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Das Titelbild zeigt die Frontalsicht eines Männchens von *Campsicnemus magius* (LOEW). Diese halophile Langbeinfliege (Dolichopodidae) kommt in den Binnensalzstellen um Halle (Saale) vor. Sie wurde von LOEW nach Tieren aus Sizilien (Syrakus) im Jahre 1845 in der Stettiner entomologischen Zeitung **6**: 392-394 als *Medeterus magius* beschrieben. Hinsichtlich der Farbgebung und der Gestaltung der Beine weisen die Männchen dieser Spezies die prächtigste und komplizierteste Abwandlung im Vergleich aller einheimischen *Campsicnemus*-Arten auf. Sie versinnbildlicht also in besonderer Weise die Schönheit der Zweiflügler und ist deshalb von uns als Signet der Zeitschrift **Studia dipterologica** ausgewählt worden.

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Dr. A. Stark, Seebener Str. 190, D-06114 Halle (Saale) (Tel/Fax 0345-5226726)

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F. Menzel, DEI, PF 100238, D-16202 Eberswalde (Tel. 03334-22936, Fax 03334-212379)

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Hibernation of fungus gnats (Diptera, Mycetophilidae) in Estonian caves

[Zur Überwinterung von Pilzmücken in Estländischen Höhlen (Diptera, Mycetophilidae)]

by
Olavi KURINA

Tartu (Estonia)

Abstract The hibernation of Mycetophilids in eight Estonian caves and in one vault has been studied. A total of 28 species belonging to 6 genera have been recorded. The most abundant of them, considering both species and specimens, was the genus *Exechiopsis* TUOMIKOSKI. The second record for *Pseudexechia hamulata* (LACKSCHEWITZ, 1937) and the third record for *Exechiopsis* (*Exechiopsis*) *januarii* (LUNDSTRÖM, 1913) are presented. Eighteen of the determined species of Mycetophilids are new to Estonia.

Key words Diptera, Mycetophilidae, Hibernation, Caves, Estonia.

Zusammenfassung Die Überwinterung von Mycetophiliden in acht Estnischen Höhlen und einem Kellergewölbe wurde untersucht. Insgesamt konnten 28 Arten aus 6 Genera festgestellt werden. Die Gattung *Exechiopsis* TUOMIKOSKI steuerte die meisten Individuen und Arten bei. Bemerkenswert erscheint der erst zweite Nachweis von *Pseudoexechia hamulata* (LACKSCHEWITZ, 1937) sowie der nunmehr dritte Fund von *Exechiopsis* (*Exechiopsis*) *januarii* (LUNDSTRÖM, 1913). Achtzehn Pilzmückenarten konnten erstmals für die Fauna Estlands nachgewiesen werden.

Stichwörter Diptera, Mycetophilidae, Überwinterung, Höhlen, Estland

Introduction

According to ØKLAND (1995), hibernation as imago seems to be the most common strategy of the Mycetophilids. There are data on hibernation in umbelliferous stems (VÄISÄNEN 1981) as well as under bark of trees (OSTROVERHOVA & ISOTOV 1986, YAKOVLEV 1988). PLASSMANN (1989) has published data on the winter activity of Mycetophilids. The fungus gnats fauna of caves has been widely studied (e. g. MOHRIG et al. 1968, BURGHELE-BLACESCO 1972, STROUHAL & VORNATSCHER 1975, ØSTBYE et al. 1987, PLASSMANN & WEBER 1988), but without special accent on overwintering of these Diptera in caves. According to GORODKOV (1962), in some caves of the Leningrad District Mycetophilids form the majority of hibernating Diptera. The caves in Estonia are mainly artificial, thus the typical cave species (troglophiles) are absent. The temperature in inner parts of the caves is 5 - 6 °C and relative humidity is 80 - 100 %, all year round (MASING 1990). These stable conditions favour overwintering of Mycetophilids in these caves.

Material and methods

Study sites

The records of Mycetophilids are based on investigations in 8 different caves or cave systems and in one old castle vault in Estonia (Fig. 1.). The data on caves have been given by HEINSALU (1987) and by MASING (1990). Geographic coordinates of caves on the ellipsoid (WGS84) are given.

1: Maasi Castle Vault (58°34'N, 23°02'E) from 14th century is situated on the east coast of Saaremaa Island (Ösel). The vault is built from limestone and is mostly falling in. The vault was visited on the 25th of February and 25th of December 1995.

2: Allikukivi Cave (58°09'N, 25°00'E) lies 3 km East of the Kilingi-Nômme. A natural cave in sandstone with many splits, about 33 m long. The cave was visited on the 19th of January and 3rd of March 1996.

3: Vana - Kariste Cave (58°08'N, 25°21'E) is situated 5 km Southwest of Abja-Paluoja. It is an artificial cave in sandstone, about 106 m long. The cave was used as a manor beer cellar in the 19th century. The cave was visited on the 3rd of March 1996.

4: Helme Cave (58°01'N, 25°53'E) is situated 2 km Northwest of Tôrva. It is an old refuge cave, with most tunnels falling in. At present the cave is about 50 m long. The cave was visited on the 19th of January and 3rd of March 1996.

5: Koorküla Cave (57°56'N, 25°52'E) is a small old refuge cave, about 15 m long and lies 9 km Southwest of Tôrva. The cave was visited on the 3rd of March 1996.

6: Piusa Caves (57°51'N, 27°25'E) are situated in Southeast Estonia near the Vôru-Petseri railway. The caves consist of eight separated systems of tunnels, altogether about 20 km long. They are old sand mines used for the glass industry. The caves were visited on the 11th of February 1995 and on the 1st of February 1996.

7: Kalmistu Cave (58°24'N, 26°42'E) is a small cave in the Northwest part of Tartu. It is an artificial narrow tunnel in sandstone, about 15 m long. The cave was visited on the 18th of February 1995, on the 7th of January and the 2nd of March 1996.

8: Aruküla Cave (58°24'N, 26°42'E) is situated at the Northwest boundary of Tartu. It is an artificial labyrinth in sandstone with a total area of about 300 m^2. The cave was visited on the 18th of February 1995 and on the 7th of January 1996.

9: Ülgase Cave (59°29'N, 25°06'E) lies on the North coast of Estonia, 7 km Northeast of Maardu. It is an old phosphorite mine in limestone, about 4 km long. The cave was visited on the 31st of January 1996.

Collecting methods and material preservation

The main collecting methods were hand-picking, with use of an exhauster, from walls and splits of the caves. The material was either pinned or preserved in 70 % ethanol. The material has been deposited at the Institute of Zoology and Botany, Tartu, Estonia [IZBE].

Results

Altogether 2671 male and 2673 female specimens of fungus gnats were studied. The female material are identified to genus level (Table). Data about male Mycetophilids from caves are given in figure 2. The material of male Mycetophilids contains 28 species, 18 of them are new to Estonia (marked with a point ●). The most abundant genus, considering both species and specimens, was *Exechiopsis* TUOMIKOSKI, 1966. Most species found are widely distributed in Europe (CASPERS 1984, KRIVOSHEINA et al. 1986, PLASSMANN & PLACHTER 1986, HACKMAN 1988, SØLI 1994), if not shown otherwise in the list of species. Asterisks before Mycetophilid names in the species list indicate new species to Estonia; for the other species the literature data from Estonia are given.

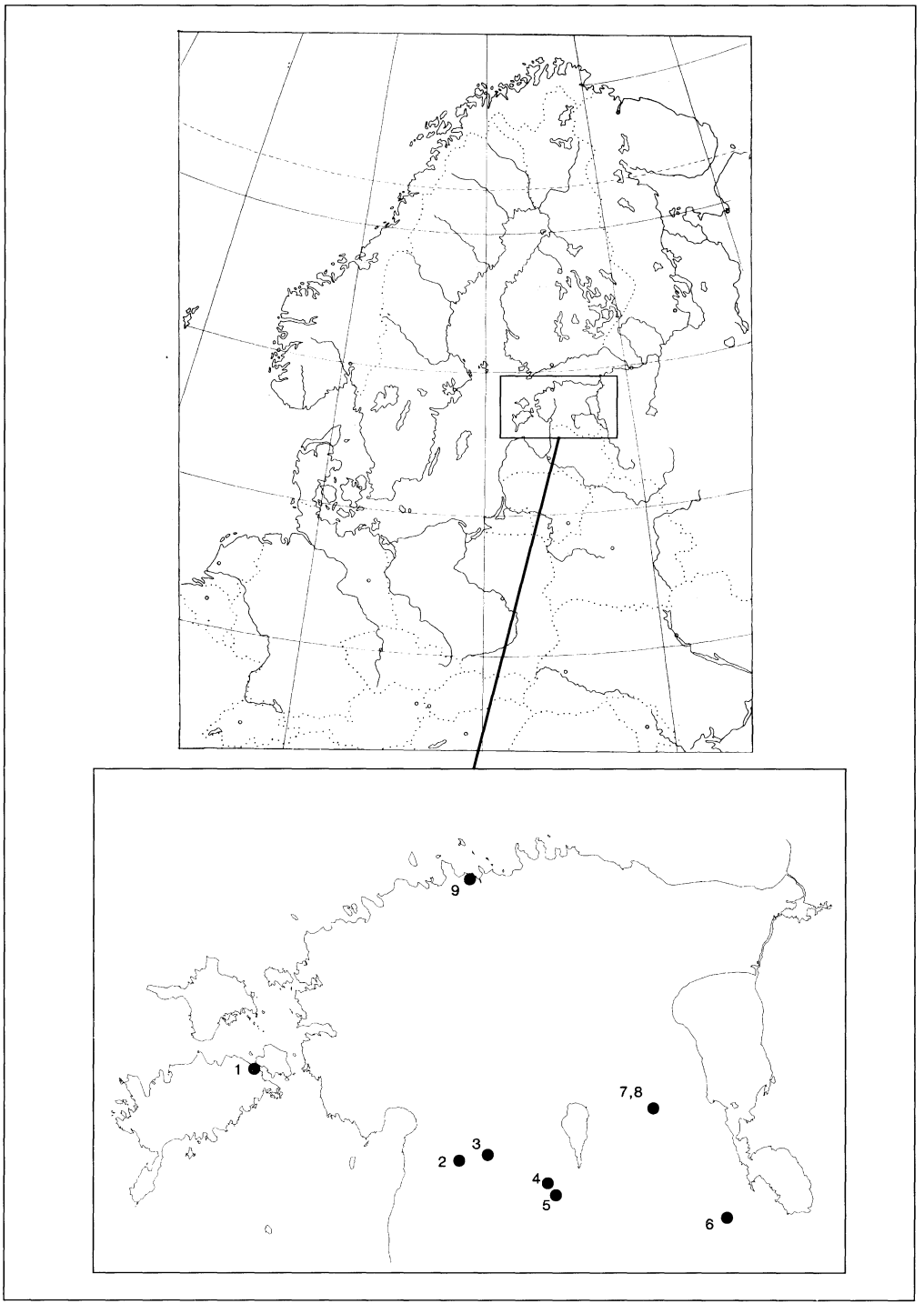

Fig. 1: The caves studied in Estonia: - **1**: Maasi; - **2**: Allikukivi; - **3**: Vana-Kariste; - **4**: Helme; - **5**: Koorküla; - **6**: Piusa; - **7**: Kalmistu; - **8**: Aruküla; - **9**: Ülgase. Scale of upper map 1 : 12,000,000.

Table: Number of female specimens of Mycetophilids from Estonian caves. 1. - Maasi, 2. - Allikukivi, 3. - Vana-Kariste, 4. - Helme, 5. - Koorküla, 6. - Piusa, 7. - Kalmistu, 8. - Aruküla, 9. - Ülgase.

Genus/Cave No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
Anatella spp.	-	-	-	-	-	-	-	-	1	**1**
Exechia spp.	9	-	-	11	-	-	40	-	-	**60**
Exechiopsis spp.	11	95	86	1005	312	607	60	28	310	**2524**
Pseudexechia spp.	-	-	-	-	-	-	20	-	-	**20**
Rymosia spp.	27	-	-	3	4	4	1	-	1	**40**
Tarnania spp.	-	-	-	1	-	-	-	-	-	**1**
Mycetophila spp. (*ruficollis* group)	-	-	-	2	-	2	-	-	3	**7**
Total	**47**	**95**	**86**	**1022**	**316**	**613**	**121**	**28**	**315**	**2673**

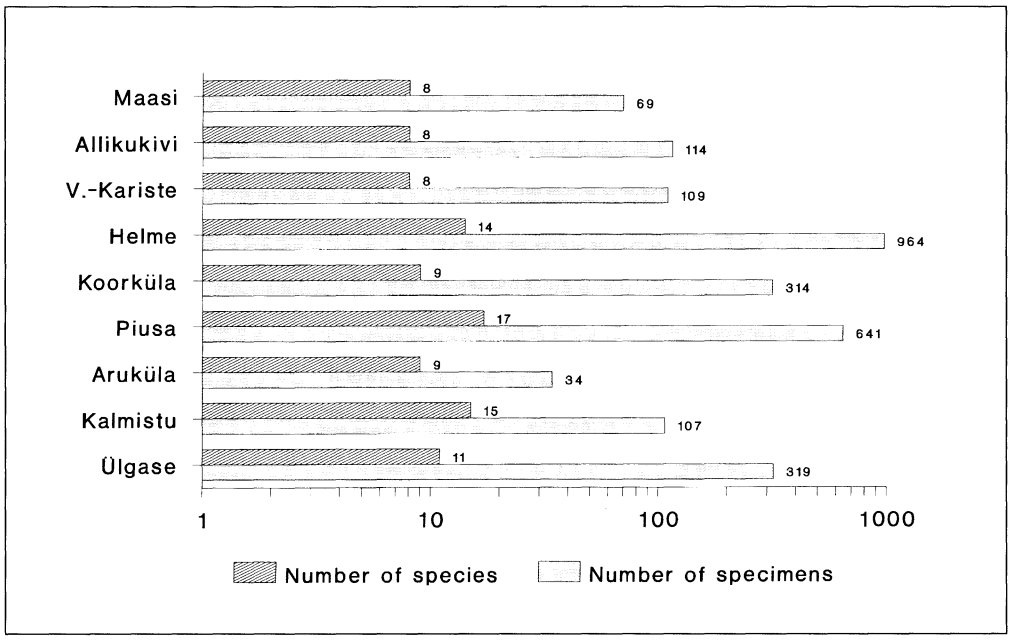

Fig. 2: Abundance of Mycetophilid species and male specimens in the caves of Estonia.

List of species

• 1. *Anatella ankeli* PLASSMANN, 1977

Earlier known from Germany (PLASSMANN 1977, PLASSMANN & PLACHTER 1986), France (MATILE 1980) and Austria (CASPERS 1984). According to ZAITZEV (1989) also from the Leningrad District. The figure of male genitalia by PLASSMANN (1977) and CASPERS (1984) are identical, but different from the figure of ZAITZEV (1989), which may be a result of misidentification.

Material: Ülgase, 31 January 1996, 1♂.

● **2. *Anatela pseudogibba* PLASSMANN, 1977**

The species has been previously recorded from Germany (PLASSMANN 1977, PLASSMANN & PLACHTER 1986), France (MATILE 1980), Great Britain (CHANDLER 1977, ZAITZEV 1989) and Sweden (PLASSMANN 1980).

Material: Aruküla, 18 February 1995: 1♂.

3. *Exechia confinis* WINNERTZ, 1863

DAMPF 1924: 43; LACKSCHEWITZ 1937: 22; KURINA 1994: 219.

Material: Maasi, 25 February 1995: 3♂♂; Kalmistu, 18 February 1995: 19♂♂; 7 January 1996: 1 ♂. Total 23♂♂.

4. *Exechia dizona* EDWARDS, 1924

Lackschewitz 1937: 22.

Material: Helme, 19 January 1996: 3♂♂, 3 March 1996: 1 ♂; Kalmistu, 18 February 1995: 1♂. Total 5♂♂.

● **5. *Exechia exigua* LUNDSTRÖM, 1909**

Material: Maasi, 25 February 1995: 1♂.

6. *Exechia fusca* (MEIGEN, 1804)

DAMPF 1924: 43 (*Exechia fungorum* DEG.); LACKSCHEWITZ 1937: 21; KURINA 1991: 88.

Material: Kalmistu, 18 February 1995: 1♂, 7 January 1996: 1♂. Total 2♂♂.

7. *Exechia spinuligera* LUNDSTRÖM, 1912

DAMPF 1924: 43, KURINA 1991: 89. LACKSCHEWITZ (1937) has cited material, earlier presented by DAMPF (1924), as *Exechia spinigera* WINNERTZ, 1863. By HACKMAN (1988) the both species are valid but the material is not preserved and there is no solution to this contradiction.

Material: Kalmistu, 18 February 1995: 1♂.

8. *Exechiopsis (Exechiopsis) clypeata* (LUNDSTRÖM, 1911)

KURINA 1991: 89.

Material: Helme, 19 January 1996: 2 ♂♂; Koorküla, 3 March 1996: 1 ♂; Piusa, 11 February 1995: 5 ♂♂, 1 February 1996: 6 ♂♂; Kalmistu, 18 February 1995: 2 ♂♂. Total 16 ♂♂.

● **9. *Exechiopsis* (*Exechiopsis*) *distendens* (LACKSCHEWITZ, 1937)**

Material: Maasi, 25 December 1995: 1♂; Allikukivi, 19 January 1996: 25♂♂, 3 March 1996: 12♂♂; Vana-Kariste, 3 March 1996: 10♂♂; Helme, 19 January 1996: 25♂♂, 3 March 1996: 12♂♂; Koorküla, 3 March 1996: 100♂♂; Piusa, 11 February 1995: 42♂♂, 1 February 1996: 54♂♂; Kalmistu, 18 February 1995: 3♂♂; Aruküla, 18 February 1995: 1♂; Ülgase, 31 January 1996: 168♂♂. Total 453♂♂.

● **10. *Exechiopsis* (*Exechiopsis*) *dumitrescui* (BURGHELE-BALACESCU, 1972)**

Material: Vana-Kariste, 3 March 1996: 4♂♂; Piusa, 11 February 1995: 24♂♂, 1 February 1996: 5♂♂; Aruküla, 18 February 1995: 2♂♂. Total 35♂♂.

11. *Exechiopsis* (*Exechiopsis*) *fimbriata* (LUNDSTRÖM, 1909)

KURINA 1991: 89.

Material: Allikukivi, 19 January 1996: 3♂♂, 3 March 1996: 5♂♂; Vana-Kariste, 3 March 1996: 10♂♂; Helme, 19 January 1996: 24♂♂, 3 March 1996: 482♂♂; Koorküla, 3 March 1996: 35♂♂; Piusa, 11 February 1995: 96♂♂, 1 February 1996: 70♂♂; Kalmistu, 18 February 1995: 1♂; Aruküla, 18 February 1995: 1♂; Ülgase, 31 January 1996: 77♂♂. Total 804♂♂.

12. *Exechiopsis* (*Exechiopsis*) *hammi* (EDWARDS, 1925)

LACKSCHEWITZ 1937: 27.

Material: Vana-Kariste, 3 March 1996: 2♂♂; Helme, 19 January 1996: 3♂♂, 3 March 1996: 7♂♂; Piusa, 11 February 1995: 4♂♂, 1 February 1996: 3♂♂; Kalmistu, 18 February 1995: 1♂, 7 January 1996, 1♂; Aruküla, 18 February 1995: 3♂♂. Total 24♂♂.

13. *Exechiopsis* (*Exechiopsis*) *indecisa* (WALKER, 1856)

LACKSCHEWITZ 1937: 27, KURINA 1991: 89.

Material: Maasi, 25 February 1995: 1♂♂; Piusa, 11 February 1995: 37♂♂, 1 February 1996: 1♂; Kalmistu, 18 February 1995: 1♂; Ülgase, 31 January 1996: 2♂♂. Total 42♂♂.

• 14. *Exechiopsis* (*Exechiopsis*) *intersecta* (MEIGEN, 1818)

Material: Maasi, 25 December 1995: 16♂♂; Allikukivi, 19 January 1996: 2♂♂; Helme, 19 January 1996: 13♂♂, 3 March 1996: 1♂; Koorküla, 3 March 1996: 4♂♂; Piusa, 1 February 1996: 2♂♂; Kalmistu, 18 February 1995: 1♂, 7 January 1996: 1♂; Ülgase, 31 January 1996: 14♂♂. Total 54♂♂.

Additional material studied: Finland, Kuustö: 1♂, LUNDSTRÖM leg., det. [*Exechia gracilicornis* (LANDROCK, 1912)]. Material deposited at Zoological Museum, Helsinki, Finland [MZHF].

• 15. *Exechiopsis* (*Exechiopsis*) *januarii* (LUNDSTRÖM, 1913)

After first record the species has been registered only in Latvia (LACKSCHEWITZ 1937).

Material: Helme, 19 January 1996: 5♂♂, 3 March 1996: 2♂♂; Piusa, 1 February 1996: 1♂. Total 8♂♂.

Additional material studied: Finland, Kuopio, 2 January 1913: 1 ♂, ENVALD leg., LUNDSTRÖM det., Spec. typ No. 4330 at Zoological Museum, Helsinki, Finland [MZHF].

• 16. *Exechiopsis* (*Exechiopsis*) *lackschewitziana* (STACKELBERG, 1948)

Material: Allikukivi, 19 January 1996: 1♂; Helme, 19 January 1996: 4♂♂; Piusa, 11 February 1995: 2♂♂; Kalmistu, 18 February 1995: 6♂♂. Total 13♂♂.

Additional material studied: Russia, Leningrad District, Sablino, 2 February 1925: 1♂ (typus), STACKELBERG leg. et det. Material deposited at the Zoological Institute of Academy of Sciences, St. Petersburg, Russia [ZMAS].

• 17. *Exechiopsis* (*Exechiopsis*) *landrocki* (LUNDSTRÖM, 1912)

Material: Allikukivi, 19 January 1996: 1♂; Vana-Kariste, 3 March 1996: 6♂♂; Helme, 19 January 1996: 1♂, 3 March 1996: 64♂♂; Koorküla, 3 March 1996: 4♂♂; Piusa, 11 February 1995: 6♂♂, 1 February 1996: 10♂♂. Total 92♂♂.

• 18. *Exechiopsis* (*Exechiopsis*) *ligulata* (LUNDSTRÖM, 1913)

Material: Allikukivi, 19 January 1996: 4♂♂, 3 March 1996: 1♂; Vana-Kariste, 3 March 1996: 1♂; Helme, 19 January 1996: 1♂, 3 March 1996: 1♂; Koorküla, 3 March 1996: 4♂♂; Piusa, 11. February 1995: 37♂♂, 1 February 1996: 57♂♂; Ülgase, 31 January 1996: 5♂♂. Total 111♂♂.

• 19. *Exechiopsis* (*Exechiopsis*) *pseudindecisa* LAŠTOVKA & MATILE, 1974

Material: Piusa, 11 February 1995: 1♂, 1 February 1996: 3♂♂; Ülgase, 31 January 1996: 1♂. Total 5♂♂.

- **20. *Exechiopsis (Exechiopsis) pseudopulchella* (LUNDSTRÖM, 1912)**

The species has been previously recorded from Finland (HACKMAN 1980), Germany (PLASSMANN & PLACHTER 1986) and Norway (SØLI 1994).

Material: Helme, 19 January 1996: 1♂, 3 March 1996: 1♂; Piusa, 11 February 1995: 2♂♂, 1 February 1996: 5♂♂; Aruküla, 18 February 1995: 1♂; Ülgase, 31 January 1996: 16♂♂. Total 26♂♂.

Additional material studied: Finland, Westend, Esbo, 5 September 1957: 1♂, HACKMAN leg., TUOMIKOSKI det. Material deposited at Zoological Museum, Helsinki, Finland [MZHF].

21. *Exechiopsis (Exechiopsis) subulata* (WINNERTZ, 1863)

LACKSCHEWITZ 1937: 27.

Material: Allikukivi, 19 January 1996: 35♂♂, 3 March 1996: 24♂♂; Vana-Kariste, 3 March 1996: 71♂♂; Helme, 19 January 1996: 29♂♂, 3 March 1996: 100♂♂; Koorküla, 3 March 1996: 112♂♂; Piusa, 11 February 1995: 80♂♂, 1 February 1996: 75♂♂; Kalmistu, 18 February 1995: 1♂; Aruküla, 18 February 1995: 13♂♂, 7 January 1996: 1 ♂; Ülgase, 31 January 1996: 18♂♂. Total 559♂♂.

- **22. *Exechiopsis (Xenexechia) pollicata* (EDWARDS, 1925)**

Material: Maasi, 25 February 1995: 1♂; Allikukivi, 19 January 1996: 1♂; Vana-Kariste, 3 March 1996: 5♂♂; Helme, 19 January 1996: 160♂♂, 3 March 1996: 19♂♂; Koorküla, 3 March 1996: 46♂♂; Piusa, 11 February 1995: 1♂, 1 February 1996: 3♂♂; Kalmistu, 18 February 1995: 39♂♂, 7 January 1996: 6♂♂, 2 March 1996: 1♂; Aruküla, 18 February 1995: 8♂♂; Ülgase, 31 January 1996: 16♂♂. Total 306♂♂.

- **23. *Pseudexechia hamulata* (LACKSCHEWITZ, 1937)**

The species is very similar to *P. parallela* (EDWARDS, 1925) registered from Great Britain (EDWARDS 1925), Germany (PLASSMANN & PLACHTER 1986, PLASSMANN & JOOST 1986), Roumania (BURGHELE-BALACESCO 1972), Leningrad and Moscow district (STACKELBERG 1948, KRIVOSHEINA et al. 1986). Only STACKELBERG (1948) and KRIVOSHEINA et al. (1986) figured the male genitalia. *P. hamulata* is known only from Latvia (LACKSCHEWITZ 1937). According to the male genitalia (especially by ventral part of gonostylus) my material belongs to the species *P. hamulata*.

Material: Kalmistu, 18 February 1995: 18♂♂.

- **24. *Pseudexexhia trisignata* (EDWARDS, 1913)**

Material: Kalmistu, 18 February 1995: 1♂.

25. *Rymosia affinis* WINNERTZ, 1863

DAMPF 1924: 43, LACKSCHEWITZ 1937: 32, KURINA 1994: 219.

Material: Maasi, 25 December 1995: 21♂♂.

- **26. *Rymosia fasciata* (MEIGEN, 1804)**

Material: Maasi, 25 Decenber 1995: 25♂♂; Helme, 19 January 1996: 2♂♂, 3 March 1996: 1♂; Koorküla, 3 March 1996: 8♂♂; Piusa, 11 February 1995: 4♂♂, 1 February 1996: 4♂♂; Aruküla, 18 February 1995: 2♂♂. Total 46♂♂.

- **27. *Rymosia placiada* WINNERTZ, 1863**

Material: Ülgase, 31 January 1996: 1♂.

- **28. *Mycetophila idonea* LAŠTOVKA, 1974**

Known from central Europe and also from Iran, Japan, China (LAŠTOVKA 1988).

Material: Piusa, 1 February 1996: 1♂.

Discussion

The prevalence of *Exechiopsis* in caves is probably caused by the peculiarities of their biology, in particular due to their strategy of hibernation. Most possibly they hibernate also in other bigger cavities with stable climatical conditions, like hollow trees. Among the individuals caught in forests during the spring and autumn in Estonia, *Exechiopsis* share with only 3% a minor part of the whole amount of Mycetophilids.

Species richness of fungus gnats hibernating in Arküla and Kalmistu caves is most interesting in regard to the low number of specimens. This contradiction may be explained by the diversity of habitats next to entrances of these caves, including dendrologically interesting cemetery and river valley with marshes. The other sites studied are surrounded by rather monotonous habitats: costal pine forest with junipers in Maasi; wet peatland forest in Allikukivi, Vana-Kariste and Koorküla; sruce-pine forest in Helme; pine forest in Piusa and humid coastal forest in Ülgase. Low number of Mycetophilids in Arküla and Kalmistu caves can be caused possibly by location of the entrance of the caves in the open landscape, thus limiting access of gnats to the caves; anthropogenic factor should also be taken in consideration. The rest of the caves are located in forested areas.

The sex ratio of Mycetophilids caught in the caves was roughly equal. A similar result has been achieved by sweeping in forests and breeding from macrofungi.

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Author's address

Olavi KURINA
Institute of Zoology and Botany
Riia str. 181
Tartu EE2400
Estonia - Estland

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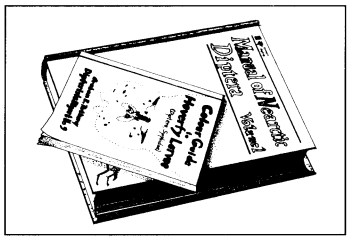

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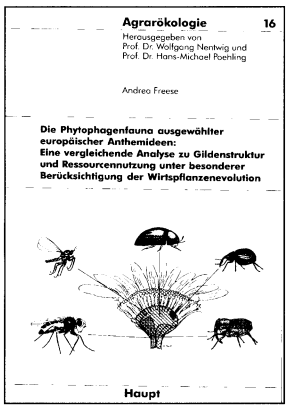

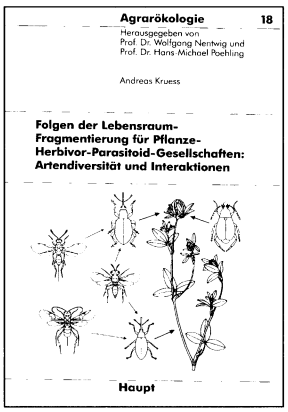

Wie bereits in einer früheren Ausgabe unserer Zeitschrift Studia dipterologica (Heft 2/1995, S.184) möchten wir auf Neuerscheinungen in der von Prof. Dr. W. NENTWIG und Prof. Dr. H.-M. POEHLING herausgegebenen und im **Verlag Paul HAUPT Bern/Stuttgart/Wien** erscheinenden Reihe **Agrarökologie** hinweisen. Die nachfolgenden kurzen Darstellungen beziehen sich auf dipterologischen Aspekte der Publikationen und sind als Inhaltsangaben in dieser Sache aufzufassen, wobei eine Wertung der Ergebnisse durch den Referenten unterbleibt.

Andrea **Freese** (1995): **Die Phytophagenfauna ausgewählter europäischer Anthemideen: Eine vergleichende Analyse zu Gildenstruktur und Ressourcennutzung unter besonderer Berücksichtigung der Wirtspflanzenevolution.** - Agrarökologie Bd. 16: 153 S., Preis 35,00 DM.

Insgesamt 9 Kamille-Arten aus den Gattungen *Matricaria*, *Chamomilla*, *Anthemis*, *Anacyclus* und *Chamaemelum* wurden hinsichtlich ihrer Phytophagenfauna untersucht. Die Herkünfte der Proben verteilte sich über ausgewählte Lokalitäten in Nord-, Mittel- und Südeuropa. Blütenköpfe, z.T. aber auch die Hauptstengel, gingen in die Bearbeitung ein. Die Dipteren waren durch (mindestens) drei Cecidomyiiden-, eine Agromyziden- (*Napomyza lateralis* FALLÉN) und zwei Tephritidenarten (*Trupanea stellata* FÜSSLY; *Tephritis nigricauda* LOEW) vertreten. Es finden sich Aussagen zur Verteilung der Dipteren auf die Kamille-Arten, ihre Parasitenkomplexe und die Phänologie.

Igor **KRAMER** (1996): **Biodiversität von Arthropoden in Wanderbrachen und ihre Bewertung durch Laufkäfer, Schwebfliegen und Stechimmen.** - Agrarökologie Bd. 17: 149 S., Preis 35,00 DM.

In einem, durch die Städte Zürich, Brugg und Bülach grob zu umreißenden Teil der Schweiz wurden die Untesuchungen in den Jahren 1989-1991 auf sogenannten Wanderbrachen in einer vornehmlich agrarisch genutzten Landschaft durchgeführt. Vier Methoden (Gelbschalen, Fenster-, Zelt- u. Bodenfallen) dienten der Erfassung der Zielorganismen. Insgesamt wurden 5485 Schwebfliegen in 87 Arten (Liste) nachgewiesen, deren Auftreten der Verfasser hinsichtlich der Parameter Jahr, "Habitat", Sammelmethode und Standort analysierte.

Andreas **KRUESS** (1996): **Folgen der Lebensraum-Fragmentierung für Pflanze-Herbivor-Parasitoid-Gesellschaften: Artendiversität und Interaktionen.** - Agrarökologie Bd. 18: 134 S., Preis 35,00 DM.

Gegenstand der Untersuchungen bildeten Insektenlebensgemeinschaften an Rotklee und Zaunwicke in Streuobstwiesen im Kraichgau (Baden-Württemberg), die anhand von Schlupfversuchen und der Sektion von Blütenköpfen und Hülsen ermittelt wurden. Isolationsgrad und Flächenausdehnung der Biotope schienen geeignet, aussagefähige Korrelationen mit der Diversität, der Abundanz, dem Parasitierungsgrad und weiterer Parameter abzubilden. Nur am Rotklee waren Dipteren, nämlich Gallmücken (Cecidomyiidae) aus den Gattungen *Lasioptera* (phytophag) und *Lestodiplosis* (zoophag) in die Insektenlebensgemeinschaft involviert. Die Mücken schlüpften aus Blütenköpfen und Stengeln, bzw. wurden als Larven in Proben erfasst die zwischen dem 4.-6. Juli 1994 eingetragen wurden.

Andreas STARK