

Short communication

NEW DATA ON *PERILLUS BIOCULATUS* (HETEROPTERA: PENTATOMIDAE) IN SERBIA: DO CLIMATE CHANGE AND A NEW FOOD SOURCE CONTRIBUTE TO THE TRUE BUG EXPANSION?

BOJANA NADAŽDIN^{1*} and JELENA ŠEAT^{1,2}

¹HabiProt, Cankareva 9/13, 21000, Novi Sad, Serbia

²Department of Ecology, University of Szeged, Közép Fásor 52, 6726 Szeged, Hungary

*Email: bojananadazdin91@gmail.com (corresponding author)

Perillus bioculatus (Fabricius, 1775) is a true bug from North America, originating in the southern Rocky Mountains (De Clercq, 2000), and it is an alien species in Europe (Rabitsch, 2008). The species is predaceous and the most-known prey in its native range is the Colorado potato beetle, *Leptinotarsa decemlineata* (Say, 1824) (Coleoptera: Chrysomelidae). The interaction between these two species was the reasoning behind the introduction of *P. bioculatus* in Europe at the beginning of the 20th century as a biocontrol agent of the Colorado potato beetle (Rabitsch, 2008).

Thomas (1994) mentioned the following countries as the former distribution of *P. bioculatus* in Europe: Czechoslovakia, Germany, Russia and Yugoslavia, without giving specific information on localities. Later, the presence of the true bug was reported in the following countries as well: European Turkey and Anatolia, Greece, Bulgaria, Serbia, Moldova, Ukraine and Romania (Kivan, 2004, Fent & Aktaç 2007, Dursun & Fent, 2018; Péricart, 2010; Simov *et al.*, 2012; Protić & Živić, 2012; Derjanschi & Elisovețcaia, 2014; Levchenko & Martynov, 2018; Rădac & Teodorescu, 2021). *P. bioculatus* in Serbia was mentioned for the first time in 1963 when the species was introduced for a series of laboratory experiments. The goal was to test the potential of commercial application of *P. bioculatus* in biocontrol of the Colorado potato beetle out of its homeland. The species successfully reproduced in the laboratory and outdoor environment, respectively; however, the released populations did not survived (Bjegović, 1971 in Protić & Živić, 2012). The discovery of the presence of *P. bioculatus* in the Serbian wilderness was published in 2012, but the finding actually dates back to 1996 from the surrounding of Đeravica Lake in the Prokletije Mountains (Protić & Živić, 2012). After the aforementioned record, there were no new data on the presence of the species in Serbia until 2018, when *P. bioculatus* was found in the vicinity of Svrlijig (Nadždin & Šeat, 2019). The specimen was photographed in the area of a textile factory, and the photo was posted on the Facebook group "Insects of Serbia" by Slobodan Stevčić, the author of the photo. We presented this interesting finding in 2019 at the XII Symposium of

Serbian Entomologists in Niš. Back then, we stated that this was an isolated record with only one adult specimen observed but that we assumed the species would probably spread throughout the country in the coming years, which was subsequently confirmed by new data from 2021 and 2022.

P. bioculatus was reported from several locations in 2021 and 2022: Pčinja Valley, Belgrade – Banjica, Batajnica, Vrčin and Adaševci (Fig. 1), and these data are new for Serbia (Table I). In the Pčinja Valley, one adult was found in a residential building of the Prohor Pčinjski Monastery, but more detailed information about the habitat and circumstances of the finding is lacking. All sites in Banjica, where the species was found, are ruderal habitats located next to roads. In Batajnica, the species was found in two locations; in one of them, nymphs and one adult were found on potato plants in a private garden. At the time of discovery, larvae and adults of *L. decemlineata* were also present in the garden's potato plot (pers. comm. Slađana Gajić). At the second site in Batajnica, *P. bioculatus* was found in an agricultural area on common ragweed, *Ambrosia artemisiifolia* L. (Asteraceae), surrounded by fields of corn, sunflowers and grain crops (pers. comm. Časlav Petrović). At this locality and all sites in Banjica (Fig. 2), Vrčin and Adaševci, *P. bioculatus* was found on common ragweed together with another non-native beetle, *Ophraella communa* LeSage, 1986 (Coleoptera: Chrysomelidae).

Table I. The newest records of *P. bioculatus* in Serbia.

Locality	Latitude	Longitude	Date	Collector	Developmental stage
Svrljig (A) **	43.422654	22.109098	01.10.2018	Slobodan Stevčić	adult
Pčinja Valley*	42.329395	21.895806	17.04.2021	Milan Đurić, Ivan Tot, Mihailo Vujić, Vidak Lakušić	adult
Banjica – Beograd (B) **	44.756167	20.49197	26.07.2022	Denis Čoso	adult
Banjica – Beograd (B) **	44.755915	20.492032	02.08.2022	Denis Čoso	nymph
Banjica – Beograd (B) **	44.755919	20.492314	09.08.2022	Denis Čoso	adult
Batajnica (A) *	44.906223	20.274700	12.08.2022	Slađana Gajić	adult
Batajnica (A) *	44.906223	20.274700	14.08.2022	Slađana Gajić	nymph
Banjica – Beograd (B) **	44.758087	20.494538	14.08.2022	Denis Čoso	adult
Banjica – Beograd (B) **	44.758232	20.494286	15.08.2022	Denis Čoso	nymph
Batajnica *	44.922849	20.308219	20.08.2022	Časlav Petrović	adult
Banjica – Beograd (B) **	44.758242	20.494136	20.08.2022	Denis Čoso	adult
Banjica – Beograd (B) **	44.76045	20.492179	21.08.2022	Denis Čoso	nymph
Banjica – Beograd (B) **	44.76107	20.483593	25.08.2022	Denis Čoso	adult
Banjica – Beograd (B) **	44.761068	20.483623	25.08.2022	Srđan Stanojević	adult
Banjica – Beograd *	44.755789	20.492094	28.08.2022	Mihailo Vujić	adult and nymph
Vrčin*	44.677017	20.608119	12.09.2022	Mihailo Vujić	adult and nymph
Adaševci**	45.040339	19.213997	29.09.2022	Jovana Damjanović	adult

Source: A – Alciphron database (Šeat & Nadaždin, 2014-2022); B – Biologer database (Šeat, 2018); * – true bug collected and photographed (specimens deposited in the private collection of the first author); ** – specimen identified only by photo.



Figure 1. *Perillus bioculatus* distribution in Serbia (orange dot – literature data, source Protić & Živić, 2012; green dots – new data from 2018, 2021, and 2022).



Figure 2. Locality in Banjica where *P. bioculatus* was found. Photo by M. Vujić.

The North American Galerucinae beetle *O. communis* is a leaf-feeding beetle, primarily associated with *A. artemisiifolia* as its host but there are more studies with new potential hosts from the genera *Xanthium*, *Parthenium*, *Helianthus* and *Iva* (Palmer & Goeden, 1991). This beetle was recorded in Serbia for the first time in 2020 at only one locality: Belgrade – Zemun (Petrović-Obradović *et al.*, 2020). In the Alciphron database (HabiProt, 2014-2022), there are new records and locations for this beetle: Vrčin (44.67675 20.607877, leg. Mihailo Vujić), Bujanj Potok (44.722302 20.546225, leg. Mihailo Vujić), Banjica (44.755789 20.492094 leg. Mihailo Vujić), Stara Pazova (44.99217 20.166236, leg. Boženka Hric) and Batajnica (44.922849 20.308219, leg. Časlav Petrović). Additionally, there are data for Belgrade in 2021 and 2022 from the Biologer database (Popović *et al.*, 2020). Many of them came from areas where *P. bioculatus* was also detected (pers. comm. Denis Čoso). In several close-by sites in Banjica, it was noticed that adults and nymphs of *P. bioculatus* feed on the larvae and adults of *O. communis* (pers. comm. Denis Čoso and Mihailo Vujić). In the same area, *O. communis* was feeding on *Iva xanthifolia* Nutt. (Asteraceae) as well, but there were no *P. bioculatus* individuals on the plant (pers. comm. Mihailo Vujić). At the second locality in Batajnica, the observed adults were in copula; at the same time, a specimen of *O. communis* was found pierced by the rostrum of the true bug (Fig. 3).

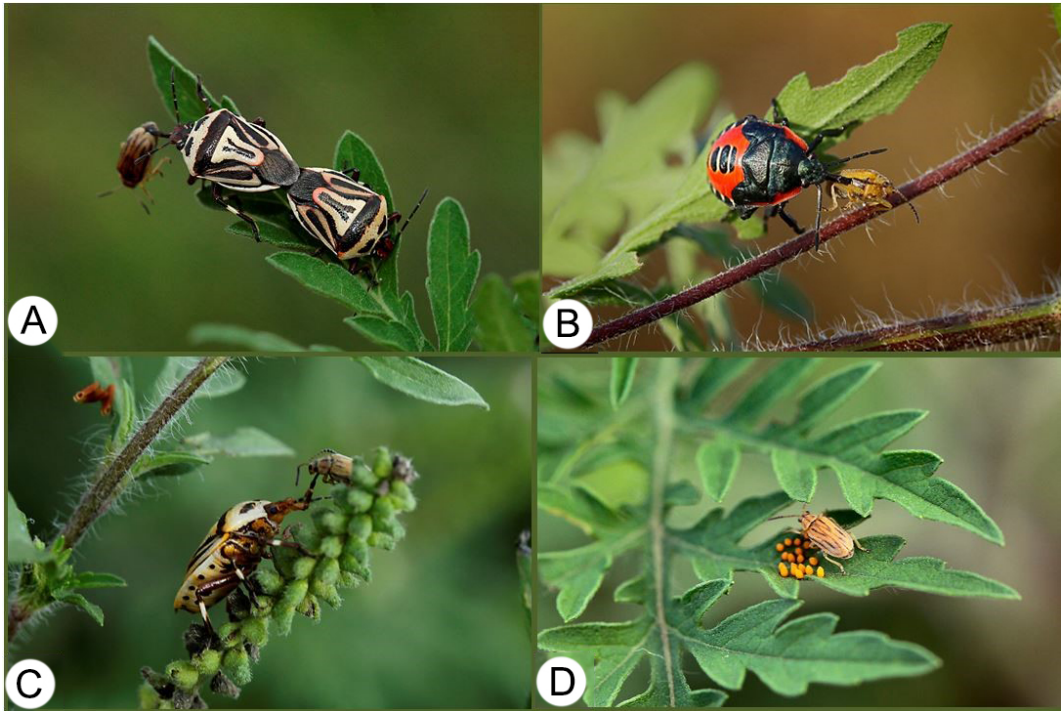


Figure 3. A – *Perillus bioculatus* in copula and with *Ophraella communis* on rostrum; B – *P. bioculatus* nymph preying on *O. communis* adult; C – *P. bioculatus* adult preying on *O. communis* adult; D – *O. communis* and its eggs on the same *A. artemisiifolia* plant as *P. bioculatus*. Photo by Č. Petrović.

P. bioculatus in Serbia definitely feeds on *O. communis*, and, we assume, on *L. decemlineata*, because at one locality both species were observed at the same time, on the same plant. At one location in Banjica where *P. bioculatus* was spotted on *A. artemisiifolia*, the beetle *Chrysolina herbacea* (Duftschmid, 1825)

(Coleoptera: Chrysomelidae) was detected on the plant *Mentha longifolia* (L.) Huds (Lamiaceae) (pers. comm. Mihailo Vujić). *C. herbacea* has been mentioned before as possible prey of *P. bioculatus* (see Elisovetcaia *et al.*, 2020), but the true bug was not detected on the same plant as *C. herbacea*. Based on the new records from Serbia, we also confirmed that *P. bioculatus* feeds on different species from the Chrysomelidae family (see Moroz, 2016; Tarla & Tarla, 2018 and Elisovetcaia *et al.*, 2020) and not only on the well-known prey *L. decemlineata*. Elisovetcaia *et al.* (2020) argue that the type of insect prey affects reproductive success (i.e. the number of eggs laid and percentage of fertile eggs) of *P. bioculatus*, however, it seems that the main factor affecting its survival outside of its native range are climate conditions during hibernation (Péricart, 2010). There are a few examples of true bugs from warm regions acclimatized in our country (see Protić, 2010; Šeat *et al.*, 2019, 2020), and the new data on the distribution of *P. bioculatus* in Serbia also support climate change-induced expansions of the species. This concept was already explained by Rabitsch (2008) on the example of Central European true bug fauna, which becomes more Mediterranean-like due to habitat and climate change. With the aforementioned in mind, we can also expect to see similar cases in the future where two or more non-native species meet again and interact outside of their native ranges (Fig. 4).

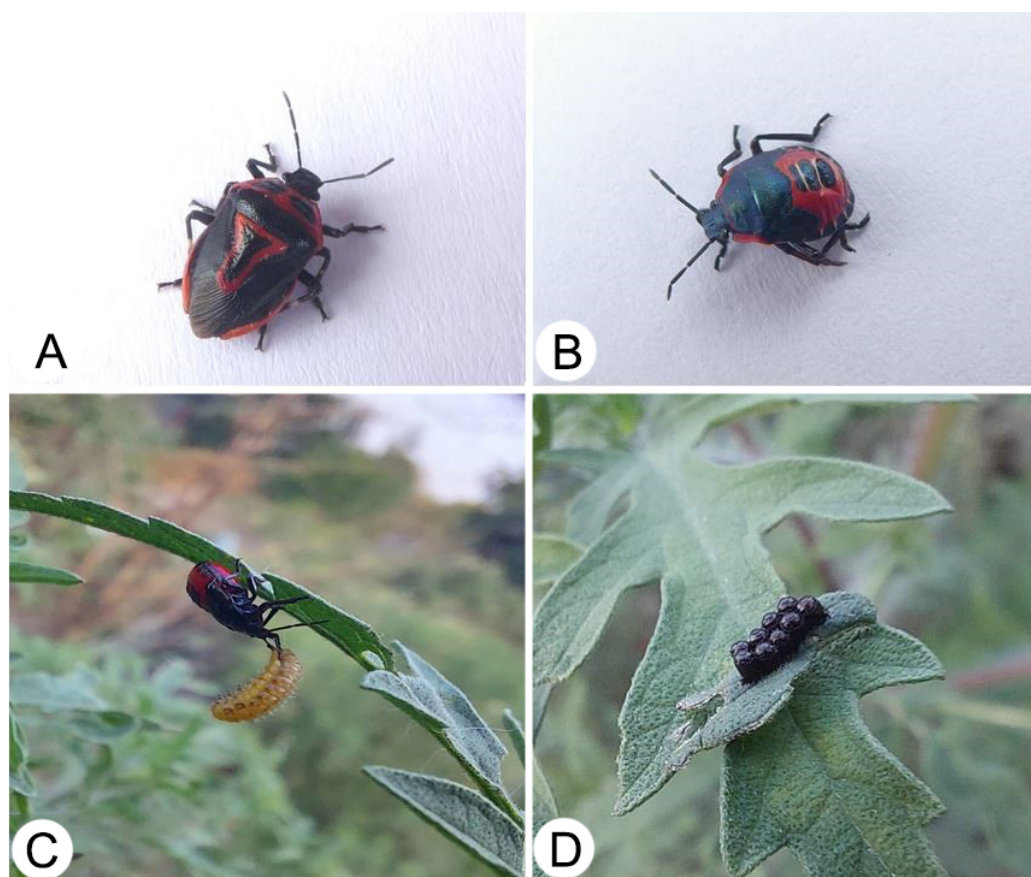


Figure 4. A – *P. bioculatus* adult from Batajnica; B – *P. bioculatus* nymph from Batajnica; C – *P. bioculatus* nymph preying on *O. communis* larvae; D – *P. bioculatus* eggs on *A. artemisiifolia*. Photo by S. Gajić (A and B) and M. Vujić (C and D).

Acknowledgements: Authors are thankful to Slobodan Stevčić, Slađana Gajić, Časlav Petrović, Milan Đurić, Ivan Tot, Mihailo Vujić, Vidak Lakušić, Denis Ćoso, Srđan Stanojević and Jovana Damjanović for providing data and photographs from the field, and to the Eparchy of Vranje, Serbian Orthodox Church, the manager of the Landscape of Outstanding Features “Dolina Pčinje”, for supporting the project during which the specimen from Pčinja locality were found.

References

- De Clercq, P. (2000). Predaceous Stinkbugs (Pentatomidae: Asopinae). In Schaefer, C.W. & Panizzi, A.R. (Eds.) *Heteroptera of Economic Importance*. CRC Press, Boca Raton, FL, 737-789 pp.
- Derjanschi, V., & Elisovețcaia, D. (2014). Predatory stink bug *Perillus bioculatus* Fabricius 1775 (Hemiptera, Pentatomidae) in the Republic of Moldova. *Oltenia, Studii și comunicări. Științele Naturii* 30(1), 104-107.
- Dursun, A. & Fent, M., (2018). Erstnachweis von *Perillus bioculatus* (Fabricius, 1775) (Hemiptera: Heteroptera: Pentatomidae) für Anatolien (Türkei). *Heteropteron*, 53, 18-20.
- Elisovețcaia, D., Derjanschi, V., Agas'eva, I., & Nefedova, M. (2020). Some results of breeding a predatory stink bug of *Perillus bioculatus* F. (Hemiptera, Pentatomidae) in the Republic of Moldova. *BIO Web of Conferences*, 21, 00024, XI International Scientific and Practical Conference “Biological Plant Protection is the Basis of Agroecosystems Stabilization”.
- Fent, M., & Aktaç, N. (2007). Die Verbreitung des *Perillus bioculatus* (Fab.) (Heteroptera: Pentatomidae: Asopinae) im türkischen Teil Thrakiens. *Heteropteron*, 25, 7-10.
- HabiProt (2014-2022). Alciphron - baza podataka o insektima Srbije. Retrieved from: <https://alciphron.habiprot.org.rs> [Accessed on: 08.09.2022].
- Kivan, M. (2004). Some observations on *Perillus bioculatus* (F.) (Heteroptera: Pentatomidae), a new record for the entomofauna of Turkey. *Turkish Journal of Entomology*, 28(2), 95-98.
- Levchenko, I. S., & Martynov, V. V. (2018). New and interesting records of stink bugs (Heteroptera: Pentatomoidea) in Donbass. *Caucasian Entomological Bulletin*, 14(2), 141-145. DOI: 10.23885/181433262018142-141145 [In Russian, English abstract].
- Moroz, M. S. (2016). Breeding of Entomophages is from family of Pentatomidae. *Вісник Житомирський національний агроєкологічний університет*, 2(56), 78-86.
- Nadaždin, B., & Šeat, J. (2019). Značajni nalazi stenica (Insecta: Heteroptera) u bazi “Alciphron”. *Rezimej XII Simpozijuma entomologa Srbije sa međunarodnim učešćem. Univerzitet u Nišu, Niš, Srbija, 25-29. septembar 2019*, 30 pp.
- Palmer, W. A., & Goeden, R. D. (1991). The host range of *Ophraella communa* LeSage (Coleoptera: Chrysomelidae). *The Coleopterists Bulletin*, 45(2), 115-120.
- Péricart, J. (2010). Hémiptères Pentatomoidea Euro-Méditerranéens (Bd. 3) Podopinae et Asopinae. *Faune de France*, 93, 290 pp.
- Petrović-Obradović, O., Smiljanić, D., & Črkrić Matijević, M. (2020). *Ophraella communa* (Coleoptera: Chrysomelidae) has arrived in Serbia. *Acta Entomologica Serbica*, 25(2), 101-104.
- Popović, M., Vasić, N., Koren, T., Burić, I., Živanović, N., Kulijer, D., & Golubović, A. (2020). Biologer: an open platform for collecting biodiversity data. *Biodiversity Data Journal* 8: e53014. Retrieved from: <https://bdj.pensoft.net/article/53014/>
- Protić, Lj. (2010). Promene areala i brojnosti Heteroptera u Srbiji. *Zaštita prirode*, 61(1), 93-104.

- Protić, Lj., & Živić, N. (2012). *Perillus bioculatus* (Fabricius) (Heteroptera: Pentatomidae) in Serbia. *Acta Entomologica Serbica*, 17(1/2), 23-28.
- Rabitsch, W. (2008). Alien true bugs of Europe (Insecta: Hemiptera: Heteroptera). *Zootaxa*, 1827, 1-44.
- Rădac, I. A., & Teodorescu, M. (2021). First records of *Mustha spinosula* and *Perillus bioculatus* (Heteroptera: Pentatomidae) in Romania. *Travaux du Muséum National d'Histoire Naturelle "Grigore Antipa"*, 64(1), 51-59, doi: 10.3897/travaux.64.e64664.
- Simov, N., Langourov, M., Grozeva, S., & Gradinarov, D. (2012). New and interesting records of alien and native true bugs (Hemiptera: Heteroptera) from Bulgaria. *Acta Zoologica Bulgarica*, 64(3), 241-252.
- Šeat, J., & Nadaždin, B. [ur.] (2014-2022). Alciphron - baza podataka o insektima Srbije (Heteroptera), HabiProt Retrieved from: <https://alciphron.habiprot.org.rs> [Accessed on: 08.09.2022].
- Šeat, J. (2018). Biologer database for collecting data on biological diversity: Heteroptera, Retrieved from: <https://biologer.rs>, visited on [Accessed on: 12.10.2022].
- Šeat, J., Vujić, M., & Nadaždin, B. (2019). New faunal data on true bugs (Heteroptera) in Serbia. *Acta Entomologica Serbica*, 24(1), 95-99.
- Šeat, J., Nadaždin, B., & Šćiban, M. (2020). *Acrosternum heegeri* (Heteroptera: Pentatomidae) in Serbia. *Acta Entomologica Serbica*, 25(1), 77-81.
- Tarla, S., & Tarla, G. (2018). Detection of *Perillus bioculatus* (F.) (Heteroptera: Pentatomidae) on a New Host in Anatolia. *International Journal of Agriculture Innovations and Research*, 7(3), 317-319.
- Thomas, D.B. (1994). Taxonomic synopsis of the Old World asopine genera (Heteroptera: Pentatomidae). *Insecta Mundi*, 8(3-4), 145-212.

НОВИ НАЛАЗИ СТЕНИЦЕ *PERILLUS BIOCULATUS* (HETEROPTERA: PENTATOMIDAE) У СРБИЈИ: ДА ЛИ КЛИМАТСКЕ ПРОМЕНЕ И НОВИ ПЛЕН ДОПРИНОСЕ ШИРЕЊУ АРЕАЛА ВРСТЕ?

БОЈАНА НАДАЖДИН И ЈЕЛЕНА ШЕАТ

Извод

Perillus bioculatus (Fabricius, 1775) потиче из Северне Америке, а у Европу је интродукован почетком 20 века. Први налази врсте из природе у Србији потичу из 1996. године, након чега стеница није регистрована све до 2018. године. Након детектовања једне јединке из 2018. претпоставили смо да ће се *Perillus bioculatus* наставити ширити по Србији, а скорашњи подаци су наше сумње и потврдили. У раду су представљени литературни и нови налази из 2021. и 2022. године, као и условљеност распострањења стенице ширењем ареала новог плена *Ophraella communa* LeSage, 1986 - такође алохтоне врста инсекта на подручју Европе, која је по први пут забележена у Србији 2020. године. На готово свим локалитетима из 2022. године *P. bioculatus* је забележен на амброзији заједно са *O. communa*.

Received: September 8th, 2022

Accepted: October 13th, 2022