VANISHING BEES

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INTRODUCTION

Honey bees are god's greatest natural gift to mankind. The vast evolution of biodiversity in nature can be credited to the enormous pollinating efforts of the 20,000 bee species over the millions of years. Without doubt, bees are god's anointed plant breeders.

Albert Einstein is said to have remarked that "if the bee disappeared off the surface of the globe, man would have only four years to live". How true this can be, only time will have to test and tell. Of late, across continents, especially in Europe and North America, there have been serious concerns on a mysterious phenomenon called 'Colony Collapse Disorder'. Honey bee colonies were found to rapidly collapse over a short period of time. The queen and young bees were starving to death because the worker bees failed to return back to hives.

Scientists have been intently trying to unravel the mystery of the 'Colony Collapse Disorder'. Though the puzzle hasn't yet been solved as yet, a number of theories have been proposed. The needle of suspicion points to a new group of insecticides called 'neonicotinoids' which were synthesized based on the molecular structure of the tobacco toxin called 'nicotine'. Neonicotinoid insecticides are water soluble and thus are absorbed and translocated within plants to be present in nectar, pollen and guttaion fluids. Of all the insecticide molecules used in agriculture until date, the neonicotinoids are probably the most toxic to bees at even trace doses of 2-3 nano grams per bee. However it is not just the toxicity of neonicotinoids that may have contributed to the colony collapses. Several research findings suggest that neonicotinoids weaken the bees, reduce their immunity thus making them highly vulnerable to a mite species called '*Varroa destructor*' commonly known as 'American foulbrood', an Acarine mite called '*Acarapis woodi*', a fungal gut parasite called '*Nosema'* commonly known as 'European foulbrood' and two virus infections called 'deformed wing virus (DWV)' and 'acute bees paralysis virus (ABPV)'. The infected bees were reported to lose their innate intelligence of communication, foraging, social duties, tracking capabilities and brood development. There can be many other factors that may be responsible for the colony collapse disorder, but, it will be tragic if we fail to protect a small insect species that has served mankind for all the evolutionary years in the most selfless manner. Reduced bee activity will have a tremendous negative impact on the evolutionary plant bio-diversity. Indeed if bees were to vanish, nature would certainly come to a stand-still.

Dear Little Bees

Dear little bees, share with us your prayers, values and culture
For us to be filled with joy when we selflessly serve
For us to enjoy when we work hard for our brethren with love
For us to care for the needy with a smile in our heart and part with what we have
For us to be happy when we toil, share it all with sisters and brothers
For us to shun jealousy and celebrate life in happiness of others
Dear little bees, teach us your prayers and secrets of your wisdom
Dear little bees, teach us your songs and the joys of your kingdom

Dear little bees, if through our own follies, should you ever die,
With no one to nurse, the flowers will curse and nature will cry
The sweet little songs, the lovely waggle dance, all would be gone
Life under bane, what would remain? Surely, God would be forlorn
Without you little bees, soon we all would be gone, surely.. all would be gone

-K. R. Kranthi

THE FASCINATING BEE KINGDOM

Of all living beings on the planet, honey bee is the most fascinating. They are probably the only species to live in perfect harmony in the most organized social structure that civilizations can ever imagine.

There are seven recognized species of honey bees across the world. Honey bees are presumed to have originated in South and Southeast Asia. Across the world, two honey bee species the European, *Apis mellifera* and the Asiatic, *Apis cerana indica* are commonly cultured for commercial honey production, It is interesting that all the seven species are known to possess similar social and communication skills.

The bee hierarchy is absolutely amazing. A single healthy bee colony consists of about 80,000 bees which live harmoniously working selflessly for the community through instinctively designated roles. The bee hive has a queen, a few hundred males called drones, cells with young larvae and thousands of females called workers.

Duties are delegated distinctly to perform specific functions. One female is designated as the queen and is fed royal jelly all through her life. The main job of the queen is to fly long distances of 7-8 km sometimes and mate with several drones (males) from other colonies. The queen can lay about 1500 to 3000 eggs per day. The queen controls the colony composition. She determines the sex of eggs with fertilized eggs developing into females and unfertilized eggs turning into males. The workers bathe the queen, clean her and ensure absolutely clean conditions in the cells. The queen lives for 3-4 years and can lay about a million eggs in her lifetime, to establish several colonies.

After the larvae turn into bees, they are fed on royal jelly, nursed for the first two days and are not allowed to work. The drones are fed copiously and do not have any working role except to mate with a queen from other colonies. The drone dies soon after mating. The females of the colony are the main work force and are aptly called ‘workers’. Three to four day old worker bees start cleaning the cells. Five days old bees feed the young larvae and nurse them. Ten to twelve day old workers produce wax and propolis (glue) to construct the honey comb. They maintain specific temperature of all the cells as per need by fanning their wings at required speed. It is amazing that the workers maintain a specific temperature of 34^{o}C all through in the cells of the young larvae to maintain the brood. Sixteen day bees guard the hive to defend and protect it from intruders. They also work as ‘under takers’ to clear up the dead ones from cells. After turning eighteen to twenty days, they become scouts and forages to fly long distances and collect nectar and pollen. Each bee makes 40-50 trips to forage about 1500 to 2000 flowers a day. The workers then produce honey. A dozen bees can make one tea spoon honey in their life time. Old bees collect water from nearby places.

AMAZING COMMUNICATION SKILLS

Apart from the primates, honey bees are endowed with brilliant communication skills. The Austrian ethologist Karl Von Frisch won the Nobel prize in 1973 for his classic work on sensory perceptions of honey bees, published in 1923. He proved that bees had colour vision and excellent sense of smell. He discovered that bees determine directions by using sun as the main compass using earth’s magnetic field in combination with polarization pattern of the blue sky and use them in communication. Professor Frisch deciphered the symbolic communication and described the now famous bees dances ‘round dance’, ‘waggle dance’ and other forms of bee language in great detail.

Round Dance: If the source of food is at a distance of 50 to 100 meters, the scout does a round dance in the thick bustle of the hive in clockwise and anti-clockwise successions in a narrow circle to exactly communicate the direction, distance and the nature of food source.

Waggle Dance: When the food source is farther than 100 meters or more**,** the scout performs the ‘waggle dance’ before the hive. It traces a half circle first and returns back to the starting point in a straight line by waggling her posterior and then takes another half circle in the other direction. The speed of waggle dance with reference to a particular angle from the position of sun, coupled with smell precisely communicates the type of food, the direction and the exact distance to food source and water.

HONEY, ROYAL JELLY, PROPOLIS, WAX AND VENOM

Bees collect nectar as source of sugars and pollen as source of proteins and vitamins. Generally at a given point of time, bees collect pollen from a single flower species which has the greatest amounts of nectar and pollen in the vicinity. In the process of collecting pollen bees perform the task of cross pollination and enhance yields. Several products produced by honey bees are not just for great nourishment

but are also unique in possessing biologically active substances that have tremendous medicinal value.

Honey: Bees produce honey, which is considered as 'liquid gold' with great properties of nourishment and healing. Honey is known for its preserving properties as the best known source of sugar nature has ever produced. Since ancient times honey was thought to be a gift from heaven and widely used as a universal remedy and medicine to heal many diseases and ailments.

Wax: Bees produce excellent organic wax like no other product in nature that can be naturally preserved for hundreds of years. Bee wax was therefore used as reference standard 'currency' in commodity exchange of International markets. Wax is an important export commodity across the globe. It has several industrial applications in aviation, electrical engineering and pharmaceuticals.

Propolis (bee glue): Bee produce a glue called propolis which has been used in medicine since ancient times. Propolis is mentioned in folk medicine and scriptures of many civilizations for its therapeutic properties for treating wounds, sores and burns. Recently scientists have discovered excellent antibiotic and antibacterial properties in propolis and are using them in the treatment of several serious diseases.

Venom: A fold proverb on honey bees says '*He who is stung is the bestowed one'.* It was commonly noticed since ancient times that people stung with bees enjoyed good health and did not suffer from diseases of the joints. In recent times, 'apitoxin' isolated from the bee venom is used to successfully treat rheumatism, neurological ailments and cardiovascular diseases.

Royal jelly: The young bees provide royal jelly to the queen and young larvae. This is a super-concentrated magic potion that has all the wonderful elements such as proteins, vitamins, fats, minerals, salts, hormones and other chemicals in absolutely perfect proportions that are required for long life, human vitality and rejuvenation. Royal jelly is strongly recommended as a remedy for physical and emotional stress and as a medicine during rehabilitation and recuperation.

THE ORIGINAL PLANT BREEDERS OF BIODIVERSITY

Mankind owes a lot to bees. It is not just the honey and wax, but honey bees actually have been the most ancient natural plant breeders. Bees are considered as nature's greatest gifts which foster the continuous expansion of biodiversity on the planet. Nature's plant bio-diversity is largely accelerated over millions of years due to the constant cross pollination carried out by pollinator insects, mainly the bees. The bees and the flowers have co-evolved in a manner that flowers provide pollen and nectar to bees so that the bees can help them in cross pollination.

Several countries have been reporting a progressive loss of biodiversity and degradation of species-rich habitats, more specifically over the past 2-3 decades. The decline in bee populations certainly would be one of the major factors for the decline in biodiversity across Europe and many developing countries where neonicotinoids are being used extensively.

The great poet Kahlil Gibran says in 'The Prophet'

And now you ask in your heart,
"How shall we distinguish that which is good in pleasure from that which is not good?"
Go to your fields and your gardens, and you shall learn that it is the pleasure of the bee to gather honey of the flower,
But it is also the pleasure of the flower to yield its honey to the bee.
For to the bee a flower is a fountain of life,
And to the flower a bee is a messenger of love,
And to both, bee and flower, the giving and the receiving of pleasure is a need and an ecstasy.
People of Orphalese, be in your pleasures like the flowers and the bees.
For food security, at least one third of our food crops owe their pollination to the bees. Honey bees play an essential role in pollinating many fruit crops such as citrus, mango and apples, apart from the wide range of crops such as nuts, pepper, onion, cabbage, cauliflower, tomato, melons, beans and coffee.

COLONY COLLAPSE DISORDER & VANSIHING BEES

Colony collapse disorder (CCD) is a new term coined in 2006 to define the large number of vanishing bee colonies in North America and Europe. Severe colony collapse problems were reported by bee keepers of Belgium, France, the Netherlands, Greece, Switzerland, Germany, Italy, Portugal, and Spain. A number of factors were examined but the exact cause seems to be elusive. Though researchers are divided over the possible main influence of insecticides on colony collapse disorder, published evidences indicate that a range of factors may have been responsible for the phenomenon. Significant amongst these are insecticides, heavy metals, *Varroa* mite, *Nosema* fungus and the Deformed Wing Virus (DWV). These factors are examined in detail.

HEAVY METALS

Heavy metals such as arsenic (As), cadmium (Cd) and selenium (Se) are toxic to honey bees. Apart from being used in agriculture as sprays, heavy metals are industrial pollutants. These contaminants can be absorbed by roots and leaves to be translocated into pollen, nectar and guttation fluids. Lead arsenate kills foraging bees when sprayed in orchards at recommended doses which generally exceed exposure of 400 micro grams per bee. At doses lower than this, arsenate causes severe oxidative stress in bees by interfering with cellular metabolic processes. Even at low concentrations, cadmium poisoning impairs muscle movement thus reducing flight capacity. Reports indicate that selenium levels of one milli gram per litre as oral toxicant causes mortality of at least 50% of a normal bee population. Honey bees are subjected to heavy metal toxicity of copper (Cu), chromium (Cr) and tin (Sn) which are used as wood preservatives in hives.

CONVENTIONAL INSECTICIDES

A wide range of insecticide molecules of the 'Organo-phosphate' and 'Carbamate' groups are known to have a broad spectrum toxicity to several insects including the bees. Contact toxicity of these insecticides ranged from 18 nano grams per bee to 31200 nano grams per bee. Dimethoate which has been commonly used in pest management across the world for several decades was found to be responsible for several cases of bee poisoning in UK and many parts of the world. Oxalic acid,

formic acid, amitraz and the organophosphate insecticide coumaphos are commonly used for the control of mites in apiaries. These chemicals accumulate in the hives over repeated use and cause harmful effects, such as reduction in activity and longevity of young larvae and the queen and nursing behaviour of young worker bees. Pyrethrins are insecticides that are derived from chrysanthemum flowers. These are highly toxic to bees as 50 to 210 nano grams per bee. The synthetic pyrethroids flumethrin and fluvalinate are used in mite control. These accumulate in the cells over a period of time and have strong mortality effects, especially on the young larvae. Fipronil is yet another systemic insecticide that is highly toxic to honey bees at 4 nano grams per bee. High levels of 1-4 nano grams of fipronil per gram of pollen have been reported. It is quite likely that over a period of time the pollen, nectar and wax in the hives may be contaminated with a range of insecticide combinations which can have strong toxic effects on the brood, queen and worker bees,

BT PROTEINS IN GM CROPS

Though Cry toxins such as Cry1Ac, Cry1Ab or Cry2Ab expressed in GM crops are unlikely to have significant toxic effects on honey bees when present in pollen, a study conducted in 2008 by Ramirez-Romero's group showed that 'bees fed sugar syrup containing 5,000 ppb Cry1Ab, approximately 50 times the concentrations likely to be encountered in pollen, did consume less food and showed learning effects, as measured by the proboscis extension response assay'. In view of any possible long term effects, there is a need for detailed studies to understand the impact of pollen from all the Cry toxins in GM crops on honey bee behaviour.

'NEONICOTINOID' INSECTICIDES

Neonicotinoid insecticides were synthesized based on the molecular structure of the tobacco toxin called 'nicotine'. There are seven insecticides in this group which have been permitted in India and abroad. These are Imidacloprid, Acetamiprid, Thiamethoxam, Thiacloprid, Clothianidin, Nitenpyram and Dinotefuran. Imidacloprid was introduced in 1991 globally by Bayer and registered in India in 1993. Subsequently, Acetamiprid and Thimethoxam were registered in India in 1999, Thiacloprid and Clothianidine in 2002, Dinotefuran in 2006 and Nitenpyram in 2012. Neonicotinoids are approved for use in 120 countries and command a global market worth Rs 16,000 crores. Across the world, imidacloprid alone is estimated to have a market share of Rs 6,500 crores.

The neonicotinoid insecticides are highly toxic to sap-sucking insects on a wide range of crops and fruit trees. Insecticides of this group are more toxic to insects as compared to mammals because the binding affinity of the neonicotinoids to the receptor sites 'nicotinic acetyl choline receptor nAChR' in the central nervous system is much stronger in insects compared to the receptors in mammals. Binding of the neonicotinoid molecules to the nicotinic receptors is similar to the binding of nicotine, but in such a strong manner that the nervous system gets over-stimulated, the receptor get blocked thereby resulting in paralysis and death. Neonicotinoids are known to cause irreversible damage to the central nervous system in a cumulative manner that can progressively get aggravated over time with repeated exposure to the toxins in miniscule levels as well. Thus acute toxicity at doses of even one nano

gram per bee can result in mortality, but even sub-lethal doses over a period of time can cause severe damage to the nervous system, resulting in loss of social behavior and efficient role functioning for which honey bees are so well known.

The neonicotinoid insecticides act at very low doses of 7 to 50 grams of active ingredient per hectare. Imidacloprid and Thimethoxam are also used extensively in seed treatment. When the treated seeds germinate or when the neonicotinoids are applied to the soil, these insecticides are absorbed by the seedlings through the roots and stem and translocated inside the plant through 'systemic' action. The seedlings thus contain the insecticide inside its leaves, stems, vascular tissues, buds, flowers, pollen, nectar and fruits and thus are protected from sap-sucking insects generally upto two months. Studies conducted at CICR Nagpur during 1991-93 showed that seed treatment with 7 gm imidacloprid per Kg cotton seeds, resulted in protection of the seedlings at least until 2 months. Research reports show that a single irrigation based imidacloprid application to citrus trees could suppress pests for five months, and upto 5 years in maple trees. Cotton seedlings from the imidacloprid treated seed exhibited significant vigour and enhanced growth. It is interesting to note that majority of cotton hybrids were highly susceptible to sap-sucking insects and would not have survived the market in India if imidacloprid seed treatment was not available. Globally seed dressing constitutes 60% of neonicotinoid usage. Foliar sprays are also very common on many fruit trees, crops and vegetables. Neonicotinoids are commonly used in seed treatment and foliar sprays on oilseed rape, cotton, sunflower and maize. These crops attract honey bees and many other pollinators.

NEONICOTINOIDS ARE THE MOST TOXIC INSECTICIDES TO HONEY BEES

The neonicotinoids act strongly as oral and contact poisons. Of the six neonicotinoid insecticides, acetamiprid and thiacloprid were found to be relatively less toxic to honey bees. Insecticides such as imidacloprid, clothianidin, thiomethoxam and binotefuran showed high toxicity to honey bees at very low concentrations. As oral poison, a dose as low as 3.7 to 7.6 nano grams per bee of any of these insecticides would be sufficient to kill at least 50% of the honey bee populations. To explain further, for example, 7.4 grams of imidacloprid can kill one billion honey bees.

Neonicotinoids have strong toxicity through contact action. A dose of 18 to 22 nano grams per bee can kill 50% of a population through contact action. It is estimated that each square cm area on the plant parts of a crop is likely to have a range of 20 to 200 ng of the toxin if 20 grams of insecticide is sprayed per hectare. Therefore neonicotinoids pose a direct risk of contact poisoning when the bees alight on treated surfaces.

A sub-lethal dose far less than this can still have detrimental effects on the general health of the bees, their vigour, energy and working capabilities. When exposed to sub lethal doses of imidacloprid, honey bees suffer from impaired memory, altered learning, reduction in immunity, motor activity, sucrose sensitivity, foraging, brood production and track return.

Neonicotinoids are translocated into the tissues of the plant when used either as seed treatment or as foliar sprays. The insecticide is highly persistent inside the plant

tissues and confers long term residual activity for several days. The insecticide is also translocated to pollen, nectar and guttation fluid, which is a liquid that oozes out from leaf edges mainly due to turgor. Worker honey bees collect nectar, pollen and guttation fluid from plants to build food reserves for the entire colony especially to feed the young ones. Insecticide in pollen, nectar and guttation fluid can have detrimental effects on the colony, mainly on the young stages of bees, the scouts, the workers, the queen, the drones and the soldiers. Workers collect floral nectar and also extra floral nectar which also carries toxic residues and cause harm. Insecticide sprays contaminate water bodies through many routes of water flow. The worker bees also collect water to dilute honey and cool the hives and contaminated water causes immense harm to the hives.

Recent studies conducted in UK showed that imidacloprid at recommended field application dose was found to reduce growth rate of the bumble bees and caused 85% reduction in production of new queens.

There are hardly any studies conducted in India on the residues of neonicotinoids in pollen, nectar and guttation fluid collected from cropping systems in any part of the country. However, there are published reports from other countries to show the presence of neonicotinoid insecticides in pollen, nectar and fluids collected from several flowering plants. Studies showed that pollen grains and floral nectar collected from sunflower, maize and melons contained 2 to 11 nano grams of imidacloprid per gram of nectar and also per gram of pollen. Studies conducted in Italy with guttation fluid collected from maize showed very high Imidacloprid levels upto 346000 ng per ml of guttation fluid, which causes instantaneous death of the bees. Studies were conducted in France, Poland, Germany and USA to find out if the nectar, pollen and wax in honey combs contained neonicotinoids. Interestingly nectar, wax and honey bees were found to have neonicotinoid insecticides in the range of 1.8 to 12 nano grams per gram of material tested. However imidacloprid levels were upto 554 nano grams per gram of pollen in the hives. A study conducted in 2011 in China by professor Yang showed that when young larvae were treated with very low doses of 0.04 nano gram per insect, the larva developed into an adult bee with impaired learning abilities. Given the wide-spread usage of imidacloprid as seed treatment and foliar sprays across a wide range of flowering crops, such constant low exposure is quite likely to occur regularly in bee-hives.

On the declining rate of biodiversity, Professor Dave Goulson of the University of Stirling, UK, states that ‘the annually increasing use of neonicotinoids may be playing a role in driving these declines’. His recent paper (2013) in the Journal of applied ecology shows that neonicotinoid concentrations were accumulating at 1 to 100 nanograms per gram of soil, at 1 to 200 nanograms per ml of water, 1-50 nanograms in nectar and pollen of flowering crops, which actually exceed the levels in crop tissues need to control insect pests.

However, many studies also point out that neonicotinoid residues were below detectable limits in many samples tested and also that imidacloprid, thiomethoxan and clothianidin did not actually cause any harm to foraging bees when the insecticides were used at recommended doses either as seed treatment or foliar sprays.

EUROPEAN UNION BAN ON NEONICOTINOIDS

Over the recent few years, there has been an intensified concern on bee decline, especially in Europe and Canada. Two years ago the European Food Safety Authority (EFSA) examined several factors and decided on 1st December 2013 to restrict the use of three pesticides clothianidin, imidacloprid and thiamethoxam, belonging to the neonicotinoid group of insecticides as seed treatment, soil application and foliar sprays for a period of two years in all the 28 member states of the European Union. Prior to the ban enforced by EU, there were several instances of suspension of neonicotinoid insecticides for use in Germany, Italy and France. Since 1999, France enforced a ban on imidacloprid in sunflower seed treatment. Imidacloprid use on maize was banned in France from 2004. In Germany mass death of bees in May 2008 in oilseed rape fields which was attributed to the drift of the neonicotinoid insecticide clothianidin from the treated maize seeds. Thus Germany enforced a ban on clothianidin seed treatment from 2008. Italy has enforced a ban on Imidacloprid, thiamethoxam and clothianidin suspended for maize seed treatment since 2008. In March 2013, the American bird conservancy called for a ban on neonicotinoids based on their review of 200 studies which showed that neonicotinoids were highly toxic to birds, aquatic vertebrates and other wildlife. In view of the recent development the Environment Protection Agency (EPA) USA, is considering a process of re-evaluation and registration review of neonicotinoids.

AMERICAN FOUL BROOD *'VARROA DESTRUCTOR'*

Varroa destructor is a blood sucking parasitic mite that attacks the European and the Asiatic bees. It is an external parasitic mite red in colour and 2.0 mm wide. It causes a disease called varroosis and prefers drone bees. The mite can feed and reproduce only in bee hives. Varroa destructor attaches to the body of bees, sucks their blood and transmits a virus called the deformed wing virus (DWV) which causes deformation of the wings. When the wings get deformed, the bees lose their normal capacities to fly, dance, forage, maintain hive temperatures and communicate properly through round and waggle dance. They also lose their navigation skills to return back to their hives, thus leading to colony collapses. *Varroa destructor* has been found to be one of the major contributing factors in colony collapse disporder in Canada, Hawaii, Ontario and the USA. Earliest records show that the mite cause problems to bees in Japan and USSR in 1960, Subsequently, *Varroa destructor* entered Eastern Europe and South America in 1970 and spread across Poland, France, Switzerland, Spain, Italy and Portugal during 1980-87. After 1987, the mite entered USA, UK, Canada, New Zealand and Hawaii. A virulent Korean strain *Varroa destructor* was first observed in Punjab during 2004. Subsequently the mite was recorded from spread to reported from Punjab, Haryana, Himachal Pradesh, Jammu & Kashmir and Rajasthan.

EUROPEAN FOULBROOD '*NOSEMA APIS*'

The European foulbrood, *Nosema apis* is a single-cell microsporidian fungal parasite of the European honey bee (*Apis mellifera*). Nosema causes a disease called Nosemosis which debilitates the intestine and weaken adult bees to the extent that they fail to return back to hives and die far away from their dwellings thus causing colony collapses over a prolonged period of time. Infected bees also suffer from

dysentery, crawling and disjointed wings, which lead to poor health, impaired navigation and flight. Infected bees also lose their sting reflexes, and degeneration of ovaries, which reduces broods. The disease is transmitted orally through feed of fungal spores, which generally spread in colonies through fecal matter from infected insects. The pathogen survives extreme environment for a long time and thus is a potential threat to bees. Nosemosis was found to cause substantial bee mortality in Spain, Germany and other European countries over the past 10 years.

Another species called *Nosema ceranae* was found to infect the Asian honey bee *Apis cerana* and thus is a threat to bee colonies in India.

There is hardly any good scientific study conducted in India to either understand the impact of neonicotinoids on honey bees or to unravel the association of various factors that potentially threaten the survival of bees in nature. Estimates show that 700 to 1000 metric tonnes of Imidacloprid and 200 to 300 metric tonnes of Thiomethoxam are used annually in India. Of this it is estimated that every year, annually 168 metric tonnes of imidacloprid is used for cotton seed dressing alone in India. These huge amounts of neonicotinoid application most certainly will have a negative impact on bee heath and survival. India is a Vavilonian centre of origin and diversity for many crops. Pollinators hold the key for natural enhancement of biodiversity. Further, India's domestic honey consumption is huge and the country exports honey worth 300 to 400 crores every year. Apart from thus the domestic honey production supports the livelihood of thousands of entrepreneurs. The ministry of Agriculture, Government of India has been making serious efforts to initiate studies and collect data that can enable a proper review and take informed decisions on taking appropriate steps to conserve bee populations in India. With the extensive use of neonicotinoids, dimethoate, fipronil and pyrethroids which are highly toxic to honey bees, which also aggravate the infestation and infection of *Varroa destructor* and Nosema spp both of which are present in India, it is high time that proper studies are conducted to evaluate the probable threat to the honey bees in India before it becomes too late, especially, since we are known as people who wake up only after disasters happen.

Extract from 'The Bee-Boy's Song' by Rudyard Kipling

A maiden in her glory,
Upon her wedding - day,
Must tell her Bees the story,
Or else they'll fly away.
Fly away -- die away --
Dwindle down and leave you!
But if you don't deceive your Bees,
Your Bees will not deceive you.