TWO NEW SPECIES OF *HARMONIA* (COLEOPTERA: COCCINELLIDAE) FROM DUZCE, TURKEY

Sevcan Öztemiz* and Şükran Yayla*

* Düzce University, Faculty of Agriculture and Natural Science, Plant Protection Department, 81620 Düzce, TURKEY. E-mails: sevcanoztemiz@duzce.edu.tr; sukranyayla@düzce.edu.tr

[Öztemiz, S. & Yayla, Ş. 2018. Two new species of *Harmonia* (Coleoptera: Coccinellidae) from Düzce, Turkey. Munis Entomology & Zoology, 13 (1): 318-322**]**

ABSTRACT: This study was carried out to determine the Coccinellidae (Coleoptera) fauna in Duzce province of Turkey. Two species *Harmonia axyridis* (Pallas, 1773) and *Harmonia quadripuctata* (Pontoppidan, 1763) belonging to Coccinellidae family have been described for the first time from Duzce province, the west Black Sea region of Turkey. Sampling was made on coniferous plants and rose during July 2017. The harlequin ladybird, *H. axyridis* was recorded on *Macrosiphum rosae* (L.) on rose (*Rosa* spp.) belonging to *Rosaceae* family. The cream-streaked ladybird, *H. quadripuctata* was recorded on *Pineus pini* (Gmelin) on pine (*Pinus* spp.) belonging to Pinaceae family in July, 2017. *Harmonia axyridis* is one of the most important an invasive biocontrol agent for aphid control which has unexpected impacts on native coccinellid populations, ecosystems and people in the world. Knowing the distribution of this species plays an important role in dealing with biological invasions. New distribution location of *Harmonia* species was given in the present paper.

KEY WORDS: Coccinellidae, fauna, *Harmonia,* new record, Düzce

Coccinellidae are cosmopolitan in distribution and found almost everywhere. This family includes about 360 genera and 6000 species (Uygun, 1981; Vanderberg, 2002). The ladybird beetles are mostly predatory, although its larvae and adults feeding on aphids, mites, thrips, scale insects, psyllids, whiteflies and eggs of butterflies and moths, the species in the tribe Coccinellini feed primarily on aphids. In most countries, the harlequin ladybird, *Harmonia axyridis* (Pallas, 1773) was introduced for the control of aphids (Brown et al., 2008; Sæthre et al., 2010). *Over time, it was seen that H. axyridis prey on and competed with the other native species* (Brown & Miller, 1998) as well as negative impacts on non-target pests, household pest, humans and fruit production (Kuznetsov, 1997; Koch, 2003; Koch et al., 2004; Kovach, 2004; Nalepa et al., 2004; Pell et al., 2008; Roy & Wajnberg, 2008; Osawa, 2011). Due to the high dispersal capacity of *H. axyridis* (Hodek et al., 1993; Nalepa et al., 1996; Osawa, 2000; Berkvens et al., 2009; Brown et al., 2011), spread quickly in other continents and countries, and many habitats have been invaded. In Turkey, *H. axyridis* species that have recently entered our country and firstly recorded by Bukejs & Telnov (2014) in Cappadocia /Nevsehir (Goreme). Because of all the adverse effects of *H. axyridis* mentioned above, It is necessary to follow this invasive species and to prevent further spread of *H. axyridis* in Turkey. The aim of the present paper is to provide new information on the distribution of this species introduced in Turkey.

MATERIAL AND METHODS

Sampling was made on coniferous plants and rose in Düzce during July 2017 (Fig. 1). Materials have been collected by shaking the plants and visual inspections

of the plants (Sæthre et al., 2010). The material collected was brought to the laboratory. The samples were separated individually and labelled for identification. The identification of the insects were made by Dr. Derya Şenal (Seyh Edebali University, Faculty of Agriculture Sciences and Technology, Bilecik, Turkey). The specimens were deposited in the Duzce University, Faculty of Agriculture and Natural Science, Turkey.

RESULTS AND DISCUSSION

In this study, two species belonging to the Coccinellini tribe of Coccinellinae (Coccinellidae) were reported in Düzce, Turkey (Fig. 2). Details of the collection data are as follows:

Subfamily Coccinellinae
Tribe Coccinellini
Genus *Harmonia* Mulsant, 1850

Harmonia axyridis (Pallas, 1773)

(Fig. 2a)

Synonyms: *Coccinella 19-sinata* Faldermann, 1835; *Coccinella axyridis* Pallas, 1773; *Coccinella conspicua* Faldermann, 1835; *Coccinella succinea* Hop, 1845; *Cocinella bisex-notata* Herbst, 1793; *Harmonia spectabilis* Faldermann, 1835; *Leis axyridis* (Pallas) Mulsant, 1850; *Ptychanatis axyridis* (Pallas) Crotch, 1874; *Ptychanatis yedoensis* Takizawa, 1917; *Anatis circe* Mulsant, 1850.

Material examined: Düzce: Konuralp, Turkey, 40°50'19.3848" N and 31°9'45.3924" E, 153 m, 4.VII.2017, leg. Sevcan Oztemiz (1 specimen, 7 samples: 4♀♀; 3♂♂), *Macrosiphum rosae* (Linnaeus, 1758) on rose (*Rosa* spp.) belonging to *Rosaceae* family.

Distribution in Turkey: This species was previously reported in Cappadocia / Nevşehir (Göreme) by Bukejs & Telnov (2014), in Tekirdağ (Malkara) (Aysal & Kivan, 2014); Çanakkale (Ayvacık, Bozcaada, Çan, Eceabat, Geyikli) (Bastug & Kasap, 2015) and Bartın (İnkum, Amasra, Bartın Center) (Sobutay, 2016).

Distribution in the World: Europe, North and South America, Middle East, South Africa and Australia (Stals & Prinsloo, 2007; Brown et al., 2008; Smith & Fisher, 2008).

Harmonia quadripuctata (Pontoppidan, 1763)

(Fig. 2b)

Synonyms: *Coccinella quadripunctata* Pontoppidan, 1763; *Harmonia marginepunctata* (Schaller, 1783).

Material examined: Düzce: Konuralp, Turkey, 40°50'19.3848" N and 31°9'45.3924" E, 153 m, 18.VII.2017, leg. Sevcan Oztemiz (1 specimen, 2 samples: 1♀; 1♂), *Pineus pini* (Gmelin) on pine (*Pinus* spp.) belonging to Pinaceae.

Distribution in Turkey: This species was previously reported in İzmir, Afyon, Isparta, Denizli, Bursa, Adana and Ankara provinces (Giray, 1970; Uygun, 1981); Ankara (Düzgüneş et al., 1980) Ülgentürk & Toros, 2000; Dostbil & Ülgentürk, 2016), Samsun, Amasya, Tokat (Kılıç & Aykaç, 1989); Erzurum (Özbek & Çetin, 1991); Manisa, İzmir (Tezcan & Uygun, 2003); Maraş (Aslan & Uygun, 2005); Konya (Sahbaz & Uysal, 2006); Artvin, Rize (Portakaldalı, 2008); Isparta (Gümüş & Avcı, 2015).

Distribution in the World: Europe, North America, Canada, Near East, Northern Asia (excluding China) (Korschefsky, 1932; Horion, 1961; Vandenberg, 1990).

As shown, two different Harmonia species were detected in two different host plants. *Harmonia axyridis* is primarily considered an arboreal species and is common in various forest trees, ornamental trees and shrubs (Brown, 2003). Similarly, in this study, we found the multicoloured ladybird on rose. *H. axyridis* in North America is reported from 40 plant species (Kovach, 2004). *H. axyridis* is also reported to be a pest to apple, pear, raspberry, wine grapes, citrus, bean, corn, wheat and potato agriculture (Koch & Galvan, 2008; Roy & Roy, 2008; Vandereycken et al., 2013). The species is also found from woodlands and forest habitats, parks and gardens, agricultural and horticultural habitats as well as from buildings in cities and villages (Aysal & Kivan, 2014; Bukejs & Telnov, 2015). Due to its strong ability to disperse, it has adapted to different environmental conditions (Brown et al., 2011; Cornacchia & Nardi, 2012). *Harmonia quadripunctata* is a conifer specialist and predator of various species of aphids, over-winter in coniferous trees such as pines. Cream-streaked ladybirds are occasionally found on herbaceous plants, shrubbery, grassland, shrubs such as nettle and gorse in close proximity to conifers (Vandenberg, 1990). Similarly, in this study, we found the ladybird on pine. Both ladybirds are likely to bespread in Turkey in which have rich biodiversity, different climate and geography. For this reason, it is necessary that the distribution of ladybirds entered our country four years ago should be revealed as soon as possible. In particular, the multicoloured ladybird has an negative impact on ecosystem by reducing in biodiversity of other aphidophages and non-pest insects. A risk assessment by van Lenteren et al. (2008) reported that *H. axyridis* should never have been used in biological control because of intraguild predation and resource competition.

CONCLUSION

The Coccinellidae fauna of Duzce was revealed with the results obtained with this study. These results have the potential to provide information on the biological control practices that will take place in the Integrated Pest Management programs in future. Furthermore, it is thought that this study will contribute to the study of Duzce and our country in determining insect biodiversity. It would be neccesary to carry out further research into the distribution of the species and monitoring of its population in Turkey to determine the spread of *H. axyridis* and *H.quadripuctata in* different hosts. The results obtained will be used in control programs against pests, and will contribute to the biodiversity of Duzce Province and our country.

ACKNOWLEDGEMENTS

We would like to express our thanks to Dr. Derya Şenal for identification of the species.

LITERATURE CITED

Aslan, M. M. & Uygun, N. 2005. Aphids (Homoptera: Aphididae) of Kahramanmaras Province. Turkish Journal of Zoology, 29: 201-209.

Aysal, T. & Kivan, M. 2014. Occurrence of an invasive alien species *Harmonia axyridis* (Pallas) (Coleoptera: Coccinellidae) in Turkey. Plant Protection Bulletin, 4: 141-146.

Başţuğ, G. & Kasap, I. 2015. Faunistic studies on Coccinellidae (Coleoptera) family in the province of Canakkale. Turkish Journal of Biological Control, 6: 41-50.

Berkvens, N., Baverstock, J., De Clercq, P., Majerus, M. E. N., Pell, J. K., Roy, H. E., Tirry, L. & Wells, P. 2009. Good and bad traits of *Harmonia axyridis*—from biological control to invasion. In: Mason PG, Gillespie DR, Vincent C (eds) Proceedings of third international symposium on biological control of arthropods, pp 394-402.

Brown, M. W. 2003. Intraguild responses of aphid predators on apple to the invasion of an exotic species, *Harmonia axyridis*. BioControl, 48: 141-153.

Brown, P. M. J., Roy, H. E., Rothery, P., Roy, D. B., Ware, R. L. & Majerus, M. 2008. *Harmonia axyridis* in Great Britain: analysis of the spread and distribution of a non-native coccinellid. BioControl (Dordrecht), 53: 55-67.

Brown, M. M. J., Thomas, C. E., Lombaert, E., Jeffries, D. L., Estoup, A. & Handley, L. J. L. 2011. The global spread of *Harmonia axyridis* (Coleoptera: Coccinellidae): distribution, dispersal and routes of invasion. BioControl, 56 (4): 623-641.

Bukejs, A. & Telnov, D. 2015. The first record of the invasive lady beetle *Harmonia axyridis* (Pallas, 1773) (Coleoptera: Coccinellidae) in Turkey. Zoology and Ecology, 25: 59-62.

Cornacchia, P. & Nardi, G. 2012. Nuovi dati su *Harmonia axyridis* in Italia (Coleoptera, Coccinellidae). Bollettino dell'Associazione Romana di Entomologia, 67 (1-4): 51-68.

Dostbil, O. & Ülgentürk, S. 2016. Bio-ecology of cedar scale insect *Torosaspis cedricola* (Balachowsky & Alkan) (Hemiptera: Diaspididae) in Ankara, Turkey. Redia, XCIX: 163-170.

Düzgüneş, Z., Toros, S., Kılınçer, N. & Kovancı, B. 1980. Detection of parasitoids and predators of Aphidoidea species in. T. C. Ministry of Agriculture and Forestry, Agricultural Mec. and General Directorate of Agricultural Quarantine, Broadcasting Branch, 251 pp.

Giray, H. 1970. Harmful and useful species Coccinellidae (Coleoptera) from Aegean region, with notes on their localities, collecting dates and hosts. Yearbook of the Faculty of Agriculture of Ege University, 1 (1): 35-50.

Gümüş, A. & Avcı, M. 2015. Poplar harmful insects and hunters in Isparta province. Turkish Journal of Forestry, 16 (2): 111-129.

Hodek, I., Iperti, G. & Hodkova, M. 1993. Long-distance flights in Coccinellidae (Coleoptera). European Journal of Entomology, 90: 403-414.

Horion, A. 1961. Faunistif der Mitteleuropäischen Käfer. Band VIII. Überlingen- Bodensee, Komissionsverlag Buchdruckerei Ang. Feysel: 283-365.

Kılıç, M. & Aykaç, M. K. 1989. Investigations on the pest management in peach orchards in the black sea region of Turkey. Plant Protection Bulletin, 29 (3-4): 211-241.

Koch, R. L. & Galvan, T. L. 2008. Bad side of a good beetle: the North American experience with *Harmonia axyridis*. Biocontrol, 53: 23-35.

Korschefsky, R. 1932. Coleopterorum Catalogus, pars 118, Coccinellidae II., W. JUNK, Berlin, 435 pp.

Kovach, J. 2004.Impact of multicolored Asian ladybeetles as a pest of fruit and people. American Entomology, 50: 159-161.

Kuznetsov, V. N. 1997. Lady beetles of the Russian Far East. The Sandhill Crane Press, Inc., Gainesville.

Nalepa, C. A., Kidd, K. A. & Ahlstrom, K. R. 1996. Biology of *Harmonia axyridis* (Coleoptera: Coccinellidae) in winter aggregations. Annual Entomology Society of America, 89: 681-685.

Nalepa, C. A., Kennedy, G. G. & Brownie, C. 2004. Orientation of multicolored Asian lady beetles to buildings. American Entomolegist, 50: 165-166.

Osawa, N. 2000. Population field studies on the aphidophagous ladybird beetle *Harmonia axyridis* (Coleoptera: Coccinellidae): resource tracking and population characteristics. Population Ecology, 42: 115-127.

Osawa, N. 2011. The ecology of *Harmonia axyridis* in its native range: population characteristics and role in the aphidophagous community. BioControl., doi:10.1007/s10526-011-9382-6.

Özbek, H. & Çetin, G. 1991. Contribution to the fauna of Coccinellidae (Col.) from Eastern Anatolia along with some new records from Turkey. Turkish Journal of Entomology, 15 (4): 193-202.

Pallas, P. S. 1773. Reise durch verschiedene Provinzen des Rußischen Reichs. Zweyter Theil, erstes Buch vom Jahr 1770. Pp. [1-6], 3-368. St. Petersburg (Kayserliche Academie der Wißenschaften).

Pell, J. K., Baverstock, J., Roy, H. E., Ware, R. L. & Majerus, M. E. N. 2008. Intraguild predation involving *Harmonia axyridis*: a review of current knowledge and future perspectives. BioControl, 53: 147-168.

Pontoppidan, E. 1763. Den Danske atlas eller Konge-Riget Dannemark, med dets naturlige egenskaber, elementer, indbyggere, værter, dyr og andre affødninger, dets gamle tildragelser og nærværende omstændingheder i alle provintzer, stæder, kirker, slotte og herre-gaarde. Forestillet ved en udførlig lands-beskrivelse, saa og oplyst med dertil forfærdigede land-kort over enhver provintz, samt ziret med stædernes prospecter, grund-ridser, og andre merkværdige kaabber-stykker. Efter Søy-kongelig allernaadigst befalning. Tomus I. - pp. [1-6], Kiøbenhavn. (Godiche).

Portakaldalı, M. 2008. Survey on Coccinellidae (Coleoptera) Fauna in Artvin and Rize Province. University of Çukurova, Institute of Natural and Applied Science, MSc Thesis, Adana, 71 pp.

Roy, H. & Roy, D. 2008. Delivering Alien Invasive Species Inventories for Europe (DAISIE). Species factsheet. *Harmonia axyridis*. Available at: http://www.europe-aliens.org/speciesFactsheet.do?speciesId=50711. Downloaded on 19th September 2014.

Roy, H. & Wajnberg, E. 2008. From biological control to invasion: the ladybird *Harmonia axyridis* as a model species. BioControl, 53: 1-4.

Şahbaz, A. & Uysal, M. 2006. The predators and parasitoids of the aphid species (Homoptera: Aphididae) on poplars in Konya provınce of Turkey. Journal of Agricultural Faculty, 20 (38): 119-125.

Sæthre, M. G., Staverløkk, A. & Hågvar, E. B. 2010. Stowaways in horticultural plants imported from the Netherlands, Germany and Denmark. Norwegian Journal of Entomology, 57: 25-35.

Sobutay, U. 2016. Coccinellidae (Insecta: Coleoptera) species in Bartın. University of Bartın, Graudate School of Natural and Applied Sciences, Forest Engineering, Bartın, MSc, 112 pp.

Smith, B. & Fisher, D. 2008, Biosecurity risk - Asian lady beetle. Wine Industry Newsletter, 3.

Stals, R. & Prinsloo, G. 2007. Discovery of an alien invasive, predatory insect in South Africa: the multicoloured Asian ladybird beetle, *Harmonia axyridis* (Pallas) (Coleoptera: Coccinellidae). South African Journal of Science, 103: 123-126.

Tezcan, S. & Uygun, N. 2003. Evaluation of the Coccinellidae (Coleoptera) fauna of ecologically managed cherry orchards in İzmir and Manisa provinces of Turkey. Turkish Journal of Entomology, 27 (1): 73-79.

Uygun, N. 1981. Taxonomic Studies on Coccinellidae (Coleoptera) Fauna in Turkey. Çukurova University, Agricultural Faculty Publications: 157, Adana Scientific Research and Investigation Thesis, 48: 110 pp.
Ülgentürk, S. & Toros, S. 2000. Preliminary studies on parasitoids and predators of Diaspididae (Homoptera: Coccoidea) species on park plants. Journal of Agricultural Sciences, 6 (4): 106-110.
Vandenberg, N. J. 1990. First North American records for *Harmonia quadripunctata* (Pontopiddian) (Coleoptera: Coccinellidae); a lady beetle native to the Palaearctic. Proceedings of the Entomological Society of Washington, 92: 407-410.
Vandereycken, A., Brostaux, Y., Joie, E., Haubruge, E. & Verheggen, F. J. 2013. Occurrence of *Harmonia axyridis* (Coleoptera: Coccinellidae) in field crops. European Journal of Entomology, 110 (2): 285-292.
Van Lenteren, J. C., Loomans, A. J. M., Babendreier, D. & Bigler, F. 2008. *Harmonia axyridis:* an environmental risk assessment for Northwest Europe. Biocontrol, 53: 37-54.

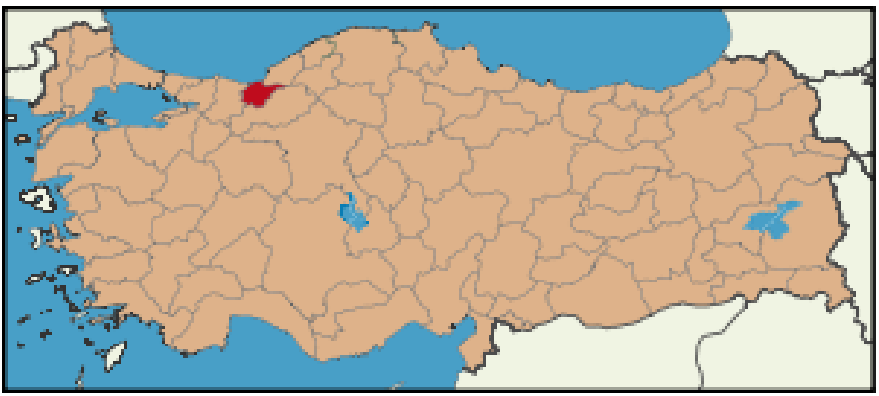

Figure 1. The locality of two *Harmonia* species in Turkey.

a **b**

Figure 2. Adults of *Harmonia,* **a:** *Harmonia axyridis* (Pallas), **b:** *Harmonia quadripuctata* (Pontoppidan) (Coleoptera: Coccinellidae).