

Ichneumonid (Hymenoptera: Ichneumonidae) parasitoids of fungus gnats (Diptera: Mycetophilidae): rearing records from the Czech Republic

[Ichneumoniden (Hymenoptera: Ichneumonidae) als Parasitoide von Pilzmücken (Diptera: Mycetophilidae): Ergebnisse von Schlupfversuchen aus der Tschechischen Republik]

by

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Abstract Twenty-one species of Ichneumonidae from the subfamilies Microleptinae and Orthocentrinae were reared from fungi, together with their potential hosts, fungus gnats (Mycetophilidae). Samples of fungi infested by dipterous larvae were collected in the years 1998–2000 at various localities of the Czech Republic. Of the 177 samples of fungi infested by mycetophilids, 44 (24.9 %) were parasitized by ichneumonids. A list of ichneumonids identified to species is provided, together with data on habitat, host insect and host fungus. Host insect is recorded for the first time for 17 ichneumonid species. Sixteen species and 4 genera of Ichneumonidae are recorded for the first time from the Czech Republic.

Key words Ichneumonidae, Mycetophilidae, host records, host fungi, Czech Republic

Zusammenfassung Insgesamt 21 Arten von Ichneumoniden aus den Unterfamilien der Microleptinae und der Orthocentrinae wurden gemeinsam mit ihren potentiellen Wirten unter den Pilzmücken (Mycetophilidae) aus Pilzfruchtkörpern gezüchtet. Proben von Pilzen, die von Dipterenlarven befallen waren, wurden in den Jahren 1998–2000 an verschiedenen Fundorten in der Tschechischen Republik gesammelt. Von den 177 Proben der von Pilzmücken befallenen Fruchtkörper waren 44 (24.9 %) von Ichneumoniden parasitiert. Es wird eine Liste der bis zum Art-niveau determinierten Schlupfwespen zusammen mit Daten zum Habitat, den Wirtsarten und den Pilzarten gegeben. Die Wirte der Wespen werden für 17 Ichneumoniden-Arten erstmals benannt. Bei 16 Arten von Ichneumoniden aus 4 Gattungen handelt es sich um Erstnachweise für die Fauna Tschechischen Republik gemeldet.

Stichwörter Ichneumonidae, Mycetophilidae, Wirte, Nachweise, Pilze, Tschechische Republik

Introduction

Ichneumonids (Hymenoptera: Ichneumonidae) from the subfamilies Oxytorinae and Orthocentrinae are known as larval parasitoids of fungus gnats (Diptera: Sciaroidea), especially of the family Mycetophilidae. These two subfamilies of Ichneumonidae have been rather neglected up to the present and host records for particular species are very sporadic. KOLAROV & BECHEV (1995) summarized almost all available data about hymenopterous parasitoids of fungus gnats, including also Braconidae and Proctotrupoidea (Hymenoptera). These authors listed 6 genera of Ichneumonidae as parasitoids of fungus gnats: *Aniseres* FÖRSTER, 1871; *Aperileptus* FÖRSTER, 1869; *Entypoma* FÖRSTER, 1868; *Orthocentrus* GRAVENHORST, 1829; *Plectiscidea* VIREECK, 1914 and *Proclitus* HALIDAY, 1838.

The Mycetophilidae is a species-rich family of Diptera with more than 1200 described Palaearctic species. The larvae of most species are more or less associated with fungi. All known larvae of the subfamily Mycetophilinae are considered mycetophagous, feeding usually inside the fruiting bodies of various species of macrofungi. Several genera of fungus

gnats are surface feeders. Both polyphagy and oligophagy have been reported (cf. e.g. CHANDLER 1978, YAKOVLEV 1994). Pupation usually takes place in the ground but some Mycetophilinae pupate in the host fungus. Fungus gnats are most abundant in humid areas, especially moist woodland. During the day adults of many species congregate in moist dark places such as overhanging stream banks and cavities under tree roots (SÖLI et al. 2000).

In this paper, new rearing records from the Czech Republic are presented. For each ichneumonid species listed below, a brief characteristics of the locality and the specific name of both host fungus and the mycetophilid host are provided.

Material and methods

All material for this study has been reared by the second author from fungi. The samples were collected in the years 1998, 1999 and 2000 in various habitats in the Czech Republic, mainly beech forests and pond dams with oak trees. The method of rearing is principally described by LAŠTOVKA (1971) and HACKMAN & MEINANDER (1979). Most of the material examined is preserved in the authors' private collections, its minor part also in the Silesian Museum (Opava, Czech Republic) and the Research Institute of Crop Production (Prague, Czech Republic). The first author of this paper identified the emerged adults of Ichneumonidae and is responsible for the data concerning their distribution and biology. The second author provided all data about the hosts, methods and localities. Grid mapping field codes are given according to PRUNER & MIKA (1997).

Results and discussion

Degree of parasitism

Altogether 177 samples of fungi infested by mycetophilid larvae were collected in the years 1998–2000 and 44 of them (24.9 %) were parasitized by ichneumonids. Species-rich genera *Mycetophila* MEIGEN, 1803 and *Allodia* WINNERTZ, 1863 have been most often attacked.

Suitable quantitative data for comparison of degree of parasitism of ichneumonids in fungus gnats are not available, although many authors studied associations of fungus gnats with fungi. The possible reason is a relatively difficult identification of hymenopterous parasitoids. Also for other parasitic Hymenoptera, such as Braconidae, these quantitative data are very sporadic (cf. YAKOVLEV & TOBIAS 1992).

Host fungi

The ichneumonid species listed below were reared from 20 species in 16 genera and 10 families of fungi (see list at the end of this paragraph). The most frequent genus of fungi in the parasitized samples was *Russula*. All but one species of the host fungi belong to the class Basidiomycetes (both Aphyllophorales and Agaricales represented), one sample to Ascomycetes.

ASCOMYCETES. Pezizaceae: *Peziza* spec. **BASIDIOMYCETES.** **Aphyllorphorales.** Thelephoraceae: *Hydnum repandum* L. Bondarzewiaceae: *Bondarzewia mesenterica* (SCHAEFF.) KREISEL / = *B. montana* (QUEL.) SINGER/. Polyporaceae: *Bjerkandera adusta* (WILLD.) P. KARST.; *Polyporus squamosus* (HUDS.) FR. **AGARICALES.** Tricholomataceae: *Calocybe gambosa* (FR.) SINGER; *Clitocybe odora* (BULL.) P. KUMM.; *Collybia confluens* (PERS.) P. KUMM.; *Mycena galericulata* (SCOP.) GREY.; *Mycena pura* (PERS. ex FR.) KUMM. Tricholomopsis decora (FR.) SINGER. Amanitaceae: *P. cervinus* (SCHAEF.) P. KUMM. / = *Pluteus atricapillus* (BATSCH) FAYOD/. Coprinaceae: *Psathyrella candolleana* (FR.) MAIRE. Cortinariaceae: *Hebeloma crustuliniforme* (BULL. ex ST. AM.) QUEL. Entolomataceae: *Entoloma nidorosum* (FR.) QUEL. Russulaceae: *Lactarius ichoratus* (BATSCH) FR. / = *L. fulvissimus* ROMAGN./; *Russula cyanoxantha* (SCHAEFF.) FR.; *Russula luteotacta* REA; *Russula nigricans* (BULL.) FR.; *Russula paludosa* BRIZ.

Survey of parasitoids reared

Altogether 21 species belonging to 9 genera of Ichneumonidae were reared from mycetophilid larvae and identified to species during this study. Several specimens, however, still remain unidentified, especially those where both males and females have not been obtained.

A particular record is given in the following order: specific name of a parasitoid, sampling locality, grid mapping field code (in parentheses), habitat, collecting date, emerging date, number of males and females examined, specific name of dipterous host and specific (or generic) name of host fungus. The species new for the fauna of the Czech Republic are marked with an asterisk.

MICROLEPTINAE

Hyperacmus crassicornis GRAVENHORST, 1829

Material examined. Moravia & Silesia, Moravskoslezské Beskydy Mts., Bílá, Velká Smradlava valley (6476), spruce forest, 17.9.2000, 7.10.2000, 2♂♂, 5♀♀, ex **Sciophila varia* (WINNERIZ, 1863) in *Hydnum repandum*.

This species has not yet been stated among the parasitoids of fungus gnats.

ORTHOCENTRINAE

**Aniseres pallipes* FÖRSTER, 1871

Material examined. Moravia & Silesia, Polanka nad Odrou (6275), pond dam, 29.10.1999/19.–23.11.1999, 4♂♂, 1♀, ex *Mycetophila fungorum* (DE GLER, 1776) in *Entoloma nidorosum*. - Moravia & Silesia, Vrbno pod Pradidem, Vidly, beech forest (5869), 19.7.2000, 4.–5.8.2000, 2♂♂, 1♀, ex *Mycetophila ruficollis* group in *Lactarius ichoratus*.

According to KOLAROV & BECHEV (1995), this ichneumonid species has already been reared from *Mycetophila fungorum* and *Mycetophila forcipata* LUNDSTRÖM, 1913. *Aniseres* is a new genus for the fauna of the Czech Republic.

Aperileptus albipalpus (GRAVENHORST, 1829)

Material examined. Moravia & Silesia, Krnov-Cvilín, Hájnický potok valley (5972), spruce forest, 25.7.2000, 11.8.2000, 1♀, ex *Mycetophila alea* LAFFOON, 1965 in *Russula nigricans*.

This species was recorded for the first time from the Czech Republic already by LAŠTOVKA (1971), who had reared it from *Mycetophila fungorum*, but this record was overlooked and not included in the checklist by ŠEDIVÝ (1989). *Mycetophila alea* LAFFOON, 1965 (= *M. guttata* DZIEDZICKI, 1884) was stated as the host of *A. albipalpus* already by THOMPSON (1957).

**Aperileptus microspilus* FÖRSTER, 1871

Material examined. Moravia & Silesia, Vítkov-Podhradí (6172), mixed submountain forest, 5.9.1998, 23.–25.9.1998, 1♂, 1♀, ex *Mycetophila alea* in *Russula nigricans*.

The hosts of this species have not yet been reported.

**Aperileptus plagiatus* FÖRSTER, 1871

Material examined. Moravia & Silesia, Studénka (6274), pond dam, 25.8.1999, 8.9.1999, 1♀, ex *Mycetophila evanida* LAŠTOVKA, 1972 in *Russula luteotacta*.

VAN ROSSEM (1985) recorded this species from Germany and the Netherlands, but its hosts have not been known up to the present.

**Aperileptus viduatus* FÖRSTER, 1871

Material examined. Moravia & Silesia, Studénka (6274), pond dam, 9.9.1999, 25.9.1999, 1♀, ex *Exechia bicincta* (STAEGE, 1840) in *Mycena galericulata*.

Only 3 females of this species have been recorded from Germany by VAN ROSSEM (1985), while males have not yet been associated. This is the first record of its host.

**Entypoma robustum* FÖRSTER, 1871

Material examined. Moravia & Silesia, Polanka nad Odrou (6275), Blücherův les, floodplain forest, 7.11.1998, 21.11.1998, 1♂, 1♀, ex *Mycetophila fungorum* in *Pluteus cervinus*.

ROMAN (1923) and VAN ROSSEM (1988) recorded *Dynatosoma fuscicorne* (MEIGEN, 1818) as a host fly of this species. KOLAROV & BECHEV (1995) added as a host also *Mycetophila alea*. *Entypoma* is a new genus for the fauna of the Czech Republic.

****Entypoma suspiciosum* (FÖRSTER, 1871)**

Material examined. Moravia & Silesia, Dolní Lomná (6478), fir-beech forest, 24.9.2000, 1♂, 2♀♀, ex *Mycetophila* spec. (probably *M. cingulum* MEIGEN, 1830, adults have not been reared, only larvae studied) in *Polyporus squamosus*. Moravia & Silesia, Ostrava-Michálkovice (6176), recultivated mine dump, 24.4.1999, 6.–7.5.1999, 2♂♂, 1♀, reared together with *Allodia ornaticollis* (MEIGEN, 1818) and *Exechia spinuligera* LUNDSTRÖM, 1912.

The hosts of this ichneumonid are recorded here for the first time.

****Hemiphanes gravator* FÖRSTER, 1871**

Material examined. Moravia & Silesia, Polanka nad Odrou (6275), Blücherův les, floodplain forest, 26.6.1999, 9.7.1999, 2♂♂, reared together with *Ditomyia fasciata* (MEIGEN, 1818) (Ditomyiidae), *Ula bolitophila* LOEW, 1869 (Pediidae). *Agathomyia antenata* (ZETTERSTILDT, 1819) (Platypozidae) and *Megaselia frameata* SCHMITZ, 1927 (Phoridae) from *Bjerkandera adusta*. The other potential host: *Mycetophila* spec. (possibly *M. trinotata* STÄFFER, 1840, only larvae obtained).

Bjerkandera adusta is one of the most attractive species of fungi for insects (cf. YAKOVLEV 1994, ŠEVČÍK 2001) and this makes problems with the identification of real host of this ichneumonid species. Considering the fact, that the larvae of *Megaselia* and *Agathomyia* are rather small, and, on the other hand, those of *Ula* rather large, the most probable hosts were in this case *Ditomyia fasciata* and *Mycetophila* spec., especially when no adult specimens of *Mycetophila* emerged. *Hemiphanes* is a new genus for the fauna of the Czech Republic. *H. gravator* has hitherto been known from Austria, Germany and Sweden (VAN ROSSEM 1987).

***Orthocentrus asper* (GRAVENHORST, 1829)**

Material examined. Moravia & Silesia, Studénka (6274), pond dam, 1.8.1999/18.8.1999, 1♂, ex *Sciophila lutea* Macquart, 1826 on *Russula luteotacta*.

Three other species of *Orthocentrus* have been recorded in the literature (KOLAROV & BECHEV 1995) as parasitoids of the genus *Sciophila* MEIGEN, 1818. Larvae of *Sciophila* are usually surface feeders on various species of fungi and they spin characteristic webs and cocoons in which pupation takes place.

****Pantisarthrus luridus* FÖRSTER, 1871**

Material examined. Moravia & Silesia, Moravskoslezské Beskydy, Bílá, Velká Smradlava valley (6476), mixed forest (spruce and beech), 9.8.1998, 26.8.1998, 2♂♂, reared together with *Cordyla nitidula* EDWARDS, 1925 and *Cordyla fusca* MEIGEN 1804 from *Russula* spec.

According to VAN ROSSEM (1987), this is a common species. Its biology, however, has not been recorded up to the present. The genus *Pantisarthrus* is new for the fauna of the Czech Republic.

****Plectiscidea agitator* (FÖRSTER, 1871)**

Material examined. Moravia & Silesia, Šilheřovice (6075), beech forest, 27.7.1998, 9.–12.8.1998, 1♂, 2♀♀, ex *Allodia grata* (MEIGEN, 1830) in *Pluteus* spec.

This species was recorded from Germany by VAN ROSSEM (1987). Its hosts have not been reported so far.

***Plectiscidea canaliculata* (FÖRSTER, 1871)**

Material examined. Moravia & Silesia, Ostrava-Třebovice (6175), town park, 22.5.1999, 10.6.1999, 4♂♂, 1♀, ex *Allodia grata* in *Calocybe gambosa*.

This species is known from Austria, the Czech Republic and Germany (VAN ROSSEM 1987). Its hosts have not been recorded.

****Plectiscidea cinctula* (FÖRSTER, 1871)**

Material examined. Moravia & Silesia, Vrbno pod Pradědem env., Jelení bučina Nature Reserve (5869), 900 m, maple-beech forest, 4.9.1999/24.–25.9.1999, 1♀, ex *Allodia foliifera* (STROBL, 1910) in *Peziza* spec.

VAN ROSSEM (1987) recorded this species from Austria, Germany and Sweden. Host insects have not been recorded up to the present.

****Plectiscidea collaris* (GRAVENHORST, 1829)**

Material examined. Moravia & Silesia, Studénka (6274), pond dam, 24.10.1999/14.11.1999, 1♂, 1♀, reared together with *Mycetophila fungorum*, *Exechia fusca* (MEIGEN, 1804) and *Allodia ornaticollis* from *Hebeloma crustuliniforme*. -

Moravia & Silesia, Polanka nad Odrou (6275), pond dam, 29.10.1999/19.-22.11.1999, 8♂♂, 3♀♀, ex *Mycetophila fungorum* in *Entoloma nidorosum*.

This species is reliably known from Germany, Italy and the Netherlands (VAN ROSSEM 1987). Its hosts have not been recorded.

***Plectiscidea deterior (FÖRSTER, 1871)**

Material examined. Moravia & Silesia, Studénka (6274), pond dam with hornbeam trees, 6. 10. 2000/29.10.2000, 1♂, 1♀, ex *Allodiopsis* spec. in *Clitocybe odora*.

This species has so far been recorded from Austria and Germany (VAN ROSSEM 1987). Males and host insects have been unknown up to the present.

***Plectiscidea monticola (FÖRSTER, 1871)**

Material examined. Moravia & Silesia, Vítkov-Podhradí (6172), mixed submountain forest, 6.6.1999/21.6.1999, 1♀, ex *Mycetophila* spec. (*ruficollis* group, only females obtained) in *Collybia confluens*.

Van ROSSEM (1987) recorded this species from Germany, Switzerland and Sweden. The biology of this species has not been recorded so far.

***Plectiscidea vagator (FÖRSTER 1871)**

Material examined. Moravia & Silesia, Úvalno (5972), mixed forest, 27.6.1999/9.7.1999, 1♀, reared together with *Allodia ornaticollis* and *Exechia* spec. from *Mycena pura*.

Male of this species remains unknown. Females are known from Germany, Switzerland and Italy (VAN ROSSEM 1987).

***Proclitus paganus (HALIDAY in CURTIS, 1838)**

Material examined. Moravia & Silesia, Moravia & Silesia, Moravskoslezské Beskydy Mts., Bílá, Velká Smradlava valley (6476), spruce forest, 17.9.2000, 3.10.2000, 2♂♂, reared together with *Allodia zaitzevi* KURINA, 1998 and *Cordyla fusca* MEIGEN, 1804 from *Russula paludosa*.

This species has hitherto been known from Ireland, Germany, Sweden and the Netherlands (VAN ROSSEM 1983). *Bolitophila glabrata* LOEW, 1869 (Diptera: Bolitophilidae) was recorded as host of this ichneumonid species in the literature (cf. KOLAROV & BECHEV 1995).

***Proclitus praetor (HALIDAY in CURTIS, 1839)**

Material examined. Moravia & Silesia, Šilhečovice (6075), beech forest, 3.7.1999, 18.-22.7.1999, 4♂♂, 1♀, ex *Mycetophila fungorum* in *Russula* spec. Moravia & Silesia, Studénka (6274), pond dam, 25.8.1999, 9.9.1999, 1♀, reared together with *Mycetophila fungorum* and *Allodia ornaticollis* from *Psathyrella candolleana*. Moravia & Silesia, Moravskoslezské Beskydy Mts., Bílá, Velká Smradlava valley (6476), spruce forest, 17.9.2000, 8.10.2000, 1♀, ex *Mycetophila finlandica* EDWARDS, 1913 in *Tricholomopsis decora*. Moravia & Silesia, Moravskoslezské Beskydy Mts., Bílá, Velká Smradlava valley (6476), spruce forest, 17.9.2000, 7.-9.10.2000, 4♂♂, 3♀♀, ex *Mycetophila ornata* in *Bondarzewia mesenterica*.

This ichneumonid species is probably rather common and is known from many European countries (VAN ROSSEM 1983). Its hosts, however, are published here for the first time and a preference for larger species of *Mycetophila* is apparent.

***Proclitus subsulcatus FÖRSTER, 1871**

Material examined. Moravia & Silesia, Brumovice-Pocheň (5972), mixed forest, 24.7.1999/10.8.1999, 1♂, reared together with *Mycetophila fungorum*, *Cordyla nitidula* and *Ula sylvatica* (MEIGEN, 1818) from *Russula cyanoxantha*.

Only one male (holotype) from Germany has been known up to the present, without any data concerning its biology. Females have not yet been associated.

Faunistic remarks

In the checklist of Hymenoptera of the former Czechoslovakia (ŠEDIVÝ 1989), 7483 species of Hymenoptera, including 1957 species in 420 genera of Ichneumonidae, were recorded. Many species, however, are only listed from the major parts of the former Czechoslovakia (i.e. Bohemia, Moravia & Silesia and Slovakia) without precise locality and the other relevant data. Moreover, only about two thirds of the real number of species occurring in this country were published in this checklist and many species thus remain unrecorded.

That is why almost all species of Ichneumonidae recorded within this study are new for the Czech Republic. Four of the 9 genera recorded above (*Aniseres*, *Entypoma*, *Hemiphanes* and *Pantisarthus*) are for the first time recorded from this country.

On the other hand, the faunistic research of the order Diptera in the Czech Republic is relatively more advanced. Only one species of Mycetophilidae stated as host of ichneumonids in this study (*Sciophila varia*) has not yet been reported from the Czech Republic.

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