Silva Gabreta	vol. 12 (3)	p. 151–155	Vimperk, 2006

Ephemeral overwintering aggregations of ladybirds in South Bohemia

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Abstract
Overwintering aggregations of two ladybird species, *Tytthaspis sedecimpunctata* and *Ceratomegilla undecimnotata* were found in the spring 2005 in South Bohemia, but they were absent in the same sites the following winter. The former species probably found a new shelter for overwintering following destruction of the old shelter in grass tussocks touching walls of a solitary building. The latter species was probably accidentally introduced to South Bohemia and did not establish a stable population in a relatively cool climate.

Key words: *Ceratomegilla undecimnotata*, *Tytthaspis sedecimpunctata*, *Semiadalia*, *Hippodamia*, Coccinellidae, diapause

Introduction

Many species of ladybirds (Coleoptera: Coccinellidae) in temperate regions form large aggregations (tens to 40 million individuals, Hodek 1996) during preparation for winter diapause (hibernation). The biggest reported mass aggregations were formed in the Sierra Nevada mountains above Central Valley in California, USA, by the convergent ladybird, *Hippodamia convergens* (Hagen 1962, 1966). Such aggregations were also exploited as a source of natural enemies of pests (aphids) in agriculture – collected and sold to farmers.

On the other hand, an invasive Multicolored Asian ladybird, *Harmonia axyridis*, introduced into North America from East Asia, causes unexpected problems. This species is very voracious, which is beneficial when targeted on harmful aphids, but has problematic, negative effects on native species of ladybirds (Yasuda et al. 2004; http://cnf.ca/ladybeetle/index.html). Moreover these ladybirds became unwanted guests in buildings during winter (Schaefer 2003). They are attracted to the southwest side of buildings, especially of brightly coloured houses. However, the color white per se is not the visual stimulus. Nalepa et al. (2005) found that the beetles prefere landing on contrasting suface, especially vertical black stripes. They often hibernate indoors in large groups (hundreds) – a behaviour that has alarmed many people – and may cause allergies (Ray & Pence 2004). Populations of *H. axyridis* are scattered also in western continental Europe. From autumn 2004, this species is recorded from many places in England (http://www.harlequin-survey.org/). It is not yet established in the Czech Republic.

The densities of several ladybirds were observed in leaf litter in late October in a beach-

-ridge forest on the shore of Lake Manitoba, Canada. There were 105 adults per m^2, mainly *Hippodamia tredecimpunctata* and *Coccinella septempunctata* (Turnock & Wise 2004). The survival rate in this suboptimal overwintering site was about 15%, while in the litter under a remnant grove of riverbank forest in Winnipeg, it reached 46%. Turnock & Turnock (1979) observed large aggregations at those sites already many years ago. They collected 3454 beetles during 15 minutes in November on the shore with low vegetation and debris. In April 1979, they found the site covered with 0.25 to 1 m snow. *Hippodamia convergens* was the most abundant species. Only 2% of individuals of all species survived till spring under the wet cold conditions among beach debris, while 53% survived at the top of foreshore.

Tytthaspis sedecimpunctata lives in almost entire Europe, through Siberia to northern Mongolia, and in North-East Africa. According to Iablokoff-Khnzorian (1982) it prefers sandy, even dry and salty soil. In central Europe, it lives in dry grassland and in fields (Bielawski 1959), often walking on the ground. Legay & DeReggi (1962) report its habit to form overwintering aggregations in dry vegetation on prominent places or at field edges, density being over 100 individuals per dm^2. These aggregations contained 1% of *Psyllobora vigintiduopunctata*. *T. sedecimpunctata* emerges from hibernation sites in mid-April near Lyon, France (Hodek 1996). Revels & Majerus (1997) report two types of overwintering sites of this species in England: either exposed positions like fence posts, or in dead herbage. The sites used seem to remain the same year after year. This species is highly polyphagous (Ricci 1986b), main components of food being conidia of mildew, order Erysiphales (Turian 1969).

Ceratomegilla undecimnotata lives in South and Central Europe (exceptionally in Norway in xerothermic habitats), Asia Minor, Caucasus and Western Siberia (Iablokoff-Khnzorian 1982), and also Central Asia (Yakhontov 1962). Although it is multivoltine in the Mediterranean (Katsoyannos et al. 2005), it is strictly univoltine in Central Europe (Ceryngier et al. 2004). It was many times reported to form large overwintering aggregations, often high in the mountains (Hodek 1996, Katsoyannos et al. 2005). Beetles usually aggregate in July on prominent hills in the landscape, mostly on their south-western upper slopes, in rock crevices or at the base of solitary shrubs. In dry windy overwintering places they have lower mortality due to mycosis (Hodek 1996). It is an aphidophagous species.

This paper describes finding of overwintering aggregations of the two species, *Tytthaspis sedecimpunctata* and *Ceratomegilla undecimnotata* in South Bohemia, subsequent absence of these aggregations from the observed locations, and suggests reasons of the disappearance.

Observations

A large overwintering aggregation of *T. sedecimpunctata* was found on 26 March, 2005 near village Římov (square grid 7152b). A solitary sacral building about 6×10 meters stands among pastures and meadows on the ridge of a small hill (465 m a.s.l.; 48°51'39"N, 14°29'13"E). Most of the bottom of outer walls was clean, surrounded by gravel, but a few grass tussocks were touching the walls. Ladybirds were mostly hidden within these tussocks in groups of hundreds of individuals, predominantly at western and southern sides of the building. The total amount of beetles around the building was estimated at 2000 individuals. On the southern side, a few of them were climbing the walls or basking on the sun at a temperature about 15°C (see Fig. 1). None were mating nor attempting to fly. There were no other ladybird species and only a few other insects, among them a mating pair of the leaf beetle *Hispa atra*. After the ladybirds were disturbed by the sampling, many of them climbed the walls and remained to bask.

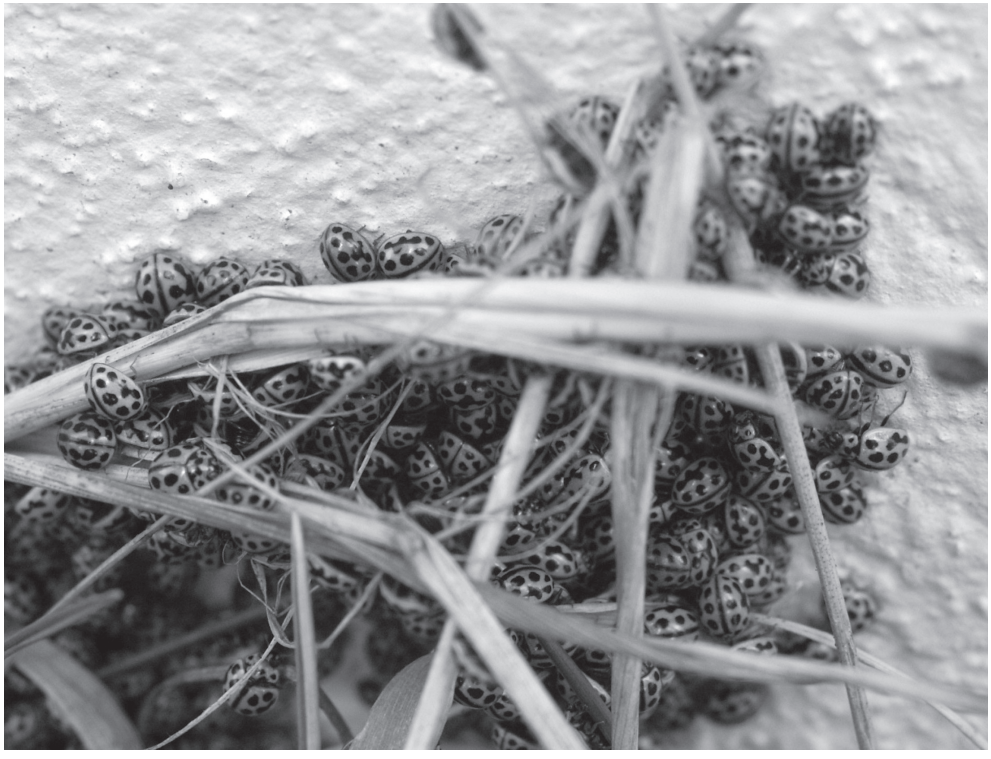

Fig. 1. Aggregation of the ladybird of *Tytthaspis sedecimpunctata* from Římov. Photo: František Petrouš sen.

Many adults and larvae of *T. sedecimpunctata* were repeatedly found near the city České Budějovice during summer, but the place near Římov was not visited again until September 9, 2005. At 24 degrees centigrade, half-sunny weather, 6 individuals were found climbing the walls of the sacral building. There was very little grass surrounding the walls to provide a shelter. No ladybirds were found in either this grass or surrounding gravel. We attempted to collect ladybirds by sweeping net on meadows up to 100 meters from the building. No *T. sedecimpunctata* were found in about 100 sweeps on grassy vegetation, and only one *Hippodamia variegata* and one *Coccinella quinquepunctata* were recorded. Next observations were made on April 15, 2006, after an exceptionally long winter. Only two individuals of *T. sedecimpunctata* were found among small stones surrounding the western wall.

A small overwintering aggregation of *Ceratomegilla undecimnotata* was found near the village Hosín (49°02'33"N, 14°28'16"E; square grid 6952d), on the top of the hill Račice (506 m a.s.l.). The hill is covered by fields and cut meadows. There is a row of electricity pillars and only a small part of the top is covered by ruderal vegetation. A solitary bushy maple (*Acer platanoides*) about 4 meters tall, was situated on the southern slope very near to the top. Among the multiple thin trunks and old dry leaves 15–20 centimeters above the ground level, an aggregation of about 40 individuals was found, still dormant on 3rd April, 2005. It was half-sunny, 16 degrees centigrade. No other species of insects was found together with these ladybirds. However, nearby, in grass tussocks under one pillar near the top, there was a sparse aggregation of *T. sedecimpunctata* (about 50 individuals) and *Coccinella septem-*

punctata (2 individuals).

Two weeks later, on April 16, a single individual of *C. undecimnotata* was found several kilometers to south-west in a lowland, near village Zalužice (square grid 6952c). At 22°C and sunny sky, it flew and landed on clothes of the author of this paper. On May 29, at sunny weather of 30°C, a single individual was found in the city České Budějovice, Palackého square, a few kilometers to south from the hill with aggregation. It was on a decorative bush *Spirea* sp., probably feeding on aphids, together with many adults of *Coccinella septempunctata* and their larvae and many adult *Adalia bipunctata*.

On September 9, the hibernaculum on the hill near Hosín was inspected, and no *C. undecimnotata* were found despite searching in many possible shelters in the vicinity. However, a sparse aggregation of *T. sedecimpunctata* (about 50 individuals) was found again in grass near a pillar, prepared for overwintering, despite still nice weather (24°C).

Discussion and conclusions

The finding of aggregated *Tytthaspis sedecimpunctata* in spring in grass tussocks surrounding a building corresponds to the previous reported overwintering behaviour of the species (see Majerus 1994 and Introduction). Survival rate was not reported in articles dealing with overwintering of this species (e.g. Revels & Majerus 1997), but it seems that dead individuals are rarely found in this and other species overwintering in relatively dry conditions, as it was in our case. It is strongly contrasting to the low survival rates of other species of ladybirds overwintering in Canada under thick snow layer (Turnock & Wise 2004).

It was surprising to find only a few individuals of *T. sedecimpunctata* in autumn on the same place where thousands of conspecifics were found in the preceding spring, because of the often recorded habit of ladybirds to return to the same place year after year (Revels & Majerus 1997). As the surrounding meadows were not altered in comparison to other years, and provided apparently suitable breeding environment for this polyphagous species, we speculate about the unsuitability of the building for their repeated overwintering. As it was almost cleared of the surrounding grass in effort to make it nice looking, the arriving ladybirds did not find any shelter and might continue the flight to more distant prominent objects. Although Ricci (1986a) reports that *T. sedecimpunctata* finishes feeding in late October in central Italy, we suggest that the Czech ladybirds had already completed their migration to hibernacula on early September, as none were found in the vegetation around the building, as they already formed an aggregation on the other locality, and few were present the next spring. Thus, the conclusion is that they moved their overwintering site due to the human care on the building appearance.

To find overwintering aggregation, although small, and a few active individuals of *Ceratomegilla undecimnotata* was unexpected in South Bohemia, with altitudes about 400 m a.s.l. Since the hibernation sites have been regularly found only in two warm regions in the Czech Republic: České Středohoří hills (lowland part of North Bohemia) and Pavlovské Vrchy hills (South Moravia), their occurrence near České Budějovice does not seem to be natural. This species is reared in the insectarium of the Institute of Entomology, Czech Academy of Sciences, in České Budějovice. The stock originates from individuals collected on the Raná hill, České středohoří. Beetles are used for research of oviposition-deterring larval tracks in aphidophagous coccinellids (Růžička 2003). We suggest that a few ladybirds, or a single fertilized female, escaped from captivity in 2004 and founded a temporal population in the city. The new generation subsequently migrated and gathered on the prominent hill top near Hosín, since it is clearly visible from a far distance. After overwintering, the small number of individuals dispersed into the large lowland so that they could not found a new

generation. Although ladybirds may mate before dispersal, and overwintered females might be fertilized (Hodek & Landa 1971, Ceryngier et al. 2004), rainy weather during summer 2005 prevented the new generation to develop successfully. We conclude that *C. undecimnotata* lived in the region only one or a few years and is absent again.

Acknowledgements. This research was supported by grant MSM 6007665801.

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Received: 15 May 2006
Accepted: 27 June 2006