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Section analysis of after born mason bee (*Osmia rufa* L.) material

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Abstract: *Section analysis of after born mason bee (Osmia rufa L.) material*. Experiment was performed at Apiculture Division, Warsaw University of Life Sciences – SGGW in 2005/2006 season. The aim of this study was to analyze the quality of mason bee pupae (*Osmia rufa* L.) originating from annual and biennial slots. Obtained cocoons were classified. Cocoons were divided into groups of healthy cocoons, empty cocoons, broken and infected. It was also examined and identified the presence of parasites praying on the mason bee cocoons. Research shows that in two-year old slots is more than 10 times less healthy cocoons and three times more damaged cocoons in comparison to the annual sockets. Species diversity of parasites in the biennial nests is wider than in the annuals. In annual material it was found only one parasite belonging to the species *Cacoxenus indagator* whereas biennial material contained species: *Cacoxenus indagator*, *Giraudiella inclusa*, *Trichodes apiarius* and *Sapyga quiquepunctata.* Research shows that the mason bee slots should be used once. Repeated use of slots increases the degree of infestation with parasites which reduces reproductive performance.

Key words: cocoons, mason bees, *Osmia rufa* L., nest parasites.

INTRODUCTION

Mason bee (*Osmia rufa L.*) belongs to the wild bees, which are increasingly used for pollination of plants in agriculture and horticulture. This bee is widespread throughout the country. It visit more than 150 plant species (Teper, 2004). In the course of the evolution this insect has developed many of the characteristics that determine their adaptation to life under certain environmental conditions. A very important feature is the ability of that bees living under various climatic conditions, mode of reproduction, the use of different types of food base and a strategy of defense against parasites. An important factor limiting the number of mason bees is parasitism. (Wójtowski, 1971; Wójtowski and Wilkaniec, 1969; Bohart, 1955; Linsley, 1958; Medler, 1958; Stephen, 1958; 1962). The largest group of animals which parasites on mason bees are insects (Wójtowski and Szymaś, 1973). They inhabit a socket trap prepared for breeding bees. They destroy nests and cocoons. Associated parasites are most often common in places with high concentration of bee populations. Every year due to excessive density of bees increases the number of parasitic insects. Improper handling and lack of knowledge can cause invasive diseases emergence (eg caused by mites), parasitic species associated to mason bees were grouped into different categories: kleptoparasits, parasitoids, nest destroyers, predators, kleptobionts

and incidental nest residents (Krunič et al., 2005).

In breeding spreading of mason bee diseases is possible in several ways:

- by the contact of bees with flowers, where previously were infected insects,
- by using apiary equipment and tools not being disinfected,
- by reuse the old nests (the stems of plants or not sterilized artificial packets) (Flaga, 2002).

Krunič et al. (1995) and Stanisavljevič (1996) found that the most frequently occurring and highly restrictive limiting population of mason bee is Hymenoptera *Cacoxenus indagator* Loew. and mite *Chaetodactylus osmiae* Dufour.

The disease caused by mites *Chaetodactylus osmiae* affects both adult bees and brood (Flaga, 2002). Infection occurs most often while bees sit on the flowers. Females carry pollen with mites from the flowers to nest cells. Young females infected by mites have reduced reproductive ability. In Pisa area (Italy), a major parasite of mason bee is *Anthrax anthrax* Schrank. (Felicili, 2000).

To limit the number of parasites tin boxes used in the following years as slots place should be treated with a high temperature and 0.07% of endosulfanol solution. However the cane tubes should be burnt (Krunič et al., 2001).

MATERIALS AND METHODS

The work was performed at Apiculture Division of Warsaw University of Life Science – SGGW in 2005 and 2006. Research material were mason bee cocoons gained from annual and biennial trap slots. Observations were conducted in perennial field of SGGW. In this place at the end of March 2005 was issued the slot material – annual traps (1028 cane tubes), biennial traps (1102 cane tubes) and 1400 cocoons of mason bee. This material was placed in two boxes hung at a height of two meters on the south wall of the outbuilding. Bees have been kept in this place from spring to early autumn. In the winter boxes with bees were moved to cool place (1–4°C). In the first week of April 2006 selection of cocoons was carried out. Reed socket were opened using a scalpel and then cocoons were removed from inside. Cocoons were segregated.

They were divided into 4 groups:

- full-shaped (ie, healthy),
- empty,
- damaged,
- infected.

During the selection the following parameters were evaluated:

1. Appearance of the cocoon:
   – Correct,
   – Damaged, strucked with parasites,
   – Damaged from other unidentified causes.
2. Developmental stages (divided into pupae);
3. The presence of parasites (larvae, pupae, imago):
   – Large – Diptera (*Cacoxenus indagator* Loew.; *Giraudiella inclusa* Frauenfeld.); Coleoptera (*Trichodes apiarius* L.),
   – Small – Hymenoptera (*Sapyga* sp.).

During each assessment it was determined the number and percentage of healthy and infected cocoons, and the percentage of cocoons infested with parasites. In the evaluation there were also

taken into account abnormal and unusual changes in cocoons and in socket material (cane tubes). It was compare the usefulness of one year old and two year old cocoons in terms of all these parameters.

RESULTS

In the experiment it has been revised and classified 16 642 cocoons, in that number 7826 originated from one year old slots and 8816 originated from two-year old slots.

The number of healthy annual cocoons was 1618 (20.67%), see Figure 1. In the material of biennial cocoons healthy cocoons was only 157 which made less than 2%.

The number of cocoons infested with parasites in annual and biennial material was similar and it amounted 5114 (65.35%) and 5109 (57.96%) respectively.

The greatest differences were found in the cocoons assigned to the group with unidentified causes of damage, annual cocoons were 1094 and biennial were 3550 representing respectively 13.98% and 40.26%.

In the study it was also classified nest material (cane tubes), depending on the condition of cocoons found in tubes. There were evaluated totally 2130 cane tubes (Tab. 1). In the two years old material there was no tube containing only healthy cocoons. Tubes infected with parasites in the biennial nests was over

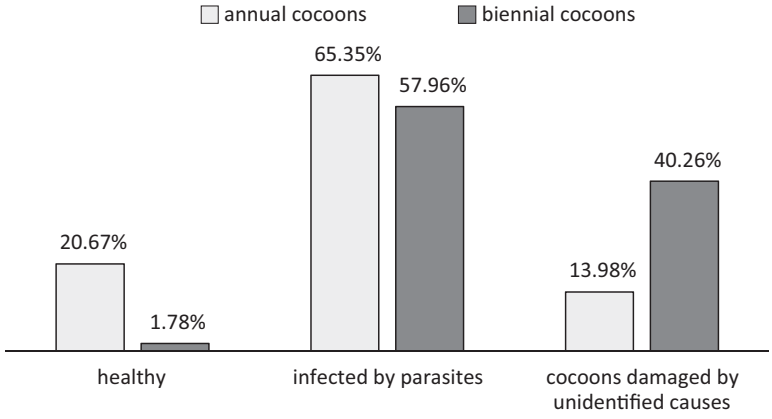

FIGURE 1. Percentage of classified cocoons

TABLE 1. Number of cane tubes originated from annual and biennial slots

Cane tubes / Cocoons	Annual	Biennial	Total
Healthy	253	0	253
With parasites	257	945	1202
Other unidentified causes of damages	518	157	675
Total	1028	1102	2130
	2130		

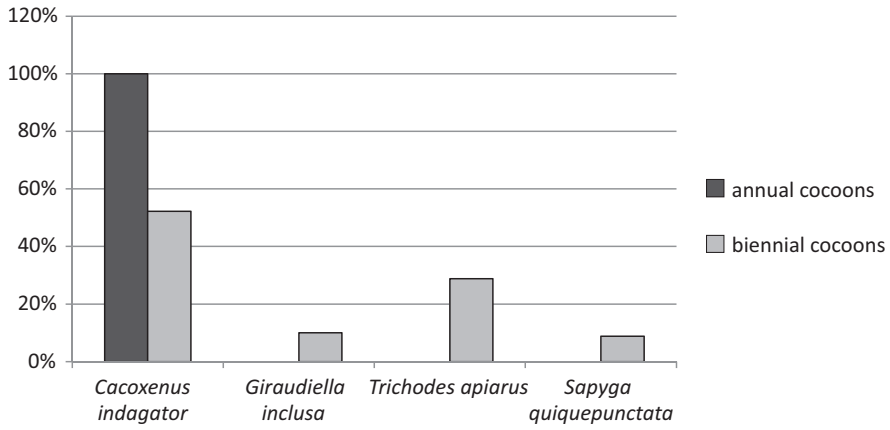

FIGURE 2. Percentage distribution of identified parasites in annual and biennial material

three times more than in the one-year slots. In biennial nest material was significantly less cocoons with damages of unidentified cause in comparison to the one year old slots. There were respectively 158 and 518 cocoons.

The parasite contamination level of the annual cocoons was similar to the contamination level of biennial parasite cocoons. The main and the only parasite that was present in the cocoons from annual nests was *Cacoxenus indagator* (100%). In biennial material was found presence of four types of parasites *Cacoxenus indagator* (52.2%), *Giraudiella inclusa* (10.03%), *Trichodes apiarus* (28.67%) and *Sapyga quiquepunctata* Fabricius (8.83%) (Fig. 2).

DISCUSION

In recent years, due to the low profitability of beekeeping and the continuing phenomenon of bees dying decreased number of honey bee colonies. Therefore, the solitary bees are increasingly used to pollinate crops, garden and trees in orchards. Mason bees breeding, among other, affects the quality and yield of onion (Wilkaniec et al., 2004; Wilkaniec et al., 2005; Biliński and Teper, 2004) and alfalfa (Wilkaniec et al., 2004). These authors found in their study that on the effectiveness of bee pollination the female mass of mason bees has a positive effect. The presence of nest parasites not only limits the number of bees that can emergence from cocoons, but also negatively impacts their individual development.

This study confirms the presence of one of the most common parasites found in socket material of mason bee which is *Cacoxenus indagator.* His presence also found Krunič et al. (1995) and Stanisavljević (1996) in their studies. The use of biennial nesting material did not affect the growth of the parasite invasion. The level of contamination with *Cacoxenus indagator* of the annual and biennial material was at similar level. In the socket material used twice in the second year there were appeared three other species of parasites: *Giraudiella inclusa, Trichodes apiarus L.* and *Sapyga quiquepunctata*. Their presence affected

very negatively for rearing mason bees. The number of healthy cocoons fell from 20% to less than 2% in such a situation it can be expected that in subsequent years without replacement of nesting material parasites could completely destroy the cocoons of mason bees. Therefore, one of the most important elements of rearing the bees is the use of a annual nesting material. Nest material used once should be destroyed such as burned (Krunič et al., 2001). In this way, we can limit the occurrence of the quantity and number of parasites species.

CONCLUSIONS

1. Healthy cocoons occurred only in the group of annual cocoons.

2. In both groups of cocoons, annual and biennial, were cocoons contaminated by parasites, and damaged by unidentified causes.

3. Sockets cane should be used once. Reuse slots increases the number of nest parasites species, and thereby reduces the number of healthy cocoons.

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Streszczenie: *Analiza sekcyjna materiału powylęgowego pszczoły murarki ogrodowej (Osmia rufa* L.*)*. Doświadczenie wykonano w Pracowni Hodowli Owadów Użytkowych SGGW w Warszawie, w sezonie 2005/2006. Celem pracy było dokonanie analizy jakości poczwarek murarki ogrodowej (*Osmia rufa* L.) pochodzących z gniazd jednorocznych i dwuletnich. Uzyskane kokony poddano klasyfikacji. Wyróżniono grupy kokonów zdrowych, pustych, uszkodzonych i chorych. Zbadano i określono również obecność pasożytów na kokonach murarki. Z badań wynika, że w gniazdach dwuletnich jest ponad 10 razy mniej zdrowych kokonów i 3 razy więcej kokonów uszkodzonych, w porównaniu z gniazdami jednorocznymi. Zróżnicowanie gatunkowe pasożytów w gniazdach dwuletnich jest większe niż w jednorocznych. W materiale jednorocznym stwierdzono jedynie obecność pasożyta należącego do gatunku *Cacoxenus indagator*, natomiast w materiale dwuletnim stwierdzono obecność czterech gatunków pasożytów: *Cacoxenus indagator*, *Gaudiella inclesa*, *Trichodes apiarius* L. i *Sapyga quiquepunctata*. Fab. Badania dowodzą, że gniazda dla murarki ogrodowej powinny być wykorzystywane jednokrotnie. Wielokrotne wykorzystywanie gniazd zwiększa stopień zarażenia pasożytami, co wpływa na obniżenie wyników reprodukcyjnych.

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