

Bumble bees: Potential and Prospective in Apiculture

Diksha Devi
PhD Scholar,

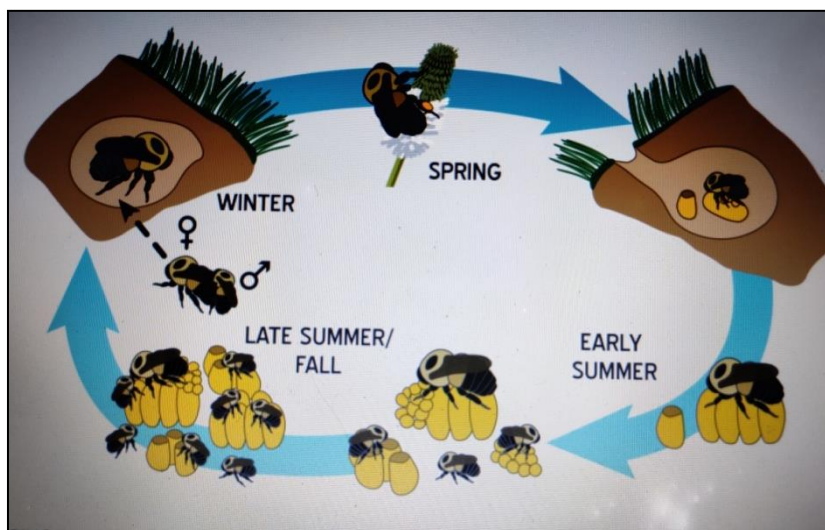
Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan

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Bumble bees are one of the most important group of pollinators belonging to order Hymenoptera, tribe Bombini, Genus *Bombus* which consists of more than 250 species all over the world while only 48 species are found in India. The main species of *Bombus* that has been reported in Himachal Pradesh are *Bombus haemorrhoidalis*, *B. rufofasicatus*, *B. asiaticus*, *B. tunicatus*, *B. waltoni*, *B. keriensis*, *B. personatus* and *B. himalaynaus*.

Life cycle:

Bumble bees generally have annual life cycle i.e. completes only one generation in a year which is the major obstacle that prevent bumble bees to be designated as commercial pollinator. Under natural conditions, bumble bees start its life cycle on the onset of spring when they emerge from hibernation and spend maximum time in searching the location for nesting as well as foraging for nectar. After a suitable site has been identified the bumble bees start building nests by secreting wax (with the help of wax glands at 4th-7th abdominal segments. Initially, the queen itself forages for collection of nectar and pollen in order to develop their ovaries and thus they start laying whitish eggs in wax cups. After 1-2 days the eggs hatch and the egg, larval and pupal stage develop within wax covering which leads to production of first worker brood of workers. Reproductive individuals including males and new daughter queens (gynes) are produced at the end of summer season. Young queens and drones leave the colony and mate. Mated queens i.e. gynes develop fat reserves and search for nesting sites for the purpose of overwintering i.e. diapause. Thus, these gynes by synthesising alcohol molecules (antifreezing molecules) entered in the diapause for a period of time. And again comes out of hibernation during onset of spring and thus completes one cycle in a year.



Pollination efficiency of bumble bees:

Bumble bees are considered as highly efficient pollinators as compared to honeybees or other pollinators due to:

1. They can fly or can become active at lower temperatures.
2. They have longer tongue length and thus are capable of pollinating even the plants having deep corolla.
3. **Buzz pollination ability** viz., a type of pollination in which bees use vibratory motions in order to remove or collect pollen from flowers incidentally fertilizing them.



Some of the earlier workers have also reported a certain percent increase in economic yield of crops as described in Table 1.

Table 1: Impact of bumble bee pollination on fruit yield of different crops

Crop	Per cent increase in fruit yield/m ² as compared to control	References
Sweet pepper	<ul style="list-style-type: none"> • 36% 	<ul style="list-style-type: none"> • Dag and Kammer, 2001
Tomatoes	<ul style="list-style-type: none"> • 64.76% 	<ul style="list-style-type: none"> • Yankit, 2016
Kiwifruit	<ul style="list-style-type: none"> • 191.75% 	<ul style="list-style-type: none"> • Nayak, 2018
Bell pepper	<ul style="list-style-type: none"> • 89.42% • 82.35% 	<ul style="list-style-type: none"> • Thakur, 2018 • Devi, 2019

Population Decline:

A decline in bumble bee's population has been observed due to a number of factors such as climatic factors, mechanization of agriculture, habitat destruction and collateral pesticide damage etc. Some researchers has reported that certain neonicotinoid pesticides such as [clothianidin](#), [imidacloprid](#), and [thiamethoxam](#) presented higher risk to bee's. These pesticides showed a considerable negative effect on colony growth of bumble bee's i.e. reduced growth rate of colony by 85%. Low levels of neonicotinoids can also reduce the number of bumble bee's in a well developed colony by as much as 55%, and thus caused disfunctioning of the bumble bees brains. Also, the bee colonies that had been affected by the neonicotinoids released more foragers and collected more pollen as compared to those bees who had not been exposed to neonicotinoid. Thus, the bees affected by the pesticides were able to collect more pollen and took a longer amount of time to do so.

Bumble Bee Specialist Groups (BBSG)

The existence of bumble bees specialist groups is to foster the conservation of bumble bees as well as their habitat all around the world. The main aim of these groups as an IUCN-SSC member is to produce Red List assessments of the Red List Status for each bumble bee species on a worldwide basis or to implement a comprehensive and detailed assessment of the global status of all bumble bee species based on IUCN Red List criteria as well as to promote bumble bee conservation worldwide.

Challenges and Future Prospective

The population decline observed in honeybees as well as bumble bees proved to a challenging aspect as it causes reduction in fruit and seed set and disruption in plant pollinator interaction as well. Their population decline can thus cause decrease in economic yield and quality of crops. Thus bumble bee population decline can cause serious threat to socio-economic status of the country particularly India where the economic value of pollinated crops is \$726 annually. This draws the attention of researchers towards the conservation, extension and exploitation of bumble bees in agricultural and wild plant pollination. Although to avoid such damage commercial rearing of bumble bees in some specific parts of India and other countries has been carried out successfully.

By the year 2004, worldwide about 99 thousand acres of greenhouse tomato production relied on bumble bee pollination with an estimation of \$15 billion dollars. Apart from effective pollination, various workers have concluded that buzz pollination leads to higher yields and better fruit quality. In the international market, the each year growing demands of bumble bee pollination has significantly increased and strengthened the trade of bumble bee industry all over the world. Presently, the year round production of bumble bee hives exceeds one million in export business. However, India is native to about 48 *Bombus* species but till now only a few of them such as *B. haemorrhoidalis*, *B. breviceps*, *B. asiaticus*, *B. albopleuralis*, *B. simillimus* have been explored for their potential as large scale sustainable pollinators and thus, opens a door to unlimited scope for the growth of this industry. It is more beneficial to rear these species in their native places, providing most congenial conditions along with most preferred flora. Better efforts should be incorporated for engineering new and more reliable domicile boxes for bumble bee rearing that are favourable to species level as well as are easier to be transported. Thus, it is the need of the hour that the small entrepreneurs and private sector of the country explore the possibilities of commercialization of bumble bee rearing and buzz pollination.