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## Studies on the Attraction of the Oriental Fruit Fly (*Bactrocera dorsalis*) and Melon Fly (*B. cucurbitae*) (Diptera: Tephritidae) to the Leaf Odor of the Malabar Chestnut (*Pachira macrocarpa* Walp) **【Research report】**

### 馬拉巴栗 (*Pachira macrocarpa* Walp) 葉片氣味對東方果實蠅 (*Bactrocera dorsalis*) 及瓜實蠅 (*B. cucurbitae*) 之誘引探討 **【研究報告】**

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#### Abstract

The leaf odor of the Malabar chestnut (*Pachira macrocarpa* Walp) was proven to be attractive to the Oriental fruit fly (*Bactrocera dorsalis*) and the melon fly (*B. cucurbitae*). It can also attract female Oriental fruit flies but not female melon flies to lay eggs in yellow plastic balls. The results of this experiment showed that the chemical compounds existing in the leaf may have great potential for development as attractants for both fruit fly species. However, further extraction, identification, and evaluation of individual compounds are needed in future studies.

#### 摘要

本試驗證實馬拉巴栗 (*Pachira macrocarpa* Walp) 葉片之氣味俱有誘引東方果實蠅 (*Bactrocera dorsalis*) 及瓜實蠅 (*B. cucurbitae*) 之效果，亦可誘使東方果實蠅雌蟲在內置有碎葉片之黃色塑膠球內產卵，但不會誘引瓜實蠅雌蟲產卵。初步試驗證實此葉片中所含的成分可同時誘引東方果實蠅及瓜實蠅，具有開發成為誘引劑之潛力，惟仍需進一步萃取、鑑定和評估。

**Key words:** *Bactrocera dorsalis*, *Bactrocera cucurbitae*, *Pachira macrocarpa*, attraction

**關鍵詞:** 東方果實蠅、瓜實蠅、馬拉巴栗、誘引

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## 摘要

本試驗證實馬拉巴栗 (*Pachira macrocarpa* Walp) 葉片之氣味俱有誘引東方果實蠅 (*Bactrocera dorsalis*) 及瓜實蠅 (*B. cucurbitae*) 之效果，亦可誘使東方果實蠅雌蟲在內置有碎葉片之黃色塑膠球內產卵，但不會誘引瓜實蠅雌蟲產卵。初步試驗證實此葉片中所含的成分可同時誘引東方果實蠅及瓜實蠅，具有開發成為誘引劑之潛力，惟仍需進一步萃取、鑑定和評估。

**關鍵詞：**東方果實蠅、瓜實蠅、馬拉巴栗、誘引

## 前言

東方果實蠅 (*Bactrocera dorsalis*) 及瓜實蠅 (*B. cucurbitae*) 產卵於瓜果內，幼蟲蛀食果肉為害果實，造成落果，影響台灣地區瓜、果產量和品質至鉅 (Liu, 1981b; Chiu and Chu, 1986)。此二種害蟲因對於瓜、果輸出常形成障礙，故被世界各國認為是重要的檢疫害蟲。針對彼等害蟲目前以化學防治、甲基丁香油及克蠅滅雄、點噴含毒蛋白質水解物和果實套袋為主要的防治方法 (Liu, 1981a; Lee, 1988)。

東方果實蠅及瓜實蠅的寄主植物合計超過 150 種，寄主植物散發的氣味可誘引雌蠅飛來產卵，而氣味中俱有誘引的成分，受到研究

人員重視及利用。由果實蠅對性費洛蒙和各種寄主和非寄主植物的行為反應研究，推斷其化學生態極為複雜 (Jang *et al.*, 1997)，其他相關化學傳訊物質之研究普遍受到重視 (Jang and Light, 1996)。誘引劑利用方面，針對雄蟲誘引的物質已有數種 (Kawano *et al.*, 1968; Fletcher *et al.*, 1975; Tan, 1983)，目前大面積推廣應用僅以甲基丁香油和克蠅為主，尚無其他物質可取代之，以誘引雌蟲為主 (亦誘引雄蟲) 的物質，則以蛋白質水解物被應用最廣。唯雌蟲專一性的誘引物質一般被認為在果實蠅防治上較具重要性，故被列為優先研究之重點項目 (Jang and Light, 1996)，例如性費洛蒙、產卵誘引劑開發與利用等。歷年來許多研究均朝此方向在進行，且大都以探討果

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實蠅寄主植物內的誘引物質為主 (Kobayash *et al.*, 1978; Liu, 1981b; Chiu, 1990; Jang and Light, 1991; Light and Jang, 1996; Hwang and Yen, 1998; Lu, 1998; Chen and Dong, 2000)。

Stark (1995) 在夏威夷木瓜栽培區研究果實蠅的夜間行為時，發現東方果實蠅雌蟲在黃昏後會飛離木瓜株，棲息在福祿桐 (*Polyscias guilfoylei*) 葉片上，隨後飛來雄蟲，停留至翌日清晨。Jang *et al.* (1997) 證實新鮮福祿桐葉片及其 methylene chloride-water 萃取液在實驗室及網室內僅對東方果實蠅雌蟲有誘引效果，尤其對已交尾的雌蠅最為顯著。

本試驗研究人員於霧峰鄉番石榴園研究果實蠅移動行為時，發現東方果實蠅雌蟲會飛至鄰近之馬拉巴栗果實上產卵，且夜間會停滯於馬拉巴栗葉背。由上述觀察顯示馬拉巴栗葉片可能對東方果實蠅具有誘引效果，然而目前尚無對馬拉巴栗誘引東方果實蠅之相關研究報告。因此，本研究於室內初步測試馬拉巴栗葉片對東方果實蠅和瓜實蠅之誘效，作為研發東方果實蠅及瓜實蠅嗅覺化學傳訊物質之參考。

### 葉片氣味引誘試驗

本試驗之東方果實蠅及瓜實蠅，分別採自霧峰田間果、瓜內的果實蠅及瓜實蠅幼蟲，在室內以人工飼料飼育多代後作為供試蟲源。東方果實蠅及瓜實蠅幼蟲培養基分別 Chiu (1978) 及 Liu and Shiao (1984) 之配方配製，兩種成蟲均以酵母抽出物加蔗糖 (1:3) 配製之飼料飼養於飼育箱 (30×30×30 cm) 內，飼養環境控制為 25±1°C，光照 8 小時。

進行室內試驗時，先將田間採回之馬拉巴

栗葉片洗淨風乾，用泰奇傾倒式粉碎機，經打碎 1 分鐘後，將碎葉片分別裝入透明玻璃製麥氏誘蟲器 (McPhail glass trap) 與產卵器內，於網箱內進行東方果實蠅及瓜實蠅誘引和產卵試驗。麥氏誘蟲器由 500 ml 之圓底燒瓶製成，誘器底部向內凹入形成一槽狀空間，瓶內可以裝填誘劑。凹入部上端有一開口，供氣味散出與果實蠅進入。試驗前先以 0.5 ml 之 25% 馬拉松可濕性粉劑 500 倍稀釋液在誘蟲器內壁佈施一層藥膜，然後置入 1 g 供試碎葉片。所使用的產卵器為直徑 7 cm 之黃色塑膠球，球之表面以直徑 0.55 mm 之鐵釘輕刺約 240 小孔，內部置入 1 g 供試碎葉片。

誘效測試時將誘蟲器懸掛在網箱 (長 100×寬 100×高 140 cm) 內的圓形轉盤上 (直徑 60 cm)，每個誘殺器下方掛一透明塑膠皿 (直徑 15 cm，高 5 cm)，以承接部分中毒後爬出落下死亡的果實蠅及瓜實蠅，並以空白誘蟲器為對照，每處理五重複。試驗時接入 50 對 18~22 日齡果實蠅或瓜實蠅，經 24 小時後記錄誘蟲器和塑膠皿內的死亡蟲數。網箱置於室內，轉盤速度設定每三分鐘一轉，光照為日間室內照明和自然光源。

### 產卵誘引試驗

產卵誘引試驗則將內裝 1 g 供試碎葉片產卵器懸掛在網箱內的圓形轉盤上，以空白產卵器為對照，每處理五重複。試驗時接入 100 對 18~22 日齡果實蠅或瓜實蠅，經 24 小時後取出產卵器，用水將產卵器內之卵沖出，放置於黑布上，於解剖顯微鏡下計數卵數。轉盤速度每三分鐘一轉，光照為日間室內照明和自然光源。

表一 馬拉巴栗葉片氣味對東方果實蠅及瓜實蠅之誘引效果

Table 1. Attraction of the Oriental fruit fly and melon fly to the leaf odor of *Pachira macrocarpa* Walp

Odor source	Mean no. of flies trapped <sup>1)</sup>					
	Oriental fruit fly			Melon fly		
	Female	Male	Total	Female	Male	Total
<i>P. macrocarpa</i>	25.0**	20.6**	45.6**	24.6**	28.0**	52.6**
Control	0.0	0.0	0.0	0.0	0.0	0.0

1) Means followed by asterisks significantly differ from the control at  $p < 0.01$  (\*\*), based on  $t$ -tests. Fifty pairs of fruit flies were used for each test.

表二 東方果實蠅及瓜實蠅在裝有馬拉巴栗葉片之黃色塑膠球內之產卵數

Table 2. Numbers of eggs laid by the Oriental fruit fly and melon fly in yellow plastic balls baited with *Pachira macrocarpa* leaves

Odor source	Mean no. of eggs laid <sup>1)</sup>	
	Oriental fruit fly	Melon fly
<i>P. macrocarpa</i>	171.8**	0.0
Control	0.0	0.0

1) Means followed by asterisks significantly differ from the control at  $p < 0.01$  (\*\*), based on  $t$ -tests. One hundred pairs of fruit flies were used for each test.

## 試驗結果與討論

馬拉巴栗為木棉科長綠喬木，產於熱帶美洲，於台灣普遍栽植為盆栽、庭園景樹或行道樹。以往未有指出其是否具有可誘引東方果實蠅或瓜實蠅之研究 (Chu and Chen, 1985; Chen and Chu, 1998)，但由本試驗結果，證實馬拉巴栗葉片經打碎後可誘引東方果實蠅及瓜實蠅雌雄蟲 (表一)，但只有東方果實蠅雌蟲會於產卵器中產卵而對瓜實蠅雌蟲則無產卵誘引作用 (表二)。誘得的瓜果實蠅蟲數中，果實蠅雌蟲數較雄蟲數多且兩者間有顯著差異 ( $t = 3.64$ ,  $p = 0.022$ )，而瓜實蠅雌雄蟲數間無差異 ( $t = 2.26$ ,  $p = 0.087$ )，但誘得之瓜實蠅總數則顯著多於東方果實蠅 ( $t = 4.26$ ,  $p = 0.013$ )。顯示馬拉巴栗葉片中含有對瓜果實蠅雌雄蠅無專一性之誘引物質，且瓜實蠅對此物質之反應大於果實蠅。另外，馬拉巴栗葉片中亦含有東方果實蠅雌蟲之產卵誘引物質。

許多東方果實蠅寄主之葉片具有誘引東方果實蠅之作用 (Chang, 1994)，但非寄主植物之葉片亦可能含有誘引成分 (Stark, 1995)。東方果實蠅和瓜實蠅常遷出果園或瓜園(陳等未發表資料)，而棲息在園外各種植物上，在其選擇棲息的植物前，是否受到某些誘引因子的影響，在吾人開發瓜果實蠅誘引劑的目標上，均值得深入探討與利用。

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## ABSTRACT

The leaf odor of the Malabar chestnut (*Pachira macrocarpa* Walp) was proven to be attractive to the Oriental fruit fly (*Bactrocera dorsalis*) and the melon fly (*B. cucurbitae*). It can also attract female Oriental fruit flies but not female melon flies to lay eggs in yellow plastic balls. The results of this experiment showed that the chemical compounds existing in the leaf may have great potential for development as attractants for both fruit fly species. However, further extraction, identification, and evaluation of individual compounds are needed in future studies.

**Key words:** *Bactrocera dorsalis*, *Bactrocera cucurbitae*, *Pachira macrocarpa*, attraction