

PhD Thesis Acceptance Report
Research Discipline Council of Biological Sciences
Jagiellonian University in Kraków

Candidate's name and surname: Jaya Sravanthi Mokkaapati

PhD Thesis Title: Toxicokinetics and toxicity of plant protection products in the solitary red mason bee, *Osmia bicornis* (Hymenoptera: Megachilidae)

Thesis Supervisor: prof. dr hab. Ryszard Laskowski

Reviewer: prof. dr hab. Adam Tofilski

THESIS EVALUATION

1. Scientific merit of the thesis

a. Originality of the research

In the PhD thesis it was verified what is the influence of three pesticides (chlorpyrifos, cypermethrin and acetamiprid) on red mason bee (*Osmia bicornis*). The research topic is very important because in recent years there is a growing problem with decline of bees and other insects which are essential pollinators of both wild and cultivated plants. The decline is attributed to many different factors, however, use of insecticides in agriculture is considered as one of the most important. Most earlier toxicological studies focused on social honey bees, therefore, providing comprehensive data about susceptibility to pesticides of *Osmia bicornis*, which is solitary bee, should be considered as an important novelty. Results presented in the thesis can prompt updating pesticides regulations and in consequence can lead to better protection of bees and other pollinators.

b. Scientific merit of the chapters / articles

In the thesis there are described four experiments which verify what is the influence of pesticides on red mason bee in four different contexts: acute and chronic toxicity to imago, toxicity to larvae and toxicokinetics. It was found that some of the pesticides, at concentrations used by farmers, cause high mortality to both imago and larvae of red mason bees. Moreover, it was proved that some of the pesticides can accumulate in the insect body and become harmful even if present at low concentrations over long time. It was also demonstrated that chronic exposure to low concentrations of the pesticides affects physiology of the bees and has many negative consequences. The four experiments were described in four chapters which can be published separately in a high quality scientific journals.

2. Substantial merit of the thesis

The research topic is clearly introduced in the first chapter. Apart from a few mistakes, mentioned later, this chapter well summarizes the current knowledge about pollinators, their importance and their decline related to pesticide exposure. Additionally, each of the four experimental chapters is preceded by separate introduction referring to the specific experiment. The experiments are well planned, the sample size is adequate, the obtained data were statistically analyzed and finally the results were thoroughly discussed and compared with earlier studies. In the final chapter there is a general discussion of all four experiments and the final conclusions were clearly formulated. The data

presented in the thesis are confronted with extensive bibliography, however, there are at least two incorrect citations, which are mentioned below.

3. Layout and register

The general layout and structure of the experimental chapters is typical for scientific publications. There are numerous figures which adequately illustrate the presented data. Moreover, the experimental chapters are illustrated with graphical abstracts. Most figures are well readable, however, in some of them (Fig. 3.3, 3.4, 5.1, 5.2) lettering in legends is too small. In general the thesis is well written in language typical for scientific publications. I have noticed only a few minor mistakes, for example in footnotes of tables 2.1, 2.3 there are explanations of symbols which were not used in the table. Moreover, abbreviations of the pesticides are introduced in the abstract but they were not used consistently in all chapters.

4. Critical notes

In chapter 1 (page 15) there is information that: "Eusocial species - living in temporary or permanent colonies build by a bee called 'queen', with the labour shared by both males and females (Michener, 2000)". This information is not precise and in general it is not correct. First of all colony of social insects is a group of cooperating individuals. Therefore, using verb "building" in context of colony is not logical. Building is usually used in case of nest where the colony lives. It is not generally true that the queen builds a nest. In some species, in absence of workers, queen starts to build the nest but normally this task is performed by workers. It is clearly not true that in eusocial bees labour is shared between males and females, because in social hymenoptera males do not work. It is very unlikely that the information presented in the mentioned earlier sentence was found in book by Michener (2000) which is cited at the end.

In chapter 1 (page19) there is information that "only a few [*Osmia*] females being sufficient for pollination of a single flowering fruit tree in contrast to the hundreds of honey bee workers (Krunić and Stanisavljević, 2006)". This information is controversial and in the cited publication I was not able to find any data or facts supporting it. The cited publication describes improved methods of rearing *Osmia* bees and there is very little information about pollination.

In chapter 2 (page 33) there is information that "1 µL of an insecticide solution was applied on the pronotum of each bee". This information is surprising because pronotum in *Osmia bicornis* is relatively narrow (particularly on the dorsal side) and hidden under long hairs. Application of the specified volume of liquid on this small surface is difficult without contamination of neighbouring body parts including head. Results of this experiment was compared with study of Uhl et al. (2019) in which the active substances were applied "on the dorsal side of the thorax between the neck and wing base". In case of honey bees the standard method of application is "on the dorsal thorax" (Medrzycki et al. 2013). It would be better to follow standard methods in order to make the results easier to compare between studies.

5. Final grade (justification 25-200 words):

The reviewed PhD thesis is a comprehensive assessment of toxicity of three pesticides to red mason bee. The strong aspect of the thesis is broad range of complementary experiments which provide convincing evidence about risk imposed by the pesticides. The obtained results are important because they extend our knowledge to solitary bees which were rarely studied in this context. The few mistakes mentioned above are relatively minor. They occur mainly in the general introduction and are only loosely related to the main topic of the thesis.

I, hereby, declare that the reviewed PhD thesis by **Jaya Sravanthi Mokkalpati** meets the criteria pursuant to art. 13.1 of Act of 14 March 2003 on Academic Degrees and Academic Title and Title in the Arts (O.J. no 65 item 595 as amended) and request that the Research Discipline Council of Biological Sciences of the Jagiellonian University in Kraków accepts **Jaya Sravanthi Mokkalpati** for further stages of doctoral proceedings.

2021-08-28

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date



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Reviewer's signature