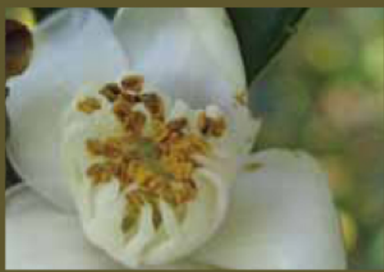
2011

台灣油茶研究之 回顧與展望 研討會論文集



主辦單位/ 行政院農業委員會林業試驗所

協辦單位/ 行政院農業委員會林務局

日　期/ 2011年8月10日

地　點/ 林業試驗所森林保育大樓12F 國際會議廳

行政院農業委員會林業試驗所　編印

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序　言

油茶與橄欖、油棕及椰子並為世界四大木本油料植物；在大陸則與烏桕、油桐與核桃同為四大木本油料植物。種植油茶除了可以保水固土外，亦可固定大氣中之二氧化碳，並提供優良的植物油脂予人類食用，可說是一舉數得。

油茶產業在台灣已發展數十年，國內油茶相關的研究早期多集中於育林及油品分析等，近年研究層面朝更多元發展。為延續前人研究成果，推展近年本所試驗及調查結果，促進相關領域人員之交流，故在今年八月十日舉辦「2011年台灣油茶研究之回顧與展望研討會」，會議內容將包含油茶之栽培與管理、油茶成分與活性等單元，每一單元內再包含 3-4 個子題。透過跨領域從不同角度切入，本研討會期望能有效彙整多年來油茶相關之重要研究成果，擴展並強化臺灣油茶產業之結構與發展。

行政院農業委員會林業試驗所

所長 黃裕星 謹識

中華民國 100 年 8 月 10 日

2011 年台灣油茶研究之回顧與展望研討會 議程表

時間	議程	主持人／發表人
8:30~8:50	報到，領取資料袋	
8:50~9:20		主持人：林副所長國銓
	所長致詞	黃所長裕星
	貴賓致詞	農委會陳主委武雄 客委會黃主委玉振
9:20~9:50	專題演講：茶油之官能品評	賴昭友
9:50~10:05	Coffee Break	
10:05-10:35	專題演講：台灣油茶研究之回顧與展望	何政坤
10:35~12:10	論文主題：油茶之栽培與經營　主持人：林務局保育組管立豪組長	
	臺灣油茶產業發展現況調查	許俊凱、許富蘭、林志東、*謝靜敏
	老佛山短柱山茶-台灣山茶科新變種植物	呂勝由、*許俊凱、林則桐、游文瑞、謝卉婷
	油茶病蟲害健康管理	*吳孟玲、莊鈴木、李芷芸
	細葉山茶與烏皮茶種子的發芽與儲藏性質	*楊正釧、郭幸榮
12:10~13:30	午餐	
13:30~14:40	論文主題：油茶之成分與活性 主持人：國立台灣大學森林環境暨資源學系 張上鎮教授	
	油茶粕抗木材腐朽菌活性之研究	*許富蘭、王姿閔、梁素貞、張上鎮
	利用 C. elegans 做為活體模式探討苦茶油茶粕萃取成分的抗氧化效應及其調控機制	*游展維、許富蘭、廖秀娟
	應用攜帶型氣相層析儀快速檢測苦茶油	*尹華文、呂勝由、陳正豐
14:40~15:00	Coffee Break	
15:00~16:15	論文主題：油茶面面觀　主持人：林試所育林組何政坤組長	
	混農林業經營模式之研究—速生樹種混植油茶	*吳俊賢、陳溢宏
	苦茶油副產物之抗氧化及防曬美白活性	*葉若鋆、曹怡靜
	大果種油茶粕甲醇萃取物對脂多醣引發主動脈血管對α-adrenoreceptor agonist 低反應性之作用	許富蘭、李鴻麟、*顏嘉宏
16:15~16:40	綜合座談	
16:40	賦歸	

目　錄

臺灣油茶產業發展現況調查

許俊凱 [1)]　許富蘭 [2)]　林志東 [3)]　*謝靜敏 [4,5)]

摘　要

依本所今年(2010)調查結果顯示，採收工一日工資約 1,000 元，每人每日約可採收鮮果 70~100 公斤，大果種油茶籽每公斤售價約 200 元，製得之苦茶油每 600 cc售價約 800~1,200 元，小果種茶油約 1,500~2,200 元。由於油茶目前在台灣多為零星種植，因此民眾普遍的反應是怕買不到純正苦茶油，而油茶農則在每年銷售後期往往有供不應求之感受。特別是小果種茶油因產量少，儘管價位高，仍是賣方市場，所以未來應有發展空間。

本研究針對臺灣油茶產業發展現況進行資料收集及田野調查。依據行政院農業委員會農糧署的農情報告資源網之資料顯示，台灣油茶栽培面積由民國 86 年的 907 公頃，增加至現今的 1,039 公頃；收穫面積由 761 公頃，增加至現今的 967 公頃，以每公頃苦茶籽收量為 2,227 公斤計算，則苦茶籽年收量為 2,154,614 公斤。目前主要種植油茶之前五大鄉鎮為嘉義縣阿里山鄉(17%)、南投縣信義鄉(13%)、台北縣三峽鎮(12%)、花蓮縣卓溪鄉(8%)及嘉義縣中埔鄉(7%)，其中台北縣三峽鎮的面積包含有 84 年前造林政策所種植的大果油茶，因受限於造林政策不能修枝，因此產果量不佳，農民只行造林而不採摘。在台灣油茶栽培主要鄉鎮中，台北縣坪林鄉及三峽鎮、桃園縣的龍潭鄉及龜山鄉及苗栗縣的南庄鄉以栽植小果油茶為主，儘管種植小果油茶較為費工，但售價也較高，對農民而言仍有誘因。

基於氣候變遷環境下節能減碳、保障國人食用油安全與自給自足、提供高級優質之國產油品等諸多考量，油茶產業之發展有其必要性。然而目前台灣油茶產業普遍存在有原種植之油茶產量及品質良莠不齊、農民找不到合適的品種可種植、本土苦茶油與其他境外油品區分不易、茶籽採收費時費工、無防火林帶及缺乏政策支持等問題，因而降低農民種植意願。建議未來發展目標為 1.朝高產油量、特殊油品、特殊萃取物及區域性品種等目標進行選育。2.發展高效能低成本之萃取製程。3.擴大國內油茶栽種面積。4.建置完備之油茶生產、供應及銷售之產業鏈。5.油茶混農林業經營。

關鍵詞：大果油茶、小果油茶、調查

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Investigation of the development status of oiltea industry in Taiwan

Chun-Kai Hsu [1] Fu-Lan Hsu [2] Chi-Tung Lin[3] *Ching-Ming Hsieh [4,5]

Summary

According to our price survey, this year, daily wages per worker is about 1,000NT, each worker collects 70 to 100 kg fruit a day, the selling price for C. oleifera seeds are 200 NT per kg, the selling price for oil from *C. oleifera* is 800 to 1,200 per 600 cc, while oil from *C. tenuifolia* is 1,500 to 2,200NT. What customers concern is whether they can buy pure Kuu-char oil. While Kuu-char oil, especially oil from *C. tenuifolia*, is always short in supply at the end of the selling season. This is because of the oil camellia plantation is still fragmentary in Taiwan. Customers' strong demand for local Kuu-char oil verify that oiltea industry is still developing in Taiwan.

In this study, the development and the status of Taiwan's oil tea industry were investigated. Based on information from Agriculture and Food Agency, Council of Agriculture, Executive Yuan, cultivation area by 1997 increased from 907 to 1,039 hectares nowadays; harvested area increased from 761 to 967 hectares. Supposed the production of seeds per hectare is 2,227 kilograms, the entire seed production for one year is 2,154,614 kg.

Five major tea planting area are Alishan Township, Chiayi County (17%), Xinyi Township, Nantou County (13%), Taipei County Sanxia (12%), Hualien County Jhuosi (8%) and Pu, Chiayi County Township (7%). Among them, due to the limitation of forest policy, C. oleifera can not be pruned and therefore the quantity and quality of seeds are poor in Sanxia. The major planted oil camellia are C. tenuifolia in Pinglin Dist., New Taipei City and the Sanxia, Longtan Township, Taoyuan County, Miaoli County and Turtle Township. Even the seed collection process of C. tenuifolia is more time-consuming, but the price is also higher, this attracts are still incentives for farmers.

Take climate change, carbon reduction, providing safety and self-sufficient cooking oil, providing high quality of the domestic oil into consideration, there is a need for the development of oiltea industry. The problems faced are unstable quality from the former oil camellia, no suitable varieties available, no easy way to distinguish local and foreign Kuu-char oil, seed-harvesting process is time-consuming, All contributes to the results that oil camellia plantation industry attract little attention from farmers. Suggestions and goals for future are 1. to breed and select high-yield oil, special oil, special extracts and regional oiltree varieties, 2. to develop high-performance and low-cost extraction process, 3. to expand planting area, 4. to build a complete production, supply and sales chain, 5. to develop Camellia agroforestry management.

Key words：*Camellia oleifera*, *Camellia tenuifolia*, Investigation

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老佛山短柱山茶－台灣山茶科新變種植物

呂勝由 [1,6]　*許俊凱 [2)]　林則桐 [3)]　游文瑞 [4)]　謝卉婷 [5)]

摘　要

本文報導一種產於台灣南部老佛山山區之山茶科、山茶屬、短柱茶組新變種植物—老佛山短柱山茶 *Camellia brevistyla* (Hayata) Cohen-Stuart var. *laufoshanensis* S.Y.Lu, T.T.Lin & C.K.Hsu，此物種之形態與原變種短柱山茶 var. *brevistyla* 近似，但老佛山短柱山茶葉下面被密毛、中肋凸起、側脈明顯、葉柄被密毛，雄蕊長 6-9mm、雄蕊筒基部 1/3 相連，可與後者區分。本文提供老佛山短柱山茶之分類描述、手繪圖、生態照片，以及台灣產同組植物之檢索表，以做為鑑識之基礎。同時，也根據現場觀察與樣區調查資料，以 IUCN 標準，評估其受威脅等級。

關鍵詞：老佛山短柱山茶、台灣植物誌、山茶科、短柱茶組

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Camellia brevistyla *(Hayata) Cohen-Stuart var. laufoshanensis S.Y.Lu, T.T.Lin & C.K.Hsu (Theaceae)*:A new variety from Taiwan

Sheng You Lu[1,6] *Chun Kai Hsu[2] Tzer Tong Ling[3]
Wen Jui Yu[4] Hui Ting Hsieh[5]

Summary

We report a new variety, *Camellia brevistyla* (Hayata) Cohen-Stuart var. *laufoshanensis* S.Y.Lu, T.T.Lin & C.K.Hsu section Paracamellia, genus *Camellia*, family Theaceae, from the mountain area around laufoshan, southern Taiwan. It is morphologically related to var. *brevistyla* , but has markedly leaves lower surface densely pubescent, midrib elevated, the veins prominent, petiole pubescent, Filaments 6-9 mm long, 1/3 basally connate. In this article, description, line drawing, photos, and key to the Taiwanese species of section Paracamellia are provided. The IUCN category of threatened species for *Camellia brevistyla* (Hayata) Cohen-Stuart var. *laufoshanensis* S.Y.Lu, T.T.Lin & C.K.Hsu is also evaluated.

Key words: *Camellia laufoshanensis* S.Y.Lu, T.T.Lin & C.K.Hsu, Flora of Taiwan, Family Theaceae, Genus *Camellia*, Section paracamellia.

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油茶病蟲害健康管理

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摘　要

油茶樹，又可稱為苦茶樹，其種子含豐富油脂，可榨取供食用，即俗稱的苦茶油或茶油，用途廣泛，除可食用外，亦可作為化妝保養品之添加物或作為近年盛行的手工肥皂之原料，極具經濟價值。台灣常見茶樹病害有赤葉枯病、枝枯病、煤病、網餅病、茶餅病、藻斑病…等，寄主範圍較廣之根瘤線蟲及根腐線蟲也被發現可危害油茶，蟲害則有蠐螬、刺粉蝨、球粉介殼蟲、小綠葉蟬、茶細蛾、茶毒蛾、茶捲葉蛾、茶姬捲葉蛾、茶黃薊馬、茶避債蛾、葉蟎…等。病害影響時間較長，大致好發於春至秋季，唯網餅病在冬季危害茶樹；蟲害則多集中在春夏季。改善田間環境，如加大植株間距、增加日照及通風、栽植抗病品種及施用藥劑皆可降低病蟲害之發生，常用病蟲害農藥有三得芬乳劑、嘉賜銅可濕性粉劑、百克敏乳劑、加保利可濕性粉劑、美文松乳劑、三氯松水溶性粉劑、畢芬寧乳劑等。然而農藥會造成許多負面影響，如：農藥殘毒、危害人體、病蟲產生抗藥性、影響生態環境、破壞生態平衡等問題。為求農地與生態之永續發展，有機栽植逐漸受到重視，強調以低毒性或非農藥方式防治病蟲害，如使用肥料或土壤添加物，增強作物抵抗病蟲害；套袋隔絕病蟲害；使用窄域油或覆蓋反光布防蟲；黃色粘板粘捕害蟲；使用費洛蒙誘捕害蟲；生物防治（利用自然天敵使害蟲減少）等，不僅可減少對環境之衝擊，皆可有效降低蟲害。生物防治用天敵主要分為寄生型（寄生蜂）及捕食型（如草蛉、瓢蟲類昆蟲）兩種。寄生型天敵又可依寄生時期區分為卵寄生蜂、幼蟲寄生蜂、蛹寄生蜂，在防治茶捲葉蛾、茶姬捲葉蛾、刺粉蝨等害蟲上有相當的成效。相對於寄主專一性較高的寄生型天敵，捕食型天敵由於專一性較低，對於地處亞熱帶昆蟲繁殖快速的台灣而言，亦在生物防治上佔有重要，如小黑瓢蟲、安平草蛉可捕食刺粉蝨、球粉介殼蟲等害蟲，其他部分蠅類及蜘蛛等亦有同樣捕食害蟲之效。除昆蟲天敵之應用外，由寄生菌所製成之生物製劑如白殭菌(*Botrytis basiana* Balisamo)，也為常見降低害蟲數量之非農藥製劑。

關鍵詞：油茶樹、苦茶樹、生物防治

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Health control and management of oil camellia

*Meng-ling Wu[1,4] Lin-mu Jaung[2] Chih-yun Lee[3]

Summary

Oil camellia, also called oiltea camellia, whose seeds contain wealth of oil and can be extracted as tea tree oil is one of the important cultivation in Taiwan. Brown blight, die-back blight, blister blight, brown round spot, sooty mold, net blister blight, algal spot and horse hair blight are common diseases found on oil camellia in Taiwan. Some nematodes like root-knot nematode and root lesion nematode are also found cause weakness of oil camellia. There are lots of pests could endanger oil camellia as well includes grub, citrus spiny white fly, mealybug, smaller green leaf-hopper, tea leaf roller, tea tussock moth, oriental tea tortrix, small tea tortrix, yellow tea thrips, tea bag-worm, mite and more. Most diseases happen during spring to autumn while net blister blight is an exception that happens in winter; pests grow faster in spring and summer which means they endanger oil camellia during these time. To control these diseases and pests, improving environment of field, enlarging distance between plants, increasing sun light exposure and wind-flow, using resistance cultivates, spreading germicides and pesticides like Tridemorph, Kasugamycin + copper oxychloride, Pyraclostrobin, Carbaryl, Mevinphos, Trichlorfon and Bifenthrin are known effective methods. However those germicides and pesticides are also known have some side effects on human and environment. Seeking the persistence management of field and balance of ecosystem, low-toxic and non-germicide/pesticide methods: using fertilizer and soil supplements to increase plant resistance, plastic bags, mineral oil, sticky paper trap, pheromone trap and biological control (use of natural enemies) are alternative methods in disease control. There are two types of biological control insects, parasites and predators, commonly used in pest control. Parasites like parasitoids work effectively in oriental tea tortrix, small tea tortrix and citrus spiny white fly; predators, with lower specificity in host range, like green lacewings and ladybugs also work effectively on citrus spiny white fly, mealybug and other pests. Parasitic fungi, like *Botrytis basiana*, could parasitize on peats to lead pests die is also an important in biological control.

Key words: Oil camellia, Oiltea camellia, Biological control

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細葉山茶與烏皮茶種子的發芽與儲藏性質

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摘　要

本研究目的在明瞭細葉山茶與烏皮茶種子的發芽特性與探討其儲藏行為，並決定其最適當的儲藏方法。結果顯示供試的細葉山茶新鮮種子不易在短期內集中發芽，以 30/20˚C(光照 8 小時)變溫 16 週後發芽率為 38.9%，且發芽零散，經 28 週後仍有零星發芽。1˚C 與 4˚C 層積處理能降低細葉山茶種子之平均發芽日數，使發芽集中，但無法顯著提高發芽率。細葉山茶種子不耐乾燥，當種子被乾燥至含水率 10.5%以下時則完全喪失活力，且新鮮種子在 1˚C 與 4˚C 下儲藏 6 個月後即完全喪失活力，故初步判斷屬壽命較短的溫帶異儲型。供試的烏皮茶新鮮種子以 30/20˚C(光照 8 小時)變溫經 12 週後之發芽率為 74.2%，平均發芽日數為 36.5 天，4˚C 層積處理能降低平均發芽日數，但無法顯著提高發芽率。烏皮茶種子稍能耐乾旱，當含水率被降至 14.5%時，約 65%種子存活，當含水率再被降至 3.8%時，仍有約 40%種子具有活力；當儲藏在-20、4 與 15˚C 時，均以含水率約 8.3%的種子最能維持活力，而含水率低至 3.8%或高至 14.5%之種子在短期內活力就會顯著下降。烏皮茶乾藏種子之最適溫度以 4˚C 優於-20 與 15˚C。因此，以其能忍受乾燥但卻對零下低溫敏感之特性，判斷屬中間型種子。儲存烏皮茶種子之最佳條件為將其乾燥到約含水率 8.5%，然後密封儲存在 4˚C，1.5 年後約 58%之原具活力種子仍有發芽能力。

關鍵詞：細葉山茶、烏皮茶、發芽、層積、種子儲藏行為

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Germination and Storage Behavior of Seeds of *Camellia tenuifolia* (Hay.) Coh.-Stuart and *Pyrenaria shinkoensis* (Hay.) Keng (Theaceae)

Jeng-Chuann Yang[1,3]   Shing-Rong Kuo[2]

Summary

The purpose of this study was to examine the germination characteristics and seed storage behaviors of seeds of *Camellia tenuifolia* and *Pyrenaria shinkoensis* and determine the appropriate seed storage methods. Results showed that fresh seeds of *C. tenuifolia* were not easy to uniformly germinate in a short time. The germination percentage of the seedlot studied was 38.9% within 16 wk under fluctuating temperatures of 30/20°C with 8 hours of light, and there were still some seeds germinating intermittently after 28 weeks. Stratification at 1 and 4°C was efficient in decreasing the mean germination time (MGT) and made seed germinated uniformly. However, there was no use to increase the germination percentage by 1 and 4°C stratification. Seeds of *C. tenuifolia* were intolerant of desiccation, and when the seeds were dried to 10.5% MCs below, they had totally lost viability. Besides, fresh seeds of *C. tenuifolia* with 1 and 4°C storage for more than 6 months were found to completely lose their viability. Thus, preliminary results show that seeds of *C. tenuifolia* have temperate-recalcitrant storage behavior and exhibit short longevity. The germination percentage of fresh seeds of *P. shinkoensis* was 74.2% within 12 weeks under fluctuating temperatures of 30/20°C with 8 hours of light, and the MGT was 36.5 days. Still, stratification at 4°C was useful to reduce the MGT, but there was no significant increase in germination percentage. Seeds of *P. shinkoensis* were tolerant of desiccation, and when the seeds were dried to 3.8% MCs, there were still 40% viable seeds left. The seeds at a MC of 8.3% had the best viability within 18-month storage at -20, 4, and 15°C. However, when the MC was below 3.8% or above 14.5%, the seeds had rapidly lost their viability in a short time. The seed storage temperature of *P. shinkoensis* was 4°C rather than -20 and 15°C. Therefore, seeds of *P. shinkoensis* were defined as intermediate according to their desiccation tolerance and sensitivity to freezing temperatures. Additionally, the optimal storage conditions of seeds of *P. shinkoensis* are desiccation to about 8.5% MCs and hermetical storage at 4°C, and the initially germinable seeds still had 58% germinability left after 1.5 years.

Key words: *Camellia tenuifolia*, *Pyrenaria shinkoensis*, Dermination, Stratification, Seed storage behavior.

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油茶粕抗木材腐朽菌活性之研究

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摘 要

油茶常見於台灣中低海拔山坡地，榨取油茶種子所得的茶油，除可供為高級食用油脂，尚具有抗菌、殺蟲、解毒等療效。榨取油茶種子油過程中會產生許多殘渣，此副產物即為茶粕，目前多被應用在清潔、肥料或毒殺福壽螺等用途。由前人研究顯示，茶粕尚具有多種活性，例如抑制蟎、斜紋夜盜蛾、血吸蟲、菜蟲等，並有做為漁塭消毒劑、農田消毒劑、農藥的增效劑或防治甘藍幼苗立枯病之潛力。然而，上述文獻皆非以小果種油茶(*Camellia tenuifolia* (Hay.) Cohen Stuart.) 作為茶粕活性之試驗材料。此外，由於消費者對木構建築之需求亦日漸殷切，再加上許多傳統木材保存藥劑因環保意識的提高在使用上受到相當之限制，因此開發環保型保存藥劑，已成為十分迫切的課題。本試驗以甲醇萃取茶粕，所得甲醇粗萃物再透過管柱劃分為成分較單純之分離部，續將粗萃物及不同分離部進行固態瓊脂試驗（Agar plate test），以評估油茶粕之抑菌活性並篩選有效分離部。試驗結果顯示茶粕甲醇粗萃物即具有良好之抑制木材腐朽菌活性，其抑菌活性主要源自於皂素分離部。透過液相層析儀及質譜儀分析技術，可以有效進行皂素成分之判別。

關鍵字：小果種油茶、油茶粕、木材腐朽菌

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Study on antifungal activity of oil camellia seed pomace against wood rot fungi

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Summary

Oil camellia is distributed at low-middle elevations in Taiwan. Oil camellia seed produce top grade edible oil with many bioactivities including antimicrobial, pesticides and detoxification etc. After the extraction of oil, the seed pomace is discarded or applied in detergent or fertilizer industry. There are some reports regarding the bioactivities of the oil camellia seed pomace extracts. However, research from *Camellia tenuifolia* (Hay.) Cohen Stuart is really limited. Besides, as increasing demand for wooden structure and concerning about traditional wood preservatives banned in many countries because of environmental and disposal concerns and governmental regulations, environmentally benign organic preservatives for wood are urgently needed.。In this study, oil camellia seed pomace was extracted with methanol. The extract was subjected to column chromatography to afford six subfractions. Then the methanol extract and the partially purified subfractions were dissolved in distilled water to conduct antifungal assay by agar plate test. Results from our preliminary screening showed that methanol extract of oil camellia seed pomace at 200 ppm markedly inhibited the mycelia growth of wood rot fungi. The antifungal activity mainly contributed from saponin subfraction. Constituents in the bioactive saponin subfraction can be recognized by high-performance liquid chromatography (HPLC) and LC-MS/MS analysis.

Key words：*Camellia tenuifolia*, Oil camellia seed pomace, Wood rot funi

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利用 *C. elegans* 做為活體模式探討苦茶油茶粕萃取成分的抗氧化效應及其調控機制

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摘　要

苦茶油是用油茶之種子經壓榨而得。苦茶油是單元不飽和脂肪酸含量豐富之食用油，冒煙點低，加熱時不易產生油煙，被認為是健康油類，性質更媲美西方的橄欖油。苦茶油的營養價值甚高，在臨床上亦有治療心臟血管性及胃疾等之效果。在台灣茶油種子主要為大果種子和小果種子，而苦茶籽榨過油後的殘渣，即是茶粕，一般被認為較無經濟價值，常被用於作為清潔劑或有機肥料。然而在茶粕的成分中含有大量的茶皂素及黃酮類，這些從茶粕中萃取的多酚性化合物對於生物體具有潛在的有利效應，藉由研究茶粕中的有效成分，將可提高其經濟效益。本研究欲利用模式生物 *C. elegans* 作為活體模式(*in vivo* model)探討苦茶油茶粕萃取成分的抗氧化效應，並更進一步探討其調控機制。研究的初步結果顯示，苦茶油茶粕的粗萃混合物具有顯著的抗氧化效應，利用不同的萃取分離方式，獲得苦茶油茶粕精萃的成分，亦顯示顯著的抗氧化效應。本研究期望藉由研究成果，補足科學數據上的佐證，藉以推動油茶相關的產業並增加其發展的潛力，以期使油茶能成為更具經濟價值的作物，進一步增進林農對此本土樹種之栽種意願。

關鍵詞：*C. elegans*、苦茶油茶粕、抗氧化

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Functional and regulatory analyses of antioxidative effects of bioactive compounds of tea seed pomace using *Caenorhabditis elegans* as an *in vivo* model system

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Summary

Tea seed oil is pressed mainly from the seeds of *Oiltea Camellis*. Tea seed oil is high quality cooking oil which is rich in monounsaturated fatty acid content. It has low smoke point and not easy produces fumes when heated. Tea seed oil is high nutritional value oil and in the clinical treatment it also has effect on heart and vascular disease and stomach disease. In Taiwan, tea seed oil is mainly from the seed of *Camellia oleifera* and *Camellia tenuifolia*. After the oil has been extracted from the seed, the remaining tea seed pomace is discarded or used as a detergent or organic fertilizer with low economic value. However, the tea seed pomace contains large amounts of active compounds such as theasaponins and flavonoids. The extractions of these polyphenolic compounds from tea seed pomace have potential beneficial effects. In this study, we used *C. elegans* as model system to investigate the antioxidative effects of bioactive compounds of tea seed pomacein *in vivo* and its corresponding regulatory mechanisms. The results showed that the mixture compounds of tea seed pomace have significant antioxidant effects. We used different extraction methods to obtain the bioactive compounds of tea seed pomace, and further showed the bioactive ingredients of pomace exhibited antioxidative effects. Our study will provide direct scientific evidence of the antioxidative effects of bioactive compound of tea seed pomace. Results from this study will further promote tea seed oil related industries and increase their development potential and to make tea seed oil become more economically valuable crops.

Key words：*C. elegans*, Tea seed pomace, Antioxidant

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應用攜帶型氣相層析儀快速檢測苦茶油

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摘　要

脂肪、糖、蛋白質為人體所必須的三大營養物質。而食用植物油所提供的脂肪，由於材料種類、貯藏及製程不同，其組成及含量均有所異，油品的價格當然也就有高低之差。就有益健康的苦茶油而言，其售價差異甚大，而販售價格與油質優劣之相關性究竟為何？常造成選購時的困擾。因此，建立快速之鑑別技術，生產者可用以控制品質，而消費者的權益也獲得保障。傳統上植物油之種類與優劣是以感官評價，就其特有的顏色及香氣判斷之，但對油品的純度或摻雜其他植物油時，則缺乏客觀的評估指標。近年來，則應用近紅外光譜、液相層析以及氣相層析，分析油品中的脂肪酸組成及含量，並依據獨特的指紋圖譜，鑑別其種類及純度。就脂肪酸之分析而言，由於脂肪酸的沸點很高，在高溫時，不穩定且易裂解，故需先行酯化，惟傳統加熱條件下，進行酯化反應，有時間長、產率低等缺點。為克服此問題，本試驗利用攜帶型氣相層析儀，就市售的苦茶油等各種油品，不先經過酯化處理，而直接進行分析。試驗結果顯示：苦茶油及各種油品都有其獨特的指紋圖譜，故可依各揮發成份之滯留時間(retention time)差異，作為鑑別的依據；當油中摻雜其他植物油時，則可將各圖譜以疊圖處理，由所呈現相同的滯留時間，而得以確認所摻入油品的種類；當油脂超過食用期，而發生氧化酸敗時，亦可由其標準圖譜判知。本實驗係首次應用攜帶型氣相層析儀，證實可以快速、有效的方式檢測苦茶油及其他食用油脂。

關鍵詞：苦茶油、食用油、攜帶型氣相層析儀

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Application of portable GC to rapid detecting camellia seed oil

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Summary

Fat, sugar, and protein are 3 essential nutrients for human body. Because the fats provided by edible vegetable oils tend to vary in compositions and contents according to their sources, storage and production conditions, it is only natural that pricing of the oils also widely differs. For instance, commercial seed oil of *Camelia* spp, regarded as a kind of healthful food, often has disparaging price range, and the oil itself is often adulterated with other inferior oils. Customers are often confused by its pricing, whereas there is no guarantee on its quality at the same time. Therefore, a rapid and efficient technique for identifying oil composition for quality control in production and safeguard rights of consumers is critically needed. Traditionally, the types and qualities of vegetable oils are judged by sensory evaluation based on specific color and aroma of the oils. When dealing with adulterated vegetable oils, however, the method often produces uncertain results. In recent years, instruments such as near-infrared spectroscopy (NIRS), liquid chromatography (LC) and gas chromatography (GC) are used to analyze the compositions and contents of fatty acids in vegetable oils and to establish the types and purities of the oils according to their unique fingerprint spectra. Because fatty acids have high boiling points and are liable to crack under the high temperature conditions necessary for these analyses, they need to be esterified before analyzing. However, the conventional heated esterification condition is both time-consuming and low-yielding. To ameliorate the problems, we applied a portable GC to directly analyzing commercial *Camelia* seed oils and other vegetable oils without the pretreatment of esterification. The results showed that every vegetable oil has a unique fingerprint, which can be used to identify the oil constitution according to the retention time of its volatile components. If an oil sample was adulterated then from its overlapped fingerprints, the constituent oils could be identified based on the retention time of the hybrid fingerprint patterns. Also, if the optimal consumption time of a vegetable oil expires, its fingerprint can be used to check its status of degradation such as oxidization and souring by comparing its fingerprint with a standard diagram. This study was the first report of applying a portable GC *in situ*, and the application has been proven to be rapid and effective for detecting *Camellia* seed oil and other edible oils.

Key words: Camellia seed oil, Edible oil, Portable GC

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混農林業經營模式之研究—速生樹種混植油茶

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摘 要

本研究模擬速生樹種混植油茶，桉樹以輪伐期 6 年、萌芽更新、連續三個輪伐期為經營期限，計算 18 年間的經濟收益。本研究結果在 5 種折現率（2%、4%、6%、8%、10%）下，不論有無造林獎勵，3 種造林方案之淨現值均為正值，以「有造林獎勵 X 模式」最高，「有造林獎勵 Y 模式」次之，「無造林獎勵」第三。而折現率越低，各種造林方案之淨現值越大。油茶和速生樹種混農林業不論在台灣平地或低海拔山坡地應該都是經濟可行的經營模式。

關鍵詞：混農林業、油茶、桉樹、淨現值

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Agroforestry management model in Taiwan—fast growing trees mixed with oiltea camellia

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Summary

The study simulates a mixed forest of fast growing species and oiltea trees. Eucalyptus is selected and assumed six-year rotation, and coppice regeneration. Economic benefits during 18 years are calculated. The results show that by 5 interest rates, with or without the subsidy, the net present value (NPV) of three reforestation programs is all positive. “X model with the subsidy” has the highest NPV, the second is “Y model with the subsidy”, and the third is the “Non-subsidized model”. The lower the interest rate, the higher the NPV of different reforestation programs. Oiltea trees mixed with fast growing trees should be an economically feasible model in plains and low mountain slope areas in Taiwan.

Key words: Agroforestry, Oiltea tree, Eucalyptus, Net present value

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苦茶油副產物之抗氧化及防曬美白活性

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摘 要

本研究探討苦茶油萃取物(非脂肪酸部份)的抗氧化活性及防曬美白活性，針對苦茶油副產物—苦茶粉、油茶粕、油茶殼進行萃取，篩選具抗氧化及防曬美白活性的天然物，做為皮膚保養商品的新素材，提昇油茶的附加價值。無論是苦茶粉、苦茶粕、油茶殼的總酚含量都大於120 mg of GAE/g，然而在DPPH自由基清除能力卻只有油茶殼有效果，IC_{50} 為26.96±6.77 ppm，都具有抗菌活性，酪胺酸酶活性抑制則以苦茶粉明顯優於其他。

關鍵詞：苦茶粕、抗氧化、酪胺酸酶活性

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The antioxidant activity and skin whitening activity of the by-product of tea seed oil

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Summary

The purpose of this paper is to investigate the antioxidant activity, skin whitening activity of the extract of tea seed oil. We extracted the small fruit species of tea seed oil (*Camellia tenuifolia*) and its by-product (tea seed cake, tea seed shell). Detection of the unsaturated fatty acids and antioxidant active ingredients become the reference of production process of tea seed oil. Screening skin whitening active ingredients as a new material of skin care products to enhance the added value of Camellia.

Key words： Tea seed oil, Antioxidant activity, Tyrosinase inhibitory activity

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大果種油茶粕甲醇萃取物對脂多醣引發主動脈血管對α-adrenoreceptor agonist 低反應性之作用

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摘　要

內毒素血症係指血液中出現脂多醣 (內毒素)而引發敗血性休克，致使病人心血管循環系統顯著地產生變化，其中包含動脈血管對血管收縮劑等之影響，如血管張力素及苯腎上腺素之產生低反應性。敗血性休克在臨床上迄今仍無積極性的治療方法，而油茶種子壓榨所製得之油脂可以有效地減少脂多醣對大鼠造成的器官損傷與死亡率，然而油茶種子中之有效成分如何保護脂多醣所造成的傷害則尚待探討。本研究目的在於探討油茶茶粕中之有效成分對脂多醣引發主動脈血管之甲型-腎上腺素受體致效劑之抑制效果。試驗係選取 10-12 週齡雄性 SD 大鼠之胸主動脈，並將其放置於組織瓶中，而後再將脂多醣及大果種油茶粕酒精萃取物分別或同時加入組織瓶中，並利用離體血管張力測量系統以評估血管段對苯腎上腺素之收縮反應影響。結果顯示：(1) 主動脈血管段在含有脂多醣(濃度為 100 微克/毫升)之前處理五小時內，對苯腎上腺素所引發的血管收縮反應會顯著地減弱，其減弱的程度為 15.4-51.1%；然而大果種油茶粕酒精萃取物則不影響苯腎上腺素所引發的血管收縮反應；(2) 以脂多醣處理的血管段，並添加大果種油茶粕酒精萃取物後，可以有效地抑制脂多醣所引發的血管段對苯腎上腺素之低反應性；(3)添加大果種油茶粕酒精萃取物經液相-液相再分離之富含皂素萃取物，亦顯示可有效地抑制脂多醣所引發的血管段對苯腎上腺素之低反應性。本研究結果顯示，大果種油茶粕酒精萃取物具有改善敗血性休克所引發器官損傷之潛力，且油茶種子中的皂素可能是一種有效保護器官與降低其損傷的重要成分。

關鍵詞：大果種油茶粕、脂多醣、血管張力素、苯腎上腺素、低反應性

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Effects of methanolic extracts of *Camellia oleifera* seed residue on lipopolysaccharide (endotoxin)-induced hyporeactivity of aorta to α-adrenoreceptor agonist

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Summary

Endotoxemia characterized by the presence of endotoxin (lipopolysaccharide, LPS) in blood leads to septic shock which is represented by significant circulatory changes including vascular hyporeactivity to vasoconstrictors such as angiotensin II and phenylephrine (PE), an α-adrenoreceptor agonist. Until now, there are no effective therapies on septic shock, and *Camellia* seed oil was proved to significantly attenuate organ injuries and mortality rate in endotoxemic rats. However, the mechanism of active components in *Camellia* seed involving protection against endotoxemia is still unknown. Therefore, this study was to investigate whether active components in *Camellia* seed can prevent LPS-induced hyporeactivity to α-adrenoreceptor agonist. Thoracic aorta isolated from male Sprague-Dawley rats (10- to 12-week old) was mounted in the organ chamber to evaluate vascular responsiveness to cumulative doses of PE using wire myography system. LPS (0111:B4) and methanolic extracts of *Camellia oleifera* seed residue were also added in the organ chamber individually or simultaneously to assess their effects on PE-induced vasoconstriction. Results revealed that: (1)Aortic rings in the presence of treatment with LPS at the dosage of 100 μg/mL for 5 hours exhibited decreased responsiveness to PE by 15.4 to 51.1%; however, methanolic extracts of *Camellia oleifera* seed residue had little effect on PE-induced vasoconstriction; (2)Comparing with LPS-treated rings, co-treatment with methanolic extracts of *Camellia oleifera* seed residue markedly restore aortic responsiveness to PE in the presence of LPS treatment; (3)Saponin enriched fraction isolated from methanolic extracts of *Camellia oleifera* seed residue also showed its ability to restore LPS-induced hyporeactivity to PE. In summary, methanolic extracts of *Camellia oleifera* seed residue possess the potential to alleviate septic shock-related organ injuries and saponin may be one of the active components in *Camellia oleifera* seed mediates the protection.

Key words: *Camellia* seed oil residue, Lipopolysaccharide, Angiotensin II, Phenylephrine, Hyporeactivity

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「2011 年台灣油茶研究之回顧與展望」研討會論文集

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編輯：尹華文

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發行單位：行政院農業委員會林業試驗所

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電話：02-23039978

出版：中華民國 100 年 8 月 10 日

網址：http://www.tfri.gov.tw