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TO THE KNOWLEDGE OF FAUNA OF SYNANTHROPIC FLIES OF THE NEPAL HIMALAYA*)

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Abstract. A material of flies collected in two localities (altitude of 3900 and 4500 m) in the Barun Khola Valley (East Nepal) was studied, representing the early spring aspect of the species composition of flies. Of the total number of 2309 fly specimens 99.3 % represented two species of the genus *Paregle* (*P. aterrima*, *P.* sp.); both are autochthonous high altitude hemisynanthrophic forms. The remaining 0.7 % represent 9 species, most of which are more or less eurytopic species of palearctic or holoarctic distribution (*Calliphora vicina*, *C. vomitoria*, *Meoneura flavifacies*, *Scatophaga stercoraria*, *Hydrotaea hirticeps*, *Orthellia caesarion*, *Paregle danieli*, Anthomyiidae g. sp. 1, g. sp. 2).

The material on which the present paper was based, had been collected during the Third Czechoslovak expedition "Himalaya 73" in the upper part of the valley of the Barun Khola river in the region of the Makalu mountain (East Nepal). The goal of the expedition, in which the junior author (M. Daniel) took part, were the remote high altitude areas only temporarily visited by shepherds. The term "synanthropic flies" was used in the title of the paper in order to maintain the continuity of publications dealing with basic knowledge on flies which are to a different degree associated with activities of man. Furthermore, the authors used this term to follow the line of similar problems solved and based on the material from the high altitude region of the East Hindu Kush (Gregor and Daniel 1971).

CHARACTERIZATION OF THE REGION STUDIED

The collections were carried out in the valley of the Barun Khola river which is a rightside tributary of the Arun river (geographic coordinates of the mouth are in longitude 87°22′ East and latitude 27°42′ North) and represents the axis of the valley extending as far as the Nepal-Tibetan border between the massifs of Mount Everest and Makalu.

The lower part of the valley is narrow and sharply cut, with very steep sloping curve and in view of vegetation belongs to the tropical evergreen upper montane forest, the belt of coniferous trees mixed with rhododendrons (Schweinfurth 1957). In some places on the bottom of the valley river terraces are developed and covered with grass. Only higher from the upper timber line (3900 m) the valley is wider and open. The fossil moraines reinforced by grass and low creeping shrubs of rhododendrons at the sides of the valley and lacustrine terraces on its bottom are extending as far as the front at the upper Barun Glacier (4500m), giving rise to the Barun Khola river.

*) Scientific results of the Czechoslovak expeditions to the Hindu Kush and Himalaya. Communication No. 18.

The expedition reached the Barun Valley at the end of winter, when the forest in the lower part of the valley was covered by layer of snow 1 m high and in the river terraces the first soddy patches of soil began to appear. As the main goal of the biological research was the collection of small mammals and birds and their parasitological investigation, the winter weather conditions did not hamper this work in the lower sections of the valley. The early spring conditions were observed only on the timber line (3900 m), where the wide valley running southwards was free of snow in open places, and in the second half of April, when the noon temperatures in the sun reached up to 10 °C, the first flies appeared.

Similar weather conditions were observed in the second locality (the surroundings of the base camp near the front of the upper Barun Glacier) as late as the last decade of May, when the temperature was rising from morning frosts up to 10 °C (maximum +14 °C on May 25, 1973) at noon. During abrupt changes of weather, however, the collections were sometimes made in temporary snow falls.

MATERIAL AND METHODS

The collections were made by standard traps (Gregor and Povolný 1960) baited by human faeces. The catches were made in morning hours because in the afternoon the weather regularly became worse. Each collecting day the traps were exposed for 5—6 hours on a sunny place protected from wind, because there were never conditions of calm during exposure. During ten collecting mornings a total of 2309 specimens of flies was collected. The material was kept in 70 % ethylalcohol and identified by the senior author (F. Gregor). All material collected and indicated below originated from the following two localities:

1. The Barun Khola valley, 3900 m, a place called Tadosa by the natives.
A gorge connecting two differently formed levels of the valley. In these places runs the upper timber line with single small patches of dwarf firs (*Abies spectabilis*) and several species of rhododendrons. Among them there are extensive shrubberies of *Salix caprea* and *Tsuga dumosa*. In the distance of about 1 km there is a shepherd's hut inhabited during the summer monsoon, when the open grassy areas (primarily on washed scree cones at the base of rocky gullies), are grazed by livestock (crossbreeds of horned cattle and yaks). The traps were exposed on a small glade among tsuga bushes which served as latrine for the expedition members two weeks before.

2. A fossil moraine at the front of the Upper Barun Glacier, 4900 m. The valley bottom filled out by a large lacustrine terrace without any vegetation. At the side of the valley are fossil moraines reinforced by tufts of grass and in some places overgrown with creeping shrubberies of rhododendrons. At the foot of the moraine the base camp of the expedition was set up and the traps were exposed in the vicinity of places serving as latrine.

RESULTS

CARNIDAE

Meoneura flavifacies Collin, 1930

1 ♂ 25 . 5 . 73, 4.900 m*) Species known all over North America including Labrador and Alaska, and in Europe. It has not been reported from Asia as yet.

SCATOPHAGIDAE

Scatophaga stercoraria (Linné, 1763)

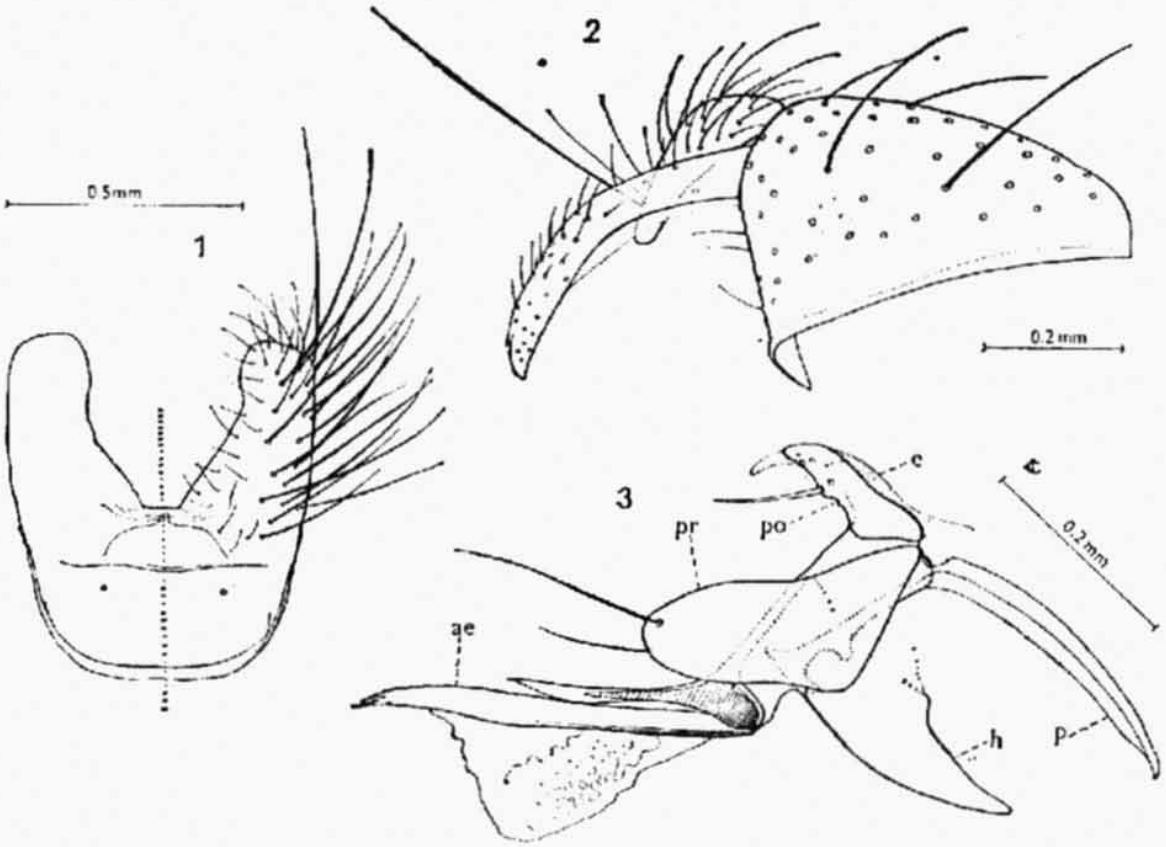
1 ♂ 21. 5., 2 ♀ 22. 5. 73, 4900 m. Holarctic, eurytopic, coprophilic species.

*) The altitude 4900 m applies to the locality at the front of the upper Barun Glacier. The altitude 3900 m to the locality of the Barun Valley-Tadosa.

Paregle aterrima Hennig, 1967

106 ♂ 124 ♀ 20—25. 5. 73, 4900 m. The species has been described from the East Pamir (4,200—4,800 m) where it is a dominant coprophag; in the Tian Shan as well as in the forestmeadow-steppe zone at the altitude of about 2,500 m it is less abundant (Sychevskaya 1966, Sychevskaya and Vtorov 1969).

According to the authors mentioned the bionomy of larvae is similar to the species *P. alatavensis* Hennig, 1967, whose numerous larvae have been found in the feces of yaks and marmots.



Figs. 1—3. *Paregle* sp. (Himalaya, Barun-Valley, 3900 m, 17. IV. 1973), male genitalia. 1 — fifth sternite; 2 — hypopygium, lateral view; 3 — the inner copulatory organ, ae — aedeagus, pr — pregonite, po — postgonite, e — epiphallus, p — phallapodeme, h — hypandrium.

Paregle sp.

5 ♂ 1975 ♀ 17. and 18. 4. 73, 3900 m; 1 ♂ 83 ♀ 20—25. 5. 73, 4.900 m. Species related to *P. radicum* (Linné, 1758), but with no hairs on notopleuron and with extremely long tuft up curved hairs on the jowls in the male. After written communication of Dr. M. Akland (British Museum, London) this species will be probably described under the name *hirtigena* in his forthcoming publication on Anthomyiidae from the whole oriental region. To the benefit of explicit additional identification we present figures of the most important characters (Figs. 1—3). Table 1 shows that adults preferred fresh faeces to those of the previous day. Very striking is the absolute predominance of females (2,058 ♀ : 6 ♂) and a lesser abundance in the higher elevated locality. Differences in the abundance and frequency between *Paregle* sp. and *P. aterrima*, as shown in the table, indicate

Table 1. A survey of flies trapped in two localities of the Nepal Himalaya.

Bait		Ff*	Fo**	Ff	Fo	Fresh human faeces						Total
Date		17.		18.		20.	21.	22.	23.	24.	25.	
		April				May						
Locality		3.900 m				4.900 m						
Species		Barun Khola Valley-Tadosa				Front of upper Barun Glacier						
Meoneura flavifacies	♀											
	♂										1	1
Scatophaga stercoraria	♀							2				2
	♂											
Paregle aterrima	♀					1	30	18	11	8	56	124
	♂						57	5	5	8	31	106
Paregle sp.	♀	580	475	630	290		14	9	2	11	47	2058
	♂		2	3			1					6
Paregle danieli	♀											
	♂										1	1
Anthomyiidae g. sp. 1	♀	2	1									3
	♂											
Anthomyiidae g. sp. 2	♀										1	1
	♂											
Hydrotaea hirticeps	♀			1								1
	♂											
Orthellia caesarion	♀						1					1
	♂											
Calliphora vicina	♀			1	2		1					4
	♂											
Calliphora vomitoria	♀										1	1
	♂											

* Fresh human faeces
** Old human faeces

a different ecology and probably chorology of both species as well. Dissection of ovarioles revealed that at the time of capture about 1/5 of all females of the new species contained fully developed eggs, while the remaining specimens were at various stages of development.

***Paregle danieli* Gregor, 1975**

1♂ 25.5 73, 4.900 m. Holotype. No biological data are available.
Note: Two species from the family Anthomyiidae failed to be identified; they are probably asyanathropic forms.

MUSCIDAE

***Hydrotaea hirticeps* (Fallén, 1824)**

1 ♀ 18. 5. 73, 3900 m. The specimen has 2 reclinate ors left and 3 right and 3 proclinate ors, but species identity is indisputable. In faunistic respect this find is suprising as regards the altitude of the locality and also because it is far beyond its range of distribution, i. e. the mountain ranges of southern Europe, if we do not take account of the single find in Armenia (Jerevan), (Hennig 1955–64). Bionomy is unknown.

***Orthellia caesarion* (Meigen, 1826)**

1 ♀ 21. 5. 73, 4.900 m. It was reported from the Himalaya by Van Emden (1965) from the Everest region, in Pamir it was observed at elevations of 4700—4900 m. (Sychevskaya, 1966). Holarctic, synbovine coprophagous species.

CALLIPHORIDAE

***Calliphora vicina* Robineau-Desvoidy, 1830**

3 ♀ 18. 4. 73, 3900 m; 1 ♀ 21. 5. 73, 4900 m. Holarctic eurytopic species.

***Calliphora vomitoria* (Linné, 1758)**

1 ♀ 25. 5. 73, 4900 m. According to Sychevskaya and Vtorov (1969) and Sychevskaya (1966) this forest species occurs in Central Asia only occasionally above the timber line.

DISCUSSION

The high altitude region visited is characterized by some specific features on which the occurrence of synanthropic flies depends. Although it is distant from permanent human settlements and very sharply separated from them by a configuration of terrain as well as continuous forest zone, a regular contact is possible through small flocks of sheep and herds of livestock which are being driven before the onset of summer monsoon (altitude of 3600—4000 m) serving as summer pastures. Together with these herds families of shepherds move to the summer pastures thus promoting a passive as well as active migration of flies from villages to the highest vegetation zones of the valley. Local conditions facilitate a further development of synanthropic flies during the growing

season and sometimes make possible their succesful hibernation as well. Our material was collected in both localities in similar phenological phase, i. e. at the onset of early spring, when the development of the same year's generation could not be taken in consideration. Consequantly, all cases represented specimens which had overwintered.*)

The grazing animals are not limited to close surroundings of summer huts of herdsmen. When the pasture is relatively poor they are beeing driven as far as the front of glacier. Such a march connected with pasturing lasts several days and the herdsmen sleep at night in temporary simple shelters provided up to the altitude of 4.900 m. Thus, in some places the dung of livestock and people accumulates and in the period before the onset of monsoon rapidly dries up in the sun and the development of fly larvae in it is hampered. The situation is quite different, of course, in the summer months with abundant precipitation.

While the seasonal presence of man and livestock in the Barun Valley provides sufficient food to coprophagous flies, schizophagous forms find less favourable conditions there. In the area studied the autochtonous fauna of vertebrates, whose faeces and carcasses make possible the existence of synanthropic Diptera, is very poor both quantitatively and qualitatively. Of mammals there are only representatives of the genera *Ochotona*, *Alticola* and *Pitimys*. Of birds important may be Galliformes (in the collecting area *Tetraogallus tibetanus*, *Lophophorus impejanus* and *Ithaginis cruentus* were found).

In order to elucidate the character and degree of synanthropy of flies the knowledge of their geographic-chorological origin may be helpful. All species of our spectrum (excluding both unidentified species of the family Anthomyiidae and *Paregle danieli* with unknown ecology and distribution) are of Palearctic origin, but differ in ecology and consequently in chorology as follows:

1. Species of a wide ecological valency and with great horizontal and vertical distribution, ranging sporadically into subnival zone, where some are capable of overwintering. These are: *Scatophaga stercoraria*, *Orthellia caesarion* and *Calliphora* spp.
2. High altitude autochtonous, more or less endemic species: *Paregle aterrima* and *Paregle* sp. Their high population density is typical.
3. Other less known species.

In our previous publication (Gregor and Daniel, 1971) dealing with synanthropic flies of the Hindu Kush we made an attempt to divide them in a similar way (l.c., p. 353), but that division included an additional group, i.e. eremic species which penetrate to the mountain valleys from the semi-desert zone. Analogically, it may be anticipated that saprophagous forms of Diptera penetrate or have already penetrated via the Nepal valleys to high altitudes from the zone of tropical evergreen upper montane forest.

The research of synanthropic flies of Central Asiatic mountains is just starting and has been advanced only in mountain ranges protruding into the territory of the USSR. Despite all gaps in our knowledge the validity of the following natural law appears to be sufficiently demonstrated: under high altitude conditions, in regions temporarily inhabited by man, autochtonous adapted forms of synanthropic flies are of primary importance. Without perceptibly changing their range of occurrence they are sensitive to their presence of man and domestic animals in that their population density increases until eventual "breeding surge" due to improved food conditions takes place. They represent a constant potential even in regions intact by man. In this sense they are true representatives of the category of hemisynanthropic forms in their original form. The genus *Paregle* with its 3 Central Asiatic high altitude species (*P. alatavensis*

*) The hibernation of adults of synanthropic species of the genus *Paregle*, *Scatophaga stercoraria* and *Orthellia caesarion* in the burrows of marmots was observed by Sychevskaya and Vtorov (1969, p. 828).

Hennig, *P. aterrima* Hennig and *P.* sp. in this publication) appears to be one of the best indicators of anthropourgic effects upon the environment of uninhabited regions. It is quite interesting to note that another two forms of the *Paregle* genus (*P. coerulescens* Strobl and *P. radicum montalpina* Gregor et Povolný) live in the Alps and also belong to dominant coprophagous species (Gregor and Povolný 1964).

CONCLUSIONS

The material of flies was collected in two localities (3900 and 4900 m where herdsmen and cattle stay during the growing season) soon after the snow thawed away and thus represents early spring aspect. There is no doubt that this was the case of flies which hibernated in those places as adults. The total number of 2309 fly specimens captured in traps baited with faeces 99.3 % represented two species of the genus *Paregle: P. atterrima* (10 %) and *P.* sp. (89.3 %). Both species are autochtonous high altitude hemisynanthropic forms which may attain high population densities apparently due to concentration of excrements in given localities. The remaining 0.7 % are shared by 9 more or less eurytopic species of palaearctic or holoarctic distribution. Among them the most important is the communicative hemisynanthropic species *Calliphora vicina* sometimes also *C. vomitoria*. In this respect it may be said about the high altitude mountains of the Central Asia that primarily autochtonous adapted coprophagous forms, such as in our case some species of the genus *Paregle*, are potential vectors of intestinal diseases and indicators of anthropurgic influences upon environment.

МАТЕРИАЛЫ ПО ФАУНЕ СИНАНТРОПНЫХ МУХ НЕПАЛЬСКИХ ГИМАЛАЕВ

Ф. Грегор и М. Даниел

Резюме. Изучен материал мух, собранных в двух местностях (3900 и 4900 м над уровнем моря) в долине Баруи Хола (восточный Непал), отражающий весенний аспект видового состава мух. Из общего количества 2309 особей мух 99,3 % представляли два вида рода *Paregle* (*Paregle aterrima*, *P.* sp.); оба вида являются автохтонными высокогорными гемисинантропными формами. Остальные 0,7 % представляют 9 более или менее эвритопных видов с палеарктическим или голарктическим распространением (*Calliphora vicina*, *C. vomitoria*, *Meoneura flavifacies*, *Scatophaga stercoraria*, *Hydrotaea hirticeps*, *Orthellia caesarion*, *Paregle danieli*, Anthomyiidae g. sp. 1, g. sp. 2).