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【Research report】

四種台灣產斑潛蠅（雙翅目：潛蠅科）之重新描述【研究報告】

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Abstract

摘要

本文重新描述四種台灣產斑潛蠅，Liriomyza katoi Sasakawa, L. Uasumatsui Sasakawa, L. brassicae （Rily），並加以分類學上的討論。

Key words:
關鍵詞: 斑潛蠅屬、潛蠅科、台灣。

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Redescription of Four *Liriomyza* Species (Diptera: Agromyzidae) from Taiwan

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ABSTRACT

Four *Liriomyza* species (Diptera: Agromyzidae), *Liriomyza katoi* Sasakawa, *L. yasumatsui* Sasakawa, *L. chinensis* (Kato) and *L. brassicae* (Riley), are described in greater detailed than previously, with further taxonomic discussion.

Key words: *Liriomyza,* Agromyzidae, Taiwan.

四種臺灣產斑潛蠅(雙翅目：潛蠅科)之重新描述

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摘 要

本文重新描述四種臺灣產斑潛蠅，*Liriomyza katoi* Sasakawa, *L. yasumatsui* Sasakawa, *L. chinensis* (Kato) 及 *L. brassicae* (Riley)，並加以分類學上的討論。

關鍵詞：斑潛蠅屬，潛蠅科，臺灣。

Introduction

Ten *Liriomyza* species are known from Taiwan: *L. asterivora* Sasakawa, *L. brassicae* (Riley), *L. bryoniae* (Kaltenbach), *L. chinensis* (Kato), *L. katoi* Sasakawa, *L. pusilla* (Meigen) (= *L. compositella* Spencer), *L. subpusilla* (Malloch), *L. trifolii* (Burgess), *L. viticola* (Sasakawa) and *L. yasumatsui* Sasakawa. Although the genus is readily distinguished from other Agromyzidae by the yellow frons and scutellum, reclinate orbital setulae , and the costa extending to vein M_{1+2}, the most reliable character for identifying is the presence of the stridulation mechanism in males (Spencer, 1986).

Malloch (1914), Spencer (1960) and Sasakawa (1972) studied the *Liriomyza* of Taiwan, but their information seems to have been insufficient for detailed species descriptions, especially as identifications in this genus require various kinds of characters. In this paper we treat four *Liriomyza* species: *L. katoi, L. yasumatsui, L. chinensis* and *L. brassicae*. We present more detailed descriptions of external morphology, host plants and both male and female terminalia. And we provide new illustrations for the purpose of identification and discuss some taxonomic problems among these four species. Terminology used here mainly follows Sasakawa (1961). The wing veins and their measurements are as in Fig.1.

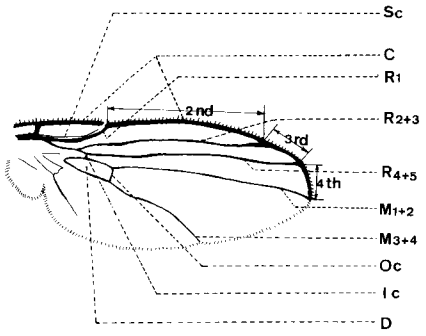

Fig. 1 Wing veins and measurements. C, costa; D, discal cell; Ic, inner cross vein; M, media; Oc, outer cross vein; R, radius; Sc, subcosta; 2nd, 2nd costal section; 3rd, 3rd costal section; 4th, 4th costal section.

Liriomyza katoi Sasakawa, 1961

Liriomyza katoi Sasakawa, 1961, Pac. Insects, 3(2-3): 400.

Description:

Head: Face yellow. Frons about 1.4 times as wide as eye. Occiput and postgenae black, black region contiguous to ocellar triangle and eyes. Antenna yellow with 3rd segment rounded. Orbital bristles 4 pairs, upper two proclinate, lower two inclinate. Two pairs of vertical bristles both on yellow ground. Ocellar triangle black with 4 long bristles.

Thorax: Mesonotum shining black. Dorsocentral bristles 1 + 3 type. Acrostichals 4 irregular

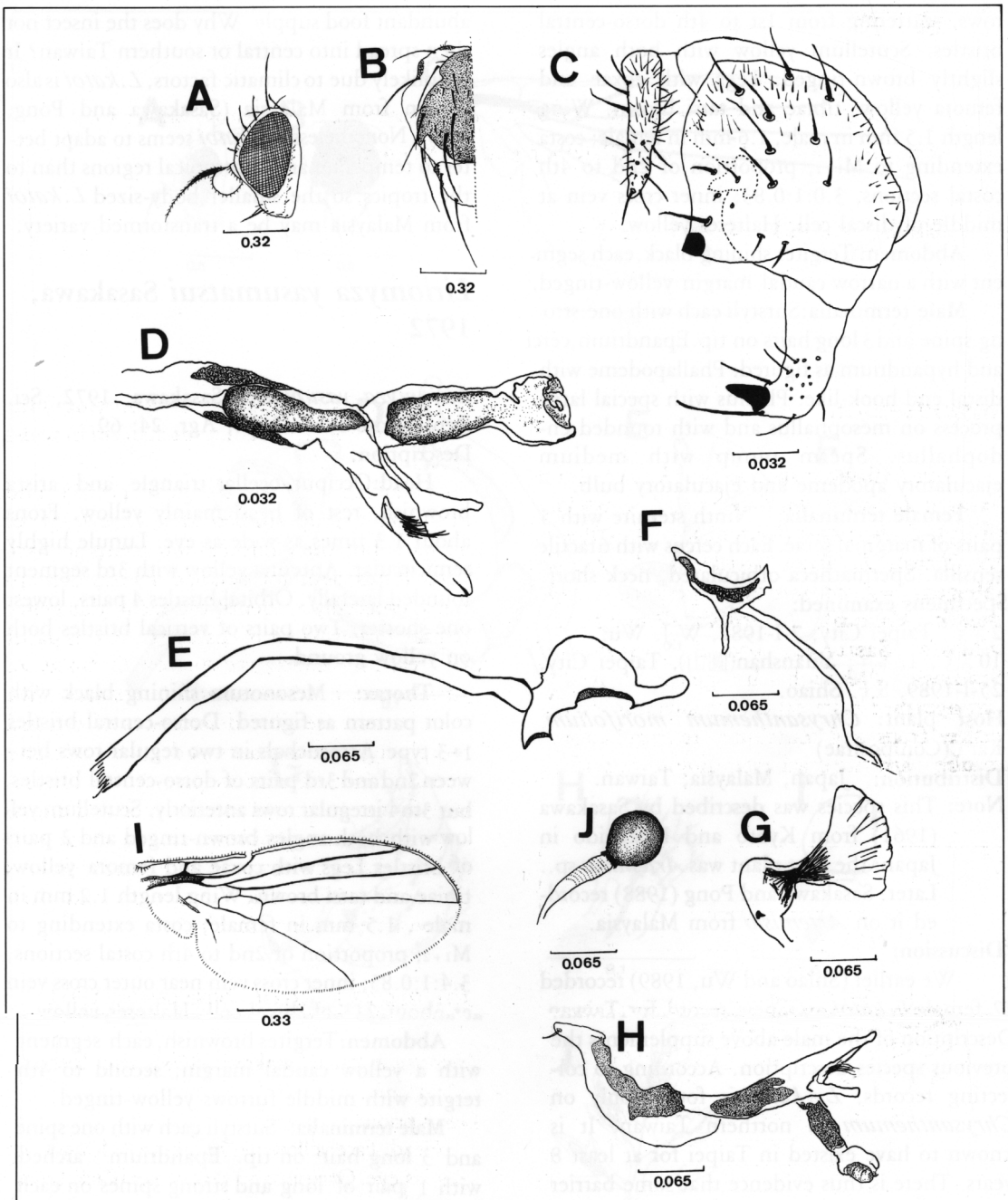

Fig. 2. *Liriomyza katoi* Sasakawa. A, Head, lateral view; B, Half of thorax, dorsal view; C, Half of epandrium with one surstylus and one cercus, posterior view; D, Phallus, lateral view; E, Phallapodeme, lateral view; F, Half of hypandrium, ventral view; G, Sperm pump; H, Phallus with distal end of phallapodeme, another aspect; I, Wing; J, Spermatheca. (Scale unit: mm).

rows, scattering from 1st to 4th dorso-central bristles. Scutellum yellow with both angles slightly brown-tinged. Legs with coxae and femora yellow, tibiae and tarsi brown. Wing length 1.5 mm in male, 1.6 mm in female; costa extending to M_{1+2}; proportion of 2nd to 4th costal sections, 3.0:1:0.83; inner cross vein at middle of discal cell. Halteres yellow.

Abdomen: Tergites shining black, each segment with a narrow caudal margin yellow-tinged.

Male terminalia: Surstyli each with one stro ng spine and 3 long hairs on tip. Epandrium, cerci and hypandrium as figured. Phallapodeme with distal end hook-like. Phallus with special large process on mesophallus and with rounded endophallus. Sperm pump with medium ejaculatory apodeme and ejaculatory bulb.

Female terminalia: Ninth sternite with 5 pairs of marginal setae. Each cercus with 6 tactile sensilla. Spermatheca orbiculated, neck short.

Specimens examined:
2 ♀♀; Taipei City, 7-I-1982, W.J. Wu.
10 ♂♂, 12 ♀♀; Yuanshan(圓山), Taipei City, 25-I-1989, S.F. Shiao.

Host plant: *Chrysanthemum morifolium* Ram.(Compositae)

Distribution: Japan, Malaysia, Taiwan.

Note: This species was described by Sasakawa (1961) from Kyoto and Hokkaido in Japan; the host plant was *Artemisia* sp.. Later, Sasakawa and Pong (1988) recorded it on *Artemisia* from Malaysia.

Discussion:

We earlier (Shiao and Wu, 1989) recorded 2 female *L. katoi* as a new record for Taiwan. Description of the male above supplements the previous species description. According to collecting records, *L. katoi* is found only on *Chrysanthemum* in northern Taiwan. It is known to have existed in Taipei for at least 8 years. There is thus evidence that some barrier prevents it from dispersing and shifting to other host plants in Taiwan. We suspect that the Taipei population represents an artificial introduction from an other country, especially from Japan. Although the host plant of *L. katoi* in Japan is *Artemisia* sp., the monocultured chrysanthemum in Taiwan provides a similar and abundant food supply. Why does the insect not then spread into central or southern Taiwan? It is unlikely due to climatic factors, *L. katoi* is also known from Malaysia (Sasakawa and Pong, 1988). Nonetheless, *L. katoi* seems to adapt better to temperate and subtropical regions than to the tropics, so the smaller body-sized *L. katoi* from Malaysia may be a transformed variety.

Liriomyza yasumatsui Sasakawa, 1972

Liriomyza yasumatsui Sasakawa, 1972, Sci. Rep. Kyoto Pref. Univ., Agr. 24: 69.

Description:

Head: Occiput, ocellar triangle and arista brownish, rest of head mainly yellow. Frons about 1.3 times as wide as eye. Lunule highly semicircular. Antenna yellow with 3rd segment rounded laterally. Orbital bristles 4 pairs, lowest one shorter. Two pairs of vertical bristles both on yellow ground.

Thorax: Mesonotum shining black with color pattern as figured. Dorso-central bristles 1+3 type. Acrostichals in two regular rows between 2nd and 3rd pairs of dorso-central bristles, but 3 to 4 irregular rows anteriorly. Scutellum yellow with both angles brown-tinged and 2 pairs of bristles. Legs with coxae and femora yellow, tibiae and tarsi brown. Wing length 1.2 mm in male , 1.5 mm in female; costa extending to M_{1+2}; proportion of 2nd to 4th costal sections, 3.4:1:0.85; inner cross vein near outer cross vein at about 2/3 of discal cell. Halteres yellow.

Abdomen: Tergites brownish, each segment with a yellow caudal margin; second to 4th tergite with middle furrows yellow-tinged.

Male terminalia: Surstyli each with one spine and 3 long hairs on tip. Epandrium arched with 1 pair of long and strong spines on each posteroventral angle. Cerci long and pubescent. Phallapodeme with distal end hooked. Sperm pump with blade broadened and neck narrowed; ejaculatory bulb with a small process. Phallus length 0.24 mm, with special processes on mesophallus; endophallus with sclerotized tubes narrowed.

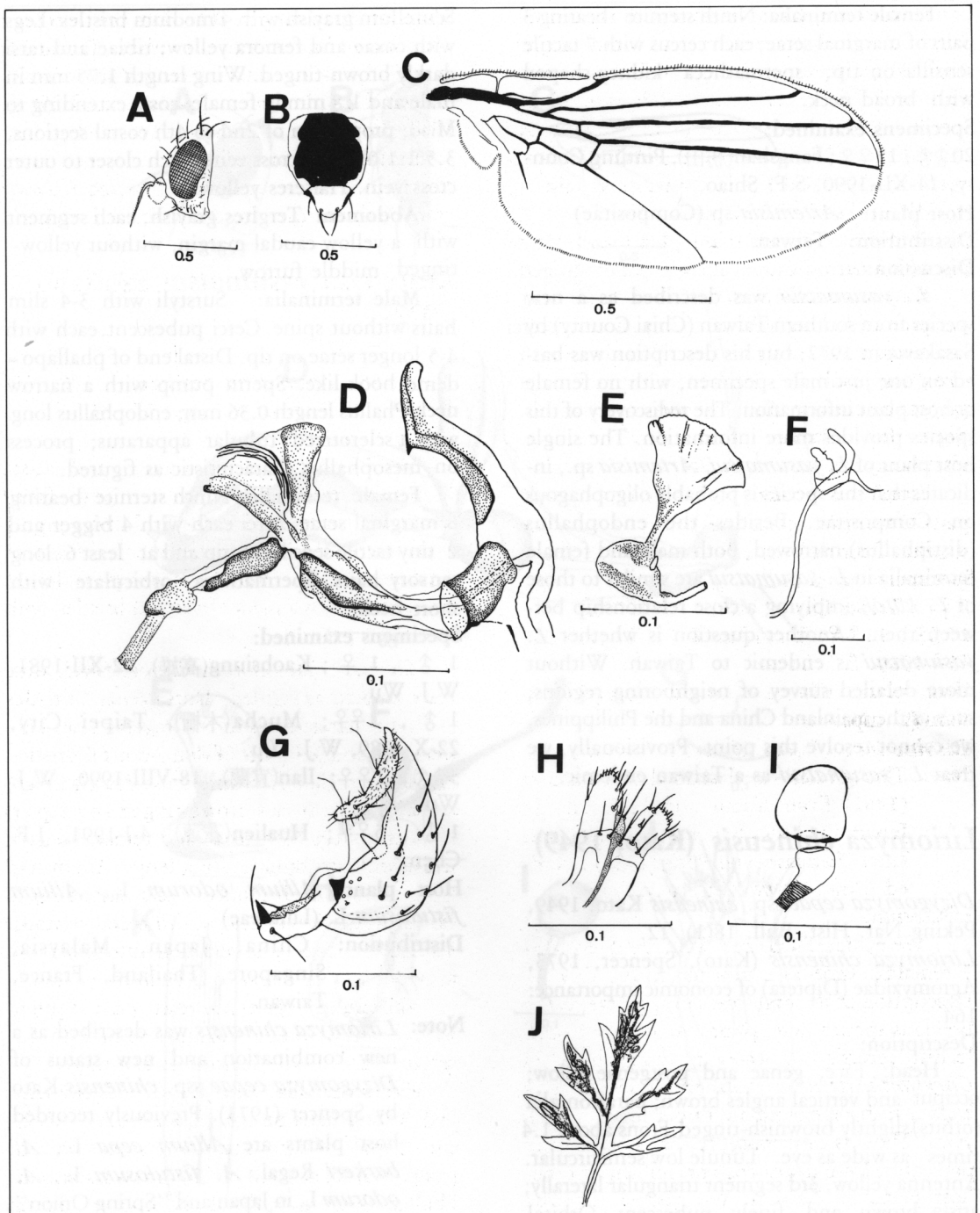

Fig. 3. *Liriomyza yasumatsui* Sasakawa. A, Head, lateral view; B, Color pattern of thorax, dorsal view; C, Wing; D, Phallus with distal end of phallapodeme, lateral view; E, Sperm pump; F, Half of hypandrium, ventral view; G, Half of epandrium with one surstylus and one cercus, posterior view; H, Part of 9th tergite and sternite with cerci (female); I, Spermatheca; J, Mines on *Artemisia* sp.. (Scale unit: mm).

Female terminalia: Ninth sternite bearing 3 pairs of marginal setae; each cercus with 7 tactile sensilla on tip; spermatheca kidney-shaped with broad neck.

Specimens examined:
20♂♂, 15♀♀; Fangshan(枋山), Pintung County, 14-XII-1990, S.F. Shiao.

Host plant: *Artemisia* sp.(Compositae)

Distribution: Taiwan.

Discussion:

L. yasumatsui was described as a new species from southern Taiwan (Chiai County) by Sasakawa in 1972, but his description was based on one just male specimen, with no female or host plant information. The rediscovery of this species provides more information. The single host plant of *L. yasumatsui, Artemisia* sp., indicates that this species is probably oligophagous on Compositae. Besides the endophallus (distiphallus) narrowed, both male and female terminalia in *L. yasumatsui* are similar to those of *L. katoi,* implying a close relationship between them. Another question is whether *L. yasumatsui* is endemic to Taiwan. Without more detailed survey of neighboring regions, such as the mainland China and the Philippines, we cannot resolve this point. Provisionally, we treat *L. yasumatsui* as a Taiwan endemic.

Liriomyza chineusis (Kato, 1949)

Dizygomyza cepae ssp. *chinensis* Kato, 1949, Peking Nat. Hist. Bull. 18(1): 12.

Liriomyza chinensis (Kato), Spencer, 1973, Agromyzidae (Diptera) of economic importance: 164.

Description:

Head: Face, genae and postgenae yellow; occiput and vertical angles brown; parafrontalia (orbits) slightly brownish-tinged. Frons about 1.4 times as wide as eye. Lunule low semicircular. Antenna yellow, 3rd segment triangular laterally; arista brown and finely pubescent. Orbital bristles 6-7 pairs; 1st pair proclinate, others slightly inclinate. Both pairs of vertical bristles on brownish ground.

Thorax: Mesonotum gray. Dorso-central bristles 1+3 type. Acrostichals in two regular rows. Scutellum grayish with 4 medium bristles. Legs with coxae and femora yellow, tibiae and tarsi darkly brown-tinged. Wing length 1.75 mm in male and 1.8 mm in female; costa extending to M_{1+2}; proportion of 2nd to 4th costal sections, 3.5:1:1.0; inner cross vein much closer to outer cross vein. Halteres yellow.

Abdomen: Tergites grayish, each segment with a yellow caudal margin, without yellow-tinged middle furrow.

Male terminalia: Surstyli with 3-4 slim hairs without spine. Cerci pubescent, each with 4-5 longer setae on tip. Distal end of phallapodeme hook-like. Sperm pump with a narrow neck. Phallus length 0.36 mm; endophallus long, with a sclerotized tubular apparatus; process on mesophallus characteristic as figured.

Female terminalia: Ninth sternite bearing 8 marginal setae; cerci each with 4 bigger and 2 tiny tactile sensilla on tip and at least 6 long sensory hairs. Spermatheca orbiculate with short neck.

Specimens examined:
1♂, 1♀; Kaohsiung(高雄), 22-XII-1981, W.J. Wu.
1♂, 2♀♀; Mucha(木柵), Taipei City, 22-X-1989, W.J. Wu.
3♂♂, 2♀♀; Ilan(宜蘭), 18-VIII-1990, W.J. Wu.
1♂, 5♀♀; Hualien(花蓮), 4-I-1991, J.F. Chen.

Host plant: *Allium odorum* L., *Allium fistulosum* L. (Liliaceae)

Distribution: China, Japan, Malaysia, Singapore, Thailand, France, Taiwan.

Note: *Liriomyza chinensis* was described as a new combination and new status of *Dizygomyza cepae* ssp. *chinensis* Kato by Spencer (1973). Previously recorded host plants are *Allium cepa* L., *A. barkeri* Regal, *A. fistulosum* L., *A. odorum* L. in Japan and "Spring Onion" in China (Inner Mongolia) (Spencer, 1973).

Discussion:

In 1972, Sasakawa recorded the leaf miners on cultivated Chinese leeks in Taiwan as *L. cepae,* but later, Sasakawa and Fan (1985) and

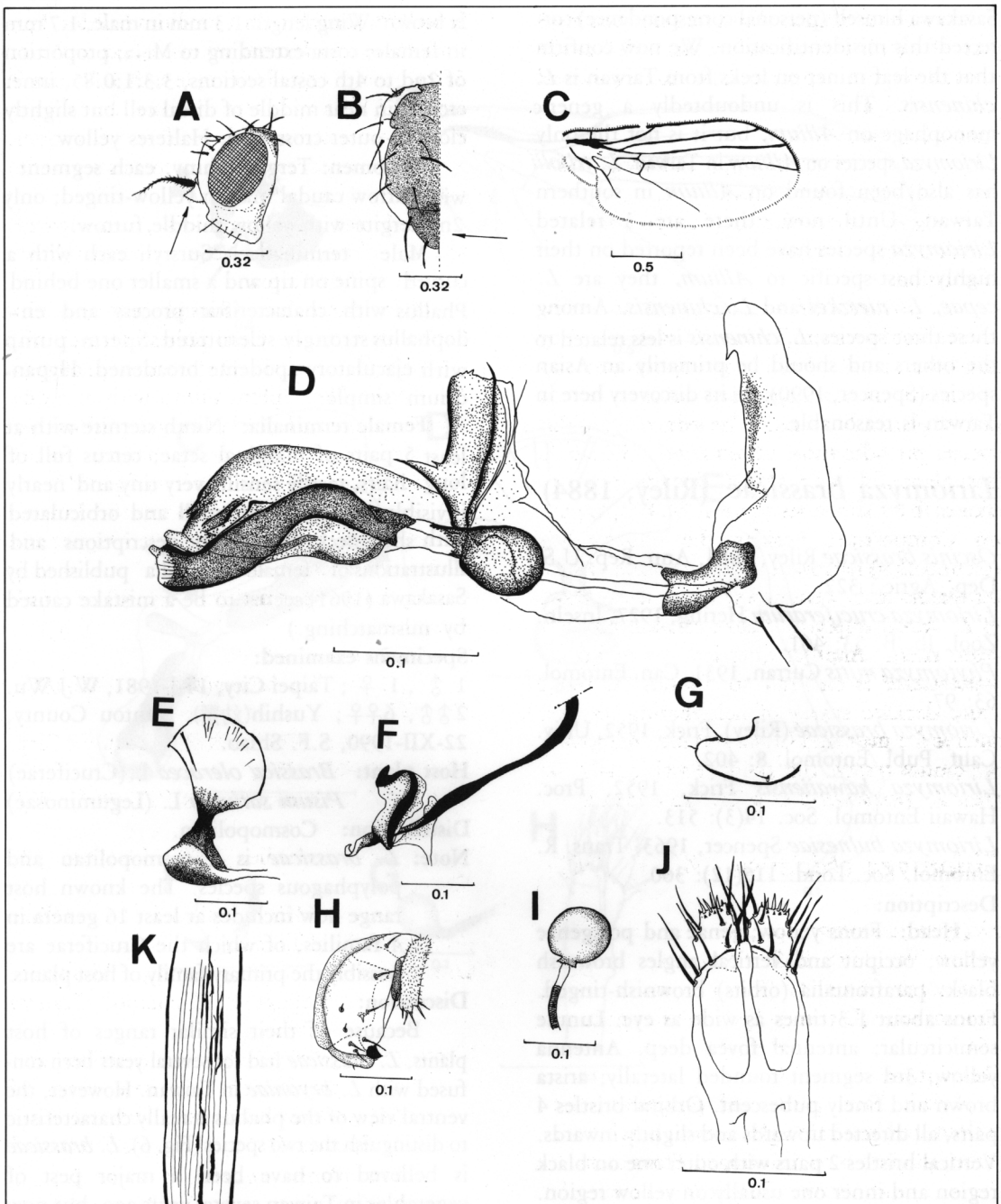

Fig. 4. *Liriomyza chinensis* (Kato). A, Head, lateral view; B, Half of thorax, dorsal view; C, Wing; D, Phallus with distal end of phallapodeme, lateral view; E, Sperm pump; F, Half of hypandrium, ventral view; G, Surstylus, posteroventral view; H, Half of epandrium with one cercus, posterior view; I, spermatheca; J, Part of 9th tergite and sternite with cerci (female); K, Mines on *Allium*. (Scale unit: mm).

Sasakawa himself (personal correspondence) corrected this misidentification. We now confirm that the leaf miner on leeks from Taiwan is *L. chinensis.* This is undoubtedly a generic monophage on *Allium,* but it is not the only *Liriomyza* species on *Allium* in Taiwan. *L. trifolii* has also been found on *Allium* in southern Taiwan. Until now, there are 3 related *Liriomyza* species have been reported on their highly host-specific to *Allium,* they are *L. cepae, L. nietzkei* and *L. chinensis.* Among these three species, *L. chinensis* is less related to the others and should be primarily an Asian species (Spencer, 1990). So its discovery here in Taiwan is reasonable.

Liriomyza brassicae (Riley, 1884)

Oscinis brassicae Riley, 1884, Ann. Rep. U.S. Dep. Agric.: 322.
Liriomyza cruciferarum Hering, 1927, Inseln. Zool. Jb. B. 53: 461.
Phytomyza mitis Curran, 1931, Can. Entomol. 63: 97.
Liriomyza brassicae (Riley), Frick, 1952, Univ. Calif. Publ. Entomol. 8: 402.
Liriomyza hawaiiensis Frick, 1952, Proc. Hawaii Entomol. Soc. 14(3): 513.
Liriomyza bulnesiae Spencer, 1963, Trans. R. Entomol. Soc. Lond. 115(12): 360.

Description:

Head: Frons yellow; genae and postgenae yellow; occiput and vertical angles brownish black; parafrontalia (orbits) brownish-tinged. Frons about 1.3 times as wide as eye. Lunule semicircular; antennal fovea deep. Antenna yellow, 3rd segment rounded laterally; arista brown and finely pubescent. Orbital bristles 4 pairs, all directed upwards and slightly inwards. Vertical bristles 2 pairs with outer one on black region and inner one usually on yellow region. Ocellar triangle black with 4 long bristles.

Thorax: Mesonotum shining black. Dorsocentral bristles 1 + 3 type. Acrostichals in 4 rows. Scutellum yellow with both angles brown-tinged. Legs with coxae and femora yellow but slightly brownish on dorsal aspects and conjunctive regions between them; tibiae and tarsi darkly brown. Wing length 1.3 mm in male, 1.7 mm in female; costa extending to M_{1+2}; proportion of 2nd to 4th costal sections, 3.3:1:0.85, inner cross vein near middle of discal cell but slightly close to outer cross vein. Halteres yellow.

Abdomen: Tergites shiny, each segment with narrow caudal margin yellow-tinged; only 2nd tergite with yellow middle furrow.

Male terminalia: Surstyli each with a curved spine on tip and a smaller one behind. Phallus with characteristic process and endophallus strongly sclerotized. Sperm pump with ejaculatory apodeme broadened. Hypandrium simple.

Female terminalia: Ninth sternite with at least 5 pairs of marginal setae; cercus full of long hairs, tactile sensilla very tiny and nearly invisible. Spermatheca small and orbiculated with short neck. (Note: The descriptions and illustrations of female terminalia published by Sasakawa (1961) seems to be a mistake caused by mismatching.)

Specimens examined:
1 ♂, 1 ♀; Taipei City, 14-I-1981, W.J.Wu. 2♂♂, 6♀♀; Yushih(幼獅), Nantou County, 22-XII-1990, S.F. Shiao.

Host plant: *Brassica oleracea* L. (Cruciferae)
Pisum sativum L. (Leguminosae)

Distribution: Cosmopolitan.

Note: *L. brassicae* is a cosmopolitan and polyphagous species. The known host range now includes at least 16 genera in 4 families, of which the Cruciferae are possibly the primary family of host plants.

Discussion:

Because of their similar ranges of host plants, *L. brassicae* had for several years been confused with *L. bryoniae* in Taiwan. However, the ventral view of the phallus is really characteristic to distinguish the two species (Fig. 6). *L. brassicae* is believed to have been a major pest of vegetables in Taiwan several years ago, but now to be replaced by *L. bryoniae* as a pest. Collecting records show *L. brassicae* as a pest of *Brassica* as recently as 1981, but recent collecting indicates smaller population sizes at higher elevation. *L. brassicae* thus appears no longer to be a pest of importance in Taiwan.

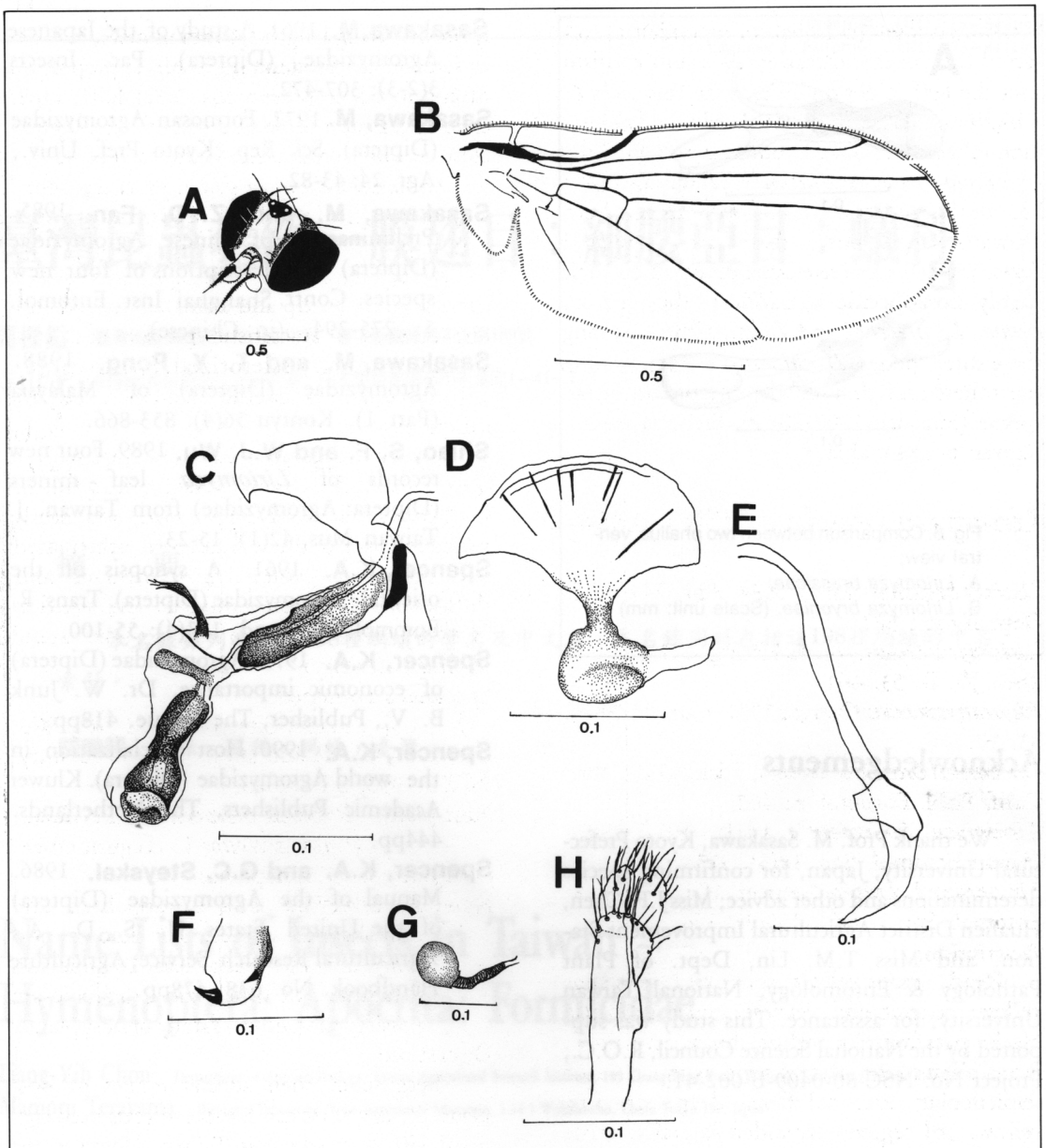

Fig. 5. *Liriomyza brassicae* (Riley). A, Head; B, Wing; C, Phallus with distal end of phallapodeme, lateral view; D, Sperm pump; E, Half of hypandrium, ventral view; F, Surstylus posteroventral view; G, Spermatheca; H, Part of 9th tergite and sternite with cerci (female). (Scale unit: mm).

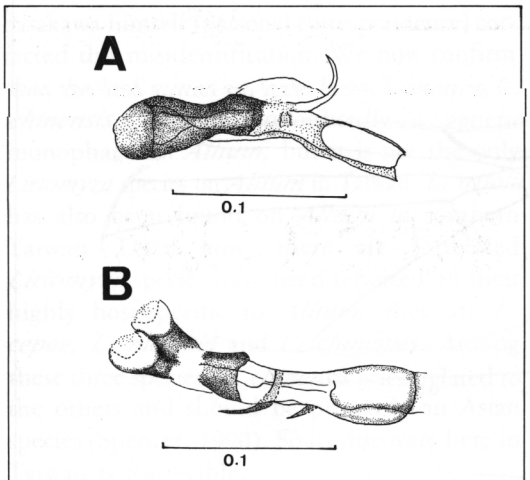

Fig. 6. Comparison between two phallus, ventral view;
A, *Liriomyza brassicae;*
B, *Liriomyza bryoniae.* (Scale unit: mm)

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