

Abstract

Small carpenter bees (genus *Ceratina*) are an excellent model taxon for the study of evolution of parental care and origin of eusociality. Prolonged offspring care is typical for this bee genus. Females usually guard their offspring until adulthood and later feed their adult offspring pollen and nectar. Moreover, most of studied species are facultatively eusocial, a trait probably inherited from the common ancestor of the genus.

Although *Ceratina* bees have generally very interesting behavior, detailed studies were performed in only a few species, usually from North America, Japan and Australia. Only anecdotal observations of natural history existed for a few European species, and detailed research has not been performed before my thesis.

The goal of my thesis is to explore the natural history of European species of *Ceratina* and to identify possible costs and benefits of this species' behavioral traits. I focused on following these behavioral traits: social nesting, guarding of offspring until adulthood, and feeding of mature offspring. Through my master project, I discovered biparental care in species *C. nigrolabiata*, therefore the most important goal of my Ph.D. project is the evaluation of costs and benefits of this behavior.

Guarding of offspring by mother significantly influences their survival, because it serves as an effective protection against natural enemies. It was supposed that mothers guard their offspring until adulthood in all *Ceratina* bees. However, we found three species, in which guarding was only a facultative strategy. The mother can continuously guard her offspring, or close and abandon the nest. Guarded nests have a higher number of provisioned brood cells and usually also higher offspring survival rate. A probable benefit of nest abandonment is the possibility of another nesting elsewhere and therefore production of higher number of offspring.

Mothers of *Ceratina* bees usually feed their adult offspring. In North American species *C. calcarata*, dwarf eldest daughters feed their siblings in case of mother's death. Feeding of mature offspring by mother occurs in three studied European species. However, no individual feeds them in case of mother's death.

Eusocial nesting was newly documented in six species. Therefore, eusociality is common under temperate as well as subtropical climates in *Ceratina* bees. Nests with six females were documented in *C. parvula*, which is the highest number of females in one nest ever documented in *Ceratina* bees. Strange eusociality occurs in *C. chalybea*. Eusocial nests contain one old female, up to nine young adults, and new brood cells. These young adults are usually males and a half of them are unrelated to the old female.

Biparental care was not previously known in bees. *Ceratina nigrolabiata* is the first bee species in which biparental care was discovered. A male and female pair was found in almost all nests with provisioned brood cells, but the pairs are not permanent and exchanging of males occurs. The currently present male is usually not related to the offspring, who are fathered by previous partners of the female. However, long term pair stability has benefits for males and also females. If a pair is stable, nest productivity increases and so does the probability of the present male's paternity. We suppose that female mating multiple times paradoxically allows establishment of biparental care. As the female is receptive through the whole nesting season, long-term male survival is selected, therefore the probability of male care development is also increasing.