

DOI: 10.11931/guihaia.gxzw201806035

引文格式: NGUYEN Khang Sinh, 温放. 越南苦苣苔科植物国家级分布新记录——大苞漏斗苣苔 [J]. 广西植物, 2018, 38(11): 1422–1427

NGUYEN Khang Sinh, WEN F. Notes on taxonomy of *Raphiocarpus begoniifolius* (Lévl.) Burt (Gesneriaceae) from Vietnam [J]. *Guihaia*, 2018, 38(11): 1422–1427

Notes on taxonomy of *Raphiocarpus begoniifolius* (Lévl.) Burt (Gesneriaceae) from Vietnam

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Abstract: *Raphiocarpus* Chun is a small genus includes all species from China to Indo-China Peninsula, and mainly distributes from southern and southwestern China to northern and central Vietnam. However, there are only three species can be found in both countries formerly. *Raphiocarpus begoniifolius* (Lévl.) Burt was once considered as an endemic species of China, and it is distributed in China (northwestern Guangxi, southwestern Guizhou, southeastern Yunnan and northwestern Hubei), but there is not reported on flora of Vietnam. This species is here reported as the first record for the flora of Vietnam, so it makes the codistributed species number of *Raphiocarpus* in both countries has been risen from three to four. Notes on taxonomy and distinguishable discussion from its congener, *Raphiocarpus macrosiphon* (Hance) Burt, are provided. The further improved key to species of *Raphiocarpus* in Vietnam is showed here. According to the field studies by both countries, respectively and/or jointly, we also discussed the endangered status of *Raphiocarpus begoniifolius* so that it furnishes direct evidence for the conservation of this species and, even, this genus in China and Vietnam. The voucher specimens are hold in Herbarium of Institute of Ecology and Biological Resources (HN).

Key words: North Vietnam, *Raphiocarpus* Chun, flora of Vietnam, flora of China

CLC number: Q949 **Document code:** A **Article ID:** 1000-3142(2018)11-1422-06

收稿日期: 2018-08-24

基金项目: 越南国家科学与技术工程院项目 (IEBR.DT.03/G2-18); 中国广西自然科学基金 (2015GXNSFBB139004); 中国广西喀斯特植物保育与恢复生态学重点实验室基金 (17-259-23); 中国科学院科技服务网络计划项目 (KFJ-3W-No1) [Supported by the Program of Institute of Ecology and Biological Resources, VAST (IEBR.DT.03/G2-18); the Natural Science Foundation of Guangxi, China (2015GXNSFBB139004); Guangxi Key Laboratory of Plant Conservation and Restoration Ecology in Karst Terrain, China (17-259-23); the STS Program of the Chinese Academy of Sciences (KFJ-3W-No1)]。

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越南苦苣苔科植物国家级分布新记录——大苞漏斗苣苔

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摘 要: 漏斗苣苔属 (*Raphiocarpus* Chun) 是分布于中国至中南半岛一带的小属, 主要产于中国华南西南抵越南北部至中部, 但之前中越两国共有分布的该属物种仅有 3 个种。大苞漏斗苣苔 [*Raphiocarpus begoniifolius* (Lévl.) Burt] 一度被认为是中国的特有种, 仅分布在中国的广西西北部、贵州西南部、云南东南部和湖北西北部, 尚未见有在越南的相关研究报道。该文首次报道了越南植物区系中大苞漏斗苣苔的国家级分布新记录, 使得中越两国共有分布的该属物种上升到了 4 个种, 并着重讨论了大苞漏斗苣苔与其近缘种长筒漏斗苣苔 [*Raphiocarpus macrosiphon* (Hance) Burt] 的区别特征, 进一步完善了越南所分布的漏斗苣苔属植物检索表。根据中越两国的各自与联合野外考察工作对该种的濒危现状进行了讨论, 为中越两国开展该种乃至该属植物的保育提供了直接证据。凭证标本保存于越南生物资源与生态研究所标本馆 (HN) 中。

关键词: 越南北部, 漏斗苣苔属, 越南植物区系, 中国植物区系

1 Introduction

The genus, *Raphiocarpus* Chun, originally described as a monotypic genus (Chun, 1946). It was merged into *Didissandra* C. B. Clarke by Wang (1980) after three decades. However, the results showed that the Sino-Vietnamese species of *Didissandra* are not congeneric with the Malesian species (which themselves had to be split into two genera, *Didissandra* and *Ridleyandra* A. Weber & B. L. Burt) (Weber & Burt, 1998). Thus, according to presently understanding, *Raphiocarpus* should include all species from China and Vietnam formerly placed in *Didissandra*. Further up, these species of the redefined *Raphiocarpus* are generally very ill-known and are quite possible that those species do not form a homogeneous group (Weber & Burt 1998, 1997; Sontag & Weber, 1998; Vitek et al, 1998). In other words, the genus may prove artificial, when the species (and adjacent genera) are better

known (Weber & Skog, 2007).

At present, *Raphiocarpus* with fourteen currently recognized species, has its main distribution from southern and southwestern China to northern and central Vietnam (Pellegrin, 1930; Ho, 2000; Li & Wang, 2004; Phuong, 2005; Zhang et al, 2010; Phuong & Xuyen, 2010; Phuong et al, 2012). *Raphiocarpus petelotii* (Pellegr.) B. L. Burt and *Raphiocarpus sinicus* Chun, do also occur in Vietnam (Li & Wang, 2004; Phuong, 2005; Phuong & Xuyen, 2010). The distribution area of *Raphiocarpus longipedunculatus* (C. Y. Wu ex H. W. Li) B. L. Burt, *Raphiocarpus maguanensis* Y. M. Shui & W. H. Chen and *Raphiocarpus jinpingensis* W. H. Chen & Y. M. Shui in Chinese Yunnan (Pingbian, Maguan, Jinping, Lüchun) are very close to the border of Vietnam and these species might be discovered in Vietnam in the future (Li & Wang, 2004; Wei et al, 2010; Zhang et al, 2010). Recently, we recognized and identified some species of this genus from the specimens of Gesneriaceae in the Hanoi Herbarium (HN). The

'Checklist of plant species of Vietnam' includes five species of *Didissandra* C. B. Clarke, now *Raphiocarpus*, in Vietnam. They are *Raphiocarpus annamensis* (Pellegr.) B. L. Burtt, *Raphiocarpus asper* (Drake) B. L. Burtt, *Raphiocarpus clemensiae* (Pellegr.) B. L. Burtt, *Raphiocarpus evardii* (Pellegr.) B. L. Burtt, *Raphiocarpus petelotii*, *Raphiocarpus sinicus* and *Raphiocarpus tamdaoensis* V. X. Phuong, D. T. Xuyen & Y. G. Wei (Phuong, 2005; Phuong et al, 2012). After consulting relevant literature (Pellegrin, 1930; Burtt, 1954; Burtt & Tan, 1984; Wang & Li, 1992, 1998; Ho, 2000; Weber, 2004; Wei et al, 2010; Zhang et al, 2010, Phuong & Xuyen, 2010; Phuong et al, 2012), as well as herbarium specimens in Vietnam and China, we considered that our unknown species from Vietnam should be *Raphiocarpus begoniifolius* (Lévl.) Burtt, which is a new record to Vietnam.

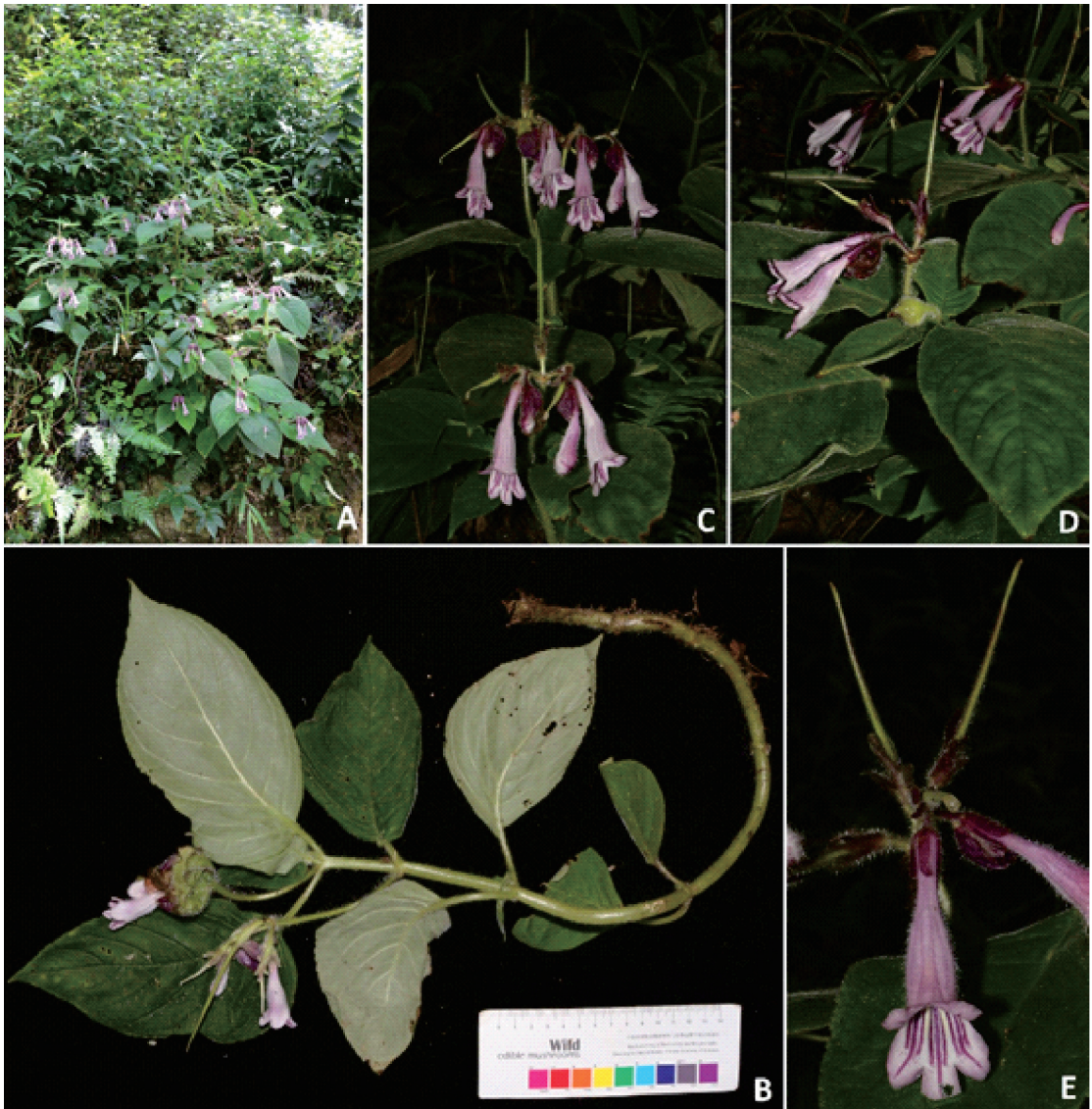
Identification key to species of *Raphiocarpus* occurring in Vietnam

1. Calyx separate, calyx lobes deeply divided to base or near base
 2. Calyx glabrous
 3. Peduncle about 5 cm long; corolla bluish green, 3–4 cm long 1. *Raphiocarpus annamensis*
 3. Peduncle very short, less than 1 cm long; corolla whitish green or reddish, 12–15 mm long
..... 2. *Raphiocarpus sinicus*
 2. Calyx pubescent.
 4. Bract 2.0–3.0 cm long; corolla whitish purple to violet 3. *Raphiocarpus begoniifolius*
 4. Bract less than 1.0 cm long; corolla yellow, orange-red or white.
 5. Ovary glabrous
 6. Peduncle 10–20 cm; corolla yellow, 2.5–3.0 cm; fruit 6–7 cm long 4. *Raphiocarpus asper*
 6. Peduncle 1.5–4.5 cm; corolla orange-red, 6–7 cm; fruit 3.0–5.0 cm long
..... 5. *Raphiocarpus macrosiphon*
 5. Ovary pubescent
 7. Cymes 1-flower; peduncle 3.0–5.0 cm; corolla yellowish, 3.0–4.0 cm long
..... 6. *Raphiocarpus tamdaoensis*
 7. Cymes 3–5 flowers; peduncle 7.0–9.0 cm long; corolla white, with violet longitudinal lines at throat, 4.0–5.0 cm long 7. *Raphiocarpus evardii*
 1. Calyx united at base, with tube funnel or cup form.
 8. Leave pubescent; calyx tube funnel form, 15 mm long, calyx lobe 5 mm long; corolla yellowish, 3.5–4.5 cm long 8. *Raphiocarpus petelotii*
 8. Leave glabrous; calyx tube cupform, 6–9 mm long, calyx lobe 3 mm long; corolla white, 2.5–3.0 cm long 9. *Raphiocarpus clemensiae*

2 Results and Analysis

2.1 Taxonomy and specimens' information

Raphiocarpus begoniifolius (Lévl.) Burtt in Beitr. Biol. Pflanze 70: 173. 1998. — ***Didissandra begoniifolia*** Lévl. in Repert. Sp. Nov. 11: 495. 1913; Burtt in Not. Bot. Gard. Edinb. 23 (3): 100. 1960; Lauener & Burtt in l. c. 38(3): 467. 1980; K. Y. Pan in W. T. Wang, Fl. Reip. Pop. Sin. 69: 231, tab. 59: 5–9. 1990; W. T. Wang et al. in Z. Y. Wu & Raven, Fl. China 18: 282. 1998. — *Chirita chamydata* W. W. Smith in Not. Bot. Gard. Edinb. 10: 170. 1918. — *Loxostigma begoniifolium* (Lévl.) Anthony in l. c. 18: 199. 134. Type: CHINA. Yunnan, Red River from manmer. J. Esquirol 972 (E, holo!).



Note: A. Habitat; B. Habit and cymes; C. Frontal view of cymes; D. Lateral view of cymes; E. Frontal view of corolla in natural status. (Photoed by Dr. Nguyen Khang Sinh)

Fig. 1 *Raphiocarpus begoniifolius* (Lévl.) Burt

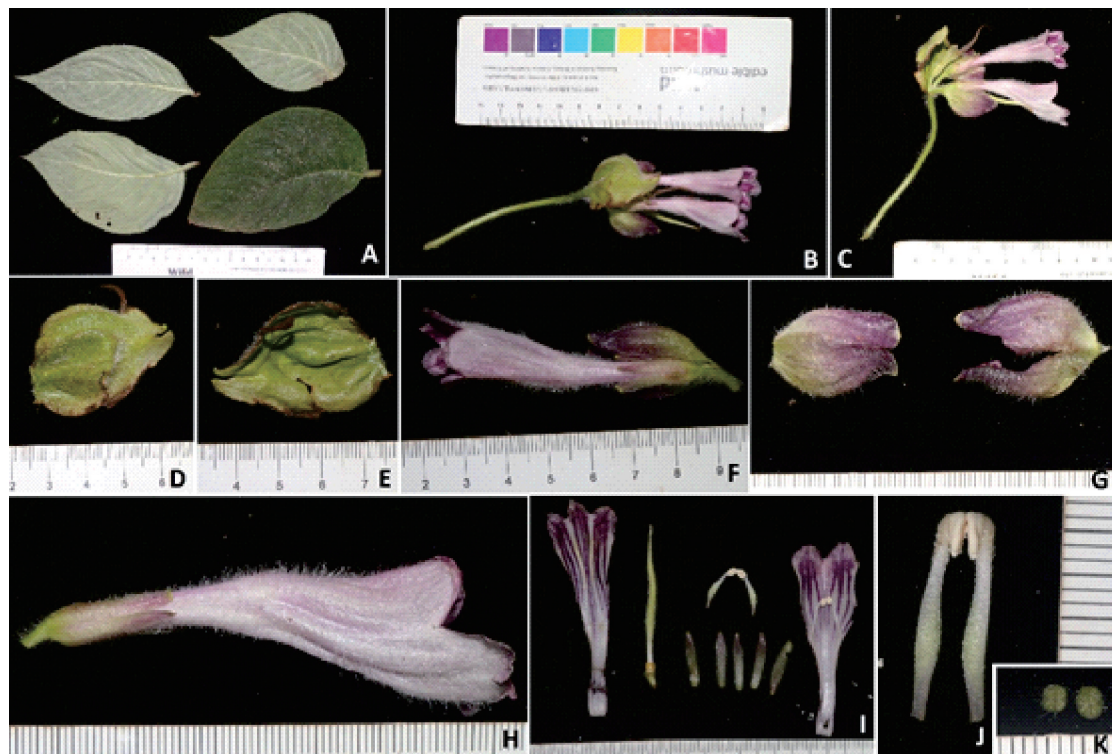
Additional specimens examined: Vietnam: Hà Giang prov., Quận Bạ distr., Cao Mã Pờ comm., Vạng Chá Phìn vill., subtropical evergreen broad-leaved forest on silicate mountain, around point 104°49'05.4" E, 23°05'24.3" N, elevation of 1 650–1 700 m a. s. l. perennial herb about 30–60 cm tall, flower purple, common in humid shaded areas of mountain slopes, Nguyen Khang Sinh, Nguyen Quang Hieu & Tu Bao Ngan, *NSK 977*, *NSK 981*, September 14, 2017.

2.2 Distribution and conservation

Ecology: Grows on wet humus-soil or crevices of rocks covered with humus under thickets and subtropical evergreen broad-leaved forest on slopes, at an elevation of 1 200–2 100 m above sea level. Flowering: August–September; Fruiting: September–October.

Distribution: China (Guangxi, Yunnan, Guizhou and Hubei) and new to Vietnam (Hà Giang prov., Quận Bạ distr., Cao Mã Pờ comm.)

Conservation status in China and Vietnam:



Note: **A.** Abaxial and adaxial views of leaves; **B, C.** Cymes; **D.** Abaxial surface of bract; **E.** Adaxial surface of bract; **F.** Flower with corolla and calyx lobes; **G.** The secondary bracts; **H.** Lateral view of corolla and calyx lobes; **I.** Opened corolla showing stamens, staminodes, and pistil; **J.** A pair of stamens; **K.** Crossed section of ovary. (Photoed by Dr. Nguyen Khang Sinh)

Fig. 2 Exploded view of *Raphiocarpus begoniifolius* organs

Because the populations found in Guangxi, Guizhou, Yunnan and Hubei of China and North Vietnam, are growing well with abundant individuals in different populations, we estimate that this species will not easily become extinct. During our field work, although we found that farmlands and fruit plantations were expanding in these areas, which would result in deforestation, habitat loss and fragmentation of this species, the individuals and populations of *Raphiocarpus begoniifolius* are abundant in two countries. Thus, following the IUCN (2017) red list categories and criteria, the conservation status of this species is Least Concern (LC).

2.3 Notes on taxonomy and key of *Raphiocarpus* in Vietnam

The vegetative organs of *Raphiocarpus begoniifolius* (Lévl.) Burtt look similar to *Raphiocarpus macrosiphon* (Hance) Burtt if there is no flower, but the flowers of the latter are orange-red and are entirely different from

the pale-purple or rusty lilac to purple flowers of the former. After a new species of *Raphiocarpus*, *Raphiocarpus tamdaoensis*, was published by Phuong et al(2012) and this new record was confirmed, there are nine species of *Raphiocarpus* in Vietnam in all. Here we present the further promoted identification key to all known species of *Raphiocarpus* occurring in Vietnam.

3 Acknowledgments

Authors would like to thank Prof. Wei Yigang from Guilin Botanical Garden and Dr. Michael Möller from Royal Botanical Garden Edinburgh to identify and confirm those specimens of *Raphiocarpus begoniifolius*.

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