Wild bee pollinators and their role in pollination

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Abstract:- Non-*Apis* bees or wild bees serve as important pollinators of cultivated and other wild crops. They not only aid in pollination but also enhance the pollination potential of honey bees. Their pollination potential is underrated and more studies need to be carried out to make more understanding of their biology, ecology, habitat, foraging behaviour, and pollination potential in order to exploit their pollination services for effective and enhanced crop production. The conservation aspects of non-*Apis* bees need to be evaluated to preserve them in their native habitats without any alteration in their nesting behaviour and pollination ecology.

Key-Words:- wild bees, non-*Apis* bees, native bees, *Megachile* bee, bumble bee
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1. Introduction

Very few among us are aware of the diverse group of hymenopteran pollinators that buzz around us. Besides the well-known domesticated honey bees (*Apis* sp.), other different types of bees, known as non-*Apis* or native or wild bees, pollinate a wide array of crops that we might not be aware of. Wild bees (Order: Hymenoptera) are opposite to honey bees. Unlike the latter, the wild bees constitute a vast taxonomic group, extremely rich in terms of biology and ecology. According to an estimate, around 20,507 species of wild bees exist globally (Ascher and Pickering, 2020) which pollinate around 75-80 percent of cultivated and wild crops and the remaining are pollinated by honey bees (Allen and Allen, 1990). The most familiar wild bees are the colorful, fuzzy, yellow-and-black striped bumble bees, metallic-green sweat bees, squash bees, leaf cutter bees, and carpenter bees. These flower-seeking pollen magnets purposefully visit flowers to collect pollen and nectar as food for themselves and their young ones. Abrol *et al*. (2021) elucidated the importance of bumble bees for enhancing crop pollination and improving food security. Most bees excavate their nest tunnels in sunny patches of bare ground, while others seek out abandoned beetle burrows in dead tree trunks or branches. The majority of bees are solitary, but a few, like sweat bees and bumble bees, are social, living in colonies that consist of a queen, worker bees, and a few males (drones). The leafcutter bees use a wrapper of leaves, resin, and sand and carder bees harvest plant fibers to make their nest. In the Jammu region, a decent figure of the wild bee population has been recorded over the past decade (Fig. 1). About sixteen insect species were recorded visiting flowers of *Ocimum basilicum* wherein 85 percent represented non-*Apis* bees or wild bees (Abrol *et al*., 2017). Singh *et al*. (2017) recorded seven wild bee pollinators in *Cajanus cajun* wherein Megachilidae were the dominant pollinators. Shankar *et al*. (2017) documented 27 insect species in *Parkinsonia aculeata* out of which 17 species were wild bee pollinators. In another event, Shankar and Mukhtar (2022) documented foraging by twenty-two wild bee pollinator species in *Sesamum indicum* L.

2. Efficiency of non-*Apis* or wild bee pollinators over *Apis* bees

Due to increasing human population, agricultural production is under enormous pressure. The increasing food demands need to be covered while safeguarding the agricultural ecosystem and conserving biodiversity. Among the cultivated crops, 87 global food crops depend on animal pollination whereas only 28 crops do not rely on pollinators for producing yield (Klein *et al*., 2007). Honey bees, primarily, *Apis mellifera* (Apidae: Hymenoptera) are the most valuable *Apis* pollinators that pollinate a wide range of cultivated crops. However, recent advancement has been done in discovering the richness and

abundance of non-*Apis* bees or wild bees and their role in global crop production. In comparison to non-*Apis* bees, honey bees are cheaper and more convenient but they cannot pollinate some agricultural crops which non-*Apis* bees can. Successful wild bee pollination has been witnessed in crops like alfalfa, sesamum, sunflower, safflower, costus, and most of the pulses wherein honey bees are unable to pollinate them successfully. Non-*Apis* bees not only pollinate the crops directly but also help in improvising the pollination potential of honey bees. Greenleaf and Kremen (2006) reported that behavioural interactions between wild and honey bees enhanced the efficiency of honey bees up to 5 folds on hybrid sunflowers, thus doubling the effect of pollination services. In addition to managed honey bee colonies, non-*Apis* bees effectively pollinate crops and enhance the fruit set of certain crops, including almonds, blueberries, and others (Garibaldi *et al*., 2013). *A. mellifera* pollination effectiveness was greater and fruit set was higher when non-*Apis* bees were present. Non-*Apis* bee visitation enhanced fruit set by twice as much as the same visitation by honey bees (Esquivel *et al*., 2021). *A. mellifera* increased their proportion of movement between tree rows when non-*Apis* bees were present, thereby improving pollination effectiveness (Brittain *et al*., 2012). More successful pollen tube growth translated into significantly higher fruit sets in the orchards where non-*Apis* bees were present. The greater proportion of between-row movements by *A. mellifera* individuals most probably resulted in the deposition of more compatible pollen, since pollen from the same variety generally does not set fruit (Klein *et al*., 2003). Daly *et al*. (2012) analyzed honey bee and non-*Apis* bee farms and recorded that 21.2 percent of Canadian bee farms had non-*Apis* bees and 16.6 percent of farms had exclusively non-*Apis* bees. They also recorded that non-*Apis* bee farms were more land-intensive and had greater diversity in terms of the primary commodity.

3. Role of wild bees in pollination

The complete impact of wild bees on pollination is not known and thus, an estimate of wild bee contribution to crop pollination cannot be depicted. Wild bees have gained equal or more importance over domesticated honeybees in pollinating food crops around the world due to the dramatic decline in the number of healthy honeybee colonies over the past fifty years. Just like the domesticated bees, wild bees also forage on crops to obtain sugary-nectar and protein-rich pollen from flowering plants and thus, play a significant role in crop pollination. They not only pollinate a vast range of wild crops but also play a major role in cultivated crop pollination. The largest international survey of insect pollinators has also found that just 2 per cent of wild bee species now accounts for 80 per cent of global crop pollination- from apples and pears to cacao chocolate and coffee. Due to little knowledge about their biology, host-plant interactions, and seasonal abundance, they have gained little attention in past years. A wide range of crops *viz*., alfalfa, clovers, and fruits like apple, pear, peach, almond, and various other crops like sunflower, hybrid tomato, cotton, onion, carrot, and cucurbits (Kapil and Dhaliwal, 1968) depend largely on non-*Apis* bees for effective pollination. A spectacular phenomenon of 'buzz pollination' or 'sonication' is found in some wild bees such as bumble bees in crops like tomato, brinjal, capsicum, potato, etc. for effective pollen collection. They grab the flower's pollen-bearing anthers with their mandibles, decouple their wings, and activate their flight muscles. This transfers the vibration to the anthers, shaking the pollen in a "salt and pepper shaker" like mechanism onto their bodies- something that honeybees cannot do. Recent research has shown that bumblebees can alter the frequency of their sonication in response to plant types and weather conditions. The approach of wild bees towards pollination is somewhat different from that of domesticated bees. Some of the wild bees are crop specific such as the mason bee (*Osmia* sp.) which pollinates the flowers of gram besides milk thistles. The hind basitarsus

of bees is equipped with a pollen basket or corbicula which is used to brush pollen. However, in Megachile bees, the pollen brush covers the entire of their ventral abdomen which they load with pollen while foraging. This characteristic feature of Megachile bees makes them the most efficient and effective pollinators.

4. Conservation aspects

At one time, honeybees were enough to pollinate most of our crops. Now there are only enough to pollinate around a quarter of them. If we didn't have wild bees to turn to, we would already be facing a food security catastrophe. The potential of wild bees in crop pollination is underrated but should not be underestimated. These bees can pollinate even those plants which honeybees cannot. This signifies a vital contribution to the conservation of wild plants and herbs. Many wild bees are facing a myriad of threats, including habitat loss, climate change, pollution, unsustainable agricultural practices, widespread use of toxic fertilizers and pesticides, diseases, as well as attacks by invasive pests, parasites, and predators. In fact, some species, such as the once-common rusty-patched bumble bees, are now listed as endangered species. Potential causes of these declines include habitat destruction, disease, agricultural and lawn and garden practices, use of pesticides, habitat fragmentation, changes in land use, invasive species, and climate change. In order to conserve these wild pollinators, planting native and wild plants is crucial. The more types of flowers and herbs, the more secure environment becomes for wild bees. Construction and installation of different conservation structures *viz*., bee hotels and bee banks should be promoted. The use of pesticides at the time of peak pollinator activity should be hampered. Pesticides have direct and indirect lethal effects on the life cycle, reproduction, foraging, and survival of bees. Systemic pesticides get sequestered in pollen and nectar of the crops and their use should not be advocated in foraging season. Pesticides should only be sprayed during evening hours when the wild bees have headed back to their nests and are not in the foraging phase. Greenleaf and Kremen (2006) focussed on the importance of wild bees and their conservation aspects to buffer the human food supply in the era of honey bee shortage.

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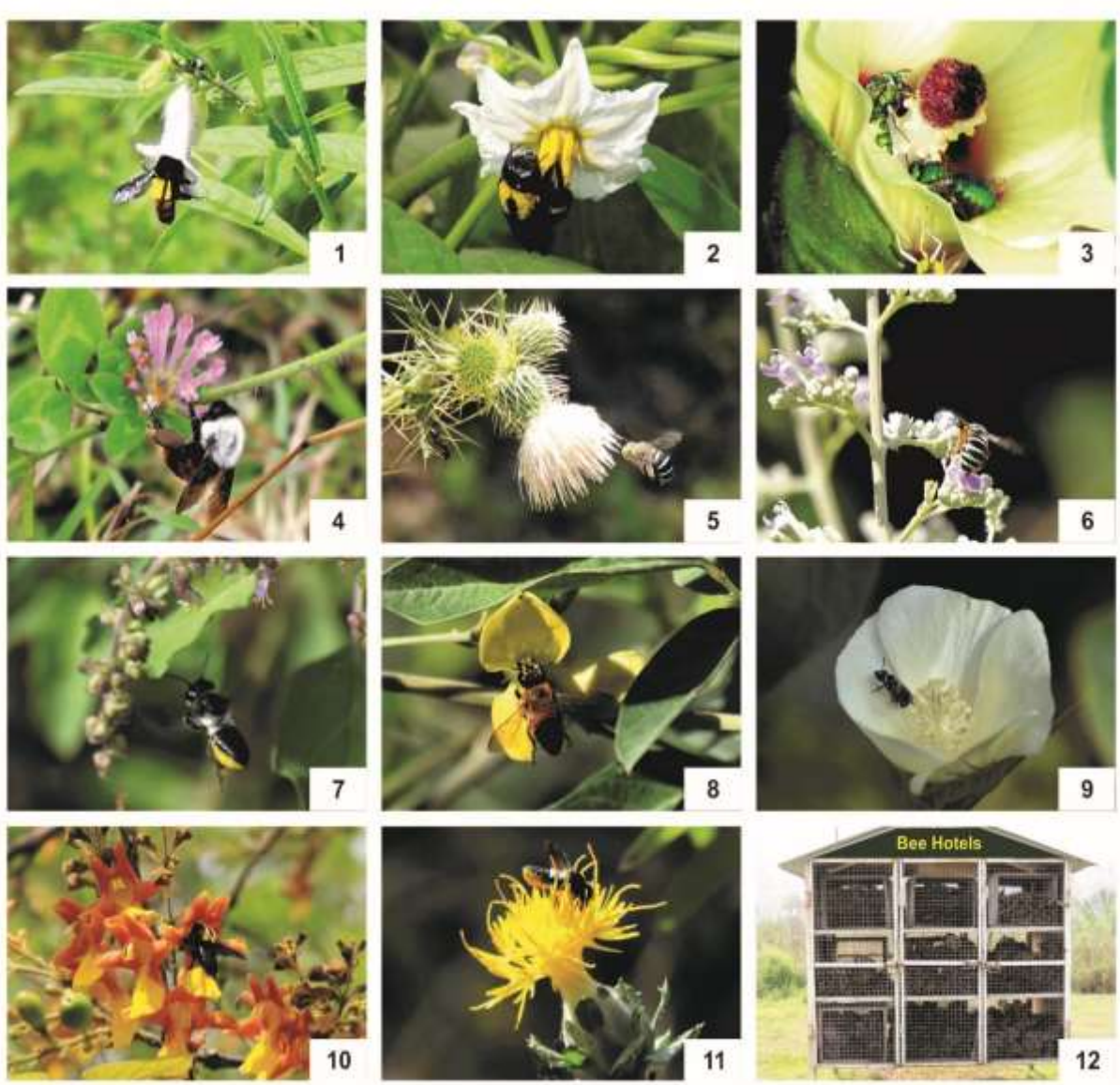

Fig 1. Wild bee fauna in Jammu region. 1) *Bombus trifasciatus* on *Sesamum indicum* 2) *Xylocopa pubescens* on *Solanum melongena* 3) *Ceratina smaragdula* on *Abelmoschus esculentus* 4) *Bombus tunicatus* on *Trifolium pratense* 5) *Amegilla cingulifera* on *Cirsium* sp. 6) *Nomia westwoodi* on *Vitex negundo* 7) *Megachile conjuncta* on *Ocimum sanctum* 8) *Megachile lanata* on *Cajanus cajan* 9) *Lassioglossum* sp. on *Gossypium* sp. 10) *Xylocopa fenestrata* on *Gmelina arborea* 11) *Megachile conjuncta* on safflower 12) Bee hotels for wild bee conservation.