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● 目 錄

1. 南投魚池鄉慣行及有機茶園之蝶類群聚
資料集
朱汶偵^{1*} 許文文¹ 陳顯彰¹ 陳柏棻²
11. 利用低成本虹吸裝置改善岸鳥覓食棲地
林瑞興¹ 蔡志偉¹ 林坤慧² 邱彩綢²
杜昀姍¹ 黃書彥^{1,3*}
31. 模擬氣候變遷下臺灣原生生質能潛力樹
種無患子的分布動態
黃靜宜^{*}
53. 測試以一種簡單且非侵入性的方式監測
台灣高雄市區的家燕繁殖
Bruno Andreas WALTHER¹, *Hsin YANG²
85. 七股濕地長期鳥 監測調查資料集
李先祐 鄭宇容
蔡文凱 王曉琪
黃書彥 洪夢祺^{*}

● contents

- 1.Butterfly assemblages of conventional and organic tea plantations in Yuchi Township, Nantou County, Taiwan**
Wen-Chen Chu¹, *Wen-Wen Hsu¹, Shean-Jang Chen¹
Bo-Jhen Chen²
- 11.A Case Study of Using Low-cost Siphon Equipment to Enhance Shorebird Foraging Habitats**
Ruey-Shing Lin¹, Jhih-Wei Tsai¹, Kun-Hui Lin², Tsai-Chou Chiu², Yu-Shan TU¹ and Shu-Yen Huang^{1,3*}
- 31. Modelling range dynamics for native bioenergy potential tree species *Sapindus mukorossi* in Taiwan under climate change**
Jing-Yi Huang^{*}
- 53.Testing a simple and non-intrusive method for monitoring the breeding season of barn swallows in an urban area in Kaohsiung, Taiwan**
Bruno Andreas WALTHER^{1*} and Hsin YANG²
- 85.Dataset of long-term bird monitoring in Qigu wetlands, Taiwan**
Hsien-Yu Lee, Yu-Jung Cheng, Wen-Kai Tsai, Hsiao-Chi Wang, Shu-Yen Huang and Meng-Chi Hung^{*}

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**Butterfly assemblages of conventional and organic tea
plantations in Yuchi Township,
Nantou County, Taiwan**
南投魚池鄉慣行及有機茶園之蝶類群聚
資料集

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Abstract

This is a research on butterfly assemblages of conventional and organic tea plantations in Yuchi Township, Nantou County, Taiwan. We conducted surveys once every two weeks from July to December in 2019, and March to December in 2020. A total of 909 butterfly occurrence datasets were recorded from 188 sampling events.

Six sampling plots had 92 species pertaining to five families with 65 species in three conventional tea plantations and 76 species in three organic tea plantations. This paper contributes to the study design, systematic survey methods, and species database of butterfly assemblages between different tea farming manipulations.

摘要

本研究是關於慣行及有機茶園之蝶類群聚組成，我們每 2 個禮拜 1 次從 2019 年 7-12 月 - 2020 年 3-12 月於南投魚池鄉進行蝶類調查。188 次調查活動，累計 909 筆蝶類出現紀錄。6 個樣區累計記錄到 5 科 92 種蝴蝶。3 個有機茶園記錄到 76 種蝴蝶，而 3 個慣行茶園則有 65 種蝴蝶。在本篇說明計畫在不同農法茶園的取樣設計、調查方法，及蝶種名錄。

Keywords: sampling event, butterfly assemblages, organic tea plantation, conventional tea plantation

關鍵詞：取樣事件、蝶類群聚、有機茶園、慣行茶園

Introduction

Lepidopterans represent one of the most extensively studied insect taxa worldwide, with butterflies and skippers being particularly well-known as environmental indicators and contributors to biodiversity (Sreekumar and Balakrishnan 2001).

During the past decades, conventional farming manipulation and monoculture cultivation have driven huge declines in butterfly assemblages, especially in suburban areas (Jonason et al. 2011). Recently, the general public is increasingly aware of agroecology, green economics, and food safety,

therefore food source, processes, and ecological equilibrium have become issues of concern, including farming types, modes of production, traceability cards, and carbon footprints, etc. (Probst et al. 2012). Organic agriculture or eco-friendly farming that regulate pesticide residue, improve human health, and protect butterfly assemblages in arable lands are also being adopted (Rödiger and Hamm 2015).

In Taiwan, tea manufacturing is one of the highest value-added agriculture industries. Around the island stand four major tea plantation areas, among which Yuchi Township, located in Nantou County of central Taiwan, is known for producing tea varieties and manufacturing black tea. Each tea plot here typically comprises 1-3 hectares with trees hedges bordering among different cultivation lands. Tea trees per se are not the main food plant of most butterfly species, while organic tea plantations without pesticides provide

proper nectar resources and shelters for butterfly assemblages that harbor higher species diversity (Tam and Bonebrake 2016; Han et al. 2021).

Project details

Project title: Ecological survey of establishment and promotion of organic tea demonstration plantations.

Funding: Tea Research and Extension Station, Council of Agriculture, Executive Yuan.

Taxonomic coverage

General taxonomic coverage description: A total of 909 butterfly occurrence datasets were recorded from 188 sampling events. There are 92 species pertaining to five families (Table 1), of which *Eurema blanda arsakia* was the most frequently recorded species in both farming types of tea plantations. Of all the butterfly species recorded in Taiwan, 23.1% had been covered in this research. Six sampling plots had

92 species pertaining to five families with 65 species in three conventional tea plantations and 76 species in three organic tea plantations.

Temporal coverage

Description: Every two weeks from July 2 to December 16, 2019, and from March 4 to December 28, 2020.

Methods

Study extent: Six different tea plantations (sizes: 0.8-2.5 ha) in Yuchi Township, Nantou County (Table 2, Figure 1). A 200-meter transect was set within each sampling plot.

Sampling description: We focused on butterflies as the target taxa, which consists of five families: Papilionidae, Nymphalidae, Lycaenidae, Nymphalidae, and Paleidae. Sampling followed the transect procedure, whenever objects detected within the distance of 5 meters from researchers were recorded (Pollard and Yate 1993). Insect nets were

also added to help identify unknown individuals. The first of each species encountered was collected and kept as dry specimens in the Endemic Species Research Institute (Taiwan Biodiversity Research Institute).

Quality control description: The first encountered individual of each species was collected and preserved as dry specimen and voucher specimen.

Step description:

1. We carried out the surveys once every two weeks from July to December in 2019 and March to December in 2020, respectively.
2. During the surveys, conductors detected and identified butterfly species with the naked eye, and used insect nets. Datasets included date, number of sampling plots, temperature (°C), relative humidity (%RH), start time, duration, species, and abundance.
3. The first individual of each species was collected, and temporarily placed in triangular paper envelopes, then made

into dry specimen for preservation.

Datasets

Dataset description

Object name: Archive Butterfly Community of Yuchi Tea Garden in 2019-2020

Character encoding: UTF-8

Format name: Darwin Core Archive format

Format version: 1.0

Distribution: https://ipt.taibif.tw/archive.do?r=yuchi_2019-2020_butterfly

Publication date of data: 2022-04-13

Language: Chinese

Licenses of use: Creative Commons Attribution (CC-BY) 4.0 License

Metadata language: Chinese

Date of metadata creation: 2022-04-06

Hierarchy level: Dataset

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Table 1. List of butterfly taxa recorded in conventional and organic tea plantations.

表 1. 2019 年 7-12 月 - 2020 年 3-12 月於 6 個茶園記錄所記錄之蝶類名錄

Family	Scientific name
Hesperiidae	<i>Badamia exclamationis</i> (Fabricius, 1775)
Hesperiidae	<i>Borbo cinnara</i> (Wallace, 1866)
Hesperiidae	<i>Hasora taminatus vairacana</i> Fruhstorfer, 1911
Hesperiidae	<i>Parnara bada</i> (Moore, 1878)
Hesperiidae	<i>Parnara guttata</i> (Bremer & Grey, 1853)
Hesperiidae	<i>Pelopidas agna</i> (Moore, [1866])
Hesperiidae	<i>Pelopidas mathias oberthueri</i> Evans, 1937
Hesperiidae	<i>Potanthus confucius angustatus</i> (Matsumura, 1910)
Hesperiidae	<i>Potanthus motzui</i> Hsu, Li & Li, 1990
Hesperiidae	<i>Tagiades trebellius martinus</i> (Plötz, 1884)
Hesperiidae	<i>Telicota bambusae horisha</i> Evans, 1934
Hesperiidae	<i>Telicota ohara formosana</i> Fruhstorfer, 1911
Lycaenidae	<i>Acytolepis puspula myla</i> (Fruhstorfer, 1909)
Lycaenidae	<i>Callenya melaena shonen</i> (Esaki, 1932)
Lycaenidae	<i>Catochrysops panormus exiguus</i> (Distant, 1886)
Lycaenidae	<i>Celastrina lavendularis himilcon</i> (Fruhstorfer, 1909)
Lycaenidae	<i>Chilades pandava peripatria</i> Hsu, 1989
Lycaenidae	<i>Deudorix epijarbas menesicles</i> Fruhstorfer, 1912
Lycaenidae	<i>Heliophorus ila matsumurae</i> (Fruhstorfer, 1908)
Lycaenidae	<i>Jamides alecto dromicus</i> (Fruhstorfer, 1910)
Lycaenidae	<i>Jamides bochus formosanus</i> Fruhstorfer, 1909
Lycaenidae	<i>Jamides celeno lydanus</i> Fruhstorfer, 1901
Lycaenidae	<i>Lampides boeticus</i> (Linnaeus, 1767)
Lycaenidae	<i>Megisba malaya sikkima</i> Moore, 1884
Lycaenidae	<i>Nacaduba beroe asakusa</i> Fruhstorfer, 1916
Lycaenidae	<i>Prosotas nora formosana</i> (Fruhstorfer, 1916)
Lycaenidae	<i>Rapala varuna formosana</i> Fruhstorfer, 1912
Lycaenidae	<i>Spalgis epeus dilama</i> (Moore, 1878)
Lycaenidae	<i>Zizeeria karsandra</i> (Moore, 1865)

- Lycaenidae *Zizeeria maha okinawana* (Matsumura, 1929)
- Lycaenidae *Zizina otis riukuensis* (Matsumura, 1929)
- Nymphalidae *Telchinia issoria formosana* (Fruhstorfer, 1914)
- Nymphalidae *Argynnis hyperbius* (Linnaeus, 1763)
- Nymphalidae *Athyma cama zoroastes* Butler, 1877
- Nymphalidae *Athyma perius* (Linnaeus, 1758)
- Nymphalidae *Athyma selenophora laela* (Fruhstorfer, 1908)
- Nymphalidae *Cupha erymanthis* (Drury, [1773])
- Nymphalidae *Cyrestis thyodamas formosana* Fruhstorfer, 1898
- Nymphalidae *Danaus genutia* (Cramer, [1779])
- Nymphalidae *Discophora sondaica tulliana* Stichel, 1905
- Nymphalidae *Elymnias hypermnestra hainana* Moore, 1878
- Nymphalidae *Euploea eunice hobsoni* (Butler, 1877)
- Nymphalidae *Euploea mulciber barsine* Fruhstorfer, 1904
- Nymphalidae *Euploea sylvester swinhoei* Wallace, 1866
- Nymphalidae *Euploea tulliolus koxinga* Fruhstorfer, 1908
- Nymphalidae *Euthalia irrubescens fulguralis* (Matsumura, 1909)
- Nymphalidae *Hypolimnas bolina kezia* (Butler, 1877)
- Nymphalidae *Ideopsis similis* (Linnaeus, 1758)
- Nymphalidae *Junonia almana* (Linnaeus, 1758)
- Nymphalidae *Junonia iphita* (Cramer, [1779])
- Nymphalidae *Junonia lemonias aenaria* (Fruhstorfer, 1912)
- Nymphalidae *Junonia orithya* (Linnaeus, 1758)
- Nymphalidae *Kaniska canace drilon* (Fruhstorfer, 1908)
- Nymphalidae *Melanitis leda* (Linnaeus, 1758)
- Nymphalidae *Melanitis phedima polishana* Fruhstorfer, 1908
- Nymphalidae *Neope muirheadii nagasawae* Matsumura, 1919
- Nymphalidae *Neptis hylas luculenta* Fruhstorfer, 1907
- Nymphalidae *Neptis nata lutatia* Fruhstorfer, 1913
- Nymphalidae *Neptis sappho formosana* Fruhstorfer, 1908
- Nymphalidae *Parantica aglea maghaba* (Fruhstorfer, 1909)
- Nymphalidae *Parantica swinhoei* (Moore, 1883)

- Nymphalidae *PentHEMA formosanum* (Rothschild, 1898)
Nymphalidae *Symbrenthia brabira scatinia* Fruhstorfer, 1908
Nymphalidae *Symbrenthia lilaea formosanus* Fruhstorfer, 1908
Nymphalidae *Tirumala limniace limniace* (Cramer, [1775])
Nymphalidae *Tirumala septentrionis* (Butler, 1874)
Nymphalidae *Vanessa indica* (Herbst, 1794)
Nymphalidae *Ypthima baldus zodina* Fruhstorfer, 1911
Nymphalidae *Ypthima atra taiwana* Lamas, 2010
Nymphalidae *Ypthima multistriata* Butler, 1883
Papilionidae *Graphium agamemnon* (Linnaeus, 1758)
Papilionidae *Graphium doson postianus* (Fruhstorfer, 1902)
Papilionidae *Graphium sarpedon connectens* (Fruhstorfer, 1906)
Papilionidae *Papilio bianor thrasymedes* Fruhstorfer, 1909
Papilionidae *Papilio dialis tatsuta* Murayama, 1970
Papilionidae *Papilio hermosanus* Rebel, 1906
Papilionidae *Papilio memnon heronus* Fruhstorfer, 1902
Papilionidae *Papilio polytes polytes* Linnaeus, 1758
Papilionidae *Papilio protenor protenor* Cramer, [1775]
Papilionidae *Papilio xuthus* Linnaeus, 1767
Pieridae *Appias lyncida eleonora* (Boisduval, 1836)
Pieridae *Catopsilia pomona pomona* (Fabricius, 1775)
Pieridae *Cepora nadina eunama* (Fruhstorfer, 1903)
Pieridae *Delias pasithoe curasena* Fruhstorfer, 1908
Pieridae *Eurema blanda arsakia* (Fruhstorfer, 1910)
Pieridae *Eurema brigitta hainana* (Moore, 1878)
Pieridae *Eurema laeta punctissima* Matsumura, 1909
Pieridae *Hebomoia glaucippe formosana* Fruhstorfer, 1908
Pieridae *Ixias pyrene insignis* Butler, 1879
Pieridae *Leptosia nina niobe* (Wallace, 1866)
Pieridae *Pieris canidia* (Linnaeus, 1768)
Pieridae *Pieris rapae crucivora* Boisduval, 1836

Table 2. The six studying sites at the tea plantations.
表 2. 6 個取樣茶園

Studying site (locationID)	Farming types	Area (ha)	Latitude, Longitude	Altitude (m)
ORG_A	Organic farm	1.0	23.8861001 120.9276700	717
ORG_B	Organic farm	2.0	23.9158842 120.9418720	621
ORG_C	Organic farm	2.5	23.89260081 120.9229122	679
CON_A	Conventional farm	0.8	23.8824373 120.931744	654
CON_B	Conventional farm	1.4	23.9226900 120.9435618	707
CON_C	Conventional farm	1.7	23.8821442 120.9346025	785

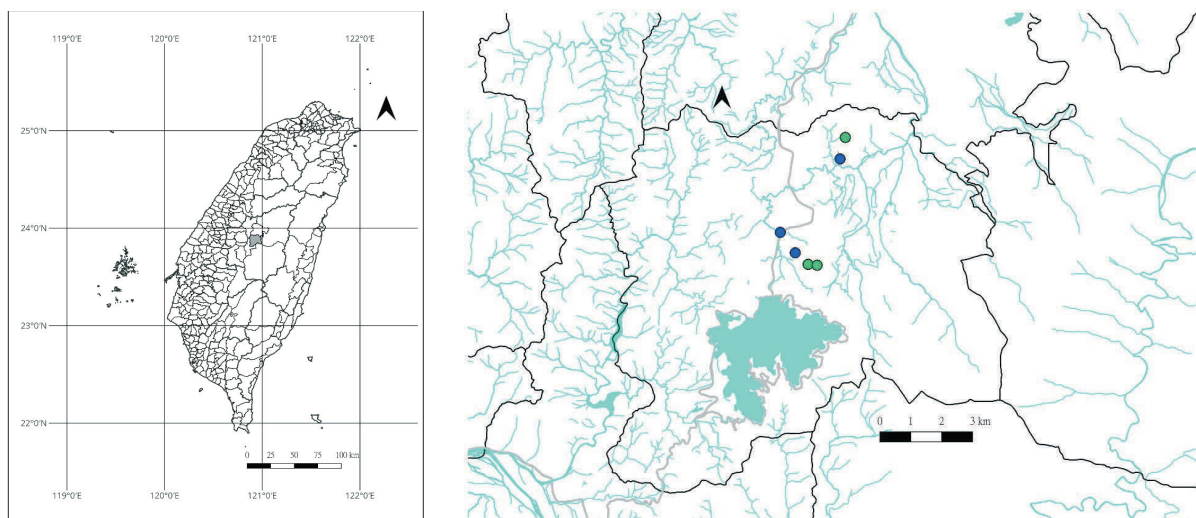


Figure 1. Survey locations of the six studying sites at the tea plantations. Blue line: the river system;
Green spot: the three study sites at the conventional tea plantations; Blue spot: the three study sites at the organic tea plantations.

圖 1. 6 個茶園樣區分布圖。藍色線條：水系及河道；綠色圓點：慣行田的 3 個樣區；藍色圓點：有機田的 3 個樣區。