ABUNDANCE OF APHIDS AND RELATED ARTHROPODS ON SIAM WEED, *Chromolaena odorata* (L.) IN WIANGSA DISTRICT, NAN PROVINCE, THAILAND

Puntharika Khongruang,¹ Chatcawan Chaisuekul,²* Duangkhae Sitthicharoenchai²

¹Program in Zoology, Department of Biology, Faculty of Science, Chulalongkorn University, Bangkok 10330, Thailand
²Department of Biology, Faculty of Science, Chulalongkorn University, Bangkok 10330, Thailand
*e-mail: chatcawan.c@chula.ac.th

Abstract: Siam weed was investigated for its role as a reservoir of aphids and related arthropods in non-cropped area in Wiangsa District, Nan province. The abundance and diversity of aphids and related arthropods were monitored monthly on nine Siam weed plants in each of six quadrats (1x1 m²) during August and November 2010 which is the early cropping season of winter vegetables in Nan province. *Aphis gossypii* and *A. spiraecola* were the only two species of aphids found on Siam weeds during the study period, and both species were reported as key economic pests and known vectors of plant viruses. The monthly mean density of aphids was 112.8 (±74.5) individuals per m². Rising of aphid density was found between October and November 2010 while the abundance of aphid-tending ants (11 species) and aphid predators (spiders, coccinellid beetles and one ant species, *Odontoponera denticulata*) were lower than those of aphids and relatively unchanged during the study period. Siam weeds served as a key reservoir for aphids as well as aphid-tending ants and predators of aphids, so Siam weeds adjacent to cropping area should be monitored for potential outbreak of aphids to crop plants and for conservation of natural enemies of aphids simultaneously.

Introduction: Siam weed, *Chromolaena odorata* (L.) King & Robinson, is a perennial shrub that was known as one of the world’s worst weeds.¹ The invasion of Siam weed has been a serious problem in Africa, western Pacific, and tropical Asia, including Thailand. It thrives in warm, humid, low altitude area below 1000 m, although it prefers the well-drained soil, it can grow in varying soil types, and usually found in disturbed area, particularly fire-disturbed area.² Siam weed has a very high growth rate (up to 20 mm per day)¹ also has a prolific seed production and dispersal. Moreover, it interferes with the cultivation of plantation crop, preventing the natural re-seeding of forest tree through allelopathy. The weed decreases the carrying capacity and species in grassland and forest.³ However, Siam weed can be utilized for its medicinal properties,⁴ as well as green manure⁵ and in conservation of natural enemies of crop pests.⁶

Aphids, an important group of crop pests, were reported to have high density and have significantly reduced the spread and density of Siam weed in Thailand.⁷ There are three aphids species, *Aphis gossypii* (Glover), *Aphis spiraecola* Patch and *Aphis craccivora* (Koch), reported on Siam weed in Thailand.⁷ Thus, Siam weeds probably serve as a reservoir of aphids and many arthropods. The increasing outbreak of Siam weed may induce the outbreak of inhabited crop pests, such as aphids and other arthropods, and consequently caused more damaged to crop plants. Most aphids are attended by ants to feed on honey-dews which causes these tending ants to be cryptic herbivores of the host plants while some ants have positive effects on host plants through predation on aphids.⁸ To understand the roles of Siam weed as a reservoir for pests or a conserved habitat for beneficial arthropods requires proper understanding of the ecological roles of arthropods inhabiting on Siam weed, particularly
during the early cropping period when aphids may move to crop plants causing great damage to the seedlings. These informations will benefit the sustainability of Siam weed management as well as biological control strategy.

**Methodology:** The arthropod survey was conducted at Chulalongkorn University Forest and Research Station in Wiangsa district, Nan province between August and November 2010, which is the early cropping season of winter vegetables in Nan province. The study site was non-cropped area adjacent to dipterocarp forest and mango plantation (0.5 ha). In each of six (1x1m²) quadrats, aphids on Siam weeds were collected monthly from three plants at 30-55 cm in height, three plants at 55-80 cm in height and three plants which were more than 80 cm in height. The number and developmental stages of aphids and the number of natural enemies on each plant were recorded. The number of ants on each plant in one minute was counted as the tending ants if they were feeding on honeydew or moving aphids from plant to plant, and was counted as the predators if they moved aphids from plant to nest. Plant height (cm) and leaf stage of Siam weeds were also recorded. For identification, the mature aphids were preserved in microcentrifugal tubes filled with 95% ethyl alcohol. For immature aphids, nymphs were removed from the host plant and reared with Siam weed leaves in plastic boxes until emerging as adult prior identification. The clearing-mounting method, dichotomous key, and aphid description followed Blackman and Eastop and Sirikajornjaru. Ants and other arthropods were also collected in 95% ethyl alcohol and were identified using keys by Bolton and Borror et al., respectively. Mean numbers of aphids and other related arthropods were calculated per (1x1m²) quadrat.

**Results, Discussion and Conclusion:** *Aphis gossypii* and *A. spiraecola* were the only two species found on Siam weeds during the four months study period while *A. craccivora* was not found during the study as reported in Napompeth and Winotai (1991). *A. gossypii* dominated the number of aphids captured during the study period more than *A. spiraecola* (Figure 1). The higher density of *A. gossypii* during the study period was probably due to its reproductive pattern (parthenogenesis), the higher offsprings per generation and wide range of its host plants, nearly 100 species of crop plants. *A. gossypii* may exclude other aphid species, or it may be only fewer aphid species that can exploit Siam weed. Moreover, *A. gossypii* also could transmit more than 50 plant viruses including important crops which could weaken host plants for effortless exploitation while *A. spiraecola* is not particularly efficient at transmitting viruses and feeding on less species of host plant.

The monthly mean number of aphids was 112.8 (±74.5) individual/m² and the density on patch tended to be greater during the last two months, October and November 2010 (Figure 1). The abundance of tending-ants and predators was relatively stable during that period (Figure 2). The abundance and distribution of newly emerged Siam weeds during October and November could also affect this higher level of aphids (sucking herbivores) that could infest crop, particularly susceptible seedlings of winter vegetables and crops such as cabbages and tobaccos.
Eleven species of tending ants from 243 individuals found in the study area belongs to 3 subfamilies; Formicinae, Dolichoderinae and Myrmicinae (Figure 3), and all these ant subfamilies were previously reported as honeydew-collected ants. Only one ant species, *Odontoponera denticulata*, was predatory. The species composition of ants highly varied among 4 months. The most abundant ant species was *Tapinoma* sp. which was only found in August. The surrounding habitats of the study area, deciduous dipterocarp forest and manga plantation, may provide nesting and foraging sites for various tending ant species, to be able to forage honeydews from aphids on Siam weeds.

---

Figure 1. Abundance of sucking herbivores on *Chromolaena odorata* (L.) between August and November 2010 (mean±SE)

Figure 2. Abundance of guides on *Chromolaena odorata* (L.) between August and November 2010 (mean±SE)
Characteristics of both preys and predators. The results showed that the mean number of crops. The suppression of prey population, such as aphid by spider, was determined by the common generalist predators and were reported to affect the abundance of herbivore in agro-ecosystems. The spiders play an important role in varied agro-ecosystems as Subfamily Dolichoderinae: Tapinoma sp., Subfamily Formicinae: Paratrechina longicornis, Camponotus sp., Oecophylla smaragdina Subfamily Myrmicinae: Monomorium sp., Crematogaster sp., Pheidologeton diversus, Monomorium pharaonis.

**Figure 3.** Abundance of tending ants and predatory ant (Odontoponera denticulata) on Chromolaena odorata (L.) between August and November 2010.

The common predators found on Siam weeds during the study were spiders and coccinellid beetles (Figure 4). The spiders play an important role in varied agro-ecosytems as the common generalist predators and were reported to affect the abundance of herbivore in crops. The suppression of prey population, such as aphid by spider, was determined by the characteristics of both preys and predators. The results showed that the mean number of

Subfamily Dolichoderinae: Tapinoma sp.
Subfamily Formicinae: Paratrechina longicornis, Camponotus sp., Oecophylla smaragdina
Subfamily Myrmicinae: Monomorium sp., Crematogaster sp., Pheidologeton diversus, Monomorium pharaonis.
collected spiders was relatively unchanged in 4 months while compared to the mean number of aphids. These latter conflicting results could be explained by the lack of density dependent to aphids of spiders due to the low level of aphid density per quadrat. Although they were low in density, they may affect the density of aphids later in the season, and predators maybe negatively affected by tending ants.

The mean numbers of coccinellid beetles were also consistent to the mean numbers of other predators. These may due to the limited consumption ability of coccinellid beetles. The mean daily aphid consumption by *Harmonia axyridis* adults, Asian lady beetle, typically ranged from 15 to 65 aphids per day. The foraging efficiency of *H. axyridis* increased (i.e., more prey consumed) with high prey density and high degree of aggregation. The relatively low level of aphid density and aggregation on Siam weed earlier in this study may determine the low abundance of coccinellid beetles during the whole study period due to the lag time of population growth in coccinellid beetles in response to prey density. Therefore, natural population of coccinellid beetles may not help in suppressing aphid population during the early growing season without the assisting of artificial growth of coccinellid beetle population through supplementary diets, such as sugar spray or pollen sources.

The potential of Siam weeds to serve as a key reservoir for aphids could result in potential risk of direct damages and plant viral infection in cropping area by dispersal of aphids from weed to crop. However, Siam weed also serves as a reservoir for sizable populations of predators, such as spiders and coccinellid beetles, so it could serve as host plant in conservation biological control. Therefore, the management strategies to control Siam weeds should be considered for both negative and beneficial impact of Siam weed to cropping area.

References:
1. CRC for Australian Weed Management. Weed management guide Siam weed or *Chromoleana odorata*. 2008, Australia.

Acknowledgements: This research was supported in part by The Science for Locale Project under the Chulalongkorn University Academic Development plan (2008 – 2012). I would like to express my grateful thanks to my major advisor and all supports at Chulalongkorn University Forest and Research Station, Wiangsa district, Nan province.

Keywords: abundance, Siam weeds, aphids, tending ants