University of Hradec Kralove, Faculty of Science, Department of Biology

DOCTORAL THESIS

Evolution of sociality and parental care in bees of the genus *Ceratina*

Opposer statement

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For the first time, I met Michael Mikát when he was 11 years old. That time he was very much interested in the insect order Odonata, and his knowledge on species and ecology of this group was much better than that of specialists, who studied this group for plenty of years. Later, he was enlarging his knowledge in entomology and biology in general, and was one of the best competitors in biology olympiad, winning several times in the Czech Republic, and usually defended older students. Michael also represented his country in IBO and was very successful in this competition. Starting his university studies, he switched his specialization into the bees, and choosing *Ceratina* as his favourite model group was very good decision. Bees of this genus are very interesting due to their diverse ecology and ethology, and there are large differences among species and subgenera, which reflects also their phylogenetic relations.

The quality of Michael's research is considerable. He has 11 scientific papers submitted mostly to journals with IF in first half in their category, of which five were published in the years 2016-2019, and the next six were submitted for publication in last few months. It is not necessary to write any review and criticism to the papers - most of them were evaluated by multiple reviewers and thus must be of good quality. I have read several of them (all yet published) before writing this statement and must confirm that the scientific quality and value of the papers is high. I especially like that the character of all papers is a combination of classic or older ecological methodology with the most recent methods. Similar studies are recently not common and in my opinion Michael's way how to study and publish ecology and ethology of *Ceratina* is the best way how-to do-good research on ecology and ethology of insects. The quality of his papers was certainly improved due to three important facts: 1) the outputs come from very large amount of data (which is very important because recently many scientific papers are perfectly evaluated and written but the basic data are very bad); 2) the supervisor of M. Mikát, Dr. Jakub Straka, is one of the best specialists in bees in Europe and probably in the world, and his experience and scientific quality much helps to the quality of Mikát's papers; 3) Michael has a very numerous group of friends, colleagues and co-workers, who are willing to help him especially with time-consuming field surveys.

This Ph.D. thesis contains the above reported publications and a short introduction or summary, which combines previously published knowledge and new records on the ecology, ethology and phylogeny of *Ceratina* from Michael's publications. Contrary to the publications, the first part of the thesis contains quite large number of spelling, formatting and

grammatical errors. But - the scientific quality is very high and brings perfect overview on the biology of *Ceratina* studied by the author. Some parts of the text are repeated more times than it should be, especially the fact that bees genus *Ceratina* do not use any matters from nest environment for building septa and closing plugs.

Here some questions and suggestions:

1) There is a number of various types of provisioning of nests in *Ceratina*, differing species from species or in different parts of the distribution area of one species. We have discovered an interesting type called "late progressive provisioning" in nests of *Pemphredon fabricii* (see Bogusch, Havelka, Astapenková, Heneberg 2018: Ethology, Ecology & Evolution 30: 114-127). Have you observed a kind of provisioning like this in *Ceratina*?

2) Several papers deal with the comparison of offspring survival rates in guarded and unguarded nests. What about parasitic species associated with *Ceratina*? Is guarding an important behaviour against parasitic species? Does better care of the brood relate to the number of parasitic species attacking nests of different species of *Ceratina*?

3) Most species of *Ceratina* have northern border of their distribution area in central Europe and in the Czech Republic (probably all except *C. cyanea*, even though *C. nigrolabiata* and *C. cucurbitina* are recently enlarging their distribution areas to the north-west). Are there any important differences in nesting behaviour of populations here in the Czech Republic to the populations of the same species in south of Europe?

4) During your research on *Ceratina*, you have certainly recorded many other bees and wasps nesting in trap nests, as well as probably interesting host associations of cuckoo bees, golden wasps and others. Did you also study other species and do you plan to make a publication from these records?

5) Are some of the newest studies (Manuscripts 6-11) now published? And what are your next research plans?

Final evaluation: Michael Mikát is young, enthusiastic researcher, with very good sense for team-work and abilities to be a leader of research team. He is becoming a specialist in bees genus *Ceratina*, can use several statistical methods, and is able to write scientific papers in high quality. After successful defence of his doctoral thesis, I agree that he can get the scientific title Ph.D.

Hradec Králové, 30th July 2020 Assoc. Prof. Petr Bogusch, Ph.D.