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Spotted lantern fly, a new pest from Asia

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NATURAL ENEMIES OF THE SPOTTED LANTERNFLY IN ASIA AND NORTH AMERICA

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ABSTRACT

Spotted Lanternfly, *Lycorma delicatula* (White) (Hemiptera: Fulgoridae), is a sporadic pest of Tree-of-Heaven, *Ailanthus altissima* (Mill.) Swingle (Simaroubaceae). The natural distribution of *L. delicatula* includes most of China (especially northern China), Taiwan and Vietnam. As an exotic pest, *L. delicatula* invaded Korea in 2004, Japan in 2009, and the U. S. in 2014. In North America, it is now found in six counties (Berks, Bucks, Chester, Lehigh, Montgomery, and Northampton) in eastern Pennsylvania, with more than 2,000 km² under state quarantine. Host species in its native range include more than 70 woody plants and vines in 25 families, such as apple, birch, grape, cherry, lilac, maple, poplar, and stone fruits (Zhou 1992, Kim et al. 2011, Dara et al. 2015). Feeding by nymphs and adults on phloem tissue causes oozing wounds on trunks and branches, resulting in wilting or death of the branches. Nymphs and adults also excrete large amounts of honeydew, attracting ants, bees, hornets, and promoting the growth of sooty mold. Significant damage has been recorded in vineyards in Korea, and it is a potential threat to the grape and fruit industries in Pennsylvania and beyond in North America (Barringer et al. 2015, Dara et al. 2015).

Natural enemies of *L. delicatula* in its native range of Asia include a solitary egg parasitoid, *Anastatus orientalis* Yang & Choi (Hymenoptera: Eupelmidae) (Choi et al. 2014, Kim et al. 2011, Yang et al. 2015); and a solitary ecto-parasitoid on nymphs, *Dryinus browni* Ashmead (Hymenoptera: Dryinidae) (Yan et al. 2008). In North America, a few generalist predators such as *Apoecilus cynicus* (Say) (Hemiptera: Pentatomidae) and *Arilus cristatus* (L.) (Hemiptera: Reduviidae) have been reported attacking *L. delicatula* adults in the field (Barringer and Smyers 2016).

Containment strategy since its discovery in North America has been focused on mechanical /chemical host tree removal and population suppression through egg scraping, tree banding and insecticide treatments. Should the eradication efforts fail, biological control could be the management option for *L. delicatula* population in natural landscapes where management with insecticides may be too expensive and/or environmentally undesirable. We carried out a study in eastern and northern China 2016 to explore for potential biological control agents, and to survey of its natural enemies in Pennsylvania.

In North America, we selected four study sites (R1, R2, OD, and LU) near the initial introduction in Berks County in Pennsylvania for field surveys and collections. Egg masses and live nymphs of *L. delicatula* were collected from March to April and in July respectively and brought back to the quarantine laboratory for rearing of potential parasitoids. A total of 252 egg masses (7,846 eggs) were collected from those four study sites, with most egg masses found on black birch, black cherry, *Ailanthus*, and sweet birch trees. We found adults of an egg parasitoid on the surface of some *L. delicatula* egg masses at two

study sites (OD and LU) during the field collections. Adults of the same species were also reared out in the laboratory from *L. delicatula* eggs collected from the OD site. This parasitoid was later confirmed as *Ooencyrtus kuvanae* (Howard) (Hymenoptera: Encyrtidae) (Liu and Mottern 2017). This parasitoid utilized 6.8% of the egg masses from that site, with 19.9% of the eggs from those egg masses parasitized. A total of 1,185 2nd - 4th instar *L. delicatula* nymphs were also collected from those four study sites. An unidentified Dryinidae (Hymenoptera) was found attacking a 4th instar nymph.

In China, exploration surveys were carried in four provinces in spring 2016. A total of 11 sites were surveyed, including Daxing, Yongdinghe, and Haidian in Beijing; Tangshan, Yongqin, and Chende in Hebei; Yantai in Shandong; and Baodi, Wuqin, Waihuan, and Guanggang in Tianjin. A total of 286 egg masses and 529 nymphs of *L. delicatula* were collected. Native egg parasitoid, *Anastatus orientalis* was recovered from nine of the 11 sites, with an egg mass parasitism of 5.5 to 92.3%, and overall egg parasitism of 0.4 to 26.0%. A native nymphal parasitoid, *Dryinus browni*, was found attacking a few 2nd-3rd instar *L. delicatula* nymphs in Beijing and Shandong.

Ooencyrtus kuvanae is an egg parasitoid of gypsy moth (*Lymantria dispar* (L.) (Lepidoptera: Erebidiae)) from Japan. It was introduced into the United States in 1908 for gypsy moth biological control. Successful establishment was achieved in Massachusetts by 1911. Since then, millions of *O. kuvanae* have been released throughout the areas infested by gypsy moth in North America (Brown 1984). Release and subsequent recovery of *O. kuvanae* in Pennsylvania occurred between 1969 and 1971 (Smilowitz and Rhoads 1973). *Anastatus orientalis* utilizes 30.4% of *L. delicatula* egg masses, with 40.2% of all eggs being parasitized in the field in China (Yang et al. 2015). Both species have the potential to be important agents for *L. delicatula* biological control in North America. Projects are underway in 2017 to study the seasonal abundance of *O. kuvanae* in the field, to expand field surveys at more sites for potential natural enemies in Pennsylvania, to continue foreign exploration surveys in China for additional natural enemy species, and to evaluate the potential of *A. orientalis* as an introduced parasitoid for *L. delicatula* biological control in North America.

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