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New records of *Liorhyssus hyalinus* (Heteroptera: Rhopalidae) in the Czech Republic, with a review of its worldwide distribution and biology

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HRADIL K., KMENT P. & ROHÁČOVÁ M. 2007: New records of *Liorhyssus hyalinus* (Heteroptera: Rhopalidae) in the Czech Republic, with a review of its worldwide distribution and biology. *Acta Musei Moraviae, Scientiae biologicae* (Brno) **92:** 53–107. – New records of the hyaline grass bug *Liorhyssus hyalinus* (Fabricius, 1794) (Heteroptera: Rhopalidae: Rhopalinae) in the Czech Republic are presented (both from Bohemia and Moravia), including the first record of a breeding population. Additional faunistic records from 42 countries are also presented, including first records of *L. hyalinus* from Thailand, the United Arab Emirates, and Bolivia. Information about the worldwide distribution, host plants, ecology, bionomics, harmfulness, and natural enemies of the species is reviewed. *Liorhyssus hyalinus* is a cosmopolitan, euryecous, polyphagous species, recorded in association with at least 172 plant taxa from 38 families, being able to develop on at least 22 taxa from 9 plant families. Its recent northward expansion in western and central Europe is discussed in connection with possible global warming.

Keywords. Heteroptera, Rhopalide, Czech Republic, Bohemia, Moravia, Bolivia, Thailand, United Arab Emirates, faunistics, biology, host plant, ecology, parasitoids, range expansion

Introduction

The hyaline grass bug *Liorhyssus hyalinus* (Fabricius, 1794) is a cosmopolitan, polyphagous species, known to cause serious damage to several crop plants (e.g., MOULET 1995a, SCHUH & SLATER 1995, SCHAEFER & KOTULSKI 2000). In the course of preparing a short communication on new records of this species from the Czech Republic, we realized that there is a large quantity of biological and distributional information scattered in several hundred papers published all around the world. Most of the previous authors writing about *L. hyalinus* did so only in quite a restricted way, usually geographically limited. The most comprehensive monographs (GÖLLNER-SCHEIDING 1976; MOULET 1995a; PUTSHKOV 1962, 1986) include only basic information and references. Moreover, the most comprehensive study of its biology (ATALAY 1978) is written in Turkish with only a short English summary. This gave us reason to attempt a

(partial) review of the distribution and biology of the hyaline grass bug, based on excerption of as many papers as we were able to obtain.

For descriptions of adults (Figs 4–5) see e.g. Stichel (1960), Putshkov (1962, 1986), Göllner-Scheiding (1976), Atalay (1978), Moulet (1995a,b); for descriptions of larvae (Figs 2–3) e.g. Kirkaldy (1907a), Readio (1928), Risbec (1951), Putshkov & Putshkova (1956), Putshkov (1962, 1986), Atalay (1978), and Moulet (1995a,b); and for descriptions of eggs (Fig. 1) e.g. Kirkaldy (1907a), Readio (1928), Risbec (1951), Miller (1956), Putshkov & Putshkova (1956), Putshkova (1957), Putshkov (1962, 1986), Atalay (1978), and Moulet (1995a). An identification key for species of the genus *Liorhyssus* Stål, 1870 has been published by Göllner-Scheiding (1976). The list of synonyms is based on papers by Göllner-Scheiding (1983), Kerzhner (2003), and Dolling (2006).

Material and Methods

BMFC . . . . . Beskydy Museum, Frýdek-Místek, Czech Republic
JBPC . . . . . Jan Batelka Collection, Praha, Czech Republic
KHMC . . . . . Karel Hradil Collection, Miletín, Czech Republic
MHBC . . . . . Michal Horsák Collection, Brno, Czech Republic
MMBC . . . . . Moravian Museum, Brno, Czech Republic
MMHC . . . . . Marion Mantič Collection, Hlučín – Bobrovníky, Czech Republic
NMPC . . . . . National Museum, Praha, Czech Republic
PKPC . . . . . Petr Kment Collection, deposited in the National Museum, Praha, Czech Republic
ZMOC . . . . . Zdeněk Malinka Collection, Opava, Czech Republic

Results

Liorhyssus hyalinus (Fabricius, 1794) (Figs 1–6)

Lygaeus hyalinus Fabricius, 1794; type locality: 'In Americae Insulis'.

= *Rhopalus bengalensis* Dallas, 1852; type locality: India: N Bengal.
= *Corizus capensis* Germar, 1838; type locality: South Africa: Cape of Good Hope.
= *Liorhyssus natalensis* var. *corallinus* Horváth, 1911; type locality: Egypt: El Maks.
= *Corizus dilatipennis* Signoret, 1859; type locality: Sudan: 'Nubia super.'.
= *Corizus gracilis* Herrich-Schaeffer, 1835; type locality: Spain: Andalusia.
= *Corizus imperialis* Distant, 1918; type locality: India: Bombay.
= *Corizus lugens* Signoret, 1859 (name attributed to Stål); type locality: Ecuador: Galapagos Islands.
= *Rhopalus lugens* Stål, 1860; type locality: Ecuador: Galapagos Islands.
= *Merocoris maculiventris* Spinola, 1852; type locality: Chile.
= *Corizus marginatus* Jakovlev, 1871; type locality: Russia: Astrakhan.
= *Merocoris microtomus* Spinola, 1852; type locality: North Chile.
= *Corizus* (*Liorhyssus*) *hyalinus* var. *nigrinus* Puton, 1881; type locality: France: Aube and Tarbes.
= *Liorhyssus hyalinus* var. *pallidus* Mancini, 1935; type locality: Libya: Fezzan, Murzuk.
= *Corizus pronotalis* Distant, 1918; type locality: India: Dehra Dun.
= *Corizus quadrilineatus* Signoret, 1859; type locality: Chile.
= *Rhopalus ruber* Dallas, 1852; type locality: Colombia: Mt. Goudo.

= *Corizus rubescens* Kolenati, 1845; type locality: Azerbaijan: Karabagh.
= *Liorhyssus hyalinus* var. *rubricatus* Reuter, 1900; type locality: Egypt: Heliopolis.
= *Corizus sanguineus* A. Costa, 1853; type locality: Italy: Napoli.
= *Corizus scotti* Distant, 1913; type locality: Seychelles: Silhouette: Mare aux Cochons.
= *Corizus siculus* Signoret, 1859; type locality: Italy: Sicily.
= *Corizus hyalinus* var. *spathula* Rey, 1887; type locality: France: Lyon.
= *Corizus truncatus* Rambur, 1839; type locality: Spain: Malaga.
= *Corizus variegatus* Signoret, 1859; type locality: Mauritius.
= *Rhopalus victoris* Mulsant et Rey, 1870; type locality: France: Var, Seyne.
= *Corizus viridicatus* Uhler, 1872 (partim); type locality: 'S-Col.' (Colorado, Nebraska, Dakota).

Material examined. CZECH REPUBLIC: Bohemia: (or.), Chomutice (5858), 253 m.a.s.l., on *Abutilon theophrasti*, 2.x.2003, 35 ♂♂ 44 ♀♀, K. Hradil lgt. & det. (KHMC, NMPC). **Observations.** *Liorhyssus hyalinus* occurred on *Abutilon theophrasti* growing in a sugar-beet field (ca. 100 m^2) as a weed that had survived attempts at agricultural eradication. The velvetleaf plants were flowering and fruit-bearing. In most cases the bugs laid their eggs on the fruit. Nymphs of all developmental stages and adults were observed on all parts of the plants in considerable quantities – approximately 10 and more bugs per plant. Apart from *L. hyalinus*, the true bug *Corizus hyoscyami* (Linnaeus, 1758) (Rhopalidae) and caterpillars of the migratory moth *Helicoverpa armigera* (Hübner, 1808) (Lepidoptera: Noctuidae), ranked among significant pest species damaging fruit, vegetables and maize, were also recorded on the velvetleaf. **Moravia:** (bor.), Ostrava – Zábřeh nad Odrou (6175), margin of Rudná street, 235 m.a.s.l., on *Solidago canadensis*, 6.ix.2000, 1 ♀, M. Roháčová lgt. & det. (BMFC); Sviadnov (6375), tapline embankment, 1 ♂, 11.x.2003, M. Roháčová lgt. & det. (BMFC); (centr.), Přerov (6570), 4.vi.1957, 1 ♂, Ondřej lgt., P. Kment det. (MMBC); Bystřice pod Hostýnem (6571–6572–6672), 315 m.a.s.l., 12.ix.1984, 1 ♀, B. Dobšík lgt., P. Kment det. (coll. B. Dobšík, deposited in MMBC).

EUROPE: ALBANIA: (bor.), Malësi e Madhe district, Bogë village, 21.vi.1994, 1 ♀, P. Chvojka lgt., P. Kment det. (NMPC). **BULGARIA:** (mer.), Zlatograd, Vrbica valley, 26.vi.1961, 1 ♂ 2 ♀♀, L. Hoberlandt & Slouková lgt., P. Kment det. (NMPC); (mer. occ.), Bansko, B'nderitsa basin, 1850–1950 m.a.s.l., 18.vii.1987, 1 ♀, P. Lauterer lgt., J. L. Stehlík 1977 det. (MMBC). Kresensko defile, 24.vi.1938, 1 ♂ 1 ♀, L. Hoberlandt lgt. & det. (NMPC); Gara Kresna (Kresensko defile) near Struma river, 230–300 m.a.s.l., 20.–21.viii.1972, 1 ♂, P. Lauterer lgt., J. L. Stehlík 1977 det. (MMBC); Gara Sandanski (west), steppe, 120–140 m.a.s.l., 8.–9.vi.1976, 1 ♂, P. Lauterer lgt., J. L. Stehlík 1977 det. (MMBC); Gara Sandanski, steppe, canal banks, 120–240 m.a.s.l., 9.viii.1972, 1 ♂, P. Lauterer lgt., J. L. Stehlík 1977 det. (MMBC); Petrič – Sladenoviči [= Petrich – Sladenovichi], 9.iii.1959, 1 ♂; dtto, 9.vii.1959, 1 ♂, both L. Hoberlandt lgt., P. Kment det. (NMPC); Petrič [= Petrich], 29.v.1964, 1 ♂ 1 ♀, J. Raušer lgt., J. L. Stehlík 1977 det. (MMBC); Sandanski, Struma river banks, steppe, 110–140 m.a.s.l., 9.viii.1972, 1 ♂ 2 ♀♀, A. Merta lgt., J. L. Stehlík 1977 det. (MMBC); Vlachi Pirin, vii.1932, 2 ♂♂ 4 ♀♀, Mařan & Táborský lgt., P. Kment det. (NMPC); (mer. or.), Harmanli (towards Topolovgrad), steppe, 20.v.1978, 1 ♀, K. Majer lgt., J. L. Stehlík 1977 det. (MMBC); Harmanli, Marica bank, 60–80 m.a.s.l., 19.vii.1971, 1 ♂, P. Lauterer lgt., J. L. Stehlík 1977 det. (MMBC); Slănčev brjag [= Sl'nchev bryag], sand, 31.viii.1972, 2 ♀♀, J. L. Stehlík lgt. & 1977 det. (MMBC); dtto, 0–2 m.a.s.l., 4.ix.1976, 2 ♂♂ 1 ♀, L. Pospíšilová lgt., J. L. Stehlík 1977 det. (MMBC); (or.), Dekilitaš [= Pobitite Kamani near Beloslav village], 9.ix.1962, 1 ♀, J. Raušer lgt., J. L. Stehlík 1977 det. (MMBC); Kamčia [= Kamchiya] river mouth, sea shore, 21.vii.1987, 1 ♂, P. Lauterer lgt., J. L. Stehlík 1977 det. (MMBC); Primorje, lawn (garden), 5–10 m.a.s.l., 14.vii.1973, 1 ♀, L. Pospíšilová lgt., J. L. Stehlík 1977 det. (MMBC); Sarafovo, shore, 28.viii.1972, 4 ♂♂ 3 ♀♀, J. L. Stehlík lgt. & 1977 det. (MMBC). **CROATIA: Brač Island** or., Selca (43°18'N 16°51'E), roadside vegetation in village, 80–160 m.a.s.l., 4.ix.2002, 1 ♂, P. Kment lgt. & det. (PKPC); Selca env., vegetation along road to Voščica bay (43°19'N 16°52'E), 3.ix.2002, 1 ♀, P. Kment lgt. & det. (PKPC); Sumartin (43°17'N 16°52'E), abandoned gardens, 40 m.a.s.l., sweeping, 11.ix.2002, 1 ♂ 1 ♀, P. Kment lgt. & det. (PKPC); dtto, 10.–22.ix.2005, 2 ♀♀, P. Kment & P. Špryňar lgt., P. Kment det. (PKPC). **Dalmatia:** Sladenovici env. near Slano, 9.–20.vii.1974, 1 ♂ 1 ♀, I. Kovář lgt., P. Kment det. (NMPC). **FRANCE: Var:** Agay, v.1928, 5 ♂♂ 10 ♀♀, J. Obenberger lgt., P. Kment det. (NMPC); Cavalaire[-sur-Mer], vi.1928, 10 ♂♂ 17 ♀♀, J. Obenberger lgt., P. Kment det. (NMPC); Draguign.[an], vii.1913, 1 ♀, without collector, P. Kment det. (NMPC); Le Lavandou, 1930, 6 ♀♀, J. Obenberger lgt. (NMPC). **Corse:** Ajaccio, v.1928, 1 ♂, J. Mařan lgt., P. Kment det. (NMPC). **GREECE: Attiki:** Kiphissia (Athens), part Tatoi, 200 m.a.s.l., *Pinus* wood and clearings, 15.ix.1998, 1 ♀, P. Lauterer lgt., P. Kment det. (MMBC). **Thessaly:** 2 km N of Sourpi (Magnissia distr.), salt marshes, 0–1

m.a.s.l., 10.ix.1998, 1 ♀, P. Lauterer lgt., P. Kment det. (MMBC); Malakasion, without date and collector, 1 ♂, P. Kment det. (NMPC); Thessalia occ., Neohori (Karditsa distr.), hill up Megdhovas, 800 m.a.s.l., maquis, dam, 11.ix.1998, 1 ♂, P. Lauterer lgt., P. Kment det. (MMBC). **Eastern Macedonia and Thrace:** Alexandroupolis, 2.v.1937, 1 ♂ 1 ♀, Bartoň lgt., P. Kment det. (NMPC); Ferre (= Ferai), 3.v.1937, 1 ♀, M. & T. Bartoň lgt., P. Kment det. (NMPC). **ITALY: Lazio:** Latina Prov., Gaeta env. (41°14'N 13°29'E), limestone hill on coast between Torre Sant'Agostino and Torre Capovento, abandoned field, 17.iv.2003, 2 ♂♂ 4 ♀♀, P. Kment lgt. & det. (PKPC, MHBC). **Puglia:** Foggia Prov., Gargano, San Menaio, beach, evening sweeping, 10.–24.vii.1998, 1 ♀, M. Mantič lgt., P. Kment det. (MMHC). **MACEDONIA:** Dojran, KaraD. [= Karadag], 17.vi.1970, 1 ♀, without collector, P. Kment det. (NMPC). **MONTENEGRO:** (bor.), Tara river valley, Selina, 600 m.a.s.l., 26.vi.1958, 2 ♂♂ 1 ♀, L. Hoberlandt lgt., P. Kment det. (NMPC); (mer.), Sutomore, 6.vi.1967, 2 ♀♀, P. Lauterer lgt., J. L. Stehlík 1977 det. (MMBC); (occ.), Tivat, 2 km S Delfin, salt marsh, 0–1 m.a.s.l., 16.x.1982, 1 ♀, P. Lauterer lgt., J. L. Stehlík 1977 det. (MMBC). **ROMANIA:** Sinaia, 8.x.1958, 1 ♀, J. Mařan lgt., P. Kment det. (NMPC). **RUSSIA:** (mer.), Astrachaň [= Astrkhan'], vi.1964, 1 ♀, J. Gottwald lgt., J. L. Stehlík 1977 det. (MMBC). **SERBIA:** (centr.), Mladenovac, 3.vi.1947, 2 ♂♂ 1 ♀, Exp. N. Mus. ČSR lgt., P. Kment det. (NMPC). **SLOVENIA:** (mer. occ.), Sela na Krasu, 27.–28.x.2002, 1 ♀, Z. Malinka lgt., P. Kment det. (ZMOC). **SPAIN: Andalucía:** Sierra Pozo, spring area of Quadalquivir, 1500 m.a.s.l., 11.–12.vi.2003, 1 ♀, M. Škorpík lgt., P. Kment det. (PKPC).

ASIA: AFGHANISTAN: Herat: Akaza-i, 520 m.a.s.l., 10.v.1964, 1 ♂, O. Jakeš lgt., J. L. Stehlík 1977 det. (MMBC); Bala Murghab, 470 m.a.s.l., 20.iii.–1.iv.1964, 2 ♂♂; dtto, 5.–10.v.1964, 8 ♂♂ 12 ♀♀; dtto, 25.–31.v.1964, 3 ♂♂ 1 ♀; dtto, 25.v.–10.vi.1964, 3 ♂♂ 6 ♀♀; dtto, 1.–10.vi.1964, 1 ♂; dtto, 8.vi.1964, 1 ♂; 10.vi.1964, 1 ♀; dtto, 11.–15.vi.1964, 1 ♂ 2 ♀♀; dtto, 20.–24.vi.1964, 12 ♂♂ 13 ♀♀; dtto, 30.vi. –2.vii.1964, 1 ♂ 2 ♀♀; dtto, 10. –13.vii.1964, 1 ♂; dtto, 11.vii.1964, 29 ♂♂ 27 ♀♀; dtto, 11.–15.vii.1964, 27 ♂♂ 24 ♀♀; dtto, 8.viii.1964, 65 ♂♂ 26 ♀♀; dtto, 28.–31.viii.1964, 2 ♀♀; dtto, 25.–27.ix.1964, 6 ♂♂ 6 ♀♀, all O. Jakeš lgt., J. L. Stehlík 1977 det. (MMBC); Bala Murghab, 550 m.a.s.l., 3.–15.iv.1964, 6 ♂♂ 6 ♀♀; dtto, 20.iv.1964, 1 ♀; dtto, 6.vii.1964, 35 ♂♂ 28 ♀♀, all O. Jakeš lgt., J. L. Stehlík 1977 det. (MMBC); Bala Murghab, 600 m.a.s.l., 24.vi.1964, 5 ♂♂ 2 ♀♀, O. Jakeš lgt., J. L. Stehlík 1977 det. (MMBC); Buzba, 800 m.a.s.l., 6.v.1964, 20 ♂♂ 22 ♀♀, O. Jakeš lgt., J. L. Stehlík 1977 det. (MMBC); Herat, 520 m.a.s.l., 24.vii.1964, 1 ♂ 2 ♀♀, O. Jakeš lgt., J. L. Stehlík 1977 det. (MMBC); Mangan, 640 m.a.s.l., 28.vi.1964, 1 ♀, O. Jakeš lgt., J. L. Stehlík 1977 det. (MMBC); Zarmast pass, 2300–2500 m.a.s.l., 4.viii.1964, 1 ♂; dtto, 2700 m.a.s.l., 22.vii.1964, 1 ♂ 2 ♀♀, both O. Jakeš lgt., J. L. Stehlík 1977 det. (MMBC). **Maimana:** Čašma-i-Yanbulaq [= Cheshmeh-ye Yanbolaq], 650–800 m.a.s.l., 19.v.1964, 2 ♀♀, O. Jakeš lgt., J. L. Stehlík 1977 det. (MMBC); Rašíd [= Rashid], 700 m.a.s.l., 18.v.1964, 3 ♂♂ 2 ♀♀, O. Jakeš lgt., J. L. Stehlík 1977 det. (MMBC). **Nengrahar:** Jalalabad, 560 m.a.s.l., 6.ii.1966, 2 ♂♂; dtto, 9.ii.1966, 3 ♀♀; dtto, 9.iii.1966, 1 ♀; dtto, 12.iii.1966, 3 ♂♂ 1 ♀; dtto, 18.iii.1966, 1 ♂ 1 ♀; all D. Povolný & F. Tenora lgt., J. L. Stehlík 1977 det. (MMBC). **CHINA: Beijing:** Pekin [= Beijing], viii.(without year), 1 ♂ 5 ♀♀, Huba lgt., P. Kment det. (NMPC). **Yunnan:** Dali, north margin of the Er Hai lake, 4.vi.2007, 1 spec., J. Votýpka lgt., P. Kment det. (NMPC). **CYPRUS:** Kyrenia env., Karavas, 1.–4.v.1969, 2 ♀♀, K. Pospíšil lgt., J. L. Stehlík 1977 det. (MMBC). **GEORGIA:** Tbilisi, 21.vi.1957, 1 ♂, J. Mařan lgt., P. Kment det. (NMPC). **INDIA: Rajasthan:** Alwar district, 30 km N of Dausa, Gola-Ka-Bas village (27°05.46'N 76°17.18'E), 359 m.a.s.l., 25.–29.ii.2004, 2 ♀♀, P. Šípek & L. Šejnohová lgt. (PKPC). **IRAQ:** (bor.), Arbil Liwa [= Irbil], viii.1962, 1 ♂ 2 ♀♀, K. Khalaf lgt., P. Kment det. (NMPC); Hadraniyah, light trap, 25.v.1968, 1 ♂, P. Starý lgt., J. L. Stehlík 1977 det. (MMBC); 30 km W of Mawsil [= Mosul], 23.v.1968, 1 ♂, P. Starý lgt., J. L. Stehlík 1977 det. (MMBC); (centr..), Baghdad, without date, 224 ♂♂ 214 ♀♀, Kálalová-di Lotti lgt., U. Göllner-Scheiding 1975, J. L. Stehlík 1977 & P. Kment det. (NMPC, MMBC); dtto, 4.xi.1948, 1 ♀, N. Elias lgt., L. Hoberlandt 1963 det. (NMPC); dtto, light trap, 27.v.1968, 1 ♂, P. Starý lgt., J. L. Stehlík 1977 det. (NMPC); (mer. or.), 5 km N Amara [= Al 'Amarah], 29.v.1979, 1 ♂, I. K. Kaddou lgt., P. Kment det. (NMPC); 123 km N Amara [= Al 'Amarah], 29.v.1979, 1 ♀, N. M. Shukri lgt., P. Kment det. (NMPC); 10 km NE Kut [= Al Kut], 29.v.1979, 5 ♀♀, I. K. Kaddou & N. M. Shukri lgt., P. Kment det. (NMPC); Samura [?= Sammari], 3.iv.1962, 1 ♀, S. Kaffaji lgt., P. Kment det. (NMPC). **ISRAEL:** Beersheba, 15.v.1953, 1 ♀, Bytinski-Salz lgt., P. Kment det. (NMPC); Ejn Seddi, 5.xii.(without year), 1 ♀, Bytinski-Salz lgt., L. Hoberlandt 1955 det. (NMPC); dtto, Singburg, 17.v.1953, 1 ♂, Div. Plant Prot. Dept. Agr. Israel lgt., P. Kment det. (NMPC). **JORDAN:** Dibbin, near Jerash, 600 m.a.s.l., 20.vi.1958, 1 ♂, J. Klapperich lgt., P. Kment det. (NMPC); Fuhes [= Al Fuhays], N. Amm.[an], 600 m.a.s.l., 14.ix.1958, 1 ♀, J. Klapperich lgt., P. Kment det. (NMPC); Jordan river valley, Deir Ala [= Dayr 'Alla], -200 m.a.s.l., 21.v.1956, 3 ♂♂ 7 ♀♀, J. Klapperich lgt., P. Kment det. (NMPC); Jordan river valley, O. Totes Meer [= E of Dead Sea], -350 m.a.s.l., 4.iv.1958, 1 ♂; dtto,

-350 m.a.s.l., 14.iv.1958, 1 ♂ 2 ♀♀; dtto, -350 m.a.s.l., 2.v.1958, 1 ♀; dtto, -360 m.a.s.l., 24.i.1958, 1 ♀, all J. Klapperich lgt., P. Kment det. (NMPC); Jubeiha, N. [of] Am.[man], 1000 m.a.s.l., 5.vi.1956, 1 ♂, J. Klapperich lgt., P. Kment det. (NMPC); Wadi Sir [= Wadi as Sir] near Am.[man], 600 m.a.s.l., 1.vi.1956, 1 ♂ 1 ♀; dtto, 8.vi.1956, 5 ♂♂ 4 ♀♀; dtto, 15.vi.1956, 1 ♀, all J. Klapperich lgt., P. Kment det. (NMPC); Zerka [= Zarqa'] river valley near Romana [= Ar Rumman], 200 m.a.s.l., 28.vi.1959, 1 ♀; dtto, 500 m.a.s.l., 1.iii.1958, 1 ♂, both J. Klapperich lgt., P. Kment det. (NMPC). **PALESTINE:** Ascar near Nabulus, 600 m.a.s.l., 26.iv.1956, 1 ♂, J. Klapperich lgt., P. Kment det. (NMPC); Jordan river valley, Jericho [= Ariha], -200 m.a.s.l., 11.v.1959, 5 ♂♂ 5 ♀♀; dtto, -200 m.a.s.l., 29.viii.1959, 1 ♂; dtto, -250 m.a.s.l., 4.vii.1958, 1 ♂; all J. Klapperich lgt., P. Kment det. (NMPC); Jordan river valley, Wadi Farra, -250 m.a.s.l., 27.x.1957, 1 ♀; dtto, -200 m.a.s.l., 16.xii.1957, 1 ♂, both J. Klapperich lgt., P. Kment det. (NMPC); Tulkerem [= Tulkarm], 200 m.a.s.l., 14.vi.1956, 1 ♂, J. Klapperich lgt., P. Kment det. (NMPC); Wadi Schaib [= Wadi Shaib], 100 m.a.s.l., 6.xi.1959, 1 ♀; dtto, tree nursery, 200 m.a.s.l., 3.x.1958, both J. Klapperich lgt., P. Kment det. (NMPC). **PAKISTAN: Kashmir:** Karakoram Mts., Haramosh Range, N slope of Mt. Haramosh, end of Kutwal valley, alpine meadows, 3200–3600 m.a.s.l., 18.ix.1970, 2 ♂♂ 3 ♀♀, O. Štěrba lgt., J. L. Stehlík 1977 det. (MMBC); Sasli (Indus valley, 50 km W of Gilgit), 1300 m.a.s.l., 21.ix.1970, 8 ♂♂ 5 ♀♀, O. Štěrba lgt., J. L. Stehlík 1977 det. (MMBC); Valley at Mt. Dobanni (Gilgit), 2300 m.a.s.l., 25.ix.1970, 1 ♂ 3 ♀♀, O. Štěrba lgt., J. L. Stehlík 1977 det. (MMBC). **Punjab:** Rawalpindi env., 25 km NE, 600–700 m.a.s.l., 8.xii.1955, 1 ♀, Ch. Lindemann lgt., P. Kment det. (NMPC); Rawalpindi env., Basal, Kalachitta Range, 16.–18.i.1956, 1 ♂ 1 ♀, Ch. Lindemann lgt., P. Kment det. (NMPC). **TAJIKISTAN:** Hissar Mts., Magov valley, 18.–21.ix.1989, 1 ♀, I. Kovář lgt., P. Kment det. (NMPC); Tigrovaya Balka, vi.1959, 1 ♂ 3 ♀♀, J. Dlabola lgt., P. Kment det. (NMPC). **THAILAND:** (bor. occ.), Chom Thong, 24.–27.iv.1991, 1 ♂, J. Horák lgt., P. Kment det. (NMPC). **TURKEY: Adana:** 48 km from Adana, Karataş env. (5–8 km W) (36°32'40"N 35°20'23"E), seaside, 28 m.a.s.l., 13.–14.vii.2003, 1 ♀, P. Janšta & J. Straka lgt., P. Kment det. (PKPC); 105 km N of Adana, Kapusbaşı NP, Şelası env. (37°45'54"N 35°23'19"E), 803 m.a.s.l., 16.vii.2003, 1 ♂, P. Janšta & J. Straka lgt., P. Kment det. (PKPC); 65 km N of Adana, 5 km N of Aladağ (Karsantı), camp, alluvium (37°34'22"N 35°23'31"E), 631 m.a.s.l., 15.vii.2003, 3 ♂♂ 3 ♀♀, P. Janšta & J. Straka lgt., P. Kment det. (PKPC); Kozan, Kale (37°26'07.6"N 35°48'24"E), 176 m.a.s.l., grassy slopes and orchards under castle, 12.v.2007, 1 ♀, P. Kment lgt. & det. (PKPC); Yeniköy env., Hierapolis Kastabala (37°10'36"N 36°11'01.9"E), 105 m.a.s.l., ruins of ancient city, ruderal vegetation, 12.v.2007, 2 ♂♂ 1 ♀, P. Kment lgt. & det. (PKPC). **Amasya:** Çakallı, 3.vi.1969, 1 ♀, Osella lgt., P. Kment det. (NMPC). **Ankara:** Sindžanköi [= Sincanköy], 1 ♂, A. M. Staněk lgt., P. Kment det. (NMPC). **Erzurum:** 1900 m.a.s.l., 18.vi.1970, 1 ♀, Exp. Nat. Mus. Praha lgt., P. Kment det. (NMPC). **Gazıantep:** Nur Dağlari Mts., Nurdağı Geç.-Kusçubeli Geç., Hasanbeyli env., 1120–1250 m.a.s.l., 9.–11.v.2005, 1 ♂, Z. Malinka lgt., P. Kment det. (PKPC). **Hatay:** Nur Dağlari Mts., Tülek, Uluçınar env., 5.–6.v.2005, 1 ♂, Z. Malinka lgt., P. Kment det. (PKPC). **İçel:** Çamalan, 3.vii.1983, 1 ♀, S. Bílý lgt. (NMPC). **İzmır** Prov., Selçuk, 17.vi.1968, 1 ♂ 1 ♀, Ardö lgt., P. Kment det. (NMPC). **Kayserı:** 140 km S of Kayseri, 8 km N of Ulupınar, way from Ulupınar to Çamlica (37°50'56"N 35°22'16"E), 1103 m.a.s.l., 17.vii.2003, 1 ♀, P. Janšta & J. Straka lgt., P. Kment det. (PKPC); 10 km S of Kayseri, 1 km S of Hisarcık, road from Develi to Kayseri (38°36'56"N 35°31'07"E), 1659 m.a.s.l., 19.vii.2003, 1 ♂, P. Janšta & J. Straka lgt., P. Kment det. (PKPC); 25 km S of Kayseri, 7 km NW of Develi, ca. 1600 m.a.s.l., 1 ♀, 24.vii.2003, J. Straka lgt., P. Kment det. (PKPC). **Sirnak:** Haberli, 13.v.2005, 1 ♂, Z. Malinka lgt., P. Kment det. (ZMOC). ?Akçay, 12.vi.1968, 1 ♀, Ardö lgt., P. Kment det. (NMPC). **Tokat:** Ardıçlı (dint Niksar), 7.vi.1969, 1 ♂, Osella lgt. (NMPC). **UNITED ARAB EMIRATES: Ajman:** AzZora (25°26'10"N 55°28'42"E), -9 m.a.s.l., 21.iii.2007, 1 ♂ 1 ♀, J. Batelka lgt., P. Kment det. (NMPC). **Dubai:** Margham env. (24°55'19.5"N 55°38'32.8"E), 163 m.a.s.l., light trap, 19.xi.2006, 1 ♂, J. Batelka & H. Pinda lgt., P. Kment det. (JBPC). **Ras Al Khaimah:** Wadi Bih (25°47'N 56°04'E), 100 m.a.s.l., 22.iii.2007, J. Batelka lgt., P. Kment det. (NMPC); Wadi Shawqa (25°06'N 56°02'E), 250–280 m.a.s.l., 20.iii.2007, 1 ♂ 1 ♀, J. Batelka lgt., P. Kment det. (NMPC); same locality, pan traps, 20.–23.iii.2007, 1 ♀, J. Batelka lgt., P. Kment det. (NMPC). **Sharjah:** Dhayd env., 15 km NE of Dhayd (25°22'23"N 55°59'07"E), 158 m.a.s.l., 16.iii.2007, 1 ♂, J. Batelka lgt., P. Kment det. (NMPC). **UZBEKISTAN:** Ala Tan, Ak Tash, 1000 m.a.s.l., shrubs, 6.vi.1959, 1 ♀, J. Dlabola lgt., P. Kment det. (NMPC). **YEMEN:** Sana'a, 1959, 1 ♂, J. Loriš lgt., P. Kment det. (NMPC).

AFRICA: ALGERIA: Tlemcen env., 8.vi.1969, 1 ♀, Tesař lgt., P. Kment det. (NMPC). **BURKINA FASO:** Ouagadougou, ix.1936, 1 ♂ 1 ♀, Škulina lgt., P. Kment det. (NMPC). **CANARY ISLANDS: Gran Canaria Island:** (mer.), Maspalomas, sandy dunes, 3.viii.2003, 1 ♀, M. Mantič lgt., P. Kment det. (MMHC). **EGYPT:** Al-Máadí, i.1959, 1 ♂ 2 ♀♀; dtto, 21.ii.1959, 6 ♀♀, both R. Veselý lgt., P. Kment det. (NMPC); Burq el Arab [= Burj al 'Arab], 1.iv.1960, R. Veselý lgt., P. Kment det. (NMPC); Giza, ii.1959, R. Veselý lgt., P. Kment det.

(NMPC); Helnán [= Hulwan, SE of Cairo], 16.x.1959, 1 ♂, R. Veselý lgt., P. Kment det. (NMPC); Wadi Hof (SE of Cairo), 22.iv.1959, 1 ♂; dtto, 26.vi.1959, 1 ♂, both R. Veselý lgt., P. Kment det. (NMPC). **ETHIOPIA:** Kombolcha-Dessie [= Dese env., Kembolcha], 370 km N of Addis Abeba, v.–viii.1987, 1 ♂ 1 ♀, Pfeiferová lgt., U. Göllner-Scheiding 1999 det. (NMPC). **MOROCCO:** (bor.), Rif Chefchaouene, 24.v.1995, 1 ♂, J. Macek lgt., P. Kment det. (NMPC); (mer.), Taroudannt env., 27.iv.1995, 1 ♂, P. Průdek lgt., P. Kment det. (NMPC). **SOUTH AFRICA: Cape:** Stelden, viii.1950, 11 ♂♂ 1 ♀, F. Zumpt lgt., U. Göllner 1975 det. (MMBC). **Transvaal:** Johannesburg, 10.ix.1950, 2 ♀♀, F. Zumpt lgt., U. Göllner 1975 det. (MMBC). **TANZANIA:** Arusha distr., Arusha env., 3.–4.iv.1997, 1 ♀, P. Senft lgt., P. Kment det. (NMPC). **TUNISIA:** (bor.), Tunis, v.1926, 1 ♀, without collector, P. Kment det. (NMPC); (mer.), S of Kebili, Blidette vill. (N 33°35' E 08°50'), Y + B trap, 25.iii.–2.iv.2006, 1 ♀, J. Batelka & J. Straka lgt., P. Kment det. (NMPC).

AMERICA: ARGENTINA: Missiones: Puerto Iguazú env., 29.i.–1.ii.2004, 1 ♀, Czech Expedition 2004 lgt., P. Kment det. (PKPC). **BOLIVIA:** no additional data, 1 ♀, P. Kment det. (NMPC). **CUBA: Habana:** Habana – Alamár, 18.–26.vii.1965, 1 ♀; dtto, 28.ix.1965, 1 ♀, both J. Prokop lgt., U. Göllner 1977 det. (MMBC); Habana – Alamar – Cojímar, 50 m a.s.l, 15.–30.x.1965, 1 ♀, J. Prokop lgt., U. Göllner 1977 det. (MMBC). **Matanzas:** Guajaybon, 20–50 m.a.s.l., 31.iii.1966, 1 ♂, F. Gregor lgt., U. Göllner 1977 det. (MMBC). Puerto Escondido, 3–4 m.a.s.l., 10.ix.1966, 1 ♀, F. Gregor lgt., U. Göllner 1977 det. (MMBC). Varadero, 1–5 m.a.s.l., 11.iv.1966, 1 ♂, F. Gregor lgt., U. Göllner 1977 det. (MMBC). **JAMAICA:** Cutlass Bay, Ocho Rios, 5.xii.1971, 1 ♂, G. W. Classey lgt., P. Kment det. (NMPC).

Distribution in the Czech Republic. The first specimen of *Liorhyssus hyalinus* from the Czech Republic was collected near Kobylí (locality 'Lecany', 48°55' N, 7067, 17.vii.1968, 1 ♂, L. Pospíšilová lgt.) in southern Moravia (Stehlík 1970). Stehlík & Vavřínová (1989) reported two additional Moravian localities: Moravský Písek, 'Kladíkov' wood (48°59' N, 7069–70; forest nursery on sands, 190 m.a.s.l., 18.viii.1977, 1 ♂ 2 ♀♀, J. L. Stehlík & L. Pospíšilová lgt.), and Trnava, 'Na Žlíbkách' (49°15' N, 6761; xerothermophilous vegetation on syenite, 480 m.a.s.l., 7.ix.1977, 1 ♂, J. L. Stehlík lgt.). The last published record was given by Farkač & Farkačová (2003) from Brno, Kamenný vrch hill (49°11' N, 6865; 300–320 m.a.s.l., iv.–viii.1996). These Moravian records were made from habitats on aeolian sands or in undulating-to-hilly terrain covered in xerothermophilous vegetation, at altitudes from 190 to 480 m.a.s.l., all situated within the area of the Pannonicum (Stehlík & Vavřínová 1989). The first record from Bohemia, originating from Kolín – Šťáralka (50°00' N, 5957; 14.ix.1994, O. Kubík lgt. & det., P. Kment revid.), originally intended to be published here, was listed by Rus (2005).

Here we present additional records from central Moravia (Přerov in 1957, 49°27' N; Bystřice pod Hostýnem in 1984, 49°24' N) as well as northern Moravia (Ostrava – Zábřeh nad Odrou in 2000, 49°48' N; Sviadnov in 2003, 49°41' N) and eastern Bohemia (Chomutice in 2003, 50°21' N). The north Moravian records come from ruderal habitats (street margin, on *Solidago canadensis*; tapline embankment). Even more important is the discovery of a population of *L. hyalinus* on *Abutilon theophrasti* in a sugar-beet field in Chomutice, the first breeding record in the Czech Republic and one of the few in northern parts of central Europe. These records document that *L. hyalinus* is no longer a rare migrant in our fauna, but an established species currently expanding northwards. For its distribution in the Czech Republic (compared with distribution of *Abutilon theophrasti*), see Fig. 6.

Worldwide distribution. *Liorhyssus hyalinus* is a cosmopolitan species of the tropical and subtropical zones (e.g., GÖLLNER-SCHEIDING 1976, MOULET 1995a). It is absent from the northern parts of Europe and the Asian part of Russia, from northern Canada and Alaska, as well as from Tasmania and New Zealand (MOULET 1995a, HENRY 1988, CASSIS & GROSS 2002, LARIVIÈRE & LAROCHELLE 2004). DUPUIS (1953) hypothesized that *Liorhyssus hyalinus* is certainly native to the Palaearctic region, and was subsequently introduced to numerous countries of the Australian, Ethiopian, Nearctic and Neotropical regions, the Hawaiian islands, and others. However, there is no evidence to date to test this hypothesis, which might involve the examination of the molecular genetic structure and differentiation of allopatric populations, as has been performed for another cosmopolitan bug – *Nezara viridula* (Linnaeus, 1758) (Pentatomidae) – by KAVAR et al. (2006). SCHAEFER (1993) suggested *L. hyalinus* might be an ancestral species to the endemic Nearctic species *L. lineatoventris* (Spinola, 1852) and *L. kaltenbachi* Göllner-Scheiding, 1976. He also wrote: 'I do not know how *L. hyalinus* arrived in the Neotropics: perhaps (passively?) from an African population of the species.' In such a case, the speciation of two new species would have required sufficient time and *L. hyalinus* must be presumed to have reached America much earlier than the first European immigrants.

Going through the available literature, we found the following country records of *Liorhyssus hyalinus*:

EUROPE: Albania (HORVÁTH 1916; MANCINI 1953a; STICHEL 1960, 1961; JOSIFOV 1970, 1986; DAVIDOVÁ-VILÍMOVÁ et al. 2000; DOLLING 2006). **Austria** (GÜNTHER & SCHUSTER 2000, DOLLING 2006; Carinthia: PROHASKA 1923; STICHEL 1960, 1961; FRANZ & WAGNER 1961; FRIESS 1998; Lower Austria: RABITSCH 2001; Styria: ADLBAUER 1997; Tirol: HEISS 1976, HEISS & JOSIFOV 1990; Vienna: RABITSCH 2003; Vorarlberg: RABITSCH 1999). **Belgium** (VREURICK 1933; STICHEL 1960, 1961; BOSMANS 1977; SLOSSE 1997; BAUGNÉE 1998, 2004, 2005; BAUGNÉE et al. 2001, 2003; DETHIER et al. 2005; DOLLING 2006). **Bosnia Herzegovina** (APFELBEK 1891; JOSIFOV 1986; PROTIĆ 1994b, 2001; DOLLING 2006). **Bulgaria** (JOAKIMOV 1909, 1914; STICHEL 1960, 1961; JOSIFOV 1963, 1969, 1974, 1986, 1999; STRAWIŃSKI & SIENKIEWICZ 1971; GÖLLNER-SCHEIDING 1988; HEISS & JOSIFOV 1990; DAVIDOVÁ-VILÍMOVÁ et al. 2000; SIMOV & ANTONOV 2006; DOLLING 2006). ?**Byelorusia** (DOLLING 2006: 'record probably refers to migrants or temporary populations', not recorded by LUKASHUK 1997). **Croatia** (HORVÁTH 1894, 1897, 1930; BLÖTE 1934; NOVAK & WAGNER 1951; MARCUZZI 1983; JOSIFOV 1986; PROTIĆ 1987, 1994b, 2001; RUCNER 1994; RUS 2005; GRUBIŠIĆ et al. 2006; DOLLING 2006). **Czech Republic** (Bohemia: RUS 2005; Moravia: STEHLÍK 1970, HOBERLANDT 1977, STEHLÍK & VAVŘÍNOVÁ 1989, NEJEDLÁ 1997; GÜNTHER & SCHUSTER 2000, DOLLING 2006). **Finland** (OLLIKAINEN & RINNE 2005, ALBRECHT et al. 2006). **France** (incl. Corsica) (MULSANT & REY 1870; WALKER 1872; PUTON 1881a; REY 1887; DOMINIQUE 1902; OSHANIN 1906, 1912; DE SEABRA 1926; GULDE 1935; DUPUIS 1953; WEBER 1953; WAGNER 1955; RAMADE 1960, 1964; STICHEL 1960, 1961; SIENKIEWICZ 1964; BLANC 1969; VILLIERS 1977; MOULET 1991, 1995a,b; DOLLING 2006). **Germany** (GÜNTHER & SCHUSTER 2000, DOLLING 2006; Baden-Württemberg: WAGNER 1966a, STRAUß 1987, RIEGER 1996, HECKMANN & RIEGER 2001, HOFFMANN & MELBER 2003; Bavaria: SINGER 1952; STICHEL 1960, 1961; FISCHER 1961; WAGNER 1966; WAGNER et al. 2002; HOFFMANN & MELBER 2003; BRÄU & SCHWIBINGER 2004; SCHUSTER 2005; SCHMOLKE et al. 2006; Brandenburg (incl. Berlin): GÖLLNER-SCHEIDING 1977; DECKERT 1996a,b; HOFFMANN & MELBER 2003; Hesse: GÜNTHER 2007; Mecklenburg-West Pomerania: HOFFMANN & MELBER 2003, MARTSCHEI & ENGELMANN 2004; Lower Saxony (incl. Bremen): KLUTH et al. 2001, HOFFMANN & MELBER 2003; Rhineland-Palatinate: GÜNTHER 2002, SIMON 2002, HOFFMANN & MELBER 2003; Thuringia: LICHTER & SANDER 1998, LICHTER et al. 1999, HOFFMANN & MELBER 2003). **Great Britain** (England: SAUNDERS 1903; THOULESS 1904; OSHANIN 1906, 1912; BUTLER 1923; KLOET & HINCKS 1945; MASSEE 1955; ALLEN 1958a,b, 1969; SOUTHWOOD & LESTON 1959; WOODROFFE 1959;

Stichel 1960, 1961; Denton 1997; Nau 1997; Dolling 2006; Wales: Judd & Howe 2004; Jersay Is.: Le Quesne 1953). **Greece** (Reuter 1891; Oshanin 1906; Paganetti-Hummler 1907; Royer 1923; Blöte 1934; Lindberg 1940; Wagner 1956; Stichel 1960, 1961; Drosopoulos 1980; Josifov 1986; Günther 1990; Rieger 1995; Dolling 2006; Crete: Josifov 1986; Heiss & Günther 1986; Heiss et al. 1991, 1993). **Hungary** (Horváth 1897; Oshanin 1906; Gulde 1935; Stichel 1960, 1961; Mészáros 1984; Bákonyi & Vásárhelyi 1987; Kondorosy & Harmat 1997; Kondorosy 1999, 2001; Dolling 2006). **Ireland** (Halbert 1935, Southwood & Leston 1959; Dolling 2006). **Italy** (incl. Sardinia, Sicily and small islands) (Costa 1853; Signoret 1859; Garbiglietti 1869; Gredler 1870; Ferrari 1874, 1878, 1888, 1892; de Bertolini 1875; Walker 1875; Montandon 1886; Ragusa 1887, 1907; Bezzi 1893; Oshanin 1906; Castellani 1951, 1952; Mancini 1935a, 1950, 1953b,c,d, 1954a,b, 1964; Singer & Mancini 1939; Filippi 1949; Giordani Soika 1949; Servadei 1952; Wagner 1954; Stichel 1960, 1961; Tamanini 1961a,b, 1973, 1981, 1982; Carapezza 1977, 1981, 1995, 1999; Carapezza et al. 1995; Dioli 1979; d'Urso et al. 1984; Melber 1993; Faraci & Rizzotti Vlach 1995; Rabitsch 1999; Dolling 2006; etc. – for review see Servadei 1967). **Kazakhstan: European part** (Kiritshenko 1954, Esenbekova 2004; Dolling 2006). **Liechtenstein** (Bernhardt 1992; Dolling 2006). **Macedonia** (Royer 1923; Kormilev 1936; Wagner 1960a; Josifov 1986; Protić 1987, 1994b, 2001; Dolling 2006). **Malta** (Walker 1875, de Lucca 1969, Schembri 1993; Dolling 2006). **Moldavia** (Oshanin 1906, Putshkov 1962, Derzhansky 1997; Dolling 2006). **Montenegro** (Horváth 1918; Josifov 1986; Protić et al. 1990; Protić 1994b, 2001). **Netherlands** (Reclaire 1936; Stichel 1960, 1961; Aukema 1989, 1994; Aukema & Cuppen 1996; Aukema et al. 2004, 2005; Günther & Schuster 2000, Dolling 2006). **Poland** (Smreczyński 1907, Stroiński 2001). **Portugal** (Lethierry 1877a; de Oliveira 1895; de Seabra 1925, 1926, 1927, 1929, 1930, 1941; Marques 1945; Pissaro 1951; Stichel 1960, 1961; Linnavuori 1971; Dolling 2006). **Romania** (Montandon 1885, 1907; Horváth 1897; Marcoci 1957; Borcea 1958; Stichel 1960, 1961; Sienkiewicz 1964; Schneider & Plattner 1968; Kis 1975, 1976, 2001; Schneider 1976; Roşca & Popov 1982; Josifov 1986; Dolling 2006). **Russia: European part** (incl. Caucasus) (Dohrn 1860; Jakovlev 1871, 1874, 1877; Oshanin 1906, 1912; Kiritshenko 1918, 1951; Stichel 1960, 1961; Putshkov 1962, 1986; Kerzhner & Jaczewski 1964; Dolling 2006). **Serbia** (Oshanin 1906; Kormilev 1936; Csiki 1940; Josifov 1986; Protić 1985, 1986a,b, 1987, 1989, 1992a,b, 1994a,b, 1996, 2001). **Slovakia** (Horváth 1897, Stehlík 1970, Hoberlandt 1977, Stehlík & Vavřínová 1995, Nejedlá 1997; Günther & Schuster 2000, Dolling 2006). **Slovenia** (Montandon 1886; Sienkiewicz 1964; Gogala & Moder 1960; Gogala & Gogala 1986, 1989; Protić 1994b, 2001; Dolling 2006). **Spain** (Herrich-Schaeffer 1835; Rambur 1839; Rosenhauer 1856; Oshanin 1906; Sánchez 1918; Lindberg 1929; Blöte 1934; Stichel 1960, 1961; Wagner 1960b,c; Ribes 1967; Linnavuori 1971; Ribes & Sauleda 1979; Vázquez-Martinez 1985; Ribes & Goula 1995; Ribes et al. 1997, 2004; Ribes & Ribes 2001a,b; Jiménez et al. 2003; Dolling 2006; Gibraltar – Walker 1875; Mallorca – Ribes 1965). **Sweden** (Pettersson & Coulianos 2004). **Switzerland** (Oshanin 1906, 1912; Hoffmänner 1924; Gulde 1935; Stichel 1960, 1961; Göllner-Scheiding & Resbanyai-Reser 2000). **Ukraine** (Jakovlev 1906; Gross-Heim 1930, 1931; Kiritshenko 1930, 1951; Kiritshenko & Talitzkij 1932; Roshko 1955; Putshkov 1962, 1986; Putshkov & Putshkov 1996; Dolling 2006). **Turkey: European part** (Atalay 1978, Pehlivan 1981, Josifov 1986; Dolling 2006).

EUROPE/ASIA: Soviet Union: For further references see Gidayatov (1982) and Putshkov (1986).

ASIA: Afghanistan (Hoberlandt 1961, Kiritshenko 1963, Miyamoto 1963, Muminov 1973, Hoberlandt & Švihla 1990a; Dolling 2006). **Armenia** (Kiritshenko 1918, Akramovskaya 1959; Dolling 2006). **Azerbaijan** (incl. Nakhichevan) (Kolenati 1845; Horváth 1878, 1891; Oshanin 1906; Kiritshenko 1918, 1938; Gidayatov 1967, 1982; Dolling 2006). **China:** Anhui**,** Gansu, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Heilongjiang, Hubei, Inner Mongolia, Jiangsu, Jiangxi, Ningxia, Shaanxi, Sichuan, Yunnan, Xizang (Lindberg 1934; Wu 1935; Stichel 1960, 1961; Hsiao 1963; Hsiao et al. 1977; Wang et al. 1999; Hua 2000; Sun et al. 2006; Dolling 2006). **Cyprus** (Dohrn 1860; Kirkaldy 1904; Oshanin 1906; Schumacher 1912; Lindberg 1948; Hoberlandt 1953a; Stichel 1960, 1961; Georghiou 1977; Dolling 2006). **Egypt: Sinai** (Priesner & Alfieri 1953, Linnavuori 1964, Gadalla 1999, El-Moursy et al. 2001; Dolling 2006). **Georgia** (incl. Abkhazia and Ajaria) (Kiritshenko 1918, 1939; Dolling 2006). **India** (Dallas 1852; Walker 1872; Lethierry & Severin 1894; Distant 1902, 1918; Maxwell-Lefroy 1909; Parshad 1953; Yousuf & Ahmad 1973). **Iran** (Kiritshenko 1949, 1966; Seidenstücker 1957, 1958; Hoberlandt 1959; Stichel 1960, 1961; Wagner 1968; Hoberlandt & Švihla 1990b; Linnavuori & Modarres 1998; Heiss 2001; Linnavuori 2004, 2007; Dolling 2006). **Iraq** (Hoberlandt 1952a, 1953c; Stichel 1960, 1961; Derwesh 1965; Al-Ali 1977; Linnavuori 1993; Dolling 2006). **Israel** (incl. Palestinian territories) (Frey-Gessner 1881, Puton

1881b, Giglio-Tos 1894, Bodenheimer 1937, Hoberlandt 1952b, Linnavuori 1960; Dolling 2006). **Japan** (Uhler 1897; Oshanin 1906, 1912; Stichel 1960, 1961; Miyamoto 1970; Tomokuni 1981, 1989; Miyamoto & Yasunaga 1989; Dolling 2006). **Jordan** (Katbeh et al. 2000; Dolling 2006). **Kazakhstan: Asian part** (Kiritshenko 1954; Asanova 1971, 1974; Beskokotov 1996; Dolling 2006). **Korea** (Josifov & Kerzhner 1978, Lee & Kwon 1991, Park & Josifov 1991, Choi et al. 2003; Dolling 2006). **Kuwait** (Linnavuori 1993, Al-Houty & Dolling 1999; Dolling 2006). **Kyrgyzstan** (Popov 1965; Dolling 2006). **Lebanon** (Puton 1881b, Giglio-Tos 1894; Dolling 2006). **Mongolia** (Wagner 1967; Kiritshenko & Kerzhner 1972, 1976; Tserendolgor 1973, 1976; Dolling 2006). **Oman** (Dolling 2006). **Pakistan** (Ahmad et al. 1979, Ahmad 1980, Rizvi et al. 2006). **Philippine** (Stål 1871, Lethierry & Severine 1894, Banks 1909). **Russia: Asian part** (southern Siberia: Linnavuori 1953 (Krasnoyarsk); Stichel 1960, 1961; Vinokurov & Kanyukova 1995; Far East: Kulik 1973, Putshkov 1986, Chernova 1988). **Saudi Arabia** (Eckerlein 1962, Shalaby 1962, Linnavuori & Alâmy 1982, Linnavuori 1986; Dolling 2006). **Syria** (Giglio-Tos 1894; Oshanin 1906; Stichel 1960, 1961; Dolling 2006). **Tadzhikistan** (Kiritshenko 1931, 1964; Putshkov 1962, 1986; Dolling 2006). **Thailand** (this paper). **Turkey: Asian part** (Puton & Noualhier 1895; Horváth 1906a; Kiritshenko 1918; Hoberlandt 1956; Stichel 1960, 1961; Linnavuori 1965; Wagner 1966b; Atalay 1978; Önder & Adigüzel 1979; Önder et al. 1981; Pehlivan 1981; Szabó 1981; Kiyak 1990; Özsaraç & Kiyak 2001; Özsaraç et al. 2001; Kiyak et al. 2004; Dolling 2006). **Turkmenistan** (Oshanin 1906; Pazhitnova & Kiranova 1956, Kaplin 1993; Dolling 2006). **Uzbekistan** (Blöte 1934; Popov 1965; Khamraev 2003; Mineo 2004, 2005; Dolling 2006). **United Arab Emirates** (this paper). **Yemen** (Linnavuori 1989; Linnavuori & van Harten 1997, 2002, 2006; Dolling 2006).

AFRICA: Algeria (Lethierry 1889; Reuter 1900a; Oshanin 1906; de Seabra 1926; Blöte 1934; Wagner 1958; Stichel 1960, 1961; Sienkiewicz 1964; Eckerlein & Wagner 1965; Dolling 2006). **Azorean Islands** (Lindberg 1941, 1954; Stichel 1960, 1961; Borges & Brown 2001; Ribes & Borges 2005; Dolling 2006). **Burkina Faso** (Linnavuori 1987). **Burundi** (Schouteden 1957). **Cape Verde Islands** (Lindberg 1958; Stichel 1960, 1961; Báez et al. 2005). **Canary Islands** (Noualhier 1893; Horváth 1909; Oshanin 1906, 1912; Lindberg 1936, 1953; Stichel 1960, 1961; Heiss 1997; Heiss & Báez 1990; Heiss & Ribes 1992; Heiss et al. 1996; Aukema et al. 2006; Dolling 2006). **Côte d'Ivoire** (Linnavuori 1987). **Democratic Republic of Congo** (former Zaire) (Schouteden 1938, 1948). **Egypt** (Stål 1873; Reuter 1900b; Horváth 1911; Oshanin 1906, 1912; Blöte 1934; Linnavuori 1953, 1964, 1971; Priesner & Alfieri 1953; Hoberlandt 1953b; Stichel 1960, 1961; Wagner 1963; Sienkiewicz 1964; Amro 2004; Abdel-Moneim & Abd El-Wahab 2006; Dolling 2006). **Eritrea** (Mancini 1954c). **Ethiopia** (Mancini 1954d, 1956, 1961). **Ghana** (Linnavuori 1987). **Lesotho** (Izzard 1960). **Libya** (de Bergevin 1932; Mancini 1935b, 1936, 1940, 1942a,b; Stichel 1960, 1961; Linnavuori 1965; Eckerlein & Wagner 1969; Dolling 2006). **Madeira** (Lindberg 1941, 1961; Stichel 1960, 1961; Dolling 2006). **Mauritania** (Risbec 1950; Villiers 1951, as *Corizus hyalinipennis*). **Mauritius** (Signoret 1859, Stål 1873). **Melilla (Spain)** (Linnavuori 1965). **Morocco** (Lethierry 1877b; Oshanin 1906; de Bergevin 1916; Lindberg 1929; Vidal 1937; Dupuis 1953; Stichel 1960, 1961; Linnavuori 1971; Dolling 2006). **Namibia** (Hesse 1925; Göllner-Scheiding 1997, 2000). **Niger** (Linnavuori 1987). **Rodriguez** (China 1924). **Rwanda** (Schouteden 1957). **Senegal** (Noualhier 1898, Risbec 1950, Linnavuori 1987). **Seychelles** (Bergroth 1913, Distant 1913). **Somalia** (Linnavuori 1982). **South Africa** (Germar 1838; Signoret 1859; Stål 1865, 1873; Wallengren 1875; Oshanin 1906; Izzard 1960). **Sudan** (Signoret 1859; Linnavuori 1978, 1980). **Tchad** (Wagner 1965). **Tunisia** (Ferrari 1884; Horváth 1906b; Oshanin 1906; Stichel 1960, 1961; Sienkiewicz 1964; Linnavuori 1965; Carapezza 1997; Kment & Batelka 2005; Dolling 2006). **Western Sahara** (Wagner 1966c).

AUSTRALIA and PACIFIC ISLANDS: Australia: New South Wales, Queensland, South Australia, West Australia (Stål 1873; Lethierry & Severin 1894; Oshanin 1906; Cassis & Gross 2002). **Hawaii** (Kirkaldy 1903, 1907a,b; Englund et al. 2002; Nishida 2002). **Micronesia:** Bonin Is., North Marianna Is., South Marianna Is., Palau, Yap, Caroline Atoll, Marshall Is., Gilbert Is. (Gross 1963). **Midway Atoll** (Nishida & Beardsley 2002). **Papua-New Guinea** (Moulet 1995a). **Polynesia:** Society Is.: Bora Bora (Cheesman 1927).

NORTH AMERICA: Canada: British Columbia, Ontario (Henry 1988). **USA:** Arizona, Arkansas, California, Colorado, Connecticut, Florida, Idaho, Illinois, Indiana, Iowa, Kansas, Louisiana, Massachusetts, Maryland, Mississippi, Missouri, North Carolina, New Mexico, Nebraska, Nevada, Ohio, South Carolina, South Dakota, Texas, Utah, Virginia, Wyoming (Uhler 1872, 1876, 1877, 1893, 1894a, 1895, 1904; Distant 1882; Van Duzee 1903, 1909, 1914, 1916, 1917; Osborn 1904; Snow 1904, 1906; Barber 1906, 1914;

Oshanin 1906; Tucker 1907; Hambleton 1908; Parshley 1917; Blatchley 1926; Deay 1928; Harris 1937; Torre Bueno 1941; Froeschner 1942; Harris & Shull 1944; Sherman 1948; Deitz et al. 1980; Hall & Teetes 1981; Henry 1988; McPherson & Weber 1990; Gibb 1991, 2003; Michailides et al. 1998; Lago & Testa 2000).

CENTRAL AMERICA and WEST INDIES: Antilles (Lethierry & Severin 1894). **Antigua** (Barber 1923a). **Bermuda** (Hambleton 1908, Henry & Hilburn 1990). **Cuba** (Uhler 1876, Distant 1882, Baker 1908, Barber 1923a, Bruner & Barber 1947, Alayo 1967). **Dominican Republic** (Walker 1872, Barber 1923a). **Guatemala** (Distant 1882). **Grenada** (Uhler 1894b). **Haiti** (Hambleton 1908). **Jamaica** (Van Duzee 1907). **Mexico** (Uhler 1876, Distant 1882, Lethierry & Severin 1894, Oshanin 1906; Hambleton 1908, Blatchley 1926). **Nicaragua** (Maes & Göllner-Scheiding 1993, Göllner-Scheiding 1994). **Porto Rico** (Barber 1923a,b, 1939; Wolcott 1923).

SOUTH AMERICA: Argentina (Berg 1878, Pennington 1922; Patagonia: Lethierry & Severin 1894). **Bolivia** (this paper). **Brasil** (Blöte 1934, Costa Lima 1940, d'Araujo et al. 1968). **Chile** (Spinola 1852; Signoret 1859, 1863; Walker 1872; Lethierry & Severin 1894; Reed 1900; Oshanin 1906; Harris 1942). **Colombia** (Dallas 1852, Walker 1872, Lethierry & Severin 1894). **Galápagos Islands** (Signoret 1859; Walker 1872; Lethierry & Severin 1894; Barber 1925, 1934; Linsley & Usinger 1966; Schaefer et al. 1980; Froeschner 1981, 1985). **Paraguay** (Lethierry & Severin 1894). **Venezuela** (Cermeli et al. 2004).

Northward expansion of European range. In both the British Isles and central Europe (sensu Günther & Schuster 2000), *L. hyalinus* has been a very rare species for a long time. For example in Poland, the only record, from Grybów (49°37' N), is dated to before 1907 (Smreczyński 1907, Stroiński 2001). In Slovakia, there are only three records – one old record from Varannó (= Vranov nad Topľou, 48°53' N) in eastern Slovakia dated to the end of the 19th century (Horváth 1897), and two additional records from aeolian sands in the Borská nížina lowlands in south-western Slovakia (Sekule, 26.ix.1968, 1 ♀, 48°36' N; Malacky, 4.vi.1969, 1 ♀, 48°26' N) (Stehlík 1970, Stehlík & Vavřínová 1995). In Austrian Carinthia it was recorded (including a breeding population) only between 1919 and 1923 (Prohaska 1923) and than again in 1998 (Friess 1998). It was further collected in Vorarlberg in 1934 (Rabitsch 1999) and Tirol in 1949 (Heiss 1976) (there are no recent records from either territory), in Lower Austria and Vienna in 1946, 1952, 1973, 1996, 2000 (two records), 2002 (Rabitsch 2001, 2003), and in Styria only in 1994 and 1996 (Adlbauer 1997). In Germany, it was probably first collected in 1909 by Neuendorf (locality uncertain, probably in south-eastern Berlin, ca. 52°27' N) in Brandenburg, which is still the only record from this territory (Göllner-Scheiding 1977, Deckert 1996a,b). Subsequently it was collected in Bavaria in 1926 and 1931 (Singer 1952), where the species was recently collected from several localities (Wagner et al. 2002; Hoffmann & Melber 2003; Bräu & Schwibinger 2004; Schuster 2005; Schmolke et al. 2006). Unfortunately, the first records from Baden-Württemberg were published without record of the year of discovery (Wagner 1966a, Strauß 1987); the new records were ascertained in 1995 and 2000 (Heckmann & Rieger 2001). In the course of recent years, it was first recorded in Thuringia (1996, environs of Wandersleben – 50°53' N) (Lichter & Sander 1998, Lichter et al. 1999), Lower Saxony (1996, environs of Göttingen – 51°32' N) (Kluth et al. 2001), Rhineland-Palatinate (15 localities (including breeding records) recorded between 1992–1994, northwards to ca. 49°50' N) (Günther 2002), and Hesse (in 2003 collected more than a hundred specimens near Leeheim – 49°51' N) (Günther 2007). It was also listed from Mecklenburg-

Vorpommern (Hoffmann & Melber 2033, Martschei & Engelmann 2004). In the Netherlands it was known for a long time from only a single female collected at Nunspeet (Gelderland province, 52°22' N) in 1923 (Reclaire 1936, Aukema 1989). It was then collected again in 1994 at Schiermonnikoog (Waddeneilanden, Friesland province, 53°28' N) and in Maastricht (Limburg province, 50°51' N) (Aukema & Cuppen 1996, Aukema et al. 1997). From 1996 onwards, it has already been collected in several other localities in the provinces of Friesland (Friesian Islands: Terschelling – 53°24' N, and Vlieland – 53°15' N), Gelderland, Zeeland, Noord-Brabant and Limburg (Aukema et al. 2004, 2005). In Belgium it was first collected in 1926 by Laeken (= Brussels – Laken, 50°52' N) (Vreurick 1933, Bosmans 1977). After a break of almost 70 years, *L. hyalinus* was found again at Oostduinkerke (West Flanders, 51°06' N) in 1994 (Slosse 1997). Several new records followed after 1996 (including a breeding record from the environs of Pondrôme – 50°05' N) (Baugnée 1998, 2004, 2005; Baugnée et al. 2001, 2003; Dethier et al. 2005); thus *L. hyalinus* is considered expansive in Belgium (Dethier et al. 2005). So far it has not been recorded from Luxembourg and Denmark (e.g., Dolling 2006). In England, two records of *L. hyalinus* occurred in 1903 – in a marshy spot near Gosfield (Essex, 51°56' N) (Sounders 1903, Butler 1923) and on a cemetery wall in Norwich (Norfolk, 52°38' N) (Thouless 1904, Butler 1923). Another intrusion took place in 1958. A single male was collected in a garden in Blackheath, south-east London (Kent, 51°28' N) (Allen 1958a,b); in the very same garden the species was recorded again in 1968 (Allen 1969). A small breeding colony was also found in late August 1958 in Braunton (Devon, 51°06' N) (Woodroffe 1959, Southwood & Leston 1959). In 1996 it was collected near Oakhanger (Hampshire, 51°06' N) (Denton 1997) and near Sandy (Bedfordshire, 52°07' N) (Nau 1997). In Wales, it was collected for the first time in 1985 at Freshwater West (Pembrokeshire, ca. 51°40' N), but an additional six records were obtained after 1999, including one breeding population at Porth Ceiriad, Llyn Peninsula (Caernarvonshire, 52°48' N), and the northernmost Welsh record from Cors Goch NNR (Anglesey, ca. 53°20' N) (Judd & Howe 2004). In Ireland it has been collected only twice, in 1903 in Portmarnock on the eastern coast (Dublin, 53°25' N) and in 1923 in the region of Kenmare on the western coast (Kerry, 51°52' N) (Halbert 1935, Southwood & Leston 1959). Le Quesne (1953) also reported it from Jersey Island in the English Channel. Traditionally, *L. hyalinus* has been assumed to be merely an occasional migrant ('vagrant species') in Great Britain (Butler 1923, Allen 1958, Southwood & Leston 1959), but the new records support its establishment in the British Isles.

Gulde (1934) summarized the occurrence of *L. hyalinus* in central Europe as follows: In France northwards to the River Loire (up to 48°00' N), in the Aube region (ca. 48°30' N), at Remiremont (48°00' N); in Switzerland in lower Rhône valley and at Geneva (46°12' N); in Hungary in the environs of Budapest (47°30' N). Although he overlooked a few northern records (e.g., Horváth 1897, Smreczyński 1907, Vreurick 1933), it seems clear that the northernmost limit of this species in central Europe was about 48°N, and only single migrant specimens were collected in the more extremely northern parts. However, from the 1990s onwards, records of *L. hyalinus* become

increasingly common and the species should be classified as expansive. It has been recorded as breeding as far north as central Bohemia (50°21' N – this paper), Rhineland-Palatinate (ca. 49°50' N – Günther 2002), Belgium (50°05' N – Baugnée 2005), England (51°06' N – Woodroffe 1959), and Wales (52°48' N – Judd & Howe 2004). Moulet (1995a) considered the northern distributional limit of *L. hyalinus* at latitude 55° N. However, in 1996 one specimen of *L. hyalinus* was swept from grassy sea-shore vegetation in Sweden (locality Ivarsboda, Västerbotten, 63°52' N), from an area just below 64° N (Pettersson & Coulianos 2004). An additional specimen (a single male) was collected in 2000 at Nagu in the Finnish South-West Archipelago (60°11' N) (Ollikainen & Rinne 2005). Both Pettersson & Coulianos (2004) and Ollikainen & Rinne (2005) regarded it as merely a sporadic migrant in Fennoscandia, most probably not able to overwinter in northern Europe. In Russia it occurs mainly south of 53°N, but it has also been recorded from the Komi region (59–68° N) (Kerzhner in Ollikainen & Rinne 2005).

In some countries in central Europe, the hyaline grass bug has been considered in danger of extinction (Germany – Achtziger et al. 1992, Günther et al. 1998; Liechtenstein – Bernhardt 1995). On the other hand, it seems sure that human activities are not the main limiting factor for this species in central Europe (see Habitat, below). Central Europe is apparently the marginal ('peius') part of its distributional area, with only scattered and patchy populations of this thermophilous bug. However, the rapidly increasing number of records in the 1990s from Great Britain, Belgium, Netherlands, Germany, Austria, and the Czech Republic, as well as records of migrant specimens from Sweden and Finland, clearly document a recent northwards range expansion for *L. hyalinus*. For polyphagous and euryecous *L. hyalinus*, the climatic conditions, and especially its thermal requirements, should represent a key limiting factor in its distribution. Thus recent thermally above-average years enable this expansion, which could be a consequence of global warming. Similar range expansions of other true bug species (e.g. *Nezara viridula*) and their possible connection with global warming were recently reviewed and discussed by Musolin & Fujisaki (2006) and Musolin (2007).

Biology. In the climatic conditions of Europe, Turkey, Central Asia, and the USA (Arizona, Kansas), *L. hyalinus* overwinters in the adult stage (e.g. in moss, on pines or junipers) (Readio 1928; Dupuis 1953; Mc Kiney in Carlson 1959; Putshkov 1962, 1986; Atalay 1978; Moulet 1995a,b; Kis 2001). However, in Pakistan the adults have been collected in January, May, June, September, October, and November (Rizvi et al. 2006), in Iraq in February, and every month from April to November (Al-Ali 1977, Linnavuori 1993), in southern Iran (Hormozgan province) from February to May, as well as in September, November, and December (Linnavuori 2004), and in Palestine it has even been collected in January (this paper). In Yemen, it has been collected in every month of the year (Linnavuori 1989; Linnavuori & van Harten 1997, 2002, 2006) and hibernation most probably does not take place there.

In the Ukraine, as well as in the forest-steppe zone of the former Soviet Union, the adults become active from early spring, starting oviposition in early May. The first adults

of the new generations appear in mid-June, and the development of gonads stops in adults maturing at the end of August and September (the overwintering generation) (PUTSHKOV 1962, 1986). In France, the eggs are laid from the end of April to mid-May, larvae of the first generation occur in June and July, and adults of the first generation from mid-July to mid-September. Adults oviposit immediately and larvae of second generation appear from mid-August to the first third of September; adults of the second generation occur from mid-September to the first frost in late October or early November, and overwinter (MOULET 1995a,b; DUPUIS 1953). In Romania, larvae appear in June–July and adults of the new generation occur until October (KIS 2001). GRUBIŠIĆ et al. (2006) observed eggs, larvae and adults of *L. hyalinus* on seed capsules of *Abutilon theophrasti* in Croatia from August to mid-November. In Sicily, the bug's development was observed on lettuce from the end of May/early June, when the first adults were recorded, until 20–25th of November (MINEO 2004, 2005). ATALAY (1978) gave the occurrence of *L. hyalinus* in Turkey from 24th March to 19th November. In the environs of İzmir, the first adults occurred on *Erodium cicutarium* and *Malva sylvatica* from the 2nd–3rd week of May and copulated 1–3 days after their emergence. The adults can mate several times in the various periods (ATALAY 1978). In Kansas, adults were found as late as in October; however, they continued to deposit eggs as long as food was supplied to them and the temperature was warm (READIO 1928).

The eggs are blood-red in colour at all stages of incubation (READIO 1928; McKinney in CARLSON 1959; PUTSHKOV 1962, 1986); yellow coloration and other details of eggs mentioned by GÖLLNER-SCHEIDING (1976) are recorded in error and are associated with *Corizus hyoscyami* (Linnaeus, 1758) (see SCHWOERBEL 1956). The females deposit clusters of eggs on various parts of the host plants, especially near the generative organs or just on them (PUTSHKOV 1962, 1986). According to MINEO (2004, 2005), the females generally lay eggs on the bifurcations of the inflorescences, but also at the lower parts of the host plants. READIO (1928) found the eggs attached to almost every part of the common food plant, *Lactuca serriola*, but more commonly on the flowering parts or in the vicinity of them. According to McKinney (in CARLSON 1959), the eggs are deposited in clusters on the seed spikes of lettuce. The eggs are laid in a one-layered mass of any number up to fifty, although single eggs are found only rarely. Each egg is attached to that portion of the plant directly beneath it by means of a short pedicel, about 0.03 mm long. There are no threads attaching all of the eggs of the mass to a single point. One female deposited 558 eggs in 50 days of confinement (READIO 1928). However, PUTSHKOV (1962, 1986) stated that in natural conditions in the Ukraine the total number of eggs per female was much lower. According to McKinney (in CARLSON 1959), individual females held in breeding cages deposited 200 or more eggs. According to ATALAY (1978), the eggs are deposited on the host plants in batches of 2–35 eggs. The average number of eggs in the batches is reduced when the temperature is lower; eggs deposited per female totalled 18–193 and 50–278 at 25°C and 34°C respectively. According to PUTSHKOV (1962, 1986) batches consist of 5–30 (maximum 50) eggs that do not touch each other. PUTSHKOVA (1957) gave the number of eggs in groups 'from 5–16 to 30–38, or more', MINEO (2004) from a few (2–3) up to 50 eggs, and MINEO (2005) 11 to 56 eggs in one cluster.

The eggs hatch after 5 days at 25°C and 3 days at 34°C (Atalay 1978). Kirkaldy (1907a) and Readio (1928) both gave the hatching period as 6–7 days. According to McKinney (in Carlson 1959), eggs deposited in Arizona in May (when temperatures were lower) hatched in 6 days, while only 4 days were needed at higher temperatures. According to Putshkov (1962, 1986), embryonic development takes 6–8 days.

There are five larval stages (Readio 1928, McKinney in Carlson 1959, Atalay 1978); an occasional sixth instar reported by McKinney (in Carlson 1959) is probably in error. The development periods for the first 4 larval instars are 2 days and 1 day at 25°C and 34°C respectively, and for the last instar 3 days at 25°C and 2 days at 34°C. The adults emerged after these periods (Atalay 1978). According to Putshkov (1962, 1986), younger larval instars take 2–3 days, while the older instars need 3–4 days each. Total larval development takes 14–18 days. According to Kirkaldy (1907a), the adult state was reached in Hawaii in 13–16 days. Readio (1928) found the following durations of larval stages: first stage 2 days, second stage 2 days, third stage 1–2 days, fourth stage 2 days, and fifth stage 2–3 days, rearing the insect from adult to adult in 17 days. (These observations were made in an out-door insectorium in Lawrence, Kansas, during late August and early September 1927 when temperatures were high, the thermometer reaching the high eighties and nineties [ca. 85–99°F = ca. 29–37°C] during the middle of the day). Very little variation was evident in the lengths of stages for the twenty individuals reared in this way (Readio 1928). In Arizona, larval development was completed in 18 to 26 days in May (when temperatures were lower), and a period as short as 11 days at high temperatures (McKinney in Carlson 1959).

The pre-oviposition period of newly emerged females extends to 8–16 days at 25°C, but only 3–5 days at 34°C (Atalay 1978). Readio (1928) found the pre-oviposition period to be only 3–4 days. Adult life is comparatively long; Readio (1928) kept one adult female in confinement for 50 days, and according to McKinney (in Carlson 1959) both males and females lived longer than 2 months in breeding cages. The adults copulate and oviposit throughout the whole summer (Putshkov 1962, 1986).

Atalay (1978) found that the development threshold of *L. hyalinus* is 17.2°C and the thermal constant 218.4 day degrees. According to this information, 5.6, 5.3 and 4.2 generations were predicted in İzmir (Bornova) during 1974, 1975 and 1976, respectively. However, 5 generations were observed in the field in all three years (Atalay 1978). According to Moulet (1995a,b), *L. hyalinus* is bivoltine in south-eastern France, but in certain conditions or according to latitude, may be monovoltine as well. Putshkov (1962, 1986) assumed at least three generations per year in the conditions of the Ukraine. Gidayatov (1982) mentioned 4 generations per year in Azerbaijan. Readio (1928) estimated the number of generation in Kansas as 4 or 5 per season. According to observations carried out in Sicily by Mineo (2005), *L. hyalinus* produces 6 generations a year there, of which three are from June (first egg clusters found from 4th June onwards and first newly-hatched larvae from 13th June) to August, and the rest from September to November.

Atalay (1978) counted an average male proportion of 48.8 % at 25°C and 47.2 % at 34°C in the laboratory. In field experiments in Turkey, nearly the same ratio of males

to females was recorded (ATALAY 1978). In the Ukraine, the population density is generally low in the early season, reaching a maximum in August (in dry and warm summers), sometimes occurring in masses (PUTSHKOV 1962, 1986). Larvae bred in overcrowded conditions produced smaller adults with a conspicuous reddish tinge to the body, while larvae bred from hatching at lower densities (2–3 larvae per plant) developed into larger adults with a predominant greenish tinge to the body coloration (PUTSHKOV 1962, 1986). In the field, females deposit their eggs on specific host plants, which results in the formation of *L. hyalinus* colonies (ATALAY 1978). According to PUTSHKOV (1962, 1986), early larval instars form groups.

Host plants. The hyaline grass bug (*Liorhyssus hyalinus*) is generally known as a polyphagous species (e.g., GÖLLNER-SCHEIDING 1976, MOULET 1995a). SCHUH & SLATER (1995) indicated that it is a cosmopolitan pest of many low-growing crop-plants, especially of the family Asteraceae. Here we summarize all the records of plants associated with *L. hyalinus*, totalling 172 plant taxa (genera, species) belonging to 38 families (see Table 1). However, the true host plants, on which the development of *L. hyalinus* has been reported, are far less numerous – only 22 species from 9 plant families (Table 1). Most of the host plant taxa belong to families Asteraceae and Malvaceae, with 6 host plant species each, followed by families Euphorbiaceae, Geraniaceae, and Solanaceae with two host plant species each. The families Cannabaceae, Chenopodiaceae, Hypericaceae, and Poaceae include single host plant species. Moreover, AL-ALI (1977) reported from Iraq that both adults and larvae attack cereals and legumes. For a complete list of associated and host plant species see Table 2. The host plant records of *Ononis spinosa*, *Cirsium*, and *Serratula* given by GÖLLNER-SCHEIDING (1976) do not belong to *L. hyalinus*, but to *Corizus hyoscyami* (see SCHWOERBEL 1956).

Feeding and damage potential. Insects of the genus *Liorhyssus* and allied genera appear to prefer the reproductive parts of plants (READIO 1928). The buds, flowers, seeds, and fruits are particularly sought, although *L. hyalinus* has been observed to feed on the leaves and stems of *Lactuca serriola* as well (READIO 1928). According to PUTSHKOV (1962, 1986), the larvae start to suck immediately after ecclosion; they stay on host plants, sucking the sap of young sprouts, leaf blades, and, in preference, on various parts of the generative organs, especially of seeds. According to McKinney (in CARLSON 1959), the larvae seemed to feed exclusively on the flower buds and developing seeds of lettuce. According to ATALAY (1978), the larvae and adults of *L. hyalinus* feed on the generative parts of the host plants, preferring them in seed development stage. GRUBIŠIĆ et al. (2006) observed eggs attached to seed capsules and both larvae and adults sucking on seeds (mostly on newly-produced capsules but also on mature ones) of *Abutilon theophrasti* in Croatia.

McKinney (in CARLSON 1959) observed that larvae fed on flower buds of cultivated lettuce matured in about half the time required by those fed on wild lettuce.

The phenology of host plants affects the seasonal occurrence of *L. hyalinus*. In western Turkey, *Lactuca sativa* and *Malva sylvestris* begin to shrivel between late June

and early July in the field. The bugs are then seen on *L. serriola*, which is coming into bloom at the same time. This change of host in the field leads to an apparent reduction of the population density of *L. hyalinus*. During the following months, the population trends extend in normal sequence and reach their peak between late July and early August (Atalay 1978).

In the Soviet literature, *L. hyalinus* was recorded as a pest of kenaf (*Hibiscus cannabinus*), *Abutilon*, marshmallows (*Althaea officinalis*, *Hibiscus*), hemp (*Cannabis sativa*), cotton (*Gossypium*), *Chondrilla*, guayule (*Parthenium argentatum*), alfalfa (*Medicago sativa*), sorghum (*Sorghum*), and flax (*Linum usitatissimum*). However, the damage never attained economic significance (see Putshkov 1962, 1986; Gidayatov 1982). Only Mineo (2005) cited serious damage to both the buds and flowers of *Hibiscus cannabinus* in Tashkent (Uzbekistan), even to the point of killing young trees, and also attacks on *Abutilon avicennae*. In Egypt it has been reported as pest of cowpea (*Vigna unguiculata*) (Amro 2004), in Turkey of tobacco (*Nicotiana*), hemp, and rice (*Oryza sativa*) (Atalay 1978); in Iraq it has attacked cotton, tobacco, cereals, and legumes (Al-Ali 1977); and in Venezuela it damages the tender grains of sorghum (Cermelli et al. 2004). Moreover, the list of the associated and host plants (see Table 2) includes many other cultivated plants and trees.

In several sources, *L. hyalinus* has been reported to attack both the inflorescences and seeds of lettuce (*Lactuca sativa*), e.g. in the United States, Italy, and Turkey (Readio 1928, Carlson 1959, Atalay 1978, Mineo 2005). McKinney (in Carlson 1959) established an economic threshold level of about 35–50 adults per lettuce plant. However, only a very high population of bugs (density 400 or more specimens per plant) caused severe loss of yield and very little germination. Mineo (2005) stated that this level of infestation was never reached during his studies in Sicily. According to Atalay (1978), the germination of injured seeds of *L. sativa* was greatly reduced. The germinated seeds showed the punctures of stylets on their cotyledons as brownish spots, and the development of such seedlings was apparently stunted. Furthermore, sucking on *Malva sylvestris* gave rise to some abnormalities in the shape of its fruits. It has been recorded that the damage done by larvae is more serious than that of adults (Atalay 1978).

In California, *L. hyalinus* feeds on pistachio (*Pistacia vera*), starting preferentially at the soft base of unripe fruits and causing epicarp lesions (Michailides 1989). Such lesions produced by the bugs serve as important entry points for pathogens, especially the fungus *Botryosphaeria dothidea* (Moug. ex Fr.) Ces. & De Not. (Ascomycetes, Dothideales). *Botryosphaeria dothidea* has been associated with (and isolated from) fruit showing punctures and/or epicarp lesions caused by hemipteran insects. True bugs (*L. hyalinus* and others), when caged with fruit clusters sprayed with spores of *B. dothidea*, were associated with significantly higher levels of infected fruit than occurred on sprayed or non-sprayed fruit clusters not caged with insects. There emerged a positive linear correlation between the incidence of punctures on fruit caged with hemipterans and fruit infected by *B. dothidea* and fruit that had pycnidia of the pathogen. These insects may play a significant role in spreading *B. dothidea* from orchard to orchard (Michailides et al. 1987, Michailides 1989, Michailides & Morgan 1996, Michailides et al. 1998, Mitchell 2004).

Apart from cultivated plants, *L. haylinus* has been recorded several times from weeds in various regions (e.g. Uhler 1877, Wolcott 1923, Pazhitnova & Kiranova 1956, Protić 1994). The bugs may move onto crops from nearby wild hosts, mostly grasses (Hall & Teetes 1981, Michailides et al. 1987, Schaefer & Kotulski 2000). Among the weeds, the life cycle of *L. hyalinus* has best been described on velvetleaf (*Abutilon theophrasti* Med.) (Gibb 1991, 2003; Grubišić et al. 2006; this paper). The velvetleaf is originally an Asian species, currently introduced to Europe, Africa, North and Central America, Australia, and New Zealand (Jehlík 1998). The results of caging studies on *A. theophrasti* showed a significant reduction in seed weight and an increase in seed mortality due to the feeding of *L. hyalinus* larvae placed in the cage. Affected seeds were shrunken overall, very blackened, and malformed at the site of feeding injury; none of seeds fed upon by *L. hyalinus* germinated (Gibb 1991). Gibb (2003) confirmed the connection of the hyaline grass bug with the velvetleaf, when it occurred together with *Helicoverpa* (= *Heliothis*) *zea* (Boddie, 1850), *Heliothis virescens* (Fabricius, 1777) (both Lepidoptera: Noctuidae), *Niesthrea louisianaica* Sailer, 1961 (Heteroptera: Rhopalidae), and *Althaeus folkertsi* Kingsolver, 1989 (Coleoptera: Bruchidae). These insect species have a negative effect on the number of viable velvetleaf seeds produced in Indiana (USA). In Gibb's opinion (2003), understanding the extent of natural seed predation and the life history of the insects involved is essential to the integration of biological control tactics into an overall pest management strategy. Grubišić et al. (2006) confirmed development of *L. hyalinus* on *A. theophrasti* in Croatia; they suggested *L. hyalinus* as a potential control agent for velvetleaf. However, taking the wide polyphagy and possible crop damage done by *L. hyalinus* into acount, the usefulness of this species for biological control is, at best, controversial.

Habitat. *Liorhyssus hyalinus* is generally considered an euryecous species. It has a wide altitude range, from the valley of the Jordan river, 360 metres below sea level (this paper), up to the high mountains. In Iran it has been recorded from altitudes of around 3500–4000 m.a.s.l. (Hoberlandt & Švihla 1990b) and in Pakistan it has been collected on alpine meadows at altitudes of 3200–3600 m.a.s.l. (this paper). In the western USA (Colorado), Uhler (1877) collected it on various weeds and flowers on Arapahoe Peak 11,000–12,000 feet a.s.l. [= 3350–3660 m.a.s.l.].

According to Dupuis (1953) it is a common species in dry and open habitats with a variety of vegetation cover, preferring Asteraceae. It inhabits a wide range of habitats, natural as well as anthropogenic, xerothermic as well as wet. However, the dry and warm habitats prevail. Some examples of the wild habitats of *L. hyalinus* follow. Sounders (1903) found it in England in a marshy place. In Wales, Judd & Howe (2004) collected adults and numerous larvae under *Erodium cicutarium* at the edge of bare sand created by rabbit activity, but one additional adult was swept from an area of tall sedges (*Cladium mariscus* and *Schoenus nigricans*) in a base-rich fen. Pettersson & Coulianos (2004) swept it in a riparian biotope (grass vegetation with *Valeriana officinalis* and *Angelica sylvestris*) on the Baltic Sea shore in Sweden. Ollikainen & Rinne (2005) swept another specimen from a coastal meadow on a sand-gravel substrate in the Finnish South-West

Archipelago. In Romania, it is a xero-thermophilous species, preferring sandy habitats (Kis 2001). In Bulgaria it has been collected on steppes, the banks of rivers and the sea shore, in Greece in salt marshes, *Pinus* wood and clearings, and maquis; in Montenegro in salt marshes. In Italy it has been swept in the evening on a beach, in the Canary Islands on sand dunes (this paper). In Serbia, it has occurred in the following natural biomes: Mediterranean sub-alpine rocky pastures and woodland on rocks, and European steppes with diverse grasses (Protić 2003). One record of *L. hyalinus* in leafy forest (*Luzulo-Quercetum*, 560 m.a.s.l.) in the Medvednica Mts in Croatia appears quite exceptional (Rucner 1994). Protić (1992a) mentioned *L. hyalinus* from Serbian marshland with waterpan growth of *Typha latifolia* and *Phragmites communis* and from mesophilous meadow with *Juncus* sp. and *Carex* sp., and Protić (1986) from aeolian sands near Deliblat (plant associations *Koelerito-Festucetum wagneri*, *Festucetum pogonetum pannonicum ischaemetosum*, *Festucetum vaginatae muscetosum* and *Festucetum vaginatae typicum*). Giordani Soika (1949) collected it in Italy on mesophilous meadows in association *Salvietum pratensis*; Ribes & Sauleda (1979) in association *Ammophilon*. In the Canary Islands and Iran it has been collected on/under halophytes (Heiss 2001, Heiss & Ribes 1992). In Central Anatolia (Turkey) it has been collected in steppe formations (1210–1290 m.a.s.l.) (Kİyak 1990), in Iran in semideserts in Khorasan (Linnavuori & Modarres 1998) as well as the steppes of Hormozgan province (Linnavuori 2004). In the desert zone of eastern Kazakhstan it lives on xerophytes (Asanova 1974). In the western Tian Shan Mts (Kyrgyzstan, Uzbekistan) it inhabits steppe and mountain steppe formations, the tree-shrub zone, the mixed forests, and the banks of rivers at altitudes of 1500–1900 m.a.s.l. (Popov 1965). Pazhitnova & Kiranova (1956) wrote that it lives individually in the region of mountain xerophytes and open canopy forests in central Asia. Tserendolgor (1973) mentioned it from the forest steppes of Mongolia (1715–1730 m.a.s.l.) on chernozem. Linnavuori (1987) listed it from central Africa from dryish localities.

Liorhyssus hyalinus is also common in various anthropogenic habitats, often in fields (e.g. in the Czech Republic – this paper, Serbia – Protić 2003, central Asia – Pazhitnova & Kiranova 1956, Iran – Linnavuori & Modarres 1998, Turkey – Kİyak 1990, Yemen – Linnavuori & van Harten 2002, central Africa – Linnavuori 1987, Venezuela – Cermeli et al. 2004, etc.), monocultures of medical plants (Serbia – Protić 1992b), gardens (e.g., in Bulgaria – this paper, Iran – Linnavuori 2004, Turkey – Kİyak 1990, central Africa – Linnavuori 1987, etc.), tree nurseries (Palestine – this paper), orchards (e.g. apple and pear orchards in Serbia – Protić 1994, 2003; pistachio orchards in California – Michailides 1989), and pastures (e.g. in the Azores – Borges & Brown 2001). Baugnée (2004) collected it in city park in Belgium. It has been collected from fallow and abandoned fields (Germany – Günther 2002, 2007; Belgium – Baugnée et al. 2000; Croatia, Italy – this paper), in the contact zone between mesophilous calcareous grassland and ruderalized fallow, in forest margin along maize fields (Belgium – Baugnée 2005), on roadside vegetation (Croatia – this paper), in abandoned quarries (Belgium – Baugnée et al. 2000, Dethier et al. 2005), in ruderal sites (Netherlands – Aukema & Cuppen 1996), in the ruins of an ancient city (Asian Turkey – this paper), in

an abandoned sugar refinery, in an abandoned railway station (Belgium – BAUGNÉE et al. 2000), on a tapline embankment, and in growth of invasive *Solidago canadensis* (Czech Republic – this paper).

Liorhyssus hyalinus is very good flyer, a fact related to its long wings, apparently longer than in other related genera. This capacity for flight was documented by SIMOV & ANTONOV (2006), who evaluated true bug material collected during the period 22 September –2 October 1999, using the neck ring method in nestlings of the second brood in a colony of the pallid swift (*Apus pallidus* (Shelley, 1870) (Aves: Apodidae)), a bird collecting its food exclusively in flight. This material contained 131 specimens of *L. hyalinus* in a total of 711 specimens, i.e. 18.4 %. Such talent for flight may well be an important factor in helping this species to colonize some of the smaller islands (see distribution above), as well as facilitating rapid spread under favourable climatic conditions. During the night, the adults fly into the light traps (GÖLLNER-SCHEIDING & REZBANYAI-RESER 2000; MCPHERSON & WEBER 1990; HEISS et al. 1991, 1993; KINGSLEY 1998; RIZVI et al. 2006; ÖNDER et al. 1981; ÖNDER & ADIGÜZEL 1979; this paper).

Natural enemies. BUTLER (1965) reported predation of *L. hyalinus* eggs by *Spanogonicus albofasciatus* (Reuter, 1907) (Heteroptera: Miridae) in Arizona (USA). Several parasitoids are known to infest *L. hyalinus* eggs; KIRKALDY (1907a) mentioned its eggs 'attacked by a chalcidoid egg-parasite, as yet unnamed'. PERKINS (1910) described *Telenomus rhopali* Perkins, 1910, and *T. paractias* Perkins, 1910 (Hymenoptera: Scelionidae), both bred from *L. hyalinus* eggs in Hawaii. SZABÓ (1981) described *Telenomus turcicus* Szabó, 1981, using specimens bred from eggs of *L. hyalinus* collected in Turkey (see also ATALAY 1978), and MINEO (2005) added *T. liorhyssi* Mineo, 2005, bred from *L. hyalinus* eggs laid on lettuce in Sicily. RISBEC (1950) also reported *T. pylus* Nixon, 1935, from Senegal and Mauretania, but according to MINEO (2005) this record needs confirmation. According to MINEO (2005), total parasitism by *T. liorhyssi* observed on lettuce never reached more than 10 % at 28°C, and on the natural host, *T. liorhyssi* produced one generation about every 12 days. BUTLER et al. (1982) reported an unidentified tachiniid fly (Diptera: Tachiniidae) parasiting *L. hyalinus* in Arizona (USA).

SIMOV & ANTONOV (2006) found *L. hyalinus* in the food of nestlings of the pallid swift (*Apus pallidus*) in Bulgaria.

Karyotype. 2n = 13 (10 + 2m + X(O)) (MARQUES 1945, PARSHAD 1957, SOUTHWOOD & LESTON 1959).

Conclusions

Compared with most other described Heteroptera species, the biology of *L. hyalinus* is quite well known. *Liorhyssus hyalinus* is a cosmopolitan species distributed in all continents except the coldest parts in the north and south. It has been recorded from almost every European country where its presence might be assumed, but in the tropics

we lack records, or at least exact documentation from many countries. The very statement that *L. hyalinus* is a cosmopolitan species (e.g., Göllner-Scheiding 1976, 1997), made in lieu of at least listing the countries from which the material examined came, hardly improved matters. With reference to possible global warming and the subsequent range expansion of this species, exact distribution records (especially from the margins of its distribution area) should be of particular interest. The recent northward expansion of *L. hyalinus* in western and central Europe appears to correspond with recent above-average warm years, possibly caused by global warming (cf. Musolin & Fujisaki 2006, Musolin 2007). All the bionomical studies of this species took place in southern Europe, Turkey, and the southern USA, where *L. hyalinus* hibernates in the adult stage and has (1)2–6 generations per year. On the other hand, we lack almost completely any biological information from the tropical regions and the southern hemisphere. Knowledge of its habitat preferences is also inadequate; almost all the records from the tropics come from agrobiocenoses. If such a situation holds, it should support the hypothesis of Dupuis (1953) that *L. hyalinus* originated in the Palaearctic region and subsequently spread, or was introduced, into other parts of the world. The study of the genetic structure of the population may prove another important source of information, possibly enabling us to reconstruct the geographical origin and spread of the species.

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Plant family	Number of associated taxa	Number of host taxa
Cycadaceae	1	
Acanthaceae	1	
Aizoaceae	1	
Amaranthaceae	1	
Anacardiaceae	2	
Apiaceae	2	
Asparagaceae	1	
Asteraceae (incl. Cichoriaceae)	34	6
Boraginaceae	1	
Brassicaceae	5	
Cannabaceae	1	1
Capparidaceae	1	
Caryophyllaceae	2	
Cistaceae	1	
Chenopodiaceae	6	1
Cucurbitaceae	1	
Cyperaceae	2	
Euphorbiaceae	8	2
Fabaceae	19	'legumes'
Geraniaceae	4	2
Hypericaceae	2	1
Juglandaceae	1	
Lamiaceae	4	
Linaceae	1	
Malvaceae	17	6
Molluginaceae	1	
Onagraceae	2	
Pedaliaceae	1	
Poaceae	22	1 + 'cereals'
Polygonaceae	1	
Rosaceae (incl. Amygdalaceae and Malaceae)	8	
Rutaceae	1	
Salicaceae	2	
Scrophulariaceae	1	
Solanaceae	9	2
Tamaricaceae	2	
Urticaceae	2	
Zygophyllaceae	1	
Total: 38 families / 9 host families	**172**	**22**

Table 1. A survey of host plant families of *Liorhyssus hyalinus* (Fabricius, 1794).

PLANT SPECIES	AREA	REFERENCE
CYCADOPHYTA		
CYCADACEAE		
Cycas sp.	Italy	Anonymus (2005)
MAGNOLIOPHYTA		
ACANTHACEAE		
Ruellia squarrosa (Fenzl) Cufod.	Bermuda	Henry & Hilburn (1990)
AIZOACEAE		
Mesembryanthemum sp.	Canary Islands	Lindberg (1953)
	Spain	Vázquez-Martinez (1985)
	–	Stichel (1960)
AMARANTHACEAE		
Euxolus viridis (L.) Moq.	Pakistan	Ahmad et al. (1979)
(= *Amaranthus viridis* L.)		Rizvi et al. (2006)
ANACARDIACEAE		
Pistacia sp.	Albania	Josifov (1970)
Pistacia vera L.	Turkey	Atalay (1978)
	USA: California	Michailides et al. (1987)
		Michailides (1989)
		Michailides & Morgan (1994)
APIACEAE	Germany	Günther (2002)
Daucus carota L.	Turkey	Atalay (1978)
Pimpinella anisum L.	Turkey	Atalay (1978)
ASPARAGACEAE		
Asparagus sp.	Cyprus	Georghiou (1977)
ASTERACEAE (incl. Cichoriaceae)	Greece: Santorin	Rieger (1995)
	Iran	Linnavuori (2004)
	–	Schuh & Slater (1995)
	–	Moulet (1995b)
Andryala pinnatifida Aiton	Morocco	Lindberg (1929)
Anthemis sp.	France	Dupuis (1953)
	Spain	Vázquez-Martinez (1985)
Aster sp.	England	Allen (1958)
Artemisia vulgaris L.	Belgium	Baugnée (1998)
Carduus acicularis Bertol.	Turkey	Özsaraç et al. (2001)
Centaurea calcitrapa L.	Spain	Ribes et al. (1997)
Chondrilla sp.	Soviet Union	Putshkov (1962, 1986)
Chondrilla juncea L. var. *acantholepis* (Boiss.) Boiss.	Turkey	Atalay (1978)
Cichorium intybus L.	Turkey	Atalay (1978)
Cirsium sp.	Germany	Günther (2002)
	Romania	Kis (2001)
	Spain	Vázquez-Martinez (1985)
Cirsium arvense (L.) Scop.	Germany	Kluth et al. (2001)
	Turkey	Atalay (1978)
Echinops sp.	Turkey	Atalay (1978)
Conyza canadensis (L.) Cronquist	Belgium	Baugnée (1998)
(= *Erigeron canadensis* L.)	Turkey	Baugnée et al. (2001)
		Atalay (1978)

Table 2. A list of host plants of *Liorhyssus hyalinus* (Fabricius, 1794). Records of egg-laying or larval development appear in bold. Continued.

PLANT SPECIES	AREA	REFERENCE
Galactites tomentosa Moench.	Malta	Schembri (1993)
Helianthus sp.	Egypt	Priesner & Alfieri (1953)
	Spain	Vázquez-Martinez (1985)
	–	Stichel (1960)
Helminthoteca echioides (L.) Holub (= *Picris echioides* L., = *P. echinoides*)	Turkey	Atalay (1978)
Inula crithmoides L.	Malta	de Lucca (1969)
Lactuca sp.	–	Schaefer & Chopra (1982)
***Lactuca sativa* L.**	**Austria**	**Prohaska (1923)**
	France	Moulet (1991)
	Italy	**Tamanini (1961a)**
		Mineo (2004, 2005)
	Nicaragua	**Göllner-Scheiding (1994)**
	Turkey	**Atalay (1978)**
	Ukraine	Kiritshenko (1930)
	USA	Essig (1958)
	USA: Arizona	**McKinney (in Carslon 1959)**
	Venezuela	Cermeli et al. (2004)
	–	Southwood & Leston (1959)
***Lactuca serriola* L.** (=*Lactuca scariola* L.)	Azerbaijan	Gidayatov (1982)
	Brazil	d'Araujo et al. (1968)
	Germany	Schuster (2005)
	Russia	Kerzhner & Jaczewski (1964)
	Soviet Union	**Putshkova (1957)**
	Turkey	**Atalay (1978)**
	Ukraine	Putshkov (1962, 1986)
	USA	Torre Bueno (1941)
	USA: Arizona	**McKinney (in Carslon 1959)**
	USA: Kansas	**Readio (1928)**
Matricaria chamomilla L.	Belgium	Baugnée et al. (2001)
(= *M. recutita* L.,	Germany	Günther (2002)
= *M. chamomilla* L. var. *recutita* (L.) Fiori)	Turkey	Özsaraç et al. (2001)
Ormenis mixta (L.) Dumort.	Morocco	Dupuis (1953)
Parthenium argentatum Gray	Soviet Union	Gidayatov (1982)
		Putshkov (1962, 1986)
***Scariola orientalis* (Boiss.) Soják**	**Tadzhikistan**	**Putshkov (1986)**
Scariola viminea (L.) F.W. Schmidt	Caucasus	Putshkov (1986)
Serratula sp.	Romania	Kis (2001)
	Spain	Vázquez-Martinez (1985)
Solidago sp.	England	Allen (1958)
Solidago canadensis L.	Belgium	Baugnée (1998)
	Czech Republic	this paper
***Sonchus* sp.**	Netherlands	Reclaire (1936)
	Morocco	**Dupuis (1953) (eggs)**
	Spain	Vázquez-Martinez (1985)
	–	Stichel (1960)
		Schaefer & Chopra (1982)
Sonchus arvensis L.	Belgium	Baugnée (2004)
	–	Southwood & Leston (1959)

Table 2. A list of host plants of *Liorhyssus hyalinus* (Fabricius, 1794). Records of egg-laying or larval development appear in bold. Continued.

PLANT SPECIES	AREA	REFERENCE
Sonchus asper (L.) Hill	Belgium	Baugnée (2005)
***Sonchus oleraceus* L.**	Egypt	Priesner & Alfieri (1953)
	Hawaii	**Kirkaldy (1907)**
	Italy	**Mineo (2005) (eggs)**
	Turkey	**Atalay (1978)**
	Venezuela	Cermeli et al. (2004)
Tanacetum sp.	Austria	Adlbauer (1997)
***Tripleurospermum inodora* (L.) Schultz Bip.** (= *Matricaria inodora* L.)	**Belgium**	**Baugnée (2005)**
BORAGINACEAE		
Tournefortia sogdiana (Bunde) M. Pop.	Turkmenistan	Kaplin (1993)
BRASSICACEAE		
Alyssum sp.	Turkey	Atalay (1978)
Cardaria draba (L.) Desv. subsp. *draba* (L.) Desv.	Turkey	Kiyak (1990)
		Özsaraç & Kiyak (2001)
Sinapis arvensis L.	Turkey	Atalay (1978)
Sisymbrium officinale (L.) Scop.	Italy	Tamanini (1961a)
Zilla spinosa (L.) Prantl.	Egypt: Sinai	Gadalla (1999)
CANNABACEAE		
***Cannabis sativa* L.**	**Soviet Union**	Gidayatov (1982)
		Putshkov (1962, 1986)
	Georgia	Kiritshenko (1939)
	Morocco	**Dupuis (1953) (eggs)**
	Turkey	Atalay (1978)
CAPPARIDACEAE		
Capparis spinosa L.	Turkey	Atalay (1978)
CARYOPHYLLACEAE		
Gypsophila struthium L.	Spain	Ribes et al. (1997)
Polycarpaea nivea (Aiten) Webb	Morocco	Lindberg (1929)
CISTACEAE		
Helianthemum squamatum (L.) Pers.	Spain	Ribes et al. (1997)
CHENOPODIACEAE		
Atriplex halimus L.	Spain	Ribes et al. (1997)
Haloxylon sp.	Tunisia	Carapezza (1997)
***Kochia odontoptera* Schrenk**	**Turkmenistan**	**Kaplin (1993)**
Salsola kali L.	Spain	Ribes et al. (1997)
Salsola vermiculata L.	Spain	Ribes et al. (1997)
Suaeda monoica Forssk.	Pakistan	Ahmad et al. (1979)
		Rizvi et al. (2006)
CUCURBITACEAE	Saudi Arabia	Shalaby (1962)
Cucumis sp.	Nicaragua	Maes & Göllner-Schedinig (1993)
CYPERACEAE		
Cladium mariscus (L.) Pohl	Great Britain	Judd & Howe (2004)
Schoenus nigricans L.	Great Britain	Judd & Howe (2004)

Table 2. A list of host plants of *Liorhyssus hyalinus* (Fabricius, 1794). Records of egg-laying or larval development appear in bold. Continued.

PLANT SPECIES	AREA	REFERENCE
EUPHORBIACEAE		
Chamaesyce olowaluana (Sherff) Croiz. & Deg.	Hawaii	Englund et al. (2002)
Euphorbia sp.	Romania	Kis (2001)
	Spain	Vázquez-Martinez (1985)
	USA	Schaefer & Chopra (1982)
***Euphorbia nutans* Lag.**	**USA: Ohio**	**Osborn (1904)**
***Euphorbia cheirolepis* Fisch. et Mey.**	**Turkmenistan**	**Kaplin (1993)**
Euphorbia cordata Meyen	Hawaii	Kirkaldy (1907)
Euphorbia cyparissias L.	Belgium	Baugnée (2005)
(= *Tithymalus cyparissias* (L.) Scop.)		
Euphorbia hirta L.	Bermuda	Henry & Hilburn (1990)
Ricinus communis L.	Nicaragua	Maes & Göllner-Scheiding (1993)
		Göllner-Scheiding (1994)
FABACEAE		
Arachis hypogaea L.	China	Hua (2000)
Cicer arietinum L.	Turkey	Atalay (1978)
Dalbergia sissoo Roxb.	Pakistan	Ahmad et al. (1979)
		Rizvi et al. (2006)
Glycine max (L.) Merr.	Nicaragua	Maes & Göllner-Scheiding (1993)
		Göllner-Scheiding (1994)
	USA: North Carolina	Deitz et al. (1980)
Glycyrrhiza glabra L.	Turkey	Atalay (1978)
legumes	**Iraq**	**Al-Ali (1977)**
	–	Anonymus (1965)
Lens culinarius Med. (= *Lens esculenta* Moench)	Turkey	Atalay (1978)
Lotus salzmanni Boiss.	Morocco	Lindberg (1929)
Medicago lupulina L.	Belgium	Baugnée et al. (2001)
Medicago sativa L.	Albania	Josifov (1970)
	Cyprus	Georghiou (1977)
	Pakistan	Ahmad et al. (1979)
		Rizvi et al. (2006)
	Soviet Union	Gidayatov (1982)
		Popov (1965)
		Putshkov (1962, 1986)
	Spain	Vázquez-Martinez (1985)
	Turkey	Atalay (1978)
	USA	Essig (1958)
	Venezuela	Cermeli et al. (2004)
Onobrychis sativa Lam.	Turkey	Atalay (1978)
Ononis sp.	Romania	Kis (2001, as *Onosis*)
	Spain	Vázquez-Martinez (1985)
Ononis angustissima Lam.	Morocco	Lindberg (1929)
Phlomis sp.	Albania	Josifov (1971)
Pueraria montana (Lour.) Merr.	China	Sun et al. (2006)
var. *lobata* (Willd.) Maesen & Almeida		
Retama monosperma (L.) Boissier	Morocco	Lindberg (1929)
(= *Lygos monosperma* (L.) Heywood)	–	Göllner-Scheiding (1976)

Table 2. A list of host plants of *Liorhyssus hyalinus* (Fabricius, 1794). Records of egg-laying or larval development appear in bold. Continued.

PLANT SPECIES	AREA	REFERENCE
Trifolium sp.	Turkey	Özsaraç & Kiyak (2001)
	USA	Essig (1958)
Trifolium pratense L.	Turkey	Kiyak (1990)
Vicia faba L.	Turkey	Atalay (1978)
Vigna unguiculata (L.) Walp.	Egypt	Amro (2004)
GERANIACEAE		
Erodium sp.	Netherlands	Aukema et al. (2004)
	Romania	Kis (2001)
	Spain	Vázquez-Martinez (1985)
***Erodium cicutarium* (L.) L'Hér.**	**Great Britain**	**Woodroffe (1959)**
		Southwood & Leston (1959)
		Judd & Howe (2004)
	Turkey	Atalay (1978)
***Geranium* sp.**	Georgia	Putshkov (1962, 1986)
	Great Britain	**Woodroffe (1959, in captivity)**
	Turkey	Atalay (1978)
Geranium robertianum L.	Belgium	Baugnée et al. (2001)
HYPERICACEAE		
***Hypericum elegans* Steph.**	**Soviet Union**	**Putshkova (1957)**
Hypericum perforatum L.	Turkey	Atalay (1978), Kiyak (1990)
JUGLANDACEAE		
Juglans regia L.	Turkey	Atalay (1978)
LAMIACEAE		
Origanum sp.	Turkey	Beyaz & Tezcan (2002)
Stachys sp.	Turkey	Atalay (1978)
Thymus serpyllum L.	Serbia	Protić (1992b)
Thymus vulgaris L.	Turkey	Atalay (1978)
LINACEAE		
Linum usitatissimum L.	Tadzhikistan	Putshkov (1962)
	Turkey	Atalay (1978)
MALVACEAE		
Abelmoschus esculentus (L.) Moench (= *Hibiscus esculentus* L.)	Cyprus	Georghiou (1977)
***Abutilon* sp.**	Azerbaijan	Gidayatov (1967, 1982)
	Georgia	Kiritshenko (1939)
	Soviet Union	**Putshkov (1962, 1986)**
	–	Schaefer & Chopra (1982)
***Abutilon avicennae* Gaertn.**	**Morocco**	**Dupuis (1953) (eggs)**
	Uzbekistan	Otten (1956), Mineo (2004, 2005)
***Abutilon theophrasti* Med.**	**Croatia**	**Grubišić et al. (2006)**
	Czech Republic	**this paper**
	USA	Torre Bueno (1941)
	USA: Indiana	Gibb (1991, 2003)
	USA: Kansas	**Readio (1928)**
Alcea rosea L. var. *nigra*	Georgia	Kiritshenko (1939)
Althaea sp.	Soviet Union	Putshkov (1962, 1986)

Table 2. A list of host plants of *Liorhyssus hyalinus* (Fabricius, 1794). Records of egg-laying or larval development appear in bold. Continued.

PLANT SPECIES	AREA	REFERENCE
***Althaea officinalis* L.**	**Soviet Union**	**Putshkov (1962, 1986)**
***Gossypium* sp.**	Azerbaijan	Gidayatov (1967, 1982)
	Brazil	d'Araujo et al. (1968)
	Egypt	Anonymus (1965)
	Georgia	Kiritshenko (1939)
	Iraq	**Al-Ali (1977)**
	Morocco	Dupuis (1953)
	Soviet Union	Popov (1965)
		Putshkov (1962, 1986)
	Spain	Vázquez-Martinez (1985)
Gossypium hirsutum L.	Iran	Couilloud (1971)
Hibiscus sp.	India	Maxwell-Lefroy (1909)
		Schaefer & Chopra (1982)
	Soviet Union	Gidayatov (1982)
		Putshkov (1962, 1986)
Hibiscus cannabinus L.	Soviet Union	Gidayatov (1982)
		Putshkov (1962, 1986)
	Uzbekistan	Otten (1956), Mineo (2004, 2005)
Hibiscus sabdariffa L.	Egypt	Abdel-Moneim &
		Abd El-Wahab (2006)
Lavatera triloba L.	Spain	Ribes et al. (1997)
***Malva sylvestris* L.**	**Turkey**	**Atalay (1978)**
Sida acuta N. L. Burman	Australia	Cassis & Gross (2002)
Sida cordifolia L.	Hawaii	Kirkaldy (1907a)
Sphaeralcea sp.	USA: Arizona	Kingsley (1998)
MOLLUGINACEAE		
Mollugo sp.	China	Hua (2000)
ONAGRACEAE		
Epilobium sp.	France	Moulet (1995a)
	Iran	Linnavuori (2004)
Oenothera biennis L.	Serbia	Protić (1992b)
	USA	Essig (1958)
PEDALIACEAE		
Sesamum indicum L.	Cyprus	Georghiou (1977)
	Turkey	Atalay (1978)
POACEAE	China	Hua (2000)
	Egypt: Sinai	Gadalla (1999)
	India	Distant (1918)
	Iran	Linnavuori (2004)
	Pakistan	Rizvi et al. (2006)
	USA	Blatchley (1926)
Agropyrum repens (L.) Beauv.	Kazakhstan	Asanova (1971)
Aneurolepidium angustum (Trin.) Nevski	Kazakhstan	Asanova (1971)
Arundo donax L.	France	Moulet (1995a)
Avena sp.	Turkey	Atalay (1978)
Avena fatua L.	France	Moulet (1995a)
Avena sativa L.	Turkey	Atalay (1978)
	USA	Essig (1958)

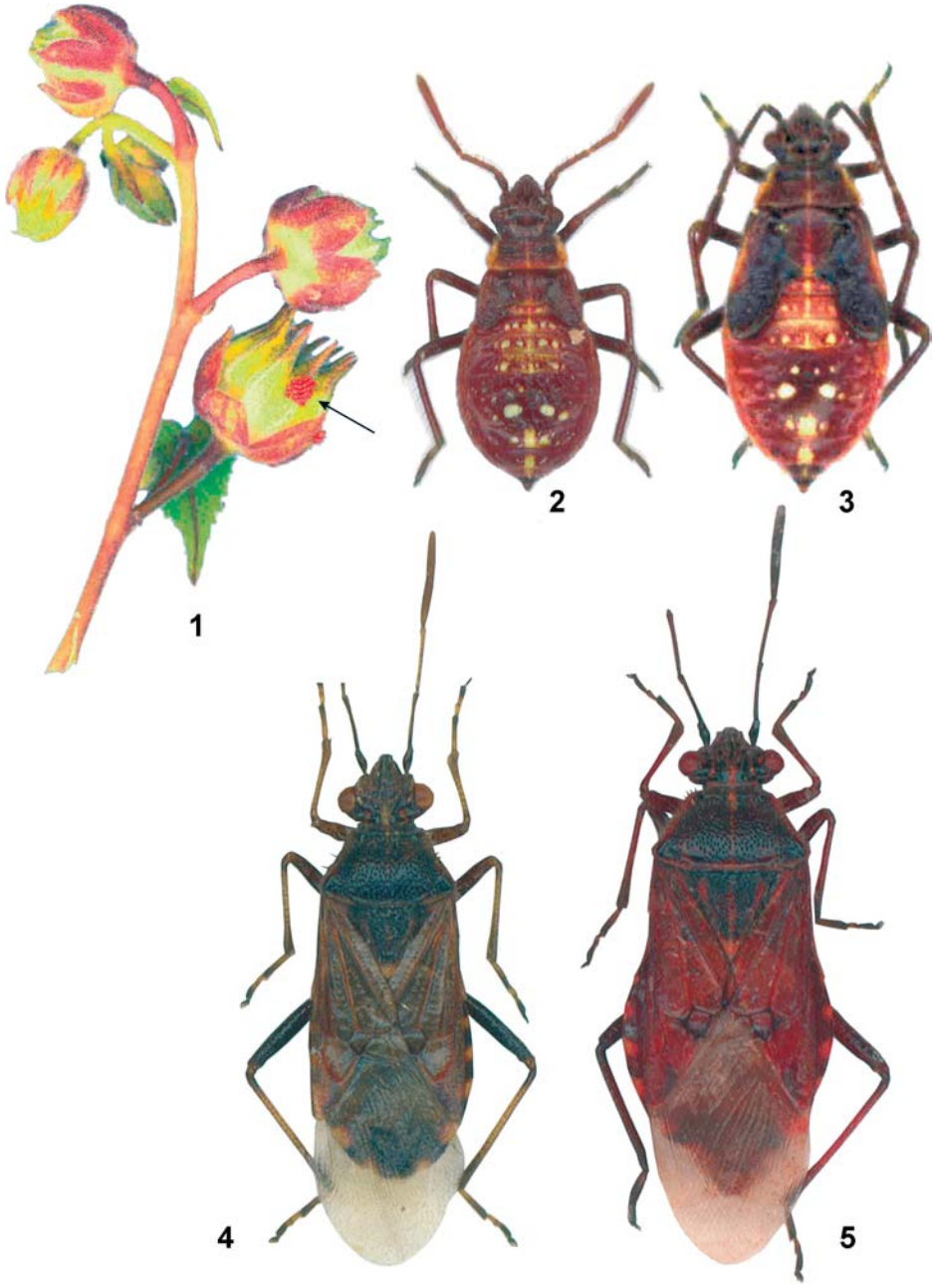
Table 2. A list of host plants of *Liorhyssus hyalinus* (Fabricius, 1794). Records of egg-laying or larval development appear in bold. Continued.

PLANT SPECIES	AREA	REFERENCE
Bromus sp.	France	Moulet (1995a)
Calamagrostis sp.	France	Moulet (1995a)
cereals	**Iraq**	**Al-Ali (1977)**
	–	Anonymus (1965)
Cynodon dactylon (L.) Pers.	Pakistan	Ahmad et al. (1979)
		Rizvi et al. (2006)
Festuca sp.	France	Moulet (1995a)
Koehleria sp.	France	Moulet (1995a)
Oryza sativa L.	Brazil	d'Araujo et al. (1968)
	China	Hua (2000)
	Nicaragua	Maes & Göllner-Scheiding (1993)
		Göllner-Scheiding (1994)
	Turkey	Atalay (1978)
Panicum miliaceum L.	Mauritania	Risbec (1950)
	Senegal	Risbec (1950)
	Turkey	Atalay (1978)
Poa bulbosa L.	Turkey	Kiyak (1990)
Saccharum officinarum L.	Hawaii	Kirkaldy (1907a)
***Sorghum* sp.**	Ukraine	Putshkov (1986)
	USA: Texas	**Hall & Teetes (1981)**
	Uzbekistan	Putshkov (1986)
Sorghum vulgare Pers.	China	Hua (2000)
	Venezuela	Cermeli et al. (2004)
Stipa cf. *pennata* L.	France	Moulet (1995a)
Triticum sp.	Cyprus	Georghiou (1977)
	Turkey	Atalay (1978)
Triticum aestivum L.	Pakistan	Ahmad et al. (1979)
		Rizvi et al. (2006)
Zea sp.	Egypt	Priesner & Alfieri (1953)
	Spain	Vázquez-Martinez (1985)
	–	Stichel (1960)
Zea mays L.	China	Hua (2005)
POLYGONACEAE		
Calligonum arborescens Litvinov	Turkmenistan	Kaplin (1993)
ROSACEAE (incl. Amygdalaceae and Malaceae)		
Amygdalus communis L. (= *Prunus amygdalus* Bartsch)	Turkey	Atalay (1978)
Armeniaca vulgaris Lam. (= *Prunus armeniaca* L.)	Turkey	Atalay (1978)
Fragaria vesca L.	Turkey	Atalay (1978)
Malus sp.	Serbia	Protić (1994a)
Malus pumila Mill.	China	Hua (2000)
Prunus domestica L.	Turkey	Atalay (1978)
Pyrus sp.	Serbia	Protić (1994a)
Rosa sp.	Turkey	Atalay (1978)
RUTACEAE		
Citrus sp.	China	Hua (2000)

Table 2. A list of host plants of *Liorhyssus hyalinus* (Fabricius, 1794). Records of egg-laying or larval development appear in bold. Continued.

PLANT SPECIES	AREA	REFERENCE
SALICACEAE		
Populus sp.	Turkey	Atalay (1978)
Salix sp.	Turkey	Atalay (1978)
SCROPHULARIACEAE		
Verbascum thapsus L.	Netherlands	Aukema & Cuppen (1996)
SOLANACEAE		
Datura stramonium L.	Venezuela	Cermeli et al. (2004)
Hyoscyamus niger L.	Greece	Rieger (1995)
***Lycopersicon esculentum* Mill.**	Cuba	Alayo (1967)
	Italy	**Mineo (2005) (eggs)**
	Porto Rico	Wolcott (1923), Barber (1939)
	Turkey	Atalay (1978)
	USA	Essig (1958)
***Nicotiana* sp.**	Afghanistan	Anonaymus (1965)
	Iraq	**Al-Ali (1977)**
Nicotiana tabacum L.	Turkey	Atalay (1978)
Solanum indicum L.	Cuba	Alayo (1967)
	Porto Rico	Barber (1939)
Solanum melongena L.	Porto Rico	Barber (1939)
Solanum tuberosum L.	Venezuela	Cermeli et al. (2004)
Withania somnifera Dunn.	Pakistan	Ahmad et al. (1979)
		Rizvi et al. (2006)
TAMARICACEAE		
Tamarix sp.	Tunisia	Carapezza (1997)
Tamarix nilotica (Ehrenb.) Bunge	Egypt	Wagner (1963)
URTICACEAE		
Urtica sp.	Switzerland	Hoffmänner (1924)
Urtica dioica L.	Italy	Carapezza et al. (1995)
	Turkey	Atalay (1978)
ZYGOPHYLLACEAE		
Zygophyllum album L.	Tunisia	Carapezza (1997)

Table 2. A list of host plants of *Liorhyssus hyalinus* (Fabricius, 1794). Records of egg-laying or larval development appear in bold.



Figs 1–5. *Liorhyssus hyalinus* (Fabricius, 1794) from Chomutice (Bohemia, Czech Republic). 1 – egg cluster on a flower of *Abutilon theophrasti* Med. (indicated by arrow); 2 – larva of 3rd instar; 3 – larva of 5th instar; 4 – male of typical form; 5 – female of var. *rubricatus* Reuter, 1900.

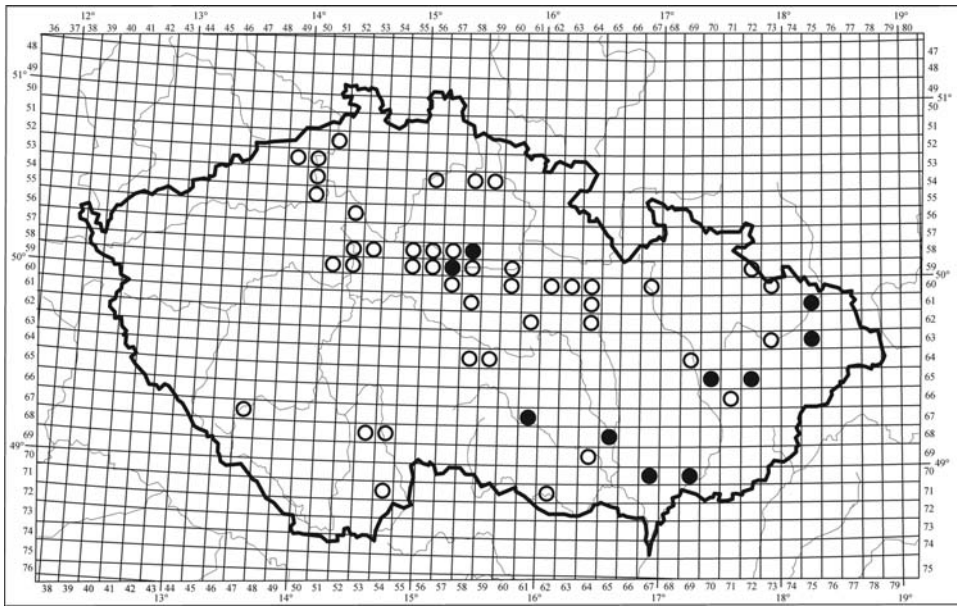


Fig. 6. Distribution of *Liorhyssus hyalinus* (Fabricius, 1794) (full circles) and the host plant *Abutilon theophrasti* Med. (empty circles, after JEHLÍK (1998)) in the Czech Republic.