Zootaxa 1044: 27–34 (2005)
www.mapress.com/zootaxa/

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

1044

A new species of *Neochrysocharis* Kurdjumov (Hymenoptera: Eulophidae), a parasitoid of serpentine leafminers (Diptera: Agromyzidae) in Southeast Asia

NICOLE FISHER & JOHN LA SALLE
CSIRO Entomology, GPO Box 1700, Canberra, ACT 2601, Australia
e-mail: john.lasalle@csiro.au

Abstract

Neochrysocharis beasleyi **sp.n.** (Hymenoptera: Eulophidae: Entedoninae) is described from Indonesia and Vietnam. This species is a parasitoid of leafmining Agromyzidae, and is a potential biological control agent for invasive agromyzid species. Variation within Southeast Asian specimens of *Neochrysocharis formosa* is described and discussed. *Neochrysocharis* **stat. rev.** is treated as a valid genus, and removed from synonymy with *Closterocerus*.

Key words: Hymenoptera, Eulophidae, *Neochrysocharis*, parasitoids, Agromyzidae, *Liriomyza*, Indonesia, Vietnam, *Neochrysocharis formosa*, variation

Introduction

Leafmining insects reduce plant metabolic activities and can lead to desiccation and premature fall of the leaves. Among the most serious leafmining pests are serpentine leafminers, which are flies in the family Agromyzidae. If leaves are seriously attacked, crops can be reduced or seedling plants even totally destroyed (Spencer, 1973; 1990). Eulophid wasps are the most common parasitoids recorded on leafminers worldwide (Reina & La Salle, 2003), as well as the most successful agents used within biological control programs against agromyzids (Minkenberg & van Lenteren, 1986; Waterhouse & Norris, 1987; Konishi, 1998; Murphy & La Salle, 1999).

This paper describes a new species of eulophid wasp in the genus *Neochrysocharis* Kurdjumov, which is a potential biological control agent for leaf-mining agromyzid pests. The New World *Liriomyza huidobrensis* (Blanchard) is a serious pest (Spencer 1973; Weintraub & Horowitz 1995), which recently invaded Southeast Asia where it attacks a variety of economically important host plants (Shepard *et al*. 1998). Three species of *Neo-*

Accepted by M. Buffington: 4 Aug. 2005; published: 2 Sept. 2005

chrysocharis have been found attacking *L. huidobrensis* in large numbers in some samples from Southeast Asia: *N. beasleyi*, *N. okazakii* Kamijo and *N. formosa* (Westwood). These species appear to be contributing to fortuitous biological control in Southeast Asia (Sivapragasam *et al*, 1999; Murphy & La Salle, 1999; La Salle, 1999; Thang, 1999; Rauf & Shepard, 1999), and have the potential for use in biological control programs of leafminers in Australia.

Morphological terminology and abbreviations used in this paper follow Gibson (1997). Acronyms used in the text are as follows. ANIC, Australian National Insect Collection, CSIRO, Canberra, Australia; BMNH, The Natural History Museum, London, UK; CNC, Canadian National Insect Collection of Insects, Arachnids and Nematodes, Agriculture and Agri-Food Canada, Ottawa, Canada; IZCAS, Institute of Zoology, Chinese Academy of Sciences, Beijing, China; MZB, Museum Zoologicum Bogoriense, Bogor, Indonesia; USNM, United States National Museum of Natural History, Washington, D.C., USA; VAIC, Victorian Agricultural Insect Collection, Knoxfield, Australia.

SYSTEMATICS

Neochrysocharis beasleyi, sp.n. (Figs 1–6)

Types. Holotype female: Indonesia, Bali, Bangli, Kintarnami, Buatian, coll. 7 Oct. 2001, I.W.Supartha, ex 10–17 Oct. 2001 on tomato, ANIC database no. 32 012622 (ANIC).

Paratypes. 64♀, 21♂ paratypes as follows.

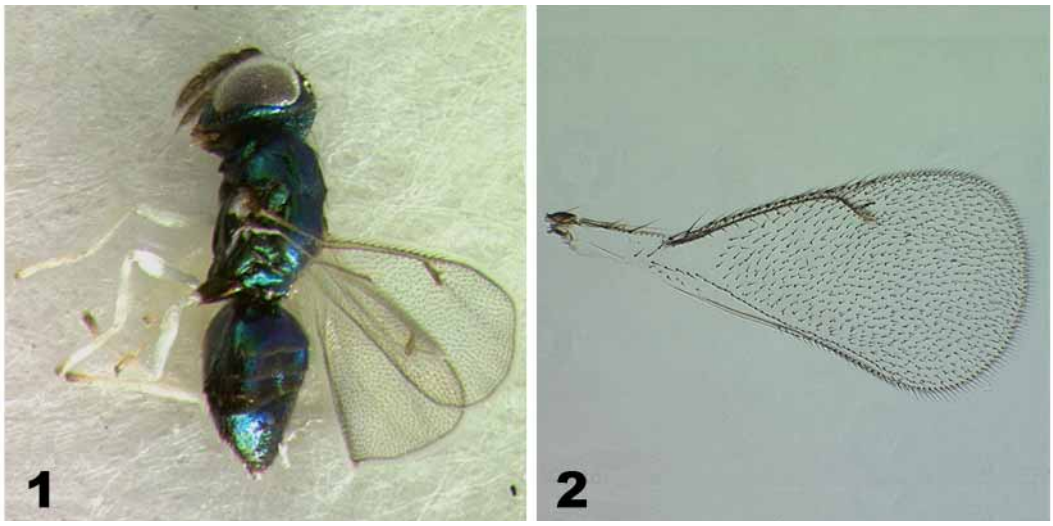
Indonesia: same data as holotype, (18♀ 7♂: 13♀ 4♂ ANIC; 1♀ 1♂ BMNH; 1♀ CNC; 1♀ IZCAS; 1♀ 1♂ MZB; 1♀ USNM; 1♂ VAIC.) WJ – Bogor, Cisarua, coll. 21 Aug. 1997, A.Rauf, snowpea, ex. 28–30 Aug. 1997, tube no. 13 (3♀ ANIC; 1♂ USNM.) WJ – Bogor, Cisarua, coll. 8 Mar. 1998, A.Rauf, broccoli, ex. 10–18 Mar. 1998, tube no. 41 (1♀ ANIC.) WJ – Bogor, Cisarua, coll. 21 Aug. 1997, A.Rauf, tomato, ex. 24–31 Aug. 1997, tube no. 42 (1♀ ANIC.) WJ – Bogor, Cisarua, coll. 8 Mar. 1998, A.Rauf, broccoli, ex. 10–18 Mar. 1998, tube no. 43 (1♀ VAIC.)

Vietnam: Hung Yen Prov., My Van Dist, Vinh Khuc village, coll. 29 Sept. 1998, Tiep, bean, tube no. HY12 (2♀ ANIC, 1♀ BMNH, 1♀ MZB, 1♀ USNM); Hung Yen Prov., My Van Dist, Trung Trac village, coll. 10 Nov. 1988, Tiep, cucumber, tube no. HY18 (4♀ ANIC, 1♀ IZCAS); Hai Phong City, An Hai Dist, Tan Tien village, coll. 3 Nov. 1998, Hoa, tomato, tube no. HP34 (2♀ ANIC, 1♂ BMNH, 1♂ CNC, 1♀ IZCAS); Hung Yen Prov. My Van Dist, Tan Quang village, coll. 19 Sept. 1998, Tiep, cucumber, sample HY10 (1♀ 2♂ ANIC, 1♀ CNC, 1♂ IZCAS, 1♂ MZB, 1♀ USNM); Ha Nai City, Tu Liem Dist, Phu Dien village, coll. 13 Oct. 1998, Mai, on tomato, sample HN3 (1♀ ANIC, 1♀ 1♂ BMNH, 1♂ CNC); Ho Chi Minh City, Binh Chanh Dist, Vinh Loc A village, coll. 16 Aug. 1998, Ngoc, cucumber, sample HCM23 (1♀ ANIC); sample HY2 (6♀ 1♂ ANIC, 1♂ USNM); Hai Phong city, An Hai Dist., Tan Tien village, coll. 11 Nov. 1998, Hoa, cabbage, sample

HP58 (1♀ ANIC); HaNoi City, DongAnh Dist, Tien Duong village, coll. 3 Nov. 1998, Cuong, bean, tube no. HN12 (1♀ ANIC); Hai Phong City, Thuy Nguyen Dist, Thuy Duong village, coll. 27 Nov. 1998, Hoi, chayote, tube no.HP50 (1♀ ANIC); sample HCM4 (3♀ ANIC); sample HPD5 (3♀ ANIC); sample HY9 (1♀ ANIC); Ho Chi Minh City, Binh Chanh Dist., Tan Tuc village, coll. 21 Aug. 1998, Ngoc, cucumber, sample HCM30 (1♀ CNC); Hai Phong City, An Hai Dist, Hong Phong village, coll. 8 Sep. 1998, Hoa, long bean, sample HP23 (1♂ IZCAS); Ho Chi Mnh City, Binh Chanh Dist, Tan Tuc village, coll. 3 Oct. 1998, Ngoc, jointed gourd, sample HCM14 (1♀ MZB); Hai Phong City, An Hai Dist, Tan Tien village, coll. 3 Nov. 1998, Hoa, tomato, tube no. HP36 (2♀ 1♂ VAIC); Hung Yen Prov., My Van Dist, Trung Trac village, coll. 10 Nov. 1998, Tiep, cucumber, tube no. HP18 (1♂ VAIC).

Diagnosis. Transepimeral sulcus (tps) curved posteriorly dorsally (Fig. 7). Female with all coxae dark metallic, in contrast to all femora and tibiae pale yellow to white; male similar, but hind femur with a distinct broad band of dark colour. Forewing completely hyaline, relatively broad: 2.0–2.15 times longer than wide. Mesosoma with weak reticulate sculpture, gaster relatively smooth and shiny. Coloration usually blue-green metallic, occasionally with purplish reflections.

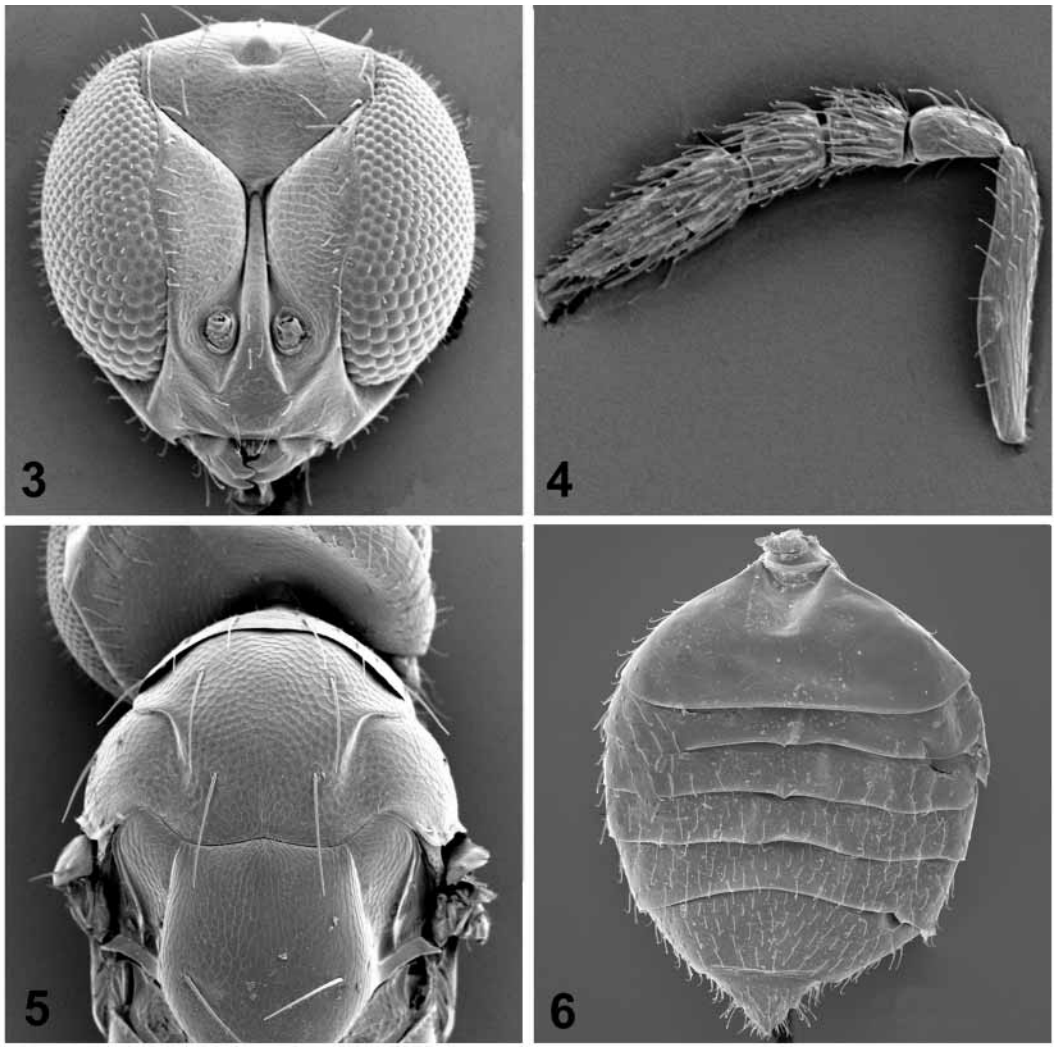
Description. ***Female*** (Figs. 1–7). Length of body 0.75–1.3 mm. Body metallic blue-green, occasionally with purplish reflections. Legs: all coxae dark metallic, all femora and tibiae pale yellow to white.



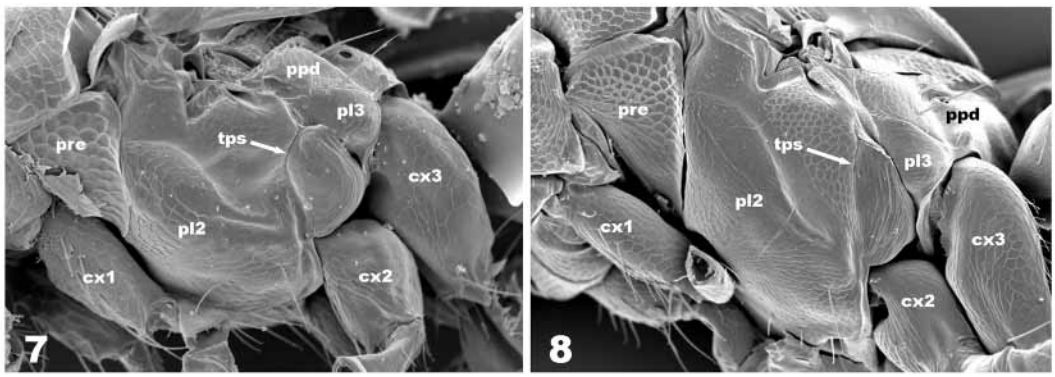
FIGURES 1–2. *Neochrysocharis beasleyi*, female. 1. Habitus. 2. Forewing.

Head (Fig. 3). Vertex, face and frons with weak to moderate reticulate sculpture. Frontal fork v-shaped and distinctly separated from anterior ocellus.

Antenna (Fig. 4). Scape linear, 0.7–0.95 times longer than wide. Funicular segments about subequal in length and width. Club longer than funicle, segments 1 and 2 wider than long, segment 3 with terminal spine which is almost as long as the segment.



FIGURES 3–6. *Neochrysocharis beasleyi*, female. 3. Head. 4. Antenna. 5. Mesosoma. 6. Gaster.



FIGURES 7–8. Mesosoma, lateral view, showing condition of the transepimeral sulcus. 7. *N. beasleyi*, female. 8. *N. formosa*, female. cx1, fore coxa; cx2, middle coxa; cx3, hind coxa; pl2, mesopleuron; pl3, metapleuron; ppd, propodeum; pre, prepectus; tps, transepimeral sulcus

Mesosoma (Figs. 5, 7). Pronotum, mesoscutum and scutellum with weak reticulate sculpture dorsally. Pronotal collar without transverse carina. Midlobe of mesoscutum with 2 strong pairs of setae. Notaulus becoming broad and shallow posteriorly. Transepimeral sulcus (tps) curved posteriorly dorsally (Fig. 7). Propodeum smooth, shiny and without median carina; callus with 2 setae.

Forewing (Fig. 2) 2.0–2.15 times longer than wide; completely hyaline with large speculum. Marginal vein 4.0–5.25 times longer than stigmal vein; postmarginal vein 0.75–1.2 times as long as stigmal vein. Cubital row of setae complete to basal vein; subcubital vein of setae indistinct and only present basally (distal to basal vein).

Gaster (Fig. 6) ovate. Gaster and thorax relatively smooth and shiny, with no distinct reticulate sculpture.

Male Length of body 0.6–1.15 mm. Male similar to female, but hind femur with a distinct broad band of dark colour.

Biology. No specific biological studies have been performed on this species. Like other *Neochrysocharis*, it is presumed to be an idiobiont endoparasitoid of host larvae.

Distribution. This species is only known from Indonesia and Vietnam, but is probably widespread through Southeast Asia.

Etymology: This species is named in honour of Edmund "Ted" Beasley, a good friend of ANIC, and a long time volunteer in the collection.

Discussion. *Neochrysocharis* species are endoparasitoids of a variety of small phytophagous insects, mainly leafminers on herbaceous plants, but other hosts are known. There has been some controversy as to the status of the generic name *Neochrysocharis*. Boucek (1988) considered *Neochrysocharis* as a synonym of *Chrysonotomyia* Ashmead, although Hansson (1990) treated the two genera as distinct and supplied a key to European species of both genera. Hansson (1994) subsequently recognized *Chrysonotomyia* as containing only a few New World species, with the bulk of the world species that had been treated in this genus properly belonging in *Closterocerus* Westwood. He has supplied revisions of species of North American *Closterocerus* (Hansson, 1994) and *Neochrysocharis* (Hansson, 1995). These works offer more information on the taxonomy and biology of these insects.

Gumovsky (2001) synonymised *Neochrysocharis*, *Asecodes* Delucchi, *Hispinocharis* Boucek and *Mangocharis* Boucek with *Closterocerus*. Further study will be required to gain a complete understanding of relationships in these groups; until that time, we are considering *Neochrysocharis* and *Closterocerus* as separate genera. *Neochrysocharis* **stat. rev.** currently contains about 45 species, and is cosmopolitan in distribution (Noyes, 2002; 2003).

There are no keys available for Southeast Asian species of *Neochrysocharis*. Using the key for Palaearctic species (Hansson, 1990), *N. beasleyi* would key to couplet 13. At couplet 13, *N. beasleyi* no longer fits the key, and differs from remaining species as follows: female with all coxae dark metallic, all femora and tibiae pale yellow to white; male

similar, but with the hind femur with a distinct broad band of dark colour. Additional characters for separating this species are given in the diagnosis.

Using the key to Nearctic species of *Neochrysocharis* (Hansson, 1995), *N. beasleyi* would key to couplet 4, based on having the tps curved dorsally and directed backwards from base of mid coxa. At couplet 4 it would differ from both remaining species (*chalybea* Hansson, *texensis* Hansson), by the coloration of the legs and strength of the sculpture on the mesosoma. *Neochrysocharis beasleyi* appears similar in habitus to the North American *N. diastatae* (Howard). It differs from *N. diastatae* in having the dorsal portion of the tps curved posteriorly (Fig. 7), and in having all the femora and tibiae completely pale yellow to white; *N. diastatae* has the tps straight (similar to what is seen in *N. formosa*, Fig. 8), and the legs generally with some dark coloration.

Keys for separating the three species of *Neochrysocharis* known to attack serpentine leafminers in Southeast Asia are given by Fisher *et al*, 2005. Briefly, *N. beasleyi* can be separated from *N. formosa* by having the forewing completely hyaline (forewing with an infuscate cloud near the stigma in *N. formosa*); and from *N. okazakii* by having the forewing 2.0–2.15 times longer than wide (more than 2.5 times longer than wide in *N. okazakii*). All three species have the coxae dark and the legs predominantly if not completely white to yellow. In this respect, Southeast Asian specimens of *N. formosa* differ from the typical European specimens of this species. This is discussed further in the section below on Southeast Asian *Neochrysocharis formosa*.

An additional character to separate these three Southeast Asian species is the shape of the transepimeral sulcus (tps). The tps is generally straight in *Neochrysocharis*, with its dorsal apex directed forward from the base of the mid coxa. This is the condition found in *N. formosa* (Fig.8). In *N. beasleyi* (Fig. 7) and *N. okazakii* the tps is curved dorsally, with its apex directed backwards from the base of the mid coxa.

Southeast Asian *Neochrysocharis formosa*

Southeast Asian specimens of *N. formosa* differ from typical European species in having the coxae dark metallic in contrast to legs that are usually totally white to yellow (femora usually predominantly dark in European specimens, especially the hind femur), and having the scape almost entirely pale yellow to white (scape dark in European specimens, although occasionally pale basally). It is not clear whether this difference indicates that a distinct species is present, or merely represents intraspecific variation. At this point, it is being considered as within species variation for the following reasons. 1) Other than coloration, specimens agree well with European *N. formosa*, particularly in regards to sculpture on the thorax and gaster, nearly complete notauli, and an infumated spot on the wing posterior to the stigmal vein. 2) Coloration can be quite variable in Chalcidoidea. 3) Hansson (1990) has already pointed out the *N. formosa* is a highly variable species, and that among the characters that do display some variation are those of the colour of the femora

and tibiae, and the colour of the scape. Further studies may prove that this is indeed a distinct species.

Acknowledgements

Various people have contributed to this paper, and we would particularly like to thank: Christer Hansson for many useful comments and suggestions on the manuscript; Phillip Fraser (St Francis Xavier High, Canberra, Australia), Andrew Muller (Canberra College, Canberra, Australia) who contributed to the project as part of a Student Research Scheme; Peter Ridland and Wendy Morgan (Victorian Department of Primary Industries, Knoxfield, Australia) for help and information and I Wayan Supartha (Department of Plant Pests and Diseases, Faculty of Agriculture, Udayana University, Denpasar, Indonesia) for shipment of specimens.This work was partially supported by an ACIAR grant no. CP/ 2000/090 to the Department of Primary Industries, Victoria.

Literature cited

Bouček Z. (1988) A*ustralasian Chalcidoidea (Hymenoptera)*. CAB International, Wallingford, U.K., 832 pp.

Fisher N., Ubaidillah R., Reina P., La Salle J. (2005) *Liriomyza Parasitoids in Southeast Asia*. World Wibe Web electronic publication. (in prep).

Gibson, GAP. (1997) Morphology and Terminology. In: Gibson, G.A.P., Huber, J.T. & Woolley, J.B. (Eds.), *Annotated Keys to the Genera of Nearctic Chalcidoidea (Hymenoptera)*. National Research Council Research Press. Ottawa, Ontario, Canada, pp. 16–44.

Gumovsky, A.V. (2001) The status of some genera allied to *Chrysonotomyia* and *Closterocerus* (Hymenoptera: Eulophidae, Entedoninae), with description of a new species from Dominican amber. *Phegea*, 29, 125–142.

Hansson, C. (1990) A taxonomic study of the Palaearctic species of *Chrysonotomyia* Ashmead and *Neochrysocharis* Kurdjumov (Hymenoptera: Eulophidae). *Entomologica Scandinavica*, 21, 29–52.

Hansson, C. (1994) Re-evaluation of the genus *Closterocerus* Westwood (Hymenoptera: Eulophidae), with a revision of the Nearctic species. *Entomologica Scandinavica*, 25, 1–25.

Hansson, C. (1995) Revision of the Nearctic species of *Neochrysocharis* Kurdjumov (Hymenoptera: Eulophidae). *Entomologica Scandinavica*, 26, 27–46.

Konishi K. (1998) An illustrated key to the hymenopterous parasitoids of *Liriomyza trifolii* in Japan. Miscellaneous *Publication of the National Institute of Agro-Environmental Sciences*, 22, 27-–76. [In Japanese].

La Salle, J. (1999) Insect biodiversity in agroecosystems: function, value and optimization.*In*: Wood, D. & Lenné, J.M. (Eds), *Agrobiodiversity: Characterization, Utilization and Management.* CAB International, Wallingford, UK, pp. 155–182.

Minkenberg, OPJM. & van Lenteren, J.C. (1986) The leafminers *Liriomyza bryoniae* and *L. trifolli (*Diptera: Agromyzidae), their parasites and host plants: a review. Agricultural University of Wageningen Papers, No. 86(2), 50 pp.

Murphy, S. & La Salle, 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.

Noyes, J.S. (2002) *Interactive Catalogue of World Chalcidoidea (2001 - second edition)*. CD-Rom. Taxapad and The Natural History Museum, London, UK.

Noyes, J.S. (2003) *Universal Chalcidoidea Database. World Wide Web electronic publication.* Available from www.nhm.ac.uk/entomology/chalcidoids/index.html

Rauf, A. & Shepard, BM. (1999) Leafminers in vegetables in Indonesia: surveys of host crops, species composition, parasitoids and control practices. *In*: Lim, G.S.; Soetikno, S.S.; Loke, W.H. (Eds.). *Proceedings of a Workshop on Leafminers of Vegetables in Southeast Asia, Tanah Rata, Malaysia, 2–5 February 1999.* CAB International Southeast Asia Regional Centre, Serdang, Malaysia, pp. 25–35.

Reina, P. & La Salle, J. (2003) Key to the World Genera of Eulophidae Parasitoids (Hymenoptera) of Leafmining Agromyzidae (Diptera). World Wide Web electronic publication. http://www.ento.csiro.au/science/eulophid_key/eulophids.htm

Shepard, BM, Samsudin & Braun, A. (1998) Seasonal incidence of *Liriomyza huidobrensis* (Diptera: Agromyzidae) and its parasitoids on vegetables in Indonesia. *International Journal of Pest Management*, 44, 43–47.

Sivapragasam, A., Syed, A.R., La Salle, J. & Ruwaida, M. (1999) *Parasitoids of invasive agromyzid leafminers on vegetables in Peninsular Malaysia*. Proceedings of Symposium on Biological Control in the Tropics, MARDI Training centre, Serdang, Selangor, Malaysia, 18–19 March 1999, pp. 127–128.

Spencer, KA. (1973) *Agromyzidae (Diptera) of Economic Importance*. The Hague, Netherlands; Dr W. Junk, 418 pp.

Spencer K.A. (1990) *Host Specialization in the World Agromyzidae (Diptera)*. Kluwer Academic Publishers, pp 444.

Thang, V.T. (1999) Surveys of leafminers (*Liriomyza*) and their parasitoids on vegetables in Vietnam 1998. *In*: Lim, G.S., Soetikno, S.S. & Loke, W.H. (Eds.), P*roceedings of a Workshop on Leafminers of Vegetables in Southeast Asia, Tanah Rata, Malaysia, 2–5 February 1999.* CAB International Southeast Asia Regional Centre, Serdang, Malaysia, pp. 42–53.

Waterhouse, DF & Norris, KR. (1987) *Biological Control: Pacific Prospects*. Ikata Press, Melborne, Australia, 454 pp.

Weintraub, PG & Horowitz, AR. (1995) The newest leafminer pest in Israel, *Liriomyza huidobrensis*. *Phytoparasitica*, 23, 177–184.

