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## 【Research report】

### 台灣東北部瓜實蠅 ( *Dacus cucurbitae* ) 棲群變動之研究【研究報告】

李文蓉、黃毓斌、程建中、章瑞駿

\*通訊作者E-mail :

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#### Abstract

#### 摘要

本文係研究台灣島最靠近日本琉球群島之東北部地區 - 宜蘭縣內瓜實蠅，melon fly : *Dacus cucurbitae* 棲群變動。研究場所係選擇蘭陽地區及蘇澳鄉的太平洋沿岸之主要哈密瓜類生產專業區：壯圍和南澳；內陸平地五結鄉苦瓜種植區和靠山之大湖瓜類種植區。研究時間係於民國78年6月至民國80年9月底。平均瓜實蠅棲群密度最高發生於7和8月間，9月遽減，12月至翌年5月最低，密度之變化受溫度、日照及瓜類作物生長時期之影響。

#### Key words:

**關鍵詞:** 瓜實蠅、棲群變動、瓜類、溫度、日照、作物生長期。

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# Population Fluctuation of the Melon Fly, *Dacus cucurbitae*, in Northeastern Taiwan

**Lena Wen-yung Lee** Institute of Zoology, Academia Sinica NanKang, Taipei, Taiwan, R.O.C.

**Yu-Bing Hwang** Institute of Zoology, Academic Sinica NanKang, Taipei, Taiwan, R.O.C.

**Chien-Chung Cheng** Department of Biology, Kaohsiung Medical College, Kaohsiung, Taiwan, R.O.C.

**Jui-Chun Chang** Institute of Zoology, Academic Sinica NanKang, Taipei, Taiwan, R.O.C.

## ABSTRACT

The population fluctuation of the melon fly, *Dacus cucurbitae* was investigated in northeastern Taiwan. The study was conducted from both along the coastal plain of Pacific Ocean and nearby inland areas of I-Lan County from June, 1989 to the end of September, 1991. The highest population density of the melon fly was observed in July and August; it then decreased in September and reached its lowest level from December to May. Higher temperatures, a longer duration of sunshine, and increased plantation activity were the most important factors influencing the population density of the melon fly in these areas.

**Key words:** *Dacus cucurbitae*, population fluctuation, melons, temperature, sunshine, plantation activity.

## 台灣東北部瓜實蠅(*Dacus cucurbitae*)棲群變動之研究

**李文蓉** 中央研究院動物研究所 台北市南港區研究院路二段 128 號

**黃毓斌** 中央研究院動物研究所 台北市南港區研究院路二段 128 號

**程建中** 高雄醫學院生物系 高雄市三民區十全一路 100 號

**章瑞駿** 中央研究院動物研究所 台北市南港區研究院路二段 128 號

## 摘要

本文係研究台灣島最靠近日本琉球群島之東北部地區—宜蘭縣內瓜實蠅，melon fly: *Dacus cucurbitae* 棲群變動。研究場所係選擇蘭陽地區及蘇澳鄉的太平洋沿岸之主要哈密瓜類生產專業區：壯圍和南澳；內陸平地五結鄉苦瓜種植區和靠山之大湖瓜類種植區。研究時間係於民國 78 年 6 月至民國 80 年 9 月底。平均瓜實蠅棲群密度最高發生於 7 和 8 月間，9 月遽減，12 月至翌年 5 月最低，密度之變化受溫度、日照及瓜類作物生長時期之影響。

**關鍵詞：**瓜實蠅，棲群變動，瓜類，溫度，日照，作物生長期。

## Introduction

The melon fly, *Dacus cucurbitae* (Diptera: Tephritidae) is prevalent on Taiwan Island, which is located between tropical and subtropical areas, and which has the mild temperature and high humidity suitable to the cultivation of many kinds of melons and gourds. Melon flies have been reported by Tseng and Lin (1974) to be distributed over a wide range of area below 2,000 m; within this range there are more than 80 species of host plants, most of them belonging to Cucurbitaceae and Solanaceae, plus some vegetables and tomatoes. Among these, the most common hosts in Taiwan are melons and sponge gourds, including honeydew melons, cantaloupes, muskmelons, watermelons, bitter melons, sponge gourds, bottle gourds and cucumbers.

Wrapping paper bags around fruit is the most popular method used for protection against the melon fly. Controlling the number of male flies through the usage of poisoned Cuelure has also been applied. Poisoned protein hydrolysate is commonly used when the fly population increases in the fruit fields. There have been several investigations of the population fluctuation of the melon fly in southern and central Taiwan (Lee, 1972;

Feng and Chang, 1984; Su, 1986); however, very few studies have been done in the northern and eastern parts of the island. In the northeastern part of Taiwan, there are two major melon planting areas which are located on the coastal plain facing the Pacific Ocean in I-Lan County; thousands of tons of honeydew melons, cantaloupes, and other melons are produced in this county every year. Understanding the population fluctuation of the melon fly in that area is therefore important for the sake of more efficiently controlling the pest.

An effort to eradicate the melon fly in Okinawa having succeeded has been previously reported by Kakinohana (1990). However, Okinawan farmers are afraid that the fly may be able to migrate from Taiwan since the distance between Taiwan and the nearest Okinawan island is only approximately 100 km. This provides a further need for understanding the population fluctuation of melon flies in northeastern Taiwan, as that area is geographically closest to Okinawa.

## Materials and Methods

A census was conducted from June, 1989 to the end of September, 1991 at four agricultural plantation areas: Chun-Wai

and Nan-Aou on the coastal plain; Wu-Chieh located further inland; and Ta-Hu, located near the mountain range. The plantation sites in Chun-Wai and Nan-Aou are the only two special melon cultivative areas along the coast of the Pacific Ocean of Taiwan Island growing different varieties of melons.

The Chun-Wai plantation site is located in the central part of I-Lan county along the shoreline of the Lan-Young River. The area, a loamy alluvial plain, is about 4.5 km long and 1 km wide. Up to three varieties of honeydew melons, plus cantaloupes, musk melons, watermelons, and some bitter melons are grown at this site from February or March to the end of September every year. After the last harvest of melons, garlic, green onion, and other quick-growing vegetables such as cabbages and spinachs are grown in the same fields.

The Nan-Aou plantation site is located in a mountainous district of the Suao area; it lies on a coastal plain and extends toward the interior hills of Suao County. It is sparsely populated area, consisting of only a few farmhouses adjacent to the plantation area; its size is 3 km long and 1 km wide. The soil is sterile and full of stones and sand. The honeydew melons and few watermelons are the major crops in this area; rice is usually grown adjacent to the melon fields. After the annual second crop of melons is harvested, rice or peanuts are usually planted in the same fields; occasionally, however, the land is left fallow.

Wu-Chieh is a small plantation area of slightly more than one-half square kilometer in size; located in the center of I-Lan County, it is surrounded by rice fields, vegetable fields, and scattered farmhouses. Bitter melons, sponge gourds, and a few bottle gourds are grown at Wu-Chieh; following the gourd and melon harvest, farmers usually cultivate vegetables such as cabbages, mustards, and radishes.

The Ta-Hu plain area lies at the foot of the mountains. The most frequently grown crop in this area is sponge gourds; there is also an orchard of orange, grapefruit, shaddock, and wax apple trees between the mountains and the gourd plantation. The entire area is only one square kilometer; a rice field is adjacent to the plantation. After gourds and melons are harvested. Farmers there usually grow cabbages, mustard greens, and radishes.

Melon fly population data were obtained through usage of monitoring traps, the Formosan lantern yellowish traps with Cuelures and 5% Dibron insecticide. Traps were placed on trees at different heights depending on environmental conditions. Flies were collected and chemicals were replenished once every two weeks.

Fruits infested by flies were obtained from rotten and ripening fruits in the fields. In the laboratory, pupae were collected, and emergent adults were identified and recorded.

Finally, all climatological data used in this study were obtained from the Central Weather Bureau, Taiwan, R.O.C (1989, 1990 and 1991).

## Results

### 1. Growing seasons

The cultivation of melons and gourds in I-Lan county takes place each year from February to the end of September (Tables 1 and 2). The growing seasons for honeydew melon, cantaloupe, musk melon, bitter melon, and different varieties of gourds all vary. Honeydew melon, cantaloupe, and musk melon have two crops each year; sponge gourd and bitter melon have only one crop. The blossoms of young fruit appear from March until the end of September, and harvesting takes place from May to the end of September.

Table 1. Melon growing seasons at Chun-Wai and Nan-Aou

Stage	MONTH										
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov
Seedling											
Blossom											
Young Fruit											
Ripening and											
Harvesting											

\* — : First Crop. - - - - : Second Crop.

Table 2. Gourd growing seasons at Wai-Chien and Ta-Hu

Stage	MONTH										
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov
Seedling											
Blossom											
Young Fruit											
Ripening and											
Harvesting											

## 2. Population Sizes of *Dacus cucurbitae*

Melon fly population data were obtained from eight traps at Chun-Wai, four traps at Wu-Chieh, four traps at Ta-Hu and eight traps at Nan-Aou. The population fluctuation at these four plantation sites (Fig. 1 to Fig. 4) exhibited the greatest abundance of melon flies from July to August, decreasing in September and almost disappearing from December to May of the following year. However, there is one respective small peak at Chun-Wai (Fig. 1) and Nan-Aou (Fig. 4), besides the peak in July or August; the former had one small peak in November 1990, the later peak in October 1989, also in the same time of 1990. Trapping flies and the climatological data of Lan-Yang area (Fig. 5) and Suao area (Fig. 6) were analyzed using the GLM (SAS Institute, 1979). Results of these studies showed significant effects of temperature duration of sunshine and host plant availability on the population density of flies (N=26, r=0.65 at Chun-Wai, 0.67 at

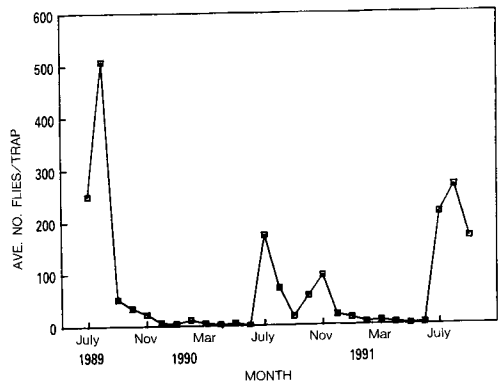


Fig. 1. Population fluctuation of melon fly at coastal plain of Pacific Ocean of Chun-Wai melons plantation site.

Wu-Chieh, 0.45 at Ta-Hu and 0.53 at Nan-Aou,  $P < 0.05$ ). Trap catches increased with higher temperature and longer duration of sunshine while the host fruits were ripen and harvested. Precipitation ( $P > 0.05$ ) did not prove to be a significant factor influencing melon fly population density. During typhoons (September,

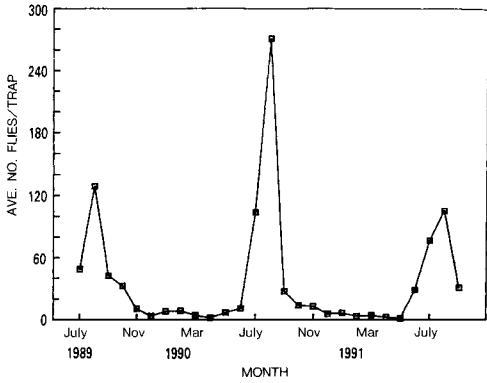


Fig. 2. Population fluctuation of melon fly at Wu-Chieh bitter melon plantation site.

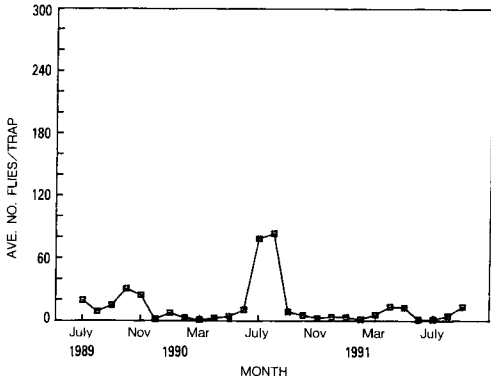


Fig. 3. Population fluctuation of melon fly at Ta-Hu sponge gourds plantation site.

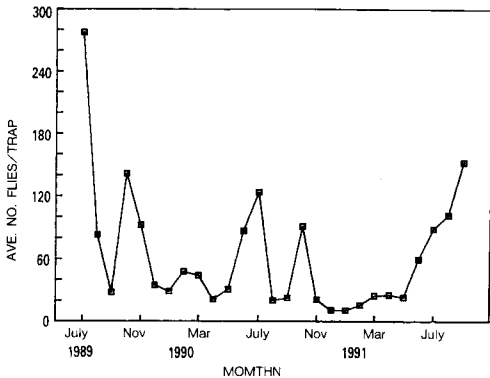


Fig. 4. Population fluctuation of melon fly at coastal plain of Pacific Ocean of Nan-Aou melons plantation site.

1989 and 1990) the melon fly population at Chun-Wai and Nan-Aou decreased dramatically, the populations, then increased slightly to reach small peaks after the typhoons passed.

### 3. Fruit infestation

The bi-weekly surveys of host fruit in the four areas infested by melon flies from June, 1989 to September, 1991. Over 10,000 fruits were inspected in the experimental areas, only seventy were found to be infested by melon flies. The melon fly apparently prefers bitter melons and sponge gourds. The infestation rate of bitter melons was 2.3% at Chun-Wai and 1.8% at Wu-Chieh. Honeydew melon infestation was measured as 0.4% at Chun-Wai and 0.5% at Nan-Aou. For sponge gourds the rate was 0.5% at Ta-Hu. Musk melons, watermelons, and bottle gourds were not infested according to fruit collected from and inspected in the experimental fields.

### Discussion

Higher population densities of *D. cucurbitae* were indicated by survey data to occur from July to August, then decreasing in September. There was a second small peak from September to December at Chun-Wai and Nan-Aou. In this regard, the population density of melon flies in I-Lan county of northeastern Taiwan has been fairly similar to those previously researched in southern Taiwan (Lee, 1972); in the south, the highest population density occurred in August. In addition, Lee at the same time found two small population density peaks, in February and December. Melon fly population fluctuations in southern Taiwan from 1982-1985 were studied by Su (1986), observing a single population density peak from August to November in Chiu-Ju, but two peaks is one in July and another from September to November is in the Li-Kong area. Two melon fly population density peaks (from March to

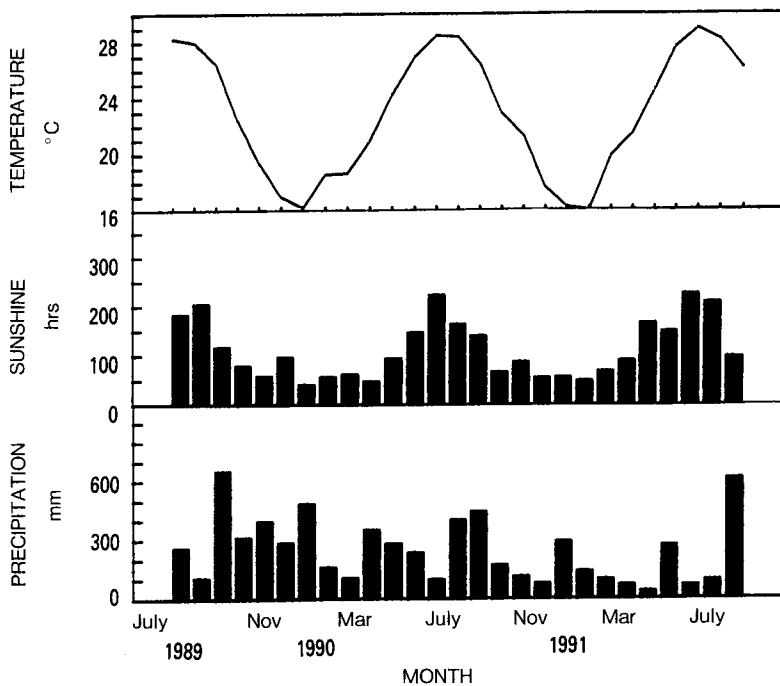


Fig. 5. Climatological data of Lan-Yang Area (1989-1991).

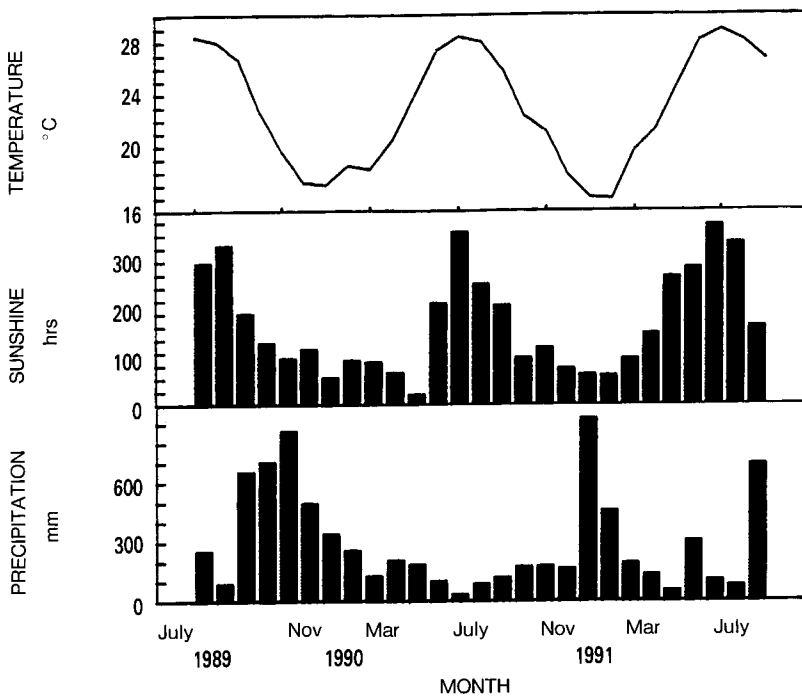


Fig. 6. Climatological data of Suao Area (1989-1991).

April and from July to August) in central Taiwan were observed by Feng and Chang (1984). Population density of the melon fly could therefore be stated vary according to different ecological environments.

Data also showed a higher melon fly population density occurring during periods with higher temperatures, longer durations of sunshine, and higher percentages of fruit ripening or fruits being harvested. Precipitation did not show a significant correlation with population density. Temperature was reported by Su (1986) to be an important factor affecting population density; however, sunshine duration was observed by him to be more important. Temperature and rainfall were found by Feng and Chang (1984) to be primary factors affecting melon fly density in Taichung. A significant negative correlation between rainfall and the number of medflies (*Ceratitis capitata*) on Kauai Island in Hawaii was noted by Vargas *et al.* (1983) to exist. Both the seasonal and annual distribution of medflies in Honolulu and in suburban areas of Oahu were studied by Harris and Lee (1987), suggesting that the most important factors influencing density and distribution were rainfall, the overall variety of fruits, and fruit ripeness. The host preferences of the female medfly and host availability were also noted as important factors.

The occurrence of a strong typhoon was found in the observed study to affect melon fly population density; fly density decreased severely, then increased slightly, then decreased again right after the typhoon moved northward. The melons on field was destroyed when the typhoon struck; the population density of fly was therefore decreased owing to the lack of available food and habitat.

The melon fly was reported by Kakinohana (1990) to be recently eradicated from Okinawa Island in Japan. Concern, however, exists that melon flies from

Taiwan possibly migrate across the 100 kilometer distance between Taiwan and the Okinawan Islands. Evidence does not support this possibility. Summer wind currents moving from southeast to northwest, and winter wind currents are indicated by the R.O.C Central Weather Bureau to be reversed. Melon flies may therefore be concluded here to possibly not migrate to the Okinawan Islands from Taiwan via wind currents. No solid evidence exists to support or criticize the hypothesis. The argument is that the source of the fly migrates to Okinawa may or may not come from Taiwan area. Further research on this particular question is needed in the future.

In conclusion, temperature, sunshine duration, fruit ripeness, and host preference were found in the observed study to be the most important factors influencing the population density of melon flies in the area under investigation.

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