Morphological Study of The Immature Stages of The Solitary Bee, *Megachile cephalotes* (Smith) (Hymenoptera, Megachilidae)

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Abstract: Bees are one of the most fascinating creatures on this earth. Most of the study regarding bees is done on their adult stages and other aspects related to them and very little work is done on the immature stages of the wild non-Apis bees. This study has been done to describe the morphological features of the immature stages of the solitary bee, *Megachile cephalotes*. Bees of family Megachilidae are wild solitary bees and are known to construct their nests independently with separate enterances. *Megachile* species are known to be found in the north, north-western and central parts of India. This study showed that the immature stages of *Megachile cephalotes* were more or less similar to that of *Megachile creusa*.

Keywords: bees, immature, larva, pupa, morphology.

I. INTRODUCTION

Bees comprise an extremely diverse group of insects of Hymenoptera. In the regions of Western Rajasthan, the work pertaining to the immature stages and nesting biology of Indian non-Apis bees are hardly described. More systematic studies have been done on the adult bees than on their immature stages. Most of the known species generally construct their nests in soil and most of the time involves a single pair of adults. Megachilidae is a cosmopolitan bee family, mostly comprising of solitary bees whose pollen-carrying structure is restricted to the ventral surface of the abdomen. Megachilids are most commonly known as mason bees and leafcutter bees, reflecting the materials from which they build their nest cells, i.e., soil or leaves respectively. Also a few bees of this family collect plant or animal hairs and fibers and are called carder bees, while others use plant resins in nest construction and are correspondingly called resin bees. All species feed on pollen and nectar but a few are cleptoparasites that feed on pollen collected by other megachilid bees. This paper emphasises on the study of immature stages of *Megachile cephalotes*. *Megachile cephalotes* is a wild solitary bee of Megachilidae family. In India, it is widely distributed in the states of Jammu & Kashmir, Himachal Pradesh, Punjab, Haryana, Rajasthan, Gujrat, Uttarakhand, Uttar Pradesh, Bihar, Odisha, Madhya Pradesh, Maharashtra, Andhra Pradesh, West Bengal and North-Eastern states. *M. cephalotes* was found to be an intensive forager of about 20 cultivated cropes and wild flowerings in six states of North-Western India (Gupta, 1993). Studies on nesting biology and life cycle of a contemporary species, *M. creusa*, have also been done (Gupta *et al*, 2003). *M. cephalotes* is found to be contemporary with another species, *M. creusa*.

II. MATERIALS AND METHODS

Several nests of many non-Apis, including those of *Ceratina* species, were observed during August to October in years 2016 to 2018 from crop fields of north-western and western Rajasthan region. The specific areas of this study were the districts of Jodhpur, Pali and nearby areas. The nests were built in the dried and hollow sticks of castor plant (*Ricinus communis*). These nests were collected from the nearby fields of Salawas village in Jodhpur district of Rajasthan.. The nests were collected at the dusk time and the openings of the nests were closed with cotton to prevent the escape of adult bees present inside it. These nests were then brought to the laboratory and were opened periodically in middle weeks of September. After opening the nest, what so ever nesting material was found, it were preserved in glass vials containing a mixture of 70% alcohol and 0.5% formaldehyde. A total of four second/third/mature instar larvae and one mature pupa, along with two adult bees were recovered from the nest and were studied. Morphology of these immatures was studied under the Olympus Stereozoom Binocular Microscope and their measurements were taken using the micrometer. Also images of the particulars were drawn with the help of Camera Lucida.

III. OBSERVATIONS AND DESCRIPTIONS

The characters of the larva and pupa have been described in the character grid in consideration with those explained by Michener (1953; 1954).

Second instar larva: BODY- Total length of body 8.10 mm; Body robust with setae over the dorsal surface; inter-segmental lines distinct; dorsal tubercles weakly visible in between thoracic segments 2 & 3, thoracic segment 3 and first abdominal segment, in between abdominal segments 1 & 2, 2 & 3, 3 & 4 and quite reduced between 4 & 5. Spiracles small and faintly visible above the body surface; anus is present in the form of a transverse slit at the posterior-dorsal surface. HEAD- almost triangular with a width of 0.90 mm and median length of 0.78 mm; slightly elongated with bulging broad ocular lobes; few setae present on the dorsal surface; labrum slightly wider; lateral lobes marginates covering a narrow inward folding at centre with 3 fine tubercles that are pigmented and limited sub-apically; surface of supra-clypeus has fine transverse striations; mandibles are slightly elongated, one-third towards dentate margin is pigmented, dentate margin smooth, lower mandibular tooth slightly

exceeding the upper in length; labio-maxillary area slightly limiting the ventral margin of mandible; maxillae elongated and sclerotized on the dorsal and ventral margins; very few setae on cardo and stipes; prominent maxillary palpi; labium divided into pre-mentum and post-mentum; hypopharynx bilobed and with few setae; transverse salivary slit; projecting dorsal and ventral lips; antennal papillae arise from broad and feeble protuberances and are longer than median width; few setae on frons; head appears to be fitted in feebly marked socket.

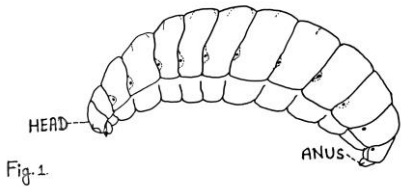

Fig.1. : second instar larva

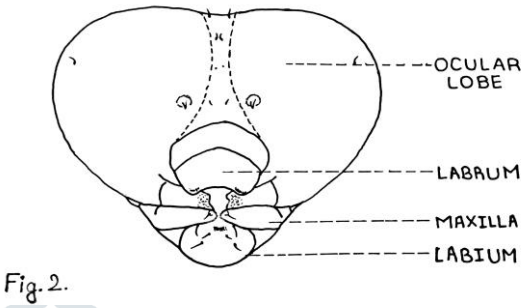

Fig.2. : head (mature larva)

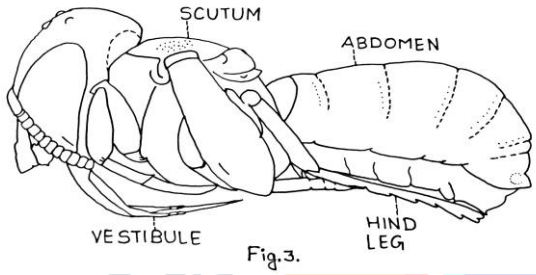

Fig.3. : mature pupa

Mature pupa: Total length 6.30 mm. HEAD- antennal scape lacks median tubercle but is finely striated; vertex is dorso-lateral with setae; ocelli prominent and bulging; clypeal apical margin at centre and is extremely invaginated, baso-centrally with projecting edge; slightly long vestibule, passing through spines of mid coxae and reaches up to the base of the hind coxae. THORAX- just before tegulae the lateral angles of pronotum are finely produced, posterior-lateral lobes not produced; two medium sized patches of erect bristles on scutum which are localized to either side of mid-line; scutellum broad and rounded posteriorly; metanotum has fine conical projection at centre; surface of tegulae has a feebly marked convexity at centre; wings lack any median tubercle; distinct projecting spine on coxae; trochanters, femur, apex of tibia dorsally with acute and distinct spines. ABDOMEN- on terga two to five basal margins of apical rims with a row of erect prominent bristles; carina of tergum 6 with small bristles widely interrupted at middle.

IV. RESULTS AND DISCUSSION

Megachile cephalotes is wild solitary bee that was recorded nesting in the hollow and dried stems of *Ricinus communis* (castor) in the western Rajasthan. The present study describes the morphological features of this mason bee. The larval stages of various species of *Megachile* are discussed by Michener (Michener, 1953). He also described the resemblance of pupa with the adult in taxonomic characters of identification (Michener, 1954). The female bee of family Megachilidae constructs typical nests. The chambers are built one after another successively after which it fills them with food and lays eggs in each cell. The cells are then closed with a lid. In *Megachile cephalotes*, the head of second instar larva was slightly wider than its median length; broad bulging ocular lobes and labrum slightly wider; mandibles slightly elongated and lower mandibular tooth exceeding the upper one; maxillae elongated and sclerotized; maxillary palpi prominent and antennal papillae longer than wider; head fitted in faintly marked socket. Body of larva was robust with distinct inter-segmental lines; dorsal tubercles present. The characters of mature pupa included the presence of finely striated antennal scape; prominent and bulging ocelli; acute spines present just before tegulae; scutum with bristles and rounded scutellum; coxae with spine. On abdominal terga 2 to 5, basal margin of apical rims with bristles. The study showed that the morphological features of the larva and pupa of *Megachile cephalotes* were more or less similar to one of the other species of Megachilidae, *Megachile creusa*.

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