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Foraging activity of Rockbee (*Apis dorsata*) on Eucalyptus: A promising MPTs in South Gujarat condition

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Abstract

The present investigation was carried out at Navsari Agricultural University campus to find out the foraging activity of rock honeybee (*Apis dorsata*) on fully bloom Eucalyptus plants during November month in South Gujarat condition. For this purpose, four fully bloomed trees in four locations in NAU campus were selected. Rock honeybee visitation and percentage of visitation per hour per tree were studied along with temperature and relative humidity at that time. Rock honeybee visitation and percentage of visitation were found maximum during the morning hours as compared to the afternoon hours. Maximum frequency of visit (334.4) and maximum percentage of visitation (16.08%) by rock honeybee was found during 9-10 AM followed by 10-11 AM.

Keywords: Bee visitation, eucalyptus, foraging, rock honeybee

Introduction

Pollinators play an important role in sustainability and continuity of the ecosystem and agriculture. Among the pollinators, about 80 per cent of the commercial crops are pollinated by the insects. ^[1] The main group of these insects are the bees, wasps, butterflies, moths, flies and beetles. However, besides honeybees, the frequency of insect visitors is very less. The number of flowers visited by honeybees per minute is more as compared to other pollinators ^[2]. Notably, honeybees especially *Apis mellifera* and *A. dorsata* which acts as the main pollinator insect of many cultivated crops as well as plantation crops (*viz.* *Eucalyptus* spp.) was observed globally for its pollination potential. ^[3-7] The foraging activity of different honeybee species such as *A. mellifera* and *A. dorsata* has been studied in many regions of India. ^[8-12] In India, different *Eucalyptus* spp. are widely cultivated throughout the country as a raw material for paper and pulp as well as plywood industry and widely used in bioenergy sector. Species of genus *Eucalyptus* are fast growing MPTs (Multipurpose Tree Species) which belongs to the family Myrtaceae. Flowers of Eucalyptus, produce nectar from the base of the style and attracts a wide range of insects, birds, possums and bats, which facilitate pollination. Some *eucalyptus* produces so much nectar that a honey bee needs to visit only a single flower to fill its honey stomach ^[13]. Although Eucalyptus tree is included in the honeybee floral calendar, but there is meager information on the foraging activity of honeybees and other insects. The objective of this study was to find the foraging activity of rock honeybee on Eucalyptus in South Gujarat condition.

Materials and Methods

The present investigation was carried out in the NAU campus comes under the South Gujarat condition, situated at 20.9272° N latitude and 72.8983° E longitude with an altitude of 10 meters above the mean sea level. The climate of South Gujarat is typically tropical, characterized by fairly hot summer, moderately cold winter and more humid and warm monsoon. Annual average rainfall of about 1500 to 1800 mm with maximum in the months of July and August with a mean maximum temperature varies from 26 ° to 38° C in summer and the mean minimum temperature ranges from 26 ° to 10 °C in winter. The monsoon commences from the middle of June and ends by the first week of September. The campus is flourished with various bee plant species consists of mainly trees, shrubs, herbs and other habitats in the category of exotic and indigenous in natural or wild and planted conditions ^[14]. *A. dorsata* popularly known as a rock honeybee is found naturally and engaged in foraging

activity on various bee plants. The present trial was carried out on fully bloom Eucalyptus plants during November month. For this four fully bloomed trees in four locations in NAU campus were selected. The observation such as rock honeybee visitation (frequency) and percentage of visitation per hour per plant was studied along with temperature and relative humidity starting from 7 AM to 5 PM at every one hour interval. The frequency of visitation was studied by observation of tree bloom coming under transect of 1 m² made from four sides of the tree. The observation of visitation was done for 10 minutes at each transect per hour. Temperature and relative humidity were recorded by using traceable instrument made by Fisher Scientific Inc. The frequency of rock honeybee visitation per hour was correlated with temperature and relative humidity to find the maximum frequency of visit during different time periods. The observation and data recordings were performed in a clear sunny day. In this investigation, only honey bee species *A. dorsata* and its visitation on *Eucalyptus* trees were studied.

Results and Discussion

In the present trial, the rock honeybee frequency of visit at four locations was studied with respect to time period, starting from 7 AM to 5 PM at an hourly interval. The findings are depicted in figure 1 and 2. Rock honeybee visitation was found maximum during the morning hours as compared to evening hours. The results confirm (Fig.-1) that the maximum frequency of visit by honeybees was found during 9-10 AM (334.4) which was followed by 10- 11 AM (331.4) and minimum frequency of visit was found during 7- 8 AM [19]. Similarly, temperature, relative humidity and percentage of honeybee visitation were studied and recorded with respect to time at an hourly interval starting from 7 AM- 5 PM (Fig.-2). The maximum percentage of visitation (16.08%) was found during 9- 10 AM when temperature was 26.3°C and relative humidity was 46.2% followed by during 10- 11 AM having percentage of visitation, temperature and relative humidity of 15.94%, 28.7°C and 42.4%, respectively.

The honeybee foraging activity on flowers were recorded higher in the morning hours than in the evening hours as in *Callistemon lanceolatus* [7] and in *Litchi chinensis*, *Mangifera indica*, *Phyllanthus emblica* and *Psidium guajava* [15]. The foraging rate of honeybee depends upon foraging behaviour and the floral structure of the concerned plant. The foraging

activity of *A. mellifera* during morning hours was maximum noted by workers in certain crop plants [16, 6, 12, 17-19]. It was also examined that the foraging activity of different bee species was at peak level during the afternoon than the morning period [20-23]. Factors responsible for the peak foraging activity during morning hours are time related floral physiology of plant, environmental factors and innate responses of honeybees. When dehiscence of anthers takes place at the appropriate time of the day, which is a characteristic of a plant species then flowers have more pollen, accordingly bees regulate their activity for pollen collection [24]. Foraging rate depends upon a number of factors including instinctive foraging behaviour of insects, floral structure [16, 25] environmental factors [26-28], type of floral rewards, density of flowers, quantity and quality of floral rewards. The environmental factors mainly temperature, light intensity, humidity and solar radiation were significantly altered by the foraging behavior in honeybees [29].

Again, mean highest foraging rate was recorded at 08:30 to 09:30 am and lowest at 04:30 to 05:30 pm in bottle brush by rock honeybee [7] whereas maximum abundance of *Apis* spp. were recorded during 10-12 hrs followed by 8:00-10:00 hrs while minimum during 12:00-14:00 hrs in *Litchi chinensis* and *Mangifera indica* while in the *Phyllanthus emblica* and *Psidium guajava* maximum *Apis* spp. visited maximum during 8:00-10:00 hrs followed by 6:00-8:00 hrs [15]. The foraging activity was influenced by the pollen and nectar-sugar concentration and environmental factors. The environmental factors mainly temperature, light intensity, humidity and solar radiation were significantly altered by the foraging behaviour in honeybees [29]. The abundance of rock honeybee decreases with increase in the temperature; on the other hand it increases with an increase in humidity in the study. The metabolic activity of insects increases as the temperature increases and they visit many flowers at that time [1]. Nectar secretion rate is temperature dependent [30, 31]. The atmospheric humidity also effects the nectar secretion in plants [32, 33]. Normally, the highest nectar yield is secreted at a particular temperature that differs from species to species [34, 35]. The density of the insect pollinators on blossoms depends on weather conditions, nectar volume and nectar sweetness [36].

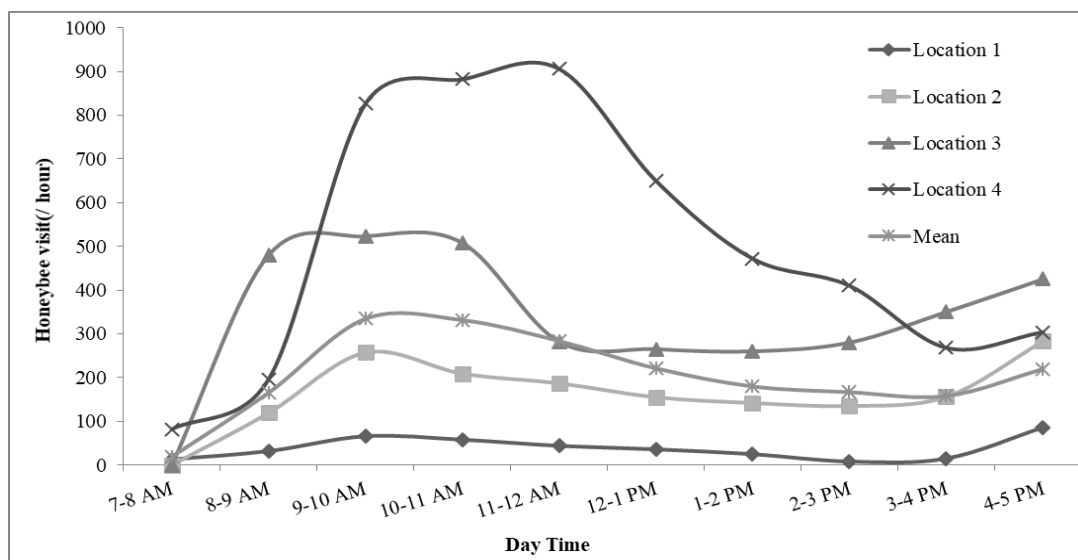


Fig 1: Rock honeybee visitation at different locations during time period of 7 AM to 5 PM

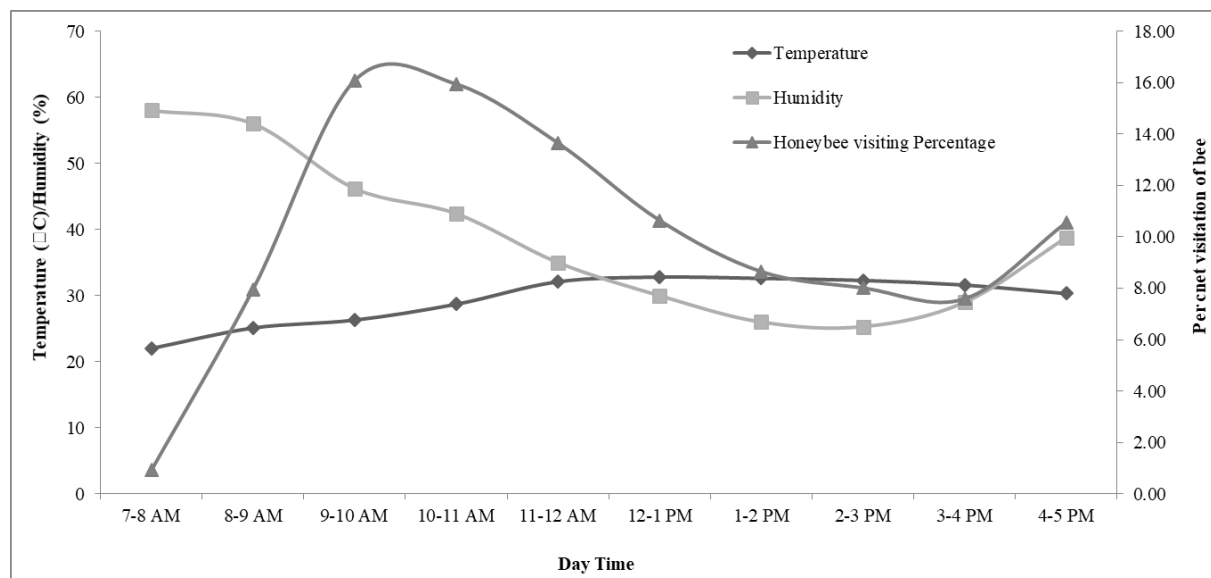


Fig 2: Rock honeybee visiting with temperature and humidity during different time period

Conclusion

A. dorsata acts as the main pollinator insect of many cultivated crops as well as plantation crops. Eucalyptus flowers produce profuse amount of nectar from the base of the style which attracts a wide range of pollinators including *A. dorsata*. Maximum frequency of visit and maximum percentage of visitation by rock honeybees were found during 9-10 AM which indicates that during the morning hours especially 9-10 AM possibly due to specific atmospheric conditions, maximum pollination by rock bees occurs.

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