

New and interesting records of Diptera on glacial sand deposits in Silesia (NE Czech Republic). Part 1 - Acalyptratae

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New and interesting records of Diptera on glacial sand deposits in Silesia (NE Czech Republic). Part 1 - Acalyptratae. – Acta Mus. Siles. Sci. Natur. 69: 1-19, 2020.

Abstract: Records of 18 species of the families *Micropezidae* (1 species), *Lonchaeidae* (1 species), *Lauxaniidae* (1 species), *Chamaemyiidae* (6 species), *Agromyzidae* (6 species) and *Chloropidae* (3 species) from glacial sand deposits in the Czech Silesia (NE Czech Republic) are presented and their association with sandy habitats is discussed. All of them are recorded from the Czech Silesia for the first time, 4 are new additions to the fauna of Moravia and 9 for the whole Czech Republic. None of the recorded species is psammobiont but five of them are classified as psammophilous, viz. *Micropeza lateralis* Meigen, 1826 (*Micropezidae*), *Calliopum geniculatum* (Fabricius, 1805) (*Lauxaniidae*), *Cerodontha (Xenophytomyza) leptophallus* L. Papp, 2016, *Ophiomyia disordens* Pakalniškis, 1998 (both *Agromyzidae*), *Aphanotrigonum parahastatum* Dely-Draskovits, 1981 (*Chloropidae*), and *Leucopis celsa* Tanasijtshuk, 1979 as probably psammophilous. A new easternmost record of *M. lateralis* (from S. Poland: Godów) is presented and the association of this species and *C. geniculatum* with growths of *Cytisus scoparius* is confirmed. *Leucopis monticola* Tanasijtshuk, 1961, *L. celsa* and *A. parahastatum* are recorded from northernmost known localities. These species, and also *C. (X.) leptophallus* seem to be thermophilous and/or xerophilous and can be considered southern elements in the Silesian fauna of Diptera.

Key words: *Diptera*, *Micropezidae*, *Lonchaeidae*, *Lauxaniidae*, *Chamaemyiidae*, *Agromyzidae*, *Chloropidae*, new records, psammophily, glacial sand deposits, Czech Republic (Moravia/Silesia)

Introduction

The glacial sand deposits were formed in the Czech Silesia (NE part of the Czech Republic) during Pleistocene glaciations (Růžička 2004; Růžičková *et al.* 2009; Nývlt 2011). Where these sands are at present exposed (usually by excavation in sand-pits) they form a distinctive and extreme ecosystem having a somewhat insular character due to unrelated surrounding habitats. The dipterous fauna on sandy ecosystems also is specific (see e. g. study by Ardö 1957 on marine shore dunes) but its knowledge on inland sandy habitats remains very fragmentary. This also is true for glacial sands in Silesia. Some information dealing with a few selected species of Diptera found in sand-pits in this area have been presented by Roháček & Ševčík (2013) in the popular book Příroda Slezska (Nature of Silesia). Additional more important results have been recently obtained within a project aimed at the investigation of the Diptera biodiversity in glacial sand habitats in this part of the Czech Republic. The dipterological field work was conducted there in the years 2013–2019, and will be continued for the next two years (2020, 2021). During this research the Diptera communities have not only been studied on glacial sand deposits in the Hlučínsko region (cf. Roháček 2015a, 2016a,b) but it has been extended also to other parts of Silesia, viz. Jesenicko and Osoblažsko regions in the west and Karvinsko region in the east (see map on Fig. 3). However, it is to be noted that some collecting activity focused on flies occurred in sand-pits and related sandy sites in the Hlučínsko and Osoblažsko areas also in the past, in years 1995–1997 and that the then obtained material is deposited in the Silesian Museum (SMOC).

During this (past and recent) field work various species of interest, including psammobiont or psammophilous, xerophilous and/or thermophilous species have been ascertained on the gla-

cial sand deposits under study. Records of some of these species have been presented by Roháček (2015a,b, 2016a) but a number of others remained unpublished, including those obtained already in 1995-1997 and those captured recently. In this paper we present a series of mainly faunistically important records of acalyptrate species from the families Micropezidae, Lonchaeidae, Lauxaniidae, Chamaemyiidae, Agromyzidae and Chloropidae. Some of these species are new additions to the fauna of the whole of the Czech Republic, others to Moravia and the remaining to the Czech Silesia. In all these species we have attempted to review their biology and distribution and, based on this knowledge and information from field work, to determine their affinity to sandy habitats.

Material and methods

All the material examined is deposited in the collection of the Silesian Museum, Opava, Czech Republic (SMOC). The collected specimens were air-dried and mounted on pinned triangular cards in the course of the study but some of them were retained alive in plastic tubes to be photographed shortly after being captured in special glass boxes by means of a digital camera (Canon EOS 60D) with a macro lens (Canon MP-E 65 mm 1–5×) and ring macro flash (Canon MR-14EX). After photography these specimens were killed and mounted for subsequent identification. Where necessary, male genitalia and female postabdomina were examined after detachment and dissection of the whole abdomen. After examination, all parts were transferred to small coalesced plastic tubes and pinned below the respective specimens. Habitat photographs were taken in the field by digital cameras Canon EOS 60D and Sony NEX-7.

The historic region of Silesia (the Czech part of Silesia), as delimited in Příroda Slezska (see Figs 2, 3 and/or Roháček *et al.* 2013, map on pp. 10–12) is treated within (the country) Moravia in all checklists of Diptera of the Czech Republic and Slovakia, including the most recent one (Jedlička *et al.* 2009). To display its location, this region is depicted on a map of the Czech and Slovak Republics (see Fig. 2) used in Jedlička *et al.* (2009). Because the Czech Silesia has been considered a part of Moravia in these checklists the area under study is listed as “N Moravia” in the material examined below to be in conformity also with previous faunistic studies.

Localities under study. Field work was performed in four regions of the Czech Silesia. Sand-pits were paired by proximity with one being actively utilized for sand extraction and the other left abandoned. A large abandoned sand-pit in Godów in S. Poland was also included in the project to complement the active sand-pit in Dolní Lutyně. Localities are listed below according to these regions and arranged from west to east (see Fig. 3):

Jesenicko region:

- (1) **Supíkovice** 1.1 km NE, 50°18'22"N, 17°15'43"E, 380 m, large abandoned sand-pit;
- (2) **Kolnovice**, active sand-pit, two plots – Kolnovice 1 km SW, 50°18'55"N, 17°18'45"E, 385 m (C part) and Kolnovice 1.2 km WSW, 50°18'59"N, 17°18'35"E, 390 m (W part).

Osoblažsko region:

- (3) **Bartultovice** 0.5 km SW, 50°16'13"N, 17°35'00"E, 315 m, small abandoned sand-pit.
- (4) **Bohušov** 0.7 km S, 50°14'14"N, 17°42'58"E, 250 m, abandoned sand-pit;

Hlučínsko region:

- (5) **Oldříšov** 0.7 km N, sand-pit, 49°59'51"N, 17°57'48"E, 280 m, abandoned sand-pit;
- (6) **Bělá** (nr. Chuchelná), three plots – Bělá 0.5 km E, 49°58'26"N, 18°09'05"E, 250 m (small abandoned sand-pit), Bělá 0.4 km NE, “Buben” sand-hill, 49°58'29"N, 18°09'01"E, 260 m (natural outcrop of sand) and Bělá 0.6 km N, 49°58'39"N, 18°08'49"E, 265 m (holt on natural outcrop of sand);
- (7) **Závada**, active sand-pit, three plots – Závada 1.8 km SE, 49°56'19"N, 18°10'28"E, 260 m (SE part, partly recultivated), Závada 2 km S, 49°56'09"N, 18°10'04"E, 270 m (SW part, not excavated but regularly disturbed) and Závada 1.6 km S, 49°56'25"N, 18°09'56"E, 265 m (NW part, with active excavation).

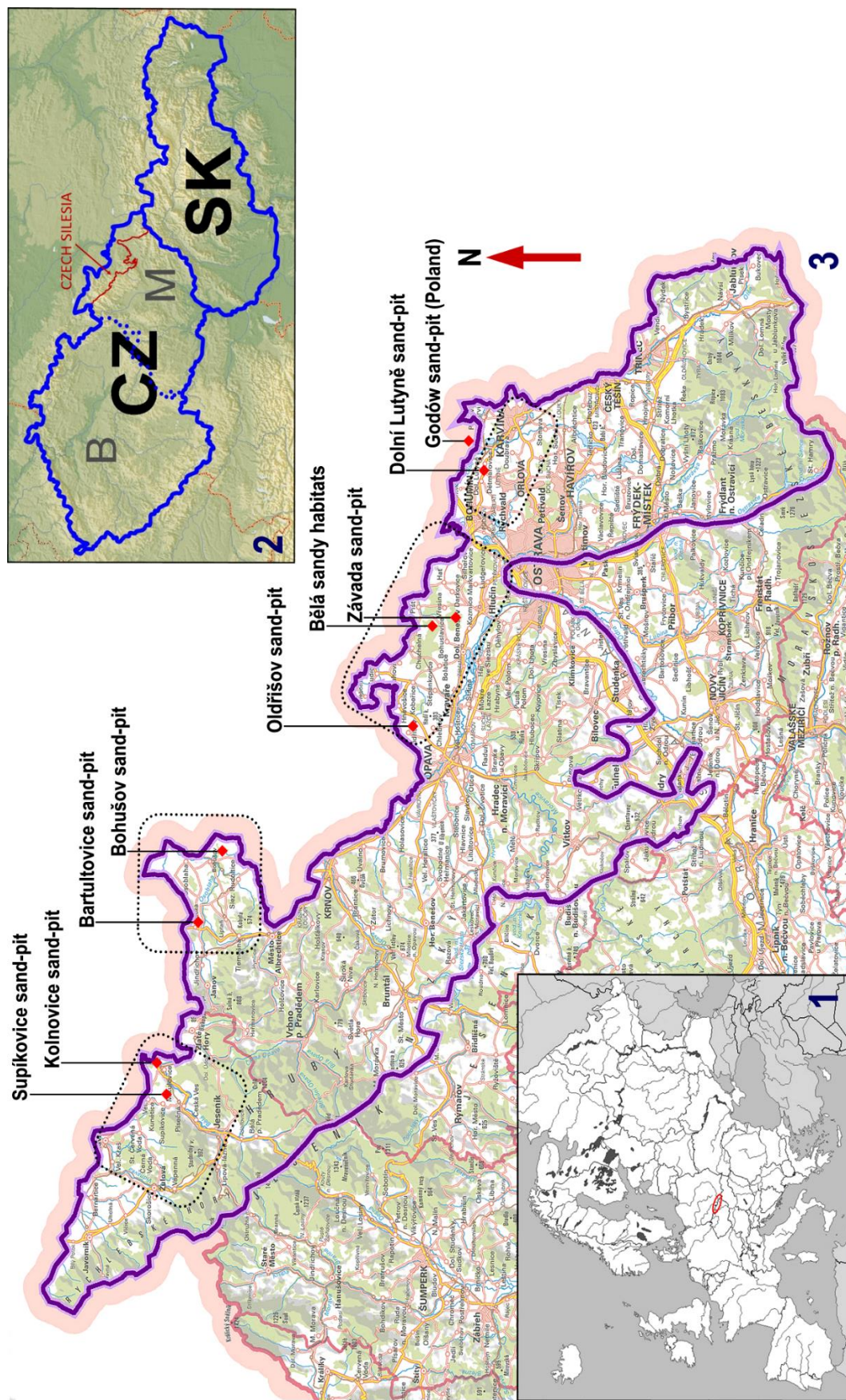
Karvinsko region:

- (8) **Dolní Lutyně** 1.2 km N, 49°54'34"N, 18°25'33"E, 210 m, active sand-pit with two artificial lakes after excavation.

S. Poland:

- (9) **Godów** 1.3 km ESE, 49°55'13"N, 18°29'41"E, 230 m, large abandoned sand-pit (close to Czech-Polish borders).

Collecting methods. The flies were collected by sweeping over sparse low vegetation or bare sand; netting of individually observed specimens, hand or aspirator collecting on flowering plants and decaying substrates on sandy ground was also used.



Figs 1–3: Maps. 1 – location of the Czech Silesia in Europe (red ellipse); 2 – situation of the Czech Silesia within the Czech Republic and Moravia; 3 – Localities of glacial sand deposits under study. Abbreviations used in maps: B – Bohemia, CZ – Czech Republic, M – Moravia, N – north, SK – Slovak Republic. Study sites are in the regions marked by dotted lines: Jesenícko (Supikovice, Kolnovice), Osoblazsko (Bartultovice, Bohušov), Hlučínsko (Oldřišov, Bělá, Závada), Karvinsko (Dolní Lutyně) and S. Poland (Godów). Map sources: Fauna Europaea (Fig. 1), <http://www.edvis.sk/diptera2009/mapCZSK.htm> (Fig. 2) and orig. (Fig. 3).

Nomenclature. Botanical nomenclature follows that used in the Checklist of vascular plants of the Czech Republic (Danihelka *et al.* 2012). Nomenclature of flies follows the most recent catalogues, checklists, monographs and/or revisions of the groups recorded here.

Author contributions. J. Roháček performed field work, conceptualized the study, designed the manuscript, identified specimens of and wrote Micropezidae, Lonchaeidae and Lauxaniidae and all general parts; M. Černý identified material of and wrote Agromyzidae; M. Ebejer identified specimens of and wrote Chamaemyiidae including discussion; Š. Kubík identified material of and wrote Chloropidae.

Results

MICROPEZIDAE

Micropeza lateralis Meigen, 1826 – psammophilous (Figs 4, 5)

Material examined: CZECH REPUBLIC: N Moravia: Kolnovice 1 km SW, 50°18'55"N, 17°18'45"E, 385 m, sand-pit C part, sweeping *Cytisus scoparius* on sand, 6.8.2019, 5♂ 6♀, 11.9.2019, 1♂ 2♀; Bělá nr. Chuchelná 0.6 km N, holt, 49°58'39"N, 18°08'49"E, 265 m, sweeping *Cytisus scoparius* on margin of oak-pine forest, 8.8.2019, 2♂; POLAND: S. Silesia: Godów 1.3 km ESE, sand-pit, 49°55'13"N, 18°29'41"E, 230 m, sweeping *Cytisus scoparius* on sand, 8.8.2019, 2♂ 1♀, all J. Roháček leg. et det. (SMOC).

Biology: *M. lateralis* seems to be closely bound to older growths of broom, *Cytisus scoparius* (L.) Link, in Britain mainly on heathland (Allen 1982; Uffen & Chandler 2010; Falk *et al.* 2016). However, already Karl (1936) collected this species on broom bushes in NW Poland. All specimens listed above were beaten or swept from *C. scoparius* growing on glacial sand ground (Figs 6, 9). The larvae possibly develop in soil and may be associated with root nodules of broom similarly as is known for *Micropeza corrigiolata* (Linnaeus, 1767) in some other species of legumes (Uffen & Chandler 2010; Falk *et al.* 2016). Adults are known to occur in V-VIII in Great Britain (Falk *et al.* 2016) but later in the Iberian Peninsula where it is a distinctly autumnal species (Roháček *et al.* 2016) occurring in VIII-X; it has been only found in VIII and IX in the sandy sites investigated.

Distribution: The European distribution of *M. lateralis* has been most recently summarized by Roháček *et al.* (2016) and Dvořák (2018): Portugal, Spain, Andorra, Great Britain, France, Belgium, The Netherlands, Denmark, Germany, Poland, Czech Republic (Bohemia) and Italy. The species has also been recorded from North America (both USA and Canada) where it is considered an introduced species (Hoebeke & Wheeler 2016). The original distribution of *M. lateralis* can be characterized as Subatlantic. While in the past its easternmost records were from northwestern Poland (Schroeder 1911: Stettin-Sandsee = now Szczecin-lake Goplana; Karl 1936: Stolp-Kl.(ein) Strellin = now Słupsk-Strzelinko) *M. lateralis* seems to be recently expanding its distribution easterly being first recorded from western and southern Bohemia in the Czech Republic (Máca 2006, Dvořák 2018) and now also found in the Czech Silesia (first records from the whole of Moravia) and in southern Poland (Godów) close to Czech border (easternmost record).

Comments: *M. lateralis* is here classified as a psammophilous species due to its association with broom often (but not always) growing on sandy ground. The above easternmost records indicate recent spreading of the species which may be caused by climate warming resulting in mild winters enabling the species to survive in newly colonized, more eastern, areas of Central Europe. The former (1995-1997) absence of *M. lateralis* in the broom growths in the locality Bělá-holt seems to support this phenomenon.

LONCHAEIDAE

Dasiops hennigi Morge, 1959 – psammoneutral?

Material examined: CZECH REPUBLIC: N Moravia: Supíkovice 1.1 km NE, 50°18'22"N, 17°15'43"E, 380 m, abandoned sand-pit, S part, sweeping over sand and sparse vegetation on sand, 7.6.2017, 1♀, J. Roháček leg., J. Máca et I. MacGowan det. (SMOC).

Biology: Largely unknown. According to MacGowan & Rotheray (2008) adults of *D. hennigi* were found at sites with a mixture of wooded and open habitats and its larvae may develop in stems or roots of herbaceous plants. The records by Máca & Barták (2001) from N. Bohemia originated from various habitats in a dump restoration area and that by Řehounek (2014) from a sand-pit at Lžín nr. Soběslav (S. Bohemia).

Distribution: Great Britain (England), The Netherlands, Poland, Czech Republic, Hungary, Finland, North European part of Russia (MacGowan & Rotheray 2008; Carles-Tolrá 2013). In the Czech Republic the species has been known from several localities from northern, central and southern Bohemia (Máca 1997; Máca & Barták 2001; Řehounek 2014). First record from Moravia.

Comments: The biology of this species is inadequately known to explain its association with sandy habitats more precisely.



Figs 4–6: *Micropeza lateralis* Meigen and its habitat. **4** – *M. lateralis*, male on *Cytisus scoparius* branch, in lateral view, body length ca 6.2 mm; **5** – the same, female, body length ca 7.3 mm; **6** – habitat of the species, growths of *Cytisus scoparius* in the Godów sand-pit (S. Poland). Photo by J. Roháček.

LAUXANIIDAE

Calliopum geniculatum (Fabricius, 1805) – psammophilous

(Figs 7, 8)

Material examined: CZECH REPUBLIC: N Moravia: Kolnovice 1.2 km WSW, 50°18'59"N, 17°18'35"E, 390 m, sand-pit W part, sweeping over sand and sparse vegetation on sand, 7.6.2017, 2♂; Kolnovice 1 km SW, 50°18'55"N, 17°18'45"E, 385 m, sand-pit C part, sweeping *Cytisus scoparius* on sand, 9.7.2019, 4♂ 2♀, 6.8.2019, 3♂ 4♀, 11.9.2019, 2♂ 1♀; Bartultovice 0.5 km SW, 50°16'13"N, 17°35'00"E, 315 m, abandoned sand-pit, sweeping *Cytisus scoparius* on sand, 9.7.2019, 3♂ 3♀; Bělá nr. Chuchelná 0.5 km E, sand-pit, 49°58'26"N, 18°09'05"E, 250 m, sweeping over forest steppe vegetation, 30.5.1995, 2♂ 1♀; Bělá nr. Chuchelná 0.6 km N, holt, 49°58'39"N, 18°08'49"E, 265 m, sweeping undergrowth of steppe forest, 14.6.1995, 4♂ 1♀, 13.6.2019, 1♀, 8.8.2019, 1♂, all J. Roháček leg. et det. (SMOC).

Biology: The species seems to be closely associated with growths of broom, *Cytisus scoparius* (L.) Link. in Great Britain (S. Falk and A. Godfrey, personal communication, 2019). All the above material from sand-pits and other glacial sand deposits was also swept from broom bushes (Fig. 9), including the series from the vicinity of Bělá collected in 1995. The more recent field work confirmed it here but revealed it in two more localities.

Distribution: Portugal, Spain, Great Britain, Denmark, Germany, Poland, Czech Republic, Austria, Hungary (Merz 2013). *C. geniculatum* has been extremely rarely recorded from the Czech Republic. There are only two definite records from the country, a more recent one from E. Bohemia (Habřina nr. Hradec Králové, 1 male collected 21.vi.1995, see Martinek 2001) and an older one from C. Moravia (Lomnice nr. Tišnov, 1 female collected 2.vii.1970, see Martinek 1977). However, Martinek (1987) had listed this species from Bohemia but the original source of this record has not been traced. The above records are the first from the Czech Silesia.

Comments: Although *C. geniculatum* has been considered very rare in the Czech Republic the above records indicate that it has been probably overlooked due to its association with *Cytisus scoparius*. It was collected in broom bushes at Bělá in 1995 thus it occurred in the Czech Silesia in the past. Interestingly, *C. geniculatum* has not been found in the sand-pit at Godów (S. Poland), although there are old growths of broom and another broom-associated species, viz. *Micropeza lateralis* (see above), was recorded in this locality. *C. geniculatum* is here considered psammophilous for the same reason (association with broom) as is the latter species.

CHAMAEMYIIDAE

Leucopis aphidiperda Rondani, 1847 – psammoneutral

Material examined: CZECH REPUBLIC: N Moravia: Kolnovice 1 km SW, 50°18'55"N, 17°18'45"E, 385 m, sand-pit C part, sweeping over sand and sparse vegetation on sand, 7.6.2017, 1♂; Kolnovice 1.2 km WSW, 50°18'59"N, 17°18'35"E, 390 m, sand-pit W part, sweeping over sand and sparse vegetation on sand, 7.6.2017, 1♂, J. Roháček leg., M. Ebejer det. (SMOC).

Biology: Larvae of this species are predators of aphids *Aphis euonymi* Fabricius, *A. craccivora* Koch, *A. salviae* Walker, *A. schneideri* (Börner), *Brachycaudus cardui* (Linnaeus), *Cinara* sp. Because of the wide range of larval prey and, consequently, also their host plants (*Melilotus*, *Salvia*, *Ribes*, *Carduus*, *Euphorbia*, *Pinus* spp.), Tanasijtshuk (1986) considered *L. aphidiperda* a “broadly oligophagous” species.

Distribution: Azerbaidjan, Bulgaria, Georgia, Hungary, Italy, Iran, Lithuania, Moldova, Russia (European part, Far East), Kazakhstan, Kirghizia, Switzerland, Ukraine (Tanasijtshuk 1986; Gaimari 2013). First record from the Czech Republic.

Comments: The affinity of this species to sandy habitats is unknown. Considering the wide range of aphid prey and their host plants *L. aphidiperda* should be treated as a psammoneutral species but see general discussion below.

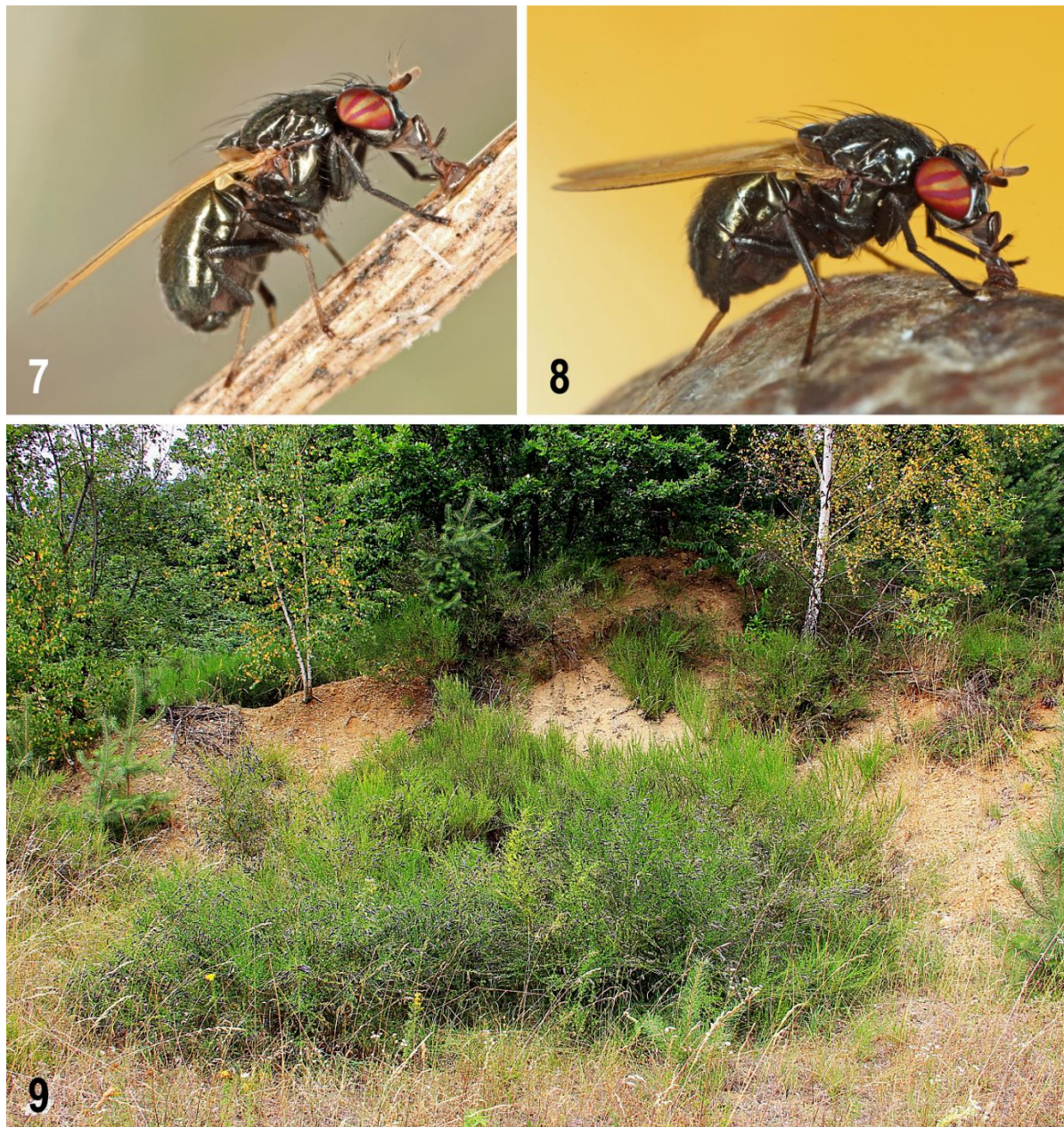
Leucopis atritarsis Tanasijtshuk, 1958 – psammoneutral

Material examined: CZECH REPUBLIC: N Moravia: Závada 1.8 km SE, sand-pit SE part, 49°56'19"N, 18°10'28"E, 260 m, sweeping over sand and sparse vegetation on sand, 29.6.2016, 1♂; 28.7.2016, 1♂; Kolnovice 1 km SW, 50°18'55"N, 17°18'45"E, 385 m, sand-pit C part, sweeping over sand and sparse vegetation on sand, 16.5.2018, 1♂; 19.9.2018, 1♀, J. Roháček leg., M. Ebejer det. (SMOC).

Biology: Tanasijtshuk (1986) listed rearing records from colonies of *Aphis citricola* van der Goot, *A. cytisorum* Hartig, *A. fabae* Scopoli, *A. idaei* van der Goot, *A. pimpinellae* Kaltenbach, *A. pomi* DeGeer, *A. rumicis* Linnaeus, *Glyphina betulae* (Linnaeus), *Hayhurstia atriplicis* (Linnaeus), *Hyalopterus pruni* (Geoffroy) and *Microlophium carnosum* (Beckton) on various trees, bushes or herbaceous plants, viz. *Citrus*, *Rubus*, *Saxifraga*, *Malus*, *Betula*, *Atriplex*, *Phragmites*, *Urtica* etc.

Distribution: A widespread Palaearctic species known from Britain, Bulgaria, France, Germany, Hungary, Italy, Moldova, Mongolia, Poland, Romania, Russia, Sweden, Switzerland, Ukraine, Middle Asian States, Eastern Russia (Tanasijtshuk 1986; Gaimari 2013). First records from the Czech Republic.

Comments: Treated as psammoneutral species owing to its wide prey and host plant tolerance (as for the foregoing species).



Figs 7–9: *Calliopum geniculatum* (Fabricius) its habitat. **7** – *C. geniculatum*, male in lateral view, body length ca 3.5 mm; **8** – the same, female, body length ca 3.6 mm; **9** – habitat of the species (and also of *Micropeza lateralis*), growths of *Cytisus scoparius* in marginal part of the Kolnovice sand-pit. Photo by J. Roháček.

***Leucopis celsa* Tanasijtshuk, 1979 – psammophilous?**

Material examined: CZECH REPUBLIC: N Moravia: Závada 1.6 km S, sand-pit NW part, 49°56'25"N, 18°09'56"E, 265 m, sweeping over sand and sparse vegetation on sand, 18.5.2017, 1♂; Kolnovice 1 km SW, 50°18'55"N, 17°18'45"E, 385 m, sand-pit C part, sweeping over sand and sparse vegetation on sand, 7.6.2017, 2♂; Kolnovice 1.2 km WSW, 50°18'59"N, 17°18'35"E, 390 m, sand-pit W part, sweeping over sand and sparse vegetation on sand, 7.6.2017, 1♀, J. Roháček leg., M. Ebejer det. (SMOC).

Biology: Prey not known. Possible host plant: *Calamagrostis pseudophragmites* (Haller f.) Koeler, see Tanasijtshuk (1986).

Distribution: Hungary, Switzerland, Tadjikistan (Tanasijtshuk 1986; Beschovski & Merz 1998). First record from the Czech Republic and a new northernmost distribution limit of the species.

Comments: Judging from the above information and the known distribution the species could be more xerophilous and associated with aphids living on large grasses. If so, *L. celsa* could be considered a psammophilous species.

***Leucopis glyphinivora* Tanasijtshuk, 1958 – psammoneutral** (Figs 10, 11)

Material examined: CZECH REPUBLIC: N Moravia: Závada 2 km S, sand-pit SW part, 49°56'09"N, 18°10'04"E, 270 m, sweeping over sand and sparse vegetation on sand, 12.5.2015, 6♀; 24.6.2015, 2♂ 2♀; 28.7.2015, 1♂ 1♀; 25.5.2016, 1♂ 1♀; 29.6.2016, 1♂ 1♀; 18.5.2017, 1♂ 1♀; Kolnovice 1 km SW, 50°18'55"N, 17°18'45"E, 385 m, sand-pit C part, sweeping over sand and sparse vegetation on sand, 16.5.2018, 4♂ 1♀; Supikovice 1.1 km NE, 50°18'22"N, 17°15'43"E, 380 m, abandoned sand-pit, S part, sweeping over sand and sparse vegetation on sand, 7.6.2017, 1♂ 2♀; 16.5.2018, 3♂ 4♀, J. Roháček leg., M. Ebejer det. (SMOC).

Biology: The species is polyphagous with larvae preying on more than 70 aphid species living on a wide range of host plants (Tanasijtshuk 1986).

Distribution: A widespread Holarctic species but in the Czech Republic only recorded from two localities in the Podyjí National Park in southern Moravia (Papp *et al.* 2005). First records from the Czech Silesia.

Comments: Considering its polyphagy (see above) *L. glyphinivora* can occur on various plants where its aphid prey live. According to Tanasijtshuk (1986) it is the most habitat tolerant species of Chamaemyiidae.

***Leucopis monticola* Tanasijtshuk, 1961 – psammoneutral**

Material examined: CZECH REPUBLIC: N Moravia: Kolnovice 1 km SW, 50°18'55"N, 17°18'45"E, 385 m, sand-pit C part, sweeping over sand and sparse vegetation on sand, 19.9.2018, 1♂, J. Roháček leg., M. Ebejer det.

Biology: Larvae were found in colonies of the following aphid species: *Aphis citricola* van der Goot on *Citrus reticulatus*, *A. idaei* van der Goot on *Rubus idaeus*, *A. urticata* Gmel. on *Urtica* sp., *Glyphina schrankiana* C. B. on *Alnus incana* and *Brachycaulus cardui* (L.) on *Carduus* sp. (see Tanasijtshuk 1986). Most records are from around 1000 m altitude.

Distribution: Only known from the southern half of the W. Palaearctic ranging from Spain through France (including Corsica), Italy, Romania, Turkey to Russia (Crimea, Dagestan) (Tanasijtshuk 1986). First record from the Czech Republic and the whole of central Europe.

Comments: A little known species formerly recorded from montane sites in southern areas of Europe. Because it is associated with common aphids living on omnipresent plants *L. monticola* hardly has any closer association with sandy habitats.

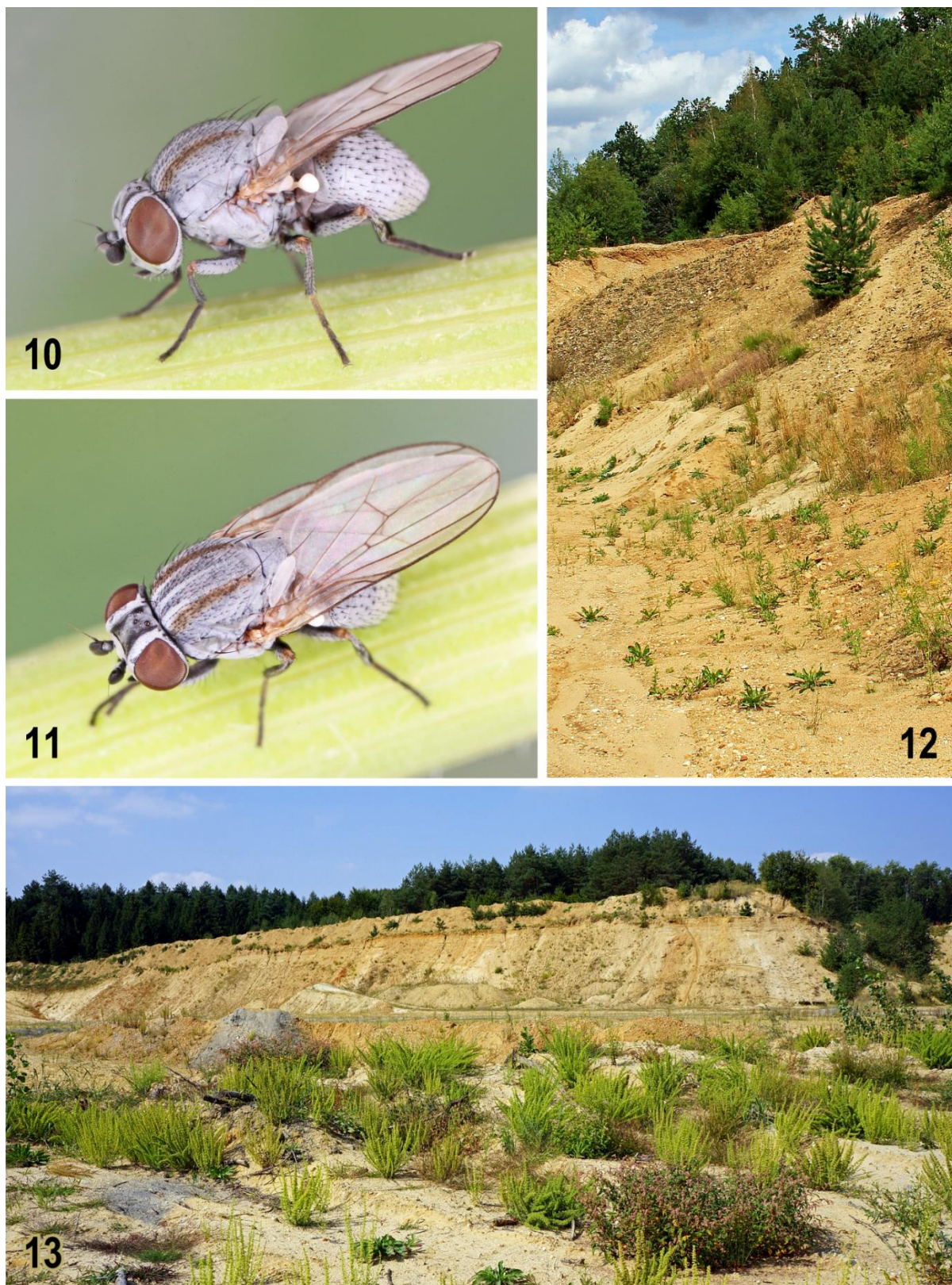
***Leucopis pallidolineata* Tanasijtshuk, 1961 – psammoneutral**

Material examined: CZECH REPUBLIC: N Moravia: Závada 2 km S, sand-pit SW part, 49°56'09"N, 18°10'04"E, 270 m, 29.8.2018, sweeping over sand and sparse vegetation on sand, 2♀; Kolnovice 1 km SW, 50°18'55"N, 17°18'45"E, 385 m, sand-pit C part, sweeping over sand and sparse vegetation on sand, 7.6.2017, 1♂, J. Roháček leg., M. Ebejer det. (SMOC).

Biology: A habitat and altitude tolerant species with larvae preying on various aphids (as many as 29 species recorded by Tanasijtshuk 1986) living on wide range of cultivated and wild plant species.

Distribution: A transpalaearctic species recorded from Europe (Bulgaria, France, Germany, The Netherlands, Italy, Moldova, Russia (European part), Switzerland, Ukraine, but also Iran, Turkey, Transcaucasia, Middle Asian States, Mongolia, China and Far East of Russia (Tanasijtshuk 1986). First records from the Czech Republic.

Comments: Treated as psammoneutral species owing to its wide prey and host plant tolerance (as for the majority of the above species). However, there are several records from elsewhere in the Palaearctic of this species occurring on sand dunes. This suggests that it is xerophilic and psammophilous to some extent.



Figs 10–13: *Leucopis glyphinivora* Tanasijtshuk and habitats of *Leucopis* species. **10** – *L. glyphinivora*, male in lateral view, body length ca 2.7 mm; **11** – the same in dorsal view; **12** – habitat of the *Leucopis* species, sparse spontaneous vegetation colonising bare sand in the Kolnovice sand-pit; **13** – similar habitat in NW part of the Závada sand-pit. Photo by J. Roháček.

General discussion on *Leucopis* species found on glacial sand deposits

In central Europe the peak flight period of most species of *Leucopis* is in June-July. This would fit well with the time large colonies of aphids become established. Overwintering takes place during the puparial stage in cold climates, but it may be as larvae in warmer regions. In the Mediterranean, as shown by Satar *et al.* (2015) the adult flight period occurs later and larvae can be found in winter. However, there are significant differences between species and the availability of alternative aphid prey colonies that become available as the seasons change could offer some polyphagous species of *Leucopis* an opportunity to exploit these and so may allow a second generation to develop.

Tansijtshuk (1986) gives a comprehensive list of prey of most species of Chamaemyiidae including the species of *Leucopis* newly recorded from the Czech Republic except for *L. celsa*, whose prey is unknown. However, he reports that this silver-fly was taken from *Calamagrostis pseudophragmitis* (Haller f.) Koeler, a widespread species of grass. On the other hand, *L. aphidiperda*, *L. atritarsis*, *L. pallidolineata* and, particularly, *L. glyphinivora* all have a long list of aphid prey species and in turn many of these aphids are polyphagous. Therefore, it is not surprising to find these species of *Leucopis* among spontaneous vegetation as may occur in the glacial sand deposits where the removal of sand regularly disturbs the flora. Satar *et al.* (2015) found Chamaemyiidae larvae preying on aphids that were infesting spontaneous vegetation that included *Capsella*, *Chenopodium*, *Cichorium*, *Cirsium*, *Mentha*, *Salvia*, *Sinapis*, *Solanum*, *Sorghum* and *Populus*, plants that were growing adjacent to cultivation of crops and orchards. Although none of these plants is strictly psammophilous, most of them can grow successfully on sand (Figs 12, 13) and on sandy soil substrate as long as this is organically enriched and has moisture. This can explain the unusual species diversity and abundance of *Leucopis* species (also *L. annulipes* Zetterstedt, 1848 recorded) and other Chamaemyiidae (2 species of *Neoleucopis*, 5 species of *Chamaemyia* and one *Parochthiphila* that are not listed here) recorded in glacial sand habitats under study, particularly in comparison to those in the surrounding woodland and/or agricultural biocoenoses.

AGROMYZIDAE

Cerodontha (Xenophytomyza) leptophallus L. Papp in Papp & Černý, 2016 – **psammophilous**

Material examined: CZECH REPUBLIC: N Moravia: Supíkovice 1.1 km NE, 50°18'22"N, 17°15'43"E, 380 m, abandoned sand-pit, S part, sweeping over sand and sparse vegetation on sand, 7.6.2017, 2♂, 16.5.2018, 2♂; Závada 1.6 km S, 49°56'25"N, 18°09'56"E, 265 m, sand-pit, NW part, sweeping over sand & sparse vegetation on sand, 25.5.2016, 1♂, all J. Roháček leg., M. Černý det. (SMOC).

Biology: Larva and host plant of *C. (X.) leptophallus* remain unknown but it can be presupposed that some grass species (Poaceae) serves as the host-plant of this species, similar to its closest relative, *C. (X.) biseta* Hendel, 1920 developing in *Poa* and *Holcus* species (Spencer 1990). Habitat of *C. (X.) leptophallus* in Závada sand-pit can be seen in Fig. 14.

Distribution: The species was originally described by L. Papp (in Papp & Černý 2016) on the basis of a single male from Kelet-Mecsek TK, Komlói: Zobákpusztá, Hidasi valley (southern Hungary). Most recently Černý (2018) recorded this species also in the Czech Republic from a sand-pit near the cemetery in Provodín in the Kokořínsko-Máchův kraj PLA (Bohemia) as well as from southern Spain (Embalse de Barbate). The above records are the first from Moravia.

Comments: *C. (X.) leptophallus* probably is a thermophilous species that could have closer affinity to sandy habitats because 3 (out of 5) records originate from sand-pits. Therefore, we have classified it as a psammophilous species.



Figs 14–15: Sandy habitats of species of Agromyzidae and Chloropidae. **14** – habitat of *Ophiomyia disordens* Pakalniškis (Agromyzidae), sparse vegetation on sandy slopes in NW part of the Závada sand-pit; **15** – habitat of *Aphanotrigonum parahastatum* Dely-Draskovits (Chloropidae), grasses on SW slope of the natural sand-hill nr. Bělá. Photo by J. Roháček.

***Liriomyza hieracivora* Spencer, 1971 – psammoneutral**

Material examined: CZECH REPUBLIC: N Moravia: Supíkovice 1.1 km NE, 50°18'22"N, 17°15'43"E, 380 m, abandoned sand-pit, S part, sweeping over sand and sparse vegetation on sand, 19.9.2018, 1♂, J. Roháček leg., M. Černý det. (SMOC).

Biology: The larva forms a primary upper surface blotch leaf mine on leaves of host plants *Hieracium* spp., including *H. lachenalii* and *H. levicaule* (Spencer 1976).

Distribution: A widespread Palaearctic species, described from Germany (Thuringia: Vogtland-Jocketal) and also known from the Czech Republic, Denmark, Hungary (Papp & Černý 2017), Lithuania, Poland, Sweden, Switzerland (Černý & Bächli 2018), Turkey and Russia (Yakutia). However, in the Czech Republic it has only been recorded from S. Moravia, based on a single male from Havraníky in the Podyjí National Park (Černý *et al.* 2006). The above record is the first from the Czech Silesia.

Comments: Host plants of *Liriomyza hieracivora* inhabit various dry as well as mesophilous habitats. Consequently, this leaf-miner fly obviously is not very closely associated with sandy habitat and should be classified as psammoneutral.

***Melanagromyza chaerophylli* Spencer, 1969 – psammoneutral**

Material examined: CZECH REPUBLIC: N Moravia: Závada 1.8 km SE, sand-pit SE part, 49°56'19"N, 18°10'28"E, 260 m, sweeping over sand and sparse vegetation on sand, 25.5.2016, 1♂, J. Roháček leg., M. Černý det. (SMOC).

Biology: Larvae of *M. chaerophylli* mine inside the stems of umbelliferous host plants *Anthriscus sylvestris*, *Chaerophyllum aromaticum*, *Ch. bulbosum* and *Heracleum sphondylium* (see Pakalniškis 1992).

Distribution: The species was described by Spencer from specimens reared from the stem of *Chaerophyllum bulbosum* collected in East Germany (Mühlhausen, Rieseninger); subsequently its presence was also confirmed in Finland, Lithuania and Slovakia (Papp & Černý 2015). A new addition to the fauna of the Czech Republic.

Comments: Considering the fact that the host plants of *M. chaerophylli* are common and habitat tolerant species the species obviously has no close association with sandy habitats.

***Ophiomyia disordens* Pakalniškis, 1998 – psammophilous**

Material examined: CZECH REPUBLIC: N Moravia: Závada 1.6 km S, sand-pit NW part, 49°56'25"N, 18°09'56"E, 265 m, sweeping over sand and sparse vegetation on sand, 20.8.2015, 1♂, J. Roháček leg., M. Černý det. (SMOC).

Biology: Larvae of this species are known to mine in stems of *Achillea ptarmica*, *Artemisia campestris* and *Tanacetum vulgare* (Asteraceae) (Pakalniškis 1998). The habitat of this species in Závada sand-pit resembles a dune overgrown by sparse vegetation (Fig. 14).

Distribution: The species was described from Lithuania (Pakalniškis 1998) and then also recorded from Hungary (Papp & Černý 2015) and Ukraine (Guglya 2012). *O. disordens* has recently been found also in the Czech Republic (Černý 2019) from localities in central Moravia: Skalička (collected on gravel-sand bank of the Bečva river) and Milotice nad Bečvou (on steppe meadow on sandy subsoil near lowland forest reserve Hustopeče-Štěrkáč. The above record is the first from the Czech Silesia.

Comments: Because host plants of *O. disordens* commonly grow on sands (also in the sand-pit Závada) and the two other records from Moravia (see above) also originate from sandy habitats we suggest this species be classified as probably psammophilous.

***Phytomyza cecidonomia* Hering, 1937 – psammoneutral**

Material examined: CZECH REPUBLIC: N Moravia: Supíkovice 1.1 km NE, 50°18'22"N, 17°15'43"E, 380 m, abandoned sand-pit, S part, sweeping over sand and sparse vegetation on sand, 7.6.2017, 1♂, J. Roháček leg., M. Černý det. (SMOC).

Biology: Larvae of this species mine the leaves of plants of the genus *Hypochoeris*. According to Spencer (1976) the main host plant of *P. cecidonomia* is *Hypochoeris radicata* where the larva feeds in the midrib, which can swell basally, gall-like, and is frequently accompanied by a reddish discoloration. Ellis (2018) added also *Crepis paludosa* and *Picris hieracioides* as host plants of this species.

Distribution: A West Palaearctic species recorded from Denmark, France, Germany, Great Britain, Greece (Černý 2011), Poland, Slovakia (Černý & Merz 2006), Sweden and Turkey (Civelek *et al.* 2009). First record from the Czech Republic.

Comments: Although at least one host plant (*Hypochaeris radicata*) of *P. cecidonomia* also occurs in the sand-pit Supíkovice, none of the above host plants is particularly associated with sandy soils and can also grow in other, although mostly relatively dry, habitats. *P. cecidonomia* can be a xerophilous species but obviously psammoneutral species.

***Phytomyza tanacetii* Hendel, 1923 – psammoneutral**

Material examined: CZECH REPUBLIC: N Moravia: Bělá near Chuchelná 0.5 km E sand-pit (distr. Opava), 49°58'26"N, 18°09'05"E, 250 m, sweeping over sand & sparse vegetation on sand, 6.9.2018, 1♂, J. Roháček leg., M. Černý det. (SMOC).

Biology: Larvae mine leaves of host plants of the genera *Achillea*, *Coleostephus*, *Leucanthemum* and *Tanacetum*. Spencer (1976) reported *Tanacetum vulgare* and *Achillea millefolium* as host plants of this species. Ellis (2018) supplemented the list of its host plants by the following European species: *Achillea clavennae*, *A. erba-rota* subsp. *moschata*, *A. ptarmica*, *Coleostephus myconis*, *Leucanthemum vulgare*, *Tanacetum cinerariifolium*, *T. corymbosum* and *T. macrophyllum*.

Distribution: A transpalaeartic species, in Europe known from Austria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Great Britain, Ireland, Lithuania, Norway, Poland, Romania, Slovakia, Spain and Sweden but also recorded from Kuril Islands in the Far East of Russia (Iwasaki 2000). In the Czech Republic the species occurs locally but is known from several localities scattered in both Bohemia and Moravia: Duchcov, Jizerské hory, Vráž u Písku, Březnice, Milotice nad Bečvou, Otrokovice-PP Na letišti and BR Pálava (Černý 2001, 2005, 2009, 2019, Černý & Vála 1999; Černý *et al.* 2013). However, Starý (1930) published finding larvae in leaves of *Laucanthemum vulgare* in the locality Držková-Červená hora in the Hrubý Jeseník Mts. and in leaves of *Tanacetum vulgare* near Lipník nad Bečvou. Also, Vimmer (1931) presented records of mined leaves of *Tanacetum parthenium* from the locality Plavý nr. Železný Brod and of *L. vulgare* from Červená hora nr. Brno, Písek, Protivín and Orlík. However, these old records have not been confirmed by reared adult specimens. The above record is the first from the Czech Silesia.

Comments: Because of the wide range of host plants (all Asteraceae) some of which grow on sand but others in distinctly different habitats *P. tanacetii* seems to be a habitat tolerant species. For this reason, it is classified as a psammoneutral species.

CHLOROPIDAE

***Aphanotrigonum parahastatum* Dely-Draskovits, 1981 – psammophilous**

Material examined: CZECH REPUBLIC: N Moravia: Bělá nr. Chuchelná 0.4 km NE, “Buben“ sand-hill, 49°58'29"N, 18°09'01"E, 260 m, sweeping over sand & vegetation on sand, 3.7.2017, 2♂ 1♀; 6.9.2018, 8♂ 1♀, J. Roháček leg., Š. Kubík det. (SMOC).

Biology: Unknown. This thermophilous species is found in sandy habitats (personal observation by ŠK from Turkey and Bulgaria). The above records originate from a natural sand-hill (originally a large sand dune formed by glaciolacustrine sediments of ice at a marginal lake after the Saalian Glaciation) where the specimens were swept from grasses growing on sandy ground (Fig. 15).

Distribution: A Mediterranean species, known from North Africa, Iberia, French mainland, Hungary, Bulgaria, Greek mainland and Crete, and Turkey (Nartshuk 2013; Kubík & Barták 2017). First record from the Czech Republic and the northernmost known occurrence of the species.

Comments: Because of its close association with sandy habitats the species is considered to be psammophilous.

***Meromyza ornata* (Wiedemann, 1817) – psammoneutral** (Figs 16, 17)

Material examined: CZECH REPUBLIC: N Moravia: Závada 1.6 km S, sand-pit NW part, 49°56'25"N, 18°09'56"E, 265 m, sweeping over sand and sparse vegetation on sand, 29.6.2016, 1♂; Závada 1.8 km SE, sand-pit SE part, 49°56'19"N, 18°10'28"E, 260 m, sweeping sparse vegetation on sand, 17.7.2013, 1♂; sweeping over sand and sparse vegetation on sand, 29.6.2016, 2♂; Závada 2 km S, sand-pit SW part, 49°56'09"N, 18°10'04"E, 270 m, sweeping over sand and sparse vegetation on sand, 28.7.2015, 1♂, J. Roháček leg., Š. Kubík det. (SMOC).

Biology: Larvae develop in shoots of *Deschampsia caespitosa*. According to Nartshuk & Andersson (2013) first instar larvae hibernate and in spring attack another shoot to complete their development. Fedoseeva (1966, as *M. sororcula*) described all instars of the larva. The specimens examined were swept from sparse graminoid vegetation on sand (cf. Fig. 18) also containing the host plant species.

Distribution: A rather common Eurasian species, ranging from the British Isles to Yakutia, East Siberia and Mongolia (Nartshuk 2013). In the Czech Republic only known from Bohemia (Kubík & Barták 2001, as *M. sororcula*; Kočová et al. 2012). First record from Moravia.

Comments: The host plant of *M. ornata* is a common, widespread and habitat tolerant grass without particular affinity to sandy habitats. Consequently, *M. ornata* is classified as a psammoneutral species.

***Meromyza palposa* Fedoseeva, 1960– psammoneutral**

Material examined: CZECH REPUBLIC: N Moravia: Bělá nr. Chuchelná 0.5 km E, sand-pit, 49°58'26"N, 18°09'05"E, 250 m, sweeping undergrowth of steppe forest, 13.7.1995, 1♂, J. Roháček leg. Š. Kubík det. (SMOC).

Biology: The grass *Nardus stricta* is the host plant of the larvae of this species (Fedoseeva 2003). Adults occur in dry meadows, in VI–VIII (Nartshuk & Andersson 2013).

Distribution: European species recorded from Albania, Austria, Belarus, Britain, Danish mainland, East European Russia, Estonia, Finland, Germany, Portugal, Latvia, Northwest European Russia, Poland, Slovakia, South European part of Russia, Sweden and The Netherlands (Nartshuk 2013). First record from the Czech Republic.

Comments: The grass *Nardus stricta* occurs rarely at low altitudes in the Czech Republic but can grow also in xerophilous habitats. Inasmuch as the sand deposits are not among its preferred habitat, *M. palposa* is also presumed not to have a closer affinity to this habitat.

Discussion and conclusions

Sand deposits in the Czech Silesia (NE Czech Republic) under study originate from Pleistocene glaciations, the older Elsterian (ca 400 000 ya) and the younger Saalian glaciation (ca 160 000 ya), see Růžicková *et al.* (2001), Růžicka (2004), Nývlt *et al.* (2011). They were formed either as glaciofluvial (in Jesenicko and Osoblažsko regions) and/or glaciolacustrine (largely in Hlučínsko and Karvinsko regions) sediments (Růžicková *et al.* 2001). The contemporary sandy habitats came into existence in these regions only in localities where the sand remained exposed, thus mainly in sand-pits, rarely in natural outcrops of sand on non-cultivated areas of land. The latter habitat type was found only in Bělá (near Chuchelná), on the “Buben” sand-hill (see Fig. 15). Because these glacial sand habitats are of distinctly insular type surrounded by largely agricultural landscape they represent extremely space-limited refugia for sand-loving fauna and flora.

Because the formerly published results of Diptera investigation in these habitats (Roháček & Ševčík 2013, Roháček 2015a,b, 2016a,b) provided new and valuable information, the field work on glacial sand habitats in Silesia was extended to cover as many as nine localities (see Fig. 3).

The recent research revealed a number of interesting species from faunistical, biogeographical and biological points of view. Some of them (a total of 18 species) belonging to Acalypterae are presented above. They all represent novelties in the fauna of the Czech Republic, Moravia or at least the Czech Silesia. More importantly, records of three of them, *Leucopis monticola*, *L. celsa* (both Chamaemyiidae) and *Aphanotrigonum parahastatum* (Chloropidae), represent new northernmost occurrence limits of these species. In addition, the hitherto known distribution area of *Micropeza lateralis* (Micropezidae) is extended eastwards by new findings from sand-pits in the Czech Silesia and S. Poland.

The above results confirm that glacial sand habitats studied in the Czech Silesia host a distinctive community of Diptera which comprises taxa closely associated with this ecosystem, namely psammobiont and psammophilous species (Roháček & Ševčík 2013, Roháček 2015a,b, 2016a,b). Although no psammobiont species have been added here, six were found to have distinct affinity to sandy habitats and can be considered psammophilous: *Micropeza lateralis* (Micropezidae), *Calliopum geniculatum* (Lauxaniidae), both associated with broom, *Cytisus scoparius*, and *Cerodontha (X.) leptophallus*, *Ophiomyia disordens* (both Agromyzidae), *Aphanotrigonum parahastatum* (Chloropidae), and possibly *Leucopis celsa*



Figs 16–18: *Meromyza ornata* (Wiedemann) and its habitat. **16** – *M. ornata*, male in dorsolateral view on grass stem, body length 4.4 mm; **17** – the same, in lateral view; **18** – habitat of the species, growth of various grasses in SW part of the Závada sand-pit. Photo by J. Roháček.

(Chamaemyiidae) which were mainly collected in microhabitats reminiscent of sand dunes or other sandy areas with sparse spontaneous vegetation (see Figs 12–14).

Other important components of the local dipterous communities are thermophilous and/or xerophilous species (cf. also Roháček 2015b, 2016a) which are probably of southern origin and often have been found in Silesia in northernmost known localities (see above). *Leucopis monticola*, *L. celsa*, *Cerodontha* (X.) *leptophallus* and *Aphanotrigonum parahastatum* can be examples of such species. The finding of the latter species, the submediterranean *A. parahastatum*, in the Czech Silesia seems to be most interesting inasmuch as it has been found in the habitat formed on the only (in the target area) natural outcrop of glacial sand but not in any of the sand-pits under study.

The above results are a further contribution to the knowledge of dipterous communities associated with glacial sand habitats in the Czech Silesia and the whole of Central Europe. It can be expected that the continuation of this research in the next years (2020–2022) will provide additional new information that can help to the understanding of the postglacial evolution of the sand-loving insect fauna in this region.

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Nové a zajímavé nálezy dvoukřídých (Diptera) na ložiskách glaciálních písků ve Slezsku (SV České republiky). Část 1 - Acalyptratae

V příspěvku jsou prezentovány nálezy 18 zajímavých druhů z čeledí Micropezidae (1 druh), *Lonchaeidae* (1 druh), *Lauxaniidae* (1 druh), *Chamaemyiidae* (6 druhů), *Agromyzidae* (6 druhů) a *Chloropidae* (3 druhy) zjištěné při výzkumu dipterofauny na glaciálních pískách v Českém Slezsku. Všechny to druhy jsou poprvé hlášeny z tohoto území, 4 z nich jsou nové pro faunu Moravy a 9 je nových pro území celé České Republiky. Podrobně je diskutována a hodnocena jejich afinita k písčitém biotopům. Žádný ze zaznamenaných druhů není sice psamobiontní, ale pět z nich je klasifikováno jako psamofilní, viz. *Micropeza lateralis* Meigen, 1826 (Micropezidae), *Calliopum geniculatum* (Fabricius, 1805) (Lauxaniidae), *Cerodontha* (*Xenophytomyza*) *leptophallus* L. Papp, 2016, *Ophiomyia disordens* Pakalniškis, 1998 (oba Agromyzidae), *Aphanotrigonum parahastatum* Dely-Draskovits, 1981 (Chloropidae) a *Leucopis celsa* Tanasijtshuk, 1979 jako provděpodobně psamofilní. Je prezentován nový nejvýhodnější nález druhu *Micropeza lateralis* z jižního Polska (Godów) a potvrzena vazba tohoto druhu, i druhu *Calliopum geniculatum*, na staré porosty janovce metlatého (*Cytisus scoparius*). Druhy *Leucopis monticola* Tanasijtshuk, 1961, *L. celsa* and *A. parahastatum* jsou na studovaném území zaznamenány z nejsevernějších známých lokalit. Tyto tři druhy, podobně jako *C. (X.) leptophallus*, jsou zřetelně teplomilné a nebo suchomilné a mohou být považovány za jižní prvky ve fauně dvoukřídleho hmyzu Slezska.

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