

Records of the mountain cicada *Cicadetta montana* (Scopoli, 1772) (Hemiptera, Cicadidae) from Estonia

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We here present the first records of the mountain cicada *Cicadetta montana* (Scopoli, 1772) from Estonia. The species was first detected in 2014, despite the fact that the Estonian Hemipterologist Juhan Vilbaste presumed the occurrence of the species in the country many decades ago. The only known population of this remarkable species is located in the eastern part of Estonia. Recent field surveys (2014–2016) from the locality revealed that the population of *C. montana* is abundant. A total of 503 exuviae were gathered in 2016. The species inhabits the area of an old abandoned gravel-pit situated in a forested landscape.

Key words: *Cicadetta montana*, mountain cicada, distribution, habitat, Estonia.

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Introduction

The genus *Cicadetta* (singing cicadas) occurs in Europe with 13 species but only one member of the genus inhabits Northern Europe – the species being *Cicadetta montana* (Scopoli, 1772) (Nast 1987). However, some recent studies with bioacoustic techniques have shown that there are at least ten different closely related species in Europe belonging to the *C. montana* species complex (e.g. Goala *et al.* 2008).

Cicadetta montana s.l. is distributed throughout most of Europe and in some parts of Asia. According to the most recent checklist from Northern Europe, the species occurs in Norway, Sweden and Finland, but also in the Leningrad region and Russian Karelia (Söderman *et al.* 2009). According to Söderman *et al.* (2009), the species is not recorded from the Baltic States,

even though Lithuanian records exists (Švitra 2007).

This remarkable insect is considered a threatened species in large parts of Europe and therefore the mountain cicada is included in many regional Red Lists. For example, in Sweden and Norway *C. montana* is considered as Near Threatened (NT) (ArtDatabanken 2015, Ødegaard *et al.* 2015) and in Finland as Endangered (EN) (Rassi *et al.* 2010). In Lithuania *C. montana* is included in the Lithuanian Red Data Book as a rare species (Rašomavičius 2007). Furthermore, there are some reports stating that the species probably has undergone local extinctions (Pinchen & Ward 2002). However, due to its cryptic way of life, specimen of *C. montana* are not easy to find, so it is possible that the occurrence and distribution of the species is under-recorded. In recent years, a smartphone application that can detect the mating

call of the mountain cicada has been developed to detect and monitor the species, mainly for the New Forest, an area of southern England, where the species has not been recorded in the last 20 years (Zilli *et al.* 2014). The species has still not been rediscovered in the New Forest.

The biology of *C. montana* is generally known. The life cycle of the species lasts 4–8 years, depending on local environmental conditions and availability of host species. The immature stage (nymph) lives subterraneously and feeds on roots of several deciduous trees and herbs (Grant & Ward 1992). The last (fifth) instar nymph builds a characteristic turret above the ground in the year of emergence and climbs out of the ground. During moulting, cicadas shed their exoskeletons (exuviae) on nearby vegetation and emerge as adults. Once the cicadas have emerged, they move up into the trees and bushes and start courtship. Male cicadas begin to sing to attract females for mating. Soon after mating, female cicadas oviposit in particular host plant species. Eventually, nymphs hatch and burrow themselves underground. The lifespan of an adult mountain cicada is 2–4 weeks.

The decline of the populations of the mountain cicada has mainly been associated with deterioration of habitat quality. Successional overgrowth of habitat by vegetation and afforestation are the main threats to the species. In addition, soil compaction via intensive grazing is suggested to endanger the species. However, extensive management regimes (e.g. mowing) are needed to keep suitable habitat patches open.

The aim of this study was to obtain information about the abundance and distribution of the mountain cicada in only known population of the species in Estonia. Given the fact that *C. montana* is threatened in many areas in Europe, understanding its habitat requirements, abundance and distribution is necessary for evaluating the possible need for the protection of the species in Estonia.

Materials and methods

The material was gathered from the only known

site of *C. montana* in Estonia during 2014–2016. The site Tiigi (58°40'45.23"N, 26°19'36.98"E) is located in the parish Puurmani, Jõgeva County, eastern Estonia, in the area of an old, abandoned gravel-pit, which has naturalized.

Exuviae counts were conducted from the end of May to the end of June. In the study area, which is approximately 5 ha in size, exuviae were visually searched for and removed from the vegetation every other day in order to reduce any negative impact of trampling directly on individuals and indirectly via soil compaction. Gathering exuviae lasted until the observer could not find any more.

Results

In 2014, the occurrence of the species was discovered by chance in Estonia. A female specimen was collected on 4 June 2014 (deposited at the Natural History Museum of the University of Tartu, TUZ 038960). Several visits were made to the area in 2014, tentatively in order to record and observe more information on the presence of *C. montana* (e.g. exuviae, turrets, adults, song of males), but with no results.

On 4 June 2015, a newly emerged cicada was recorded on the same site as in 2014. During the following consecutively field surveys, 13 exuviae were gathered, turrets were noticed on the ground, two mating cicadas were observed high up in a smaller scots pine (*Pinus sylvestris*) and the calling song of male cicadas were heard.

In 2016, the field surveys of cicadas in the same area revealed abundant presence of the species. In total, 503 exuviae (five of them are deposited at the Natural History Museum of the University of Tartu, TUZ 038961–TUZ 038965) were collected in the quite large study area. Slopes (Figure 1a) with a southern exposure and warm patches (Figure 1b) were apparently favoured by the species. During the period of 25 May–15 June newly emerged adult specimens and their emerging (Figure 2) were observed. The emergence of cicadas took place mainly in the forenoon. The activity of adult specimens (Figure 3) was detected until the end of June.

In the close surrounding area of the favoured

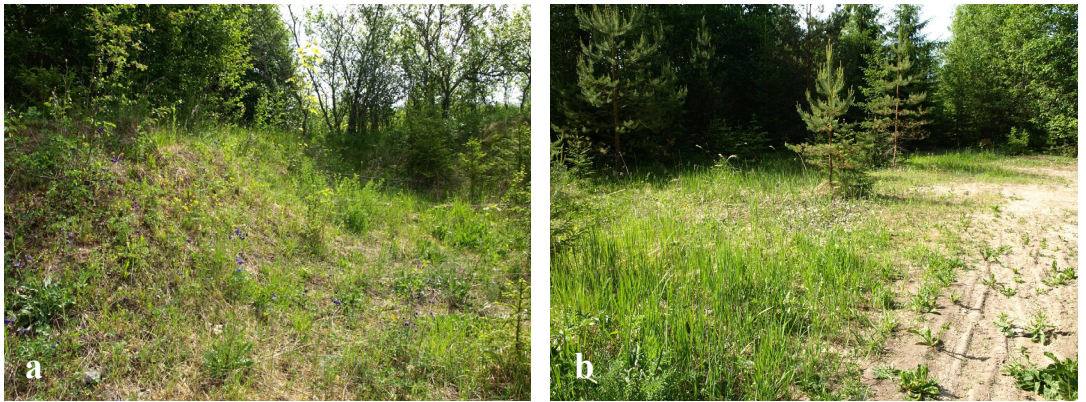


FIGURE 1. Slopes (a) and small patches (b) with a southern exposure are favourable sites for the mountain cicada in the eastern part of Estonia. Photos from Tiigi, Jõgeva County. Photo: A. Liivamägi.



FIGURE 2. Emerging of adult specimen takes place mainly in the forenoon. Photo is taken from Tiigi, Jõgeva County, 28 May 2016. Photo: A. Liivamägi.



FIGURE 3. A female specimen of the mountain cicada is looking for particular host plant species to lay eggs. Photo is taken from Tiigi, Jõgeva County, 8 June 2016. Photo: A. Liivamägi.

slopes and patches, the following species of trees, bushes and ferns as possible food resources for the species were determined: *Betula pendula*, *Populus tremula*, *Alnus incana*, *Salix* sp, *Sorbus aucuparia*, *Acer platanoides*, *Frangula alnus*, and *Pteridium aquilinum*.

Discussion

The first known record of *C. montana* in Estonia is from 2014, despite the fact that the Estonian Hemipterologist Juhan Vilbaste (1924–1985) presumed the occurrence of the species in the country by many decades ago (Vilbaste 1971). Furthermore, the results presented here indicate that the so far only known population of the mountain cicada in Estonia is rather abundant and it is obvious that *C. montana* has been inconspicuously inhabiting our country for some

time. In addition, there may be other undiscovered localities of the species in Estonia. The causes behind the relatively late discovery of the mountain cicada, compared to some other neighbouring areas, lie partly in the modest studying and collecting activity of Auchenorrhyncha during the recent decades in our country. The relatively long-lasting (4–8 years) life cycle and the rather cryptic way of life of the species are additional reasons for the few records of *C. montana*. On the other hand, it seems that it is possible to observe adult cicadas not only in every 4–8 years, but in many consecutive years. This phenomenon has also been noticed in Finland (Söderman 2007). An explanation for this may be that there are multiple cycles in a population.

Gathering exuviae is an effective method for evaluating the size of populations of *C. montana* whose adult specimens are otherwise not easy to find. Despite the fact that detailed manual

surveys are needed and that not all exuviae can be found (especially at the larger spatial scale), our results show that exuviae counts provide valuable information on the presence and abundance of the species.

In Estonia, the mountain cicada occurs in warm and sun-exposed semi-open slopes and small patches with sandy or gravelly soils adjacent to deciduous forests. The importance of deciduous forests on the occurrence of the species can be explained by forest margins accumulating heat and therefore, in the immediate vicinity of a habitat patch, forests may provide habitats with warmer microclimatic conditions. In addition, a number of species of deciduous trees can serve as the food plant of the mountain cicada.

Habitats of the species in neighbouring countries and areas also have warm microclimatic conditions. For example, in Finland the species inhabits dry exposed woody slopes (Söderman 2007). In Lithuania, populations of *C. montana* are found in dry and open slopes with a southern exposure (Švitra 2007).

In conclusion, our results indicate that we have at least one viable population of the mountain cicada in Estonia. The distribution, abundance and habitat requirements of the species definitely needs further investigations. Deterioration of habitat quality resulting from overgrowth of habitat by vegetation and afforestation or loss of habitat patches due to a possible re-establishment of excavation activity at the locality, are probably the main threats to the species' existence in Estonia and, therefore, the protection of this remarkable insect should be discussed in our country.

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