Calypogeia aeruginosa Mitten, a Newly Recorded Liverwort to Taiwan

台灣新紀錄蘚類－銅綠護蒴蘚

Jia-Dong Yang[1, 2] and Shan-Hsiung Lin[2, *]

楊嘉棟[1, 2] 林善雄[2, *]

[1] Endemic Species Research Institute, Jiji, Nantou,Taiwan
[2] Department of Life Science, Tunghai University, Taichung, Taiwan

[1] 行政院農業委員會特有生物研究保育中心 南投縣集集鎮民生東路 1 號
[2] 東海大學生命科學系 台中市台中港路三段 181 號

*Corresponding author: slin@thu.edu.tw

*通訊作者：slin@thu.edu.tw

Abstract

We report *Calypogeia aeruginosa* Mitten as a newly recorded species of liverwort to Taiwan. It is distinguishable from other congeners on the island by having very large orbicular to reniform underleaves with obtuse or emarginated apices, and the dark blue to bluish brown oil bodies in its leaf cells. This paper also briefly describes its characters with illustrations and provides information on its habitat and distribution.

摘 要

本文報導台灣新紀錄蘚類－銅綠護蒴蘚（新擬）。本種可藉由其先端微凹或鈍頭、呈球形至腎形的巨大腹葉及具有深藍色至藍褐色之葉細胞的油體等特徵，與台灣其他同屬物種區別之。文中並附有本種之形態描述、圖片及棲地與分布等資料。

Key words: *Calypogeia aeruginosa*, liverwort, new record, Taiwan

關鍵詞：銅綠護蒴蘚、蘚類、新紀錄、台灣

Received: February 11, 2009 Accepted: April 29, 2009

收件日期：98 年 2 月 11 日 接受日期：98 年 4 月 29 日

Introduction

Six species of liverworts belonging to the genus *Calypogeia* have been reported from Taiwan (Lin 2000). In our recent plant inventory survey of Taiwan, we collected a specimen of *Calypogeia aeruginosa* Mitten from Mt. Ali, Chiayi County, in 2008. And found it to be a new record to the liverwort flora of Taiwan. This paper briefly describes its characters with illustrations and provides information on its habitat and distribution. The voucher specimen is deposited at the Herbarium of Endemic Species Research Institute (**TAIE**).

Taxonomic Treatment

Calypogeia aeruginosa Mitten, Journal of the Proceedings of the Linnean Society 5: 107 (1861).

銅綠護蒴蘚 Figs. 1-2

Description: Plants up to 55 mm in length, with leaves 1.6-2.5 mm in width, fresh specimen bluish green to dark olive green in color, dried specimen yellowish brown to dark brown. Stems irregularly branched, elliptical-rectangular in cross-section, 0.35-0.40×0.18-0.22 mm in diameter; cortical cells small in a single layer, medullary cells larger, cells almost undifferentiated, with thin-wall and small trigones. Leaves densely imbricate, incubous, obliquely insertion, and obovate to orbicular, 1.6-2.0 mm in length, 1.0-1.6 mm in width, apex rounded, margin involuted. Leave cells thin-walled, trigones minute, and intermediate thickening absent; marginal cells rectangular, 30-45×20-30 μm; median cells polygonal, 28-48×22-40 μm; and basal cells similar to median ones in shape but larger, 42-73×25-40 μm. Cuticle smooth. Oil bodies usually 2 per cell for leaf lobe, dark blue to bluish brown in color, compound type and filled with minute granules, oblong to orbicular, 5-9×4-6 μm. Underleaves very large, orbicular to reniform, 1.3-1.5 mm in length, 1.7-2.1 mm in width, imbricate, with arched insertion, apices emarginated to obtus. Fertile plants and sporophyte not seen.

Habitat and Distribution: According to literature (Hasegawa 2000; Singh and Singh 2008) and our field observation in this study, *C. aeruginosa* grows on wet and exposed rock surface, such as along road sides, with constantly seeping or dripping water.

C. aeruginosa is found at Mt. Ali in Chiayi County of Taiwan (elevation 2,300m) (Fig. 3), Sikkim, Lachen (elevation 366m) (Inoue 1969) and Sikkim, Pangthang (elevation 1,780m) (Singh and Singh 2008) of India, Yakushima Island in Kagoshima Prefecture (elevation 1,700-1,850m) of Japan (Inoue 1969; Hasegawa 2000), and Kaua Island of Hawaii, USA (Miller 1967; Inoue 1969; Staples and Imada 2006).

Specimens examined: Chiayi County: Mt. Ali, Alishan Railroad Mian-yue branch 8.4 km, on the wall of seeping rock-slab just beside the trail and without any shade, elevation 2,300m, 120°48'30"E, 23°32'56"N; Mar. 11, 2008, *J. -D. Yang 4920* (**TAIE**).

Remarks: The oil bodies in leaf cells are fairly fixed character for the species and apparently have taxonomic value. However, they have not been commonly used, because they are absent in dried herbarium materials (Stewart 1978; Furuki and Higuchi 1996). The genus *Calypogeia* comprises about 30 species worldwide (Gradstein and Costa 2003), and only five species have the blue oil bodies. They are *C. aeruginosa*, *C. azurea* Stotler & Crotz. 【= *C. tricomanis* (L.) Corda】, *C. goebelii* (Schiffn.) Steph., *C. granulata* Inoue and *C. peruviana* Nees & Mont. (Inoue 1968, 1975; Schuster 1969; Huneck 1983; Hasegawa 2000; Furuki 2001). There are two species *C. aeruginosa* and *C. azurea* in Taiwan with blue oil bodies. *Calypogeia aeruginosa* is easily distinguishable from other congeners in Taiwan by having very large orbicular to reniform underleave with emarginated or obtuse apex, and the dark blue to bluish brown oil bodies of leaf cells. The *C. azurea* is different from its underleaves small and bifid for more than 1/3 the length.

According to the IUCN categories of threatened species, *Calypogeia aeruginosa* has been considered as a rare species and cataloged as critically endangered (CR) in India and vulnerable (VU) in Japan (Iwatsuki *et al*. 2008; Singh and Singh 2008). In Taiwan, the population status of this species needs a futher study. The Mt. Ali population is small and only found on the wall of seeping rock-slab just beside the trail without any shade. Such habitat is easily to be destroyed by landslides.

The occurrence of this species reported herein provides another evidence of the phytogeographic affinity of the bryoflora in Taiwan with those in the Southeast Himalayas (Lin 2000; Yang and Lin 2008).

Acknowledgements

We are grateful to Miss Hsiu-Jane Chen and Mrs. Kui-Chu Chen who assisted in field collection and plate preparation. This study was supported in part by the grants of National Science Council (NSC 97-2321-B-329-005) and the Council of Agriculture, Taiwan.

Literature Cited

Furuki, T. 2001. Hepaticopsida. pp. 231-320. *In*: Z. Iwatsuki (ed.). Mosses and liverworts of Japan. Heibonsha Ltd. Publishers, Tokyo, Japan. (In Japanese)

Furuki, T. and M. Higuchi. 1996. Studies of oil bodies and oil droplets of some Hepatics (Jungermanniales) from New Caledonia. Bulletin of The National Science Museum

Series B (Botany) 22(2): 59-75.

Gradstein, S. R. and D. P. Costa. 2003. The Hepaticae and Anthocerotae of Brazil. Memoirs of New York Botanical Garden 87: 54-57.

Hasegawa, J. 2000. Oil bodies of *Calypogeia aeruginosa* Mitt. Bryological Research 7(9): 286-287.

Huneck, S. 1983. Chemistry and biochemistry of bryophytes. pp. 1-116. *In* : R. M. Schuster (ed.). New Manual of Bryology. Hattori Botanical Laboratory, Nichinan, Miyazaki, Japan.

Inoue, H. 1968. A new species of *Calypogeia* Raddi. The Journal of Japanese Botany 43(10-11): 468-472.

Inoue, H. 1969. Miscellaneous notes on Hepatics of Japan (6). The Journal of Japanese Botany 44(10): 300-303.

Inoue, H. 1975. Two new species of *Calypogeia* Raddi from Japan. Bulletin of The National Science Museum Series B (Botany) 1(4): 135-140.

Iwatsuki, Z., T, Furuki, H. Kanda, J. Hasegawa and M. Higuchi. 2008. New red list of bryophytes of Japan, 2007. Bryological Research 9(8): 259-267.

Lin, S. H. 2000. The liverwort flora of Taiwan. The Council of Agriculture, Taipei, Taiwan. (In Chinese)

Miller, H. A. 1967. Oddments of Hawaiian bryology. Journal of the Hattori Botanical Laboratory 30: 271-276.

Schuster, R. M. 1969. The Hepaticae and Anthocerotae of North America. II. Columbia University Press, New York.

Singh, D. K. and D. Singh. 2008. Rediscovery of *Calypogeia aeruginosa* Mitt. (Hepaticae: Calypogeiaceae) - a long lost liverwort from Sikkim, India. Journal of Bryology 30: 229-231.

Staples, G. W. and C. T. Imada. 2006. Checklist of Hawaiian Anthocerotes and Hepatics. Tropical Bryology 28: 15-47.

Stewart, G. H. 1978. Oil bodies of New Zealand leafy Hepaticae (Jungermanniales). New Zealand Journal of Botany 16: 185-205.

Yang, J. D. and S. H. Lin. 2008. *Lejeunea bidentula* Herz. as a newly recorded liverwort to Taiwan. Endemic Species Research 10(2): 65-69.

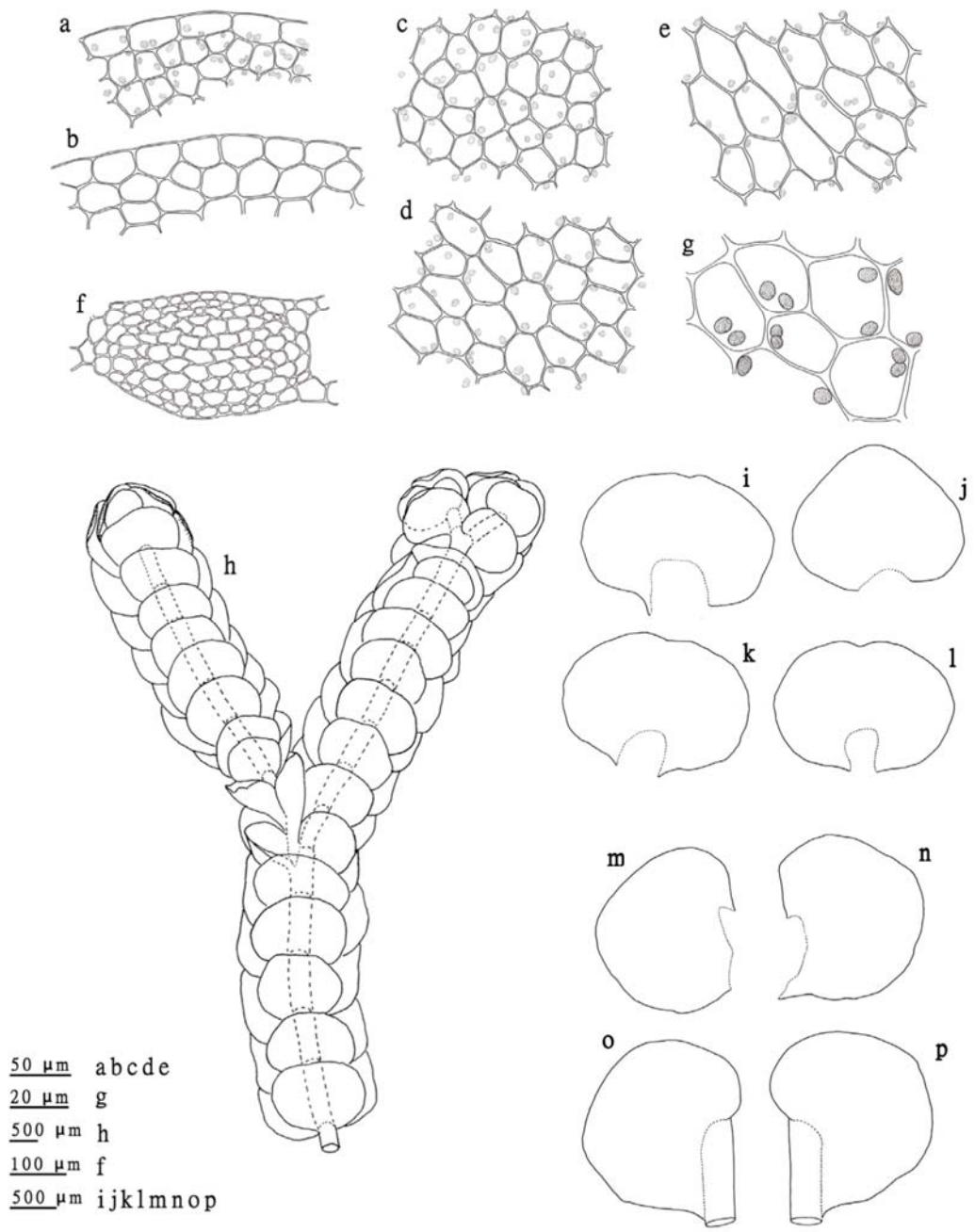

Fig. 1. ***Calypogeia aeruginosa*** Mitten: a and b, marginal cells of leaf lobes; c and d, median cells of leaf lobes; e, basal cells of leaf lobe; f, transverse section of stem; g, oil bodies in the median cells of leaf lobe; h, ventral view of a portion of sterile plant; i-l, underleaves; m-p, leaves. All drawn from *J. -D. Yang 4920*.

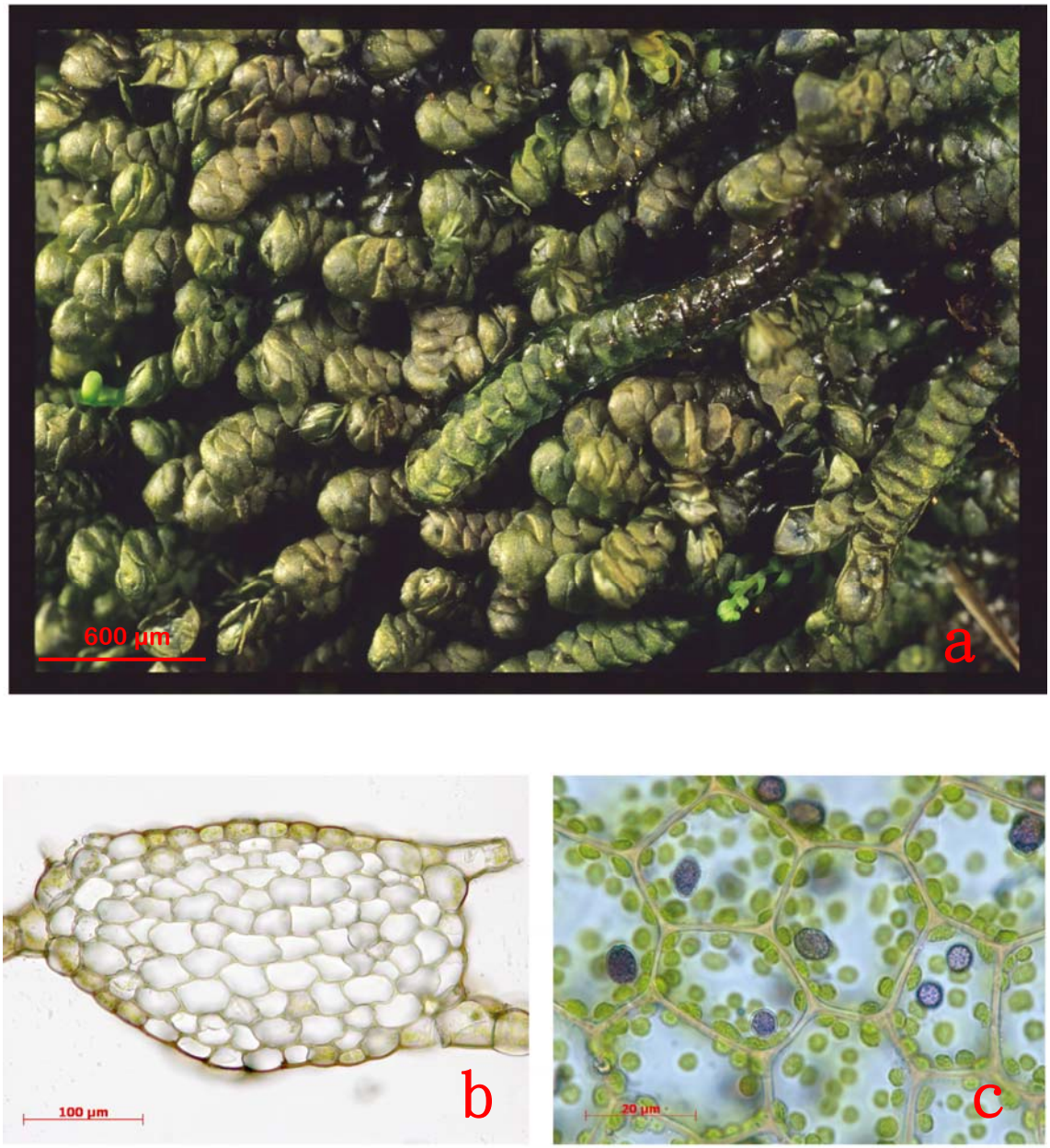

Fig. 2. ***Calypogeia aeruginosa*** Mitten: a, plants; b, transverse section of stem; c, dark blue to bluish brown oil bodies filled with minute granules. (from *J. -D. Yang 4920*)

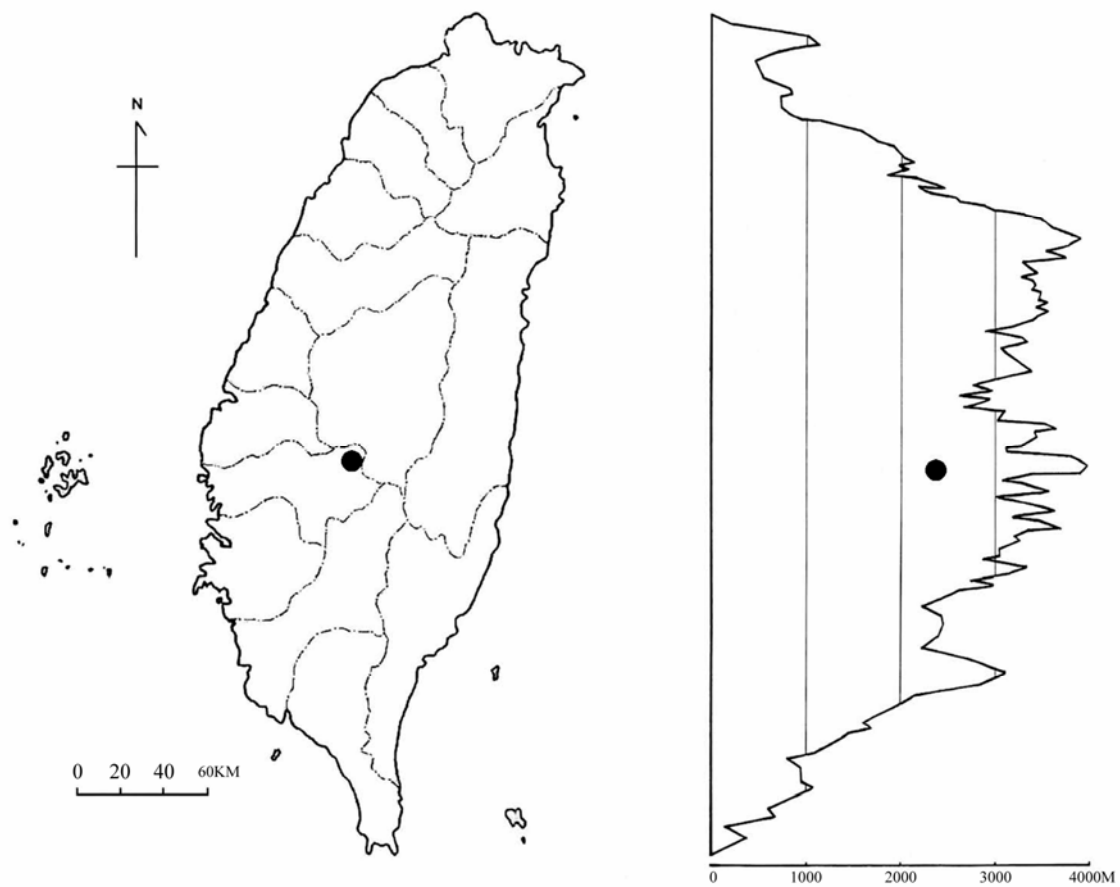

Fig. 3. The collection location of *Calypogeia aeruginosa* Mitten (solid circle) in Taiwan.