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Effect of Insecticide Poisoning on Mortality of Giant Honeybee, *Apis dorsata* Colonies

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Abstract

The colonies of giant honeybee, *Apis dorsata* are most frequently exposed to insecticide poisoning for their innate aggressive behavior. The impact of insecticide poisoning on mortality of giant honeybee colonies was assessed in Bangalore urban and rural districts during 2013-14. The observations revealed that, the mortality of bee colonies was continuous throughout the year and was greater during March and April followed by August and September. The results also showed that, the greater numbers of the colonies were killed with insecticide poisoning at the beginning of their nesting than later periods. Comparatively, the Lindane was most commonly used insecticide in removal of *A. dorsata* colonies than Melathion and Sevin in Bangalore urban and rural regions.

Introduction

The Asian giant honeybee, *A. dorsata* is well distributed in Southeast Asian countries both in plains and hilly regions. These colonies are highly migratory and normally move to hills during dry seasons and return back to plains in monsoon and post monsoon seasons where the flora is quite abundant (Nagaraja and Rajagopal, 2000; Woyke *et al*., 2005). Congregation of these colonies is more evident and their number ranges from 50 to 500 on a tree or rock, where bee forage sources are abundant (Nagaraja and Yathisha, 2015). Most of these colonies prefer to build nests on suitable manmade structures such as apartments, school and college buildings, and high-rise towers in urban regions (Reddy *et al*., 1986). It is evident that, thousands of *A. dorsata* colonies are distributed in and around Bengaluru during winter and summer seasons for availability of rich source of pollen and nectar from the bee flora found in parks, botanical gardens, trees on the roadways etc.

Apparently, these colonies are most frequently irked at mid-noon hours of the day even on least disturbances caused by its predators such as hornets and birds. It generally leads to attack on common public with massive stinging most frequently in urban regions. It forces the general public to destroy giant honeybee nests in the locality by application of highly toxic insecticides mostly through pest control agencies. Such brutal bee killings are directly responsible for loss of thousands of honeybee colonies annually. There is a greater need to protect *A. dorsata* colonies from insecticide poisoning through bee-friendly techniques to conserve these species for greater honey production and effective cross pollination (Abrol, 1996, Nagaraja, 2012). Therefore, in the present study, an attempt was made to find out the

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impact of insecticide poisoning on mortality of giant honeybee colonies in urban and rural regions of Bengaluru, Karnataka.

Materials and Methods

The studies on influence of insecticide poisoning on mortality of *A. dorsata* colonies were conducted in Bangalore urban and rural districts during 2013-14. The study area covers a large deciduous canopy distributed with abundant bee flora and experiences a tropical savanna like climate with distinct wet and dry seasons.

Insecticide formulations

The pest control agencies based at Bangalore urban and rural districts are routinely involved in removing giant honeybee colonies. They use varieties of insecticides which are highly toxic to exterminate giant honeybee colonies. In the study region, they used organochlorines, organophosphates and carbomates groups of insecticides. Among these, they most commonly used Lindane (organochlorine), Melathion (organophosphate) and Sevin (carbomate) insecticides in removal of *A. dorsata* colonies.

Lindane is a broad spectrum neurotoxic insecticide and its LD_{50} value for honeybees is 0.56 µg/bee. Melathion is a cholinesterase inhibitor with low mammalian toxicity and its LD_{50} value for honeybees is 2µg/bee. Similarly, Sevin is a slowly reversible inhibitor of the enzyme acetylcholinesterase. It is highly toxic to bees and its oral LD_{50} value ranges from 0.14 µg/bee to 1.49µg/bee, and contact LD_{50} value from 1.3 µg/bee to 33.9 µg/bee. The formulations of each test insecticides were prepared in distilled water according to manufacturers' protocol and were sprayed on bees nests in removal of giant honeybee colonies.

Methods of application

Apis dorsata generally build arboreal nests few meters above, from the ground level. This nesting behviour made the pest control agencies to use aerial methods of insecticide application. During aerial application, the operator used a hand pump with filling capacity of 6 liters. It was made up of brass sheet (Model: MT/15). It has a spray lance of 48 centimeters with working pressure 60 Pounds per square inch (Psi). A known quantity (200-300ml) of test insecticide depending on the population of bee colonies was filled in to a cylindrical pressure pump. An operator with protective equipment sprayed the insecticide on bee nests covered with the curtain of adult bee population.

Assessment of bee mortality

The number of giant honeybee colonies killed on exposure to different groups of insecticides was recorded throughout the year. Similarly, the number of colonies killed by each type of insecticides and the behavior of bees on exposure to insecticides was documented.

Results and Discussion

The colonies of *A. dorsata* were well distributed in Bangalore urban and rural districts in greater numbers despite continuous disturbance from anthropogenic activities (Fig.1). The rich source of pollen and nectar in these regions attracted large number of colonies. Obviously, varieties of ornamental plants, huge trees in botanical gardens and roadside trees supplied sufficient quantities of food to bees in urban regions in contrast to eucalyptus,

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mango and agricultural crops in rural regions. The mortality of colonies was greater in urban regions due to more indents from owners of the buildings to remove the colonies for frequent attack of bees on common public in urban regions.

Fig. 1. Aggregation of giant honeybee, *Apis dorsata* colonies at Ramgovindapura in Hosakote taluk of Bangalore rural district, Karnataka

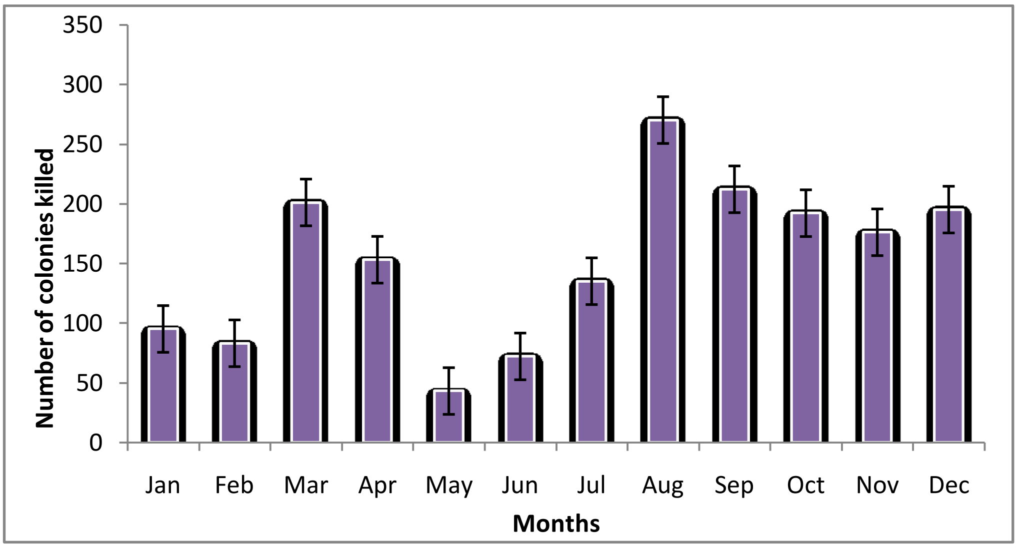

Fig. 2. Number of *Apis dorsata* colonies killed due to insecticides application in Bangalore urban and Rural districts, Karnataka during 2013-14

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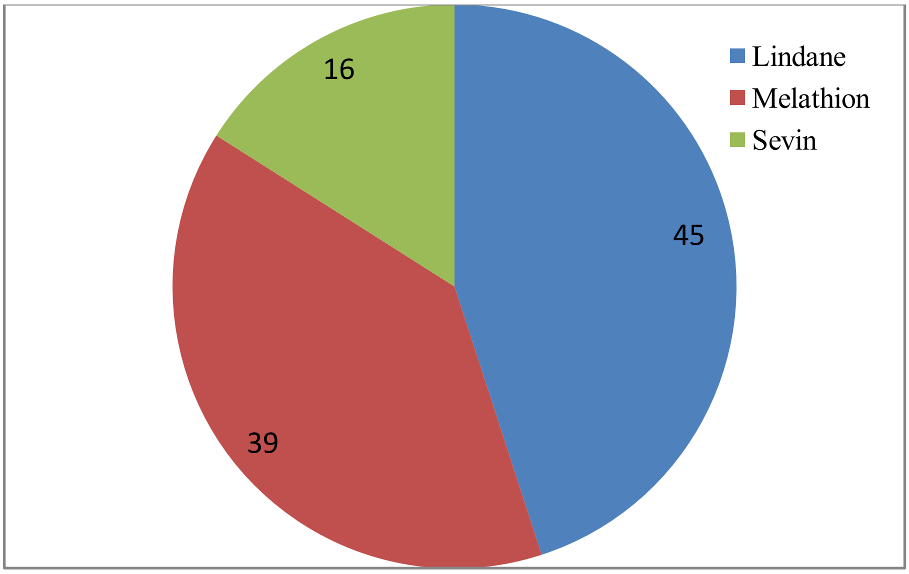

Fig. 3. Mortality (%) of *Apis dorsata* colonies on exposure to different groups of insecticides

The mortality of bee colonies due to insecticide poisoning was continuous throughout the year (Fig. 2). However, greater number of colonies were killed during March and April followed by August to September. The mortality of greater number of colonies was attributed to arrival of bee swarms in good numbers especially from hilly regions to plains during summer and late rainy seasons. These seasons made the pest control agencies to kill bee colonies in greater numbers. However, only few colonies were killed during May and June in both the study districts.

The pest control agencies use varieties insecticides in pest management practices. However, they most frequently used three groups of insecticides such as Lindane, Melathion and Sevin. Comparatively, Lindane was used in large scale followed by Malathion and Sevin. The per cent colonies killed by application of Lindane, Melathion and Sevin were 45%, 39% and 16% respectively (Fig.3). The highly toxic properties of these insecticides were responsible for successful killing of bee colonies in a short period of time (Khan *et al.*, 2004).

Most of the pest control agencies removed *A. dorsata* colonies during evening hours of the day, mostly at dark light. Before application of insecticides, the bees became aggressive expressed and various defensive strategies and even few bees attacked the operator and people around the nesting site through massive stinging. However, the insecticides lead bees to hovering, flying with uncoordinated wing movements, paralysis and finally to death by protruding their tongues on the ground. Most of the bees flew away from the nest by leaving developing brood and young ones. The dead and dying bees formed a thick layer on the ground. The concentrations of insecticides used were able to kill even the brood and young bees that were involved in play flights within a few minutes. These brutal killings are responsible for death of thousands of *A. dorsata* colonies every year.

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The insecticides not only kill honeybees, but also cause ecological imbalance by entering into the food chain. These insecticides also contaminate the hive products including honey and other bee products (Crane, 1999; Sihag *et al*., 1998). It is apparent that, if these unscientific methods of insecticide poisoning continue against *A. dorsata*, these bee species have no way to become endangered in near future. It demands urgent need for conservation of these organic honey producers and natural breeders through eco-friendly methods of colony removal (Paliwal, 1996). There is need for development of eco-friendly methods of removal of bee colonies if necessary without killing brood and adult bee population. Obviously, creating awareness on impact of these anthropogenic activities among the public is needed for conservation of *A. dorsata* bee colonies.

Acknowledgements

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References

1. Abrol, D.P. 1996. Sunflower pollination: abundance and diversity of pollinating insects and their effect on seed yield, Indian Bee Journal. 58: 60−63.
2. Crane, E. 1999. The World History of Beekeeping and Honey Hunting, Duckworth, London .
3. Khan, M.S., Kumari, B., Rohilla, H.R., Kaushik, H.D. and Arora, R.K. 2004. Analysis of insecticide residues in honeys from apiary (*Apis mellifera*) and wild honey bee (*Apis dorsata* and *Apis florea*) colonies in India, Journal of Apiculture Research. 43: 79−82.
4. Nagaraja, N. and Rajagopa, D. 2000. Foraging and brood rearing activity of rock bee, *Apis, dorsata* F. (Hymenoptera: Apidae), Journal of Entomological Research. 24: 243−248.
5. Nagaraja, N. 2012. Asian honeybees: Biology, threats and their conservation. In Bees: Biology, threats and colonies, Nova Science Publishers, USA.
6. Nagaraja, N. and Yathisha, V. 2015. Nest orientation of Asian giant honeybee, *Apis dorsata* in plains of Karnataka, India, Journal of Entomological Research. 39: 197−201.
7. Paliwal, G.N.1996. Eco-friendly management of giant Honeybee, *Apis dorsata* in India, Proceedings of 3rd Asian Apicultural Association Conference, Hanoi, p. 148.
8. Reddy, C.C., Reddy, M. S. and Ramesh, S.P. 1986. Studies on the colony population of *Apis dorsata* Fabr., Indian Bee Journal, 48: 57−58.
9. Sihag, R.C., Kumar, S. and Gahlawat, S. 1998. Acute contact toxicity of endosulfan and carbaryl insecticides to two honeybee species, *Apis mellifera* L. and *Apis dorsata* F., Korean Journal of Apiculture 13: 55−60.
10. Woyke, J., Wilde, J, Reddy, C.C. and Nagaraja, N. 2005. Periodic mass flights of giant honeybee, *Apis dorsata* performed in successive days at two nesting sites in different environmental conditions, Journal of Apiculture Research. 44:180-189.