香港有機農業生態研究協會(NGO)
HK Organic Agriculture & Ecological Research Association(NGO)

April 2011 ~ March 2012
年報 Annual Report




9周年

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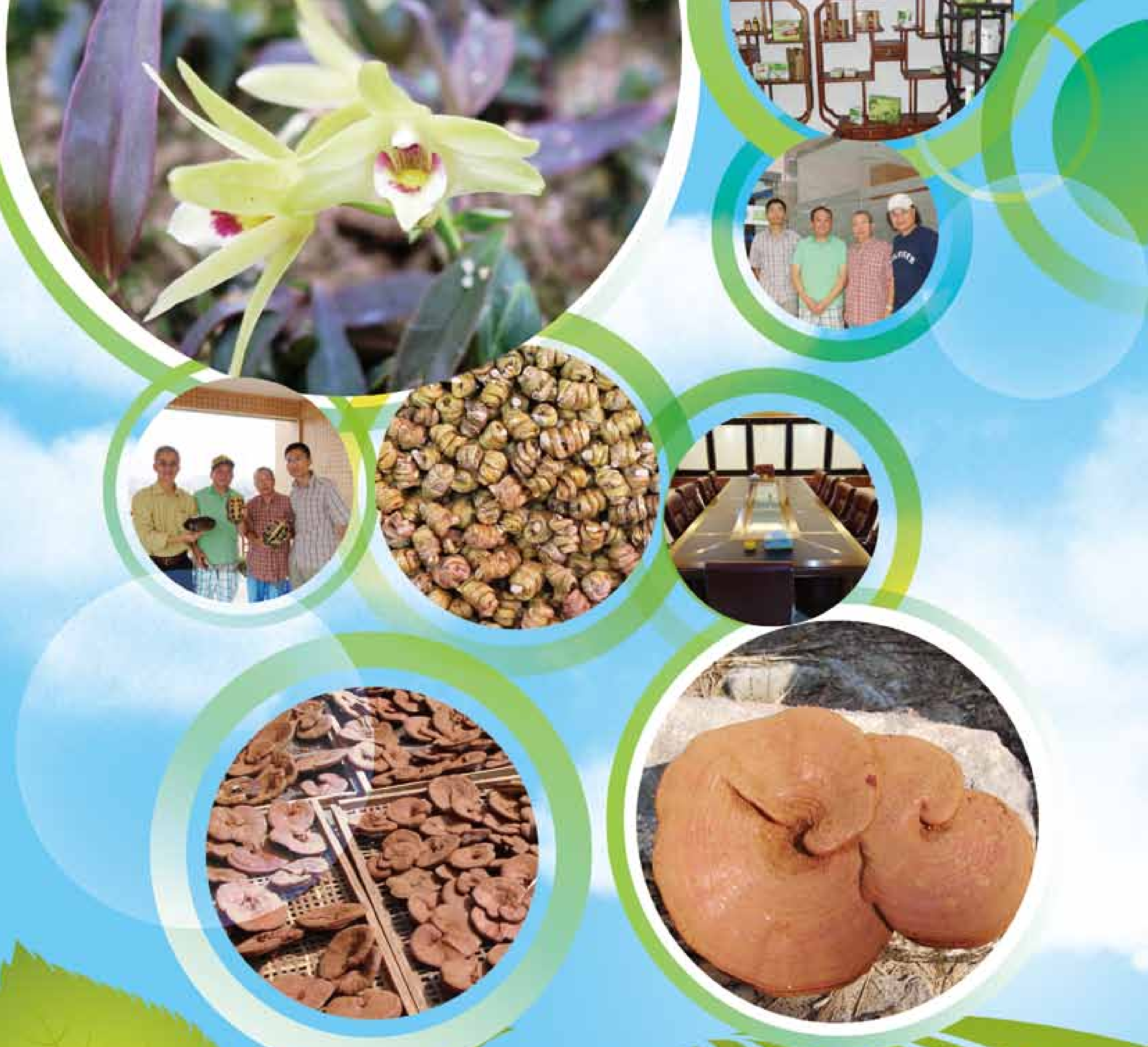


香港有機農業生態研究協會成立九周年誌慶

踐行環保

廣倡有機

行政長官梁振英

香港有機農業生態研究協會成立九周年誌慶

倡弘有機耕作
力求生態平衡

漁農自然護理署署長黃志光

香港有機農業生態研究協會周年大會

與時俱進
共創明天

中央政府駐港聯絡辦
新界工作部長 陳卓 題

九载辛劳传大爱
春华秋实满神州

贺香港有机农业生态
研究协会成立九周年

[illegible] 2012.11.6

賀香港有機農業生態研究協會九周年會慶

保育有機生態環境
農業持續發展所依

黃容根太平紳士

敬題

时值香港有机农业生态研究协会成立九周年，

恭祝协会事业蒸蒸日上，

为研究有机农业生态开创新的篇章！

广东昆虫研究所

李丽英

2012年11月1日

賀香港有機農業生態研究協會成立九周年周年大會誌慶

保育香江生態環境
宏揚農業有機精神

立法會議員 何俊賢


祝 賀
香港有機農業生態研究協會
九週年慶
共謀有機農作之益
同讚自然生態之美
台灣有機食農遊藝教育推廣協會
Taiwan Organic F.A.R.M. Educational Resources Society
全體會員 恭賀

祝香港有机农业生态研究协会九周年

以人为本认真做好有机农产品认证工作为民众解难作贡献！

张维球
二〇二一年十一月

香港有機農業生態研究協會九周年會慶

簡樸自然不破壞
社會生態倆和諧

香港社會服務聯會行政總裁

方敏生敬賀

祝賀香港有機農業生態研究協會會慶

有機生活
樂享明天

西貢北約鄉事委員會 主席

鄧光榮先生銅紫荊星章 敬賀

目錄

主席獻詞

李熙瑜博士
香港有機農業生態研究協會主席
香港有機認證中心榮譽主席

今天是「香港有機農業生態研究協會」成立九周年的慶典，在此，我謹代表協會向給予本會大力支持的各位朋友表示誠摯的感謝！

本會是香港特區政府註冊的非牟利慈善團體。1998 年開始進行有機認證，於 2003 年本會以主辦團體角色，聯同「華南農業大學資源環境學院昆蟲生態研究室」和「香港幼聯」正式成立「香港有機認證中心」。

到目前為止，本會認證的基地已逾一百個，認證項目包括有機米、有機荔枝、有機龍眼、有機沙田柚、有機火龍果、有機鳳梨、有機大豆、有機蔬菜、有機茶、有機香草等，產品更趨多元化，認證的有機基地覆蓋兩岸三地。

2012 年香港的有機農業繼續得到關注及發展。香港人對農業尤其是有機農業的參與情況，令人感到欣慰，全港復耕農田逐步攀升。雖然香港可耕農地不多，但是農業是人類仰以為生的原產業，所以我們仍要擔負起對下一代進行農業教育。慶倖當今香港社會對這方面有了新的認識，也有與本會志同道合人士，幫助其他非牟利團體透過有機農業來建立社會企業，以扶助弱勢社群，我們亦因此而多了一股生力軍參與有機農業發展，同時亦為香港這個現代都市保留多一點農業基礎。

在此，衷心感謝各位專家顧問在百忙中義務工作，希望我們能繼續發揮公益精神，為市民提供更多健康、優質的有機產品。

2012 年 11 月 29 日

香港有機認證中心主席獻詞

溫麗友太平紳士

香港有機認證中心 主席

香港有機農業生態研究協會 副主席

經過十多年來的接觸有機耕種，與各方友好共同推廣有機食品及有機認證，共同研究推動有機種植方法，保障市民健康。今年本會更在本港多個有機農場及機構支持和信任參與本中心的認證服務。肯定本中心之有機認證與支援服務能幫助本地農友的種植技術得以提高。本會成立九年以來，其公信力得到各界認可，希望本會可以繼續為市民服務，並得到同業多多指導。

在此我祝賀香港有機農業生態研究協會成立九周年

有機生活

安全健康

總幹事報告

曾贊安博士

香港有機農業生態研究協會 總幹事

尊敬的各位嘉賓、委員及會員：
大家晚上好！

今天是我們香港有機農業生態研究協會成立九周年的慶典。我們很榮幸地邀請到各位相聚香港，齊聚首，盡享有機生活。首先，我代表香港有機農業生態研究協會向各位來賓表示衷心的感謝！

以下是2012年度工作匯報：

2012年度，經濟危機陰影下，中國有機農業發展也走到了一個十字路口，經過多年的快速發展，有機認證市場及有機消費市場混亂不堪，國家有機農業認證管理迎來一系列改革。內容包括：促進農產品認證的推廣、實施。集中資源，重點加強涉及食品安全的相關認證制度建設；加強對有機產品等認證有效性監管工作，為消費者營造一個放心的食品安全環境。為食品安全監管方式轉變提供有力的認證認可技術支撐。研究、建立統一的食品農產品碳排放認證制度，促進節能減排目標的實現。深化對台港澳合作。推進海峽兩岸認證認可工作，全面開展海峽兩岸認證交流、人員互訪，制定雙方共同協調程式。加強與香港、澳門在認證認可領域的資訊交流與實質性合作，支持香港將檢測和認證作為優勢產業發展，為內地與香港、澳門之間的貿易創造更為便利的條件，服務香港、澳門經濟發展和與內地建立緊密經貿關係。

國家對有機認證的計劃將香港的有機認證市場囊括其中，使我們認清有機市場在香港的任務和地位，因此擺在我們前面的是美好的市場前景，我們只需要做的就是謹守崗位，腳踏實地，繼續發揚我們非牟利公益團體角色。至次，本中心認證基地已達100多個，認證產品多元化，遍及兩岸三地。

去年本會推行「低碳消費」、「低碳生活」，在我們園藝農場應用太陽能科技。本年度，我們計劃與本地大學合作利用臭氧技術開展農田減排活動，我們承諾將進行減排節能進行到底。

多謝各位一如既往的支持和幫助，讓我們的有機生活多姿多彩！
有關本會2011-2012年的年度核數報告，請各位參閱本年報。
最後，我祝各位嘉賓身體健康，家庭幸福！

2012年11月29日

HKOCC
香港有機認證中心簡介

香 港 有 機 認 證 中 心
Hong Kong Organic Certification Centre

主辦機構

香港有機農業生態研究協會
Hong Kong Organic Agriculture & Ecological Research Association

香港有機農業生態研究協會
HKOAERA (NGO)
(非牟利慈善機構)

合辦機構

幼聯 CECES

香港幼聯
HKCECES (NGO)
(非牟利慈善機構)

華南農業大學

華南農業大學昆蟲生態研究室

資料簡介Information
轉有機及全有機生產標準

轉有機產品
Organic-in-conversion Product

轉有機農產品

表示該農產品在持續實施有機生態農法生產規程六個月以上,但未滿三年的農地所栽培出來.

Organic-in-conversion Product

The product is produced by the farm which follows the protocol of organic crop production for at least 6 months but not more than 3 years.

全有機產品
Organic Product

全有機農產品

表示該農產品在持續實施有機生態農法生產規程三年以上的農地所栽培出來.

Organic Product

The product is produced by the farm which follows the protocol of organic crop production for more than 3 years.

歡迎查詢:香港有機認證中心(HKOCC) 電話Tel:(852)2792 8164
E-mail:nscfarm@netvigator.com http://www.hkgardenfarm.org

香港有機認證中心
Hong Kong Organic Certification Centre

Supervision over production by the Organic Certification Committee of Hong Kong Organic Certification Centre
香港有機認證中心有機認證監督生產程序

1 Acceptance of applications submitted by a farmer who intends to be converted to organic cultivation
接受轉有機農戶申請

Farmers who have not been approved can apply again in three months.
如不能通過本會審查，須3個月後方可再次申請。

2 Courses on organic cultivation
有機耕種課程

3 Data examination
資料審查

Hong Kong Organic Certification Centre and guilding organization will send people to the farmland for examination and guidance.
香港有機認證中心及輔導單位派員對農地檢查及作出輔導.

4 Analysis of heavy metals contents in the soil and the quality of irrigation water
土壤重金屬及灌溉水質檢驗

5 Inspection of surrounding environment and farmland
周邊環境及農地審查

6 Examination of agricultural products
農產品審查

7 The agricultural products must be under cultivation for over 6 months in accordance with the basic standards of organic-in-conversion cultivation set forth by Hong Kong Organic Certification Centre
必須按照香港有機認證中心轉有機及有機農法執行基準栽培超過6個月

Approval by the farmer to be converted to organic cultivation
通過認定爲轉有機農戶

8 Signing the production agreement
簽署生產同意書

9 Issuing organic-in conversion certificate to converted farmer
頒發轉有機農戶認定證書

10 Spot-check of soil, water and agricultural products
土壤、水及農產品抽查

11 Farmers can apply for organic certification only after above three years of cultivation in accordance with the basic standards of organic-in-conversion cultivation set forth by Hong Kong Organic Certification Centre
必須按照香港有機認證中心轉有機及有機農法執行基準栽培超過3年方可申請

Application to become an organic farmer member of the Centre
申請爲本會有機農戶

12 Approved as an organic farmer and issued with organic certificate
通過認定爲有機農戶及頒發有機農戶認定證書

香港有機認證中心有機評審委員會（四年一任）2010年4月1日起任

榮譽主席：　李熙瑜博士　（香港有機農業生態研究協會主席）

（香港漁農業科技促進協會主席）

主　　席：溫麗友太平紳士

副 主 席：程德智女士（幼聯總幹事）

副 主 席：曾玲教授（華南農業大學教授）

首席專家：梁廣文教授（華南農業大學教授）

委　　員：（排名不分先後）

陳炳旭研究員（廣東省農科院植保所）

陳玉成博士（香港理工大學）2012年9月起

張茂新教授（華南農業大學副院長）

李美雲小姐（社團法人台灣有機食農遊藝教育推廣協會理事長）

李敏儀小姐（香港有機農業生態研究協會秘書長）

馬關兆求校長（聖母無玷聖心幼稚園校長）

林永亨先生（幼聯代表1）

張文谷先生（幼聯代表2）

黃壽山教授（華南農業大學教授）

顏玲小姐（華南農業大學碩士，有機檢測員）

曾贊安博士（香港有機農業生態研究協會總幹事）

專業人士列席

認識有機標簽符合官方標準的官方有機標簽

香港消費者委員會公佈資料2010年5月刊

表示符合官方標準的官方有機標籤

美國　台灣　歐盟(現時標籤)

中國　日本　歐盟(7月1日以後使用的標籤)

認證機構的認證標籤

本港

香港有機資源中心認證有限公司*　香港有機認證中心

內地

國家環境保護部有機食品發展中心

外國

Australian Certified Organic　ECOCERT　Organic Crop Improvemen Association

BCS　Soil Association　Quality Assurance International

2011年週年大會花絮

迎賓接待處

本會團隊

嘉賓合影

嘉賓合影

嘉賓合影

曾繁光處長,曾贊安博士及曾玲教授

嘉賓合照留念

嘉賓合照留念

本會團隊

嘉賓合照留念

嘉賓合照留念

嘉賓合照留念

嘉賓合照留念

嘉賓合照留念

嘉賓合照留念

主席李熙瑜博士致詞

大會司儀致歡迎詞

首席專家梁廣文教授

中聯辦曾繁光處長致詞

漁護署陳益民博士高級農業主任致詞

立法會議員黃容根太平紳士致詞

認證中心主席溫麗友太平紳士致詞

總幹事曾贊安博士致謝詞

主席李熙瑜博士頒發感謝狀給何二仔先生夫人

主席李熙瑜博士頒發感謝狀給關兆求校長

首席專家梁廣文教授頒發感謝狀給吳永恩先生

首席專家梁廣文教授頒發感謝狀給園藝高爾夫中心

首席專家梁廣文教授頒發感謝狀給王見龍先生

首席專家梁廣文教授頒發感謝狀給來賓

首席專家梁廣文教授頒發感謝狀給新生精神康復會

首席專家梁廣文教授頒發感謝狀給
菲萊雅(遠東)有限公司

立法會議員黃容根太平紳士頒發感
謝狀給陳長貴先生

立法會議員黃容根太平紳士頒發感
謝狀給楊義山先生

立法會議員黃容根太平紳士頒發感
謝狀給唐志強先生

立法會議員黃容根太平紳士頒發感
謝狀給伍啟華先生夫人

由陳益民博士高級農業主任頒發感
謝狀給來賓

由陳益民博士高級農業主任頒發感
謝狀給彭安生先生

由陳益民博士高級農業主任頒發感
謝狀給黃得永先生

由陳益民博士高級農業主任頒發感
謝狀給沈贊坤先生

副主席曾玲教授頒發感謝狀給馬盧
金華女士

副主席曾玲教授頒發感謝狀給天朗
有機農場

副主席曾玲教授頒發感謝狀給李良
驥先生

主席溫麗友太平紳士頒發感謝狀給
大會司儀

主席溫麗友太平紳士頒發感謝狀給
林玉琴小姐

主席溫麗友太平紳士頒發感謝狀給
義工劉紹達夫婦


主席溫麗友太平紳士頒發感謝狀給來賓


主席李熙瑜博士頒發感謝狀給黃兆榮先生


主席李熙瑜博士頒發感謝狀給江惠東先生


主席李熙瑜博士頒發感謝狀給深圳有機荔枝基地


嘉賓合照留念


嘉賓祝賀


嘉賓祝賀


嘉賓祝賀


嘉賓合照


嘉賓祝賀


嘉賓祝賀


兩岸三地有機產品展示


嘉賓撰擇有機產品


嘉賓撰擇有機產品


嘉賓撰擇有機產品

HKOCC-036T台灣有機茶基地及考察

有機茶園

溫室蕃茄

參觀溫室

參觀巨農有機農場

參觀牛場

台灣有機茶基地

巨農有機農場堆肥

巨農有機粟米田

有機玫瑰花

有機玫瑰花田

有機玫瑰花茶

OIC-090福建壽寧有機茶基地

3000畝有機茶園準備開發

奠基

取土化驗

取茶葉化驗

OIC-101江西有機水稻基地

取水樣本化驗

合照

培訓

收割

OIC-095河源有機蔬菜基地









HKOCC-068有機油茶基地

有機水稻田

有機油茶基地


HKOCC-049及50有機水果基地







參觀沙井蠔博物館

香港Stream車會在HKOCC-049及50基地採摘有機水果

OIC-092得生北潭涌村有機蔬果基地



OIC-093得生綠州蔬果香草基地

得生馮都新總幹事介紹綠州基地

有機水稻田

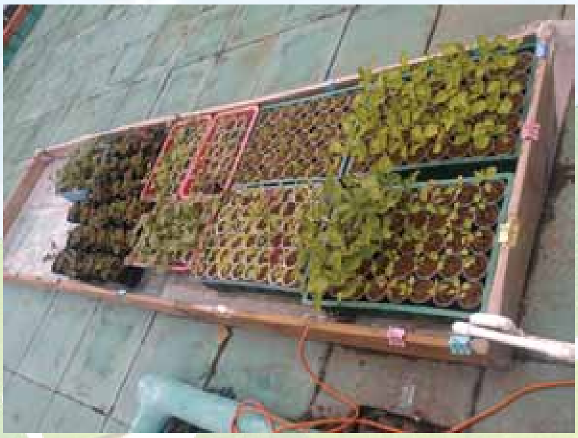
有機產品及天然酵素

由本會委員關兆求校長頒發有機認證證書

OIC-096大埔有機蔬果基地

OIC-097香港理工大學天台基地




OIC-098上水天光甫有機蔬果基地









OIC-099上水燕崗村有機蔬果基地








湖南考察—鐵皮石斛企業







2011年新疆農業大學有機農業及檢測課程







與新疆農大馬德英教授合照

2012年新疆水果及葡萄基地考察

與當地領導見面

與江惠東先生合照.

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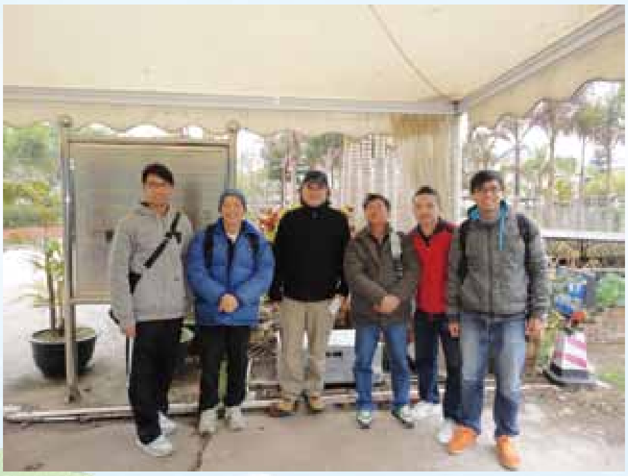

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ORIGINAL ARTICLE

G.Y.S. CHAN

Ozone applications: from farm to fork and from A to Z

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TITOLO
Applicazioni dell'ozono: dalla fattoria alla tavola e dalla A alla Z

KEY WORDS
Ozone, oxidation, antioxidant, agriculture, aquaculture

PAROLE CHIAVE
Ozono, ossidazione, antiossidante, agricoltura, acquacoltura

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Summary

Ozone is a strong oxidant and can be generated easily by simple machinery. In addition to its potent functions on microbial control, through innovative ideas and applied in better modes and doses, it can be used within our daily activities, and for a healthier life. This article summarizes novel applications of ozone in food science, from farm to fork levels (primary production, trading, transportation, retail, commercial and domestic processing), and compiled from A to Z for easier keyword search.

Riassunto

L'ozono è un forte ossidante e può essere facilmente generato con semplici strumenti. In aggiunta alle sue potenti funzioni sul controllo microbico, attraverso idee innovative e applicate in migliori modalità e dosi, può essere utilizzato nelle nostre attività quotidiana, e per una vita più sana. Questo articolo riassume le nuove applicazioni dell'ozono nella scienza dell'alimentazione, dalla fattoria ai vari livelli della tavola (produzione primaria, commercio, trasporto, vendita al dettaglio, trasformazione, lavorazione commerciale e domestica), ed è organizzato in ordine alfabetico dalla A alla Z per una più facile ricerca delle parole chiave.

Introduction

Ozone is a strong oxidant and potent disinfecting agent. It has had industrial applications for over 100 years, mostly in European countries. In 1982 the United States Food and Drug Administration (FDA) granted "generally recognized as safe" (GRAS) status for use of ozone in bottled water. In 1997, it was decreed that ozone is a GRAS substance for use as a disinfectant or sanitizer for foods when used in accordance with good manufacturing practices (GMPs). Since these milestones of acceptance, and other factors, including advancement in voltage control, there were rapid developments on ozone application. For example, ozone applications in the food industry and catering are accepted for surface hygiene, sanitation of plant equipment, reuse of waste water, treatment and lowering biological oxygen demand and chemical oxygen demand of food waste (1). This article attempts to summarize major ozone applications in food supply logistics with a wider scope, from farm to fork levels (primary production, trading, transport, retail, commercial and domestic processing), and compiled from A to Z for easy keyword search.

Agriculture

Pre-harvest

The importance of ozone applications in agriculture can be partially read in the report submitted to the California Energy Commission in 1999 (2); including the roles of ozone in soil fumigation, aqueous disinfectant, gas fumigant, fruit storage and wastewater management. The effects of ozone to soil are complicated, as soil matrix is heterogeneous. Johnson and Pregitzer (3), after site investigation, suggested that the concentration of soluble phenolic acids and free amino acids in soil were strongly influenced by soil properties, plant and microbial activity, plant community and to a lesser degree, changes in atmospheric O3. McCrady & Andersen (4) reported that rhizosphere microbial activity may be initially stimulated by plant exposure to ozone. Elevated ozone in rhizosphere may influence the dynamic of decomposition processes and the turnover of nutrients (5).

There are numerous reports indicating the adverse impacts of ozone in agriculture, e.g. to rice (6) and cotton (7). Pasqualini et al. (8) reported that atmospheric ozone decreased the gallic acid and vanillin levels in Aleppo pine. In 2000, ozone induced global yield reduction ranged 8.5-14% for soybean, 3.9-15% for wheat and 2.2-5.5% for maize (9), with ozone as an air pollution index. Different models for mapping potential ozone damage on vegetation showed very different spatial variations in the risk (10) and the role of ozone by itself may be quite different (see Section Antioxidant).

Post-harvest

Ozone, in the form of gas and ozonated water, is getting more popularly used for the preparation of fresh cut vegetables. Ozone treatment was found to be better than the chlorine and organic acid treatments in maintaining the sensory quality of lettuce (11). It is expected that an excessive dose of oxidants will consume the antioxidant in mature fruits where the pericarp is already well developed. However, contact of ozone with fruit juice should be avoided as it will greatly hit anthocyanins, ascorbic acid and color values (12).

Antioxidant production

Reactive oxygen species (ROS) are an unenviable part of aerobic life. The dynamic equilibrium in vascular plants can be disturbed leading to enhanced ROS level and damage to cellular constituents which is called oxidative stress (13). However, in recent years, research in biology showed special interest in ROS on enhancing plant tolerance.

Ozone can be used as an oxidative stress to induce the production of antioxidants in fruits or vegetables; other factors include temperature, UV exposure and pathogenic attacks (14). The effect of ozone treatment on total phenol, flavonoid, and vitamin C content of fresh-cut honey pineapple, banana and guava was investigated by Alothman et al. (15). The antioxidant capacity of the fruits was evaluated by measuring the ferric reducing/antioxidant power (FRAP) and 1,1-diphenyl-2-picrylhydrazyl (DPPH). Total phenol and flavonoid contents of pineapple and banana increased significantly after exposure to ozone for up to 20 min, with a concomitant increase in FRAP and DPPH values; however, the opposite was observed for guava. Ascorbic acid (AS) increase is used as a systemic response to ozone stress; in the study conducted by Severino et al. (16), ozone-resistant clones of *Trifolium repens* and *Centaurea jacea* showed the highest concentration of antioxidants, with 50-70% more AS than ozone-sensitive clones. Liu et al. (17) also reported that antioxidant and total phenolic content were affected by environmental conditions. Elevated ozone increased the net photosynthetic rate of red clover leaves and antioxidant phenolic compounds before visible injuries in a large area study (18). In sunflower, reduced plasticity of cell wall induced by ozone exposure may oppose an unspecific mechanical resistance against abiotic stress (19).

Increases in antioxidant level in crops may be good for consumers but not be favorable for farmers. Frei et al. (6) studied the effects of ozone exposure on feeding quality of rice shoots for ruminant herbivores. Rice biomass was reduced by an average of 24% and significant reduction was observed in crude protein content after ozone treatment; however, the antinutritive lignin and phenolic components increased.

Aquaculture

In 1970, fish from aquaculture that was consumed by human was 0.7 kg per capital. This value rose dramatically to 7.8 kg per capital in 2008 (20). China is the largest country producing fish products with 47.5 million tonnes in 2008. Since the same year, fish products in China from aquaculture (68.8%) overshot the figure of capturing from natural water bodies. For aquaculture in Europe, recirculating aquaculture systems (RAS) provide opportunities to reduce water usage and to improve waste management and nutrient recycling. Ozone is helpful for RASs especially on nitrogen budget control and sludge thickening (21). It had been considered that ozone-produced oxidants (OPO) during ozonation of seawater may lead to toxicity impacts. If excessive ozone is applied in water, it will affect the physiological activities and mucus function of fish. However, it only occurred on fish samples after the ORP was increased to an extremely high level of 600 mV (Fong et al., 2011). Reiser et al. (22) using 0.06 mg/l and above OPO for a 21-day study reported that no major alterations in histological and physiological parameters were observed in juvenile turbot. Similar safe levels were reported by Schrader et al. (23) on Pacific white shrimp.

Biosecurity

Food safety, from farm to fork, and human health implications were well noted (24). On a larger scope, biosecurity for the worker and organism in food supply chains, environment and consumer is of equal important. Ozone alone or in combination with UV can effectively disinfect recirculating water before it returns to the fish culture tank (25). This application is especially important in live seafood logistics and temporarily holding at Chinese restaurant aquarium tanks where fish density may be extremely high.

Bleach vs. ozone

Bleach and other oxidizers are getting more popular and used in the food industry and domestic environments. However, ozone is regarded as an environmentally friendly disinfectant as it rapidly disintegrates into water and oxygen. On the other hand, it has to be made on site because of its instability and may react and disintegrate before reaching the target organism (26).

Color

Do not expose foods to ozone, unless you want to see its faded glory. Ozone is very effective for color removal, including natural and artificial colors (27). In an early article published in 1907, Bridge has already indicated that ozone discharges vegetable colors (28).

Depuration

Ozone is suited for depuration of contaminated seafood. It was reported that ozonated water treatment reduced the total microbial load of fresh Pacific oysters by about 10-fold (29). In another study, southern quahog clams (*Mercenaria campechiensis*) were dosed with *Vibrio vulnificus* and placed in a pilot-scale depuration system using ozonated recirculated artificial seawater. Twenty-four hours of treatment with ozone-treated recirculating artificial seawater reduced the numbers of *V. vulnificus* in the shellfish meats by an average of 2 log units when compared to natural die-off in control clams (30). Application of ozone for depuration of seafood is also effective for Florida red tide organisms and its associated toxins removal (31).

Environmental Friendly; Egg

Excessive ozone will be depleted by itself and leaving not problem of residual effects compared to other forms of chemicals for food treatment. For example, after cleansing of poultry egg, the shelf life can be extended. However, it also imposes a controversial issue of life cycle assessments of long-distance transportation of foods (32).

Flotation separation

While air aeration does not, ozone produced effective solid-liquid separation through flotation (33), which is helpful especially for treatment of catering waste with high levels of protein fragments and grease.

Gas

Ozone at ordinary temperature and atmospheric conditions is a gas. Except under laboratory conditions, all ozone produced for industrial or domestic use is generated by coronary discharge method or by UV. Dissolving ozone into water produces ozonated water. Oxygen level in ambient gas is relatively low (20.9%); as a general rule, it is impossible to feed ambient air into an ozone generator so as to produce ozonated water with dissolved ozone above 10 mg/L. If higher concentration of ozone gas and ozonated water is to be produced, high concentration of oxygen, supplied from an oxygen cylinder or by molecular sieve oxygen generation, must be employed.

Hydroponic culture

Disease control is difficult in mass hydroponic culture, as the pathogens may be reinoculated in the recirculation process (34). In addition to chemical control, other methods in disease control in hydroponic systems include ozone, UV, filtration, adsorption and biological control (35).

Indoor Air quality, work place

Ozone is one of the parameters for indoor air quality objective. It is also an index for outdoor air quality as a secondary pollutant. It is getting more popular to use ozone for indoor microbial control, especially for pharmaceutical and food production. Guidelines and recommendation for safe use of ozone were summarized by Rosenthal (36).

Juvenile fish culture

Ozone is mostly effective in continuous water disinfection process for recirculating aquaculture systems (37), which is very important for juvenile fish culture. Ozone systems are also cost-effective and carry low risk in biosecurity control in fingerling husbandry (38).

Kitchen

Pesticide application should be

avoided in kitchens to prevent accidental food poisoning, especially with rodenticides. However, not many people realize that if ozone is applied in a kitchen at very low dose, it will remove the odor or ordinary pests including rats, cockroaches and ants. Pheromones and odor from droppings are important gas messages telling common kitchen pests that it is their city hall and meeting point. Ozone is effective to remove odors and pheromones. Kitchen pests will not feel at home without the odor they are used to; then, they will leave the kitchen, and seek for another more "comfortable" place.

Laundry

Table cloth washing demands a huge quantity of water. Apart from hospital soiled fabric, high temperature disinfection is not necessary for washing ordinary fibers, including table cloths and napkins. Ozonated water laundry is effective to remove difficult stains in soiled fibers. Ozone will also remove the odor in fiber; no restaurant customers would like to put on a napkin with a special smell!

Microbial control

Ozone is effective on microbial control for postharvest pathogenic fungi or commodities that tolerate this gas, such as *Penicillium* and *Botrytis* species on grapes (39). Factors affecting antimicrobial effects on food including 1) form of application (gaseous or dissolved), 2) ozone concentration (40), 3) microbial densities, 4) temperature, 5) pH, 6) contact time, 7) physiological status of the organisms (actively growing parts are more susceptible than spores) and 8) physicochemical properties of the outermost layer of organisms, 9) present of protective layer (e.g. whipping cream) in food (41).

Nitrite

Similar to carbon monoxide to humans, nitrite is toxic to aquatic life. Nitrite combines with hemoglobin and forms methemoglobin. Nitrite levels should be kept below 0.1 mg/L to avoid fish death (42). Ozone is mostly effective in nitrite removal, when compared to other forms of nitrogen compounds in aquaculture (43).

Odor and taste control

Ozone is effective for odor control of kitchen waste gas. In aquaculture, however, unless at a high dose with resultant oxidation reduction potential (ORP) higher than 600 mV, ozonation will not affect the fish mucus density and activity (44). Ozone also will not affect the "earthy" and "musty" off-flavors in fish culture due to the presence of metabolites geosmin and 2-methylioboreol (MIB) (45).

Pharmaceutical production and packaging

Ozone is commonly employed for indoor air quality control for pharmaceutical production and packaging to avoid air-borne pathogen contamination. Similarly, ozone systems are also suitable for air quality control of food processing units.

Quickly disappears after application, no secondary pollutant will be left; it is an advantage of ozone application. However, no long-lasting effect is also a disadvantage of ozone use.

Removal of pesticide residues

Ozonated water was effective for pesticide removal [fenitrothion: (46); diazinon, parathion, methyl-parathion, cypermethrin] (47). After ozonation, the tested pesticide by-products did not cause adverse effects on gap junctional intercellular communication in cell lines and therefore was considered safe (48). The major constraint is the availability of machinery for production of ozonated water, with high level of dissolved ozone for commercial and domestic use. Low cost machinery for production of microbubble with dissolved ozone should be available in the market in the near future; rinsing water with ozone microbubble is most effective for pesticide removal (49).

Shelf life and sterilization

Ozone treatment delayed both the development of red color, as well as rotting in tomato, and shelf life was enhanced by 12 days at 15°C (50). Continuous low ozone exposure (50 nL/L) was effective for decay control caused by *Sclerotinia sclerotiorum* and *Botrytis cinerea* and extended the storage period up to 6 months (51). Tzortzakis et al. (52) reported that ozone-enrichment maintained tomato fruit firmness and did not affect fruit weight.

Toxicity

Ozone is commonly considered toxic and it is bad to have excessive level in the troposphere. The controversial clinical issue of ozone, especially on the damages on respiratory system and extrapulmonary organs was discussed by Bocci (53) in his article "It it true that ozone is always toxic? The end of a dogma". Benefiting from the advancement in ozone sensing device, monitoring of ozone is relatively simple nowadays, and therefore it is quite safe for the food industry to employ ozone for food and environmental hygiene control.

Unstable

Ozone is unstable, and must be freshly prepared at the site of operation. However, it can be considered as one of the major superior features of ozone, as it will be gone by itself without leaving residues in the work place.

Virus deactivation; Veterinary

Ozone can chemically destroy the worst virus. It is effective for surface disinfection of haddock eggs against piscine nodavirus (54). It can inactivate norovirus in conditions relevant to healthcare (55). However, its efficacy on norovirus control on depuration of contaminated seafood is still uncertain, due to the complicated interaction between the virus and the host.

Water and wastewater treatment

Casani and Knøchel (56) compared water treatment methods for microbial decontamination of processed water in the food industry. The superior features for ozone included short contact time, sensitivity to turbidity and effects on microorganisms. The inferior features included high occupational hazards, corrosion and relatively high cost. Ozone is mostly effective for treatment of commercial aquaculture effluents (57). It is especially effective for phenolics removal in food wastewaters (58; 59). Synergistic effects are commonly observed for waste water treatment using ozone in combination with other oxidants such as hydrogen peroxide and UV radiation (60). However, some of the reported cases were of bench scale and employed excessive dose of ozone for optimal treatability - which causes a false impression to the reader that treatment may incur extensive energy cost. Actually, treatment will low concentration of ozone together with related technology (see flotation separation section) may also easily achieve superior outcomes.

Xenobiotic degradation

Ozone is suitable for the degradation of difficult xenobiotic compounds in food waste (61).

Yield

The ultimate concern for farmer, fishermen and food industry is on the yield and profit. There are numerous scientific articles describing the adverse effects on air pollution, and atmospheric ozone on crop yield (62). Therefore, ozone pollution poses a growing threat to global food security in the coming decades (63). Indeed high levels of ozone in air reduce plant growth, photosynthesis and carbohydrate allocation (7). Unfortunately, ozone is commonly used as an air pollution index for the overall quality of ambient air. However there is uncertainty on crop yield reduction purely caused by ozone -or other active air pollutants; further research is needed.

Zoonoses control

Zooplanktons are minute simple organisms; however, they are mostly opportunistic. They know how to survive and may have suitable biological function at suitable times and locations. The pros and cons effects of ozone in food industrial environments were summarized above. Ozone applicants should learn from zooplanktons; let ozone be applied at the right dose and right mode. Excessive levels should be avoided, as it wastes energy, may reduce the nutritional value and incurs inferior results.

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李敏儀碩士論文
（節錄部份內容）

温度对安荔赤眼蜂生长发育的影响

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荔枝蒂蛀虫 *Conopomorpha sinensis* Bradley 亦称荔枝细蛾，隶属于鳞翅目 Lepidoptera 细蛾科 Gracillariidae，是危害荔枝、龙眼的主要害虫之一（姚振威，1990），该虫在我国主要分布于广西、广东、福建、台湾等地，一年可发生 10 代~12 代，不同世代危害荔枝的不同部位，但以幼虫为害为主，其成虫产卵部位不同幼虫危害部位也就所不同。待虫孵化后蛀入果实，造成虫粪果或落果。孵化幼虫取食嫩梢、嫩叶、花穗，造成梢轴或花穗顶部枯死或影响其正常生长和翌年开花结果（冯莉等，2004；李小云，2005）。随着荔枝、龙眼种植面积的扩大，该虫的为害程度有加重之趋势。据报道广东一些荔枝成熟期果实受害率高达 60%~80%（黄汉杰等，2001），2003 年早熟种三月红的虫果率达 83.6%（冯莉等，2004），严重降低了产量和品质，造成重大经济损失。早在 1941 年陈文训就提出选种硬壳荔枝品种抗幼虫蛀果，作者在调查中也发现不同品种的虫果率差异较大，发现果壳厚薄、软硬及果核的大小与虫果率有一定的关联性。姚振威（1988）报道，中早熟品种受害最重，小核品种受害较轻，特别是桂味。主栽品种为早中熟品种的区域的虫口密度最大，受害最重；主栽品种为中晚熟品种并混有少数早中熟品种的荔枝园虫口密度受害程度次之；单一栽晚熟品种的荔枝园，虫口密度就明显较低，受害较轻；挂果不正常的荔枝园（树龄在 10 年以下的幼树），虫口密度更低，甚至形成不了峰期。荔枝蒂蛀虫的高峰期出现也不同，主栽早熟品种的果园为 5 月~7 月，主栽中熟品种的果园为 6 月~9 月，主栽晚熟品种的果园为 8 月~1 月（何等平，1986）。谢钦铭（2001）研究了不同品种对荔枝蒂蛀虫的初孵低龄幼虫的抗生力的差异性，结果显示桂味对荔枝蒂蛀虫的低龄幼虫的抗生力最大，其次是淮枝、新兴香荔和龙眼（广东石硖）；而以黑叶、三月红、红皮及妃子笑对荔枝蒂蛀虫的低龄幼虫的侵入的抗生力最差，为荔枝蒂蛀虫的感性品种。

荔枝蒂蛀虫属钻蛀类害虫，在其防治上有很大难度。虽有报道称多种寄生蜂如蒂蛀虫绒茧蜂（*Apanteles sp*）、甲腹茧蜂（*Chelonus sp*）、白茧蜂（*Phanerotoma sp*）、分盾细蜂（*Ceraphron sp*）、刻绒茧蜂（*Glyptapanteles conopomorphae Tsang et You sp.Nov*）等能寄生于荔枝蛀蒂虫幼虫。但现阶段，对于荔枝蒂蛀虫的防治仍以化学防治为主，效果也不甚理想。因为化学防治虽能对危害荔枝花穗、嫩叶和嫩梢的幼虫进行控制，

但却不能防治蛀食果蒂和种仁的幼虫。而且，与幼虫期或其它虫期的寄生天敌相比，作为卵寄生的赤眼蜂能将害虫杀死于孵化取食为害前，因此在害虫治理中显得更为重要。而且，在有机农业的生产过程中，绝对不能使用任何化学成分的农药和化学肥料，这让生物防治成为首选。由于荔枝蒂蛀虫为害特性的特殊性，势必控制其对荔枝果实的为害。鉴于此，就要寻求一种方法，在荔枝蒂蛀虫发育至幼虫期前将其控制在最低经济水平以下。曾赞安（2007）经室内试验结果发现，安荔赤眼蜂*Thichogramma oleae* Voegele et Pointel等对荔枝蛀蒂虫卵具有一定的寄生能力。该虫在室内的寄生率为30%左右。而赤眼蜂的生殖力、生长发育和存活本是研究赤眼蜂生物学特性与利用的重要方面（马春森等，2005）。

赤眼蜂属(膜翅目 Hymoaoptera、小蜂总科 Chalcldaidea、赤眼蜂科 Trichogrammatidae)是一类重要的卵寄生蜂，特别是鳞翅目卵，是世界上农林害虫生物防治中应用最广泛的重要天敌（刘树生和施祖华，1996）。目前发现可寄生隶属于10 目、近 50 科的 400 余种昆虫卵（包建中，1998）。但特定蜂种的寄主范围却不相同（耿金虎，2006）。较早对赤眼蜂进行研究的是 1882 年加拿大 Saunders 自美国引进微小赤眼蜂 *T. minutum* 防治茶藨叶蜂的试验（王承纶等，1981；李丽英，1984）。而我国对赤眼蜂的研究始于 20 世纪 30 年代。1934 年祝汝佐与胡永锡在浙江省汤溪县从松毛虫卵内发现了赤眼蜂，随后对其生活史、寄主种类、生物学及生态学特性等进行了研究。1951 年起蒲蛰龙等对赤眼蜂的寄主、人工大量繁殖，田间散放等问题进行了一系列的研究，首次发现了蓖麻蚕卵是繁殖某些赤眼蜂种类的良好寄主，推动了赤眼蜂应用工作的发展（蒲蛰龙，1956）。

赤眼蜂也是世界范围内害虫生物防治中研究最多、应用最广的一类卵寄生蜂（Li，1994，2004；冯斌等，2004），尤其对如亚洲玉米螟等农业害虫的防治。到目前为止，全世界约有20种赤眼蜂被用于大量繁殖和释放，其中规模较大的有松毛虫赤眼蜂（*T. dendrolimi*）、广赤眼蜂(*T. evanescens*)、螟黄赤眼蜂(*T. chilonis=T. confusum*)、稻螟赤眼蜂(*T. japonicum*)、短管赤眼蜂、*T. brassicae*(=*T. maidis*)、玉米螟赤眼蜂(*T. astriniae*)7种，每年放蜂治虫的面积达3000万公顷以上，主要包括玉米、水稻、甘蔗、棉花、蔬菜等农作物及一些林木和果树，一般都能有效地控制害虫为害，取得明显的经济、生态和社会效益(Li，1994；King，1993)。例如，在德国、法国、瑞士，近年来每年玉米地放蜂治虫面积约2.7万公顷，作物损失一般下降70~ 90% (Hassan，1994)。我国自上个世纪50年代以来，在开展赤眼蜂研究和应用方面取得了举世瞩目的成就，是目前

世界上应用赤眼蜂防治害虫面积最大的国家之一（刘树生&施祖华，1996；詹根祥&梁广文，1999）。1936年广东等地利用赤眼蜂防治甘蔗螟做了试验。目前如广赤眼蜂（*T. evanescens*）、松毛虫赤眼蜂、玉米螟赤眼蜂、螟黄赤眼蜂、稻螟赤眼蜂、暗黑赤眼蜂(*T. euproctidis*)、食胚赤眼蜂（*T. embryophagum*）、卷蛾赤眼蜂（*T. cacoeciae*）及微小赤眼蜂（*T. minutum*），已经广泛用来防治如玉米[玉米螟(*Ostrinia nubilalis*)]、棉花[棉铃虫*Helicoverp aarmigera*(Hubner)}、水稻[稻纵卷叶螟(*Cnap halocrocis medinalis* Guenee)]、甘蔗[甘蔗条螟(*Chilo saccharighagrs*)]、蔬菜[豆天蛾*Clanis bilineata*(Walker)]、果树[枣尺蠖*Sucra jujuba* Chu]、桃蛀螟*Dichocrocis punctiferalis* (Guenee)、苹果蠹蛾[*Laspeyresi pomonella* (*Linnaeus*)]和森林[松毛虫(*Dendrolimus* spp.)、黄刺蛾*Monema flavescens*(Walker)]害虫等（中国科学院动物研究所，1979）。

大量研究证明进行 关于赤眼蜂的生物学、生态学，商品化生产和大面积释放应用等方面的研究，在亚洲、美洲和欧洲的一些国家中均有较多的报道和评论（Ridgway，1977）。自从Gatenby（1917）开始对赤眼蜂胚胎发育进行了一般性的研究以来，很多中外学者等都先后对赤眼蜂的个体发育进行了研究。有关赤眼蜂寄生方面的研究文献较多，趋向于研究温度、湿度、赤眼蜂的种类、品系、放蜂时间、寄主卵的新鲜程度、赤眼蜂及寄主的生理状态等（张光美，1995；侯照远，1997；包建中，1998）。赤眼蜂属节肢变温动物，卵寄生蜂的个体发育，既受温度等环境因素的影响，又受寄主种类和寄生数量的影响。但温度仍为控制发育速度的主要因素。对于温度与赤眼蜂的关系，已有很多专家学者进行了较系统全面的研究（张英健，1984）。李丽英等（1983）研究了11种赤眼蜂对温度的反应，结果表明发育起点温度种间有差异，约在10℃~14℃范围内，发育上限温度约在32℃~34℃。如在10℃时，拟澳洲赤眼蜂只能完成前蛹期发育，不能完成后期发育，故其全期发育的下限温度应在10℃以上；在16℃时，发育极慢平均达32d~33d；在35.5℃时尚有部分个体能完成发育，但出现发育延缓现象。田坤发&姜永莉（1999）研究发现舟蛾赤眼蜂最适温度为24.9℃~35℃，相对湿度为80%左右，在此环境中发育的蜂体壮，生活力强，寿命长；温度超过35℃，相对湿度低于60%时，子代发育不良，蜂体弱，繁殖力低，寿命短；温度低于10.3℃，成蜂不能羽化。广赤眼蜂在15℃~32℃的温度范围也能正常发育，发育历期、成蜂寿命随温度的升高而缩短（连梅力等，2007）。据资料显示，赤眼蜂*T. sp. nr. mwanzai*在20℃~35℃时均能完成发育，发育历期最长约18d，最短7d；而在15℃以下则不能完成发育（Lund，1938；Stern & Brown，1963）。

目前，对安荔赤眼蜂的生物学、生态学特性以及对荔枝蒂蛀虫寄生作用的报道却极少。Sorokina（1993）对安荔赤眼蜂的生态学及形态特征进行了描述，雌蜂雄蜂外生殖器阳基腹中突的基部略收窄及有不大的微呈角状之爪。阳基侧瓣较长，其突出于钩爪顶端的距离明显长于钩爪；雄蜂触角棒节的毛长出棒节最宽处3.4~4倍；雌蜂产卵管略短于后胫节；雄蜂黄赭色，前、中胸背板、腿节及后足转节与腹为褐色；雌蜂体色微黄赭色，腹背有部分暗色。分布于原南斯拉夫、意大利、保加利亚、希腊及法国。寄主为橄榄树上的绢螟属*Diaphania (Glyphodes) unionales* HB.及菜蛾科橄榄蛾*Prays oleae* Bernard。在赤眼蜂生产中，繁蜂温度的控制等技术而有关该蜂生物学的基础研究报道甚少报道，从而限制了对此天敌的进一步开发与利用。作者在不同温度下测定安荔赤眼蜂的生长发育、存活寿命、繁殖能力，旨在定量研究温度对该蜂种群数量增长的影响，为该寄生蜂的大量繁殖和利用奠定基础。

结论与讨论

荔枝安荔赤眼蜂是荔枝蒂蛀虫卵寄生蜂，在有机农业的应用上有着广阔的前景。但迄今为止对此蜂的相关研究报道甚少。本研究用的安荔赤眼蜂是作为防治荔枝蒂蛀虫的卵寄生蜂，是广东省昆虫研究所从德国引进的。本文对该寄生蜂发育历期、发育起点温度和有效积温等进行了研究，研究结果可为利用天敌开展荔枝蒂蛀虫的生物防治提供科学依据。

4.1 由于赤眼蜂的卵小，又产于寄主卵内，难以直接观察，用米蛾卵作为寄主，并用变黑卵粒数作为赤眼蜂的产卵量只是一个估计值（黄寿山等，1996）。于此不同的是，在本试验中，作者并不是单看变黑的卵粒数来作为单雌的产卵量。作者事先统计孵化卵粒数，然后还对成功羽化后的米蛾卵解剖查看卵粒里面是否存有未羽化的卵数，最后将羽化成蜂数加上没有羽化的蛹作为安荔赤眼蜂的产卵量。

4.2 在各种温度下群体发育至羽化高峰期的时间（众数历时）较其加权平均的发育时间（平均历时）略短。赤眼蜂在米蛾卵内的发育时间，可因寄生量的不同而有差异。在本实验中的调查也发现，未羽化的米蛾卵内多数都是一卵多蜂。这用平均历时表示较适当。因而本试验的试验结果采用平均历时表示。赤眼蜂寄生的米蛾卵开始出现由白变灰直到黑，发育进入蛹期的时间，在 33℃时为 （6.94±0.22）d；在 17℃时高达（35.03±0.59）d。安荔赤眼蜂在 17℃卵期发育需要(5.35±0.26)d，在 33℃时为(1.86±0.14)

d；在 17℃幼虫期发育需要（13.29±0.24）d，在 33℃时为（1.86±0.12）d；在 17℃蛹期发育需要（16.39±0.30）d，在 33℃时为（3.58±0.26）d。在每种温度下发育历时最长与最短之间的时差亦随温度的增加而缩小。

赤眼蜂的发育适温可因不同种类而略有差异。本实验的安荔赤眼蜂其发育适温在 21℃~29℃。在适温范围内其发育历期最长为 25.34d，最短 8.13d。发育速率呈稳步而有规律地增长。

4.3 在众多的气象因素中，对昆虫影响最显著的是温度（Hagastrum，1988）。在有效温度区内主要决定昆虫的生长发育进度及存活。在低适温度区和最适温度区内，随着温度的升高，昆虫的活动增强，发育加速；当温度超过适宜范围，即温度过高或过低是，昆虫的活动受阻，发育缓慢，死亡率增加（北京农业大学，1981；王承伦等，1981）。研究表明，安荔赤眼蜂的生长发育和温度也有密切关系，不同温度对安荔赤眼蜂的时代发育历期都有显著影响。在试验进行的温度范围内，安荔赤眼蜂均能完成时代发育，该蜂各发育阶段的历期随温度的升高而缩短，表现为双曲线关系；发育速率则随温度的升高而增大，表现为直线关系。而湿度是昆虫另一个生存因子，它主要决定昆虫的存活率（包建中等，1998）。湿度对安荔赤眼蜂发育的影响有待研究。

4.4 在 17℃~33℃的温度条件下，安荔赤眼蜂各虫期的发育都能正常完成，最后羽化成蜂。虽然 33℃时发育最快，但成蜂寿命却缩短了，产卵量也有所下降。安荔赤眼蜂成蜂在 17℃时存活寿命显著长于 33℃，但其产卵量及其孵化却低于 33℃。很多学者研究已经明确表明赤眼蜂可以生长发育的温度范围，大致为 10℃~35℃。超过这一温度范围时，赤眼蜂发育受阻不能完成全期发育和羽化过程。因此赤眼蜂的发育温度范围可划分为部分虫期发育温度、全期发育极限温度及不影响各项生长发育指标的全期正常发育温度。其中，发育起点温度 8℃~15℃，最适温区 22℃~30℃，在恒温 10℃以下及 35℃以上不能羽化，成虫在 13℃~14℃下不活动。繁殖适温在 20℃~30℃之间，在适温下，赤眼蜂的群体羽化盛期主要集中在开始的 2 d~3d。在低温下群体羽化过程较长。本实验中也显示在 17 时羽化时间长达 8 d~9d，而在 33℃时羽化时间仅为 1d 左右。

4.5 试验测定了安荔赤眼蜂的发育起点温度和有效积温，得到安荔赤赤眼蜂的各虫态的发育历期，结果表明发育历期的幼虫期的发育起点温度高于蛹期，蛹期高于卵期、而有效积温则不同于此，幼虫期的有效积温最小，接着是卵期，最后才是蛹期。知道了发育起点温度和有效积温后，我们可以根据实际情况推算出繁蜂所需的时间。发育

起点温度和有效积温是昆虫的基本生物学特性，受很多因素影响（徐世新等，2002）。昆虫在自然变温条件下比在恒温条件下的发育要快一些，所以在恒温试验与变温条件中得到的结果是存在差异的。因此，在实际应用中还应结合该寄生蜂大田的实际发育进度进行试验。

4.6 在温度为 21℃~25℃时，羽化出蜂较高，17℃羽化出蜂其次，29℃~33℃较低。成蜂在羽化的当天就可以产卵。安荔赤眼蜂的单雌产卵量也不同。安荔赤眼蜂的单雌产卵量随着温度由低至高的变化，分别是 25℃（41.14 粒）、21℃（32.55 粒）、29℃（32.10 粒）、33℃（28.23 粒）、17℃（25.89 粒）。试验结果也表明了温度对安荔赤眼蜂的产卵历期也有影响。温度越高，产卵时间短，温度越低，产卵时间较长。同时也知，安荔赤眼蜂在 25℃寄生率最高为 75.81%，33℃最低为 45.81%。

4.7 各方面的试验数据显示，安荔赤眼蜂发育繁殖比较适宜的温度为21℃~25℃范围内，33℃以上时已经不利于安荔赤眼蜂的发育、产卵、寄生率。本实验是在人工气候箱内恒温下进行的，其他环境因子如湿度、光周期和光照强度等的设定尽可能接近自然状态。实验所得数据与其在自然变温条件下的实际发育情况存在一定差异。另外，由于本试验历期用加权平均统计，所得发育起点温度可能会存在一些误差。但本实验结果在实际工作中仍具有参考价值（张履鸿等，1993）。而有关安荔赤眼蜂的其他生物学、生态学特性及其室内繁育技术及其田间效果试验则有待进一步研究。还有，本试验所使用的安荔赤眼蜂已经在室内繁殖多代，其生育能力及其寄生能力是否退化，荔枝生产区是否本身有存有安荔赤眼蜂等一系列问题都还需要进行更深入的研究。

致　　谢

本论文研究是在第一导师梁广文教授及第二导师韩诗畴教授的悉心指导下完成的，在论文的选题、设计、实施，到数据分析和论文撰写都倾注了导师的心血。三年来，在学习、工作、生活上得到了导师无微不至的关心和帮助。导师严谨的治学方式和开创性的思维方式使我受益匪浅，在此表示衷心的感谢！

在实验设计与实施过程中得到华南农业大学昆虫生态研究室曾玲教授、黄寿山教授以及广东省昆虫研究所刘文惠研究员、陈巧贤实验师、华南农业大学张维球教授的支持和帮助，在此表示感谢！

同时要向那些关心本论文完成的单位领导、同事、在职研究生同学及朋友表示衷心的感谢！作为香港学生，将努力为国家和社会作贡献！

Incidence Occurrence of *Conopomorpha sinensis* Bradley and its Chemical Control Technology

Lee Man Yee , Guang- Wen Liang

(HK Organic Agriculture & Ecological Research Association (NGO),Laboratory of Insect Ecology, South China Agricultural University, Guangzhou, P.R.China 510642)

Abstract: *Conopomorpha sinensis* Bradley one of the major pests, is harmful to lychee and longan. It is very difficult to control *C. sinensis* because of a borer pest. *Thichogramma oleae* Voegele et Pointel have capacity to parasitic eggs of *C. sinensis*. The experiment is conducted the development duration and others biological. Four development period of *T. oleae* were recorded at 17 ℃, 21 ℃, 25 ℃, 29 ℃ and 33 ℃. The results are shown below:

1. In the experimental temperature range, egg, larva and pupa of the development period is (5.35 ± 0.26)d, (13.29 ± 0.24) d and (16.39 ± 0.30) d respectively at 17 ℃, and (1.86 ± 0.14) d, (1.87 ± 0.12) d and (13.21 ± 0.17d at 33 ℃. The developmental duration became short as the increasing of temperature. The reproductive capacity became enhanced with the temperature increased, then decreased. The expectancy model for development period and speed of *T. oleae* is established by the linear regression method.
2. The results show that developmental threshold temperatures and effective temperature of egg, larva and pupa were 10.615 ℃ and 41.444 day-degree, 16.509 ℃ and 31.927 day-degree, 14.984 ℃ and 55.924 day-degree respectively, the development threshold and effective accumulated temperature from egg to pupa are 14.917 ℃and 125.330 day-degree.
3. In a certain temperature range, reproductive capacity is enhanced with increasing temperature and to reach the largest decreases. Fecundity is largest (41.14 ± 15.22) at 25 ℃; Emergence number is highest (38.14 ± 16.37)% at 25 ℃. Meanwhile, the temperature is effect on Oviposition period of *T. oleae*.

Key word: *Conopomorpha sinensis* Bradley; Development period; Occurrence law; Chemical control technology

2011-2012 年鳴謝篇

過去一年，本會在研究、推廣及宣傳有機耕種及健康教育得以順利舉行，實在有賴各方好友、團體、政府部門及學校鼎力支持。我們特別在此加以鳴謝，盼望未來日子繼續得到更多有心人士多多支持，令有機食品和健康生活的信念推動更廣.

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INDEPENDENT AUDITOR'S REPORT

TO THE MEMBERS OF

HONG KONG ORGANIC AGRICULTURE & ECOLOGICAL

RESEARCH ASSOCIATION LIMITED

(Incorporated in Hong Kong and limited by guarantee)

....../Continued

Auditor's responsibility (continued)

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Opinion

In our opinion, the financial statements give a true and fair view of the state of the Company's affairs as at March 31, 2012, and of its surplus and cash flows for the year then ended in accordance with Hong Kong Financial Reporting Standards and have been properly prepared in accordance with the Hong Kong Companies Ordinance.

Emphasis of matter

In forming our opinion, we have considered the adequacy of the disclosures made in note 2 to the financial statements which explains that the executive committee members have confirmed that they will provide such financial assistance as is necessary to maintain the Company as a going concern. On the strength of this assurance, the financial statements have been prepared on going concern basis. The financial statements do not include any adjustments that would be necessary if such assurance was not valid. We consider that appropriate disclosures have been made and our opinion is not qualified in this respect.

Philip Poon & Partners CPA Limited
Mr. Poon Chin Chung, Philip
Practising Certificate No.: P01748

Certified Public Accountants
Hong Kong
September 15, 2012

HONG KONG ORGANIC AGRICULTURE & ECOLOGICAL

RESEARCH ASSOCIATION LIMITED

BALANCE SHEET AT MARCH 31, 2012

	NOTE	2012 $	2011 $
CURRENT ASSETS			
Rent receivable		8,000	--
Bank balances		50	1,178
		8,050	1,178
CURRENT LIABILITIES			
Other accounts payable and accruals		8,720	47,930
Amounts due to executive committee members	8	16,764	102,888
Amount due to a related company	9	53,720	22,240
Bank overdraft		19,167	--
		98,371	173,058
NET CURRENT LIABILITIES		(90,321)	(171,880)
FINANCED BY			
Accumulated deficit		(90,321)	(171,880)

Approved and authorised for issue by the Executive Committee on September 15, 2012

EXECUTIVE COMMITTEE MEMBER

EXECUTIVE COMMITTEE MEMBER

The notes on pages 9 to 16 form part of these financial statements.

HONG KONG ORGANIC AGRICULTURE & ECOLOGICAL

RESEARCH ASSOCIATION LIMITED

STATEMENT OF COMPREHENSIVE INCOME

FOR THE YEAR ENDED MARCH 31, 2012

	NOTE	2012 $	2011 $
SURPLUS FOR THE YEAR			
Income	4	941,059	813,577
Expenditure	5	(859,500)	(772,356)
		81,559	41,221
OTHER COMPREHENSIVE INCOME		--	--
TOTAL COMPREHENSIVE INCOME		81,559	41,221

The notes on pages 9 to 16 form part of these financial statements.

HONG KONG ORGANIC AGRICULTURE & ECOLOGICAL

RESEARCH ASSOCIATION LIMITED

NOTES TO THE FINANCIAL STATEMENTS

FOR THE YEAR ENDED MARCH 31, 2012

4. INCOME

	2012	2011
	$	$
Activity income	173,000	49,718
AGM income	139,600	118,400
Certification income	418,124	464,602
Charity sales	16,070	13,295
Donation received	82,725	14,122
Membership fee income	18,400	21,800
Other income	19,140	31,640
Service income	74,000	100,000
	941,059	813,577

5. EXPENDITURE

	2012	2011
	$	$
Activities	24,760	7,140
AGM expenses	55,088	27,400
Auditors' remuneration	6,800	6,600
Bank charges	551	1,407
Certification expenses	1,000	8,940
Entertainment	13,660	3,236
Fuel	14,921	18,040
Insurance	3,492	9,180
Internet	3,363	3,912
License	--	6,940
Local travelling	34,370	31,900
Membership fee	1,000	1,000
MPF contribution	1,120	--
Office supplies	--	339
Overseas travelling	987	2,753
Personal emoluments	595,200	567,700
Postage	1,224	280
Repairs and maintenance	--	4,217
Salaries	22,400	--
Secretarial service fee	1,920	4,940
Stationery and printing	200	15,940
Sundry expenses	6,290	250
Telephone and fax	5,254	4,542
Transportation	--	870
Volunteers' expenses	65,900	44,830
	859,500	772,356

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ALS Technichem (HK) Pty Ltd 於 1994 年在香港成立，我們是澳洲集團 ALS Limited 在全球 350 多個化驗所的其中一個成員 ，自開業至今，我們一直被香港實驗所認可計劃 (HOKLAS) 認可，並以國際 **ISO/IEC 17025** 的標準來經營運作。我們的認証編號為 066。

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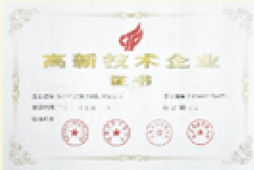

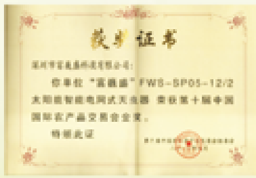

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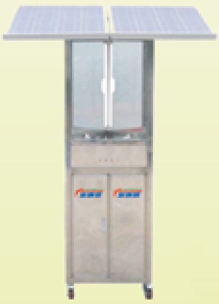

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