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ESTABLISHMENT OF THE INVASIVE PEST OF BAMBOO *DINODERUS JAPONICUS* LESNÉ, 1895 (COLEOPTERA BOSTRICHIDAE) IN THE CAUCASUS AND NOTES ON OTHER BEETLE SPECIES CURRENTLY ESTABLISHED IN THIS REGION(*) *A.N. Severtsov Institute of Ecology and Evolution, Leninskij pr. 33, Moscow 119071, Russia; e-mail: bienkowski@yandex.ru, marinaorlben@yandex.ru*Bieńkowski A.O., Orlova-Bienkowskaja M.J. – Establishment of the invasive pest of bamboo *Dinoderus japonicus* Lesné, 1895 (Coleoptera Bostrichidae) in the Caucasus and notes on other beetle species currently established in this region.

Dinoderus japonicus Lesné, 1895, a beetle native to East Asia, is firstly recorded in Russia and the Caucasus. In May 2016 three specimens of this serious pest of bamboo were collected in the thicket of *Phyllostachys* sp. in Sochi (near the Black Sea Coast in the South of European Russia), where bamboo is widely cultivated as an ornamental plant. Probably this record represents a successful establishment, since the likelihood of catching three individuals from a current introduction, rather than from a breeding population, is vanishingly small. *Dinoderus japonicus* was often intercepted in Europe, but did not establish until recently. However in 2012-2013 established populations were found in France and Italy. The record of one more population – in the Caucasus – indicates that the pest potentially could be established in any region of Europe, where bamboo is cultivated. Therefore, it is recommended to survey bamboo plantations in all regions for this pest. The populations of at least 14 alien beetle species have been firstly recorded in European Russia in Sochi since 2000. Special phytosanitary measures should be taken in this region to prevent future invasions.

KEY WORDS: *Dinoderus japonicus*, pest of bamboo, Japanese Shot-Hole Borer, exotic species, the Caucasus.

INTRODUCTION

Invasions of alien beetle species to Europe cause significant economic loss and are a major threat to biodiversity loss (KENIS & BRANCO, 2010). In the 21st century invasions of beetles from other regions, especially from Asia, is increasing dramatically (DENUX & ZAGATTI, 2010). Many beetle species naturalized in Europe in the last years. In particular, the Japanese Shot-Hole Borer *Dinoderus* (*Dinoderastes*) *japonicus* Lesné, 1895 (Coleoptera, Bostrichidae) recently established in France (BRUSTEL & ABERLENC, 2014) and in Italy (NARDI *et al.*, 2015). The first record of established population of this species in the Caucasus is reported herein. It is the third record of established population in Europe and the first record of *D. japonicus* in Russia.

Two species of *Dinoderus* were already known from Russia: *Dinoderus* (*Dinoderus*) *minutus* (Fabricius, 1775) and *Dinoderus* (*Dinoderus*) *bifoveolatus* (Wollaston, 1858). Both are alien. Only *D. minutus* is established, while *D. bifoveolatus* was only intercepted. Until recently, *D. japonicus* was not recorded from Russia (KRIVOLUTSKAYA, 1992).

MATERIALS AND METHODS

The collecting site of *D. japonicus* is located in the south of European Russia in the Northwest Caucasus near the Black Sea Coast (Krasnodar Krai, Sochi, Krasnoselskaya Str., 43.575921N, 39.761427E). The climate of Sochi is humid subtropical with a warm rainy winter and a sunny summer. The average annual temperature is +14.2 °C. The

average annual precipitation is 1703 mm. The coldest months in the city are January and February with an average temperature of +6.0 °C. The warmest month is August, its average daily temperature is + 23.6 °C.

Bamboo (*Phyllostachys aurea* and *P. bambusoides*) is widely cultivated in Sochi as an ornamental plant and often occurs outside plantations as an adventive plant. Probably bamboo became widely planted in Sochi after 1925, when the city became a resort.

Three adults of *D. japonicus* were collected in pitfall traps settled in a thicket of *Phyllostachys* sp. near houses. Trapping period spanned from 18 May to 23 May 2016. The species was identified referring to LESNÉ (1895), BOROWSKI & WĘGRZYNOWICZ (2012) and WALKER (2007).

DIAGNOSTIC CHARACTERS

The genus *Dinoderus* Stephens, 1830 contains 26 species grouped into two subgenera: *Dinoderus* s. str. with 22 and *Dinoderastes* Lesne, 1914 with 4 species (BOROWSKI & WĘGRZYNOWICZ, 2013). *Dinoderus japonicus* (Fig. 1) belongs to the subgenus *Dinoderastes* which differs from the subgenus *Dinoderus* s. str. in the following characters: first tarsomere long, at least as long as the next two together; distal tarsomere somewhat shorter than sum of others; ventral side of basal two tarsomeres with brushes of long setae (BOROWSKI & WĘGRZYNOWICZ, 2012). *Dinoderus japonicus* can be distinguished from other species of the subgenus *Dinoderastes* by following characters: antennae 11-jointed; elytral setae thin, on elytral declivity apically pointed; prescutellar depressions on pronotum very shallow, hardly discernible; median two dents on anterior margin



Fig. 1 – *Dinoderus japonicus* captured in Sochi, Krasnodar Krai, South of European Russia. Photo is taken by K.V. Makarov.

large, much larger than others, close to one another and produced forwards; body dark, chestnut-brown or black (BOROWSKI & WĘGRZYNOWICZ, 2012).

DISCUSSION

Species of the subgenus *Dinoderus* s. str. feed on Palmaceae, Anacardiaceae, Caricaceae, Bambusoideae, Dipterocarpaceae, Euphorbiaceae, Convolvulaceae, some species are polyphagous. Species of the subgenus *Dinoderastes* feed on Bambusoideae, Annonaceae and Dipterocarpaceae. Four species of the genus are related with bamboo: *D. brevis*, *D. japonicus*, *D. ocellaris* and *D. minutus*. Seven species of the genus *Dinoderus* are recorded in Europe: *Dinoderus (Dinoderus) bifoveolatus* (Wollaston, 1858), *Dinoderus (Dinoderus) distinctus* Lesné, 1897, *Dinoderus (Dinoderus) minutus* (Fabricius, 1775), *Dinoderus (Dinoderus) ocellaris* Stephens, 1830, *Dinoderus (Dinoderus) porcellus* Lesné, 1923, *Dinoderus (Dinoderus) brevis* Horn, 1878, and *Dinoderus (Dinoderastes) japonicus* (BOROWSKI, 2007; BOROWSKI & WĘGRZYNOWICZ, 2012; NARDI *et al.*, 2015). All are alien. *Dinoderus ocellaris*, *D. minutus* and *D. bifoveolatus* have established in Europe as well as in other continents outside their native ranges and became almost cosmopolitan. *D. distinctus*, *D. porcellus* and *D. brevis* were only intercepted. *Dinoderus bifoveolatus* is a polyphagous species, which is often introduced with grains, mainly with rice. *Dinoderus minutus*, *D. brevis* and *D. ocellaris* feed on bamboo and are often introduced with bamboo products. *Dinoderus porcellus* feed on palm trees. Host plant of *D. distinctus* is unknown.

Dinoderus japonicus is frequently intercepted outside its native Asian range from imported bamboo, rattan and bamboo products (ZHI LIN *et al.*, 2009). It was intercepted in the USA, Australia and at least in 9 European countries: Austria, Sweden, Switzerland, Great Britain, the Netherlands, Germany, Poland, France and Italy (BURAKOWSKI *et al.*, 1986; BOROWSKI, 2007; BOROWSKI & WĘGRZYNOWICZ, 2012; BRUSTEL & ABERLENC, 2014; NARDI, *et al.*, 2015). But no established populations were recorded in Europe before 2012 (BOROWSKI & WĘGRZYNOWICZ, 2012). In 2012 an established population was recorded in France: Muret (Haute-Garonne) (BRUSTEL & ABERLENC, 2014). In 2013 a specimen of *D. japonicus* was collected with a trap in Italy: Veneto Region, Treviso Province, which probably indicated the existence of another established population (NARDI *et al.*, 2015). Probably the record of *D. japonicus* in the Caucasus represents a successful establishment, since the likelihood of catching three individuals from a current introduction, rather than from a breeding population, is vanishingly small. Therefore, the population in the Caucasus found in 2016 is the third one in Europe. It seems that the species begins to establish in the regions of Europe, where bamboo is planted as an ornamental plant.

Why did *D. japonicus* begin to establish in Europe in the last years, if it did not establish before? It corresponds to the general current tendency of dramatic increase of insect invasions from Asia caused by the increase of import from this region (DENUX & ZAGATTI, 2010). It is known that ecological resistance of native ecosystems can be overwhelmed by the increase of propagule pressure (HOLLE & SIMBERLOFF, 2005). So it is possible that the increase the rate of introduction of *D. japonicus* from Asia has increased

the probability of its establishment. Therefore, it is recommended to survey bamboo plantations in different regions of Europe for this pest.

Dinoderus japonicus was originally described from Japan (LESNÉ, 1895). In Asia this species occurs also in Korea and China: Hong Kong, Kiangsi, Zhejiang, Yunnan, Taiwan (CHANG *et al.*, 1979; BELOKOBYLSKIJ, 2008; BOROWSKI & WĘGRZYNOWICZ, 2012; PARK *et al.*, 2015). *Dinoderus japonicus* is one of the most important pests of bamboo in China (CHANG *et al.*, 1979). It develops in sprouts, especially of the genera *Phyllostachys* and *Pleioblastus*, damages also harvested culms and finished bamboo products (WALKER, 2007; BOROWSKI & WĘGRZYNOWICZ, 2012). Bamboo is not of the great economic importance in Europe. But this Bostrichid occasionally damages stored grain, paddy and maize (YAN *et al.*, 2010). So it is not excluded that if the species becomes abundant, it could become a pest of stored products as *D. minutus*.

Currently invasions of pest insects are common in the Northwest Caucasus in the vicinity of Sochi. In 2000-2016 established populations of at least 13 other alien beetle species were firstly recorded in European Russia in this region.

Xylosandrus germanus (Blandford, 1894) (Curculionidae: Scolytinae) was first recorded in 2000 (MANDELSHTAM, 2000). It is a xylophagous beetle, pest of different deciduous and coniferous trees. This pest is native to Japan, China and Vietnam and spreading in Europe since 1951 (RABITSCH & SCHUH, 2002). It could have been introduced to the Caucasus with imported wood.

Megabruchidius tonkineus (Pic, 1904) and *M. dorsalis* (Fåhræus, 1839) (Chrysomelidae: Bruchinae) were first recorded in 2005 and 2013 respectively (KOROTYAEV, 2011; 2015). They are native to Asia and established in the south of Europe. Both species develop in seeds of *Gleditsia* and could have been introduced from Europe with these seeds.

Harmonia axyridis (Pallas, 1773) (Coccinellidae) is native to East Asia. It was used for biological control of aphids and other pests all over the world and become almost cosmopolitan. Established population of this species was first recorded in the Caucasus in 2012. It is suggested that it could have appeared as a result of natural dispersal from the West or originated from specimens released in this region for biocontrol of pest (BELYAKOVA & REZNIK, 2013; UKRAINSKY & ORLOVA-BIENKOWSKAJA, 2014).

Stelidota geminata (Say, 1825) (Nitidulidae) is native to North America and spreading in Europe at least since the 1980th. It was first recorded in the Caucasus in 2013 (TSINKEVICH & SOLODOVNIKOV, 2014). In Europe this beetle occurs on decaying fruits on the ground and is not regarded as a pest, though in its native range it is the pest of strawberry. Probably it was introduced to the Caucasus with imported fruits.

Epitrix hirtipennis (Melsheimer, 1847) (Chrysomelidae) is a pest of tobacco and other plants of the family Solanaceae. It is native to South America and south of North America and established in South Europe in the 1980th. This pest could have been introduced to the Caucasus with seedlings, because its larvae develop on roots. It was first recorded in the Caucasus in 2013 (ORLOVA-BIENKOWSKAJA, 2014).

Rhynchophorus ferrugineus (Olivier, 1791) (Dryophthoridae) is a pest of palm trees. It is native to Oriental region and established in South Europe. Apparently it was introduced with imported seedlings of palms. It was first recorded in the Caucasus in 2014 (ZHURAVLEVA & KARPUN, 2014).

Luperomorpha xanthodera (Fairmaire, 1888) (Chrysomelidae) is a pest of flowers. It is native to China and Korea and established in Europe. Adults feed on flowers, the larvae develop on roots (DEL BENE & CONTI, 2009; BEENEN & ROQUES, 2010). So larvae could be introduced with seedlings. The pest was first recorded in the Caucasus in 2016 (BIENKOWSKI & ORLOVA-BIENKOWSKAJA, article in press).

Medythia nigrobilineata (Motschulsky, 1861) (Chrysomelidae) is a pest of soybeans native to East Asia. It was first recorded in the Caucasus in 2016 and could have been unintentionally introduced with soybean seeds (BIENKOWSKI & ORLOVA-BIENKOWSKAJA, article in press).

Lamprodila festiva (Linnaeus, 1767) (Buprestidae) is a xylophagous beetle feeding on Cupressaceae. This pest native to Mediterranean region and South Europe was first recorded in the Caucasus in 2013 (KARPUN & VOLKOVITSH, 2016). Probably it was introduced with seedlings.

Arthrolips fasciata (Erichson, 1842) (Corylophidae) native to Tasmania, Australia and New Zealand, *Silvanoprus cephalotes* (Reitter, 1876) (Silvanidae) widely distributed in the Oriental and Papuan regions and also in the Palaearctic Far East, and *Psammoecus trimaculatus* Motschulsky, 1858 (Silvanidae) originated in the Oriental Region are associated with decaying plant substrates and could be introduced with such substrates. These species were first recorded in the Caucasus in 2014 (KOVALEV, 2016).

Probably some species, in particular *Rhynchophorus ferrugineus*, *Luperomorpha xanthodera* and *Lamprodila festiva*, could have been unintentionally introduced with ornamental seedlings imported from Europe when landscaping the city just before the 2014 Sochi's Olympic Games. Invasion of other species does not seem to be connected with these Olympic Games, but probably reflects the increase in import of goods, especially from China and other countries of East Asia. It is known that some regions in Europe are more prone to invasion of alien insects than others (DENUX & ZAGATTI, 2010). Current data show that introduced insects could easily establish in the Black Sea shore of the Caucasus. So special quarantine measures should be taken in this region, where the risk of pest insect invasions is high.

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