

# Potential host range of *Cotesia vanessae* (Hymenoptera: Braconidae), a parasitoid new to North America and a possible biological control agent of noctuid pest species — Supplementary Text 1

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**Supplementary Text 1.** Discussion on the importance of host plants for the ecological host range of *Cotesia* spp.

The plant species on which hosts feed are a crucial aspect of parasitoid-host specificity. If plant species are used by parasitoids to locate their hosts, this also strongly impinges on the issue of fundamental versus realized host niche. Some *Cotesia* species, although they have been reared from taxonomically distant hosts, appear to be associated with few plant species. For example, *Cotesia ferruginea* (Marshall) has been reared from three host species, each of them belonging to a different family: *Archanara geminipuncta* (Haworth) (Lepidoptera: Noctuidae), *Phragmataecia castanea* (Hübner) (Lepidoptera: Cossidae), and *Chilo phragmitella* (Hübner) (Lepidoptera: Crambidae) (Wilkinson 1945). The two first species feed solely on *Phragmites* spp. and the third one feeds on both *Phragmites* and *Glyceria maxima* (Hartm.) Holmb. (Poaceae). This suggests that *C. ferruginea* is associated with specific plant species rather than specific host species. The hypothesis that some parasitoid species are associated with plant species rather than host species, and thus parasitize taxonomically distantly related species simply because they feed on the same plant species, has previously been formulated (Cushman 1926). To test this hypothesis, Tawfik (1957) exposed *Cotesia glomerata*, a known parasitoid of *Pieris* spp. (Lepidoptera: Pieridae) associated with *Brassica* spp. (Brassicaceae), to a non-host species, *Mamestra brassicae*, which also feeds on *Brassica* spp. In the laboratory, *C. glomerata* oviposited within *M. brassicae*. Although the eggs didn't hatch within this species because they became encapsulated, this showed a key biological aspect of the parasitoid for selecting hosts. Similarly, the solitary parasitoid *Cotesia marginiventris* and the gregarious parasitoid *Cotesia congregata*, which were thought to be specific on Noctuidae and Sphingidae, respectively, were exposed to the other species' natural host in the laboratory; i.e., *C. marginiventris* to *Manduca sexta* (L.) (Lepidoptera: Sphingidae) and *C. congregata* to *T. ni* (Noctuidae). Both *Cotesia* species were found to readily parasitize these species, and *C. marginiventris* even did so in the presence of its natural host *S. exigua*. Surprisingly, individuals of both lepidopteran species produced parasitoids, some of which successfully matured to adults (Beckage and Tan 2002, Beckage et al. 2003). These results show that *Cotesia* parasitoids are not as specific as they seem to be to particular host species, and that distantly related lepidopteran species may be suitable hosts. However, species found to be hosts in the laboratory may never be hosts in natural settings. A number of steps are necessary to lead to parasitism (i.e., host habitat location, host location, host acceptance, and host suitability), which are each essential to complete parasitism (Vinson and Iwantsch 1980). The current study focuses on host suitability. Therefore, results reflect the fundamental, but not necessarily the ecological, host range of *C. vanessae*. Future studies should attempt to bridge this gap by studying host range in more natural conditions.

To understand the ecological host range of *C. vanessae*, it is essential to know the plant species it is associated with. Plant species from which caterpillars parasitized by *C. vanessae* have been collected include: thistles in the tribe Cynareae (Asteraceae), common mallow, *Malva*

*sylvestris* (L.) (Malvaceae) (Stefanescu et al. 2012), tomatoes, *Solanum lycopersicum* Linnaeus (Solanaceae), cucumbers, *Cucumis sativus* Linnaeus (Cucurbitaceae), cabbages, *Brassica* spp. (Hervet et al. 2014), *Chenopodium murale* (L.) S. Fuentes, Uotila & Borsch (Amaranthaceae) (Papp 2011-2012), and an *Agrimonia* sp. (Rosaceae) (Tobias 1971). Known host plants of previously reported host species may also indicate an affinity of *C. vanessae* for nettles, *Urtica* spp., beet, *Beta vulgaris* Linnaeus (Amaranthaceae), poplars, *Populus* spp., and willows, *Salix* spp. (Salicaceae) (Yu et al. 2016).

The affinity of *C. vanessae* for both Nymphalidae and Noctuidae may have originated in the common food source of its hosts. Species of Noctuidae have been reported from plant species also used by larvae of *Vanessa atalanta* (L.), *V. cardui* (L.), and *Aglais urticae* (L.) (Lepidoptera: Nymphalidae) (Stefanescu et al. 2012, DBIF 2016). Serendipitous encounter of parasitoids with prospective hosts on plants may have led to the extension of the host range of *C. vanessae* from Noctuidae to Nymphalidae or vice versa.

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