



Productive And Protective Management Of Bee Colonies.

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Abstract:

Pollination transfers pollen grains from a blossom's male anther to its female stigma the process of pollination incorporates all events from maturation to zygote division. Honeybees are primary pollinators for the majority of the world's angiosperms, pollinating about 66% of the world's 1500 crop species accounting for 15-30% of food production, (Ollerton et al., 2012) honeybees have proved to be effective pollinators of a variety of crops including horticultural crops, oilseeds, forage crops, fibre crops and cereal crops (Rahman, 2006). Bees are the champion pollinators in fruit crop production. However, honeybees are still more important to farmers because of their pollination service, which increase the crop yield, (Sharma et al., 2015). Honeybee pollinators directly (or) indirectly provide 30 percent of the world's food supply.

Introduction:

Honeybees are important pollinators for flowers, fruits, and vegetables. They live on stored honey and pollen all winter and cluster into a ball to conserve warmth. All honeybees are social and cooperative insects. Members of the hive are divided into three types. Workers forage for food (pollen and nectar from flowers), build and protect the hive, clean, and circulate air by beating their wings. The queen's job is simple—she lays the eggs that will spawn the hive's next generation of bees. There is usually only a single queen in a hive. If the queen dies, workers will create a new queen by feeding one of the worker females a special food called "royal jelly." This elixir enables the worker to develop into a fertile queen. Queens regulate the hive's activities by producing chemicals that guide the behavior of the other bees. Male bees are called drones—the third class of honeybee. Several hundred drones live in each hive during the spring and summer, but they are expelled for the winter months when the hive goes into a lean survival mode.

Keywords: Honeybee, Pollination activity, Crop yield, Enhancement of Honeybees.

Materials and Methods:

Methods for Keeping Sugar Solution:

(a) The study was conducted at Annamalai Nagar campus during 2015-2016 in the dept of entomology, Annamalai Nagar. Indian bees are involved with various regular activities and bee behaviour to ascertain its efficient exploitation for pollination. Observations were made with Annamalai Nagar crop ecosystem with latitude of 11°23'48"N and longitude with 79°42'58" with +4.680 m MSL.

(b) Bees can also use the sugar syrup as food (sugar dissolved) in an equal quantity of water. Sugar is offered to supplement honey resources or in the extreme case to save the weak colonies from starvation. Early in

the spring, when the flowers are not in abundance bees can be stimulated to start brood rearing, as it should synchronize with the main honey flow, so that the bees can take best advantage of it. Under proper management, not more than one or two kilograms of sugar are needed to use in a year/colony. When the stores fall below this level, bees should be fed artificially. If syrup is given as a winter reserve, the syrup should be thick, prepared by mixing two parts of sugar with one part of warm water.

Honeybees' species in India:

In India, generally, four species of honey bees of commercial importance are found, i.e., little bee (*Apis florea*), Rock bee (*Apis dorsata*), Indian bee (*Apis cerana indica*), Italian bee (*Apis mellifera*). Among these first three are indigenous to India, but *Apis mellifera* was introduced to India in the 19th century, which is highly suitable for domestication in India (Chadha, 2001). *Apis cerana indica* takes flight only up to 1-2 km, so it is not effective for pollination, while *Apis mellifera* and *Apis dorsata* take flight or visit flowers up to 5-6km. Still, *Apis dorsata* is difficult to be domesticated. At the same time, the Italian bee has been used extensively to enhance the yield because it is easy to rear and highly suitable for pollination in India. It is estimated that pollination by this bee increases yield by up to 25% compared to the other crop pollinated through other means of pollination or other bee species (Sharma, 2006). Recently identified bee species *Apis karinjodian* also play an essential role in pollinating many crops.

Effect of Pollination in improving horticultural crop productivity:

Honey bees may be more effective pollinators due to their colony size (up to 60,000 honey bee workers in the summer). However, native bees are also important pollinators and, in some cases, are more efficient than honey bees at the individual level. Bee pollination not only results in a higher number of fruits, berries or seeds, but it may also give a better quality of produce, and the efficient pollination of flowers may also protect the crops against pests. The better weight due to sufficient pollination arises from the development of all seeds in a fruit. It has been estimated that the benefit of using honeybees for enhancing crop yields through cross-pollination is much higher than their role as producers of honey and beeswax. Many horticultural crops are self-sterile and require cross-pollination to produce seeds and fruit (McGregor, 1976; Free, 1993). However, self-sterile varieties benefit from crosspollination, and self-fertile varieties also produce better-quality seeds and fruits if they are cross-pollinated (Free, 1993). Logically, the increase in the cultivation of cross-pollinated horticultural crops will also increase the need for managed pollination. There are two wellknown methods for improving crop productivity. The first method uses agricultural inputs such as quality seeds or planting material and good cultural practices like timely irrigation, organic and inorganic fertilizers and chemical pesticides to increase yield. The second method includes biotechnological techniques, such as manipulating the rate of photosynthesis and biological nitrogen fixation, etc. These conventional techniques ensure the healthy growth of crop plants but work up to a limit. At some stage, crop productivity becomes stagnant, or declines with additional inputs for the known agronomic potentials of the crop will have been harnessed (Partap and Partap, 1997). Nearly 70 per cent of the cultivated crops worldwide are cross-fertile and depend on insects like honeybees for pollination. Insects are the most commonly occurring pollinators of many agricultural and horticultural crops.

Visitation rate:

It is the mean number of flowers a pollinator specimen visited per minute. It is another crucial behavioural parameter because it determines the number of flowers a particular species can pollinate per unit of time. Visitation rate has been studied in many crop Vol. 3 Issue-12, August 2023 (e-ISSN: 2582-8223) www.justagriculture.in Page384 systems, and the parameter is variable between honey bees and non-Apis bees. Also, among non-Apis bees, there are apparent differences.

Increase in total yield due to bee pollination:

Crops	Crop Increase yield (%)
Cherry	5-15
Citrus	5-15
Mango	3-5
Cashew	5-15
Coconut	3-5
Guava	5-10
Papaya	5-10

The basic requirement for productive colony management beekeeping are large, food- reserves of pollen and honey at all times and ample- room for these food- reserves, brood rearing - and the storage of surplus honey. Young productive queens from good: stock are essential the queen should be supported by a large population favorable to, the time of the year.

The object is to build maximum colony populations for the nectar flow and maintain them throughout the season. The most 'populous colonies produce not only the most honey per colony but the most honey per bee. Brood rearing is the basis of colony development and the maintenance of maximum populations during the flow. It is dependent. upon the queen's capacity to lay eggs; the supporting population's ability to maintain favorable temperature and feed the brood, reserves of pollen and honey, and space the proper position for expansion of the brood nest.

Manipulations that maintain the most favorable organization of hive equipment for. maximum brood rearing and honey storage will help to insure strong colonies and minimize swarming. The maintenance of a reserve of young productive queens in nuclei makes it possible to replace inferior queens promptly. The development of colonies inadequately provisioned with pollen can be increased by feeding pollen supplemented with 75 percent of soybean flour. Efficient management requires the proper timing of colony development so that maximum populations will coincide with the available nectar flows.

Where To Place Hives For Pollination:

The beekeeper can guide the bees to special crops for pollination. By feeding the colony inside the hive with sugar syrup mixed with flowers from the crop. To a certain degree, this will make the bees search for that scent and find the crop concerned. The feeding has to take place inside the hive to prevent fighting between bees from different colonies. It is important not to spill any sugar water on the ground because it will attract ants to the area.

It is important to place colonies for pollination inside or as near as possible to the crop requiring pollination. If there is another crop also attracting the bees, the hives must be placed so that they have to cross the field the farmer wants pollinated, before they can reach the other attracting crop. If possible, the hives should be spread out within the crop.

If we consider that maximum harvest of seeds or fruits require maximum pollination, it is clear that there is a potential lack of bee colonies in many areas of the world. This lack is much bigger than the number of existing bee colonies, and even if all hives were easy to transport and could be placed in the fields for the most effective use, still there would be a lack of many millions of bee colonies.



Pollination of mango:

The degree of self-fertility and sterility in different cultivars has not been determined properly, but there is apparently some variation. Self-sterility has not, however, been identified as a major problem for percentage fruit set. Whatever the degree of self-sterility within a cultivar, there is a definite need for pollen to be transferred to the stigma by an outside agent. The evidence showed that the importance of cross-pollination between mango cultivars is not critical, at least for most cultivars, but there must be abundance pollinating insects to transfer the pollen from anthers to stigma within the cultivar to obtain satisfactory results. Bee pollination significantly increase fruit set percentage in mango. Sturrock (1944) [68] also considered the flowers as self-fertile. It was supported by the earlier work of Popenoe (1917) [49], who stated that though mango is self-fertile, but cross-pollination helps to increase fruit set.

Pollination in citrus:

The pollination requirements for citrus are quite diverse (Sanford 2003; McGregor 1976) [56, 41], ranging from self-fertile (Valencia oranges) to almost complete self-sterile (mandarin and mandarin-hybrid complex). Pollen must be transferred to these self-sterile or partially self-sterile flowers from those of different compatible type for maximum fruit production (Sanford 2003) [56]. In others (Washington navel oranges), the plant is benefited if pollen is moved from flower to flower within the cultivar or within the species (Sanford 2003), and finally others such as lemons, have no known to be benefited from transfer of foreign pollen to the stigma (Sanford 2003; McGregor 1976) [56, 41]. The literature mentioned conflicting reports on the need for bees in some citrus varieties and therefore it is difficult to generalize regarding the responsiveness of citrus crops to honey bee pollination. Such as the variety, conditions at the site and honey bee pollination may all contribute or alternatively, have no effect in increasing yields, fruit size and seed number. Some have suggested as citrus flowers have complete or perfect flowers so they will generally pollinate themselves and produce fruit (i.e. they are self-compatible and self-fruitful). There are few special cases with tangelo and tangerines where a pollinator is required for better fruit set. Citrus trees produce an abundance of flowers. It is a natural tendency to drop its fruit, and most of the fruit set at bloom will not hold on until maturity. A good crop may be borne if only 3–7% of the flowers that are set yield mature fruit. Several studies have revealed increased fruit set and resultant production when managed honey bee colonies for pollination services (Sanford 2003) [56]. Butcher (1960) [8] discovered that honey bee foraging on Minneola tangelo increased fruit set, with optimal fruit set occurring at 60–90m from a group of honey bee colonies. However, some growers of seedless cultivars readily discourage honey bee pollination as seedless fruits are often more sought-after, demanding higher retail prices in comparison to seeded varieties. Conflicting situations can occur when beekeepers and citrus growers (who blame the bees for causing otherwise seedless mandarins and oranges to develop pips) are operating in close proximity (McGregor 1976) [41]. It is quite next to impossible to issue pin point recommendations about citrus pollination for a wide range of reasons. There exist several citrus varieties and more are being developed all the time. Each has its own characteristic that must be addressed in order to assure adequate pollination. Recommendations for grapefruit will differ from limes which again will differ from oranges. In addition, a good many variables exist under field conditions which often do not mirror those of controlled experiments (Sanford 2003) [56]. The recordings in literature contain conflicting reports on the need for bees in some citrus varieties. It is therefore difficult to generalize. Depending on the variety and conditions at the site, honeybee pollination may increase fruit set, fruit size and seed number. Krezdom, 1970 suggested that this by no means indicates pollination is not necessary in citrus. Although cross pollination is required, use of honey bees remains the most consistent, effective and economical means of ensuring adequate yields.

Pollination in papaya:

For papaya fruit to develop, pollen must be transferred from the staminate (male) flowers to the (female) flowers. The fruit may produce 1,000 or more seeds and well over 1,000 pollen grains which must be transfer to the stigma while it is receptive. Fruit with less than 300 seeds is usually not marketable, and the more seeds the larger the fruit (McGregor 1976) [41]. Papaya plants may be self-pollinating (bisexual plants) or cross pollinated by insects or wind. Pollinators include honey bees, wasps, midges, thrips, syrphid flies, and butterflies (Crane, 2013) [14]. The result of earlier research describes the pollination of papaya by insects vary as to which insects (if any) are the most important. Some have considered wind to be the primary agent for pollination while others argue a combination of wind and insect pollination is needed for optimal pollination and still others give credit to several other insects including the hummingbird moth (*Macroglossus sumstellatarum*) and various species of *Trigona* and *Xylocopa* (McGregor 1976) [41]. Stingless bees also participate in papaya pollination (Heard, 1999) [26]. More recently (Garrett 1995) [24] reported that the hawk moth was the primary pollinator in Queensland orchards. Honeybees also reported to be primary pollinating agents of papaya, but conflicting evidence persists with reference to the pollinating capabilities of honey bees in papaya orchards. Westerkamp and Gottsberger (2000) [74] found that attractive

nectar produced by male flowers around the rudimentary pistil is out of reach of the bees because of the long tube. Walsh et al. (2006) [72] highlight the importance of insects in general in the pollination of the papaya. The study was carried out with three types of netting (coarse, medium and fine mesh) for exclusion of insects to control phytoplasma diseases and the results showed that pollination was poor under netting condition, with the individual fruit weight and total harvested fruit weight reduced to around 50% compared to the control.

Pollination in guava:

Honey bees were the best pollinators for increasing the fruit set and the quality of fruit was also improved (Rajagopal and Eswarappa, 2005) [51]. Twenty to forty per cent of pollination was due to honeybees. Fruit characteristics like length and girth were also significantly improved in bee pollination treatment over without bee pollination (Anonymous, 2011; Sehgal, 1961).



Conclusion:

The declining horticultural productivity can be attributed to several factors, but pollination is crucial. Promoting the use of beekeeping to pollinate horticultural crops will benefit both the beekeeper and the farmer, by the production of agriculture sector of pollinator's ecological and economic benefits. Many growers are not aware of how significant the contribution of native pollinators is to the production of their crops and farm profitability other challenges include the active participation of researchers and extension specialists, which will help expand the use of honey bee rearing for crop pollination. Honey bee superior pollinators comparatively other insects.

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