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# *Gastrochilus kadooriei* (Orchidaceae), a new species from Hong Kong, with notes on allied taxa in section Microphyllae found in the region.

PANKAJ KUMAR[1, *], STEPHAN W. GALE[1], ALEXANDER KOCYAN[2], GUNTER A. FISCHER[1], LEONID AVERYANOV[3], RENATA BOROSOVA[4], AVISHEK BHATTACHARJEE[5], JI-HONG LI[1] & KUEN SHUM PANG[6]

[1] *Kadoorie Farm and Botanic Garden, Lam Kam Road, Tai Po, New Territories, Hong Kong; E-mail: pkumar@kfbg.org*
[2] *University of Potsdam, Institute of Biochemistry and Biology, Biodiversity Research/Systematic Botany, 14469 Potsdam, Germany*
[3] *Komarov Institute of Russian Academy of Science, Prof. Popov Str., 2, St. Petersburg, 197376, Russia*
[4] *Herbarium, Library, Art & Archives, Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3AE, UK*
[5] *Central National Herbarium, Botanical Survey of India, Acharya Jagadish Chandra Bose Indian Botanic Garden, Howrah 711103, West Bengal, India*
[6] *Agriculture, Fisheries and Conservation Department, Cheung Sha Wan Government Offices, 303 Cheung Sha Wan Road, Kowloon, Hong Kong*

## Abstract

A new species, *Gastrochilus kadooriei*, is described from Hong Kong. Notes are presented on its distribution, ecology and conservation status, and its distinguishing features are compared with those of allied taxa. *Gastrochilus jeitouensis* is reduced to the synonymy of *G. distichus*, and a lectotype is assigned for *G. pseudodistichus*. *Gastrochilus fuscopunctatus* is reinstated as an accepted species. Dichotomous keys to this taxonomically difficult group of morphologically similar species are presented.

## Introduction

The monopodial orchid genus *Gastrochilus* Don (1825: 32) (Epidendroideae; Vandeae; Aeridinae) is identified by the lip, which is typically biparted with a saccate hypochile and broad epichile that connects the lip to the column, two porate, globose pollinia borne on slender stipe and a bilobed viscidium, and a short axillary inflorescence. It is represented by 53 species distributed from India to Japan (Govaerts *et al.* 2013). Twenty-nine species have been reported from China, of which 17 are believed to be endemic (Chen *et al.* 2009: 491).

Hong Kong is endowed with a wide diversity of orchid taxa representing all five subfamilies (Barretto *et al.* 2011), and new records continue to be added (e.g. Gale *et al.* 2013). During a recent routine survey of upland forest in the central New Territories, an unusual lithophytic orchid was discovered. It was tentatively identified as a species of *Gastrochilus* section *Microphyllae* Bentham & Hooker (1883: 579), which is characterised by plants with numerous distantly spaced leaves compared to plants in the other section, *Gastrochilus*, which have clustered leaves. After undertaking a comprehensive literature and herbarium review, as well as consulting experts from the region, the authors realised that the taxon had previously been collected on several occasions from different localities outside Hong Kong (*i.e.* southern China and Vietnam), but it had remained confused with morphologically similar taxa and therefore not properly identified. Further examination of this species alliance revealed several unresolved taxonomic issues regarding the identity and circumscription of its constituent taxa, and eventually this allowed us to determine that the plants discovered in Hong Kong actually belong to a species new to science. We therefore performed a comprehensive morphological and taxonomic review of six allied species from the region, namely, *Gastrochilus corymbosus* Das & Chanda (1989: 401), *G. distichus* (Lindley 1858: 36) Kuntze (1891: 661), *G. formosanus* (Hayata 1911: 336) Hayata (1915: Additions and Corrections), *G. fuscopunctatus* (Hayata 1912: 143) Hayata (1917: 78), *G. jeitouensis* Ormerod (2013: 24) and *G. pseudodistichus* (King & Pantling

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1895: 341) Schlechter (1913: 315). In this article, the Hong Kong plants are formally described as new, and notes on distribution, ecology and conservation are provided. A lectotype is selected for *G. pseudodistichus*, and *G. jeitouensis* is newly reduced to synonymy of *G. distichus*. The name *G. fuscopunctatus*, formerly treated as a synonym of *G. pseudodistichus* (Jin *et al*. 2010: 32), is shown to constitute a distinct species and accordingly is reinstated. Keys for the identification and a table for the differentiation of these closely allied species are presented.

## Description of the new species

***Gastrochilus kadooriei*** Kumar, S.W.Gale, Kocyan, G.A.Fisch. & Aver. *sp. nov.* (Figs 1, 2, 3A,B)
Type:—CHINA. Hong Kong: Tai Mo Shan, 27 July 2013, *Kumar 12022* (holotype: KFBG!).

Diagnosis: *Gastrochilus kadooriei* is similar to *G. fuscopunctatus*, but can be differentiated on the basis of its glabrous, triangular epichile, as compared to that of the latter, which is elliptic-orbicular and hirsute. In addition, the leaves of the new species are ovate, the length of its stem internodes is more than 5 mm and the length of inflorescence is less than 1 cm, whereas the leaves of the latter are oblong, the length of its stem internodes is less than 5 mm, and the length of its inflorescence is more than 1 cm.

Lithophytic herbs, prostrate, apex ascending, 3–30 cm tall. Roots vermiform, slender, up to 10.0 cm long, 1.5–1.8 mm in diameter. Stem rarely branched, up to 30.0 cm tall, 1.5–2.0 mm in diameter, covered with sheathing leaf bases, green, glabrous, ridged and woody towards the base, herbaceous towards the apex; internodes of stem 5–6 mm long. Leaves alternate, distichous, green, ovate, 1.3–1.8 × 5.0–6.0 mm, margin finely serrate towards upper quarter; leaf apex aristate with a smaller lateral tooth on either side, median aristae 1.5–3.0 mm long, lateral teeth less than 1.5 mm long (teeth shorter in older leaves); leaf base amplexicaul, sometimes with tiny red-purple spot only on young shoots. Inflorescence a raceme, 1 or 2, pendulous, thick (1.5 mm in diameter) green, up to 1 cm long, 1–3-flowered; peduncle 9 mm long. Flowers 9 × 9 mm, pale yellow, petals and sepals with red-brown spots. Pedicel and ovary 5.0–5.2 mm long, green at base, reddish-green towards the apex. Sepals and petals 1-veined, margins entire, thicker towards middle; dorsal sepal obovate, 3.5 × 2.0 mm; lateral sepals obliquely obovate, 3.5 × 2.2 mm; petals obovate, 3.0 × 1.7 mm. Labellum 4.0–4.2 × 5.0 mm, glabrous; hypochile attached to the base of column wings, saccate, 4.2–4.5 × 3.0–3.5 mm, with an obscure median ridge giving a roughly scrotiform appearance from the front, ecallose, margin entire, reddish towards attachment with column, yellow elsewhere; epichile projecting forwards, triangular with rounded corners, slightly concave, around 1/3 the height of hypochile, 1.6 × 1.6 mm, yellow with some red-brown spots at the front. Column rounded at back, flat in front, 2.0 mm long, 1.4 mm thick, 1.6 mm wide; anther cap copular, with two chambers, trapezoid, 1.5 × 1.3 mm, with a beak on the front that partly covers the stipe; pollinarium 1.7–1.9 mm long; pollinia 2, yellow, bilobed, 0.6 × 0.5 mm, almost hemispheric with a depression at the centre; stipe elongate, obovate, 0.8 mm long; viscidium thicker and broader than the stipe, elliptic, 0.3 × 0.1 mm, sticky, yellowish; rostellum inverted L-shaped, 1.8 mm long, yellow, forked apically with rounded tips, arising from the centre of horseshoe-shaped clinandrum, hanging in front of the stigma without touching the stigmatic surface; stigma deeply seated, almost triangular in outline with rounded corners.

**Flowering:—**July–August.

**Habitat:—**In Hong Kong, plants grow on moss-covered granite rocks and boulders in seasonal streams with leaves devoid of or with faint purple spots. In Vietnam, plants are found on limestone rocks and may reach up to 30 cm or more tall and, if in bright sunlight, have purple spots on the leaves. In both places, plants grow only loosely attached to the rock surface. As they are found near streams, they seem to be highly vulnerable to flash flooding.

**Etymology:—**Named in honour of Sir Horace Kadoorie (28 September 1902 – 22 April 1995), co-founder of Kadoorie Farm and Botanic Garden, Hong Kong, renowned industrialist and philanthropist, in recognition of his contribution to the conservation of flora and fauna in the region.

**Specimens examined:—CHINA**. Hong Kong: Tai Mo Shan, 27 July 2013, *Kumar 12022* (KFBG!). Yunnan: Malipo, Tung-ting, 1300–1500 m, 21 November 1947, *Feng 13493* (AMES!); Malipo, Hwang-jin-in, 1400–1600 m, 7 November 1947, *Feng 13023* (AMES!); Malipo, Xichou County, 1000 m, 4 January 1940, *Chang & Liu 86174* (KUN!); Xichou County, Tuopishu Community, 1350 m, 3 June 1964, *Wang-Shou-Zheng 666* (KUN!); Xichou County, Fadouhoulongshan, 1500 m, 30 September 1980, *Heng 217* (KUN!). **LAOS**. Vientiane Province: Kasi District, Namken village, Phachao Mt., 24 March 2013, *Averyanov, Khang, Lorphengsy, LA-VN 794* (HN!).

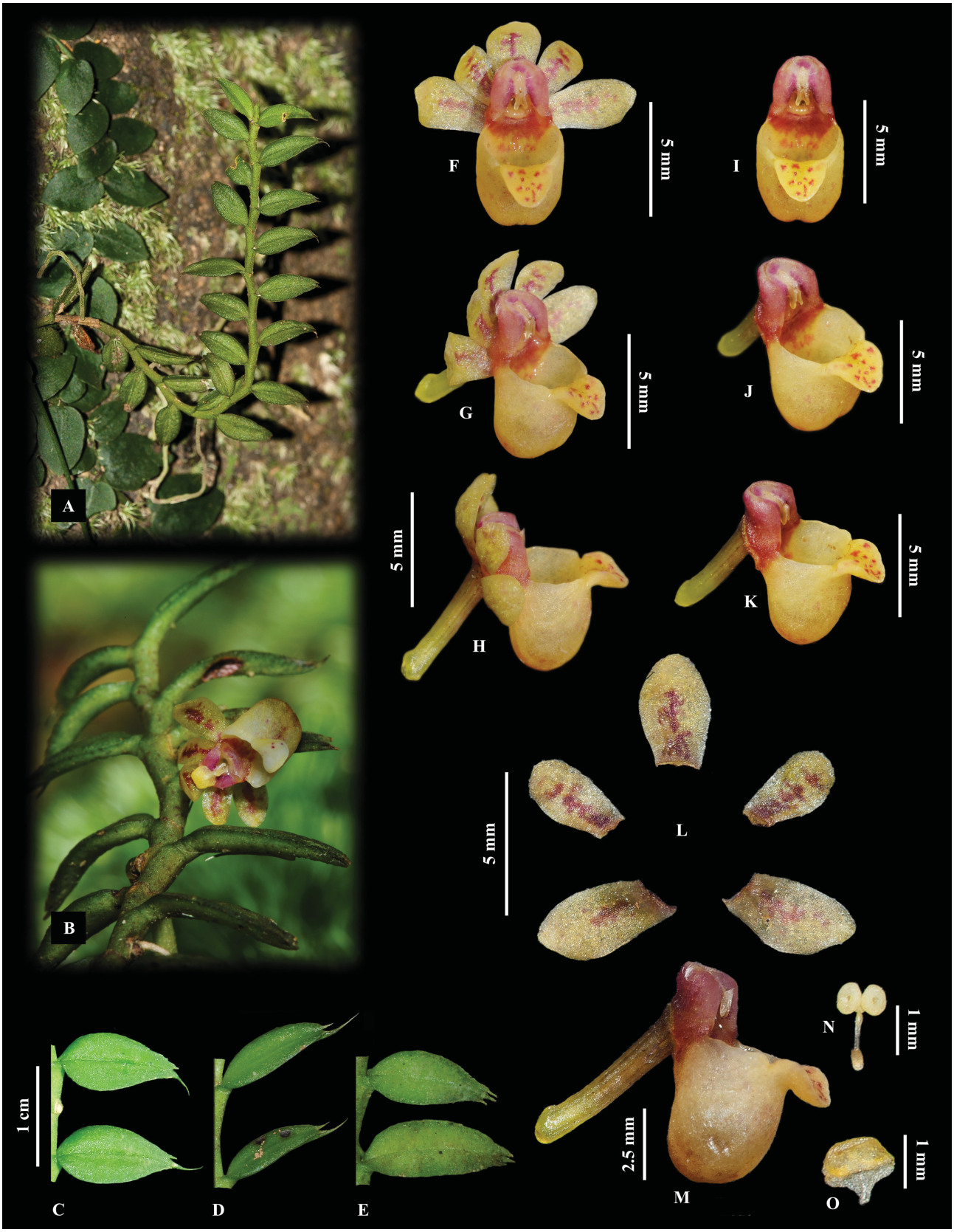


**FIGURE 1.** *Gastrochilus kadooriei.* A. Plant habit. B. Plant with inflorescence. C–E. Variation in leaf apices. F–H. Front, partial and side view of flower. I–K. Front, partial and side views of labellum with column and ovary. L. Sepals and petals. M. Labellum. N. Pollinarium. O. Anther cap.

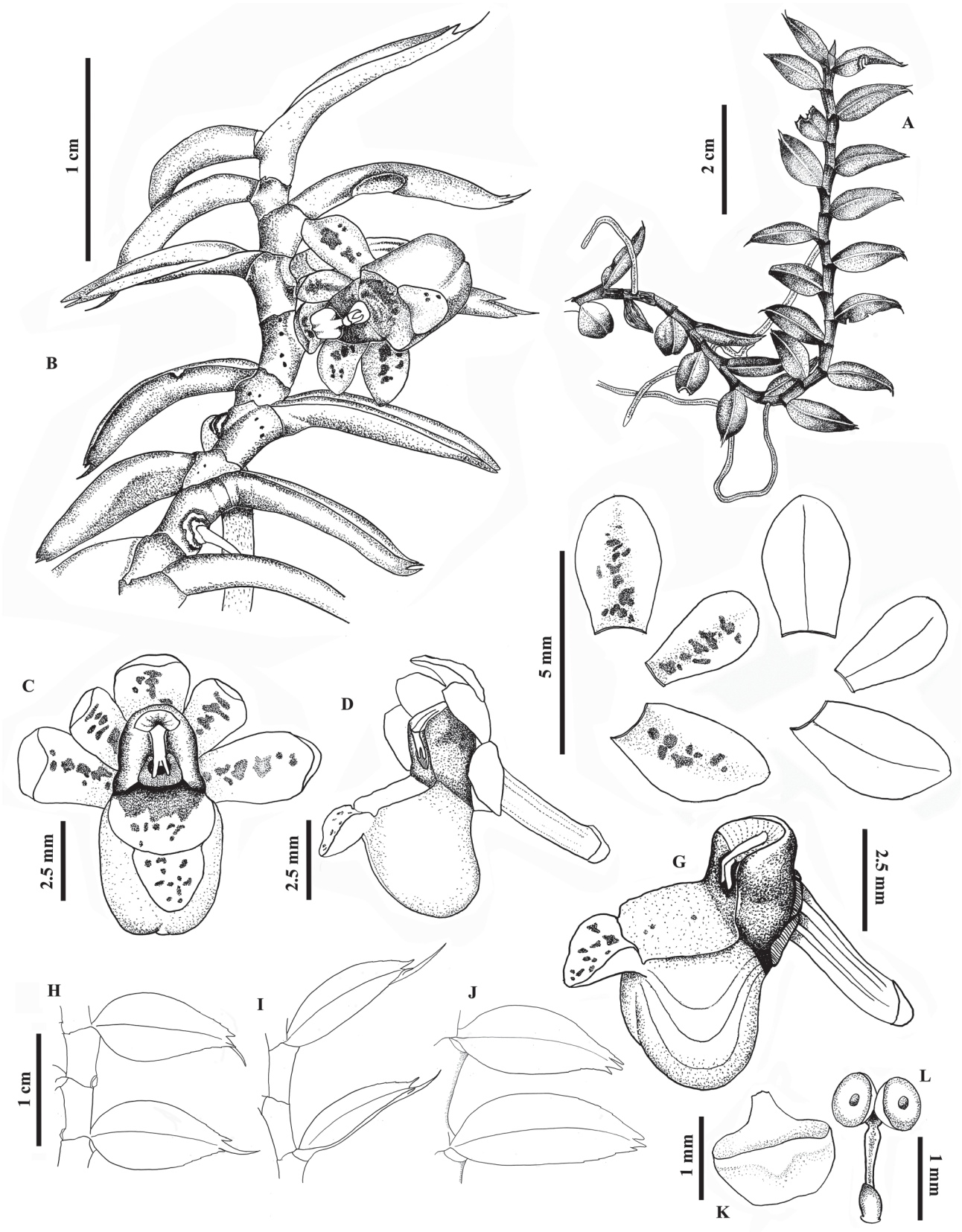


**FIGURE 2.** Gastrochilus kadooriei. A. Plant in habit. B. Plant with inflorescence. C. Close-up of flower (front view). D. Side view of flower. E–F. Petals and sepals, showing colour pattern and venation. G. Labellum with column and ovary. H–J. Variation in leaf apices. K. Anther cap. L. Pollinarium. [Drawn by P. Kumar from live specimens and Kumar 12022].


**FIGURE 3.** A. *Gastrochilus kadooriei*. B. Fruit of *Gastrochilus kadooriei*. C. *Gastrochilus pseudodistichus*. D. *Gastrochilus distichus*. E. *Gastrochilus formosanus*. F. *Gastrochilus fuscopunctatus.* [Photographs by: A—Pankaj Kumar, Hong Kong; B—L. Averyanov, Vietnam; C—Marni Tarkel; D—Xiao-Hua Jin, China; E—Jody Hsieh, Taiwan; F—Su Dung Sheng, Taiwan].

**VIETNAM**. Cao Bang Province: Bao Lac, Yen Lac, Yen Lac Village, 15 November 1998, *Averyanov, Hiep, Loc, Tam-CBL 320* (HN!, P!); Nguyen Binh, Ca Thanh, 21 November 1998, *Averyanov, Loc, Tam-CBL 556* (HN!, P!); Nguyen Binh District, Ca Thanh Municipality, Ta Pin Village, 3 October 2013, *Averyanov, Hiep, Tuan, Khang, Maisak, Osinovets - CPC 5354* (LE!, CPC!); Thong Nong District, Yen Son Municipality, NganVai Village, 7 October 2013, *Averyanov, Hiep, Tuan, Khang, Maisak, Osinovets - CPC 5442* (LE!, CPC!); Thong Nong District, Yen Son Municipality, Nhieu Lung Village, 8 October 2013, *Averyanov, Hiep, Tuan, Khang, Maisak, Osinovets - CPC 5467* (LE!, CPC!). Ha Giang Province: Dong Van, Ho Quang Phin, 28 April 1999, *Loc, Hoang, Averyanov-CBL 1803* (HN!); MeoVac, Sung Chang, 29 April 1999, *Loc, Hoang, Averyanov-CBL 1861* (HN!); Yen Minh, Lao Va Chai, 01 May 1999, *Loc, Hoang & Averyanov-CBL 1989* (HN!); Quang Ba, Bat Dai Son, 1100–1260 m, 4 April 2000, *Harder, Hiep, Averyanov, Hieu, Daria-DKH 5282* (HN!); Quan Ba, Can Ty, 1200 m, 7 December 2005, *Averyanov, Loc, Thao, The, Khang-HAL 8385* (HN!); Yen Minh, Lao Va Chai, Chi Sang Village, 1500 m, 9 December 2005, *Averyanov, Loc, Thao, The, Khang-HAL 8441* (photo- HN!); MeoVac, Pa Vi, Pa Vi Thuong, 1450 m, 13 December 2005, *Averyanov, Loc, Thao, The, Khang-HAL 8558* (HN!); Yen Minh, Lao Va Chai, Lao Va Chai Village, 9 October 1999, *Hiep, Binh, Averyanov, Cribb - NTH 3493* (HN!). Hoa Binh Province: Mai Chau District, Hang Kia, 1344 – 1400 m., 7 December 2012, *Harder et al. 7859* (MO!, HN!); Mai Chau, Hang Kia, near Hang Kia Village, 1100–1300 m, 7 April 2001, *Hiep, Averyanov, Vinh, Doan-HAL 740* (HN!); Mai Chau, Pa Co, near 3 km to northeast of Pa Co village, 1200 m, 27 December 1995, *Averyanov, Ban, Budantzev, Budantzev, Hiep, Huyen, Loc, Yakovlev-VH 2414* (HN!). Kontum Province: NW slopes of Ngoc Linh mountains, 2000 m, 23 February 1995, *Averyanov, Ban, Binh, Budantzev, Budantzev, Hiep, Huyen, Loc, Tam, Yakovlev-VH 112* (HN!); northern slope of Ngoc Linh Mountains, 2100 m, 10 March 1995, *Averyanov, Ban, Binh, Budantzev, Budantzev, Hiep, Huyen, Loc, Tam, Yakovlev-VH 635* (HN!); southeast slope of Ngoc Linh Mountain, 2100 m, 22 March 1995, *Averyanov, Ban, Binh, Budantzev, Budantzev, Hiep, Huyen, Loc, Tam, Yakovlev-VH 880* (HN!). Tuyen Quang Province: Na Hang District, Sinh Long Municipality, Khuoi PhinVillage, 29 September 2013, *Averyanov, Hiep, Tuan, Khang, Cuong, Truong, Maisak, Osinovets - CPC 5323* (LE!, CPC!).

**Distribution:—**Southwestern China (Yunnan), Hong Kong, Laos and Vietnam. The species is also likely to occur in intervening and adjacent areas. In addition to the Yunnan specimens cited above, we suspect that the image in Xu *et al.* (2009: 476, plate 695a) labeled as *Gastrochilus pseudodistichus* is probably referable to *G. kadooriei*. The growth habit, flower colour, and morphology of the stem/leaves are a close match for the species. There is one more photographic record of the species, *Averyanov et al. HAL 8441* (Averyanov pers. comm.), from Vietnam, Ha Giang, Yen Minh, Lao Va Chai, vicinity of Chi Sang village.

**Conservation Status:—**The global conservation status of *Gastrochilus kadooriei* was assessed using IUCN (2012) Criterion B (geographic range). Sightings of the species within the last 50 years (i.e. post-1963) were compiled from georeferenced herbarium collections, and the Extent of Occurrence (EOO) and Area of Occupancy (AOO) of the populations were estimated using the conservation assessment tool extension developed by the Royal Botanic Gardens, Kew (Moat 2007) in ArcView software. For AOO, a 2 × 2 km grid cell size was used. The preliminary assessment obtained using the values for EOO and AOO was then qualified using the three subcriteria (a, b and c) provided under Criterion B, and this result was further verified based for this species on an understanding of inferred threats and ecological attributes (estimated population size, inferred habitat requirements and reproductive success).

We confirmed 24 sightings at 22 localities for *G. kadooriei* over the period 1963–2013. Based on grid cell adjacency, these formed 20 discrete geographic clusters. EOO was estimated at ca. 63,3000 km$^2$ (Least Concern) and AOO was estimated at 88 km$^2$ (Endangered). However, although the species might be considered to have a severely fragmented distribution (with the records for Laos, southern Vietnam and Hong Kong being especially isolated), we have no data to indicate, nor any reason to infer or project, that it has undergone, or will undergo, decline or extreme fluctuation and cannot therefore justify its status at the higher of these two ranks or at one rank lower (Vulnerable). Indeed, seven of the 24 sightings have occurred within the last five years, suggesting that the species may yet prove to be more abundant and/or widespread than currently known. Nevertheless, most sightings were in forests ranging from 900–1600 m elevation, an increasingly threatened habitat in the Indo-Burma region due to both climate change and piecemeal degradation, deforestation and limestone mining. Plants in Hong Kong did not set fruit over the two-year period of observation (2012–2013), and therefore we suspect that the species may be pollinator-limited. Given these factors, we conclude that *G. kadooriei* should be considered **Near Threatened** (**NT**). The Hong Kong population is particularly precarious because it comprises fewer than 20 plants

at a single location at which suitable habitat is extremely restricted, and it is over 800 km away from the nearest known population in Cao Bang Province, northern Vietnam.

**Taxonomic notes:—**Prior to its description as a new species here, *Gastrochilus kadooriei* had been collected from a few localities in northern Vietnam and southwestern China, but it was misidentified as *G. pseudodistichus*, to which the new species looks similar, especially when sterile. However, it is one of the smallest species of section *Microphyllae* and possesses distinct, broadly ovate leaves unlike those found in any allied species. Thus, it can be differentiated on the basis of its shorter leaves, which are less than 2 cm long, as compared to those of *G. pseudodistichus*, which are more than 2 cm long. In addition, the ratio of leaf length to stem internode length is 1:3 or more in the former, but less than 1:3 in the latter. Furthermore, the epichile is less than half the height of the sac that forms the hypochile in *G. kadooriei*, whereas in *G. pseudodistichus* it is more than half the height of the hypochile. There are no lateral wings on the epichile in *G. kadooriei* (Fig. 3A), whereas prominent wings are present at the base of the epichile in *G. pseudodistichus* (Fig. 3C).

## Notes on allied species

The following synopses outline the key features that distinguish allied species of *Gastrochilus* section *Microphyllae*, with which *G. kadooriei* might be confused. Data were sourced from type specimens and other vouchers at the herbaria cited, as well as from digital images downloaded from herbarium websites and protologues and other descriptions available in the literature.

***Gastrochilus corymbosus*** Das & Chanda (1989: 401).

Type:—INDIA. West Bengal: Darjeeling, Jalapahar, 2200 m, 29 October 1982, *Das 823* (holotype cited as CAL, but we have been unable to find it).

Epiphytic herbs. Roots terete. Stem up to 15 cm tall, internodes 3–4 mm long, sheathed with leaf bases. Leaves distichous, ovate, 22 × 8 mm, leaf apex acuminate; young sheaths and lamina spotted brown. Inflorescence axillary, peduncle 1.3 cm long, closely appressed to the stem. Flowers 4, opposite, decussate, forming a perfect corymb with their labellum projecting towards the centre, 1.8 × 1.2 cm, boat shaped. Sepals and petals similar, 8 × 4 mm, dark brown with 4–6 blotches on the ventral surface; labellum adnate to the base of the column; hypochile saccate, 7 × 6 mm; epichile rhomboid with diamond-shaped depression in the centre, glabrous, margin alate. Column 2.0 × 2.5 mm.

**Distribution:—**Endemic to India, found exclusively in the Darjeeling District of West Bengal.

**Taxonomic notes:—***Gastrochilus corymbosus* is similar to *G. distichus*, but it can be differentiated by the base of the shorter peduncle, which remains appressed to the stem, and by the four opposite, decussate flowers arranged in a corymb. The flowering period of *G. corymbosus* is October, whereas *G. distichus* flowers during March to July (Das & Chanda, 1989: 401; Pearce & Cribb 2002: 525–526; Misra, 2007: 300; Lucksom, 2007: 892–893; Raskoti, 2009: 139). It can be differentiated from *G. pseudodistichus* by its ecallose labellum (Das & Chanda 1989: 401, Pearce & Cribb 2002: 525). Das & Chanda (1989: 401) described *G. corymbosus* as having a diamond-shaped depression on the epichile, as opposed to the convexity seen in *G. distichus*, and we therefore maintain it as a distinct taxon. Unfortunately, the type collection, purportedly deposited at CAL, could not be found, and no other image, specimen or secondary reference pertaining to this species could be located for detailed study. The description above was derived from the protologue alone.

***Gastrochilus distichus*** (Lindl.) Kuntze (1891: 661). Basionym: *Saccolabium distichum* Lindley (1859: 36).

Type:—INDIA. Sikkim: *Hooker 206* (K000883754) [holotype: K, photo!]. Note: The plant in the centre and the one on the right hand side of the type sheet are both *G. distichus*.

Heterotypic synonym: *Gastrochilus jietouensis* Ormerod (2013: 24), *syn. nov.* Type:—CHINA. Yunnan: Tengchong, Jietou, Datang Cun, top ridge ca. 14.2 km NNE of Datang, W side of Gaoligong Shan, 2660 m, 18 May 2006, Gaoligong Shan Biodiversity Survey, *Li et al. 30360* (holotype: CAS, photo!).

Plants epiphytic. Roots terete. Stem elongate, filiform, 10–20 cm long, sheathed with leaf bases. Leaves distchous, lanceolate, 20–25 × 5–6 mm wide, leaf apex aristate and with a smaller lateral tooth on either side. Inflorescence terminal and axillary, 1.5–2.5 cm long, pendulous, peduncle upto 2.5 cm long. Flowers 2–4, short racemose or subumbellate, randomly oriented, 8–10 × 10–18 mm. Sepals similar, oblong, 4.5–5.0 × 2.5–3.0 mm wide, concave, apex obtuse, green with dark purple spots; lateral sepals with oblique base; petals subobovate, 4.0 × 2.3 mm, apex obtuse; labellum adnate to the base of the column; hypochile saccate, 3.2 × 4.0 mm; epichile semicircular, membranous, acute, convex with 2 fleshy discs at the centre, glabrous, margin alate; column short, 2.0 × 2.2 mm. (Fig. 3D).

**Specimens examined:—INDIA**. Sikkim: 1500–2500 m, *Hooker 206* (K!); 1800 m, September 1876, *King 3052* (on the left) (K!); Neetay, 6500 ft, 11 October 1875, *Clarke 25239* (K!). West Bengal: Darjeeling, 9 August 1875, *sin coll. 26931* (K!). **CHINA**. Yunnan: *Forrest 17667* (AMES!); Yongde County, Wu Mu Long Town, Gan He Village, 2600 m, 30 April 2003, *Ende 509* (KUN!); Yongde County, Niutoushanchalukou, Daxueshan Town, 2326 m, 30 September 2008, *Ende & Xin 2021* (KUN!); Wumulongan River, Yongde County, 2600 m, 30 April 2003, *Ende 509* (KUN!); Lung-ling Hsien, 2400 m, 06 January 1934, *Tsai 54564* (AMES!); Chen-Kang Hsien, 2700 m, March 1936, *Wang 72267* (AMES!).

**Distribution:—**Northeastern India (Sikkim, West Bengal, Tripura, Mizoram), Nepal, Bhutan and southwestern China (Yunnan).

**Taxonomic notes:—**There are three plants on the type sheet at Kew. The plant on the left hand side is *G. pseudodistichus*, and the two other plants (the one in the middle and the one on the right hand side) are *G. distichus*. On this sheet, these two species can be distinguished on account of the longer and thinner peduncle in *G. distichus*, which is shorter and thicker in *G. pseudodistichus*.

Ormerod (2013: 24–25) differentiated the recently described *Gastrochilus jietouensis* from *G. corymbosus* on the basis of its racemose inflorescence and the two convexities on the epichile. These two characters make it a match for *G. distichus*, and hence we here reduce *G. jietouensis* to the synonymy of *G. distichus*.

***Gastrochilus formosanus*** (Hayata) Hayata (1915: Additions & Corrections).
Basionym: *Saccolabium formosanum* Hayata (1911: 336).
Type:—TAIWAN. Chiayi County: Arisan, Mt. Morrison, May 1908, *Kawakami & Mori 3164* (holotype: TI!).

Plants epiphytic. Roots terete. Stem upto 40 cm long, foliaceous, prostrate, nodes rooting, sheathed with leaf bases. Leaves distichous, oblong, 25 mm long, 7 mm wide, apex retuse, minutely setaceous in the sinus, with purple-red dots. Inflorescence axillary, 2–3cm long, pendulous shortly racemose or subumbellate; peduncle 1.0–1.5 cm long. Flowers 2 or 3, randomly oriented, 13 × 13 mm. Dorsal sepal concave, elliptic oblong, 4.8 × 3–4 mm wide, apex obtuse; lateral sepals same as dorsal, obliquely oblong; petals similar to sepals, narrowing towards the base; hypochile saccate, 6 × 6 mm at the broadest part, 4 mm wide at the contracted part; epichile suborbicular, 4 × 10 mm, thickened at centre, hirsute, margin alate; column 1.5 × 1.5 mm. (Fig. 3E).

**Specimens examined:—TAIWAN.** Chiayi County: Arisan, Mt. Morrison, May 1908, *Kawakami & Mori 3164* (TI!); Tashan, 9 July 1930, *Kudo and Yamamoto s.n.* (TAI115382) (TAI!); Nantou: Meifeng Farm, Musya Santinozyo, 1 August 1939, *Mori 2428* (TAI!); Hosya Kusunokizinzya, 13 October 1935, *Suzuki 315A* (TAI!); Meifeng, 2100 m, 13 September 1999, *Weng s.n.* (TAI278208) (TAI!); Taichung: Shihchiayang, Mt. Sikayauntaizan,9 July 1930, *Suzuki 5472* (TAI!); Chsinchu: Tapachienshan, Mt. Taihasenzan, August 1972, *Lin s.n.* (TAI148595) (TAI!); Kaohsiung: Takao, 26 August 1934, *Suzuki s.n.* (TAI157422) (TAI!); Hualien: Mukuashan, Mt. Mokkui, 10 October 1987, *Hsu 43* (TAI!).

**Distribution:—**Taiwan. Chen *et al*. (2009: 498) and Govaerts *et al*. (2009) mentioned occurrence of this species also in mainland China, from northern Fujian and western Hubei and southern Shaanxi. However, we have not seen any specimens of this species from outside Taiwan at the herbaria consulted.

**Taxonomic notes:—***Gastrochilus formosanus* is similar to *G. distichus*, but it can be easily differentiated on the basis of its hirsute epichile and bigger hypochile (6.0 × 6.0 mm). In *G. distichus*, the epichile is glabrous and the hypochile is smaller (4.0 × 3.2 mm).

***Gastrochilus fuscopunctatus*** (Hayata) Hayata (1917: 78). Basionym: *Saccolabium fuscopunctatum* Hayata (1912: 143).

Type:—TAIWAN. Chiayi County: Arisan, January 1912, *Hayata & Sasaki s.n.* (TI0021516) (holotype–TI photo!).

Plants epiphytic. Roots terete. Stem prostate, less than 15 cm long, sheathed by leaf bases. Leaves distichous, narrowly oblong, 17–19 × 4–5 mm, apex retuse, minutely setaceous. Inflorescence axillary or subterminal, 1–2 cm long; pedicel 8–20 mm long. Flowers 1 or 2, racemose, yellowish-green with brown spots, 9 × 9 mm. Sepals spreading or reflexed; dorsal sepal elliptic, 4 mm long, 2.3 mm wide, apex rounded; lateral sepals obliquely ovate, 4 × 2 mm; petals sub-elliptic, 3.2 × 2.2 mm, apex rounded; labellum adnate to the base of the column; hypochile saccate, 5 × 5 mm; epichile fleshy, elliptic-orbicular, 2.5 × 2.0 mm wide, strongly concave, thickened and hirsute at centre, margin not alate; column short, 1 × 3 mm. (Fig. 3F).

**Specimens examined:—CHINA.** Yunnan: Yunnan-Sikang expedition, 1959, *Li 2520* (KUN!), **TAIWAN.** Chiayi County: Arisan, January 1912, *Hayata & Sasaki s.n.* (TI!); Hualien: Taoyuan, Chatienshan, Mt. Minami-Soten, 1300 m, 10 May 2011, *sin. coll. s.n.* (*TAI278551*) (TAI!); Mt. Chingshui, 2000 m, 19 January 2001, *Liou 1461* (TAIF!); Taoyuan County, Tamanshan, 1700 m, 20 November 2001, *Liou 1601* (TAIF!); Mt. Chingshui, 2100 m, 11 April 2009, *Chung 9583* (TAIF!); Yuen Mei, 11 October 2001, *Lin 11681* (TAIF!); Tailoku-Tailokutaishan, 15 June 1933, *Sasaki s.n.* (TAI157824) (TAI!); Kaohsiung County: Yuyuchan, 1880 m, 26 April 2000, *Liou 1351* (TAIF!). Taipei: Taranan, 1 April 1939, *Suzuki-Tokio 17933* (TAI!); Chiachiuling, 29 January 1974, *Lin 242* (TAIF!); Ilan County: Mt. Ayu, 1000–1100 m, 16 May 2003, *Chung & Lee 6335* (TAIF!); Taichung County: Mt. Tahsueh Logging Trail 32K, 1700–1900 m, 23 January 2005, *Lu 9350* (TAIF!); Taitung County, Hsiangyang Forest Recreation Area, 2000–2100 m, 11 April 2007, *Chung, Hsu & Yu 9062* (TAIF!).

**Distribution:—**Taiwan. Chen *et al.* (2009: 496) and Govaerts *et al.* (2009) regard this species as occurring in mainland China but do not give a precise locality. We have seen only a single collection of this species (*Li 2520*, KUN) from Yunnan-Sikang expedition but without precise locality.

**Taxonomic notes:—**Jin *et al.* (2010: 32) reduced *Gastrochilus fuscopunctatus* to synonymy of *G. pseudodistichus*, but attributed the latter to "(Lindl.) Kuntze", the author citation for *G. distichus*. We have established that the authority was given in error, and that the intention was indeed to synonymise it under *G. pseudodistichus* (King & Pantling) Schlechter (X.-H. Jin, pers. comm.). Tsi (1999: 401) and Chen *et al.* (2009: 492) differentiated these two species on account of the former having 1 or 2 flowers per inflorescence and lacking awns at the leaf apex, whereas the latter has 5 or 6 flowers per inflorescence and distinct awns at the leaf apex. In addition, the upper surface of the epichile in *G. fuscopunctatus* is hirsute, but it is glabrous in *G. pseudodistichus*. We believe that these morphological features represent significant differences for species delimitation within section *Microphyllae* and hence reinstate *G. fuscopunctatus* as a distinct species.

***Gastrochilus pseudodistichus*** (King & Pantl.) Schlechter (1913: 315). Basionym: *Saccolabium pseudodistichum* King & Pantling (1895: 341); *Saccolabium distichum* var. *pseudodistichum* (King & Pantl.) Finet (1913: 506).

Type:—INDIA. Sikkim (now in West Bengal near Darjeeling): Senchul, 2100 m, October 1892, *Pantling 49* (*CAL0000000502*), [lectotype, designated here–CAL, photo!]

*Gastrochilus hoyopsis* (Rolfe ex Downie) Seidenfaden & Smitinand, (1963: 623). Basionym: *Saccolabium hoyopse* Rolfe ex Downie (1925: 387-388).

Type:—THAILAND. Chiang Mai: Doi Suthep, 1650 m, *Kerr 231* (holotype–K, photo!).

Plants epiphytic. Roots terete. Stems slender, pendulous, 15–25 cm, often branched, sheathed with leaf bases. Leaves distichous, fleshy, lanceolate, 20–30 × 3–6 mm, leaf apex aristate and with a smaller lateral tooth on either side. Inflorescence axillary or sub-terminal; peduncle 9 mm long. Flowers 5 or 6, sub-umbellate, 8 × 8 mm. Sepals sub-equal; dorsal sepal concave, oblong to oblanceolate, 5.0 × 2.3 mm wide, pale green with purple spots, apex obtuse; lateral sepals 4.5 × 2.3 mm,oblong to oblanceolate, 4.8 × 2.3 mm, apex acute; petals oblong to oblanceolate, 4 × 2 mm, apex rounded; labellum adnate to the base of column; hypochile saccate, 2.3 × 3.0 mm; epichile 2.1 × 2.2 mm, broadly cordate, alate near the base; column short, 1.5 × 1.8 mm. (Fig. 3C).

**Specimens examined:—INDIA.** Sikkim: Senchul, 2100 m, October 1892, *Pantling 49* (CAL!); Sikkim, 1800 m, October 1892, *Pantling 49* (CAL!);2100 m, October 1891, *Pantling 49* (CAL!); 1800 m, October 1892, *Pantling 49* (CAL!); 1800 m, 16 September 1876, *King 3050* (CAL!); Rishisoom, 1800 m, 2 October 1876, *King*

*4949* (CAL!); Rishisoom, 1600 m, 2 October 1877, *King 4919* (CAL!); 1800 m, September 1876, *King 3052* (plant on the right) (CAL!); *Muller 1021/98* (RENZ photo!); 1800 m, October 1892, *Pantling 49* (K!); Paona, Naga Hills, 1800 m, 2 September 1935, *Bor 6278* (K!). West Bengal: Darjeeling, 2100 m, December 1879, *Gamble 8013* (CAL!). **CHINA.** Yunnan: Ta-li Hsien, 1500 m, May 1935, *Wang 63369* (AMES photo!); Ta-li Hsien, 2700 m, May 1935, *Wang 63294* (AMES photo!); Mt. Dawei, Pingbian, Daheishan, 1800 m, 9 March 2000, *Shui et al. 12589* (KUN photo!). Xizang: Medog, Pangxin, Pangguo, 2000 m, 28 February 1993, *ETM 4172* (KUN photo!); Pangxin, Pangguo, 2000 m, 28 February 1993, *ETM 4115* (KUN photo!); Chayu County, Shang Chayu Town, 2400 m, 26 September 1973, *QTT 73-896* (KUN photo!).

**Distribution:—**India, China, Nepal, Thailand and Vietnam.

**Taxonomic notes:—**This plant is known to grow together with *Gastrochilus distichus* (King and Pantling 1895: 341), and both appear on the same herbarium sheet under a single collection number in some cases, as for example *Hooker 206* and *King 3052* (CAL). This has resulted in a lot of taxonomic confusion.

When describing *Saccolabium pseudodistichum*, King and Pantling (1895: 341) did not cite any particular voucher or collection number from Sikkim, and instead just mentioned "Sikkim: at elevations of 6,000 to 8,000 feet; flowering time August to October" in the protologue. However, in a subsequent publication (King and Pantling 1898: 229), they mentioned multiple collection numbers, namely, *Pantling 49*, *Clarke 36327*, *King 3052 & 4949*, *Gamble 8013* and *Mann s.n.*. The earliest collection of this species was made by King in 1876 from Sikkim (locality not precisely mentioned), but this specimen was not cited (along with the above mentioned specimens) in the protologue. However, Art. 9.3 of the Melbourne Code (McNeil *et al*. 2012: 33) states that, "For the purposes of this *Code*, original material comprises the following elements: *(a)* those specimens and illustrations (both unpublished and published either prior to or together with the protologue) upon which it can be shown that the description or diagnosis validating the name was based; *(b)* the holotype and those specimens which, even if not seen by the author of the description or diagnosis validating the name, were indicated as types (syntypes or paratypes) of the name at its valid publication; and *(c)* the isotypes or isosyntypes of the name irrespective of whether such specimens were seen by either the author of the validating description or diagnosis or the author of the name (but see Art. 7.7, 7.8, and 9.10)". It is clear from the annotations/labels that all of the above mentioned specimens of *S. pseudodistichum* were studied by King and Pantling before describing *S. pseudodistichum* as these were annotated (on the label) with "new species" by Pantling. Therefore, all the specimens cited by King and Pantling in the latter publication (King & Pantling, 1898: 229) were 'original materials' of *S. pseudodistichum.* Among these, the specimen *Pantling* 49 [CAL0000000502; 'Senchal, 7000 ft (2100 m), October 1892'] is hereby selected as the lectotype of *S. pseudodistichum* for three reasons. Firstly, it is evident from the handwritten note attached to the CAL specimen by Robert Pantling and David Prain that King & Pantling (1895: 341) placed greater emphasis on this collection when describing *S. pseudodistichum*. Secondly, this is the only sheet that states a precise locality in Sikkim "Senchul", which currently lies on the political boundary of Darjeeling District in West Bengal. Thirdly, this collection has duplicates widely distributed at K, L and CAL.

When studying this taxon, Seidenfaden (1988) did not refer to any original material associated with the taxa, citing instead his illustrations belonging to the type of *G. hoyopsis*. At the same time, he claimed that plate 73 of *Saccolabium distichum* in Hooker (1895: 49) contains images of *Gastrochilus pseudodistichus*. We concur with this conclusion because the habit sketch of the plant in plate 73 (Hooker 1895: 49) more closely resembles *G. pseudodistichus*, even though the illustration of the flowers matches *G. distichus*.

**Key to *Gastrochilus kadooriei* and allied species:**

Key for sterile specimens with a persistent peduncle

1. Stem internode length 1/3rd or more of the leaf length ..... *G. kadooriei*
- Stem internode length less than 1/3rd of the leaf length ..... 2
2. Dry peduncle more than 2 cm long ..... *G. distichus*
- Dry peduncle 2 cm long or less ..... 3
3. Stem internode 4.5 cm long or more ..... 4
- Stem internode less than 4.5 cm long ..... 5
4. Leaf more than 2 cm long ..... *G. formosanus*
- Leaf less than 2 cm long ..... *G. fuscopunctatus*

5. Leaf ovate, apex tridentate ..... *G. pseudodistichus*
- Leaf lanceolate, apex acuminate ..... *G. corymbosus*

Key for fertile specimens

1. Lip epichile bearing a callus, margin alate ..... 2
- Lip epichile ecallus, margin not alate ..... 5
2. Epichile wings broad, extending from junction with hypochile to apical margin of epichile ..... 3
- Epichile wings narrow, restricted to base of epichile close to junction with hypochile only ..... *G. pseudodistichus*
3. Epichile hirsute ..... *G. formosanus*
- Epichile glabrous ..... 4
4. Inflorescence racemose, peduncle more than 2 cm long ..... *G. distichus*
- Inflorescence corymbose, peduncle less than 2 cm long ..... *G. corymbosus*
5. Epichile glabrous, less than 1/3 of the height of the hypochile ..... *G. kadooriei*
- Epichile hirsute at centre, half or more than half of the height of the hypochile ..... *G. fuscopunctatus*

**TABLE 1**: *Table comparing Gastrochilus kadooriei with allied species of section Microphyllae.*

| | ***G. kadooriei*** | ***G. corymbosus*** | ***G. distichus*** | ***G. pseudodistichus*** | ***G. formosanus*** | ***G. fuscopunctatus*** |
|---|---|---|---|---|---|---|
| **Plant length** | 3–30 cm | 10 –15 cm | 10–25 cm | 15–30 cm | 10–30 cm | <10 cm |
| **Stem internode length** | 5.0–6.0 mm | 3.0–4.0 mm | 4.5 mm | 4.0–4.5 mm | 4.5–5.0 mm | 4.5–5.0 mm |
| **Leaf outline** | Ovate | Ovate | Lanceolate | Lanceolate | Oblong | Oblong |
| **Leaf dimensions** | 1.3–1.8 x 0.5–0.6 cm | 2.2 × 0.8 cm | 2.0–2.5 × 0.5–0.6 cm | 1.3–2.5 × 0.4–0.6 cm | 2.5 × 0.7 cm | 1.7–1.9 × 0.4–0.5 cm |
| **Leaf apex** | Leaf apex aristate and with a smaller lateral tooth on either side | Acuminate | Leaf apex aristate and with a smaller lateral tooth on either side | Leaf apex aristate and with a smaller lateral tooth on either side | Retuse, minutely setaceous in the sinus | Retuse, minutely setaceous in the sinus |
| **Leaf length:stem internode length ratio** | <1:3 | ≥1:5 | ≥1:4 | >1:3 | 1:4 | 1:4 |
| **Inflorescence** | Raceme, 1.0 cm | Corymb, 1.3 cm | Raceme, 2.5–3.0 cm | Raceme, 2.0 cm | Raceme, 3.0 cm | Raceme, 1.0–2.0 cm |
| **Peduncle length** | 0.9 cm | 1.3 cm | 2.5 cm | Upto 1.3 cm | 1.0–1.5 cm | 0.8–2.0 cm |
| **No. of flowers per inflorescence** | 1–4 flowers | 4 flowers | 2–4 flowers | 5 or 6 flowers | 2 or 3 flowers | 1–4 flowers |
| **Flower dimensions (height and width)** | 9.0 × 9.0 mm | 1.8 × 1.2 cm | 1.0 × 1.8 cm | 1.1 cm | 1.3 cm diameter | 9.0 × 9.0 mm |
| **Hypochile** | 4.2–4.4 × 3.0–3.5 mm | 7.0 × 6.0 mm | 4.0 × 3.2 mm | 4.5 × 5.0 mm | 6.0 × 6.0 mm | 5.0 × 5.0 mm |
| **Epichile** | Triangular with rounded corners, thin, ecallose, margin not alate, glabrous | Rhomboid with diamond shaped depression in the centre, margin alate, glabrous | Semicircular, ecallose with two thick convexities, margin alate, glabrous | Broadly cordate, ecallose, margin alate at the junction with hypochile, glabrous | Suborbicular, thick, margin not alate, hirsute | Elliptic-orbicular, thick, margin not alate, hirsute |
| **Epichile length:hypochile height ratio** | >1:3 | ca. 1:2 | ca. 1:2 | 1:2 | ca. 1:3 | 1:3 |

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