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# Suitability assessment of neem formulations as biopesticide against honey bees and other pollinators

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***Abstract :*** *To study the effect of insecticidal spraying on non target insects have never been an important issue. In this article the foraging behaviour of honey bee worker and other pollinators was investigated after the spraying of insecticide. The study of antifeedancy and toxicity of two agricultural insecticides 0.07% endosulfan, 0.02% phosphamidon and three neem formulations 0.05% have been examined on three species of honey bees viz., Apis cerana indica F., Apis dorsata F., Apis mellifera L. and other pollinators such as hymnopterous insect Vespa orentalis (Yellow jackets or hornets), lepidopterous insect Pieris brassicae (cabbage butterfly) and dipterous insect Hirmoneura bruanea (naenestrinid fly). Research results indicated that spray of these formulations of neem on mustard crop was found to be most effective @ 700 l/h. the effects were consistent and comparable to the endosulfan and phosphamidon. As a biological, plant derived prepration, neem formolatiom could be suitable for integrated pest management (IPM) programs, specially in small orchids, parks, tree growers in urban environments and on small private gardens. Such areas, toxic insecticides use should be avoided.*

**Key Words:** Honey bee, Pollinators, Biopesticide, Neem formulations, Mustard

## Introduction

Human population pressure let to rising of demand for agricultural products and food production. Farmers, in developed and developing countries have been using excessive agrochemicals in order to increase crop yields. The indiscriminate use of insecticides contaminating environment, soil, water, turf and vegetation. In addition to toxic for other organisms including birds, fish, beneficial insects, bees. (Pimentel, 1995; Incerti *et al.*, 2003; Akea *et al.*, 2005.)

Among social hymenoptera, *Apis* species have developed remarkable social complex. The worker bees are primarily responsible to search suitable food for them selves and young ones. The live bees are important pollinators. They can be managed and their large numbers can be placed wherever and whenever required. Pesticides, used for plant protection purposes are generally hazardous to honey bee. Mostly bee poising occurs when insecticides are applied to the crop during blooming period. Drifting of toxic spray over the adjoining crops which are in bloom is another hazard. Bees come in contact with insecticidal residue on plant and get poisoned by taking the contaminated dew and pollen evaluated acute toxicity of seven insecticides on honey bees while azadirectin was environment friendly prepration for controlling hazelnut pest. Biopesticides of plant origin being indigenous resources with insecticidal, repellent, antifeedant and insect growth regulatory action are in use for over a century to minimize loss in ecosystem as they are non toxic to mammalians, create no adverse effect on growth viability less expensive and easy to handle. Elzen *et al.* (2004) found that no mortality of honey bee was observed after spraying azadirachtin spray in ecosystem which appears to be relatively safe to beneficial arthropods. Mustard is one of the important crops among various oil seeds. It is a confirmed conclusion that the yield is dependent on various factors i.e. agronomical practices, climatic conditions, degree of pest and diseases infestation and the visiting of pollinators including

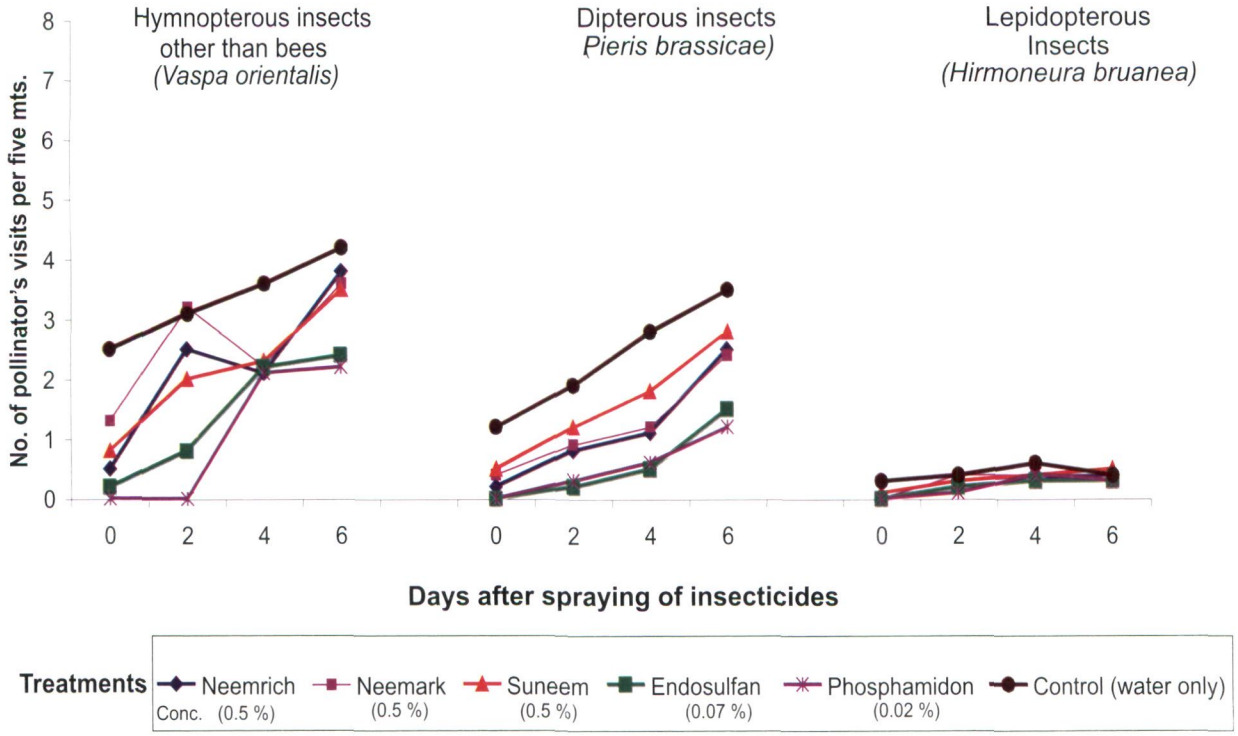


**Fig. 1.** *Number of pollinators visited mustard flower per five minutes after spraying of insecticides*

honey bees. The present investigations were carried out to study the effect of three commercial formulations of neem oil and few of most common insecticides against the honey bees and other pollinators.

## Materials and Methods

The experiment were carried out on mustard crop (VARUNNA) cultivated in Bithoor, Kanpur (Utter Pradesh) following conventional agronomical practices. The mature plants were subjected to receive the experimental exposure of neem formulations and chemical pesticides in triplicates. Total eighteen plots of 25x10 meter sized were selected in the study. Vehicle control exposed to water only was also run under identical conditions and served as basal control. At day 0, 2, 4 and 6 after spraying the neem formulations and pesticides, well blooming plants at central most region of the plots were observed to calculate the number of different types of pollinators visiting to the flowers of mustard plants. It was evaluated through (1) time spent per flower and (2) no. of flowers visited per min. the time spent on a flower by a bee gathering pollen and/ or nectar was recorded using a stop watch with an accuracy of ± 0.1 seconds. Foragers of each kind were timed during the five minutes on each of the four days. Observations were restricted between 8-11 am at an interval of five minutes. The number of visits effect on behavior of different types of honey bees and other pollinators were recorded. The analysis of data were done by taking the mean of triplicates and comparing with the effects posed by conventional pesticides used (positive control) and vehicle (basal control).

## Results and Discussion

Data of number of pollinators and honey bees visited on the flowers of mastered plants are summarized in Figure-1 & 2. In general, a significant reduction in the frequency of visits of both honey bees and other pollinators was recorded following the spraying of all three neem formulations. Though, the effect was more pronounced for endosulfan and phosphamidon, when compared with neem formulations. The response was found to be most effective on day

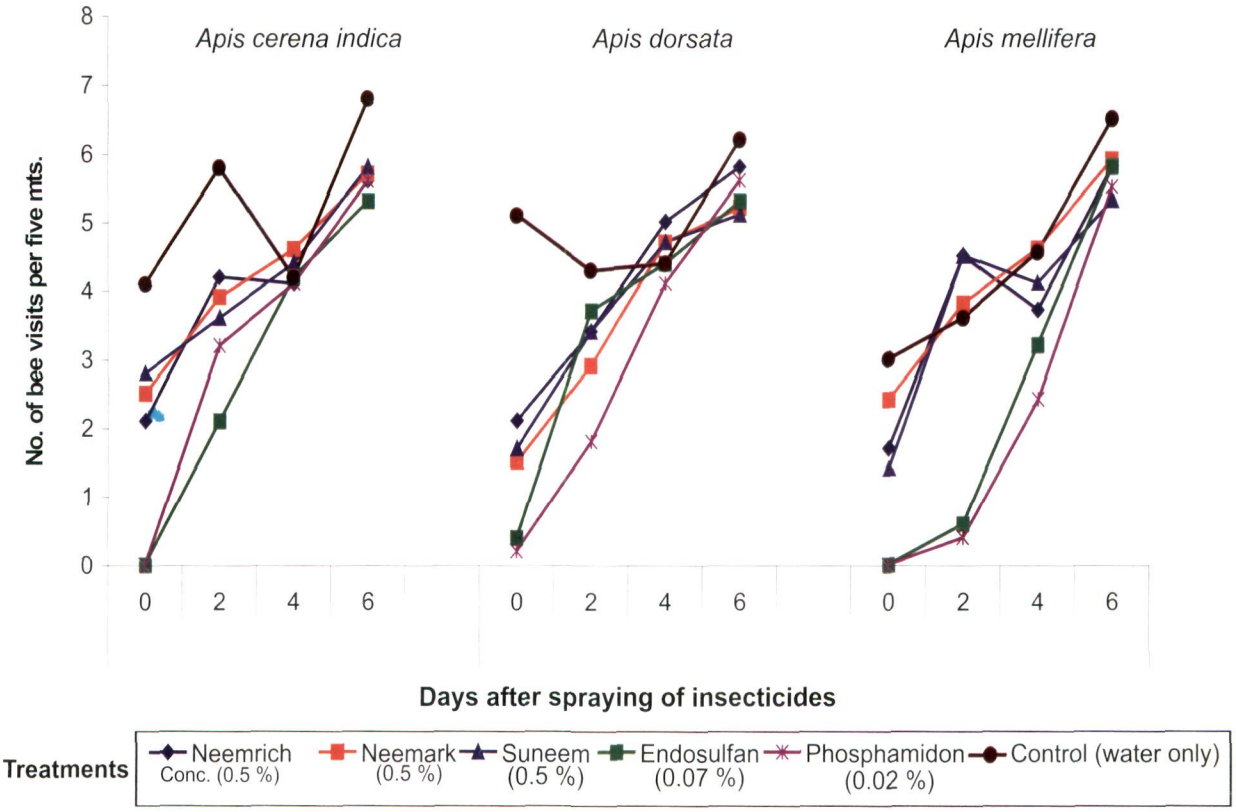


**Fig. 2.** Number of honey bees visited mustard flower per five minutes after spraying of insesecticides

zero, and decreased gradually over the period of six days. Our results are well correlated with the earlier studies carried out with phosphamidon and endosulfan. Devillers (2002) has recorded the maximum cumulative mortality of bees in endosulfan after 8 days of spraying. Tark (2005) has shown that neem formulations were having relatively low level of toxicity when compared with synthetic pesticides and other chemicals. Among the synthetic chemicals used for the purpose, phosphamidon was recorded as most toxic followed by endosulfan (Bailey *et. al.* 2005;). Data recorded for other than honey bees are pollinators belonging to Hymnoptera, Diptera and Lepidoptera. In case of pollinators, neem formulations were also found to be more efficacious than the synthetic chemicals with no reported toxicity. Day six onwards of spraying, there was no significant difference between treated and control groups. Similar results were also observed in different studies under almost identical test conditions (Pandey and Tripathi, 2003; Klein *et. al.,* 2007; Bosch and Blas, 2009). We observed insignificant difference of visits of pollinators on mustered flowers between phosmhamidon and untreated control on day six of spraying, while the presence of phosmhamidon has been reported up to day 9 of exposure ( Chauzat *et. al.,* 2006). This difference indicates the development of resistance/ tolerance in the pollinators against this insecticide. Our study suggest the utility of neem derived biopesticide for urban and agro forestry practices.

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## References


Akea, I., Yilmaz N.D.K. and Kizilkaya R. (2005). Effects of Azadirachtin on Beet soil borne pomovirus and soil Biological Properties on Sugar Beet. *J. Environ. Sci. Hlth.*, **40**, *285-296.*

Pandey Ankita and Tripathi Shikha (2003). Foraging activity of honey bees in mustard. *Ann. Pl. Protec. Sci.*, **2,** 378-380

Bailey, J.C, Scott-Dupree C.D., Harris C.R., Tolman J., and Harris B.J.. (2005). *Contact and oral toxicity to honey bees (Apis mellifera L.) of agents registered for use for sweet corn insect control in Ontario, Canada. Apidol.*, **36**, 623-633.

Bosch, J. and Blas M..(2009). Foraging behavior and pollinating efficiency of *Osmia cornuta* and *Apis melliferason* almond (Hymoptera : Megachilidae and Apidae). *Appl. Entomol. Zool.*, **29**., 1-9.

Chauzat, M. P., Faucon J. P., Martel A. Lachaize C., Cougoule J., N. and Aubert M.. (2006). Survey of Pesticide Residues in Pollen Loads Collected by Honey Bees in France. *J. Econ. Entomol.*, **99**, 253-262.

Devillers, J. (2002). Acute toxicity of pesticides to honey bees, pp. In J. Devillers and M.H. Pham-Delegue[eds.], honey bees: estimating the environmental impact of chemicals. Taylor and Fancis, London, United Kingdom.

Elzen P.J.., Elzen G.W. and Lester G.E. (2004). Compatibility of an organically based insect control program with Honey bee(Hymnoptera:Apidae) *Pollination in Cantaloups. J. Econ. Entomol.* **97**, 1513-1516.

Incerti, F., Bortolotti L., Porrini C., Sebrenna A.M. and Sbrenna G.,(2003). An extended laboratory test to evaluate the effects of pesticides on bumblebees. Preliminary results. *Bull. Insectol., **56**, 159-164.*

Klein, M.A., Vaissiere B.E., Cane J.H., Steffan-Dewenter I., Cunningham S.A. and Tscharntke T. (2007). *Impotence of pollinators in changing landscape for world crops. Pratection Biol. Sci.*, **274**, 303-313.

Pimentel, D., (1995). Amounts of pesticides reaching target pests: Environmental impacts and ethics. *J. Agric. Environ. Ethics, 8, 17-29.*

Tark, J.D., Jepson P.C., and Mayer D.F..(2005). Limitations to use of topical toxicity data for predictions of pesticide side effects in the field. *J. Econ. Entomol.*, **88**, 1081-1088.