A REVIEW OF THE GENUS LIPOLEXIS FÖRSTER, 1862 (HYMENOPTERA, BRACONIDAE: APHIDIINAE) IN THE FAUNA OF UKRAINE

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Genus Lipolexis Förster, 1862 is represented by four species in the world fauna and only one species, Lipolexis gracilis Förster, 1862, in the fauna of Europe, and Ukraine as well. Data on the genus Lipolexis and its species L. gracilis are presented according to available published information and material from collection of I. I. Schmalhausen Institute of Zoology, NAS of Ukraine, identified by author. Lipolexis gracilis is distributed generally in Palaearctic and Oriental regions, where it prefers steppificated habitats. In Ukraine species is recorded in Cherkasy, Kirovohrad and Ternopil Regions, which are situated in Forest-Steppe Zone and Zone of Broadleaf Forests of Ukraine. Lipolexis gracilis is polyphagous species that parasitizes various aphid species mostly from subfamily Aphidinae, as well as aphids from subfamily Anoeciinae and subfamily Calaphidinae. Data on tritrophic interactions of L. gracilis in the fauna of Ukraine is given and possibility of species application as a biocontrol agent is discussed. In Ukraine L. gracilis was reared from Aphis cracciae L., Aphis craccivora Koch, Aphis fabae Scopoli, and Brachycaudus cardui L. Among hosts of L. gracilis, there are economically important aphids, and this species was previously used as biocontrol agent of soybean aphid, Aphis glycines Matsumura. On our opinion this aphidiine species could be considered as potential biocontrol agent of other economically important aphid species. To facilitate identification of L. gracilis a new morphological character is established: this is the ratio of the forewing length and the length of C+SC+R vein. This character will facilitate identification of broken specimens.

Key words: aphidiines, aphid parasitoids, Lipolexis, tritrophic interactions, Ukraine.
Introduction. Aphidiines (Hymenoptera, Braconidae: Aphidiinae) are solitary endoparasitoids of aphids; some aphidiine species are important as biocontrol agents that are used to manage pest aphids throughout the world (Starý, 1970; Tobias and Chiriac, 1986; Davidyan, 2007; Yu et al., 2012). Before the beginning of our research, data on aphidiines of Ukraine was rather scarce (Kaliuzhna, 2015, 2017). Now we continue to fill the gap in the knowledge of this evolutionary interesting and practically important braconid subfamily in Ukraine.

Genus Lipolexis Förster, 1862 is distributed worldwide and includes four species: Lipolexis gracilis Förster, 1862, L. myzakkaiae Pramanik & Raychaudhuri, 1984, L. oregmae Gahan, 1932, L. wuyiensis Chen, 1981. Only one species, L. gracilis, is registered in Europe (Yu et al., 2012). Lipolexis is included in tribe Trioxini, however this genus has rather complicated phylogenetic position that needs further clarification (Žikić et al., 2017). For the fauna of Ukraine Lipolexis was recorded by Tobias and Chiriac (1986) for Crimea (but no material was mentioned) and by the author for the Forest-Steppe Zone of Ukraine (Kaliuzhna, 2015; Kaliuzhna and Zubenko, 2013). Previously review of data on Lipolexis from the fauna of Ukraine was absent.

Material and methods. Material was collected from 2010 until 2018 by sweeping in various regions of Ukraine or rearing in laboratory from infested aphids collected in a field. Morphological characters were examined on slides under upright Olympus CX41 microscope with mounted camera Olympus C3040. The morphological terminology follows the Hymenoptera Anatomy Ontology (Yoder et al., 2010), and Sharkey & Wharton (1997). Material is deposited in I.I. Schmalhausen Institute of Zoology, NAS of Ukraine (SIZK). Geographical coordinates were found through Google Earth Pro, version 7.3.2.5491 (64-bit), and show location of the settlement indicated on the label.

Results and discussion. Lipolexis gracilis Förster, 1862

Lipolexis chinensis Chen, 1980; Lipolexis palputor (Gautier et Bonnamour, 1931); Lipolexis pietlaimi (Quilis, 1931)


Habitats: Steppe and meadows, rarely forest edges and gardens (Starý, 1965, 2006; Starý and Lukáš, 2009).

Distribution: Europe, North Africa, Turkey, Iran, Middle East, Russia (European part, Siberia, Far East); Central Asia, China, Japan, Korea, India, Pakistan, Thailand (Yu et al., 2012).

Trophic specialization: poliphasous.


Notes on bionomy: Lipolexis gracilis belongs to steppe complex of aphidiine species (Tobias and Chiriac, 1986; Starý, 1965). It is a parasitoid of many aphid species from three aphid subfamilies (see the list of hosts above). Among them, there are economically important aphids, such as Aphis craccivora Koch, A. fabae Scopoli, A. gossypii Glover, Brachycadus helichrysi (Kalt.), Myzus cerasi


In Ukraine *L. gracilis* was reared mostly from *Aphis* spp. as well as from *Brachycaudus cardui* L. (table 1).

*Lipolexis gracilis* was previously considered as biocontrol agent of soybean aphid, *Aphis glycines* Matsumura (Heimpel et al., 2004). Moreover, P. Starý considered *L. gracilis* as a valuable biological control agent of economically important aphids because of its ability to colonize agricultural fields early in the growing season (Starý, 1966 by Heimpel et al. 2004).

On our opinion, this aphidiine species could be considered as potential biocontrol agent of economically important aphid species in Ukraine (Kaliuzhna, 2017).

Table 1

<table>
<thead>
<tr>
<th>Aphid</th>
<th>Plant</th>
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<tbody>
<tr>
<td><em>Aphis craccae</em> L.</td>
<td><em>Vicia sylvatica</em> L.</td>
</tr>
<tr>
<td><em>Aphis craccivora</em> Koch</td>
<td><em>Medicago procumbens</em> Bess.</td>
</tr>
<tr>
<td><em>Aphis fabae</em> Scop.</td>
<td><em>Trifolium aureum</em> Poll.</td>
</tr>
<tr>
<td><em>Brachycaudus cardui</em> L.</td>
<td><em>Cirsium arvense</em> (L.) Scop.</td>
</tr>
</tbody>
</table>

Notes on morphology of *Lipolexis gracilis*: *L. gracilis* is identified via several diagnostic characters. These are specific shape of ovipositor sheath (curved downwards and with little dilation on apex) and venation pattern (fig. 1), sculpture of propodeum and petiole (Starý, 1959; Tobias and Chiriac, 1986). However, there are reports of other researchers that *L. gracilis* is not a single species, but rather species group, because of ambiguities of morphological characters and quite wide host range (Poodineh et al., 2012). This hypothesis makes searching for the new diagnostic characters very actual. Recently we have initiated comparative review of aphidiine morphology, especially the body parts being traditionally neglected and rarely used in aphidiine taxonomy (Kaliuzhna, 2016). New characters will help to facilitate identification of specimens, which do not have important body parts with traditional diagnostic characters (it could be male specimens or broken specimens of both sexes).

Venation of *L. gracilis* is characterized as "hook type" (Žikić et al., 2017) and in general is similar with representatives of genera *Diaeretiella*, *Adialytus*, *Trioxys*, *Binodoxys* and some others (fig. 2).

Nevertheless, *L. gracilis* has very characteristic forewing venation with wide triangular stigma, long R1 and r&RS veins (fig. 2, a). The latter vein is very long, almost reaching forewing edge. The forewing of *L. gracilis* is clearly different from *Diaeretiella* (fig. 2, e) and *Diaeretus* spp. (fig. 2, f),

Fig. 1. Scheme of "hook type" forewing venation (*Lipolexis gracilis*).
which have short R1 and r&RS veins; difference is noticeable comparing with Adialytus spp. (fig. 2, d), which have long R1, but shorter r&RS vein. However, it is not so easy to describe the difference between forewings if compared with representatives of Trioxys (fig. 2, b) and Binodoxys (fig. 2, c). In this case, we recommend looking at forewing proportion. If we compare ratio of the whole length of forewing (fig. 3, a, Lw) and C+SC+R vein length (fig. 3, a, Lc), we will see, that L. gracilis has shorter proximal part of the forewing and longer distal part comparing to representatives of Trioxys and Binodoxys (fig. 3, b). Measurements are given in the table 2.

As we can see (table 2), Lw/Lc ratio in L. gracilis exceeds 2.5, however this ratio in other species does not reach 2.4. It remains a question whether this character is true to other species of Lipolexis. Unfortunately, we have not enough specimens of L. gracilis to perform appropriate statistical analysis. As the next step of research, we plan to collect more material and conduct morphometric analysis of L. gracilis forewing venation in comparison with representatives of genera with the same venation pattern.

Fig. 2. Venation of “hook type” forewings: a – Lipolexis gracilis, b – Binodoxys acalephae, c – Trioxys pallidus, d – Adialytus salicaphis, e – Diaeretiella rapae, f – Diaeretus leucopterus. Scale bar: 0,5 mm

Fig. 3. Diagnostic character in forewing venation: a – ratio of the length of forewing (Lw) and C+SC+R vein length (Lc); b – comparison of forewing of Lipolexis gracilis (grey color) and Binodoxys acalephae (black color).
Table 2

<table>
<thead>
<tr>
<th>Species</th>
<th>Lw/Lc ratio</th>
</tr>
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<tbody>
<tr>
<td>Lipolexis gracilis</td>
<td>2.55</td>
</tr>
<tr>
<td>Binodoxys acalephae</td>
<td>2.26</td>
</tr>
<tr>
<td>Trioxys pallidus</td>
<td>2.32</td>
</tr>
<tr>
<td>Adialytus salicaphis</td>
<td>2.32</td>
</tr>
<tr>
<td>Diaeretiella rapae</td>
<td>2.38</td>
</tr>
<tr>
<td>Diaeretus leucopterus</td>
<td>2.37</td>
</tr>
</tbody>
</table>
Junk (Series entomologica, vol. 6).


