

# High Parasitism Rates of a Rare Ladybird *Platynaspis luteorubra* (Goeze, 1777) (Coleoptera: Coccinellidae) – a Reason of its Rarity?

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**Abstract.** Larvae of a rare, myrmecophilous ladybird *Platynaspis luteorubra* (Goeze, 1777) were collected in three regions in central and northern Poland (Mazovian Lowland, Masurian Lakeland and Gdańsk Shoreland) to check their parasitism by the hymenopteran parasitoid *Homalotylus platynaspidis* Hoffer, 1963. The larvae were parasitized in all the three regions, and the recorded parasitism rates were surprisingly high, ranging between 0.56 and 0.69. This suggests that the constantly high parasitoid pressure may be the main force maintaining numbers of *P. luteorubra* at low levels. *H. platynaspidis* has not previously been reported from Poland. The reported records represent the northernmost known localities of this species in central and western Europe.

**Key words:** Coccinellidae, Encyrtidae, *Homalotylus platynaspidis*, parasitoid, *Platynaspis luteorubra*, Poland

## Introduction

*Platynaspis luteorubra* (Goeze, 1777) is a myrmecophilous ladybird that specializes in exploiting aphid resources attended by ants, most often by *Lasius niger* (Linnaeus, 1758) (VÖLKL 1995). Although *P. luteorubra* is widely distributed in the Western Palaearctic (KOVÁŘ 2007), it is usually rare throughout its range (e.g. HALPERIN et al. 1995, BURGIO et al. 2004, HERGER 2007, ROY et al. 2011, GÖZÜAÇIK et al. 2012, ADRIAENS et al. 2015).

In several localities in Europe and western Asia, *P. luteorubra* was recorded as a host of a parasitoid wasp *Homalotylus platynaspidis* Hoffer, 1963 (Hymenoptera: Encyrtidae) (HÖFFER 1963, VÖLKL 1995, SEMYANOV & TRJAPITZIN 2004, TYUMASEVA & GUSKOVA 2017). The studies conducted by VÖLKL (1995) in Bonn (Germany) showed that this parasitoid can cause substantial mortality among *P. luteorubra* juveniles.

Our study aimed at assessing whether *P. luteorubra* is parasitized by *H. platynaspidis* in Poland and, if so, what is the commonness of this association there.

## Materials and Methods

Material for this study was obtained in summers of 2005, 2015 and 2016 in three geographic regions: Mazovian Lowland (central Poland), Masurian Lakeland (north-eastern Poland) and Gdańsk Shoreland (northern Poland) (Fig. 1). Details on the collection localities are given in Table 1. All localities were situated in lowland landscapes, with altitudes ranging between 20 and 145 m a.s.l.

We collected larvae of *P. luteorubra*, either directly observed on plants (2005) or caught in sweeping net (2015 and 2016). Most of the collected larvae belonged to the last (fourth) instar, but in several cases younger (second and third instar) larvae were taken as well. Those younger larvae could also be potentially parasitized by *H. platynaspidis*, as in the genus *Homalotylus* females usually oviposit into early instars of ladybird larvae (CERYNGIER et al. 2012). The collected larvae were transferred to the laboratory and reared separately in Petri dishes on aphids *Aphis acetosae* Linnaeus, 1761 or *Acyrtosiphon pisum* (Harris, 1776) until pupation and then kept

until adult ladybird or parasitoid emergence. If neither adult ladybird nor parasitoids emerged till spring of the next year, the ladybird larva or pupa was dissected for the presence of parasitoids in its body cavity. Before dissection it was soaked in water for 24 hours.

## Results

In the summer of 2005, numerous larvae of *P. luteorubra* were observed in Sadowa in colonies of the aphid *Aphis acetosae* developing on *Rumex acetosa* Linnaeus, 1753 and attended by the ant *Lasius niger*. Some of those larvae were collected and reared in the laboratory. Three of them, collected on 24 June, 25 July and 9 August, after pupation gave rise to two, two and three *H. platynaspidis* wasps, respectively. Quantitative data on the rates of parasitism are not available for those early samples.

More detailed data obtained in the three regions in 2015 and 2016 are presented in Table 2. Of the total number of 42 *P. luteorubra* larvae collected, 13 developed into adult beetles and 27 were parasitized: 26 by *H. platynaspidis* and one by an undetermined parasitoid (total parasitism rate – 0.64, parasitism rate by *Homalotylus* – 0.62). The undetermined parasitoid was detected by dissection of a mummified larva of *P. luteorubra*. Dissection revealed nine larvae jointly occurring in the body cavity of host larva. These larvae could not belong to *Homalotylus* because larvae of *Homalotylus* are either solitary or, if gregarious, avoid direct contact with conspecific

larvae by occupying different parts of the host separated by septa made of dry host tissue (CERYNGIER et al. 2012). In all regions parasitism rates were high: 0.62 in Mazovian Lowland, 0.56 in Masurian Lakeland, and 0.77 (total parasitism) and 0.69 (parasitism by *Homalotylus*) in Gdańsk Shoreland.

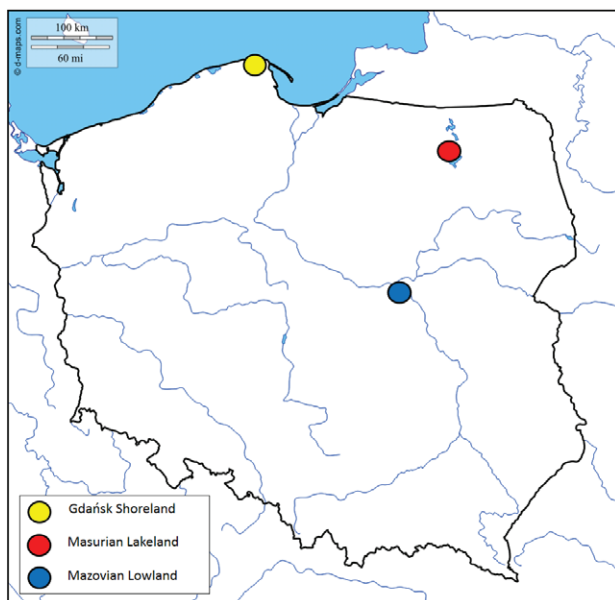
In all cases of complete development of *H. platynaspidis*, adult wasps were emerging from *P. luteorubra* pupae. We bred seven *H. platynaspidis* wasps from three *P. luteorubra* pupae in 2005 and 66 wasps from 21 pupae in 2015–2016 (altogether 73 wasps from 24 host pupae). Additionally, by means of dissection, we found 15 pupae of *Homalotylus* (presumably also *H. platynaspidis*) in six dead pupae of *P. luteorubra*. Putting these two groups together, there were 88 *Homalotylus* individuals found in 30 *P. luteorubra* hosts (2.9 parasitoids per host on the average). The number of *Homalotylus* individuals recorded in a single host ranged between two and seven.

## Discussion

Six genera of parasitoid wasps presumed to be specific for Coccinellidae: *Cowperia* (Hymenoptera: Encyrtidae), *Dinocampus* (Hymenoptera: Braconidae), *Homalotylus* (Hymenoptera: Encyrtidae), *Metastenus* (Hymenoptera: Pteromalidae), *Nothoserphus* (Hymenoptera: Proctotrupidae) and *Uga* (Hymenoptera: Chalcididae) (CERYNGIER et al. 2012). Among them, *Homalotylus* is the most species-rich, with over 65 described species (NOYES 2017). About 30 species in this genus have been proven to be larval or larval-pupal endoparasitoids of ladybirds (CERYNGIER et al. 2012). Although hosts of many *Homalotylus* species remain unknown, it is believed that the genus entirely consists of specialized parasitoids of juvenile stages of Coccinellidae (TRJAPITZIN 1989, ANIS & HAYAT 1998, CERYNGIER et al. 2012).

Nine species of *Homalotylus* are known to occur in Europe (CERYNGIER et al. 2012) and, until this study, only one was reported from Poland under the name *Homalotylus flaminus* (Dalman, 1820) (PANKANIN-FRANCZYK & CERYNGIER 1999, SKIBIŃSKA 2004). This species, however, is actually not *H. flaminus*, but either *Homalotylus eytelweinii* (Ratzeburg, 1844) or, more probably, *Homalotylus hemipterinus* (De Stefani, 1898) (see NOYES 2010 and TRJAPITZIN 2013 for taxonomic discussion on those species).

*Homalotylus platynaspidis* is the second species of the genus *Homalotylus* recorded in Poland. It has so far been reported from central and south-eastern



**Fig. 1.** Location of the three areas in Poland where larvae of *Platynaspis luteorubra* were collected (base map: [http://d-maps.com/carte.php?num\\_car=2474&lang=en](http://d-maps.com/carte.php?num_car=2474&lang=en)).

**Table 1.** Characteristics of localities where larvae of *Platynaspis luteorubra* were collected.

| Region            | Locality       | Coordinates      | Habitat         |
|-------------------|----------------|------------------|-----------------|
| Mazovian Lowland  | Sadowa         | 52°21'N, 20°50'E | sandy wasteland |
|                   | Łomianki       | 52°20'N, 20°53'E | roadsides       |
|                   | Warsaw         | 52°15'N 21°01'E  | lawn            |
| Masurian Lakeland | Lipowo         | 53°47'N, 21°26'E | warm grassland  |
|                   | Łuknajno       | 53°48'N, 21°39'E | warm grassland  |
|                   | Mikołajki      | 53°48'N 21°33'E  | warm grassland  |
|                   | Nowy Most      | 53°44'N, 21°31'E | warm grassland  |
|                   | Suchy Róg      | 53°48'N, 21°45'E | warm grassland  |
|                   | Grabnik        | 53°47'N 21°28'E  | warm grassland  |
|                   | Szeroki Ostrów | 53°44'N 21°44'E  | warm grassland  |
|                   | Piersławek     | 53°46'N, 21°23'E | warm grassland  |
|                   | Bobrówko       | 53°44'N 21°30'E  | warm grassland  |
| Gdańsk Shoreland  | Pustki         | 54°48'N, 18°07'E | warm grassland  |

**Table 2.** Details on the sampling dates, sample sizes and parasitism of *Platynaspis luteorubra* larvae collected in 2015 and 2016. L2, L3, L4 – larval instars.

| Locality       | Date of collection | Number of <i>P. luteorubra</i> : |                    |                          |                           |
|----------------|--------------------|----------------------------------|--------------------|--------------------------|---------------------------|
|                |                    | collected                        | eclosing to adults | parasitized <sup>1</sup> | dying from unknown causes |
| Łomianki       | 21 July 2015       | 2 L4                             | 1                  | 1                        |                           |
|                | 31 July 2015       | 1 L4                             |                    | 1                        |                           |
|                | 29 June 2016       | 5 L4                             | 3                  | 2                        |                           |
|                | 30 June 2016       | 2 L2                             | 1                  | 1                        |                           |
|                | 30 June 2016       | 2 L4                             |                    | 2                        |                           |
| Warsaw         | 13 June 2016       | 1 L4                             |                    | 1                        |                           |
| Lipowo         | 5 July 2015        | 1 L4                             |                    | 1                        |                           |
|                | 8 July 2016        | 1 L4                             |                    | 1                        |                           |
| Łuknajno       | 6 July 2015        | 1 L4                             |                    | 1                        |                           |
| Mikołajki      | 7 July 2016        | 1 L4                             |                    | 1                        |                           |
|                | 10 July 2016       | 1 L3                             | 1                  |                          |                           |
|                | 10 July 2016       | 1 L4                             | 1                  |                          |                           |
| Nowy Most      | 7 July 2015        | 1 L4                             |                    | (1)                      |                           |
| Suchy Róg      | 8 July 2015        | 2 L4                             |                    | 1 + (1)                  |                           |
| Grabnik        | 8 July 2016        | 1 L3                             |                    | (1)                      |                           |
| Szeroki Ostrów | 12 July 2016       | 2 L4                             | 1                  | 1                        |                           |
| Piersławek     | 11 July 2015       | 1 L4                             | 1                  |                          |                           |
| Bobrówko       | 16 July 2016       | 1 L3                             | 1                  |                          |                           |
|                | 16 July 2016       | 2 L4                             | 2                  |                          |                           |
| Pustki         | 26-27 July 2015    | 13 L4                            | 1                  | 7 + (3) <sup>2</sup>     | 2                         |
| Total          |                    | 42                               | 13                 | 21 + (6)                 | 2                         |

<sup>1</sup> Numbers in parentheses indicate *P. luteorubra*, in which parasitization was ascertained by dissection

<sup>2</sup> In one of the three *P. luteorubra* found to be parasitized by means of dissection, larvae of a parasitoid other than *Homalotylus* were recorded.

Europe (Germany, Czech Republic, Slovakia, Moldova, Romania, Bulgaria, Croatia), the Middle Ural region (Russia), the Caucasus region (Armenia, Azerbaijan) and the Middle Asia (Kazakhstan, Tadjikistan, Turkmenistan, Uzbekistan) (NOYES 2017, TYUMASEVA & GUSKOVA 2017). A single report from south-western Europe (Los Monegros in Spain) needs confirmation (ASKEW et al. 2001). Localities reported in this study represent the northernmost

records of *H. platynaspidis* in central and western Europe. Localities of similar latitudes of about 53-54°N were also reported in eastern Europe (Kaluga region in Russia) (SEMYANOV & TRJAPITZIN 2004) and the Europe-Asia border (the Southern Urals) (TYUMASEVA & GUSKOVA 2017).

Our data, although preliminary, indicate that *H. platynaspidis* is widespread and relatively common in Poland. As in other European countries, the

host of *H. platynaspidis*, *Platynaspis luteorubra*, is rather rare there (BURAKOWSKI et al. 1986), and hence it is difficult to collect it in high numbers. However, even based on the samples collected in this study, it seems evident that *H. platynaspidis* is an important mortality factor of *P. luteorubra*, possibly responsible for its rarity. Heavy parasitism of *P. luteorubra* by *H. platynaspidis*, with mean parasitism rates often reaching values of 50% or more, was also recorded by VÖLKL (1995) in ruderal vegetation in Bonn (Germany). However, parasitism rates recorded by TYUMASEVA & GUSKOVA (2017) in the Southern Urals were at most 10%.

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