

Larval parasitoids of agromyzid leaf miner genus *Liriomyza* in the southern Thailand : species and their host plants

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Abstract

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Larval parasitoids of the leaf miner genus *Liriomyza* were studied in six provinces of southern Thailand, Songkhla, Phatthalung, Nakhon Si Thammarat, Trang, Satun and Pattani, from April 2000-March 2001. Two families of hymenopteran parasitoids, Eulophidae and Braconidae, were found. The eulophid included *Asecodes* sp. nr. *notandus* (Sivestri), *Cirrospilus ambiguus* Hanssan & LaSalle, *Hemiptarsenus variconis* (Girault), *Neochrysocharis formosa* (Westwood) and *Quadrastichus* sp. nr. *liriomyzae* Hanssan & LaSalle. There was only one braconid species, *Opius dissitus* (Muesebeck). Among these, *A. sp. nr. notandus* was found in highest frequency while *H. variconis* had the widest range of host plants. The parasitoids were found on 14 host plant species. *Vigna sesquipedalis* was able to be used by all six species of parasitoids. It was also the host plant most often used by the parasitoids in this study.

Key words : agromyzid leaf miner, *Liriomyza*, larval parasitoids, *Liriomyza* 's parasitoid

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บทคัดย่อ

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 แมลงตัวเบียนระยะหนอนของแมลงวันหนอนชอนใบสกุล *Liriomyza* ในภาคใต้ของ
 ประเทศไทย : ชนิดและพืชอาศัย

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จากการสำรวจชนิดแมลงตัวเบียนระยะหนอนของแมลงวันหนอนชอนใบสกุล *Liriomyza* ใน 6 จังหวัดภาคใต้ คือ สงขลา พัทลุง นครศรีธรรมราช ตรัง สตูล และปัตตานี พบแมลงตัวเบียนอันดับ Hymenoptera จำนวน 2 วงศ์ 6 ชนิด คือวงศ์ Eulophidae ได้แก่ *Asecodes* sp. nr. *notandus* (Silvestri) *Cirrospilus ambiguus* Hansson & LaSalle *Hemiptarsenus varicornis* (Girault) *Neochrysocharis formosa* (Westwood) และ *Quadrastichus* sp. nr. *liriomyzae* Hansson & LaSalle และวงศ์ Braconidae คือ *Opius dissitus* (Muesebeck) โดยพบ *A.* sp. nr. *notandus* ในความถี่สูงสุด และ *H. varicornis* มีช่วงกว้างของพืชอาศัยสูงสุด พืชอาศัยของแมลงตัวเบียนมี 14 ชนิด โดยพบแมลงตัวเบียนทั้ง 6 ชนิดในถั่วฝักยาว (*Vigna sesquipedalis*) และพบแมลงตัวเบียนใช้ถั่วฝักยาวเป็นพืชอาศัยในความถี่สูงสุด

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The agromyzid leaf miner genus *Liriomyza* is a cosmopolitan group of pests that consists of more than 300 species (Spencer and Stegmaier, 1973). Larvae of this genus are polyphagous, attacking ornamental and vegetable crops in the families Cucurbitaceae, Leguminosae, Solanaceae, Brassicaceae, Asteraceae, Compositae and many other species of plant (Musgrave *et al.*, 1975 ; Waterhouse and Norris, 1987 ; CAB International, 2001).

Infestation by *Liriomyza* spp. can cause both direct and indirect damage (Musgrave *et al.*, 1975, Minkenberg and van Lenteren, 1986). Direct damage by larval feeding on palisade parenchyma tissue can reduce the photosynthetic capacity of the plant up to 62% (Johnson *et al.*, 1983), and severely infested leaves may fall (CAB International, 2001). Indirect injury occur when both adult males and adult females feed. Also when females lay eggs, they may act as vectors for disease (Matteoni and Broadbent, 1988 ; Zitter and Tsai, 1977).

Liriomyza spp. are known to have many natural enemies, particularly in their native home in the New World (Murphy and LaSalle, 1999 ;

Waterhouse and Norris 1987). In Asia 41 species of parasitoids in four different families were found (Chien and Ku, 1998 ; Lin and Wang, 1992 ; Murphy and LaSalle, 1999). However, in general and under natural conditions, parasitism is usually low early in crop development and gradually increases as the crop matures (Parrella, 1987). At least 23 species of parasitoids have been used in biological control programmes against *L. trifolii* and *L. sativae* in Senegal, California, Hawaii, Barbados, Marianas, Tonga, Taiwan and Guam (Greathead and Greathead, 1992 ; Johnson, 1993 ; Waterhouse and Norris, 1987).

The objective of this study was to identify species of *Liriomyza* 's parasitoids and their host plants in southern Thailand.

Materials and Methods

Surveys for *Liriomyza* - infested crops were done in Songkhla and the nearby provinces in Phatthalung, Nakhon Si Thammarat, Trang, Satun and Pattani. Each province was visited at 3-month intervals from April 2000 to March 2001. Leaves of different host plants infested by

leaf miner were collected and held in insect boxes at room temperature (25-28 °C). Species of host plants were recorded. *Liriomyza* leafminers and their parasitoids emerged from field samples were preserved in 75% ethyl alcohol. *Liriomyza* spp. were identified using insect external morphology and male aedeagus (Spencer, 1973). Parasitoids were identified according to Hansson (1990) and Xu *et al.* (1999). Parasitoids that we

were unable to identify were sent to Identification Services, Department of Entomology, The Natural History Museum, London, UK.

Results and Discussion

The *Liriomyza* leaf miners in this area of southern Thailand were attacked by six species of parasitoids (Figure 1).

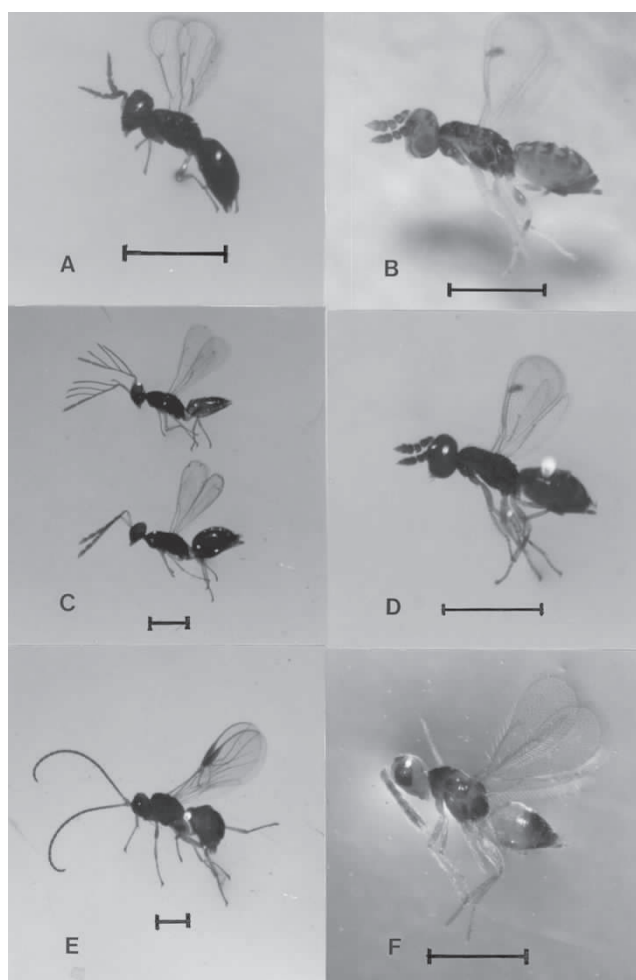


Figure 1. Adult parasitoids of *Liriomyza* spp. found in the lower southern Thailand

- A) Female *Asecodes* sp. nr. *notandus* (Silvestri) (Hymenoptera : Eulophidae)
 - B) Female *Cirrospilus ambiguus* Hansson & LaSalle (Hymenoptera : Eulophidae)
 - C) Male and Female *Hemiptarsenus variconis* (Girault) (Hymenoptera : Eulophidae)
 - D) Female *Neochrysocharis formosa* (Westwood) (Hymenoptera : Eulophidae)
 - E) Female *Opius dissitus* (Muesebeck) (Hymenoptera : Braconidae)
 - F) Female *Quadrastichus* sp. nr. *liriomyzae* (Hymenoptera : Eulophidae)
- Bar = 0.05 mm.

Most of the parasitoids found in this investigation are in family Eulophidae a family which is normally known to attack many hosts live in confined places (Gauld and Bolton, 1988). *Asecodes* sp. was also reported to attack *Liriomyza* in Malaysia (Sivapragasam et al., 1999), Japan and England (Fry, 1989). In this country, *H. variconist* was first reported in North Eastern Thailand by Jaemjanya (1994). It is one of the cosmopolitan parasitoids of *Liriomyza* around the world (CAB International, 2001; Fry, 1989; Sivapragasam et al., 1999; Waterhouse and Norris 1987; and Xu et al. 1999).

A. sp. nr. notandus was the most frequently found parasitoid (Table 1). However it was found on only eight species of host plants while *H. variconis* was found on 14 host plant species. We assume from this that *A. sp. nr. notandus* was able to survive and distribute better in this area of investigation but it was more specific to host plants.

V. sesquipedalis was the mostly used host plant of *Liriomyza*'s parasitoids (Table 2). All six species, including the single specimen of *O. dissitus*, were also found on this plant species. In Malaysia, Sivapragasam et al. (1999) was also obtained the highest diversity of parasitoids on *V. sesquipedalis*. In southern Thailand *V. sesquipedalis* is one of the most common plants found all year long in vegetable growing area so it may have a greater chance to be used by both the leaf miner and parasitoid. However, preference of the leaf miner host may also involved, because we

observed that in mixed crops areas, yardlong bean was also heavily infested by *Liriomyza* spp. The biology and mass rearing methods for *Hemiptarsenus varicornis* are currently being studied at the National Biological Control Research Center, Southern Regional Center, Prince of Songkla University.

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References

- CAB International. 2001. Crop Protection Compendium, 2001 Edition. [CD-ROM]. CAB International, Wallingford.
- Chien, C.C. and Ku, S.C. 1998. The occurrence of *Liriomyza trifolii* (Diptera : Agromyzidae) and its parasitoids on field of *Gerbera jamesonii*. Chin. J. Entomol. 18:187-197.
- Fry, J.M. 1989. Natural Enemy Databank 1987. CAB International, Wallingford. 185 pp.
- Greathead, D.J. and Greathead, A.H. 1992. Biological control of insect pests by insect parasitoids and predators:the BIOCAT database. Biocontrol News and Information. 13:61-68.
- Gauld, I. And Bolton, B. (eds.) 1988. The Hymenoptera. Oxford University Press, New York. 332 pp.

Table 1. Frequency of parasitoids found during April 2000 - March 2001 and number of their host plant species.

Parasitoid	Frequency (%)	Host plant (%)
<i>Asecodes</i> sp. nr. <i>Notandus</i>	59 (39.33)	8 (19.05)
<i>Neochrysocharis formosa</i>	41 (27.33)	10 (23.81)
<i>Cirrospilus ambiguus</i>	20 (13.33)	6 (14.29)
<i>Hemiptarsenus variconis</i>	20 (13.33)	14 (33.33)
<i>Quadrastichus</i> sp. nr. <i>liriomyzae</i>	9 (6.00)	3 (7.14)
<i>Opius dissitus</i>	1 (0.67)	1 (2.38)

Table 2. List of host plants and frequency with which they were used by *Liriomyza*'s parasitoid in Southern Thailand.

Host Plant	Frequency (%)						Total (%)
	<i>Asecodes</i>	<i>Neochrysocharis</i>	<i>Hemiptarsenus</i>	<i>Cirrospilus</i>	<i>Quadrastichus</i>	<i>Opius</i>	
Yardlong bean	40 (25.00)	20 (12.50)	13 (8.13)	12 (7.50)	7 (4.38)	1 (0.62)	93 (58.13)
<i>Vigna sesquipedalis</i> Koern							
Cucumber	5 (3.13)	6 (3.75)	6 (3.75)	4 (2.50)	-	-	21 (13.13)
<i>Cucumis sativus</i> L.							
Luffa	7 (4.38)	6 (3.75)	3 (1.88)	1 (0.63)	-	-	17 (10.64)
<i>Luffa acutangula</i> Roxb.							
Wax gourd	3 (1.88)	2 (1.25)	2 (1.25)	-	-	-	7 (4.38)
<i>Benincasa hispida</i> Cogn.							
Watermelon	1 (0.62)	-	1 (0.62)	1 (0.62)	1 (0.62)	-	4 (2.48)
<i>Citrullus vulgaris</i> Serad							
Pumpkin	1 (0.62)	2 (1.25)	1 (0.62)	-	-	-	4 (2.49)
<i>Cucurbita moschata</i> Decne							
Tomato	1 (0.62)	1 (0.62)	1 (0.62)	1 (0.62)	-	-	4 (2.48)
<i>Lycopersicon seculentum</i> Mill							
Green Kuang Futsioi	-	1 (0.62)	1 (0.62)	-	1 (0.62)	-	3 (1.86)
<i>Brassica chinensis</i> var <i>parachinensis</i> Tsen							
Kale	-	1 (0.62)	1 (0.62)	-	-	-	2 (1.24)
<i>Brassica oleracea</i> var <i>aboglabra</i> Bail							
Chinese cabbage	-	-	1 (0.62)	1 (0.62)	-	-	2 (1.24)
<i>Brassica perkinensis</i> L.							
Sweet Basil	-	-	1 (0.62)	-	-	-	1 (0.62)
<i>Ocimum bacilicum</i> L.							
Eggplant	-	-	1 (0.62)	-	-	-	1 (0.62)
<i>Solanum melongena</i> var <i>serpentium</i> L.							
Brinjal	-	1 (0.62)	-	-	-	-	1 (0.62)
<i>Solanum xanthocarpum</i> Schard & Wendl.							

- Hansson, C. 1990. A taxonomic study on the Palearctic species of *Chrysonotomyia* Ashmead and *Neochrysocharis* Kurdjumov (Hymenoptera: Eulophidae). Ent. Scand. 21:29-52.
- Jaemjanya, T. 1994. Outbreak of new insect species: the leafminer. Khon Kaen Agric. 22:118-121. (In Thai)
- Johnson, M.W. 1993. Biological control of *Liriomyza* leafminers in the Pacific Basin. Micronesica Supplement 4:81-92.
- Johnson, M.W., Welter, C., Toscano, N.C., Ting, I.P. and Trumble, J.T. 1983. Reduction of tomato leaflet photosynthesis rates by mining activity of *Liriomyza sativae* (Diptera: Agromyzidae). J. Econ. Entomol. 76:1061-1063.
- Lin, F.C. and Wang, C.L. 1992. The occurrence of parasitoids of *Liriomyza trifolii* (Burgess) in Taiwan. Chin. J. Entomol. 12:247-257.
- Matteoni, J.A. and Broadbent, A.B. 1988. Wounds caused by *Liriomyza trifolii* (Diptera: Agromyzidae) as sites for infection of *Chrysanthemum* by *Pseudomonas cichorii*. Can. J. Plant Pathol. 10:47-52.
- Minkenberg, D.P.T.M. and van Lenteren, J.C. 1986. The leafminers *Liriomyza bryoniae* and *L. trifolii* (Diptera : Agromyzidae), their parasites and host plants : A review. Agricultural University Wageningen Papers 86(2).
- Murphy, S.T. and LaSalle, J. 1999. Balancing biological control strategies in the IPM of New World invasive *Liriomyza* leafminers in field vegetable crops. Biocontrol News and Information 20:91N-104N.
- Musgrave, C.A., Poe, S.L. and Bennett, D.R. 1975. Leaf miner population estimation in polycultured vegetables. Proc. Flo. State Hort. Soc. 88:156-160.
- Parella, M.P. 1987. Biology of *Liriomyza*. Annu. Rev. Entomol. 32:201-224.
- Sivapragasam, A., Syed, A.R., LaSalle, J. and Ruwaida, M. 1999. Parasitoids of invasive agromyzid leafminers on vegetables Proceedings of the Symposium on Biological Control in the Tropics held at MARDI Training Centre, Serdang, Malaysia from 18-19 March 1999. pp. 127-132.
- Spencer, K.A. 1973. Agromyzidae (Diptera) of economic importance. Series Entomologica, Vol. 9. Dr. W. Junk B.V. The Hague, Netherland. 418 pp.
- Spencer, K.A. and Stegmaier, C.E. 1973. Agromyzidae of Florida. Fla. Dept. Agric. and Cons. Serv. 7:106-107.
- Waterhouse, D.F. and Norris, K.R. 1987. Biological Control : Pacific Prospects. Inkata Press, Melbourne. 454 pp.
- Xu, Z., Gao, Z., Chen, X., Hou, R. and Zeng, L. 1999. Hymenopterous parasitoids of *Liriomyza sativae* Blanchard (Diptera: Agromyzidae) in Guangdong Province, China. Natural Enemies of Insect 21:126-132.
- Zitter, T.A. and Tsai, J.H. 1977. Transmission of three potyviruses by the leafminer *Liriomyza sativae* (Diptera : Agromyzidae). Plant Dis. Rep. 61:1025-1029.