

New and Interesting Records of Alien and Native True Bugs (Hemiptera: Heteroptera) from Bulgaria

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Abstract: New and interesting records of alien true bugs species (*Corythucha ciliata* (Say, 1832), *Deraeocoris flavilinea* (A. Costa, 1862), *Oxycarenus lavaterae* (Fabricius, 1787), *Leptoglossus occidentalis* Heidemann, 1910, *Perillus bioculatus* (Fabricius, 1775), *Nezara viridula* (Linnaeus, 1758)) in Bulgaria are reported. The spread pace of these species in Bulgaria and some their biological peculiarities, their potential threat to the native fauna and biodiversity in Bulgaria as a whole are briefly discussed. *Deraeocoris flavilinea* (A. Costa, 1862) is newly discovered among Bulgarian fauna. *Oxycarenus* (s. str.) *lavaterae* (Fabricius, 1787) is newly discovered in Greece. New data on the distribution of two native species with expanding range (*Nagusta goedeli* Kolenati, 1857; *Arocatus longiceps* Stål, 1872) are presented.

Key words: alien species, Heteroptera, Bulgaria, Greece, new records

Introduction

During the last 40 years, six alien Heteroptera species were recorded in Bulgaria: *Corythucha ciliata* (Say, 1832), *Stephanitis rhododendri* Horváth, 1905, *Amphiareus obscuriceps* (Poppius, 1909), *Oxycarenus* (s. str.) *lavaterae* (Fabricius, 1787), *Leptoglossus occidentalis* Heidemann, 1910, *Perillus bioculatus* (Fabricius, 1775) (KAJTAZOV 1972, JOSIFOV 1990, PÉRICART, STEHLÍK 1998, KALUSHKOV 2000, SIMOV, PENCHEVA 2007, SIMOV 2008). Five of the species originate outside of Europe (four species are Nearctic and one has its origins in Eastern Palaearctic regions).

The present paper is a continuation of a previous study of alien true bugs in Bulgaria and summaries data on the occurrence of one newly recorded and five established alien species in Bulgarian fauna. It is based on authors' field observations and data provided by other Bulgarian entomologists. The rate at which

these species are spreading and some biological characteristics of Bulgarian samples of these species are presented. The potential threats of these alien bugs to the native fauna and the biodiversity in Bulgaria as a whole are also considered, along with new data on the increasing range of two native species.

Material and Methods

The material was collected by standard entomological sweep net or hand collected after searching hibernating places or host plants. Material collected by flight-interception traps and light traps are also included. The material is deposited in the authors' collections in the National Museum of Natural History, Sofia, in the Faculty of Biology, University of Sofia and in the Institute of Biodiversity and Ecosystem Research - BAS.

Results and Discussion

List of records

Tingidae

Corythucha ciliata (Say, 1832)

Material examined: Bulgaria: Western Stara Planina Mt.: Varshets Vill., 390 m a. s. l., 10. IV. 2005, under bark of *Platanus occidentalis*, 14♂, 25♀, N. Simov lgt.; Skravena Vill., 315 m, 12. X. 2011, many individuals on bark of *Tilia cordata* near infested *Platanus x acerifolia*, N. Simov & M. Langourov obs.; **Prebalkan Mt.:** Dryanovo, 251 m, infested *Platanus x acerifolia*, 20.VII. 2011, S. Grozeva obs.; **Danube Plane:** hibernating individuals under bark of *Platanus x acerifolia*: Nikopol, 65 m, 25. XI. 2005, N. Simov obs.; Svishtov 90 m, 25. XI. 2005, N. Simov obs.; Pleven 109 m, 24. XI. 2005, N. Simov obs.; infested *Platanus x acerifolia*: Ruse, 47 m, 14. VIII. 2011, S. Grozeva obs.; Tutrakan, 87 m, 14.VIII. 2011, S. Grozeva obs.; **Southern Dobrudzha:** infested *Platanus x acerifolia*: Dobrich, 16 m, 13.VIII. 2011, S. Grozeva obs.; Silistra, 28 m, 14.VIII. 2011, S. Grozeva obs.; **Black Sea Coast:** infested *Platanus x acerifolia*: Bulgarevo Vill., 90 m, 20. IX. 2005, N. Simov obs.; Kavarna, 128 m, 08. VI. 2005, N. Simov obs.; Albena, 16 m, 20. IX. 2005, N. Simov obs.; Balchik, 43 m, 08.VI.2005, N. Simov obs.; Varna, 35 m, 07.VI.2005, N. Simov obs.; Staro Oryahovo Vill., 7 m, 07.VI.2005, N. Simov obs.; Shkorpilovtsi, 212 m, 11.VIII. 2011, S. Grozeva obs.; **Sofia:** City center, 550 m, 21.XII.2011, under bark of *P. x acerifolia* 3♂, 5♀, N. Simov lgt.; **Osogovo Mt.:** Kyustendil, 525 m, infested *Platanus x acerifolia*, 20.VIII. 2011, S. Grozeva obs.; **Kresna Gorge**, Kresnensko Hanche, 200 m, 22.VIII.2005, many individuals on *P. orientalis*, N. Simov obs.; **Pirin Mt.:** Sandanski, City park, 257 m, 09.XI.2011, infested *P. orientalis*, N. Simov obs.; **Ali Botush/Slavyanka Mt.:** Petrovo Vill., 430 m, 01.VIII.2007, many individuals on *P. orientalis*, N. Simov obs.; 20.VIII.2008, many individuals on *P. orientalis*, N. Simov obs.; **Belasitsa Mts.:** above Petrich, ~ 500 m, plot N13, WGS 84 N 41.3746920388713, E 023.2065620274705, flight interception trap on *Castanea sativa*, 08.V.-31.V.2010, 1♂, 1♀, N. Simov lgt.; plot N13, WGS 84 N 41.3746920388713, E 023.2065620274705, flight interception trap on *C. sativa*, 08.VIII.-07.X.2010, 2♂, 2♀, N. Simov lgt.; **Stroumeshnitsa River Valley:** near Stroumeshnitsa Vill., ~ 190 m,

18.IV.2004, under bark of *Platanus orientalis*, 2♂, 2♀, N. Simov lgt.; **Mesta River Valley:** many individuals on *P. orientalis*: Garmen Vill., 550 m, 30.VI.2010, M. Langourov obs.; Gotse Delchev, 550 m, 30.VI.2010, M. Langourov obs.; **West Rhodopes Mt.:** Krichim, 31.VII.2005, many individuals on *P. orientalis*, N. Simov obs.; Bachkovo Vill., Bachkovski Monastery, 378 m, 05.VIII.2005, many larvae on *P. orientalis*, N. Simov obs.; Asenovgrad, 240 m, 05.VIII.2005, many larvae on *P. orientalis*, N. Simov obs.; hibernating individuals under bark of *P. orientalis*: Velingrad, 740 m, 27.X.2011, M. Langourov obs.; Peshtera, 430 m, 27.X.2011, M. Langourov obs.; **Maritsa River Valley:** many individuals on *Platanus orientalis*: Stamboliyski Vill., 31.VII.2005, N. Simov obs.; Septemvri, 240 m, 18.VI.1998, N. Simov obs.;

The native range of *C. ciliata* includes USA and Southern Canada, where the species is trophically associated with *Platanus occidentalis* and other sycamores such as *P. wrightii* and *P. racemosa* (COYLE *et al.* 2005, FROESCHNER 1988). It is occasionally observed on other tree species: *Fraxinus*, *Brousoniella*, *Carya*, *Chamaedaphne* (PÉRICART 1983). First record of *C. ciliata* from Europe is from Italy (Padua) in 1964 (SERVADEI 1966). During the last five decades the species spread across almost all of Europe (RABITSCH 2010), where the most preferred areas are those with Sub-Mediterranean and Mediterranean climate.

In Bulgaria the species was reported for the first time in 1987 in the City center of Sofia (JOSIFOV 1990). The following year they were reported in the town of Plovdiv (JOSIFOV 1990). After 1990 the species was found in Russe and Burgas (M. Josifov in litt.), on Septemvri railroad station in 1998, in Stroumeshnitsa River Valley in 2004 (this was the first recording of the species in a natural habitat). During 2005, the species was recorded at many localities along Northern Black Sea Coast, Danube Plain, Western Stara Planina Mts. and Prebalkan. The sycamore lace bug was found in natural habitats in the Western Rhodopes, Kresna Gorge and Maritsa River Valley in 2005, on Southern Pirin Mt. and Alibotush Mt. in 2007 and Belasitsa Mt. in 2010 (see above).

In Bulgaria, the main host for *C. ciliata* in human settlements is *Platanus x acerifolia* (a hybrid between *Platanus occidentalis* and *P. orientalis*). In natural habitats the host is *P. orientalis*. Recently, *C.*

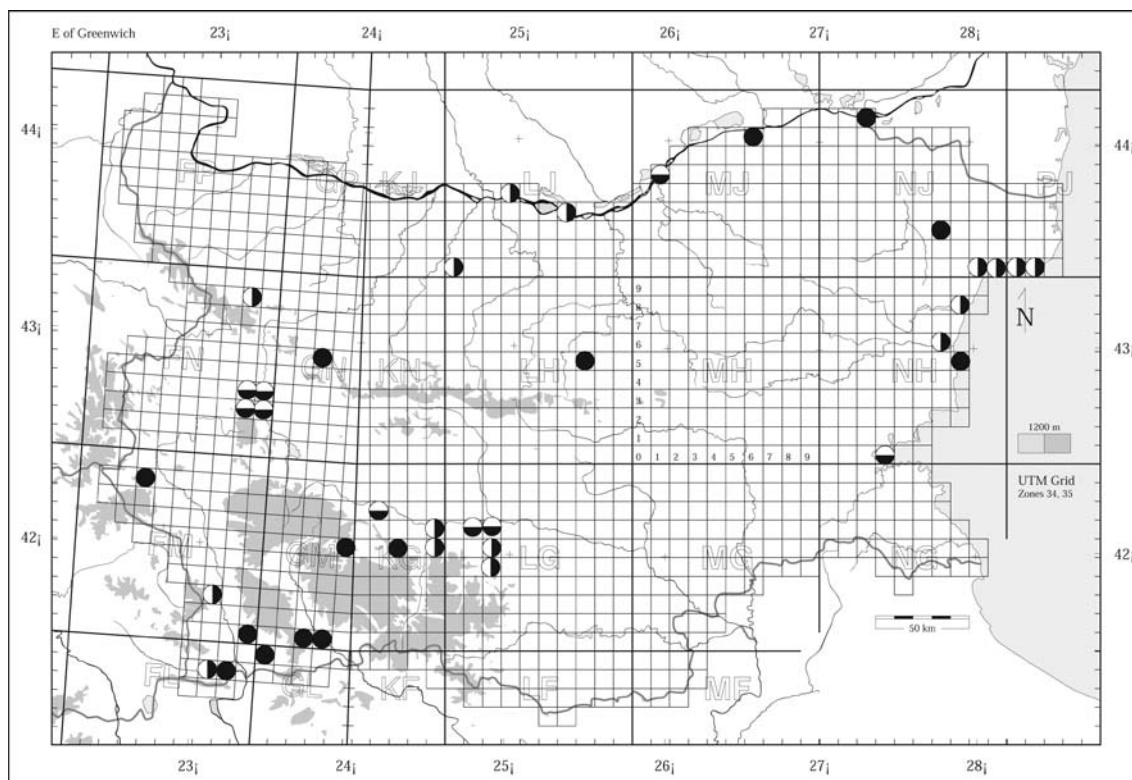


Fig. 1. Distribution of *Corythucha ciliata* (Say, 1832) in Bulgaria. ◐ – 1987-2000; ◑ – 2001-2005; ● – 2006-2011.

ciliata has been found in the whole range of Oriental plane in Bulgaria (Fig. 1).

In Bulgaria the species is bivoltine. The imagoes from the first generation appear in mid-June; those from the second one appear at the end of August and September. At the end of September and beginning of October the insects actively migrate from leaves to thicker branches and stems and hibernate under the bark of planes or neighboring trees. During the spring (April-May), there is a second migration from the hibernating places to the tree crowns.

Passive dispersal by wind-drift, but also human-mediated translocations via clothes, cars, etc., are reported (RABITSCH 2008). In Bulgaria human-mediated dispersal is the most probable. The information on the pace and order of the species distribution in Bulgaria as a whole supports this hypothesis – initially, these insects appear in the towns, and about 10 years later they occupy the natural habitats.

In its native range, this species causes serious damage to the host trees. Similar damage has not yet been reported from species in the introduced ranges. However, in cases of high abundance (up to 200 bugs per leaf), discoloration and reduced photosynthetic activity are obvious (RABITSCH 2008). The observations in the Western Rhodopes show

that in August, about 2/3 of the leaves at the area of Bachkovo Monastery suffer damage due to *C. ciliata* feeding activity. About 15% of the leaves display discoloration, which can be spread over the half of the leaf surface.

The bugs' feeding may weaken the plants vitality and support secondary infections by fungi and pathogens (NEAL, SCHAEFER 2000, RABITSCH 2008). Threats of the mass growth and development of the Sycamore lace bug to the stability the tree populations of Oriental plane in Bulgaria, has not yet been studied. Since the ecological communities of Oriental plane have great conservation value in Bulgaria (KAVRAKOVA *et al.* 2005) we believe the damage we report here will call for a long term study and evaluation of the threat and actual damage already suffered from the spread of this bug.

Miridae

Deraeocoris (Deraeocoris) flavilinea (A. Costa, 1862)

Material examined: Bulgaria: Sofia: small garden in the city center, 560 m a.s.l., N 42° 41'15.19"; E 023° 18' 47.06", 9.VII.2011, 1♀, N. Simov lgt.; 10.VII.2011, 1♀, on *Acer pseudoplatanus*, N. Simov lgt.

Deraeocoris flavilinea was originally described

in Sicily and for just one century the species was recorded only in Italy. In 1961 the species was collected from Corsica (PÉRICART 1965), the first record outside Italian territory. During the last two decades of XX and first decade of XXI century the species was recorded in a large part of Western and Central Europe, including France, the Netherlands, Germany, Switzerland, Luxembourg, Belgium, Malta, United Kingdom, Slovenia, Albania, Spain, Austria, Czech Republic and Sweden (KMENT *et al.* 2005, RABITSCH 2008, 2010). It was expected to reach Bulgaria in a short time.

D. flavilinea is a zoophytophagous dendrobiont species, associated with various shrubs and trees (for detailed information see KMENT *et al.* (2005). Generally it feeds on aphids (BOSELLI 1932, TRIGGIANNI 1973, EHANNO 1989), but there are also reports of feeding on true bugs' eggs and the larvae of psyllids and flies (BOSELLI 1932, KMENT *et al.* 2005). The reported feeding of these bugs on plants like hazel is an exception to its predatory habits (BOSELLI 1932, KMENT *et al.* 2005).

On 9. VII. 2011, *Deraeocoris flavilinea* was found in Bulgaria for the first time (Fig. 2 and Fig. 3).

This is the most southeastern record for the species in Europe.

Oxycarenidae

Oxycarenus (s. str.) *lavaterae* (Fabricius, 1787)

Material examined: Bulgaria: Western Stara Planina Mt.: Montana, 150 m a.s.l., large aggregations on *Tilia* sp., 20. X. 2011, A. Ignatov obs.; **Rila Mt.:** Sapareva Banya, 750 m, large aggregations on *T. cordata*, 07.I.2012, N. Simov lgt.; **Pirin Mt.:** Blagoevgrad, Neofit Rilski South-West University, 370 m, large aggregations on *T. cordata*, 14.XII.2011, N. Simov obs.; Katuntsi Vill., 169 m, small garden in the center, on *Tilia cordata* and *T. tomentosa*, 08.VI.2007, 1♂, 5♀, N. Simov lgt.; 19.VI.2009, 10♂, 5♀, N. Simov lgt.; **Greece:** Strouma River Valley, 35 m, Syar Prefecture, Kerkini Village, large aggregations on *Tilia* sp., 19.I.2009, A. Ignatov obs.

Oxycarenus lavaterae is a west-mediterranean species trophically associated with members of plant family Malvaceae *sensu lato* – generally with *Tilia* sp., and also with *Lavatera olbia*, *Malva sylvestris*, *Malva* sp., *Althea rosea* (PÉRICART 1999, KMENT *et al.* 2006). During the last two decades of XX and first decade of XXI century, the species rapidly spread to Northern and Eastern Europe, in-

cluding to Montenegro, Hungary, Slovakia, Serbia, Northern France, Austria, Northern Switzerland, Southern Germany, Czech Republic, Slovenia and Romania (KMENT *et al.* 2006, KMENT 2009, RABITSCH 2008, 2010).

In Bulgaria, for the first the time the species was recorded at Sofia Airport in 1998 (KALUSHKOV 2000). During 2000, the species spread to Sofia City center and other regions of the town. Later, in 2001, the species was found near the town of Pleven (Dolni Dabnik Vill.). Then it was recorded near the town of Veliko Turnovo (2003), Russe (2005), Kyustendil, Kresna and Burgas (2006); in Varna, Radomir, Gotse Delchev and Petrich (2007) (KALUSHKOV *et al.* 2007a, b, KMENT 2009, KALUSHKOV, NEDVĚD 2010); in Katuntsi Village (2007), and most recently in Montana and Blagoevgrad (2011, see above). On 19 January 2009, *O. lavaterae* was also found in Greece for the first time. It was expected, because of the proximity of these localities close to Bulgarian-Greek border (Fig. 4) and because of the fact that main road from Bulgaria to Greece crosses these towns and villages. For the moment, the territory of Bulgaria encompasses the eastern border of the range of *O. lavaterae*.

Up to now, in Bulgaria *O. lavaterae* was found in association only with *Tilia* sp. trees, generally with *T. cordata* (KALUSHKOV *et al.*, 2007a, b as *Tilia parvifolia*), with the exception of two recordings of small aggregations on *T. tomentosa* (KALUSHKOV *et al.* 2007a, as *Tilia argentea*) and *T. rubra* (KALUSHKOV *et al.* 2007a). The species avoids other native or introduced linden species like *T. platyphyllos* and *Tilia tuan*, apparently due to their thick seed shells (KALUSHKOV, NEDVĚD 2010). Our field observations show that the insects generally feed on the reproductive organs of linden trees and it is easy to see many individuals sucking on flowers and young as well as mature seeds.

In an outdoor experimental cage, in 1999 the bug developed in 3 overlapping generations but during the period 2004-2006 development occurred in only one generation (June to middle of August). In August, adults stopped to copulate and laid eggs (KALUSHKOV *et al.* 2007a, b). The specimens started to gather for overwintering on tree trunks in middle of September. The individuals started to disperse from winter aggregations in May, which coincided with the beginning of flowering of lindens.

Up to now, there is no evidence that the species

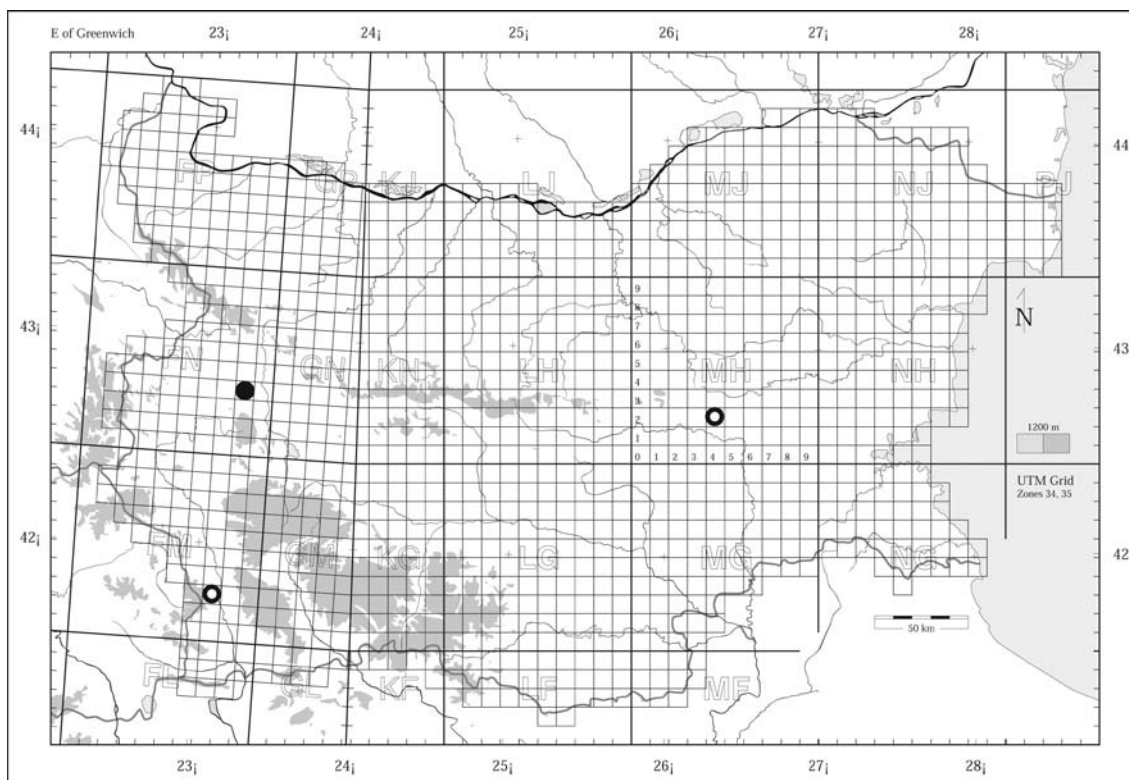


Fig. 2. Distribution of *Deraeocoris (Deraeocoris) flavilinea* (A. Costa, 1862) – ● and *Perillus bioculatus* (Fabricius, 1775) – ○ in Bulgaria.

causes tree damage in Bulgaria. We also did not observe any damage on infested linden trees. We might assume that feeding generally on reproductive organs can cause reduction of seed fertility, which may have consequences not only for forestry management but to native stands as well. The fact that bugs occupied different trees every year (KALUSHKOV *et al.* 2007a) may account for the lack of observed tree damage.

Passive dispersal by human-mediated translocations via clothes, cars, etc., is the most probable cause of the spread of this species in Bulgaria. This is supported by our observations of specimens on different types of vehicles far from earlier species aggregations and the lack of recordings of association of the bugs with more natural habitats (even though appropriate lime woods exist in Bulgaria (KAVRAKOVA *et al.* 2005) and some of them have been investigated).

Coreidae

Leptoglossus occidentalis Heidemann, 1910

Material examined: Bulgaria: Western Stara Planina Mt.: 440 m a.s.l., Bozhenishki Urwich Fortress near Bozhenitsa Vill., 12.X.2011, 1♂2♀, N. Simov lgt.; Vrachanski Balkan Nature Park, near Ledenika Cave, 856 m, 17.X.2011, 1♂, S. Beshkov

lgt.; Barzia Vill., University of Forestry - Training and Experimental Forest Range, 535 m, 01.XI.2011, 4♂♀, H. Didov lgt.; **Prebalkan Mt.:** Devetashko Plateau 483 m, Kukrina Vill., 31.X.2011, 1♂, M. Langourov obs.; Oreshak Vill., 475 m, 05.XII.2011, 2♂1♀, S. Beshkov lgt.; **Black Sea Coast:** Durankulak Vill., 20 m, 09.X.2009, 1♂, light trap, S. Beshkov lgt.; **Southern Dobrogea:** Bezhanovo Vill., 80 m, 16.xi.2011, 1♂, S. Beshkov lgt.; **Lyulin Mt.:** 980 m, hut Bonsovi polyani, 20.X.2011, 1♀, N. Simov lgt.; **Vitosha Mt.:** hut Planinets, 1365 m, 14.x.2011, 1♂1♀, N. Simov lgt.; above Simeonovo, in a building, 04. XII. 2011, T. Lyubomirov lgt.; **Sofia:** 540-



Fig. 3. Female specimen of *Deraeocoris (Deraeocoris) flavilinea* (A. Costa, 1862) from Sofia.

635 m: Faculty of Biology of University of Sofia, October 2009, in building, 1♂, 2♀, D. Gradinarov lgt.; Borisova Gradina City Park, on buildings near *Pinus sylvestris* trees, 10.X.2009, 5♀, N. Simov lgt.; 15.X.2009, in debris near *P. sylvestris* trees, 5♂, 10♀, D. Gradinarov lgt.; 15.X.2011, near *Pinus sylvestris* trees, 2♀♀, D. Gradinarov lgt.; Lyulin Quarter-2, near building, on snow, 03.III.2010, 1♂, D. Gradinarov lgt.; Forest Research Institute – BAS, 09.II.2011, in building, 2♂, G. Georgiev lgt.; Lyulin Quarter, in a building, October 2011, 1♂, D. Gradinarov lgt.; October 2011, 1♀, Y. Petrova lgt.; Lozenets Quarter, 25.X.2011, in building, 13♂♀, V. Haralampieva lgt.; Nadezhda Quarter, 31.X.2011, in building, 1♂, A. Ignatov lgt.; **Osogovo Mt.:** Hyssarluka Hill, 703 m, building in *P. nigra* forest, 09.X.2011, 12♂19♀, N. Simov lgt.; *P. sylvestris* forest stand near Gyueshevo Vill., 950 m, 04.X.2011, 1♂; D. Doichev lgt.; **Zemen Gorge:** near Zemen, 580 m, near the first rail tunnel, 30.IV.2011, 1♀, D. Gradinarov lgt.; **Cherna Gora Mt.:** Giginski Monastery, 975 m, 01.XI.2011, 1♀, N. Simov obs.; **Pirin Mt.:** Sandanski, 257 m, city park, 09.XI.2011, 2♂1♀, N. Simov lgt.; **Thracian Lowland:** E from Stara Zagora, 500 m, under the bark of dead *Pinus*

nigra, 12.III.2011, 1♀, K. Petrova lgt.; **Derventski Hights:** Malko Kirilovo Vill., 269 m, 08.X.2011, 1♀, T. Stefanov lgt..

Leptoglossus occidentalis is an invasive alien species of North American origin. The species was first recorded in Europe in 1999 in Vicenza, Italy (BERNARDINELLI, ZANDIGIACOMO 2001). In a decade it spread throughout almost all of Europe (RABITSCH 2008, 2010, KMENT, BAÑAR 2008, FENT, KMENT 2011, WERNER 2011, WINKELMANN, BAHR 2011). The western conifer seed bug feeds on the young seeds and strobiles of various conifers from Pinacea and Cupressaceae families (WERNER 2011), causing reduction of seed fertility (CONNELY, SCHOWALTER 1991). It is classified as a pest in its native range (MITCHELL 2000) and in Italy (TIBERI 2007).

In Bulgaria, the species was recorded for first time in the Sofia City center on the wall of the National Radio building in autumn of 2008 (SIMOV 2008). During the next year the species spread to the whole of Sofia City center and Borisova Gradina City Park. Later, the species was found on Black Sea Coast (Durankulak). Three years after the first record, the species had spread over almost all over the country (Fig. 5). Austrian and Scots pine are the most

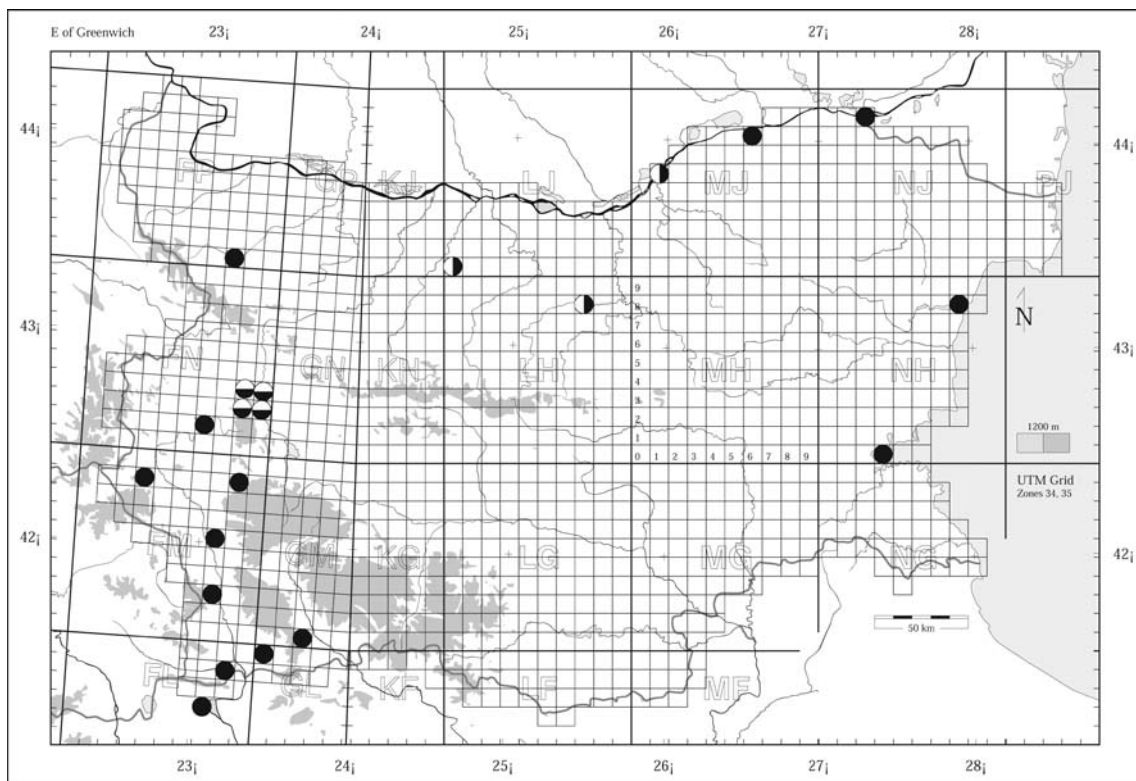


Fig. 4. Distribution of *Oxycarenus* (s.str.) *lavaterae* (Fabricius, 1787) in Bulgaria.

● – 1998-2000; ◐ – 2001-2005; ● – 2006-2011.

cultivated trees in the intensive forestry in Bulgaria. This fact and strong flight abilities of western conifer seed bugs could be the main reasons for its very rapid spread in Bulgaria. On other hand, some of the coniferous trees are endemics or relicts with restricted range (*Abies borisii-regis*, *Pinus peuce*, *Pinus heldreichii*, *Juniperus excelsa*). Although the economic impact of *L. occidentalis* as an alien species is as yet poorly understood in Europe, and though there is no data available for Bulgaria, the future stable establishment and mass development of *L. occidentalis* in Bulgaria will most likely be a problem for protected areas and forestry seed zones. The future monitoring of this invasive alien species and an investigation of the competition with other native seed-feeding true bugs in Bulgaria are needed.

Pentatomidae

Perillus bioculatus (Fabricius, 1775)

Material examined: Bulgaria: East Stara Planina Mt.: Sinite Kamani Nature Park, above town of Sliven, meadows in Grebenets area, 500-700 m a.s.l., 27.ix.2002, 1♂, B. Petrov lgt.; **Maleshevska Planina Mt.:** Gorna Breznitsa Vill., 300 m, 27.II.2003, under bark of *Platanus orientalis*, 1♂, T. Lyubomirov lgt.;

Perillus bioculatus is native to North America, where it is distributed from Mexico to Canada (FROESCHNER 1988, RABITSCH 2008, 2010). The species is trophically associated with Colorado potato beetle, *Leptinotarsa decemlineata* Say, 1824 and it is believed that its range expanded from Rocky Mountains with the expansion of the range of its primary prey (RABITSCH 2008).

Since 1960, *P. bioculatus* has been repeatedly introduced and used against Colorado potato beetles in several European countries (LE BERRE, PORTIER 1963, DE CLERCQ 2000, RABITSCH 2010). However, only in Greece and European Turkey has successful establishment in the field been observed (KIVAN 2004, FENT, AKTAÇ 2007, RABITSCH 2008, 2010).

First attempts for introduction and acclimatization of *P. bioculatus* into Bulgaria took place during the period 1962-1966. Despite some subsequent records of individuals in the region of introduction in 1967 and 1968 (KAJTAZOV 1972), acclimatization of the two spotted stink bug was unsuccessful (SIMOVA, TOMOV 2010). For a period of 34 years after 1968, no records in the field are available in Bulgaria (Fig. 2). In 2002-2003, we recorded the first observations of the species in natural habitats in Bulgaria, but the

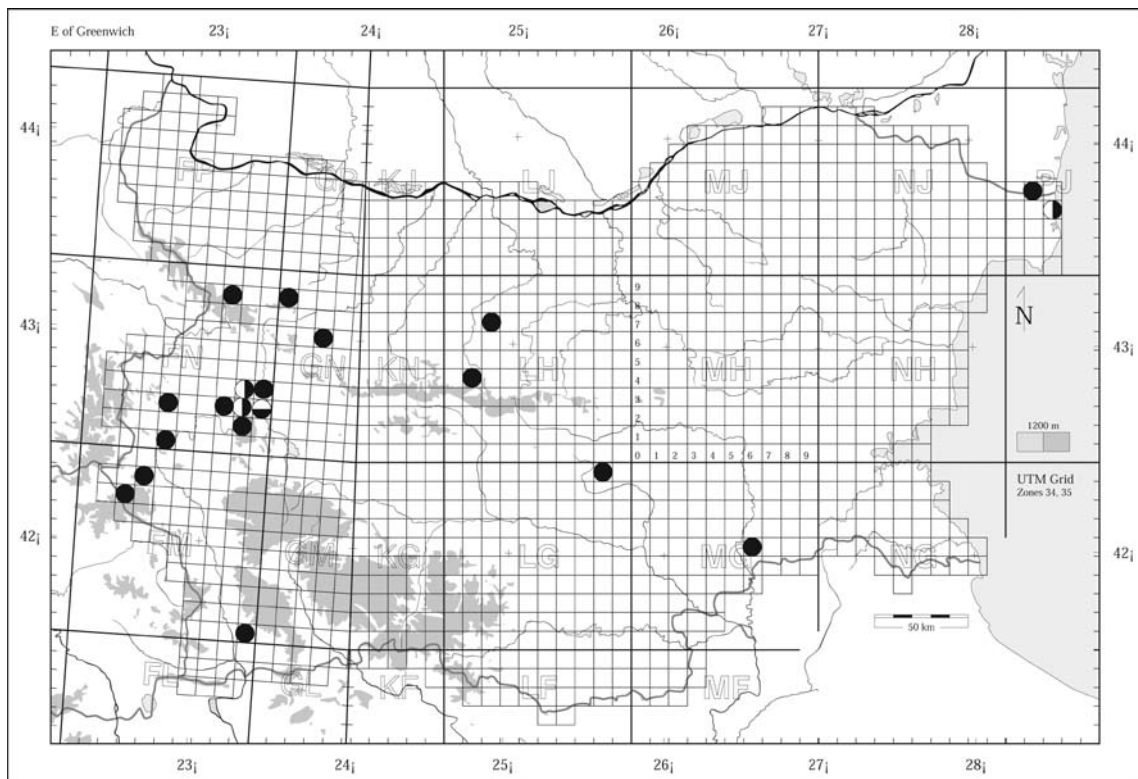


Fig. 5. Distribution of *Leptoglossus occidentalis* Heidemann, 1910 in Bulgaria.

◐ – 2008; ◑ – 2009; ● – 2010-2011.



Fig. 6. Nymph of *Nezara viridula* (Linnaeus, 1758) on *Humulus* sp. from Varna.

species was not recorded again in the same regions. It is possible that the species is very rare or these specimens are migrants from southern territories of Balkan Peninsula and they do not survive during the winters in Bulgaria. Presence of appropriate wind currents for insect drift (SIMOV 2011), large potatoes' fields in Southern Bulgaria and the last years' tendency for milder winters predict a stable establishment of the species among Bulgarian fauna in the near future.

***Nezara viridula* (Linnaeus, 1758)**

Material examined: Bulgaria: Black Sea Coast, Primorsko Vill., garden in the center, 10 m a.s.l., 12.ix.2001, 30 ♂♀, N. Simov obs.; Varna, Marine Garden of 'Sts Constantine and Elena' Resort, 7 m, 03.IX.2011, many nymphs from different stages on *Humulus* sp., D. Gradinarov obs. (Fig. 6); **Sofia:** City center, 550 m, 21.x.2011, 1♂, N. Simov lgt.; 14.XI.2011, 1♀, E. Simova lgt.

Nezara viridula is a cosmopolitan to tropical and subtropical regions. Originally it is a Mediterranean or Ethiopian species, being introduced to all continents by transport of goods (TODD 1989, RABITSCH 2008). In the last half of XX and the last decade of XXI century, the southern green stink bug has been recorded in West and Central European countries including Hungary, United Kingdom; Germany, Switzerland, Austria, Belgium, Finland and Ukraine (RABITSCH 2008, 2010).

In Bulgaria, the species was recorded in regions with Mediterranean climatic influence like Sandanski-Petrich Kettle, Kresna Gorge and the

Eastern Rhodopes (STRAWINSKI 1959, JOSIFOV 1963, 1999, JOSIFOV, SIMOV 2004). In the last decades, the southern green stink bug rapidly spread to the North and was recorded in Sofia and Black Sea Coast.

It is a polyphytophagous species, feeding on many different host plants, and it may become a pest on several cultivated plants (e.g. soybean, nuts) (RABITSCH 2008, 2010). There is already preliminary evidence from Sandanski-Petrich Kettle that the species may be a pest in Bulgaria. In 2007-2008, we recorded damage (chlorosis) on tomatoes fruits in Gorno Spanchevo Vill., due to many piercings by larvae and adults of the southern green stink bug.

Native species in expansion

***Nagusta goedeli* (Kolenati, 1857)**

Material examined: Bulgaria: Prebalkan Mt.: Devetashko Plateau 483 m a.s.l., Kukrina Vill., 29.III.2011, 1♂, N. Simov lgt.; **Sofia:** City center, 21.IX.2009, 1♂, A. Stojanov lgt.; 15-17.X.2010, 4♂, 5♀, N. Simov lgt.;

Nagusta goedeli is a ponto-mediterranean zoophytophagous dendrobiont species, associated with various shrubs and trees (JOSIFOV 1964b, 1978, PUTSHKOV, MOULET 2010).

In Bulgaria, until the first decade of XXI century the species was recorded only in *Quercus* forests in Southern Bulgaria – zone BG1 after JOSIFOV (1986) (JOAKIMOV 1909, 1922, JOSIFOV 1954, 1964a, 1964b, 1974, 1986, 1999, JOSIFOV, SIMOV 2004). Recently, the species spread to the north of the country and was found in Sofia and in Northern Bulgaria. We can assume that recent records from localities more northern than the previously known range of the species (e.g. Prague; KMENT, DOLEŠOVÁ 2010), are not accidental. High mortality during overwintering is a possible reason for this species scarcity in northern areas (PUTSHKOV 1987). In the context of the last years' tendency for milder winters, the successful overwintering might be more frequent.

***Arocatus longiceps* Stål, 1872**

Material examined: Bulgaria: Western Stara Planina Mt.: Varshets Vill., 390 m a.s.l., 10.IV.2005, under bark of *Platanus occidentalis*, 1♂, N. Simov lgt.; **Sofia:** City center, 550 m, 18.X.2009, under bark of *P. occidentalis* 7♂10♀, N. Simov lgt.; 30.XII.2009, under bark of *P. occidentalis* 2♂5♀, N. Simov lgt.; 15-17.X.2010, under bark of *P. occidentalis* and *Platanus x acerifolia* 6♂, 5♀, N. Simov lgt.; 21.XII.2011, under bark of *P. x acerifolia* 4♂, 2♀, N. Simov lgt.

Arocatus longiceps is a ponto-mediterranean species, associated with *Platanus* trees (PÉRICART 1998, 2001). In Bulgaria it is native on *Platanus orientalis* in southern parts of the country. It only recently spread to the north, where it lives on cultivated *P. occidentalis* and *Platanus x acerifolia*. This species is very easy to observe, because it hibernates under the bark of *Platanus* trees and can easily be found during the winter and early spring.

Up to now, seven alien true bugs are recorded in Bulgaria. As in other European countries (RABITSCH 2008, 2010), the main pathways of introduction and dispersal of alien true bugs in Bulgaria are human activities: ornamental trade and movement as 'stowaways' in transport vehicles (3 species) and intentional introduction as biocontrol agent (1 species), followed by unintentional introduction through natural dispersal across political borders (3 species).

Until the second half of XX century, Bulgarian Heteroptera fauna was insufficiently known. Thus, the earlier presence or the time of introduction of some species in Bulgaria remains unclear. The following example illustrates this point. *N. viridula* was originally a Mediterranean or Ethiopian species (RABITSCH 2008, 2010). More than half of Bulgarian true bug fauna is also of Mediterranean origin (JOSIFOV 1986, 1999, JOSIFOV, SIMOV 2006). But the first record for the species in Bulgaria was just in 1959, when the investigations of Mediterranean habitats in Strouma River Valley started (STRAWINSKI 1959, JOSIFOV 1963).

In Bulgarian natural habitats, the establishment of alien Heteroptera by natural dispersal mechanisms is faster than the establishment of species by passive dispersal due to human-mediated transloca-

tions. The cases of *C. ciliata* and *L. occidentalis* illustrate this point. *C. ciliata* specimens first appear in the towns, and about 10 years later the species has occupied the natural habitats. Most probably the establishment of stable populations in towns as well as next to and across transport arteries is critical for the onset of dispersal along these roadways as vehicle 'stowaways'. *C. ciliata* was recorded for the first time in natural habitat near parking places in Kresna Gorge and South Pirin Mts. In contrast, *L. occidentalis* spread practically to the whole Bulgarian territory only 3 years after the first record in the country. The presence of some of its host plants (Austrian and Scots pine are the most cultivated trees in the intensive forestry in Bulgaria) and good flight abilities of western conifer seed bugs probably are the reasons of its very rapid spreading.

Compared with other European countries the number of alien species of true bugs in Bulgaria is still low. In the context of the last year's tendency for milder winters and new records of invasive alien true bugs in the adjacent territories we might expect an increase in the number and spread of alien Heteroptera species in Bulgaria. In the near future, *Corythucha arcuata* (Say, 1832), *Stephanitis pyrioides* (Scott, 1874), *Nesidiocoris tenuis* (Reuter, 1895), *Empicoris rubromaculatus* (Blackburn, 1889) and *Belonochilus numenius* (Say, 1832) are expected to be candidates for inclusion in the list of Bulgarian true bugs.

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