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Introductory Article

Joint ESENIAS and DIAS Scientific Conference and 9th ESENIAS Workshop *Species, Ecosystems and Areas of Conservation Concern under Threat from the Invasive Alien Species: Outcomes*

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Abstract: Recent scientific reports have highlighted that biodiversity and nature globally are in a state of crisis and there is urgent need for radical changes in the management of natural resources. Invasive alien species (IAS) together with climate change have been recognised as major and fast growing direct drivers of the loss of biodiversity and ecosystem services in Europe and worldwide. The ecosystems with globally significant biodiversity, including the aquatic ecosystems, are most vulnerable to the impact of IAS and, therefore, need special protection. The EU Regulation 1143/2014, the EU Biodiversity Strategy for 2030, and the EU Strategy for the Danube Region Revised Action Plan call for urgent actions addressing IAS in order to minimise their impact on the threaten and protected species and habitats. In response to the necessity of coordinated actions in this respect, the third Joint ESENIAS and DIAS Scientific Conference and 9th ESENIAS Workshop entitled *Species, ecosystems and areas of conservation concern under threat from the invasive alien species* was held on 3–6 September 2019, in the town of Ohrid, Republic of North Macedonia. The conference was organised by the Hydrobiological Institute Ohrid, Public Institution Galicica National Park, ESENIAS, DIAS, and the Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences. The conference was supported by the Ministry of Education and Science of the Republic of North Macedonia and the Public Institution Galicica National Park. In this introductory article, we present information about the venue of the conference: the Galicica Mountain and lakes Ohrid and Prespa, a region of globally significant biodiversity, as well as conference participants and their contributions. We also review the scientific outcomes of the conference under the seven topics.

Key words: Invasive alien species, biodiversity hotspot areas, Galicica National Park, regional cooperation, ESENIAS, DIAS, conference outcomes.

Background

Recent scientific reports have brought to the fore that biodiversity and nature globally are in a state of crisis and there is urgent need for radical changes in

the management of natural resources. In the last four decades, global wildlife populations fell by 60% as a result of human activities (WWF 2018). The Global Assessment Report on Biodiversity and Ecosystem Services released by the Intergovernmental Science-

Policy Platform on Biodiversity and Ecosystem Services (IPBES 2019) confirms that the rate of wildlife extinction is accelerating. The biodiversity and ecosystems in Europe are also under serious threat (IPBES 2019, EU 2020a).

Invasive alien species (IAS) together with climate change have been recognised as major and fast growing direct drivers of the loss of biodiversity and ecosystem services in Europe and worldwide (EU 2014). According to the European Alien Species Information Network (EASIN), there are about 14,000 alien species in Europe, of which around 10% are invasive. A report of the Institute of Environmental Protection and IUCN SSC Invasive Species Specialist Group (GENOVESI et al. 2015) states that IAS are the 3rd most severe threat to European threatened (red-listed) species, after dams and water management, and agricultural forestry effluents. The report also states that one out of five threatened species in Europe is directly affected by IAS; animals are usually more impacted than plants, with fish being particularly affected by this threat; and the main mechanism of impact by IAS is competition (accounting for 40% of all cases), followed by grazing and predation. Of the 1,872 species now considered threatened in Europe, 354 are under threat from invasive alien species (EU 2020a).

At the regional level, the results of the Joint Danube Survey 4 (JDS4) show that the Danube River and its main tributaries are under considerable influence of biological invasions (CSANYI et al. 2020). An increase in the number of identified alien species over three times is reported since 2007, the number of alien taxa being higher in the Middle and Upper Danube. The level of biocontamination of the Danube River is estimated as moderate to high, with higher levels for the Upper (high to severe biocontamination) and Middle Danube (moderate to high biocontamination), in comparison to the Lower Danube (low biocontamination). The biocontamination by type of water bodies ranges from moderate in the shoreline zone of the Danube River, through moderate to high in the canals and lakes adjacent to the Danube River, to severe in the Danube tributaries and reservoirs (TRICHKOVA et al. 2019).

The ecosystems with globally significant biodiversity, including the aquatic ecosystems, are most vulnerable to the impact of IAS and, therefore, need special protection. The EU Regulation 1143/2014 (EU 2014) on invasive alien species requires assessment of the adverse impact on biodiversity and related ecosystem services, focusing explicitly on: 1) threatened (red-listed) species; 2)

species protected under the Birds Directive (EU 2009) and Habitats Directive (EU 1992); 3) red-listed and protected habitats (under the Habitats Directive); and 4) protected sites. The Regulation also calls for undertaking of restoration measures in order to strengthen the ecosystems' resilience towards invasions, to repair the damage caused and to enhance the conservation status of species and their habitats in accordance with the Directive 92/43/EEC (EU 1992) and Directive 2009/147/EC (EU 2009).

The EU Biodiversity Strategy for 2030 (EU 2020a) calls for urgent actions addressing the invasive alien species and implementation of the IAS Regulation in order to minimise, and where possible eliminate, the introduction and establishment of alien species in the EU environment. It is stated that without effective control measures, the rate of invasion and the risks it brings to our nature and health will continue to rise. One of the key commitments by 2030 of the EU Nature Restoration Plan is to manage established invasive alien species and decrease the number of Red List species they threaten by 50% (EU 2020a).

The European Union Strategy for the Danube Region (EUSDR) has developed and included new targets and actions in the revised Action Plan (EU 2020b). Priority Area 6 *Biodiversity and landscapes, quality of air and soils* defines Action 4: Promote research to develop and apply the most appropriate methods for prevention and control of IAS and for management of the priority pathways in line with the DIAS Strategy and IAS Regulation (EU) 1143/2014.

In response to the global, European and regional needs of coordinated actions towards protection of biodiversity and threatened species against IAS, the East and South European Network for Invasive Alien Species (ESENIAS) and the Danube Region Invasive Alien Species Network (DIAS) networks organised jointly their third scientific conference under the theme *Species, ecosystems and areas of conservation concern under threat from the invasive alien species*. The aims of the conference were:

- Presentation of research results from the ESENIAS and DIAS project activities;
- Sharing of results and information on other IAS related initiatives carried out in the region, such as national and local monitoring programmes, risk assessments, pathway analyses and action plans, control and eradication projects, management plans and national strategies, citizens activities and responsibilities, data planning and management;
- Networking and cooperation among scientists in the ESENIAS and DIAS regions and with other networks and projects in Europe.



Fig. 1. Galicica Mountain. View to the mountain, Lake Ohrid and Lake Prespa.

ESENIAS & DIAS Conference venue – Galicica National Park and lakes Ohrid and Prespa, a region of globally significant biodiversity

The Joint ESENIAS and DIAS Scientific Conference and 9th ESENIAS Workshop *Species, Ecosystems and Areas of Conservation Concern under Threat from the Invasive Alien Species* was held on 03–06 September 2019, in the town of Ohrid, Republic of North Macedonia.

There are not many regions in the world, which are characterised by a significant natural biogeographical uniqueness (endemism and relict species) and cultural and historical heritage, such as the region of Lake Ohrid. The global significance of this small area has been recognised worldwide and the ancient Lake Ohrid (the oldest European lake) has been designated as a World Natural and Cultural Heritage site by the United Nations Educational, Scientific and Cultural Organization (UNESCO) since 1979. Because of its value and the peculiarity of the whole region, in 2014 Lake Ohrid and its sister Lake Prespa were declared as Ohrid-Prespa Transboundary Biosphere Reserve under the Man and Biosphere Programme of UNESCO. Much earlier, in 1995, in recognition of its high value for the protection of bird species and other wildlife, Ezerani at Lake Prespa was designated as the first Ramsar Site in the Republic of North Macedonia. Another initiative of the Government of the R. North Macedonia in 2018 was the proposal for designation of Studenchishta Marshland, the last remnant of the former Ohrid Marsh, as a Ramsar Site, based on its importance for biodiversity and maintenance of the stability of the Lake Ohrid ecosystem. Another biodiversity hotspot, the Galicica Mountain (Fig. 1), has been protected at national level and declared as a national park.

The Galicica Mountain is located in the southwestern part of the Republic of North Macedonia between Lake Prespa and Lake Ohrid. The Public Institution Galicica National Park was proclaimed in 1958, with the aim of preserving the plant and animal diversity and the natural appearance of the Galicica Mountain. The results achieved during the past more than 60 years through the efforts of the management authority, but also owing to the support of the local communities and the broader social public, have justified the need of proclaiming the area a national park to the full extent (AVRAMOSKI et al. 2010).

The altitude of the Galicica Mountain massif on the territory of R. North Macedonia ranges from 695 m a.s.l. (the level of Lake Ohrid) to 2,265 m a.s.l. (the border with Albania). The geological base of the mountain consists of Paleozoic metamorphic silicates covered with a layer of massive porous limestone, 500–550 m thick. Due to the porosity of the massive limestones, there is an underground connection between Lake Prespa and Lake Ohrid. The waters of Lake Prespa on the western slopes of Galicica spring up on many coastal and underwater karst springs. The most impressive karst springs of Lake Ohrid are the springs near the monastery of St. Naum. They consist of 30 underwater and 15 coastal springs, with a total capacity of about 7.5 cubic meters of water per second (AVRAMOSKI et al. 2010).

The Galicica National Park has been recognised as a hotspot of biodiversity at regional and global level. It stands out from other areas of similar size for the exceptional richness of species and habitats in a relatively small area. In an area of approximately 24,000 ha, there are more than 37 habitat types, 40 plant communities, about 1,600 taxa of vascular plants, over 143 species of

lichenoid fungi, more than 480 species of fungi and over 3,279 taxa of animals (AVRAMOSKI et al. 2010). The park has four invertebrate and 13 vertebrate taxa that are listed as globally threatened. Many rare and protected species in the park are represented by stable populations. Some of them are endemic for the mountain: 29 taxa of algae, 12 species of vascular plants, 68 taxa of invertebrates and four taxa of vertebrates. In addition, the park is inhabited by a large number of taxa endemic for Macedonia and the Balkans Peninsula, as follows: 46 taxa of higher plants, 89 invertebrates and 14 vertebrates (AVRAMOSKI et al. 2010). The importance of the Galicica National Park in terms of biodiversity has been acknowledged by numerous international nominations, such as: UNESCO World Heritage, Emerald Area, Important Plant Area, Prime Butterfly Area, and potential Natura 2000 Protected Area. For the Public Institution Galicica National Park this represents an additional incentive, but also an obligation, to preserve this natural wealth and leave it as a legacy for the generations to come.

In the implementation of its main general management objectives, such as: protection of natural values, visitor support, environmental education, and support of local communities, the Public Institution Galicica National Park has been conducted numerous activities, including training and research. A modern information and visitor centre has been developed (Fig. 2). With its natural rarities, rich plant and animal life, Galicica Mountain has been the focus of numerous studies and research projects of national and international scientific teams. Several projects devoted to IAS have been conducted in the region in the frame of the ESENIAS network, such as: "Climate change and invasive alien species – growing threats to biodiversity and ecosystem functionality in ancient Lake Ohrid and its watershed" (2012–2014), funded by the Royal Norwegian Embassy – Skopje/ Belgrade; the ESENIAS-TOOLS Case Study: "Assessment of the impact of alien species on the biodiversity and endemism of ancient Balkan lakes" (2015–2017), funded by the Financial Mechanism of the European Economic Area 2009–2014, Programme BG03 "Biodiversity and Ecosystem Services"; and "Invasive and alien species a real threat for the ancient Lake Ohrid (IASLO)" (2019–2020), funded by UNESCO.

ESENIAS & DIAS Conference organisers, topics and participants

The conference was organised by the Hydrobiological Institute Ohrid (HIO), Public Institution Galicica

National Park, ESENIAS, DIAS, and the Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences. It was supported by the Ministry of Education and Science of the Republic of North Macedonia and the Public Institution Galicica National Park. The following topics were covered:

1. Invasive alien species traits and trends – invasive alien species introduction and spread, biological and ecological traits; characteristics of recipient environment; invasive alien species and climate change;
2. Vectors and pathways for invasive alien species introductions – analysis, prioritisation, action plans;
3. The Danube River as invasive alien species corridor – priority species for the Danube Region, impact on threatened species, specificity of biological invasions in the Lower, Middle and Upper Danube River sections;
4. Invasive alien species impact – impact on biodiversity and ecosystem services, impact on human health, safety and the economy; pests and pathogens; adverse impact on protected areas, endangered species and habitats;
5. Invasive alien species prevention and management – early detection and rapid eradication, surveillance systems; risk assessment and horizon scanning; control measures; restoration of damaged ecosystems; education, citizen science, strategies, policy and legislation;
6. Management and sharing of IAS data – IAS networks and information systems, databases, data planning and management; and
7. Other topics – general aspects related to the quality of the aquatic and terrestrial environments and associated biological communities, which may influence the introduction and spread of IAS, as well as the application of prevention and management measures.

One hundred participants from 21 countries (Bulgaria, Croatia, Czech Republic, France, Georgia, Greece, Hungary, Italy, Latvia, Lithuania, Moldova, Montenegro, Republic of North Macedonia, Romania, Serbia, Spain, Turkey, UK, Ukraine, USA, and Vietnam) took part in the conference (Fig. 3).

ESENIAS & DIAS Conference outcomes

A total of 124 contributions, including six keynote presentations, 42 oral presentations and 76 posters were presented and published in the Book of Abstracts (TRAJANOVSKI et al. 2019). Selected full papers (10) presented at the conference and related to IAS plant species were published in the volume



Fig. 2. Public Institution Galicica National Park, information and visitor centre Prespa – Stenje (Photo: Teodora Trichkova).

of *Phytologia Balcanica* 25 (3) (VLADIMIROV 2019).

The current special issue of *Acta Zoologica Bulgarica* presents the results of the Joint ESENIAS and DIAS Scientific Conference and 9th ESENIAS Workshop *Species, Ecosystems and Areas of Conservation Concern under Threat from the Invasive Alien Species* related to IAS of animal species. It is the 4th volume of the series ESENIAS Scientific Reports. The volume comprises 22 contributions: 16 research articles, three review articles and three short communications, covering all conference scientific topics.

Ten of the contributions are related to invasive alien species traits and trends and the vectors and pathways for their introduction and spread, mostly in aquatic environments. YILDIZ & FEYZIOĞLU (2020) present data on the spatial and seasonal variation of the new invader, the cyclopoid copepod *Oithona davisae* (Ferrari F. D. & Orsi, 1984) (Cyclopoida: Oithonidae) in the Southeast Black Sea. Their results show that the abundance of *O. davisae* is higher in the coastal area compared to the offshore area. The mean abundance changes

with seasons and the autumn is the most productive period for this species. ARSLAN et al. (2020) give information about the distribution of the Ponto-Caspian species *Pontogammarus robustoides* (Sars, 1894) (Amphipoda) in the inland waters of Turkey. This species is reported from eight new localities in Turkey and for the first time from the Central Anatolia and Mediterranean regions. The results indicate that this species has expanded its distribution area in many freshwater systems in Turkey. MUNJIU et al. (2020) report on the distribution and characteristics of the invasive alien bivalve species *Sinanodonta woodiana* (Lea, 1834) (Bivalvia: Unionidae) in the Republic of Moldova. Their results demonstrate that this mussel species has successfully established population in the R. Moldova, spreading upstream in the Prut River basin with estimated rate of 15 km per year. The authors discuss certain competitive advantages of *S. woodiana*, such as phenotypic plasticity, regeneration capacity, early maturation, high density and biomass, and tolerance to a wide range of environmental factors, which may pose a high risk to the native unionid bivalves in the Lower



Fig. 3. Participants in the Joint ESENIAS and DIAS Scientific Conference and 9th ESENIAS Workshop *Species, Ecosystems and Areas of Conservation Concern under Threat from the Invasive Alien Species*, 06.09.2019, Galicica National Park (Photo: Milcho Todorov).

Prut River basin.

Two of the contributions focus on alien and invasive alien species of aquatic animals in Georgia. VADACHKORIA et al. (2020) present current data on the distribution and quantitative characteristics of four invasive alien species off the Black Sea Coast of Georgia: the ctenophores *Mnemiopsis leidyi* A. Agassiz, 1865 (Ctenophora: Tentaculata) and *Beroe ovata* Bruguière, 1789 (Ctenophora: Nuda), the crustacean *Amphibalanus improvisus* (Darwin, 1854) (Crustacea: Cirripedia) and the bivalve *Anadara kagoshimensis* (Tokunaga, 1906) (Mollusca: Bivalvia). Their results confirm that the four invasive alien species established stable populations off the Black Sea coast of Georgia and may play a key role as factors which influence the native biodiversity. JAPOSHVILI et al. (2020) report the first DNA-based records of new alien freshwater species in the Republic of Georgia. DNA barcodes (CO1) have been obtained from samples, which turned out to belong to the crustacean *Rhithropanopeus harrisii* (Gould, 1841) (Decapoda: Panopeidae) and the fish *Rhinogobius lindbergi* Berg, 1933 (Gobiiformes: Oxudercidae), detected in Georgia for the first time. Their results demonstrate the usefulness of the molecular methods for the identification of new species introductions that can play an important role in the early detection and the timely decision making.

Two of the articles present results on distribution and biological traits of invasive alien and translocated fish species in Turkey. INNAL & GIANNETTO (2020)

report on the occurrence of *Gambusia holbrooki* Girard, 1859 (Poeciliidae) in four Mediterranean river estuaries of Turkey: Manavgat, Göksu, Seyhan, and Ceyhan. Along with *G. holbrooki* and other alien species a total of 24 native species at juvenile stages are recorded. Some of them, such as the critically endangered *Anguilla anguilla* and the endemic goby *Pomatoschistus anatoliae*, are of particular conservation interest. Therefore, the authors conclude that the presence of *G. holbrooki* in the studied estuaries that could serve as recruitment areas for the populations of the sensitive native and threatened species may act as additional threat for their survival and may distort the ecological equilibrium of the river estuary ecotones. GENÇOĞLU et al. (2020) compare the growth performance of the marine, brackish and translocated freshwater populations of the sand smelt *Atherina boyeri* Risso, 1810 (Atherinidae) in Turkey. The age, body length and weight parameters of native populations of *A. boyeri* are studied at six locations in the Mediterranean Sea, Black Sea, Sea of Marmara, Aegean Sea, and one in Köyceğiz Lake lagoon. The same parameters of translocated inland populations are studied in two reservoirs (Aslantaş and Hirfanlı) and in two freshwater lakes (Eğirdir and İznik). The findings show that *A. boyeri* exhibit similar growth performance in the marine, brackish, and fresh water, indicating that this species is successful in adaptation to various environmental conditions that favours its invasive potential in Turkey.

KORNILEV et al. (2020) update the distribution

of the alien pond slider *Trachemys scripta* (Thunberg in Schoepff, 1792) in Bulgaria. The authors report observations of hatchlings of *T. s. elegans* from two consecutive years in Rupite Area and of two subadults at Velyov Vir (Ropotamo River, Black Sea coast), strongly suggesting successful breeding in the wild. Furthermore, they provide the first national ecological niche model for *T. scripta*, concluding that large potentially suitable areas exist throughout the country, especially at low altitudes. The authors discuss similarities in the climatic conditions between the native range and Bulgaria, suggesting that the species could likely survive and potentially reproduce across the country. STĂNESCU et al. (2020) provide an updated review regarding the presence of alien vertebrates in Romania (i.e., fish, reptiles, birds, and mammals), taking into consideration both published data and a selection of international, regional and national public online databases. The final list contains 46 alien vertebrate species for Romania, of which 17 are established, and 29 are considered casual. Fish are the most abundant group (29 species) representing 63% of all vertebrate species, followed by mammals (eight species), birds (seven species) and reptiles (two species).

CICEOI & GUTUE (2020) present a comprehensive review and updated list of host plants of *Tuta absoluta* (Meyrick, 1917) (Lepidoptera: Gelechiidae) worldwide and identify potential hosts for Romania. In total, plants belonging to 11 families, 27 genera and 64 species, including one species of Monocots clade, are reported as hosts of *T. absoluta* in the available literature. Most of those species (40) are weeds and/ or wild plants. Of all plant species, 33 are found in Romania and may serve as potential hosts of *T. absoluta*.

Four of the contributions present new data about the invasive alien species in the Danube River basin. TODOROV et al. (2020) report the first records of the magnificent bryozoan *Pectinatella magnifica* (Leidy, 1851) (Bryozoa: Plumatellida: Pectinatellidae) in the Bulgarian shoreline zone of the Danube River and the first records in Bulgaria. The species has been recorded at two sites during JDS4 (2019). Colonies of different size are found freely flowing or attached to the branches of fallen trees in an open canal near the town of Vidin (790 rkm). The species is also caught with fishing nets upstream of the village of Archar (771 rkm). ATANACKOVIĆ et al. (2020) present data on the range extension of the Ponto-Caspian polycheate *Manayunkia caspica* Annenkova, 1929 (Annelida: Fabriciidae) in the Danube River. The species extends its distribution upstream of the Iron Gate

to Central and Western Europe, with Klizska Nema (Slovakia/Hungary) as the most upstream locality, where it appeared to have established populations, making this species a regular component of the macroinvertebrate fauna along the entire stretch of the Danube River. ZORIĆ et al. (2020) summarise data on the distribution of the spiny-cheek crayfish *Faxonius limosus* (Rafinesque, 1817) (Decapoda: Cambaridae) in Serbian inland waters. In the period 2007–2019, the species has been detected at seven new localities along the main course of the Danube River and in all main tributaries – the rivers Sava, Tisa and Velika Morava, as well as the Danube–Tisa–Danube Canal (DTD Canal), which shows its rapid dispersal rate within the Danube River basin in Serbia. DJIKANOVIĆ et al. (2020) report on the diet of the invasive round goby (*Neogobius melanostomus* Pallas, 1811) (Gobiidae) in the Danube and Velika Morava Rivers in Serbia. The diet of this fish in the Velika Morava River consists mostly of Oligochaeta and Gammaridae, while its diet in the Danube River consists of larvae of Trichoptera and mollusks.

Under the topic on the invasive alien species impact, RADONJIĆ & HRNČIĆ (2020) make a comprehensive review of the arthropod pests of citrus plants in Montenegro. The survey results for the period 2002–2019 reveal 20 pest species from commercial citrus orchards, nurseries and individual trees in backyards and gardens in the Montenegro seacoast. They include five species of mites (Acari) and 15 species of insects (Hemiptera, Lepidoptera and Diptera). The three species recorded throughout the whole growing season, most widespread and with the highest abundance are *Aphis spiraecola*, *Phyllocnistis citrella* and *Planococcus citri*. *Ceratitidis capitata* is considered the most important pest for the fruit production, followed recently by *A. spiniferus*. The most damaging for the nursery production is *P. citrella*, followed by *P. citri* and *Dialeurodes citri*. CHIRECEANU et al. (2020) presents the results of three-year survey (2016–2019) on the presence and distribution of five invasive insect species on grapevine in Romania. The species *Erasmoneura vulnerata* (Fitch, 1851) is reported for the first time for Romania.

FĂTU et al. (2020) presents experimental field application of *Beauveria bassiana* (Bals.) Vuill. for control of the invasive sawfly *Aproceros leucopoda* Takeuchi, 1939 (Hymenoptera: Argidae) in Romania under the topic related to the invasive alien species prevention and management. The biological treatment based on *B. bassiana* applied in forests infested with *A. leucopoda* (larvae and eonymphs) lead to the reduction of *A. leucopoda* densities. The

blastospore suspension applied at three different sites induces the biological efficiency percentage levels in the range from 60% to 90% after 10 days. As a result, the defoliation of the elm trees registered at the treated plots is 2–5 lower than in the untreated plots.

Two of the contributions refer to other topics related indirectly to invasive alien species. INNAL et al. (2020) publish data on diversity and distribution of the ichthyofauna in the Göksu River Estuary, Turkey. A total of 47 fish species are identified in the coastal marine zone and 32 species in the river estuary in the period 2014–2017. *Chelon auratus*, *Chelon saliens* and *Mugil cephalus* are the dominant species and comprise over 75% of the total catch number. Marine fish dominate by species richness and abundance. Five alien species are caught in the estuary, of which *G. holbrooki* has the highest abundance. KALCHEVA et al. (2020) reports on the zooplankton diversity and its correlations with abiotic and biotic factors, including some alien species, in two lake-type wetlands, the Mocskos–Danube and the Riha, and the Danube River at Mohács, located in the protected side of the Béda-Karapanca National Park in the Middle Danube River, Hungary.

Three short communications present the first records of alien species in Bulgaria and Republic of North Macedonia. KONJEVIĆ (2020) presents the first records of the brown marmorated stink bug *Halyomorpha halys* (Stål, 1855) (Hemiptera: Pentatomidae) in Republic of North Macedonia: in the town of Gevgelija, situated close to the Greek border and in the capital Skopje. The transport as a stowaway and natural dispersal across borders are discussed as potential pathways of introduction. TOMOV (2020) reports the first record of the Japanese grape leafhopper *Arboridia kakogawana* (Matsumura, 1932) (Homoptera: Cicadellidae, Erythroneurini) in Bulgaria. It is detected on grapevines (*Vitis* sp.) at 16 localities mainly in the Northern Bulgaria and the Black Sea coast. Heavily infested plants are recorded only in towns along the Danube River – Nikopol, Ruse and Silistra. The current distribution pattern of the species in Bulgaria suggests that its dispersal is human-mediated and the main pathways are the transport of contaminant nursery material and transport – stowaway. TOMOV (2020) reports also on the first records of the walnut shield bearer *Coptodisca lucifluella* (Clemens, 1860) (Lepidoptera: Heliozelidae) in Bulgaria. The species is detected on the common walnut *Juglans regia* L. (Juglandaceae) at 36 localities in the urban and suburban areas in Bulgaria. Most probably the

moth has been introduced in Bulgaria by walnut plants imported for planting.

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