

Blue Banded Bee, *Amegilla spp.*: A Potential Pollinator in Pollination of Crop plants

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SUMMARY

Pollinators improve the shape, quality as well as seed yield of various crops. Blue banded bees are effective pollinators that are fossorial and solitary soil nesting creatures. Male bees and female worker bees are floral visitors and collect floral rewards. They are alternative to the mechanical pollination. Flight activity of female bee begins just before dawn and continues upto dusk. They collect nectar or pollen or both from crop plants and weeds. Among the various plant families, Fabaceae, Solanaceae and Cucurbitaceae are predominantly preferred and foraged. They are attracted mainly to yellow coloured flowers. Female bee guards the nest by remaining within the nest shaft. Most of the sleeping clusters are intraspecific and male biased and rarely sex mixed. Males take rest during dusk either singly or in a cluster on the terminal end of the dried weeds by grasping the stem firmly with their mandibles and fall asleep. Interspecific sleeping clusters are also found occasionally which involve cuckoo bees (*Thyreus spp.*) and leaf cutter bees (*Megachile spp.*). When both the sexes are brought together and confined in enclosures, forced mating can occur.

INTRODUCTION

Of all the diverse bee species, about 90% of them are solitary (Jena *et al.* 2022). Blue banded bees are solitary creatures and commonly seen on flowers and play a greater role in crop pollination. Many Solanaceous plants such as, eggplant, capsicum and tomatoes depend on bee pollination for increasing their productivity (Buchmann, 1992). Blue banded bees are potential pollinators of greenhouse tomatoes (Bell *et al.* 2006). Tomato yield was increased in greenhouses due to the pollination activity of *Amegilla chlorocyanea* (Hogendoorn *et al.* 2006). The huge, plumpy, juicy grubs of Dawson's bees (*Amegilla dawsoni*) were used as food for the local aborigines of Australia. The male bees wait at the nest entrance for the virgin female bee to come out. They can detect the presence of female bee even while she is inside the tunnel. The male bees fight with each other using their mandibles and winning bee alone can mate with female bee (Houston, 1991). Mating occurs in nesting areas and mainly at the forage sites. The female bee normally mates only once and mating lasts about seven minutes in *Amegilla dawsoni* (Simmons *et al.* 2001). The female, mounted by the successful male, ran over the ground for some meters until the pair was hidden beneath some small plants and there coupling lasted for about two minutes (Houston, 1991). Sleeping aggregations have been observed in various solitary bees (Michener, 1974). Such aggregations consist of usually conspecific males rarely with few females gathering on plant stems. In most of the Hymenopteran species, males have been observed spending the night on flowers or leaves but most of the females spend the night in burrows or nest structures. Normally they do not sting. They are not aggressive. Even if they sting it will be just only like a pin prick. The bees swarm about intruders at nest aggregations but do not attack them. Hence, they do not pose any threat to the people.

Different Species of Blue Banded Bees

- *Amegilla (Zonamegilla) adelaide*(Cockerell, 1905)
- *Amegilla (Notomegilla) aeruginosa*(Smith, 1854)
- *A. alpha*(Cockerell, 1904)
- *A. asserta* (Cockerell, 1926)
- *A.perasserta*(Rayment, 1947)
- *A. chlorocyanea*(Cockerell, 1914)
- *A. cingulata* (Fabricius, 1775)
- *A. indistincta*(Lejis, Batley and Hogendoorn, 2017)
- *A. karlba*(Lejis, Batley and Hogendoorn, 2017)
- *A. murrayensis*(Rayment, 1939)
- *A. paeninsulae*(Lejis, Batley and Hogendoorn, 2017)
- *A. pulchra*(Smith, 1854)
- *A. thorogoodi*(Rayment, 1939)

- *A. virdicingulata*(Fabricius, 1775)
- *A.pulverea* (Walker, 1871)
- *A. zonata*(Linnaeus, 1758)
- *A. dawsoni* (Rayment, 1951)

Glittering Colours

The common name, Blue Banded Bee refers to the bold stripes of iridescent or metallic blue fur that many of these bees have across their black abdomens (or tail sections). However, some blue banded bee species actually have green, reddish or white stripes except *A. aeruginosa* which has a nearly uniform coat of metallic greenish or bronzy fur.Blue banded bees usually have a thick fleece of red brown fur on their thoraxes (or mid sections) and yellow, cream or white markings on their faces.

Nesting Biology

Blue banded bees build their nests in the soil. The bees show special preference for soil kept in flower pots. More nests are found closer to the edge of the pot rather than in the central zone of the pot. Thus, they form nest congregation in flower pots. They also build several nests along the sides of well shaded irrigation channels. Occasionally they build nests in the brick walls of old buildings where clay is used as mortar and a mixture of sand and red soil used for plastering.



Fig1: Nestsconstructednear pottedge



Fig 2: Femaleof*Amegilla zonata* diggingsoil

Preference of Nesting Substrate

Blue banded bees show almost equal preference for both red soil and potting mixture. These bees do not prefer black soil for nesting.

Floral Resources

Blue banded bees collect nectar or pollen or both. They are usually more attracted towards the yellow coloured flowers followed by white and purple flowers. Among the various plant families, Fabaceae, Solanaceae, Cucurbitaceae, Compositae and Bignoniaceae appear to be predominantly preferred for foraging by these bees. Both male and female bees are floral visitors. Female bees collect both pollen and nectar while male bees sip nectar alone from the flowers. They frequently hover above and around the flowers before landing on them. They fly very fast and quickly visitmany flowers per minute. They are often seen darting around the flowers. They commence their foraging activity around 6.00 am and stop foraging at 6.30 pm and their flight activity continue all throughout the day. However, they show intense activity from 7.00 am to 9.00 am. The bee visitation is generally more on days following the rains. A single bee visits numerous flowers during each foraging trip. Pollen foraging is taken up by the mother bee after brood cell construction. Bees after pollen foraging return to the nest with their scopa on hind legs loaded with pollen.

Developmental Biology

Egg

Eggs are present only in brood cells which are adequately provisioned with larval food or bee bread. The bee bread is usually semisolid and sometimes semi liquid that remain only at surface. The pollen bread is kept at the bottom and a small quantity of nectar is placed over it. Eggs are creamy white in colour, slightly arched and singly laid on the brood food. It is cylindrical in shape with bent ends. The bent caudal ends of the egg are just touching the brood food. Middle part of the egg do not touch the brood food.

Larva

Newly hatched larvae is straight and found at the top of the brood food. As the larva grow, the body become 'C' shaped and robust. Second instar larva have slightly pigmented mandibles. The grownup larva is distended and only a small amount of unutilized brood food is left out in the brood cell. The fourth instar larva consume the remaining provisions and also the cell linings. Head capsule is well developed with two well-developed mandibles. It is elongate without any legs in thorax and abdomen. The dorsal blood vessel is faintly visible in the mature larva. Similarly, Malpighian tubules are also visible through the transparent larval cuticle. The grown up fourth instar larva void the black colour faeces at the bottom of the brood cell.



Fig3:Cylindricalbroodcells



Fig4:Life stagesof *Amegillazonata*

Pre-pupa

The body of the fully grown larva shrink to form the pre-pupa. The cell housing the pre-pupa neither have any larval food nor wax linings. Pre-pupa moult into an exarate pupa without any covering within the brood cell.

Pupa

Newly formed pupa is yellow in colour with yellow coloured compound eyes. As the pupae matures, the eye colour also change from yellow to orange and then to brown and finally to black. Sexing was possible even during the pupal stage based on the number of bands present on the metasoma. Male pupa have five bands whereas female pupa have four bands only. The pupa transform into an adult bee within a fortnight.



Fig5:Malepupaof *Amegilla zonata*

Adult



Fig6:Femalepupaof *Amegilla zonata*

The newly emerged adult, the callow remain within the earthen cell for two to three days and then come out of the nest and walk for a while near the nest. It cleans its compound eyes with its fore legs and rub its gaster with its hind legs and flutter its wings. Activity of blue banded bee is reduced markedly especially during rainy seasons. Eggs and larvae do not transform into adults under in vitro conditions.



Fig7:Roosting on *Achyranthus aspera*



Fig8:*Amegilla zonata* foraging on cucumber



Fig9: Isolated,femalebiased clustering of *Amagilla zonata*



Fig10: Interspecific sleeping cluster

Mating Behaviour

Male bee widely stretches out its middle and hind legs prior to mating. The female bee approach the male bee from below and establish sexual contact and mate with male. During copulation the female bee is lying on its back and male bee is found above. Since, the chances of pairing is more usually in nesting sites and it can also occur in foraging sites. The female bee mate with a male bee only once in her life time and mating does not harm the male bee in anyway.

Female and Male Behaviour

Bee guards the nest by remaining within the nest shaft and bees hover around the intruder at nest congregation site but they do not sting. Bees sting only when provoked or roughly handled at nesting, foraging and sleeping sites. Sting autotomy does not occur after stinging. Most of the sleeping clusters are intraspecific and male dominated, male bees exhibit stereotypic movements during and after the formation of sleeping clusters. Female biased and sex mixed sleeping clusters also occur rarely. Males take rest during dusk either singly or in a cluster on the terminal end of the dried weeds by grasping the stem firmly with their mandibles. Interspecific sleeping clusters are also found occasionally and interspecific clusters have cuckoo bees (*Thyreus spp.*) and leaf cutter bees (*Megachile spp.*) apart from blue banded bees (*Amegilla spp.*). Sleeping clusters are found on weeds viz., *Achyranthus aspera*, *Vicoa spp.* and *Chloris barbata*.

Flying Season

Blue banded bees are seen throughout the year. However, they rest inside the nest during the cooler months.

Natural Enemies of Blue Banded Bees

- Sphecid wasp, *Liris spp.*
- Cricket

- Mites, *Rhizoglyphus spp.*, *Pymotes ventricosus* and *Histiostoma spp.*

CONCLUSION

Blue banded bees play an important role in the pollination of cucurbitaceous and solanaceous plants. They are alternative to the physical or bumble bee pollination in some countries. They appear throughout the year and are solitary creatures. Both males and females have foraging as well as guarding habits. Brood mites, crickets and sphecid wasps cause reduction in the population and serve as natural enemies. They show both intraspecific as well as interspecific roosting habits.

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