

Research article

Submitted: November 4th, 2023 – Accepted: April 5th, 2024 – Published: June 30th, 2024
DOI: 10.13133/2284-4880/1547

The species of the booklice genus *Liposcelis* Motschulsky, 1852 of Belarus (Psocoptera: Liposcelididae)

Artsiom OSTROVSKY^{1,*}, Dilian GEORGIEV²

¹ Department of Public Health and Health Services with the course of the Faculty of Professional Development and Retraining, Gomel State Medical University, 5 Lange Street, 246000 Gomel, Belarus – arti301989@mail.ru; <https://orcid.org/0000-0003-1729-9750>

² Department of Ecology and Environmental Conservation, University of Plovdiv, 24 Tsar Assen Street, 4000 Plovdiv, Bulgaria – diliangeorgiev@gmail.com; <https://orcid.org/0000-0003-2885-4895>

* Corresponding author

Abstract

Eight species of the apterous genus *Liposcelis* (Psocoptera: Liposcelididae), *L. bostrychophila* Badonnel, 1931, *L. corrodens* (Heymons, 1909), *L. decolor* (Pearman, 1925), *L. pearmani* Lienhard, 1990, *L. silvarum* (Kolbe, 1888), *L. formicaria* (Hagen, 1865), *L. aleksandrowiczii* Georgiev, Ostrovsky & Lienhard, 2020 and *L. sp. cf. entomophila* (Enderlein, 1907), are recorded for Belarus. The latter species is recorded in Belarus for the first time. Brief information about their modern distribution, as well as features of biology and ecology is given.

Key words: Liposcelididae, *Liposcelis*, new finds, fauna, Belarus.

Introduction

The booklice genus *Liposcelis* Motschulsky, 1852, belongs to the family Liposcelididae Broadhead, 1950, a kind of cosmopolitan wingless insects (Nayak et al. 2014). So far, a total of 127 species have been found worldwide (Johnson et al. 2023). It is one of the most important groups in both natural and anthropized habitats. Many play a vital role in natural ecosystems by making micro-organic debris and microflora available for others in the food chain. At the same time, they can worsen the quality of stored products by their presence, and for their important role as diffusers of a large variety of moulds. Some synanthropic species of *Liposcelis* spp. are of great allergenic significance (Kucerová 2002; Turner 1998).

The apterous genus *Liposcelis* for a long time has been represented in the fauna of Belarus by one species – *L. divinatorius* (Müller, 1776) (Litvinava 1985), but this problematic taxon is considered now as a *nomen dubium* (Lienhard & Smithers 2002). Since the beginning of our study of this group of insects, six representatives of this genus have been registered (Ostrovsky & Georgiev 2020, 2021) and one species new to science has been described (Georgiev et al. 2020). The finding of one further species, *L. sp. cf. entomophila* (Enderlein, 1907), is reported in this article.

Material and Methods

The study was carried out 2016–2023 in various biocenoses on the territory of the Gomel Region (South-Eastern Belarus). The booklice were collected by first author, using a sieve or by hand. In the wild, the plant debris, the areas under the bark, and litter were inspected, as well as the anthills, bird, mammal and wasp nests have been sieved; in the anthropogenic environment, the areas under household and construction waste, bird droppings, residential and non-residential premises, as well as entomological collections, were checked. Psocids were fixed in 96% ethanol or glycerin (when prepared on microscope slides) and were determined was carried out according to keys of Broadhead (1950), Martini (1975) and Lienhard (1998). The taxonomy is given according to the catalog of Lienhard & Smithers (2002). Information on the GPS coordinates (following WGS84 system, simplified) and altitude (in m a.s.l.) of the collecting sites are given for each species. The photos were taken by second author by a camera Canon PowerShot SX500IS through the eyepiece of a light microscope Optika and Carl Zeiss-Jena. Materials are deposited in the author's collections.

List of the Species**Genus *Liposcelis* Motschulsky, 1852*****Liposcelis aleksandrowiczi* Georgiev, Ostrovsky & Lienhard, 2020 (Fig. 1)**

Material examined. Gomel District: W of Gomel, Makeevka forestry, 52.25.13N, 30.53.31E, 137 m, 22 Aug 2020, roadside, in the nest of *Formica pratensis* Retz., 2 ex.; W of vill. Starye Dyatlovichi, 52.13.50N, 30.51.02E, 132 m, 20 Sep 2020, the edge of the power line clearing in the pine forest, in the nest of *Formica rufa* L., 5♀, 3 nymphs; vill. Borets, 52.17.56N, 30.57.07E, 121 m, 4 Jun 2022, in the nest of *Formica rufa* L. under the trunk of an oak tree, 11♀, 3♂, 2 nymphs; N of “Klenki” gardens, 52.27.21N, 31.05.17E, 125 m, 17 Sep 2022, in the nest of *Formica pratensis* Retz. under the trunk of an pine tree, 1♀; W of “Romantika” gardens near Klenki, 52.27.59N, 31.05.29E, 122 m, 17 Sep 2022, the hillside of a transformer substation in a meadow in the floodplain of the Sozh River, in the nest of *Formica pratensis* Retz., 5♀, 1♂; N of “Medvezhiy Log” gardens between the vill. Znamya Truda and the vill. Medvezhiy Log, 52.23.03N, 31.09.45E, 128 m, 15 Aug 2023, in the nest of *Formica pratensis* Retz. under the support of a power line in the field, 3♀, 3♂; N of vill. Borets, 52.18.19N, 30.57.20E, 123 m, 3 Sep 2023, pine forest, in an abandoned bird’s nest in the recess of a column of a brick building, 1♀.

Distribution. Known only from its type locality in SE Belarus (Georgiev et al. 2020).

Notes. Bisexual species (Georgiev et al. 2020). This species was previously known from nests of *Formica pratensis* Retz. (Georgiev et al. 2020). Is the first time this species is found in bird nests.

***Liposcelis bostrychophila* Badonnel, 1931 (Fig. 2)**

Material examined. Bragin District: vill. Gden’, 51.20.37N, 30.26.39E, 105 m, 29 Jul 2020, in an abandoned bird’s nest inside an old pear tree, 2♀. **Buda-Koshelevo District:** SW of vill. Rudnya-Ol’khovka, 52.32.54N, 30.22.35E, 140 m, 8 Nov 2020, pine forest, in the nest of *Formica rufa* L., 2♀; vill. †Yaslishche, 52.33.01N, 30.24.09E, 135 m, 8 Nov 2020, in the nest of *Formica polyctena* Förster, many ♀♀. **Dobrush District:** SW of vill. Dudarevo, 52.21.53N, 31.11.56E, 143 m, 12 Apr 2020, pine forest, in the nest of *Formica polyctena* Förster, many ♀♀. **Gomel:** Auerbaha Str., 52.25.49N, 30.59.12E, 140 m, 28 Sep 2019, in entomological collection, 11 ex.; 30 Oct 2019, in the same place, many ex.; 18 Oct 2020, in the same place, many ex.; 20 Sep 2022, in the same place, many ex.; 8 Oct 2019, in the herbarium, 2♀. **Gomel District:** SE of Gomel, Korenevka forestry, 52.22.29N, 31.02.34E, 133 m, 4 Jun 2017, mixed forest, in the nest of *Formica rufa* L., 6♀; 11 Oct 2020, mixed forest, in the nest of *Formica rufa* L., many ex.; 52.22.35N, 31.03.18E, 137 m, 11 Oct 2020, mixed forest, under oak bark, 1♀; 52.22.36N,

31.02.40E, 137 m, 11 Oct 2020, mixed forest, in the nest of *Formica rufa* L., 20♀; W of Gomel, Makeevka forestry, 52.25.13N, 30.53.31E, 137 m, 22 Aug 2020, roadside, in the nest of *Formica pratensis* Retz., many ex.; W of vill. Starye Dyatlovichi, 52.13.50N, 30.51.02E, 132 m, 20 Sep 2020, the edge of the power line clearing in the pine forest, in the nest of *Formica rufa* L., many ex.; vill. Starye Dyatlovichi, 52.13.48N, 30.51.30E, 125 m, 20 Sep 2020, sparse pine forest, in the nest of *Formica rufa* L., many ♀♀; E of vill. Starye Dyatlovichi, 52.13.55N, 30.53.25E, 113 m, 20 Sep 2020, a brick building of a stationary oil localization and collection line in case of emergencies at underwater crossings of the main oil pipeline “Unecha – Mozyr” across the Sozh River, in an abandoned nest of *Vespa crabro* L., many ♀♀; vill. Borets, 52.17.56N, 30.57.07E, 121 m, 4 Jun 2022, in the nest of *Formica rufa* L. under the trunk of an oak tree, 10♀, 1 nymph; N of vill. Borets, 52.18.19N, 30.57.20E, 123 m, 3 Sep 2023, pine forest, in an abandoned bird’s nest in the recess of a column of a brick building, many ♀♀. **Khoyniki District:** E of vill. †Krasnyi Pakhar’, 51.54.45N, 30.06.08E, 120 m, 30 Jul 2023, field, in an abandoned bird’s nest under a reinforced concrete bridge over the Velikiy Canal, 2♀; E of Khoyniki, 51.55.00N, 30.01.12E, 143 m, 1 Aug 2023, mixed forest, in the nest of *Formica rufa* L., 9♀; 51.55.03N, 30.01.17E, 139 m, 1 Aug 2023, mixed forest, in the nest of *Formica rufa* L., many ex.; 51.55.00N, 30.01.14E, 142 m, 1 Aug 2023, mixed forest, in the nest of *Formica rufa* L., 34♀, 1 nymph; 51.55.01N, 30.01.17E, 140 m, 1 Aug 2023, mixed forest, in the nest of *Formica polyctena* Förster, many ♀♀. **Loev District:** E of vill. Abakumy, 51.59.25N, 30.51.54E, 116 m, 13 Jun 2020, lowland oak forest, in the nest of *Formica pressilabris* Nyl., 7♀ and nymphs; 51.59.23N, 30.51.53E, 117 m, 13 Jun 2020, lowland oak forest, in the nest of *Formica rufa* L., many ♀♀; vill. Podrechitskoe, 52.02.05N, 30.47.12E, 112 m, 27 Aug 2022, in the nest of *Formica pratensis* Retz. under the trunk of an pine tree, 15♀, 2 nymphs.

Distribution. Cosmopolitan species found in Palaearctic Region including Africa, Atlantic Ocean Islands, Australia, Central America, Indian Ocean Islands, North America, Oriental Region and South America (Lienhard & Smithers 2002).

Notes. Parthenogenetic (thelytokous) species (Lienhard 1998). One of the most common polyphagous pest psocids of stored food products, particularly flours, cereals, semolina and rice (Turner 1994). This species was also described as a herbarium pest (Retief et al. 1995). Infestations of *L. bostrychophila* were found on paper, books and entomological collections (Turner 1987). This species also can survive on fungi in living places or storage areas (Mills et al. 1992). In the wild, it was found under the bark of trees, in anthills, abandoned bird and wasp nests.

***Liposcelis corrodens* (Heymons, 1909)** (Fig. 3)

Material examined. Bragin District: vill. Verkhnie Zhary, 51.20.51N, 30.35.13E, 104 m, 20 Jul 2020, in an abandoned nest of *Vespa crabro* L. in the attic of an abandoned house, many ex.; vill. Nizhnie Zhary, 51.17.32N, 30.34.14E, 103 m, 23 Jul 2020, in an abandoned swallow's nest inside an abandoned house, many ex.; 51.17.50N, 30.33.47E, 104 m, 23 Jul 2020, in an abandoned bird's nest under the roof of an abandoned house, many ex.; 51.17.51N, 30.33.25E, 106 m, 23 Jul 2020, in the marten's nest in the old bee-tree, many ex.; Zhary forestry between the vill. Nizhnie Zhary and the vill. Gden', 51.20.15N, 30.30.20E, 112 m, 25 Jul 2020, mixed forest, in an abandoned bird's nest inside an abandoned gazebo, many ex.; vill. Gden', 51.19.58N, 30.27.18E, 106 m, 27 Jul 2020, in an abandoned swallow's nest inside an abandoned house, many ex.; 51.20.29N, 30.26.15E, 105 m, 27 Jul 2020, in an abandoned bird's nest inside an abandoned house, many ex.; 51.20.04N, 30.27.12E, 103 m, 28 Jul 2020, in swallow droppings on the floor inside an abandoned house, many ex.; NW of vill. Velikiy Les, 51.54.38N, 30.09.01E, 124 m, 30 Jul 2023, pine forest, in the nest of *Formica rufa* L., 1♀. **Buda-Koshelevo District:** Uvarovichi, 52.36.18N, 30.44.54E, 131 m, 23 May 2019, among garbage remains and dry bird droppings in an old water tower, 29 ex.; between the vill. Uza and the vill. Rudenets, 52.35.30N, 30.49.01E, 138 m, 25 Oct 2020, spontaneous landfill of household waste, among the garbage, 2♂, 1 nymph; vill. Uza, 52.35.51N, 30.48.59E, 140 m, 1 Nov 2020, railway station, in an abandoned bird's nest inside an abandoned outbuilding, 2 ex.; S of vill. Rudnya-Ol'khovka, 52.32.43N, 30.23.02E, 144 m, 8 Nov 2020, pine forest, in the nest of *Formica rufa* L., many ♀♀ and ♂♂; vill. †Yaslishche, 52.33.01N, 30.24.09E, 135 m, 8 Nov 2020, in the nest of *Formica polyctena* Förster, many ♀♀; N of vill. †Yaslishche, 52.33.33N, 30.23.55E, 142 m, 8 Nov 2020, pine forest, in the nest of *Formica rufa* L., many ex.; SW of vill. Zarech'ye, 52.33.26N, 30.25.52E, 150 m, 23 Apr 2023, pine forest, in the nest of *Formica rufa* L., 1♂; 52.33.00N, 30.25.30E, 143 m, 23 Apr 2023, pine forest, in the nest of *Formica rufa* L., 3♂. **Dobrush District:** SW of vill. Dudarevo, 52.21.53N, 31.11.56E, 143 m, 12 Apr 2020, pine forest, in the nest of *Formica polyctena* Förster, many ♀♀; NE of vill. Larishchevo, 52.24.44N, 31.13.40E, 126 m, 16 Aug 2020, mixed forest on the bank of the Iput' River, in the mixed nest of *Formica rufa/polyctena*, 1♀; 52.24.44N, 31.13.39E, 126 m, 16 Aug 2020, mixed forest on the bank of the Iput' River, in the nest of *Formica rufa* L., many ex. **Gomel:** Auerbaha Str., 52.25.49N, 30.59.12E, 140 m, 8 Oct 2019, in the herbarium, 8 ex.; 18 Oct 2020, in entomological collection, many ex.; Kosmonavtov Av., 52.26.54N, 30.58.10E, 138 m, 14 Jul 2022, in a fallen down city swallow's nest, 1♂. **Gomel District:** S of vill. Zalyad'e, 52.25.37N, 31.10.27E, 119 m, 6 Sep 2020, pond shore, in the nest of *Formica rufa* L., many ex.; vill. Starye

Dyatlovichi, 52.13.48N, 30.51.30E, 125 m, 20 Sep 2020, sparse pine forest, in the nest of *Formica rufa* L., many ex.; W of vill. Starye Dyatlovichi, 52.13.50N, 30.51.02E, 132 m, 20 Sep 2020, the edge of the power line clearing in the pine forest, in the nest of *Formica rufa* L., many ex.; E of vill. Starye Dyatlovichi, 52.13.55N, 30.53.25E, 113 m, 20 Sep 2020, a brick building of a stationary oil localization and collection line in case of emergencies at underwater crossings of the main oil pipeline "Unecha – Mozyr'" across the Sozh River, in an abandoned nest of *Vespa crabro* L., many ♀♀; SE of Gomel, Korenevka forestry, 52.22.36N, 31.02.40E, 137 m, 11 Oct 2020, mixed forest, in the nest of *Formica rufa* L., 2♀ (many more); S of Gomel, Novobelitsa forestry, 52.20.36N, 30.59.53E, 122 m, 28 Mar 2021, mixed forest, in a beehive on a dry pine tree, 1♀; N of vill. Borets, 52.18.16N, 30.57.25E, 125 m, 4 Jun 2022, pine forest, in an abandoned bird's nest under the window on the two floor of an abandoned building, 3♀; 52.18.18N, 30.57.33E, 141 m, 4 Jun 2022, pine forest, in an abandoned nest of *Vespa crabro* L. inside an abandoned summerhouse, 5♀, 1 nymph; 52.18.18N, 30.57.32E, 140 m, 4 Jun 2022, pine forest, in the nest of *Formica rufa* L., 1♂, 5♀; 52.18.15N, 30.57.26E, 127 m, 3 Sep 2023, pine forest, in an abandoned bird's nest under the roof of an abandoned wooden building, 8♀; 52.18.19N, 30.57.20E, 123 m, 3 Sep 2023, pine forest, in an abandoned bird's nest inside an abandoned brick building, 10♂, 60♀, 2 nymphs; 3 Sep 2023, pine forest, in an abandoned bird's nest in the recess of a column of a brick building, many ♀♀ and ♂♂; N of vill. Znamya Truda, 52.22.46N, 31.08.23E, 130 m, 15 Aug 2023, in the nest of *Formica rufa* L. inside a ruined gazebo near the woods, 2♂, 17♀, 1 nymph; "Glushets" gardens, 52.15.28N, 30.50.40E, 121 m, 23 Aug 2023, in an abandoned bird's nest in a tangle of vines at the dacha, 2♀. **Khoyniki District:** vill. Okt'yabr', 51.54.54N, 30.02.42E, 126 m, 29 Jul 2023, in an abandoned swallow's nest inside an abandoned house, 2♂, 29♀, 3 nymphs; 51.54.55N, 30.02.39E, 126 m, 1 Aug 2023, in an abandoned bird's nest inside an abandoned house, 1♂, 16♀; 1 Aug 2023, in an abandoned swallow's nest inside an abandoned house, 2♂, 3♀; vill. Korchevo, 51.55.26N, 30.03.26E, 126 m, 31 Jul 2023, in an abandoned bird's nest inside an abandoned house, 6♂, 20♀, 2 nymphs. **Loev District:** E of vill. Abakumy, 51.59.23N, 30.51.53E, 117 m, 13 Jun 2020, lowland oak forest, in the nest of *Formica rufa* L., many ♀♀; NE of vill. Abakumy, 51.59.25N, 30.51.55E, 117 m, 10 Jun 2021, lowland oak forest, in an abandoned bird's nest in a hollow tree on the shore of a forest lake, 3♂, 5♀; vill. Karpovka, 52.01.09N, 30.54.06E, 116 m, 11 Jun 2021, in an abandoned swallow's nest inside an abandoned farm building, 2♀; 52.01.21N, 30.54.12E, 117 m, 12 Jun 2021, in an abandoned bird's nest inside an abandoned bathhouse, 4♂, 16♀, 2 nymphs; E of vill. Pervomaisk, 52.03.35N, 30.46.25E, 114 m, 25 Jun 2022, in an abandoned bird's nest inside an abandoned

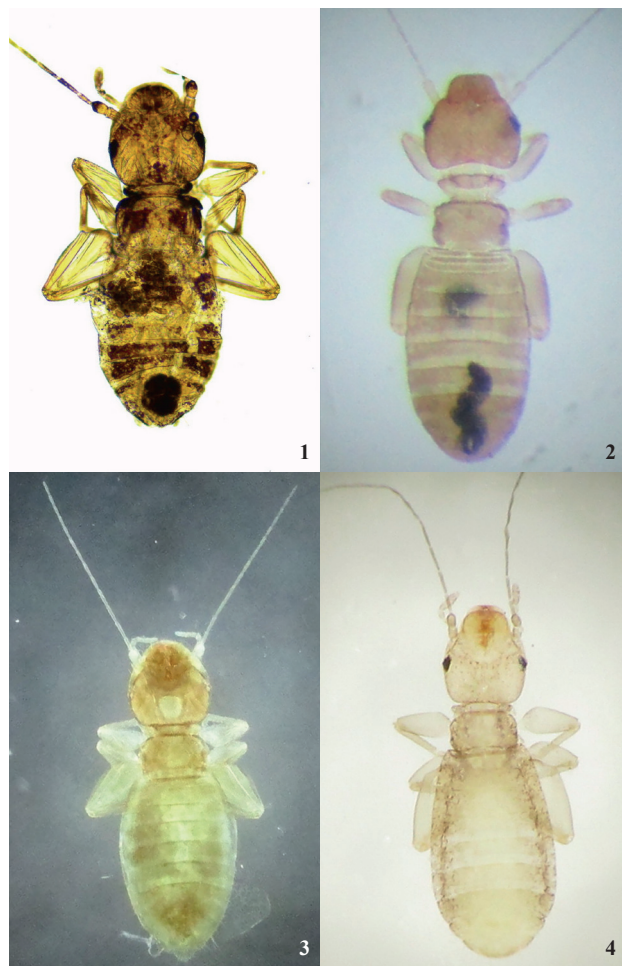
woodshed, 1♀; 27 Aug 2022, in an abandoned wasp's nest on the attic of an abandoned house, 2♂, 10♀, 1 nymph; 52.03.34N, 30.46.25E, 114 m, 27 Aug 2022, in a pile of dead bees on the floor of an abandoned house, 4♂, 15♀, 9 nymphs; N of vill. Koshevoe, 52.03.35N, 30.46.42E, 115 m, 25 Jun 2022, in an abandoned bird's nest inside an abandoned house, 7♂, 7♀, 1 nymph; vill. Koshevoe, 52.02.44N, 30.47.10E, 115 m, 25 Jun 2022, in an abandoned swallow's nest inside an abandoned brick building, 5♂, 8♀, 2 nymphs; 52.03.07N, 30.47.03E, 114 m, 27 Aug 2022, in the nest of *Formica rufa* L. inside an abandoned house, many ex.

Distribution. Nearly cosmopolitan species found in every continent except Antarctica (Yoshizawa & Lienhard 2010; Cui et al. 2020). *L. corrodens* has record occurring in nature in Palearctic Region and America (Lienhard 1994).

Notes. Bisexual species (Lienhard 1998). This is most common species of the genus *Liposcelis* and one of common stored product booklouse (Cui et al. 2020). Often domestic. Infestations of *L. corrodens* were found on paper, books, herbarium and entomological collections. This species also can survive on dead insects and dry bird droppings. In the wild, it was found in anthills, beehives, abandoned bird, mammal and wasp nests.

Liposcelis decolor (Pearman, 1925) (Fig. 4)

Material examined. Bragin District: vill. Nizhnie Zhary, 51.17.51N, 30.33.25E, 106 m, 23 Jul 2020, in the marten's nest in the old bee-tree, many ex.; Zhary forestry between the vill. Nizhnie Zhary and the vill. Gden', 51.20.15N, 30.30.20E, 112 m, 25 Jul 2020, mixed forest, in an abandoned bird's nest inside an abandoned gazebo, many ex.; vill. Gden', 51.20.29N, 30.26.15E, 105 m, 27 Jul 2020, in an abandoned bird's nest inside an abandoned house, many ex.; 51.20.04N, 30.27.12E, 103 m, 28 Jul 2020, in swallow droppings on the floor inside an abandoned house, many ex. **Buda-Koshelevo District:** SW of vill. Rudnya-Ol'khovka, 52.33.00N, 30.22.30E, 132 m, 8 Nov 2020, pine forest, in the nest of *Formica rufa* L., 17♀ and nymphs. **Dobrush District:** SW of vill. Dudarevo, 52.21.53N, 31.11.56E, 143 m, 12 Apr 2020, pine forest, in the nest of *Formica polycytena* Förster, many ♀♀; NE of vill. Larishchevo, 52.24.44N, 31.13.40E, 126 m, 16 Aug 2020, mixed forest on the bank of the Iput' River, in the mixed nest of *Formica rufa/polycytena*, 3♀. **Gomel:** Auerbaha Str., 52.25.49N, 30.59.12E, 140 m, 30 Oct 2019, in entomological collection, many ex.; 10 Jul 2021, in dry vegetable raw materials, 5 ex.; 2 Apr 2023, in the pantry, 3♀, 3 nymphs. **Gomel District:** W of Gomel, Makeevka forestry, 52.24.11N, 30.53.38E, 136 m, 2 May 2020, power line clearing in mixed forest, in the nest of *Formica exsecta* Nyl., 1♀; E of vill. Zalyad'e, 52.25.51N, 31.11.55E, 124 m, 23 Aug 2020, power line clearing in mixed forest, in the nest of *Formica rufa* L., many ex.; vill. Starye Dyatlovichi,



Figs 1-4 – Habitus of the so far known species of genus *Liposcelis* in Belarusian fauna: 1, *L. aleksandrowiczii*; 2, *L. bostrychophila*; 3, *L. corrodens*; 4, *L. decolor*.

52.13.48N, 30.51.30E, 125 m, 20 Sep 2020, sparse pine forest, in the nest of *Formica rufa* L., many ♀♀; W of vill. Starye Dyatlovichi, 52.13.50N, 30.51.02E, 132 m, 20 Sep 2020, the edge of the power line clearing in the pine forest, in the nest of *Formica rufa* L., many ex.; vill. Borets, 52.17.56N, 30.57.07E, 121 m, 4 Jun 2022, in the nest of *Formica rufa* L. under the trunk of an oak tree, 1 ex.; N of vill. Borets, 52.18.15N, 30.57.26E, 127 m, 3 Sep 2023, pine forest, in an abandoned bird's nest under the roof of an abandoned wooden building, 1♀; 52.18.19N, 30.57.20E, 123 m, 3 Sep 2023, pine forest, in an abandoned bird's nest inside an abandoned brick building, 4♀; 3 Sep 2023, pine forest, in an abandoned bird's nest in the recess of a column of a brick building, 4♀. **Khoyniki District:** vill. Oktyabr', 51.54.55N, 30.02.39E, 126 m, 1 Aug 2023, in an abandoned bird's nest inside an abandoned house, 2♀, 2 nymphs; 1 Aug 2023, in an abandoned swallow's nest inside an abandoned house, 1♂, 1 nymph; E of Khoyniki, 51.55.03N, 30.01.17E, 139 m, 1 Aug 2023, mixed forest, in the nest of *Formica rufa* L., many ex.;



Figs 5-8 – Habitus of the so far known species of genus *Liposcelis* in Belarusian fauna: **5**, *L. sp. cf. entomophila*; **6**, *L. formicaria*; **7**, *L. pearmani*; **8**, *L. silvarum*.

51.55.00N, 30.01.14E, 142 m, 1 Aug 2023, mixed forest, in the nest of *Formica rufa* L., 2♂, 2♀, 1 nymph; 51.55.01N, 30.01.17E, 140 m, 1 Aug 2023, mixed forest, in the nest of *Formica polyctena* Förster, 2♂, 8♀. **Loev District:** SW of vill. Svirezha, 51.59.47N, 30.52.17E, 115 m, 13 Jun 2020, the edge of the pine and lowland oak forests, in the nest of *Formica pressilabris* Nyl., 5♀ and nymphs; E of vill. Abakumy, 51.59.23N, 30.51.53E, 117 m, 13 Jun 2020, lowland oak forest, in the nest of *Formica rufa* L., many ♀♀; vill. Koshevoe, 52.02.44N, 30.47.10E, 115 m, 25 Jun 2022, in an abandoned swallow's nest inside an abandoned brick building, 2♀, 2 nymphs; 52.03.07N, 30.47.03E, 114 m, 27 Aug 2022, in the nest of *Formica rufa* L. inside an abandoned house, many ex.

Distribution. Nearly cosmopolitan species (Yoshizawa & Lienhard 2010).

Notes. Bisexual species (Lienhard 1998). Invasive psocid that is a minor pest of stored products internationally (Mikac & Fitzsimmons 2010). It is often domestic, found in warehouses and dwellings, dry vegetable raw materials,

entomological collections and similar commodities (Lienhard 1990, 1998). In the wild, it was mostly associated with anthills, bird and mammal nests.

***Liposcelis sp. cf. entomophila* (Enderlein, 1907) (Fig. 5)**

Material examined. Bragin District: NW of vill. Velikiy Les, 51.54.40N, 30.09.00E, 123 m, 30 Jul 2023, pine forest, in the nest of *Formica polyctena* Förster, 1♂. **Gomel District:** W of vill. Uza, 52.22.57N, 30.52.42E, 121 m, 1 Oct 2017, sand quarry, under cover, 1 ex. (dry sample, glued specimen, difficult to identify).

Distribution. Cosmopolitan species (Yoshizawa & Lienhard 2010). A new record for the fauna of Belarus.

Notes. Bisexual species (Lienhard 1998). Very often domestic. One of the most common pest psocids of stored food products, inhabiting warehouses, wheat granaries, dwellings, etc. (Lienhard 1990, 1998). In the wild, this species was found in anthills and on the surface of the soil.

***Liposcelis formicaria* (Hagen, 1865) (Fig. 6)**

Material examined. Bragin District: NW of vill. Velikiy Les, 51.54.40N, 30.09.00E, 123 m, 30 Jul 2023, pine forest, in the nest of *Formica polyctena* Förster, 4♂, 10♀. **Buda-Koshelevo District:** SE of vill. †Yaslishche, 52.32.54N, 30.25.20E, 147 m, 23 Apr 2023, pine forest, in the nest of *Formica rufa* L., 1♀; S of vill. †Yaslishche, 52.32.44N, 30.24.31E, 150 m, 23 Apr 2023, mixed forest, in the nest of *Formica rufa* L., 5♀. **Gomel District:** vill. Borets, 52.17.56N, 30.57.07E, 121 m, 4 Jun 2022, in the nest of *Formica rufa* L. under the trunk of an oak tree, 1 ex.; N of vill. Borets, 52.18.18N, 30.57.32E, 140 m, 4 Jun 2022, pine forest, in the nest of *Formica rufa* L., 17♀. **Khoyniki District:** E of Khoyniki, 51.55.03N, 30.01.17E, 139 m, 1 Aug 2023, mixed forest, in the nest of *Formica rufa* L., 1♀. **Loev District:** between the vill. Svirezha and vill. Karpovka, 52.00.40N, 30.53.20E, 122 m, 11 Jun 2021, the cutting area in the pine forest, in a fallen down birdhouse, 1♀.

Distribution. This is a mainly widespread Eurasian species but has been recorded also from U.S.A. (Yoshizawa & Lienhard 2010).

Notes. Bisexual species (Lienhard 1998). Often woodland (Lienhard 1990, 1998). It is species mostly associated with anthills and bird nests, also found under bark and on the surface of the soil.

***Liposcelis pearmani* Lienhard, 1990 (Fig 7)**

Material examined. Bragin District: W of vill. Velikiy Les, 51.54.22N, 30.09.40E, 124 m, 30 Jul 2023, mixed forest, in the nest of *Formica rufa* L., 2♂, 4♀, 4 nymphs; NW of vill. Velikiy Les, 51.54.40N, 30.09.00E, 123 m, 30 Jul 2023, pine forest, in the nest of *Formica polyctena* Förster, 1♂, 10♀. **Buda-Koshelevo District:** N of vill. †Yaslishche, 52.33.33N, 30.23.55E, 142 m, 8 Nov 2020, pine forest, in the nest of *Formica rufa*

L., 3♀, 1 nymph (many more); SW of vill. Zarech'ye, 52.33.00N, 30.25.30E, 143 m, 23 Apr 2023, pine forest, in the nest of *Formica rufa* L., 2♂, 4♀. **Gomel:** Auerbaha Str., 52.25.49N, 30.59.12E, 140 m, 12 Sep 2016, in entomological collection, 7 ex.; 17 Aug 2017, in the same place, 25 ex.; 18 Aug 2017, in the same place, 1 ex.; 19 Jul 2018, in the same place, 1♀; 10 Oct 2019, in the same place, 87 ex.; 12 Oct 2019, in the same place, 12 ex.; 30 Oct 2019, in the same place, many ex.; 20 Sep 2022, in the same place, many ex.; 7 Oct 2023, in the same place, 1♀. **Gomel District:** W of Gomel, Makeevka forestry, 52.24.11N, 30.53.38E, 136 m, 2 May 2020, power line clearing in mixed forest, in the nest of *Formica exsecta* Nyl., 1♀; 52.24.11N, 30.53.37E, 136 m, 22 Aug 2020, mixed forest, in the nest of *Formica rufa* L., many ♀♀ and ♂♂; E of vill. Zalyad'e, 52.25.51N, 31.11.55E, 124 m, 23 Aug 2020, power line clearing in mixed forest, in the nest of *Formica rufa* L., many ex.; S of vill. Zalyad'e, 52.25.20N, 31.10.48E, 117 m, 6 Sep 2020, meadow, in the nest of *Formica pratensis* Retz., 1♂; 52.25.37N, 31.10.27E, 119 m, 6 Sep 2020, pond shore, in the nest of *Formica rufa* L., many ex.; SW of vill. Zadorovka, 52.25.38N, 30.38.18E, 126 m, 8 May 2023, field, in an abandoned swallow's nest on a shepherd's hut, 1♀. **Khoyniki District:** E of Khoyniki, 51.55.00N, 30.01.12E, 143 m, 1 Aug 2023, mixed forest, in the nest of *Formica rufa* L., 17♀, 1 nymph; 51.55.03N, 30.01.17E, 139 m, 1 Aug 2023, mixed forest, in the nest of *Formica rufa* L., 5♂, 10♀, 1 nymph; 51.55.01N, 30.01.17E, 140 m, 1 Aug 2023, mixed forest, in the nest of *Formica polyctena* Förster, 1♂, 21♀, 2 nymphs. **Loev District:** E of vill. Abakumy, 51.59.23N, 30.51.53E, 117 m, 13 Jun 2020, lowland oak forest, in the nest of *Formica rufa* L., many ♀♀.

Distribution. This is a widespread European species but has been recorded also from Japan, China and U.S.A. (Yoshizawa & Lienhard 2010).

Notes. Bisexual species (Lienhard 1998). Often domestic. It is mainly found in houses, entomological collections, stored products (Lienhard 1990, 1998), sometimes in anthills and abandoned bird nests.

Liposcelis silvarum (Kolbe, 1888) (Fig 8)

Material examined. **Buda-Koshelevo District:** N of Uvarovichy, 52.36.28N, 30.43.15E, 137 m, 11 May 2021, field, in the harvest mouse's nest on the bush, 23♀, 6 nymphs. **Gomel District:** W of vill. Uza, 52.22.55N, 30.52.40E, 119 m, 1 Oct 2016, sand dune, under bark, 1 ex.; S of Gomel, Novobelitsa forestry, 52.20.36N, 30.59.53E, 122 m, 28 Mar 2021, mixed forest, in a beehive on a dry pine tree, 2♀; N of "Medvezhiy Log" gardens between the vill. Znamya Truda and the vill. Medvezhiy Log, 52.23.11N, 31.09.43E, 130 m, 18 Apr 2021, in an abandoned bird's nest on a tree, 1♀; vill. Gorodskaya Sloboda, 52.23.23N, 30.53.35E, 127 m, 22 May 2021, in a fallen

down birdhouse, 1♀; S of vill. Sharpilovka, 52.06.23N, 30.55.44E, 124 m, 21 Jun 2021, pine forest, in a fallen down birdhouse, 2♀; "Glushets" gardens, 52.15.28N, 30.50.40E, 121 m, 23 Aug 2023, in an abandoned bird's nest in a tangle of vines at the dacha, 1♀, 1 nymph. **Khoyniki District:** E of Khoyniki, 51.55.01N, 30.01.17E, 140 m, 1 Aug 2023, mixed forest, in the nest of *Formica polyctena* Förster, 1♂, 1♀.

Distribution. This is a mainly widespread Eurasian species but has been recorded also from Morocco, Canary Islands and U.S.A. (Yoshizawa & Lienhard 2010).

Notes. Bisexual species. Very often woodland (Lienhard 1990, 1998). It is species mostly associated with bird and mammal nests, also found in anthills and under bark.

Conclusions

As a result of this study, eight species of the apterous genus *Liposcelis* are recorded from south-eastern Belarus. One species, *L. sp. cf. entomophila* (Enderlein, 1907), is new for the Belarusian fauna. The fauna of Belarus consists of four cosmopolitan species, three Holarctic species, and one species that until now is apparently endemic. In the future we should expect an expansion of the species list of this group of insects, and we planned to continue further study on booklice of Belarus.

References

- Broadhead E. 1950. A revision of the genus *Liposcelis* Motschulsky with notes on the position of this genus in the order Corrodentia and on the variability of ten *Liposcelis* species. Transactions of the Royal Entomological Society of London, 101(10): 335–388, 3pls.
- Cui J., Su Y., Feng S., Wei P., Liu X., Li Z. 2020. Morphological and molecular identification of *Liposcelis corrodens* (Heymons, 1909) (Psocodea: Liposcelididae) as the first record from China. Journal of Stored Products Research, 87: 101588, Doi: 10.1016/j.jspr.2020.101588
- Georgiev D., Ostrovsky A., Lienhard C. 2020. A new species of *Liposcelis* (Insecta: Psocoptera: Liposcelididae) from Belarus. Ecologica Montenegrina, 29: 41–46, Doi: 10.37828/em.2020.29.6
- Johnson K.P., Smith V.S., Hopkins H.H. 2023. Psocodea Species File Online. Version 5.0/5.0. Available on-line at: <http://Psocodea.SpeciesFile.org>
- Kucerová Z. 2002. Weight losses of wheat grains caused by psocid infestation. Plant Protection Science, 38(3): 103–107.
- Lienhard C. 1990. Revision of the Western Palaearctic species of *Liposcelis* Motschulsky (Psocoptera: Liposcelididae). Zoologische Jahrbücher (Abteilung Systematik), 117: 117–174.
- Lienhard C. 1994. Staubläuse (Psocoptera) – ungebundene Gäste in Haus und Vorrat. Mitteilungen aus der Entomologischen Gesellschaft Basel, 44: 122–160.
- Lienhard C. 1998. Psocoptères Euro-Méditerranéens, pp. 1–517.

- In: Faune de France, Vol. 83, Fédération Française des Sociétés de Sciences Naturelles Press, Paris. [In French]
- Lienhard C., Smithers C.N. 2002. Psocoptera (Insecta). World catalogue and bibliography. pp. 1–745. In: Instrument Biodiversitatis, Vol. 5, Muséum d'histoire naturelle Press, Genève.
- Litvinava A.M. 1985. Barkflies (Psocoptera), p. 485. In: Shamyakin I.P. et al. (eds.), Encyclopedia of Nature of Belarus, Vol. 4, Belarusian encyclopedia named after Petrus Browka Press, Minsk. [In Belarusian]
- Martini J. 1975. Gryzki – Psocoptera, pp. 3–56. In: Goljan A., Mikołajczyk W., Mroczkowski M. (eds), Klucze do oznaczania owadów Polski, Vol. 14(85), PWN Press, Warszawa. [In Polish]
- Mikac K.M., Fitzsimmons N.N. 2010. Genetic structure and dispersal patterns of the invasive psocid *Liposcelis decolor* (Pearman) in Australian grain storage systems. Bulletin of Entomological Research, 100(5): 521–527.
- Mills J.T., Sinha R.N., Demianyk C.J. 1992. Feeding and multiplication of a psocid, *Liposcelis bostrychophilus* Badonnel (Psocoptera: Liposcelididae), on wheat, grain screenings and fungi. Journal of Economic Entomology, 85(4): 1453–1462.
- Nayak M.K., Collins P.J., Throne J.E., Wang J. 2014. Biology and management of psocids infesting stored products. Annual Review of Entomology, 59: 279–297.
- Ostrovsky A., Georgiev D. 2020. New Psocoptera (Hexapoda, Insecta) records from Belarus. ZooNotes, 157: 1–3.
- Ostrovsky A., Georgiev D. 2021. Some Psocoptera species (Hexapoda, Insecta) new to the fauna of Belarus. ZooNotes, 176: 1–3.
- Retief E., Nicholas A., Baijnath H. 1995. The psocid *Liposcelis bostrychophilus* Badonnel (Psocoptera: Liposcelidae): an occasional herbarium pest. Bothalia, 25(2): 247–253.
- Turner B.D. 1987. Forming a clearer view of *L. bostrychophilus*. Environmental Health, 95: 9–13.
- Turner B.D. 1994. *Liposcelis bostrychophila* (Psocoptera: Liposcelididae), a stored food pest in the UK. International Journal of Pest Management, 40(2): 179–190.
- Turner B.D. 1998. Psocids as a nuisance problem in the UK. Pesticide Outlook, 9: 27–30.
- Yoshizawa K., Lienhard C. 2010. In search of the sister group of the true lice: A systematic review of booklice and their relatives, with an updated checklist of Liposcelididae (Insecta: Psocodea). Arthropod Systematics & Phylogeny, 68(2): 181–195.

