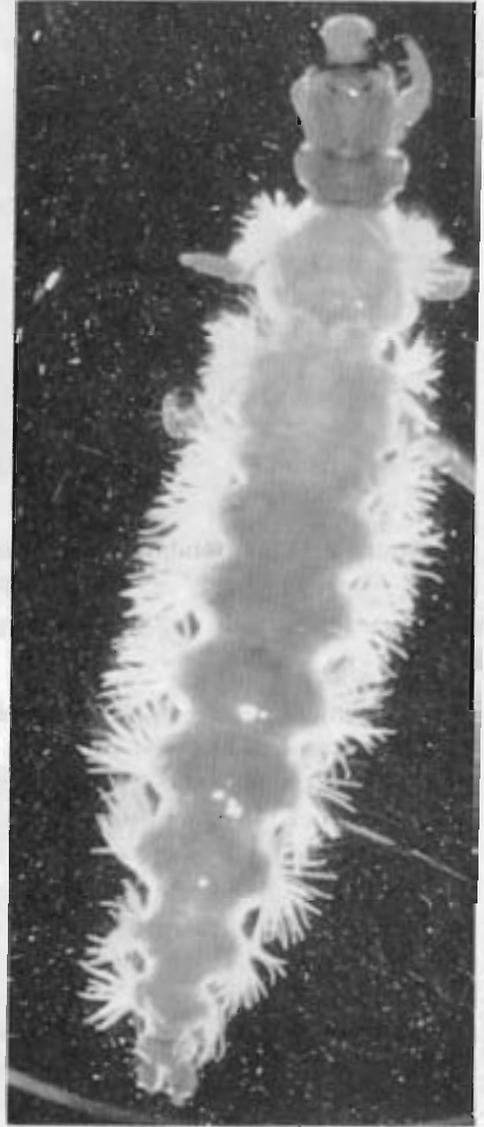
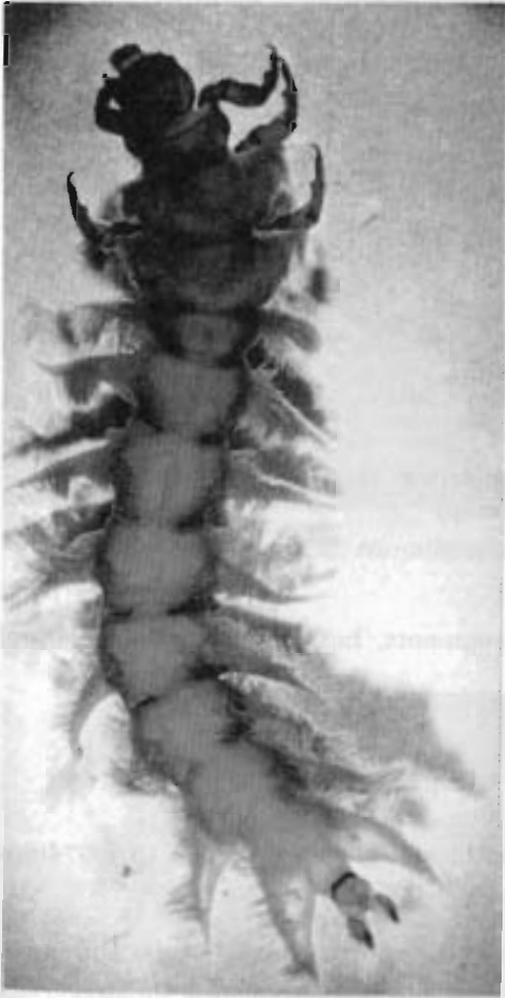


Figure 1: Larva of a: *Himalopsyche* Type A; b: *Himalopsyche tibetana*

- It has a pronotum with a longitudinal row of setae on both sides of the median suture.
- The anal claw is short and broad (Fig. 3b).
- The relation of the head capsule length to width: is < 1 . Range: 0.940mm-0.946mm (n=4).

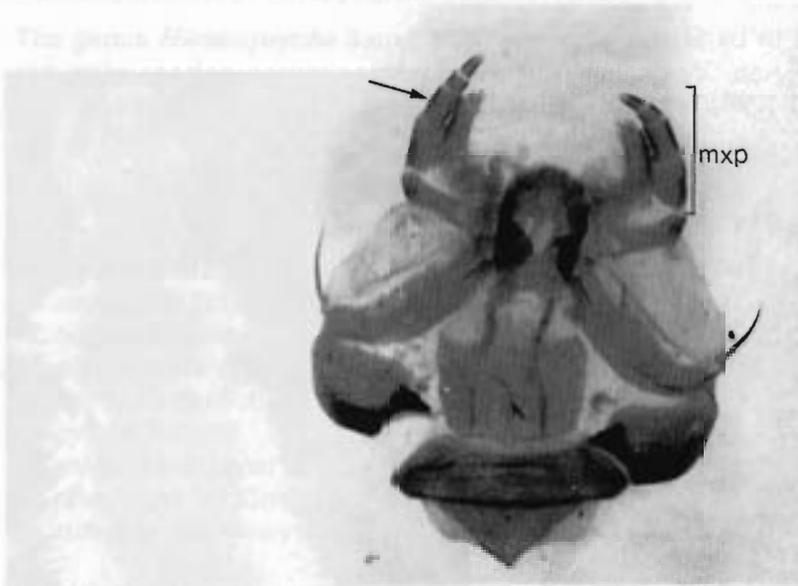


Figure 2: Maxillolabium of *H. tibetana*; arrow: second segment of maxillary palp (mxp)

Type B shows:

- no conical processes on abdominal segments, but lateral and dorsolateral gills arranged in dense tufts (Fig. 1b);
- femora, tibiae and tarsi without such a crest of thin setae (Fig. 4b);
- no feather-like seta on the femora;
- no longitudinal row of setae on the pronotum;
- anal claw longer and not as broad as in type A (Fig. 3b); and
- relation of head capsule length to width: >1 . Range: 1.031mm to 1.074mm (n=11).

The only description of the second type of *Himalopsyche* known to the authors is that of the Nearctic species, *H. phryganea*, given by Flint (1961). *Himalopsyche tibetana* belongs to type B.

Material Studied

Nangpo Dzangpo (Bhotekosi) River, Solukhumbu district, Dharmo village 3400m, 29.III.94, 7 larvae, 1 praepupa;
left tributary to Hinku Drangka River, Solukhumbu district, Gaikharka village 1990m, 4.IV.94, 2 larvae;
left tributary to Dudhkosi River, Solukhumbu district, Thaog village 2825m, 30.III.94, 8 larvae;
*left tributary to Dudhkosi River, Solukhumbu district, Thaog village 2825m, 30.III.94, 1 male pupa of *H. tibetana*;*
Theso Khola, Solukhumbu district, Theso village, 29.III.94, 1 female pupa;
*Kyashar Drangka River, Solukhumbu district, Monjo village 2800m, 28.III.1994, 4 male pupae of *H. tibetana*;*

Theso Khola; Solukhumbu district, Theso village 3440m, 29.III.94, 2 larvae;
Surke Drangka, Solukhumbu district, Surke village 2293m, 1.IV.94, 2
praepupae, 4 larvae; and
Share Dranga River, Solukhumbu district, Sanam village, 2750m, 7.IV.94, 2
larvae.

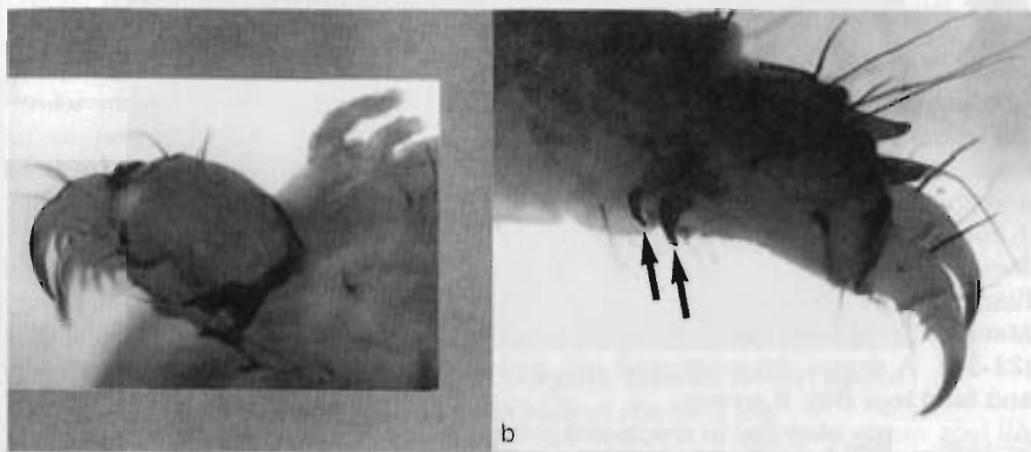


Figure 3: Anal Leg of a: *Himalopsyche* Type A; b: *H. tibetana*; pr = process

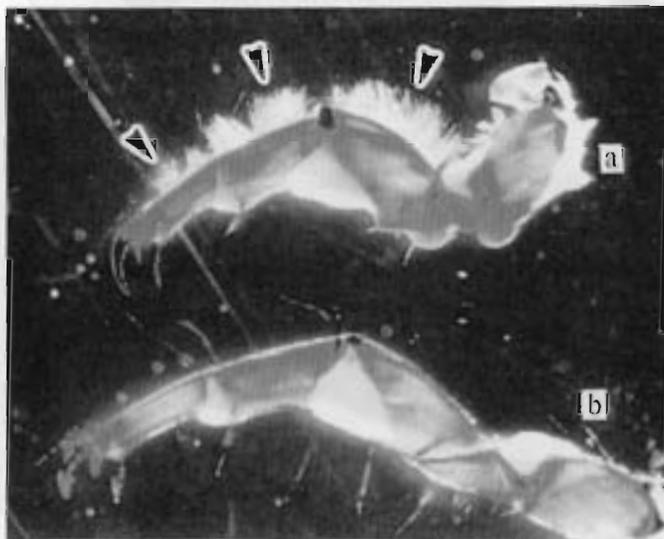


Figure 4: Middle Leg of a: *Himalopsyche* Type A; b: *Himalopsyche tibetana*;
 arrows: crest of setae

All the material listed above consists of Himalopsyche type B; leg. (collectors):
Grasser, Hutter, Maskey, Ofenböck, Sherpa and Sharma

Muktinath Khola; Mustang district, Muktinathchhetra 3,800m, 20.XI 1993, 9 larvae type B; 3 larvae type A; leg. (collectors): Graf and Sharma

Description of the Final Larva of *Himalopsyche tibetana* (Martynov 1936)

Body: length: 2.8mm-3.6mm, praepupal length: 20.1mm-20.4mm; pupal length: 20.7mm;

Head: Mean width 3.27mm to 3.75mm (mean width: 3.51mm, n=4), frontoclypeus width at the anterior edge: 1.29mm to 1.33mm (mean width: 1.31mm, n=4), frontoclypeus width at the broadest section (caudal to its incision): 1.27mm to 1.37mm, (mean width: 1.32mm, n=4). Colouration of head and frontoclypeus as in Figures 5 and 8. Pronotum width at the anterior edge: 1.86mm-2.11mm (mean width: 1.98mm, n=2) (Fig. 9).

Mesonotum: a large linear area of gill filaments laterally (number of gill filaments: 80-90).

Metanotum: a linear area of lateral gill filaments (85-90) and anterodorsal gills (22-30). A single, finger-shaped gill arising laterally at the base of the middle and hind legs (Fig. 6 arrow).

All legs nearly identical in shape and setae pattern.

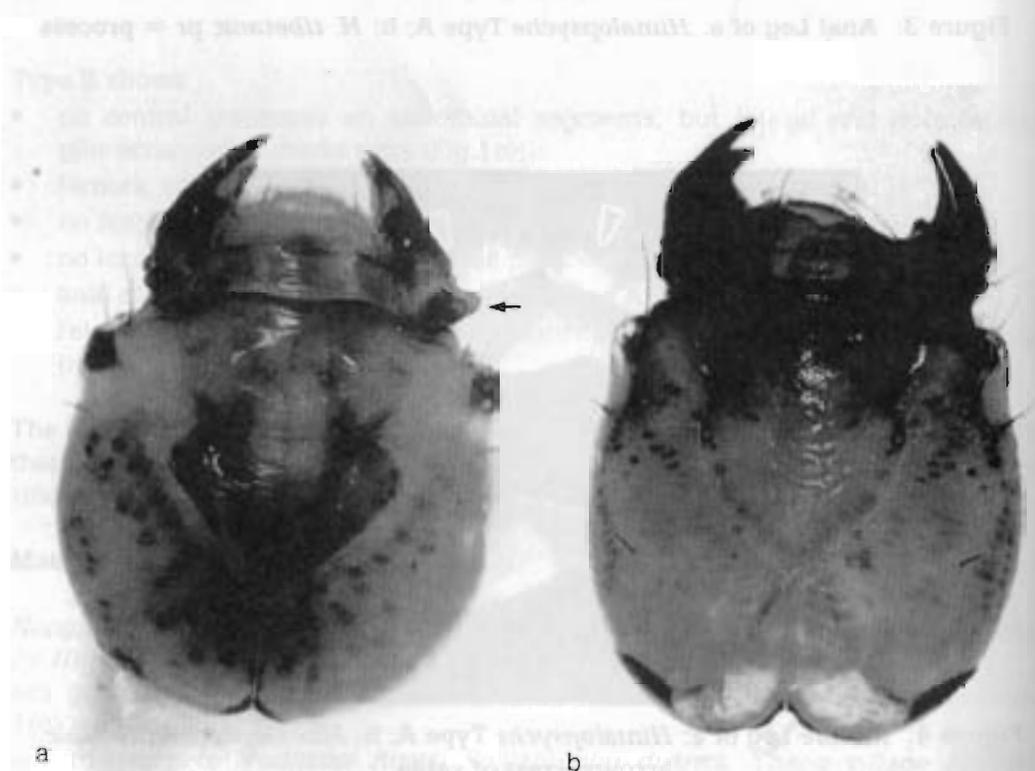


Figure 5: Head of a: *Himalopsyche* Type A; b: *H. tibetana* - arrow: prominent tubercles on the mandible

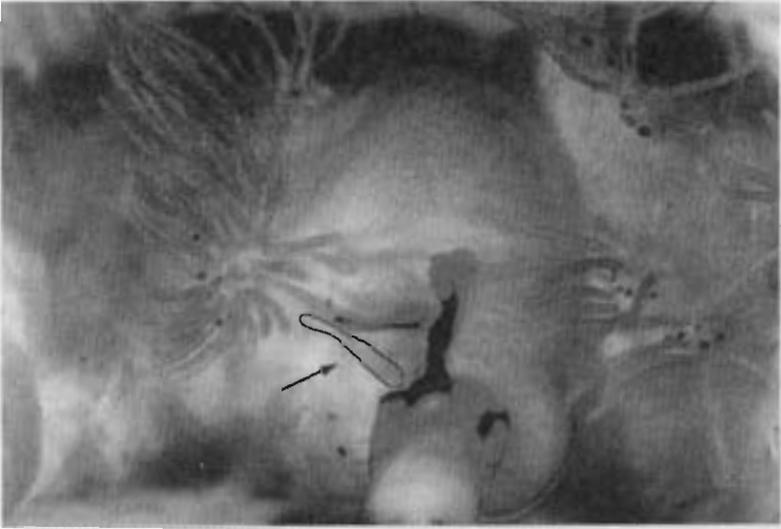


Figure 6: Metathorax of *H. tibetana*, Lateral; arrow: single gill filament at the base of the hind leg

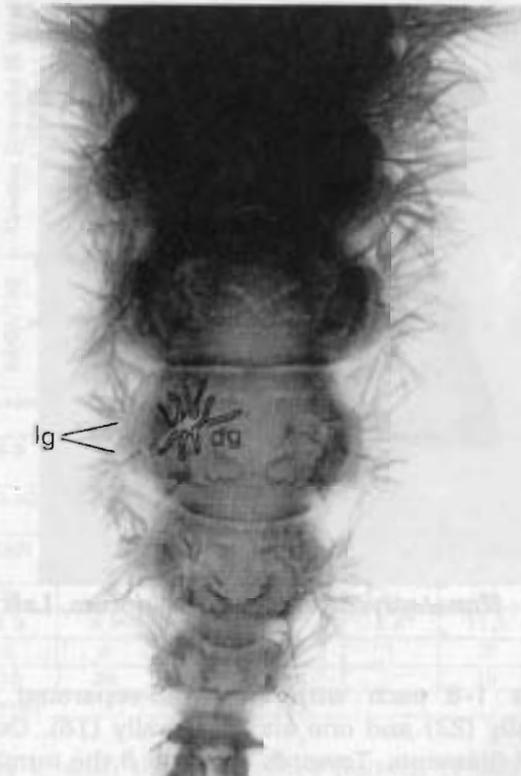


Figure 7: *H. tibetana*, Abdomen Dorsal View; dg = dorsal gills, lg = lateral gills

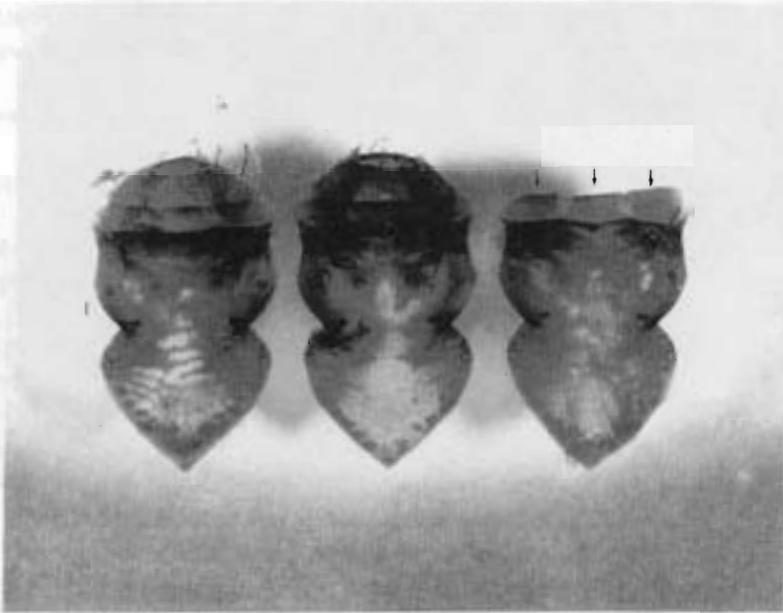


Figure 8: *Himalopsyche tibetana*; Different Coloration of Frontoclypeus; arrows: anteclypeus with three brownish longitudinal stripes

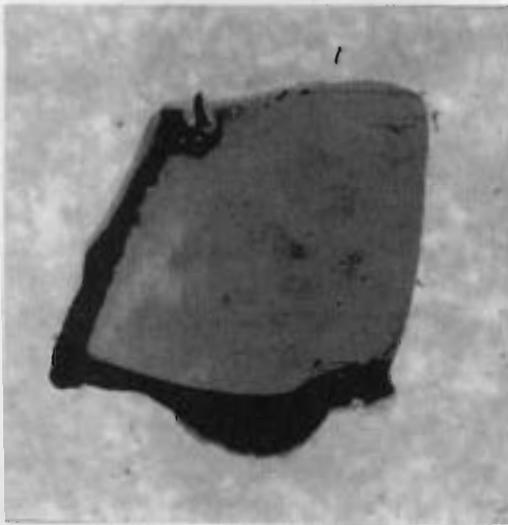


Figure 9: *Himalopsyche tibetana*; pronotum, Left Half

Abdomen: Segments 1-8 each with two well-separated areas bearing gill filaments, one laterally (23) and one anterolaterally (18). One dorsal area with approximately 22 gill filaments. Towards segment 8 the number of gill filaments declines. Note: The number of gill filaments can change within one species depending on environmental factors.

Anal leg. without a sword process, proximal sclerite with a ventral, caudally directed spine, distal sclerite with a strong process, anal claw with 2 ventral teeth (Fig. 3a).

Habitat Description

As shown in Table 1, *Himalopsyche* prefers a substratum with boulders. Flow velocity preferences of the genus are not uniform: it was found inhabiting high to very slowly flowing mountain streams with a water temperature that varied from 1.9-11.2°C. Except for Muktinath *Khola* in Muktinath *Chhetra*, all other sites with findings of the genus fall under Fore-Himalayan higher mountain regions with an average geological setting that features Pre-Cambrian rocks consisting of undifferentiated gneiss, quartzites, and schists; the former, on the other hand, features predominantly sediments of the Recent Inner Himalayan formation. The conductivity measured from 13-57 μ S/cm with a total hardness measured using kits in degree drops hardness unit ($^{\circ}$ dH) as 1-4 $^{\circ}$ dH. The genus *Himalopsyche* preferred sites with moderate plant cover except for on one occasion in which the deterioration was due to latest glacial outburst.

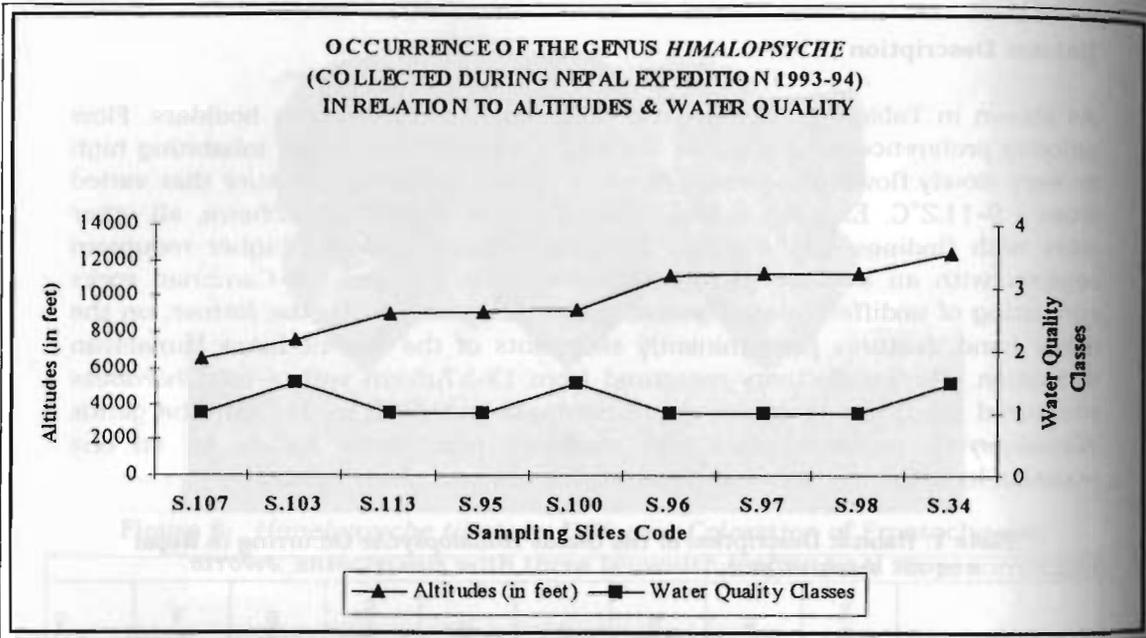
Table 1: Habitat Description of the Genus *Himalopsyche* Occurring in Nepal

DESCRIPTION OF THE SAMPLING SITES									
Localities	Kyashar Drangka at Monjo (S.95)	Dudhkosi (Tributary) at Thaug (S.100)	Surke Drangka at Surke (S.103)	Theso <i>Khola</i> at Theso (S.98)	Bhotekoshi at Dhamo (S.96)	Hinku Drangka (Tributary) at Gaikharka (S.107)	Share Drangka at Sanam (S.113)	Bhotekoshi (Tributary) at Dhamo (S.97)	Muktinath <i>Khola</i> at Muktinathchhetra (S.34)
Date of collection	28/03/1994	30/03/1994	01/04/1994	29/04/1994	29/04/1994	04/04/1994	07/04/1994	29/03/1994	20/11/1993
Dominant substratum	Boulders	Mixed*	Boulders	Boulders	Boulders	Bedrock	Boulders	Bedrock	Gravels
Width (m) of the river	4-5	1-1.5	2-5	2-5	4-7	1-3	2.5-3.5	1-2	1
Depth (cm) of the river	20-30	10-30	20-100	25-80	-	30	25	-	5-10
Current velocity	High	Slow	Mode-rate	Mode-rate	Very high	High	Mode-rate	Very slow	Mode-rate
Conductivity (μ S/cm)	28	13	57	28	41	19	34	-	-
Temperature ($^{\circ}$ C)	1.9	6.1	9	4.9	5.6	11.2	5.2	-	-
total Hardness ($^{\circ}$ dH)	2	2	4	1	1	3	2	-	-
Shading (%)	10	30	10	10	-	15	70	-	10

* Boulders, cobbles, and Rocks

As shown in Graph 1, with the occurrence pattern of the genus in relation to altitude and water quality, the genus *Himalopsyche* was found within an altitudinal range of 6,000-12,000 feet in not too pure to slightly polluted streams.

Graph 1: Occurrence Pattern of the Genus *Himalopsyche* in Relation to Altitude and Water Quality in Nepal



Summary

The collection of numerous larvae and several pupae of the genus *Himalopsyche* enabled us to describe distinct larval characteristics in order to separate the genera *Himalopsyche* and *Rhyacophila*. Within the genus *Himalopsyche*, two larval types exist which can be easily distinguished by several characteristics given by the authors.

Döhler (1950) divided the European species of the complex genus *Rhyacophila* into six subgenera according to larval morphology, which was adopted by Lepneva (1970), who established species' groups based on gill morphology. Although this classification of larval characteristics turned out not to apply to adult species' groups, it is a quite helpful tool in characterising the different larval groups.

It is apparent that, within the genus *Himalopsyche*, an analogy to the genus *Rhyacophila* regarding larval morphology exists. A classification according to Döhler's subgenera is in preparation by the authors.

The larvae of the genus *Himalopsyche* are restricted to hypocrrenal to epirhithral regions of cold rivulets and brooks with a stony bottom and strong currents at altitudes between 3,500-15,500 feet (Schmid and Botosaneanu 1966, Schmid 1963, and our own findings). The water quality (WQ) in which *Himalopsyche* larvae were found is comprised of classes I to I-II (Tab. 1, Fig.1).

Acknowledgements

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