

Effect of Genetically Modified Crops on Beneficial's with Special Reference to Honey Bees

Gurve S. S.¹, Shirke M. S.² and Turkhade P. D.³

¹Subject Matter Specialist (Plant Protection), Krishi Vigyan Kendra, Borgaon, Statara (M.S)

²Program Coordinator, Krishi Vigyan Kendra, Borgaon, Statara (M.S)

³Subject Matter Specialist (Plant Protection), Shree Siddhagiri Krishi Vigyan Kendra, Kaneri Math, Kolhapur (M.S)

Corresponding Author*: swatihny18@gmail.com

SUMMARY

Increasingly, crop plants are being genetically modified for protection against pest attack. In the last decade, there has been a steady increase in the global acreage of transgenic commercial crops. The success of cultivars containing these genes will depend in part upon their safety to beneficial pollinating insects such as honey bees, which may be exposed to gene products either through pollen or nectar. Foraging activity, foraging bee weight, pollen load and pollen consumption didn't differ in Bt and non Bt corn field. Protein like Cry1Ba, Cry1Ab, avidin, aprotinin did not had any adverse effect on feeding and survival of honey bees. Development of hypopharyngeal glands in honey bees is not affected by transgenic proteins (aprotinin, avidin or Cry1Ba). Acquisition and extinction from proboscis was almost similar for sucrose solution and proteins. On average, of the total Bt maize pollen consumed 74.5% of pollen grains were completely digested while 23.3% were partially digested and 2.2% remained undigested. Bees fed with SBTI (0.1% and 1%) produced lighter hypopharyngeal glands and for first 10 days of adult life it negatively affects the development of glands. SBTI could not be found in the hypopharyngeal glands-not transferred to the larval offspring via food produced in the glands. Transgenic Bt corn pollen do not affect and pupal mortalities, pupal weight, and haemolymph protein concentration of newly emerged adults. Larval survival, adult recovery, hemolymph concentration and pupal weight were not affected by transgenic canola pollen. Forging activity, honey area, pollen area, SOD activity, brood area didn't differ much between Bt cotton and non-Bt cotton fields. Bt-cotton affect on predator-prey interaction in South Africa. GM crops have no effect on bumble bees, predators, parasitoids.

INTRODUCTION

The most important pollinator for numerous angiosperm plants, honeybees depend completely on flower products, including mainly pollens and nectar, for their nutrition in nature. *Bacillus thuringiensis* (Bt) is a soil bacterium, producing several insecticidal toxins that have been proved effective to eliminate outbreaks of some Lepidopteron pests. So far most investigations have focused on plants expressing *Bacillus thuringiensis* (Bt) toxins or Proteinase inhibitors (PIs). Less is known of the impacts of other pest-resistant transgenic plants or transgene products on bees.

Toxicity tests with purified transgene products are often the first step in assessing risks to honey bees from transgenic crop plants. Pollen is a significant component of the diets of both larval and adult bees. It has been estimated that colonies require between 20 and 30 kg of pollen per year. It is important to determine the potential detrimental effects of transgene products on honey bees, it is also important to determine whether pollen from transgenic plants has negative effects on honey bees. This is because there might be other new proteins expressed in the transgenic plants besides the transgene product(s), due to either pleiotropic effects of the inserted genes, alternative splicing, or other mechanisms such as interactions between host genes and inserted genes. Inserted genes, alternative splicing. Laboratory studies to assess

potential non-target effects of Bt corn on honey bees, *Apis mellifera* L., have involved feeding Bt pollen or purified endotoxin mixed with honey or sugar syrup directly to the larvae.

Exposure to Bt pollen could have other direct and indirect non-target effects on brood development in a honey bee colony. Not only the worker bees, but also the larvae bees, queen bees and drone bees have chances to be impacted by the pollens. For young bees, the presence of Bt proteins in ingested pollen may affect hypopharyngeal gland development and thus the ability of nurse bees to make brood food. Effects on the orientation, foraging, and communication behavioural activities could also impair the ability of worker bees to find and relocate food sources.

What is Transgenic Crop ?

The plant obtained from genetic engineering contain a desire gene or genes usually from an unrelated organism such genes are called as transgenes.

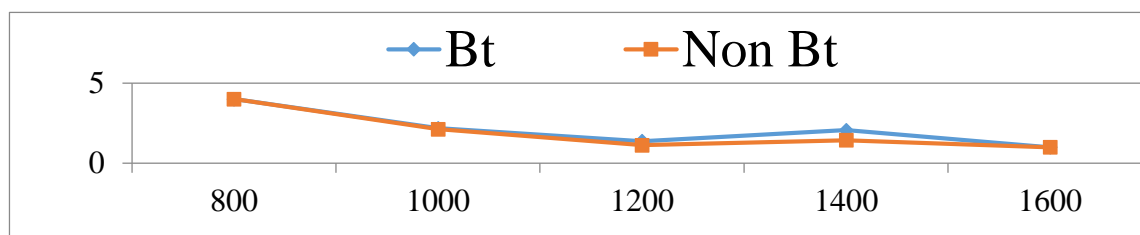
Direct and Indirect effects of GM crops on honey bees.

Direct effect- effects that arise when a bee ingests the protein that a transgene encodes.

Indirect effect- It arises when, the process of introducing the transgene into the plant results in inadvertent changes to plant phenotype affecting its attractiveness or nutritive value to bees.

Effect of transgenic crops on foraging activity and colony

Nachappa and Viraktamath in 2004 from Dharwad reported that there was no significant difference out going foraging activity of *Apis mellifera* and *Apis cerena* colony kept in Bt and non- Bt RCH-2 cotton hybrids respectively.



Effect of transgenic crops on Weight survival and Feeding activity

Laboratory feeding studies showed no effects on the weight and survival of honey bees feeding on Cry1Ab-expressing sweet corn pollen., Rose *et al.*, 2007 (USA).

Effect of transgenic crops on hypopharyngeal gland

Bees fed GM crops had significantly reduced hypopharyngeal gland protein content and midgut proteolytic enzyme activity but there were no significant differences between contro treatments. There was no significant difference in number of adult bees survived fed with three different types of food., Daun *et al.*, 2005.

Effect of transgenic crops on digestion

There was no significant difference in mean consumption of Bt maize pollen per honey bee larva for the five bee colonies investigated. Melon *et al.*, 2001 (Switzerland)

Effect of transgenic crops on survival of honey bees

No statistically significant effect of Bt Cry protein treatments on survival of honey bees. No significant effects on survival occurred with either larval or adult stages., Nachappa and Viraktamath, 2004.

Effect of transgenic crops on Colony performance

No any effect on colony performance only differences in stores of pollen and honey greater than 75% from the control could be detected with 80%., Huang *et al.*, 2004 (China).



CONCLUSION

Transgenic proteins do not have any adverse effect on honey bees except SBTI (Soya bean Trypsin Inhibitor) which adversely affects the gland acini development. So we have to use the transgenic plants in a proper manner to protect the beneficials and the environment to ensure food security. All these results are based on short term experiments. Hence, future research need be concentrated on indirect and long term effects on honey bees like effect on colonies for generations due to continued feeding.

REFERENCES

- Nachappa, M.S and Virktamath, S., 2004, Foraging activity and performance of European bee, *Apis mellifera* (L.) in Bt and non Bt cotton hybrids. Proc. of Int Symp. on Strat Sust. Cotton prod. – A G Vis, Uni. of Agric. Sci., Dharwad.
- Rose, R., Dively, G.P., Jeff Pettis, 2007, Effects of Bt corn pollen on honey bees: emphasis on protocol development, *Apidologie* 38 :368-377.
- Malone, L.A., Burgess, P.J., Gatehouse, H.S., Voisey, C.R., Tregidga, L.M., Philip, B.A., 2001, Effects of ingestion of a *Bacillus thuringiensis* toxin and a trypsin inhibitor on honey bee flight activity and longevity, *Apidologie* :57-68.
- Huang, Z.Y., Hanley, A.V., Pett, W.L., Michael Langenberger, Duan, J.J., 2004, Field and semifield evaluation of impacts of transgenic canola pollen on survival and development of worker honey bees. *J.Econ. Entomol*: 1517-1523.
- Duan, J.J., Marvier, M., Huesing, J., Dively, J., Huang, Z.Y., A Meta-Analysis of Effects of Bt Crops on Honey Bees (Hymenoptera: Apidae). www.plosone.org.