RISK ASSESSMENT AFTER THE HARMONIA+ PROTOCOL OF INVASIVE ALIEN GALL-FORMING ARTHROPOD SPECIES IN BELARUS

D. L. Petrov, F. V. Sautkin, S. V. Buga
Belarusian State University, 4 Nezavisimosti Ave., 220030, Minsk, Belarus
Corresponding author: D. L. Petrov (*dlpetrov@tut.by*)

Introduction. Risk assessment of invasive alien species is effective instrument enabling decision makers to develop risk management strategies resulting in control and eradication measures. Detailed risk assessment methods are quite labour-intensive and there is a wide range of scientific approaches. Using the same protocol makes it possible for territories sharing similar invasive species and eco-climatic conditions to exchange information on a comparable basis.

Materials and methods. Risk assessment of invasive alien gall-forming arthropod species has been made using the internet-based Harmonia+ protocol (BFIS, 2019) developed by the Belgian Biodiversity Platform and widely used in the Benelux countries and beyond (Vanderhoeven et al., 2015; Ries, Krippel & Pfeiffenschneider, 2020). Harmonia+ belongs to the risk-screening procedures which inherently deal with negative impacts only, and leave eventual positive impacts outside of scope. The protocol can be used for prioritisation schemes of already present alien species (D'Hondt et al., 2015). This protocol refers to multiple kinds of impacts. It consists of 41 questions grouped in 6 categories, which concern environment, cultivated plants, domesticated animals, public health, human infrastructure, and ecosystem services. A risk score and level of confidence are assigned to each issue. As results are numerical scores between 0 and 1, they allow for a clear ranking of species' overall risks.

The list of invasive alien gall-forming arthropod species carried out invasions into Belarus during the current century and information on their geographical distribution, biology, ecology, and pestfulness for decorative trees and shrubs in green areas are based on own studies; data available from published sources and open internet-databases on gall-forming arthropods has also been used.

Results. A risk assessment of 6 invasive alien gall-forming arthropod species has been carried out for Belarus, using the internet-based Harmonia+ protocol that assesses the invasion process and the impacts on the environment, cultivated plants, domesticated animals, public health and on human infrastructure. Among them walnut leaf gall mite (*Aceria erinea* (Nalepa, 1891)) (Acari: Acariformes: Eriophyidae), walnut blister mite (*Aceria tristriata* (Nalepa, 1890)) (Acari: Acariformes: Eriophyidae), boxwood psyllid (*Psylla buxi* (Linnaeus, 1758)) (Insecta: Sternorhyncha: Psyllidae), cherry plum aphid (*Brachycaudus divaricatae* Shaposhnikov, 1956) (Insecta: Sternorhyncha: Aphididae)), black locust gall midge (*Obolodiplosis robiniae* (Haldeman, 1847)) (Insecta: Diptera: Cecidomyiidae) and honey locust pod gall midge (*Dasineura gleditchiae* (Osten Sacken, 1866)) (Insecta: Diptera: Cecidomyiidae) which carried out invasions in Belarus during the current century (Petrov, 2019). A species with the highest overall risk score is *Brachycaudus divaricatae* (0.48) which has wide geographical distribution in Belarus and damages Myrobalan plum (*Prunus cerasifera* Ehrh.) in orchards and green areas. A species with the lowest overall risk score is *Aceria tristriata* (0.07) which has local geographical distribution in Belarus and damages the common walnut (*Juglans regia* L.) only sporadically. The values of invasion risk were the next: 0.59 for *Aceria erinea*, 0.22 for *Aceria tristriata*, 0.79 for *Brachycaudus divaricatae*, 0.40 for *Psylla buxi*, 0.50 for *Obolodiplosis robiniae*, and only 0.01 for *Dasineura gleditchiae.* The values of impact were the next: 0.33 for *Aceria erinea* and *Aceria tristriata*, 0.60 for *Brachycaudus divaricatae*, 0.50 for *Psylla buxi*, *Obolodiplosis robiniae*, and *Dasineura gleditchiae.*

Conclusion. A risk assessment of 6 invasive alien gall-forming arthropod species were carried out by using the internet-based Harmonia+ protocol that assessed the invasion process and the impacts on the environment, cultivated plants, domesticated animals, public health and on human infrastructure. A risk assessment protocol resulting in numerical scores that were

suitable for ranking a list of invasive alien species with the purpose of identifying those which caused the strongest impact and/or the highest risks, and thus, should be included in the invasive alien species list of national concern.

References

BFIS, 2019. Harmonia+ database. Belgian Forum on Invasive Species (BFIS). [online]. http://ias.biodiversity.be/harmoniaplus [viewed 11 December 2020].

D'Hondt B., Vanderhoeven S., Roelandt S., Mayer F., Versteirt V., Adriaens T., Ducheyne E., San Martin G., Grégoire J.C., Stiers I., Quoilin S., Cigar J., Heughebaert A. & Bran-Quart E. 2015. Harmonia+ and Pandora+: risk screening tools for potentially invasive plants, animals and their pathogens. *Biological Invasions*, **17**: 1869–1883. DOI: 10.1007/s10530-015-0843-1

Vanderhoeven S., Adriaens T., D'hondt B., van Gossum H., Vandegehuchte M., Verreycken H., Cigar J. & Branquart E. 2015. A science-based approach to tackle invasive alien species in Belgium – the role of the ISEIA protocol and the Harmonia information system as decision support tools. *Management of Biological Invasions*, **6**: 197–208. DOI: 10.3391/mbi.2015.6.2.10.

Ries C., Krippel Y. & Pfeiffenschneider M. 2020. Risk assessment after the Harmonia+ protocol of invasive alien vascular plant species in Luxembourg. *Bulletin de la Société des naturalistes luxembourgeois*, **122**: 197–205.

Petrov D.L. 2019. Povrezhdayushchie dekorativnye drevesnye rasteniya teratformiruyushchie fitofagi, osushchestvivshie invaziyu na territoriyu Belarusi v tekushchem stoletii [The gall-forming phytophagous arthropods damaging ornamental woody plants, expanded on the territory of Belarus in the current century]. *Journal of the Belarusian State University. Ecology*, **1**: 24–31 (In Russian).