Agric Res (June 2019) 8(2):197–206
https://doi.org/10.1007/s40003-018-0370-2

FULL-LENGTH RESEARCH ARTICLE

Diversity, Species Richness and Foraging Behaviour of Pollinators in Cashew

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Received: 3 August 2017 / Accepted: 30 August 2018 / Published online: 5 September 2018

Abstract Insect visitors documented on cashew flowers during the present investigation include 40 species belonging to 13 families of three insect orders. The Hymenopterans were the major floral visitors comprising of bees, ants and wasps followed by dipterans. Among the 40 species recorded as flower visitors, only 13 are considered as pollinators of cashew, in which eight belong to Apidae and five belong to Halictidae. Among the two bee families, Apidae was the most abundant contributing 75.6% of the bee abundance. Within Apidae, the highest species abundance was recorded for *Braunsapis picitarsus* (20%) followed by *Apis cerana indica* (16.7%). Halictidae bees contributed to 24.4% of bee abundance, among which *Pseudapis oxybeloides* was most abundant (17.6%). Peak bee activity was recorded between 11.00 and 13.00 h for most of the bees. During 10.00–13.00 h, *B. picitarsus* was the most abundant (22–31%) followed by *P. oxybeloides* (18–25%), *A. c. indica* (12–15%), *Ceratina* sp. (8–13%) and *A. florea* (6–14%). Foraging rate was more for *A. c. indica* followed by *B. picitarsus* and *A. florea*. Lesser time was spent by *A. c. indica* for nectar and *P. oxybeloides* for pollen (i.e. 1–4 s), while longer time of 3–21, 8–16 and 5–11 s was spent by *A. florea*, *B. picitarsus* and *Tetragonula* sp., respectively. Bees of *C. hieroglyphica*, *Lasioglossum* sp. and *Seledonia* sp. spent 2–6 s per flower. Foraging rate was higher in *A. c. indica* and *B. picitarsus*, while foraging speed was lesser in *A. c. indica* and *P. oxybeloides*. Nesting sites of different bee species and the common bee flora in the study area were also recorded.

Keywords Cashew · Pollen · Anthers · Foragers · Nests · Activity · Bees · *Apis cerana indica* · *Apis florea* · *Braunsapis picitarsus* · *Ceratina hieroglyphica* · *Tetragonula* sp. · *Lasioglossum* sp. · *Pseudapis oxybeloides* · *Seledonia* sp.

Introduction

Pollination plays an important role in the reproduction and fruit set of flowering plant communities [6, 8]. In nature, only five per cent of the crops are self-pollinated and remaining 95% are cross-pollinated, in which 10% depend upon wind and 85% on animal pollination [32], in which insect pollination alone accounts 90% of animal pollination [6]. Cashew (*Anacardium occidentale* L., Fam: Anacardiaceae) is also an insect-pollinated crop being cultivated over an area of 10.72 lakh ha in India with an annual production of 7.25 lakh ton during the year 2014–2015 [9]. Cashew is andromonoecious having sticky pollen and even longer stamen of the hermaphrodite flower is shorter than style, thus making self-pollination difficult and hence favouring cross-pollination by insects. Several studies showed that fruit set in cashew is mainly influenced by activity of pollinators [12, 26]. Flies [27], moths [18] and bees [5, 14, 15] have been recorded as the major cashew pollinators worldwide, but little information is available about the effective pollinators of cashew, their foraging behaviour and their pollination efficiency. Hence, it is imperative to understand and address the issue of pollination in cashew so as to increase the productivity. Documentation is very important with relevance to pollinator diversity in a particular locality, followed by their

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