



Wing Coupling Apparatus Found in Different Species of Honey Bees

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1. INTRODUCTION :

Biological attachment devices are unique in nature they are mainly used for permanent or temporary attachment of different body parts of an organism to a substrate or to each other. Except Dipterans all other winged insects possess two pair of wings. Among them some have special adaptations to couple wings together to function as single pair. Of those insects the aerodynamic efficiency in flight is improved due to coupling of fore & hindwings. They fly faster than insects with uncoupled wings. Some four-winged insect Orders- such as Hymenoptera has well developed wide variety of morphological wing coupling mechanism for efficient insect flight. (Hepburn & Radloff, 2004).

In Hymenoptera, the elaborate coupling mechanism acts as a multifunctional joint. It couples a rolled membrane at the trailing edge of the forewing to set of hook like structures at the leading edge of the hind wing during flight and uncouples at them at the rest (R.E.Snodgrass, 1910). The wing coupling apparatus consists of hooks, setae, spines, lobes, & folds displaced along posterior margin of forewings & anterior margin of hindwings, these structure couple with each other during flight & have different shapes in various classes. (Raj, 2018).

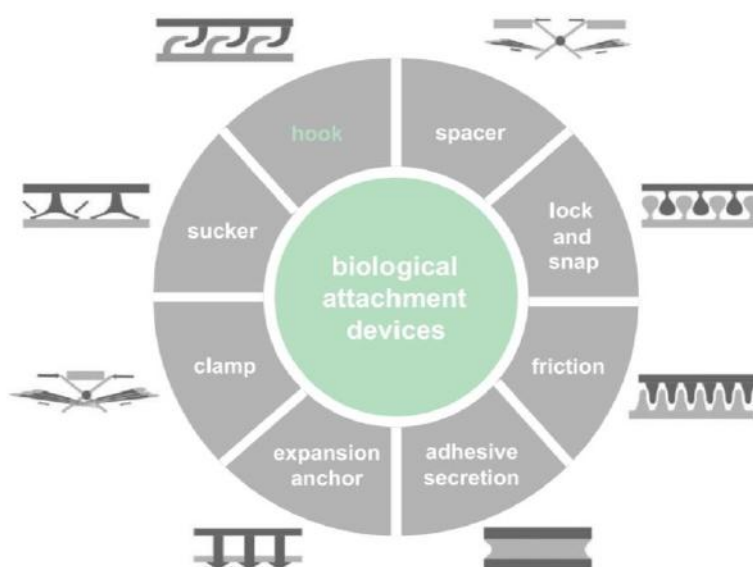


Fig.1, Biological attachment devices.

Among insects with two pairs of wings, the wings may work separately as in Dragonflies & Damselflies. But in higher Pterygote insects, fore & hindwings are coupled together as a unit, so that both pairs move synchronously. By coupling the wings of insects become functionally two winged. (Hepburn & Radloff, 2004).



There are also types in Wing coupling,

- Hamulate - A row of small hooks are present on coastal margins of hindwings which are known as hamuli. There engages the folded posterior edge of forewing.
- Amplexiform - It is simplest form of wing coupling. A linking structure is absent. Coupling is achieved by broad overlapping of adjacent margins.
- Jugate – Jugam of forewings are lobe like & it is locked to coastal margin of hindwings.
- Frenate -
 - Male frenate - Hindwings bears near the base of coastal margin, a stout bristle called frenulum which is normally held by curved process.
 - Female frenate - Hindwings bears near the base of coastal margin a group of stout bristle which lies beneath extended forewings & engages there in a retinaculum formed by patch of hairs near cubitus.

Honey bees has comparatively higher flying speed, shows a wing coupling mechanism along with angle changing mechanisms in wing flapping. These mechanisms support to carry heavy loads of pollen as well as nectar in the gut. Their wing coupling mechanism is commonly known as Hamulate coupling. (Jayashree , Tharadevi, & Armugum, 2017). In this system, the upper margin of hindwings possess row of small hooks (hamuli) & folded lower margin of forewing. In the flight the hamuli lock onto fold at lower margin of forewing & function as one unit. Both wings move together with utilizing body energy in efficient way to obtain higher flying & wing moving speed. Bees have two wings on each side of body, which are held together with comb-like teeth called Hamuli. These allow the two wings to act as one large surface & help Bees to create greater lift when flying (Patil, 2022).

2. MATERIALS & METHODS :

The present work on the wing coupling apparatus of Honey bees species was carried out at the Department of Zoology, LVH Arts, Science & Commerce College, Panchavati, Nashik-03.

The work was carried out in relation with two parameters as to have quantitative study in which features of hindwing comprising hamulis were examined in three of honey bee species. Simultaneously, the number of hamuli were counted for the comparative studies in this work, (Patil, 2022).

MATERIALS:

1. Cover slips
2. Slides
3. Forceps
4. DPX

TEST ORGANISMS:

For this comparative study, Honey bees species were collected from surrounding localities as they are locally available. Specimen were immediately brought to the college laboratory, killed & preserved in 10% formalin. Specimen were grouped according to their species level. From each of species, individuals were used to mount their hindwings.

Three species were selected for the work,

Apis dorsata

Apis cerena indica

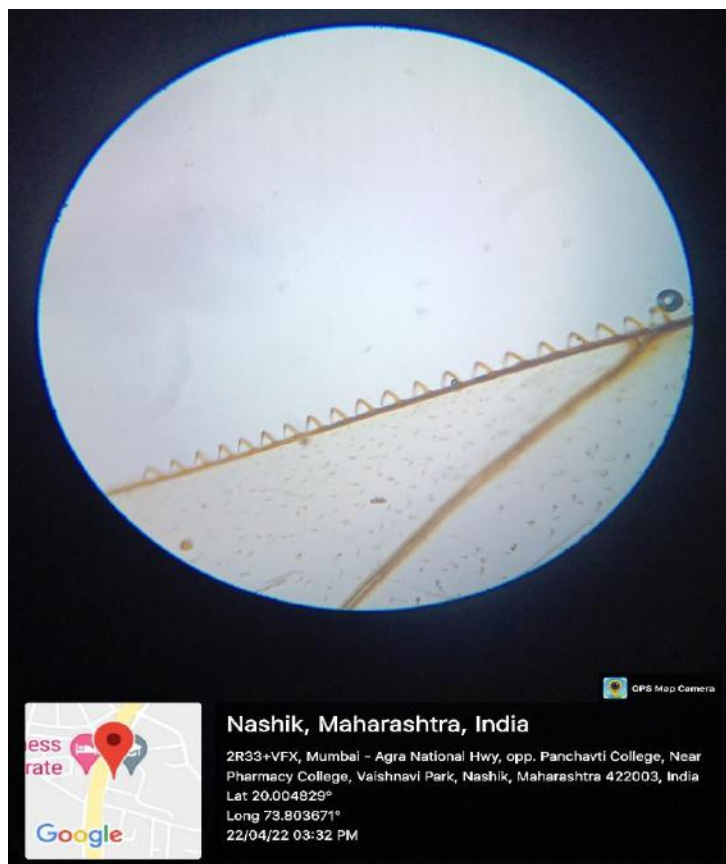
Apis florea

The individuals were dissected to make complete structure of their hindwings. For this purpose the hindwings were directly dissected & permanently mounted. Mounting was performed by DPX. In the course of quantitative study counting the number of hamuli was taken into consideration (S.D.Patil, 2022).

3. OBSERVATIONS :

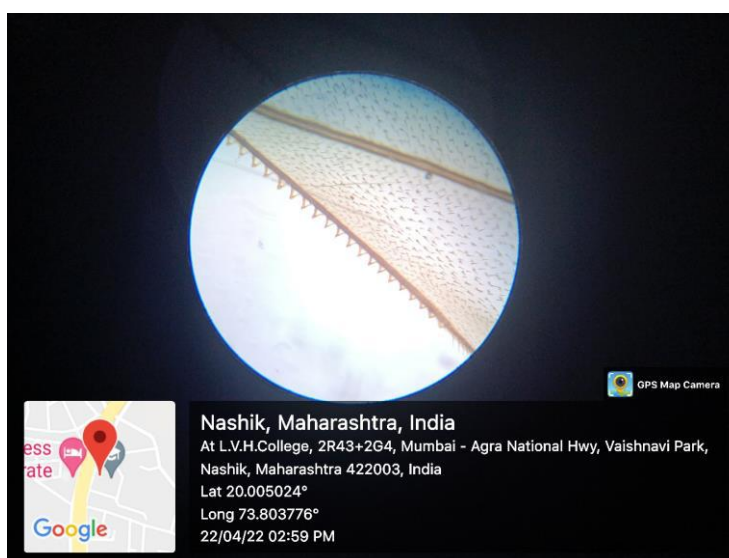
A number of variations are seen in the comparative studies which are as follows:-

Apis cerana indica hamuli:-



- Above picture is of Apis cerana indica species hamuli of hindwing.
- 20 number of hamuli are present.
- Hamuli are medium in size as compared to other Bee species.

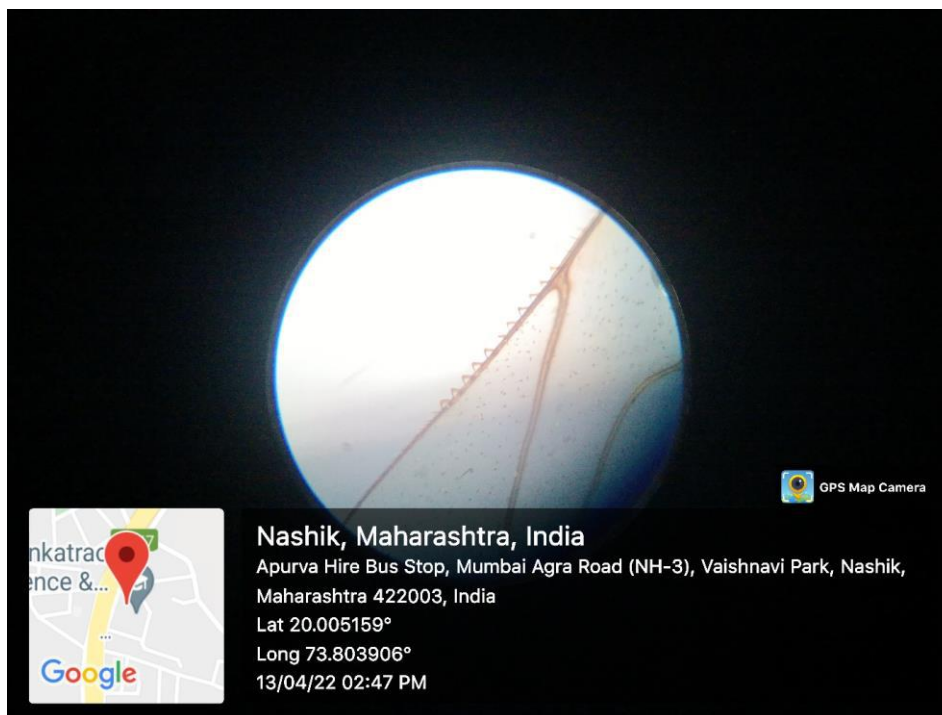
Apis dorsata hamuli:-



- Above picture is of Apis dorsata species hamuli of hindwing.
- 22 number of hamuli are present.
- Hamuli are larger in size as compared to other bee species.



Apis florea hamuli:-



- Above picture is of Apis florea species hamuli of hindwing.
- 11 number of hamuli are present.
- Hamuli are smaller in size as compared to other bee species.

4. CONCLUSION :

Bee species	Size of hamuli	No of hamuli
<u>Apis cerana indica</u>	Medium	20
<u>Apis dorsata</u>	Larger	22
<u>Apis florea</u>	Smaller	11

- In this research work, three species of hamuli are calculated for statistical analysis.

Apis cerana indica

Apis dorsata

Apis florea

- Variations are seen among the three species taken for quantitative analysis, are as follows:-

1. Apis cerana indica has 20 number of hamuli and they are in medium size.
2. Apis dorsata has 22 number of hamuli and they are in larger size.
3. Apis florea has 11 number of hamule and they are in smaller size.

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