Life cycle of bumble bee *Bombus haemorrhoidalis* Smith in Himachal Pradesh

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Bumble bees belong to order Hymenoptera, tribe Bombini and genus *Bombus* having more than 250 species in temperate, sub-temperate and sub-tropical regions. In India, *Bombus haemorrhoidalis* Smith is the only species on which rearing trials are being made (Dayal and Rana, 2004; Thakur et al., 2005). The total life cycle has not been studied due to non-availability of bumble bee culture after late summer or mid monsoon. Keeping in view the factors responsible for successful rearing of bumble bees, present studies were made to study the life cycle of native bumble bee, *B. haemorrhoidalis*.

In nature, bumble bee starts its life cycle with the onset of spring when the fecundated queens come out from hibernation and start nesting in sites generally in abandoned nests of rodents and small mammals. It was observed that after locating the nesting sites (Fig.1), queens start building nests with the secretion of wax from the four pairs of wax glands present on 4-7th sternal plates of the abdomen. Initially each queen foraged for collecting food (nectar and pollen) and then laid 1-4 white rice shaped eggs in the wax cups which had been moulded by her. Sometimes she secreted a multilayered wax crest in which eggs were laid. On hatching, the crests were converted into cells. For laboratory rearing, thirty nine overwintered fecundated queens were collected to study the biology and life cycle of bumble bees during March 2013 as per earlier studies (Chauhan, 2011; Chauhan and Thakur, 2011). Of these, thirty two queens formed wax mounds and eggs were laid in them. The eggs hatched after 1-2 days into white larvae. The egg, larval and pupal stages were found covered with wax and can be seen only when the wax coverings are opened daily for feeding by queen/workers. It means that bumble bee exhibits progressive provision. The larvae were fed daily with a mixture of pollen and nectar. After 28±4 days of wax secretion, workers emerged. The colour of abdomen of newly emerged workers was covered with white and orange bands on dorsal side (Fig.2) which later on changes to yellow and orange bands (Fig. 2). Ventrally, they were black. After 3-7 days of emergence, the workers undertook all the duties of the nest which was earlier done by the queen such as nest
building, feeding of larvae, protection of nest and brood etc., except egg-laying. After this, the queen did not leave the nest. Young workers helped in building of egg cups, honey pots, pollen pots and feeding of larvae (Fig. 2). In this manner, 10-15 brood batches (Fig. 3a) were laid by the queen till the onset of winter totaling up to 150-200 workers. During the last week of May 15.62% colonies laid, had in them queen and drone brood (Fig 3b). Drones were located serendipitously while cleaning the colonies. Bees were kept in the plastic vials for cleaning of debris from the colonies. In some vials mating was observed. When these bees were examined it was found that some bees had round abdomen without sting apparatus having longer antennae, especially flagellum part was longer than other bees. Similar observations were recorded in other developing colonies. Thus drones do not bear sting and have round abdomen while queens have pointed ovipositor which develop into sting. Workers were also found bearing sting with reduced ovaries compared to queens. The life span of a drone from emergence was 44-49 days while workers lived for 40-56 days under laboratory conditions.

When the daughter queens and drones emerged during last week of May, they started mating after 6-8 days of emergence. Mating was usually noted during the day outside the nest both under laboratory (Fig.4a) and natural conditions (Fig.4b). When daughter queens and drones were kept for mating under laboratory conditions (in transparent plastic vials), their mating behavior studies reflected single to multiple mating. Multiple mating was observed in queens. The maximum number of drones was recorded as 3 drones mated with a single queen. The mating time varied from 15-43 min. Drones were always found ready to escape when colonies were opened for regular examination and feeding while workers and queens did not try to escape from the nest. Even if they ventured out, bees returned back into the nest and attended the brood. Six mated daughter-queens were kept in the wooden boxes in the incubator and fed with pollen and sucrose (50%). After 14-32 days, three of them initiated nest building. Sixteen to twenty one workers emerged in one colony while in the second colony only one worker emerged. No worker emerged in the third colony. It is for the first time in the country that rearing bumble bees till second generation was realised. The possible reason for the cessation of brooding in second generation colonies might be due to partial mating.
In nature, drones leave the nest forever after 2-7 days of emergence. Queens do not leave the mother nest and continue foraging even after mating. The mated queen’s forage for nectar and pollen, their size increased due to fat stores in the body which help them in successful overwintering. With the end of autumn, new queens searched for hibernacula to hibernate/overwinter or remain in the nest for group overwintering. In winter, worker bees die with the old queen while the daughter queens hibernate in groups in the same nest or separately by searching new/fresh hibernacula. These daughter queens come out of hibernation in the next spring and the life cycle continues year after year.

References:


Fig. 3a Brood batches  
Fig. 3b Developing colony showing drones, queen and workers  

Fig. 4a Mating under laboratory condition  
Fig. 4b Mating under natural conditions