INITIAL SURVEY OF PREDACIOUS DIPTERA ON HEMLOCKS IN JAPAN

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ABSTRACT

Some species of Coleoptera and Diptera are specialist predators of adelgids. Previously, we reported our survey of predacious Coleoptera on hemlocks in Japan (Shiyake et al. 2008). Two of these beetles, *Sasajiscymnus tsugae* and *Laricobius* sp. nov., have been exported to the U.S. for biological control. Here, we provide the first report of Diptera collected in Japan from its native hemlocks, *Tsuga sieboldii* and *T. diversifolia*.

Monthly surveys were made from 2005 to 2009 of hemlock in the Kansai Region and yearly at other areas on the map (Fig. 1). Nets on long poles that could reach up to 5 m were used to sweep the canopy. Hemlock woolly adelgid (HWA)-infested hemlock twigs also were collected for examination with a microscope in the lab. About 250 specimens of Diptera were collected and identified to family and morpho-species. Our primary source for nomenclature and background information on the feeding behavior of the family was the Manual of Nearctic Diptera (McAlpine et al. 1981)

Twenty-six families of Diptera, representing >100 species, were collected from Japanese hemlocks. Ten of the families include some species with terrestrial predacious larvae, and four of these have species that feed on Aphidoidea (aphids, adelgids and phylloxera) and are of special interest to us:

Cecidomyiidae is a family of midges, most of which feed on plants, but the genera *Aphidoletes* and *Lestodiplosis* are predators of Homoptera. *Aphidoletes aphidimyza* Rondani is used for biological control of aphids. These genera were collected in North Carolina from hemlock (Wallace and Hain 2000), but not in Oregon (Kohler 2007). This family was scarce in our aerial collections.

Syrphidae, or hover flies, have many well-known predators of Homoptera, but have had little success as biological controls. *Heringia familiaris* Matsumura was collected as a larva from heavily infested hemlock on Shikoku Island and reared to adult. Considering the abundance of hover flies in nature, we collected surprisingly few from hemlock.

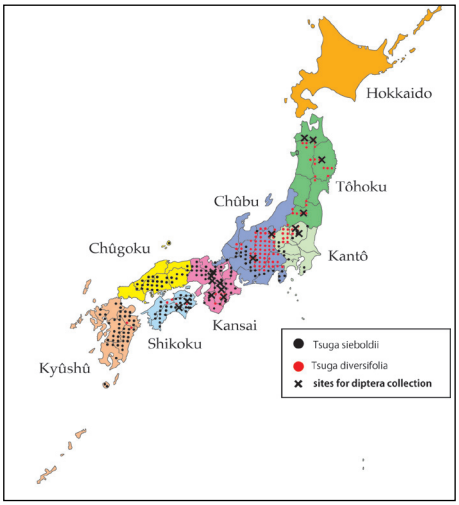

Figure 1.—Map showing hemlock distribution and Diptera collection sites.

Chamaemyiidae, or silver flies, is a small family that feed on scale insects and Aphidoidea. The genera *Neoleucopis, Leucopis, Lipoleucopis,* and *Cremiferania* have species that are adelgid specialists. *Leucopis taipiae* Blanchard has successfully been used for biological control of pine adelgid in several countries. Many species were released in North America for control of *Adelges piceae* and several reportedly established, but none have provided effective control. *Leucopis argenticollis* Zetterstedt, a cosmopolitan species, was collected from HWA in Oregon (Kohler 2007). This family seems to be rare on hemlock in Japan; we collected no adults and only one puparium.

Chloropidae are mostly phytophagous and known mostly as pests of cereal grasses. Some are predacious and several species in the genus *Thaumatomyia* feed on Homoptera. Chloropidae were very abundant in our sweep net collections and may have been attracted to the honeydew of HWA and *Cinera* sp. aphids feeding on the hemlock. We will use a recently acquired key (Kanmiya 1983) to see if any of the taxons we collected belong to predacious genera or species. Future work on Diptera will make more a thorough collection, including larvae on HWA infested foliage. Larvae will be observed for feeding on HWA and reared to adults for identification to species. We especially want to determine the family of the very small fly larvae we find on HWA infested foliage in Japan.

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