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Muscidae from above the Tree-line in the Upper Ötz Valley (Tyrol, Austria)

(Insecta, Diptera)

by

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Synopsis: 70 species of Muscidae are listed from above the tree-line (nival and alpine zones) around Obergurgl, Tyrol, Austria. Ten species are restricted to this zone, and ten others occur more abundantly above the tree-line than below. Factors affecting altitudinal dispersal of Muscidae are discussed, and some examples given. Changes in the altitudinal range of *Lispe pygmaea* FALLÉN, 1825, over 25 years are listed. Two species of boreal *Spilogona*, *S. micans* (RINGDAHL, 1918) and *S. triangulifera* (ZETTERSTEDT, 1838), are recorded for the first time from Central Europe.

1. Introduction:

In the northern hemisphere, flies of the family Muscidae are abundant both in species and in individuals at high altitudes (e.g. STOCKNER 1982, TROGER et al. 1994) and at high latitudes (e.g. DANKS 1981, PONT 1993). A variety of specialised niches is available at high altitude where the adult flies can carry out the functions of feeding, mating and reproduction, and where the larvae can obtain food for growth and development. However, surprisingly little work has been done on them, partly because of the physical and logistic difficulties of carrying out prolonged research in zones above the tree-line and partly because of the problems involved in dealing with the material obtained (principally taxonomic difficulties and lack of specialists). With renewed interest now focusing on life zones at high altitude and high latitude and on the observed and potential effects of climatic change on the biota, it has become essential for investigations to be made into the faunal composition, altitudinal amplitude and tolerance, reproductive and nutritional biology, and habits of muscid flies in the mountain tundra zone of Central Europe.

This paper offers a preliminary review of Muscidae from above the tree-line in the Upper Ötz Valley of the Austrian Tyrol. Its purpose is to summarise some of the results of fieldwork carried out in the Ötz Valley at irregular intervals over the last 30 years, and to point out some of the changes in faunal composition and abundance observed over this period. It is hoped that these results will serve as a baseline for future investigations of the Muscidae of this area. Despite the obvious abundance of these flies, remarkably little biological information is available: the life-histories of even the most common species are largely unknown (SKIDMORE 1985), and there is ample scope for research in this field. The role of Muscidae as pollinators of flowers at high latitude, where they replace bees and hover-flies as the principal flower visitors, has recently been studied (PONT 1993), and analogous studies are needed at high altitude in the Alps.

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The bulk of the material discussed here was collected by myself and my wife on two fieldtrips to Obergurgl, 11-22 August 1969 and 24 July - 14 August 1972. This has been supplemented by collections made on a brief visit, 6-8 August 1981, and more recently 24 July - 3 August 1994 when the main objective was to collect at sites above the tree-line. Material collected around Obergurgl by J.R. VOCKEROTH (1953), B.H. COGAN (1966, 1967, 1969, 1973) and K. ROGNES (1986) has also been used, as has been an earlier collection I made at the Vernaghütte near Vent, 7-14 July 1964. Records published by LINDNER & MANNHEIMS (1956), HENNIG (1955-1964), GREGOR & POVOLNÝ (1964), GREGOR (1968) and LINDNER (1973) have also been incorporated where appropriate.

Most of the material dealt with here was collected with a hand-net, either individually or by sweeping. GREGOR & POVOLNÝ's material was collected in faeces-baited traps.

Material has been identified using the monograph by HENNIG (1955-1964), together with more recent taxonomic literature on Muscidae (especially d'ASSIS-FONSECA 1968). The classification and nomenclature follow PONT (1986).

3. Results:

Muscidae were collected at the following sites above the tree-line around Obergurgl:

- (1) Nival (boulder) zone.
Gaißbergtal, 2400 - 2500 m.
Rotmoostal, 2280 - 2320 m.
Upper part of track from Seenplatte to Gurgler Schartl, 2720 - 2930 m.
Gurgler Schartl, 2930 m.
Ramolhaus, 3006 - 3020 m.
- (2) Alpine (heath) zone.
Gaißbergtal, 2260 - 2400 m.
Hohe Mut to Gaißbergtal, 2400 - 2600 m.
Rotmoostal, 2260 - 2280 m.
Seenplatte, 2500 - 2680 m; including Soomsee, 2560 m and Itlsee, 2670 m.
Track to Ramolhaus, 2700 and 2800 m.
- (3) Timmelsbach bridge, 2101 m, and Timmelsjoch, 2480 - 2509 m.
These sites are both in the alpine zone.
- (4) Vent, around the Vernaghütte, 2500 - 2850 m. Nival zone.

The surprisingly large number of 70 species of Muscidae has been collected above the tree-line (Table 1). 55 of these have been found in the nival (boulder) zone and 54 in the alpine (heath) zone. To put these figures into perspective, the following comparisons can be made:

825 species known from the Palaearctic region (PONT 1986).

282 species known from Austria (from PONT 1986).

143 species known from the Upper Ötz Valley (Obergurgl - Zwieselstein - Vent, PONT unpublished data) (51 % of the Austrian total).

70 species above the tree-line (49 % of the Upper Ötz Valley total, 25 % of the Austrian total).

Table 1: Species of Muscidae (Diptera) found above the tree-line around Obergurgl. - * Occurs in the lower meadow/riverine/forest zones, but most abundant above the tree-line. ** Occurs occasionally or irregularly above the tree-line, but most abundant in the lower meadow/riverine/forest zones.

Species	Nival (boulder) zone	Alpine (heath) zone	Lower zones
<i>Azelia nebulosa</i> DESVOIDY		+	**
<i>Coenosia acuminata</i> STROBL	+	+	**
<i>Coenosia means</i> MEIGEN	+	+	**
<i>Coenosia nigridigita</i> RONDANI	+		**
<i>Coenosia obscuricula</i> (RONDANI)	+	+	*

Species	Nival (boulder) zone	Alpine (heath) zone	Lower zones
<i>Coenosia pedella</i> (FALLÉN)		+	**
<i>Coenosia pumila</i> (FALLÉN)		+	**
<i>Coenosia styriaca</i> HENNIG		+	**
<i>Dasyphora penicillata</i> (EGGER)	+	+	**
<i>Drymeia alpicola</i> (RONDANI)	+	+	**
<i>Drymeia brumalis</i> (RONDANI)		+	*
<i>Drymeia cinerea</i> (MEIGEN)	+	+	**
<i>Drymeia hamata</i> (FALLÉN)	+	+	**
<i>Eudasyphora zimini</i> (HENNIG)		+	**
<i>Graphomya maculata</i> (SCOPOLI)	+		**
<i>Haematobosca stimulans</i> (MEIGEN)		+	**
<i>Helina annosa</i> (ZETTERSTEDT)	+		*
<i>Helina cinerella</i> (WULF)	+	+	**
<i>Helina evecta</i> (HARRIS)	+	+	**
<i>Helina fratercula</i> (ZETTERSTEDT)	+	+	**
<i>Helina obscurata</i> (MEIGEN)		+	**
<i>Helina obtusipennis</i> (FALLÉN)	+	+	*
<i>Helina reversio</i> (HARRIS)	+	+	**
<i>Helina subvittata</i> (SÉGUY)	+		**
<i>Hydrotaea irritans</i> (FALLÉN)	+		**
<i>Hydrotaea pandellei</i> STEIN		+	**
<i>Hydrotaea pilitibia</i> STEIN	+	+	**
<i>Limnophora pandellei</i> SÉGUY	+	+	+
<i>Limnophora setinerva</i> SCHNABL	+		**
<i>Lispe consanguinea</i> LOEW		+	**
<i>Lispe pygmaea</i> FALLÉN	+	+	**
<i>Lispecephala erythroera</i> (DESVOIDY)	+	+	*
<i>Mesembrina meridiana</i> (LINNAEUS)		+	**
<i>Morellia hortorum</i> (FALLÉN)	+		**
<i>Morellia podagrica</i> (LOEW)	+	+	**
<i>Musca autumnalis</i> DE GEER	+		**
<i>Musca domestica</i> LINNAEUS	+		**
<i>Musca osiris</i> WIEDEMANN	+		**
<i>Muscina pascuorum</i> (MEIGEN)	+	+	**
<i>Mydaea rufinervis</i> (POKORNY)	+	+	*
<i>Myospila alpina</i> HENDEL	+	+	**
<i>Myospila mediatubunda</i> (FABRICIUS)		+	*
<i>Phaonia alpicola</i> (ZETTERSTEDT)		+	
<i>Phaonia chalinata</i> (PANDELLÉ)	+	+	
<i>Phaonia consobrina</i> (ZETTERSTEDT)		+	+
<i>Phaonia latifrontalis</i> HENNIG	+		
<i>Phaonia lugubris</i> (MEIGEN)			**
(syn: morio ZETTERSTEDT)	+	+	
<i>Phaonia tenuiseta</i> (POKORNY)	+	+	

Species	Nival (boulder) zone	Alpine (heath) zone	Lower zones
<i>Polietes lardaria</i> (FABRICIUS)	+		**
<i>Schoenomyza litorella</i> (FALLÉN)	+	+	+
<i>Spilogona alpica</i> (ZETTERSTEDT)	+	+	
<i>Spilogona brunneisquama</i> (ZETTERSTEDT)	+	+	**
<i>Spilogona caliginosa</i> (STEIN)	+	+	*
<i>Spilogona depressiuscula</i> (ZETTERSTEDT)	+	+	*
<i>Spilogona meadei</i> (SCHNABL)	+	+	**
<i>Spilogona micans</i> (RINGDAHL)	+	+	
<i>Spilogona solitaria</i> (COLLIN)	+	+	**
<i>Spilogona triangulifera</i> (ZETTERSTEDT)	+	+	
<i>Spilogona</i> sp.	+		
<i>Thricops aculeipes</i> (ZETTERSTEDT)	+	+	**
<i>Thricops beckeri</i> (POKORNY)		+	**
<i>Thricops culminum</i> (POKORNY)	+	+	
<i>Thricops cunctans</i> (MEIGEN)	+	+	**
<i>Thricops furcatus</i> (STEIN)	+	+	*
<i>Thricops genarum</i> (ZETTERSTEDT)	+	+	**
<i>Thricops lividiventris</i> (ZETTERSTEDT)	+		**
<i>Thricops longipes</i> (ZETTERSTEDT)	+	+	**
<i>Thricops nigrifellus</i> (ZETTERSTEDT)	+	+	**
<i>Thricops rostratus</i> (MEADE)	+		
<i>Thricops villosus</i> (HENDEL)	+		
Total species: 70	55	54	

The majority of these species are not confined to the zones above the tree-line, and appear either to have a rather wide ecological tolerance or to be casual or seasonal migrants into the higher zones. However, 10 species do appear to be restricted to the nival and alpine zones (Table 2). Of the other 5 species included in this table, four (*Coenosia pumila*, *Limnophora pandelei*, *Limnophora setinerva*, *Lispe consanguinea*) occur in lower zones but have not yet been found there in the Obergurgl area, whilst one (*Spilogona* sp.) is of uncertain status but is almost certainly a species from the lower zones. A further 10 species, indicated by "*" in Table 1, occur in the lower zones but are much more abundant above the tree-line: *Coenosia obscuricula*, *Drymeia brumalis*, *Helina annosa*, *Helina obtusipennis*, *Lispocephala erythrocerata*, *Myospila alpina*, *Phaonia alpicola*, *Spilogona caliginosa*, *Spilogona depressiuscula*, *Thricops furcatus*.

Two species of *Spilogona* have not previously been found in Central Europe. The records were included in the Catalogue of Palaearctic Muscidae (PONT 1986: 170, 175), and details are as follows:

Spilogona micans (RINGDAHL, 1918)

Obergurgl: Gaisbergtal, 2260 - 2400 m, glacier valley, high-alpine swampy heath, 12.viii.1969 (A.C. & B. PONT), 2 ♀; Rotmoostal, 2280 m, swampy heath, 7.viii.1972 (A.C. & B. PONT), 3 ♂ 1 ♀; Rotmoostal, boulder zone, 2300 m, 27.vii.1994 (A.C. PONT), 6 ♂ 3 ♀.

Table 2: Species of Muscidae (Diptera) that are found only above the tree-line around Obergurgl. — ** Species endemic to the zones above tree-line. Other species listed occur in lower zones, but have not yet been found in these lower zones around Obergurgl.

Species	Nival (boulder) zone	Alpine (heath) zone	Nival & alpine zones	
<i>Coenosia pumila</i> (FALLÉN)		+		
<i>Limnophora pandellei</i> SÉGUY		+		
<i>Limnophora setinerva</i> SCHNABL	+			
<i>Lispe consanguinea</i> LOEW		+		
<i>Mydaea rufinervis</i> (POKORNY)			+	**
<i>Phaonia chalinata</i> (PANDELLÉ)	+			**
<i>Phaonia latifrontalis</i> HENNIG	+			**
<i>Phaonia tenuiseta</i> (POKORNY)			+	**
<i>Spilogona alpica</i> (ZETTERSTEDT)			+	**
<i>Spilogona micans</i> (RINGDAHL)			+	**
<i>Spilogona triangulifera</i> (ZETTERSTEDT)			+	**
<i>Spilogona</i> sp.	+			?
<i>Thricops culminum</i> (POKORNY)			+	**
<i>Thricops rostratus</i> (MEADE)	+			**
<i>Thricops villosus</i> (HENDEL)	+			**
Total species: 15	6	2	7	10

Distribution: Alps (Obergurgl), North Scandinavia, Iceland, Svalbard. Recorded from North America, but Nearctic specimens belong to a distinct species (WOOD in DANKS 1981: 489). This is the first record south of Scandinavia, and there is a clear arcto-alpine disjunction: this is a true relict species in the Alps. Oreo-tundral, of tundra origin. Adults were found on patches of muddy sand alongside the Rotmoos Bach.

Taxonomic note: These specimens have been compared with Swedish specimens of *S. micans*, and the male terminalia have also been dissected and compared.

Spilogona triangulifera (ZETTERSTEDT, 1838).

Obergurgl: Gaißbergthal, 2260 m, swampy heath, 2.viii.1972 (A.C. & B. PONT), 4 ♂ 2 ♀; Gaißbergthal, 2260 - 2400 m, glacier valley, high-alpine swampy heath, 12.viii.1969, 1 ♀, and 27.vii.1972, 1 ♂ 1 ♀ (A.C. & B. PONT); Rotmoostal, swampy heath, 2280 m, 7.viii.1972 (A.C. & B. PONT), 1 ♀; Itlsee, 2670 m, 10.viii.1972 (A.C. & B. PONT), 1 ♂ 1 ♀; Itlsee, 2670 m, on stones, 29.vii.1994 (A.C. PONT), 2 ♂ 2 ♀; Gurgler Scharfl, 2930 m, 10.viii.1972 (A.C. & B. PONT), 1 ♂. Timmelsjoch, 2480 m, 9.viii.1972 (A.C. & B. PONT), 1 ♂.

Distribution: Alps (Obergurgl), Scotland, North Scandinavia, Arctic islands (Svalbard, Novaya Zemlya), arctic Siberia; northern Canada. This is the first record from the Alps. The distribution shows a clear arcto-alpine disjunction. Oreo-tundral, of tundra origin. Adults were found close to water, on stones around pools and (in the Gaißbergthal) at a swampy patch of heath flooded with meltwater trickles. Adults are evidently cold-tolerant: they have been observed in Scotland and North Sweden to hunt over snow patches, feeding on the bodies of other small insects that have fallen on to the snow.

Taxonomic note: These specimens have been compared with Swedish specimens of *S. triangulifera*, and the male terminalia have also been dissected and compared. The only difference is that the Alpine specimens have the fore and hind femora more thinly haired.

In his epoch-making work, BEZZI (1918: 39) characterised the highest life-zone, the nival region, as the "regione degli Antomiidi", under which he included both Anthomyiidae and Muscidae in the modern sense. It will be clear from the list of species given in Table 1 that the Muscidae are very well represented above the tree-line. This reinforces the impression acquired in the field that Muscidae, together with the Anthomyiidae, are the most numerous insects in this harsh and unpromising environment.

Muscidae (and certain Anthomyiidae) are also the most abundant and obvious visitors to flowers (e.g. MÜLLER 1881), and are thus important passive pollinators. Indeed, clumps of flowering *Saxifraga azoides* are often smothered with muscoid flies. On 30 July 1994, in the nival zone of the Rotmoostal at 2300 m, I collected a sample of flies from *Saxifraga azoides* by lowering the net over several clumps and counting all the flies captured, as follows:

Anthomyiidae, 79 ex.
Muscidae, 37 ex. (15 species).
Calliphoridae, 6 ex.
Dolichopodidae, 1 ex.
Scathophagidae, 1 ex.
Syrphidae, 16 ex.
Tachinidae, 1 ex.

There are also species with dung-breeding larvae, which exploit this scarce high-alpine resource (e.g. *Mydaea rufinervis*, *Myospila alpina*), and adults which are active predators of other small insects (e.g. genera *Spilogona*, *Lispe*, *Limnophora*). Most of the species in the nival zone are to be found resting on stones or on the ground, but may seek the shelter of isolated grass tufts or cushion plants. A few species are active on the sandy mud alongside rivers of glacial meltwater.

Of the 10 species that live only above the tree-line (Table 2), four are endemic to the Alps: *Mydaea rufinervis*, *Phaonia latifrontalis*, *Phaonia tenuiseta*, *Thricops villosus*. Two species, *Phaonia chalinata* and *Thricops culminum*, are endemic to the European mountains: both are known from the Alps and Pyrenees, and *T. culminum* additionally from the Apennines and Tatras. The remaining 4 have an arcto-alpine distribution: *Spilogona alpica* and *Spilogona triangulifera* (both also in North America), *Spilogona micans* (Alps and Scandinavia), and *Thricops rostratus* (North and montane Central Europe).

Among the ten species listed in Table 1 that occur more abundantly above the tree-line than below, the patterns of distribution are more complicated:

Spilogona caliginosa: endemic in the Alps.

Myospila alpina: mountains of Central Europe.

Coenosia obscuricula and *Drymeia brumalis*: mountains of Central Europe, and Pyrenees.

Thricops furcatus: arcto-alpine disjunction (Alps, Pyrenees, Scandinavia; also North America).

Helina annosa, *Lispocephala erythrocerca*, *Phaonia alpicola*, *Spilogona depressiuscula*: boreo-alpine disjunction (European uplands, UK, Scandinavia; all except *S. depressiuscula* also in North America).

Helina obtusipennis: boreo-alpine disjunction (European uplands, Scandinavia, north-east Turkey).

Most of these species may in fact be oreoal rather than arboreal species since they are common only in open or exposed areas below the tree-line, such as boggy meadows and heaths, or alongside rivers where cold water lowers the air temperature of adjacent areas.

One of the questions that I considered is whether the data from this Obergurgl fieldwork is sufficient to indicate any changes of distribution over the last quarter-century and whether such changes could be a manifestation of global warming. It is to be expected that muscid flies at the highest altitudes may move higher as the glaciers retreat and more land is exposed. There will come a point when further upward movement is not possible, and extinctions will take place. But can such changes be monitored in the way that changes in plant distribution can be (e.g. GRAB-

area and of acquiring new material of European Diptera for the Natural History Museum in London, UK. The visit in 1994 was briefer and less intensive, with objectives restricted to investigations above the tree-line.

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