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Short Communication

FORESTRY CROPS DEPENDENT ON BEES IN INDIA

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ABSTRACT

Insect pollinators are the mean of pollination, an ecosystem service which regulates natural ecosystem. Bees are efficient pollinators and key element for sustaining environment without which many species of plants would not survive in many forests. Bees are becoming a source of income and livelihood for many forest dwellers. Such bee population was declining at alarming rate due to various factors including shrinkage in natural ecosystems. Hence, integrating bee floral trees into agroforestry system and apiculture would be considered as an optimal opportunity to augment bee population for sustainable biodiversity conservation.

Keywords: Bees, Pollination, Ecosystem service, Apiculture.

INTRODUCTION

Pollination plays a vital role as a regulating ecosystem service in nature. Among the insect pollinators, solitary and social bees provide most pollination in both managed and natural ecosystems. Most of the world's staple foods, including wheat, corn, and rice reproduce without insect pollination. These crops account for 65% of global food production, still leaving as much as 35% depending on pollinating animals (Klein *et al*., 2007). In part due to the massive scale and homogeneity of modern agriculture, the majority of crops requiring pollination are dependent on managed pollinators, and especially on managed honeybees (Aizen *et al*., 2008).Pollinator-plant interactions have been estimated to encompass almost 400,000 species, the precise nature of the relationship between plant and pollinator varies enormously. Although some animals visit flowers for nectar or pollen, not all flower visitors bring about pollination. Effective pollinators often have behavioral and anatomical traits that greatly increase the efficiency and accuracy of pollen delivery (Proctor *et al*., 1996; Lewinsohn *et al*., 2006). In general, pollination is a mutually beneficial interaction; pollinating animals receive some form of nutritional "reward" for visitation and pollen delivery. Pollen itself can be a reward, serving as the primary food resource for most larval bees and as an important source of protein for some flies, butterflies, birds, and bats. Other plants provide nectar, oils, resins, fragrances, pheromone precursors, and other resources to induce visitation and pollen delivery (Roulston and Cane, 2000).

Bees as Pollinators

Bees can, in a sense, be considered as livestock. With the increasing commercial value of honey, bees are becoming a growing generator of income, livelihood strategy and means of food security for many small-scale producers and forest dwellers in many developing countries. Clearly, the benefits that bees and other small pollinators bring us go beyond human food. Thanks to these pollinators, farm animals have diverse forage sources and hence more flexibility to adapt to an increasingly changing climate.

Domesticated species

There are two most important hive species. European honeybee, *Apismellifera L*. is a native of old world except tropical Asia and introduced to most parts of the new world. It has a foraging range of 3 km. The Indian hive bee, *A. cerana indica* F., a native of tropical Asia is prevalent in a wide region with a flight range of 1.5 km. It is even a better pollinator than *A. mellifera* because of their longer foraging period and many other characters (Sihag and Mishra 1995).

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Wild species

Two other species, *A. dorsata* (rock/giant bee) and *A. florea* (little bee) are also native of tropical Asia and efficient pollinators. But these cannot be managed for long time, as they do not live in artificial hives. Their foraging range is 2.5-4.0 and 1 km, respectively.

Role of bees in forest: A part of an Ecosystem

In working to retain natural environments, it is widely understood that habitats cannot be protected without the interest and involvement of local people. Beekeeping offers a good way for people to generate income from natural resources and access to good markets for their products. Pollinators strongly influence ecological relationships, ecosystem conservation and stability, genetic variation in the plant community, floral diversity, specialization and evolution. Bees play an important, but little recognized role in most terrestrial ecosystems where there is green vegetation cover for at least 3 to 4 months each year. Bees and trees are interdependent, and have been perfecting their relationship for over 50 million years. Trees do not just need bees for their own reproduction, but for the whole system within which the trees exist. In tropical forests, savannah woodlands, mangrove, and in temperate deciduous forests, many species of plants and animals would not survive if bees were missing. Bees are essential for sustaining our environment, this is because the production of seeds, nuts, berries and fruits are highly dependent on insect pollination, and among the pollinating insects, bees (Table 1) are the major pollinators they pollinate more species of flowering plants, and thereby increasing yields of seeds and fruits within a system. In rain forests, especially in high mountain forests where it is too cold for most bees, other pollinators like bats and birds play a greater role in plant pollination, the greater its biodiversity and the greater its life-carrying and life-enhancing capacity.

Table 1. Forestry tree species dependent on pollinators.

S.No.	Name of the forestry tree species
1.	*Acacia nilotica*
2.	*Acacia sp.*
3.	*Adina cordifolia*
4.	*Aegle marmelos*
5.	*Ailianthus excelsa*
6.	*Aspidopterys sp.*
7.	*Azadirachta indica*
8.	*Bombaxceiba*
9.	*Delonixregia*
10.	*Emblica officinalis*
11.	*Eucalyptus globulus*
12.	*Feronia limonia*
13.	*Ficus sp.*
14.	*Flacourtia indica*
15.	*Holopteleaintegrifolia*
16.	*Lagerstroemia speciosa*
17.	*Mangifera indica*
18.	*Melia azedarach*
19.	*Moringa oleifera*
20.	*Peltophorum sp.*
21.	*Pongamia pinnata*
22.	*Prosopis spicigera*
23.	*Symplocosracemosa*
24.	*Syzygiumcumini*
25.	*Terminalia sp.*
26.	*Trewianudiflora*
27.	*Xanthium strumarium*
28.	*Ziziphus sp.*

Pollinators under Threats

The population of both wild and managed pollinators is declining at alarming rates owing to alteration in their food and nesting habitats, shrinkage in natural ecosystems, i.e. forests and grassland ecosystems, pesticide poisoning, diseases and pests, over-collecting, smuggling and trading in certain rare and endangered species. People living in or near tropical forests and woodlands are amongst the poorest in the world, often depending on shifting cultivation for their food, and local wood as their fuel source. To conserve forests, Beekeeping fits this category so perfectly: using locally available, renewable resources, forest beekeeping is an environmentally sound activity, yet one that enables forest – dwelling people to harvest products that can be of world quality. Present bee species extinction rates are 100 to 1 000 times higher than normal due to human impacts. Insects will likely make up the bulk of future biodiversity loss with 40 percent of invertebrate pollinator species – particularly bees and butterflies – facing extinction. Though to a lesser degree, vertebrate pollinators (16.5 percent) are also threatened with extinction globally. Changes in land use and landscape structure, intensive agricultural practices, monocultures and use of pesticides have led to large-scale losses, fragmentation and degradation of their habitats. Pests and diseases resulting from reduced resistance of bee colonies and from globalization, which facilitates the transmission of pests and diseases over long distances, pose a special threat. Furthermore, climate change also has a negative impact. Higher temperatures, droughts, floods, other extreme climate events and changes of flowering time hinder pollination largely by desynchronizing the demand (flowers in bloom) with the supply of service providers (abundant and diverse populations of pollinators).

Focus on Apiculture: Promoting Conservation and Management of Pollinators

In India, the total cultivated area is about 160 million hectares and at least one third (if not half) of the areas is under entomophilous crops which require insect pollination. At a very modest rate of 3 colonies per hectare we need 160 million colonies of honeybees but against this requirement we have just less than one million bees colonies at present. This would be possible only if the apiculture as a whole gets boost and number of colonies are multiplied and managed. Besides, it is very necessary to

survey different agroclimatic zones to determine the distribution and abundance of pollinating insects so that pollinator's specific to different zones are multiplied and managed. The focus of beekeeping needs to change from conventional honey production to crop pollination. A crop's pollinator dependence differs between species, including between crops and crop varieties. Some plants must be cross-pollinated, others do not need pollinators but produce better fruit and seed if pollinated, and a number of them are strictly self-pollinated.

Further, plants differ in their pollinator-type requirements; some require specific pollinators while others are pollinated by a variety of visitors, and many are wind pollinated. Effective pollinators of the same crop may vary from one site to another. Honeybees from a single hive will fly 2–3 miles from the colony, the radius of greatest efficiency and greatest pollination is only 200–300 yards from the colony. There are many flowers competing for the bee's attention; some may be more attractive or "profitable" to work than the crop needing pollination. Bees will not fly a great distance to forage on an unattractive crop.By moving bees directly into a field, a grower can increase the flight activity in that area. The fact that the bee pollination will provide sufficient pollination of his crop which enhances crop yields. Evidently, bee/insect should be encouraged for increased and sustainable agriculture production gathering specific knowledge on pollinator dependence and types is important for agriculture and biodiversity (including agro-biodiversity) conservation.

Agroforestry system for bee and beekeeping

Crops relying on bee pollination include apple, citrus, tomato, melon, strawberry, apricot, peach, mango, grape, carrot, potato, onion, pumpkin, bean, cucumber, sunflower, various nuts, alfalfa, etc. Even crops that do not require pollination for harvesting, such as those producing fibre or timber, still require pollination to produce further generations, and crops such as cotton that do not require pollination to produce seeds, provide greater yields when pollinators are available (Allen-Wardell*et al*., 1998).Apart from direct benefits derived from honeybees in the form of honey and beeswax, indirect benefits realized by way of increased yields of certain farm crops and forest products due to their pollination services are immense.

Forests provide excellent resources for bees and beekeeping, and bees are a vital part of forestecosystems. Indigenous bee species are natural forest resources, and beekeeping enables theirexploitation by humans for valuable products, without necessarily damaging the honeybee populations, or extracting anything except the products, honey and beeswax. This is also the case where exotic honeybee species have been introduced, for example in the tropical forests of SouthAmerica, now home to large populations of African honeybees. Honey bees are key element, active and efficient pollinators for forestry crop production, integration of beekeeping in agroforestry system can increase crop yield dramatically. For which efficient beekeeping requires bees continuously dependent upon apiphilic flowers containing good source of nectar and pollen status throughout the year. A floral calendar is made and incorporation of good bee floral trees in agroforestry system will beneficially gain higher productivity. Plantation of trees like *Deris indica, Tamarindus indica, Cocos nucifera, Eucalyptus spp., Moringa oleifera, Acacia auriculiformis, Syzygiumcumini, Azadirachta indica, Borassusflabellifer, Dalbergia sissoo, Acacia nilotica, Peltophorumpterocarpum, Anthocephalus cadamba, Leucaenaleucocephala* and *Sapinduslaurifolius* etc. play crucial role in terrestrial ecosystem, from which vital resources such as fruits, nuts, herbs, spices, oleoresins, resin, gums, fibres, flosses, fuel wood, dyes were derived and contributed economically to the rural livelihoods.

CONCLUSION

Bees are essential key element for crop production and plays vital role in income generation and livelihood for forest dwellers. Integrating beekeeping with agroforestry will enhance bee population in turn survival of many forest tree species for sustaining ecosystem and ecosystem services as well.

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REFERENCES

Aizen, M.A., Garibaldi L.A., Cunningham S.A. & Klein A.M (2008). Long-Term Global Trends in Crop Yield and Production Reveal No Current Pollination Shortage but Increasing Pollinator Dependency. *Current Biology*, 18, 1572-1575.

Allen-Wardell, Gordon, Bernhardt, P., Bitner, R., Burquez, A., Buchmann, S., Cane, J., Cox, P. A., Dalton, V., Feinsinger, P., Ingram, M., Inouye, D., Jones, C. E., Kennedy, K., Kevan, P., Koopowitz, H., Medellin, R., Medellin-Morales, S., Nabhan, G. P., Pavlik, B., & Walker, Set al. (1998). The Potential Consequences of Pollinator Declines on the Conservation of Biodiversity and Stability of Food Crop Yields." *Conservation Biology*, 12(1), 8–17.

Klein Alexandra-Maria., Vaissière Bernard E., Cane James H., Steffan-DewenterIngolf., Cunningham Saul, A., Kremen Claire &TscharntkeTeja (2007). Importance of pollinators in changing landscapes for world crops. *Proceedings Research Society*. B.274, 303-313.

Lewinsohn, T.M., Prado, P.I., Jordano, P., Bascompte, J. and Olesen J.M (2006). Structure in plant–animal interaction assemblages. *OIKOS Advanced Ecology*, 113(1), 174-184.

Proctor M., Yeo P. & Lack A (1996). The natural history of pollination.1996, 479 pp. ref. 37 pp.

Roulston, T.H &Cane, J.H (2000). Pollen nutritional content and digestibility for animals. *Pl Syst Evolution*. 222, 187–209.

Sihag, R. C& R. C (1995). Mishra. Crop pollination and Apis cerana. 135-141.

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