



New record of *Calosoma (Campalita) auropunctatum* (Herbst, 1784) in Latvia with notes on its occurrence in the Eastern Baltic region.

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Abstract

Background and purpose: *Calosoma auropunctatum* (Herbst) is the species with no confirmed records in the last 150 years in the Latvian fauna. Until now, the species was considered probably extinct in this area. The species was confirmed for Latvia in 2014, during the research project devoted to biodiversity monitoring in various agrocenoses with different management systems. The aim of this paper is to clarify habitat peculiarities of the species in Latvia and discuss the possibilities of widest distribution of this species in Eastern Baltic region.

Materials and methods: The study site is located in the eastern part of Latvia. The ground beetles were collected from May 2014 to August 2015 using pitfall traps, installed in 2 linear transects located at the field margin and in the central part of the field, more than 100 m far away from the field border.

Results: One male and three females were caught by pitfall traps during vegetation period in course of 2014–2015 years. *Calosoma* specimens deposited in coleopterological collections in Latvia were reviewed. Previous record of this species in Latvia based on specimen deposited in Latvian Museum of Natural History is disproved. In addition, the paper presents information on the geographical distribution and biology of the species.

Conclusions: The first proven findings of *C. auropunctatum* in Latvia was presented during two field seasons, that suggest a presumption of occurrence of small, local population of this species in territory of Latvia.

INTRODUCTION

Calosoma genus comprises quite large and diverse group of world-wide-distributed ground beetles. According to recent revision of this group, 128 species assigned to 19 subgenera are known in world (1). Only 7 of 32 species found in the Palaearctic are known in Europe (1, 2, 3, 4). All of them are rare, sporadically distributed in the region and most of them are granted status of protected species in many countries (5, 6, 7, 8, 9, 10, 11, 12). Adults of majority of species in *Calosoma* genus are well distinguished by their specific shape of the body: relatively narrow but strongly transverse pronotum, and wide, almost parallel, slightly broadened toward apex, sides of elytra. Most species of this genus are winged and in some cases they fly very well (1). *Calosoma* species are well known as caterpillar hunters because usually they hunt larvae of Lepi-

doptera in the trees, shrubs or on the ground (1, 13, 14). Therefore, some *Calosoma* species are important for biological control both in forestry and agriculture (15, 16, 17). The Eastern Baltic region belongs to the area of northern part of distribution range of six *Calosoma* species: *C. (Callisphaena) reticulatum reticulatum* (Fabricius, 1787), *C. (s.str.) inquisitor inquisitor* (Linnaeus, 1758), *C. (s.str.) syncophanta* (Linnaeus, 1758) *C. (Campalita) auropunctatum* (Herbst, 1784), *C. (Campalita) denticolle* Gebler, 1833 and *C. (Charmosta) investigator* (Illiger, 1798) (18, 19). All these species are extremely rare in this region, and either listed in local Red Data books or considered as extinct (20, 21, 22, 19, 23). There is no any information of occurrence of *C. denticolle* in Eastern Baltic region, but this species is mentioned in the old faunistic literature from Finland as accidentally visited species, which was collected as drift from sea shore, when eastward wind transported some material to east coast of Brännskär Island (24). However this species is listed for whole Eastern Europe (25). The occurrence of next two species *C. investigator* and *C. reticulatum* in the region is questionable as well. Both of them are noted for Eastern Prussia by Horion (26), and occasionally found in Sweden (19), however *C. reticulatum* is not listed for Eastern Europe by Kryzhanovskiy *et al.* (25).

Three species (*C. syncophanta*, *C. inquisitor* and *C. auropunctatum*) were noted for whole of the Baltic region (4, 20, 25).

However, the notes on distribution of *C. syncophanta* in this region are based only on old data (27, 28, 22, 29, 19, 30). The most recent record of this species is known only from Lithuania (31). The most common *Calosoma* species in Eastern Baltic region is *C. inquisitor*. The numerous records of the species were published from Latvia, Lithuania and Kaliningrad region in recent years (20, 5; 21, 32), however *C. auropunctatum* was recently known only from Lithuania (33, 34). Precht (35) mentions the first note on presence of this species in Latvian fauna in the first catalogue of Latvian beetles, where this species was indicated for Kircholm (currently Salaspils, Riga environs). Subsequently next record of this species from Buļļi, Kurzeme region in western part of Latvia (probably more than 150 years old) was mentioned by Stiprais (36) based on material of Carl Müthel's collection. Currently this collection is deposited in the Latvian Museum of Natural History. *C. auropunctatum* is considered as extremely rare species in Estonia, and is included in Red data book of Estonia, as extinct or probably extinct species (9). Only three, more than 80 years old records of this species are reported in this country. A knowledge on distribution of this species from Kaliningrad region is poor as well. Only three old records of this species are mentioned in literature sources: Sambian peninsula, Mechnikov (19th century) and Yantarny (the early 20th century) (27).

New findings of *Calosoma auropunctatum* in Latvia focused our attention to this remarkable species and

stimulate further study of its bioecology. In this paper we aimed to present new data on records of *C. auropunctatum* as well as peculiarities of its habitats in Latvia and discuss the possibilities of wider distribution of this species in Eastern Baltic region.

METHODS AND RESULTS

Specifics of Latvian findings of *Calosoma auropunctatum*

Calosoma auropunctatum (fig. 1.) was accidentally captured in the course of research project devoted to the long-term monitoring of status of biodiversity in various agrocenoses with different management systems, which was started in 2014. The study site is located close to the Dubna village (eastern part of Latvia) on the western slope of Latgale upland, where slightly-undulating morainic plain and gently sloping hummocks compose post-glacial landscape typical for south-eastern part Latvia (37) (fig.



Figure 1. *Calosoma auropunctatum* habitus, dorsal view.

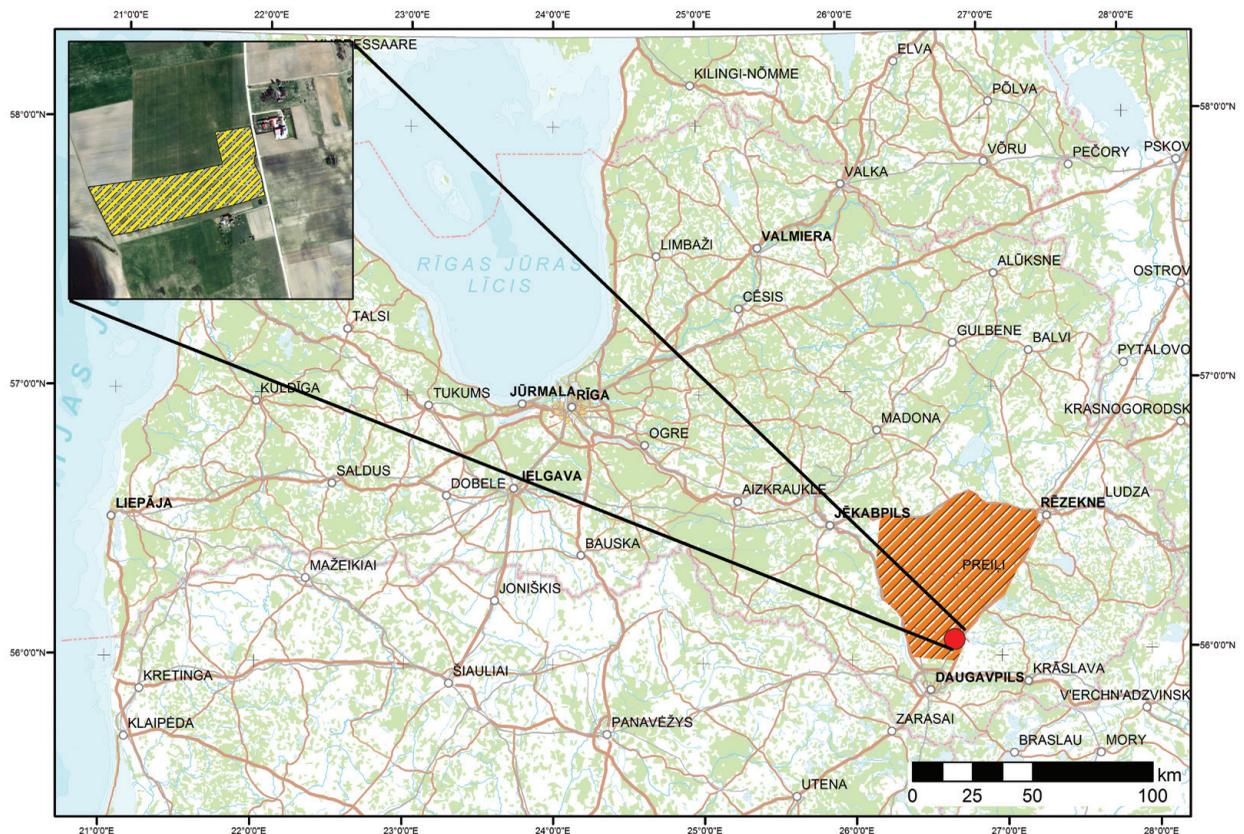


Figure 2. Map of the study area and locality of *Calosoma auropunctatum* in the crop field near the Dubna village.

2). Considering lithology of Quaternary deposits at the study site, glacial-till derived Stagnic Albeluvisols with stony loamy – clayey diamicton textures prevail in this part of territory (38). This field characterized as conventionally used agricultural land, which is enriched with mineral fertilizers, as well as intensive sprayed with pesticides. The spring wheat was cultivated in 2014 and winter wheat – in 2015 in this field. The field plot was about 8.3 ha, surrounded by a road from one side and other crops on another sides. The studied area is situated in mosaic agricultural landscape.

The beetles were collected using pitfall traps, which were consisted by plastic cups with 7 cm hole diameter and 9 cm high. The cups were inserted in the soil surface and filled by 50 % solution of ethylene glycol to 1/3 of their capacity. Altogether, we used ten pitfall traps in each plot, which were installed in two linear *transects with 2 m intervals between each other*. Five traps were installed along the field border (56°04'02"N, 26°41'29"E) with the distance 10 m from the field margin in the first transect, while further five traps were arranged in the line more than 100 m far away from the field border (56°03'58"N, 26°41'17"E) (Fig. 3). The traps were active for two 14 days long periods during the season: 27 of May to 10 of June and from first to 15 of August in 2014 and 26 of May to

9 of June and from 29 July to 12 of August in 2015. Altogether, four specimens of *C. auropunctatum* were found in pitfall traps: three specimens (1 male and 2 females) were captured in the active trap period 01–15 August 2014, at the edge of the sampling plot and a single male was captured in winter wheat crop in the period 01–15 July 2015, in the centre of the field. The prepared specimens were identified by the experts of Daugavpils University to species level using various specialized keys for identification of Coleoptera and stereomicroscope Nikon SMZ 745T. The macrophotograph was taken using a single-lens reflex camera Canon EOS 60D, lens EF 100mm f/2.8L IS USM.

DISCUSSION

Geographic distribution

The taxonomic status of the species has changed several times and there is no consensus on it currently. In Csiki (39) *C. auropunctatum* is mentioned as a variety of *C. maderae*, but Breuning (40) and Lindroth (41) considering it as subspecies of *C. maderae*. Most authors consider *C. auropunctatum* as distinct species (25, 42, 43, 44, 45, 46, 47, 48, 49), and we agree with this point of view. Most remarkable difference is the opinion of Bruschi (1)

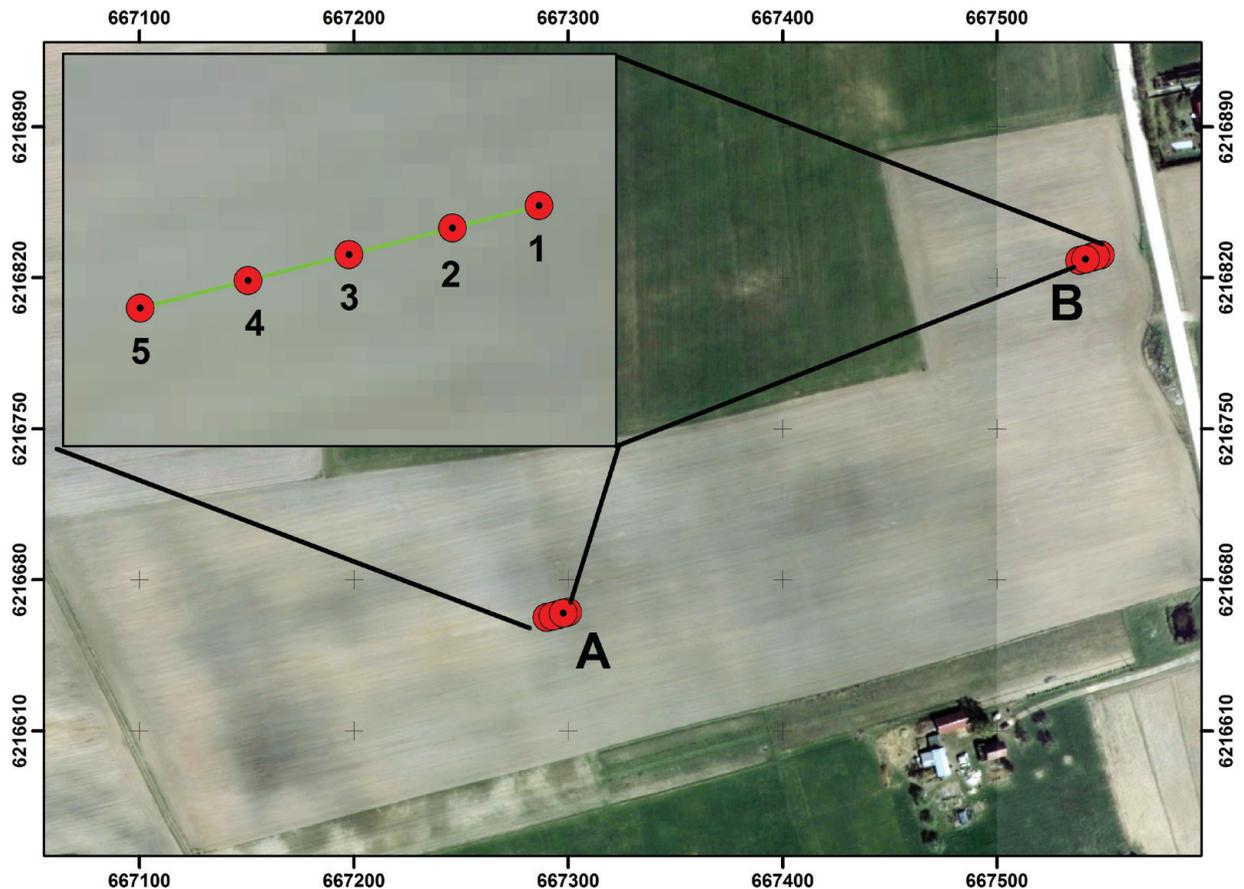


Figure 3. Transects position in the plot; A – in central part of the plot, B – along the field border.

who is considering the complex of taxa: *C. maderae*, *C. auropunctatum*, and *C. indicum* Hope 1831, as single *C. maderae* species including 3 subspecies: *C. maderae maderae*, *C. maderae dsungaricum* Gebler 1833 and *C. maderae indicum*. *C. auropunctatum* is found in a broad range of European countries, from Mediterranean countries to Scandinavia. Nevertheless, northern border of its distribution range remains unclear. The records of this species from many countries of northern Europe, such as Norway, Sweden, Estonia, northern part of European Russia (Sankt Petersburg region) are very scarce and old (19). In Denmark where *C. auropunctatum* is considered a critically endangered and has been constantly declining during 20th century, an unknown population of the species was found in 1998, in the northern part of Jutland (49). This species is rare and sporadically distributed in the countries of central Europe, such as Germany (50), Poland (51), Slovakia and Czech Republic (52), but becomes more frequent when going to the South and East (14, 53, 54, 55, 56).

Before this study the species had not been reported from territory of modern Latvia for almost 165 years. During the study *Calosoma* specimen deposited in the Latvian Museum of Natural History was re-examined. It

was found out that specimen previously identified erroneously as *C. auropunctatum* actually belongs to *Calosoma (Chrysostigma) calidum* (Fabricius, 1775). This species spreads through southern Canada and northern United States (13). Assuming this fact, our records of *C. auropunctatum* are the first actual findings of the species in Latvia. Of course, our data is insufficient to explain the distribution of this species at population level, but continuous findings in two seasons course, suggest a presumption of presence of at least a small, local population of this species in territory of Latvia. However, we can't eliminate the possibility of the occasional migration of specimens from southern regions, maybe caused by relatively high temperatures during the summers of last decades. Moreover, the latter presumption become more persuasive considering an enormous number of previous studies on carabids in agrocenoses in various parts of Latvia without any catches of *C. auropunctatum* till 2014.

Bionomy

The knowledge on bionomy of *C. auropunctatum* is not sufficient. There are only short notes on its activity of adults and habitat preference mentioned in old literature sources (19). The diurnal activity of adults of this species

was proved by Jorum (49). However, its presence in the light traps (57) clearly exposing their nocturnal activity and flight ability. With respect to life cycle, this species is widely represented as spring breeding species with maximum activity of adults in June (19, 56, 58). Altogether 39 specimens of *C. auropunctatum* were captured in Lithuania since the first record of this species in the country in 1964 (59) and exclusively all of them were harvested in arable fields (partially published data in 33, 34). As much as 29 of them were caught in July, similarly to specimens from this study that were captured in July and August. *C. auropunctatum* are referred as open land species with strong preference to sandy, dry habitats with sparse vegetation (19, 49, 52). The records of this species are from agricultural lands with different crops, but mainly from cereals in most of Europe (53, 56, 58). Our findings confirm these preferences, but we caught this species in habitats with loamy soil type that coincide with findings in Lithuania (33, 34). As an accompanying species of *C. auropunctatum* we disclosed complex of another 30 species of ground beetles, where *Poecilus cupreus*, *Pseudoophonus rufipes* and *Harpalus affinis* were most frequent among them. However, in case of Lithuanian studies, the complex of attendant ground beetles was enriched by *Pterostichus melanarius* – a hygrophilic species (34). The tolerance of this species to moisture could prove also its presence in grasslands close to the rice fields (55, 60). These facts suggest proposition that this species tolerate more heavy and moister soils than it was regarded before. Also assuming that distribution of this species is limited to warmer regions, the temperature could be essential for its occurring in the northern parts of its distribution range where loamy soils that better accumulate temperature could be more attractive substrate.

The caterpillars, mostly Noctuidae family are present as a main part of diet of *C. auropunctatum* (19) but it can be supplemented by eggs and larvae of *Leptinotarsa decemlineata* Say, 1824 as well (15). Nevertheless, more recent and precise studies of food preference of this species are still unknown.

Final remarks

Despite that *C. auropunctatum* is considerably large carabid species, and its distribution range covers most of the Europe, the data on its frequency and life cycle is not so numerous. Naturally this species inhabit regions of steppes and semi deserts and probably the spreading to the forest regions depend on development of the agriculture and creation of wide open areas. This species exclusively occurs in the agriculture landscapes and sandy dunes of seacoasts in the zone of deciduous and mixed forest in Europe. Its excellent dispersal ability seems to be very helpful to survive under high anthropogenic pressure and readjust to various agrobiocenoses. Varvara et al. (56) reports on occurrence of this species not only in wheat, maize, sugar beet, sunflowers, potatoes crops, but also in

vineyards or even apple orchards. Moreover Tamutis et al. (34) and our current discoveries show tolerance of this species to even conventionally managed fields. Assuming that the main factor limiting the spread of this species to northern regions is the temperature, the spread of this species to the northern regions could be indicative of environmental and species composition changes taking place, as a consequence of global warming. Hence, this species could be useful as an indicator of global warming in Northern Europe and further monitoring could give important information that are associated with global warming processes.

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