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THE CARPOMYINI FRUIT FLIES (DIPTERA: TEPHRITIDAE) OF EUROPE, CAUCASUS, AND MIDDLE EAST: NEW RECORDS OF PESTS, WITH IMPROVED KEYS

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The Carpomyini Fruit Flies (Diptera, Tephritidae) of Europe, Caucasus, and Middle East: New Records of Pest Species, with Improved Keys. Korneyev, V. A., Mishustin, R. I., Korneyev, S. V. — Based on previously unpublished specimens from the collection of I. I. Schmalhausen Institute of Zoology (Kyiv), all the species of the tribe Carpomyini known to occur in Europe and Asia westwards of the Caspian Sea and Afghanistan, are listed. The melon fruit fly, *Carpomya* (*Myiopardalis*) *pardalina* (Bigot) is recorded for the first time from Ukraine and Europe, and *Carpomya* (s. str.) *vesuviana* (A. Costa, 1854) for continental Ukraine, based on collection material. *Carpomya* (*Goniglossum*) *liat* (Freidberg, 2016), **comb. n.**, is established as *Goniglossum* has not been adopted at the genus rank. New records and illustrated keys to species are given.

Key words: Diptera, Tephritidae, *Carpomya*, *Rhagoletis*, Europe, Caucasus, Israel, Turkey, Iran.

Introduction

The fruit flies of the tribe Carpomyini occur predominantly in the New World, (Korneyev, 1996; Smith & Bush, 1999) with 35 species occurring in the Palearctic Region, and six or more species in the Oriental Region (Nepal, India, Thailand, Cambodia). Two pest species, *Rhagoletis cingulata* and *R. completa*, have been introduced from North America to Europe (Merz, 1991) and two others, *Carpomya pardalina* and *C. vesuviana*, — from the Middle East into the Oriental Region (Hardy, 1973, 1977). Some species are serious pests of fruits (including cherries, melons, walnuts, and apples) as well as wild berries (*Cornus*, *Berberis*, *Rosa*, etc.) and are subjects for quarantine control.

The Palaearctic species of *Rhagoletis* (including *Zonosema*, *Megarrhagoletis*, and *Microrhagoletis* now considered its synonyms) were reviewed and keyed by Rohdendorf (1961). Later, larval morphology of known and some additional species was described by Kandybina (1961, 1962, 1972, 1977), Kandybina & Richter (1976), and Richter & Kandybina (1997). The Middle Asian, Far East, and Oriental species of *Carpomya* and *Rhagoletis* were keyed by Korneyev & Merz (1997), Korneyev & Ovchinnikova (2004), and Ito (2011). Freidberg & Kugler (1989), Merz (1994), Korneyev (1997), and Mohamadzade Namin & Rasouljan (2009) provided keys to the European, Middle Eastern, and Caucasian species, but no keys covering the whole Western Palaearctics existed. In this paper, keys to all the species of Europe, Asia Minor, Caucasus, and Near East including Iran, are provided, along with references to each species, data on its known host plants and distribution, as well as some taxonomic remarks are provided.

Material

The specimens mentioned in this paper are deposited mostly in the collection of SIZK — Schmalhausen Institute of Zoology, Kyiv, Ukraine; except a few specimens from MHNG — Muséum d'Histoire Naturelle, Genève.

Carpomya Costa, 1854

Carpomya Costa, 1854: 87.

Type species: *Carpomya vesuviana* Costa, 1854 (by monotypy).

Goniglossum Rondani, 1856: 110.

Type species: *Trypeta wiedemanni* Meigen (by original designation).

Myiopardalis Bezzi 1910: 10

Type species: *Carpomyia pardalina* Bigot (by original designation).

Carpomyia Rondani, 1870: 22, misspelling of *Carpomya* Costa.

Gonyglossum Eflattoun, 1924: 19, misspelling of *Goniglossum* Rondani.

Gonioglossum Hendel, 1914: 90, misspelling of *Goniglossum* Rondani.

Diagnosis. Middle-sized (3.5–5.0 mm) fruit flies with 3 frontal and 2 orbital setae, pale postocellar seta, variable shape of head, antenna and proboscis (short with flat, slightly receding or vertical face, apically pointed flagellomere 1 and short labellum, as on figs 2, 2–4, in *Carpomya* s. str. and *Myiopardalis* and long, with carinate, anteriorly produced face and long, geniculate proboscis as on fig. 2, 1, in *Goniglossum*), usually brightly patterned, pale yellow to orange mesonotum with shiny black spots and grey microtrichose areas (if, in *C. incompleta* uniformly pale reddish yellow and microtrichose, then flagellomere 1 pointed and ocellar setae short), long and strongly acute posterior lobe of surstylus of male, oviscape with T-shaped desclerotized posteromedial area ventrally, and aculeus either uniformly tapered apically (in *Carpomya* s. str. and *Myiopardalis*) or abruptly cut into a wide, serrate apex in *Goniglossum* (see Freidberg, 2016). Third instar larva with a few (3–4) serrate oral ridges and stomal sensory organ with strong preoral teeth.

Remarks. *Carpomya* shows no significant differences from the largest genus of Carpomyini, *Rhagoletis*, except for the mesonotal pattern as on figs 1, 1, 3, 1–3, 3 and 3, 5 (though *C. incompleta* has uniformly pale reddish yellow mesonotum, as in some *Rhagoletis* and can be distinguished from them only by having short ocellar seta, which is long in all *Rhagoletis*) species.

Neither *Carpomya* nor *Rhagoletis* have been definitively proven to be monophyletic (V. Korneyev, unpublished data; J. Jenkins, unpublished data; J. Smith et al., in prep.): *Carpomya* is either the sister-group of *Rhagoletis*, or an in-group within the species assigned to *Rhagoletis*. Taxonomic consequences and concepts of both genera likely will be influenced by the results of forthcoming phylogenetic analyses based on the sequences of multiple genes (J. Smith et al., in prep.), and we abstain from any taxonomic changes (including those by Freidberg, 2016) until their phylogenetic relationships are more clearly resolved.

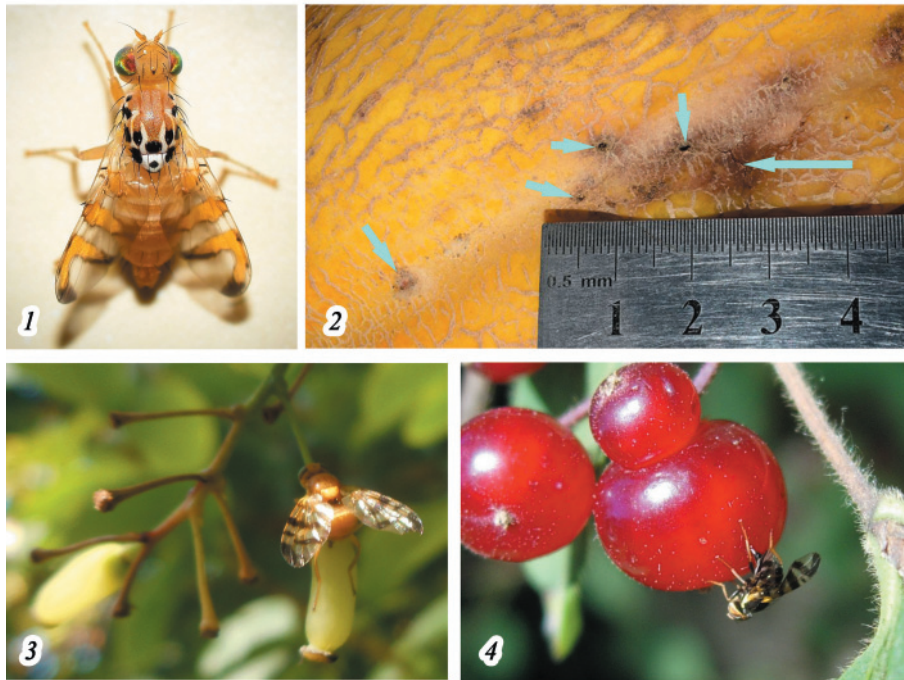


Fig. 1. *Carpomyini*. 1–2 — *Carpomya pardalina*, Kherson (1 — freshly emerged male; 2 — infested melon with holes in skin (cyan arrows) prepared by larvae for emerging of adults); 3 — *Rhagoletis meigenii* on *Berberis* fruit, Berlin; 4 — *R. cerasi* on *Lonicera* fruit, Kyiv, Grishko Botanical Gardens. Photos by R. I. Mishustin (1–2) and V. A. Korneyev (3–4).

Key to species of *Carpomya* of the Old World

1. Proboscis with extremely long and narrow labellum (fig. 2, 1). Head shape: face with ventral margin produced anteriorly and strongly developed medial carina (fig. 2, 1). Cell bcu closed by arcuate vein without lobe (fig. 4, 1). Flagellomere 1 apically rounded. Scutellum with large medial black spot on disk (fig. 3, 1–2). In fruits of *Bryonia*. *C. (Goniglossum)* 2.
- Proboscis with fleshy and moderately short labellum (figs 2, 2–4). Head shape: face with slightly produced carina, ventral margin not strongly produced anteriorly (figs 2, 2–4). Cell bcu with posteroapical lobe (figs 4, 2–5). Flagellomere 1 apically pointed. Scutellum either entirely yellow (fig. 3, 4), or only with marginal spots (fig. 3, 5), or at most with small medial black dot on disk (fig. 3, 3). 3.
2. Medial black spot on scutellum disk very large, confluent with black dots at bases of apical scutellar setae (fig. 3, 1). In fruits of *Bryonia cretica* L. and *B. syriaca* Boiss. Southern Turkey, Israel. *C. (Goniglossum) liat* (Freidberg)
- Medial black spot on scutellum disk smaller, separate from black dots at bases of apical scutellar setae (fig. 3, 2). In fruits of *Bryonia alba* L. and *B. dioica* Jacq. Europe, Caucasus. *C. (Goniglossum) wiedemanni* (Meigen)
3. Face high, longer than frons and 3 times as long as flagellomere 1 (fig. 2, 2). Scutellum with small medial black dot on its disk (fig. 3, 3). In fruits of melons. *C. (Myopardalis) pardalina* Bigot
- Face shorter, at most 2 times as long as flagellomere 1 (figs 2, 3–4). Scutellum without medial black dot on its disk (fig. 3, 4–5). Not in melons..... *C. (Carpomya) s. str.* 3.
4. Apical crossband absent (fig. 4, 3). Scutum and scutellum entirely reddish yellow (fig. 3, 4). In fruits of *Ziziphus*. *C. incompleta* (Becker)
- Wing with 4 yellow crossbands (figs 4, 4–5). Scutum with dark pattern; scutellum with pair of large black spots at posterior margin (fig. 3, 5). 4.
5. Anepisternum and mediotergite (below scutellum) yellow. Ocellar seta setula-like, almost inconspicuous. In *Ziziphus*. *C. vesuviana* A. Costa
- Anepisternum and mediotergite black. Ocellar seta usually as long as orbital setae. In *Rosa* fruits. *C. schineri* Loew

Carpomya (Carpomya) incompleta (Becker, 1903) (figs 2, 3; 3, 4; 4, 3)

Trypeta incompleta Becker, 1903: 135; *Carpomyia incompleta*: Bezzi, 1910: 11; Silvestri, 1916: 179; Efflatoun, 1924: 40; Hendel, 1927: 92; *Carpomya incompleta*: White & Elson-Harris, 1992: 281; Norrbom, 1997: 340; Norrbom et al., 1999: 115; Korneyev & Diribek, 2001: 479.

Material. **Israel**: Ein Gedi, –400 m, swept from *Ziziphus*, 31.05.2000, 3 ♂, 2 ♀ (V. Korneyev) (SIZK).

Distribution. Italy; Egypt, Sudan, Eritrea; Israel, Iraq.

Host plants. *Ziziphus jujuba* Mill., *Z. lotus* L., *Z. spina-christi* (L.) Willd., *Z. sativus* Gaertn. (Rhamnaceae) (Freidberg & Kugler, 1989; Smith & Bush, 1999).

Carpomya (Carpomya) schineri (Loew, 1856) (figs 2, 4; 3, 5; 4, 4)

Trypeta schineri Loew, 1856: 52; *Oedaspis schineri*: Loew, 1862b: 49; *Myiopardalis schineri*: Bezzi, 1910: 9; *Carpomyia schineri*: Hendel, 1927: 92; Kandybina, 1965: 668, 1977: 117; Korneyev, 1983: 12; Kameneva & Korneyev, 1985: 68; Smit, 2010: 127; *Carpomya schineri*: White & Elson-Harris, 1992: 285; Norrbom, 1997: 340; Norrbom et al., 1999: 115.

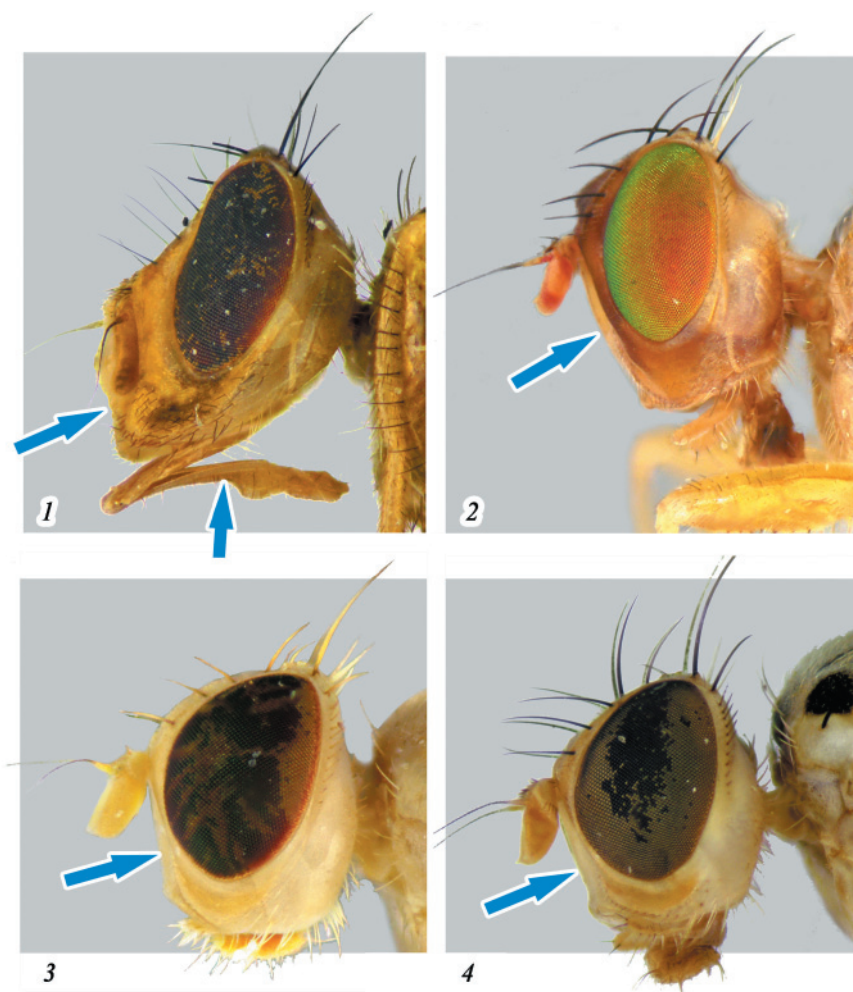


Fig. 2. *Carpomya* spp. heads, left lateral view: 1 — *C. (Goniglossum) liat*; 2 — *C. (Myiopardalis) pardalina*; 3 — *C. (s. str.) incompleta*; 4 — *C. (s. str.) schineri*.

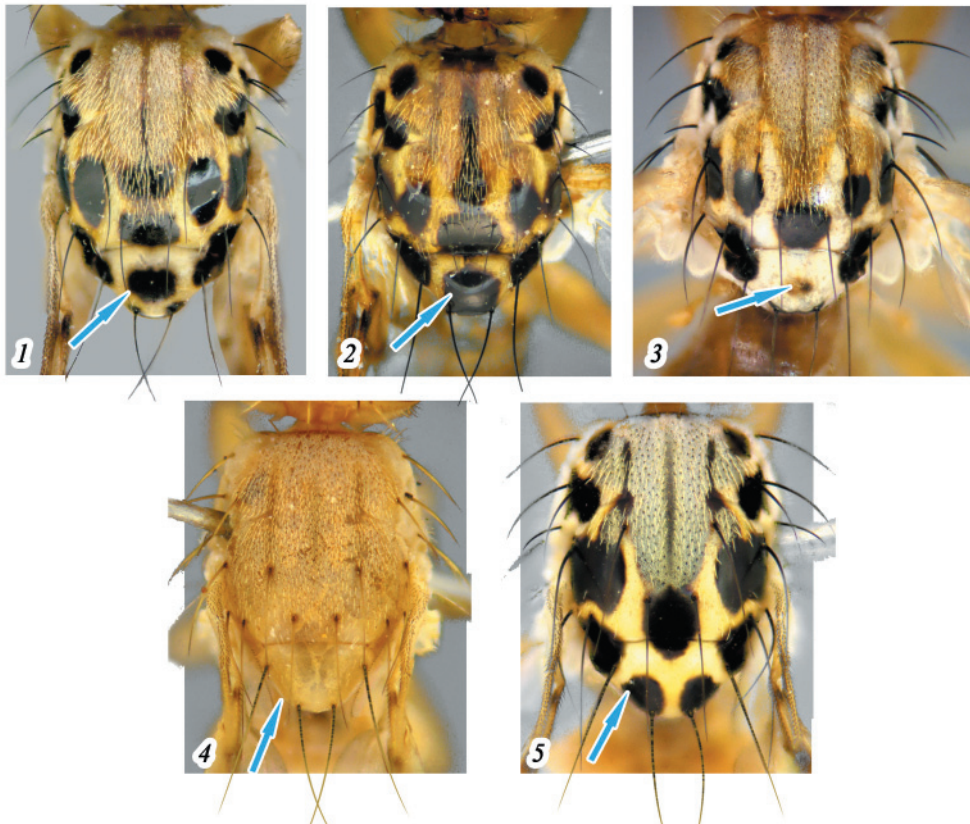


Fig. 3. *Carpomya* spp. mesonotums, dorsal view: 1 — *C. (Goniglossum) wiedemanni*; 2 — *C. (G.) liat*; 3 — *C. (Myiopardalis) pardalina*; 4 — *C. (s. str.) incompleta*; 5 — *C. (s. str.) schineri*.

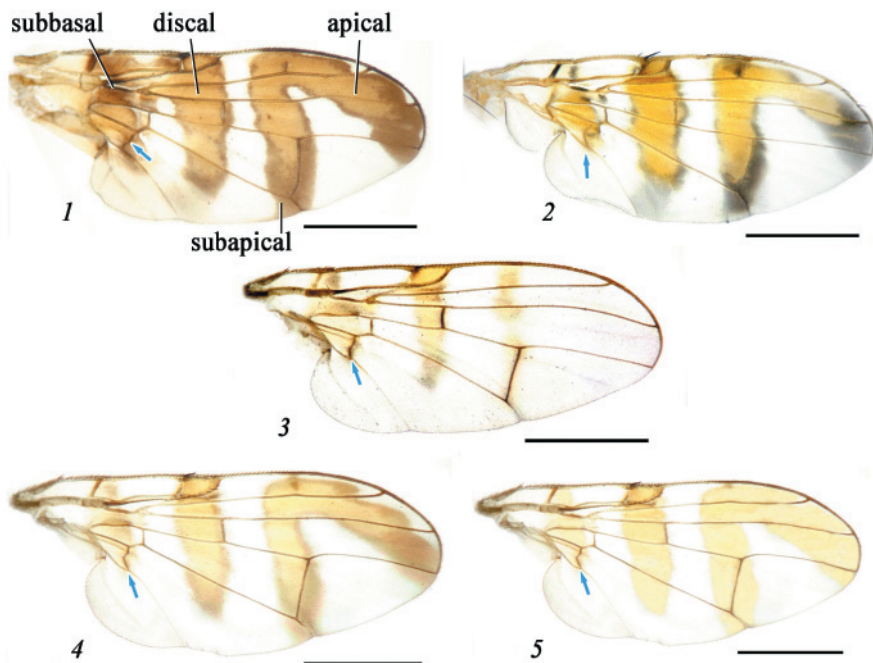


Fig. 4. *Carpomya* spp. wings: 1 — *C. (Goniglossum) wiedemanni*; 2 — *C. (Myiopardalis) pardalina*; 3 — *C. (s. str.) incompleta*; 4 — *C. (s. str.) schineri*; 5 — *C. (s. str.) vesuviana*.

Material. **Georgia:** [no locality], 5.10.1959, ex fruits of *Rosa* sp. 3 ♂, 1 ♀ [no collector name]; **Ukraine:** Cherkasy: Kaniv, 24.07.1957, 1 ♂ [no collector name]; Mykolaiv: Trykraty, Aktove, 47.70 N 31.43 E, 1 ♂, 1 ♀ (S. & V. Korneyev); Donetsk: Kamyani Mohyly Nature Reserve, ex *Rosa* fruit, 10.1992–04.1993, 1 ♀ (V. Korneyev); Crimea: Karadagh, 07.1984, 2 ♂ (Karachevskaya) (SIZK).

Distribution. Austria, Belgium, Bulgaria, European Russia (Centre, East, and South), France (mainland), Germany, Hungary, Italy (mainland), Lithuania, Slovakia, Spain (mainland), Switzerland, Ukraine; Asian Russia (Northern Caucasus; East Siberia, Far East), Georgia, Israel, Turkey, Kazakhstan, Kyrgyzstan.

Host plants. *Rosa canina* L., *R. beggerana* Schrenk, *R. damascena* Mill., *R. gallica* L., *R. kokanica* (Rgl.) Juz., *R. pulverulenta* M.B., *R. rubiginosa* L., *R. rugosa* Thunb., *R. spinosissima* L., *R. villosa* L., (Rosaceae) (Hendel, 1927; Freidberg & Kugler, 1989; Kandybina, 1977; Smith & Bush, 1999).

Carpomya (Carpomya) vesuviana A.Costa, 1854 (fig. 4, 5)

Carpomya vesuviana Costa, 1854: 175; White & Elson-Harris, 1992: 283; Norrbom, 1997: 340; Norrbom et al., 1999: 115; Mohamadzade Namin, 2016; *Carpomyia vesuviana*: Bezzi, 1910: 10; Silvestri, 1916: 179; Hendel, 1927: 93; Kandybina, 1965: 666, 1977: 112; Trikoz & Litvinova, 2007: 74; Mamedov et al., 2015.

Material. **Ukraine:** Kherson, in fruits of *Ziziphus*, 07.2016, 4 third-instar larvae (R. Mishustin) (SIZK).

Distribution. Italy, Moldova (unconfirmed records), Ukraine (first confirmed record); Asian Russia (North Caucasus), Afghanistan, Azerbaijan, Cyprus, Iran, Iraq, Israel, Lebanon, Syria, Tajikistan, Turkey, Turkmenistan, Uzbekistan; Cambodia, India, Pakistan, Thailand; Mauritius.

Host plants. *Ziziphus jujuba* Mill., *Z. mauritiana* Lam., *Z. nummularia* (Burm.) Wight and Arn., *Z. rotundifolius* Lam., *Z. sativus* Gaertn. (Rhamnaceae) (Freidberg & Kugler, 1989; Smith & Bush, 1999).

Remarks. Trikoz & Litvinova (2007) and various Internet sites report *C. vesuviana* from Crimea (since 1998) and Kherson Region in Ukraine, but no material in collections was available for identification. Now this species is considered to be well established pest in all the areas of planting of *Ziziphus* in Southern Ukraine.

Carpomya (Goniglossum) liat (Freidberg, 2016), comb. n. (figs 2, 1, 3, 2)

Goniglossum wiedemanni: Freidberg & Kugler, 1989: 189 (misidentification). — *Goniglossum liat* Freidberg, 2016: 59.

Material. **Type:** Paratypes 3 ♂, 4 ♀; **Israel:** Nizzanim, 03–04.05.2005, 3 ♂, 2 ♀ (A. Freidberg) (SIZK). **Non-type: Israel:** [Nizzanim], ex fruits of *Bryonia* sp., coll. 1.05 — exit 30.05.2000, 2 ♂, 1 ♀ (A. Freidberg) (SIZK).

Distribution. Israel, Turkey (South).

Host plants. *Bryonia cretica* L., *B. syriaca* Boiss. (Cucurbitaceae) (Freidberg & Kugler, 1989; Freidberg, 2016).

Remarks. This species was recently recognized and described by Freidberg (2016); its distribution apparently does not exceed the one mapped in that paper. As we consider *Goniglossum* (and *Myiopardalis*) as subgenera within *Carpomya*, *G. liat* is also transferred to the latter genus.

Carpomya (Goniglossum) wiedemanni (Meigen, 1826) (figs 3, 1; 4, 1)

Trypeta wiedemanni Meigen, 1826: 320; *Oedaspis wiedemanni*: Loew, 1862 b: 49; *Carpomya wiedemanni*: Norrbom, 1997: 340; Norrbom et al., 1999: 115; *Goniglossum wiedemanni*: Hendel, 1927: 92; Richter, 1960: 804; Kandybina, 1977: 112; Korneyev, 1983: 12; Kameneva & Korneyev, 1985: 68; *Goniglossum wiedemanni*: Smit, 2010: 128; Freidberg, 2016: 59; *Gonyglossum wiedemanni*: Bezzi, 1910: 4, 6; Silvestri, 1920: 209. — Tephritis

bryoniae Meigen, 1826: 321 (nomen nudum); *Goniglossum wiedmanni*: Rondani, 1856: 110 (misspelling of *wiedemanni* Meigen).

Material. **France:** Gard: Pont du Gard, 43.95 N, 4.53 E, 5.06.1995, 1 ♂, 1 ♀ (B. Merz & M. Eggenberger); **Italy:** Bognocavallo 10 km W Ravenna, Rt S253, 44.40 N, 12.05 E, ex *Bryonia dioica*, exit 10.04.2007, 3 ♂, 2 ♀ (G. Pezzi); **Ukraine:** Crimea: Kerch Peninsula, Opuk Mt., 45.03 N, 36.22 E, slopes, 21.06.1950 (I. Maltsev); **Armenia:** Gudemnis, 38.95 N, 46.18 E, 22.06.1984, 4 ♂ (V. Ermolenko) (SIZK).

Distribution. Austria, Belgium, Britain, European Russia (south); France (mainland and Corsica), Germany, Hungary, Italy (mainland and Sicily), Spain (mainland), Switzerland, the Netherlands, Ukraine; Armenia (first record).

Host plants. *Bryonia dioica* (Cucurbitaceae) (Merz, 1994); *Bryonia cretica* L., *B. syriaca* Boiss. (Smith & Bush, 1999).

Remarks. This species was recorded from Ukraine (Richter, 1960) based on specimens collected by Jaroszewsky in Myrhorod in the 19th century; the specimen from Crimea was collected almost 70 years ago. This species has not been collected in Ukraine recently, to our knowledge.

Carpomya (Myopardalis) pardalina Bigot, 1891 (figs 1, 1–2; 2, 2; 3, 3; 4, 2)

Carpomyia pardalina Bigot, 1891: 51; *Myiopardalis pardalina*: Bezzi 1910: 4, 8; Hendel, 1927: 90; Freidberg & Kugler, 1989: 194; White & Elson-Harris, 1992: 349; *Carpomyia (Myiopardalis) pardalina*: Zaitzev, 1919: 66; 1947: 6; Rohdendorf, 1936: 22, 35; Kandybina, 1965: 668; 1977: 51; *Carpomyia pardalina*: Norrbom, 1997: 340; Norrbom et al., 1999: 115. — *Carpomyia caucasica* Zaitzev, 1919: 64; *Carpomyia (Myiopardalis) caucasica*: Rekach, 1930: 5. — Kryshtal, 1949: 203 (misidentification).

Material. **Israel:** Genin, 1.07.1971, 1 ♂, 1 ♀ (A. Freidberg); **Ukraine:** Kherson: Skadovsk District, emerged from *Cucumis melo*, 17.09.1916, 1 ♂ (R. Mishustin) (SIZK).

Distribution. Ukraine (**first record in Europe**); Asian Russia (North Caucasus); Cyprus, Iran, Iraq, Israel, Lebanon, Syria, Turkey, Armenia, Georgia, Azerbaijan, Turkmenistan, Afghanistan; India.

Host plants. Cucurbitaceae: *Cucumis melo*, *C. melo* var. *flexuosus* (Freidberg & Kugler, 1989).

Remarks. It is believed that the melon fruit fly is now widespread in all the areas of melon plantings within Ukraine, as it was entirely neglected at the beginning of its spread. Furthermore, it has been found to be imported into many other regions of Ukraine with melon transported for commercial purposes; for instance, in the Transcarpatian Region (http://izan.kiev.ua/ukrbin/show_image.php?imageid=41666). Its establishment, however, has been restricted to the southern Ukraine, which is the only appropriate area for cultivation of its hosts.

Rhagoletis Loew, 1862

Rhagoletis Loew, 1862b: 44

Type species: *Rhagoletis cerasi* (Linnaeus, 1758) (by monotypy).

Zonosema Loew 1862b: 43

Type species: *Tephritis alternata* Fallén, by subsequent designation of Rondani, 1870: 6.

Microrrhagoletis Rohdendorf, 1961: 187

Type species: *Microrrhagoletis samojlovitshae* Rohdendorf (by original designation).

Megarrhagoletis Rohdendorf, 1961: 196.

Type species: *Megarrhagoletis magniterebra* Rohdendorf (by original designation).

Diagnosis. Medium-sized (3.0–8.0 mm) fruit flies with 3 frontal and 2 orbital setae, pale or dark postocellar seta, short head, pointed apex of flagellomere 1 (except in *R. kurentsovi* (Rohdendorf, 1961) from Far East Russia and some Neotropical species); either pale yellow to orange, or mostly black with creamy white or yellow scutellum except

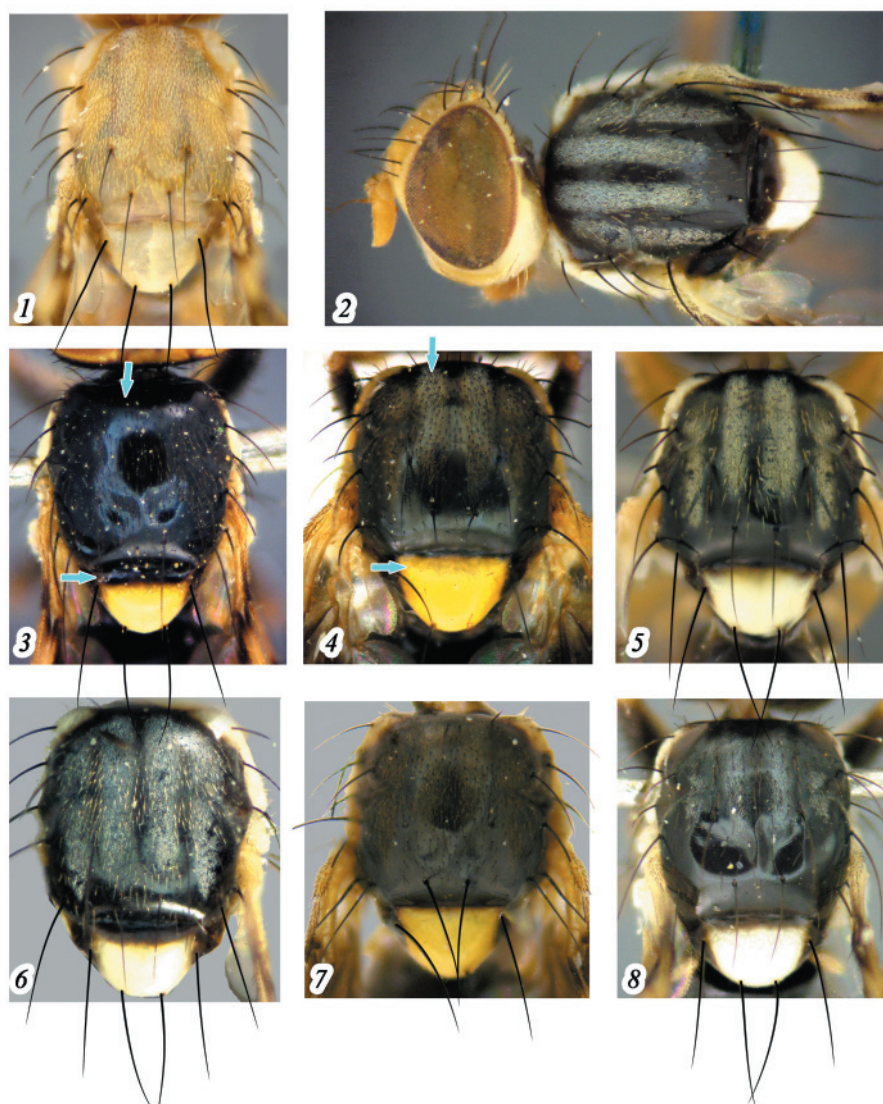


Fig. 5. *Rhagoletis* spp. mesonotums (1–8), dorsal view, and head (2), lateral view: 1 — *R. completa*; 2 — *R. bagheera*; 3 — *R. berberidis*; 4 — *R. cerasi*; 5 — *R. flavicincta*; 6 — *R. flavigenualis*; 7 — *R. obsoleta*, Myhiia; 8 — *R. sp. near obsoleta*, Mt. Hermon.

base and postpronotal lobes, long and variously acute posterior lobe of surstylus of male, oviscape with T-shaped desclerotized posteromedial area ventrally, and aculeus uniformly tapered apically. Third instar larva with variable number (from 3 to 20) of oral ridges and stomal sensory organ with or without preoral teeth.

Remarks. *Rhagoletis* is a heterogeneous genus with five to seven groups of species associated with different host plant families (Rhamnaceae, Berberidaceae, Solanaceae, etc.) in the Palaearctic, Nearctic, and Neotropical Regions (and a few species in montane areas in the northern Oriental Region), with the relationships among them and the other genera of the tribe Carpomyini (e. g., *Carpomya* and *Zonosemata*) still poorly resolved and understood.

In the case *Carpomya* is found to be an in-group within *Rhagoletis*, the latter either would incorporate its species and become a junior synonym of the latter, or should be split into several monophyletic genera (V. Korneyev, unpublished data; J. Jenkins,

unpublished data; J. Smith et al., in prep.). Here, we abstain from any taxonomic changes until phylogenetic relationships in *Rhagoletis* are better understood.

Key to species of *Rhagoletis* of western Palearctic Region

1. Mesonotum uniformly reddish-yellow (as on fig. 5, 1), rarely brown posteriorly. 2.
— Scutum black; postpronotal lobe, sides and scutellum yellow or whitish (as on figs 5, 2–8). 5.
2. Wing with short accessory crossband in cell r_1 (figs 6, 1–3). 3.
— Wing without accessory crossband in cell r_1 (fig. 7, 3). Larvae in walnut (*Juglans*) husk
..... *R. completa* Cresson
3. Subapical band not extending anterior of vein R_{2+3} (usually not beyond R_{4+5}) (fig. 6, 1). Larvae in *Berberis*.....
..... *R. meigenii* (Loew)
— Subapical band reaching anterior wing margin (figs 6, 2–7). 4.
4. Abdominal tergites 1–5 entirely reddish-yellow. Larvae in *Rosa*. *R. alternata* (Fallén)
— Abdominal tergites 1–5 black basally or entirely. Larvae in *Berberis*. *R. caucasica* Kandybina & Richter
5. Wing with short accessory crossband in cells r_1 and r_{2+3} (figs 6, 4–6). 6.
— Wing without accessory crossband in cell r_1 and r_{2+3} (figs 7, 1–8). 7.
6. Scutum with four silvery tomentose vittae; scutellum entirely yellow, except faint anterior band (fig. 5, 4). Wing with apical crossband crossing vein M and entering into cell m (figs 6, 5–6). Larvae in *Lonicera* and cherry fruits. *R. cerasi* (Linnaeus)
— Scutum shining black; anterior margin of scutellum black (fig. 5, 3). Wing with apical crossband touching M apex, but not entering into cell m (fig. 6, 4). Larvae in *Berberis* seeds..... *R. berberidis* Jermy
7. Apical crossband simple, not bifurcated (fig. 7). [Fore femur colouration variable.] Larvae not in cherries. .. 8.
— Apical crossband bifurcated posteriorly, usually with distal branch isolated as separate spot (fig. 6, 7). [Fore femur usually entirely yellow.] Larvae in cherries
..... *R. cingulata* (Loew)
8. Apical crossband entirely contiguous with apical wing margin (figs 7, 1–2, 4). 9.
— Apical crossband separated from apical wing margin by crescentic marginal hyaline area (figs 7, 5–8). .
..... 10.
9. Femora yellow. Larvae in *Lonicera*..... *R. flavicincta* Enderlein
— Femora black. *R. obsoleta* Hering and *R. sp. near obsoleta*
10. Femora yellow. Larvae in *Juniperus*..... 11.
— Femora black. 12.
11. Discal and subapical crossbands widely connected at least in cell r_{2+3} (fig. 7, 5). *R. zernyi* Hendel
— Discal and subapical crossbands entirely separated (fig. 7, 6). *R. flavigenualis* Hering
12. Smaller: WL ♂ < 2.45mm (2.0–2.4mm), WL ♀ < 2.55mm (2.2–2.5 mm). Larvae in *Rhamnus*.
..... *R. bagheera* Richter & Kandybina
— Larger: WL ♂ > 2.45mm (2.5–3.2mm), WL ♀ > 2.55mm (2.6–3.2mm)..... 13.
13. Fore femur mostly black, except yellowish ventral side. Larvae in *Hippophae*. *R. batava* Hering
— Fore femur mostly yellow, except brownish dorsal band. Larvae in *Juniperus*..... *R. sp. near flavigenualis*

Rhagoletis alternata (Fallén, 1814) (figs 6, 2)

Tephritis alternata Fallén, 1814: 162, 1820: 3; *Trypeta alternata* Loew, 1844: 315; *Zonosema alternata*: Loew, 1862b: 43; *Zonosema alternatum*: Rohdendorf, 1961: 192; *Rhagoletis alternata*: Hendel, 1927: 74; Rohdendorf, 1936: 23; Bush, 1966: 512; Korneyev, 1983: 12; Kameneva & Korneyev, 1985: 68; White & Elson-Harris, 1992: 386; Merz, 1994: 108, 2001: 92; Korneyev, 1997: 95; Norrbom et al., 1999: 200; Merz & Korneyev, 2004; Smit, 2010: 129.

Material. Ukraine: Kyiv: “Kyiv”, 27.06.1920, 1 ♂ [S. Paramonov], Irpin, 50.5279 N, 30.2643 E, ex *Rosa* sp., 7.09.1993–07.1994, 2 ♀ (V. Korneyev); Chernihiv: Yaduty, 51.41 N, 32.39 E, ex *Rosa* sp., 08.2000–1.06.2001, 1 ♂, 1 ♀ (V. Korneyev); Cherkasy: Kaniv Nature Reserve, 49.70 N, 31.53 E, ex *Rosa* sp., 2.10.1980–1.06.1981, 1 ♂ (V. Korneyev); **Russia: Northern Caucasus:** Karachaevo-Cherkessia: Teberda, 43.44 N, 41.74 E, 18.07.2013, 1 ♂, 19.07.2013, 1 ♀ 21.07.2013, 1 ♂, 1 ♀ (S. & V. Korneyev) (SIZK).

Distribution. Andorra, Austria, Belgium, Britain, Bulgaria, Czech Republic, Denmark (mainland), Finland, France (mainland), Germany, Hungary, Lithuania, Norway (mainland), Poland, Romania, Russia (European: North-Eastern, Central,

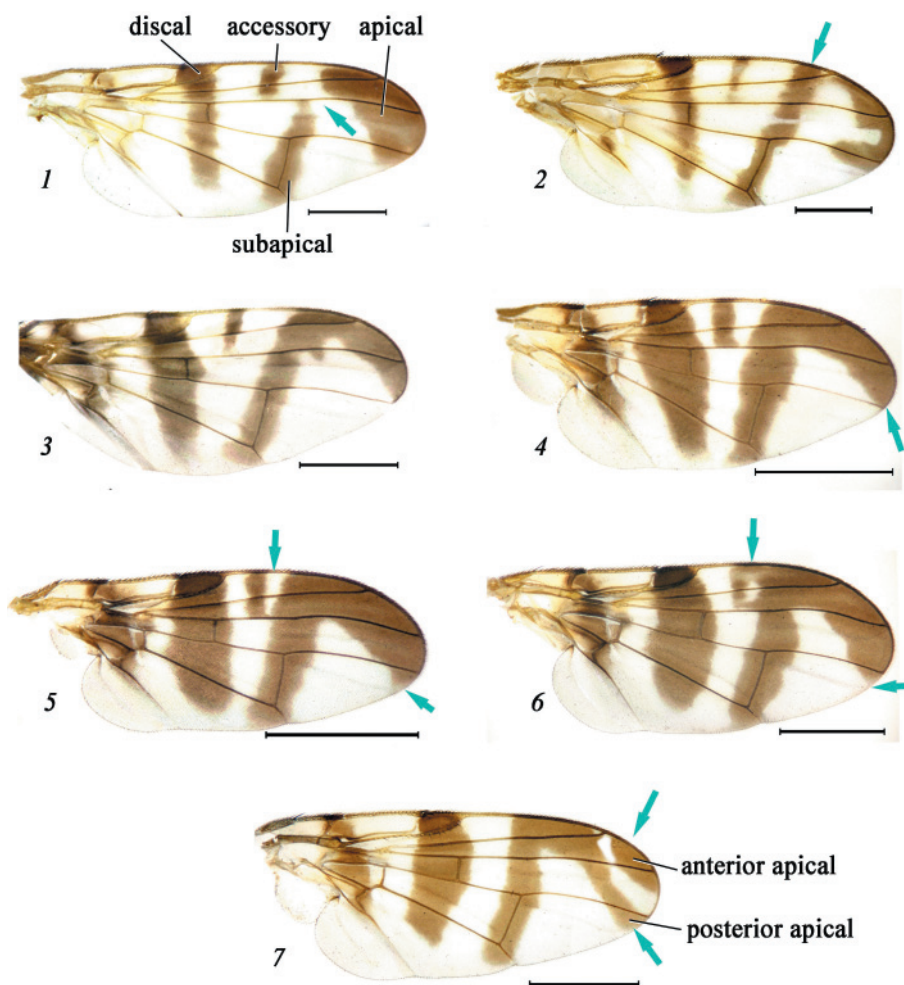


Fig. 6. *Rhagoletis* spp. wings: 1 — *R. meigenii*; 2 — *R. alternata*; 3 — *R. caucasica*; 4 — *R. berberidis*; 5–6 — *R. cerasi*; 7 — *R. cingulata*.

Eastern), Slovakia, Sweden, Ukraine; Asian Russia: Northern Caucasus, Altai, Tyva, south of Far East; Kazakhstan, Kyrgyzstan, Japan.

Host plants. *Rosa acicularis* Lindl., *R. alberti* Rgl., *R. canina* L., *R. rugosa* Thunb., *R. spinosissima* L., *R. villosa* (Kandybina, 1977; Smith & Bush, 1999).

***Rhagoletis bagheera* Richter & Kandybina, 1997 (figs 5,2, 7,7)**

Rhagoletis bagheera Richter & Kandybina, 1997: 915.

Material. Paratypes 1 ♂, 1 ♀: **Armenia**: Asni, Vedi Distr., 5.08.1965, (V. Richter) (SIZK).

Distribution. Armenia, E Georgia.

Host plant. *Rhamnus pallasii* (Rhamnaceae) (Richter & Kandybina, 1997).

Remarks. This species can be recognized among the related Western Palaearctic species (*R. batava*, *R. flavigenualis*, *R. sp. near flavigenualis*) by the combination of black femora, smaller size, and different host plant.

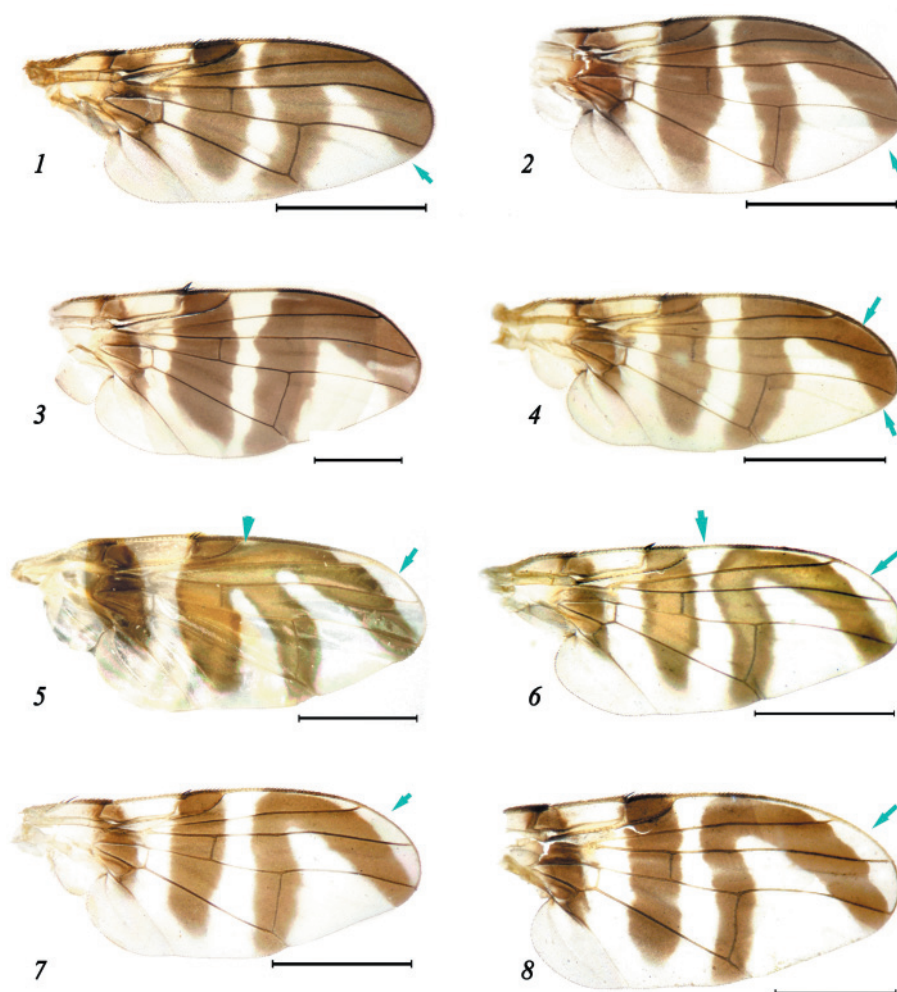


Fig. 7. *Rhagoletis* spp. wings: 1 — *R. obsoleta*, Myhiia; 2 — *R. sp. near obsoleta*, Mt. Hermon; 3 — *R. completa*; 4 — *R. flavicineta*; 5 — *R. zernyi*; 6 — *R. flavigenualis*; 7 — *R. bagheera*; 8 — *R. batava*.

Rhagoletis batava Hering, 1958 (figs 7, 8)

Rhagoletis batava Hering, 1958: 2; Rohdendorf, 1961: 183; Kandybina, 1977: 145; White & Elson-Harris, 1992: 388; Merz, 2001: 92; Norrbom et al., 1999: 200; Smit, 2010: 129.

Material. **The Netherlands:** Hompelvoet, Z.H., 10, 18.08.2000, 3 ♂, 3 ♀ (B. v. Aartsen); **Kyrgyzstan:** on *Hippophae rhamnoides*, numerous specimens; **Asian Russia:** Altai, numerous specimens (SIZK).

Distribution. The Netherlands, Switzerland (?); Spain (?); Russia: Northern Caucasus; Altai, Tyva; Kyrgyzstan.

Host plant. *Hippophae rhamnoides* (Elaeagnaceae) (Kandybina, 1977).

Remarks. This species can be recognized among the related western Palearctic species (*R. bagheera*, *R. flavigenualis*, *R. sp. near flavigenualis*) by the combination of black femora, slightly larger size (WL = 3.5–4), and different host plant (*Hippophae rhamnoides* rather than *Rhamnus* or *Juniperus*). We have seen no material from Switzerland or Spain, and records from these countries need verification by reexamination of specimens.

Rhagoletis berberidis Jermy, 1961 (figs 5, 3, 6, 4)

Rhagoletis berberidis Jermy, 1961: 133, 136; Benedek, 1961: 45; Kandybina, 1962: 450, 1977: 159; White & Elson-Harris, 1992: 388; Merz, 1994: 108; Korneyev, 1997: 94; Norrbom et al., 1999: 200.

Material. **Switzerland:** **Visp:** Baltschieder, 46.31 N, 7.88 E, h = 640 m, 22.06.1989, 1 ♂, Betten-Talstation, 46.37 N, 8.08 E h = 850 m, 19.07.1991, 3 ♂ (B. Merz); **Ukraine:** **Kyiv:** Lysa Hora, 50.40 N, 30.55 E, 16.07.1997, 6 ♂, 19.07.1997, 2 ♂, 1 ♀ (V. Korneyev); **Russia:** **Northern Caucasus:** Karachaevo-Cherkessia: Teberda, Jamagat, 43.46 N, 41.76 E, 26.07.2013, 2 ♂ (V. Korneyev); Kabardino-Balkaria: Nalchik, ex *Berberis vulgaris*, 26.08.1960, 2 ♂, 9 ♀ (Sheldeshova) (SIZK).

Distribution. Austria, Hungary; Slovakia, Switzerland; Ukraine; Russian Northern Caucasus; Armenia.

Host plant. *Berberis vulgaris* L. (Berberidaceae) (Jermy, 1961; Benedek, 1961; Kandybina, 1977; Merz, 1994).

Rhagoletis caucasica Kandybina & Richter, 1976 (figs 6,3)

Rhagoletis caucasica Kandybina & Richter, 1976: 184; Kandybina, 1977: 171; Norrbom et al., 1999: 200.

Material. **Russia:** **Northern Caucasus:** Karachaevo-Cherkessia: Teberda, 43.43 N, 41.74 E, 7.07.2013, 1 ♂, 10.06.2013, 3 ♂, 3 ♀ (S. & V. Korneyev), 18.07.2013, 1 ♂, 21.07.2013, 1 ♀ (S. & V. Korneyev) (SIZK).

Distribution. Russian Northern Caucasus.

Host plant. *Berberis vulgaris* L. (Berberidaceae) (Kandybina & Richter, 1976; Kandybina, 1977).

Rhagoletis cerasi (Linnaeus, 1758) (figs 1, 4; 5, 4; 6, 5–6)

Musca cerasi Linnaeus, 1758: 600; *Trypeta cerasi*: Loew, 1844: 361; *Rhagoletis cerasi*: Loew, 1862b: 45; Hendel, 1927: 75; Rohdendorf, 1936: 23, 1961: 179; Zaitzev, 1947: 5; Boller & Bush, 1974; Boller et al., 1976; Korneyev, 1983: 12; Kameneva & Korneyev, 1985: 68; White & Elson-Harris, 1992: 353; Merz, 1994: 109, 2001: 92; Mohamadzade & Rasoulian, 2009: 84; Smit, 2010: 130.

Material. **Austria:** Nickelsdorf, 47.92 N, 17.04 E, on mahaleb cherry, 4.06.2003, 4 ♂ (V. Korneyev); **Greece:** Koupa NW of Skra, 41.07 N, 22.35 E, h = 700 m, swept from sweet cherry tree, 5.06.2002 (E. Kameneva, S. & V. Korneyev); **Moldova:** Vişniovca, 46.33 N, 28.44 E, 13.08.1988, 1 ♀ (V. Korneyev); **Switzerland:** **Visp:** Vispertermenin, 1600–1900 m, swept from *Lonicera*, 24 ♂, 11 ♀, Leuk, 46.33 N, 7.63 E, swept from *Lonicera*, 22.07.2004, 28 ♂, 4 ♀ (S. & V. Korneyev); **Ukraine:** **Donetsk:** Donetsk, at light, 15.06.1992, 1 ♀ (G. Popov); **Khmelnysk:** Kamyanets-Podilsky Distr., “Tovtra Verbetska” Botanical Reserve, 14.07.1997, 2 ♀ (O. Gumovsky), **Kyiv:** Kyiv, 50.467 N, 30.471 E, 1.07.2007, swept from sour cherry tree, 5 ♂, 4 ♀, Obukhiv, 50.136 N, 30.613 E, on sour cherry, 14.06.1983, (V. Korneyev); **Mykolaiv:** Myhiia, 48.00 N, 30.58 E, 21.06.2009, 4 ♂, idem, swept from *Lonicera*, 22.06.2009, 23 ♂, 12 ♀, idem, 23.06.2009, swept from *Lonicera* and *Prunus*, 11 ♂, 8 ♀ (S. & V. Korneyev) (SIZK).

Distribution. Andorra, Austria, Belgium, Britain I., Bulgaria, Croatia, Czech Republic, Denmark (mainland), Finland, France (mainland, Corsica), Germany, Greece (mainland, Crete), Hungary, Italy (mainland), Latvia, Lithuania, Moldova, The Netherlands, Norway (mainland), Poland, Portugal (mainland), Romania, Sardinia, Sicily, Slovakia, Russia (European Territory: Center, East, South), Spain (mainland), Sweden, Switzerland, Ukraine; Asian Russia (Western Siberia), Georgia, Armenia, Turkey, Iran, Kazakhstan (Northern and North-Eastern).

Host plants. Cherries (Rosaceae: *Prunus cerasus* L., *P. avium* L., *P. serotina* Ehrh., *P. mahaleb* L.) and honeysuckles (Caprifoliaceae: *Lonicera tatarica* L., *L. xylosteum* L.) (Hendel, 1927; White & Elson-Harris, 1992; Merz, 1994).

Rhagoletis cingulata (Loew, 1862) (figs 6, 7)

Trypeta cingulata Loew, 1862a: 76; *Rhagoletis cingulata*: Loew, 1873: 263; Bush, 1966: 473; White & Elson-Harris, 1992: 359; Norrbom et al., 1999: 201; Boller and Mani, 1994: 83; Merz & Korneyev, 2004; Smit, 2010: 130; EPPO, 2004: 8, 2010a: 4, 2010b: 5; 2013: 6; 2014: 6; Baugnée, 2006; Szeoke, 2006: 470; Bjeliš & Seljak, 2008: 14; Egatner et al. 2010: 158; EFSA, 2014: 3854; CABI, 2016; Bjeliš et al., 2016: 75. — *Rhagoletis indifferens*: Merz, 1991: 56, 1994: 109 (misidentification).

Material. **The Netherlands:** Burgh Zld., 51.69N, 3.73E, 9.08.2000, 2♂, 1♀, 17.08.2000, 1♀ (B. v. Aartsen); USA: Michigan: Oceana Co., near Hart, 26.07.1989, 1♂, 1♀ (J. Jenkins); Florida: Lake Co., Clermont, McPhail trap, 11.06.1992, 1♂, 1♀ (J. Hunt); Orange Co., Orlando, 12.05.2005, 1♂, 1♀ (J. McDermott); Lakeland, Steine trap, 4.05.1964, 1♂ (R. Vild), 11.05.1964, 1♂, 1♀ (D. C. Phelps) (SIZK).

Distribution. Belgium, Croatia, Czech Republic, France, Germany, Hungary, Italy (mainland), the Netherlands, Poland, Slovenia, Switzerland; Canada, USA.

Host plants. *Prunus serotina* Ehrn., *P. pensylvanica* L., *P. virginiana* L., *P. cerasus* L., *P. avium* L., and *P. mahaleb* L. (Rosaceae) (Smith & Bush, 1999).

Remarks. Casually recorded in 1983, this species was recorded from Switzerland by Merz (1991) as "*R. indifferens*", but later was correctly identified as *R. cingulata* (Boller & Mani, 1994; EPPO, 2004, 2010 a; Merz & Korneyev, 2004). European specimens often have widely darkened mid and hind femora, as well as the wing pattern typical for *R. indifferens*. Available barcoding data of European specimens (J. Smit, unpublished data) fit well to existing COI sequences for *R. cingulata*, rather than *R. indifferens*, on GenBank.

R. cingulata is a quarantine species, which is expected to spread to Ukraine.

Rhagoletis completa Cresson, 1929 (figs 5, 1, 7, 3)

Rhagoletis suavis ssp. *completa* Cresson, 1929: 412; *Rhagoletis completa*: Bush, 1966: 488; Merz, 1991: 56; 1994: 109; White & Elson-Harris, 1992: 359; Norrbom et al., 1999: 200; Verheggen et al., 2017: 1.

Material. USA: Washington: Asotin Co., Clarkston, ex *Juglans regia*, 17.10.1982, 1♂, 17.10.1983, 1♂, 2♀, 30.10.1988, exit 5.08.1989, 2♀ (W. J. Turner) (det. J. Jenkins) (SIZK). No European material was available during this study.

Distribution. Austria, Croatia, France, Hungary, Germany, Slovenia, Spain, Switzerland (Verheggen et al., 2017); Canada, USA.

Host plants. *Juglans nigra* L., *J. microcarpa* Berl., *J. hirsuta* Manning, *J. major* (Torr.) Heller., *J. regia* L., *J. californica* S. Watson, *J. hindii* Rehd., *J. regia* L. (Smith & Bush, 1999).

Remarks. According to Verheggen et al. (2017), invasive European populations of the walnut husk fly initially were recorded from Switzerland and Italy (1988–1991). This species has subsequently established in least seven additional countries in Europe, but still has not reached the limits of its potential distribution, mainly by natural adult dissemination and adult hitchhiker behavior, and, to a lesser extent, transportation of larvae in fresh fruits. When the fly is uncontrolled, 100% of walnut trees can be infested, and losses in walnut yields may be up to 80 %. Under phytosanitary control, the negative effect can be reduced to less than 10% yield loss. There is a strong need for *R. completa* monitoring across European countries. In Ukraine, it is expected to invade the Transcarpatian Region.

Rhagoletis flavicincta Enderlein, 1934 (figs 5, 5; 7, 4)

Rhagoletis flavicincta: Loew, 1873: 263 (nomen nudum); *Rhagoletis flavicincta* Enderlein, 1934: 426; Rohdendorf, 1961: 184; Kandybina, 1961: 204; 1977: 143 (larvae); Korneyev & Merz, 1997: 57; Norrbom et al., 1999: 201; Mohamadzade & Rasouljan, 2009: 84.

Material. **Ukraine:** Mykolaiv: Myhiia, 48.00 N, 30.58 E, swept from *Lonicera*, 21.06.2009, 6 ♂, 22.06.2009, 2 ♂, 23.06.2009, 3 ♂, 1 ♀ (S. & V. Korneyev); **Kyrgyzstan:** numerous specimens swept from *Lonicera* in various localities (SIZK).

Distribution. Ukraine; European Russia; Iran; Kazakhstan, Kyrgyzstan, Tadjikistan, Uzbekistan; Mongolia.

Host plants. *Lonicera korolkowii* Stapf, *L. stenantha* Pojark., *L. nummularifolia* Jaub. and Spach (Caprifoliaceae) (Kandybina, 1977; Smith & Bush, 1999).

Rhagoletis flavigenualis Hering, 1958 (figs 5, 6; 7, 6)

Rhagoletis flavigenualis Hering, 1958: 3; Rohdendorf, 1961: 186; White & Elson-Harris, 1992: 388; Korneyev & Merz, 1997: 57; Norrbom et al., 1999: 201; Mohamadzade & Rasouljan, 2009: 84. — *Rhagoletis zernyi*: Rohdendorf, 1936: 5; Zaitzev, 1947: 6 (misidentification).

Material. **Kyrgyzstan:** Ysyk-Köl Region: Terskey Alatau Mts, ex *Juniperus sabina*, 1 ♂ (M. Kandybina); Kyrgyz Alatau Mts., 42.36 N, 73.87 E, 5–7.08.1998, 2 ♂, 1 ♀ (E. Kameneva & V. Korneyev); **Kazakhstan:** Aksu-Djabagly Natural Reserve, ex *Juniperus seravhanica*, 5.08.1984, 17.08.1984, 15.09.1984, 5 ♂ (Fisechko) (SIZK); **Turkmenistan:** Kopet-Dagh between Firyuza and [Iranian] border, 23.09.1930 (L. Bianchi) (ZISP).

Distribution. Georgia, Turkey, Iran, Turkmenistan, Kazakhstan, Kyrgyzstan, Tajikistan.

Host plants. *Juniper excelsa* M. Bieb., *J. seravschanica* Kom., *J. semiglobosa* Rgl., *J. sabina* L., *J. turkestanica* Kom. (Cupressaceae) (Kandybina, 1977; Smith & Bush, 1999).

Remarks. This species can be recognized among the related Western Palearctic species (*R. bagheera*, *R. batava*, *R. sp. near flavigenualis*) by the combination of yellow femora (only hind femur usually brown in basal one-third), smaller size, and different host plant.

Rhagoletis sp. near flavigenualis Hering

Rhagoletis batava: Merz, 1994: 108 (misidentification). — *Rhagoletis flavigenualis*: Merz, 2006: 8 (misidentification).

Material. **Switzerland:** Graubunden: Mezocco, 890 m, 1.07.1990, 1 ♂: (B. Merz) (MHNG); Visp: Vispetrterminen, 1300–1900 m, 21.07.2004, 1 ♂, 1 ♀ (S. & V. Korneyev) (SIZK); idem, 1500 m, “Kreuz” (the cross on a hill), 21.07.2004, idem, 1400–1600 m, 18.05, 17.07, 20.07, 26.07.1993, 4 ♂, 3 ♀ (B. Merz) (MHNG).

Distribution. Switzerland.

Host plants. Unknown; swept from *Juniperus sp.*

Remarks. This species can be recognized from the related Western Palearctic species (*R. flavigenualis*, *R. bagheera*, *R. batava*) by the combination of black femora (including entire fore femur), smaller size, and different host plant. It can be readily differentiated from *R. flavigenualis*, which also feeds in juniper “berries”, by the femora black (mostly yellow, except base of hind femur in *R. flavigenualis*) and by the wing crossbands uniformly dark brown (yellow, brown bordered in *R. flavigenualis*). It differs from *R. batava* and *R. bagheera* by the fore femur largely black and the scutellum only narrowly darkened on anterior 0.1–0.2 (in *R. batava* and *R. bagheera*, fore femur only with black dorsal vitta, and scutellum widely darkened on anterior 0.25–0.30). In addition, it differs from *R. batava* by its smaller size (WL = 3.0–3.5 mm; in *R. batava*, WL = 3.5–4.0 mm). Molecular analysis (Hulbert, Smith & S. Korneyev, in prep.) supports the hypothesis that this is an undescribed new species, which will be subject to a forthcoming paper.

Rhagoletis meigenii (Loew, 1844) (figs 1, 3, 6, 1)

Trypeta meigenii Loew, 1844: 316; *Zonosema meigenii* Loew, 1862b: 44; *Zonosema meigeni*: Rohdendorf, 1961: 194; Kandybina, 1961: 209; *Rhagoletis meigeni*: Hendel, 1927: 74; Rohdendorf, 1936: 23; Kandybina, 1977: 165; *Rhagoletis meigenii*: Korneyev, 1983: 12; Kameneva & Korneyev, 1985: 68; White & Elson-Harris, 1992: 388; Merz, 1994: 109, 2001: 92; Korneyev, 1997: 95; Norrbom et al., 1999: 201; Merz & Korneyev, 2004.

Material. **Ukraine:** Kyiv: National Botanical Gardens, 50.42 N, 30.56 E, 24.07.2006, 10 ♀ (V. Korneyev & E. Kameneva); Lysa Hora, 50.40 N, 30.55 E, 19.07.1997, 2 ♀ (V. Korneyev); Motovylyvka, 50.20 N, 30.05 E, 15.07.1985, 1 ♀ (V. Korneyev); Cherkasy: Kaniv Distr., Trostyanets, 49.77 N, 31.36 E, 20.06.1980, 3 ♀ (E. Kameneva); **Russia: Northern Caucasus:** Karachaevo-Cherkessia: Teberda, 43.43 N, 41.74 E, 10.06.2013, 4 ♂, 4 ♀, 19.07.2013, 2 ♀, 21.07.2013, 6 ♀, 22.07.2013, 4 ♀, 23.07.2013, 2 ♀, 24.07.2013, 12 ♀, 29.07.2013, 1 ♀, 30.07.2013, 1 ♀, 2.08.2013, 7 ♀, idem, Jamagat, 43.46 N, 41.76 E, 26.07.2013, 1 ♀, (S. & V. Korneyev).

Distribution. Spain, Latvia, Estonia; Ukraine; Russia: European Territory, Northern Caucasus (**first record**).

Host plant. *Berberis vulgaris* L. (Kandybina, 1977).

Rhagoletis obsoleta Hering, 1936 (figs 5, 7; 7, 1)

Rhagoletis cerasi f. *obsoleta* Hering, 1936: 182; *Rhagoletis obsoleta*: Rohdendorf, 1961: 182. — *Rhagoletis cerasi* (in synonymy): Norrbom et al., 1999: 201; Merz & Korneyev (2004) (partly).

Material. **Ukraine: Mykolaiv:** Myhiia, 48.00 N, 30.58 E, swept from *Lonicera*, 23.06.2009, 1 ♂ (S. & V. Korneyev) (SIZK).

Host plant. *Lonicera* sp. (Kandybina, 1977).

Remarks. This species was briefly described by Hering (1936) as a form of *R. cerasi* without the accessory dark crossband on the wing and in a comparison with *R. reducta* Hering from northeastern China. Subsequently Rohdendorf used *Rhagoletis obsoleta* as the valid name for a single specimen from the Voronezh Region of southwestern Russia. The name became available and then used in synonymy with *R. cerasi* but without sound proofs. All the known records (Hering, 1936; Rohdendorf, 1961; current paper) are based on single specimens collected together with numerous *R. cerasi* or also with *R. flavicincta* on *Lonicera* bushes. It shows indirectly that the specimens identified as *R. obsoleta* are merely the dark morph of *R. cerasi* with the accessory band completely fused with the subapical crossband. All of them have a very narrow hyaline gap between the discal and subapical crossbands (fig. 7, 1) as if the accessory band were incorporated into the subapical crossband, as well as entirely black femora and abdominal tergites, which is common for many European populations of *R. cerasi* from *Lonicera*. In addition, many specimens of *R. cerasi* have the accessory band connected or partly fused to the subapical crossband. The synonymy of the two names is very highly probable, but further proof based on molecular analysis of specimens from the type locality of *R. obsoleta* (Berlin-Frohnau) is needed.

An alternative hypothesis that *R. obsoleta* could be a hybrid form of *R. cerasi* and *R. flavicincta*, though less probable, must be also checked, as all three nominal species occur on *Lonicera* in southwestern Ukraine and, according to Rohdendorf (1961), in southwestern European Russia (Voronezh).

Rhagoletis* sp. near *obsoleta (figs 5, 8; 7, 2)

Material. **Israel:** Mt Hermon, 33.38N, 35.83E, 1600 m, on *Lonicera arborea*, 18.07.1995, 1 ♂, 1 ♀, idem, ex berries of *L. arborea*, 3.08.1995 — exit 05.1996, 2 ♀ (A. Freidberg), idem, 1650 m, 17–18.07.1995, 2 ♂ (I. Yarom) (SIZK).

Remarks. The specimens from Mt. Hermon precisely fit the characters of *R. obsoleta* (all the femora and abdominal tergites black, wing with four wide dark brown crossbands, without traces of the accessory band). Apparently all the specimens in this locality and the

only population of a *Rhagoletis* species known from Israel do not vary in their wing patterns (unlike the European *R. cerasi* / *R. obsoleta*), but it has not been ever recorded in the literature due to its dubious species identity. It is quite possible that this geographically isolated population represents a new species.

Further molecular analysis and comparison with European species is necessary.

Rhagoletis zernyi Hendel, 1927 (fig. 7, 5)

Hendel, 1927: 76; Merz, 2001: 92; Merz & Blasco-Zumeta, 1995: 132; Norrbom et al., 1999: 202.

Material. **Spain:** Monegros, Pina-de-Negro, 13.08.1992, 1♂ (Blasco-Zumeta) (Merz det. 1994) (SIZK).

Distribution. **Spain.**

Host plants. *Juniperus thurifera* L. (Merz & Blasco-Zumeta, 1995).

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References

- Baugnée, J. Y. 2006. Contribution à la connaissance des Tephritidae de Belgique (Diptera: Brachycera). *Notes faunistiques de Gembloux*, 59, 63–113.
- Becker, T. 1903. Ägyptische Dipteren. (Fortsetzung und Schluss). *Mitteilungen aus dem Zoologischen Museum in Berlin*, 2 (3), 67–195.
- Bezzi, M. 1910. Restaurazione del genere *Carpomyia* (Rond.) A. Costa. *Bollettino del Laboratorio di Zoologia Generale e Agraria della Regia Scuola d'Agricoltura, Portici* (1911) 5, 3–33.
- Bigot, J. M. F. 1891. The Baluchistan melon fly. *Indian Museum Notes*, 2, 51.
- Bjeliš, M., Buljubašić, I., Oštrkapa-Međurečan, Ž. 2016. Slow establishment of *Rhagoletis cingulata* in Croatia. *Bulletin of Insectology*, 69 (1 supplement), 75–80.
- Bjeliš, M., Seljak, G. 2008. *Rhagoletis cingulata* L. (Diptera, Tephritidae) — new quarantine pest in Croatia and Slovenia. In: *5 simpozij of plant protection in Bosnia and Herzegovina. Sarajevo, 16–18 December 2008. Zbornik rezimea*, 14
- Boller, E. F. & Bush, G. L. 1974. Evidence for genetic variation in populations of the European cherry fruit fly, *Rhagoletis cerasi* (Diptera: Tephritidae) based on physiological parameters and hybridization experiments. *Entomologia Experimentalis et Applicata*, 17, 279–293.
- Boller, E. F. & Mani, E., 1994. Two North American *Rhagoletis* spp. in Europe. *IOBC/wprs Bulletin*, 17, 83.
- Boller, E. F., Russ, K., Vallo, V., Bush, G. L. 1976. Incompatible races of European cherry fruit fly, *Rhagoletis cerasi* (Diptera: Tephritidae), their origin and potential use in biological control. *Entomologia Experimentalis et Applicata*, 20, 237–247.
- Bush, G. L. 1966. The taxonomy, cytology and evolution of the genus *Rhagoletis* in North America. *Bulletin of the Museum of Comparative Zoology*, 134, 431–562.
- CABI. 2016. *Rhagoletis cingulata*. In: *Invasive species compendium*. CAB International, Wallingford, UK. [online] URL: <http://www.cabi.org/isc/datasheet/47051>
- Costa, A. 1854. Frammenti di entomologia napoletana. *Annali Scientifici. Giornal di Scienze Fisiche, Matematiche, Agricoltura, Industria ec. ec. ec. (Napoli)*, 1, 69–91.
- Cresson, E. T., Jr. 1929. A revision of the North American species of fruit flies of the genus *Rhagoletis* (Diptera: Trypetidae). *Transactions of the American Entomological Society (Philadelphia)*, 55, 401–414.
- Curran, C. H. 1932. New North American Diptera, with notes on others. *American Museum Novitates*, 526, 1–13.
- Efflatoun, H. C. 1924. A monograph of Egyptian Diptera, Part II., Fam. Trypanidae. *Memoires de la Societe Entomologique de Egypte*, 2 (2), 1–132.
- Enderlein, G. 1934. Dipterologica. I. *Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin*. (1933), 416–429.
- EFSA. 2014. Scientific opinion on the pest categorisation of *Rhagoletis cingulata* Loew. *EFSA Journal*, 12 (10), 3854.
- Egatner, A., Zeisner, N., Hausdorf, H., Blümel, S., 2010. First record of *Rhagoletis cingulata* (Loew) (Dipt., Tephritidae) in Austria. *Bulletin OEPP/EPPO Bulletin*, 40 (1), 158–162.
- EPPO. 2004. *Rhagoletis cingulata* occurs in the Netherlands, but not *R. indifferens*. *EPPO Reporting Service*, 6 (87), 8.
- EPPO. 2010a. *Rhagoletis cingulata* occurs in Switzerland, but not *R. indifferens*. *EPPO Reporting Service*, 7 (127), 4–5.
- EPPO. 2010b. First record of *Rhagoletis cingulata* in Belgium. *EPPO Reporting Service*, 7 (128), 5.
- EPPO. 2013. *Rhagoletis cingulata* detected for the first time in Languedoc-Roussillon region (FR). *EPPO Reporting Service*, 3 (55), 6.

- EPO. 2014. First report of *Rhagoletis cingulata* in the Czech Republic. *EPO Reporting Service*, **10** (186), 6–7.
- Fallén, C. F. 1814. Beskrifning ofver de i sverige funna tistel-flugor, horande till dipter-slaget *Tephritis*. *Kungliga Svenska Vetenskapakademiens Handlingar*, **35**, 156–177.
- Fallén, C. F. 1820. *Ortalides sveciae*. Berling, Lundae, 1–34.
- Freidberg, A. 2016. New taxa of Carpomyini, with special emphasis on Goniglossum (Diptera: Tephritidae: Trypetinae). *Zootaxa*, **4144** (1), 54–70. doi: 10.11646/zootaxa.4144.1.2.
- Freidberg, A., Kugler, J. 1989. *Fauna Palaestina. Insecta IV. Diptera: Tephritidae*. Israel Academy of Sciences and Humanities, Jerusalem: [i-vi] + 1–212, pls. 1–8, 1 map.
- Hendel, F. 1914. Die Gattungen der Bohrfiegen. (Analytische Übersicht aller bisher bekannten Gattungen der Tephritinae.). *Wiener Entomologische Zeitung*, **33**: 73–98.
- Hendel, F. 1927. 49. Trypetidae. In: Lindner, E. Ed. *Die Fliegen der palaearktischen Region. Schweizerbart*, Stuttgart, **5** (Lfg. 16–19), 1–221.
- Hering, E. M. 1936. Bohrfiegen aus der Mandschurei. (11. Beitrag zur Kenntnis der Trypetidae.). *Konowia*, **15**, 180–189.
- Hering, E. M. 1958. Zwei neue paläarktische *Rhagoletis* (Dipt., Trypet.). (55. Beitrag zur Kenntnis der Trypetidae.). *Stuttgarter Beiträge zur Naturkunde*, **7**, 1–4.
- Hulbert, D. L., Korneyev, V. & Smith, J. J. 2016. Updating the phylogeny of *Rhagoletis*: focus on relationships of the North American species groups. *Poster presented at International Congress of Entomology, Orlando, Florida, USA, 25–30 September 2016*.
- Kameneva, E. P. & Korneyev, V. A. 1985. Tephritid flies (Diptera: Tephritidae) of the Ukrainian SSR fauna. *Problems of general and molecular biology*. Kiev, **4**, 67–71 [In Russian].
- Kandybina, M. N. 1961. On the diagnostics of the larvae of fruit flies (Diptera, Trypetidae). *Entomologicheskoe Obozrenie*, **40**, 202–213 [In Russian].
- Kandybina, M. N. 1962. On the diagnostics of the larvae of fruit flies (Diptera, Trypetidae) II. *Entomologicheskoe Obozrenie*, **41**, 447–456 [In Russian].
- Kandybina, M. N. 1965. On the larvae of fruit-flies of the genus *Capomyia* A. Costa (Diptera, Trypetidae). *Entomologicheskoe Obozrenie*, **44**, 665–672.
- Kandybina, M. N. 1977. *Larvae of fruit-infesting fruit flies (Diptera, Tephritidae)*. Nauka, Leningrad, 1–210 [In Russian].
- Kandybina, M. N., Richter, V. A. 1976. A new species of the picture-winged fly genus *Rhagoletis* Loew (Diptera, Tephritidae) from North Caucasus. *Doklady Akademii Nauk Armyanskoy SSR*, **62**, 184–188.
- Korneyev, V. A. 1983. Tephritid flies (Diptera: Tephritidae) of the Middle Dnieper Territory. manuscript deposited in the Ukrainian Institute of Scientific & Technical Information [UkrNIINTI], Kiev (1.12.1983, No 1343, Uk-D83), 1–28 [In Russian].
- Korneyev, V. A. 1996. Reclassification of Palaearctic Tephritidae (Diptera). Communication 3. *Vestnik Zoologii*, (1995) (5–6), 25–48.
- Korneyev, V. A. 1997. *Rhagoletis berberidis* (Diptera, Tephritidae, Trypetinae), the first faunistic record from Ukraine. *Vestnik Zoologii*, **31** (5–6), 94–95.
- Korneyev, V. A., Dirlbek, J. The fruit flies (Diptera: Tephritidae) of Syria, Jordan and Iraq. *Studia dipterologica* (2000), **7** (2), 463–482.
- Korneyev, V. A., Merz, B. 1997. A new species of *Rhagoletis* Loew (Diptera: Tephritidae), with notes on Central Asian species. *Journal of Ukrainian Entomological Society*, **3** (1), 55–64.
- Korneyev, V. A. & Ovchinnikova, O. G. (2004) 79. Tephritidae — pestrokrylki [fruit flies]. In: Lehr, P. A., ed., *Key to the insects of Russian Far East. Vol. VI. Diptera and Siphonaptera. Pt. 3*, Dal'nauka, Vladivostok, 456–564. [In Russian]
- Kryshchal, O. P. 1949. [Materials to the study of entomofauna of the Middle Dnipro valley. I.] Kyiv University Publishers, Kyiv, 1–294 [In Ukrainian].
- Linnaeus, C. 1758. *Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Tomus I. Editio decima, reformata*. L. Salvii, Holmiae, 1–824.
- Loew, H. 1844. Kritische Untersuchung der europäischen Arten des Genus *Trypeta* Meig. *Zeitschrift fuer Entomologie (Germar)*, **5**, 312–437.
- Loew, H. 1856. Neue Beiträge zur Kenntniss der Dipteren. Vierter Beitrag. *Programm der Koeniglichen Realschule zu Meseritz*, 1856, 1–57.
- Loew, H. 1862a. Diptera Americae septentrionalis indigena. Centuria secunda. *Berliner Entomologische Zeitschrift*, **6**, 185–232.
- Loew, H. 1862b. *Die europäischen Bohrfiegen (Trypetidae)*. W. Junk, Wien, 1–128 p.
- Loew, H. 1873. Monographs of the Diptera of North America. Part III. *Smithsonian Miscellaneous Collection*, **11** (3 [= pub. 256]): i–vii + 1–351 + I–XIII.
- Mamedov, D. Sh., Zhikharevich, G. P. & Mamedova, G. D. 2015. Main pests of the unabis and development of the agrotechnical measures of control them in Apsheron. *Uspekhi sovremennoy nauki*, (3), 53–58 [In Russian].
- Meigen, J. W. 1826. *Systematische Beschreibung der bekannten europäischen zweiflügeligen Insekten. Fünfter Theil*. Schulz, Hamm, i–xii + 1–412.

- Merz, B. 1991. *Rhagoletis completa* Cresson und *Rhagoletis indifferens* Curran, zwei wirtschaftlich bedeutende nordamerikanische nordamerikanische Fruchtfliegen neu für Europa. *Mitteilungen der Schweizerischen Entomologischen Gesellschaft*, 64, 55–57.
- Merz, B. 1994. *Diptera: Tephritidae*. *Insecta Helvetica Fauna*. HGE Press, Geneva, 10, 1–198.
- Merz, B. 2001. Faunistics of the Tephritidae (Diptera) of the Iberian Peninsula and the Balears. *Mitteilungen der Schweizerischen Entomologischen Gesellschaft*, 74, 91–98.
- Merz, B. 2006. The 3rd Tephritoid Taxonomists' Meeting. *Instrumenta Biodiversitatis, Muséum d'histoire naturelle, Genève*, 7, 7–13.
- Merz, B. & Blasco-Zumeta, J. 1995. The fruit flies (Diptera, Tephritidae) of the Monegros region (Zaragoza, Spain), with the record of the host plant of *Rhagoletis zernyi* Hendel, 1927. *Zapateri — Revista aragonesa de entomologia*, 5, 127–134.
- Merz, B., Korneyev, V. A. 2004. Tephritidae. Fauna Europaea, version 1.1, <http://www.faunaeur.org> (accessed 6.05.2016).
- Mohamadzade Namin, S. 2016. New distributional data on the fruit flies (Diptera: Tephritidae) in Iran. *Ukrainska Entomofaunistyka*, 7 (1), 47–52.
- Mohamadzade, S. & Rasouljan, G. R. 2009. Fruit flies of the genus *Rhagoletis* Loew (Diptera: Tephritidae) of Iran and bordering countries, with the key to species. *Vestnik Zoologii*, 43 (1), 81–86.
- Norrbom, A. L. 1997. The genus *Carpomyia* Costa (Diptera: Tephritidae): new synonymy, description of the first american species, and phylogenetic analysis. *Proceedings of the Entomological Society of Washington*, 99 (2), 338–347.
- Norrbom, A. L., Carroll, L. E., Thompson, F. C., White, I. M., Freidberg, A. 1999. Systematic Database of Names. In: Thompson, F. C., ed. *Fruit Fly Expert Identification System and Systematic Information Database*. Backhuys Publishers, Leiden, 65–299.
- Rekatch, V. N. 1930. Studies on biology and control of the melon-fly *Carpomyia (Myiopardalis) pardalina* Zaitz. (? *M. pardalina* Big.). *Bulletin of the Azerbaijan Central Agricultural Plant Breeding Experimental Station*, 9, 1–35.
- Richter, V. A. 1960. New and little-known species of fruit-flies (Diptera, Trypetidae) in the fauna of the USSR. *Entomologicheskoe Obozrenie*, 39 (4), 893–896.
- Richter, V. A. & Kandybina, M. N. 1997. A new species of the fruit flies of the genus *Rhagoletis* (Diptera, Tephritidae) from Transcaucasia. *Entomologicheskoe Obozrenie*, 76 (4), 914–920.
- Rohdendorf, B. B. 1936. [Fruit flies (Trypaneidae), their distribution and significance as quarantine pests]. Sukhumi, NKZ Abkhazii, 1–44.
- Rohdendorf, B. B. 1961. Paläarktische Arten der Gattung *Rhagoletis* Loew (Diptera, Trypetidae) und verwandte Bohrfliegengattungen. *Entomologicheskoe Obozrenie*, 40 (1), 176–213.
- Rondani, C. 1856. *Dipterologiae Italicae prodromus*. Vol. 1: *Genera Italica ordinis dipterorum ordinatim disposita et distincta et in familiae et stirpes aggregata*. Parmae, 1–228 + [1–2].
- Rondani, C. 1870. *Dipterologiae Italicae prodromus*. Vol. 7. *Genera Italica ordinis dipterorum ordinatim disposita et distincta et in familias et stirpes aggregata*. (Pars 4, Sect. 1). Parmae, 1–59.
- Silvestri, F. 1916. Sulle specie di Trypaneidae (Diptera) del genere *Carpomyia* dannose ai frutti di *Zizyphus*. *Bollettino del Laboratorio di Zoologia Generale e Agraria della Regia Scuola Superiore d'Agricoltura, Portici*, 11, 170–182.
- Silvestri, F. 1920. La mosca della *Brionia*, *Gonyglossum wiedemanni* Meig. (Diptera: Trypaneidae). *Boll. Lab. Zool. Gen. Agrar. Portici*, 14, 205–215.
- Smit, J. T. 2010. De Nederlandse boorvliegen (Tephritidae). *Entomologische Tabellen*, 5, 1–159.
- Smith, J. J., Bush, G. L. 1999. Phylogeny of the subtribe *Carpomyina* (Trypetinae), emphasizing relationships of the genus *Rhagoletis*. In: Aluja, M., Norrbom, A. L., eds. *Fruit flies (Tephritidae): Phylogeny and evolution of behavior*. CRC Press, London, 187–217.
- Szeoke, K. 2006. First report about the occurrence of American eastern cherry fruit fly (*Rhagoletis cingulata* Loew.) in Hungary. *Növényvédelem*, 42 (8), 470.
- Trikoz, N. N. & Litvinova, T. V. 2007. Damage to *Zizyphus* caused by the Ber Fruit Fly in the Nikita Botanical Gardens. *Bulletin of the Nikita Botanical Gardens*, 94, 74–76.
- Verheggen, F., Verhaeghe, A., Giordanengo, P., Tassus, X., Escobar-Gutiérrez, A. 2017. Walnut husk fly, *Rhagoletis completa* (Diptera: Tephritidae), invades Europe: invasion potential and control strategies. *Applied Entomology and Zoology*, 52 (1), 1–7.
- White, I. M. & Elson-Harris, M. M. 1992. *Fruit flies of economic significance: their identification and bionomics*. International Institute of Entomology, London. i–xii + 1–601.
- Zaitzev, F. A. 1919. [The Transcaucasian melon fly — *Carpomyia (Myiopardalis) caucasica*, sp. n. (Diptera, Trypetidae)]. *Zapiski Nauchno-Prikladnogo Otdela Tiflisskogo Botanicheskogo Sada*, 1, 64–66.
- Zaitzev, F. A. 1947. The fruit fly fauna of the Caucasus and adjacent lands (Diptera, Trypetidae). *Trudy Zoologicheskogo Instituta Akademii Nauk Gruzinskoy SSR*, 7, 1–16 [In Russian].

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