

phytophagous insects, acting as physical and/or chemical barriers. However, during the evaluation of the foliage feeder (*G. boliviana*) as an agent for biocontrol of Tropical Soda Apple (*Solanum viarum*), it was found that the presence of trichomes is a requirement for the plant to be a suitable host. The tarsal claws of *G. boliviana* larvae are broadly joined to the tarsus and a hook arises from the external side, giving the claw a depressed "c" shape. In order to walk, the trichomes are grasped with the "c" shaped claws and the body is pulled forward. The TSA leaf surface studied under Environmental Scanning Electronic Microscope (ESEM) reveals the presence of five types of trichomes: simple trichomes, simple articulated trichomes, stellate trichomes, glandular trichomes type A, and glandular trichomes type B. The response of neonate larvae to 20 species of Solanaceae plants was analyzed. In some species the lack or the presence of low densities of trichomes does not allow the insects to walk. The movements of the larvae are uncoordinated and even a light draft shakes them off the leaf surface (e.g. *Solanum capsicoides*). In other species the larvae can walk but they do not feed, probably due to the presence of deterrents, absence of phagostimulants or both (e.g. tomato). Finally, there are species where the high density of stellate trichomes form an intricate web that acts as a physical barrier that prevents or makes difficult for first instars to reach the leaf surface (e.g. eggplant).

***Cheilosia praecox* and *C. psilophthalma*, Two Phytophagous Hoverflies Selected as Potential Biological Control Agents of Hawkweeds (*Hieracium* spp.) in New Zealand**

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Several *Hieracium* spp. (Asteraceae) of Eurasian origin have been accidentally introduced into New Zealand. Of these, *Hieracium caespitosum*, *H. pilosella*, *H. praealtum*, and *H. lepidulum* are noxious weeds in pastures and areas of conservation. Since mechanical and chemical control are ineffective and/or not economical, a biological control project was initiated in 1993. Surveys for specialized phytophagous insects were made in Europe. Three hoverfly species, *Cheilosia mutabilis*, *C. praecox*, and *C. psilophthalma*, were found to be associated with *Hieracium pilosella*. *C. praecox* and *C. psilophthalma*, strictly univoltine species with adults occurring in April and May, were chosen for further investigation. Both species were found to occur simultaneously at the same sites. Although females of both, *C. praecox* and *C. psilophthalma*, lay their eggs at the leaf axils of the host plant, their larvae feed and develop on different plant parts. Upon eclosion, *C. praecox* larvae move into the soil to feed externally on the roots, creating small cavities,

while *C. psilophthalma* larvae feed on the above ground plant parts. Larvae of both species pupate in September/October and adults emerge in spring of the following year. Due to the lack of information on the host plant range, no-choice larval transfer tests are currently being undertaken to determine the physiological host range of *C. praecox* and *C. psilophthalma*. So far, development of both species is restricted to species within the genus *Hieracium*. *C. psilophthalma* developed on all nine hawkweed species tested and *C. praecox* on eight of these. Results of oviposition tests carried out with field collected females in April and May, as well as results of open-field tests, which allowed host selection by females, are presented.

The Theory of Plant-Insect Interactions and Its Application to Host Specificity Testing[†]

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Recent advances have been made in applying the theory of plant-insect interactions to the practice of determining the host specificity of insects. An understanding of both the proximate mechanisms that influence the selection of a host plant by an insect and the ultimate causes of the evolution of host specificity can be utilised by biocontrol practitioners and others interested in predicting field host use. The proximate factors include the sequence of behaviours in the host selection process, the effects of experience, and time dependent changes on host acceptance or rejection. An understanding of the ultimate evolutionary causes of a host specificity can allow the prediction of the stability of host associations and can also assist in the selection of plants for a host test list. An improved understanding of the physiological ecology of host-plant interactions has also assisted practitioners by allowing an improved interpretation of the importance of oogenesis tests, adaptations of insects to their host plant, and the mismatch between adult oviposition selection and suitability for larval development. The means by which practitioners can incorporate this body of theory into the design, implementation, and interpretation of host specificity tests is reviewed. Practical issues include cage size and design (e.g., small cages vs. open field tests vs. quasi-cages vs. wind tunnels), the duration of tests, the use of behavioural observations examining the process instead of the end result, the interpretation of the results of choice vs. no-choice tests, and the use of insect and host plant phylogenies.

FOOTNOTE: Full paper in

[†]Heard T.A. 2000. Concepts in insect host-plant selection behavior and their application to host specificity testing. In R. Van Driesche, T.A. Heard, A.S. McClay, R. Reardon [eds.], *Proceedings of Session: Host Specificity Testing of Exotic Arthropod Biological Control Agents - The Biological Basis for Improvement in Safety*, USDA Forest Service, Publication #FHTE-99-1, August 2000, pp. 1-10.