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Records of winter-active insects (Coleoptera, Diptera, Mecoptera) on snow in westernmost Bohemia (Czech Republic)

Nálezy hmyzu se zimní aktivitou (Coleoptera, Diptera, Mecoptera) na sněhu v nejzápadnějších Čechách (Česká republika)

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Coleoptera, Diptera, Mecoptera, occurrence on snow, new records, Czech Republic

Abstract. Among the huge variety of insects, only a small number of species are capable of active lifestyles during the winter period. This paper give results of a detailed survey of the winter insect fauna collected by hand on snow in January and February 2021 in the westernmost Czech Republic. A total of 31 insect species (Coleoptera 3 spp., Diptera 27 spp. and Mecoptera 1 taxon) are recorded. In addition to taxa already known to occur on snow, at least 10 other species with the same behaviour are reported. *Chionea botosaneanui* (Burghele-Bălăcesco, 1969) (Diptera: Limoniidae) is recorded from Bohemia for the first time; two other species, *Copromyza neglecta* (Malloch, 1913) and *Ischiolepta denticulata* (Meigen, 1830) (both Diptera: Sphaeroceridae), are known from a few records in the Czech Republic and classified as vulnerable (VU) species in the country. In Coleoptera, *Rabocerus gabrieli* (Gerhardt, 1901) (Salpingidae) is a rare and endangered (EN) species in the Czech Republic.

INTRODUCTION

Occurrence of insects on snow during winter has been recorded from several European countries. There have been studies on snow-active insects in Norway (Hågvar & Greve 2003, Hågvar 2010), Poland (Soszyńska 2004, Soszyńska-Maj & Klasa 2009, Soszyńska-Maj 2010, Soszyńska-Maj et al. 2015, Soszyńska-Maj & Woźnica 2016) and Russia (Pavlov 2006). In the Czech Republic, this phenomenon remains poorly known. Apart from old reports by Obenberger (1923, 1952) from the Krkonoše Mts (Giant Mts) in northern Bohemia and by Perutík (1956) from Kotouč Mt. near Štramberk in northern Moravia no other treatment on snow occurring insects is known from this country. However, records of insects from snow in the winter period are also scattered in numerous papers aimed at particular groups, typically in studies on winter-active groups such as *Chionea* Dalman, 1816 (Diptera: Limoniidae) (Burghele-Bălăcesco 1969, Oosterbroek & Reusch 2008) or *Boreus* Latreille, 1816 (Mecoptera: Boreidae) (Ševčík 2010, Kaspřák 2012). This is also true for the Czech Republic. For example,

various species of flies were reported on snow in papers by Kratochvíl (1936), Martinek (1987), Martinek & Mocek (1995), Roháček (1989, 1991), Šámal (1925), Ševčík (2010) and Šlais (1946). Ševčík (2010) and Kaspřák (2012) reported Mecoptera (*Boreus* sp.) on snow.

The present contribution is based on material collected on snow in the region of Karlovy Vary (westernmost part of Bohemia, Czech Republic) during January and February 2021. All recorded species are treated below with notes on their distribution and discussion of their affinity to snow.

MATERIAL AND METHODS

Collecting was made incidentally while walking on the snow, only few localities were visited repeatedly. The insects were collected visually from the snow, put into tubes with 70% ethanol and, subsequently, sorted under microscope for identification by specialists. Identifications were made by the specialists as follows: Diptera: Heleomyzidae (except for *Oldenbergiella* Czerny, 1924), Lauxaniidae and Sciomyzidae by K. Dvořáková; Diptera: Sphaeroceridae and *Oldenbergiella* by J. Roháček; Diptera: Lonchopteridae by J. Oboňa; Diptera: Limoniidae and Trichoceridae by J. Starý; Mecoptera, Coleoptera: Carabidae and Diptera: Anisopodidae, Opomyzidae and Tephritidae by L. Dvořák and Coleoptera: Salpingidae and Staphylinidae by S. Benedikt.

The voucher specimens identified by L. Dvořák, K. Dvořáková and J. Starý are deposited in their personal collections, by J. Oboňa in the laboratory the University of Prešov, by J. Roháček in the collection of SMOC – Silesian Museum in Opava. The nomenclature follows Jedlička et al. (2009) for Diptera and Löbl & Smetana (2008) and Löbl & Löbl (2015, 2017) for Coleoptera.

Abbreviations: LD – Libor Dvořák, KD – Kateřina Dvořáková, leg. – legit.

List of localities

(1) **Bečov nad Teplou** (5942), forest margin south of the town, 50°04′2.6″N, 12°49′34.9″E, 19.i.2021, LD leg.
(2) **Horní Slavkov** (5842), forest margin on south periphery of the town, 50°08′17.7″N, 12°48′27.9″E, 19.i.2021, LD leg.
(3) **Hrušková** (5842), forest path north-north-west of the town, 50°09′51.8″N, 12°42′14.1″E, 20.i.2021, LD leg.
(4) **Hřebeny** (5741), spruce forest south of the village, 50°13′38.0″N, 12°34′21.4″E, 27.i.2021, LD leg.
(5) **Kamenec** (6041), spruce forest south of the village, 49°57′6.1″N, 12°35′11.3″E, 7.i.2021, LD & KD leg.
(6) **Krásné** (6041), forest path west of the village, 49°57′27.7″N, 12°36′13.1″E, 26.i.2021, LD & KD leg.
(7) **Lázně Kynžvart** (5941), spruce forest with deciduous tree admixture, east of the cemetery, 50°00′46.6″N, 12°37′51.6″E, 6.ii.2021, LD & KD leg.
(8) **Mariánské Lázně** (6042), park behind the swimming pool, 49°58′0.8″N, 12°41′58.4″E, 23.i.2021, LD leg.
(9) **Mariánské Lázně** (5942), Králův Kámen, climax spruce forest, 50°00′33.3″N, 12°41′18.2″E, 4.ii.2021, LD leg.
(10) **Mariánské Lázně** (5942), Králův Kámen, forest meadow, 50°00′35.6″N, 12°41′3.0″E, 4.ii.2021, LD leg.
(11) **Nové Domy** (5741), forest margin north-north-east of the village, 50°14′39.8″N, 12°34′58.6″E, 20.i.2021, LD leg.
(12) **Podhradí** (5739), deciduous forest in the ravine, 50°15′25.5″N, 12°11′56.0″E, 21.i.2021, LD leg.
(13) **Tachovská Huť** (6041), alley west of the village, 49°56′16.3″N, 12°35′17.4″E, 30.i.2021, LD leg.
(14) **Trstěnice** (6042), bank of Zaječí rybník pond, 49°55′4.7″N, 12°41′27.8″E, 22.i.2021, LD & KD leg.
(15) **Tři Sekery** (6041), bushes by pond west of the village, 49°56′33.1″N, 12°36′25.2″E, 18.i.2021, LD & KD leg.
(16) **Tři Sekery** (6041), meadows east of the village, 49°56′33.15″N, 12°37′44.8″E, 2.ii.2021, LD & KD leg.
(17) **Tři Sekery** (6041), field north-west of the village, 49°56′29.0″N, 12°37′12.9″E, **(a)** 20.i.2021, KD leg.; **(b)** 21.i.2021, KD leg.
(18) **Tři Sekery** (6041), spruce forest east of the village, 49°56′26.2″N, 12°38′16.7″E, 10.i.2021, KD leg.
(19) **Tři Sekery** (6041), garden of house No. 21, 49°56′29.0″N, 12°37′12.9″E, **(a)** 18.i.2021, LD leg.; **(b)** 20.i.2021, KD leg.; **(c)** 2.ii.2021, LD leg.
(20) **Vítkov** (5842), forest margin south-east of the village, 50°09′29.9″N, 12°41′14.9″E, 20.i.2021, LD leg.
(21) **Vysoká** (6041), spruce forest west of the village, 49°58′40.8″N, 12°31′58.6″E, 9.i.2021, LD & KD leg.
(22) **Výškov** (6042), Lazurový vrch Nature Reserve, deciduous forest on rocky debris, 49°54′59.7″N, 12°46′39.5″E, 28.i.2021, LD leg.
(23) **Výškovice** (6042), spruce forest south-west of the settlement, 49°55′50.6″N, 12°47′52.7″E, 28.i.2021, LD leg.

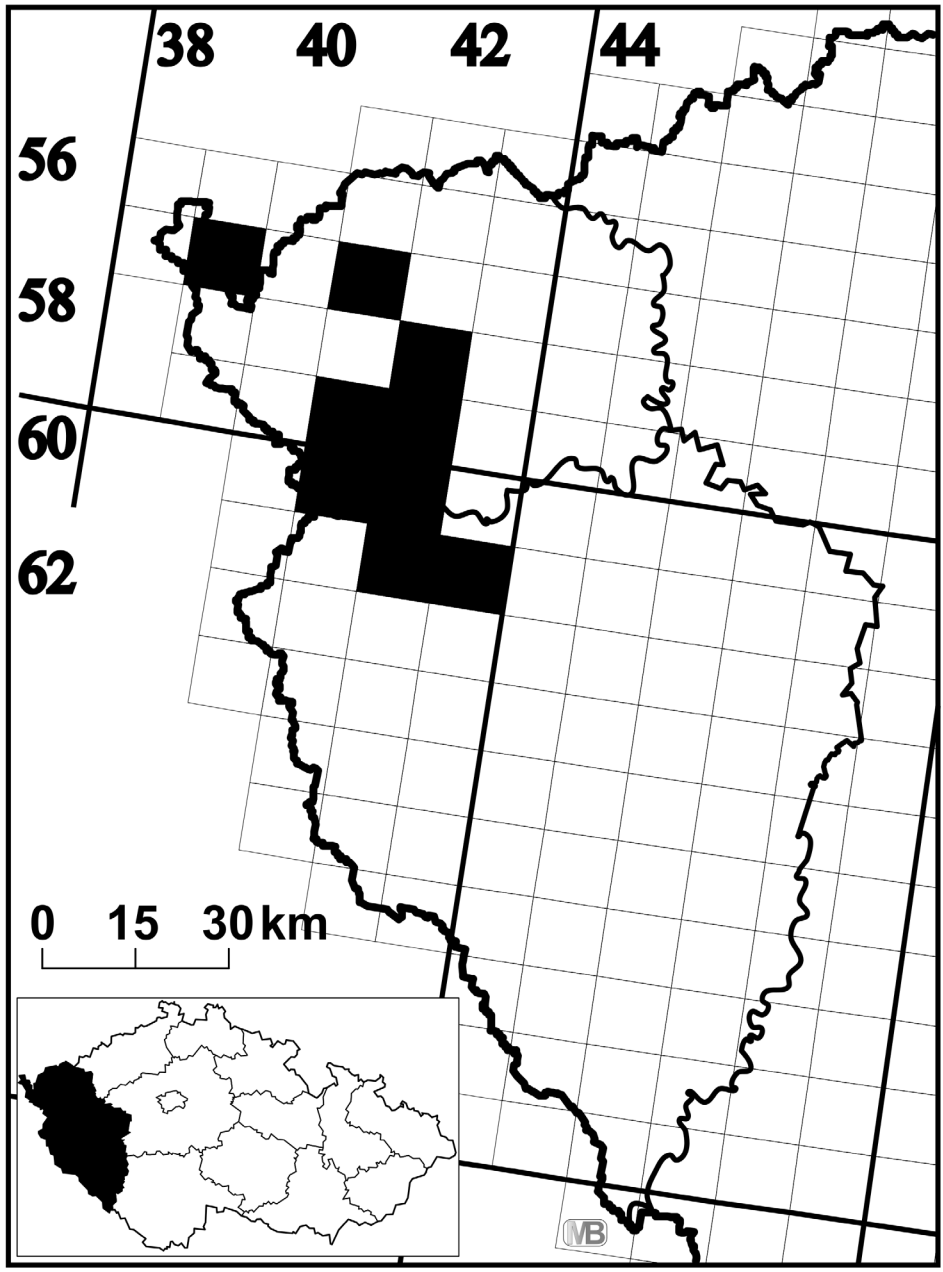


Fig. 1. Survey of mapping quadrants with the studied samples of insects on snow. Orig. M. Boukal.
Obr. 1. Přehled mapovacích kvadrátů se studovanými vzorky hmyzu na sněhu. Orig. M. Boukal.

(24) Výškovice (6042), mixed forest on rocky debris -west of the settlement, 49°55′42.7″N, 12°47′37.5″E, 28.i.2021, LD leg.
(25) Křínov (6142), Český mlýn mill, spruce forest by Kosí potok stream, 49°51′51.6″N, 12°48′58.6″E, 21.i.2010, LD leg.
(26) Okrouhlé Hradiště (6143), quarry, 49°52′24.9″N, 12°58′41.9″E on snow, 6.ii.2014, LD leg.
The mapping quadrants used in the study are on Fig. 1.

RESULTS AND DISCUSSION

Coleoptera: Carabidae

Pterostichus minor (Gyllenhal, 1827)
Locality: **14:** 1 ♀.

Common species in the Czech Republic on water banks covered with vegetation, in swamps and mires (Hůrka 1996). Its finding on snow was caused by a weather change, when the temperature was several degrees above zero. The water from melting snow washed out the hibernating specimens, which started to be active on the snow (P. Vonička, pers. comm.).

Coleoptera: Salpingidae

Rabocerus gabrieli Gerhardt, 1901
Locality: **23:** 1 ex.

Mycetophilous, saproxylic species rare in the Czech Republic, associated with dying branches of deciduous trees. Classified as EN (endangered) species (Hejda et al. 2017) in the Czech Republic. *Rabocerus gabrieli* is often collected during early spring or in autumn, so its accidental occurrence on snow during winter is not surprising (S. Benedikt, pers. comm.).

Coleoptera: Staphylinidae

Paederus riparius (Linnaeus, 1758)
Locality: **16:** 1 ex.

Common hygrophilous species in the Czech Republic. Its activity on snow can be explained similarly to *Pterostichus minor*.

Diptera: Anisopodidae

Sylvicola cinctus (Fabricius, 1787)
Locality: **7:** 1 ♂.

The most common species of the family Anisopodidae in the Czech Republic (Dvořák & Poláček 2020). It can be sometimes encountered in the cold periods of the year in the studied region (e.g., Dvořák 2019), which corresponds with the winter records of this species in molasses-baited traps in Great Britain (Hancock 1991). The occurrence of the family Anisopodidae on snow was reported by Soszyńska (2004), but without specific records of *Sylvicola* spp. (not listed). Pavlov (2006) reported two species of *Sylvicola* Harris, 1776 on snow from the



Fig. 2. *Gymnomus caesius* (Meigen, 1830), male, dorsolaterally. Photograph by J. Roháček.
Obr. 2. *Gymnomus caesius* (Meigen, 1830), samec, dorsolaterálně. Fotografie J. Roháček.

Vladimir region in Russia but his data on the occurrence of *S. fenestralis* (Scopoli, 1763) could refer to *S. cinctus* in fact, because the two species are often confused.

Diptera: Heleomyzidae

Gymnomus caesius (Meigen, 1830) (Fig. 2)
Locality: **3:** 1 ♀.

Common but not frequent European coprophagous species. Adults occur mainly in the colder periods of the year, it was caught in traps installed during winter (Preisler & Dvořáková 2009). According to Martinek (1996) it is a glacial relict in the Czech Republic. It occurs in caves and galleries too (for example Dvořák & Dvořáková 2012). According to Soszyńska-Maj & Woźnica (2016) it is a very common species on snow in the Beskid Mountains in Poland.

Heleomyza modesta (Meigen, 1838) (Fig. 3)
Locality: **17b:** 1 ♀, **21:** 1 ♂.

Common but infrequent West Palaearctic saprophagous and necrophagous species. It occurs in caves and galleries, outside on snow or in traps operating during the colder period of the year (for example Dvořák & Dvořáková 2012, Preisler & Dvořáková 2009). Soszyńska-Maj & Woźnica (2016) recorded this species as the most frequent and the most abundant Heleomyzid on snow during their investigation in the Beskid Mountains in Poland.



Fig. 3. *Heleomyza modesta* (Meigen, 1838), female, laterally. Photograph by J. Roháček.
Obr. 3. *Heleomyza modesta* (Meigen, 1838), samice, laterálně. Fotografie J. Roháček.

Heteromyza atricornis Meigen, 1830
Locality: **23:** 1 ♂, 1 ♀.

West Palaearctic coprophagous species, relatively recently reported from the Czech Republic (Košel et al. 2006). It was captured by means of traps operated during winter (Dvořáková et al. 2006). It also occurs in caves and galleries (Košel et al. 2006). Here, we record it on snow for the second time, the first record was from 2011 in the park near Valeč castle (Dvořák & Dvořáková 2012). This species was collected on snow by Soszyńska-Maj & Woźnica (2016) in the Beskid Mountains in Poland.

Heteromyza rotundicornis (Zetterstedt, 1846)
Locality: **7:** 3 ♂♂.

Common but not frequent European saprophagous and coprophagous species, collected regularly by means of traps during the colder period of the year (Preisler & Dvořáková 2009) and on snow (Martinek & Mocek 1995). It also occurs in caves and galleries (Dvořák & Dvořáková 2012). Soszyńska-Maj & Woźnica (2016) collected it during the whole winter season in considerable abundance in the Beskid Mountains in Poland.

Oldenbergiella brumalis Czerny, 1924
Locality: **18:** 1 ♀.

Rarely collected necrophagous species, with adults active only in the cold period of the year. Adults fly in search of carrion mainly in early spring. It is difficult to record them using usual collecting methods. They have been caught (sometimes in large quantities) by means of protein (meat) traps operated in winter in suitable localities (forests at higher altitudes)



Fig. 4. *Pachycerina seticornis* (Fallén, 1820), male, laterally. Photograph by J. Roháček.
Obr. 4. *Pachycerina seticornis* (Fallén, 1820), samec, laterálně. Fotografie J. Roháček.

(Roháček 1997). This species was collected on snow by Soszyńska-Maj & Woźnica (2016) in the Beskid Mountains in Poland several times, once in mass abundance.

Suillia oldenbergii (Czerny, 1904)
Localities: **25:** 1 ♀.

Rare Palaearctic species, developing in shoots of *Sambucus nigra*. It is rarely found, mainly in the colder period of the year, for example in traps (Preisler & Dvořáková 2009, Dvořáková et al. 2006). We also captured one specimen in a cellar in October (K. Dvořáková, unpublished). The finding presented here is the first record on snow.

Tephrochlamys laeta (Meigen, 1838)
Locality: **8:** 2 ♀♀.

Rather rare West Palaearctic species. It occurs in the cold period of the year as do other members of the genus. A winter finding, probably on snow, from the Czech Republic, is reported by Martinek & Mocek (1995). In winter 2021 we captured one more specimen using a protein trap (K. Dvořáková, unpublished). Outside the Czech Republic, this species has not been not recorded on snow.

Tephrochlamys rufiventris (Meigen, 1830)
Localities: **15:** 1 ♂, 1 ♀, **17a:** 2 ♂♂, **17b:** 1 ♂, **19b:** 1 ♀, **22:** 1 ♀, **21:** 1 ♀.

Very common saprophagous (necrophagous and coprophagous) species, widespread in the Holarctic Region. This is the most frequent species of the genus. It often occurs on snow (Hågvar & Greve 2003, Martinek & Mocek 1995, Pavlov 2006, Soszyńska-Maj & Woźnica 2016) and in winter traps, too (for example Preisler & Dvořáková 2009).

Diptera: Lauxaniidae

Pachycerina seticornis (Fallén, 1820) (Fig. 4)
Locality: **7:** 1 ♂.

Northern and Central European, relatively rare species, with unknown biology. In the Czech Republic, it occurs in forests at middle to high altitudes (e.g., Dvořáková & Vonička 2009), in western Bohemia in shaded cold habitats on ferns growing on debris (L. Dvořák, pers. observ.). It was recorded on snow in Bavaria (Schacht et al. 2004), in a number of localities in southern Norway (Hågvar & Greve 2003) and also in the Vladimir region in Russia (Pavlov 2006). The species overwinters in the adult stage (Hågvar & Greve 2003) and occurs in the warmer as well as in the colder periods of the year, but less abundantly in summer. It can be captured by means of traps during the colder period of the year (Dvořáková & Vonička 2009).

Diptera: Limoniidae

Chionea botosaneanui (Burghele-Bălăcesco, 1969)
Localities: **15:** 1 ♀, **16:** 1 ♂, **21:** 2 ♂♂, 1 ♀, **24:** 1 ♀.

One of the three species of the genus *Chionea* Dalman, 1816 known from the territory of the Czech Republic (Starý 2009). Recorded only from a few European countries (see Oosterbroek & Reusch 2008). From the Czech Republic known only from two localities in Moravia (Starý 1981, as *C.* (*N.*) *kratochvili*, Oosterbroek & Reusch 2008). First record for Bohemia. For its distribution in the Czech Republic, see map on Fig. 5. Adults of *Chionea*

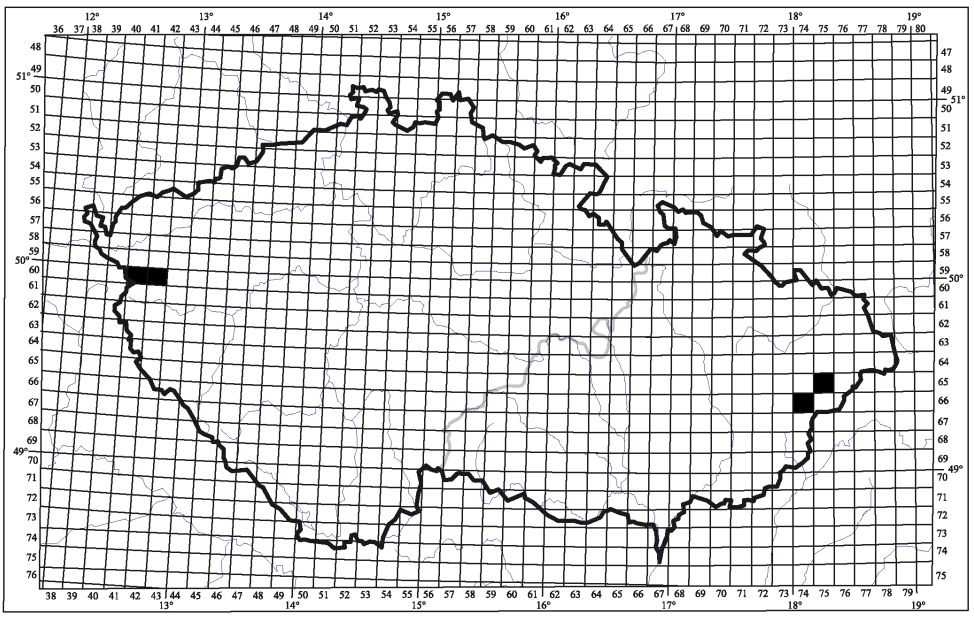


Fig. 5. Distribution of *Chionea botosaneanui* (Burghele-Bălăcesco, 1969) in the Czech Republic.
Obr. 5. Rozšíření *Chionea botosaneanui* (Burghele-Bălăcesco, 1969) v České republice.



Fig. 6. *Chionea lutescens* Lundström, 1907, female, dorsolaterally. Photograph by P. Šrámek.
Obr. 6. *Chionea lutescens* Lundström, 1907, samice, dorsolaterálně. Fotografie P. Šrámek.

species are mainly active during the winter period (Oosterbroek & Reusch 2008) and are often collected or observed on snow (see Fig. 6), including the type material of this species (Burghele-Bălăcesco 1969). This is also true for other species of the genus *Chionea* known from the Czech Republic (Obenberger 1923, Šrámek 2006).

Diptera: Lonchopteridae

Lonchoptera lutea Panzer, 1809
Localities: **14:** 2 ♀♀, **17:** 3 ♀♀.

Nine species of *Lonchoptera* Meigen, 1803 are known in the Czech Republic; adults are common in humid places, near streams or ponds, in marshes and deciduous forests or even in dry meadows (Barták 2009). *Lonchoptera lutea* is the most common species of the family. It is a widespread West Palaearctic species, also known from Transcaucasia (Oboňa et al. 2019). Information on the occurrence of this family on snow is given, for example, by Pavlov (2006) who recorded three species including *L. lutea*.

Diptera: Opomyzidae

Geomyza tripunctata Fallén, 1823
Locality: **14:** 1 ♀.

Very common and widespread species (Roháček et al. 2017). Occurrence of the family Opomyzidae on snow is mentioned by Soszyńska (2004), and specific data from Vladimir region in Russia are given by Pavlov (2006).

Diptera: Sciomyzidae

Pherbellia schoenherri (Fallén, 1826)
Locality: **15:** 1 ♂.

Common Holarctic species. Larva develops in snails (*Succinea* sp.) (Rozkošný 1967), adults occur near ponds and brooks during the whole year and the adult is the overwintering stage. It was recorded on snow cover in southern Norway (Hågvar & Greve 2003) and also in the Vladimir region of Russia where 106 individuals were found on snow over a period of five years (Pavlov 2006).

Diptera: Sphaeroceridae

Copromyza neglecta (Malloch, 1913)
Locality: **14:** 1 ♀.

Holarctic species, restricted to the boreal and temperate belt. It is relatively common in North America (Norrbom & Kim 1985b), but very local in Europe (and the whole of the Palaearctic Region). In Europe, coinciding with the edge of its distribution range, the species is parthenogenetic (Roháček 1989, Haarto et al. 2019). *Compromyza neglecta* is associated with runs and burrows of small mammals on humid, cold open habitats, in the Czech Republic largely on the lagg of mires and on peat-bog meadows at middle and higher altitudes (Roháček 1984, as *C.* cf. *parastercoraria* Papp, 1973, Roháček 1989). Adults occur during the whole year and, in the U.S.A., they were also found on snow (Norrbom & Kim 1985b), see also a photograph of an adult on snow from Massachusetts – https://bugguide.net/node/view/494689/bgpage. The sporadic records in the Czech Republic include one finding from December (Roháček 1989). Because of its close affinity to moorland habitats it is considered tyrphophilous in the Czech Republic (Roháček 1984, as *C.* cf. *parastercoraria*) and owing to its very local occurrence (currently only 4 localities in the country, see map on Fig. 7) it was classified as VU – vulnerable (Roháček 2005).

Copromyza stercoraria (Meigen, 1830)
Localities: **13:** 1 ♀, **14**: 1 ♀, **16**: 1 ♂, **23**: 1 ♀.

Similarly widespread Holarctic species (Norrbom & Kim 1985b), but common in Europe, frequently encountered from lowlands to mountains (Roháček 1989). It also is terricolous and mainly occurs in burrows of small mammals, in the droppings of which its larvae develop. Adults are active during the whole year (Richards 1930, Hackman 1965, Roháček 1989), thus also in winter (cf. also Bährmann 1996) when they can occur also on snow (Hågvar & Greve 2003). Sometimes, adults (migrating individuals) can be found on the surface on various decaying substrates (Roháček 1989). Because of its regular and common occurrence on lagg meadows of peat-bogs it also is considered tyrphophilous in the Czech Republic (Roháček & Barták 1999).

Crumomyia nitida (Meigen, 1830)
Locality: **23:** 2 ♀♀.

Widespread and common in Europe (albeit only in mountain ranges in southern areas), with a distinct preference for woodland. The species also migrates to open habitats during cold period of the year (Roháček 1991). It is polysaprophagous and cold-tolerant and, therefore,

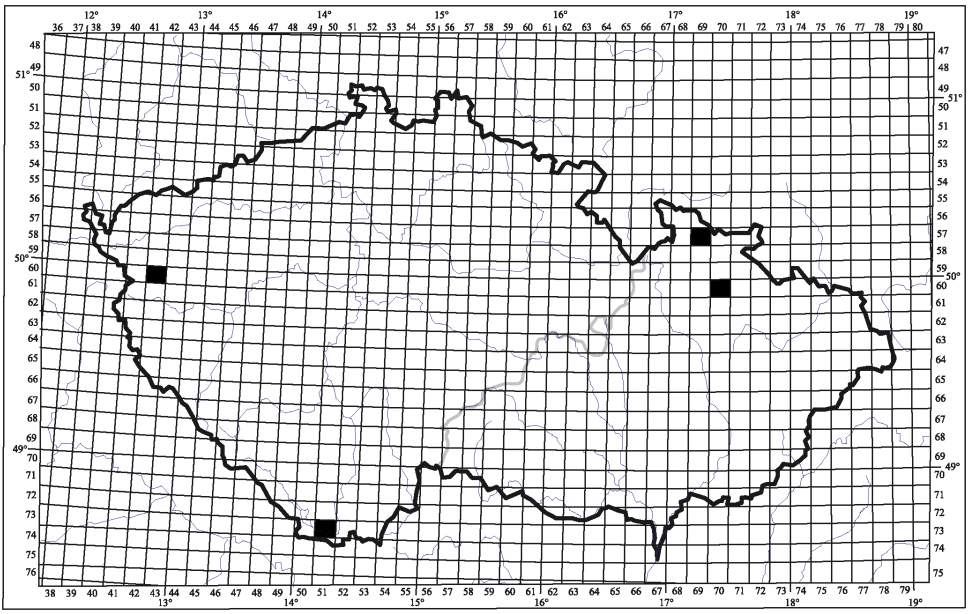


Fig. 7. Distribution of *Copromyza neglecta* (Malloch, 1913) in the Czech Republic.
Obr. 7. Rozšíření *Copromyza neglecta* (Malloch, 1913) v České republice.

it can also live in the entrance zone of caves and above the treeline in mountains. Adults have been found throughout the whole year. They are also active during winter (Bährmann 1996) and have several times been captured directly on snow (Florén 1989, Roháček 1991, Hågvar & Greve 2003).

Crumomyia notabilis (Collin, 1902) (Fig. 8)
Localities: **9:** 1 ♀, **14:** 1 ♀, **26:** 1 ♀.

Apparently a Eurosiberian species (Marshall et al. 2011), but inhabiting only boreal and temperate climatic belts (only occurring in mountains further south). It is a typically psychrophilous species occupying subterraneous habitats (burrows of mammals, caves, mines) where its larvae develop in various decaying organic matter (Roháček 1991). Adults are active throughout the whole year (Norrbom & Kim 1985a) and migrate in winter at temperatures above 0 °C so that they were often found on the surface and also on snow (Hackman 1963, Roháček 1991, Hågvar & Greve 2003, Soszyńska 2004, Hågvar 2010). Hågvar & Greve (2003) recorded *C. notabilis* in Norway as the most frequently encountered species of Sphaeroceridae on snow, and also as the only species having females gravid (with fully developed eggs in the abdomen) in winter.

Crumomyia rohaceki Norrbom et Kim, 1985
Locality: **18:** 1 ♀.

Distributed throughout Europe, but also recorded from Mt. Hermon in Israel (Marshall et al. 2011). The species is also psychrophilous and occurs only in high mountains in more



Fig. 8. *Crumomyia notabilis* (Collin, 1902), male, laterally. Photograph by R. Ahlburg.
Obr. 8. *Crumomyia notabilis* (Collin, 1902), samec, laterálně. Fotografie R. Ahlburg.

southern areas. *Crumomyia rohaceki* is a subterranean species inhabiting caves, mammal burrows, cellars and mines, often together with *C. notabilis*. Similarly to the latter its adults also leave these habitats in the cold period of the year (autumn, spring) when they can be encountered on vegetation or various rotting matter of plant, fungal or animal origin (Roháček 1991). However, records of *C. rohaceki* from winter months are rare. Only Hågvar & Greve (2003) presented a finding of an adult on snow in February (in Norway).

Ischiolepta denticulata (Meigen, 1830)
Locality: **16:** 1 ♂.

Probably a Eurosiberian species (ranging from Andorra and Great Britain to West Siberia in Russia), also restricted to boreal and temperate climatic belts but with very sporadic records in all parts of its distribution area (Marshall et al. 2011). It can be considered a terricolous and hygrophilous species because occurring in various very humid, mainly marshland, habitats (including alder forests) where it lives in burrows of small mammals (in those of European water vole, *Arvicola amphibius* (Linnaeus, 1758), in particular) and in nests of waterfowl (most frequently of Common coot, *Fulica atra* Linnaeus, 1758) in the dung of which its larvae develop (Richards 1938, Rotheray 1991, both as *Sphaerocera paracrenata* Duda, 1920). Also Hackman (1967) reared it from debris in burrow of *Arvicola amphibius*, and Falcoz (1921, as *Sphaerocera falcozi* Duda, 1921) reared one male from nesting burrow of Common kingfisher (*Alcedo atthis ispida* Linnaeus, 1758). In the Czech Republic, the majority of specimens were sifted from grass, moss and other debris taken from and around runs of small mammals

(*Arvicola*, *Microtus*) in waterlogged alder forests and lowland fens (J. Roháček, unpublished). Adults were found from April to November but there is no published record from winter or on snow. Previous records of *I. denticulata* from the Czech Republic are scarce: in Bohemia it was reported from two localities in Duchcov region (Roháček & Barták 2001) and from Čertova hora Reserve near Vráž (Albrecht et al. 2003); in Moravia there are records from Úvalenské louky Reserve near Úvalno (Roháček 1985) and Křivé jezero Reserve near Nové Mlýny (Rozkošný & Vaňhara 1995, Roháček 1999). Based on limited and localized records this species is considered VU – vulnerable in the Czech Republic (Roháček 2005).

Diptera: Tephritidae

Tephritis vespertina (Loew, 1844)
Localities: **7:** 1 ♂, **19b:** 1 ♂.

This species was considered to be rather rare in the past (cf. Kinkorová et al. 2004), but recently, it was regularly recorded on well-established meadows in all the mountains of Western Bohemia (Heřman 2016). Soszyńska-Maj & Klasa (2009) reported seven species of the family Tephritidae on snow in Poland and cited records from three papers from Finland, the last of them is almost 80 years old. Another species, *Tephritis dilacerata* (Loew, 1846), was found on snow by Pavlov (2006) in the Vladimir region (Russia). However, *T. vespertina* was not mentioned in any of these studies.

Diptera: Trichoceridae

Trichocera* (*Saltrichocera*) *parva Meigen, 1804
Locality: **15:** 1 ♀.

Relatively common species known from northern and central Europe and western Russia, most frequent in autumn, rarely found also in spring (Krzemińska & Brunhes 1991, Krzemińska 2014).

Trichocera* (*Saltrichocera*) *regelationis (Linnaeus, 1758)
Localities: **16:** 3 ♂♂, 2 ♀♀, **19:** 1 spec., **17:** 1 spec., **15:** 1 ♂, 2 ♀♀, **23:** 1 ♀, 1 spec., **14:** 1 ♂, **13:** 1 ♀, 1 spec.

One of the most abundant species widely distributed in the Holarctic Region, and known also from North Africa (Morocco) (Driauach et al. 2015). Adults are found during autumn, winter and spring months (Krzemińska & Brunhes 1991), in winter they regularly appear on snow (Hågvar 2010).

Trichocera* (*Saltrichocera*) *rufescens Edwards, 1921
Localities: **19:** 2 ♀♀, **17b:** 1 ♀.

Uncommon species known from several European countries and North Africa (Morocco) (Driauach et al. 2015, Krzemińska 2014). Occurrence on snow not formerly confirmed.

Trichocera* (*Saltrichocera*) *rufulenta Edwards, 1938
Localities: **6:** 2 ♀♀, **3:** 2 ♀♀, **7:** 1 ♀, **4:** 1 ♀, **17a:** 2 ♀♀, **23:** 1 ♀.

Common European species known from several European countries (Starý 1997, Krzemińska 2014). Occurrence on snow not formerly confirmed.

Trichocera* (*Saltrichocera*) *saltator (Harris, 1776)
Localities: **3:** 2 ♀♀, **20:** 1 ♀, **19:** 1 ♀, **17a:** 1 ♀, **1:** 1 ♀, **24:** 1 ♀, **11:** 1 ♀, **12:** 1 ♀.

Very common Palaearctic species occurring from autumn till spring (Krzemińska & Brunhes 1991, Krzemińska 2014), known also from North Africa (Morocco) (Driauach et al. 2015). Occurrence on snow not formerly confirmed.

Trichocera* (*Trichocera*) *hiemalis (De Geer, 1776)
Locality: **17a:** 1 ♂.

Central and Northern Holarctic species, regularly appearing on snow, found from early autumn till late spring (Krzemińska & Brunhes 1991, Hågvar 2010).

Mecoptera: Boreidae

***Boreus* sp.**
Localities: **5:** 2 ♂♂, **6:** 2 ♀♀, **7:** 2 ♀♀, **10:** 1 ♂, **13:** 1 ♀, **17b:** 1 ♀, **21:** 1 ♂, 1 ♀, **22:** 1 ♀, **23:** 2 ♀♀.

Identification of *Boreus* Latreille, 1816 to species is currently very problematic. As Kaspřák (2012) wrote: "Determination of European *Boreus* species has previously been based mainly on the shape of dorsal processes on the second and third abdominal tergite of males. Preliminary results suggest that the shape of the abdominal processes show considerable variation which does not correspond with the definition of individual species in the literature. Considering that, an analysis of selected sequences on mtDNA markers (12S, 16S, COI) and nuclear ITS2 marker has been carried out, which in the case of 12S and 16S markers supports the hypothesis that individuals from the populations under study most probably represent only one species. On the other hand, higher variability of the sequences in the ITS2 and COI markers does not exclude the existence of several distinct species.".

Three nominal species of the genus *Boreus* (Mecoptera: Boreidae), *Boreus hyemalis* (Linnaeus, 1767), *Boreus westwoodi* Hagen, 1866 and *Boreus lokayi* Klapálek, 1901, are reported from the Czech and Slovak Republics. Based on above mentioned results of morphological and molecular-taxonomic revision, it is currently unclear whether these represent a single morphoplastic species or several distinct species. For this reason, the studied material is not identified to the species, but only to the genus level.

The winter occurrence of representatives of the genus *Boreus* on snow is well known, see, e.g., Hågvar (2010), Soszyńska-Maj (2010), Ševčík (2010) or Kaspřák (2012).

CONCLUSIONS

(1) The material of insects hand-collected on snow in 26 localities of the Karlovy Vary region (Western Bohemia, Czech Republic) in January and February 2021 yielded three species of Coleoptera, 27 species of Diptera and one taxon of Mecoptera. Most of them were previously known to occur on snow in winter (cf. studies referred to under particular species and in introduction), but for at least 10 species (*Pterostichus minor*, *Rabocerus gabrieli*, *Paederus riparius, Ischiolepta denticulata*, *Suillia oldenbergii*, *Tephrochlamys laeta*, *Tephritis vespertina*, *Trichocera rufescens*, *T. rufulenta*, *T. saltator*) such behaviour had not previously been recorded.

(2) In Coleoptera, *Rabocerus gabrieli* (Salpingidae), a rare and endangered (EN) species in the Czech Republic (Hejda et al. 2017), is the most interesting record.

(3) In Diptera, *Chionea botosaneanui* (Limoniidae) is recorded from Bohemia for the first time. It seems to be a rare species in the Czech Republic, formerly only known from two montane localities in Moravia (Starý 1981, as *C.* (*N.*) *kratochvili*, Oosterbroek & Reusch 2008). Other important records include *Copromyza neglecta* and *Ischiolepta denticulata* (Sphaeroceridae), both known from a few records in the Czech Republic and considered vulnerable (VU) species in the country (Roháček 2005).

(4) The authors plan to continue with the research, focused mainly on several localities visited more times during the winter, and to compare the species' occurrence under different climatic conditions (mainly of sunlight and temperature).

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REFERENCES

ALBRECHT J. (ed.) 2003: *Chráněná území ČR VIII. – Českobudějovicko (kapitola Čertova hora u Vráže)*. [*Protected areas of the Czech Republic VIII – Českobudějovicko (chapter Čertova hora u Vráže)*]. P. 276. Agentura ochrany přírody a krajiny ČR, Praha & EkoCentrum Brno, 807 pp. (in Czech).

BÄHRMANN R. 1996: Winteraktive Zweiflügler (Insecta, Diptera Brachycera) in xerothermrasen Thüringens. *Studia Dipterologica* **3**: 259–274.

BARTÁK M. 2009: Lonchopteridae Curtis, 1839. In: JEDLIČKA L., KÚDELA M. & STLOUKALOVÁ V. (eds): *Checklist of Diptera of the Czech Republic and Slovakia*. http://zoology.fns.uniba.sk/diptera2009 (accessed 26 March 2021).

BURGHELE-BĂLĂCESCO A. 1969: Révision des genres Chionea et Niphadobata en Europe centrale et méridionale (Dipt. Tipulidae). *Annales de la Société Entomologique de France* **5**: 983–1000.

DRIAUACH O., KRZEMIŃSKA E. & BELQAT B. 2015: Genus Trichocera in Morocco: first records from Africa and a new species (Diptera: Trichoceridae). *Zootaxa* **4059**: 181–190.

DVOŘÁK L. 2019: Dvoukřídlí (Diptera) Mariánskolázeňska II. Anisopodidae. (Diptera of the Marienbad Region II. Anisopodidae (western Bohemia, Czech Republic)). *Západočeské Entomologické Listy* **10**: 1–5 (in Czech, English abstract).

DVOŘÁK L. & DVOŘÁKOVÁ K. 2012: Dvoukřídlí čeledi Heleomyzidae podzemních prostor západních a jihozápadních Čech. (Heleomyzid flies of subterranean spaces of western and southwestern Bohemia). *Západočeské Entomologické Listy* **3**: 33–43 (in Czech, English abstract).

DVOŘÁK L. & POLÁČEK R. 2020: Stružilky (Diptera: Anisopodidae) České republiky: přehled dosavadních znalostí. (Window gnats (Diptera: Anisopodidae) in the Czech Republic: a review of present knowledge). *Acta Carpathica Occidentalis* **11**: 53–59 (in Czech, English abstract).

DVOŘÁKOVÁ-MARSOVÁ K., MARTINEK V., BARTÁK M. & KUBÍK Š. 2006: Heleomyzidae. Pp. 325–331. In. BARTÁK M. & KUBÍK Š. (eds): *Diptera of Podyjí National Park and its Environs*. Česká zemědělská univerzita v Praze, Praha, 432 pp.

DVOŘÁKOVÁ K. & VONIČKA P. 2009: Stínomilkovití (Diptera. Lauxaniidae) Jizerských Hor a Frýdlantska. (Lauxaniidae (Diptera) of the Jizerské hory Mts and Frýdlant region (northern Bohemia, Czech Republic)). *Sborník Severočeského Muzea, Přírodní Vědy* **27**: 73–80 (in Czech, English abstract).

FALCOZ L. 1921: Matériaux pour l'étude de la faune pholéophile. – 1re note: Diptères, avec la description d'une espèce nouvelle de Sphaerocera Latr. *Bulletin de la Société Entomologique de France* (Paris) **1921**: 137–142.

FLORÉN F. 1989: Distribution, phenology and habitats of the lesser dung fly species (Diptera, Sphaeroceridae) of Sweden and Norway, with notes from adjacent countries. *Entomologisk Tidskrift* **110**: 1–29.

HAARTO A., KAKKO I. & WINQVIST K. 2019: Lisäyksiä Suomen Diptera-faunaan vuoden 2014 jälkeen. (Additions on the Finnish Diptera fauna after 2014). *W-album* **22**: 3–31 (in Finnish, with English abstract).
HACKMAN W. 1963: Studies on the dipterous fauna in burrows of voles (Microtus, Clethrionomys) in Finland. *Acta Zoologica Fennica* **102**: 1–64.
HACKMAN W. 1965: On the genus Copromyza Fall. (Diptera, Sphaeroceridae), with special reference to the finnish species. *Notulae Entomologicae* **45**: 33–46.
HACKMAN W. 1967: On Diptera in small mammal burrows in Northern Europe and Southern Spain. *Notulae Entomologicae* **47**: 1–14.
HÅGVAR S. 2010: A review of Fennoscandian arthropods living on and in snow. *European Journal of Entomology* **107**: 281–298.
HÅGVAR S. & GREVE L. 2003: Winter active flies (Diptera, Brachycera) recorded on snow – a long-term study in south Norway. *Studia Dipterologica* (Saale) **10**: 401–421.
HANCOCK E. G. 1991: Winter activity in the common window gnat, Sylvicola cinctus (Fabr.) (Diptera, Anisopodidae). *Dipterists Digest* **8**: 18–22.
HEJDA R., FARKAČ J. & CHOBOT K. 2017: Červený seznam ohrožených druhů České republiky. Bezobratlí. (Red list of threatened species in the Czech Republic. Invertebrates). *Příroda* **36**: 1–612.
HEŘMAN P. 2016: *Zpráva z entomologického průzkumu Localities Zhůří u Rejštejna v sezóně 2016*. [*Report from entomological survey of the locality Zhůří by Rejštejn in the season 2016*]. Unpublished manuscript, deposited in: GeoVision, Plzeň, 6 pp. (in Czech).
HŮRKA K. 1996: *Carabidae of the Czech and Slovak Republics. Carabidae České a Slovenské republiky*. Kabourek, Zlín, 565 pp.
JEDLIČKA L., KÚDELA M. & STLOUKALOVÁ V. (eds) 2009: *Checklist of Diptera of the Czech Republic and Slovakia*. http://www.edvis.sk/diptera2009/ (accessed 25 November 2021).
KASPŘÁK D. 2012: *Morfologická a molekulárně-taxonomická revize rodu Boreus (Mecoptera: Boreidae) na území České a Slovenské republiky*. (*Morphological and molecular-taxonomic revision of the genus Boreus (Mecoptera: Boreidae) in the territory of the Czech and Slovak Republics*). Unpublished diploma thesis, 64 pp. [Deposited in: Přírodovědecká fakulta, Katedra biologie a ekologie, Ostravská Univerzita v Ostravě]. (in Czech, English abstract).
KINKOROVÁ J., HEŘMAN P. & CHVÁLA M. 2004: Genus Tephritis (Diptera: Tephritidae) of Central Europe; systematics, morphology and biology. *Acta Universitatis Carolinae Biologica* **48**: 237–272.
KOŠEL V., DVOŘÁKOVÁ K. & MARTINEK V. 2006: Faunistic records from the Czech and Slovak Republics. Heleomyzidae. P. 155. In: KINKOROVÁ J. (ed.): Dipterologica bohemoslovaca Vol. 13. *Acta Universitatis Carolinae – Biologica* **50**: 1–158.
KRATOCHVÍL J. 1936: Renseignements sur les espèces du genre Chionea Dalm. de Tchécoslovaquie. *Bulletin de la Société Entomologique de France* **15**: 243–250.
KRZEMIŃSKA E. 2014: Fauna Europaea: Trichoceridaee. In: PAPE T. & BEUK P. (eds): *Fauna Europaea: Diptera, Brachycera*, https://fauna-eu.org (updated 15 June 2014; accessed 1 April 2021).
KRZEMIŃSKA E. & BRUNHES J. 1991: Trichoceridae of Massif Central (France) (Dipt. Nematocera). *Bulletin de la Société Entomologique de France* **96 (1)**: 49–54.
LÖBL I. & LÖBL D. (eds) 2015: *Catalogue of Palaearctic Coleoptera. Volumes 2/1, 2/2. Hydrophiloidea – Staphylinoidea. Revised and Updated Edition*. Brill, Leiden & Boston, xxvi + 1702 pp.
LÖBL I. & LÖBL D. (eds) 2017: *Catalogue of Palaearctic Coleoptera. Volume 1. Revised and Updated Edition. Archostemata – Myxophaga – Adephaga*. Brill, Leiden & Boston, 1443 pp.
LÖBL I. & SMETANA S. (eds) 2008: *Catalogue of Palaearctic Coleoptera. Volume 5. Tenebrionoidea.* Apollo Books, Stenstrup, 670 pp.
MARSHALL S. A., ROHÁČEK J., DONG H. & BUCK M. 2011: The state of Sphaeroceridae (Diptera: Acalyptratae): a world catalog update covering the years 2000–2010, with new generic synonymy, new combinations, and new distributions. *Acta Entomologica Musei Nationalis Pragae* **51**: 217–298.
MARTINEK V. 1987: Přehled druhů čeledi Heleomyzidae (Diptera – Acalyptrata) ve sbírce hmyzu Národního muzea v Praze. (Survey of species of the family Heleomyzidae (Diptera – Acalyptrata) in collections of the Entomological Department of the National Museum in Prague). *Časopis Národního Muzea* **156**: 36–42 (in Czech, English summary).
MARTINEK V. 1996: Dvoukřídlý hmyz (Diptera) na lesní louce v Orlických horách v letním a podzimním aspektu. (Dipterous insects (Diptera) in a forest meadow in the Orlické mts. in summer and fall aspects). *Lesnictví – Forestry* **42**: 193–212 (in Czech, English abstract).

MARTINEK V. & MOCEK B. 1995: Druhy některých čeledí dvoukřídlých (Diptera, Acalyptrata) v entomologické sbírce Muzea východních Čech v Hradci Králové. (Species of some families of Diptera – Acalyptrata in the insect collection of the Regional museum at Hradec Králové). *Acta Musei Reginaehradecensis* **24**: 21–60 (in Czech, English abstract).
NORRBOM A. L. & KIM K. C. 1985a: Systematics of Crumomyia Macquart and Alloborborus (Diptera: Sphaeroceridae). *Systematic Entomology* **10**: 167–225.
NORRBOM A. L. & KIM K. C. 1985b: Taxonomy and phylogenetic relationships of *Copromyza* Fallén (s. s.) (Diptera: Sphaeroceridae). *Annals of the Entomological Society of America* **78**: 331–347.
OBENBERGER J. 1923: Entomologie na lyžích. [Entomology on skis]. *Časopis Československé Společnosti Entomologické* **20**: 126–127 (in Czech).
OBENBERGER J. 1952: *Krkonoše a jejich zvířena*. [*Krkonoše mountains and their fauna*]. Přírodovědecké vydavatelství, Praha, 290 pp. (in Czech).
OBOŇA J., DVOŘÁK L., HAENNI J.-P., HRIVNIAK Ľ., JAPOSHVILI B., JEŽEK J., KERIMOVA I., MÁCA J., MURANYI D., RENDOŠ M., SŁOWIŃSKA I., SNEGOVAYA N., STARÝ J. & MANKO P. 2019: New and interesting records of Diptera from Azerbaijan and Georgia. *Zoosystematica Rossica* **28 (2)**: 277–295.
OOSTERBROEK P. & REUSCH H. 2008: Review of the European species of the genus Chionea Dalman, 1816 (Diptera, Limoniidae). *Braunschweiger Naturkundliche Schriften* **8 (1)**: 173–220.
PAVLOV A. V. 2006: O vydovom sostave i uslovijach sbora dvukridlych (Diptera) so snega v biotopach severnoj Meshchery (Vladimirskaja oblasť). (About structures of specieses and conditions of collection of Dipterans from snow in biotopes of Northern Meshchera (Vladimir Area)). *Eversmannia* **6**: 56–61 (in Russian, English abstract).
PERUTÍK R. 1956: Příspěvek k poznání sněžní zvířeny vrchu Kotouče u Štramberka a okolí. (Beitrag zur Kenntnis der Schneefauna des Berges Kotouč bei Štramberg und dessen Umgebung). *Časopis Slezského musea v Opavě, Series A, Historia Naturalis* **5**: 13–15 (in Czech, German summary).
PREISLER J. & DVOŘÁKOVÁ K. 2009: Lanýžkovití (Diptera: Heleomyzidae) Jizerských hor a Frýdlantska. (Heleomyzidae (Diptera) of the Jizerské hory Mts. and Frýdlant region (northern Bohemia, Czech Republic)). *Sborník Severočeského Muzea, Přírodní Vědy* **27**: 149–171 (in Czech, English abstract).
RICHARDS O. W. 1930: The British species of Sphaeroceridae (Borboridae, Diptera). *Proceedings of the Zoological Society of London* **1930**: 261–345.
RICHARDS O. W. 1938. A species of Sphaerocera (Diptera, Sphaeroceridae) new to Britain. *Proceedings of the Royal Entomological Society of London* (B) **7**: 127–130.
ROHÁČEK J. 1984: Acalypterate Diptera of peat-bogs in North Moravia (Czechoslovakia). Part 6. Sphaeroceridae. *Časopis Slezského Zemského Muzea, Série A – Vědy Přírodní* (Opava) **33**: 97–131.
ROHÁČEK J. 1985: Dvoukřídlí – málo známá součást půdní zvířeny slatinišť a mokřadních luk Severomoravského kraje. [Diptera – a little known component of the soil fauna of fens and marshy meadows in North Moravia]. *Vlastivědné listy Severomoravského kraje* **11 (1)**: 29–32 (in Czech).
ROHÁČEK J. 1989: Sphaeroceridae (Diptera) of Czechoslovakia Part 1. Lotophila Lioy and Copromyza Fallén. *Časopis Slezského Zemského Muzea, Série A – Vědy Přírodní* (Opava) **38**: 1–16.
ROHÁČEK J. 1991: Sphaeroceridae (Diptera) of Czechoslovakia. Part 2. Crumomyia Macquart. *Časopis Slezského Zemského Muzea, Série A – Vědy Přírodní* (Opava) **40**: 1–27.
ROHÁČEK J. 1997: Borboropsis and Oldenbergiella (Diptera, Heleomyzidae) in the Czech and Slovak Republics: faunistic records and notes on their biology. *Folia Facultatis Scientiarum Naturalium Universitatis Masarykianae Brunensis, Biologia* **95**: 145–147.
ROHÁČEK J. 1999: Sphaeroceridae. In: ROZKOŠNÝ R. & VAŇHARA J. (eds): Diptera of the Pálava Biosphere Reserve of UNESCO, II. *Folia Facultatis Scientiarum Naturalium Universitatis Masarykianae Brunensis, Biologia* **100**: 347–357.
ROHÁČEK J. 2005: Sphaeroceridae (mrvnatkovití). Pp. 344–346. In: FARKAČ J., KRÁL D. & ŠKORPÍK M. (eds): *Červený seznam ohrožených druhů České republiky. Bezobratlí. Red list of threatened species in the Czech Republic. Invertebrates*. Agentura ochrany přírody a krajiny České republiky, Praha, 760 pp. (in Czech and English).
ROHÁČEK J. & BARTÁK M. 1999: Sphaeroceridae (Diptera) of peat-bogs in the Šumava Mts. (SW Bohemia, Czech Republic). *Časopis Slezského Zemského Muzea, Série A – Vědy Přírodní* (Opava) **48**: 9–32.
ROHÁČEK J. & BARTÁK M. 2001: Sphaeroceridae. In: BARTÁK M. & VAŇHARA J. (eds): Diptera in an industrially affected region (north-western Bohemia, Bílina and Duchcov environs), II. *Folia Facultatis Scientiarum Naturalium Universitatis Masarykianae Brunensis, Biologia* **105**: 415–423.

ROHÁČEK J., VAN ZUIJLEN J. W. & VONIČKA P. 2017: Opomyzoid families – Clusiidae, Opomyzidae, Anthomyzidae, Aulacigastridae, Periscelididae, Stenomicridae and Asteiidae (Diptera: Acalyptrata) of the Jizerské hory Mts, Frýdlant region and Liberec environs (northern Bohemia, Czech Republic). *Sborník Severočeského Muzea, Přírodní Vědy* **35**: 121–154.
ROTHERAY G. E. 1991: E B Basden's collection of Diptera from bird and mammal nests and mammal runs, burrows and droppings. *National Museum of Scotland Information Series* **3**: 1–46.
ROZKOŠNÝ R. 1967: Zur Morphologie und Biologie der Metamorphosestadien mitteleuropaischer Sciomyziden (Diptera). *Acta Scientiarum Naturalium Academiae Scientiarum Bohemoslovaceae Brno* **4**: 1–160.
ROZKOŠNÝ R. & VAŇHARA J. 1995: Monitoring Diptera in southern Moravia by pitfall traps. Pp. 143–157. In: BITUŠÍK P. (ed.): *Dipterologica bohemoslovaca 7*. Technical University in Zvolen, Zvolen, 202 pp.
SCHACHT W., KURINA O., MERZ B. & GAIMARI S. 2004: Zweiflügler aus Bayern XXII (Diptera: Lauxaniidae, Chamaemyiidae). *Entomofauna* **25**: 41–80.
SOSZYŃSKA A. 2004: The influence of environmental factors on the supranivean activity of Diptera in Central Poland. *European Journal of Entomology* **101**: 481–489.
SOSZYŃSKA-MAJ A. 2010: Nowe dane o chionobiontach Polski z Beskidu Sądeckiego. (New records of chionobionts of Poland from the Beskid Sądecki Mountains). *Wiadomosti Entomologiczne* **9 (Suplementum)**: 147–150 (in Polish, English abstract).
SOSZYŃSKA-MAJ A. & KLASA A. 2009: Records of fruit flies (Diptera: Tephritidae) on snow in Poland. *Dipteron* **25**: 50–56.
SOSZYŃSKA-MAJ A. & WOŹNICA A. 2016: A case study of Heleomyzidae (Diptera) recorded on snow in Poland with a review of their winter activity in Europe. *European Journal of Entomology* **113**: 279–294.
SOSZYŃSKA-MAJ A., PAASIVIRTA L. & GIŁKA W. 2015: Why on the snow? Winter emergence strategies of snow-active Chironomidae (Diptera) in Poland. *Insect Science* **23 (5)**: 754–770.
STARÝ J. 1981: Nachträge und Berichtigungen zur Limoniiden-Fauna der Tschechoslowakei (Diptera) II. *Acta Rerum Naturalium Musei Nationalis Slovaci* **27**: 99–122.
STARÝ J. 1997: Trichocera (s. str.) rufulenta Edwards, 1938, a valid species (Diptera, Trichoceridae). *Studia Dipterologica* **3** (1996): 357–364.
STARÝ J. 2009: Limoniidae Speiser, 1909 (1840). In: JEDLIČKA L., KÚDELA M. & STLOUKALOVÁ V. (eds): *Checklist of Diptera of the Czech Republic and Slovakia*. http://zoology.fns.uniba.sk/diptera2009 (Accessed 26 March 2021).
STARÝ J., KUBÍK Š. & BARTÁK M. 2005: Limoniidae. Pp. 24–32. In: KUBÍK M. & KUBÍK Š. (eds): *Diptera of Podyjí National Park and its environs*. Česká zemědělská univerzita v Praze, Praha, 432 pp.
ŠÁMAL J. 1925: Příspěvek k entomologickému výzkumu Šumavy. [Contribution to the entomological research of the Bohemian Forest]. *Acta Musei Nationalis Pragae* **99**: 41–43 (in Czech).
ŠEVČÍK J. 2010: Neuroptera, Raphidoptera and Mecoptera of the Podyjí National Park (Czech Republic). *Časopis Slezského Zemského Muzea, Série A – Vědy Přírodní* (Opava) **59**: 103–112.
ŠLAIS J. 1946: Faunistické a bionomické poznámky k znalosti našich bezkřídlých sněhobytných Dipter. [Faunistic and bionomic notes to the knowledge of our apterous snow Diptera]. *Entomologické Listy* **9**: 98–101 (in Czech).
ŠRÁMEK P. 2006: Sněžnice, pavoučnice a jiní hmyzí otužilci. (Winter scorpionflies, snowflies and other hardy Insects). *Živa* **2006 (2)**: 78–80 (in Czech, English abstract).

SOUHRN

Z velké škály hmyzu je pouze malý počet druhů schopen aktivního života v zimním období. Tento příspěvek představuje kompetentní průzkum zimní hmyzí fauny sbírané ručně na sněhu v lednu a únoru 2021 v nejzápadnější části České republiky. Celkem bylo zaznamenáno 31 druhů hmyzu (Coleoptera tři druhy, Diptera 27 druhů a Mecoptera 1 taxon), pro nejméně 10 z nich se jedná o první známé údaje o jejich výskytu na sněhu. *Chionea botosaneanui* (Burghele-Bălăcesco, 1969) (Diptera: Limoniidae) je poprvé zaznamenán z Čech; dva další druhy, *Copromyza neglecta* (Malloch, 1913) a *Ischiolepta denticulata* (Meigen, 1830) (oba Diptera: Sphaeroceridae), jsou známy jsou jen z několika nálezů v České republice a jsou klasifikovány jako zranitelné druhy (VU) dle červeného seznamu bezobratlých České republiky. Z řádu Coleoptera je *Rabocerus gabrieli* Gerhardt, 1901 (Salpingidae) v České republice vzácným a ohroženým druhem (EN).