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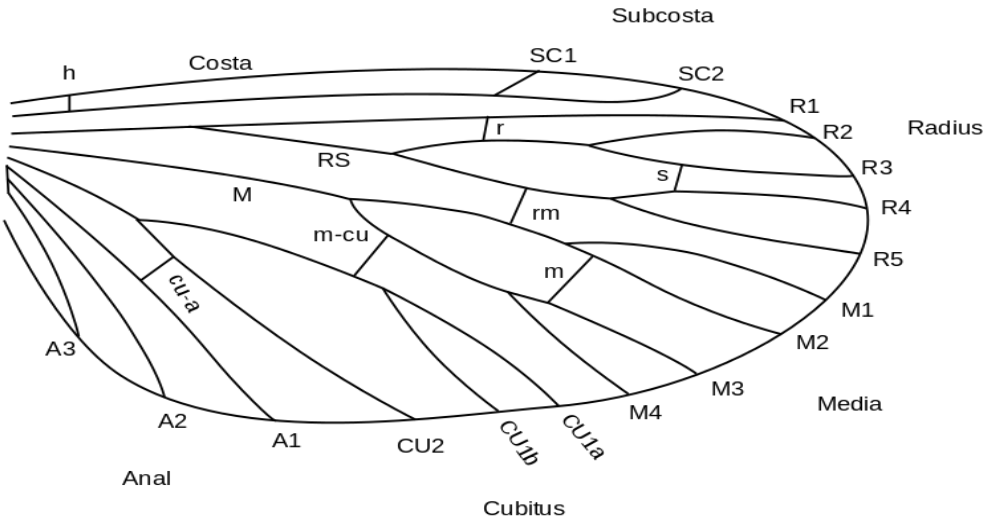
Lecture note by Alam M A April 2, 2020

LECTURE 11 &12

11. Wing venation (Comstock & Needham)
12. Modification and wing coupling apparatus

WINGS: Insects are of two type 1. which do not have the wing are called APTERIGOTE /wingless insect and 2, those have wings at any stage of their life called PTERIGOTE /winged insects . insects have one or two pair of wing originate at pterothoracic region . the first pair of wing that originate at the junction point of pro and mesothorax is known as fore wing while the wing which develop from meso and meta thorax joint is called hind wing. These are helping the insect for aerial movement. Shape and size of wing shows a great variation among insects .wings are strengthen by numerous vein called wing venation. The venation pattern in the wing help the insect taxonomist in identification of insect species and classification. A generalized structure of wing venation was given by Comstock &and Needham that is being discussed as under.

Wing venation (Comstock &and Needham)



Longitudinal veins and cross veins

Source (https://www.amentsoc.org/insects/glossary/terms/venation)

Venation is the name given to the arrangement (number and position) of veins within an insect's wing. Most insect groups have the veins running down the wing (longitudinal veins) are connected by a series of cross veins. Most insect groups have less cross veins. However but some insects such as dragonflies and damselflies have wings with large number of cross veins. Thvenation is often used as a way of differentiating between related similar species. According to current code, the archedictyon contained 6-8 longitudinal veins. According to a system devised by John Comstock and George Needham—the Comstock–Needham system:

Costa (C) – the leading marginal vein of the wing, some time small pre costa is found

Subcosta (Sc) –It is second longitudinal vein (behind the costa), typically unbranched vein

Radius (R) –Third longitudinal vein, which is branched into five separate veins. The radius is generally the strongest vein of the wing. Toward the middle of the wing, it is divided into a first undivided branch (R1) and a second branched called

radial sector (Ra), which is further subdivides into four distal branches (R2, R3, R4, R5). Basally, the radius is articulated with the anterior end of the second axillary (2Ax)

Media (M) – it is fourth longitudinal vein, the media is divided into two main branches ie. a media anterior (MA), which is further subdivides into two distal branches (MA1, MA2), and a median sector, or media posterior (MP), which has four terminal branches (M1, M2, M3, M4) which reaches to the wing margin

Cubitus (Cu) – fifth longitudinal vein, it is primarily two branched. The primary forking takes place near the base of the wing, forming main branches (Cu1, Cu2). The CU1 branch may break up into a number of secondary branches, but commonly divided into two distal branches ie. Cu1a & cu1 b while CU2 branch of the cubitus would be unforked branch.

Anal veins (A1, A2, A3) –These are unbranched veins located behind the cubitus

The cross veins commonly occur in insects are:

C-Sc cross-veins – run between the costa and subcostal and indicated by small" h"

R cross-veins – run between adjacent branches of the radius and indicated by small "r"

R-M cross-veins – run between the radius and media and indicated by rm

M-Cu cross-veins – run between the media and cubitus and indicated by m-cu

Modifications of insect wings .insects usually shows following form of wings

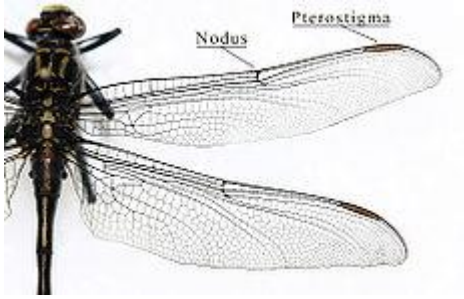
1 **Tegmina**- Wings are leathery in appearance and protective in function. Eg.

Forewing of Cockroach.

2. **Elytra**- fore wing in some insects are quietly tough and provide protection to hindwings and abdomen. Eg . Forewings of Beetles and Weevils.

3 **Hemelytra**- The basal half of the wing is thick and leathery and distal half is membranous. Eg. Fore wing of Red Cotton Bug.

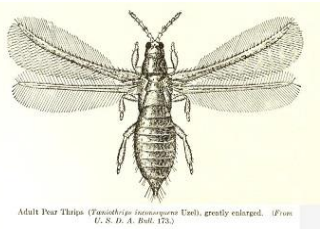
4 **Membranous**- These wings are thin and transparent. Eg. Dragon Fly, Honeybee and Termites.



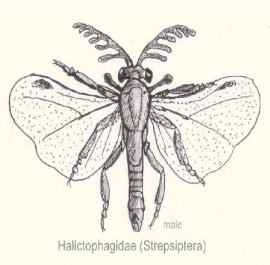
5 **Halteres**- These wings are modified into small knob like structure which maintain the body balance during flight . Hind Wing of Housefly (Diptera order).

6 **Scaly wings**- Wings are covered with unicellular scales. Eg. Moths and Butterfly.

7 **Fringed wings** - Wing lamina is usually reduced in size and are feather like. Eg. Thrips(Thysanoptera order)



. 8 Pseudo Halteres- Similar to Halteres but Location is different. Eg. Fore wings of Stripsiptera .



Functions of insect wings

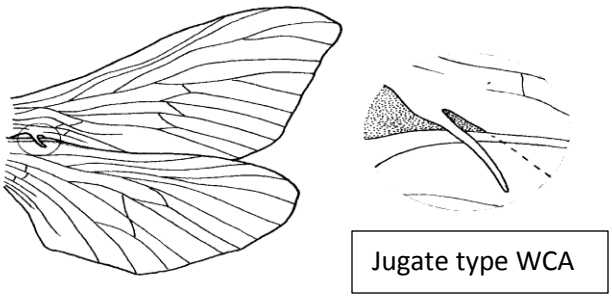
1 The main function of wing is flying, gliding & skydiving

1 altitude stability while jumping.

2 Thermoregulation.

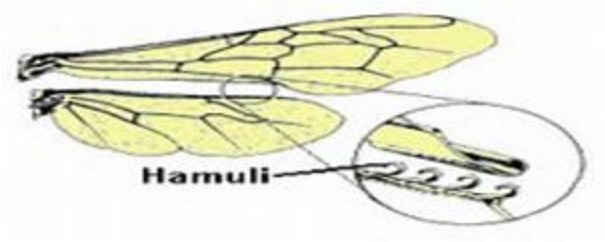
Wing coupling apparatus: in pterigote insects wings have some arrangement for syncronised movement of fore and hind wing for being the strong flying insects.These structure of the wing are known as wing coupling apparatus. These structure are commonly seen in hymenopterous and lepidopterous insects. The common type wing coupling apparatus of insects are;

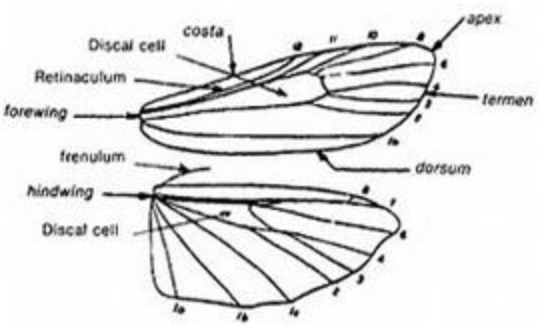
1 Jugal and humeral Type (Jugate Type): The wing coupling is achieved by lobes or spines lying at wing and humeral lobe of the fore wing and the costal margin of hind wings. Some **trichoptera** have a **strong jugal lobe** which lies beneath the costal margin of the hind wing



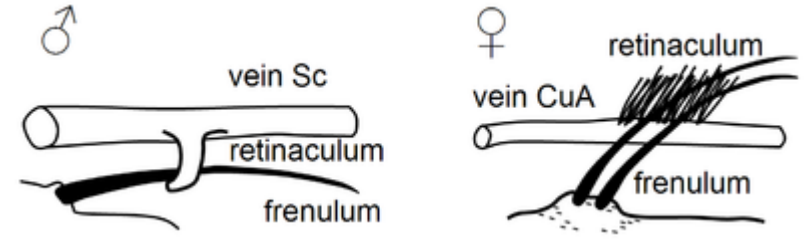
Jugate type WCA

2 Hamuli Type (Hamulate Type) Hamulate : A row of small hooks is present on the coastal margin of the hind **wing** which is known as hamuli. Example honey bee





Hamuli in Hymenoptera | Frenulum in lepidoptera



3 Frenulum and retinaculum Type(Frenulate Type) This type wing coupling structure is found in insects of Lepidoptera.varation in structure is seen in male and female insect. The male posses a hook like structure (retinaculum)in sub costa of fore wing while the hind wing has spine like long structure called frenulum which is locked into retinaculum . in female Lepidoptera fore wing bear hard brush like retinaculum at cubitus vein and hind wing has long hard spinous frenulum which fit into retinaculum . see the above image.

4 Amplexiform Type _ It is the simplest form of wing coupling structure. It is found in sphyngid moth. Here the anal margin of the fore wing and the costal margin of the hind wing have canal like structure which are directed opposite to each other, these structure make coupling during flight,

Upper image- view of wing coupling from dorsal position of sphyngid moth
Lower image– view of wing coupling from ventral side