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INVASIVE BRUCHID SPECIES *BRUCHIDIUS SILIQUASTRI* DELOBEL,
2007 AND *MEGABRUCHIDIUS TONKINEUS* (PIC, 1914)
(INSECTA: COLEOPTERA: CHRYSOMELIDAE: BRUCHINAE)
NEW IN THE FAUNA OF SERBIA – REVIEW OF THE DISTRIBUTION,
BIOLOGY AND HOST PLANTS

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Abstract

Two invasive bruchid species – *Bruchidius siliquastri* Delobel, 2007 and *Megabrchidius tonkineus* (Pic, 1914) – found on Mt. Fruška Gora during 2011 and 2012 were recorded for the first time in Serbian fauna. Originating from Asia, these beetles were accidentally introduced into Europe. Data on their introduction into Serbia, distribution, biology and host plant associations are presented and discussed.

KEY WORDS: Bruchinae, invasive, Serbia, distribution, biology, host plants

Introduction

Seed beetles or weevils are small beetles with worldwide distribution. Approximately 1400 species from 58 genera have been described (BUKEJS, 2010). This phytophagous group of insects has the greatest diversity in tropical and subtropical regions. They have a significant economic importance since a large number of species feed on agriculturally important plants and stored products (SOUTHGATE, 1979). Recently bruchids have often been placed in the family Chrysomelidae as subfamily Bruchinae, although they have historically been treated as a separate family.

The presence of two invasive bruchid species – *Bruchidius siliquastris* Delobel, 2007 and *Megabruchidius tonkineus* (Pic, 1914) – was recorded for the first time for Serbia. They were collected on Mt. Fruška Gora during the years 2011 and 2012. Both species originate from eastern and southeastern parts of Asia and were accidentally introduced into Europe, likely brought in on imported decorative plants.

This study aims to investigate the process of introduction of the two mentioned species and the likely scenario of their arrival in Serbia. Known information on their distribution, life cycle, potential economic importance and their ability to adapt to new host plants in Serbia is given.

Material and Methods

Imagines of the species *Bruchidius siliquastris* Delobel, 2007 were first collected on 23 August 2011, and those of *Megabruchidius tonkineus* (Pic, 1914) on 31 August 2012. Both species were found on the slopes of Mt. Fruška Gora (Vojvodina Province). Individuals of *B. siliquastris* Delobel, 2007 were hand-collected from pods of *Cercis siliquastrum* L. at the Rakovac locality, while those of *M. tonkineus* (Pic, 1914) were gathered from pods of *Gleditsia triacanthos* L. at Sremska Kamenica park.

Insects were temporarily preserved in ethanol and later were mounted as dry specimens on entomological pins or glued on paper cards. Identification was done on the basis of the morphological determination characters that can be found in numerous taxonomic and faunistic papers (GYÖRGY, 2007; KERGOAT *et al.*, 2007; YUS RAMOS, 2009; KOROTYAEV, 2011; GYÖRGY & GERMANN, 2012). Entomological material is deposited in the private collection of the first author.

Results and Discussion

In Serbia, the species *Bruchidius siliquastris* Delobel, 2007 and *Megabruchidius tonkineus* (Pic, 1914) are currently only known from Mt. Fruška Gora. There is also an unconfirmed finding of *B. siliquastris* in the vicinity of Subotica. It is believed that both species have a wider distribution in the country, although this has yet to be confirmed by future investigations.

Insects were probably accidentally introduced into Serbia with the seeds of their host plants. Considering that both species have become established in Hungary, it is most likely that they originate from that country. Taking into account the large number of specimens encountered in the field it is assumed that the two species have possibly been present in Serbia for several years.

Bruchidius Schilsky, 1905

Genus *Bruchidius* Schilsky, 1905 includes about 300 species distributed mostly in the Palaearctic region. Certain species have been transported to other parts of the world (KINGSLOVER, 2004). The majority of the species feeds on plants of the family Fabaceae and on Apiaceae and Asteraceae (BOROWIEC, 1987; GYÖRGY & GERMANN, 2012).

Species *Bruchidius siliquastris* was first discovered in France (Montpellier) in 2003 (KERGOAT *et al.*, 2007). It was found to feed on seeds of the genus *Cercis* L. KERGOAT *et al.* (2007) mentioned that it was accidentally introduced from China – where it is native – to Europe. It is currently known that species have established in

France (2003), Hungary (2005), Bulgaria (2009) and Spain (2009) (KERGOAT *et al.*, 2007; YUS RAMOS *et al.*, 2009a; STOJANOVA *et al.*, 2011).

Genus *Cercis* L. (Fabaceae: Caesalpinioideae) comprises about 10 species spread through North America, China, Central Asia and Europe. *Cercis siliquastrum* L., also known as the Mediterranean redbud or Judas tree, inhabits regions with a temperate climate. This tree, which grows up to 13 m high, is grown in parks and gardens as an ornamental plant. In Serbia it is encountered in many urban environments. *Cercis siliquastrum* L. was probably the main vector for the introduction of *Bruchidius siliquastris* into Serbia and many other countries. The plant sheds its leaves during autumn. Reddish flowers are formed during spring from April till May. Its fruit is a pod that matures during the summer months and starts to dry out and wither in the autumn. In this dried state pods can remain on a tree for a very long time. They fall to the ground under the influence of wind. Seeds are available to bruchids during many months of the year.

It is believed that the oligophagous species *Bruchidius siliquastris* Delobel, 2007 primarily feeds on the Oriental species of the genus *Cercis* L. and that host-switching to *C. siliquastrum* L. occurred recently (KERGOAT *et al.*, 2007). Besides *C. siliquastrum* L. this bruchid is also known to feed on the following plant species in Europe: *Cercis chinensis* Bunge (originating from East Asia), *C. griffithii* Boiss. (from southern parts of central Asia) and *C. occidentalis* A. Gray (from California) (STOJANOVA *et al.*, 2011). In Serbia the species was recorded only from *C. siliquastrum* L.

In nature there is one generation per year. After overwintering imagines appear during spring. They feed on the pollen and nectar of flowers. This kind of nutrition allows for the maturation of gonads. Mating occurs at the end of spring but can continue during the entire summer until autumn. Eggs are deposited in groups of 4–9 on the inside walls of pods, mainly along the mid-rib. During oviposition females release pheromones that suppress other females from laying eggs on the same pod. Larvae hatch after seven days. Most of the larvae hatch during summer when pods have ripened. Shortly after hatching larvae bore into seeds. There is usually only one larva per seed, but one seed can support two larvae. Numerous larvae that bore into the same seed most often die as a result of intraspecific competition. Most seeds that we inspected had only one hole which marks the presence of only one larva inside. Most of the total number of examined seeds were damaged by the insects. Larvae that hatch later during the season have difficulties penetrating the hard integument of dry older seeds and they can die of hunger. During development larvae enlarge the chamber inside the seed. There are four larval instars. Development lasts for 20 days. Pupation inside the seed progresses through stages of prepupa and pupa. Prepupa is an inactive stage of the fourth larval instar in which imaginal organs – that later develop in pupa – haven't yet differentiated. Pupal development lasts for about 10 days. Imagines of the new generation appear at the end of summer and the beginning of autumn. In Serbia a new generation of imagines was recorded at the end of August. After eclosion imagines need to burrow their way out of the pods or, if the seeds have fallen out of the pods and dropped to the ground, they leave the seeds directly. At Rakovac insects were collected as they were leaving the pods (Fig. 1). Numerous specimens were seen on pods on the trees and on the ground. It seems that imagines undergo eclosion simultaneously and appear in nature in great numbers. *Bruchidius siliquastris* beetles overwinter in sheltered locations – under fallen leaves, tree bark, stones, etc. It is possible – although it rarely happens – that mating occurs at the beginning of autumn, so that with the coming of cold weather development halts at the stage of larva or pupa and continues the following spring (YUS RAMOS *et al.*, 2009b).

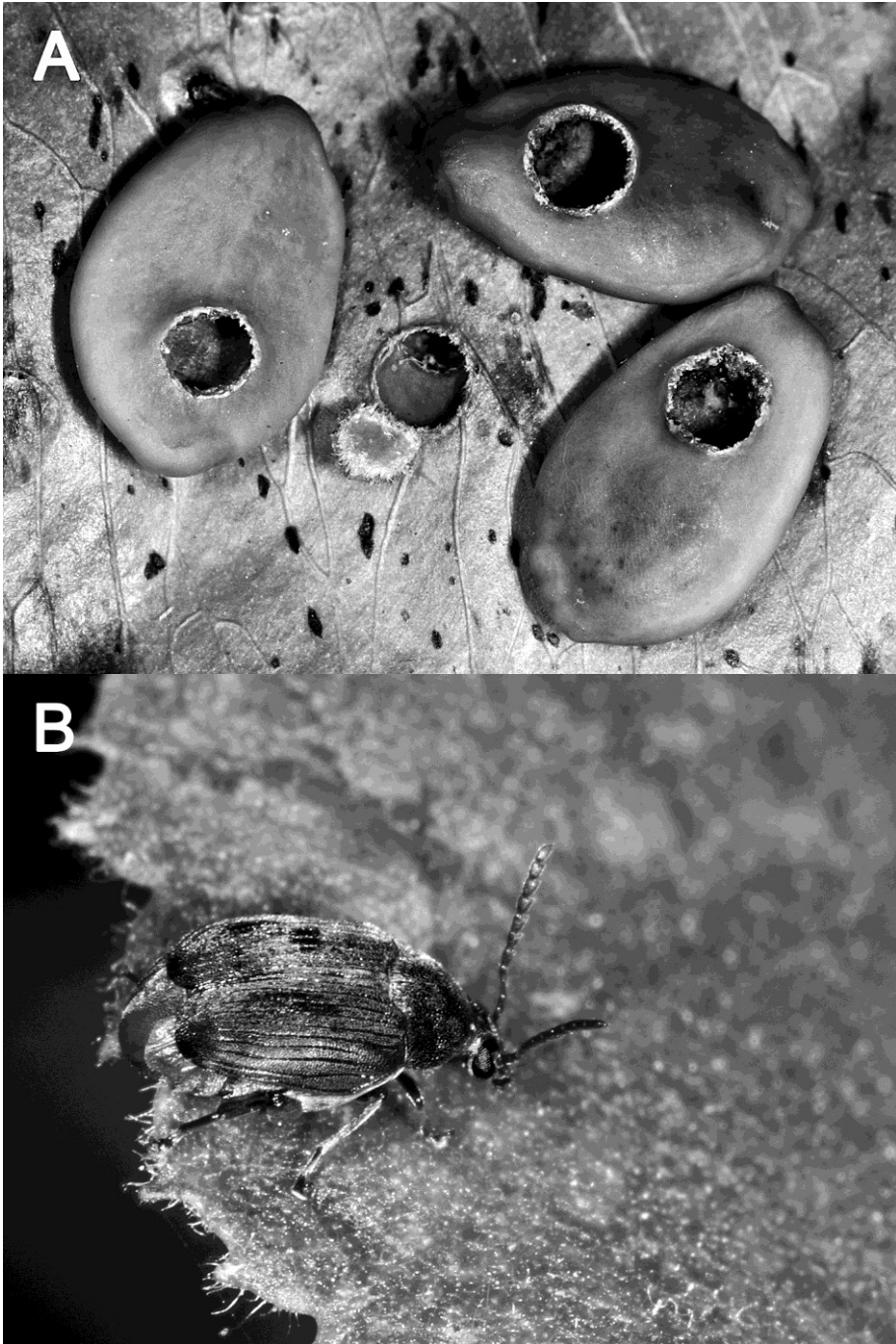


Figure 1. A – Exit holes made by imagines of *Bruchidius siliquastrae* Delobel, 2007 as they were leaving their pupal chambers inside the seeds and pods of *Cercis siliquastrum* L.; B – *Bruchidius siliquastrae* Delobel, 2007 imago.

Many different species of Hymenoptera parasitize various developmental stages of *Bruchidius siliquastri* Delobel, 2007. Although not observed during this study, the following parasitoid taxa were mentioned in literature: Ceraphronidae, Braconidae, Eulophidae, Eupelmidae (*Eupelmus urozonus* Dalman, 1820), Eurytomidae (*Bruchophagus* sp.) and Pteromalidae (*Dinarmus acutus* Thomson, 1878, *D. italicus* (Masi, 1922), *Mesopolobus* sp.) (STOJANOVA *et al.*, 2011).

Megabruchidius tonkineus (Pic, 1914)

Megabruchidius Borowiec, 1984 is an Oriental genus with three or four species (KOROTYAEV, 2011; YUS RAMOS, 2009). They feed on plants of the family Fabaceae.

Megabruchidius tonkineus (Pic, 1914) is autochthonous to southeast and east Asia. The species was originally described from Vietnam from where it was introduced into Europe. It is currently established in France, Germany, Switzerland, Hungary, Greece, Bulgaria and European parts of Russia (WENDT, 1980; JERMY & SZENTESI, 2002; JERMY *et al.*, 2002; STOJANOVA, 2007; YUS RAMOS, 2009; GYÖRGY & GERMANN, 2012). The species is also possibly present in South America (Argentina and Chile) (YUS RAMOS, 2009). Insects feed on plants of the genus *Gleditsia* L. In Vietnam they feed on seeds of *Gleditsia australis* Hemsley, while in Europe they burrow into the seeds of *G. triacanthos* L. – most likely a recent adaptation (GYÖRGY & GERMANN, 2012). Specimens were collected from pods in the Sremska Kamenica Park. Currently this is the only known host plant for this bruchid species in Serbia.

Genus *Gleditsia* L. (Fabaceae: Caesalpinioideae) comprises 12 species that inhabit North America and Asia. *Gleditsia triacanthos* L. originates from North America, but was introduced to other parts of the world as an ornamental plant. In Europe it is grown in parks and gardens. In Serbia it can be found in urban environments. This decorative tree can grow up to 20–30 m high. Flowers that appear at the end of spring are cream-colored and strongly scented. The fruit is an elongated flat pod that matures in early autumn.

Megabruchidius tonkineus (Pic, 1914) has one generation per year. Imagines spend the winter in the state of diapause. During spring they feed on the pollen and nectar of flowers and shortly thereafter they mate. About 7 days later the females lay eggs. They use ovipositor to deposit the eggs on the inside wall of the pod near the seeds. Eggs are laid on pods on the trees and on pods that have fallen on the ground. After 15–20 days, larvae hatch from the eggs during summer and burrow through the pods to feed on the seeds. Usually only one larva and rarely two feed inside one seed. A new generation of imagines emerges at the end of summer. They need to bore holes in the pod's wall to make their way out. The emergence of this new generation was recorded in Sremska Kamenica (Fig. 2). Only the pods on the ground under the trees were examined. In the autumn imagines search for suitable overwintering sites. It is known that *M. tonkineus* (Pic, 1914) can tolerate very low temperatures during winter (below -20°C) (GYÖRGY, 2007).

Both species have little economic significance. In Serbia they occur on decorative plants that grow mostly in community parks. Larvae can damage a significant amount of seeds a plant can produce – a fact observed during collection. Imagines seem to feed primarily on the pollen and nectar of flowers and pod sap, but usually do not damage the plant. It is unknown whether two analyzed bruchids can adapt to new host plant species present in the Serbian flora. They could eventually use pollen and nectar of some indigenous plants. Distribution of bruchids is currently restricted to Vojvodina Province but further analysis of these two species is needed to determine their dispersal and nutritional trends.

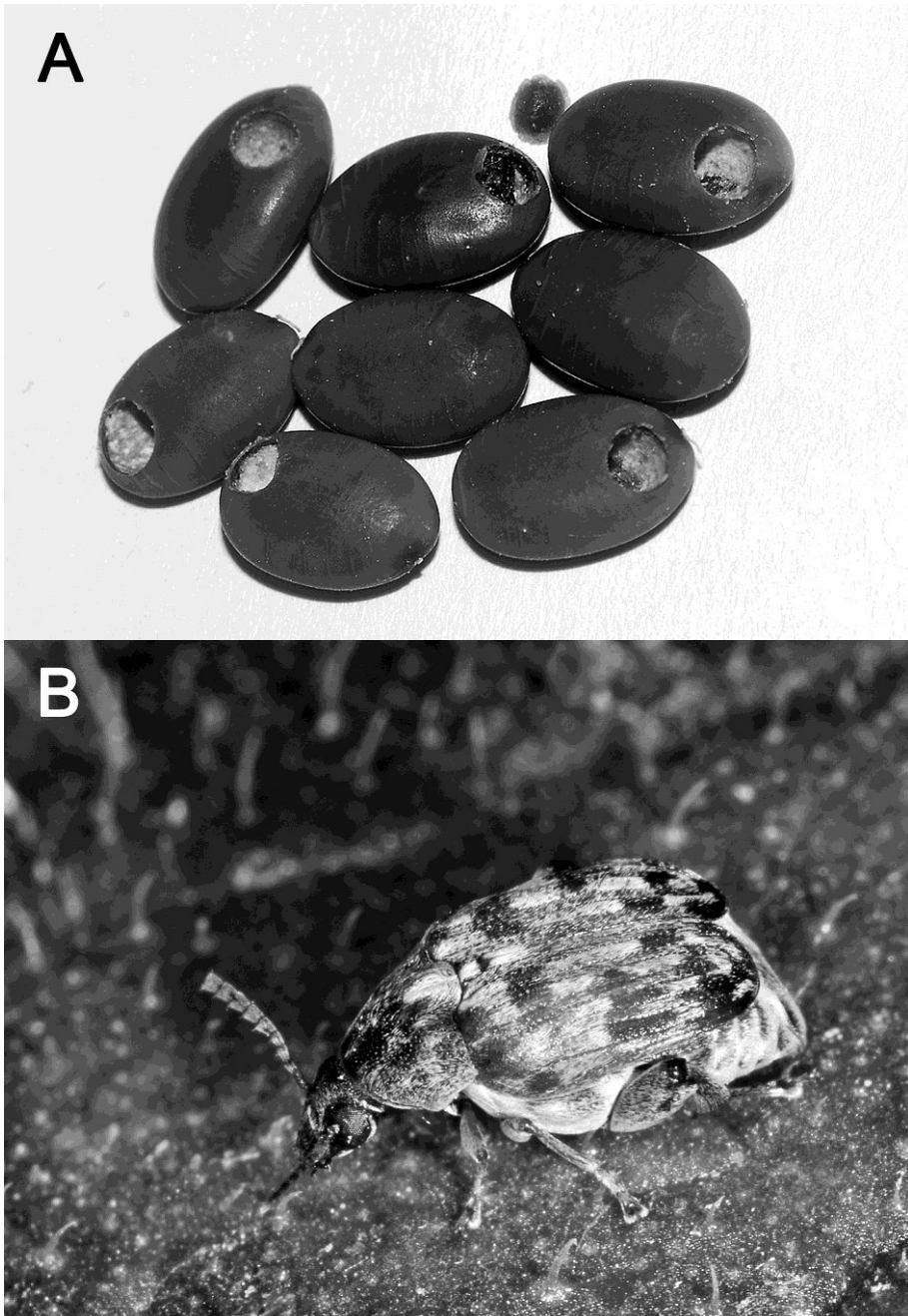


Figure 2. A – Holes on the seeds of *Gleditsia triacanthos* L. left after emergence of the new generation of *Megabruchidius tonkineus* (Pic, 1914) imagines; B – *M. tonkineus* (Pic, 1914) imago.

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ИНВАЗИВНЕ ВРСТЕ BRUCHINAE - *BRUCHIDIUS SILIQUASTRI*
DELOBEL, 2007 И *MEGABRUCHIDIUS TONKINEUS* (PIC, 1914)
(INSECTA: COLEOPTERA: CHRYSOMELIDAE: BRUCHINAE)
НОВЕ ЗА ФАУНУ СРБИЈЕ – ПРЕГЛЕД ДИСТРИБУЦИЈЕ,
БИОЛОГИЈЕ И БИЉАКА ХРАНИТЕЉКИ

БОЈАН ГАВРИЛОВИЋ И ДРАГИША САВИЋ

Извод

Присуство две инвазивне врсте *Bruchidius siliquastri* Delobel, 2007 and *Megabruchidius tonkineus* (Pic, 1914) је забележено на Фрушкој Гори током 2011. и 2012. године. Обе врсте до сада нису констатоване у фауни Србије. Врсте су пореклом из Азије и случајно су интродуковане у Европу. Приказани су и продискутовани подаци о интродукцији ових врста у Србију, њиховој дистрибуцији, биологији и биљкама хранитељкама.

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