



Survey of Lepidopterous Pests of Litchi and Longan in Taiwan 【Research report】

荔枝與龍眼鱗翅目害蟲種類與發生情形調查【研究報告】

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Received: 2005/10/27 Accepted: 2006/01/30 Available online: 2006/03/01

Abstract

Lepidopterous pests of litchi (*Litchi chinensis* Sonn) and longan (*Dimocarpus longans* Lour.) in Taiwan were surveyed by studying shoots, spikes of flowers, and fruits of litchi and longan, and were also detected using the sex pheromones of *Cydia notanthes* Meyrick and *Conopomorpha cramerella* (Snellen). Results showed that 20 species of lepidopterous pests were collected from litchi shoots. Only 13 of them were indentified which included two species of the Gracillariidae, *Conopomorpha sinensis* Bradley and *C. litchiella* Bradley; six species of the Tortricidae, *Statherotis leucaspis* Meyrick, *Dudua aprobola* Meyrick, *Eboda celligera* Meyrick, *Adoxophyes privatana* (Walker), *Lobesia* sp., and *Cryptophlebia ombrodelta* (Lower); two species of the Pyralidae, *Diaphania indica* (Saunders) and *Conogethes evaxalis* (Walker); two species of the Noctuidae, *Sympis rufibasis* Guenée and *Oxyodes scrobiculata* (Fabricius); and one species of the Geometridae, *Thalassodes immissarius* Walker. Species of lepidopterous pests in litchi in central and southern Taiwan were similar, while species of the Larentiinae and *S. rufibasis* were collected from central and southern Taiwan, respectively. Five species of lepidopterous pests were collected from the spikes of flowers and fruits of litchi, and greater numbers of *Conopomorpha* sp. were found. There were nine species consistently collected from litchi shoots from 1992 to 1994 in Shetou Township, Changhua County. These species included *Conopomorpha* sp., *S. leucaspis*, *E. celligera*, *D. aprobola*, species of the Larentiinae, *S. rufibasis*, *T. immissarius*, and two unknown species. The survey density and frequency of collection of *S. leucaspis* were the highest among all species in litchi orchards from 1992 to 1994. The frequencies of collection of *Conopomorpha* sp. and *T. immissarius* were 21.4-51.7% and 21.4-58.6%, respectively. The lepidopterous pests collected from longan shoots were similar to those of litchi, including *Conopomorpha* sp., *S. leucaspis*, species of the Larentinae, and *T. immissarius*. Among species of the Gracillariidae on litchi and longan of Taiwan, the main species was *C. sinensis* collected from shoots, fruits of litchi and longan, and sex pheromone traps of using pheromones from *C. cramerella*. The number of *C. litchiella* collected was very small, coming only from the shoots of litchi and longan and the traps. Based on the results of those detected with the sex pheromone, the bagging method, and rearing with shoots of litchi, the carambola fruit borer, *C. notanthes*, infests litchi as well as carambola in Taiwan. Both *C. notanthes* and *C. ombrodelta* (Lower) produced similar levels of infestation on litchi, infesting the shoots and fruits. However the performances of both species reared on litchi shoots were worse than those reared on an artificial corn diet.

摘要

本試驗以採集荔枝、龍眼之嫩梢、花穗、果實及以性費洛蒙誘蟲器誘集等方法調查荔枝、龍眼園內之鱗翅目害蟲種類與發生情形。結果顯示由此二種園內採集到的鱗翅目昆蟲有 20 種，經鑑定有細蛾科二種：荔枝細蛾(*Conopomorpha sinensis* Bradley) 及荔枝尖細蛾(*C. litchiella* Bradley)；捲葉蛾科六種：三角新捲葉蛾(*Statherotis leucaspis* Meyrick)、灰白條捲葉蛾(*Dudua aprobola* Meyrick)、圓翅捲葉蛾(*Eboda celligera* Meyrick)、*Adoxophyes privatana* (Walker)、*Lobesia* sp.、及粗腳姬捲葉蛾(*Cryptophlebia ombrodelta* (Lower))；螟蛾科兩種：*Diaphania indica* (Saunders)及夜蛾科兩種：*Sympis rufibasis* Guenée 及 *Oxyodes scrobiculata* (Fabricius)；尺蠖蛾科一種 *Thalassodes immissarius* Walker 等 13 種。大致上台灣中部與南部荔枝害蟲種類類似，其中屬 Larentiinae 蛾類及 *S. rufibasis* 分別於中、南部採到。由荔枝花穗及果實採集到之 5 種害蟲中，以細蛾(*Conopomorpha* sp.) 數量較多。荔枝嫩梢上害蟲之年發生情形顯示較常見種類有細蛾(*Conopomorpha* sp.)、三角新捲葉蛾、灰白條捲葉蛾、圓翅捲葉蛾、屬 Larentiinae 之蛾類、*S. rufibasis*、*T. immissarius* 及兩種待鑑定的蛾類昆蟲。當中以三角新捲葉蛾之密度及採到的頻度均較高，關鍵害蟲 *Conopomorpha* sp. 害蟲採到頻度為 21.4~51.7%，而尺蠖蛾 *T. immissarius* 採到之頻度亦高 21.4~58.6%。龍眼上的鱗翅目害蟲種類與荔枝者類似，包括有細蛾(*Conopomorpha* sp.) 害蟲、三角新捲葉蛾、屬 Larentiinae 之蛾類及 *T. immissarius*。荔枝、龍眼上細蛾類害蟲調查顯示以荔枝細蛾危害荔枝、龍眼果實及嫩梢為主；而荔枝尖細蛾僅於嫩梢中採集到。以性費洛蒙偵測法、套袋接蟲法及荔枝嫩梢飼育結果顯示花姬捲葉蛾(*Cydia notanthes* Meyrick) 除危害楊桃外亦可危害荔枝，其在荔枝上之危害習性與粗腳姬捲葉蛾類似，兩者皆能危害荔枝果實及嫩梢；且二者均能以荔枝嫩梢飼育完成其生活史，惟其發育繁殖情形均較以玉米人工飼料飼育者為差。

Key words: litchi, longan, lepidopterous pests

關鍵詞: 荔枝、龍眼、鱗翅目害蟲

Full Text: [PDF \(1.05 MB\)](#)

荔枝與龍眼鱗翅目害蟲種類與發生情形調查

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摘 要

本試驗以採集荔枝、龍眼之嫩梢、花穗、果實及以性費洛蒙誘蟲器誘集等方法調查荔枝、龍眼園內之鱗翅目害蟲種類與發生情形，結果顯示由此二種園內採集到的鱗翅目昆蟲有 20 種，經鑑定有細蛾科二種：荔枝細蛾(*Conopomorpha sinensis* Bradley)及荔枝尖細蛾(*C. litchiella* Bradley)；捲葉蛾科六種：三角新捲葉蛾(*Statherotis leucaspis* Meyrick)、灰白條捲葉蛾(*Dudua aprobola* Meyrick)、圓翅捲葉蛾(*Eboda celligera* Meyrick)、*Adoxophyes privatana* (Walker)、*Lobesia* sp.、及粗腳姬捲葉蛾(*Cryptophlebia ombrodelta* (Lower))；螟蛾科兩種：*Diaphania indica* (Saunders)及 *Conogethes evaxalis* (Walker)；及夜蛾科兩種：*Sympis rufibasis* Guenée 及 *Oxyodes scrobiculata* (Fabricius)；尺蠖蛾科一種 *Thalassodes immissarius* Walker 等 13 種。大致上台灣中部與南部荔枝害蟲種類類似，其中屬 *Larentiinae* 蛾類及 *S. rufibasis* 分別於中、南部採到。由荔枝花穗及果實採集到之 5 種害蟲中，以細蛾(*Conopomorpha* sp.)數量較多。荔枝嫩梢上害蟲之年發生情形顯示較常見種類有細蛾(*Conopomorpha* sp.)、三角新捲葉蛾、灰白條捲葉蛾、圓翅捲葉蛾、屬 *Larentiinae* 之蛾類、*S. rufibasis*、*T. immissarius* 及兩種待鑑定的蛾類昆蟲。當中以三角新捲葉蛾之密度及採到的頻度均較高，關鍵害蟲 *Conopomorpha* sp. 害蟲採到頻度為 21.4~51.7%，而尺蠖蛾 *T. immissarius* 採到之頻度亦高 21.4~58.6%。龍眼上的鱗翅目害蟲種類與荔枝者類似，包括有細蛾(*Conopomorpha* sp.)害蟲、三角新捲葉蛾、屬 *Larentiinae* 之蛾類及 *T. immissarius*。荔枝、龍眼上細蛾類害蟲調查顯示以荔枝細蛾危害荔枝、龍眼果實及嫩梢為主；而荔枝尖細蛾僅於嫩梢中採集到。以性費洛蒙偵測法、套袋接蟲法及荔枝嫩梢飼育結果顯示花姬捲葉蛾(*Cydia notanthes* Meyrick)除危害楊桃外亦可危害荔枝，其在荔枝上之危害習性與粗腳姬捲葉蛾類似，兩者皆能危害荔枝果實及嫩梢；且二者均能以荔枝嫩梢飼育完成其生活史，惟其發育繁殖情形均較以玉米人工飼料飼育者為差。

關鍵詞：荔枝、龍眼、鱗翅目害蟲。

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前 言

荔枝 (*Litchi chinensis* Sonn) 及龍眼 (*Dimocarpus longans* Lour.) 為多年生常綠果樹，皆屬無患子科(Sapindaceae)。此兩種果品為台灣的特產，亦屬台灣加入世界貿易組織後較具競爭力的果品種類，栽植面積分別為 12,150 及 12,241 公頃。荔枝產地集中於高雄縣、南投縣、台南縣、台中縣及彰化縣等，年產量約 82,000 公噸。龍眼產地集中於台中縣、南投縣、嘉義縣、台南縣、高雄縣等地區，產量約為 102,000 公噸(Anonymous, 2004)。

荔枝及龍眼生育期間，害蟲種類繁多，據 Hwang (1988)報導已記錄者共計七日二十七科五十四種，常見者僅十餘種，而危害普遍且嚴重，必須採取防治措施的關鍵害蟲，主要有膠蟲 (*Kerra lacca* Kerr)、荔枝蓹蟪 (*Eriophyes litchi* Keifer) (Huang, 1967)及荔枝細蛾(*Conopomorpha sinensis* Bradley) (Hwang and Hung, 1996)等三種。Wen *et al.* (2002)報導龍眼上害蟲有 59 種，其中鱗翅目害蟲有 14 種。荔枝細蛾為直接影響荔枝及龍眼產量與品質之關鍵害蟲，其屬鱗翅目、細蛾科(Lepidoptera: Gracillariidae)，分佈於泰國、尼泊爾、印度、香港、廣東、廣西、福建、台灣等地區。其寄主植物包括荔枝、龍眼、決明(*Cassia tora* L.)、荳寶蓮(*Syzygium jambos* (L.) Alston)、蒲桃(*Syzygium malaccense* Merr.)等熱帶果樹。有關其生態、生活史、危害習性及防治都有報導(Hwang and Hsieh, 1983, 1989; Hwang and Hung, 1993; Huang *et al.*, 1994; Hung and Hwang, 1995; Hwang *et al.*, 1996; Hung *et al.*, 2002)。

鱗翅目昆蟲的幼蟲口器屬咀嚼式口器。當大量發生時，取食量大增，因而大量葉片被啃

食，致果樹營養的製造及生長受阻。尤其在矮化及畦式栽培管理時，荔枝植株葉片數量如較少則受影響更大。本試驗為了解荔枝及龍眼植株上鱗翅目害蟲種類與發生情形，定期採取荔枝、龍眼樹之嫩梢、花穗及果實調查其上之鱗翅目害蟲種類，同時利用性費洛蒙誘蟲法調查荔枝及龍眼上細蛾之種類及在荔枝園偵測花姬捲葉蛾。並且以套袋接蟲法、荔枝嫩梢飼育法觀察花姬捲葉蛾及粗腳姬捲葉蛾在荔枝上之發育繁殖及危害情形，冀望提供栽培者及農政相關單位之參考。

材料與方法

一、荔枝及龍眼之嫩梢、花穗及落果上之鱗翅類害蟲種類鑑定及調查方法

荔枝及龍眼之嫩梢、花穗之鱗翅類害蟲種類調查方法係將荔枝、龍眼園剪取之 20~30 枝嫩梢、花穗枝條，置入 57×50 cm 之塑膠袋中帶回試驗室，再將荔枝嫩梢枝條置於 30×30×30 cm 之壓克力網箱中，通風孔以報紙封口供幼蟲在其內取食，置於 25 ± 2°C 下，經二週檢視並記錄收集的昆蟲種類與蟲數。荔枝及龍眼落果上鱗翅類害蟲種類調查係撿拾地面落果攜回試驗室，以報紙包裹後置於 25 ± 2°C 下，經一~二週檢視並記錄報紙及果實上的昆蟲種類與蟲數。同時亦檢視以可可細蛾性費洛蒙配方(Beevor *et al.*, 1986; Hwang *et al.*, 1996)誘得之細蛾種類。本試驗調查所得之細蛾蟲體以 10% NaOH 水溶液浸 2~4 小時後解剖，依 Bradley (1986)所述細蛾雄蟲交尾器及雌蟲生殖系統形態鑑定種類，其他鱗翅目昆蟲送至國立台灣博物館王效岳先生及大英博物館 Enquiries Manager George R. Else 先生及其助理 Lee Rogers 先生鑑定。另並以花姬捲葉蛾性費洛蒙(Hwang *et al.*,

1987; Hung *et al.*, 2001)偵測花姬捲葉蛾在荔枝園發生之可能性。

二、荔枝鱗翅目害蟲種類與發生情形之調查

荔枝鱗翅目害蟲種類與發生情形之調查進行下列五個試驗：1.調查不同地區荔枝嫩梢害蟲種類：於1994年荔枝開花結果3至6月間，每月自台灣中部彰化縣社頭鄉、南投縣南投市、南投縣名間鄉及台灣南部高雄縣大樹鄉、台南縣竹崎鄉、嘉義縣白河鎮等不同地區荔枝園剪取荔枝嫩梢1~2次，依前述方法收集及記錄鱗翅類昆蟲種類及蟲數，比較台灣中部及南部於開花結果期3~6月間危害荔枝嫩梢之害蟲種類。2.荔枝花穗及果實害蟲種類發生情形調查：於1994年3月14日至7月4日每7~14日採集南投縣荔枝園之荔枝花穗及果實，依前述方法收集及記錄鱗翅類昆蟲種類及蟲數，以了解荔枝花穗及果實害蟲種類發生情形。3.調查荔枝嫩梢不同種類害蟲之年發生情形：1992年8月至1994年12月每週採集彰化縣社頭鄉荔枝園之荔枝嫩梢，如前述方法調查記錄鱗翅目害蟲種類及蟲數。所得資料換算為每月每次調查之平均蟲數，並進行出現頻度分析[(出現次數/調查總次數)×100%]，以了解各害蟲在為害荔枝嫩梢之重要性。4.調查荔枝上之細蛾種類：於1991至1994年間，將分別從台灣中部之台中縣、南投縣、彰化縣及南部之嘉義縣、台南縣、高雄縣等地之荔枝園內，以含有可可細蛾性費洛蒙的甲富黏膠式誘蟲盒誘集的細蛾及由落果及嫩梢收集之細蛾蟲體，依Bradley (1986)所述細蛾雄蟲交尾器及雌蟲生殖系統形態等，鑑定細蛾種類。

三、龍眼鱗翅目害蟲種類與發生情形之調查

龍眼鱗翅目害蟲種類與發生情形調查進行下列兩次試驗：1.龍眼嫩梢害蟲種類之調

查：於1994年9月22日至1994年12月7日於彰化縣社頭鄉龍眼園每週採取龍眼嫩梢，依前述方法收集及記錄鱗翅類昆蟲種類及蟲數。2.龍眼上之細蛾種類之調查：於1993年6~7月及1994年5~6月於彰化縣社頭鄉龍眼園每週採取龍眼嫩梢及撿取地上落果，收集細蛾蟲體，依Bradley (1986)所述細蛾雄蟲交尾器及雌蟲生殖系統形態等，鑑定細蛾種類。

四、花姬捲葉蛾及粗腳姬捲葉蛾危害荔枝之探討

探討花姬捲葉蛾及粗腳姬捲葉蛾危害荔枝之情形，進行下列三次試驗調查：1.利用性費洛蒙偵測花姬捲葉蛾於荔枝園之發生情形：1990年5月10日至7月10日分別於南投縣南投市及彰化縣社口鄉兩地區荔枝果園各設置3個花姬捲葉蛾三層式寶特瓶性費洛蒙誘蟲器，經兩個月後檢視誘蟲器內之蟲數，以了解花姬捲葉蛾在荔枝園發生的可能性。2.花姬捲葉蛾及粗腳姬捲葉蛾於荔枝樹上危害習性觀察：於荔枝第一次落果後(4月15日)，以50×50 cm之100 mesh 尼龍紗網將荔枝果穗套袋，防止荔枝幼果遭受蟲害。待至5月18日荔枝果實發育為中果時，每個套袋內接入粗腳姬捲葉蛾或花姬捲葉蛾一日齡成蟲5對，再每隔7天剪取3~5個套袋荔枝果穗，至6月18日為止，剪取的套袋果穗於室內觀察荔枝果實受粗腳姬捲葉蛾及花姬捲葉蛾為害情形。3.花姬捲葉蛾及粗腳姬捲葉蛾在荔枝嫩梢上之發育繁殖情形：花姬捲葉蛾及粗腳姬捲葉蛾試驗蟲源係取自試驗室以玉米人工飼料大量飼育之蟲源(Hung *et al.*, 1988; Hung and Hwang, 1991)，經以荔枝嫩梢飼育後產出之子代，單隻接入含有嫩梢之塑膠養蟲瓶，每日觀察記錄粗腳姬捲葉蛾及花姬捲葉蛾在荔枝

嫩葉中之發育、存活及繁殖情形，並依 Howe (1971) 方法以環境指數評估其對寄主之適宜性。分別觀察粗腳姬捲葉蛾及花姬捲葉蛾各 43 及 41 隻。同時分別量取以荔枝嫩梢及玉米人工飼料飼育的粗腳姬捲葉蛾及花姬捲葉蛾 1 日齡雌、雄蛹體的長與寬；以荔枝嫩梢飼育的粗腳姬捲葉蛾及花姬捲葉蛾雌、雄蛹分別量取 6、6 個及 15、8 個，以玉米人工飼料飼育者雌、雄蛹分別量取 100、100 個及 30、30 個。

結 果

一、荔枝鱗翅目害蟲種類與發生情形之調查

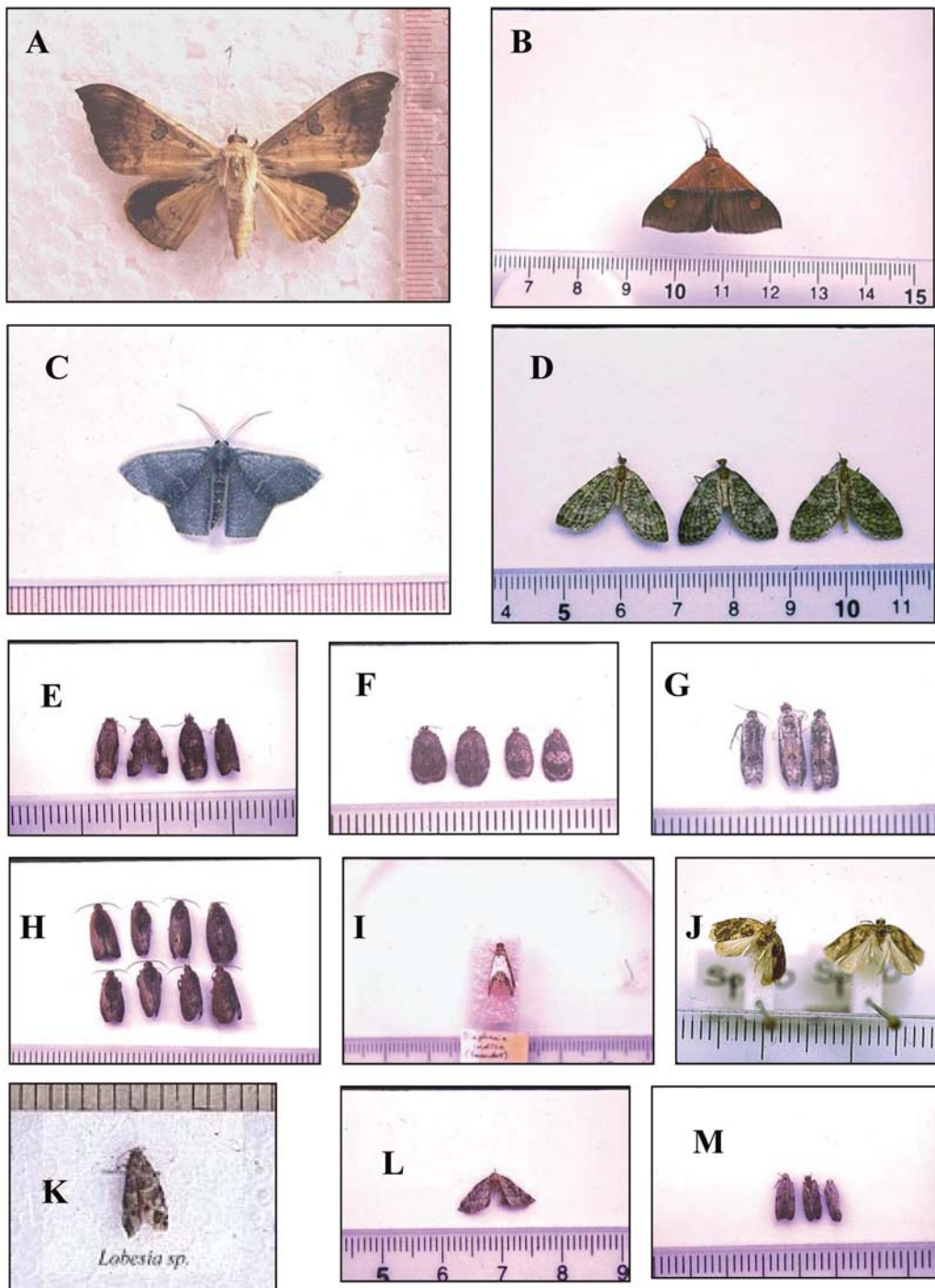
由荔枝、龍眼園內採集嫩梢調查鱗翅類昆蟲有 20 種，經鑑定結果有細蛾科二種；荔枝細蛾(*Conopomorpha sinensis* Bradley)及荔枝尖細蛾(*C. litchiella* Bradley)；捲葉蛾科六種：三角新捲葉蛾(*Statherotis leucaspis* Meyrick)、灰白條捲葉蛾(*Dudua aprobola* Meyrick)、圓翅捲葉蛾(*Eboda celligera* Meyrick)、*Adoxophyes privatana* (Walker)、*Lobesia* sp.及粗腳姬捲葉蛾(*Cryptophlebia ombrodelta* (Lower))；螟蛾科兩種：*Diaphania indica* (Saunders)及*Conogethes evaxalis* (Walker)；及夜蛾科兩種：*Sympis rufibasis* Guenée 及*Oxyodes scrobiculata* (Fabricius)；尺蠖蛾科(Geometridae)一種*Thalassodes immissarius* Walker 等 13 種。較常見種類有 *Conopomorpha* sp.、三角新捲葉蛾、灰白條捲葉蛾、圓翅捲葉蛾、屬 *Larentiinae* 之蛾類、*S. rufibasis*、*T. immissarius*、及兩種未知的蛾類昆蟲(圖一)。

不同地區荔枝嫩梢害蟲種類調查結果如圖二、三。於台灣中部及南部由荔枝嫩梢採集到的害蟲均有四種，南部者較中部者數量為多。由台灣中部荔枝嫩梢收集的鱗翅類害蟲有

Conopomorpha sp.、三角新捲葉蛾、屬 *Larentiinae* 之蛾類、及 *T. immissarius* 等四種，於 3、4 月者收集到之數量極少，以 6 月份者較多，其中三角新捲葉蛾數量較多(圖二)。由台灣南部荔枝嫩梢收集的鱗翅類害蟲有 *Conopomorpha* sp.、三角新捲葉蛾、*S. rufibasis* 及 *T. immissarius* 等四種，於 3 至 6 月間以三角新捲葉蛾發生數量最多(圖三)。由兩地區之害蟲別顯示 *Conopomorpha* sp.、三角新捲葉蛾及 *T. immissarius* 等三種害蟲普遍發生，而 3~6 月間屬 *Larentiinae* 之蛾類於中部、*S. rufibasis* 於南部發生較多。

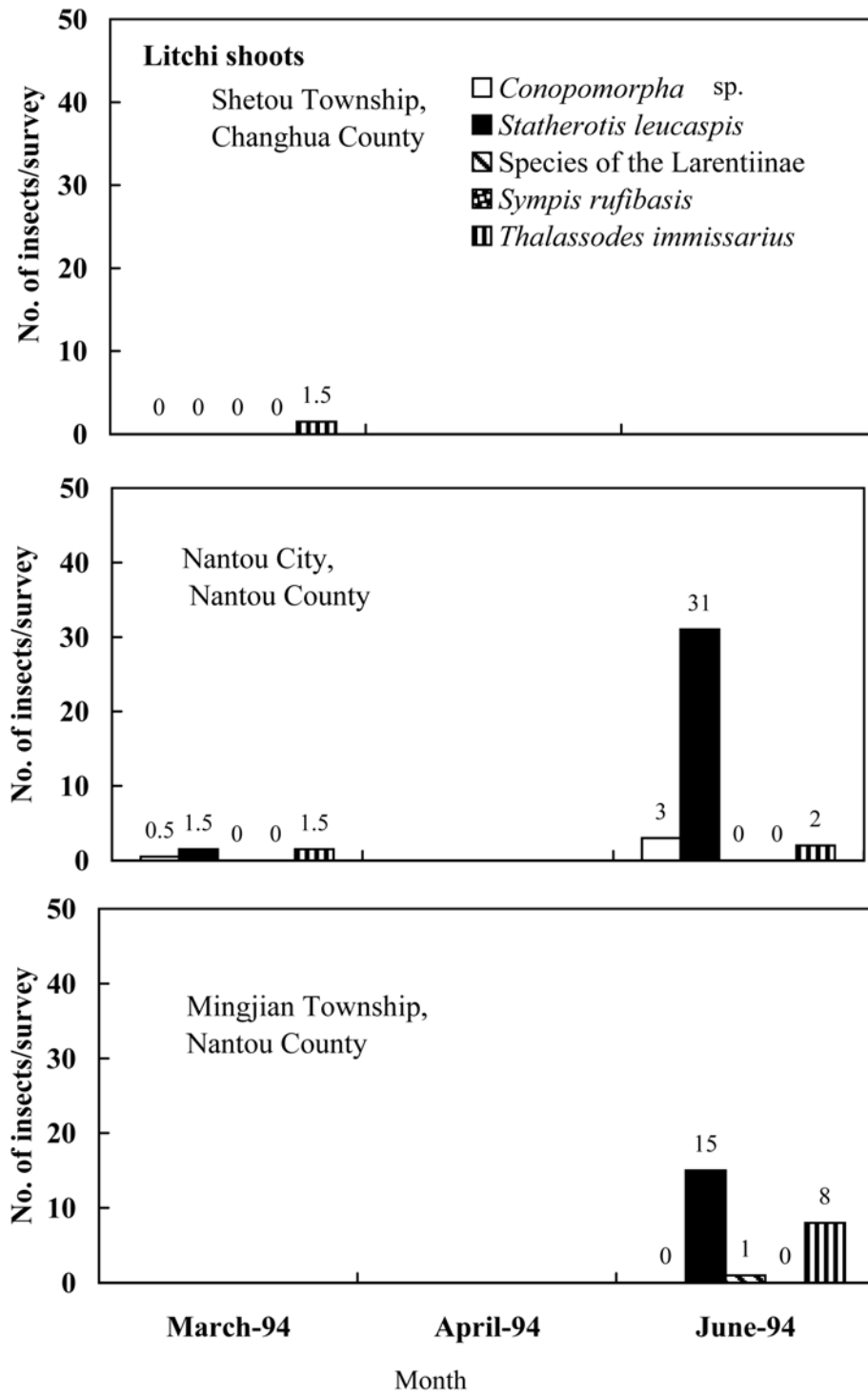
荔枝花穗及果實害蟲種類發生情形如圖四。從三至七月害蟲採集情形，三月份未採集到；於四月份採集到較多的種類有三角新捲葉蛾、圓翅捲葉蛾、*T. immissarius*、及 unknown species B，分別為 1.3、7.3、0.5、1.8 insects/survey；五至七月僅採集到細蛾，分別為 3、37.3、52 insects/survey，顯示荔枝果實期害蟲以細蛾為主。

彰化縣社頭鄉荔枝嫩梢不同種類害蟲之年發生情形如圖五。較常見者有 9 種，分別為 *Conopomorpha* sp.、三角新捲葉蛾、圓翅捲葉蛾、屬 *Larentiinae* 之蛾類、灰白條捲葉蛾、*S. rufibasis*、*T. immissarius* 及 unknown species A、unknown species B 等。在荔枝抽梢期 2~3 月、9~10 月有高峰，其中以三角新捲葉蛾密度最高，其他蟲種每次採集數量都低於 5 insects/survey (圖五)。就採集到的頻度分析，採集到的頻度高於 50%者，有三角新捲葉蛾、屬 *Larentiinae* 之蛾類、細蛾、及 *T. immissarius*。其中以三角新捲葉蛾的採集到的頻度最高，社頭地區者於 1992、1993、1994 年分別為 100、90.5、62.9%，南投市者於 1994 年為 65.5%。屬 *Larentiinae* 之蛾類在 1992 年社頭地區者達 65%，細蛾類害蟲在



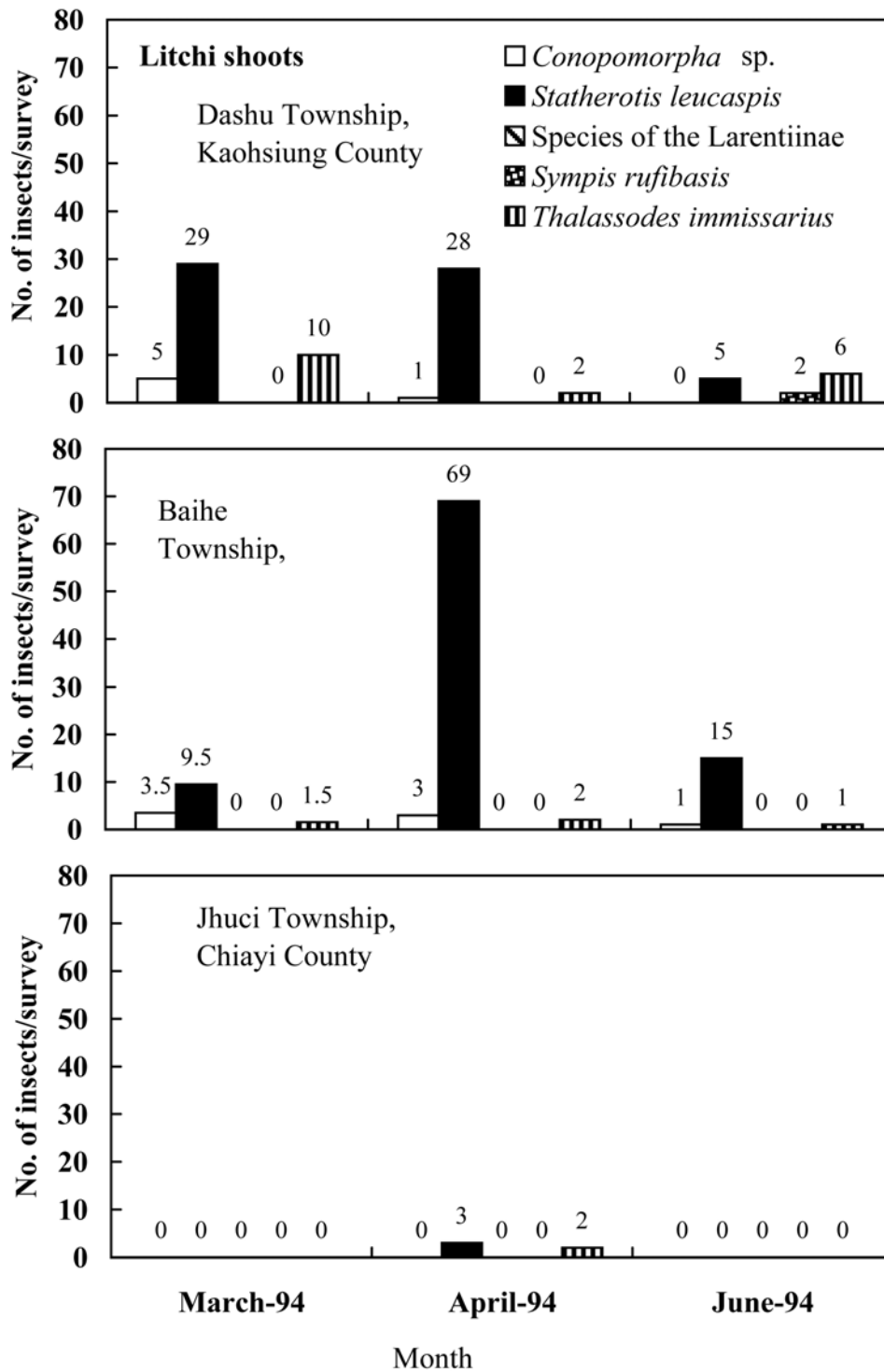
圖一 由荔枝、龍眼嫩梢採得之鱗翅類害蟲種類。

Fig. 1. Lepidopterous pests collected from litchi and longan shoots in Taiwan. Their scientific names are as follows: A: *Oxyodes scrobiculata* (Fabricius), B: *Sympis rufibasis* Guenée, C: *Thalassodes immissarius* Walker, D: species of the Larentiinae, E: *Statherotis leucaspis* Meyrick, F: *Eboda celligera* Meyrick, G: *Dudua aprobola* Meyrick, H: *Cryptophlebia ombrodelta* (Lower), I: *Diaphania indica* (Saunders), J: *Adoxophyes privatana* (Walker), K: *Lobesia* sp., L: unknown species A, and M: unknown species B. One graduation of the scale in each figure is equivalent of 1 mm.



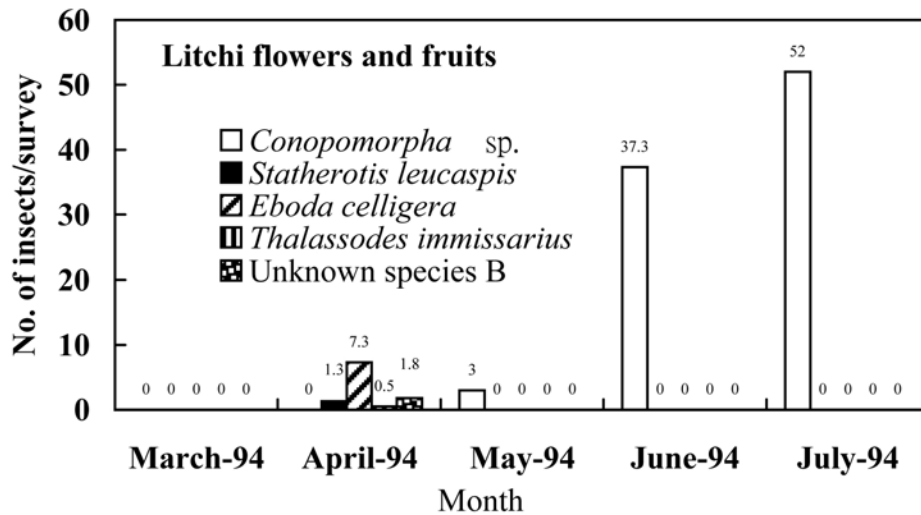
圖二 1994年3~6月於台灣中部不同地區荔枝嫩梢鱗翅類害蟲之發生情形。

Fig. 2. Occurrence of lepidopterous pests collected from litchi shoots in central Taiwan from March to June, 1994.



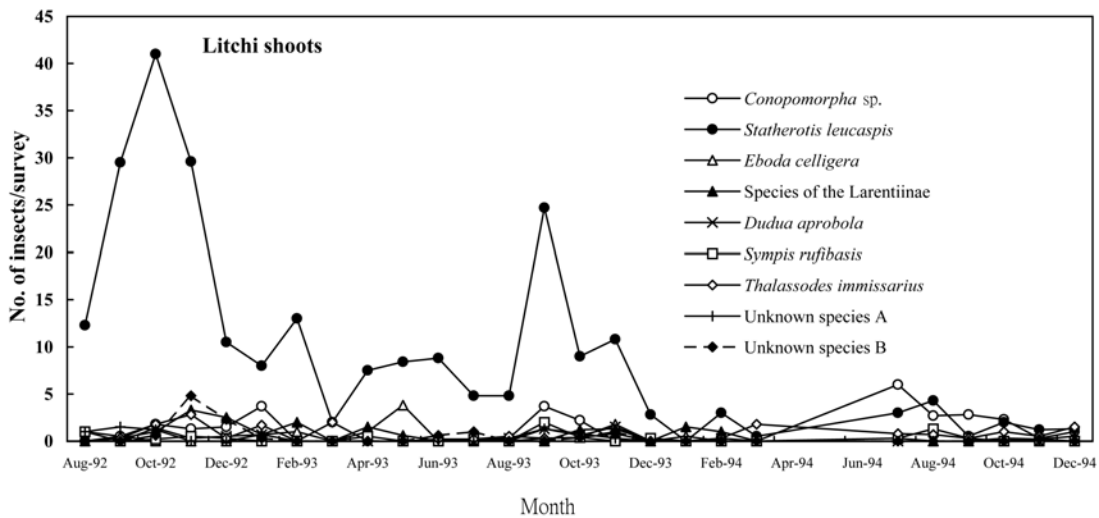
圖三 1994年3~6月於台灣南部不同地區荔枝嫩梢鱗翅類害蟲之發生情形。

Fig. 3. Occurrence of lepidopterous pests collected from litchi shoots in southern Taiwan from March to June, 1994.



圖四 1994年3~7月於南投縣荔枝花穗及果實鱗翅類害蟲之發生情形。

Fig. 4. Occurrence of lepidopterous pests collected from litchi flowers and fruits in Nantou County, Taiwan, from March to July, 1994.

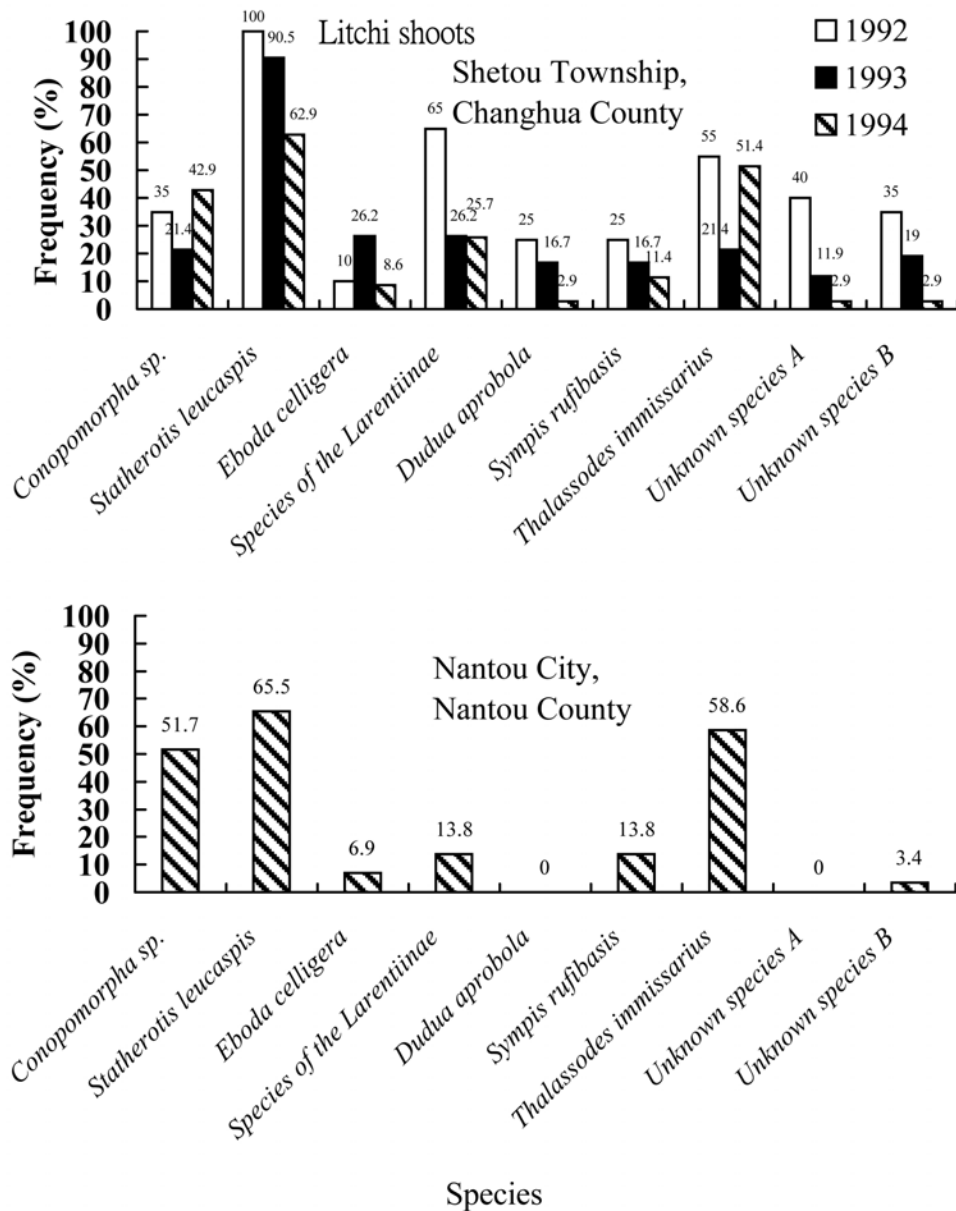


圖五 1992年至1994年於彰化縣社頭鄉荔枝果園荔枝嫩梢鱗翅類害蟲之發生情形。

Fig. 5. Occurrence of lepidopterous pests collected from litchi shoots in Shetou Township, Changhua County, Taiwan from 1992 to 1994.

1994年南投市者為51.7%。*T. immissarius*在1992及1994社頭地區者與在1994年南投市者分別達55及51.4%與58.6%(圖六)。

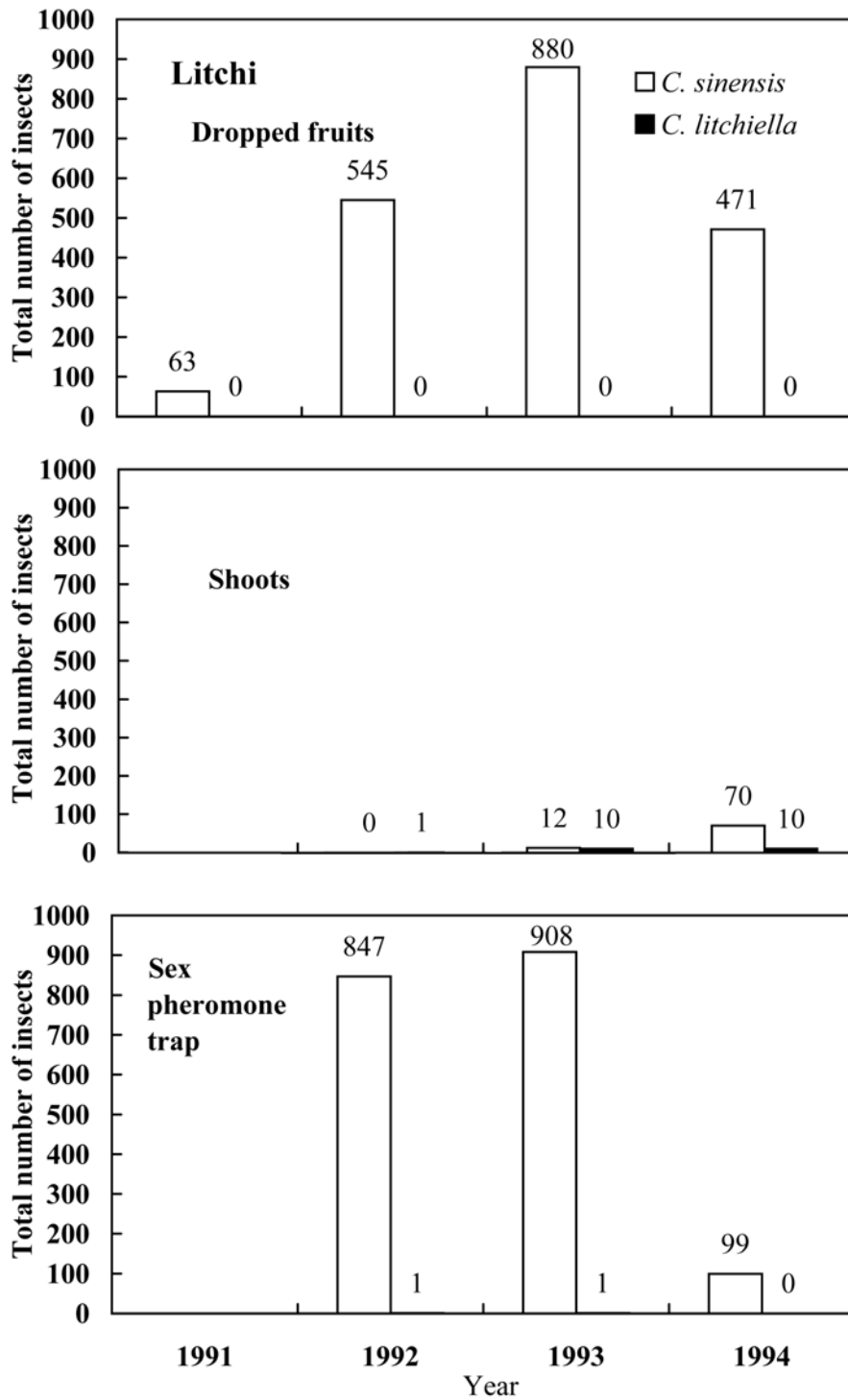
經1991至1994年進一步調查荔枝上之細蛾種類結果顯示於荔枝果實上危害之細蛾種類為荔枝細蛾(*C. sinensis*)，由嫩梢上採得



圖六 彰化縣社頭鄉及南投市荔枝園之荔枝嫩梢鱗翅類害蟲種類之發生頻度。
 Fig. 6. Frequency (%) of lepidopterous pests collected from litchi shoots in Shetou Township, Changhua County, and Nantou City, Nantou County, Taiwan from 1992 to 1994.

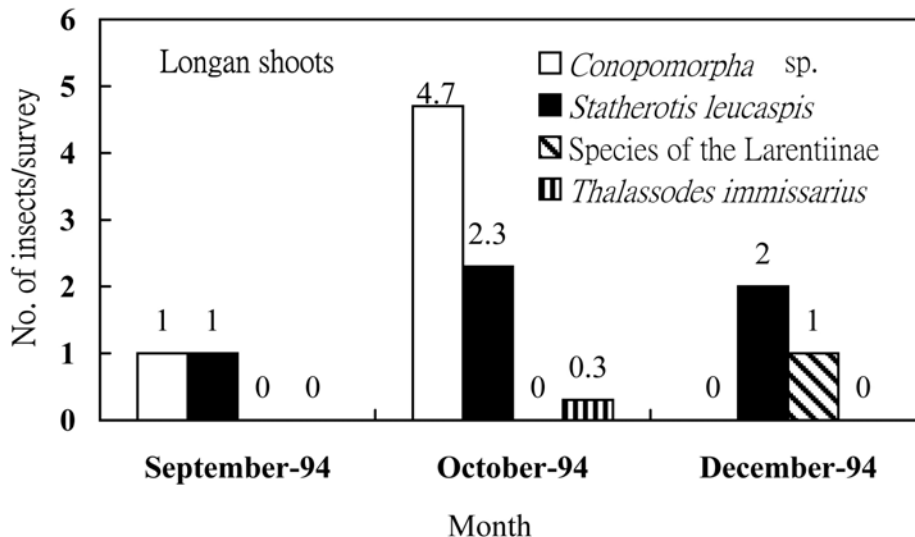
的細蛾有兩種為荔枝細蛾及荔枝尖細蛾(*C. litchiella*)；而由可可細蛾性費洛蒙誘餌誘集之細蛾種類多為荔枝細蛾，於三年誘集調查中

1856 隻細蛾僅有 2 隻荔枝尖細蛾(圖七)。由此顯示危害台灣荔枝的細蛾主要為荔枝細蛾，而荔枝尖細蛾以取食嫩梢為主，發生量極少。



圖七 於 1991 至 1994 年於荔枝嫩梢、落果及以性誘引劑收集之細蛾種類調查結果。

Fig. 7. Species of *Conopomorpha* collected from dropped fruits and shoots of litchi, and trapped with sex attractants in Taiwan from 1991 to 1994.



圖八 1994年9至12月於彰化縣社頭鄉龍眼嫩梢鱗翅類害蟲種類之發生情形。

Fig. 8. Occurrence of lepidopterous pests collected from longan shoots in Shetou Township, Changhua County, Taiwan from September to December, 1994.

二、龍眼鱗翅目害蟲種類與發生情形調查

龍眼嫩梢害蟲種類調查結果如圖八。由彰化縣社頭鄉龍眼嫩梢收集的鱗翅類害蟲有 *Conopomorpha* sp.、三角新捲葉蛾、屬 Larentiinae 之蛾類及 *T. immissarius* 等四種，於 9~12 月者收集到之數量極少，其中細蛾類於 10 月收集到之數量較多，達 4.7 insects/survey (圖八)。由龍眼落果及嫩梢上收集的細蛾種類如圖九。經解剖鑑定結果顯示由龍眼落果收集到的細蛾其種類為 *C. sinensis*；由龍眼嫩梢收集到的細蛾數量很少，含 *C. sinensis* 及 *C. litchilla* 兩種細蛾類害蟲(圖九)。

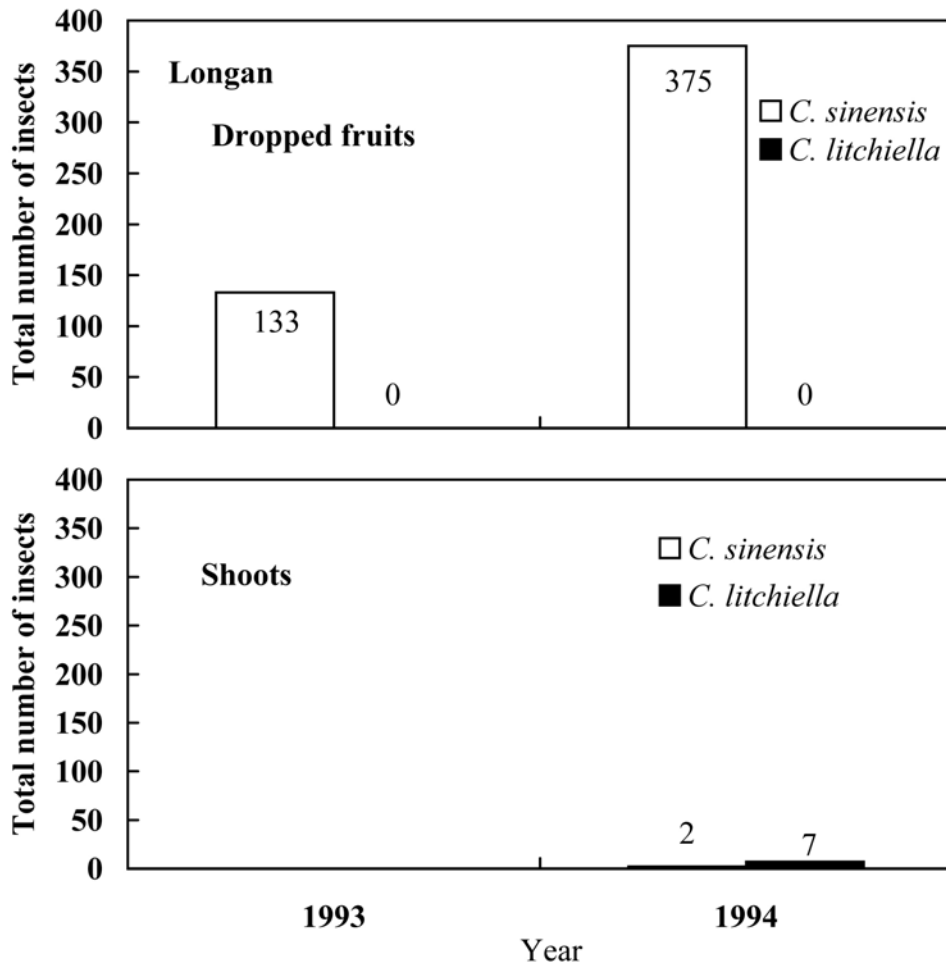
三、花姬捲葉蛾及粗腳姬捲葉蛾危害荔枝之探討

1990 年於南投及社口兩地區荔枝果園各設置 3 個三層式寶特瓶性費洛蒙誘蟲器偵測花姬捲葉蛾存在荔枝園之可能性，經兩個月期間

分別於兩地誘到 72、69、101 隻及 122、78、36 隻，由此顯示荔枝果園中有花姬捲葉蛾存在。

再經套袋接蟲法試驗結果顯示花姬捲葉蛾確可危害荔枝，而於嫩葉上有採到的粗腳姬捲葉蛾亦能危害荔枝的果實。花姬捲葉蛾及粗腳姬捲葉蛾兩者危害荔枝習性及發育期相似，其成蟲可產卵於荔枝葉面、枝條及果實上，另將荔枝果穗接入成蟲後，經 16 日發現發育中之 2~3 齡幼蟲，並於果實內取食種仁，排出糞便，再經 7 日後發現有蛹，老熟幼蟲大多化蛹於枝條間及網袋上。

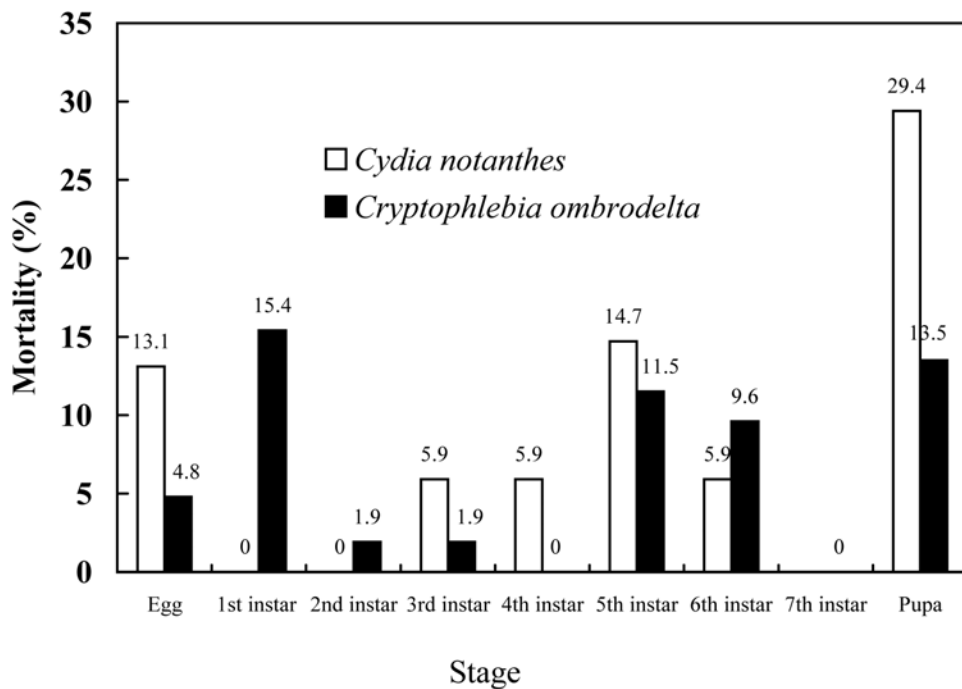
花姬捲葉蛾及粗腳姬捲葉蛾以荔枝嫩梢飼育結果如圖十、表一、二及三。花姬捲葉蛾及粗腳姬捲葉蛾以荔枝嫩梢飼育可完成其生活史，惟蛹體、繁殖力、環境指數等均較室內以玉米人工飼料飼育者為差。於 $25 \pm 2^\circ\text{C}$ 以荔枝嫩梢飼育花姬捲葉其卵期 3.2 日、幼蟲期 24.5 日及蛹期 6.9 日，雌、雄蟲壽命分別為



圖九 1993 及 1994 年由龍眼落果及嫩梢收集之細蛾種類調查結果。
 Fig. 9. Species of *Conopomorpha* collected from dropped fruits and shoots of longan in Taiwan from 1993 to 1994.

12.7 及 9.2 日。以荔枝嫩梢飼育粗腳姬捲葉蛾其卵期 4.1 日、幼蟲期 23.2 日及蛹期 8.8 日，雌、雄蟲壽命分別為 9.5 及 11.2 日(表一)。以荔枝嫩梢飼育之花姬捲葉蛾及粗腳姬捲葉蛾之幼蟲齡期數增加，分別達 6 及 7 齡(表一)；各齡期死亡情形花姬捲葉蛾以蛹期死亡率最高，達 29.4%；粗腳姬捲葉蛾者則以第一、五、六齡幼蟲及蛹期者較高，分別達 15.4、11.5、9.6 及 13.5%；顯示花姬捲葉蛾及粗腳姬捲葉蛾以荔枝嫩梢飼育從卵至成蟲羽化之存活率

偏低，分別為 25.1 及 41.4% (圖十)。以荔枝嫩梢飼育之花姬捲葉蛾及粗腳姬捲葉蛾之蛹體較以玉米人工飼料飼育者為小，約僅為以玉米人工飼料飼育者之一半。如以荔枝嫩梢飼育之花姬捲葉蛾之蛹體的長×寬，雌、雄蛹分別為 5.5、4.0 mm²；以玉米人工飼料飼育者為 13.5、10.3 mm² (表二)。以荔枝嫩梢飼育之粗腳姬捲葉蛾之蛹體的長×寬，雌、雄蛹分別為 12.54、14.40 mm²；以玉米人工飼料飼育者為 29.29、27.16 mm² (表二)。花姬捲葉蛾



圖十 花姬捲葉蛾、粗腳姬捲葉蛾以荔枝嫩梢飼育之各齡期死亡率。

Fig. 10. Mortality of *Cydia notanthes* and *Cryptophlebia ombrodelta* reared on litchi shoots at $25 \pm 2^\circ\text{C}$, $70 \pm 5\%$ RH, and a 12L: 12D photoperiod.

及粗腳姬捲葉蛾以荔枝嫩葉飼育之繁殖情形如表三。二者之繁殖力分別為 65.7 及 59.3 eggs/female，其環境指數分別為 7.33 及 7.36。由本試驗結果證實粗腳姬捲葉蛾及花姬捲葉蛾於荔枝上可完成其生活史，惟二者在荔枝上之發育繁殖較室內以玉米人工飼料飼育者為差。

討 論

由本調查顯示危害荔枝及龍眼的鱗翅類害蟲種類類似，荔枝、龍眼園內採集嫩梢調查鱗翅類昆蟲共有 20 種，其中除荔枝細蛾為荔枝及龍眼的關鍵害蟲外，其他在荔枝上經年較常見種類有 *Conopomorpha* sp.、三角新捲葉蛾、灰白條捲葉蛾、圓翅捲葉蛾、屬

Larentiinae 之蛾類、*S. rufibasis*、*T. immissarius*、及兩種未知的蛾類昆蟲等 9 種。在龍眼嫩梢採集到常見的鱗翅類害蟲有 *Conopomorpha* sp.、三角新捲葉蛾、屬 Larentiinae 之蛾類、及 *T. immissarius* 等四種。Wen *et al.* (2002) 報導台灣南部龍眼上害蟲有 59 種，其中鱗翅類害蟲有灰白條捲葉蛾、小白紋毒蛾(*Orgyia posticus* Walker)、台灣黃毒蛾(*Porthesia taiwana* Shiraki)、南投天社蛾(*Stauropus alternus* Walker)、斜紋夜蛾(*Spodoptera litura* Fabricius)、荔枝尖細蛾、荔枝細蛾、三角新捲葉蛾、咖啡木蠹蛾(*Zeuzera coffeae* Nietner)、圓翅捲葉蛾、大避債蛾(*Clania preyeri* Leech)、台灣青尺蠖(*Pingasa sngnaiuia* Guenue)、樟青尺蠖蛾(*Thalassodes acuta* Pront)、及恆春小灰蝶

表一 花姬捲葉蛾、粗腳姬捲葉蛾以荔枝嫩梢飼育之各齡期發育日數

Table 1. Duration of development of *Cydia notanthes* and *Cryptophlebia ombrodelta* reared on litchi shoots at 25 ± 2°C, 70 ± 5% RH, and a 12L:12D photoperiod

Stage	<i>C. notanthes</i>		<i>C. ombrodelta</i>	
	<i>n</i>	Duration in days (X ± S.D.)	<i>n</i>	Duration in days (X ± S.D.)
Egg	138	3.2 ± 1.0	335	4.1 ± 1.0
Larval	23	20.5 ± 3.9	31	23.2 ± 2.2
1 st instar	19	3.2 ± 0.9	39	4.1 ± 0.3
2 nd instar	17	3.1 ± 0.3	37	1.8 ± 0.7
3 rd instar	21	2.8 ± 0.8	37	3.5 ± 1.2
4 th instar	21	3.6 ± 1.8	41	2.5 ± 1.2
5 th instar	25	6.1 ± 2.6	34	4.6 ± 3.0
6 th instar	2	8.5 ± 2.1	21	6.0 ± 2.8
7 th instar			7	7.7 ± 1.0
Pupa	12	6.9 ± 0.8	24	8.8 ± 0.8
Adult longevity				
♀	11	12.7 ± 5.5	26	9.5 ± 4.6
♂	6	9.2 ± 8.5	18	11.2 ± 4.2

表二 以荔枝嫩梢及玉米人工飼料飼育花姬捲葉蛾及粗腳姬捲葉蛾蛹之長、寬(mm)

Table 2. Body size of pupae of *Cydia notanthes* and *Cryptophlebia ombrodelta* reared on litchi shoots

Sex	Food	<i>n</i>	Length (X ± S.D., mm)	Width (X ± S.D., mm)	L×W
<i>Cydia notanthes</i>					
♀	Litchi shoot	6	5.0 ± 0.3	1.1 ± 0.2	5.5
	Corn diet	100	7.5 ± 0.3	2.3 ± 0.1	13.5
♂	Litchi shoot	6	4.0 ± 0.4	1.0 ± 0	4.0
	Corn diet	100	5.7 ± 0.2	1.8 ± 0.1	10.3
<i>Cryptophlebia ombrodelta</i>					
♀	Litchi shoot	15	6.6 ± 0.7	1.9 ± 0.2	12.54
	Corn diet	30	10.1 ± 0.5	2.9 ± 0.2	29.29
♂	Litchi shoot	8	7.2 ± 0.6	2.0 ± 0	14.40
	Corn diet	30	9.7 ± 0.5	2.8 ± 0.2	27.16

(*Deudorix epijarbas* Moore)等 14 種。本次調查結果同有灰白條捲葉蛾、荔枝尖細蛾、荔枝細蛾、三角新捲葉蛾、圓翅捲葉蛾等種類。台灣中、南部兩地區之荔枝嫩梢害蟲調查顯示 *Conopomorpha* sp.、三角新捲葉蛾及 *T. immissarius* 為台灣較常見的種類；而於 3~6 月間以屬 Larentiinae 之蛾類於中部，*S. rufibasis* 於南部較多。荔枝花穗及果實害蟲

種類發生情形，花穗及幼果期有三角新捲葉蛾、圓翅捲葉蛾、*T. immissarius*、及 unknown species B 等種類危害取食。於荔枝果實期害蟲以 *Conopomorpha* sp. 為主。荔枝嫩梢不同種類害蟲之年發生情形顯示較常見鱗翅類害蟲有 9 種，採集到的頻度高於 50% 者，有三角新捲葉蛾、屬 Larentiinae 之蛾類、*Conopomorpha* sp. 及 *T. immissarius* 等。至

表三 花姬捲葉蛾、粗腳姬捲葉蛾以荔枝嫩梢飼育之繁殖情形

Table 3. Periods of preoviposition, oviposition, sex ratio, and fecundity of *Cydia notanthes* and *Cryptophlebia ombrodelta* reared on litchi shoots

Species	Period in days (X ± S.D.)		Sex ratio (♀ / ♀ + ♂)	Fecundity (eggs / ♀)	E.I. ¹⁾
	Pre-oviposition	Oviposition			
<i>C. notanthes</i>	3.2 ± 2.8	4.5 ± 1.8	0.58	65.7 ± 45.4	7.33
<i>C. ombrodelta</i>	2.8 ± 2.8	3.8 ± 2.6	0.63	59.3 ± 63.5	7.76

¹⁾ E.I.: Environmental index, $(\ln(S \times E \times F)) / T \times 100$, where ln: natural logarithm, S: survival rate, E: fecundity, F: sex ratio, T: developmental period.

於危害台灣荔枝及龍眼的細蛾種類，經調查結果顯示危害荔枝及龍眼果實的細蛾種類為荔枝細蛾，荔枝尖細蛾僅在嫩梢收集到。而以可可細蛾性費洛蒙誘蟲器誘得之細蛾皆為荔枝細蛾(*Conopomorpha sinensis*)，顯示在台灣造成荔枝及龍眼經濟危害之細蛾種類為荔枝細蛾。

在本試驗中由荔枝嫩梢採到的粗腳姬捲葉蛾，經文獻查詢其英名有 litchi fruit moth (荔枝果蛀蟲)，macadamia nut borer (胡桃果蛀蟲)及 tamarind fruit borer (羅望子果蛀蟲)。分布於亞洲、印度、澳洲及大洋洲等地。為害胡桃、荔枝、羅望子、楊桃、皇帝豆、阿勃勒(臘腸樹)、橙、豆科之決明屬及合歡屬等寄主 (Ironside, 1974; Lingappa and Siddappaji, 1981; Ho, 1985; Chang and Chen, 1989; Jones, 1994)。在澳洲、夏威夷主要危害荔枝和胡桃，於澳洲曾報導胡桃受其危害損失率高達 60%，於印度報導其亦能危害羅望子，由於其鑽入果實危害的習性，藥劑防治不易(Lingappa and Siddappaji, 1981; Jones, 1994)。於台灣楊桃上，其重要性為僅次於花姬捲葉蛾的果實蛀蟲(Ho, 1985)。另筆者曾於 91 年 6 月 26 日於霧峰荔枝園地面落果採到一隻粗腳姬捲葉蛾，由本試驗以套袋接蟲於荔枝果穗中及荔枝嫩梢飼育，顯示粗腳姬捲葉蛾可於荔枝之果實及嫩梢上發育繁殖。在荔

枝嫩梢中發育繁殖之環境指數 7.36，較於室內以玉米人工飼料飼育者 11.4 及以皇帝豆飼育者 12.2 為低(Hung *et al.*, 1988)。

本試驗中雖未從荔枝嫩梢、果實中採得花姬捲葉蛾蟲體，但由兩地區誘蟲偵測結果、套袋接蟲結果以及以嫩梢單隻飼育結果顯示荔枝可為花姬捲葉蛾之寄主。惟由其在荔枝嫩梢中發育繁殖之表現與環境指數 7.33，較室內以玉米人工飼料飼育者 9.83 為低(Hung and Hwang, 1991)。粗腳姬捲葉蛾及花姬捲葉蛾兩者皆可於荔枝果穗上取食危害，幼蟲期約為 23 日。由採樣調查顯示二者在荔枝園的密度很低，此可能係二者在果實中之幼蟲期較荔枝細蛾者(10 日)為長，且荔枝細蛾多取食果實蒂部導致落果；引來螞蟻攻擊之故。另荔枝嫩梢生長期僅為每年 2~3 月、7~8 月及 10~11 月間，果實發育期亦僅為每年的 4~7 月，無法有連續性的食物供給致影響其發育繁殖。

綜合以上所述，荔枝細蛾、三角新捲葉蛾及 *T. immissarius* 等三種害蟲為台灣地區荔枝、龍眼較普遍發生之鱗翅類害蟲。荔枝細蛾為荔枝、龍眼關鍵害蟲；三角新捲葉蛾屬小型蛾類，取食部位主為荔枝、龍眼之新梢處；尺蠖蛾 *T. immissarius* 為屬中型蛾類，其幼蟲取食量較大，須注意其發生。尤其是在矮化及畦式栽培管理時葉片數量較少時，可能會影響植株養分之製造。花姬捲葉蛾及粗腳姬捲葉蛾

在荔枝及龍眼園中族群密度很低，本試驗證實兩者均可直接取食危害果實，應注意其族群密度的變化。

誌 謝

本研究經費承農委會 85 科技-1.6-糧-28(7)、86 科技-1.6-糧-19(4)、87 科技-1.3-糧-26(3-3B)、90 農科-6.2.3-藥-P1 計畫經費補助，試驗期間承江碧媛、謝玉琴、陳美華、馬意蘋小姐、林信宏、白健民、陳冠宇先生協助試驗，助理王文龍先生協助校稿，僅此一併致謝。

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收件日期：2005年10月27日

接受日期：2006年1月30日

Survey of Lepidopterous Pests of Litchi and Longan in Taiwan

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ABSTRACT

Lepidopterous pests of litchi (*Litchi chinensis* Sonn) and longan (*Dimocarpus longans* Lour.) in Taiwan were surveyed by studying shoots, spikes of flowers, and fruits of litchi and longan, and were also detected using the sex pheromones of *Cydia notanthes* Meyrick and *Conopomorpha cramerella* (Snellen). Results showed that 20 species of lepidopterous pests were collected from litchi shoots. Only 13 of them were identified which included two species of the Gracillariidae, *Conopomorpha sinensis* Bradley and *C. litchiella* Bradley; six species of the Tortricidae, *Statherotis leucaspis* Meyrick, *Dudua aprobola* Meyrick, *Eboda celligera* Meyrick, *Adoxophyes privatana* (Walker), *Lobesia* sp., and *Cryptophlebia ombrodelta* (Lower); two species of the Pyralidae, *Diaphania indica* (Saunders) and *Conogethes evaxalis* (Walker); two species of the Noctuidae, *Sympis rufibasis* Guenée and *Oxyodes scrobiculata* (Fabricius); and one species of the Geometridae, *Thalassodes immissarius* Walker. Species of lepidopterous pests in litchi in central and southern Taiwan were similar, while species of the Larentiinae and *S. rufibasis* were collected from central and southern Taiwan, respectively. Five species of lepidopterous pests were collected from the spikes of flowers and fruits of litchi, and greater numbers of *Conopomorpha* sp. were found. There were nine species consistently collected from litchi shoots from 1992 to 1994 in Shetou Township, Changhua County. These species included *Conopomorpha* sp., *S. leucaspis*, *E. celligera*, *D. aprobola*, species of the Larentiinae, *S. rufibasis*, *T. immissarius*, and two unknown species. The survey density and frequency of collection of *S. leucaspis* were the highest among all species in litchi orchards from 1992 to 1994. The frequencies of collection of *Conopomorpha* sp. and *T. immissarius* were 21.4-51.7% and 21.4-58.6%, respectively. The lepidopterous pests collected from longan shoots were similar to those of litchi, including *Conopomorpha* sp., *S. leucaspis*, species of the Larentiinae, and *T. immissarius*. Among species of the Gracillariidae on litchi and longan of Taiwan, the main species was *C. sinensis* collected from shoots, fruits of litchi and longan, and sex pheromone traps of using pheromones from *C. cramerella*. The number of *C. litchiella* collected was very small, coming only from the shoots of litchi and longan and the traps. Based on the results of those detected with the sex pheromone, the bagging method, and rearing with shoots of litchi, the carambola fruit borer, *C. notanthes*, infests litchi as well as carambola in Taiwan. Both *C. notanthes* and *C. ombrodelta* (Lower) produced similar levels of infestation on litchi, infesting the shoots and fruits. However the performances of both species reared on litchi shoots were worse than those reared on an artificial corn diet.

Key words: litchi, longan, lepidopterous pests