

# First Record of Biocontrol Agent *Torymus sinensis* (Hymenoptera; Torymidae) in Bosnia and Herzegovina

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## ABSTRACT

**Background and Purpose:** *Dryocosmus kuriphilus* is an invasive insect species of sweet chestnut (*Castanea* spp.) originating from China, and the only effective control measure against this pest is classical biological control with introduced parasitoid *Torymus sinensis*. This parasitoid has been widely released in many European countries, but it also has the ability to rapidly spread naturally. No official releases have been done in Bosnia and Herzegovina.

**Material and Methods:** *D. kuriphilus* galls were collected in July 2017 on 6 localities in forest district Unsko (Una Sana canton) in Bosnia and Herzegovina. Presence and parasitism rates of *T. sinensis* were recorded in the entomological laboratory, Croatian Forest Research Institute. *T. sinensis* larvae were identified morphologically and by being compared with the voucher specimens.

**Results and Discussion:** *Torymus sinensis* larvae were positively identified in the examined *D. kuriphilus* galls from all localities in Bosnia and Herzegovina. Parasitism rates ranged from 44.83 to 74%. Occurrence and high parasitism rates in Bosnia and Herzegovina observed in this study are not results of biocontrol releases of *T. sinensis*, but can be attributed to natural spread from Croatia. High parasitism rates observed in this study can indicate that the parasitoid was present in Bosnia and Herzegovina in 2016.

**Conclusions:** This study presents the first record of *Torymus sinensis* in Bosnia and Herzegovina. We predict that the parasitoid will continue its spread over Bosnia and Herzegovina in sweet chestnut forests and orchards and that it will act as effective biological control agent against *D. kuriphilus*.

**Keywords:** parasitoid, invasive species, *Dryocosmus kuriphilus*, natural spread, classical biological control, parasitism rate.

## INTRODUCTION

*Dryocosmus kuriphilus* Yasumatsu (Hymenoptera; Cynipidae) is an invasive insect species, originating from China, which has spread in sweet chestnut (*Castanea* spp.) forests and orchards around the world [1]. In Europe, it has been first introduced to Italy [2] and from there it spread to the majority of European countries [1]. In Bosnia and Herzegovina *D. kuriphilus* was first recorded in 2015 in Una Sana canton [3]. *D. kuriphilus* is regarded as a serious threat to chestnuts, especially to fruit production [4] and crown leaf area loss [5]. Parasitoid *Torymus sinensis* Kamijo [Hymenoptera; Torymidae] has successfully been used as a classical biological control agent against *D. kuriphilus* and

it has been released in biocontrol campaigns in Japan, the USA, Italy, France, Slovenia, Croatia and Hungary [6, 7, 8, 9, 10, 11]. *Torymus sinensis* is native to China, phenologically well synchronised with *D. kuriphilus*, it is highly specific, and lowers the outbreak levels of its host [9, 12, 13]. This parasitoid has shown high dispersal ability by being able to cover more than 70 km in only a few days aided by wind [13]. Croatia has done extensive biocontrol releases of *T. sinensis* since 2014, and apart from releases, the parasitoid has also rapidly spread from Italy over Slovenia to Croatia and has built a viable population with parasitism rates up to 90% [11, 14]. Based on this experience, we have expected

*T. sinensis* to spread towards Bosnia and Herzegovina. Bosnia and Herzegovina has so far done no official releases of *T. sinensis* on its territory.

The aim of this paper is to report first record of biocontrol agent *T. sinensis* and its parasitism rates in sweet chestnut (*Castanea sativa* Mill.) forests of Bosnia and Herzegovina.

## MATERIALS AND METHODS

*D. kuriphilus* galls were collected in July 2017 on 6 localities in forest district Unsko (Una Sana canton) in Bosnia and Herzegovina (Table 1). The galls were collected from randomly selected sweet chestnut trees from a height of 1.5-2.5 m. From each locality a sample of 100 galls was taken. Each gall from the sample was sliced open and examined under a binocular microscope Olympus SZX7 in entomological laboratory, Croatian Forest Research Institute. In dissected galls, larval chambers, the number of *T. sinensis* larvae, *D. kuriphilus* larvae and pupae (if present), and other parasitoid larvae were counted and parasitism rates were calculated: PR = (the number of *T. sinensis* specimens/the number of *D. kuriphilus* larval chambers) × 100 (%). *T. sinensis* larvae were identified morphologically [11, 15] and by being compared with the voucher specimens deposited at the Department for Forest Protection, Croatian Forest Research Institute. The larvae were stored in absolute ethanol at -20°C in entomological laboratory, Croatian Forest Research Institute, for further analyses.

## RESULTS AND DISCUSSION

*Torymus sinensis* larvae were positively identified in examined *D. kuriphilus* galls from all six localities. Parasitism rates ranged from 44.83 to 74% (Table 1).

The results of our study show presence of *T. sinensis* in Bosnia and Herzegovina. Occurrence and high parasitism rates in Bosnia and Herzegovina observed in this study (Table 1) are not results of biocontrol releases of *T. sinensis*, but can be attributed to natural spread [13, 14]. This biocontrol agent spread naturally from Croatia over interconnected sweet chestnut forests and wooded chestnut patches bordering Croatia and Bosnia and Herzegovina in Una Sana canton. It has already been documented that *T. sinensis* is rapidly spreading naturally eastwards from Italy all over Croatia [14]. This rapid natural spread was additionally assisted by releases from laboratory rearing in Croatia in the area near the border with Bosnia and Herzegovina in 2016 and 2017 [14]. High parasitism rates observed in this study can indicate that the parasitoid was present in Bosnia and Herzegovina in 2016, but was not sampled and identified. We predict that the parasitoid will continue its spread over Bosnia and Herzegovina in sweet chestnut forests and orchards and that it will act as effective biological control agent against *D. kuriphilus*, lowering its population and damages in sweet chestnut forests.

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**TABLE 1.** Localities, coordinates and parasitism rates of *Torymus sinensis* for the samples taken in Una Sana canton, Bosnia and Herzegovina, in 2017.

Locality name (management unit/compartment/locality)	WGS coordinates (x; y)	<i>Torymus sinensis</i> parasitism rates (%)
Gomila/54/Projsa	15,960596; 44,979998	44.83
Gomila/61/Pivnice	15,995468; 45,001145	53.75
Baštra-Čorkovača/50/Čorkovača	16,143863; 45,060535	51.98
Glinica/22/Radoč	16,118054; 45,078491	61.64
Glinica/46/Zaradostovo	16,062802; 45,074912	65.43
Kladušnica/24/Šiljkovača	15,785067; 45,150493	74.00

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