Behavioral Ecology of Bees

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**Abstract**  
  
Bees constitute one of the major plant pollinators globally. They experience adaptation for feeding on pollen and nectar. Pollination is as well defined as the process by which pollen grains are transferred between plants in reproduction. The amount of colonies (maintained by beekeepers) has gradually declined due to systematic use of pesticide, urbanization, Varroa mites, and tracheal. However, this has increased the competition of bee keeping for pollination purposes.  
Pollination refers to process via which transfer of pollen in plants reproduction occurs, thus facilitating sexual reproduction as well as fertilization. Pollination constitutes an essential step in flowering plants reproduction, resulting in a remarkable production of genetically diverse offspring. The general study of in-depth pollination entails various disciplines such as horticulture, botany, ecology, and entomology. Pollination was first viewed by scientists as an interaction process (in 18th century) between vector and flower. The fact that fruiting is fertilization dependent and is as a result of pollination guarantees the importance of pollination in agriculture as well as horticulture. Pollination can either be abiotic (mediated with no other organisms involved) or biotic (organisms carry the pollen grains from the flower’s anthers to the respective part of the pistil or carpel. Beetles have emerged to be the insects that pollinated the most ancient animal-pollinated flowers; thus the syndrome pertaining insect pollination emerged before the first appearance of bees. However, bees are (specialists) pollination agents with physical and behavioural modifications that facilitate pollination, and are relatively more efficient in performing the task than other pollinating insects such as flies, beetles, pollen wasps, and butterflies. The emergence of these floral specialists has driven the angiosperms’ adaptive radiation, and, consequently, the bees themselves (Riedl, (Johansen, & Barbour, 2006).  
**Methodology**:

All the details availed by this research has been delicately collected from subject-related articles and in-depth analysis of various case studies.  
Semisocial and Eusocial bees  
  
Bees can either be solitary or live in certain community types such as for instance, the eusocial colonies (common among the bumblebees, stingless bees, and honey bees). Different types of sociality have evolved amongst the bees. In certain species, groups (of cohabiting females) may function and live as sisters; otherwise, labor division in the group guarantees them to be considered Semisocial. However, if, in spite of labor division, the group entails a mother and corresponding daughters, the group is then called eusocial. The mother serves as the “queen” while the daughters serve as “workers”. The system is said to be “primitively eusocial” if these cases are purely behavioural while, on the other hand; the system is “highly eusocial” once the cases are found to be morphologically discrete. Nevertheless, the primitively eusocial bees constitute relatively more species as compared to the highly eusocial bees. In most cases, the highly eusocial bees are found to live in colonies with each colony having a single queen and several workers.  
Bumblebees are found to be eusocial, and the queen is found to initiate a nest singly. Colonies of bumblebees contain 50-200 bees at maximum population, which takes place in the duration mid-to-late summer. Bumblebees constitute one of the vital wild pollinators; however, their population has declined recently. Communal and solitary bees: Most bees are said to be solitary if all the females are fertile and inhabits own constructed nests. Solitary bees are vital pollinators whereby pollen is collected for providing the brood’s food in the nest. They are said to be **oligoleges** (collect pollen from a few plant species) unlike bumblebees and honey bees which are generalists. Monoculture and decline in bee species has made honey bee keepers concentrate on seasonally dynamic pollination areas. Fuzzy bees have an electrostatic charge thus adherence of pollen is facilitated. Bee gathering pollen grains are more efficient pollinators rather than those that gather nectar (Davies, Kreb, and West, 2012).  
In New Zealand, three general of native bees managed to venture into flower buds of the native mistletoe Peraxilla tetrapetala. Bellbird and Tui are some of the birds that orient the ripe bud top since cannot undergo self-opening. This results in a mechanism that causes spring-opening of the petals thus providing access to the pollen and nectar. The individual efficiency of bees determines their population value. Thus while pollination efficiency of bumblebees is high on cucurbits, the cumulative efficiency of honey bees colony is relatively greater as a result of their greater numbers. Bumblebees and honeybees use their spatial vision and color vision to sort out tasks such as to recognize rewarding flowers especially during foraging. **Cognitive factors** are very significant in determining what bees see. With progressed visual experience, honey bees know much in using non-elemental processing, entailing rule learning and configurable mechanisms. Honey bees can as well learn delayed-matching-to-sample tasks, as well as the policies governing this decision-making process; exchange acquired rules between various sensory modalities. Lastly, bees can familiarize with complicated categorization tasks and also processing abilities of displaying numbers up to four (inclusive). A combination of the above evidences suggests that bees possess sophisticated visual behaviors (that fit cognition’s definition); hence simple primary bee vision models should know how various factors influence the results gained from experiments of animal behavior (Wilson, 2004).  
In regions where introduced honey bees have invaded, the floral resources of several plant species are used exclusively by honey bees, on the other hand, the native bees are endangered. However, native bees visit and pollinate the plant species in the regions where honey bees have not been established. In New Zealand (Heine, 1938; Thomson, 1927; Craig et al., 2000) and Tsamania (Goulson et al., 2003), similar effect has been realized as a result of invasion of honey bees. The predominance of honey bees in New Zealand will have severe plant-pollinator interactions, for instance, variations in order of gene flow in plants, native bees population decrease and boosted reproductive fitness of (invasive) exotic weeds. Pollination disruption by the invaded honey bees evident in plants grown in orchards suggests that removal of pollen by honey bees may lower pollination success in plant species such as ornithophilous plants. In addition to that, if the population of a particular bee species declines due to disease or natural cycles of parasites, a reliable and stable pollination source is provided when native bees fill the left gap. Nevertheless, native pollinators save money since they exhibit less need for imported honey bees’ hives. Sustainable management practices and reduced use of pesticides make organic farms vital participants in pollinator conservation efforts. For instance, since 70% of native bees nest underground, **heavy tillage** may be essential on farms where bees are needed pollinators. This benefits the growers by decreased need for rental-honey bees, greater farm biodiversity, and improved pollination services. Native bees can be relied upon by organic farmers who care for the chemical inputs (e.g., miticides and antibiotics) which are mostly used in maintenance of managed honey bees. Native bees pollinate crops when sufficient habitat is availed and bee-friendly practices of management are implemented (Kelly, 1998).  
**Conservation of bees** can be achieved via: **classical biological control**; existence of beneficial organisms’ populations is practiced. **Conservation biological control**; habitats are provided to encourage populations of resident predatory insects. This reduces the need for pesticides and also provides extra food as well as nest habitat for bees. **Resistant varieties**; use of crops that are not vulnerable to pest insects reduce the use of pesticides, thus benefit both beneficial insect populations and pollinators. Native plants are the best source of bees’ food, but some garden plants are great sufficient for pollinators**. Local native plants’ use**; native plants are more attractive (to native bees) than exotic flowers**. Choosing a wide variety of flower colors**; especially purple, blue, yellow, violet and white attract bees**. Diversified plants flowering all seasons**; a range of pollinators (bee species), flying at varying times of the year, is supported (Holzschuh et al. 2007; Dramstad & Fry 1995). Pollinators perform several ecological obligations in natural ecosystems (that they constitute a keystone combination in almost all terrestrial ecosystems), essential for plant reproduction as well as forming the foundation of a food web rich in energy (Kearns et al. 1998). Most bee species nest underground, digging tunnels heading to some brood cells. Honeybees and bumblebees are excluded from this phenomenon since they need a small cavity (e.g., an abandoned rodent nest) for their colony (Thomson & Kearns 2001). Feral honey bees occupy large cavities, e.g., a hollow tree (Raw & O’Toole 1999).  
**In the temperate regions**, honey bees manage winter as a colony. Within the cluster, an internal temperature of 95oF is maintained (optimal temperature for wax creation). Honey bees can forage optimally at the air temperature range 72-77oF, mostly because they exhibit physiological and behavioural mechanisms responsible for their flight muscles’ temperature regulation. Bees can be poisoned by insecticides (once they drink tainted nectar, absorb toxins via their exoskeleton, or when their pollen-collecting hairs trap insecticidal dusts**. Movement or coverage** of honey bee hives before application of pesticides cannot protect the wild bees’ scattered populations. However, **during the winter season**, bumblebee queens seek “winter safety” in some of the honey bee hives. Most of the bumblebees, hardly tolerate the winter season thus, are found dead as the spring season commences. In addition to that, chemical treatments of honey bees against Varroa mites saved several commercial operations and also improved cultural practices. In regions of mild climate, resistant breeds’ repopulation and Varroa resistance’s natural selection has facilitated the recovery of feral bees’ populations.

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