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Two new records of *Boesenbergia* Kuntze (Zingiberaceae: Zingibereae) for the Flora of Myanmar

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Abstract. *Saensouk P, Saensouk S, Boonma T, Oo WP, Htet NM, Maknoi C, Bongcheewin B, Htway NN, Minn HM. 2025. Two new records of* Boesenbergia *Kuntze (Zingiberaceae: Zingibereae) for the Flora of Myanmar. Biodiversitas 26: 480-489.* This study reported two new records of *Boesenbergia* for Myanmar: *Boesenbergia meghalayensis* Aishwarya & M.Sabu, found in Yangon Region, and *B. siphonantha* (King ex Baker) M.Sabu, Prasanthk. & Škorničk., found in Kayin State and Mon State. The study aimed to confirm the presence of these species in Myanmar through comprehensive taxonomic analysis based on morphological observations of living specimens collected from their natural habitats. Additionally, to expand the known distribution of *Boesenbergia* and support ongoing efforts to document the region's rich botanical diversity. Morphological characteristics were analyzed using specimens from natural habitats and compared with taxonomic literature and herbarium records. This study confirmed the presence of *B. meghalayensis* in Yangon Region and *B. siphonantha* in Kayin and Mon States as new records for Myanmar, along with verifying *B. plicata* in the Bago Region. These findings expand the distribution of *Boesenbergia* in Myanmar, providing an updated checklist and emphasizing the importance of taxonomic research for conservation and preserving the country's plant diversity.

Keywords: *Boesenbergia meghalayensis*, *B. siphonantha*, Myanmar, new record, Zingibereae

Abbreviations: CAL: Central National Herbarium, Kolkata, India; CALI: Calicut University Herbarium, Kozhikode, India; FOF: Faculty of Forestry Herbarium, Vientiane, Laos; K: Royal Botanic Garden, Kew, Richmond, United Kingdom; MBK: Kochi Prefectural Makino Botanical Garden, Kochi, Japan; MSU: Mahasarakham University Herbarium, Maha Sarakham, Thailand; RAF: Forest Research Institute Herbarium, Dehradun, India; TNS: National Museum of Nature and Science, Tsukuba, Japan; US: United States National Herbarium, Smithsonian Institution, Washington, D.C., USA

INTRODUCTION

The genus *Boesenbergia* Kuntze (Zingiberaceae) comprises approximately 100 species native to various regions globally, including the Andaman Island, Assam, Bangladesh, Borneo, Cambodia, South-Central China, Eastern Himalaya, Hainan, India, Java, Laos, the Lesser Sunda Islands, Malaya, Myanmar, Nicobar Islands, the Philippines, Sumatra, Thailand, and Vietnam (Meekiong and Lim 2014; Mood et al. 2014a, b, et al. 2018, et al. 2019, et al. 2020; Izzaty et al. 2015; Aishwarya and Sabu 2015, 2021; Aishwarya et al. 2015a, b; Leong-Škorničková and Newman 2015; Leong-Škorničková et al. 2015; Lý 2017; Docot et al. 2020; Saensouk and Saensouk 2020, 2022; Singh and Srivastava 2020; Narasimhan and Irwin 2021; Chowlu et al. 2022; Lam et al. 2022; Tad-O et al. 2022; Newman et al. 2023; Yongco et al. 2023; Debnath et al. 2024; POWO 2024; Santharam and Kaliamoorthy 2024). Some species in the genus serve various purposes including food, spices, medicine, and rituals as well as socio-religious practices (Atun et al. 2018; Kanjanasirirat et al. 2020; Numpulsuksant et al. 2021; Silalahi et al. 2021; Wang et al. 2022; Boonma et al. 2023, et al. 2024; Hop and Son 2023; Inta et al. 2023; Debnath and Vijayan 2024).

The genus *Boesenbergia* has a notable taxonomic history related to Myanmar. It was first described as *Gastrochilus* Wall. by Nathaniel Wallich in 1829, including two species: *Gastrochilus longiflorus* Wall. [now is *Boesenbergia longiflora* (Wall.) Kuntze] and *Gastrochilus pulcherrimus* Wall. [now is *Boesenbergia pulcherrima* (Wall.) Kuntze], both species were collected by Nathaniel Wallich and William Gomez during their expedition to Rangoon (Yangon), Myanmar in 1826 (Wallich 1829). Subsequently, *Boesenbergia parvula* (Wall. ex Baker) Kuntze was discovered in Tavoy (Tenasserim Division) by Gomez in 1827 and included in Wallich's 1832 work under the name *Gastrochilus parvula* Wall. (Wallich 1832). Though not formally described then, it was later described

in Baker's Flora of British India (Baker 1890) and renamed in 1891 by Kuntze (1891). Later studies by Kress et al. (2002), confirmed the classification to position the genus *Boesenbergia* within the tribe Zingibereae.

Myanmar remained a focal point for *Boesenbergia* research from the 19th to the early 20th centuries. Key works by Lace and Rodger (1912), Rodger (1922), Hundley and Ko (1961), and Hundley (1987) documented various species, offering a comprehensive view of the genus's distribution and diversity in the country. This was followed by Kress et al. (2003) compilation of the first comprehensive checklist in Myanmar, listing five species of *Boesenbergia*, namely *B. parvula* (Wall. ex Baker) Kuntze, *B. plicata* (Ridl.) Holttum, *B. pulcherrima* (Wall.) Kuntze, *B. rotunda* (L.) Mansf., and *B. thorelii* (Gagnep.) Loes. In addition, *B. longiflora* (Wall.) Kuntze was also recorded but under the name *Curcumorpha longiflora* (Wall.) Rao and Verma (Kress et al. 2003). Later, *B. kingii* Mood and L.M.Prince, and *B. maxwellii* Mood, L.M.Prince, and Triboun were described and documented for Myanmar in 2013 (Mood et al. 2013). This was followed by the recording of *B. albomaculata* S.Q.Tong and *B. kerrii* Mood, L.M.Prince and Triboun in Myanmar by Mood et al. (2016a). Their study confirmed the presence of eight *Boesenbergia* species in Myanmar while also questioning the occurrence of *B. plicata* and *B. thorelii*, as no verified specimens from the country have been found (Mood et al. 2016a). Recent work by Tanaka et al. (2018, 2024) reported 11 species in the country.

This study focuses on the discovery of two taxa of *Boesenbergia* in Myanmar, which are similar to *B. meghalayensis* Aishwarya & M.Sabu (Aishwarya et al. 2015b) and *B. siphonantha* (King ex Baker) M.Sabu, Prasanthk & Škorničk (Sabu et al. 2004; Mood et al. 2016b). These taxa were examined to confirm their true identity through a taxonomic treatment based on morphological observations of living specimens from their natural habitats, along with confirmation of the occurrence of *B. plicata* in Myanmar by the specimens deposited at the National Museum of Nature and Science (NMNS), with an updated checklist and of *Boesenbergia* in Myanmar are also presented. This study aimed to expand the known distribution of *Boesenbergia* and support ongoing efforts to document the region's rich botanical diversity. Accurate species identification and confirmation are essential for effective conservation planning and protecting Myanmar's native plant diversity.

MATERIALS AND METHODS

Study area

Plant materials were collected in 2024 from their natural habitats in Myanmar: *Boesenbergia meghalayensis* Aishwarya & M.Sabu were collected in Yangon, while *B. siphonantha* (King ex.Baker) M.Sabu, Prasanthk & Škorničk found in Kayin and Mon states (Figure 1).

Procedures

Morphological characteristics were assessed using 20 living specimens collected from their natural habitats. Measurements were conducted with a vernier caliper, and detailed observations were made using a stereoscopic microscope (Stemi 2000-C, ZEISS, Oberkochen, Germany). The specimens were subsequently deposited in the Faculty of Forestry Herbarium (FOF) in Laos, with additional specimens archived at the Mahasarakham University Herbarium (MSU). The specimens that are still alive have been cultivated at the Brio Botanical Research Garden (BBRG), Nakhon Nayok, Thailand.

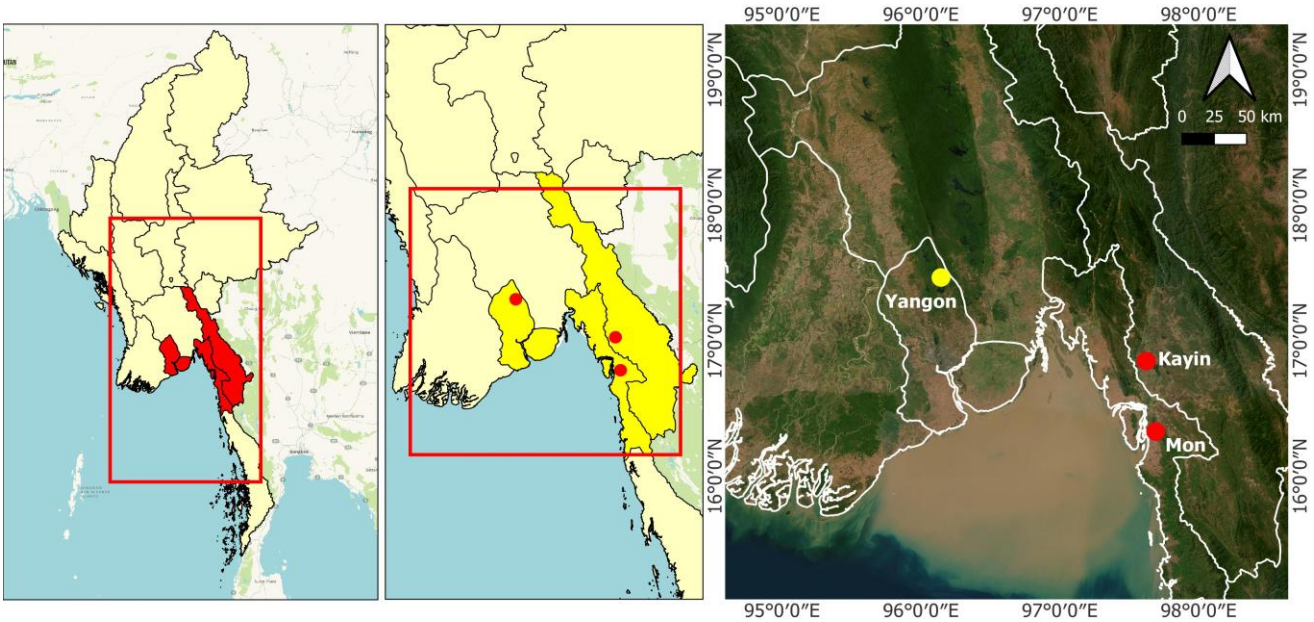

Figure 1. Location of *Boesenbergia meghalayensis* Aishwarya & M.Sabu (*yellow dot*), and *B. siphonantha* (King ex Baker) M.Sabu, Prasanthk. and Škorničk. (*red dot*) in Myanmar

To accurately document morphological characteristics, precise measurements were taken using tools such as rulers and vernier calipers, with detailed examinations conducted using a stereoscopic microscope (Stemi 2000-C, ZEISS, Oberkochen, Germany). For accurate species identification, a comprehensive comparison of the morphological characteristics of our specimens' morphological traits was carried out. This included analyzing the morphological descriptions of Zingiberaceae family plants, focusing on their distribution in Thailand and surrounding countries.

Data analysis

We thoroughly reviewed detailed descriptions from primary taxonomic publications and major databases, such as Scopus, Web of Science, and Google Scholar. Additionally, we utilized photographs of specimens from Kew's Herbarium and the International Plant Names Index (https://www.ipni.org/) and the Plants of the World Online (https://powo.science.kew.org/), data from the Muséum national d'Histoire Naturelle online collection (https://science.mnhn.fr), and the Zingiberaceae Resource Center online database (https://padme.rbge.org.uk/ZRC). Digital images and data from notable herbarium collections, including Central National Herbarium (CAL), Kolkata, India; Calicut University Herbarium (CALI), Kozhikode, India; Faculty of Forestry Herbarium (FOF), Vientiane, Laos; Royal Botanic Garden, Kew (K), Richmond, United Kingdom; Kochi Prefectural Makino Botanical Garden (MBK), Kochi, Japan; Mahasarakham University Herbarium (MSU), Maha Sarakham, Thailand; Forest Research Institute Herbarium (RAF), Dehradun, India; National Museum of Nature and Science (TNS), Tsukuba, Japan; and the United States National Herbarium, Smithsonian Institution (US), Washington, D.C., USA. were also reviewed through visual inspection. This comprehensive approach ensured that our comparisons were based on accurate and thorough information.

RESULTS AND DISCUSSION

This study reported the first records of *B. meghalayensis* Aishwarya & M.Sabu and *B. siphonantha* (King ex Baker) M.Sabu, Prasanthk. & Škorničk. in Myanmar. *Boesenbergia meghalayensis*, previously known as endemic to India, and *B. siphonantha*, which is also distributed in Thailand and Vietnam, were both identified during recent fieldwork in Myanmar, along with confirmation of the occurrence of *B. plicata* in Myanmar by the specimens deposited at the National Museum of Nature and Science (NMNS) which collected from Bago Region by Nobuyuki T., Ito Y., Aung M.M. and Hnin P.P. in 2017. The protologues of all species studied have been thoroughly reviewed and compared with the specimens examined in this study, with all relevant taxonomic details, including descriptions and type specimens. In addition to these discoveries, a comprehensive checklist of *Boesenbergia* species in Myanmar has been compiled, along with a key for accurate species identification.

Taxonomic treatments

Boesenbergia meghalayensis Aishwarya & M.Sabu, Phytotaxa 197 (3): 186-196 (2015b). Type: India, Meghalaya, Shillong, Nortiang roadside, altitude 1,120 m above sea level (m asl), 18 August 2004, Sanoj E. 95637 (holotype CALI) (Figures 2-3)

Description: Perennial rhizomatous herb 47-65 cm tall. Rhizome ovoid, 0.7-1.6 cm in diam., externally brown, internally cream colored, slightly aromatic. Roots are fibrous with many root tubers. Pseudostem 8-13 cm long. Leaves 3-7 per pseudostem; ligule bilobed 1-2 mm long, lobes oblong, pale green, translucent, villous; petiole 7-15 cm long, green, villous; lamina 18-37 × 8-12 cm, elliptic, green, glabrous, base oblique, apex acute, margin undulate. Inflorescence terminal, 10-12 cm long, enclosed within the innermost leaf-sheaths, elongate rachis, usually one open per day. Bracts distichous, 3.9-5.2 × 0.7-0.8 cm long, oblong, translucent, white to very pale greenish white, glabrous, apex acute. Bracteoles 2.5-3.8 × 0.6-0.7 cm, whitish, glabrous. Spike with 4-5 flowers, one open per day, Flowers 8-10 cm long. Calyx tubular 2-2.3 × 0.35-0.5 cm, membranous, apex bifid, white, glabrous, with a unilateral slit up to 1 cm long. Floral tube cylindrical, 6-6.5 cm long, white, sparsely hairy; dorsal corolla lobe lanceolate, 2.2-2.4 × 0.6-0.7 cm, incurved, apex acuminate, hooded, white, glabrous; lateral corolla lobes oblong, 1.8-2.0 × 0.5-0.6 cm, incurved, apex acute, slightly hooded, white, glabrous. Lateral staminodes 2, obovate to obovate-oblong, 1.6-1.8 × 0.9-1.2 cm, white, glabrous. Labellum saccate, ovate, 2.5-2.8 × 1.0-1.4 cm, apex acute to rounded, reflexed and sometimes emarginate, white with dark reddish towards the apex and dark reddish spots in the throat, with pale yellow along the mid-lobe, glabrous excepted hairy along a mid-lobe, margin undulate towards the apex. Stamen 1, 7-8 mm long, white; filament 0.2-0.3 × c. 0.2 cm, white, glabrous; anther 5-6 × 2-2.3 mm, white with minute orange spots; anther crest c. 2.5 × 2 mm, recurved backward, apex emarginate. Style filiform, 6.5-8 cm long, white, glabrous; stigma peltate, opening slightly ciliate, white with pinkish spots. Epigynous glands 2, 0.8-0.9 cm long, linear, cream-colored. Ovary cylindrical, trilocular, 5-6 × 1.5-2 mm, axile placentation, glabrous or with sparse hairs at the apex. Fruit not seen.

Distribution: India (Meghalaya and Mizoram), Myanmar (Nay Pyi Taw, Mawlamyine, and Yangon).

Ecology: In India, this species is found in open habitats along the roadsides of Northeast India, particularly within the states of Meghalaya and Mizoram. While in Myanmar, it is found in shady areas adjacent to highways in the Yangon Region.

Phenology: Flowering from July to September.

Utilization: Young pseudostem eats fresh with chili paste and rhizome used as spices.

Additional specimen examined: India, Mizoram: Hauruang, 602 m asl, 22°56'57" N, 97°46'51" E, 08 September 2002, Prasanth Kumar, M.G. and Jana Škorničková 86232 (CALI!). Myanmar, Yangon, near the highway to Yangon, 45-55 m asl, Htet N.M. and Boonma T. 2401(MSU!).

Figure 2. *Boesenbergia meghalayensis* Aishwarya & M.Sabu in natural habitat in Myanmar (Yangon). Photographs by Nyi Min Htet

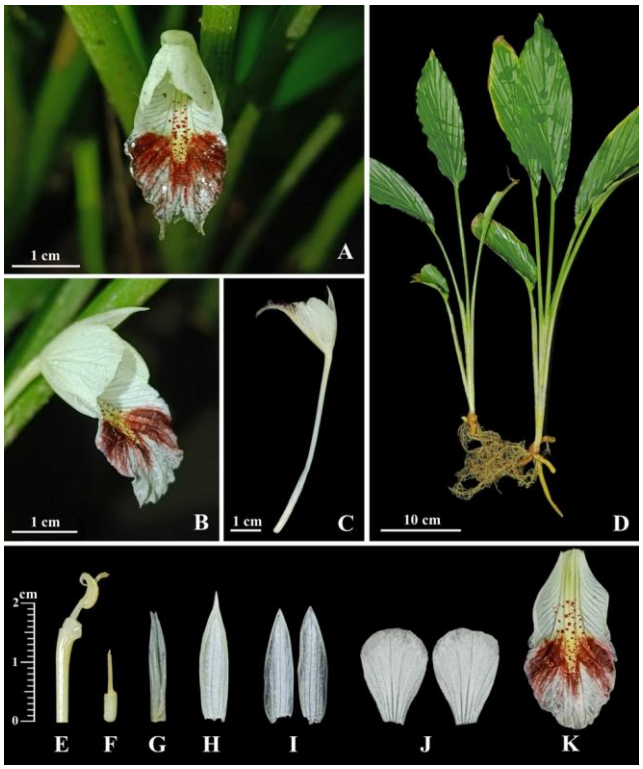

Figure 3. *Boesenbergia meghalayensis* Aishwarya & M.Sabu: A. Front view of flower; B. Semi-side view of flower; C. Side view of the whole flower; D. Habit; E. Side view of the anther; F. Ovary with epigynous glands; G. Calyx; H. Dorsal corolla lobe; I. Lateral corolla lobes, J. Lateral staminodes; and K. Labellum. Photographs by Nyi Min Htet**,** Designed by Thawatphong Boonma

Conservation status: We propose the species be classified as DD (Data Deficient) on the IUCN Red List Version 16 (IUCN Standards and Petitions Committee 2024) due to insufficient data to accurately determine its extinction risk. All known populations are located near roadsides (not in the conservation area) which poses a potential risk from future road expansion. Such developments could lead to habitat loss, negatively impacting the species. Therefore, until further evidence is gathered regarding its population size, distribution, and ecological needs, we recommend treating the species as endangered. This is a crucial step to prioritize conservation efforts and protect it from potential threats, as the potential loss of this species is significant. This precautionary approach will ensure that appropriate measures are in place while awaiting more comprehensive data.

Boesenbergia siphonantha (King ex Baker) M.Sabu, Prasanthk. & Škorničk., Rheedea 14: 55 (2004) - Kaempferia siphonantha King ex Baker in Hook.f., Fl. Brit. India 6: 222 (1890). — TYPE: India, Andaman Islands, 1884, King's Collector 372 (lectotype CAL [CAL0000000916]; isolectotypes CAL [CAL0000000912, CAL0000000913], K [K000640517]) (Figure 4)

Description: Perennial rhizomatous herb 20-60 cm tall, clumping. Rhizome globular, 0.7-1.6 cm in diam., developed in various directions, externally brown, internally cream-yellow colored, and slightly aromatic. Roots are fibrous with many elongated root tubers. Pseudostem 5-cm long. Leafless sheaths 1-2, green or reddish-tinged. Leaves 4-7 per pseudostem; leaf sheaths 10-21 cm long; ligule bilobed, 1-6 mm long, lobes linear to rounded, pale green, translucent, glabrous or with few hairs; petiole 3-12 cm long, green, glabrous; lamina ovate to oblong-lanceolate, 10-30 × 4-12 cm, base cordate sometimes oblique, apex acute to acuminate, adaxial dark green, glabrous, abaxial pale green, glabrous or slightly pubescent, margin undulate. Inflorescence terminal and radical; peduncle 1-3 cm long, branched or unbranched; spike 4-6 cm long, c. 0.4 cm diam., base white, apex dark reddish-brown, ribbed. Bracts 2-8, distichous, ovate-lanceolate to linear, 3.5-5 × 0.5-1 cm, white, green, or green with a reddish tinge at the distal part, glabrous. Bracteoles tubular, 1-2.9 × c. 0.1 cm, whitish or cream, glabrous or pubescent, apex 2-3 toothed, unilateral incision

1-3.6 mm. Spike with 3-8 flowers, one opens per day, flowers 7-12 cm long. Calyx tubular 6 × 1.5 mm, apex trifid, white or white with reddish dots, with a unilateral slit up to 3 mm long. Floral tube cylindrical, 6-9 cm long, white, glabrous; dorsal corolla lobe triangular-lanceolate, 1.2-1.3 × 0.4-0.6 cm, apex acute, hooded, cream, glabrous; lateral corolla lobes linear, c. 1.3 × 0.4-0.5 cm, apex acute, slightly hooded, cream, glabrous. Lateral staminodes 2, obovate, 0.8-3 × 0.4-1 cm, cream-white, apex rounded, revolute. Labellum deeply saccate, ovate to obovate, 2 × 0.5-1.7 cm, apex rounded or emarginate, cream-white (more yellowish with age), throat and mib-lobe bright red, and broadening outward to dark pink, externally covered with short glandular hairs, margin slightly undulate. Stamen 1, 7-8 mm long; filament 1-4 mm long, white, glabrous; anther 5-6 × 3-4 mm, pale yellow, darker towards the tip, glabrous; anther crest absent. Style filiform, 7-8 cm long, white; stigma white, ciliate. Epigynous glands 2, 0.8-0.9 cm long, linear, cream colored. Ovary cylindrical, trilocular, 5-6 × 1.5-2 mm, axile placentation, glabrous or with sparse hairs at the apex. Fruit not seen.

Distribution: Andaman Is., Myanmar, Nicobar Is., Thailand, and Vietnam.

Ecology: In Myanmar, this species grows in dry evergreen to evergreen forest, moist, under the shade of the trees, near the watercourse, 100-120 m asl.

Figure 4. *Boesenbergia siphonantha* (King ex Baker) M.Sabu, Prasanthk. & Škorničk: A. Front view of flower; B. Side view of flower; C. Back view of flower; D. Habits; E. Side view of the anther; F. Ovary with epigynous glands; G. Dorsal corolla lobe; H. Lateral corolla lobes; I. Lateral staminodes; J. Labellum; and K. Side view of flower. Photographs by Hein Myat Minn, Nyi Nyi Htway, and Thawatphong Boonma

Phenology: Flowering from June to September. It can produce both terminal and lateral inflorescence, but not at the same time.

Utilization: Young pseudostem eats fresh with chili paste.

Additional specimens examined: Myanmar, Kayin State, Mt. Zwegabin, c. 120 m asl, Htet N.M., and Boonma T. 2402 (FOF!, MSU!). Myanmar, Mon State, Mawlamyine, c. 100 m asl, Htway N.N. and Boonma T. 2403 (MSU!).

Conservation status: We propose the species be classified as DD (Data Deficient) on the IUCN Red List Version 16 (IUCN Standards and Petitions Committee 2024) due to insufficient data to determine its extinction risk accurately. Therefore, until further evidence is gathered regarding its population size, distribution, and ecological needs, we recommend treating the species as endangered to prioritize conservation efforts and protect it from potential threats. This precautionary approach will ensure that appropriate measures are in place while awaiting more comprehensive data.

An update checklist of *Boesenbergia* Kuntze in Myanmar

The genus *Boesenbergia* Kuntze occurs across tropical and subtropical Asia, with the highest species diversity observed in Southeast Asia. These species hold ecological, medicinal, and ornamental significance, rendering them a critical focus of botanical studies. Despite their importance, research on the genus *Boesenbergia* in Myanmar has remained limited, with relatively few studies exploring its distribution and diversity. Recent field investigations and taxonomic reviews have improved the knowledge of *Boesenbergia* in Myanmar, leading to the identification of newly recorded species and confirmation of earlier reports. As a result, the total number of recognized *Boesenbergia* species in the country has increased to 13 species. The following checklist provides an updated overview of these species, along with their confirmed presence in Myanmar and a diagnostic key to the *Boesenbergia* species of Myanmar follows the checklist to assist with species identification and classification.

Boesenbergia albomaculata S.Q.Tong, Acta Phytotax Sin 24: 323 (1986).

Myanmar.--Kachin State, Myitkyina Township, elevation 220 m asl, 24 February 2002, Kress WJ, Htun T, Bordelon M & Hla KM 02-7056 (US!). Kachin, Myitkyina Township, elevation 240 m asl, 24 February 2002, Kress WJ, Htun T, Bordelon M & Hla KM 02-7065 (US!).

Distribution.--Native to China and Myanmar.

Boesenbergia kerrii Mood, L.M.Prince & Triboun, Gard Bull Sing 65: 64 (2013).

Myanmar.--Tanintharyi Region, Mainmapan, Taninthayi Reserved Forest, Yephyu Township, altitude 160 m asl., 31 July 2015, Tanaka N, Aung MM, Latt MM & Thu AK MMA141, TNS01249064 (TNS!). Tanintharyi Region, the roadside along the gas pipeline, Taninthayi Nature Reserve, Yephyu Township, elevation 28 m, 11 June 2016, Tanaka N, Naiki A, Tagane S & Aung MM MY698, TNS01283296 (TNS!).

Distribution.-- Native to Myanmar and Thailand.

Boesenbergia kingii Mood & L.M.Prince, Gard Bull Sing 65: 76 (2013).

Myanmar.-- Mandalay Region, Maymyo Hills, June 1888, Khan 50 (CAL!); Mandalay Region, Kyaukpadaung Township, elevation 860-977 m asl, 17 May 1996, Kress WJ, Bell DA & Kyi YY 96-5646 (US!). Sagaing Region, Katha District, Pile R.F., 20 August 1915, Rogers C 991 (CAL!). Sagaing Region, Kani Township, elevation 450 m asl, 17 July 1997, Kress WJ, Bell DA & Htun T 97-5821 (US!). Sagaing Region, Kani Township, elevation 370 m asl, 13 April 2000, Kress WJ, Bordelon M, Tun T & Win UH 00-6639 (US!). Sagaing Region, Kani Township, elevation 370 m asl, 13 April 2000, Kress WJ, Bordelon M, Tun T & Win UH 00-6646 (US!). Sagaing Region, Kani Township, elevation 470 m asl, 15 April 2000, Kress WJ, Bordelon M, Tun T & Win UH 00-6661 (US!). Shan State, elevation 630 m asl, 26 June 2003, Kress WJ, Pe A, Htay TT, Aung WW & Htun T 03-7366 (US!).

Distribution.-- Native to Bangladesh, China, India, Laos, Myanmar, and Thailand.

Boesenbergia longiflora (Wall.) Kuntze, Revis. Gen Pl 2: 685 (1891).- *Gastrochilus longiflorus* Wall., Pl Asiat Rar 1: 22 (1829).- *Curcumorpha longiflora* (Wall.) A.S.Rao & D.M.Verma, Bull Bot Surv India 13: 339 (1971 publ. 1974).

Myanmar.-- Rangoon (Yangon), Wallich N Cat. No. 6589, K00575371 (K!). Yangon Region, Insein District, Myaukhlaing Reserve, 30 m asl, 11 Jun 1948, Khant P 426 (RAF!). Sagaing, Kani Township, elevation 500 m asl, 16 July 1997, Kress WJ, Bell DA & Htun T 97-5817 (US!). Sagaing, Kani Township, elevation 370 m asl, 13 April 2000, Kress WJ, Bordelon M, Tun T & Win UH 00-6639 (US!). Sagaing, Kani Township, elevation 375 m asl, 13 April 2000, Kress WJ, Bordelon M, Tun T & Win UH 00-6647 (US!). Rakhine State, elevation 20 m asl, 18 June 2003, Kress WJ, Pe A, Htay TT, Aung WW & Bordelon M 03-7305 (US!). Rakhine State, elevation 5 m asl, 16 November 2004, Kress WJ, Bordelon M, Ohn TM & Tin K 04-7772 (US!).

Distribution.--Endemic to Myanmar.

Boesenbergia maxwellii Mood, L.M.Prince & Triboun, Gard Bull Sing 65: 72 (2013).

Myanmar.--Chin State, elevation 1,635 m asl, 10 November 2004, Kress WJ, Bordelon M, Ohn TM & Tin K 04-7722 (US!). Chin State, elevation 1,635 m asl, 10 November 2004, Kress WJ, Bordelon M, Ohn TM and Tin K 04-7724 (US!). Chin State, between Kanpetlet and Saw, Laung Pan, 1 September 2011, Funakoshi H, Mang H, Man S, Shein L & Htay WM 085387, MBK no. 0246182 (MBK!). Chin State, along the roadside, near Saw Town, Natmataung National Park, Western Myanmar, 9 June 2002, Tanaka N, Sugawara T, Murakami N, Aoki K, Sakai S, Watanabe K & Htwe KM 023015, MBK 0059681 (MBK!). Kayah State, Mt. Kholeso, Phruso Township, Loikaw District, elevation 1,167 m asl, 8 August 2018, Nobuyuki T, Aung MM and Win AK 3459, TNS01317283 (TNS!).

Distribution.--Native to Laos, Myanmar, and Thailand.

Boesenbergia meghalayensis Aishwarya & M.Sabu, Phytotaxa 197: 187 (2015b).

Myanmar.-- Yangon, near the highway to Yangon, Htet NM & Boonma T 2401 (FOF!, MSU!).

Distribution.--Native to India (Meghalaya and Mizoram) and Myanmar.

Boesenbergia moodii Nob.Tanaka & Paing, Bull Natl Mus Nat Sci Ser B 50(4): 149 (2024). (Tanaka et al. 2024).

Myanmar.-- Rakhine State, Chit Soe Paing 001 (RAF, TNS).

Distribution.--Native to Myanmar.

Boesenbergia parvula (Wall. ex Baker) Kuntze, Revis. Gen Pl 2: 685 (1891). - *Gastrochilus parvulus* Wall. ex Baker in J.D.Hooker, Fl Brit India 6: 218 (1890).

Boesenbergia parvula var. *parvula*. *Gastrochilus phyllostachyus* Gagnep., Bull Soc Bot France 53: 146 (1906). - *Boesenbergia gelatinosa* K.Larsen, Nordic J Bot 17: 361 (1997). - *Boesenbergia jahaiana* Meekiong & C.K.Lim, Folia Malaysiana 15: 42 (2014). - *Boesenbergia phyllostachya* (Gagnep.) K.Larsen ex Veldkamp, Philipp J Sci 142: 220 (2014).

Myanmar.--Tanintharyi Region, Mainmapan, Taninthayi Reserved Forest, Yephyu Township, altitude 17 m asl, 31 July 2015, Tanaka N, Aung MM, Latt MM & Thu AK MMA138, TNS1249067 (TNS!). Tanintharyi Region, Michaung Hlaung (Old village), Taninthayi Reserved Forest, Yephyu Township, altitude 17 m asl, 1 August 2015, Tanaka N, Aung MM, Latt MM & Thu AK MMA153, TNS1249065 (TNS!).

Distribution.--Native to Laos, Malaysia, Myanmar, Thailand, and Vietnam.

Boesenbergia plicata (Ridl.) Holttum

Myanmar.--Bago Region, Shin Pin Kyet Thouk, Oktwin Township, Taungoo, 18 August 2017, Nobuyuki T, Ito Y, Aung MM & Hnin PP 2521, TNS01300778 (TNS!).

Distribution.--Native to Malaysia, Myanmar, and Thailand.

Boesenbergia pulcherrima (Wall.) Kuntze, Revis Gen Pl 2: 685 (1891). - *Gastrochilus pulcherrimus* Wall., Pl Asiat Rar 1: 22 (1829).

Myanmar.--Bago State, Paungpyin Township, elevation 400 m asl, 13 July 2002, Kress WJ, Bordelon M & Thant H 02-7151 (US!). Bago State, Paungpyin Township, elevation 400 m asl, 13 July 2002, Kress WJ, Bordelon M & Thant H 02-7153 (US!). Taninthayi Region, Thetkaekawt Compartment, Taninthayi Reserved Forest, Yephyu Township, elevation 76 m asl, 3 August 2015, Nobuyuki T, Aung MM, Latt MM & Thu AK MMA171, TNS01249061 (US!).

Distribution.--Native to India (Assam), Malaysia, Myanmar, and Thailand.

Boesenbergia purpureorubra Mood & L.M.Prince, Gard Bull Sing 66: 208 (2014).

Myanmar.--Tanintharyi Region, Bo Cho Island, Kawthaung Township, Lampi Island Marine National Park,

elevation 11 m, 18 May 2017, Tanaka N, Aung MM, Ba S & Kyi N MY2031, TNS01289501 (RAF!, TNS!).

Distribution.--Native to Myanmar and Thailand.

Boesenbergia rotunda (L.) Mansf., Kulturpflanze 6: 239 (1958). - *Boesenbergia cochinchinensis* (Gagnep.) Loes. in H.G.A.Engler, Nat Pflanzenfam ed. 2. 15a: 571 (1930). - *Boesenbergia pandurata* (Roxb.) Schltr., Repert Spec Nov Regni Veg 12: 316 (1913). - *Curcuma rotunda* L., Sp Pl 2 (1753). - *Gastrochilus panduratus* (Roxb.) Ridl., J. Straits Branch Roy Asiat Soc 32: 114 (1899). - *Gastrochilus rotundus* (L.) Alston in H.Trimen, Handb Fl Ceylon 6 (Suppl.): 281 (1931). - *Kaempferia cochinchinensis* Gagnep., Bull Soc Bot France 54: 165 (1907). - *Kaempferia ovata* Roscoe, Trans Linn Soc London 8: 351 (1807). - *Kaempferia pandurata* Roxb., Asiat Res 11: 328 (1810).

Myanmar.--Sagaing, Kani Township, elevation 625 m asl, 15 July 1997, Kress WJ, Bell DA, & Htun T 97-5804 (US!). Shan State, Nawnghkio Township, elevation 730 m asl, 2 July 1999, Kress WJ, Bordelon M, Williams KJ & Htun T 99-6502 (John Kress No. 99-6502a)(US!). Mandalay, Pyin Oo Lwin Township, elevation 650 m asl, 3 July 1999, Kress WJ, Bordelon M, Williams KJ & Htun T. 99-6511 (US!). Sagaing, Kani Township, elevation 560 m asl, 14 April 2000, Kress WJ, Bordelon M, Tun T & Win UH 00-6648 (US!). Mandalay, Thabeikyin Township, elevation 550 m asl, 11 June 2001, Kress WJ, Htun T, Bordelon M, Williams KJ & Rehse T 01-6896 (US!). Sagaing, elevation 345 m asl, 19 June 2001, Kress WJ, Htun T, Bordelon M, Williams KJ & Rehse T 01-6935 (WJK 01-6935 vouchered by WJK 02-7231)(US!). Taninthayi Region, Mainmapan, Taninthayi Reserved Forest, Yephyu Township, elevation 17 m asl, 31 July 2015, Tanaka N, Aung MM, Latt MM & Thu AK MMA133, TNS01249066 (TNS!). Taninthayi Region, Mainmapan, Taninthayi Reserved Forest, Yephyu Township, elevation 17 m asl, 31 July 2015, Tanaka N, Aung MM, Latt MM & Thu AK MMA137, TNS01249063 (TNS!). Kayah State, 30 km SW of Loikaw, toward the border of Kayin State, Demotho District, Loikaw Township, elevation 1,320 m asl, 21 August 2017, Nobuyuki T, Ito Y, Aung MM & Hnin PP 2666, TNS01300876 (TNS!). Bago Region, Nat Thamee Thuye Taung reserved forest compartment No. 7, Pyay District, 8 Aug 2019, Nobuyuki T, Sugawara T, Aung LM & Aung MM MY5135, TNS01351049 (TNS!). Kayin State, 15 miles east of Taungoo, along the Thaundaungyi Road, Thaundaung Township, elevation 360 m asl, 5 August 2018, Nobuyuki T, Aung MM & Win AK 3396, TNS01317370 (TNS!). Bago Region, Shin Pin Kyet Thouk, Oktwin Township, Taungoo, 18 August 2017, Nobuyuki T, Ito Y, Aung MM & Hnin PP 2519, TNS01300779 (TNS!).

Distribution.--Native to Andaman Is., Cambodia, China (South-Central), India (Assam), Indonesia (Jawa, Lesser Sunda Is., Sumatra), Malaysia, Thailand, and Vietnam.

Boesenbergia siphonantha (King ex Baker) M.Sabu, Prasanthk. & Škorničk., Rheedea 14: 55 (2004).

Myanmar.-- Myanmar, Kayin State, Htet NM & Boonma T. 2402 (FOF!). Myanmar, Mon State, Mawlamyine, Htway NN & Boonma T 2403 (MSU!).

Distribution.--Andaman Is., Myanmar, Nicobar Is., Thailand, and Vietnam.

Discussion

The discovery of *B. meghalayensis* and *B. siphonantha* as new documented records in Myanmar is a significant milestone in our understanding of the region's ecological diversity. These findings not only underscore the importance of ongoing field research in under-explored regions like Myanmar but also pique our curiosity about the yet-to-be-discovered flora. The documentation of these species is a testament to our increasing knowledge about the genus and our growing understanding of the diversity of *Boesenbergia* within the family Zingiberaceae. Mood et al. (2016a) raised questions about the presence of *B. plicata* in Myanmar, citing the lack of verified specimens from the country.

Our research resolves this uncertainty by presenting specimens collected from the Bago Region, which have been deposited at the National Museum of Nature and Science (TNS!). This confirmation supports the broader distribution of *B. plicata* within Myanmar, indicating that the species may be more widespread than previously documented.

Key to 13 species of *Boesenbergia* in Myanmar

1a. Androecial cup absent	2
1b. Androecial cup present	3
2a. Staminodes pink	*B. rotunda*
2b. Staminodes white	*B. meghalayensis*
3a. Inflorescence terminal	4
3b. Inflorescence radical	10
4a. Stem branched	*B. parvula*
4b. Stem unbranched	5
5a. Leafy shoot less than 60 cm tall	6
5b. Leafy shoot more than 60 cm tall	8
6a. Corolla lobes orangish yellow	*B. moodii*
6b. Corolla lobes creamy white or white	7
7a. Leaves with an attenuate to rounded base	*B. purpureorubra*
7b. Leaves with a cordate base	*B. siphonantha*
8a. Spike lanceolate	*B. plicata*
8b. Spike oblong to oblanceolate	9
9a. Inflorescence exserted beyond leaves	*B. albomaculata*
9b. Inflorescence clapsed between leaves	*B. pulcherrima*
10a. Leafy shoot less than 60 cm tall	*B. siphonantha*
10b. Leafy shoot more than 60 cm tall	11
11a. Labellum white	12
11b. Labellum pale yellow	13
12a. Rhizomes creeping, with well spaced pseudostems	*B. kingii*
12b. Rhizomes not creeping, with tufted pseudostems	*B. maxwellii*
13a. Labellum 2.2-2.5 cm long, floral tube to 10 cm long	*B. longiflora*
13b. Labellum 3.8-4 cm long, floral tube 12-14 cm long	*B. kerrii*

The validation of these occurrences contributes significantly to the existing literature and provides a more comprehensive checklist of *Boesenbergia* species in Myanmar, now totaling 13 species. This enriched understanding of species distribution is vital for both taxonomists and conservationists working to document and protect Myanmar's rich botanical heritage.

The finding of *B. meghalayensis*, previously considered endemic to India in multiple regions of Myanmar, suggests that this species possesses a broader ecological adaptability than previously understood. This adaptability may indicate its ability to thrive in various environmental conditions, which could be a crucial factor in its potential for conservation. Similarly, the identification of *B. siphonantha* in Myanmar aligns with its distribution in other Southeast Asian countries, such as Thailand and Vietnam. This continuity of habitat preferences in comparable environments points to a shared ecological niche that may facilitate its survival across geographical boundaries.

In the context of conservation, both species have been classified as DD (Data Deficient) under the IUCN (IUCN Standards and Petitions Committee 2024) due to insufficient data on their population size and distribution. This classification emphasizes the urgency for targeted conservation efforts. The vulnerability of these species, particularly those found near roadsides and in areas experiencing habitat degradation, underscores the risks posed by human activities, including land development and agricultural expansion. The encroachment of urbanization on natural habitats can disrupt local ecosystems, leading to a decline in plant populations and biodiversity.

Therefore, to address these concerns, future research should prioritize the collection of detailed ecological and population data for *B. meghalayensis* and *B. siphonantha*. Assessing their conservation status accurately will require comprehensive field studies, including surveys to evaluate population densities, reproductive success, and habitat requirements. Such data will be critical for formulating effective conservation strategies tailored to these species' needs. Furthermore, the participation of local communities in conservation initiatives is essential. Community-based conservation programs are instrumental in raising public awareness of the ecological significance of this species and its habitat. By involving local stakeholders in conservation efforts, we can cultivate a sense of ownership and responsibility for preserving Myanmar's unique plant diversity. Educational campaigns that highlight the importance of biodiversity and promote sustainable practices are key in mitigating the detrimental effects of development and enhancing ecological resilience.

The significance of ongoing research in botanical exploration is a fascinating aspect of conservation. The findings obtained in this study demonstrate how continuous research can yield significant results that enhance our understanding of regional flora. Each new species record contributes to a more comprehensive picture of biodiversity, thereby playing a crucial role in informing conservation planning and policy making. This is particularly intriguing in countries with high biodiversity, such as Myanmar, where many species are yet to be studied and appreciated. In addition to expanding species records, this study highlights the need for further taxonomic research within the *Boesenbergia* genus and the Zingiberaceae family as a whole. Continued taxonomic exploration and refinement will not only help identify and describe new species but also provide insights into evolutionary relationships, aid in conservation planning, and guide breeding programs. Such taxonomic clarity is vital for conservation efforts, as it ensures that protective measures are based on accurate and up-to-date information regarding species distributions and ecological requirements.

In conclusion, this study confirmed the presence of *B. meghalayensis* in Yangon Region and *B. siphonantha* in Kayin and Mon States as new records for Myanmar, along with verifying *B. plicata* in the Bago Region. These findings expand the distribution of *Boesenbergia* in Myanmar, providing an updated checklist and emphasizing the importance of taxonomic research for conservation and preserving the country’s plant diversity. This study provides a foundation for future research aimed at protecting and conserving the country's diverse plant life, ensuring that both *Boesenbergia* species and their habitats are preserved for future generations. However, these efforts are under threat from deforestation, climate change, or illegal trade. It is, therefore, imperative that we act swiftly and decisively to protect these species and their habitats.

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