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Descriptions of a new aphid species of *Lipaphis* Mordvilko, 1928 (Hemiptera: Aphididae) from South Korea and the hitherto unknown oviparae of *Lipaphis ruderalis* Börner, 1939 from the Czech Republic

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Abstract. Apterous viviparous ♀♀ of *Lipaphis* (*Lipaphidiella*) *holmani* sp. nov., living on *Lepidium virginicum* L. (Brassicaceae) in South Korea, are described and differences with all known species belonging to the subgenus *Lipaphidiella* Doncaster, 1954 and *Lepidium*-feeding *Lipaphis* spp. are presented. In addition, the poorly known *Lipaphis sisymbrii* Bozhko, 1976 is redescribed based on apterous and alate viviparous ♀♀ from Kazakhstan and its subgeneric position based on the morphological features is revised. Finally, the hitherto unknown oviparous ♀♀ of *Lipaphis ruderalis* Börner, 1939 are described from the Czech Republic. An identification key for apterous viviparous ♀♀ of all species currently included in the subgenus *Lipaphidiella* is given.

Key words. Aphids, Asia, Macrosiphini, *Lipaphidiella*, taxonomy.

INTRODUCTION

The genus *Lipaphis* Mordvilko, 1928 (Aphididae: Aphidinae: Macrosiphini) was erected for *Aphis erysimi* Kaltenbach, 1843 (type species). The genus comprises 12 species within two subgenera: *Lipaphidiella* Doncaster, 1954 (3 species) and *Lipaphis* Mordvilko, 1928 (9 species) which are associated without host alternation with Brassicaceae mostly in the Western Palaearctic region (Blackman 2010; Blackman & Eastop 2022). The mustard aphid *Lipaphis pseudobrassicae* (Davis, 1914) is an important pest of *Brassica* crops worldwide (Blackman & Eastop 2000). *Lipaphis* is related to *Brevicoryne* Das, 1915, and is characterized in apterae by weakly developed antennal tubercles, short antennae, the absence of secondary rhinaria on antennal segment III, a wrinkled or reticulate sclerotic dorsum, cylindrical or distally slightly swollen siphunculi, broadly based, tongue-shaped, or elongate triangular cauda with 4–6 setae, and 3:3:2 or 3:3:3 first tarsal chaetotaxy (Heie 1992; Blackman & Eastop 2006; Blackman 2010).

During an examination of Jaroslav Holman's aphid collection deposited at Biology Centre CAS, Institute of Entomology, České Budějovice, Czech Republic (IECA), fourteen slides with aphids determined by J. Holman as "*Lipaphis"* or "*Lipaphis* aff. *lepidii*", sampled on *Lepidium virginicum* L. (Brassicaceae) in South Korea and two slides with aphids determined as "*Lipaphis ruderalis"* by J. Holman, sampled on *Lepidium ruderale* L. (Brassicaceae) in the Czech Republic were found.

The following 12 aphid species are recorded on *Lepidium virginicum* worldwide: *Aphis craccivora* (Koch, 1854), *A. fabae* Scopoli, 1763, *A. gossypii* Glover, 1877, *Brevicoryne brassicae* (Linnaeus, 1758), *Lipaphis pseudobrassicae* (Davis, 1914), *Macrosiphum euphorbiae* (Thomas, 1878), *Myzus ascalonicus* Doncaster, 1946, *M. ornatus* Laing, 1932, *M. persicae* (Sulzer, 1776), *Neomyzus circumflexus* (Buckton, 1876), *Pemphigus populitransversus* Riley, 1879, and *Protaphis middletonii* (Thomas, 1879) (Holman 2009; Villalobos Muller et al. 2010; Blackman & Eastop 2022), while 11 aphid species (*Aphis craccivora* Scopoli, 1763, *A. gossypii* Glover, 1877, *Aulacorthum solani* (Kaltenbach, 1843), *Brevicoryne brassicae* (Linnaeus, 1758), *Lepidaphis deformans* (Nevsky, 1929), *Lipaphis erysimi* (Kaltenbach, 1843), *L. lepidii* (Nevsky, 1929), *L. ruderalis* Börner, 1939, *Macrosiphum euphorbiae* (Thomas, 1878), *Myzus cerasi* (Fabricius, 1775), *M. persicae* (Sulzer, 1776)) are record-

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ed on *Lepidium ruderale* (Holman 2009; Blackman & Eastop 2022).

Among the examined material an undescribed *Lipaphis* species from South Korea feeding on *Lepidium virginicum*, and hitherto unknown oviparae of *Lipaphis ruderalis* Börner, 1939 were recognized. The undescribed species and *Lipaphis ruderalis* belong to the subgenus *Lipaphidiella* because they have a medial supracaudal process on abdominal tergite VIII (Doncaster 1954; Heie 1992; Blackman & Eastop 2006). *Lipaphis sisymbrii* Bozhko, 1976 was described extremely briefly on *Sisymbrium polymorphum* (Murray) Roth (Brassicaceae) from Ukraine (Bozhko 1976). Therefore, it became necessary to redescribe it in more detail.

Here we describe the new *Lipaphis* species from South Korea and the hitherto unknown oviparae of *Lipaphis ruderalis*; in addition, we redescribe the poorly known *L. sisymbrii* and revise its subgeneric position.

MATERIAL AND METHODS

The measurements of the morphological characters of aphid specimens mounted on slides were done according to Blackman & Eastop (2006) using an Accu–Scope–Exc–350 compound microscope, and each character was measured using CaptaVision Software ver. 3.9. and photographed with a Excelis HDS digital camera. Measurements are given in millimeters (mm). Actual host plant names are given according to The Plant List (2013).

Abbreviations for morphological terms

ABD TERG	= abdominal tergite
ANT	= antenna
ANT I–VI, Vb, VIb	= antennal segments I–VI, Vb , VIb respectively
ANT III BD	= basal diameter of antennal segment III
BL	= length of body along midline, excluding cauda
BW	= maximum width of body
FTC	= first tarsal chaetotaxy
HFEM	= hind femur
HTIB	= hind tibia
HT II	= second segment of hind tarsus
HW	= head width across compound eyes
L	= length
MSL	= maximal setal length
MTu	= marginal tubercle(s)
PT	= processus terminalis
SIPH	= siphunculus
URS	= ultimate rostral segments IV and V together
W	= width

Institutional abbreviations

BMNH	=	Natural History Museum, London, UK
IECA	=	Biology Centre CAS, Institute of Entomology, České Budějovice, Czech Republic
IZAK	=	Institute of Zoology, Ministry of Education and Sciences, Almaty, Kazakhstan
IZISU	=	Institute of Zoology, Ilia State University, Tbilisi, Georgia

RESULTS

Taxonomy

Lipaphis holmani sp. nov.

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Figs 1, 3, 5, Table 1

Type material

Holotype. N 99HO39A, apterous viviparous ♀ on slide, on *Lepidium virginicum* L., SOUTH KOREA, Gyeonggi Province, Suwon, Yeogisan (as "Yogi-san, Kvonggi-do prov." On slide label), 37°16'49" N, 126°59'0" E, 105 m a.s.l., 09.v.2003, J. Holman leg. (IECA).

Paratypes. 13 apterous viviparous ♀♀ on slides: N 99HO39A, 10 apterous viviparous ♀♀ on slides, the same data as for holotype, (IECA); N TA–T–00054-55, 2 apterous viviparous ♀♀ on slides, the same data as for holotype, (IZISU); N 99HO39A, 1 apterous viviparous ♀ on slide, the same data as for holotype, (BMNH).

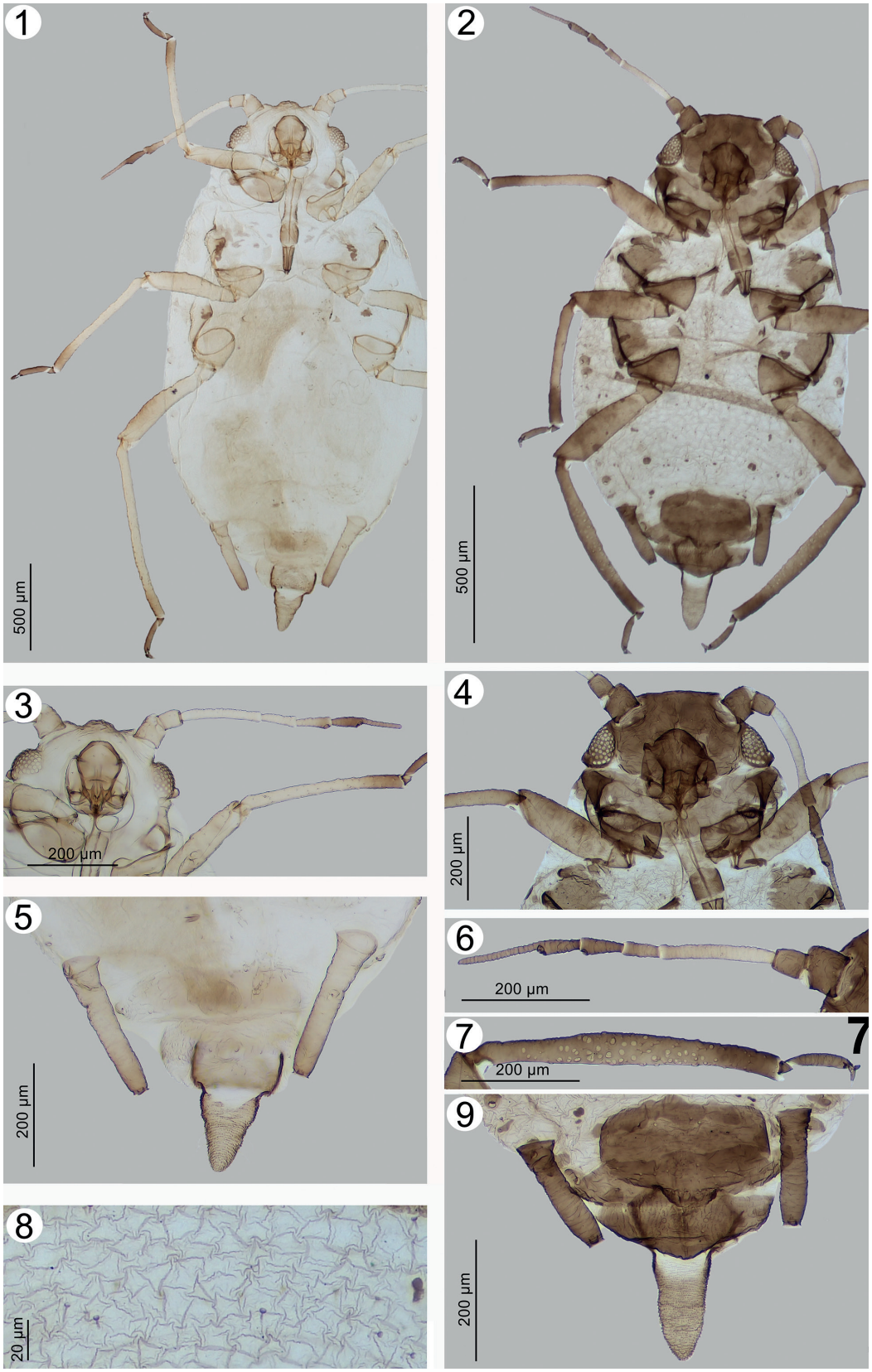
Etymology. The authors have chosen the specific name in honor of Dr Jaroslav Holman, who was collector of this species and outstanding aphid taxonomist.

Description

Apterous viviparous ♀ (n = 14)

Color in life: Unknown. *Pigmentation on slide*: ANT I–II brown, concolorous to head dorsum; ANT III–IV pale; ANT V pale with brown apex; ANT VI, clypeus, rostral III–V and tarsi dark brown; cluster of round–shaped dark brown spots always developed in pleural position on the thorax; coxae and trochanters pale brown; femora with pale bases and gradually darker remaining parts; tibiae with pale middle section and pale brown bases and dark brown apices; dark intersegmental sclerites on abdomen always absent; SIPH pale brown with darker apical ⅓ or ¼; brown transverse bands present on ABD TERG VII–VIII; subgenital and anal plates and cauda pale brown; stigmal plates brown (Fig. 1).

Morphological characters: Body oval. Frons w-shaped (Figs 1, 3). ANT 6–segmented (Figs 1, 3). ANT tubercles lower than rounded medial frontal tubercle. ANT cuticle imbricated. Primary rhinaria ciliated. Secondary rhiniaria always absent. Rostrum short, reaching to middle coxae. URS sub-parallel sided with pointed apex and fine



Figs 1–9. 1, 3, 5. *Lipaphis holmani* sp. nov. apterous viviparous ♀. **2, 4, 6–9**. *L. ruderalis* Börner, 1939 oviparous ♀. 1. Apterous viviparous ♀, general view. **2**. Oviparous ♀, general view. **3**. Head and antenna. **4**. Head. **5**. Posterior end of abdomen. **6**. Antenna. 7. Hind tibia with scent plaques. **8**. Dorsal abdominal cuticle. **9**. Posterior part of abdomen.

Table 1 (continued on next page). Metric and meristic characteristics of apterous viviparous ♀♀ of *Lipaphis* (*Lipaphidiella*) *holmani* sp. nov. and oviparous ♀♀ of *L.* (*Lipaphidiella*) *ruderalis* Börner, 1939. Explanations about abbreviations used in the table are given in the Material and methods section.

	Apterae, *L. holmani* sp. nov. n = 14	**Oviparae, *L. ruderalis*** Börner, 1939 n = 6
Characters		
BL	1.482–1.854	1.457–1.795
BW	0.853–1.026	0.856–1.062
ANT	0.576–0.676	0.565–0.710
ANT III	0.168–0.212	0.185–0.237
MSL ANT III	0.003–0.007	0.005–0.006
ANT IV	0.069–0.087	0.050–0.074
ANT V	0.071–0.095	0.070–0.089 (if 6 segmented)
ANT V b or VI b	0.063–0.079	0.069–0.076
PT	0.094–0.122	0.112–0.149
HW	0.387–0.410	0.419–0.445
MSL on cephalic dorsum	0.009–0.012	0.008–0.010
URS L	0.098–0.107	0.085–0.090
Posterior setae on hind trochanter	0.014–0.026	0.013–0.018
HFEM	0.329–0.404	0.314–0.358
Dorsal MSL on femora	0.006–0.011	0.007–0.010
HTIB	0.594–0.700	0.521–0.606
Dorsal MSL in the middle of HTIB	0.009–0.013	0.010–0.018
HT II L	0.111–0.124	0.107–0.123
MSL ABD TERG III	0.006–0.011	0.007–0.010
MSL ABD TERG VIII	0.007–0.010	0.009–0.011
SIPH L	0.226–0.271	0.199–0.273
Cauda L	0.143–0.184	0.191–0.213
Ratios		
ANT/BL	0.35–0.40	0.34–0.44
PT/ANT V b or VI b	1.33–1.61	1.62–2.06
PT/ANT V (if 6 segmented)	1.15–1.48	1.62–1.94
PT/ANT IV	1.18–1.58	1.94–2.98
PT/ANT III	0.49–0.63	0.47–0.73
PT/HW	0.24–0.28	0.27–0.35
PT/URS L	0.94–1.16	1.32–1.67
PT/SIPH	0.37–0.48	0.45–0.68
ANT IV/ANT V (if 6 segmented)	0.81–1.04	0.59–0.93
ANT III/ANT IV+ANT V (if 6 segmented)	1.08–1.27	1.27–1.75
ANT III+PT/SIPH	1.04–1.40	1.29–1.61
ANT III/URS L	1.67–2.12	2.05–2.79
ANT III/SIPH L	0.64–0.94	0.76–0.95
MSL ANT III/ANT III BD	0.15–0.33	0.20–0.28
MSL on cephalic dorsum/ANT III BD	0.43–0.60	0.36–0.45
URS L/URS W	1.72–2.26	1.27–1.51
URS L/ANT VI b	1.26–1.60	1.17–1.28
URS L/HW	0.24–0.26	0.20–0.21
URS L/HT II L	0.81–0.92	0.72–0.79
URS L/SIPH L	0.38–0.44	0.33–0.45
Posterior setae on hind trochanter/suture	0.31–0.56	0.19–0.30
HFEM/BL	0.20–0.25	0.19–0.23
HFEM/HW	0.83–1.00	0.75–0.83
Dorsal MSL on femora/ANT III BD	0.27–0.55	0.32–0.43
Dorsal MSL on femora/suture	0.15–0.24	0.11–0.14

Table 1. continued.

	Apterae, *L. holmani* sp. nov. n = 14	**Oviparae, *L. ruderalis*** Börner, 1939 n = 6
Ratios		
HTIB/BL	0.36–0.44	0.31–0.38
HTIB/HW	1.46–1.71	1.24–1.39
Dorsal MSL in the middle of HTIB/ANT III BD	0.43–0.65	0.43–0.82
Dorsal MSL in the middle of HTIB/diameter of HTIB at the middle section	0.25–0.41	0.16–0.34
HT II L/HW	0.28–0.31	0.25–0.29
MSL ABD TERG III/ANT III BD	0.26–0.52	0.30–0.48
MSL ABD TERG VIII/ANT III BD	0.30–0.48	0.39–0.52
SIPH L/ SIPH BW	3.23–4.59	3.16–4.06
SIPH L/BL	0.13–0.17	0.14–0.16
SIPH L/HW	0.55–0.65	0.47–0.65
SIPH L/HT II L	1.85–2.31	1.63–2.32
Cauda L/Cauda W	1.17–1.57	1.50–1.95
Cauda L/ANT III	0.79–0.99	0.81–1.03
Cauda L/HW	0.36–0.43	0.44–0.50
Cauda L/SIPH L	0.57–0.78	0.77–0.96
Cauda L/URS L	1.43–1.77	2.12–2.39
Chaetotaxy		
SN ANT III	3–4	4–5
SN (accessory) on URS	3–5	2
First tarsal formula	3:3:2 or 3:3:3	3:3:2 or 3:3:3
SN on ABD TERG VIII	4–6	6–10
SN on discal part of subgenital plate	2–4	2–5
SN on hind margin of subgenital plate	7–9	11–16
SN on Cauda	(3) 4	7–11

and pointed accessory setae. Setae on body very pale; setae on dorsum and ANT rarely blunt, mostly capitate or fan–shaped. Ventral setae on abdomen pointed and longer than dorsal ones located there. Dorsum of head, thorax and abdomen sclerotized, wrinkled and reticulated. Reticulation pattern comprising small cells with irregular edges. SIPH rough, imbricated with spinulose imbrication on apical halves, tapering or slightly swollen in the apical third and with marked flange, its swollen part 1.03–1.10 × the immediate proximal narrow part (Figs 1, 5). ABD TERG VIII with low, rugose medial supracaudal swelling with 2 setae on it. Subgenital plate oval, sclerotic, with spinulose imbrications. 0–3 small MTu present on ABD TERG II–V on one side (0–4 in total). Cauda elongate triangular or tongue–shaped with laterally situated long, curved and pointed setae and numerous strong dark spinules (Figs 1, 5). Measurements, ratios and chaetotaxy are provided in Table 1.

Differential diagnosis

Lipaphis holmani sp. nov. belongs to the subgenus *Lipaphidiella* Doncaster, 1954 because of (1) the weakly developed antennal tubercles, (2) the presence of the medial supracaudal process on ABD TERG VIII, and (3) the ratio of the ANT/BL which is less than 0.5 (Doncaster 1954; Heie 1992; Blackman & Eastop 2006). At present, four species are known in the subgenus: *L. jungarica* Kadyrbekov, Renxin & Shao, 2002, *L. lepidii* (Nevsky, 1929), *L. ruderalis* Börner, 1939 and *L. sisymbrii* Bozhko, 1976 (Favret 2022).

Apterous viviparous ♀♀ of *Lipaphis holmani* sp. nov. are distinguished from the same morph of *L. jungarica* by (1) the absence of secondary rhinaria on ANT III, which are present in *L. jungarica*; (2) by the number of accessory setae on URS: 4 (rarely 3 or 5) setae in the new species, but only 2 in *L. jungarica*; (3) by the presence of reticulation on dorsum of thorax and abdomen being absent in *L. jungarica*; and (4) by the number of setae on the posterior margin of the subgenital plate: 7–9 in the new species, but only 2 setae in *L. jungarica* (see also Kadyrbekov et al. 2002).

Apterous viviparous ♀♀ of *Lipaphis holmani* sp. nov. can be distinguished from the same morph of *L. lepidii* based on Doncaster 1954; Blackman & Eastop 2022, including investigated type material of *L. lepidii*, by (1) the number of accessory setae on URS: 4 (rarely 3 or 5) setae in the new species, but only 2 in *L. lepidii*; (2) the ratio of the CAUDA L/ANT III: 0.79–0.99 in the new species,

but 0.45–0.75 in both subspecies of *L. lepidii* (*L. lepidii lepidii* (Nevsky, 1929) and *L. lepidii cardariae* Knechtel & Manolache, 1944).

Apterous viviparous ♀♀ of *Lipaphis holmani* sp. nov. are distinguished from the same morph of *L. ruderalis* and *L. sisymbrii* by (1) the number of accessory setae on URS: 4 (rarely 3 or 5) setae in the new species, while 2, rarely 3 in *L. ruderalis* and *L. sisymbrii*; (2) the ratio of the URS L/HT II L: 0.81–0.92 in the new species, but 0.60–0.70 in *L. ruderalis* and 0.62–0.82 in *L. sisymbrii*; (3) the presence/absence of intersegmental sclerites on abdomen: absent in the new species, but always present in *L. ruderalis* and *L. sisymbrii*; (4) the shape of the medial supracaudal process on ABD TERG VIII: a small rugose medial swelling in the new species, but a large, medial, conical-shaped supracaudal process in *L. ruderalis* and *L. sisymbrii* (Doncaster 1954; Heie 1992; Blackman & Eastop 2022).

Apart from above mentioned *Lipaphis* species, two species – *L. erysimi* and *L. pseudobrassicae* – utilize *Lepidium* spp. as host plants (Holman 2009; Blackman & Eastop 2022), from which the new species should be distinguished easily by the presence of the medial supracaudal process on ABD TERG VIII, which is absent in *L. erysimi* and *L. pseudobrassicae* (Blackman & Eastop 2022). Only *Lipaphis erysimi* has been recorded previously from the Korean Peninsula (Lee et al. 2002).

Biology. The new species lives on *Lepidium virginicum* L. (Brassicaceae). Other morphs and life cycle of the new species are unknown.

Distribution. It is known only from the type locality—Yeogisan hill, Suwon, Gyeonggi Province, South Korea, Korean peninsula. The new aphid species should be widely distributed because it lives on a widely distributed invasive host plant, Virginia pepperweed (*Lepidium virginicum*) (Stoyanov & Vladimirov 2015). This plant species is native to North America. It was introduced to Africa, Asia, Australia, Europe and South America and is naturalized widely elsewhere (Zhou et al. 2001; Stoyanov & Vladimirov 2015).

Lipaphis ruderalis Börner, 1939
Lipaphis ruderalis Börner, 1939: 79.
Figs 2, 4, 6, 7–9, Table 1

Material examined
N 4395, 3 oviparous ♀♀ on 1 slide, on *Lepidium ruderale* L., CZECH REPUBLIC, Central Bohemian Region, Nymburk District, Lysá nad Labem, 50°12′5″ N, 14°49′58″ E, 183 m a.s.l., 09.v.2003, J. Holman leg. and det. (IECA) – N 4395, 3 oviparous ♀♀ on 1 slide, same collection data as for preceding (IZISU).

Description
Oviparous ♀ (n = 6)

Color in life: Unknown. P*igmentation on slide*: Head, ANT I–II, IV–VI, clypeus, rostral III–V, tarsi, large marginal sclerites on thoracic I–III, intersegmental sclerites on abdomen, SIPH, postsiphuncular sclerites, subgenital and anal plates, spinopleural bar on ABD TERG VI, transverse bands on ABD TERG VII–VIII dark brown; ANT III with paler basal and darker apical halves; cauda pale brown or dark brown; coxae, trochanters and basal part of femora pale brown with dark brown remaining part; tibiae with dark brown bases and apices and pale brown middle section; stigmal plates pale brown (Fig. 2).

Morphological characters: Body oval. Frons slightly convex (Figs 2, 4). ANT 5 or 6–segmented (Figs 2, 4, 6). ANT tubercles weakly developed. ANT cuticle imbricated. Primary rhinaria ciliated. Secondary rhiniaria always absent. Rostrum short, reaching to middle coxae. URS sub-parallel sided with pointed apex and fine and pointed accessory setae (Fig. 2). HTIB swollen (Fig. 7), diameter of its swollen part 1.27–1.67 × its narrowest diameter at base with 51–81 round pseudosensoria, mostly single or in clusters of two or three. Setae on body dusky on dusky sockets; setae on head, thorax and abdominal dorsum and ANT capitate or fan–shaped. Ventral setae on abdomen are pointed and longer than dorsal ones located there. Dorsum of head, thorax and abdomen is sclerotic, wrinkled and reticulated. Reticulation pattern comprising small cells with irregular edges (Fig. 8). SIPH rough, imbricated with spinulose imbrication on apical 1/3, slightly swollen in the apical third and with marked flange, its swollen part 1.06–1.20 × the immediate proximal narrow part (Figs 2, 9). ABD TERG VIII with high, medial conical process with 2 setae on it. Subgenital plate oval, sclerotic, with spinulose imbrications. 1–4 small MTu present on ABD TERG II–V on one side (2–8 in total). Cauda elongate triangular, not or slightly constricted in the middle, with laterally situated long, curved and pointed and dorsally situated short, straight and point or slightly curved and capitated setae and numerous strong dark spinules (Figs 2, 9). Measurements, ratios and chaetotaxy are provided in Table 1.

Differences between apterous viviparous and oviparous ♀♀. Differences were found in (1) the number of setae on ABD TERG VIII: maximum 6 in apterae, while 6–10 in oviparae; (2) the number of setae on cauda: maximum 7 in apterae, while 7–11 in oviparae; (3) shape of HTIB and (4) presence/absence of pseudosensoria: it is none-swollen without pseudosensoria in apterae, while it is swollen with pseudosensoria in oviparae.

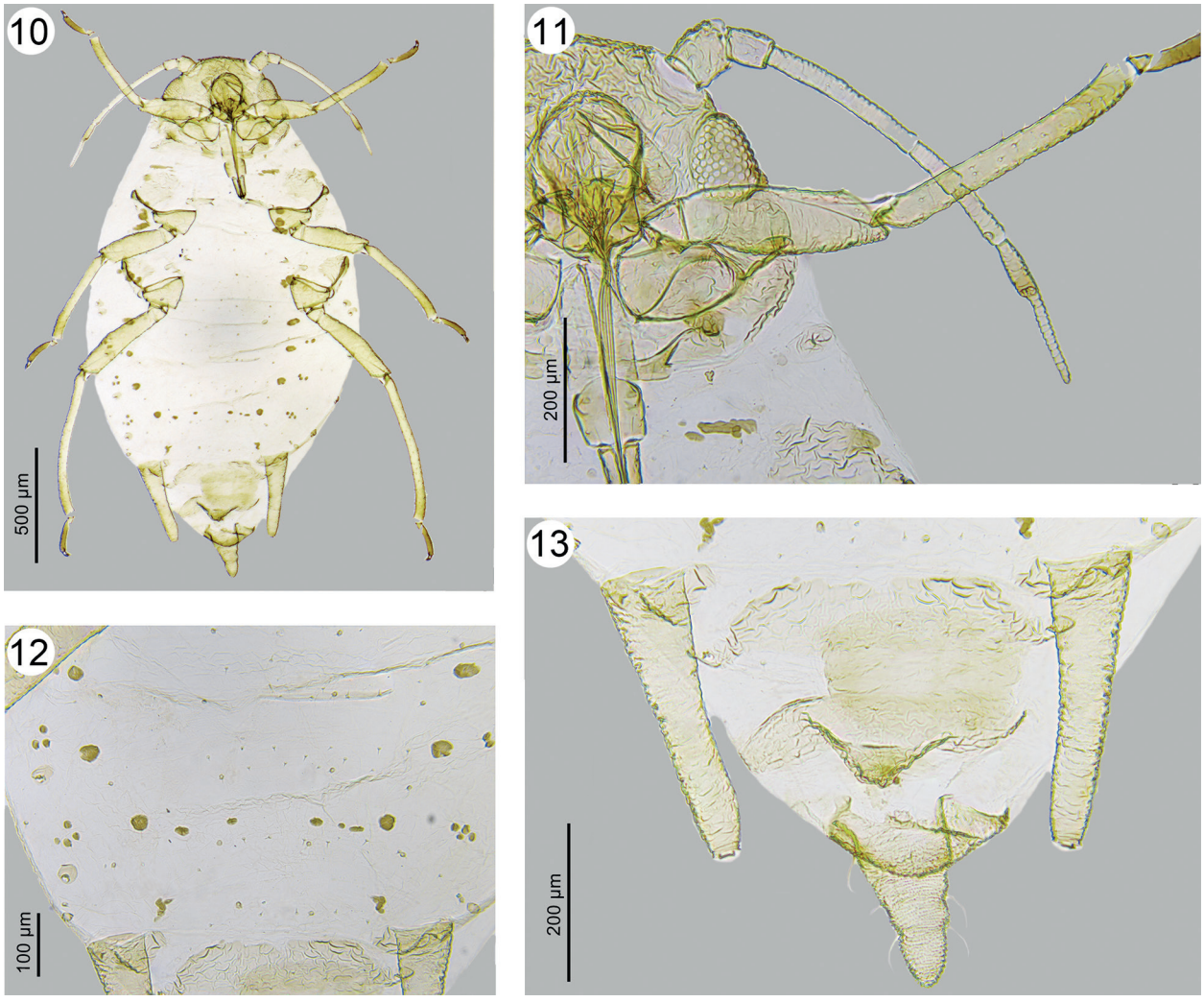
Biology. The species lives on undersides of leaves, stems and flower-stalks of *Berteroa incana* (L.) DC., *Cardaria draba* (L.) Desv., *Lepidium* spp. (*L. apetalum* Willd., *L. densiflorum* Schrad., *L. ruderale* L., *L. sativum* L., *Lepidium* sp.) and *Sisymbrium altissimum* L. (Brassi-

caceae) (Holman 2009; Blackman & Eastop 2022). It is clear that this species is a monoecious holocyclic.

Distribution. It is distributed from Eastern Europe to China: Germany, Poland, Czech Republic, Slovakia, Hungary, Romania, Ukraine, Russian Federation, China (Tao 1999; Holman 2009).

Lipaphis sisymbrii Bozhko, 1976
Lipaphis sisymbrii Bozhko 1976: 102.
Figs 10–16, Table 2

Material examined
N 1927, 1 apterous viviparous ♀, on *Sisymbrium polymorphum* Murray) Roth, KAZAKHSTAN, West Kazakhstan region, Aksay town environments, 51° 9’52.28” N, 52°58’23.08” E, 57 m a.s.l., 27.vi.1990, R.Kh. Kadyrbekov leg. (IZAK) – N 2772, 5 apterous viviparous ♀♀ and 1 alate viviparous ♀, on *Sisymbrium polymorphum* Murray) Roth, KAZAKHSTAN, East Kazakhstan region, env. st. Kajnar, 23.vi.1978, N.E. Smailova leg. (IZAK) – N 230a, 4 apterous viviparous ♀♀ and 3 alate viviparous ♀♀, on *Sisymbrium loeselii* L., KAZAKHSTAN, Almaty region, Karatal river, 40 km to North-West Ushtobe town, 19.v.2005, M.O. Aitzhanova leg. (IZAK) – N 1456, 6 apterous viviparous ♀♀, on *Sisymbrium loeselii* L., KAZAKHSTAN, Almaty region, Zhungar Alatau mounting system, Zhabyk ridge, 30 km to east Koktuma village, 6.viii.1989, R.Kh. Kadyrbekov leg. (IZAK) – N 2077, 5 alate viviparous ♀♀, on *Sisymbrium loeselii* L., KAZAKHSTAN, Almaty region, Zhungar Alatau mounting system, Kojandytau ridge, 25.vi.1991, R.Kh. Kadyrbekov leg. (IZAK) – N 2295, 7 apterous viviparous ♀♀ and 1 alate viviparous ♀, on *Sisymbrium polymorphum* (Murray) Roth, KAZAKHSTAN, Almaty region, Tentek river, 4 km to West from Usharal town, 46°10’3.28” N,



Figs 10–13. *Lipaphis* (*Lipaphidiella*) *sisymbrii* Bozhko, 1976. Apterous viviparous ♀. **10**. General view. **11**. Head, thorax, and antenna. **12**. Abdominal dorsum with reticulation pattern. **13**. Posterior part of abdomen.

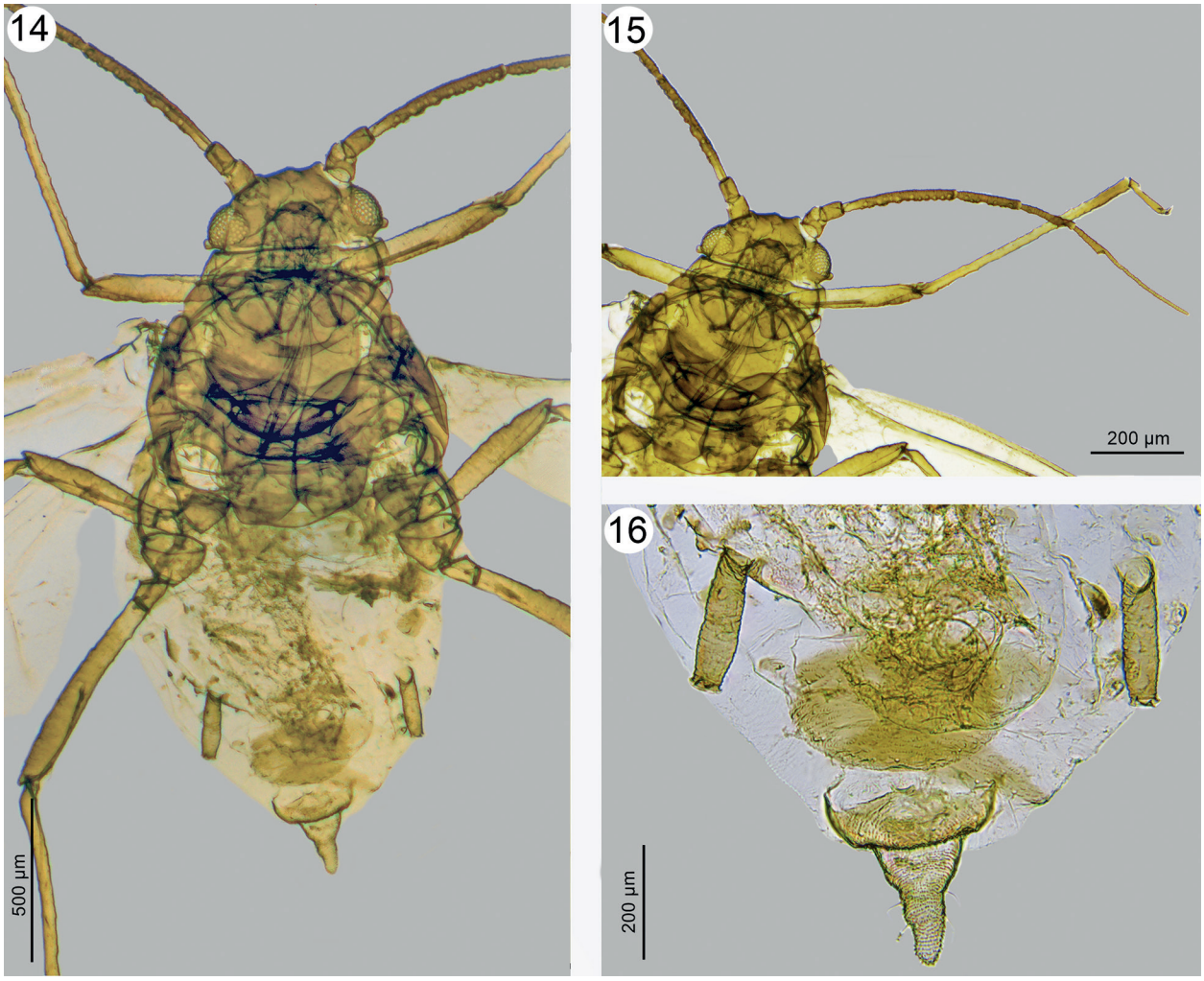
80°54’7.03” E, 384 m a.s.l., 29.v.2005, M.O. Aitzhanova leg. (IZAK).

Redescription

Apterous viviparous ♀ (n = 23)

Color in life: Yellowish or light green, with a slight light bloom, on the dorsal side of the body there are parallel segmental light brown small spots, SIPH, cauda, coxae and trochanters are light, sometimes dusky; legs, except for tops of tibiae and tarsi, light. Apices of tibiae and tarsi brown. *Pigmentation on slide*: Head pale or brown. ANT I–II pale or dusky in some specimens; ANT III–IV pale, apex of ANT V and ANT VI brown. Clypeus, rostral III–V, apices of tibiae and tarsi pale brown; subgenital and anal plates dusky; marginal spots on thoracic I-III and small intersegmental sclerites - light brown; SIPH and cauda are light, dusky in some specimens; stigmal plates light brown (Figs 10–13).

Morphological characters: Body oval (Fig. 10). Frons uniformly convex without ANT tubercles (Figs 10–11). ANT 5 or 6-segmented (Fig. 11). ANT tubercles not developed (Figs 10–11). ANT cuticle wrinkled. Primary rhinaria ciliated. Secondary rhinaria always absent. Rostrum short and not reach the middle coxae; URS sub-parallel-sided with pointed apical and accessory setae (Fig. 10). Dorsum setae pale, short, obtuse. Cuticle of head and genital plate sclerotized, squamous (Figs 11–13). Thoracic I–III with small, sometimes larger, squamous marginal sclerites (Fig. 11). The rest of body are not sclerotized, with delicate cellularity. Reticulation pattern comprising small cells with irregular edges. SIPH imbricated, with slightly swollen in the apical third and with marked flange, its swollen part 1.10–1.20 × the immediate proximal narrow part (Figs 10, 13). ABD TERG VIII with high medial conical-shaped supracaudal process with 2 setae on it (Figs 10, 13). Subgenital plate oval, sclerotized, squamous. 0–3 small MTu present on



Figs 14–16. *Lipaphis* (*Lipaphidiella*) *sisymbrii* Bozhko, 1976. Alate viviparous ♀. **14**. General view. **15**. Head, thorax, and antennae. **16**. Posterior part of abdomen.

Table 2 (continued on next page). Metric and meristic characteristics of apterous and alate viviparous ♀♀ of *Lipaphis* (*Lipaphidiella*) *sisymbrii* Bozhko, 1976. Explanations about abbreviations used in the table are given in the Material and methods section.

	Apterae n = 23	**Alatae n = 10**
Characters		
BL	1.290–2.180	1.580–1.958
BW	0.576–1.037	0.576–0.898
ANT	0.498–0.911	1.012–1.602
ANT III	0.149–0.311	0.334–0.495
MSL ANT III	0.007	0.007
ANT IV	0.058–0.115	0.144–0.265
ANT V	0.069–0.104	0.115–0.219
ANT V b or ANT VI b	0.048–0.081	0.092–0.127
PT	0.092–0.150	0.255–0.380
HW	0.323–0.420	0.369–0.403
MSL on cephalic dorsum	0.008–0.009	0.008
URS L	0.075–0.104	0.081–0.115
Posterior setae on hind trochanter	0.008–0.009	0.008–0.009
HFEM	0.265–0.426	0.436–0.622
Dorsal MSL on femora	0.008–0.009	0.008–0.009
HTIB	0.438–0.783	0.818–1.140
Dorsal MSL in the middle of HTIB	0.008–0.009	0.008–0.009
HT II L	0.104–0.138	0.127–0.161
MSL ABD TERG III	0.008–0.009	0.008–0.009
MSL ABD TERG VIII	0.011–0.012	0.011–0.012
SIPH L	0.186–0.334	0.149–0.230
Cauda L	0.161–0.230	0.127–0.184
Ratios		
ANT/BL	0.33–0.46	0.67–0.83
PT/ANT V b or VI b	1.40–2.51	2.61–3.68
PT/Ant V or VI	0.58–0.72	0.72–0.78
PT/ANT IV	1.25–2.46	1.39–2.40
PT/ANT III	0.40–0.85	0.65–0.90
PT/HW	0.21–0.44	0.68–0.94
PT/URS L	1.23–2.13	2.61–4.12
PT/Siph	0.33–0.54	1.29–2.09
ANT IV/ANT V or VI	0.28–0.72	0.32–0.52
ANT III/ANT V or VI	0.71–1.56	0.80–1.23
ANT III+PT/Siph	0.84–2.07	3.46–4.48
ANT III/URS L	1.84–3.55	3.10–5.37
ANT III/Siph L	0.54–0.96	1.95–2.67
MSL ANT III/ANT III BD	0.18–0.19	0.18–0.19
MSL on cephalic dorsum/ANT III BD	0.33–0.37	0.33–0.37
URS L/URS W	2.27–2.31	2.19–2.25
URS L/HW	0.18–0.26	0.21–0.30
URS L/H II L	0.62–0.82	0.58–0.83
URS L/Siph L	0.24–0.33	0.41–0.77
Posterior setae of hind trochanter/suture	0.36–0.37	0.36–0.37
HFEM/BL	0.16–0.23	0.24–0.32
HFEM/HW	0.71–1.03	1.15–1.54
Dorsal MSL on femora/ANT III BD	0.35–0.38	0.35–0.38
Dorsal MSL on femora/suture	0.20–0.21	0.20–0.21
HTIB/BL	0.28–0.41	0.46–0.59
HTIB/HW	1.18–1.86	2.15–2.83

Table 2. continued.

	Apterae n = 23	Alatae n = 10
Dorsal MSL in the middle of HTIB/ANT III BD	0.35–0.37	0.35–0.37
Dorsal MSL in the middle of HTIB/Diameter of HTIB at the middle section	0.21–0.22	0.21–0.22
H II L/HW	0.27–0.39	
MSL ABD TERG III/ANT III BD	0.37–0.38	0.37–0.38
MSL ABD TERG VIII/ANT III BD	0.45–0.50	0.45–0.50
Siph L/ Siph BW	4.17–5.97	2.56–3.96
Siph L/BL	0.15–0.19	0.09–0.12
Siph L/HW	0.66–0.85	0.39–0.57
Siph L/H II L	2.11–2.90	1.08–1.54
Siph L/Cauda L	1.34–1.93	1.00–1.54
Cauda L/ Cauda W	1.36–1.77	1.18–1.45
Cauda L/ANT III	0.69–1.11	0.37–0.46
Cauda L/HW	0.44–0.59	0.33–0.48
Cauda L/Siph L	0.59–0.74	0.80–1.00
Cauda L/URS L	2.10–2.84	1.10–2.14
Chaetotaxy:		
SN ANT III	1–3	3–7
SN (accessory) on URS	2	2–3
First tarsal formula	3:3:3 or 3:3:2	3:3:3 or 3:3:2
SN on ABD TERG VIII	2	2-3
SN on discal part of subgenital plate	2	2-5
SN on hind margin of subgenital plate	4–6	6–8
SN on Cauda	4	4

ABD TERG II–V on one side (2–6 total). Cauda elongated triangular or tongue-shaped with curved and pointed setae, with numerous strong spinules (Figs 10, 13). Measurements, ratios and chaetotaxy are given in Table 2.

Alate viviparous ♀ (n = 10)

Color in life: head, ANT, legs, SIPH, cauda, thorax, marginal spots ABD TERG II–IV are brown. Abdomen light green with a slight light bloom. *Pigmentation on slide*: head, thorax, ANT, except the paler base of ANT III, clypeus, rostral III–V, legs, except pale bases of femora and middle of tibiae, SIPH, cauda, subgenital and anal plates, marginal spots on ABD TERG II–V brown (Figs 14–16).

Morphological characters: Body elongated-oval (Fig. 14). Frons W-shaped with a median tubercle, on which the ocellus is located, and only just marked ANT tubercles (Figs 14–15). ANT six-segmented (Fig. 15). ANT cuticle wrinkled; primary rhinaria ciliated. Secondary rhinaria are present on ANT III (9–36), IV (1–14), and V (0–5) (Figs 14–15). Rostrum short, not reach the middle coxae; URS sub-parallel-sided with pointed apical and accessory setae. Dorsum setae pale, short, obtuse. Cuticle of head, thorax, and genital plate sclerotized, squamous. Abdomen not sclerotized, finely reticulated. Reticulation pattern comprising small cells with irregular edges. SIPH imbricated, with slightly swollen in the apical third and with marked flange, its swollen part 1.15–1.20 × the immediate proximal narrow part (Fig. 16). ABD TERG VIII bears high medial conical-shaped subracaudal process, with 2 setae. Subgenital plate oval, sclerotized, scabrous. 0–5 small MTu present, on ABD TERG II–V on both sides (2–8 total). Cauda elongated triangular with curved and pointed setae, with numerous spinules (Fig. 16). Measurements, ratios and chaetotaxy are given in Table 2.

Differential diagnosis. *Lipaphis sisymbrii* is morphologically similar to *L. ruderalis* in shape of the high medial conical-shaped supracaudal process on ABD TERG VIII, the presence of intersegmental sclerites on the abdomen, and the chaetotaxy of the URS (2 accessory setae). It differs from *L. ruderalis* in shape of a faintly convex frons without ANT tubercles, the fine and less distinct reticulation of the light dorsal parts of the thorax, and ABD, light SIPH and cauda, chaetotaxy of the ABD TERG VIII (2 setae versus 4–6) and cauda (4 setae versus 5–7), ratios of the cauda to SIPH (0.59–0.74 versus 0.77–0.96). Besides, they use different host plants.

Biology. The species lives on *Sisymbrium loeselii* L. and *S. polymorphum* (Murray) Roth (Brassicaceae).

Distribution. Ukraine and Kazakhstan (west, east, south-east) (Bozhko 1976; Kadyrbekov 2009, 2017).

Taxonomic position of *Lipaphis sisymbrii* Bozhko, 1976

Lipaphis sisymbrii Bozhko, 1976 was described extremely briefly based on apterous and alate viviparous ♀♀ on *Sisymbrium polymorphum* (Murray) Roth (Brassicaceae) from Ukraine (Bozhko 1976). In spite of the fact that in the original description presence of the medial supracaudal process on ABD TERG VIII was mentioned (p. 102), it was considered as a member of the subgenus *Lipaphis* in Blackman & Eastop (2006, 2022) and in Favret (2022). Based on the presence of the medial supracaudal process, mentioned in the original description and shown in specimens from Kazakhstan (Figs 10, 13), this species is transferred in the subgenus *Lipaphidiella* Doncaster, 1954. At present, five species are united in the subgenus *Lipaphidiella*: *L. jungarica* Kadyrbekov, Renxin & Shao, 2002, *L. lepidii* (Nevsky, 1929), *L. ruderalis* Börner, 1939, *Lipaphis sisymbrii* Bozhko, 1976 and *L. holmani* sp. nov. The identification key for these species is given below.

Identification key to the species of the subgenus *Lipaphidiella* Doncaster, 1954

1. Reticulation on dorsum of thorax and abdomen absent. Secondary rhinaria on ANT III present. Posterior margin of the subgenital plate with only 2 setae ..... ***L. jungarica*** Kadyrbekov, Renxin & Shao, 2002
– Dorsum of thorax and abdomen reticulated. Secondary rhinaria on ANT III absent. Posterior margin of the subgenital plate with more than 2 setae 2
1. ABD TERG VIII with high medial conical-shaped supracaudal process (Figs 2, 9, 10, 13). Intersegmental sclerites on abdomen present (Figs 2, 10, 12) 3
– ABD TERG VIII with medial supracaudal process as low rugose swelling (Fig. 5). Intersegmental sclerites on abdomen absent (Fig. 1) 4
3. Thoracic and ABD reticulation less distinct (Fig. 12). Cauda L 0.59–0.74 × SIPH L with 4 setae ..... ***L. sisymbrii*** Bozhko, 1976
– Thoracic and ABD reticulation more distinct (Fig. 8). Cauda L 0.77–0.96 × SIPH L with 5–7 setae ..... ***L. ruderalis*** Börner, 1939
4. Cauda L 0.45–0.75 × ANT III. URS with 2 accessory setae ..... ***L. lepidii*** (Nevsky, 1929)
– Cauda L 0.80–1.10 × ANT III. URS with 3–5 accessory setae ..... ***L. holmani*** sp. nov.

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