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Fanniidae, Muscidae and Anthomyiidae associated with Burrows of the Alpine Marmot *Marmota marmota* LINNAEUS) in the Upper Ötz Valley (Tyrol, Austria)

(Insecta, Diptera)

by

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Synopsis: One species of Fanniidae, 15 of Muscidae and 5 of Anthomyiidae are recorded as associated with the burrows of the Alpine Marmot (*Marmota marmota* LINNAEUS). *Mydaea rufinervis* (POKORNY) and *Phaonia tenuiseta* (POKORNY) (Muscidae) are considered to be obligate commensals, probably breeding in excrement. *Fannia* sp. (Fanniidae), *Helina cinerella* (WULP) and *Myospila alpina* HENDEL (Muscidae), and *Botanophila bompadrei* (BEZZI) and *Eutrichota paratunicata* (HENNIG) (Anthomyiidae), are considered to be facultative commensals, probably breeding in excrement and debris in the burrows.

1. Introduction:

Since the classic work of MÜLLER (1881), it has been known that there is an intimate connection between flowers and adult muscoid flies, and in many cases the larvae too: not only do flowers supply nectar and pollen, containing all the nutrients required by flies, but they also provide sites where the sun's warmth is concentrated and enhanced, shelters from high winds, sites for courtship and copulation, sites where predators hunt for prey and where flies find haven from predators, and even brood-places (PONT 1994). Most of these features are provided by another, almost entirely overlooked, high-alpine niche, the burrows of Marmots.

The Alpine Marmot (*Marmota marmota* LINNAEUS) occurs commonly above the treeline between 2000 and 3000 m, especially on south-facing slopes where there is sufficient soil or stabilised scree for its deep burrows. Marmots feed on grasses, sedges and other herbs, and store dry grass in their burrows for bedding. Excrement, soiled bedding straw and other debris is stored deep underground in a small chamber close to the main living area, and it is in this "chambre sanitaire" that the insect commensals live and breed (MARIÉ 1930). Temperatures in the depths of the tunnel remain around 8° in summer and 5-6° in winter.

Marmots used to be hunted, to provide fresh meat for isolated human settlements during the long winter months. This has been discontinued for many years, and the Marmot is now an abundant and obvious element of the high-altitude environment in many parts of the Alps.

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2. Previous Investigations:

The only papers known to us that deal with the insect fauna of Alpine Marmot burrows are by MARIÉ (1926 - 1930), who worked in the French Basses-Alpes, Savoie and Dauphiné. He concluded that no Diptera are truly associated with Marmots. He assigned all the Diptera that he encountered to his Group D, of fortuitous visitors to Marmot burrows (MARIÉ 1930), and this group included the following muscoids:

Mydaea albotalla [sic] MEIGEN [now *Helina allotalla* (MEIGEN, 1830), Muscidae]
Spilogaster atrior PANDELLÉ [now *Spilogona denigrata* (MEIGEN, 1826), Muscidae]
Chortophila cinerella FALLÉN [now *Adia cinerella* (FALLÉN, 1825), Anthomyiidae]
Hylemia [sic] *varicolor* MEIGEN [now *Botanophila varicolor* (MEIGEN, 1826), Anthomyiidae]
Hylemia [sic] *nigrimana* MEIGEN [now *Hylemya nigrimana* (MEIGEN, 1826), Anthomyiidae]

There are a few other scattered reports in the literature that refer to species collected in or around Marmot burrows, but it is evident that this is a largely unexplored association.

LINDNER (1973: 132-134) collected *Mydaea rufinervis* (POKORNY) at six localities in the German and Austrian Alps, and noted: "Alle meine Exemplare fing ich an den Eingängen der Murmeltierbauten". LINDNER concluded from the behaviour of the flies that larval development took place in Marmot excrement.

In the East Pamir and Tien Shan Mountains of Central Asia, SYCHEVSKAYA & VTOROV (1969) and SYCHEVSKAYA (1970) found a number of Muscidae and Anthomyiidae associated with the Altay Marmot (*Marmota bobak* THOMAS) and the Long-Tailed Marmot (*Marmota caudata aurea* BLANDFORD) in alpine and subalpine zones up to 4670 m:

Muscidae
Helina bohemani (RINGDAHL, 1916)
**Morellia aenescens* ROBINEAU-DESVOIDY, 1830
* *Orthellia caesarion* MG. [now *Neomyia cornicina* (FABRICIUS, 1781)]
**Xestomyia pamirensis* HENNIG, 1964
Phaonia hirtirostris (STEIN, 1907) [probably *Phaonia nigrirostrata* ZINOVIEV, 1983]
Phaonia hybrida (SCHNABL, 1888) [actually *Phaonia tianshanica* ZINOVIEV, 1983]
Phaonia subdecussata HENNIG, 1963
Phaonia sytschevskajae HENNIG, 1963
Pogonomyia sp. n. [now *Drymeia* sp. n.]
Trichopticoides gymnophthalma HENNIG [now *Drymeia gymnophthalma* (HENNIG, 1963)]

Anthomyiidae
Hydrophoria pamirensis HENNIG [now *Zaphne pamirensis* (HENNIG, 1969)]
**Paregle alatavensis* HENNIG [now *Adia alatavensis* HENNIG, 1974]
* *Paregle aterrima* HENNIG, 1976
* *Paregle cinerella* FALL. [now *Adia cinerella* (FALLÉN, 1825)]
* *Paregle grisella* ROND. [now *Adia grisella* (RONDANI, 1870)]
* *Paregle radicum* L. [now *Paregle audacula* (HARRIS, 1780)]

Those marked with * were found breeding in dung; the others were collected on dung or in the burrows.

ZINOVIEV (1983: 181) reviewed and corrected some of SYCHEVSKAYA's material of *Phaonia* (Muscidae), as noted above, and in revising species of the *Phaonia tenuiseta*-group he also recorded material of *Phaonia subdecussata* HENNIG, 1963, and *Phaonia decussata* (STEIN, 1907), as trapped in Marmot burrows in the Hissar Mountains of Tadzhikistan.

In North America, GRIFFITHS has summarised records of several species of *Eutrichota* (Anthomyiidae) from the burrows of small mammals, but none was from mountainous areas. He noted *E. affinis* (STEIN, 1898), *E. cylindrica* (STEIN, 1898) and *E. lipsia* (WALKER, 1849) from the burrows of *Marmota monax* LINNAEUS in Ontario province in Canada (GRIFFITHS 1984: 471, 558, 586).

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3. The Present Investigations:

Most of the material discussed in this paper was collected by A.C.P. In the course of field trips to Obergurgl in 1972 and 1981, flies were collected around the entrance to Marmot burrows by sweeping over spoil heaps and the immediately adjacent vegetation, as follows: Auf der Nase and west, 2020 - 2040 m (1 August 1972); Rotmoostal, 2280 m (7 August 1972); and Gaißbergtal, 2400 m (27 & 30 July 1972, 7 August 1981). On 30 July 1994, on the north side of the Rotmoostal at 2310 m, further flies were collected by holding the net over the entrance to several burrows, and all the flies collected were identified and counted.

In addition, we have studied Muscoidea collected in 1993 by Dr J.W. Ismay and Dr J.R. Haslett from the entrance to Marmot burrows at localities in the Fuscher Tal of the Hohe Tauern National Park, Austria.

The material discussed here is in the Natural History Museum, London, U.K.; the University Museum, Oxford, U.K.; the Zoology Department of Innsbruck University, Austria; and our private collections.

In this report, the sections dealing with Fanniidae and Muscidae are by A.C.P. and those with Anthomyiidae by D.M.A.

4. Results:

4.1. Species Account:

4.1.1. Family Fanniidae:

Fannia sp. indet. Gaißbergtal, 2400 m, 7.viii.1981, 1 ♀; Rotmoostal, 2310 m, 30.vii.1994, 1 ♀.

This is a remarkable species of the *canicularis*-subgroup: parafacial setulae strong, palpi not dilated, abdomen entirely dark in colour, hind coxa setulose on posterior margin, hind tibia with several setulae basad and apicad of the strong submedian anterodorsal seta, several proepimeral setulae around the strong seta. The proepisternal depression has several setulae in the 1981 ♀, but only 1 setula on one side in the 1994 ♀. It is possible that this is the female of *Fannia brinae* ALBUQUERQUE, 1951, a species known only from a few males from two localities in the French Alps (La Grave at 1600 m, and Moutière).

Larvae of *Fannia* species are generally scavengers in decaying organic matter, but some species specialise in insect nests, birds' nests, and small mammal burrows and runs.

4.1.2. Family Muscidae:

Helina cinerella (WULP, 1867). Gaißbergtal, 2400 m, 30.vii.1972, 1 ♂. Rotmoostal, 2310 m, 30.vii.1994, 3 ♀.

Helina fratercula (ZETTERSTEDT, 1845). Rotmoostal, 2310 m, 30.vii.1994, 2 ♂ 1 ♀.

The larva of this species has been found in moss growing on a tree trunk (SKIDMORE, 1985: 457).

Helina obscurata (MEIGEN, 1826). Rotmoostal, 2310 m, 30.vii.1994, 1 ♀.

Larva found in humus soil (SKIDMORE, 1985: 464).

Helina obtusipennis (FALLÉN, 1823). Rotmoostal, 2310 m, 30.vii.1994, 1 ♀.

Helina reversio (HARRIS, 1780) (*duplicata* (MEIGEN, 1826)). Gaißbergtal, 2400 m, 30.vii.1972, 1 ♀.

Reared from old cow dung, also moss, a tree stump, and a hornet's nest (SKIDMORE, 1985: 461).

Larvae of *Helina* are monomorphic, i.e. the larva is already in the third (final) instar when it hatches from the egg. They are obligate carnivores, in temperate regions living mainly in mosses or humus soil.

Mydaea rufinervis (POKORNY, 1889). Auf der Nase and west, 2020 - 2040 m, 1.viii.1972, 5 ♂ 4 ♀. Rotmoostal, 2280 m, 7.viii.1972, 2 ♂; 2310 m, 30.vii.1994, 12 ♂ 38 ♀. Gaißbergtal, 2400 m, 27.vii.1972, 2 ♂, and 30.vii.1972, 11 ♂ 4 ♀; 7.viii.1981, 1 ♂ 2 ♀. Also from the Hohe Tauern National Park, Fuscher Tal, Gamsboden, 2400 m, 27.vii.1993, 1 ♂.

The species is not uncommon at the entrance to Marmot burrows, and is never found far from Marmot colonies. In 1994 it was the most abundant fly in the Rotmoostal, the adults much in evidence on the tourist path and adjacent boulders. The larvae probably live in Marmot droppings. For this reason we propose the name "Marmot Fly" for this species. It is replaced in Central Asia (East Pamirs) by *Mydaea asiatica* PONT, 1967, and in western North America by an as yet undescribed species.

Larvae of *Mydaea* are di- to monomorphic. They are obligate carnivores in dung and in rotting fungi.

Myospila alpina HENDEL, 1901. Rotmoostal, 2310 m, 30.vii.1994, 2 ♀.

Larvae of *Myospila* are dimorphic, but sometimes monomorphic. They are obligate carnivores in mammal excrement.

Phaonia alpicola (ZETTERSTEDT, 1845). Gaißbergtal, 2400 m, 30.vii.1972, 1 ♀.

Phaonia lugubris (MEIGEN, 1826) (*morio* (ZETTERSTEDT, 1845)). Gaißbergtal, 2400 m, 30.vii.1972, 1 ♀.

Phaonia tenuiseta (POKORNY, 1893). Gaißbergtal, 2400 m, 30.vii.1972, 1 ♀.

This species belongs to a group of *Phaonia*-species known only from the alpine zones of the Alps, the Caucasus Mts, and the mountains of Central Asia (Pamirs, Tian Shan). As mentioned in the introduction, several species of the group are known to be associated with Marmot burrows.

Larvae of *Phaonia* are monomorphic. They are obligate carnivores, living in mosses, humus soil, decaying wood and rotting plants.

Spilogona brunneisquama (ZETTERSTEDT, 1845). From the Hohe Tauern National Park, Fuscher Tal, Gamsboden, 2400 m, 27.vii.1993, 1 ♂.

The larva is probably dimorphic, and an obligate carnivore. Its regular breeding site is probably in dense moss cushions on rocks or soil (SKIDMORE, 1985: 360).

Thricops culminum (POKORNY, 1889). Gaißbergtal, 2400 m, 30.vii.1972, 19 ♂ 6 ♀, and 7.viii.1972, 2 ♀. Also from the Hohe Tauern National Park, Fuscher Tal, Gamsboden, 2400 m, 27.vii.1993, 1 ♀.

Thricops furcatus (STEIN, 1915). Gaißbergtal, 2400 m, 7.viii.1981, 1 ♀. Also from the Hohe Tauern National Park, Fuscher Tal, Gamsboden, 2400 m, 27.vii.1993, 1 ♂.

Thricops genarum (ZETTERSTEDT, 1838) (*sundewalli* (ZETTERSTEDT, 1845)). Gaißbergtal, 2400 m, 7.viii.1981, 1 ♂.

Thricops longipes (ZETTERSTEDT, 1845). Gaißbergtal, 2400 m, 30.vii.1972, 1 ♂.

The pupa has been found in wet moss (SKIDMORE, 1985: 154).

Larvae of *Thricops* are trimorphic facultative to dimorphic obligate carnivores, mainly living in soil.

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4.1.3. Family Anthomyiidae:

Botanophila bompadrei (BEZZI, 1918). Rotmoostal, 2310 m, 30.vii.1994, 11 ♂ 20♀. Also from the Hohe Tauern National Park, Fuscher Tal, Gamsboden, 2400 m, 27.vii.1993, 4 ♂ 7♀.

This species is very little known, being restricted to alpine zones in the Alps (Austria, Italy) and in the Russian Far East (Yakutiya).

Larvae of most *Botanophila* species are phytophagous, living in the heads of various flowering plants.

Delia commixta (SÉGUY, 1925). Rotmoostal, 2310 m, 30.vii.1994, 1 ♂.

Known only from the alpine zone in the Alps of France (Lautaret) and Austria (Osttirol, Matrei, 2100 - 2200 m; Hohe Tauern National Park, Fuscher Tal, 2000 - 2500 m).

The larvae of most *Delia* species are phytophagous.

Eutrichota paratunicata (HENNIG, 1973). Gaißbergtal, 2260 - 2400 m, 30.vii.1972, 1 ♂. Rotmoostal, 2310 m, 30.vii.1994, 2 ♂ 2 ♀. Also from the Hohe Tauern National Park, Fuscher Tal, Langereitboden, 2000 - 2500 m, 24.vii.1993, 5 ♂.

Nothing is known about the life history of this species.

Paregle audacula (HARRIS, 1780) (*radicum* of authors). Rotmoostal, 2310 m, 30.vii.1994, 14 ♂ 3 ♀.

The larvae live in various kinds of dung and in plant roots.

Pegoplata aestiva (MEIGEN, 1826). Rotmoostal, 2310 m, 30.vii.1994, 1 ♀.

The larvae live in dung.

5. Discussion:

MARIÉ (1930) proposed four groups of insect commensals in Marmot burrows:

Group A: Life-cycle passed entirely within Marmot burrows.
Group B: Life-cycle passed in Marmot burrows or in the burrows of other small mammals.
Group C: Usually found in burrows, but also able to disperse elsewhere.
Group D: Occurrence in Marmot burrows fortuitous.

The biology of most of the species we have listed here is completely unknown, and the larval habitat and food have not been recorded. However, several species occur so commonly in and around Marmot burrows, and nowhere else, that it is difficult not to conclude that they are commensals in the burrows, the larvae breeding in the mixture of Marmot excrement and bedding material ejected into the "chambre sanitaire". In our view, the following species should be considered as obligate commensals:

Mydaea rufinervis
Phaonia tenuiseta

Other species that probably breed in the burrows as facultative commensals are as follows:

Fannia sp.
Helina cinerella
Myospila alpina
Botanophila bompadrei
Eutrichota paratunicata

Of the remaining species listed above, many were probably feeding on Marmot excrement (especially the female flies), whilst others were probably sunning themselves in the sheltered warmth of the tunnel entrances. A few (e.g. the *Thricops*-species) were undoubtedly fortuitous, being common species of the high-alpine heaths that were caught because they happened to be close to the spoil heaps around the burrows.

It is worth pointing out that in the sample collected by A.C.P. on 30 July 1994 all the flies belonged to the Fanniidae, Muscidae and Anthomyiidae except for some 11 Sphaeroceridae (Lesser Dung Flies) and 1 Piophilidae.

It is a commonplace that most flies, especially in the Calyptrate series, are attracted to light and will avoid dark places. It is the principal upon which most baited fly traps and Malaise traps are based. Females of certain species in the genera *Fannia* and *Hydrotaea,* which lay their eggs in the burrows and runs of small mammals, are exceptions to this rule and will penetrate far into the darkness of the burrows on foot. Species searching for a substrate upon which to oviposit must be guided in the darkness by an acute sense of smell.

In many cave-dwelling Diptera there is a marked trend towards a reduction in the size of the compound eyes. This trend can be clearly seen in the species *Mydaea rufinervis* and *Phaonia tenuiseta* which we have listed as obligate commensals, and is particularly marked in females. In this context, it should be noted that a group of North American species of *Mydaea* together with *M. rufinervis* has in the past been assigned to a separate genus *Xenomydaea* on the basis of enlarged genae and parafacials (i.e. of reduced eyes). Whilst *"Xenomydaea"* is most probably a monophyletic group and includes species with similar biologies, we do not consider that any useful purpose is served by separating it from *Mydaea* which, without *"Xenomydaea"*, is a paraphyletic assemblage. It has also been suggested by GRIFFITHS (1984: 491) that the reduced eye size in North American species belonging to the *Eutrichota spinosissima* superspecies is probably an adaptation to a partly subterranean existence in the underground burrow systems of Pocket Gophers.

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6. References:

GRIFFITHS, G.C.D. (1984): Cyclorrhapha II (Schizophora: Calyptratae). Anthomyiidae [part]. – In: GRIFFITHS, G.C.D. (ed.), Flies of the Nearctic Region **8,** 2(4): 409 - 600. E. Schweizerbart, Stuttgart.

HENNIG, W. (1966-1976): Family Anthomyiidae. – In: E. LINDNER (ed.): Fliegen palaearkt. Reg. **63a:** 974 + lxxviii pp. E. Schweizerbart, Stuttgart.

LINDNER, E. (1973): Alpenfliegen. – Goecke & Evers, Krefeld, 204 pp.

MARIÉ, P. (1926): Recherche des insectes commensaux des Marmottes. – Bull. Soc. ent. Fr. **1926:** 13 - 16.

– (1927a): Recherche des insectes microcavernicoles propres aux terriers de Marmottes. – Bull. Soc. ent. Fr. **1927:** 64 - 73.

– (1927b): Nouvelles captures d'insectes biologiquement adaptés aux terriers de Marmottes. – Bull. Soc. ent. Fr. **1927:** 256 - 260.

– (1929): Recherche des insectes commensaux des Marmottes. – Bull. Soc. ent. Fr. **1929:** 163 - 167.

– (1930): Contribution à l'étude et à la recherche des arthropodes commensaux de la marmotte des Alpes. – Annls Sci. nat. (Zool.) (10), **13:** 185 - 233.

MÜLLER, H. (1881): Alpenblumen, ihre Befruchtung durch Insekten und ihre Anpassungen an dieselben. – iv + 611 pp., Engelmann, Leipzig.

PONT, A.C. (1994): Muscidae (Diptera) as flower-visitors and pollen-feeders. – Dipt. Digest (2) **1:** 58 - 61.

SKIDMORE, P. (1985): The biology of the Muscidae of the World. – Series ent. **29:** xiv + 550 pp.

SYCHEVSKAYA, V.I. (1970): Zonal distribution of coprophilous and necrophilous flies (Diptera) in Middle Asia. [In Russian, with English summary.] – Ent. Obozr. **49:** 819 - 831 [English translation in Ent. Rev. Wash. **49:** 498 - 505.

SYCHEVSKAYA, V.I. & P.P. VTOROV (1969): Synanthropic flies (Diptera) from mountain Kirghizia. – Ent. Obozr. **48:** 816 - 830 [In Russian; English translation in Ent. Rev. Wash. **48:** 518 - 527.]

ZINOVIEV, A.G. (1983): Flies of the genus *Phaonia* R.-D. (Diptera, Muscidae) of the Middle Asia. – Ent. Obozr. **62:** 178 - 192 [In Russian; English translation in Ent. Rev. Wash. **62:** 165 - 181.]

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