

Host-plant selection: how to find a host plant

Insects use many different ways to find their host plants

1-Searching

Whenever an insect is remote from a potential foodplant, it needs to search for and find that plant. To locate a host plant, the insect needs to move towards it and contact it, or at least to arrive and stay in the proximity of it in order to examine its characteristics further. The term ‘searching’ means ‘to look carefully in a place in an effort to find something’. ‘Finding’ (sometimes unfortunately used as a synonym).

2- Selection

In the strict sense of the word, ‘to select’ means to choose from among alternatives. In order to do this, it is necessary that differential sensory perception of alternative food plants occurs.

3-Acceptance

Acceptance of a plant is said to occur when either sustained feeding or oviposition occurs. For example, when a beetle is released in the middle of a monoculture of beans and is observed to initiate sustained feeding after climbing a bean plant, it cannot be concluded that the beetle selected the bean plant as a host plant, as no alternatives were available. It can only be said that the bean plant has been accepted by the insect. Acceptance is a term distinct from acceptability, which is a plant trait

and defined as the likelihood that a particular plant species is selected for feeding or oviposition.

4- Preference

When, in dual or multiple choice assays, an insect consistently feeds or oviposits more often on one of the alternative plants, it is said to ‘prefer’ that plant over the others. This may also be observed under field conditions when the degree of feeding or oviposition on a certain plant species is higher than would be predicted from its relative abundance.

5-Recognition

This term is often used in connection with acceptance. It means ‘to know again’ and implicitly refers to a neural process. It implies that there is an internal standard or ‘image’ of the plant(s) sought for. This image is present in one or another form in the central nervous system (CNS) of the insect. The profile of incoming sensory information on plant cues is compared with this stored image and, when it matches sufficiently, the plant is recognized as a host.

From the above, it appears that the terms searching, selection, preference, and recognition implicitly refer to complex behavioural processes, the neural mechanisms of which are being elucidated. It is also important at this point to relate the behavioural terms defined above to the classification of behaviour-modifying chemicals. These chemicals are collectively termed semiochemicals or infochemicals. For this purpose we adopt the terminology proposed by Dethier et al.,⁴⁸

which is summarized. Corresponding terms in semiochemical and infochemical terminology are: kairomone, for attractant and feeding and oviposition stimulants; allomone, for repellent and deterrent. Flower volatiles that attract pollinators are examples of synomones. The difference between semiochemical and infochemical terminology is that, whereas in semiochemical terminology the origin of the produced chemical determines its designation as a kairomone, allomone, or synomone, in infochemical terminology the adaptive value of the use of the information that the chemical carries is the central issue.

A standardized host-plant selection sequence can be described as follows:

1. The insect has no physical contact with a plant and either rests or moves about randomly, walking or flying.
2. It perceives plant-derived cues, optical and/or olfactory.
3. It responds to these cues in such a way that the distance between its body and the plant decreases.
4. The plant is found, i.e. it is contacted by either touching or climbing it, or by landing on it.
5. The plant surface is examined by contact-testing (e.g. palpation of leaf surface).

6. The plant may be damaged and the content of tissues released by nibbling or test-biting (in the case of biting–chewing species), probing (piercing– sucking species), or puncturing with the ovipositor.

7. The plant is accepted (as evidenced by one or more eggs being laid or continued feeding) or is rejected, resulting in the insect’s departure.