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Parasitism of *Urophora Affinis* (Diptera: Tephritidae) by *Aprostocetus* Sp. (Hymenoptera: Eulophidae) in Michigan

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PARASITISM OF UROPHORA AFFINIS (DIPTERA: TEPHRITIDAE) BY APROSTOCETUS SP. (HYMENOPTERA: EULOPHIDAE) IN MICHIGAN

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_Urophora affinis_ Frfld. and _U. quadrifasciata_ (Meig.) (Diptera: Tephritidae) are Eurasian gallcolous fruit flies introduced to North America in 1972 as biological control agents for _Centaurea biebersteinii_ DC (spotted knapweed, Asteraceae, = _C. maculosa_ auct. non Lam.) (Harris 1980). Through natural dispersal and numerous introductions, both _Urophora_ species have become distributed throughout the introduced range of _C. biebersteinii_ (Foote et al. 1993, Lang et al. 1997, Mays and Kok 2003). Use as biological control agents for _C. biebersteinii_ focused on the diversion of energy from seed production to the development of _Urophora_ spp. larvae within galls (Harris 1980). In the introduced range of _U. affinis_ and _U. quadrifasciata_, mortality of these species has occurred as a result of predation by bird and mammal species, as well as parasitism by _Pteromalus cardui_ (Erdős) (Hymenoptera: Pteromalidae) (Story et al. 1995, Pearson 1999, Marshall et al. 2004).

_Aprostocetus_ sp. (Hymenoptera: Eulophidae) was initially observed emerging from _C. biebersteinii_ seed heads in rearing during February 2008. Typically the subfamily Tetrastichinae, containing the genus _Aprostocetus_ Westwood, is endoparasitic of eggs, larvae, or pupae of Coleoptera, Diptera, Hymenoptera, and Lepidotera, with a distinct association with gall inducing hosts (Noyes 2003, Yegorenkova et al. 2007). Species within _Aprostocetus_, approximately 670, are distributed globally (Graham 1987, LaSalle 1994, Yegorenkova et al. 2007).

_Centaurea biebersteinii_ seed heads were collected from three sites in Livingston County, MI, on 18 February 2008. Sixty seed heads from each site were randomly selected and placed into 8 dram plastic shell vials for rearing. Vials were a third filled with wet sand, topped with a layer of dry sand, and were capped with cotton fabric. Each vial contained 2 _C. biebersteinii_ seed heads (30 vials/site), stored at 80° C at 45 percent humidity, and were checked every 2 days until emergence began. Following initial emergence, vials were checked daily and _Aprostocetus_ sp. adults were removed and sexed. Adult _Urophora_ species were identified using Foote et al. (1993). Chi-square tests were used to test for the independence of _U. affinis_ from the occurrence of _Aprostocetus_ sp. 

_Aprostocetus_ sp. first emerged after 14 days. Seed heads were left in vials for an additional 10 weeks, which resulted in 34.4 percent of vials producing a total of 373 adult _Aprostocetus_ sp. All emergence of _Aprostocetus_ sp. occurred during days 14-17. In vials that produced adult _Aprostocetus_ sp., 12.03 ± 9.04 individuals emerged per vial with a sex ratio of 0.36 males/females. A total of 36 adult _U. affinis_ emerged from 26.7 percent of vials with a sex ratio of 0.89 males/females. In vials that produced adult _U. affinis_, 1.50 ± 0.83 individuals emerged per vial. The presence of _U. affinis_ was independent of the presence of _Aprostocetus_ sp. individuals ($\chi^2 = 0.404, df = 1$). There was no significant difference in the count of _U. affinis_ in vials with and without _Aprostocetus_ sp. emergence ($t = 0.672, df = 88$). In addition to _Aprostocetus_ sp. and _U. affinis_, three _P. cardui_ females and 10 _U. quadrifasciata_ (6 males and 4 females) emerged.

Seed heads not placed into rearing were dissected and inspected for _U. affinis_ and _U. quadrifasciata_ galls. Galls produced by these two _Urophora_ species are structurally different, with _U. affinis_ producing woody, lignified galls and

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*U. quadrifasciata* producing papery, non-lignified galls (White and Korneyev 1989, Burkhardt and Zwölfer 2002). Only galls produced by *U. affinis* were encountered. A sample of 15 *U. affinis* galls was dissected and 8 contained multiple *Aprostocetus* sp., with a mean parasitism rate of 8.36 ± 4.07 *Aprostocetus* sp. individuals per *U. affinis* gall.

The gregarious endoparasitism of *Aprostocetus* sp. on *U. affinis* caused mortality in *U. affinis* at the sites in Livingston County, MI, where seed heads were collected. While this mortality did reduce the mean number of *U. affinis* individuals emerging within vials, it did not create significant differences in the vials with and without *Aprostocetus* sp. and did not significantly influence the presence of *U. affinis* individuals. With this first record of *Aprostocetus* sp. parasitizing *U. affinis*, further investigations into host selection and the geographic distribution of this parasitoid within the introduced ranges of *Urophora* spp. are warranted.

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**LITERATURE CITED**


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