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Research Article

CONSERVATION OF ASIAN GIANT HONEYBEE, *APIS DORSATA* FABRICIUS (HYMENOPTERA: APIDAE)

N. Nagaraja*

UGC-Human Resource Development Centre, Bangalore University, Jnana Bharathi Campus, Bengaluru-560 056, Karnataka, India

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ABSTRACT

The giant honeybee, *Apis dorsata* builds single largest open comb on a suitable substratum. It is a major honey producer and important pollinator of both wild and crop plants. However, recently colony population of these species is gradually declining due to many factors including traditional honey harvesting and pesticide poisoning. Conservation of these species is immediately required through development of sustainable methods of honey harvesting and reduced insecticide poisoning for better honey production and effective pollination.

Keywords: *Apis dorsata,* Honey hunting, Insecticide poisoning, Conservation.

INTRODUCTION

The Asian giant honeybee, *Apis dorsata*, largest in body size among honeybee species, is found through southern Asia from Pakistan to Indonesia (Hepburn and Radloff, 2011). It builds single, large sized vertical nests mostly on tall trees, multi-storeyed buildings, rock cliffs, water tanks etc. (Reddy and Reddy, 1993, Nagaraja, 2017), especially at an inaccessible elevation (Nagaraja and Rajagopal, 2000, Woyke *et al.*, 2012). These species tend to nest high in the air, usually from 3 to 25 m above the ground and are most frequently found in aggregations and their numbers in an aggregation may be varied from 50 to 100 colonies (Paar *et al.*, 2000, Nagaraja, 2012) (Figure 1). During dearth season, its colonies abandon their combs and migrate to regions where floral resources are aplenty and are able to travel up to a distance of 2000 kms (Koeniger and Koeniger, 1980) and establish new nests. However, no brood was reared in the combs at least two weeks before migration (Woyke, *et al.*, 2005).

Apis dorsata colonies are mostly free from any major pests and diseases and contribute about 70 to 75% of total honey production in Indian subcontinent. Physical communication through dance language coupled with wide foraging range, workers of its colonies rapidly identify and exploit floral resources from the radius of 2 to 3 kms from the nests. *A. dorsata* which has the unique ability to forage at dusk, is essential for the pollination of crops and trees especially which bloom at night, such as the dragon fruit, *Hylocereus undatus.* However, recently population of these honeybee species is gradually declining. Long-term decline in honeybee population may leads to deforestation through unsucessful pollination of trees (Oldroyd and Nanork, 2009).

MAJOR THREATS

Traditional methods of honey harvesting

The practice of hunting *A. dorsata* nests, for their honey and beeswax has been followed in its distribution regions since ancient times (Crane, 1999). Gradually increasing human population demands desire for natural products from the wild, enhances economic incentive for hunting and gathering within the remaining forests (Nath and Sharma, 2007).In most parts of Indian subcontinent, the honey hunters, who are mostly from economically weaker sections, depend primarily on honey, beeswax and other forest produce for their livelihood. They harvest honey preferably during night time to overcome from bees ‘mass stinging’ and most often exposé bees to flames of fire with shouldering torch of tightly bound brush (Nath *et al.*,

*Corresponding Author: N. Nagaraja, UGC-Human Resource Development Centre, Bangalore University, Jnana Bharathi Campus, Bengaluru-560 056, Karnataka, India Email: nagaraja@bub.ernet.in.

1994). It leads to brutal killing of the brood, and adult bees in the comb (Figure 2 & 3). Many bee queens are lost during these harvests. Occasionally, a portion of adult population with queen bee was survived but the survived colonies may not rebuild their nests on same nest site due to low population. This unscientific method of honey harvesting was responsible for mortality of millions of *A. dorsata* colonies annually.

Insecticide poisoning

Apis dorsata colonies are not only distributed in rural regions, but also found in large numbers in urban and semi-urban regions (Nagaraja, 2019). The urban regions are mostly blessed with large trees on the road sides and variety of bee flora spread over gardens and parks. These bee plants successfully produce copious amounts of pollen and nectar to bee colonies. Similarly, there are abundant suitable nesting structures such as high-rise buildings, water tanks, monumental structures and large trees in these regions. However, these bees most frequently cause nuisance to general public through mass attack even on least disturbance. It forces owners of the buildings to evict bee colonies through pest control agencies who destroy bee nests by direct application of toxic insecticides. Insecticide mixtures are sprayed directly on the bee nest preferably during evening hours until all the adult population was killed and made a thick carpet of dead bees on the ground. (Figure 4 & 5). These dead adult bees, brood and even bees wax were eaten by wax moths, ants, wasps, lizards, birds and few mammals. Through these routes, the insecticide toxins even enter the food chain by causing poisoning in target organisms (Desneux *et al*., 2007).

Figure 1. Aggregation of giant honeybee, *Apis dorsata* nests on a banyan tree near Bengaluru, India.

Other threats

Other threats faced by *A. dorsata* colonies are deforestation and intensification of agriculture. Deforestation in tropical parts is known to lose large area of original forest and its biodiversity by depriving of nesting sites and floral resources. Similarly, clearing of forest and intesification of agriculture is also a major threat to native honeybee population.Forest fires especially during extended droughts and high unseasonal temperatures are likely to affect bee population through colony destruction. Climate change modifies the phenological overlap between flower blooms and colony migration.

CONSERVATION STRATEGIES

Development of scientific methods of honey harvesting

Impact of honey hunting on giant honeybee colonies depends on their population size, number of colonies survive a typical harvest, number of harvested colonies, migration of bee colonies and their reproductive tendency (Caughley and Sinclair, 1994). In a few parts of Southeast Asia, the hunters harvest honey in a non-destructive manner using bee smokers and protective clothing to shield hunters from stings in daylight so that some harvested *A. dorsata* colonies may survive (Waring and Jump, 2004). Development and production of such smokers is very much required to handle *A. dorsata* by produceing required quantities of smoke to silence bees during honey harvesting in its distribution regions.

Application of rafter technology

Apis dorsata colonies generally build large sized single comb where they rear young ones and store pollen. They store honey on top portion of the comb. During honey harvesting, entire comb containing egg, larvae, pupae, and adult population is being destroyed. Bees spend lots of energy by consuming large quantities of honey to rebuild their new combs if survived.

In parts of southeast Asia, tree poles or rafters of about 2 m long are suspended at 45º angle that mimic tree branches in order to attract migratory swarms of *A.dorsata*. (Tan *et al*. 1997). During honey harvesting, the wooden rafters with bee nest are pulled down to the ground using ropes. The lower part of the comb containing brood and pollen is tied back and rafters are hoisted again after honey harvesting. It is much easier to harvest honey from a colony nesting on a rafter 1m above the ground than a wild colony nesting in tall trees. It is known to facilitate 3-4 times more honey harvest in contrast to single harvest after traditional honey hunting.

Use of honeybee repellents

Figure 2. Comb of *Apis dorsata* with damaged brood and dead worker bees.

Figure 3. A portion of honey comb collected in a container during honey hunting.

Figure 4. Giant honeybee workers dead due to insecticide poisoning.

Figure 5. Dead and decaying honeybee workers due to insecticide poisoning.

Insect repellents act as topical barriers in personal protection against arthropod-borne infectious diseases (Diaz, 2016). DEET (N, N-diethyl-m-toluamide, also known as N, N diethyl-3-methylbenzamide) is the most effective and most widely used insect repellent (Koren *et al.* 2003). Its products are available with concentrations of 5% to 100% of DEET in the forms of aerosols, pump sprays, lotions, creams, liquids etc. Collins *et al., (*1996) found that, DEET (N,N-diethyl-m-toluamide), as an effective repellent against giant honeybees. Similarly, Citronella, a compound chemically related to the attractant, Nasonov pheromone of honey bees acts as repellent for honeybees (Schmidt *et al*.1989). The sap of *Amomum aculeatum* leaves was found to be effective as repellent against *A. dorsata* workers. Development and use of suitable bee repellents against *A. dorsata* during honey harvesting would greatly helpful in safeguarding millions of giant honeybee colonies. Similarly, creating awareness on importance of bees in pollination and protecting their habitat is also need of the hour. Pollination by bees is crucial for conservation of natural ecosystems. There is an increasing concern that anthropogenic disruption of plant pollinator mutualisms will lead to a wave of plant extinctions (Bond, 1994). Therefore, implementation of non-destructive methods of honey harvesting is needed to conserve these bee species. Similarly, providing an alternative source of income to honey hunters, may encourage hunters to retun away from their traditional honey hunting activities. In such a way, there is a greater scope to conserve the nests of *A. dorsata* in its distribution regions which also enhances honey production and effective pollination of bee flora.

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REFERENCES

Bond, W. J. (1994). Do mutualisms matter? Assessing the impact of pollinator and disperser disruption on plant extinction. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences*, *344*, 83-90.

Caughley, G., & Sinclair, A. R. E. (1994). *Wildlife ecology and management*. Blackwell Science, Cambridge, p. 334.

Collins, A. M., Rubink, W. L., Cuadriello Aguilar, J. I., & Hellmich, R. L. (1996). Use of insect repellents for dispersing defending honey bees (Hymenoptera: Apidae). *Journal of Economic Entomology*, *89*(3), 608-613.

Crane, E. (1999). *The world history of beekeeping and honey* hunting. Routledge. New York, p. 720.

Desneux, N., Decourtye, A., & Delpuech, J. M. (2007). The sublethal effects of pesticides on beneficial arthropods. *Annual Review of Entomology*, *52*(1), 81-106.

Diaz, J. H. (2016). Chemical and plant-based insect repellents: efficacy, safety, and toxicity. *Wilderness & Environmental Medicine*, *27*(1), 153-163.

Hepburn, H.R.& Radloff, S.E. (2011). Biogeography. In: Hepburn, H.R., Radloff, S.E. (eds.) Honeybees of Asia, pp. 62–63. Springer-Verlag, Berlin

Koeniger, N., & Koeniger, G. (1980). Observations and experiments on migration and dance communication of *Apis dorsata* in Sri Lanka. *Journal of Apicultural Research*, *19*(1), 21-34.

Koren, G., Matsui, D., & Bailey, B. (2003). DEET-based insect repellents: safety implications for children and pregnant and lactating women. *Canadian Medical Association Journal*, *169*(3), 209-212.

Nagaraja,N (2012). Asian honey bee: Biology, threats and their conservation. In: Biology, threats and colonies, Richards M Florio (Ed), Nova Publisher Inc USA, pp 99-123.

Nagaraja, N. (2017). Population fluctuation of giant honeybee, *Apis dorsata* (Hymenoptera: Apidae) colonies in Bengaluru, Karnataka, India. *Journal of Entomological Research*, *41*(3), 307-310.

Nagaraja, N. (2019). Nesting patterns of giant honeybee, *Apis dorsata* in plains of Karnataka, India. *Journal of Entomological Research*, *43*(4), 503-508.

Nagaraja, N., & Rajagopal, D. (2000). Foraging and brood rearing activity of rock bee, *Apis dorsata* F. (Hymenoptera: Apidae). *Journal of Entomological Research*, *24*(3), 243-248.

Nath, S., & Sharma, K. (2007). Honey trails in the Blue Mountains: Ecology, people and livelihood in the Nilgiri Biosphere Reserve, India. *Keystone Foundation, Kotagiri*. Tamil Nadu, p.271.

Nath, S., Roy, P., Leo, R., & John, M. (1994). Honey hunters and beekeepers of Tamil Nadu. *A survey document. Keystone,* Pondicherry, p.164.

Paar, J., Oldroyd, B. P., & Kastberger, G. (2000). Giant honeybees return to their nest sites. *Nature*, *406*(6795), 475-475.

Oldroyd, B. P., & Nanork, P. (2009). Conservation of Asian honey bees. *Apidologie*, *40*(3), 296-312.

Reddy, C. C., & Reddy, M. S. (1993). Studies on the distribution of nests of giant honeybee (*Apis dorsata* F.). *Indian Bee Journal*, *55*, 36-39.

Schmidt, J. O. Thoenes, S.C and Hurley (1989). Swarm traps. *American Bee Journal.*129, 465-471.

Tan, N. Q. (2007). Biology of *Apis dorsata* in Vietnam. *Apidologie*, *38*(3), 221-229.

Waring, C., & Jump, D. R. (2004). Rafter beekeeping in Cambodia with *Apis dorsata*. *Bee world*, *85*(1), 14-18.

Woyke, J., Wilde, J., & Wilde, M. (2012). Swarming and migration of *Apis dorsata* and *Apis laboriosa* honey bees in India, Nepal and Bhutan. *Journal of Apicultural Science*, *56*(1), 81.

Woyke, J., Wilde, J., Reddy, C. C., & Nagaraja, N. (2005). Periodic mass flights of the giant honey bee *Apis dorsata* in successive days at two nesting sites in different environmental conditions. *Journal of Apicultural Research*, *44*(4), 180-189.