LECTURE 11. Sense organs

Sense organs

Sensilla are the organs associated with sensory perception and develop from
epidermal cells. The different types of sense organs are:

1. Mechanoreceptors
2. Auditory receptors
3. Chemoreceptors
4. Thermo receptors and
5. Photo receptors.

1. Mechano receptors (detect mechanical forces)

i. **Trichoid sensilla**: Hair like little sense organ. Sense cell associated with spur and seta.
These cells are sensitive to touch and are located in antenna and trophi (mouth parts).

ii. **Campaniform sensilla** (Dome sensilla): Terminal end of these sensilla is rod like and
inserted into dome shaped cuticula. These cells are sensitive to pressure and located in
leg joints and wing bases.

iii. **Chordotonal organ**: The specialized sensory organs that receive vibrations are
subcuticular mechano receptors called chordotonal organ. An organ consists of one to
many scolopidia, each of which consists of cap cell, scolopale cell and dendrite. These
organs are interoceptors attached to both ends of body wall.

Functions :

i. Proprioception (positioning of their body parts in relation to the gravity).

ii. Sensitive to sound waves, vibration of substratum and pressure changes.

iii. Johnston's organ: All adults insects and many larvae have a complex chordotonal
organ called Johnston's organ lying within the second antennal segment (Pedicel). These
organs sense movements of antennal flagellum. It also functions in

hearing in some
insects like male mosquitoes and midges.
iv. Subgenual organ: Chordotonal organ located in the proximal tibia of each leg, used to
detect substrate vibration. Subgenual organs are found in most insects, except the
Coleoptera and Diptera

2. Auditory receptors (detect sound waves)

i. Delicate tactile hairs: Present in plumose antenna of male mosquito.
ii. Tympanum: This is a membrane stretched across tympanic cavity responds to sounds
produced at some distance, transmitted by airborne vibration. Tympanal membranes are
linked to chordotonal organs that enhance sound reception. Tympanal organs are located

* Between the metathoracic legs of mantids.
* The metathorax of many nectuid moths.
* The prothoracic legs of many orthopterans.
* The abdomen of short horned grasshopper, cicada.
* The wings of certain moths and lacewings.

3. Chemoreceptors (detect smell and taste)

Detect chemical energy. Insect chemoreceptors are sensilla with one pore (uniporous) or
more pores (multiporous). Uniporous chemorceptors mostly detect chemicals of solid and
liquid form by contact and are called as **gustatory receptor**. Many sensor neurons
located in antenna are of this type. Multiporous chemoreceptors detect chemicals in
vapour form, at distant by smell and are acalled as **olfactory receptor**. Few sensory
neurons located in trophi and tarsi are of this type. Each pore forms a chamber known as
pore kettle with more number of pore tubules that run inwards to meet multibranched
dendrites.

4. Thermoreceptors (detect heat)

Present in poikilothermic insects and sensitive to temperature changes. In bed bug
it is useful to locate the host utilizing the temperature gradient of the host.

5. Photoreceptors (detect light energy)

a. Compound eyes: The compound eye is based on many individual units called
ommatidia. Each ommatidium is marked externally by a hexagonal area called facet.

Compound eye is made up of two parts called optic part and sensory part.

Optic part
contains a cuticular lens called **corneal lens** secreted by corneagenous cells and
crystalline cone covered by **primary pigment cells**. Function of the optic part is to
gather light. **Sensory part** contains six to ten
visual cells called **retinular cells** covered by secondary pigment cells which collectively
secrete a light sensitive rod at the centre called **rhabdom**. Rhabdom contains light
sensitive pigments called **rhodopsin**. Each ommatidium is covered by a ring of light
absorbing pigmented cells, which isolates an ommatidium from other. Nerve cells are
clustered around the longitudinal axis of each ommatidium.

Types of ommatidia

i. **Apposition type** (light tight): Due to the presence of primary pigment cells light cannot
enter the adjacent cells. The mosaic image formed is very distinct. The image formed by
the compound eye is of a series of opposed points of light of different intensities. This
functions well in diurnal insects.

ii. **Super position type**: Primary pigment cells are absent allowing light to pass between
adjacent ommatidia. Image formed in this way are indistinct, bright and blurred. This
type is seen in nocturnal and crepuscular insects.

b. Lateral ocelli (Stemmata): Visual organs of holometabolous larva. Structure is
similar to ommatidium. It helps to detect form, colour and movement, and also to scan
the environment.
c. Dorsal ocelli: Visual organs of nymph and it vary from 0-3 in numbers. It contains a
single corneal lens with many visual cells individually secreting the rhabdomere. Dorsal
ocelli perceive light to maintain diurnal rhythm and is not involved in image perception.

Sources

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