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Life cycles of *Cazira verrucosa* (Westwood) and *Eocanthecona concinna* (Walker) (Heteroptera: Pentatomidae) 【Scientific note】

厲椿與雙峰疣椿象 (半翅目：椿科) 之生活史【科學短訊】

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Abstract

The life cycles of two predatory stink bugs *Cazira verrucosa* and *Eocanthecona concinna* (Heteroptera: Pentatomidae) were studied in the laboratory under L:D 14:10 regime with temperature controlled at $23 \pm 3^\circ\text{C}$ and relative humidity at 70%. *E. concinna* were fed with blowfly larvae, *C. verrucosa* with *Aulacophora indica*. Eggs were laid in egg masses. For *E. concinna* there were 60 eggs per mass and for *C. verrucosa* there were only 7.7 eggs per mass. The egg stage for *E. concinna* and *C. verrucosa* was 8.0 and 7.7 days, respectively. For both species there were 5 stadia. For *E. concinna*, the body length of five instars was 1.48, 1.97, 3.74, 6.64 and 9.89 mm, and the stadia duration was 4.6, 5.2, 5.4, 6.1 and 10.3 days, respectively. For *C. verrucosa*, the body length of five instars was 1.33, 2.75, 3.75, 5.12 and 7.56 mm and the stadia duration was 4.0, 4.2, 5.4, 5.0 and 10 days, respectively.

摘要

在實驗室室溫 $23 \pm 3^\circ\text{C}$ 及光照14D:10L、相對溼度70%的環境下，進行兩種肉食性椿象厲椿與雙峰疣椿象的生活史研究。用麗蠅的幼蟲作為飼料飼養厲椿。雌蟲產卵，皆產於背光處，產卵時常多粒產於一處，形成卵塊。每次產卵約45~75顆卵的卵塊，平均60顆，卵期 8.0 ± 2.5 天。若蟲脫皮四次，為五個齡期，第五次脫皮即為成蟲；一至五齡若蟲體長分別為1.48、1.97、3.74、6.64以及9.89 mm；各齡期為4.6、5.2、5.4、6.1以及10.3天。用鱗翅目幼蟲及黃守瓜作為飼料飼養雙峰疣椿象，卵為黑色，形狀呈壺型，具卵蓋；雌蟲大多產卵於葉下等背光處，雌蟲每次產卵約2~13粒卵之卵塊，平均 7.7 ± 3.6 粒，卵期平均 10.4 ± 1.3 天。若蟲分為五個齡期，體長分別為1.33、2.75、3.75、5.12及7.56 mm。若蟲各齡期平均為4.0、5.4、5.0、5.3及10.2天。

Key words: *Cazira verrucosa*, *Eocanthecona concinna*, Heteroptera, Pentatomidae, life cycle

關鍵詞: 厲椿、雙峰疣椿、異翅目、椿科、生活史。

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厲椿與雙峰疣椿象 (半翅目：椿科) 之生活史

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摘 要

在實驗室室溫 $23 \pm 3^{\circ}\text{C}$ 及光照 14D:10L, 相對溼度 70% 的環境下, 進行兩種肉食性椿象厲椿與雙峰疣椿象的生活史研究。用麗蠅的幼蟲作為飼料飼養厲椿。雌蟲產卵, 皆產於背光處, 產卵時常多粒產於一處, 形成卵塊。每次產卵約 45~75 顆卵的卵塊, 平均 60 顆, 卵期 8.0 ± 2.5 天。若蟲脫皮四次, 為五個齡期, 第五次脫皮即為成蟲; 一至五齡若蟲體長分別為 1.48、1.97、3.74、6.64 以及 9.89 mm; 各齡期為 4.6、5.2、5.4、6.1 以及 10.3 天。用鱗翅目幼蟲及黃守瓜作為飼料飼養雙峰疣椿象, 卵為黑色, 形狀呈甕型, 具卵蓋; 雌蟲大多產卵於葉下等背光處, 雌蟲每次產卵約 2~13 粒卵之卵塊, 平均 7.7 ± 3.6 粒, 卵期平均 10.4 ± 1.3 天。若蟲分為五個齡期, 體長分別為 1.33、2.75、3.75、5.12 及 7.56 mm。若蟲各齡期平均為 4.0、5.4、5.0、5.3 及 10.2 天。

關鍵詞：厲椿、雙峰疣椿、異翅目、椿科、生活史。

前 言

椿象全世界約有 55,000 種, 屬半翅目之昆蟲 (Hemiptera)。由於口器的特化, 形成吸食式口器 (sucking type), 而常見的種類有肉食性與植食性兩類。肉食性者口器較為粗短, 而植食性者較為細長。其中以食蟲椿科 (Reduviidae) 與椿科 (Pentatomidae), 益椿亞科 (Asopinae) 為主。本文所研究的對象厲椿 (*Eocanthecona concinna* (Walker)) 與雙峰疣椿 (*Cazira verrucosa* (Westwood)) 則屬於椿科, 益椿亞科之昆蟲, 成蟲與若蟲以捕

食昆蟲為主。兩者皆分佈於台灣中低海拔山區。

台灣在日據時代曾有日籍學者專家評估側刺椿 (*Andrallus spinidens*) 對於甘蔗害蟲之生物防治, Chu and Chu (1975a, b) 曾進行黃斑粗喙椿象 (*Eocanthecona furcellata*) 生活史、發育、食餌密度與捕食習性之相關研究; Chang and Hsieh (2001) 進一步評估黃斑粗喙椿象生活史與對數種食餌之捕食量。整體而言, 有關肉食性椿象生活史的文獻尚少。在美國亦曾自國外引進益椿亞科椿象防治 Florida 州之科羅拉多甲蟲 (*Leptinotarsa*

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declimlineata)；亦有美國 Florida 產 Pentatomidae 肉食性椿象 *Alcaeorrhynchus grandis*、*Euthyrhynchus floridanus*、*Podius maculiventris*、*Stiretrus anchorago* (Richman and Whitcomb, 1978) 作為天敵之研究。此外，馬來西亞之生物防治專家亦會應用 Reduviidae 科之 *Sycanus dichotomus* 作為天敵 (Zulkefli *et al.*, 2004)，這些都是大型捕食性椿象應用於生物防治工作之範例。雖然在國內外的研究中曾記錄黃斑粗喙椿象 (*Eocanthecona furcellata*)，生物防治與應用的研究討論頗多 (Chu and Chu, 1975a, b; Kumar, *et al.*, 1996; Okada *et al.*, 1997; Chang and Hsieh, 2001; Ho *et al.*, 2003, 2005; Yasuda, 1997, 1998, 2000)，但能從這些益椿亞科分類群中尋找更有效果、專一性高、繁殖力強的物種，亦不失為生物防治基礎研究工作之一。本研究目的為建立簡易之飼養方法外，探討肉食性椿象生活史，將有助於瞭解這二種天敵，評估其在生物防治之可行性。

厲椿與雙峰疣椿蟲源

厲椿於 2005 年 7 月中旬在台北市南港區中央研究院附近的農地採集 2 隻若蟲及 1 隻雌蟲。雙峰疣椿 2005 年 11 月下旬在台北市南港區中央研究院附近的農地採集到 5 隻二齡若蟲，二齡若蟲正在捕食植食性茄二十八星瓢蟲 (*Epilachna vigintioctopunctata*) 的幼蟲；爾後則在 2006 年 3 月份捕捉正在白蘿蔔葉上的雙峰疣椿象成蟲及若蟲數隻。蟲源皆從野外攜回研究室飼養繁殖，並將羽化之成蟲送由農業委員會特有生物研究保育中心何健銘博士鑑定物種。

飼養方法

厲椿與雙峰疣椿之飼養參考黃斑粗喙椿象的方法 (Ho *et al.*, 2003)，環境條件控制於室溫 $23 \pm 3^{\circ}\text{C}$ 及光週期 (14D : 10L)，相對溼度 70% 飼養若蟲與成蟲。蒐集雌蟲產於紗布上的卵塊，直接放入透明布丁杯 (直徑 9 cm; 高 6 cm)，杯底放入剪成方形之紙巾 ($5 \times 5 \text{ cm}^2$)。用圓規刀在透明的杯蓋中央劃出直徑 3 cm 的孔徑，再用剪刀作成方形小塊紗網 ($13 \times 13 \text{ cm}^2$, 250 mesh/1 cm)，置於杯面上，再蓋入杯蓋，最後以小塊棉花沾水置於紗網上。每天觀察卵的孵化及各齡期生長情形，並觀察與紀錄蟲體發育情形。不同天產下的卵需隔開記錄、並記錄每卵塊之卵數、卵孵化所需時間及孵化率。用測微尺來測量各齡期若蟲成蟲的生長數據。

厲椿各齡若蟲及成蟲主要以麗蠅 *Chrysomya megacephala* 幼蟲餵食，麗蠅幼蟲可購自南港地區之魚具用品店；雙峰疣椿象的成蟲及若蟲則採用野外之鱗翅目幼蟲 (Lepidoptera larvae)、茄二十八星瓢蟲、黑守瓜 (*Aulacophora lewisii*) 及黃守瓜 (*Aulacophora femoralis*) 等昆蟲餵食。每隔 1 天更換飼育容器，提供新鮮的食餌供若蟲與成蟲捕食。

厲椿生活史

雌蟲將卵產於背光處，產卵時常多粒產於一處，每次產卵約 45-75 顆的卵塊，平均 60 顆 ($n = 45$)，形成卵塊。卵呈甕型且上端具有卵蓋表面光滑，具有金屬光澤，剛產下的卵為綠白色，爾後漸漸轉為深古銅色或黑色；卵的上蓋周緣有突起物。產卵數不一，少則 12 粒，多者可達 89 粒 (圖一 A)，卵期平均為 $8.0 \pm$

表一 厲椿與雙峰疣椿各生活期之比較

Table 1. Times of development of *E. concinna* and *C. verrucosa*

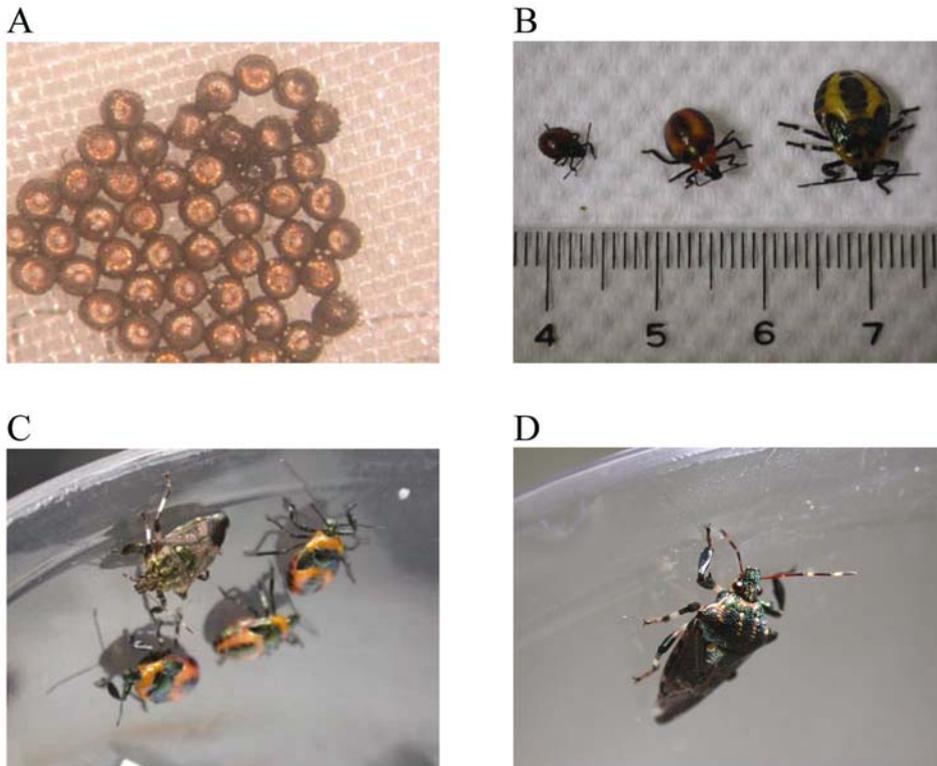
Life stage	<i>E. concinna</i>		<i>C. verrucosa</i>	
	Sample size	Duration (day)	Sample size	Duration (day)
Egg	n = 266	8.0 ± 2.5	n = 78	9.6 ± 1.3
1st instar	n = 296	4.6 ± 0.7	n = 44	4.0 ± 0.5
2nd instar	n = 162	5.2 ± 1.3	n = 39	5.4 ± 1.0
3rd instar	n = 111	5.4 ± 1.8	n = 27	5.0 ± 1.3
4th instar	n = 101	6.1 ± 1.5	n = 25	5.3 ± 1.5
5th instar	n = 92	10.3 ± 3.1	n = 23	10.2 ± 2.6
Male	n = 21	142.7 ± 65.5*	n = 10	61.6 ± 55.1
Female	n = 19	93.4 ± 51.3*	n = 10	46.5 ± 46.1

* $p < 0.05$ with pair t test

2.5 天 (n = 266)。卵將孵化時顏色轉為暗紅色。

孵化時，若蟲頭部先破卵蓋上部而出，觸角和口喙捲縮在頭部下方，慢慢伸展後，腹部大部分開始露出，爾後逐漸伸展觸角、口喙及

六足等。若蟲期共蛻皮 4 次，共五個齡期。甫孵化的若蟲聚集性很強，常聚集於卵塊上方，或一起吸水或吸取植物葉片汁液。二齡及三齡



圖一 厲椿的各齡期。A. 卵；B. 三，四，五齡若蟲；C. 五齡若蟲與成蟲；D. 成蟲。

Fig. 1. Morphology of various stages of *E. concinna*: A. eggs; B. nymphs of 3rd, 4th and 5th instar; C. Adult and nymphs of 5th instar; D. Adult.

表二 厲椿與雙峰疣椿若蟲與成蟲之頭寬、體寬及體長之測量

Table 2. Body measurements of nymph and adult specimens of *E. concinna* and *C. verrucosa*

Life stage	Measurement (mm)						
	1st instar	2nd instar	3rd instar	4th instar	5th instar	Female	Male
Sample size	50	50	50	50	50	10	10
<i>E. concinna</i>							
Head width	0.64 ± 0.03	0.83 ± 0.03	1.14 ± 0.05	1.55 ± 0.08	2.16 ± 0.12	2.64 ± 0.11	2.1 ± 0.13
Body width	1.00 ± 0.07	1.32 ± 0.08	2.24 ± 0.29	4.02 ± 0.52	5.87 ± 0.34	9.21 ± 0.35	7.35 ± 0.31
Body length	1.48 ± 0.21	1.97 ± 0.10	3.74 ± 0.37	6.64 ± 0.35	9.89 ± 0.56	15.14 ± 0.43	12.37 ± 0.24
<i>C. verrucosa</i>							
Head width	0.7 ± 0.03	0.91 ± 0.02	1.14 ± 0.06	1.41 ± 0.05	1.77 ± 0.06	2.02 ± 0.07	1.85 ± 0.96
Body width	1.21 ± 0.07	2.0 ± 0.16	2.76 ± 0.30	3.67 ± 0.38	5.18 ± 0.58	6.68 ± 0.45	5.93 ± 0.5
Body length	1.33 ± 0.17	2.75 ± 0.32	3.75 ± 0.59	5.12 ± 0.57	7.56 ± 0.84	9.38 ± 0.45	8.31 ± 0.52

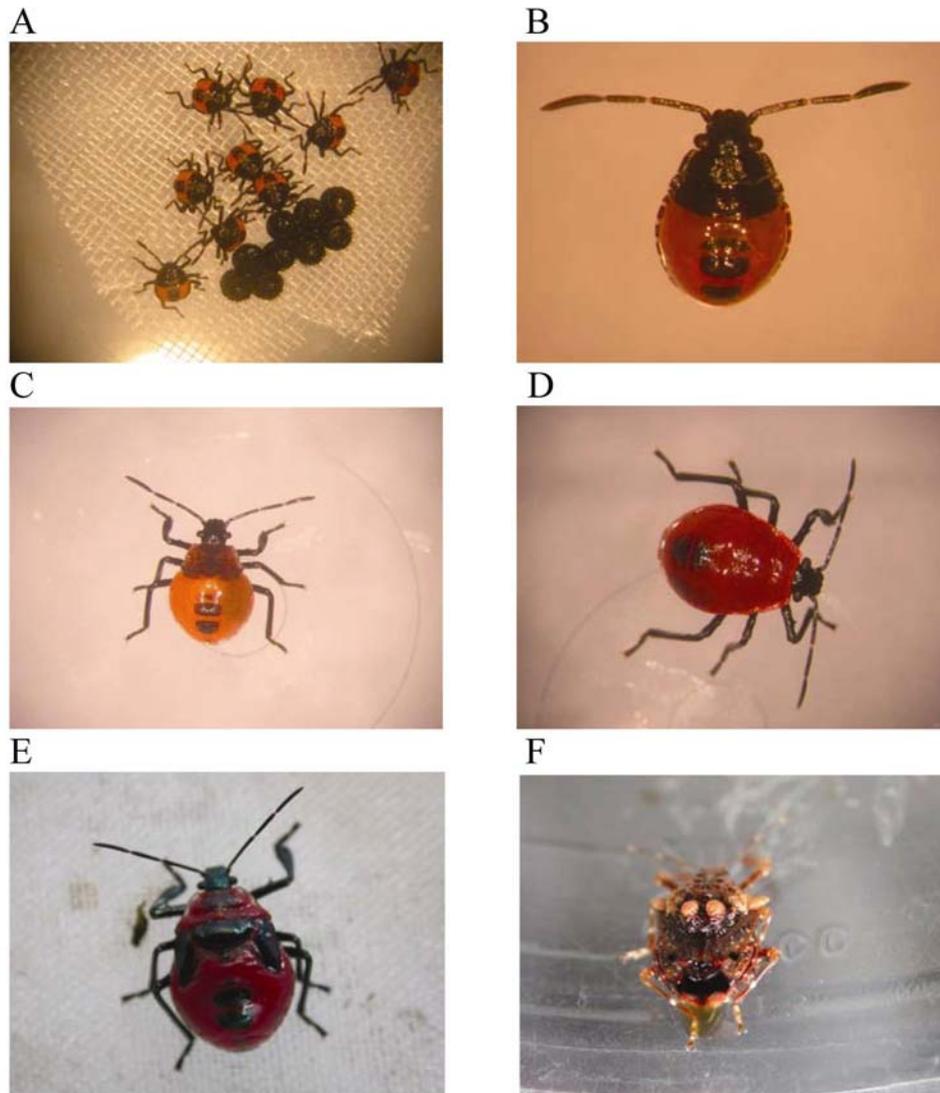
表三 厲椿各齡若蟲外部形態與行為

Table 3. Morphology and behavior of nymphal stage of *E. concinna*

Characters	1st instar	2nd instar	3rd instar	4th instar	5th instar
Head	Black	Black with metallic color	Black	Black with metallic color	Dark green with metallic color
Thorax	Black	Black with green metallic color	Black	Prothorax with orange color; metathorax with dark green with metallic color	Yellow orange
Abdomen	Dark red with three stripes	Dark red with three stripes	Dark red and black with three stripes	Orange yellow color with three black transverse stripes	Orange yellow color with three black transverse stripes
Antenna	Last segment longer than the others.	Second segment as long as last segment. Basal segment is the shortest.	Second segment longer than the others.	Third segment as long as last segment. Second segment is the longest.	Second segment is the longest. Third segment as long as last segment.
Mouth part	Black	Black	Black	Orange yellow	Orange yellow
Trochanter of fore leg	—	—	Processes on the mid-postal area	Dark green with setae	Dark green with setae
Tibia of fore leg	—	—	Flat	Flat	Flat
Wing buds	—	—	—	—	Dark green
Behavior response	Aggregation	Aggregation	Aggregation	Some aggregation	No aggregation
Hunting type	No hunting; sucking water	Several aggregating individuals hunt the prey together	Several aggregating individuals hunt the prey together	Hunting the prey individually	Hunting the prey individually

若蟲亦會以數隻或十幾隻聚集一起捕食寄主昆蟲，捕獲率也較高，因為這時寄主昆蟲的體型大小，往往是厲椿若蟲的數十倍甚至百倍大。到第四齡若蟲時，個體間就較為分散，到

五齡若蟲大多為各自獨立的生活。各齡若蟲的頭寬、體寬及體長，生長時間，特徵等資料列如表一與表二，若蟲外部形態與行為特徵列於表三。卵和各齡期若蟲的照片如圖一 A、一 B



圖二 雙峰疣椿象的各齡期。A. 卵與一齡若蟲；B. 二齡若蟲；C. 三齡若蟲；D. 四齡若蟲；E. 五齡若蟲；F. 成蟲。
 Fig. 2. Morphology of various stages of *C. verrucosa*: A. eggs and nymphs of 1st instar; B. 2nd instar; C. 3rd instar; D. 4th instar; E. 5th instar; F. adult (female).

與一 C 所示。有效卵塊孵化率 60%；一齡若蟲存活率 54%；二齡若蟲存活率 66%；三齡若蟲存活率 79%；四齡若蟲存活率 90%；五齡若蟲存活率 100%。

甫羽化為成蟲之初為粉紅色，2-3 小時後始轉為深色。頭部、胸背及倒三角小盾板散佈

黑褐色點刻，有些個體則呈現綠色金屬光澤，前胸背板有四個白色不規則雲狀分佈，小盾板的兩端亦有白色圓點；前胸背板的兩側端部，各有微小兩齒的鈍角，觸角共有五節，基節短且粗，其他四節細長呈棒狀，第四及第五節觸角前端部在 1/4 及 1/3 處為白色。

表四 雙峰疣椿各齡若蟲形態與行為

Table 4. Morphology and behavior of nymphal stage of *C. verrucosa*

Characters	1st instar	2nd instar	3rd instar	4th instar	5th instar
Head	Black	Black with green metallic color	Black	Dark blue with metallic color	Dark blue with metallic color
Thorax	Black	Black	Red brown	Prothorax with orange color and metathorax with dark blue color	Orange red
Abdomen	Orange yellow with three spots	Orange yellow with three spots	Orange yellow with three spots	Orange yellow with three spots	Orange yellow with three spots
Antenna	Last segment longer than the others.	Second segment as long as the last segment. Basal segment is the shortest.	Second segment longer than the others.	Third segment as long as the last segment. Second segment is the longest.	Second segment is the longest. Third segment as long as the last segment.
Mouth part	Black	Black	Black	Orange yellow	Orange yellow
Femur of fore leg	—	—	Processes on the mid-postal area	Processes on the mid-postal area	Processes on the mid-postal area
Tibia of fore leg	—	—	Flat	Flat	Flat
Wing buds	—	—	—	—	Dark blue
Behavior response	Aggregation	Some aggregation	Little aggregation	Little aggregation	No aggregation
Hunting type	No hunting; sucking water	Several aggregating individuals hunt the prey together	Hunting the prey individually	Hunting the prey individually	Hunting the prey individually

成蟲在第二、第三對足，除脛節中段為白色外，第一跗節亦呈白色，且前、中、後三對足的腿節從中段到基部亦為白色；前翅革部暗褐色，膜質部亦為暗褐色；後翅則略成暗色透明，而被翅膀覆蓋的腹部，上面則為大片的紫綠金屬光澤。下腹部則大致為灰白色，除周圍有些刻點外，雌蟲腹部光滑，跗節在第六節中間具黑色圓形紋斑。雌蟲體型平均體長 15.14 ± 0.43 mm、體寬 9.21 ± 0.35 mm、頭寬 2.64 ± 0.11 mm (n = 10)。

雄蟲除體型較小，外觀大致與雌蟲相似，下腹部有褐色細毛，且腹部不如雌蟲一般的膨脹飽滿。雄蟲體長 12.37 ± 0.24 mm、體寬 7.35 ± 0.31 mm、頭寬 2.1 ± 0.13 mm (n = 10)。

厲椿雌、雄成蟲具有重複交尾的現象。成蟲平均壽命，雄蟲 142.7 ± 65.5 天 (n = 21)，

最長 240 天；雌蟲 93.4 ± 51.3 天 (n = 19)，最長 179 天；產卵前期，雄蟲 16.4 ± 3.1 天 (n = 15)，雌蟲 16.9 ± 1.6 天 (n = 15)；雌蟲一生可產 250~350 顆卵，平均 253.8 ± 85.1 粒 (n = 11)，其計算依據是取產卵期超過一個月、有效產卵次數超過五次以上的雌蟲為計算對象。

雙峰疣椿生活史

卵為囊型，顏色漆黑色，直徑 1 cm，上具卵蓋，且卵蓋周圍有明顯棘刺；雌蟲每次產卵約 2~13 顆卵粒，平均 7.7 ± 3.6 粒 (n = 19)，卵期為 8~13 天，平均 9.6 ± 1.3 天 (n = 78) 通常產卵於葉背，或背光處下；卵孵化率為 85.1% (圖二 A)。

若蟲期脫皮四次，分五個齡期。甫孵化若

蟲，聚集於卵塊上，或群集於附近吸取樹葉汁液或水分；若蟲的孵化，同一卵塊會在同一個時間內全部孵化，通常不到二個小時即可全部孵化完成；若蟲只有一齡會有群聚的習性，二齡過後就分散取食。各齡若蟲的頭寬、體寬及體長、生長期及特徵等資料列如表一與表二，若蟲外部形態與行為特徵列於表四。卵和各齡期若蟲的照片如圖二 A、二 B、二 C、二 D 與二 E 所示。

第五齡若蟲蛻皮後即為成蟲。剛羽化成蟲之初為淺黃色透明，靜待 2~3 小時後體色轉為深色。雙峰疣椿成蟲體型略成圓形，體色變化大，如土黃色、褐色或者黑色。成蟲體壁凹凸不平，有明顯的疣狀突起。前胸背板之側角向外延伸，末端分岔，但不明顯。小盾片具二枚明顯的半球狀突起。觸角共五節，基節短且粗，其他四節就呈細長棒狀，第四及第五節觸角前端部在 1/4 及 1/3 處為白色（圖二 F）。成蟲在第二、第三對足脛節中間一小段為白色，第一跗節亦呈白色，且前、中、後三對足的腿節從中段到基部亦為白色；前翅革質部及膜質部均為暗褐色；後翅部分則略成暗色透明，上腹部為大片紅褐色。下腹部除周圍有些刻點外，而雌蟲腹部光滑。雙峰疣椿象雌蟲體長 9.38 ± 0.45 mm、體寬 6.68 ± 0.45 mm、頭寬 2.02 ± 0.07 mm (n = 10)。雄蟲體型較小，體長 8.31 ± 0.52 mm、體寬 5.93 ± 0.5 mm、頭寬 1.85 ± 0.96 mm (n = 10)。

雌雄成蟲具重複交尾的現象。成蟲壽命雄蟲 61.6 ± 55.1 天 (n=10)，最長 153 天；雌蟲 46.5 ± 46.1 天 (n = 10)，最長 134 天；雌、雄蟲產卵前期時間 11 ± 1.3 天 (n = 9)。

由於野外採集鱗翅目幼蟲等飼養雙峰疣椿象比較麻煩，所以我們嘗試用魚具店買的到的麗蠅幼蟲飼養，結果我們發現因為麗蠅幼蟲的扭動的動作快速，通常二，三齡期的若蟲較

不易捕食到麗蠅幼蟲，而四，五齡期的若蟲可以捕食到麗蠅的幼蟲，因此二，三齡若蟲用麗蠅幼蟲餵養，存活率較差。但是，如果將雙峰疣椿象若蟲各齡期，例如四，五齡的若蟲和二，三齡期的若蟲混和飼養，則二，三齡若蟲存活率會較高。這一點對想要以雙峰疣椿象作為有機農業的天敵使用者而言，會是一個很好的資訊，因為麗蠅幼蟲很容易買到，飼養這種天敵會比較容易。

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Life cycles of *Cazira verrucosa* (Westwood) and *Eocanthecona concinna* (Walker) (Heteroptera: Pentatomidae)

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ABSTRACT

The life cycles of two predatory stink bugs *Cazira verrucosa* and *Eocanthecona concinna* (Heteroptera: Pentatomidae) were studied in the laboratory under L:D 14:10 regime with temperature controlled at $23 \pm 3^\circ\text{C}$ and relative humidity at 70%. *E. concinna* were fed with blowfly larvae, *C. verrucosa* with *Aulacophora indica*. Eggs were laid in egg masses. For *E. concinna* there were 60 eggs per mass and for *C. verrucosa* there were only 7.7 eggs per mass. The egg stage for *E. concinna* and *C. verrucosa* was 8.0 and 7.7 days, respectively. For both species there were 5 stadia. For *E. concinna*, the body length of five instars was 1.48, 1.97, 3.74, 6.64 and 9.89 mm, and the stadia duration was 4.6, 5.2, 5.4, 6.1 and 10.3 days, respectively. For *C. verrucosa*, the body length of five instars was 1.33, 2.75, 3.75, 5.12 and 7.56 mm and the stadia duration was 4.0, 4.2, 5.4, 5.0 and 10 days, respectively.

Key words: *Cazira verrucosa*, *Eocanthecona concinna*, Heteroptera, Pentatomidae, life cycle

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