



## Influence of Annual Ornamental Flowers (Asteraceae) on the Relative Abundance of Honey Bee Species in the Hot Semi-arid Environment

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Received: January 2020

**Abstract:** Honey bees are an important component of the agricultural ecosystem and provide valuable pollination service. Cultivation of annual ornamental flowering plants is being recognized as a suitable options to compensate for the loss of natural floral resources for conserving the declining population of the honey bee. The capitulum/ inflorescence of commonly grown annual ornamental flowers of the Asteraceae family differs in morphology. The morphology of flowers affects the abundance and diversity of bee species. Therefore, the present study was conducted with an aim to study the influence of commercially cultivated flowering plants of India (*Calendula officinalis*, *Chrysanthemum indicum*, *Glebionis segetum*, *Tagetes patula* and *Tagetes erecta*) on honey bee diversity and abundance in the hot semi-arid environment. The capitulum of these plant species differed significantly in length and diameter of the corolla tube. It was observed that dwarf (*Apis florea*) and giant (*Apis dorsata*) honey bee were the most common visitors, however, the abundance of both bee species was significantly different ( $P < 0.01$ ) on different plant species. Plants with relatively longer (15.25-18.9 mm) and wider corolla tube (*Tagetes erecta* and *Tagetes patula*) were visited by both the bee species. However, plants having short (5.0-6.5 mm) and narrow (1.0-1.33 mm) corolla tubes (*Calendula officinalis*, *Chrysanthemum indicum* and *Glebionis segetum*) were dominantly visited by only *Apis florea*. Therefore, the cultivation of *Tagetes patula* and *Tagetes erecta* may enhance the population and conservation of both *Apis florea* and *Apis dorsata*, while *Calendula officinalis*, *Chrysanthemum indicum* and *Glebionis segetum* may only enhance the population of *Apis florea* in the arid and semi-arid zone of India.

**Key words:** Flower size, *Apis dorsata*, *Apis florea*, arid region, foraging behavior.

Honey bees are a key biotic component of the agro-ecosystem. They provide valuable ecosystem service in the form of pollination to the agricultural and horticultural crops for seed and fruit set (Chakrabarty and Shama, 2007; Das *et al.*, 2011). They also provide additional income to the farmers in the form of honey and wax. The annual economic value of pollination services has been estimated at over US\$ 200 billion around the world (Gallai *et al.*, 2009). About two-third of the leading global crop plants get benefited from animal-mediated pollination and among these animals, bees are primary pollinators (Klein *et al.*, 2007). However, there is clear evidence of the recent decline in bees colonies, and parallel decline in the population of plant species that are dependent on bees for outcrossing (Biesmeijer *et al.*, 2006). The decline in honey bee colonies has been reported in the different parts of the world (Potts *et al.*, 2010) and also in India (Sihag

2014). If the declining trend continues, it may reduce seed and fruit production from many outcrossing crops.

One of the major causes which have often been linked with pollinators decline is degradation and loss of natural habitats and floral resources due to developmental activities, e.g., intensification of agriculture and urbanization (Potts *et al.*, 2010; Hülsmann *et al.*, 2015). Therefore, enhancing the availability and diversity of floral resources is one of the major strategies for conserving honey bee population and diversity. Garden flowering plants are being frequently recognized as alternative options for substituting dwindling diversity of natural forage sources for bees and other flower-visiting insects (Garbuzov *et al.*, 2013; Hülsmann *et al.*, 2015). Bringing some part of agricultural land under floriculture may be a good option to enhance population and diversity of pollinators especially honey bee.

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