

ORIGINAL ARTICLE

Suitable bee flora availability for commercial apiculture during dearth period in the heavy rainfall zone of South Gujarat

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ABSTRACT

Honey bee is an important social and beneficial insect. It benefited the society in one hand by producing honey and other produces and other hand by pollinating the cross-pollinated plants for fruits and seeds setting and ultimately increases the production. Honey is one of the important non-wood forest products. Tribal communities living in and around forest improve their social and economical livelihood by collecting and selling honey and other products of honey bees in the local market. For commercial apiculture, *Apis cerana* and *Apis mellifera* are the main species of honey bees generally practiced for honey production in India. It is essential to manage the honey bees and bee hives in the dearth period. During this period, there is lack of availability of nectar and pollen in flora required for quantitative and qualitative production of honey due to heavy rainfall in the South Gujarat condition. To overcome this problem, it is important to find out the suitable bee flora available in the locality to propagate and manage the plant species with abundant nectar and/or pollen to overcome the problem during the period for commercial apiculture. Consequently, a study was carried out during the dearth period of July and August to find out the suitable bee flora available in Navsari Agricultural University campus of South Gujarat. It was observed that both *Apis cerana* and *Apis mellifera* visited 25 numbers of plant species including climbers, herbs, shrubs and tree species for the collection of nectar and pollen. Out of these plant species most frequently visit was found on 9 plant species namely *Vitex negundo*, *Hamelia patens*, *Calliandra* spp., *Cocos nucifera*, *Tamarindus indica*, *Acacia auriculiformis*, *Acacia catechu*, *Samanea saman* and *Anthocephalus cadamba*.

Key words: Apiculture, bee flora, dearth period, honey bee

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INTRODUCTION

Honey bee is an important primitive social and beneficial insect. It is social in terms of living in a colony with different cast systems having queen, drone and worker. It is beneficial by producing honey and other produces which are used for various purposes and also pollinated the cross-pollinated plant species for production of foods. On an estimate, about 80% of honey is used directly in medicines and 10% is used in Ayurvedic and pharmaceutical production. Honey bees during foraging for pollen and nectar from flowers of different plant species, enhance agricultural productivity to the tune of 30– 80% annually through cross-pollination [1]. According to Dukku [2] honey bee visits thousands of flowers in order to collect nectar and/or pollen. While doing this they pollinate these flowers, thereby helping to increase fruit and seed-setting both in wild and cultivated plants. The implication of this is that honey bees contribute immensely to the maintenance of ecosystems and agricultural production while they produce important products such as honey. Five species of honey bees are found all over the world, namely *Apis florea*, *A. cerana*, *A. dorsata*, *A. mellifera* and *Trigona iridipennis*. However *A. cerana* and *A. mellifera* are reared in hives in India for commercial apiculture [3]. Flowers are the mainstay of the bee's life. From flowers, they obtain pollen, the protein rich food used mostly to feed the brood and nectar, the carbohydrate fuel for their flight, foraging, hive activity and for rearing brood. The abundance of bee flora and their continuous availability is one of the major pre-requisites for successful beekeeping. This enables the beekeepers to exploit these sources to the maximum utilization by the bees. Every region has its floral dearth period(s) of short or long duration and it is essential to manage the honey bees and bee hives in the dearth period. As during this period, there is lack of availability of nectar and pollen in flora required for quantitative and qualitative production of honey. To overcome this problem, it is important to find out the suitable bee flora available in the locality to propagate and manage the plant species with a option of abundant nectar and/or pollen to overcome the problem during the dearth period for commercial apiculture.

Consequently, a study was carried out during the dearth period of July and August to find out the suitable bee flora available in Navsari Agricultural University (NAU) campus of South Gujarat condition.

MATERIALS AND METHODS

The present investigation was carried out in the NAU campus, situated at 20.9272° N latitude and 72.8983° E longitude with at an altitude of 10 meters above the mean sea level. Annual average rainfall of about 1500 to 1800 mm with maximum in the months of July and August with mean maximum temperature varies from 26.00° to 38° C in summer and the minimum temperature ranges from 26.00° to 10.0° C in winter. The campus extends up to of 400 hectares and in which various plant species were found, consists of mainly grasses, climbers, herbs, shrubs and tree species in the category of exotic and indigenous. A methodology followed by Delaplane et al. [5] and Adebayo et al. [6] was adopted for this experiment. For this, visual observation was carried out for *A. cerana* and *A. mellifera* separately during the dearth period of July and August, in NAU campus of South Gujarat to find the blooming plants species visited by honeybees for collection of nectar and/ or pollen. The intensity of visitation by the foraging bees was visually monitored by recording the number of times a particular foraging source was visited by different species of bees. Number of bees visiting flowers/ plant/ minute was counted. On the basis of frequency of visit by these bees, the plant species were categorized into frequently visit, moderately visit and poor visit and indicated by ‘++++’, ‘++’ and ‘+’ respectively. For this investigation the frequently visit and moderately visit plant species were taken into consideration for suitable bee flora availability during dearth period.

RESULTS

In this experiment, *A. cerana* visits a large number of plant species which includes climbers, herbs, shrubs and trees species during July or July and August month(s) (Table 1). Similarly, *A. mellifera* visits less number of plant species as compared to *A. cerana*, which also includes herbs, shrubs and trees species but no climbers during the same time period (Table 2). It was also found that both the species of honeybees visited common species of herbs, shrubs and trees and most frequently visited tree species. (Table 3)

Table 1. *Apis cerana* visiting plants during dearth period

Sl No	Plant Name	Family	Plant category	Month(s) of visit	Frequency of visit
1	<i>Quisqualis indica</i>	Combretaceae	Climber	J,A	++
2	<i>Momordica spp.</i>	Cucurbitaceae	Climber	J,A	++
3	<i>Tridax procumbens</i>	Asteraceae	Herb	J,A	++
4	<i>Mimosa pudica</i>	Mimoseae	Herb	J,A	++
5	<i>Turnera subulata</i>	Turneraceae	Herb	J,A	++
6	<i>Vitex negundo</i>	Verbanaceae	Shrub	J,A	+++
7	<i>Hamelia patens</i>	Rubiaceae	Shrub	J,A	+++
8	<i>Jatropha gossypifolia</i>	Euphorbiaceae	Shrub	J,A	++
9	<i>Jatropha hastata</i>	Euphorbiaceae	Shrub	J,A	++
10	<i>Calliandra spp.</i>	Leguminosae	Shrub	J,A	+++
11	<i>Carica papaya</i>	Caricaceae	Shrub	J,A	++
12	<i>Thevetia peruviana</i>	Apocynaceae	Shrub	J	++
13	<i>Callistemon lanceolatus</i>	Myrtaceae	Shrub	J	++
14	<i>Cocos nucifera</i>	Palmae	Tree	J,A	+++
15	<i>Acacia catechu</i>	Mimosaceae	Tree	J,A	+++
16	<i>Eucalyptus spp.</i>	Myrtaceae	Tree	J	+++
17	<i>Tamarindus indica</i>	Caesalpiniaceae	Tree	J,A	+++
18	<i>Acacia auriculiformis</i>	Mimosaceae	Tree	J,A	+++
19	<i>Samanea saman</i>	Mimosaceae	Tree	J	+++
20	<i>Anthocephalus cadamba</i>	Rubiaceae	Tree	J	+++
21	<i>Leucaena leucocephala</i>	Mimosaceae	Tree	J,A	++
22	<i>Tabebuia spp.</i>	Bignoniaceae	Tree	J	++
23	<i>Moringa oleifera</i>	Moringaceae	Tree	J,A	++
24	<i>Terminalia arjuna</i>	Combretaceae	Tree	J	++

J stands for July month, A for August month, +++ for frequent visiting and ++ for moderate visiting.

Table 2. *Apis mellifera* visiting plants during dearth period

Sl No	Plant Name	Family	Plant category	Month(s) of visit	Frequency of visit
1	<i>Tridax procumbens</i>	Asteraceae	Herb	J,A	++
2	<i>Vitex negundo</i>	Verbanaceae	Shrub	J,A	+++
3	<i>Hamelia patens</i>	Rubiaceae	Shrub	J,A	+++

4	<i>Calliandra spp.</i>	Leguminosae	Shrub	J,A	+++
5	<i>Carica papaya</i>	Caricaceae	Shrub	J,A	++
6	<i>Cocos nucifera</i>	Palmae	Tree	J,A	+++
7	<i>Acacia catechu</i>	Mimosaceae	Tree	J,A	+++
8	<i>Tamarindus indica</i>	Caesalpiniaceae	Tree	J,A	+++
9	<i>Acacia auriculiformis</i>	Mimosaceae	Tree	J,A	+++
10	<i>Samanea saman</i>	Mimosaceae	Tree	J	+++
11	<i>Anthocephalus cadamba</i>	Rubiaceae	Tree	J	+++
12	<i>Peltophorum pterocarpum</i>	Caesalpiniaceae	Tree	J,A	++
13	<i>Couropita guianensis</i>	Baringtoniaceae	Tree	J,A	++
14	<i>Tabebuia spp.</i>	Bignoniaceae	Tree	J	++

J stands for July month, A for August month, +++ for frequent visiting and ++ for moderate visiting.

Table 3. *Apis cerana* and *Apis mellifera* visiting common plants during dearth period

Sl No	Plant Name	Family	Plant category	Month(s) of visit	Frequency of visit
1	<i>Tridax procumbens</i>	Asteraceae	Herb	J,A	++
2	<i>Vitex negundo</i>	Verbanaceae	Shrub	J,A	+++
3	<i>Hamelia patens</i>	Rubiaceae	Shrub	J,A	+++
4	<i>Calliandra spp.</i>	Leguminosae	Shrub	J,A	+++
5	<i>Carica papaya</i>	Caricaceae	Shrub	J,A	++
6	<i>Cocos nucifera</i>	Palmae	Tree	J,A	+++
7	<i>Acacia catechu</i>	Mimosaceae	Tree	J,A	+++
8	<i>Tamarindus indica</i>	Caesalpiniaceae	Tree	J,A	+++
9	<i>Acacia auriculiformis</i>	Mimosaceae	Tree	J,A	+++
10	<i>Samanea saman</i>	Mimosaceae	Tree	J	+++
11	<i>Anthocephalus cadamba</i>	Rubiaceae	Tree	J	+++
12	<i>Tabebuia spp.</i>	Bignoniaceae	Tree	J	++

J stands for July month, A for August month, +++ for frequent visiting and ++ for moderate visiting.

DISCUSSION

Out of two honey bee species, *A. cerana* visits a large number of plant species which includes climbers, herbs, shrubs and trees species during July or July and August month(s). Similarly, *A. mellifera* visits less number of plant species as compared to *A. cerana*, which includes herbs, shrubs and trees species but no climbers during the same time period. It was also found that both the species of honeybees visited common species of herbs, shrubs and trees most frequently. The plants species contain nectar or pollen or both thus, these are suitable as bee flora for commercial apiculture. These studies were supported by Atwal et al. [4], Deodikar and Suryanarayana [7], Chaubal and Kotmire [8], Singh [9], Verma [10], Abrol et al. [11], Chaudhary and Singh [12], Garg [13], Sihag [14], Sharma and Gupta [15], Kaur and Sihag [16], Kumar and Chaudhary [17], Mishra and Kumar [18], Pastagia [19] and Dukku [2].

CONCLUSION

The present studies on availability of suitable bee flora for commercial apiculture during dearth period in the high rainfall zone of South Gujarat condition reveals that both *A. cerana* and *A. mellifera* visited 25 numbers of flora including climbers, herbs, shrubs and tree species for the collection of nectar and pollen. Out of these flora most frequently visit was found on 9 plant species namely *Vitex negundo*, *Hamelia patens*, *Calliandra spp.*, *Cocos nucifera*, *Tamarindus indica*, *Acacia auriculiformis*, *Acacia catechu*, *Samanea saman*, and *Anthocephalus cadamba*.

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