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Four new species of *Limonia* from the Mediterranean (Diptera: Limoniidae)

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Abstract. Four new species of *Limonia* Meigen, 1803 are described, viz. *L. hartveldae* sp. nov. (Portugal), *L. opacipennis* sp. nov. (Algeria, Tunisia), *L. oosterbroeki* sp. nov. (Turkey), and *L. enormis* sp. nov. (Greece: Crete), and their male terminalia are illustrated.

Key words. Diptera, Limoniidae, *Limonia*, new species, male terminalia, Palaearctic Region

Introduction

In the present, restricted sense (Savchenko 1985), the genus *Limonia* Meigen, 1803 contains over 200 species and subspecies and seems to be distributed world-wide. In the Neotropical Region, however, a single species with uncertain generic position is known. By far the highest diversity, a total of 91 species, is observed in the Oriental Region, with about a third of these being similarly doubtful as to their generic affiliation. In the Palaearctic Region, altogether 65 species and subspecies are known, with 24 West-Palaearctic species previous to this paper (Oosterbroek 2017). Combined usage of the identification keys by Savchenko (1985) (for Ukraine), Geiger (1986) (for Switzerland), and Stubbs & Kramer (2016) (for Great Britain) covers 17 of 23 species of *Limonia* occurring in Europe. Images of important specific characters may assist in identification even when identification keys to species are not attached. Thus, for example, illustrations of the male terminalia and/or other features are available from Oosterbroek (2017) for 21 European *Limonia* species. The two remaining species, *L. caucasica* Lackschewitz, 1940 and *L. subaequalis* Savchenko, 1979, are included in the keys by Lackschewitz & Pagast (1940) and Savchenko (1985), respectively.

The main distinguishing venational character, though not peculiar to *Limonia* only, is the terminal section of R_1 (beyond point of fusion with vertical R_2) which is longitudinal, continuing the direction of R_1 proximal of R_2 and at least twice as long as R_2 (Dienske 1987, Podenas & Gelhaus 2007). Representatives of *Limonia* are mostly moderate in size for the Limoniidae and

comparatively easily identified based on external characters, such as colouration, structure of antennae, wing pattern, etc. Male terminalia are distinguished by a single gonostylus (inner or ventral gonostylus of the other limoniine Limoniidae) and vary among species sometimes only by slight differences in the shape of the gonostylus and details of the aedeagal complex. The female terminalia are still more uniform and are not described in detail here.

The genus *Limonia* (= *Limnobia*) was subdivided into several species groups by Lackschewitz (1928) and this classification was in part adopted by Savchenko (1985) who differentiated the *L. flavipes* (Fabricius, 1787), *L. nigropunctata* (Schummel, 1829), *L. tripunctata* (Fabricius, 1781) [= *L. phragmitidis* (Schrank, 1781)], and *L. macrostigma* (Schummel, 1829) species groups. Although this concept is untenable taxonomically from a global point of view, being based solely on the wing pattern, I use it here as an auxiliary criterion for better characterizing the species.

Limonia species may be commonly encountered in a wide range of habitats, from humid to comparatively dry, and seem not to be especially associated with flowing or stagnant waters. Larvae live mostly in leaf litter or the upper layer of soil, but also in fungi and decaying wood (e.g. Lindner 1959, Savchenko 1985, Starý & Salmela 2004).

I here give descriptions of four new species of the genus *Limonia* from the Mediterranean, with illustrations of their male terminalia.

Material and methods

The descriptive terminology adopted here essentially follows McAlpine (1981). Terminology of wing veins is in accordance with Hennig (1954).

The following acronyms for museums and collections are used in the text:

JSOC Jaroslav Starý collection, Olomouc, Czech Republic;
RMNH Naturalis Biodiversity Center, Leiden, The Netherlands (formerly Rijksmuseum voor Natuurlijke Historie);
ZMAN Zoological Museum, University of Amsterdam, Amsterdam, The Netherlands.

The material is dried, pinned or micro-pinned, originally deposited in ZMAN, since 2011 in RMNH. One paratype each of *L. hartveldae* sp. nov. and *L. opacipennis* sp. nov. is in JSOC.

Taxonomy

Limonia hartveldae sp. nov.

(Figs 1–2)

Type material. Holotype: ♂ (RMNH), **PORTUGAL: Guarda District (formerly Beira Alta Province):** Serra da Estrela, 3 km S Manteigas, 1000 m, deciduous forest, 9.v.1994 (P. Oosterbroek & C. Hartveld leg.), labelled 'PORTUGAL Beira Alta / Serra da Estrêla / P.Oosterbroek / & C.Hartveld' // '3 km Z MANTEIGAS / decid. forest 1000 m / 9 V 1994 ST.31' [both printed, white labels] // 'HOLOTYPE / Limonia / hartveldae sp. n. ♂ / J. Starý 2017' [printed, red label]. The specimen is micro-pinned on a stage of polyporus, all legs attached but of hind left leg only femur is present; apex of abdomen cut off, terminalia dissected and placed in a sealed plastic tube with glycerine, pinned with the specimen.

Paratypes: 2 ♂♂, same data as for holotype (RMNH, JSOC). Both specimens micro-pinned.

Diagnosis. Medium-sized species. Body colouration in general dark brown, with paler areas, especially on pleuron. Wing membrane slightly tinged with brownish grey. Wing pattern

diffuse but distinct. Male terminalia with aedeagus of moderate length and breadth and paramere moderately emarginated at posterior margin, with its inner process subacute at tip. Body length 7.8–8.5 mm, wing length 8.1–9.8 mm.

Description. ***Male.*** Head dark brown to black, suffused with grey pruinosity on frons and vertex, somewhat shiny on rostrum. Palpus dark brown. Antenna 14-segmented, moderately long, reaching to about base of wing, dark brown. Flagellomeres elongate, subcylindrical. Longest verticils very long, about five times as long as their respective flagellomeres.

Thorax generally dark brown. Pronotum dark brown throughout. Prescutum and scutum with dark brown median area demarcated with prescutal setae, and with dark brown patch laterally; interspaces slightly paler. Scutal lobes dark brown, with yellowish brown area in between. Scutellum yellowish brown anteromedially, otherwise dark brown. Mediotergite yellowish brown anterolaterally, rest dark brown. Pleuron generally dark brown, with paler areas on anepimeron, laterotergite, and around base of wing and halter. Wing moderately broad, with width-length ratio about 1 : 3.5. Wing membrane slightly tinged with brownish grey. Wing pattern consisting of three darker spots at anterior margin, more or less diffuse but distinct, at origin of Rs, at tip of Sc_1, and over R_2 (= cross-vein r) (pterostigma). Diffuse, darker seams along veins, especially Cu and so-called outer cord (series of subvertical vein elements, including base of discal cell, at about two thirds length of wing). Venation usual for *Limonia*, with discal cell moderately long; M_{3+4} (lower margin of discal cell) and M_4 subequal in length. Halter with pale stem, slightly darker on knob. Legs generally yellow, with coxae, especially fore ones, darker, brown; femora fading from yellow to yellowish brown distally, with pale subapical and dark apical rings; tarsi dark brown, with tarsomeres 1 slightly longer than rest of tarsi.

Abdomen generally dark brown, with anterior margins of tergites narrowly yellowed; tergites 1 and 8 often dark brown throughout; ventral side paler, with yellow areas on sternites larger. Male terminalia (Figs 1–2) dark brown. Tergite 9 essentially semicircular in outline. Its posterior margin broadly rounded, formed by chitinized bar, with shallow, rather V-shaped median notch. Gonocoxite usual in length and breadth. Gonostylus conical, rather long, evenly arched and tapered to subacute tip, not markedly swollen in proximal half. Aedeagus of moderate length and breadth, moderately enlarged in proximal half, with another slight enlargement before apex. Paramere moderately emarginated at posterior margin, with its inner process rather broad at base, subacute at tip.

Female unknown.

Differential diagnosis. According to Savchenko (1985), the new species belongs to the *L. flavipes* species group and seems to be most similar to European species, such as *Limonia sylvicola* (Schummel, 1829) and *L. taurica* (Strobl, 1895). Its body colouration and wing pattern are, however, distinctly darker. The male terminalia have the gonostylus rather long and slender and the inner process of the paramere subacute at the tip, whereas, in both *L. sylvicola* and *L. taurica*, the gonostylus is shorter and broader and the inner process of the paramere rounded at the tip.

Etymology. The new species is named in honour of one of its collectors, Cita Hartveld (Amsterdam, The Netherlands) who, together with Pjotr Oosterbroek, has made extensive collections in the Mediterranean. A noun in genitive singular.

Limonia opacipennis sp. nov.

(Figs 3–4)

Type material. Holotype: ♂ (RMNH), **ALGERIA:** Petite Kabylie Mts, 32 km S El Aouana, 1300 m, 25.v.1986 (P. Oosterbroek leg.), labelled 'ALGÉRIE / PETITE KABYLIE / P.Oosterbroek' // '32 km S EL AOUANA / 1300 m / 25.V.1986' [both printed, white labels] // 'HOLOTYPE / Limonia / opacipennis sp. n. ♂/ J. Starý 2017' [printed, red label]. The specimen is pinned, with left fore leg missing; apex of abdomen cut off, terminalia dissected and placed in a sealed plastic tube with glycerine, pinned with the specimen.

Paratypes: 2 ♂♂ 2 ♀♀, same data as for holotype (RMNH, JSOC). **TUNISIA:** Oued ed Demene, 7 km S of Aïn Draham, 600 m, along brook, 24.iv.1980, 1 ♀ (E. v.Nieukerken, G. Bryan & P. Oosterbroek leg.); Hotel les Chenes, 5 km S of Aïn Draham, 750 m, at light, Quercus faginea & suber veg., 23.-25.iv.1980, 1 ♀ (collector(s) not given, but most probably the same as for the preceding specimen) (RMNH). All specimens pinned or micro-pinned on a stage of polyporus; terminalia, if dissected, placed as for holotype.

Diagnosis. Medium-sized species. Body colouration in general brown, restrictedly dark brown on dorsum of thorax and obscure yellow on pleuron. Wing membrane tinged brownish. Wing pattern diffuse, indistinct. Male terminalia with aedeagus of moderate length and breadth and paramere narrowly emarginated at posterior margin, with its inner process short, slender, rounded at tip. Body length 8.3–9.8 mm, wing length 8.2–10.6 mm.

Description. ***Male.*** Head dark brown to almost black, suffused with grey pruinosity on frons and vertex, somewhat shiny on rostrum. Palpus black. Antenna 14-segmented, short, not reaching to base of wing. Scape black, pedicel and flagellomeres paler, brown to yellowish brown. Flagellomeres elongate, subcylindrical. Longest verticils very long, about five times as long as their respective flagellomeres.

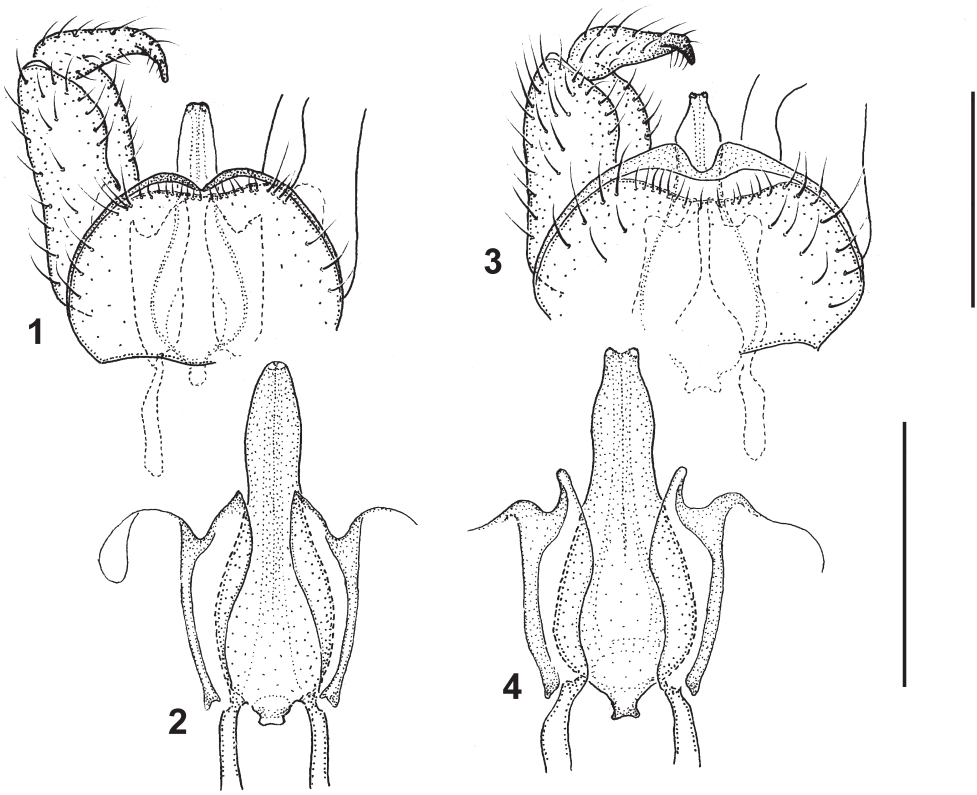
Thorax generally obscure yellow to yellowish brown. Pronotum brown dorsally, yellowed laterally. Prescutum and scutum with broad, dark brown, median area demarcated with prescutal setae, darker anteriorly, slightly paler posteriorly, sides of prescutum yellowish brown. Scutal lobes similarly dark as median prescutal area, obscure yellow in between. Scutellum pale yellow anteriorly, darker posteriorly. Mediotergite generally yellowish brown, paler anterolaterally. Pleuron essentially obscure yellow, darker on katepisternum. Wing moderately broad, with width-length ratio about 1 : 3.5. Wing membrane conspicuously tinged brownish. Wing pattern consisting of three darker spots at anterior margin, diffuse and little-distinct, at origin of Rs, at tip of Sc_1, and over R_2, added with slightly indicated, diffuse, darker seams especially along Cu and so-called outer cord. Venation usual for *Limonia*, with discal cell moderately long; M_{3+4} and M_4 subequal in length. Halter with pale stem and darker knob. Legs generally yellow, including coxae and trochanters, tips of femora slightly darkened, distal tarsomeres dark brown; tarsomeres 1 slightly longer than rest of tarsi.

Abdomen brown dorsally, paler ventrally. Male terminalia (Figs 3–4) yellowish brown. Tergite 9 essentially semicircular in outline. Its posterior margin broadly rounded, formed by chitinized bar, with distinct U-shaped median notch. Gonocoxite usual in length and breadth. Gonostylus darkened distally, conical, moderate in length, evenly moderately arched and tapered to narrowly rounded tip, only slightly swollen in proximal half. Aedeagus of moderate length and breadth, considerably broad in proximal half, with another, narrower enlargement before apex. Paramere narrowly emarginated at posterior margin, with its inner process short, generally slender, rounded at tip.

Female resembling male in general appearance. Female terminalia with cercus slightly upturned, subacute at tip, subequal in length to tergite 10. Hypogynial valve straight, reaching beyond middle of cercus.

Differential diagnosis. This new species, probably a member of the *L. phragmitidis* (= *L. tripunctata*) species group (cf. Savchenko 1985), is distinctive by having its wing membrane conspicuously tinged brownish. A significant feature of the male terminalia is the shape of the paramere which is narrowly emarginated at its posterior margin, with its inner process slender, and rounded at the tip. A similar condition, with other features quite different, is known in *L. sylvicola* and *L. eos* Starý & Savchenko, 1976.

Etymology. The name of this new species, *opacipennis*, a combination of *opacus* (= dark) and *penna* (= wing), refers to its brownish wing membrane. An adjective in nominative singular.



Figs 1–4. 1–2 – *Limonia hartveldae* sp. nov., male terminalia (holotype): 1 – general view, dorsally; 2 – aedeagal complex, dorsal view. 3–4 – *Limonia opacipennis* sp. nov., male terminalia (holotype): 3 – general view, dorsally; 4 – aedeagal complex, dorsal view. Scale bars = 0.5 mm.

Limonia oosterbroeki sp. nov.

(Figs 5–6)

Type material. Holotype: ♂ (RMNH), **TURKEY: Kastamonu Province:** Ilgaz Dağı National Park, pine forest, 1700 m, 5.viii.1996 (P. Oosterbroek & C. Hartveld leg.), labelled 'TURKEY, prov. Kastamonu / P.Oosterbroek & / C.Hartveld 1996' // 'ILGAZ DAGI MP / Pine forest, 1700 m / 5.VIII.1996 St. 20' [both printed, white labels] // 'HOLOTYPE / Limonia / oosterbroeki sp. n. ♂ / J. Starý 2017' [printed, red label]. The specimen is micro-pinned on a stage of polyporus, with right fore, right mid and left hind leg missing; apex of abdomen cut off, terminalia dissected and placed in a sealed plastic tube with glycerine, pinned with the specimen.

Diagnosis. Medium-sized species. Body colouration pale yellow, with dark brown prescutal stripe. Wing membrane hyaline. Wing pattern with anterior spots small but sharply indicated. Male terminalia with aedeagus of moderate length and breadth and paramere moderately emarginated at posterior margin, with its inner process narrowly rounded at tip. Body length 7.2 mm, wing length 8.5 mm.

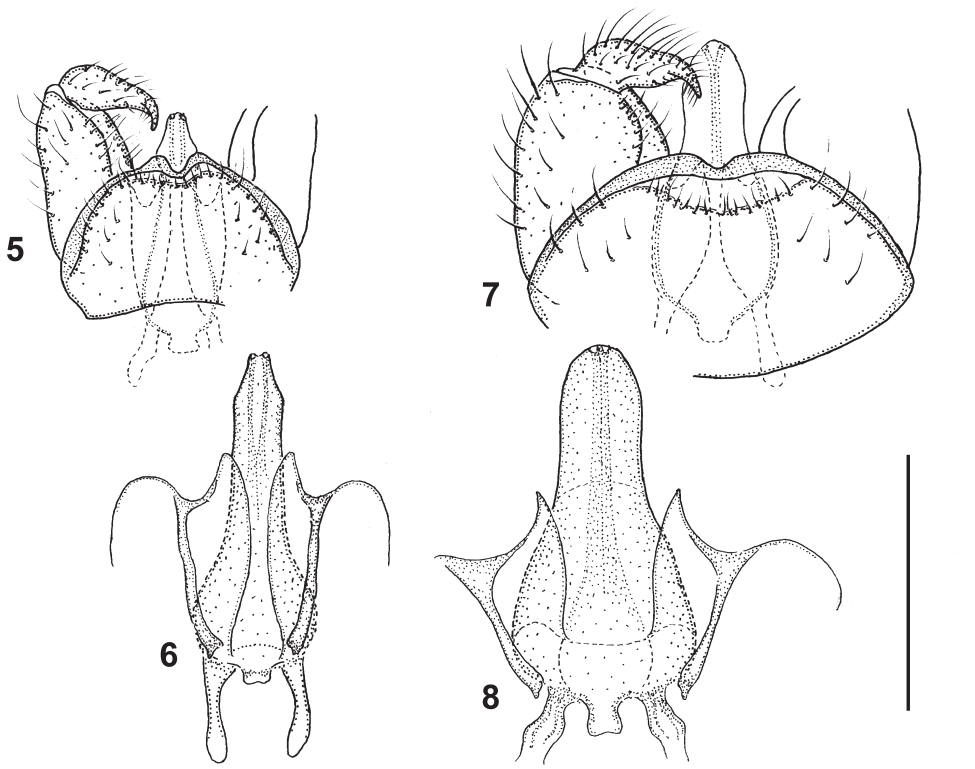
Description. ***Male.*** Head generally yellow, suffused with pale greyish pruinosity on frons and vertex, shiny on rostrum. Palpus yellow, last palpomere darkened. Antenna 14-segmented, short, not reaching to base of wing. Scape, pedicel, and flagellomeres 1–2 yellow, flagellomere 3 and following segments slightly darkened, with still darker bases. Flagellomeres moderately elongate, subcylindrical. Longest verticils short, subequal in length to their respective flagellomeres.

Thorax generally pale yellow. Pronotum pale yellow, slightly darkened medially. Prescutum and scutum with dark brown stripe medially, otherwise pale yellow, as other dorsal parts of thorax. Pleuron pale yellow throughout. Wing rather narrow, with width-length ratio about 1 : 4. Wing membrane hyaline. Wing pattern consisting of three darker spots at anterior margin, comparatively small but sharply indicated, at origin of Rs, at tip of Sc_1, and over R_2, with narrow, darker seams along Cu and all vertical elements, especially so-called outer cord. Venation usual for *Limonia*, with discal cell moderately long; M_{3+4} and M_4 subequal in length. Halter with pale stem and slightly darker knob. Legs yellow, including coxae and trochanters, with femora darkened at tips, tibiae only slightly so, and distal tarsomeres dark brown; tarsomeres 1 slightly longer than rest of tarsi.

Abdomen obscure yellow dorsally, paler ventrally. Male terminalia (Figs 5–6) yellow. Tergite 9 essentially semicircular in outline. Its posterior margin broadly rounded, formed by chitinized bar with distinct U-shaped median notch between short lobes. Gonocoxite comparatively short. Gonostylus conical, rather short, evenly arched and tapered to narrowly rounded tip, slightly swollen in proximal half. Aedeagus of moderate length and breadth, bulbous in proximal third, then parallel-sided, narrowed before apex. Paramere moderately emarginated at posterior margin, with its inner process rather broad at base, narrowly rounded at tip.

Female unknown.

Differential diagnosis. According to Savchenko (1985), the new species clearly belongs to the *L. phragmitidis* species group and resembles *L. stigma* (Meigen, 1818) in general appearance. Its body colouration is, however, still paler, antenna paler, with shorter verticils, and the



Figs 5–8. 5–6 – *Limonia oosterbroeki* sp. nov., male terminalia (holotype): 5 – general view, dorsally; 6 – aedeagal complex, dorsal view. 7–8 – *Limonia enormis* sp. nov., male terminalia (holotype): 7 – general view, dorsally; 8 – aedeagal complex, dorsal view. Scale bars = 0.5 mm.

prescutal stripe is less distinct. The three spots at the anterior wing margin, although small in extent, are more intensive and more sharply indicated. The aedeagus of the male terminalia is bulbous only in the proximal third and the inner process of the paramere is narrowly rounded at the tip, whereas, in *L. stigma*, the aedeagus is considerably broad in the proximal half and the inner process of the paramere is broadly rounded at the tip.

Etymology. This new species is named in honour of one of its collectors, Dr. Pjotr Oosterbroek (ZMAN), an outstanding specialist of Tipulidae and a world-famous compiler of the electronic Catalogue of the Craneflies of the World. A noun in genitive singular.

Limonia enormis sp. nov.

(Figs 7–8)

Type material. Holotype: ♂ (RMNH), **GREECE: Crete: Rethymno Region:** Ida Mt., Ida cave, 1500 m, 35°12.6′N 24°49.8′E, 6.v.2002 (J. J. Wieringa leg.), labelled 'GREECE, CRETE, Rethymno / Mt. IDA, Ida Cave, 1500 m / 35°12.6′N 24°49.8′E / 6.V.2002, J.J. Wieringa' [printed, white label] // 'HOLOTYPE / Limonia / enormis sp. n. ♂ / J. Starý 2017' [printed, red label]. The specimen is pinned, with right antenna and both mid legs missing; apex of abdomen cut off, terminalia dissected and placed in a sealed plastic tube with glycerine, pinned with the specimen.

Diagnosis. Very large species. Body colouration in general yellowish brown, restrictedly darker on dorsum of thorax and obscure yellow to yellowish brown on pleuron. Wing membrane smoky greyish. Wing pattern with unusual darker streak along distal anterior margin approximately from R_2 to tip of R_3. Male terminalia with aedeagus unusually broad and paramere widely and shallowly emarginated at posterior margin, with its inner process subacute at tip. Body length 13.2 mm, wing length 16.9 mm.

Description. ***Male.*** Head dark brown on frons and vertex, somewhat paler, brown, and more shiny on rostrum. Palpus dark brown. Antenna 14-segmented, moderately long, reaching to about base of wing. Scape brown, pedicel dark brown, flagellomeres brown, elongate, subcylindrical. Longest verticils about 1.5 times as long as their respective flagellomeres.

Thorax generally yellowish brown. Pronotum brown, narrowly yellowed laterally and posteriorly. Prescutum and scutum with broad, brown, median area demarcated with prescutal setae, sides of prescutum yellow. Other dorsal part of thorax generally yellowish brown. Pleuron paler than dorsum of thorax, obscure yellow to yellowish brown, slightly darker on anterior part. Wing moderately broad, with width-length ratio about 1 : 3.5. Wing membrane smoky greyish. Wing pattern consisting of three darker, diffuse spots at anterior margin, at origin of Rs, at tip of Sc_1, and over R_2; latter spot extended distally, forming diffuse streak along anterior margin of wing in cells C and R_1, reaching approximately from R_2 to tip of R_3. Space between latter two markings slightly yellowed. Variously distinct darker, diffuse seams, especially along Cu and so-called outer cord. Venation usual for *Limonia*, with discal cell short, squarish; M_{3+4} shorter than M_4. Halter with pale stem, slightly darker on knob. Legs generally yellow, with fore coxa slightly darker, obscure yellow; tips of femora darkened, distal tarsomeres dark brown; tarsomeres 1 about twice as long as rest of tarsi.

Abdomen yellowish brown, with anterior and posterior margins of tergites yellow; ventral side paler. Male terminalia (Figs 7–8) yellowish brown, broad and robust. Tergite 9 essentially lentil-shaped in outline, transverse. Posterior margin broadly rounded, formed by chitinized bar with shallow U-shaped median notch. Gonocoxite very stout and short. Gonostylus conical, rather short, evenly arched and tapered to narrowly rounded tip, considerably swollen in proximal half. Aedeagus remarkable in being unusually broad, still more so in proximal half. Paramere widely and shallowly emarginated at posterior margin, with its inner process broad at base, tapered to subacute tip.

Female unknown.

Differential diagnosis. With its wing length of 16.9 mm, the new species represents the largest Palaearctic *Limonia*. Two other Palaearctic species of the genus approach the size, viz. *Limonia lindbergi* Nielsen, 1962 (wing length 14–16 mm), of Afghanistan, and *L. synempora* Alexander, 1933 (wing length 15 mm), of China. These are considerably different in

general appearance both from each other and from *L. enormis* sp. nov. Whereas the other species described in this paper all have the typical appearance of *Limonia* within the species groups adopted by Savchenko (1985), *L. enormis* sp. nov. looks rather strange with its smoky greyish wing and diffuse wing pattern, with an unusual streak along the distal anterior margin. Although *L. lindbergi* has only a single spot on the wing (over R_2), (having been compared with *L. macrostigma* (Schummel, 1829) in the original description) its male terminalia, as far as they were adequately illustrated (cf. Nielsen 1962: Fig. 2), show some similarities with *L. enormis* sp. nov., such as a lentil-shaped tergite 9 and a powerful aedeagus.

Etymology. The new species is named *enormis* after its enormous body size. An adjective in nominative singular.

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