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MOSSES OF MANTAILANG WITH NEW SPECIES RECORDS FOR CROCKER RANGE PARK, SABAH, MALAYSIAN BORNEO

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ABSTRACT

SULEIMAN, M., ANTHONY, F., REPIN, R. & ANWAR, I. 2025. Mosses of Mantailang with new species records for Crocker Range Park, Sabah, Malaysian Borneo. *Reinwardtia* 24(2): 145–159. — A two-day bryological survey was conducted in Mantailang of the Crocker Range Park (CRP), Sabah, East Malaysia, during the 2018 Mantailang scientific exploration. The survey aimed to carry out an inventory of mosses in the study area. A total of 89 species from 49 genera and 23 families were identified, with the family Calymperaceae being the most represented. Notably, 11 species were newly recorded for the CRP. Mantailang harbours rare and Bornean endemic species, highlighting the park's significance as a moss biodiversity hotspot and its importance for bryophyte conservation in Borneo.

Key words: Malaysia, moss flora, new records, Sabah.

ABSTRAK

SULEIMAN, M., ANTHONY, F., REPIN, R. & ANWAR, I. 2025. Lumut sejati dari Mantailang dengan catatan jenis baru di Crocker Range Park, Sabah, Malaysia Borneo. *Reinwardtia* 24(2): 145–159. — Survei briologi selama dua hari telah dilakukan di Mantailang di Crocker Range Park (CRP), Sabah, Malaysia Timur, pada saat eksplorasi ilmiah Mantailang 2018. Survei ini bertujuan untuk melakukan inventarisasi lumut sejati di kawasan tersebut. Sebanyak 89 jenis dari 49 marga dan 23 suku diidentifikasi, dengan suku Calymperaceae yang paling banyak terwakili. Sebanyak 11 jenis merupakan rekaman baru untuk CRP. Mantailang mempunyai jenis langka dan endemik di Borneo, mengutamakan pentingnya taman ini sebagai pusat keanekaragaman hayati lumut sejati dan pentingnya konservasi lumut di Borneo.

Kata kunci: Catatan baru, flora lumut sejati, Malaysia, Sabah.

INTRODUCTION

Mantailang is located in the Tenom District of southwestern Sabah, Malaysian Borneo (Fig. 1). It is located in the southernmost tip of the Crocker Range Park (CRP), the largest terrestrial national park in Sabah, with an area of 140,738 ha. This relatively remote area is about 6 km from Tenom Town, the capital of Tenom District, and 150 km South from Kota Kinabalu, the capital of Sabah State.

The moss flora of the CRP has been extensively studied in the last two decades (Suleiman & Aki-

yama, 2004; Suleiman & Jotan, 2015; Ellis *et al.*, 2016a, b; Suleiman *et al.*, 2017a, b). This park has recorded a total of 304 taxa of mosses belonging to 118 genera and 38 families, accounting to about 40% of the total number of mosses for Borneo. These studies have reported numerous new records of mosses for Sabah and Borneo, contributing significantly to the knowledge of moss diversity in this region. This park is also home to several Bornean endemic moss species and many rare mosses, cementing its importance as a protected area in Sabah.

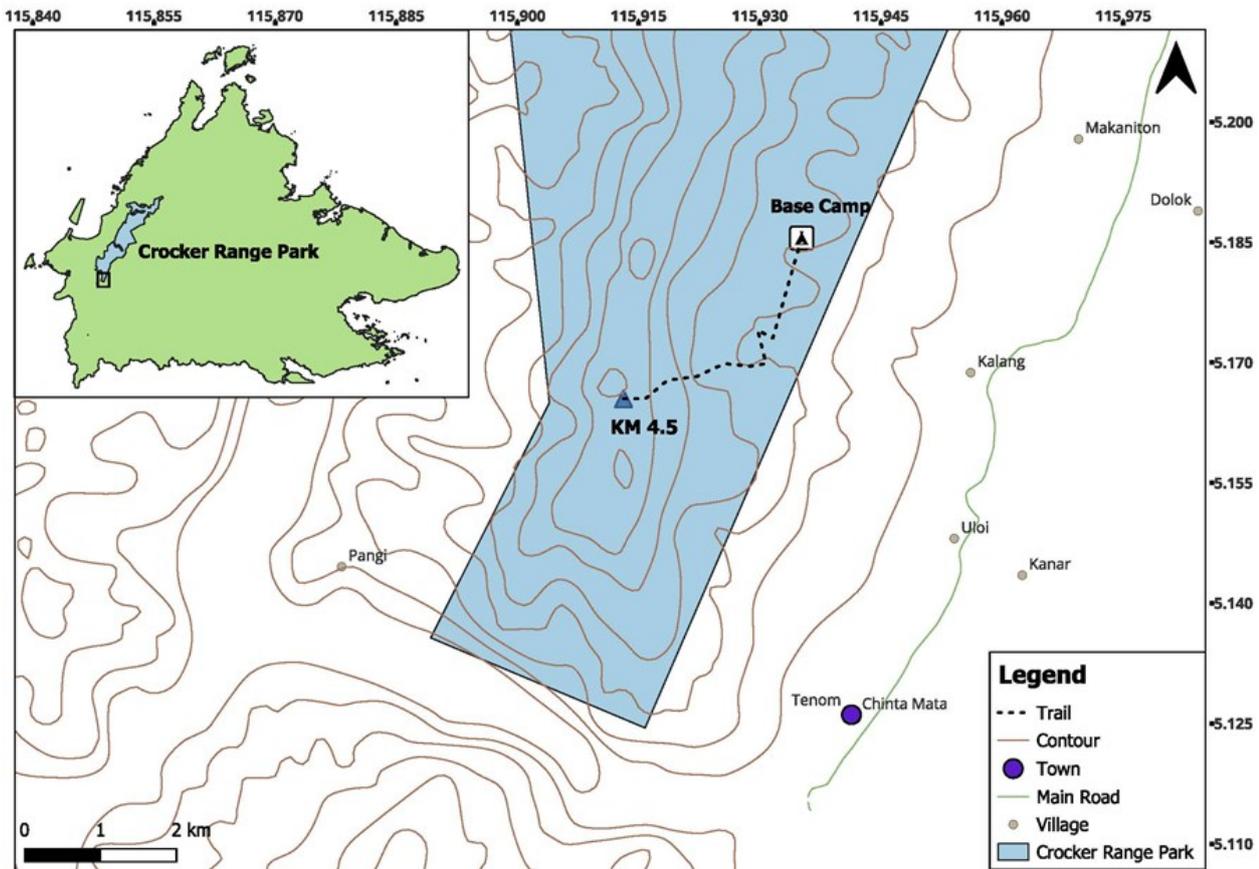


Fig. 1. Map of southern part of Crocker Range Park showing the study site. Insert is map of Sabah, Malaysian Borneo.

A large part of CRP's remote and less accessible areas were not surveyed in previous studies, including Mantailang. Thus, the objective of this study was to carry out an inventory of mosses from Mantailang, Crocker Range Park.

MATERIALS AND METHODS

Mosses were collected along the trails from the exploration Base Camp ($5^{\circ}11'7.88''\text{N}$, $115^{\circ}56'6.69''\text{E}$) to km 4.5 ($5^{\circ}9'55.7''\text{N}$, $115^{\circ}54'47.3''\text{E}$; Fig. 1) from 2nd to 3rd November 2018. The study area is characterized by mixed dipterocarp forest, ranging from 500 m to 1,200 m asl. It sits in a hilly and rugged terrain, from lowland mixed dipterocarp forest to lower montane forest; mossy forest starts to develop from 1,100 m asl. The area is largely considered to be a primary forest, except for the lowland areas adjacent to the base camp with signs of previous anthropogenic disturbances.

The collected specimens were curated and identified at the BORNEENSIS Herbarium (BORH) of the Universiti Malaysia Sabah. Taxonomic keys for Malesian mosses were used in species identifi-

cation, such as Akiyama (2010), Eddy (1988, 1990, 1996), Menzel (1992), Mohamed & Robinson (1991), Noguchi (1976), Tan & Iwatsuki (1989), and Touw (2001). The classification of the moss families, genera and species names were based on the World Flora Online (WFO, 2025). The specimens were deposited at the Sabah Parks Herbarium (SNP) and a set of duplicates in BORH.

RESULTS AND DISCUSSION

A total of 103 specimens of mosses were collected during the survey and out of these, 89 species in 49 genera and 23 families of mosses were identified, including three uncertain taxa (Table 1; Fig. 2–4; Appendix 1). This number represents *ca.* 13% of the mosses reported for Sabah and *ca.* 11% of the mosses reported for Borneo (Suleiman *et al.*, 2006; Suleiman *et al.*, 2024a, b). The Calymperaceae has the highest number of species with 11 species, followed by the Neckeraceae and Sematophyllaceae each with nine species, the Daltoniaceae with eight species, and the Fissidentaceae with six species (Table 1). These families are expected to be

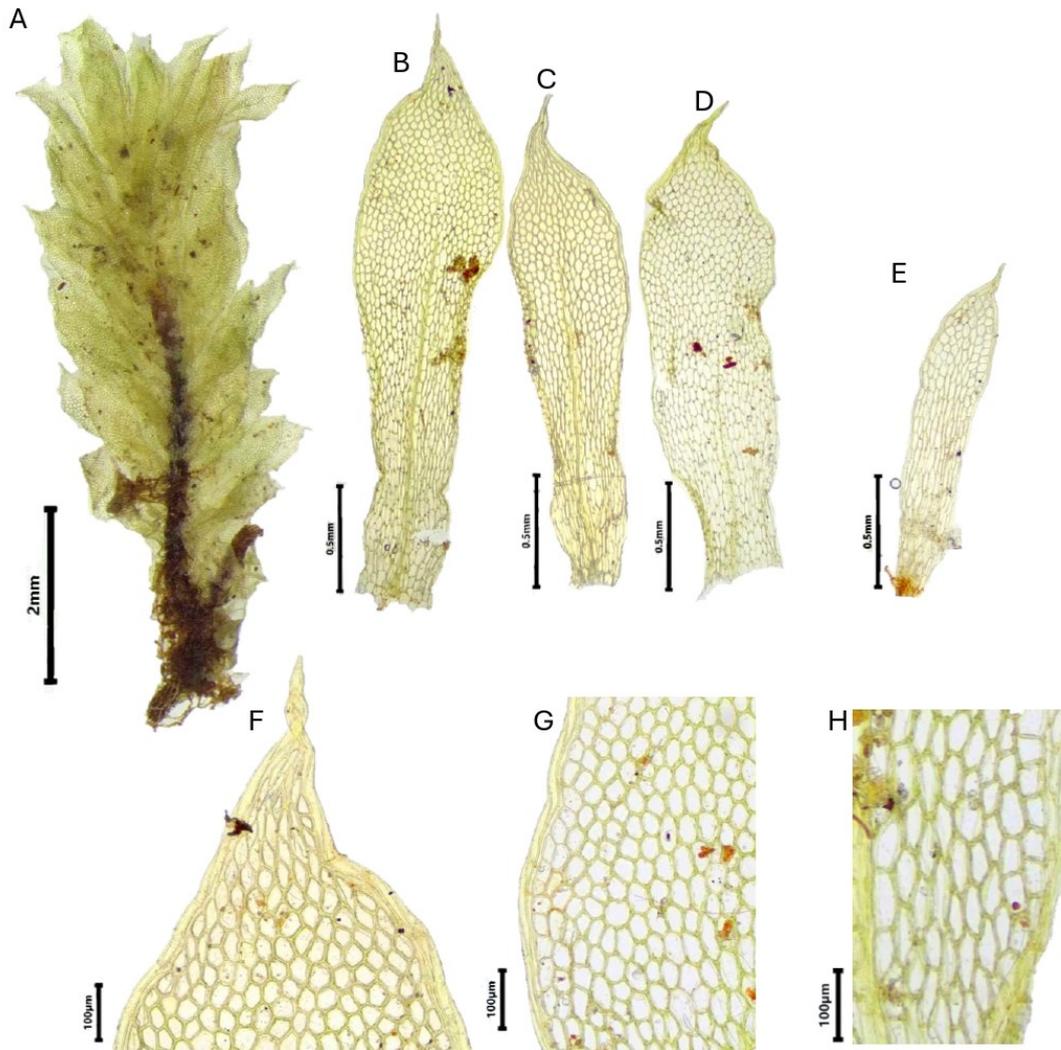


Fig. 2. *Distichophyllum* cf. *angustifolium* Dixon. A. Plant. B–D. Leaves. E. Perichaetial leaf. F. Leaf apex. G. Mid-lamina cells. H. Basal cells. (A–H from *M. Suleiman & I. Anwar 6593*). Photos by Irmah Anwar.

rich in species in lowland areas of the CRP. Previous studies have identified the five dominant moss families in the CRP as Calymperaceae, Sematophyllaceae, Pylaisiadelphaceae, Dicranaceae, and Daltoniaceae (Suleiman *et al.*, 2017a). Notably, the highest peak in the CRP, Mount Minduk Sirung (2,076 m asl), was surveyed in earlier research. However, the current study focused on elevations from 500 m to 1,200 m asl, resulting in a limited representation of montane families such as the Dicranaceae and Leucobryaceae (Appendix 1). The extensive survey of several streams near the camp site and along the trail yielded a significant number of species of Neckeraceae, Daltoniaceae, and Fissidentaceae.

Among the 89 species of mosses collected from the study area, 11 are new records for the CRP

(Appendix 1). This addition is notably high for a two-day survey in only 4.5 km long trail. The findings increase the total moss taxa count in CRP to 315, accounting for approximately 47% of Sabah's mosses and 40% of Borneo's moss flora. This has highlighted the park as one of the hotspots for moss diversity in Borneo.

Borneo has only about 25 species (*ca.* 3%) of endemic moss species. Low endemism in bryophytes is due to their efficient spore dispersal and ecological versatility, allowing them to colonise diverse habitats across large areas (Glime, 2017; Vanderpoorten & Goffinet, 2009). These factors contribute to their widespread distribution, reducing species confinement to specific regions. One species of Bornean endemic species was collected from Mantailang which is *Racopilum laxirete*

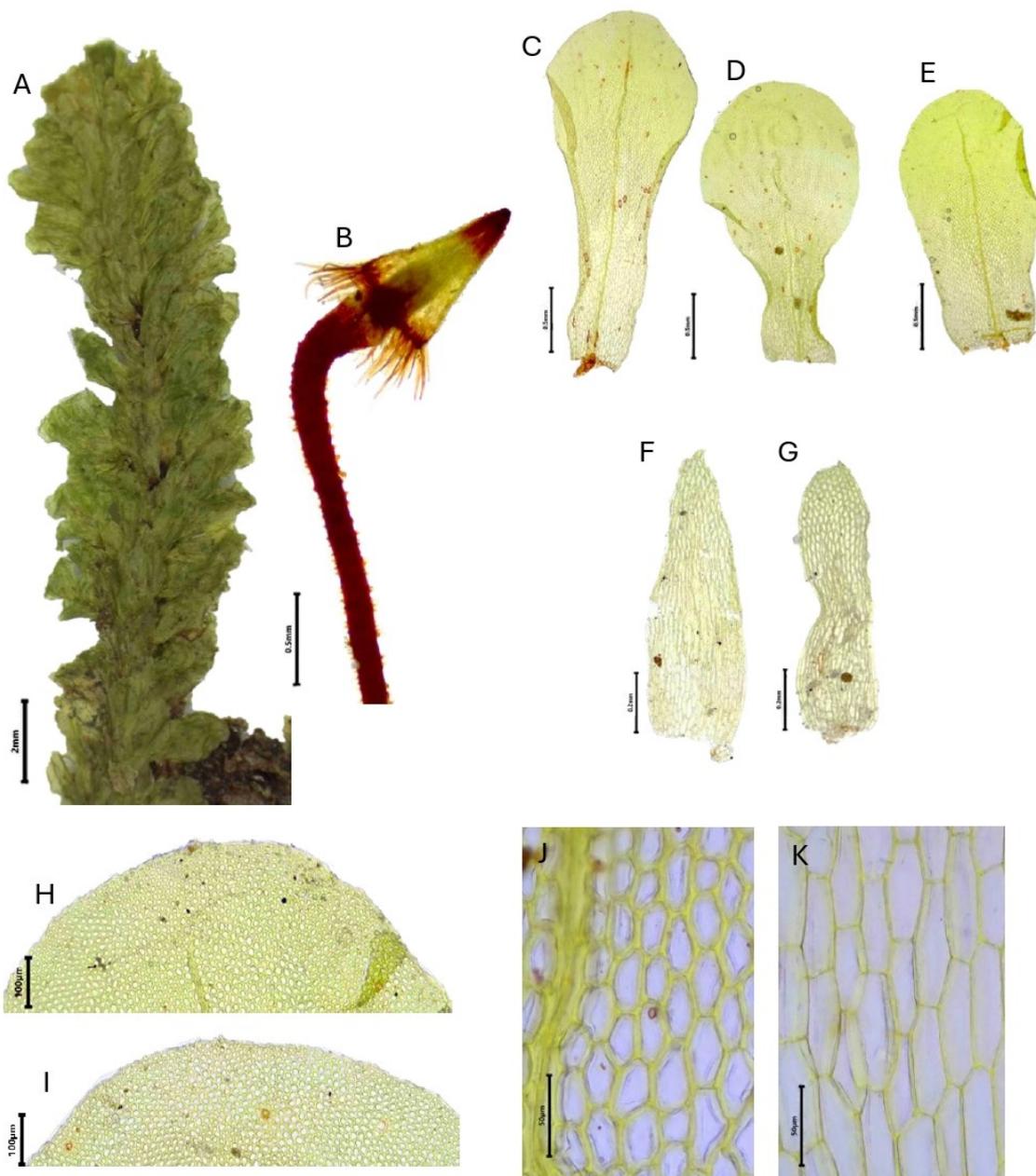


Fig. 3. *Distichophyllum* cf. *undulatum* Dozy & Molk. ex Bosch & Sande Lac. A. Plant. B. Sporophyte. C–E. Leaves. F–G. Perichaetial leaves. H–I. Leaf apices. J. Mid-lamina cells. K. Basal cells. (A–K from *M. Suleiman & I. Anwar 6647*). Photos by Irmah Anwar.

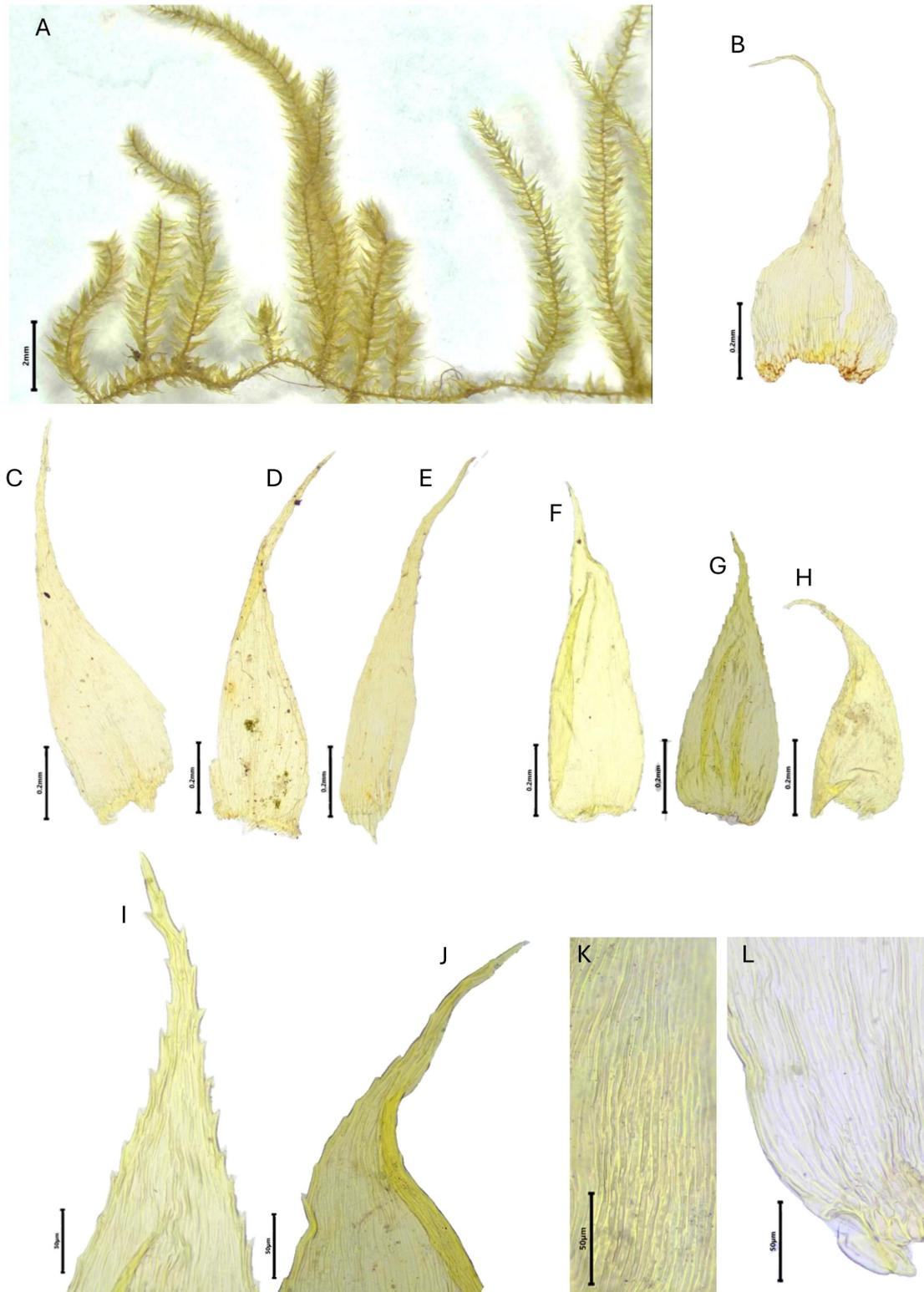


Fig. 4. *Ectropothecium* sp. A. Plant. B. Perichaetial leaf. C–E. Branch leaves. F–H. Stem leaves. I–J. Leaf apices. K. Mid-lamina cells. L. Basal cells. (A–L from *M. Suleiman & I. Anwar 6644*). Photos by Irmah Anwar.

Table 1. Summary of mosses collected from Mantailang, Crocker Range Park, in descending order of species number.

No	Families	Genera	Species
1	Calymperaceae	6	11
2	Neckeraceae	7	9
3	Sematophyllaceae	4	9
4	Daltoniaceae	3	8
5	Fissidentaceae	1	6
6	Leucobryaceae	1	5
7	Pylaisiadelphaceae	4	5
8	Hypnaceae	1	4
9	Spiridentaceae	2	4
10	Thuidiaceae	2	4
11	Dicranaceae	2	3
12	Polytrichaceae	1	3
13	Meteoriaceae	3	3
14	Orthotrichaceae	1	2
15	Ptychomniaceae	1	2
16	Racopilaceae	1	2
17	Hypopterygiaceae	2	2
18	Pterobryaceae	2	2
19	Brachytheciaceae	1	1
20	Callicostaceae	1	1
21	Calomniaceae	1	1
22	Diphysciaceae	1	1
23	Myuriaceae	1	1
Total		49	89

Broth. This species has been reported in Sabah, Sarawak and Kalimantan (Akiyama & van Zanten, 1999; van Zanten, 2006; GBIF, 2025). With this addition, the CRP now has four Bornean endemic species (Suleiman *et al.*, 2017a), adding value to this park.

Several of the species collected in the study area are rarely reported in Sabah or Borneo. Examples are *Claopodium prionophyllum* (Müll. Hal.) Broth., *Distichophyllum jungermannioides* (Müll. Hal.) Bosch & Sande Lac., *D. osterwaldii* M. Fleisch., *Ectropothecium penzigianum* var. *rigens* M. Fleisch., *Macromitrium blumei* var. *zollingeri* (Mitt. ex Bosch & Sande Lac.) S.L. Guo, B.C. Tan & Virtanen, and *Neolindbergia cladonioides* H. Akiyama. Some of these species could be widely distributed in Borneo but overlooked because of

their small size or misidentified because of the lack of revised keys of certain genera in the Malesian region, such as *Distichophyllum* and *Ectropothecium*.

CONCLUSION

This study expands the known species richness of mosses in the Crocker Range Park, adding new records of 11 species for the park. The presence of rare and endemic species further emphasises the park's importance as a hotspot for bryophyte diversity. Future exploration of other remote areas within the park may yield further discoveries, underscoring the need for continued research and protection of the area.

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REFERENCES

- AKIYAMA, H., KOPONEN, T. & NORRIS, D. H. 1991. Bryophyte flora of the Huon Peninsula, Papua New Guinea. XLV. *Neolindbergia* (Pterodontaceae, Musci). *Acta Botanica Fennica* 143: 77–89.
- AKIYAMA, H. 1992. Additional notes on the genus *Neolindbergia* (Pterobryaceae). *Acta Phytotaxonomica et Geobotanica* 43(2): 120.
- AKIYAMA, H. 2010. Taxonomic revision of the genus *Trismegistia* (Pylaisiadelphaceae, Musci). *Humans and Nature* 21: 1–77.
- AKIYAMA, H. & VAN ZANTEN, B. O. 1999. *Racopilum niutensis*, a new species from Kalimantan Barat (Indonesian Borneo) and notes on Bornean species of the Racopilaceae (Bryopsida). *Bryobrothera* 5: 17–21.
- BROTHERUS, V. F. 1908. *Sematophyllaceae*. In: ENGLER, A. & PRANTL, K. (Eds.). *Die natürlichen Pflanzenfamilien*, 1st ed. Vol. 1(3): 701–1246. Leipzig.
- DAMANHURI, A. & MOHAMED, H. 1986. Two new species of *Distichophyllum* from Malaya. *Journal of Bryology* 14(2): 327–331.
- DIXON, H. N. 1935. A contribution to the moss flora of Borneo. *Journal of the Linnean Society, Botany* 50: 57–143.
- DOZY, F. & MOLKENBOER, J. H. (continued by VAN DEN BOSCH, R. B. & VAN DER SANDE LACOSTE, C. M.). 1855. *Bryologia Javanica seu descriptio Muscorum Frondosorum Archipelagici indici*. 2 Vols. Leiden.
- EDDY, A. 1988. *A Handbook of Malesian Mosses: Sphagnaceae to Dicranaceae*. Volume 1. Natural History Museum Publications, London.
- EDDY, A. 1990. *A Handbook of Malesian Mosses: Leucobryaceae to Buxbaumiaceae*. Volume 2. Natural History Museum Publications, London.
- EDDY, A. 1996. *A Handbook of Malesian Mosses: Splachnobryaceae Leptostomaceae*. Volume 3. Natural History Museum Publications, London.
- ELLIS, L. T., ASTHANA, A. K., SRIVASTAVA, P., OMAR, I., RAWAT, K. K., SAHU, V., CANO, M. J., COSTA, D. P., DIAS, E. M., DIAS, DOS SANTOS N., SILVA, J. B., FEDOSOV, V. E., KOZHIN, M. N., IGNATOVA, E. A., GERMANO, S. R., GOLOVINA, E. O., GREMMEN, N. J. M., ION, R., ȘTEFĂNUȚ, S., VON KONRAT, M., JIMENEZ, M. S., SUÁREZ, G. M., KIEBACHER, T., LÉBOUVIER, M., LONG, D. G., MAITY, D., OCHYRA, R., PARNIKOZA, I., PLÁŠEK, V., FIALOVÁ, L., SKOUPÁ, Z., POPONESSI, S., ALEFFI, M., SABOVLJEVIĆ, M. S., SABOVLJEVIĆ, A. D., SAHA, P., AZIZ, M. N., SAWICKI, J., SULEIMAN, M., SUN, B.-Y., VÁNA, J., WÓJCIK, T., YOON, Y.-J., ŻARNOWIEC, J. & LARRAIN, J. 2016a. New national and regional bryophytes records, 46. *Journal of Bryology* 38(1): 47–63.
- ELLIS, L. T., AGCAGIL, E., KIRMACI, M., ALEFFI, M., BAKALIN, V. A., BEDNAREK-OCHYRA, H., CYKOWSKA-MARZENCKA, B., STRYJAK-BOGACKA, M., BOJACA, G. F. P., FANTACELLE, L. B., ARAÚJO, C. A. T., MACIEL-SILVA, A.S., BRUNO SILVA, J., CALLEJA, J. A., CANO, M. J., CASTILLO DIAZ, J., GABRIEL, R., DIAS DOS SANTOS, N., ENROTH, J., ERZBERGER, P., GARILLETI, R., HÁJEK, M., HEDENÄS, L., HERAS, P., INFANTE, M., KIEBACHER, T., KOCZUR, A., KRAWCZYK, R., KUČERA, J., LÉBOUVIER, M., LÜTH, M., MAZIMPAKA, V., VIGALONDO, B., LARA, F., NAGY, J., NÉMETH, C., KOVÁCS, A., NOBIS, M., WĘGRZYN, M., WIETRZYK, P., NORHAZRINA, N., VANDERPOORTEN, A., NOWAK, A., GIGANTE, D., VENANZONI, R., PLÁŠEK, V., RANGEL, G. S., SCHÄFER-VERWIMP, A., SÉRGIO, C., CLARO, D., GARCIA, C. A., SHIRZADIAN, S., AKHOONDI, D. S., STEBEL, A., SULEIMAN, M., YONG, K.-T., VIRCHENKO, V. M., VONČINA, G., YOON, Y.-J., CHOI, H.-G. & KIM, J. H. 2016b. New national and regional bryophytes records, 49. *Journal of Bryology* 38 (4): 327–347.
- GBIF. 2025. GBIF Home Page. <https://www.gbif.org>. (Accessed 26 March 2025).
- GLIME, J. M. 2017. *Bryophyte Ecology. Volume 1: Physiological Ecology*. Ebook sponsored by Michigan Technological University and the International Association of Bryologists. <https://digitalcommons.mtu.edu/bryophyte-ecology>. (Accessed 4 October 2024).
- HE, S. (Ed.). 2005. *Moss Flora of China (English Version). Vol. 8. Sematophyllaceae–Polytrichaceae*. Science Press (Beijing), China & Missouri Botanical Garden Press (St. Louis), U.S.A.
- HO, B.-C., TAN, B. C. & ANDO, H. 2010. Notes on *Distichophyllum* (Daltoniaceae, Bryophyta) from Malesia, with special reference to Borneo and Java. *Journal of Bryology* 32(4): 279–286.
- LUBOS, L. C. 2007. New records of Philippine mosses from Mindanao Island. *Liceo Journal of Higher Education Research* 5(1): 1–8.
- MENZEL, M. 1992. The bryophytes of Sabah (North Borneo) with special reference to the

- BRYOTROP transect of Mount Kinabalu. XVII. Meteoriaceae (Leucodontales, Bryopsida). *Willdenowia* 22: 171–196.
- MOHAMED, H. & ROBINSON, H. E. 1991. A taxonomic revision of the moss families Hookeriaceae and Hypopterygiaceae in Malaya. *Smithsonian Contributions to Botany* 80: 1–44.
- NOGUCHI, A. 1976. A taxonomic revision of the family Meteoriaceae of Asia. *Journal of the Hattori Botanical Laboratory* 41: 231–357.
- NOGUCHI, A. & IWATSUKI, Z. 1972. Mosses of North Borneo I. *Journal of the Hattori Botanical Laboratory* 36: 455–486.
- TAN, B. C. & IWATSUKI, Z. 1989. The bryophytes of Sabah (North Borneo) with special reference to the BRYOTROP transect of Mount Kinabalu. VII. Fissidentaceae (Bryopsida). *Willdenowia* 18: 591–602.
- SHEVOCK, J. R. & YORONG, A. P. 2018. New additions to the moss flora of Mindanao Island, Republic of the Philippines. *Philippine Journal of Systematic Biology* 12(1): 67–72.
- SULEIMAN, M. & AKIYAMA, H. 2004. A preliminary checklist of the mosses of Crocker Range Park. In: MARYATI, M., ZULHAZMAN, H., TACHI, T. & NAIS, J. (Eds.). *Crocker Range Scientific Expedition 2002*. Universiti Malaysia Sabah, Kota Kinabalu. Pp. 1–15.
- SULEIMAN, M., AKIYAMA, H. & TAN, B. C. 2006. A revised catalogue of mosses reported from Borneo. *Journal of the Hattori Botanical Laboratory* 99: 107–183.
- SULEIMAN, M. & JOTAN, P. 2015. Diversity of epiphytic mosses along an altitudinal gradient at Minduk Sirung Trail in Crocker Range Park, Sabah, Malaysia. *Sepilok Bulletin* 21 & 22: 49–57.
- SULEIMAN, M., MASUNDANG, D. P. & AKIYAMA, H. 2017a. The mosses of Crocker Range Park, Malaysian Borneo. *PhytoKeys* 88: 71–107.
- SULEIMAN, M., MASUNDANG, D. P. & AKIYAMA, A. 2017b. *Thamnobryum negrosense* (E.B.Bartram) Z.Iwats. & B.C.Tan (Neckeraaceae, Musci), a new record for Borneo. *Bryological Research* 11(8): 229–231.
- SULEIMAN, M., ANDI, A. M. A. M., RIMI, R. & ANWAR, I. 2024a. Mosses of Marai Parai trail, Mount Kinabalu. *Sabah Parks Nature Journal* 13: 109–125.
- SULEIMAN M., RAJIAN N. J. & ANDI M. A. M. 2024b. A checklist of mosses from former Mamut Copper Mine, Sabah, Malaysia. In: BAVOH, E. M., TAN, B. L. H., JUSTINE, V. T., ADAM, M. M., NOORANNEZZA, J., RIMI, R., SOFIANA, W. & MARTIN, A. (Eds.). *Prosiding Seminar Saintifik Mamut 2023*. Lembaga Taman-Taman Sabah: 74–91. (In Malaysian).
- SUZUKI, T. & IWATSUKI, Z. 1999. *Fissidens guangdongensis* Z. Iwats. & Z.-H. Li newly found in Japan. *Bryological Research* 7: 261–263.
- TOUW, A. 2001. A taxonomic revision of the Thuidiaceae (Musci) of Tropical Asia, the Western Pacific, and Hawaii. *Journal of Hattori Botanical Laboratory* 91: 1–136.
- VAN ZANTEN, B. O. 2006. A synoptic review of the Racopilaceae (Bryophyta, Musci). 1. Asian, Pacific and Australasian species of the genus *Racopilum*. *Journal of the Hattori Botanical Laboratory* 100: 527–552.
- VANDERPOORTEN, A. & GOFFINET, B. 2009. *Introduction to Bryophytes*. Cambridge University Press, Cambridge.
- WFO. 2025. World Flora Online. <http://www.worldfloraonline.org>. (Accessed 26 March 2025).

APPENDIX

Preliminary checklist of mosses from Mantailang, Crocker Range Park.

The families, genera, and species of mosses were arranged alphabetically. Species reported for the first time for Crocker Range Park is marked with “*” and “+” for species endemic to Borneo. MS – Monica Suleiman; IA – Irmah Anwar.

BRACHYTHECIACEAE

***Claopodium prionophyllum* (Müll. Hal.) Broth.**

On rock, partially shaded, 500 m asl, *MS & IA 6566*.

CALLICOSTACEAE

***Callicostella papillata* (Mont.) Mitt.**

On rock, by stream, partially shaded, 500 m asl, *MS & IA 6577, 6578b*.

CALOMNIACEAE

***Pyrrhobryum spiniforme* (Hedw.) Mitt.**

On rotten log, partially shaded, 850 m asl, *MS & IA 6594*.

CALYMPERACEAE

***Arthrocormus schimperi* (Dozy & Molk.) Dozy & Molk.**

On tree trunk, partially shaded, 600 m asl, *MS & IA 6582*.

***Calymperes afzelii* Sw.**

On tree trunk, by stream, partially shaded, 500 m asl, *MS & IA 6573*.

***Calymperes lonchophyllum* Schwägr.**

On tree trunk, partially shaded, 600 m asl, *MS & IA 6585*.

***Leucophanes octoblepharioides* Brid.**

On tree and shrub trunks, open and partially shaded areas, 600–1,100 m asl, *MS & IA 6579, 6634*.

***Exostratum blumei* (Nees ex Hampe) L.T. Ellis**

On tree trunk, by stream, partially shaded area, 500 m asl, *MS & IA 6570*.

****Mitthyridium jungquianum* (Mitt. ex Dozy & Molk.) H. Rob.**

On treelet trunk, partially shaded, 1,000 m asl, *MS & IA 6622*.

Note: Leaves $2.2\text{--}2.7 \times 0.5\text{--}0.6$ mm with dentate margin. This species can be distinguished from the more common *Mitthyridium undulatum* (Dozy & Molk.) H. Rob. from its much shorter cancellinae which is only $1/4\text{--}1/6$ of leaf length, and the leaf is linear-lanceolate with less undulate margins.

Illustrations: Eddy, 1990: 137, Fig. 253.

***Mitthyridium undulatum* (Dozy & Molk.) H. Rob.**

On tree trunk, partially shaded, 600 m asl, *MS & IA 6580*.

***Syrrhopodon albovaginatus* Schwägr.**

On tree stump and rotten log, partially shaded, 600–700 m asl, *MS & IA 6583, 6587*.

***Syrrhopodon confertus* Sande Lac.**

On climber, partially shaded, 1,100 m asl, *MS & IA 6631*.

***Syrrhopodon muelleri* (Dozy & Molk.) Sande Lac.**

On tree trunk, by stream, partially shaded, 500 m asl, *MS & IA 6569*.

***Syrrhopodon tristichus* Nees ex Schwägr.**

On climber, partially shaded, 1,100 m asl, *MS & IA 6629*.

DALTONIACEAE

***Calypstrochaeta remotifolia* (Müll. Hal.) Z. Iwats., B.C. Tan & Touw**

On leaf and shrub branch, partially shaded, 1,200 m asl, *MS & IA 6654, 6651*.

***Distichophyllum cuspidatum* (Dozy & Molk.) Dozy & Molk.**

On treelet trunk, partially shaded, 1,200 m asl, *MS & IA 6649*.

****Distichophyllum jungermannioides* (Müll. Hal.) Bosch & Sande Lac.**

On tree trunk, partially shaded, 1,200 m asl, *MS & IA 6653*.

Note: Leaves 1.24–1.49 mm × 0.77–0.85 mm, obovate with narrowed base, apex obtuse and cuspidate with short apiculus of *ca.* 80 µm. The easily detached leaves of this species aids in its identification. This is the second record for Sabah and the third for Borneo (Noguchi & Iwatsuki, 1972; GBIF, 2025).

Illustrations: Mohamed & Robinson, 1991: 23, Fig. 58-64.

***Distichophyllum cf. angustifolium* Dixon** (Fig. 2)

On rotten log, partially shaded, 800 m asl, *MS & IA 6593*.

Note: Leaves up to 2.73 × 0.69 mm, oblanceolate to lingulate-spathulate from long and narrowed base. The leaf cells are large, lax, thin-walled, and more or less uniform in size above, 39–53 µm × 29–39 µm, but much larger below, reaching to 110 × 25 µm. This taxon has all the species characters except for the longer leaf subula (98–147 µm). It also resembles *D. malayense* Damanhuri & Mohamed but the latter has weak costa which is only up to 0.4 of the leaf length and leaf apices are more obtuse with longer subula, reaching 450 µm (Damanhuri & Mohamed, 1986; Ho *et al.*, 2010).

***Distichophyllum spathulatum* (Dozy & Molk.) Dozy & Molk.**

On rotten log, partially shaded, 1,200 m asl, *MS & IA 6655*.

***Distichophyllum cf. undulatum* Dozy & Molk. ex Bosch & Sande Lac.** (Fig. 3)

On shrub branch, partially shaded, 1,200 m asl, *MS & IA 6647*.

Note: Leaves obovate to spatulate, up to 2.5 × 1.1 mm, recurved below, slightly rugose above, and margin bordered by elongated cells from the base (1–2 cell rows) to the apices (single cell row). The leaf apices are broadly obtuse with minute apiculus, at most 12 µm tall, and the margin is weak and irregularly denticulate. Leaf cells are more or less homogenous 1/3 above, 12–22 (–26) µm in diameter, becoming gradually bigger below, paracostal cells are 22–41 µm in mid-lamina, and up to 98 × 27 µm at the base. Its costa is strong, reaching 3/4 to 4/5 of the leaf length. Calyptra fringed at base with long hairs and the surface scabrous with some short hairs, 12–24 µm long. Perichaetial leaves small, oblong-ovate, apex of the inner ones is short acuminate but outer one are short acute to obtuse. Seta is about 5 mm long and spinose to the base.

This taxon has all the characteristics of the species except for the apex of the outer perichaetial leaves that are not acuminate as illustrated by Dozy & Molkenboer (1855–1870). It can be confused with *Distichophyllum mittenii* Bosch & Sande Lac. but its denticulate margin will separate it from the latter species. *Distichophyllum undulatum* has been reported in Borneo (Dixon, 1935), the Philippines (Shevock & Yorong, 2018), Java, Micronesia, Papua New Guinea, Sumatra and Vietnam (GBIF, 2025).

***Distichophyllum osterwaldii* M. Fleisch.**

On boulder, by stream, partially shaded, 900 m asl, *MS & IA 6598*.

***Ephemeropsis tjibodensis* K.I. Goebel**

On tree trunk, partially shaded, 1,200 m asl, *MS & IA 6650*.

DICRANACEAE

***Dicranoloma assimile* (Hampe) Broth. ex Renaud**

On tree trunk, partially shaded, 1,200 m asl, *MS & IA 6646*.

***Dicranoloma brevisetum* (Dozy & Molk.) Paris**

On rotten log and shrub trunk, partially shaded, 1,105–1,100 m asl, *MS & IA 6633, 6639*.

***Leucoloma molle* (Müll. Hal.) Mitt.**

On rotten log, partially shaded, 1,000 m asl, *MS & IA 6618*.

DIPHYSCIACEAE***Diphyscium mucronifolium* Mitt. ex Dozy & Molk.**

On rock, partially shaded, 800 m asl, *MS & IA 6592*.

FISSIDENTACEAE***Fissidens crassinervis* Sande Lac.**

On soil, partially shaded, 1,000 m asl, *MS & IA 6617*.

Fissidens crispulus* Brid. var. *crispulus

On rock and soil, by stream, partially shaded, 500–850 m asl, *MS & IA 6578a, 6599*.

***Fissidens hollianus* Dozy & Molk.**

On tree root, partially shaded, 850 m asl, *MS & IA 6595*.

***Fissidens javanicus* Dozy & Molk.**

On rock, partially shaded, 800 m asl, *MS & IA 6591*.

***Fissidens pallidus* Hook. f. & Wilson**

On rock, partially shaded, 1,100 m asl, *MS & IA 6625*.

****Fissidens guangdongensis* Z. Iwats. & Z.-H. Li**

On termite mount, partially shaded, 1,100 m asl, *MS & IA 6637*.

Note: Leaves up to 1.49×0.45 mm, ovate-lanceolate and apices broadly acute to apiculate. The costa which is ceasing 7–8 cells below apex can separate it from *F. pellucidus* Hornsch. which has percurrent apex.

Illustrations: Suzuki, T. & Iwatsuki, Z., 1999: 261, Fig. 1.

HYPNACEAE****Ectropothecium penzigianum* var. *rigens* M. Fleisch.**

On treelet branch, partially shaded, 1200 m asl, *MS & IA 6660*.

Note: Large plants with stems to 15 cm long and regularly but remotely branched. Stem leaves triangular-lanceolate, slightly cordate and widest at insertion, *ca.* 1.4×0.6 mm, and apex falcate and gradually acuminate. Branch leaves are smaller and different in outline, about *ca.* 1.1×0.4 mm ovate below and apex more strongly falcate. This is the second record of the species for Borneo (Suleiman *et al.*, 2006).

Illustrations: He, S., 2005; 113, Fig. 640.

***Ectropothecium striatulum* Dixon**

On shrub branch, partially shaded, 1,100 m asl, *MS & IA 6640*.

****Ectropothecium zollingeri* (Müll. Hal.) A. Jaeger**

On rock, by stream, partially shaded, 500 m asl, *MS & IA 6575*.

Note: Plant irregularly pinnate and complanate. Leaves slightly falcate, margin sharply serrulate above and cells are clearly prolulose throughout the leaf.

Illustrations: He, S., 2005; 116, Fig. 642.

***Ectropothecium* sp. (Fig. 4)**

On tree trunk, partially shaded, 1,200 m asl, *MS & IA 6644*.

Note: The plant habit of this soft-textured moss is similar to the genus *Floribundaria*, which is laxly branched and forming elongated fronds. The stem leaves are very lax, ovate-lanceolate, 0.99×0.3 mm, asymmetrical, falcate above with finely acuminate apices and the margin is serrate half above. The branch leaves are *ca.* 0.77×0.3 mm, not falcate, very variable in shape, from ovate-lanceolate to narrowly lanceolate, finely acuminate and more sharply serrate.

HYOPTERYGIACEAE

***Hypopterygium vriesei* Bosch & Sande Lac.**

On rock, by stream, partially shaded, 500–900 m asl, *MS & IA* 6576, 6604.

***Lopidium struthiopteris* (Brid.) M. Fleisch.**

On tree trunk, by stream, open area, 900 m asl, *MS & IA* 6607.

LEUCOBRYACEAE

Leucobryum aduncum* Dozy & Molk. var. *aduncum

On rotten tree, partially shaded, 700 m asl, *MS & IA* 6586.

***Leucobryum arfakianum* Müll. Hal. ex Geh.**

On treelet trunk, partially shaded, 1,100 m asl, *MS & IA* 6643.

***Leucobryum chlorophyllosum* Müll. Hal.**

On rotten log, partially shaded, 1,100 m asl, *MS & IA* 6627.

Leucobryum javense* (Brid.) Mitt. var. *javense

On tree trunk, partially shaded, 1,100 m asl, *MS & IA* 6662.

***Leucobryum sanctum* (Nees ex Schwägr.) Hampe**

On rotten log, partially shaded, 900 m asl, *MS & IA* 6616.

METEORACEAE

***Cryptopapillaria fuscescens* (Hook.) M. Menzel**

On treelet branch, partially shaded, 1,200 m asl, *MS & IA* 6658.

***Floribundaria intermedia* Thér.**

On rock, partially shaded, 500 m asl, *MS & IA* 6574.

****Pseudotrachypus wallichii* (Brid.) W.R. Buck.**

On treelet trunk, by stream, partially shaded, 900 m asl, *MS & IA* 6609.

Note: This species is very variable in terms of habit, size and colouration. In general, this species has complanate and widely spreading leaves with strongly undulate margins. The stem leaves are *ca.* 1.98×0.67 mm while branch leaves are slightly bigger, *ca.* 2.9×0.62 mm. The seta is 18 mm long, scabrous almost to the base.

Illustrations: Noguchi, 1976: 297–298, Fig. 26–27.

MYURACEAE

***Oedycladium rufescens* (Reinw. & Hornsch.) Mitt.**

On tree trunk, partially shaded, 1,100 m asl, *MS & IA* 6628.

NECKERACEAE

***Circulifolium exiguum* (Bosch & Sande Lac.) S. Olsson, Enroth & D. Quandt**

On liana, partially shade, 500 m asl, *MS & IA* 6572.

***Circulifolium microdendron* (Mont.) S. Olsson, Enroth & D. Quandt**

On tree root, partially shaded, 500 m asl, *MS & IA* 6562.

***Himantocladium plumula* (Nees) M. Fleisch.**

On tree trunk, open area, by stream, 900 m asl, *MS & IA* 6605.

***Neckeromnion gracilentum* (Bosch & Sande Lac.) S. Olsson, Enroth, Huttunen & D. Quandt**
On treelet trunk, partially shaded, at ridge, 600 m asl, *MS & IA 6584*.

***Neckeromnion lepineanum* (Mont.) S. Olsson, Enroth, Huttunen & D. Quandt**
On liana, partially shaded, 900 m asl, *MS & IA 6613*.

***Neckeropsis cyclophylla* (Müll. Hal.) S. Olsson, Enroth & D. Quandt.**
On tree root, partially shaded, 500 m asl, *MS & IA 6563*.

***Pinnatella kuehliana* (Bosch & Sande Lac.) M. Fleisch.**
On tree root, partially shaded, by stream, 900 m asl, *MS & IA 6610*.

***Taiwanobryum mucronatum* (Bosch & Sande Lac.) S. Olsson, Enroth & D. Quandt**
On rock, by stream, partially shaded, 500 m asl, *MS & IA 6568*.

***Touwia elliptica* (Bosch & Sande Lac.) S. Olsson, Enroth & D. Quandt**
On rock, by stream, partially shaded, 900 m asl, *MS & IA 6603*.

ORTHOTRICHACEAE

****Macromitrium blumei* var. *zollingeri* (Mitt. ex Bosch & Sande Lac.) S.L. Guo, B.C. Tan & Virtanen**
Canopy epiphyte, partially shaded, 800 m asl, *MS & IA 6590*.

Note: Leaves *ca.* 1.4 × 0.3 mm, lingulate, apex broadly obtuse with a short excurrent costa, awn *ca.* 150 µm. Seta is very short, only *ca.* 7 mm long and smooth. This variety is rarely collected in Borneo and thus far only found on Crocker Range (Suleiman *et al.*, 2024a, b).

Illustrations: Eddy, 1996: 77, Fig. 384. (as *Macromitrium zollingeri* Mitt. ex Bosch & Sande Lac.)

***Macromitrium orthostichum* Nees ex Schwägr.**
On fallen branch, partially shaded, 600 m asl, *MS & IA 6581*.

POLYTRICHACEAE

***Pogonatum cirratum* subsp. *fuscatum* (Mitt.) Hyvönen**
On soil, partially shaded, 1,100 m asl, *MS & IA 6624*.

***Pogonatum iwatsukii* Touw**
On soil, open area, by stream, 900 m asl, *MS & IA 6608*.

***Pogonatum piliferum* (Dozy & Molk.) Touw**
On rock, partially shaded, 700 m asl, *MS & IA 6588*.

PTEROBRYACEAE

****Neolindbergia cladomnioides* H. Akiyama**
On tree trunk, by stream, partially shaded, 900 m asl, *MS & IA 6606*.

Note: Secondary stems erect, up to 4 cm tall, terete and not branched. Leaves *ca.* 3.0 × 1.2 mm, strongly plicate, and apex acute and widely recurved on one side. Leaf margins coarsely serrate, costa not reaching the apex and keeled 1/3 below the apex. The type specimen of this species was collected from Mount Kinabalu in 1961 (Suleiman *et al.*, 2006). This species is also recorded in East Kalimantan (Akiyama, 1992) and the Mindanao Island of the Philippines (Lubos, 2007). This is the third record of this species for Borneo.

Illustrations: Akiyama *et al.* 1991: 83, Fig. 4a–e.

Symphysodon neckeroides* Dozy & Molk. var. *neckeroides
On fallen branch, partially shaded, 1,000 m asl, *MS & IA 6619*.

PTYCHOMNIACEAE

***Garovaglia elegans* (Dozy & Molk.) Hampe ex Bosch & Sande Lac.**

On climber, partially shaded, 900–1,100 m asl, *MS & IA 6614, 6632*.

***Garovaglia angustifolia* Mitt.**

On treelet trunk, partially shaded, 1,000 m asl, *MS & IA 6623*.

PYLAISIADELPHACEAE

***Isocradiella surcularis* (Dixon) B.C. Tan & Mohamed**

On treelet trunk, partially shaded, 850 m asl, *MS & IA 6596*.

Mastopoma armitii* (Broth. & Geh.) Broth. var. *armitii

On shrub branch and treelet trunk, partially shaded, 1,200 m asl, *MS & IA 6645, 6652*.

***Taxithelium lindbergii* (A. Jaeger) Renaud & Cardot**

On shrub branch, partially shaded, 1,100 m asl, *MS & IA 6636*.

****Trismegistia calderensis* var. *convoluta* K.T. Yong, B.C. Tan & B.C. Ho**

On rock and rotten log, by stream, partially shaded, 900 m asl, *MS & IA 6597, 6615*.

Note: This variety is rigid in habit with well-developed stipes, *ca.* 1.5 cm tall. The stipe and stem leaves are 1.7–2.4 × 0.8–0.9 mm, and apex abruptly long acuminate and twisted. Seta 5 cm and smooth.

Illustrations: Akiyama, 2010: 47–50, Pl. 6–7 (as *T. calderensis* var. *rigida* (Reinw. & Hornsch.) H. Akiyama).

Trismegistia lancifolia* (Harv.) Broth. var. *lancifolia

On treelet trunk, partially shaded, 1,105 m asl, *MS & IA 6641*.

RACOPILACEAE

+*Racopilum laxirete* Broth.

On boulder, by stream, partially shaded, 500 m asl, *MS & IA 6567*.

Racopilum spectabile* Reinw. & Hornsch. var. *spectabile

On tree trunk, partially shaded, 900 m asl, *MS & IA 6612*.

SEMATOPHYLLACEAE

***Acanthorrhynchium papillatum* (Harv.) M. Fleisch.**

On tree trunk, partially shaded, 900 m asl, *MS & IA 6611*.

Acroporium convolutum* (Sande Lac.) M. Fleisch var. *convolutum

On tree trunk, partially shaded, 1,100 m asl, *MS & IA 6630*.

***Acroporium diminutum* (Brid.) M. Fleisch.**

On treelet branch and liana, partially shaded, 1,200 m asl, *MS & IA 6648, 6657*.

Acroporium hyalinum* (Reinw. ex Schwägr.) Mitt. var. *hyalinum

On fallen branch, partially shaded, 1,200 m asl, *MS & IA 6626*.

Acroporium lamprophyllum* Mitt. var. *lamprophyllum

On fallen branch, partially shaded, 1,000 m asl, *MS & IA 6620*.

***Acroporium rigens* (Broth. ex Dixon) Dixon**

On rotten log, partially shaded, 1,150–1,200 m asl, *MS & IA 6638, 6656*.

****Rhaphidostichum bunodicarpum* (Müll. Hal.) M. Fleisch.**

On rock, by stream, partially shaded, 900 m asl, *MS & IA 6600*.

Note: Plants smaller than *Rhaphidostichum piliferum* (Broth.) Broth., leaves 2.9 × 0.9 mm and arista *ca.* 0.9 mm long. Seta 2 cm long, smooth but rough at extreme tip. Capsule 1.5 mm long and mamillate.

Illustration: Brotherus, 1908: 1123, Fig. 785 (as *Sematophyllum bunodicarpum* (Müll.Hal.) Broth.)

***Rhaphidostichum piliferum* (Broth.) Broth.**

On treelet branch, partially shaded, 1,200 m asl, *MS & IA 6659*.

***Trichosteleum mammosum* (Müll.Hal.) A. Jaeger**

On rock, partially shaded, 700 m asl, *MS & IA 6589*.

SPIRIDENTACEAE

***Dendro-hypnum beccarii* Hampe**

On treelet trunk, partially shaded, 1,100 m asl, *MS & IA 6635*.

***Dendro-hypnum milnei* subsp. *korthalsii* (Bosch & Sande Lac. ex Paris) N.E. Bell, A.E. Newton & D. Quandt**

On rock, by stream, partially shaded, 900 m asl, *MS & IA 6602*.

***Dendro-hypnum subspininervium* subsp. *arborescens* (Mitt.) N.E. Bell, A.E. Newton & D. Quandt**

On climber and treelet trunk, partially shaded, 1,000–1,200 m asl, *MS & IA 6621, 6661*.

***Mniodendron dendroides* (Brid.) Wijk & Margad.**

On tree trunk, partially shaded, 1,200 m asl, *MS & IA 6642*.

THUIDIACEAE

***Thuidium cymbifolium* (Dozy & Molke.) Dozy & Molk.**

On tree trunk and boulder, partially shaded, 500–900 m asl, *MS & IA 6564, 6601*.

Thuidium pristocalyx* (Müll.Hal.) A. Jaeger var. *pristocalyx

On rotten log, partially shaded, 1,200 m asl, *MS & IA 6663*.

***Pelekium velatum* Mitt.**

On liana, partially shaded, 500 m asl, *MS & IA 6565*.

****Pelekium bonianum* (Besch.) Touw**

On tree trunk, partially shaded, 500 m asl, *MS & IA 6571*.

Note: This species can be identified from its low mammillose seta, and the branch leaves are distant and incurved when dry and median leaf cells are clearly with 1–3 papillae. *Pelekium velatum* on the other hand has spinose calyptra and hispid-papillose seta (Touw, 2001). This is the third record of this species for Borneo (Suleiman *et al.*, 2006).

Illustration: Touw, 2001: 111, Fig. 35.

THE REVISION OF THE GENUS *PTERISANTHES* (VITACEAE) IN SUMATRA

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ABSTRACT

TRIAS-BLASI, A., DAMIT, A., WAMBRAUW, H. L., AHMAD, R. P. P., WARSENO, T. & HUSSIN, Z. 2025. Revision of the genus *Pterisanthes* (Vitaceae) in Sumatra. *Reinwardtia* 24(2): 161–184. — The genus *Pterisanthes* consists of 16 accepted species, with nine species being native to Sumatra, two of which are endemic to the island. Here we provide synonymy, typifications, an identification key, descriptions, distribution maps, type images, and conservation assessments.

Key words: *Pterisanthes*, Sumatra, taxonomy, Vitaceae.

ABSTRAK

TRIAS-BLASI, A., DAMIT, A., WAMBRAUW, H. L., AHMAD, R. P. P., WARSENO, T. & HUSSIN, Z. 2025. Revisi marga *Pterisanthes* (Vitaceae) di Sumatra. *Reinwardtia* 24(2): 161–184. — Marga *Pterisanthes* terdiri dari 16 jenis, dengan sembilan jenis asli Sumatra, dua endemik. Sinonim, tipifikasi, kunci identifikasi, deskripsi, peta distribusi, foto tipe, dan penilaian konservasi disajikan pada naskah ini.

Kata kunci: *Pterisanthes*, Sumatra, taksonomi, Vitaceae.

INTRODUCTION

The family Vitaceae has 20 genera and *ca.* 1,000 species with a pantropical and (warm) temperate distribution (POWO, 2024). APG III recognizes two subfamilies in Vitaceae: Vitoideae and Leeioideae (Old World only) (Stevens, 2001 onwards). The Leeioideae are herbs, shrubs or trees with no tendrils, while the Vitoideae are generally lianas climbing by leaf-opposed tendrils (Stevens, 2001 onwards). However, some experts prefer to recognise two separate families, Vitaceae and Leeaceae (Trias-Blasi *et al.*, 2012; Wen *et al.*, 2018; Ma *et al.*, 2021). Vitaceae are commonly characterized

by having these morphological characters: stipule at petiole base, leaves alternate, flowers actinomorphic, ovary superior, leaf-opposed tendrils and inflorescences, intrastaminal disk, fruit a berry and seed with an endosperm.

Pterisanthes is one of the genera of the Vitaceae family, which has more than 16 species (POWO, 2024) with a distribution in Borneo, Java, Malay Peninsula, Sulawesi, Sumatra, the Thai Peninsula, Myanmar, and possibly the Philippines although the latter has not been confirmed (Latiff, 1982, 2001; Latiff, 1987; Wen 2007). *Pterisanthes* was first described by Blume in 1825 from a collection of samples originating from Java with the type spe-

Identification Key of *Pterisanthes* in Sumatra

- 1a. Inflorescence without pedicellate flowers on the margin of the lamellae 2
- 1b. Inflorescence with pedicellate flowers on the margin of the lamellae 5
- 2a. Tail-like structure at the apex of the inflorescence present 2. *P. caudigera*
- 2b. Tail-like structure at the apex of the inflorescence absent 3
- 3a. Leaves simple, central leaflet base cordate 4. *P. eriopoda*
- 3b. Leaves compound, central leaflet base obtuse to cuneate 4
- 4a. Lateral leaflet blade shape elliptic to oblanceolate; lamellae oblong 7. *P. rufula*
- 4b. Lateral leaflet blade shape lanceolate; lamellae rectangular 9. *P. sumatrana*
- 5a. Leaves simple 6
- 5b. Leaves compound 7
- 6a. Primary branch inflorescence not more than 10 cm; pedicels 1–2 mm 1. *P. brevipedicellata*
- 6b. Primary branch inflorescence frequently more than 10 cm; pedicels 12–25 mm 6. *P. polita*
- 7a. Number of pairs of secondary veins on leaf 8–9; indumentum of upper leaf surface rough ... 8. *P. stonei*
- 7b. Number of pairs of secondary veins on leaf 4–7; indumentum of upper leaf surface smooth 8
- 8a. Stem indumentum glabrous to sparsely arachnoid, without rust to red coloured hairs, indumentum of lower surface of leaf sparsely tomentose 3. *P. cissioides*
- 8b. Stem indumentum pilose and arachnoid, with rust to red coloured hairs; indumentum of lower surface of leaf with arachnoid hairs concentrating homogeneously in various parts of the lamina forming loose “spots”, lateral leaflet blade shape asymmetrical base subcordate 5. *P. heterantha*

cies being *Pterisanthes cissioides* Blume. These samples had a very distinctive inflorescence in the form of a leaf-opposed, somewhat fleshy, leaf-like, flat lamellate panicle, where often the lamellate flowers are partially immersed in the lamina, and with a tendril at the base of the peduncle (Trias-Blasi *et al.*, 2014). Van Steenis & Bakhuizen van den Brink (1967) suggested that *Pterisanthes* has close morphological characteristics in seed morphology, petiole anatomy, indumentum types, and association of the tendril in the inflorescence, with *Ampelocissus* (Latiff, 1982). Molecular studies (Wen *et al.*, 2007; Liu *et al.*, 2015; Wen *et al.*, 2018) show that *Pterisanthes* is close to *Ampelocissus*, *Nothocissus*, and *Vitis*, and is nested within the former. Thus, it is possible that *Pterisanthes* will be sunk into *Ampelocissus* in the future. Until this is the case, we treat it as a separate genus. In this study we focus on the island of Sumatra, which is the most under-sampled area in the Malesian phytogeographical region, with likely many species new to science awaiting discovery (Mustaqim & Putra, 2020).

The aim of this research is to revise and classify *Pterisanthes* species in Sumatra. Based on specimen examinations carried out by the *Pterisanthes*

team in the “Taxonomy Skills for Conservation 2024” course in Herbarium Bogoriense (BO) and the subsequent work of Z.H. and A.T-B. At the Royal Botanic Gardens, Kew, we identified a total of nine species, two of them endemic to Sumatra.

MATERIALS AND METHODS

This study is based on examining herbarium specimens in herbarium Bogoriense (BO), Kew (K), and also examining herbarium specimens that have been recorded digitally at JSTOR (<https://www.jstor.org>), GBIF (<https://www.gbif.org>), and Naturalis bioportal (<https://bioportal.naturalis.nl>), with approximately 700 samples examined from nine species. The results of these examinations were then compared with protologues and other revisions of the genus, such as Latiff (1982) and Trias-Blasi *et al.* (2014). Georeferencing was performed using a variety of resources, such as GeoNames (<https://www.geonames.org/>) and GoogleEarth. SimpleMappr (www.simplemappr.net) was used to construct the distribution map based on the coordinates given on the specimen labels. GeoCAT (<https://geocat.iucnredlist.org/>) was used to determine the conservation status of the species.

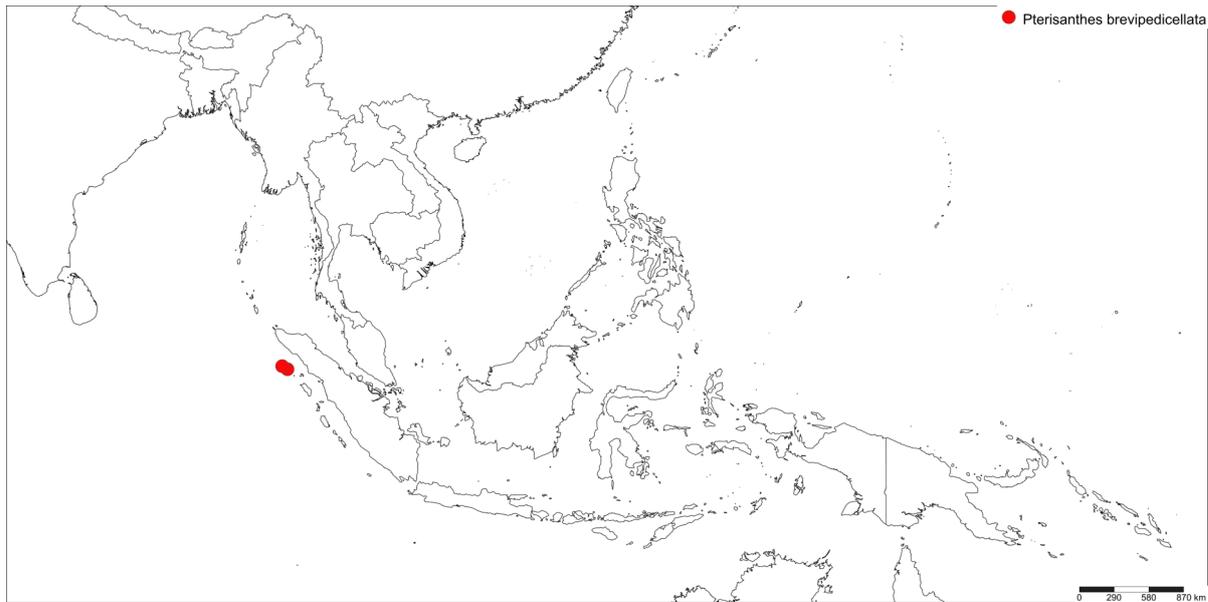


Fig. 1. Distribution map of *Pterisanthes brevipedicellata* Latiff.

TAXONOMY

Pterisanthes Blume (1825: 192). — Type: *Pterisanthes cissioides* Blume.

Embamma Griffith (1854: 694).

Vitis L. sect. *Pterisanthes* Miquel (1863: 73).

Slender wiry climbers. *Stem* slender, cylindrical, striate, glabrous. *Leaves* simple or palmately (2)3–7-foliolate, some species heterophyllous. *Inflorescence* a leaf-opposed flat lamellate panicle, leaf-like and slightly fleshy with associated tendrils at the peduncle; lamella shape very variable: horseshoe-shaped, rectangular, rounded to very narrow. Flowers in Sect. *Pterisanthes* lamellate and pedicellate, in Sect. *Paginiflora* lamellate; only lamellate flowers hermaphrodite, sessile, partially embedded in the lamella, (3)–4–5-merous, calyx obscure, corolla petals ovate-triangular, ovary adnate to the disk; pedicellate flowers placed at the margin of the lamella, either male or sterile always 4-merous, calyx cupuliform; corolla petals ovate-oblong; filaments filiform, attached to the inner side of the petal by a thin membrane; anthers minute; ovary exserted; style short; stigma inconspicuous. Seeds obovate, rugose.

Distribution. Brunei Darussalam, Indonesia (Java, Kalimantan, Sulawesi, Sumatra), Malaysia (Peninsula, Sabah, Sarawak), Philippines (Mindanao), Singapore, Thailand (Ranong, Songkhla, Narathiwat).

SPECIES DESCRIPTIONS

1. *PTERISANTHES BREVIPEDICELLATA* Latiff – Fed. Mus. J. 27: 55 (1982). — Type: INDONESIA, Sumatra, Simaloer Island, 2°35'16"N, 96°7'56"E, 10 April 1918. *Achmad* 354. (holo-

type: L (L0715708), isotypes BO! (BO1337740, BO1337717, BO1616160)).

Climber. *Stem* cylindrical and ridged, glabrous. *Leaves* simple; petiole 1–4 cm long, glabrous to sparsely arachnoid pale hairs; Leaf blade ovate to oblong, 8.5–15 cm × 6–9 cm, base cordate, apex acuminate, margin entire with marked teeth with arachnoid rusty hairs; indumentum of the upper surface of the leaf glabrous to some rusty arachnoid hairs on the midrib, indumentum of the lower surface of the leaf glabrous; 5–6 pairs of secondary veins. *Inflorescence* with pedicellate and lamellate flowers; peduncle 1.5–3.5 cm long; primary branch of the inflorescence 5–7 cm long; Inflorescence panicle of lamellae, 5.5–12 × 1.3–3 cm; pedicel 1–2 mm long.

Distribution. Sumatra (Fig. 1).

Conservation status. There are only two known collections of this species. This could warrant the categorisation of this species as Critically Endangered as it has an AOO of 8 km² and the EOO could not be calculated (GeoCAT (Bachman *et al.*, 2011)). However, the specimens occur in forested areas, where no threats are apparent. We also lack information on fragmentation, decline and extreme fluctuations of the populations. Therefore, the most appropriate categorisation of this species is as Data Deficient (IUCN, 2023).

Notes. This species only occurs on Simaloer Island in Aceh Province.

Specimens examined. INDONESIA. Sumatra, Aceh, Simaloer Island, 2°35'16"N, 96°7'56"E, 10 April 1918, flowering, *Achmad* 354 (BO

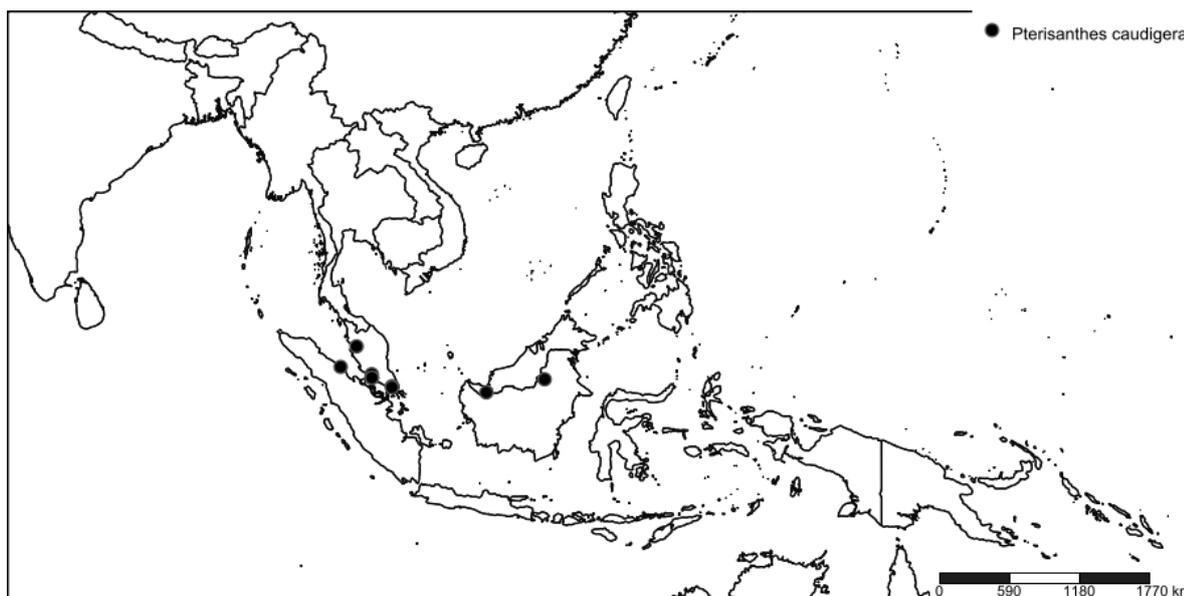


Fig. 2. Distribution map of *Pterisanthes caudigera* (Griff.) Planch.

(BO1337740, BO1337717, BO1616160)); Aceh, Hulu Langi Forest, Desa Langi, Dusun Sejahtera, Kec. Alafan, Kab. Simaloer, 2°49'N, 95°43'59"E, 30 July 2017, flowering, Santoso, W., Rosalina, D., Fathi, M. WS138 (BO (BO1972236)).

2. *PTERISANTHES CAUDIGERA* (Griff.)Planch. – Monogr. Phan. 5(2): 420 (1887); Suess., in Engler & Prantl, Natur. Pflanzfam. 20d: 318 (1953). *Embamma caudigerum* Griff., Not. Pl. Asiat. 4: 695 (1854). — Type: MALAYSIA, Malacca, *Griffith, W. 1299*. (holotype K (K000574970! (Fig 2); syntypes K (K000574969!), P (P00697392 image!), A (51608 image!)).

Climber. *Leaves* simple and compound, 3-foliolate or 5-pedate; petiole 1.6–5.2 cm long; central blade ovate, 5.5–11.8 cm × 3.2–6.3 cm, base semicordate, apex acuminate, margin subentire to sinuate with teeth; lateral blade asymmetrically oblong, 4.2–9.8 cm × 2.8–5.1 cm, base oblique, apex acuminate, margin subentire to sinuate with teeth; petiolules 0.2–0.6 cm long; indumentum of the upper surface of the leaf sparsely fibrillose, indumentum of the lower surface of the leaf sparsely tomentose. *Inflorescence* with lamellate flowers, peduncle 1.8–4.6 cm long; primary branch of the inflorescence 2.8–6.5 cm long; inflorescence panicle of lamellae, 6.2–14.1 × 1–3.1 cm with a tail-like structure at the apex of the inflorescence.

Distribution. Borneo, Sumatra, and Malay Peninsula (Fig. 3).

Conservation status. The extent of occurrence (EOO) of this species is 343,095.535 km² whereas the area of occupancy (AOO) is 32.000 km², which suggest this species might be Least Concern or

Endangered, respectively. We think that the species might be Endangered as there are only few locations. However, we do not have information regarding the populations' decline or fragmentation. Therefore, this species should be considered as Data Deficient (IUCN, 2023).

Specimens examined. INDONESIA. Sumatra, Asahan, 3°00'47"N, 99°31'01"E, *Rahmat Si Boeea 6613* (L); Aceh, P.T. Hargas logging concession, S. of the road Sibulussalam-Gelombang, just N of the crossing of the approach road with Lae (=River) Batu Batu (a tributary of Alas River), near the abandoned village of Belintang, 2°44'56"N, 97°59'45"E, 164 ft, 6 August 1985, flowering, *de Wilde, W. J. & de Wilde-Duyffes, B. E. 20686* (US (00920018)). MALAYSIA. Malay Peninsula, Negri Sembilan, Tampin, 2°28'12"N, 102°13'48"E, 30 January 1916, flowering, *A. ? 1439* (K (K004492985)); Johor, Mount Austin, 1°33'9"N, 103°46'23"E, 11 January 1904, flowering, *Ridley, H. N. 11997* (K (K004492986)); Malacca, *Maingay M. D. 430/1135* (K004492987); Malacca, *Maingay M. D. 432/1142* (K004492988); Malacca, *s.n. s.n.* (K (K004492 991, K0044929 92)); Johor, 18 January 1917, *Ridley, H. N. s.n.* (K (K004492990)).

3. *PTERISANTHES CISSIOIDES* Blume – Bijdr., Fl. Ned. Ind. 4: 193 (1825) [as *cissioïdes*]. *Vitis cissioïdes* (Blume) Backer (1911: 245). — Type: INDONESIA, Java, Bogor, *Blume s.n.* (lectotype: L (L0747475!)), designated by Trias-Blasi *et al.* (2014); isotype L (L0715778!).

Vitis pterisantha Miquel Miq., Ann. Mus. Bot. Lugduno-Batavi 1: 94 (1863). — Type: INDONESIA, Sumatra, *Korthals s.n.* (holotype L! [L0715787!]; isotype L! (L0715788!)).

Pterisanthes dalhousiae var. *major* Ridl., Fl. Ma-

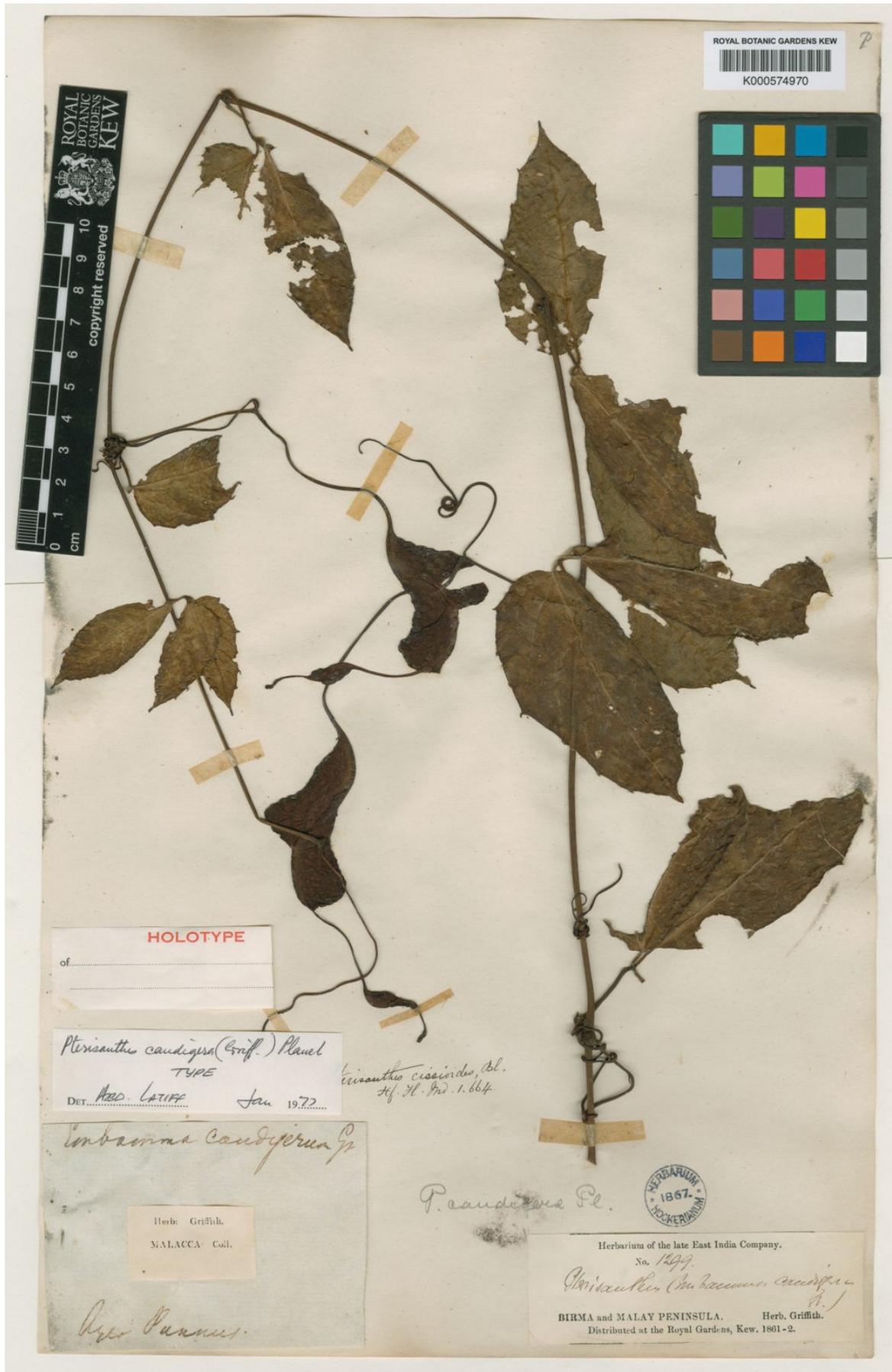


Fig. 3. Holotype of *Pterisanthes caudigera* (Griff.) Planch.

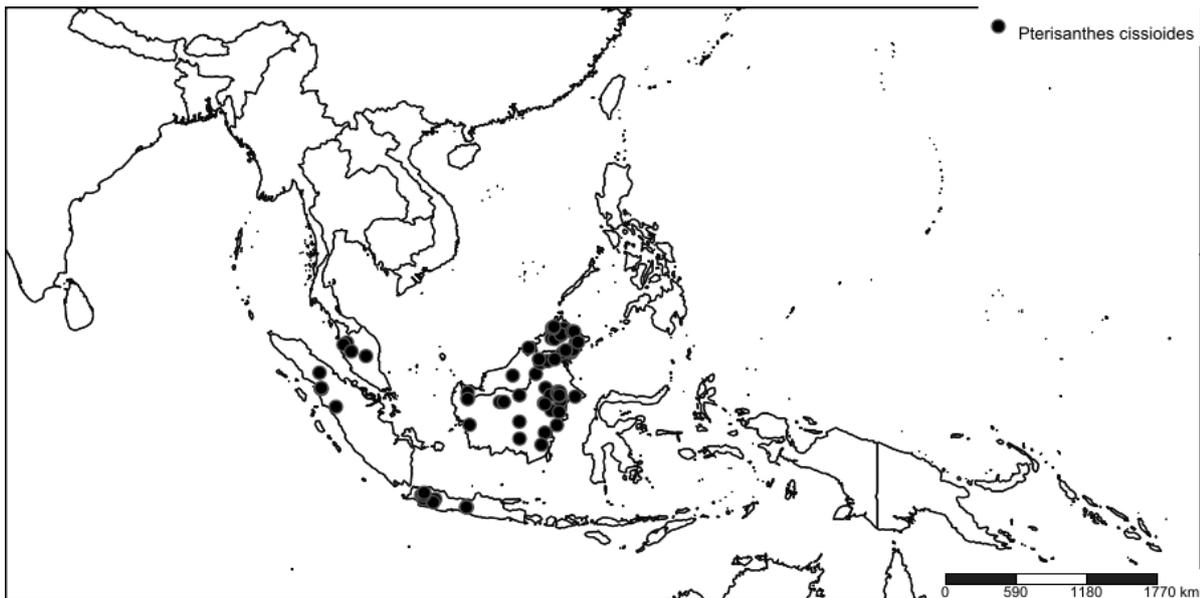


Fig. 4. Distribution map of *Pterisanthes cissioides* Blume.

lay Penins. 1: 481 (1922). — Type: MALAYSIA, Peninsular Malaysia, Perak, Hermitage, December 1887, *Curtis 1289* (holotype K!).

Pterisanthes trifoliata Merr., Univ. Calif. Publ. Bot. xv. 182 (1929). — Lectotype: MALAYSIA, Sabah, Tawao, Elphinstone Province, British North Borneo, October 1992 to March 1923, *Elmer 20829* (lectotype UC!, designated by Trias-Blasi *et al.* (2014); holotype: PNH likely lost; isolectotypes: K!, L (L0013712!)).

Climber. *Stem* glabrous to sparsely arachnoid. *Leaves* compound, 3-foliolate or 5-pedate; petiole 3.4–9.1 cm long, puberulous to hirsute; central blade elliptic to oblanceolate, 10.1–18.2 × 4.1–6.9 cm, base asymmetrical to oblique, apex acuminate, margin entire with 0.1–0.4 cm long back teeth and glabrous to arachnoid hair; lateral blade oblong, 9.1–16.2 × 4.0–6.7 cm, base asymmetrical to oblique, apex acuminate to caudate, margin entire with 0.1–0.4 cm long back teeth and glabrous to arachnoid hair; central petiolule 0.8–1.8, puberulous; lateral petiolule 0.3–0.4, puberulous; indumentum of the upper surface of the leaf glabrous and smooth, indumentum of the lower surface of the leaf sparsely arachnoid; 5–6 pairs of secondary veins. *Inflorescence* with pedicellate flowers; peduncle 2.8–5.4 cm long; primary branch of the inflorescence 8–25 cm long; inflorescence panicle of lamellae, 14.5–25.1 × 2.7–8.4 cm, glabrous.

Distribution. Brunei Darussalam, Indonesia (Java, Kalimantan, Sumatra), Malaysia (Peninsula, Sabah), Thailand (Phangnga) (Fig. 4).

Conservation status. Using GeoCAT (Bachman *et al.*, 2011), we calculated an EOO of 2,255, 654.004 km² and an AOO of 104.000 km² for this

species. As this species is very widespread in its distribution, it is likely that the AOO has been overestimated. However, this species is likely to be categorised as Least Concern (IUCN, 2023).

Specimens examined. INDONESIA. Sumatra, North Sumatra, Kab. Simalungun, Kec. Girsang Sipangang Bolon, Sibaganding forest, secondary forest, 2°42'53"N, 98°56'8"E, 4,317 ft, 21 March 2018, flowering, *Damayanto, I. P. G. P., Rahmawati IPGPD554* (BO (BO1959568, BO1959569)); West coast, E of Lubuk Sikaping, Mt. Gadang, W side, primary forest, 0°7'33"N, 100°10'15"E, 2,953 ft, sterile, *Borssum, J. v. 2062* (BO (BO1620787)); inland (N-NW) of the town of Kecamatan Batangtoru, medium stature forest on montane ecotone, 1°29'22"N, 99°2'52"E, 2,460 ft, flowering, *Takeuchi, W., Sambas, E. 18432* (BO (BO1542245)). Borneo, East Kalimantan, Kab. Malinau, Kec. Pujungan, Long Belaka, 2°37'16"N, 115°14'11"E, 25 March 2009, fruiting, *Koizumi, M., Lalo, Koizumi 1962* (BO (BO1954311)); East Kalimantan, Bukit Bangkirai, old secondary forest, to track III, 1°1'30"S, 116°51'53"E, 3 February 2001, fruiting, *Ruskandi, A., Rugayah, AR & R 306* (BO (BO1831734)); East Kalimantan, Sebulu, North of Samarinda, 0°7'1"S, 116°30'7"E, 22 January 1974, *Nuhamara, T.S. 30* (BO (BO1973371)); East Kalimantan, Loa Djanan R. Region West of Samarinda, 0°34'58"S, 117°5'42"E, 6 September 1954, fruiting, *Kostermans, A. 9960* (BO (BO1973372)); East Kalimantan, Loa haur, West of Samarinda, 0°8'42"S, 116°24'54"E, 131 ft, 15 May 1952, flowering, *Kostermans, A. 6944* (BO (BO1973369)); Sungai Wain region, North of Balikpapan, 1°16'3"S, 116°49'43"E, 98.5 ft, August 1950, *Kostermans, A. 4277* (BO (BO1973368), L (L0672039)); Batu Kajang, 1°50'6"S, 115°54'47"E,

- 1,476 ft, 28 November 1979, fruiting, *Ma'roef, A. AM.243* (BO (BO1973370)); Central East Borneo, W. Koetai, no. 5, near Lahoem, 0°22'12"N, 115°23'33"E, 98.5 ft, 1 August 1925, *Endert, F.H. 1846* (BO (BO1620798)); Central East Borneo, Long Petah, 0°2'32"N, 115°23'30"E, 1,968 ft, 10 September 1925, flowering, *Endert, F.H. 3147* (BO (BO1620797)); Central East Borneo, West Koetai, 0°24'18"N, 115°51'5"E, 98.5 ft, 22 November 1925, flowering, *Endert, F.H. 5130* (BO (BO1620799), L (L0672046)); Wanariset research area, Rintis Baru, 1°2'44"S, 116°59'15"E, 164 ft, 30 July 1990, flowering, *Kessler 603* (K (K004493000), L (L0672056)); Wanariset. Plot Matthys, 1°2'44"S, 116°59'15"E, 164 ft, 15 May 1990, flowering, *van Balgooy & Kessler 5959* (K (K000605883), L (L0672059, L0672060)); Central Kalimantan, Kalampangan, Peat swamp forest, 2°16'12"S, 114°1'55"E, 65.6 ft, 25 July 2004, flowering, *Sadili, A., 1157* (BO (BO1665470)); Ketapang, Gunung Palung National Park, Cabang Panti Research Site. DT5, -1.24, 110.239, 65.6 ft, 24 January 1996, fruiting, *Laman T. G., TL112* (BO (BO1803334), K (K004493001) A (2326863), E (E00088154) L (L0762161)); West Kalimantan, G. Berui, 2.5 km SSW Kota Serimbu, 0°44'28"N, 110°5'18"E, 164–328 ft, November 1995, flowering, *Kohyama, Tukirin, Yamada, K 10631* (BO (BO1480044), L (L0374578)); Western Kalimantan, Serawai, Desa Jelundung, surrounding environs to 0.5 km, 0°29'43"N, 112°32'3"E, 393.8 ft, 2 October 1995, flowering, *Church, A. C., Ismail, Ruskandi, A. s.n.* (K (K000073652)); South Kalimantan, Tanah Boemboe, Batoelitjin, 3°25'59"S, 115°54'11"E, 98.5 ft, 28 January 1928, *Kostermans, A. 2150* (BO (BO1973367)); North Kalimantan, G. Samenggaris, 4°13'6"N, 117°15'1"E, December 1912, *Amdjah 1050* (BO (BO1620782, BO1620783, BO1620784)). Java, Bogor, Res. Batavia, Goenoeng Djamboe (W of Leuwiliang), Forest, 6°34'36"S, 106°36'34"E, 26 June 1921, flowering, *Bakhuizen van den Brink 5253*, (BO (BO1620789), K (K004492997, K004492998), L (L0715781), P (P02343271)); Res. Preanger, Tjijambong bij Tjikidang, 6°52'44"S, 107°38'35"E, 24 March 1907, flowering, *Bakhuizen van den Brink, 14* (BO (BO1920173)); Bogor, Tjambangkong, Leuwiliang, 7°7'1"S, 107°30'7"E, 1,640 ft, 2 February 1929, sterile, *Bakhuizen van den Brink 7049* (BO (BO1620776)); Bogor, 6°35'39"S, 106°47'21"E, 19 February 1929, flowering, *Merr Stiger s.n.* (BO (BO1620779)); Bogor, 6°35'39"S, 106°47'21"E, January 1929, flowering, *Merr Stiger s.n.* (BO (BO1620778)); Tapos bij Tjisalala (Paroengkoeda), 6°51'9"S, 106°45'34"E, 1,968 ft, 21 December 1920, fruiting, *Bakhuizen van der Brink, R. C. 658* (BO (BO1920170)); G. Kendeng bij Nirmala, 7°10'41"S, 109°39'43"E, 3,937 ft, 23 December 1913, flowering, *Backer, C. A. 11002* (BO (BO1620781)); Depok, 6°24'S, 106°49'7"E, 3 September 1911, flowering, *Casprius? s.n.* (BO (BO1616164)). MALAYSIA. Sabah, Mount Kinabalu, B. N. B., Dallas, Mt. Spur, 6°1'46"N, 116°27'59"E, 3,000 ft, 21 December 1931, flowering, *Clemens, J., Clemens, M. S., 30317* (BO (BO1620774), K (K0044930 03), L (L0672044), K (K000574968), A (2326868, 2326865)); Mount Kinabalu, Tenompok, secondary forest, 5°4'28"N, 116°33'29"E, 4,000 ft, 20 February 1932, fruiting, *Clemens, J., Clemens, M. S., 26042bis* (BO (BO1620771)); Mount Kinabalu, Kiau, 5°58'0.12"N, 116°31'29"E, 1 January 1915, flowering, *Clemens, M. S., 9975* (BO (BO1620772), K (K004493005), A (2326868, 2326868)); Mount Kinabalu, B. N. B., Dallas, 914.4 m elevation, Woods, 5°51'47"N, 116°31'29"E, 5,000 ft, 9 August 1931, flowering, *Clemens, J., Clemens, M. S., 26042* (BO (BO1620773), K (K004493004, K004493007), L (L0672043, L0672048, L0672040), A (2326869)); Tawao, Elphinstone Province, British North Borneo, 4°14'40"N, 117°53'28"E, October 1922–March 1923, *Elmer, A. D. E. 20829* (K (K000574968)); Sabah, *Lowe s.n.* (K (K004493006)); Beluran, Bukit Tangkunan, Telupid, 5°38'N, 117°12'E, 30 January 1982, fruiting, *Rahim, Abd. et al. 93296* (K (K004493008), L (L0672053)); Lahad Datu, Takun Kennedy, Bay section 31. Sandakan, 4°58'46"N, 118°13'42"E, 8 September 1961, fruiting, *Muin Chai 26101* (K (K004493009)); Tawau Hills Park near headquarters camp, 4°24'N, 117°53'E, 984–1,312 ft, 15–16 July 1984, flowering, *Beaman, J., Beaman, R., Beaman, T. & Decker, P. 10179* (K (K004493010)); Beluran, Bidu-Bidu Hill, 5°48'24"N, 117°14'58"E, 31 July 1990, fruiting, *Maikin, Francis & Donggop 130676* (K (K004493011), L (L0761953)); Kota Belud, Ridge S of Melangkap Tamis on NW side of Mt. Kinabalu, 6°8'N, 116°29'E, 1,804–2,952 ft, 28 January 1984, flowering, *Beaman, J., Beaman, R., Decker, P & Medley, K. 8394* (K (K004493013)); Hap Seng Km. 12, 4°28'4"N, 118°3'23"E, 19 May 1982, flowering, *Krispinus, F. 94804* (K (K004493014), L (L0672054)). Sarawak, Bt. Lawi, Bario, 4th Division, 3°44'5"N, 115°28'45"E, 4,593 ft, 22 August 1985, fruiting, *Awa, Dyg., Bernard Lee 50950* (K (K004493016), L (L0672062)).
4. PTERISANTHES ERIOPODA (Miq) Planch. – Monogr. Phan. 5(2): 418 (1887). *Vitis eriopoda* Miq., Ann. Mus. Bot. Lugduno-Batavi 1: 95 (1863). — Type: INDONESIA, Sumatra, *Korthals s.n.* (lectotype L! (L0715762 image (Fig. 5)), designated by Trias-Blasi *et al.* (2014); isolectotype L! (L0715763 image) and K! (K001089984)). *Pterisanthes ovata* Korth. nom. nud. *Cissus araneosa* Miq., Fl. Ned. Ind., Eerste Bijv.: 517 (1861), nom. illeg. *Vitis araneosa* Miq., Ann. Mus. Bot. Lugduno-



Fig. 5. Lectotype of *Pterisanthes eriopoda* (Miq.) Planch.

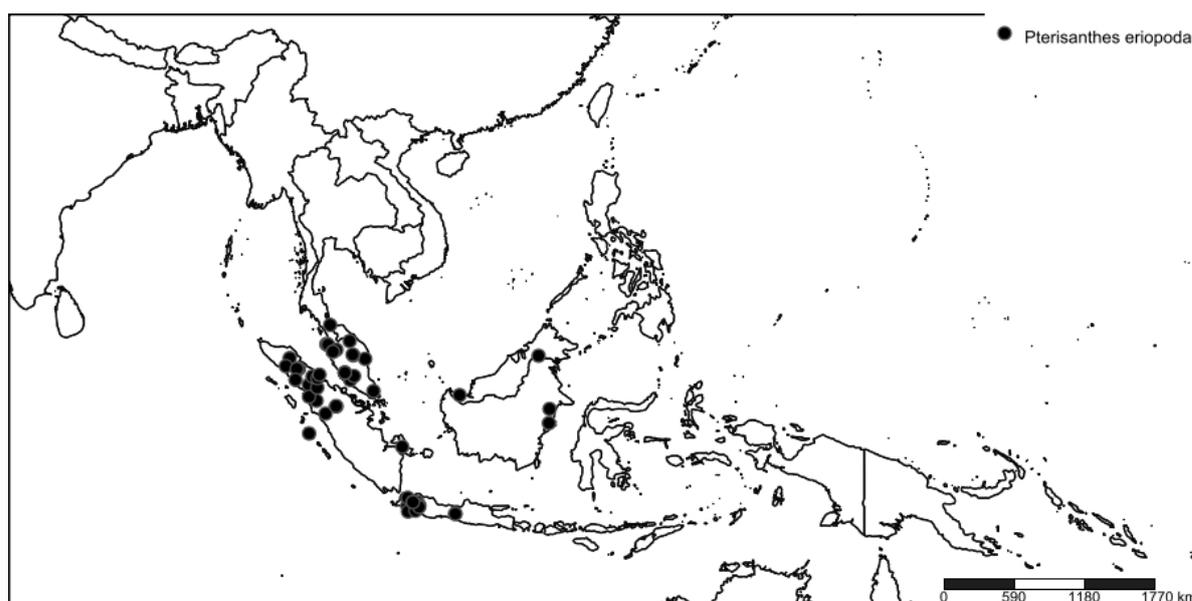


Fig. 6. Distribution map of *Pterisanthes eriopoda* (Miq.) Planch.

Batavi 1: 94 (1863), nom. illeg.

P. coriacea var. *araneosa* King (1896: 408). — Type: MALAYSIA, Peninsular Malaysia, Perak (central), Gopeng Kinta, July 1883, *King's Collector 4621* (lectotype K! (K000801205), designated by Trias-Blasi *et al.* (2014); isolectotype K! (K004492971), designated here)).

P. beccariana Planchon (1887: 418). — Type: MALAYSIA, Sarawak, *Beccari 796* (lectotype FI! (No: 2743), designated by Trias-Blasi *et al.* (2014); isolectotypes FI! (No: 2743A), FI! (No: 2743B)).

P. miquelii Planch., Monogr. Phan. 5(2): 418. 1887. **synon. nov.** *Vitis araneosa* Miq. Ann. Mus. Bot. Lugduno-Batavi 1: 94 (1863), nom. illeg. — Type: INDONESIA, Sumatra, *Korthals s.n.* (lectotype L (L.2338567 image!) designated here).

P. cissoides var. *rubiginosa* Korth. Herb.

Climber. *Stem* cylindrical, glabrous to floccose. *Leaves* simple; petiole 1–5 cm long, long with wavy ferruginous hairs; blade narrowly ovate to broadly ovate to elliptical, 6.5–19 cm × 4–10 cm, base cordate to subcordate, apex acute to acuminate, margin entire with 1–2 mm long black teeth at the end of the veins (to 5 per side); indumentum of the upper surface of the leaf often glabrous, sometimes with a few scattered hairs more dense on the veins, indumentum of the lower surface of the leaf arachnoid (occasionally sparsely pubescent) with long ferruginous wavy hairs, conspicuously dense on the protruding veins and persistent on the leaf margin; 5–6 pairs of secondary veins. *Inflorescence* with lamellate flowers; peduncle 1.5–4.5 cm long; primary branch of the inflorescence 0.1–9 (17) cm long; inflorescence panicle of lamellae, 4–20 × 1–3.5 cm, glabrous.

Distribution. Borneo, Peninsular Thailand, Ja-

va, Sumatra and Peninsular Malaysia (Fig. 6).

Conservation status. Using GeoCAT (Bachman *et al.*, 2011), we calculated an EOO of 2,439,103.686 km² and an AOO of 204,000 km² for this species. As this species is very widespread in its distribution, it is likely that the AOO has been overestimated. This species is likely to be categorised as Least Concern (IUCN, 2023).

Notes. When Miquel (1863) first described *Vitis eriopoda* Miq., he distinguished this species from *V. araneosa* Miq. based on the difference in the leaf shapes, despite their very similar inflorescence. However, the name *V. araneosa* had already been used by Leconte (1854), so Miquel's name was therefore illegitimate. Subsequently, Planchon (1887) described *P. miquelii* Planch., based on *Vitis araneosa* Miq. He also recognized the similarity of *P. eriopoda* (Miq.) Planch. with *V. araneosa* (now *P. miquelii*) based on Miquel's description, despite lacking direct examination of the specimens. Similarly, Latiff (1982) recognized the similarity in the gross morphology of *P. eriopoda* and *P. miquelii*. However, he distinguished them based on leaf shape (narrowly ovate vs. broadly ovate) and colour indumentum below (cinnamomeous vs. reddish). Here, we synonymize *P. eriopoda* (Miq.) Planch. and *P. miquelii* because from the specimens examined, we believe that the characters used in the past to differentiate the two species overlap.

Several possible *P. miquelii* syntypes collected by Korthals were found (K000574959, BO1337720, P00697395, L2338557, L2338558, L2338560, L2338561, L2338562, L2338563, L2338564, L2338565, L2338566, L2338567, L2338568, L2338569, L2338570). It has been very difficult to

pick a lectotype among these syntypes as they all are of the same condition and are similar to each other. However, we selected specimen L2338567 as it shows the inflorescences better and also is located in Leiden where Miquel would have likely seen the specimen. As Korthals did not specify a collector's number, we cannot be sure if the other syntypes are from the same collection or not.

Specimens Examined. INDONESIA. Sumatra. Palembang, Moeara Doewa, 2°55'S, 104°44'45"E, *Teijsmann 3851* (BO (BO1621393)); Tapanuli Selatan, Kotanopan, Sibanggorjulu, G. Sarikmarapi, 0°41'38"N, 99°33'E, 4,921 ft, 30 March 1983, *Sarkat Danimihardja SD2264* (BO (BO1919061, BO1919062)); Mentawai Island, 2°12'S, 99°39'E, 9 September 1924, *IBOET 29* (BO (BO1621397, BO1621398)); Bangka, 2°23'1"S, 105°59'5"E, *Teijsmann, s.n.* (BO (BO1621379, BO1621380)); W. Sumatra, Sijunjung, Muro Kulampi, ridge top, lowland forest, 0°42'38"S, 101°58'31"E, 820 ft, 25 February 1974, flowering, *Dransfield, J. 3951* (BO (BO1906622), L (L0715767)); N. Sumatra, Sijunjung, Teiteibati Nat. Reserve, Siberut Island, rare shade place, 1°21'36"S, 98°53'31"E, 328 ft, July 1992, fruiting, *Afriastini, J. J. 1912* (BO (BO0010891)); Jambi, Parawisata Mt. Bukit Lawang Bohorok, 250 m elevation, primary forest, 3°32'23"N, 98°6'56"E, 820 ft, 5 December 1980, fruiting, *Wiriadinata, H. & Maskuri 519* (BO (BO192003)); Jambi, 87 m elevation, forest, 2°58'4"N, 99°11'11"E, 285 ft, 15 March 2013, *Rembold, K. & Hardianto Mangopo 713* (BO (BO1981135)); N. Sumatra, Bt. Lawang, Bohorote, Langkai, climber on riverside tree, 3°32'55"N, 98°7'E, 656 ft, 25 February 1973, flowering, *Dransfield, J. 3330* (BO (BO1891101) L (L0715766)); N. Sumatra, Aceh, Gunung Leuser Natural Park, Sekundur Forest Reserve, upper Besitang River area, Langkat: base camp at aras Napal, primary and old logged-over lowland rain forest, 4°21'57"N, 97°27'50"E, 164–328 ft, 10 August 1991, fruiting, *de Wilde W. J. J. O. & de Wilde-Duyffes, B. E. E. 21340* (BO (BO1891093), L (L0715770)); Atjeh, S and SW parts of Gunung Leuser Natural Park, Sekundur Forest Reserve, upper Besitang River area, Langkat: base camp at Aras Napal, 50 m elevation, logged over dry land forest on rolling hills with yellow, red loamy soils, 2°43'N, 97°54'E, 164 ft, 6 August 1985, flowering, *de Wilde, W. J. J. O. & de Wilde-Duyffes, B. E. E. 20687* (BO (BO0119938), L (L0715772)). Java. Jakarta, op den Salak, helling, Tjiapoesezide, 6°40'57"S, 106°44'8"E, 3,937 ft, 1918, sterile, *Bakhuizen van den Brink, R. C. 704* (BO (BO1620777), (L0715761, U1770491)); Java, ord. Tjiharoen by Tjibeber (Tjihaoer by Tjibeber), 6°23'58"S, 106°18'43"E, 3,937 ft, 24 November 1916, *Leeuwen, V. 2377* (BO (BO1621391, BO1621392, BO1621385)); Preanger, Tjadas Malang, Tjidadap, Tjibeber, 7°1'55"S, 107°8'12"E, 3,280 ft,

6 January 1917, *Bakhuizen van der Brink, R. C. 1521* (BO (BO1621390)); Preanger, Lengkong, luncen Tjibadak en Jandbaai, 6°56'29"S, 107°37'37"E, 1,804 ft, 2 August 1918, *Bakhuizen van der Brink, R. C. 1696* (BO (BO1621389)); Pasir Angin, Tjadas-Malang, Tjidadap, Tjibeber, 6°56'9"S, 107°8'31"E, 3,280 ft, 22 June 1917, *Winckel, W. F. 576* (BO (BO1919820)); G. Beser nearby Tjidadap h. va Tjibeber, 6°23'58"S, 106°18'43"E, 3937–4429 ft, 15 June 1917, *Backer, C. A. 22636* (BO (BO1919798, BO1919797)); Or. Sombing nearby Tjidadap L. va. Tjibeber, 7°36'31"S, 109°30'47"E, 1,100 ft, 11 September 1917, *Backer, C. A. 22997* (BO (BO1621383), L (L0715755, U.1770489)); Tjadas Malang nearby Tjidadap L. va. Tjibeber, 6°23'58"S, 106°18'43"E, 2,952–3,280 ft, 12 June 1917, *Backer, C. A. 22530* (BO (BO1620804)); Preanger, Tapos, by Tjimoujed/Tjisalak - Padaenghoeda, 1,968 ft, 11 January 1920, *Bakhuizen van der Brink, R. C. 3098* (BO (BO1621387)); Preanger, Tjadas-Malang Tjidadap, Tjibeber, 6°23'58"S, 106°18'43"E, 3,280 ft, 29 July 1917, *Bakhuizen van der Brink, R. C. 2529* (BO (BO1621388), L (L0715759)); Preanger, Tjadas-Malang Tjidadap, Tjibeber, 6°23'58"S, 106°18'43"E, 3,280 ft, 18 April 1917, *Bakhuizen van der Brink, R. C. 2970* (BO (BO1620802)); Tjidadap (L. v. Tjibeber), 6°23'58"S, 106°18'43"E, 3,280 ft, 25 February 1918, *Winckel W. F. 577* (BO (BO1620803)); Buitenzorg, Djasinga, 6°35'49"S, 106°48'21"E, 328 ft, 7 August 1927, *Beumee, J. G. B. 1512* (BO (BO1621386)); Paui Tamiang, Tjadas Malang, 8°12'14"S, 112°47'45"E, 3,280 ft, 31 January 1917, *Winckel, W. F. 774* (BO (BO1621384)); Preanger, Tjadas Malang (Near Tjidadap, south of Tjibeber), 6°56'10"S, 107°8'31"E, 3,280 ft, 1923, *Winckel, W. F. 1235* (BO (BO1621376), L (L0715750)). MALAYSIA. Malay Peninsula, Terengganu, Kemamam, Sungai Nipah Forest Reserve, Compartment 56, Sungai Ayam, 10 m elevation, secondary forest, 4°17'8"N, 103°10'20"E, 32.8 ft, 25 May 2006, flowering, *Rafidah, A. R. FRI51658* (BO (BO1874494)); Pulau Pinang, Penang, West Hill, 5°25'36"N, 100°15'7"E, *Curtis 1402* (K); Pulau Pinang, Penang, Govt. Hill, 5°25'36"N, 100°15'7"E, *Curtis 168* (K (K004492967), (SING)); Johor, foot of Gunong Muntahak, 1°51'9"N, 103°47'8"E, 600 ft, 1 March 1928, *Holtum, R.E. 19901* (BO); Selangor, Hulu Selangor, Bukit Tunggul F.R., Dirt road (with drop gate) trailhead. Secondary. Lowland Dipt. forest. Edge of Belukar, 33°3'19"N, 101°24'50"E, 85 ft, 24 April 2016, flowering, *Chew, M. Y. 73094* (K (K004492968)); February 1867–68, flowering, *Maingay, A. C. 431/2707* (K (K004492969, K004492970)); Perak, Larut, 4°50'60"N, 100°43'59"E, July 1883, fruiting, *Dr. King's Collector 4621* (K (K004492971, K000801205), L (L0715775)); Negeri Sembilan, Gunung Angsi, path to wood, 2°41'54"N, 102°2'52"E, 2,000 ft, 24 March 1923, flowering, *s.n. 1702* (K (K004492975)); Pahang, Wray's camp, 4°34'6"N. 102°16'



Fig. 7. Holotype of *Pterisanthes heterantha* (Griff.) M.A.Lawson.

49°E, fruiting, *Ridley, H. N. s.n.* (K (K004492976)); Pahan, Gunung Tahan, 4°37'57"N, 102°14'2"E, 3,500 ft, 9 June 1912, flowering, *Ridley, H. N. 8027* (K (K004492977)). Sarawak. Kuching, 1°33'25"N, 110°20'27"E, 11 February 1894, flowering, *Haviland, G. D. & Hose, C. 1503* (BO (BO1621378), K (K004493068), L (L0672036), P (P02343264), A (2326879)). THAILAND. Songkhla Province, Kopah, Ban Krap, Bk. Tinggi, 6°53'24"N, 100°31'48"E, 11 December 1917, flowering. *Haniff & Nur 2728* (K (K004492995)).

5. *PTERISANTHES HETERANTHA* (Griff.) M. A. Lawson, Fl. Brit. India 1(3): 664 (1875). *Embamma heteranthum* Griff. in Not. Pl. Asiat. 4: 694 (1854). — Type: MALAYSIA, Malacca, Verupha Alor Golah. *Griffith, W. 1298* (holotype: K (K000574972! (Fig. 7)), isotype (K000574973!)) (Fig. 7).

Pterisanthes heterotricha Merr., Pap. Michigan Acad. Sci. 1933, xix. 167 (1934). — Type: INDONESIA, Sumatra, East Coast, near Aek Sordang, Loendoet Concession, Koealoe, 3 May 1927, *Bartlett 7597* (holotype MICH (MICH1138556! image); isotypes NY (00415146! image), MIN (1002867! image), US (US 3169341)).

Climber. *Stem* pilose and arachnoid. *Leaves* compound, 3-foliolate; petiole 1.5–4 cm long, rust to red coloured arachnoid hairs and multicellular hairs longer than the arachnoid hairs; central blade ovate to oblong, 8–12 cm × 2–6 cm, base acute, slightly oblique, apex acuminate, margin entire with numerous minute teeth and multicellular hairs; Lateral blade obliquely lanceolate or asymmetrical, 3–9 cm × 2–6 cm, base subcordate, apex acute to acuminate, margin entire with numerous minute teeth and multicellular hairs; central petiole 1–5 cm long, rust to red coloured arachnoid hairs and multicellular hairs longer than the arachnoid hairs; lateral petiole 1–3 cm long, rust to red coloured arachnoid hairs and multicellular hairs longer than the arachnoid hairs; indumentum of the upper surface of the leaf sparsely pilose and smooth, indumentum of the lower surface of the leaf rust to red coloured arachnoid hairs concentrating homogeneously in various parts of the lamina forming loose “spots”; 6–7 pairs of secondary veins. *Inflorescence* with pedicellate and lamellate flowers; peduncle length 1–2 cm long; primary branch of the inflorescence length 4–6 cm long; inflorescence panicle of lamellae, 6–8 × 3 cm, rust to red coloured arachnoid hairs.

Distribution. Malay Peninsula, Borneo (West Kalimantan) and Sumatra (Fig. 8).

Conservation status. The extent of occurrence (EOO) is 403,886.225 km² whilst the area of occupancy (AOO) is 40,000 km². According to the

AOO, the species might be Endangered but we think this might have been overestimated; therefore, this is categorised as Least Concern (IUCN, 2023).

Notes. *Pterisanthes heterantha* and *P. stonei* have a difference in lamella shape (rectangular versus shoe shape), indumentum of the upper surface of the leaf (smooth vs. rough) and number of pairs of secondary veins (4–7 vs. 8–9), but other characters are relatively similar. Variability of *Pterisanthes* spp. has long been the subject of controversy because of their morphological variations and widespread distribution in Sumatra lowland rain forest compared with Borneo or Java’s specimen collections based on BO collections.

Specimens examined. INDONESIA. Sumatra, Jambi, Kebun Raya Bukit Sari, Kec. Tebo ilir. Kab. Tebo, 1°34'00"S, 102°46'59"E, 75 ft, 21 December 2005, flowering, *Hidayat, A. & Widjaya, E. A. AH1075* (BO (BO1944325, BO1842663, BO1842662)); Jambi, Lubuk Kepayang, Kec. Air Hitam, Kabupaten Sarolangun, 2°03'46"S, 102°45'57"E, 292 ft, 28 September 2013, flowering, *Rembold, K & Manpopo Katja Rembold 1605* (BO (BO1946547)); Archipel. Ind Sumatra. Djambi my m/s Manau, 590 ft, 17 August 1925, flowering, *Posthumus?, O. 701* (BO (BO1621375), L (L0715748)). Kalimantan, Kalimantan Barat (West Kalimantan), Sintang. Bukit Baka National Park. Slope NE of camp; environs leading up to ridge, 0°37'59"N, 112°16'58"E, 1,017 ft, 17 October 1993, fruiting, *Church, A. C. with Mahyar, U. W., Ruskandi, A. and Nurdin 167* (A (02326871), L (L0763293)). MALAYSIA. Malay Peninsula. Negeri Sembilan, Senawang Forest Reserve, 2°42'00"N, 101°59'00"E, 4 December 1922, flowering, *Holtum, R. E. 9954* (K (K004492961)); 26 July 1865–66, flowering, *Maingay, A. C. 429/1384* (K (K004492961)); Selangor, Templer Park, ca. 20 miles N of Kuala Lumpur along the road to Rawang, in lowland tropical forest on the way to the waterfall, 3°18'15"N, 101°35'42"E, 24 October 2010, *Wen, J. 11804* (US (1175924, 1175925)); Negeri Sembilan, Jelebu, Pasoh F. R., 50 ha plot, 3°00'00"N, 102°19'58"E, 28 October 2010 *Wen, J. 11820* (US (1175823)).

6. *PTERISANTHES POLITA* (Miq.) M.A. Lawson – (1875: 663). *P. coriacea* Korth. ex King (1896: 693). nom. superfl. — Type: INDONESIA, Sumatra, in fruticetis prope Pao, *Korthals s.n.* (lectotype L (L0013706! (Fig. 9)) designated by Trias-Blasi *et al.* (2014); isolectotypes L (L0013704!, L0013705!, L0013707!)).

Pterisanthes sinuosa Merrill (1907: 423). — Type: PHILIPPINES, Mindanao, Lake Lanao, Camp Keithley, November 1906, *Clemens 647* (lectotype A! (image seen!)), designated by Trias-Blasi *et al.* (2014)).

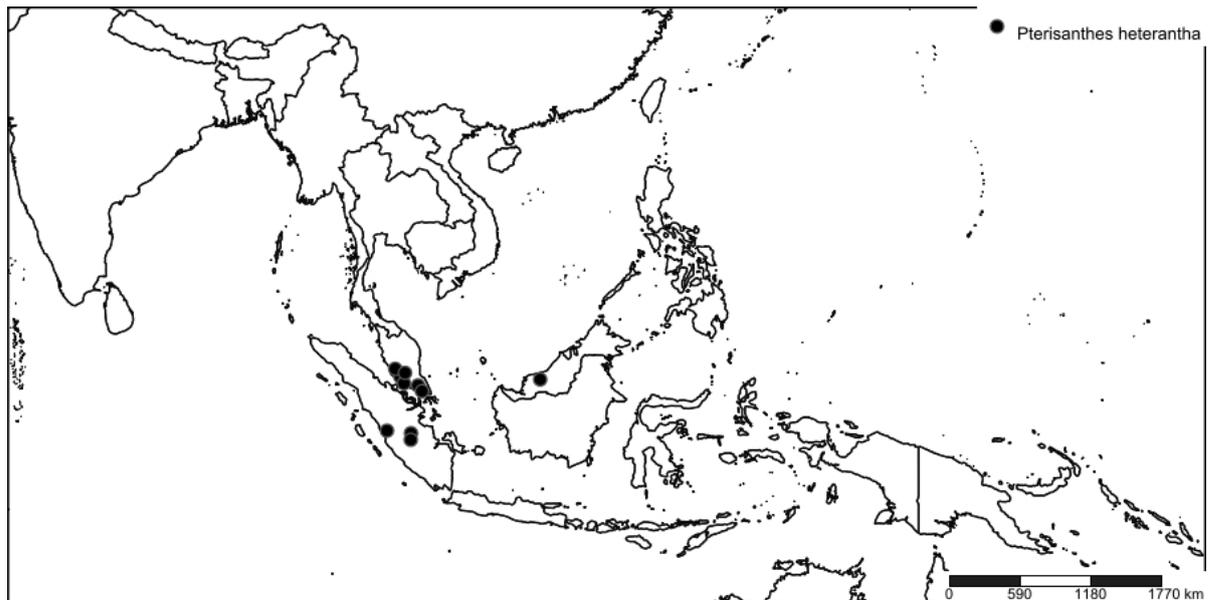


Fig. 8. Distribution map of *Pterisanthes heterantha* (Griff.) M.A.Lawson.

Pterisanthes parvifolia Merrill (1917: 76). — Type: MALAYSIA, Sarawak, Baram District, Marudi, 26 October 1894, *Hose 231* (lectotype K! (K000801204), designated by Trias-Blasi *et al.* (2014); isolectotypes, A! (00051640), BM, L! (L0672034).

Pterisanthes gladiata Van Steenis (Van Steenis & Bakhuizen Van Den Brink 1967: 388) — Type: MALAYSIA, Sabah, Mount Kinabalu, 1,200–1,500 m, 15 February 1933, *J. & M. Clemens 31582* (holotype L (L0013703!)).

Climber. *Stem* cylindrical, glabrous. *Leaves* simple; petiole 1.5–6.2 cm, glabrous; Leaf blade oblong to broadly ovate, 7.7–14.9 cm × 4.0–12.6 cm, base semi cordate to cordate, apex acuminate, margin entire, with hook-like teeth; indumentum of the upper surface of the leaf glabrous or rarely sparsely hairy, indumentum of the lower surface of the leaf glabrous or rarely sparsely hairy; 4–5 pairs of secondary veins. Inflorescence with pedicellate and lamellate flowers; peduncle 2.2–5.9 cm long; primary branch of the inflorescence 6.4–26.4 cm long; *Inflorescence* panicle of lamellae, 5.4–36.1 cm, sparsely pale arachnoid hairs, pedicel 12–25 mm long.

Distribution. Myanmar, Peninsular Thailand, Sulawesi, Sumatra, Peninsular Malaysia, Singapore, and Borneo (Fig. 10). It is possibly distributed in the Philippines (Latiff, 1982), but no specimens have been found from the country.

Vernacular names. Simple-leaved ribbon vine, Akar janggut baung.

Conservation status. The EOO of this species is 5,104,101.259 km² and the AOO is 520,000 km². As this species is abundant and widespread, it is

suggested to be categorised as Least Concern (IUCN, 2023).

Specimens Examined. INDONESIA. Sumatra, Aceh, Northern Sumatra, Gunung Leuser Natural Park, Sekundur Forest Reserve, upper Besitang River area, Langkat; base camp Aras Napal, 3°33'N, 98°E, 164–328 ft, 9 August 1991, flowering, *de Wilde, W. J. J. O & de Wilde-Duyffjes, B. E. E. 21314* (L (L0715729)); Old jungle near the Aek Kanopan, Loendoet Concession, Koealoe, 2°34'3"N, 99°37'3"E, 1–17 April 1927, flowering, *Bartlett, H. H. 7321* (K (K004493041), L (L0715722)); hauptstaechlich Oatklaste, 1914–1917, flowering, *Surbeck, H. 337* (L (L0715723)); *Meranky 2759* (L (L0715721)), Indonesia, Sumatra, flowering; Indonesia, Sumatra, July 1933, *Wilcamp? s.n.* (BO (BO1620805)), flowering. Kalimantan, Kalimantan Barat, Ketapang, Gunung Palung National Park, Cabang Panti Research Site IF 14, freshwater swamp forest, 1°13'S, 110°6'E, 65 ft, 22 March 1997, *Laman, T. G., Rachman, I. A, Mirmanto, E., TL968* (BO (BO1803332), A (2326884)); Long Bagun, disturbed primary forest, 0°31'30"N, 115°14'3"E, 328 ft, 24 June 1975, flowering, *Wiradinata, H., 563* (BO (BO1919785), K (K004493085), L (L0672011)); Central Kalimantan, Bukit Raya and Upper Katingan (Mendawai) River area. Upper Katingan river, ca. 50–100 km WNW of Tumbang Samba, primary rainforest, 1°15'N, 112°40'E, 492 ft, 23 December 1982, flowering, *Mogea, J. P., de Wilde, W. J. J. O., MOGEA 4404* (BO (BO1919784), L (L0672009)); East Kalimantan, Iiantawir, Balikpapan, disturbed primary forest, 1°14'33.7"S, 116°51'9"E, 15 September 1951, flowering, *Saveur, E. G., 4* (BO (BO1919783), K (K004493040), L (L0671998)); Kalimantan Tengah, Project Barito Ulu Base camp and environs, track waterfall below J. Banbangalong river, 0 m elevation, river-

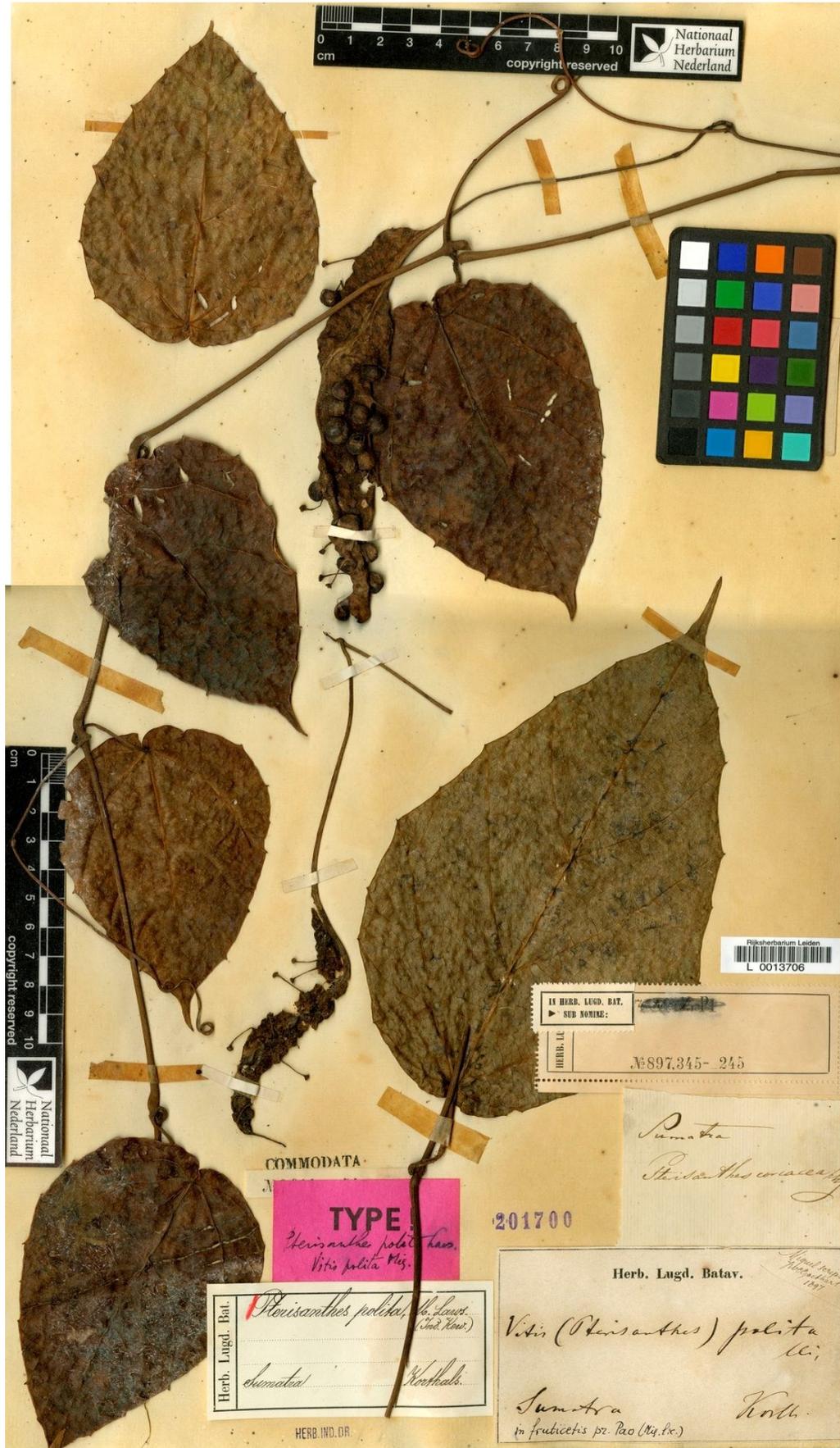


Fig. 9. Lectotype of *Pterisanthes polita* (Miq.) M.A.Lawson.

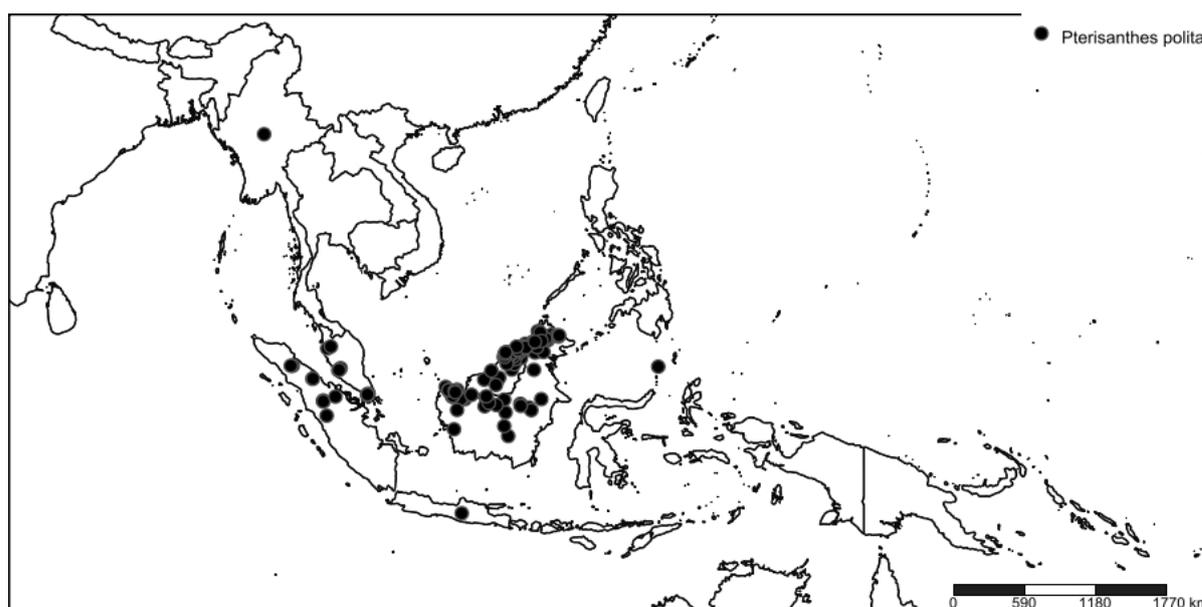


Fig. 10. Distribution map of *Pterisanthes polita* (Miq.) M.A. Lawson.

rine forest, 3°14'32.5"N, 114°13'53.6"E, 11 June 1990, flowering, *Risdale, C. E. PBU490* (BO (BO 0009777), K (K004493046, K004493047), L (L0202163, L0202165)); West Kutai Borneo, Kelian river, 0°4'S, 115°25'E, 656.1 ft, 10 October 2017, flowering, *Nanda Utami, NU2203* (BO (BO1951841), K (K004493046, K004493047), L (L0202163, L0202165)); Khapoueas, (1°45'S, 114°17'60"E), flowering, *Teysmann, 8695* (BO (BO1620815)); Soengei bloeoe, 1°6'N, 112°39'E, 1896–97, flowering, *Jaheri, 680* (BO (BO1620818, BO1620820)); Soengai bloeoe, 1°6'N, 112°39'E, 1896–97, flowering, *Jaheri, 294* (BO (BO1620819)); G. Bentuang area; 5–10 km N. of Masa village; 150 km N. E. of Pontianak, 0°52'S, 100°26'E, 8 June 1989, flowering, *Burley, J. S., Turkin et al. 2351* (K (K004493045), L (L0672029)); East Kalimantan, PT. Limbang Ganeca, Ulu Mahakam, Belayan river area, 0°12'N, 116°2'E, 164 ft, 15 June 1999, flowering, *Sidiyasa, K. & Ambriansyah 1656* (K (K004493048), L (L0374641)). BRUNEI. Tutong, Rambai, Ladan Hill Forest Reserve, Bukit Bedawan, Southern of LP-263. Dilah hantu (Ib.), 4°29'33"N, 114°48'52"E, 1,591 ft, 26 March 1997, fruiting, *Kalat, A., Dr. Idris, Niga, Joffre, Suhaili, Kapat, Jangarun, Han & Clayton 18076* (K (K004493021)); Temburong, Sungei Temburong above Kuala Belalong. Dilah Hantu (Ib), 4°34'42.17"N, 115°8'40.94"E, 23 June 1989, flowering, *Wong, K. M., 1230* (K (K004493022), L (L0763252)); Temburong, Subd. Amo. Upper Belalong river west of Bukit Belalong, 4°30'N, 115°8'E, 426 ft, 24 March 1991, flowering, *Johns, R. J., Sands, M., Awong, Shanang, Ariffin, Saleh 7021* (K (K004493023), L (L2338486)); Belait, Melilas. Ulu Belait, 4°10'N, 114°44'E, 82 ft, 22 July 1993, flowering, *Atkins, S., Cowley, E. J., Davies, S., Sands, M. J. S., Awong, Han 526*, (K

(K004493024, K004493025), L (L0762782)); Belait, Jalan Merangking Buau, 4°27'34"N, 114°37'17.45"E, 10 August 1991, flowering, *Niga Nangkat NN250* (K (K004493027)); Tutong, Lamunin, Ladan Hills, 4°38'N, 114°46'E, 295 ft, 23 March 1993, fruiting, *Coode, M. J. E., Ferguson, I. K. et al.: Salleh Bat, Shanang Pikir 7330* (K (K004493028), L (L0761419)); Temburong, Selapon, village margin, 4°40'N, 115°12'E, 50 ft, 18 November 1990, flowering, *Dransfield, J., Wong Khoon Meng, Dransfield, S., Kirkup, D., Salleh et al. 6911* (K (K004493029, K004493030), L (L0672017)); Belait, Bukit Teraja. Disturbed Kerangas/Forest Margins. Belait series sandstones, 4°18'N, 114°26'E, 951 ft, 5 December 1991, flowering, *Coode, M. J. E., Kirkup, D. W., Soe Paing, Niga, Ariffin, Jangarun, Ibrahim, Salleh, Ramli, Han 6934* (K (K004493031), L (L0762971)); Belait, Labi: Bukit Teraja, 4°10'48"N, 114°15'36"E, 1,148 ft, 18 October 1991, flowering, *Simpson, D. A., Marsh, M. 2124* (K (K004493032)); Belait, Melilas, Ulu Sungai Belait, 4°10'N, 114°42'E, 82 ft, 29 August 1995, fruiting, *Kalat, A., Niga, Salleh, Ibrahim, Clayton, Noorazman, Talip & Munau BRUN17075* (K (K004493033)); Tutong, Ladan Hills Forest Reserve Nyamokning West, east of LP-230, by Sungai Apan, 4°25.45'N, 114°48.36'E, 295 m, 7 June 1996, fruiting, *Joffre Hj Ali Ahmad, Said, I. M., Niga, N., Ariffin, K., Rosli, M., Ibrahim, A., et al. 17536* (K (K004493034)); Belait, Labi. Jalan Melayan, 4°30'N, 114°28'E, 262 ft, 3 March 1992, flowering, *Dransfield, J., Kamariah Abu Salim, Joffre, Shanang Salleh, Suhaili, Maung Soe Paing JD7256* (K (K004493036), L (L2338512)); Labi Hills Forest Reserve, Compartment 46, Bukit Telingan, 4°12'N, 114°35'E, 164 ft, 17 April 1990, fruiting, *Coode, M. J. E. Wong Khoon Meng et al.*

6812 (K (K004493038)); Belait, New road to Merankin from 13 km Labi Road, ca. 4 km from junction, 4°32'N, 114°35'E, 32 ft, 6 November 1990, flowering, *Kirkup, D., Dransfield, J., Wong Khoon Meng, Dransfield, S.* 200 (K (K004493086), L (L0672016)); Belait, Bukit Telingan, Labi. Belait series sandstones, 4°21'34.18"N, 114.2°8'21.95"E, 394 ft, 8 November 1990, flowering, *Kirkup, D., Dransfield, J., Dransfield, S., Niga et al.* 239 (K (K004493087)); Temburong, S. Belalong above Kuala Belalong Field Study Centre, 4°30'N, 115°10'E, 164 ft, 6 March 1991, flowering, *Argent, G. & Mitchel, D.* 91201 (K (K000605631), L (L0672026)). MALAYSIA. Malay Peninsula, Perak, Hill Garden Larut, 4°50'60"N, 100°43'60"E, August 1885, flowering, *Wray, L.* 654 (K (K004492964)); Selangor, Sungai Buluh, (3°12'36"N, 101°33'36"E), flowering, *Ridley, H. N. s.n.* (K (K004492965)); Perak, flowering, *Wray, L.* 150 (K (K004492966)). Sabah, Mount Kinabalu, in jungle near camp, 6°2'47"N, 116°33'43.7"E, 15 February 1933, flowering, *Clemens, J., Clemens, M. S.,* 31583 (BO (BO1620808)); Mount Kinabalu, 6°4'N, 116°33'E, 11 March 1933, flowering, *Clemens, J., Clemens, M. S.,* 32099 (BO (BO1620807)); Ranau, Hutan Simpan trus madi 1, 5°21'54"N, 116°18'3.6"E, 23 February 1990, fruiting, *Majwat, J.* 128756 (K (K000605631)); Nabawan, KM. 55 Jalan Nabawan/Sepulut. Ulu Sg. Nabawan, 4°37'7"N, 116°27'46.98"E, 24 February 1990, flowering, *Sumbing, J.* 128411 (K (K000605639), E (E00166264), L (L0761825)); Tenom, HS. Kalang, 5°8'85"N, 115°57'15"E, 10,827 ft, 18 September 1991, flowering, *Gambio et al* 133697 (K (K000605643)); Keningau, Logged area pisngon, 5°29'14"N, 116°9'24"E, 17 January 1990, flowering, *Sumbing, J.* 128268 (K (K000605582)); Pandewan, Sungai Pemaatarian, 17 February 1987, fruiting, *Mantor, A.* 119987 (K (K000605581)); Pensiangan, Ponnontoman fr., 4°32'41"N, 116°18'42"E, 16 August 1994, fruiting, *Sumbing, J.* 136971 (K (K004493089), L (L0763711)); Sipitang, Hutan Simpan Kuala Megalong, 5°4'44"N, 115°32'59"E, 82 ft, 24 August 1991, flowering, *Amin Sigun, Ag.* 106036 (K (K004493090), L (L0762671)); Kota belud, Melangkap Kappa on NW side of Mt. Kinabalu, 6°9'N, 116°31'E, 1,968.5–2,296.6 ft, 15 February 1984, flowering, *Beaman J., Beaman, R., Decker, P. & Medley, K.* 8570 (K (K004493093, K004493098)); Beluran, West of Bt. Luminitong, 5°53'46"N, 117°33'26"E, 11 March 1982, flowering, *Aban, G.* 94482 (K (K004493094), L (L0672012)); Sandakan, Sg. Ruku-ruku, Telupid, 5°30'4"N, 117°17'32"E, 6 August 1981, flowering, *Aban, G.,* 94034 (K (K004493095)); H. S Tangkulap, 5°26'29"N, 117°10'15"E, 12 May 1989, flowering, *Majawat, G. et al.* 110036 (K (K004493096), L (L0762669)); Sandakan, Sepilok Forest Reserve, 5°50'21"N, 117°56'59"E, 22 April 1960, fruiting, *Dr. Meijer, W.* SAN 21239 (K (K004493099)); Keningau, Logging area, Lanas, 5°19'41"N, 116°29'51"E, 18 July 1987, fruiting, *Fidilis Krispinus* 119661 (K (K004493103), L (L0672023)); Telupid, Tawai Forest Reserve, 5°36'15"N, 117°5'48"E, 18 October 1985, flowering, *Francis et al.* 109624 (K (K004493104), L (L0672027)); Kinbatagan, Corridor Creek - Nr. Sg. Malesian Mallau Basin Kuamut Islands, 500 m, 4°35'11"N, 116°56'46"E, 1,640 ft, April 1988, flowering, *Lamb, A.* 125/88 (K (K004493105, K004493106)). SARAWAK. Ulu Mayeng, Kakus, basalt hillside, mixed dipterocarp forest, 2°39'6.6"N, 113°37'23.96"E, 29 July 1964, fruiting, *Sibat ak Luang, S.* 21829 (BO (BO1919786), K (K004493077), L (L0671992)); Bkt. Tebunan, Ulu Trusan, Lawas, 5th Division, 4°47'9.44"N, 115°16'18.47"E, 7 May 1986, flowering, *Lee, B. S.* 52406 (K (K004493049), L (L2338492)); Semunsan Wildlife Sanctuary, 1°57'15.98"N, 109°36'43.17"E, 5 May 1988, flowering, *Mohtar, Abg., Othman, Is.* S.52653 (K (K004493050), L (L0763773)); Bukit Lambir, Miri, 4th Division, 4°12'N, 113°59'E, 23 May 1966, flowering, *Banyek ak Ludong & Sibat ak Luang S.* 24479 (K (K004493051), L (L0671993)); Bako National Park. Path to Telok Paku, 1°43'N, 110°28'E, 10 November 1963, flowering, *Chai, P.* S.18015 (K (K004493053), L (L0672031)); 1865–68, flowering, *Beccari, O.* 1333 (K (K004493059)); Baram, Miri river, 4°33'11.04"N, 114°6'19.17"E, January 1894–95, flowering, *Hose, C.* 544 (K (K004493060), L (L0672001)); 4th division, Bkt. Kelaby, Ulu Dapoi, Tinjar, Marudi, 4°24'22.81"N, 114°15'46.17"E, 300 ft, 3 April 1965, fruiting, *Pa'ie, I. S.* 22945 (K (K004493062), L (L0671995)); 1st division, G. Undan, 17th miles Bau/Lundu Road, 1°28'47.33"N, 110°0'36.33"E, 164 ft, 30 April 1983, flowering, *Yii Puan Ching S.* 45954 (K (K004493063), L (L0672015)); 1st division, Gunong Buri, 1°10'N, 110°56'E, 18 March 1982, flowering, *Yii Puan Ching S.* 45656 (K (K004493064), L (L0672019)); 2nd division, Bukit Alak, Tebakang area, 1°6'16.33"N, 110°30'42.94"E, 2,493 ft, 16 April 1983, flowering, *Awa, Dyg. & Paie, I. S.* 45656 (K (K004493065), L (L0672022)); Ulu S. Jangkang, Lambir National Park, 4°11'54.14"N, 114°2'34.34"E, 25 October 1983, flowering, *Mohtar, Abg. et al. S.* 47151 (K (K004493067, K004493071), L (L0761261)); Gunong Api, Ulu Melinau, Tutoh, Baram District, NE flank of mountain, 4°7'N, 115°15'E, 2,800 ft, 1 October 1971, flowering, *Anderson, J. A. R. S.* 30870 (K (K004493070), L (L0672007)); Baram, Marudi F. R., 4°10'41.59"N, 114°19'19.94" E, 12 October 1963, *Yacup, F. R. S.* 8277 (K (K004493072)); N. Semperaja, Mujong Balleh, 2°6'14.65"N, 113°22'42.16"E, 60.86 ft, 14 April 1964, flowering, *Pa'ie, I. S.* 19866 (K (K004493076), L (L0671996)); Serian, Bukit Nyereng Balai Ringin P. F., 1°2'50.55"N, 110°44'58.14"E, 25 March 1961, fruiting, *Muas, A.* 13470 (K (K00449



Fig. 11. Lectotype of *Pterisanthes rufula* (Miq.) Planch.

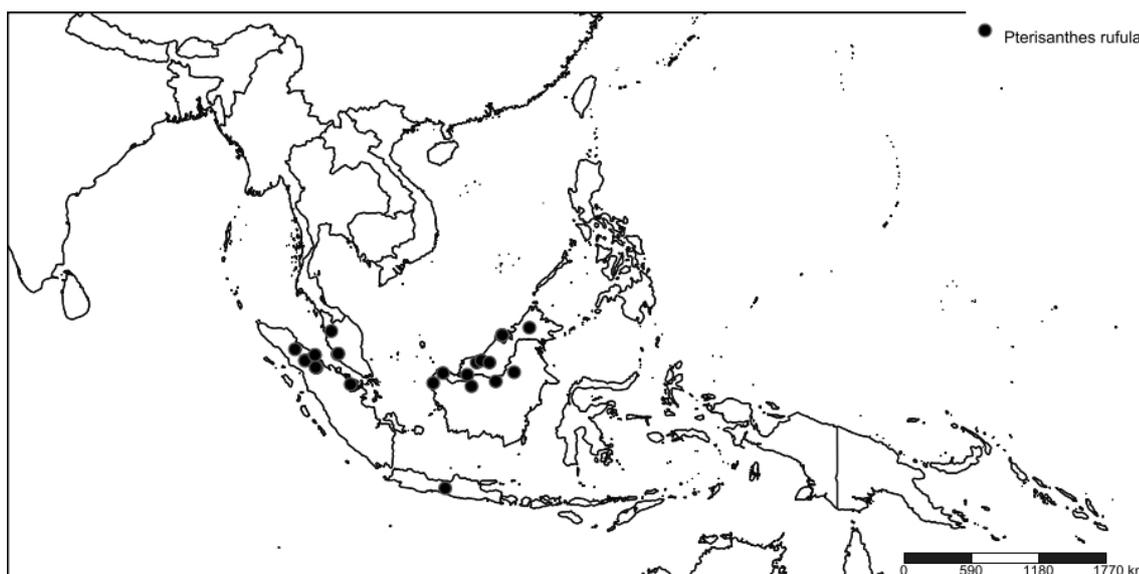


Fig. 12. Distribution map of *Pterisanthes rufula* (Miq.) Planch.

3078)); Lundu, G. Gading, 1°40'18.59"N, 109°51'11.72"E, 11 April 1961, fruiting, *Pa'ie*, I. 13593 (K (K004493079), L (L0671997)); Miri, Lambir Hills F. R., 4°11'54.14"N, 114°2'34.34"E, 500 ft, 5 June 1961, fruiting, *Dan bin Hj. Bakar* 3028 (K (K004493080), L (L0672002)); Bidi Cave, 4°2'33.5"N, 114°48'45"E, 18 October 1929, flowering, *M. & Clemens*, J. 20616 (K (K004493081)); Lundu, 1st Division, Gunong Gading, 683 m, 1°42'22"N, 109°49'32"E, 2,240 ft, 22 September 1974, flowering, *Mamit*, J. S. 35129 (K (K004007102), L (L0672010)); South side of Bungoh range, near summit, 1°15'31"N, 110°8'13"E, 5 December 1959, flowering, *J. A. R. A., Ilias & Dawos*, J. S. 29311 (K (K004493083), L (L2338526)). SINGAPORE. Jurong Road, 15th Mile, (1°21'16"N, 103°43'37"E), 19 December 1932, flowering, *Corner*, E. J. H. s.n. (K (K004492962)); Bukit Mandai, (1°24'44"N, 103°43'37"E), January 1894, flowering, *Ridley*, H. N. s.n. (K (K004492963)); Sana, Sungei Tau, 28 May 1956, fruiting, *Purseglove*, J. W. P. 5128 (K (K004493082)).

7. *PTERISANTHES RUFULA* (Miq.) Planch. – Monogr. Phan. 5(2): 417 (1887); POWO (2021). – *Vitis rufula* Miq., Ann. Mus. Bot. Lugduno-Batavi 1: 94 (1863). — Type: INDONESIA, Sumatra, in m., Melintang, *Korthals* s.n. (lectotype L (L0013711 image! (Fig. 11)) designated here; isotypes L (L0013708 image!, L0013709 image!, L0013710 image!).

Pterisanthes taeniata Planch., Monogr. Phan. 5 (2): 419 (1887). — Type: MALAYSIA, Borneo, *Beccari* 2264 (holotype FI; isotype K (K000574960!)).

Climber. *Leaves* compound, 3-foliolate or 5-pedate; petiole 2–10 cm long, puberulous to hirsute; central blade elliptic to oblanceolate, 7.5–15

× 2.0–8.0 cm, base obtuse to cuneate, apex acuminate to caudate, margin entire with 0.1–0.6 cm long black teeth; lateral blade elliptic to oblanceolate, 4.0–15.0 × 1.5–6.5 cm, base asymmetrical to oblique, apex acuminate to caudate, margin entire with 0.1–0.6 cm long black teeth; central petiolule 0.5–1, puberulous; lateral petiolule 0.5–1 cm, puberulous; 4–5 pairs of secondary veins. *Inflorescence* with lamellate flowers; peduncle 1.97–3 cm long; primary branch of the inflorescence 1.5–12 cm long; Inflorescence panicle of lamellae, 6.5–21 × 1 cm, oblong.

Distribution. Sumatra, Peninsular Malaysia, Borneo (Fig. 12).

Vernacular Names. Akar tasak (Sumatra).

Conservation status. Using GeoCAT (Bachman *et al.*, 2011), we calculated an EOO of 1,598,361.049 km² and an AOO of 108,000 km² for this species. As this species is very widespread in its distribution, it is likely that the AOO has been overestimated. Therefore, this species is likely to be categorized as Least Concern (IUCN, 2023).

Notes. Four specimens thought to be syntypes of *P. rufula* were found at L. We selected the specimen in the best condition and portraying the characteristics of the species.

Specimens examined. INDONESIA. Sumatra, North Sumatra, Bukit Lawang. Bohorok. Langkat, 3°33'19"N, 98°08'41"E, 1,640 ft, 27 November 1973, flowering, *Soedarsono* 389 (K (K004493116)); North Sumatra, Bukit Lawang. Bohorok. Langkat, 3°33'19"N, 98°08'41"E, 1,476 ft, 27 November 1973, fruiting, *Soedarsono* 388 (K (K0044



Fig. 13. Holotype of *Pterisanthes stonei* Latiff.

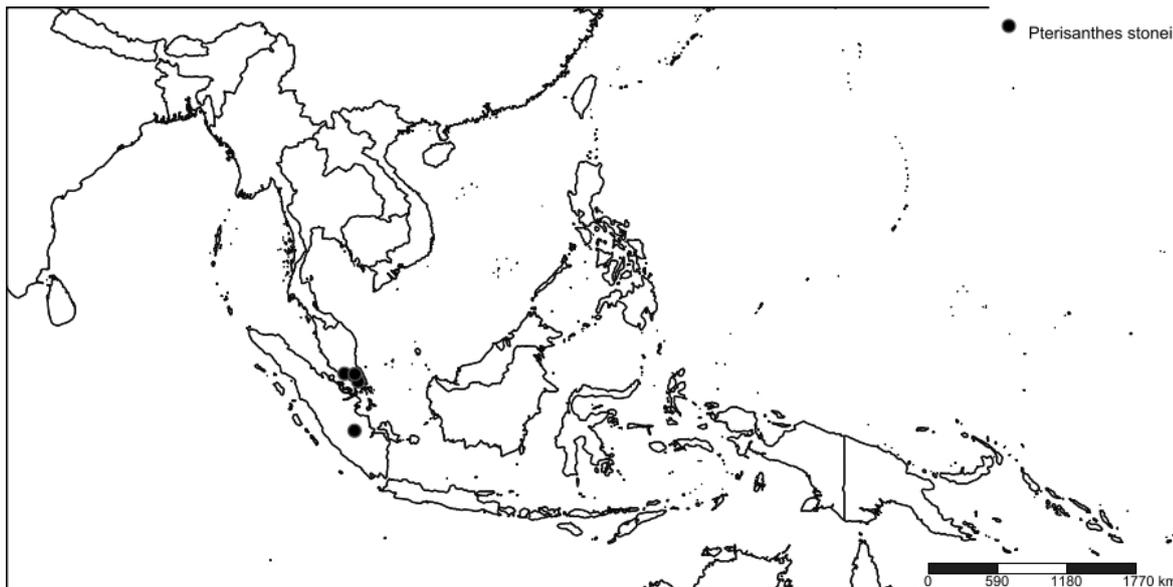


Fig. 14. Distribution map of *Pterisanthes stonei* Latiff.

93117)); North Sumatra, Bukit Lawang. Bohorok. Langkat, 3°33'19"N, 98°08'41"E, 1,476 ft, 27 November 1973, flowering, *Soedarsono 332* (K (K004493117)); flowering, *Korthals s.n.* (K (K004493119)). MALAYSIA. Malay Peninsula, Selangor, 1899, flowering, *Ridley, H. N. 10204* (K (K004492982)); Selangor, Sungai Buluh, 3°12'36"N, 101°33'39"E 1 August 1908, flowering, *Ridley, H. N. 13348* (K (K004492983)); August 1880, flowering, *Dr. King's Collector 678* (K (K004492984)). Sarawak, Bintulu Division, Bukit Kana, Ulu Sg. Sangan, Tatau, 2°40'00"N, 112°52'00"E, 14 October 1994, fruiting, *Yii Puan Ching et al. S.67049* (K (K004493107)); Base camp to Bt. Sadok, 1°31'59"N, 111°45'00"E, 14 October 1982, fruiting, *Ilias Paie & Manggi S.45013* (K (K004493108)); 1865–68, flowering, *Beccari, O. 2264* (K (K000574960)). BRUNEI. Belait, Sungai Liang Arboretum Recreation Park, 4°40'00"N, 114°28'58"E, 82 ft, 6 May 1996, flowering, *Joffre Hj Ali Ahmad & Ariffin Kalat BRUN 17443* (K (K004493109)); Tutong, Ulu Tutong, Bukit Bahak. Vicinity of LP338A, 4°22'51"N, 114°50'13"E, 426 ft, 13 December 1991, flowering, *Kirkup, D. W., Coode, M., Niga, SoePaing, Ariffin, Ibrahim, Jangarun, Shanani 513* (K (K004493110)); Belait, Bukit Sawat. Andulau Forest Reserve, 4°34'59"N, 114°32'60"E, 164 ft, 3 July 1996, flowering, *Said, I. M., Niga Nangkat, Suhaili H. Zinin, Ibrahim Abdullah & Han Sing BRUN 16202* (K (K004493111)); Belait, Sungai Liang, Arboretum Reserve, 4°41'00"N, 114°30'07"E, 3 January 1988, fruiting, *Wong, K. M. WKMI* (K (K004493112)); Belait, Sungai Liang, Arboretum Reserve, 4°41'00"N, 114°30'07"E, 16 May 1988, fruiting, *Wong, K. M. WKMI26* (K (K004493113)); Belait, Sungai Liang Arboretum, 4°41'00"N, 114°30'07"E, 26 October 1989, flowering, *Forman, L.L. & Blewett, J. B. J. 1089* (K (K004493114, K004493115)).

8. PTERISANTHES STONEI Latiff. – Fed. Mus. J. 27: 51 (1982). — Type: MALAYSIA, Malay Peninsula, Johor, 19–23 February 1969, *Jumali & Heaslett s.n.* (holotype SING (SING0390773 image! (Fig. 13))).

Climber. *Stem* hairy. *Leaves* compound, 3-foliolate; petiole 5.6–8.4 cm; central blade elliptic to rhombic, 11.3–15.2 cm × 3–5 cm, base acute, apex acuminate, margin sinuate with teeth; lateral blade oblong, 9.3–14.8 cm × 2.8–4 cm, base oblique, apex acuminate, margin sinuate with teeth; petiolules 0.6–1.1 cm long; indumentum of the upper surface of the leaf hairy and rough, indumentum of the lower surface of the leaf heterotrichous; 8–9 pairs of secondary veins. *Inflorescence* pedicellate and lamellate flowers; peduncle length 2 cm; primary branch of the inflorescence length 13 cm; Inflorescence panicle of lamellae, 13 × 5 cm.

Distribution. Malay Peninsula and Sumatra (Fig. 14).

Conservation status. It has an AOO of 28,414.267 km² and the EOO is 16,000 km² (GeoCAT (Bachman *et al.*, 2011)). This species is suggested to be classified as Near Threatened or Endangered, respectively. However, the specimens occur mostly in forested areas, where no threats are apparent. We also lack information on fragmentation, decline, and extreme fluctuations of the populations. Therefore, the most appropriate categorization of this species is as Data Deficient (IUCN, 2023).

Specimens examined. INDONESIA. Sumatra, Jambi, Harapan Rain Forest, Simpang Tanding (Km. 38), (2°2'49"S, 103°18'40"E), 30 March



Fig. 15. Holotype of *Pterisanthes sumatrana* Latiff (Meijer 7134).

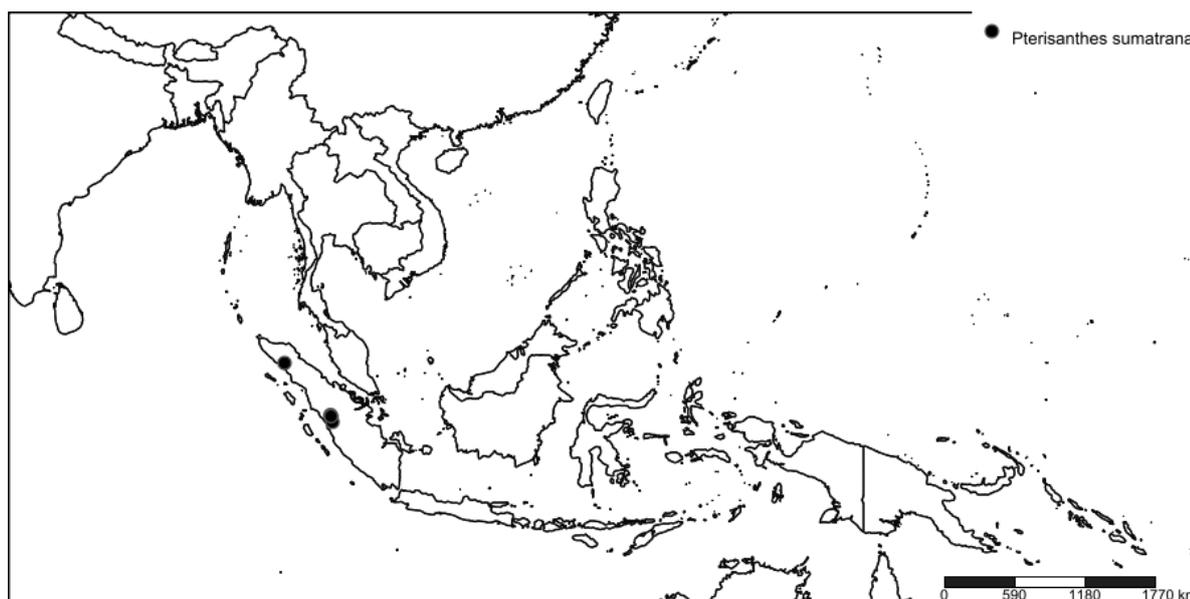


Fig. 16. Distribution map of *Pterisanthes sumatrana* Latiff.

2013, flowering, *Wardi, Ruhiyat, de Kok, R., Drinkell, C. BOHK374* (BO (BO1909587), K (K000734623), E (E00622131)); Jambi, Kabupaten Batangharu, SPAS, 50 m (2°11'1"S, 103°22'15"E) 6 April 2008, fruiting, *de Kok, R. Rdk 1295* (K (K000576271)). MALAYSIA. Malay Peninsula, Johore, Bukit Lemanoh forest reserve, (2°27'3"N, 103°13'30"E), 19 February 1969, flowering, *Jumali & Heaslett, E.A. s.n.* (SING (54669)).

9. *PTERISANTHES SUMATRANA* Latiff. – Fed. Mus. J. 27: 61 (1982). — Type: INDONESIA, Sumatra, base of Gunung Nantigo, near Mount Sago, 17 July 1957, *Meijer, W. 7134* (holotype L (L2338074 image! (Fig. 15))).

Climber. *Stem* cylindrical, glabrous to sparsely hairy. *Leaves* compound, 3-foliolate; petiole 1.1–3 cm long; central blade lanceolate, 7.1–10.2 × 2–3.1 cm, base obtuse (rounded), apex acuminate to apiculate (with a short, sharp tip), margin entire, with a hook-like teeth; central leaflet blade lanceolate, 7.1–10.2 × 2.0–3.1, base obtuse (rounded), acuminate to apiculate, margin entire, with hook-like teeth, lateral blade lanceolate, 6.4–9.2 × 1.7–3.5 cm, base asymmetrical to oblique, apex acuminate-apiculate, margin entire, with hook-like teeth; central petiolule 0.7–2.2 cm long; lateral petiolule 0.3–1.3 cm; indumentum of the upper surface of the leaf glabrous, indumentum of the lower surface of the leaf glabrous; 4–5 pairs of secondary veins. *Inflorescence* with lamellate flowers; peduncle 1.2–3.9 cm long; primary branch of the inflorescence 2.4–6.8 cm long; inflorescence panicle of lamellae, 6.6–11.1 cm, rectangular shaped.

Distribution. Sumatra (Fig. 16).

Vernacular names. Sumatra vine.

Conservation status. Using GeoCAT (Bachman *et al.*, 2011), we calculated an EOO of 7,874.584 km² and an AOO of 20,000 km² for this species and consists of 5 localities, mainly in the Gunung Sago range (between Payakumbuh and Bukittinggi). Based on the IUCN Red List criteria (IUCN, 2012), and as the habitat of *P. sumatrana* is affected by human activities and is in decline, we propose a conservation status of Endangered (EN) B2ab (i,ii,iii).

Notes. *Pterisanthes sumatrana* is similar to *P. rufula* in general appearance but differs in the rectangular shape of the lamellae (Latiff, 1982) and the oblong shape of the lateral leaflet blade.

Specimens examined. INDONESIA. Sumatra, Aceh, Gunung Leuser. P. T. Hargas logging concession, S. of the road Sibulussalam-Gelombang, just N. of the crossing, 50 m 3°44'27"N, 97°9'17"E, 164 ft, 6 September 1989, flowering, *de Wilde, W. J. J. O. & de Wilde-Duyfjes, B. E. E. s.n.* (BO (BO0120043)); West Sumatra, G. Nantigo, near Mt. Sago, 0°23'12"S, 100°41'20"E, 2,952 ft, 17 July 1957, *Meijer, W. 7134* (L (L0715712)); Bukit Tinggi, afd. L. Kolo, 1,100 m, 0°19'S, 100°22'E, 3,608 ft, 18 June 1918, *Bünnemeijer HAB, 3023* (L (L0715713)); Mt. Sago near Payakumbuh, 0°18'27"S, 100°43'1"E, 2,952 ft, 28 February 1957, *Maradjo, P. 442* (L (L0715710)); Sumatra Barat, Batu Badinding, G. Sago, Lubak, Payakumbuh, 0°20'54"S, 100°30'53 "E, 3,937 ft, 7 April 1983, *Sarkat Danimihardja 2333* (L (L0715709)).

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REFERENCES

- BACHMAN, S., MOAT, J., HILL, A.W., DE LA TORRE, J. & SCOTT, B. 2011. Supporting Red List threat assessments with GeoCAT: Geospatial conservation assessment tool. *ZooKeys* 150: 117–126.
- BLUME, K. L. 1825. *Pterisanthes*. Bijdragen tot de Flora van Nederlandsch Indie 4: 192.
- IUCN. 2023. The IUCN Red List of Threatened Species. Version 2023-1. <https://www.iucnredlist.org>. (Accessed on 17 March 2025).
- LATIFF, A. 1982. Studies in Malesian Vitaceae, I–IV. *Federation Museum Journal* 27: 41–69.
- LATIFF, A. 1987. Portraits of threatened plants. 13. *Pterisanthes pulchra* Ridl. *Malayan Naturalist* 41(2): 26.
- LATIFF, A. 2001. Diversity of the Vitaceae in the Malay Archipelago. *Malayan Nature Journal* 55(1–2): 29–42.
- LECONTE, J. E. 1854. Vitaceae. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 1854: 272.
- LIU, X., ICKERT-BOND, S. M., NIE, Z., ZHOU, Z., CHEN, L. & WEN, J. 2015. Phylogeny of the *Ampelocissus*–*Vitis* clade in Vitaceae supports the New World origin of the grape genus. *Molecular Phylogenetics and Evolution* 95: 217–228.
- MA, Z., NIE, Z., REN, C., LIU, X., ZIMMER, E. A. & WEN, J. 2021. A new phylogenetic tribal classification of the grape family (Vitaceae). *Molecular Phylogenetics and Evolution* 154: Art. 106948.
- MIQUEL, F. A. W. 1861. Ampelideae. Flora van Nederlandsch Indie. Suppl. 1: 514–518. Van der Post, Utrecht.
- MIQUEL, F. A. W. 1863. *Annales Musei Botanici Lugduno-Batavi*, I. Van der Post, Amsterdam.
- MUSTAQIM, W. A. & PUTRA, H. F. 2020. *Thottea tapanuliensis* (Aristolochiaceae): a new species from Sumatra, Indonesia. *Telopea* 23: 163–168.
- PLANCHON, J. E. 1887. Monographie des Ampélidées vrais. In: DE CANDOLLE, A. F. P. & DE CANDOLLE, C. (Eds.). *Monographiae Phanaerogamarum*, 5. G. Masson, Paris. Pp. 305–654.
- POWO. 2024. Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. <https://powo.science.kew.org/>. (Accessed 11 December 2024).
- STEVENS, P. F. 2001-onwards. Angiosperm Phylogeny Website. Version 14, July 2017 [and more or less continuously updated since]. <http://www.mobot.org/MOBOT/research/APweb/>. (Accessed on 17 March 2025).
- TRIAS-BLASI, A., PARNELL, J. A. N. & HODKINSON, T. R. 2012. Multi-gene region phylogenetic analysis of the grape family (Vitaceae). *Systematic Botany* 37(4): 941–950.
- TRIAS-BLASI, A., CHAYAMARIT, K., TEE-RAWATANANON, A. & PARNELL, J. A. N. 2014. A taxonomic revision of *Pterisanthes* (Vitaceae) in Thailand and a new Thai record for *Pterisanthes cissioides*. *Phytotaxa* 159(2): 95–104.
- VAN STEENIS, C. G. G. J. & BAKHUIZEN VAN DEN BRINK, R. C. 1967. Miscellaneous botanical notes XVI. 104: Two new Bornean *Pterisanthes* (Vitaceae). *Engler's Botanische Jahrbücher* 86: 385–390.
- WEN, J. 2007. *Vitaceae*. In: KUBITZKI, K. (Ed.). *The Families and Genera of Vascular Plants*. 14 Vol. 9. Springer-Verlag, Berlin. Pp. 466–478.
- WEN, J., NIE, Z. -L., SOEJIMA, A. & MENG, Y. 2007. Phylogeny of Vitaceae based on the nuclear GAI1 gene sequences. *Canadian Journal of Botany* 85: 731–745.
- WEN, J., LU, L., NIE, Z., LIU, X., ZHANG, N., ICKERT-BOND, S., GERRATH, J., MANCHESTER, S. R., BOGGAN, J. & CHEN, Z. 2018. A new phylogenetic tribal classification of the grape family (Vitaceae). *Journal of Systematics and Evolution* 56(4): 162–272.

SYNTHESIS OF *BUCEPHALANDRA* SCHOTT (ARACEAE: SCHISMATOGLOTTIDEAE) STUDIES IN KALIMANTAN, INDONESIA: CHECKLIST, KEY, AND UPDATED DISTRIBUTION MAPS

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ABSTRACT

YUZAMMI, ERLINAWATI, I., ASIH, N. P. S., DAMAYANTO, I. P. G. P., SUMADIJAYA, A., SULISTYANINGSIH, L. D., ARDIYANI, M., RUSTIAMI, H., WITONO, J. R., KEIM, A. P. & RAYHANNISA. 2025. Synthesis of *Bucephalandra* Schott (Araceae: Schismatoglottideae) studies in Kalimantan, Indonesia: checklist, key, and updated distribution maps. *Reinwardtia* 24(2): 185–198. — *Bucephalandra*, a member of the Araceae family, is an endemic rheophyte genus of Borneo. The majority (26 out of the 32 species) of this genus, are found in Indonesian Borneo (Kalimantan). *Bucephalandra oblanceolata* (M.Hotta) S.Y.Wong & P.C.Boyce, previously known from Brunei and Sarawak, has been identified in Kalimantan. This study presents a comprehensive overview of *Bucephalandra* in Kalimantan, accompanied by a detailed map and an identification key.

Key words: Araceae, *Bucephalandra*, checklist, Kalimantan, rheophyte, synopsis.

ABSTRAK

YUZAMMI, ERLINAWATI, I., ASIH, N. P. S., DAMAYANTO, I. P. G. P., SUMADIJAYA, A., SULISTYANINGSIH, L. D., ARDIYANI, M., RUSTIAMI, H., WITONO, J. R., KEIM, A. P. & RAYHANNISA. 2025. Sintesis *Bucephalandra* Schott (Araceae: Schismatoglottideae) di Kalimantan, Indonesia: daftar jenis, kunci identifikasi, dan pemutakhiran peta distribusi. *Reinwardtia* 24(2): 185–198. — Marga *Bucephalandra* merupakan tumbuhan reofit dari suku Araceae, dengan penyebaran hanya di Borneo. Sebagian besar *Bucephalandra* (26 dari 32 jenis) terdapat di Kalimantan. *Bucephalandra oblanceolata* (M.Hotta) S.Y.Wong & P.C.Boyce yang sebelumnya hanya tercatat di Brunei dan Sarawak, kini ditemukan juga di Kalimantan. Studi ini menyajikan gambaran umum yang komprehensif mengenai *Bucephalandra* di Kalimantan, disertai dengan peta terperinci dan kunci identifikasi.

Kata kunci: Araceae, *Bucephalandra*, daftar jenis, Kalimantan, reofit, sinopsis.

INTRODUCTION

The island of Borneo hosts the most diverse aroid flora in Southeast Asia, encompassing multiple genera and numerous endemic species. Among them, *Bucephalandra* is one of the endemic genera with 32 species distributed in the island (Wong *et al.*, 2022; Boyce & Croat, 2023; POWO, 2025). This genus was first described by Schott in 1858, based on a specimen collected by J. Motley in Kalimantan, later named *Bucephalandra motleyana* Schott. Motley first collected and documented this species in 1854 (Nugraha *et al.*, 2020). As an administrator of the Julia Hermina coal mine, he was keenly interested in botany and frequently sent plant specimens from Labuan, Borneo—including *Bucephalandra*—to Europe, also to Kew Herbarium (K), where the holotype specimen is deposited. In recognition of his contributions, *B. motleyana* was named in commemoration of his role as the first collector of this aquatic plant endemic to South Kalimantan (Boyce & Wong, 2012).

Over the past 160 years, this taxon has been extensively documented and studied. The extensive genetic diversity of *Bucephalandra* represents a valuable component of biodiversity, offering potential economic benefits. Due to its aesthetic appearance, *Bucephalandra* has gained popularity as an ornamental plant in aquariums. It can be cultivated in small pots with moist sand and abundant water to simulate its natural habitat. Additionally, it thrives in humid environments, such as rice fields, provided its roots remain consistently moist (Boyce, 1995). With a wide range of morphological characteristics, *Bucephalandra* has several

trade names. The trade names of *Bucephalandra* species are highly diverse, often driven by morphological differences (inflorescences and leaves) influenced by habitat conditions such as light intensity and growth substrate (soil, water, or rock). In recent years, several species of *Bucephalandra* have been commercially traded under the name “rheophyte”. As rheophytic plants, they exhibit remarkable adaptability, perennial growth, extensive root systems and rugged, streamlined leaves. However, the commercial utilization of this plant often lacks proper taxonomic understanding. Difficulties in recognizing members of *Bucephalandra* are apparent with the chronology of any misidentifications that may have occurred.

To facilitate identification of *Bucephalandra*, Boyce & Wong (2012) proposed a morphological key based on several characteristics: (1) the structure of the appendix staminodes, particularly surface ornamentation; (2) the shape and three-dimensional arrangement of the staminode filaments; (3) the insertion, orientation, and surface texture of the thecae; (4) the orientation, posture, and relative length of the thecae horns; (5) the shape and ventral surface topology of shield-shaped staminodes; (6) the shape and colouration of the pistils; and (7) the morphology of the sub-pistillar staminodes. In addition to the work of Wong & Boyce (2014), continued research into species diversity, identification, and morphological traits is crucial for accurately documenting the aquatic plant trade. The goal of this publication is to address the current taxonomic issues by generating an infrageneric classification and improving the species key of the genus *Bucephalandra*, exclu-

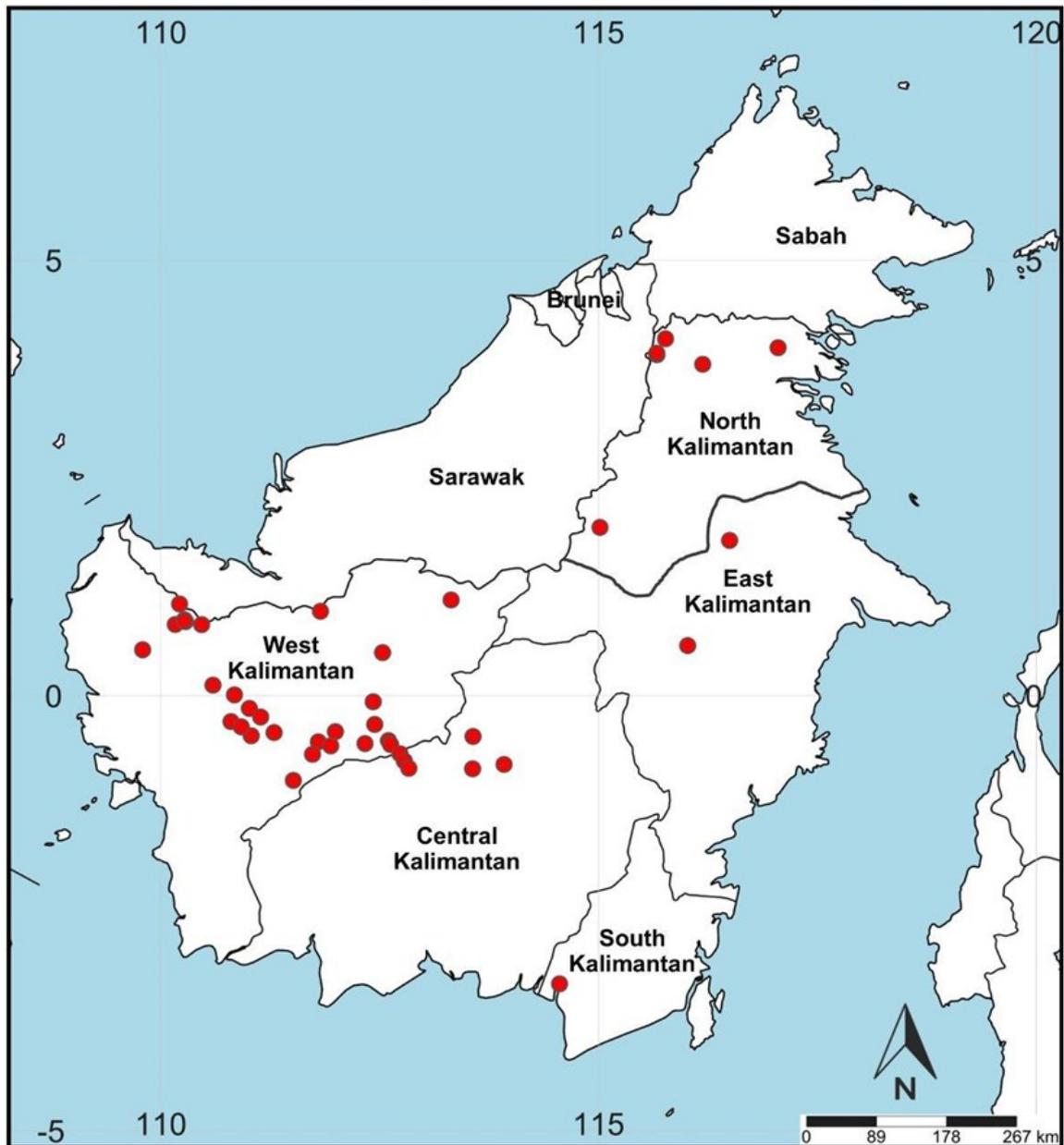


Fig 1. Distribution of all species of *Bucephalandra* in Kalimantan.

sively 26 species in Kalimantan, which were not included in previous publications.

MATERIALS AND METHODS

Study Area, Specimen Materials, and Literature Review

This study focused on *Bucephalandra* species across Kalimantan, Indonesia, with particular emphasis on regions where the genus is known to thrive, such as riverbanks, forest streams, and flood-prone terrestrial areas. Historical and recent herbarium specimens from institutions such as Herbarium Bogoriense (BO), Kew (K), and Naturalis (L) were examined to verify species identities and distributions. Literature reviews included taxonomic

revisions, floristic treatments, and ecological studies related to *Bucephalandra* species.

Morphological Characterization, Identification Key Development, and Distribution Mapping

Specimens were characterized using standard taxonomic methods. Key morphological characters were listed, including vegetative traits (plant height, leaf shape [oblong, obovate, and lanceolate], leaf margin [smooth, undulate, and crispulate], and substrate adaptation) and reproductive traits (inflorescence structure [spathe and spadix], staminode arrangement, thecae horn orientation, and pistil morphology). The key was refined using comparative analysis of specimens and type mate-

rial. Geographic coordinates from field collections and herbarium records were used to generate distribution maps (Figs. 1–7) using SimpleMapp (Short-house, 2010).

RESULTS AND DISCUSSION

Kalimantan, Indonesia, is a biodiversity hotspot for the genus *Bucephalandra*, harboring 26 species of *Bucephalandra*, 20 of which are endemic (Fig. 1). This accounts for approximately 81% of the total 32 species recorded in Borneo (see Wong *et al.*, 2022). There are six species of *Bucephalandra* (*B. akantha*, *B. kerangas*, *B. micrantha*, *B. oblan- ceolata*, *B. pygmaea*, and *B. spathulifolia*) that also present beyond Indonesian Borneo. In addition, we list two species, *i.e.* *B. akantha* and *B. kerangas*, previously recorded exclusively in Sarawak, also occur in Kalimantan, based on Wong &

Boyce (2014). A new record for Kalimantan has been documented: *B. oblan- ceolata*, recorded in North Kalimantan based on a herbarium specimen (Dewi Lestari 327). Previously, this species was only reported from Brunei Darussalam and Sarawak (Wong & Boyce, 2014). This was originally described as *Microcasia oblan- ceolata* M.Hotta and later transferred to *Bucephalandra* by Wong & Boyce (2014).

In this study, the 26 *Bucephalandra* species in Kalimantan are treated as one group. At the moment, we are unsuccessful in splitting these species into informal groups as in *Alocasia* (Hay, 1998; Asih *et al.*, 2024), *Rhaphidophora* (Boyce, 2001; Boyce & Haigh, 2016), and *Homalomena* (Ng *et al.*, 2011). The limited range of morphological characters, as a result of limited sampling across species, unfortunately, does not fulfill the division into informal groups.

Key to the species of *Bucephalandra* in Kalimantan

- 1a. Herb below 30 cm tall 2
- 1b. Herb 30 cm tall or above 24
- 2a. Habitat exclusively in heath forest (kerangas) 12. *B. kerangas*
- 2b. Habitat favouring riparian areas 3
- 3a. Leaves in rosettes, creeping and forming dense carpet 4
- 3b. Leaves ascending to erect, not in rosettes 9
- 4a. Blade very narrowly oblong-linear 5
- 4b. Blade obovate to elliptic 8
- 5a. Interprimary veins invisible or nearly invisible 6
- 5b. Interprimary veins visible, pale coloured 7
- 6a. Interprimary veins invisible, structure of interstice 2 or 3 rows scale-like staminodes
..... 15. *B. micrantha*
- 6b. Interprimary veins nearly invisible, structure of interstice a single row scale-like staminodes
..... 4. *B. belindae*
- 7a. Blade relatively thin, margin usually weakly undulate 8. *B. diabolica*
- 7b. Blade relatively thick, margin somewhat recurved 24. *B. tetana*
- 8a. Blade adaxial semi-glossy, margin usually straight 21. *B. pygmaea*
- 8b. Blade adaxial olive green, margin undulate to crispulate 22. *B. sordidula*
- 9a. Ligule absent 10
- 9b. Ligule narrow to narrowly triangular 12
- 10a. Blade lanceolate, size up to 12 cm long, *ca.* 2.5 cm wide 14. *B. magnifolia*
- 10b. Blade not lanceolate, size up to 8 cm long, *ca.* 2.8 cm wide 11
- 11a. Blade coriaceous, interstice with up to 2 rows of flat, trapeziform to obovate 17. *B. motleyana*
- 11b. Blade strongly coriaceous, interstice with 1 row of flat, obovate 5. *B. catherineae*

Key to the species of *Bucephalandra* in Kalimantan (continued)

- 12a. Leaves spreading, petiole scabrid 13
- 12b. Leaves (sub) erect to arching, petiole not scabrid 15
- 13a. Blade ovate to broadly elliptic, up to 9.5 cm long, *ca.* 4.5 cm wide 19. *B. oncophora*
- 13b. Blade narrowly elliptic to oblong lanceolate, up to 12 cm long, *ca.* 2 cm wide 14
- 14a. Inflorescence several together 20. *B. pubes*
- 14b. Inflorescence solitary 25. *B. vespula*
- 15a. Blade oblong-spathulate, midrib abaxially weakly ridged 23. *B. spatulifolia*
- 15b. Blade elliptic or lanceolate or ovate, midrib abaxially prominent 16
- 16a. Blade adaxially very dark reddish black or purple-green, primary lateral veins very prominent adaxially 13. *B. kishii*
- 16b. Blade adaxially medium to dark green, margin usually straight, primary lateral veins flush with blade adaxially 17
- 17a. Appendix cylindrical 18
- 17b. Appendix globose to subglobose 21
- 18a. Appendix tip blunt, staminodes obpyramidal 19
- 18b. Appendix tip tapering, staminodes trapezoidal 20
- 19a. Appendix staminodes surfaces papillate; filament stout; connective arching, thecae horns pointing horizontally 1. *B. adei*
- 19b. Appendix staminodes surfaces smooth; filament slender; connective semi-terete, thecae horn upward-turned 16. *B. minotaur*
- 20a. Inflorescence up to three together; peduncle with numerous bright reddish speckles; pistils arranged in 3–5 spirals 3. *B. aurantiithecra*
- 20b. Inflorescence solitary; peduncle suffused reddish brown with dark red ridges; pistils arranged in *ca.* 3 rows 6. *B. chimaera*
- 21a. Appendix 15–20 mm long × 6–7 mm in diam., upper surface of staminodes smooth and slightly glossy 11. *B. goliath*
- 21b. Appendix 4–6 mm long × 3–4 mm in diam., upper surface of staminodes echinate 22
- 22a. Flowers in *ca.* 2 rows, pistillodes absent; staminate zone 2–3 mm long × *ca.* 3.5 mm in diam. 7. *B. chrysokoupa*
- 22b. Flowers in 3–5 rows, pistillodes present; staminate zone 3–5 mm long × 2–3 mm in diam. 23
- 23a. Pistillate zone 2.5–3 mm long × *ca.* 2 mm in diam., pistils cylindric-globose, arranged in 3 spirals; thecae horns spreading to slightly downward-directed 2. *B. akantha*
- 23b. Pistillate zone *ca.* 5 mm long × *ca.* 3 mm in diam., pistils rhombic-globose, arranged in *ca.* 4 spirals; thecae horns upward-directed 26. *B. yengiae*
- 24a. Spathe narrowly ovate, 8–10 cm long; pistillate zone 4–7 mm long × *ca.* 7 mm in diam.; appendix bullet-shaped 9. *B. forcipula*
- 24b. Spathe ovate to oblong-ovate, 2.5–4 cm long; pistillate zone 3–5 mm long × 1.5–3 mm in diam.; appendix cylindrical 25
- 25a. Stigma disc-like, pistilloides absent; thecae horns, 1.3–1.8 mm long, directed upwards 10. *B. gigantean*
- 25b. Stigma umbonate, pistilloides present; thecae horns very short *ca.* 0.3 mm long, directed outwards 18. *B. oblanceolata*

TAXONOMIC TREATMENT

BUCEPHALANDRA Schott, Gen. Aroid.: t. 56 (1858) — Type: *Bucephalandra motleyana* Schott = *Microcasia* Becc. in Bull. Reale Soc. Tosc. Ortic. 4: 180, fig. 8. 1879.

1. BUCEPHALANDRA ADEI S.Y.Wong, Hii & P.C.Boyce, J. Pl. Taxon. & Geogr. (Webbia) 77: 136 (2022). — Type: INDONESIA, Kalimantan Barat, Ngabang, Landak, Riam Desa Sungai Durian, 0°31'41"N 109°47'39"E, 45 m asl., 27 Jul. 2017, *A. A. Setiawan AR-2766* (holotype: SAR + spirit, isotype: BO + spirit).

West Kalimantan: Ngabang, Landak, Riam Desa Sungai Durian (Fig. 2).

2. BUCEPHALANDRA AKANTHA S.Y.Wong & P.C.Boyce. — Type: MALAYSIA, Sarawak, Bahagian Kuching, Padawan, Annah Rais, Kampung Sadir, Air Terjun Sadir, 01°06'28.3"N, 110°16'47.1"E, 6 Apr. 2012, *P. C. Boyce et al. AR-3863* (holotype: SAR, isotypes: SBC, SING).

West Kalimantan: Kabupaten Sanggau, Kecamatan Entikong (Fig. 2).

3. BUCEPHALANDRA AURANTIITHECA S.Y. Wong & P.C.Boyce, Willdenowia 44: 153 (2014). — Type: INDONESIA, Kalimantan Barat, Kabupaten Sekadau, Kecamatan Nanga Taman, SE of Manterahidup, 00°08'45.2"S, 111°00'47.0"E, 22 May 2012, *K. Nakamoto AR-3937* (holotype: BO, isotypes: SAR, SBC, SING).

West Kalimantan: Kabupaten Sekadau, Kecamatan Nanga Taman, SE of Manterahidup (Fig. 2).

4. BUCEPHALANDRA BELINDAE S.Y.Wong & P.C.Boyce, Willdenowia 44: 155 (2014). — Type: INDONESIA, Kalimantan Barat, Kabupaten Melawi, Kecamatan Nanga Pinoh, 33 km S of Nanga Pinoh and 11 km before Kotabaru junction of logging road to Kalimantan Tengah, 00°31'46.0"S, 111°48'02.4"E, 3 Feb. 2012, *K. Nakamoto AR-3531* (holotype: BO, isotypes: SAR, SBC, SING).

West Kalimantan: Kabupaten Melawi, Kecamatan Nanga Pinoh (Fig. 2).

5. BUCEPHALANDRA CATHERINEAE P.C. Boyce, Bogner & Mayo, Bot. Mag. 12: 152 (1995). — Type: INDONESIA, Kalimantan Utara, Kabupaten Malinau, Kecamatan Kayan Hulu, Apo Kayan, E of Long Nawan, Gunung Sungai Pendan, E ridge, ca. 01°56'N, 115°01'E, 14 Oct. 1991, *E. F. de Vogel & P. J. Cribb 9210* (holotype: L, isotype: K – spirit coll. no 57575).

North Kalimantan: Kabupaten Malinau, Kecamatan Kayan Hulu, Apo Kayan, east of Long Nawan, Gunung Sungai Pendan (Fig. 2).

6. BUCEPHALANDRA CHIMAERA S.Y.Wong & P.C.Boyce, Willdenowia 44: 159 (2014). — Type: INDONESIA, Kalimantan Barat, Kabupaten Sekadau, Kecamatan Nanga Taman, environs of Nanga Taman, 4 Apr. 2012, *K. Nakamoto AR-3846* (holotype: BO, isotypes: SAR, SBC, SING).

West Kalimantan: Kabupaten Sekadau, Kecamatan Nanga Taman, environs of Nanga Taman (Fig. 3).

7. BUCEPHALANDRA CHRYSOKOUPA S.Y. Wong & P.C.Boyce, Willdenowia 44: 161 (2014). — Type: INDONESIA, Kalimantan Utara, Kabupaten Nunukan, Kecamatan Mentarang Hulu, Long Berang, 03°48'25.2"N, 116°11'24.7"E, 18 Jun. 2012, *K. Nakamoto AR-3977* (holotype: BO, isotypes: SAR, SBC, SING).

North Kalimantan: Kabupaten Nunukan, Kecamatan Mentarang Hulu, Long Berang (Fig. 3).

8. BUCEPHALANDRA DIABOLICA S.Y.Wong & P.C.Boyce, Willdenowia 44: 163 (2014). — Type: INDONESIA, Kalimantan Barat, Kabupaten Melawi, Kecamatan Sayan, Bukit Baka-Bukit Raya National Park, Bukit Baka, 00°24'45.2"S, 111°59'43.9"E, 1 Sep. 2012, *M. Lo AR-4027* (holotype: BO, isotypes: SAR, SBC, SING).

West Kalimantan: Kabupaten Melawi, Kecamatan Sayan, Bukit Baka-Bukit Raya National Park, Bukit Baka (Fig. 3).

9. BUCEPHALANDRA FORCIPULA S.Y.Wong & P.C.Boyce, Willdenowia 44: 167 (2014). — Type: INDONESIA, Kalimantan Barat, Kabupaten Sekadau, Kecamatan Nanga Taman, SE of Nanga Taman, Gunung Tajam, E slope, 00°27'35.4"S, 111°02'03.2"E, 5 Feb. 2012, *K. Nakamoto AR-3772* (holotype: BO, isotypes: SAR, SBC, SING).

West Kalimantan: Kabupaten Sekadau, Kecamatan Nanga Taman, SE of Nanga Taman, Gunung Tajam (Fig. 3).

10. BUCEPHALANDRA GIGANTEA Bogner, Pl. Syst. Evol. 145: 159 (1984). — Type: INDONESIA, Central East Borneo, West Koetai, Kiau River, 25 Oct. 1925, *F. H. Endert 4580* (holotype: K!, isotypes: BO!, L!).

East Kalimantan: West Koetai, Kiau River (Fig. 3).

11. BUCEPHALANDRA GOLIATH S.Y.Wong & P.C.Boyce, Willdenowia 44: 169 (2014). — Type: INDONESIA, Kalimantan Barat, Kabupaten Mela-

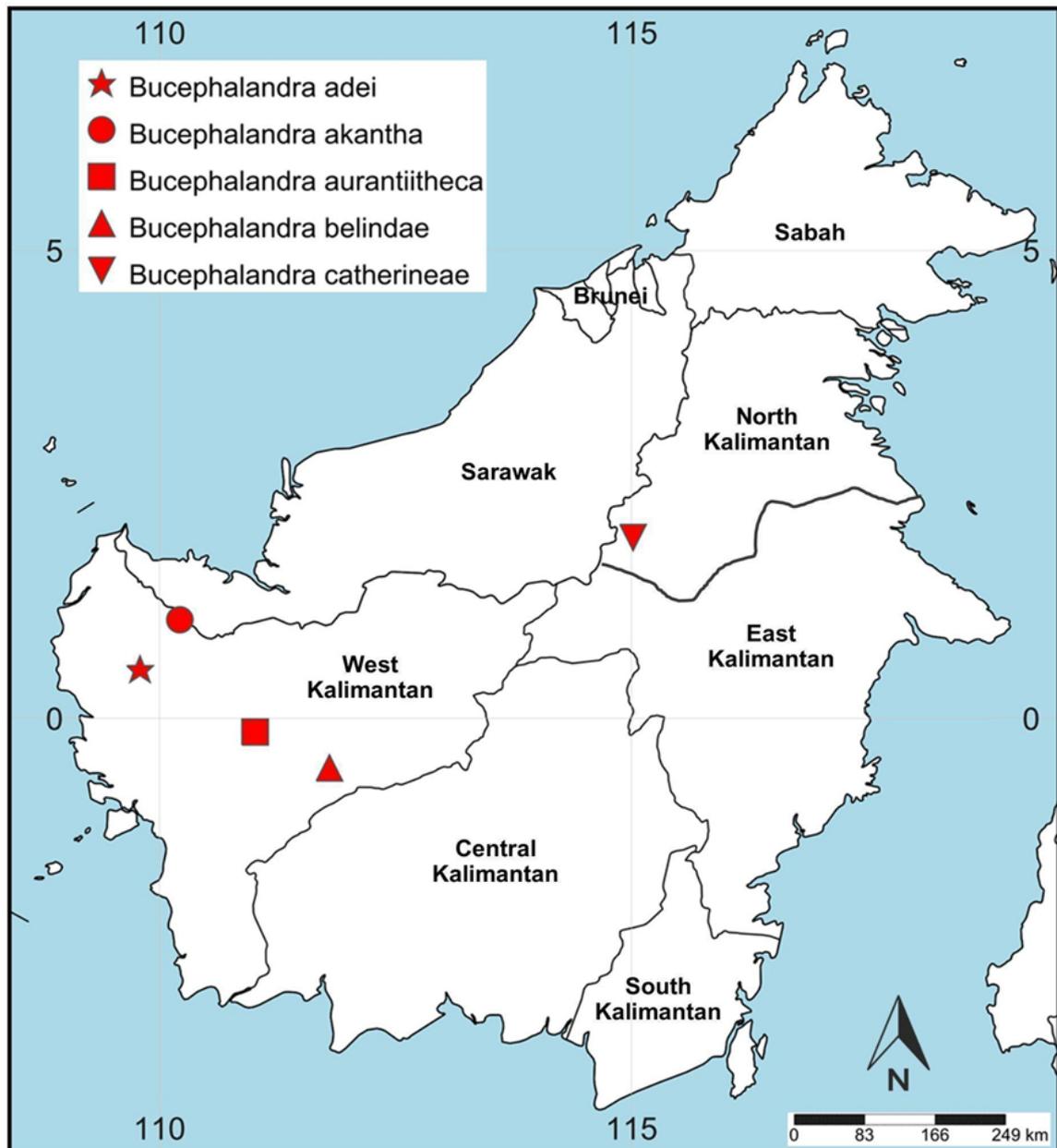


Fig. 2. Distribution of *Bucephalandra adei*, *B. akantha*, *B. aurantiithecra*, *B. belindae*, and *B. catherineae* in Kalimantan.

wi, Kecamatan Nanga Pinoh, Jalan 28.8 km E of Kampong Nyangai, Landau Garong, logging road 25 km S of Nanga Pinoh, Ulu Sungai Reret and Ulu Sungai Sentulang, 00°34'31.9"S, 111°56'30.8"E, 16 Oct. 2012, *K. Nakamoto AR-4040* (holotype: BO, isotypes: SAR, SBC, SING).

West Kalimantan: Kabupaten Melawi, Kecamatan Nanga Pinoh (Fig. 4).

12. BUCEPHALANDRA KERANGAS S.Y. Wong & P.C.Boyce, Willdenowia 44: 171 (2014). — Type: MALAYSIA, Sarawak, Bahagian Samarahan, Simumjan District, Sebuyau, logging road at Sabal, 7 Feb. 1995, *Runi ak Pungga et al. S.71313* (holotype: SAR, isotypes: K, KEP, L, MO, SAN).

West Kalimantan: Kabupaten Kapuas Hulu, Kecamatan Badau, Wong Garai (Fig. 4).

13. BUCEPHALANDRA KISHII S.Y.Wong & P.C.Boyce, Willdenowia 44: 173 (2014). — Type: INDONESIA, Kalimantan Barat, Kabupaten Melawi, Kecamatan Nanga Taman, Kampung Entebah, Gunung Saran, 00°25'24"S, 111°17'42"E, 1,500 m asl, 25 Aug. 2012, *K. Nakamoto AR-4019* (holotype: BO, isotypes: SAR, SBC, SING).

West Kalimantan: Kabupaten Melawi, Kecamatan Nanga Taman, Kampung Entebah, Gunung Saran (Fig. 4).



Fig. 3. Distribution of *Bucephalandra chimaera*, *B. chrysokoupa*, *B. diabolica*, *B. forcipula*, and *B. gigantea* in Kalimantan.

14. *BUCEPHALANDRA MAGNIFOLIA* H.Okada & Y.Mori, Acta Phytotax. Geobot. 51: 4 (2000). — Type: INDONESIA, Kalimantan Utara (“East Kalimantan”), Kabupaten Nunukan (“Bulungan”), Kecamatan Krayan, Long Bawan, Gunung Malim, 03°55'N, 115°40'E (estimated from Google Earth), 11 Sep. 1990, *H. Okada & D. Komara 5024* (holotype: TI, isotype: BO).

North Kalimantan: Kabupaten Nunukan (“Bulungan”), Kecamatan Krayan, Long Bawan, Gunung Malim (Fig. 4).

15. *BUCEPHALANDRA MICRANTHA* S.Y. Wong & P.C.Boyce, Willdenowia 44: 415 (2014). — Type: INDONESIA, Kalimantan Barat, Sintang, Sepauk, Kayu Lapis, village at km 46 on

road to SE of Kayu Lapis, 00°14'39.7"S, 111°08'29.1"E, 10 Dec. 2012, *H. Kishi AR-4080* (holotype: BO [spirit], isotype: SAR [spirit]).

West Kalimantan: Kabupaten Sintang, Sepauk, Kayu Lapis (Fig. 4).

16. *BUCEPHALANDRA MINOTAUR* S.Y.Wong & P.C.Boyce, Willdenowia 44: 175 (2014). — Type: INDONESIA, Kalimantan Barat, Sekadau/Melawi regencies boundary, 115 km S of Nanga Pinoh, 00°58'21.8"S, 111°30'54.4"E (estimated from Google Earth), 22 May 2012, *K. Nakamoto AR-3951* (holotype: BO, isotypes: SAR, SBC, SING).

West Kalimantan: Kabupaten Sekadau/Melawi

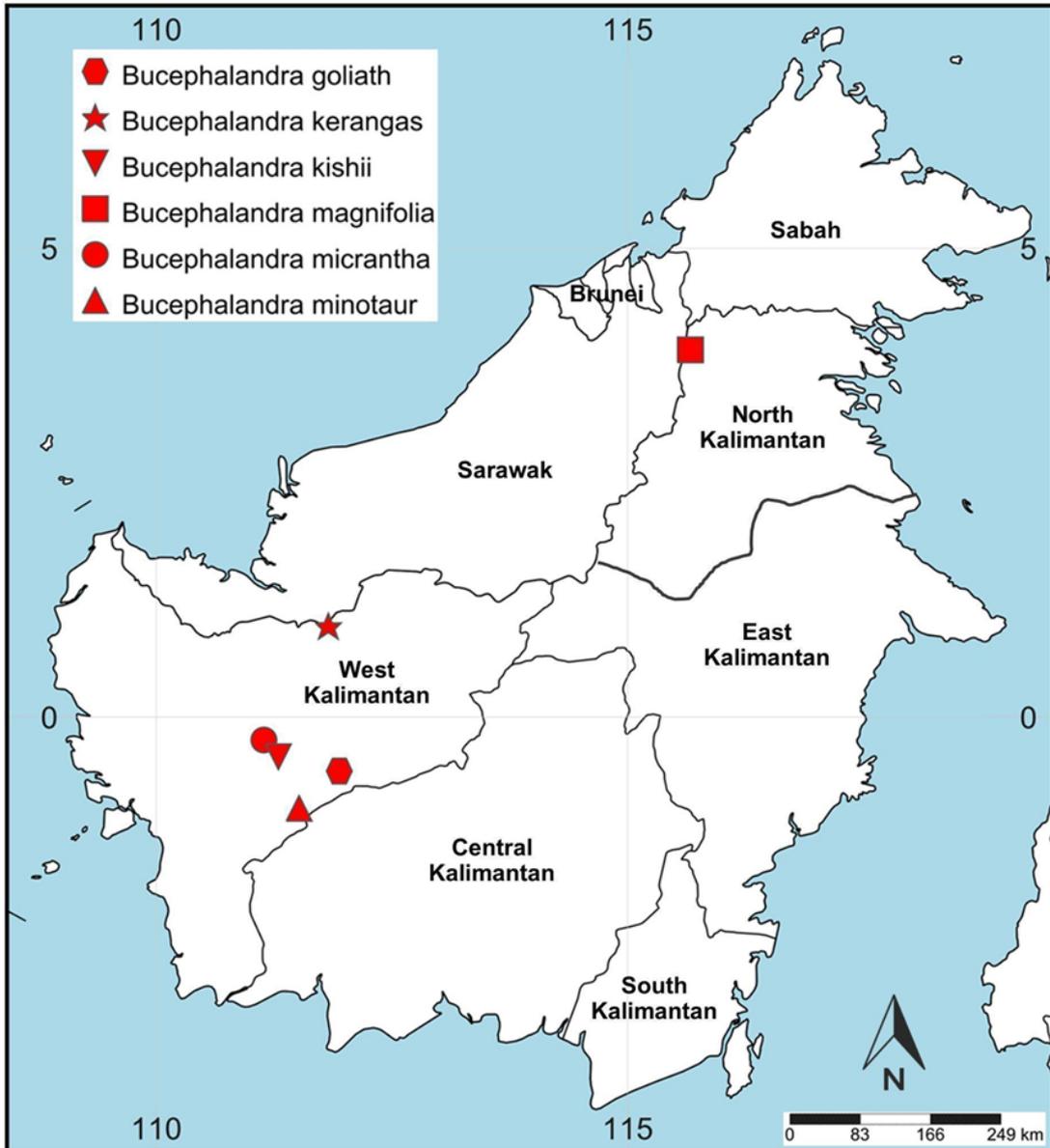


Fig. 4. Distribution of *Bucephalandra goliath*, *B. kerangas*, *B. kishii*, *B. magnifolia*, *B. micrantha*, and *B. minotaur* in Kalimantan.

regencies boundary, 115 km S of Nanga Pinoh (Fig. 4).

17. *BUCEPHALANDRA MOTLEYANA* Schott, Gen. Aroid.: t. 56 (1858). — Type: INDONESIA, Kalimantan Selatan, *J. Motley 404* (holotype K!).

South Kalimantan: Based on type locality. **West Kalimantan:** Betung Kerihun National Park, Putussibau, Harongon river; Ulu Juwoi Deras, near visitor lodge; Serawai, 8 km NE of Desa Jelundung, Batu Lintang; Serawai, Sungai Merah, 1 km to W of camp around S. Labang and surrounding environs; Serawai, 3 km south of Nanga Jelundung, growing beside Sungai Salake, branch of Sungai Serawai; Gunung Bentuang area; Sanggau;

along bank of Sungai Ella, 600 m east of camp, Bukit Baka National Park, Sintang; Sungai Menyakan, upstream of Sungai Sibau, Betung Kerihun National Park, Putussibau, Kapuas Hulu; Sungai Tekelan, Sungai Sabong, branch of Sungai Embaloh, Betung Kerihun National Park, Putussibau, Kapuas Hulu. **Central Kalimantan:** Headwaters of S. Kahayan, 5 km NW of Tumbang Sian logging camp, Sikatan Wana Raya logging concession; Bukit Raya; upper Katingan (Mendawai) River area, upper Samba river, 60–80 km NNW of Tumbang Samba, Base camp Tambang Riang; camp at logging road *ca.* 25 km W of the village Sungai Buluh, Nangabulik, Bulik, Lamandau. **East Kalimantan:** Between Long Bawan and Panado (Fig. 5).

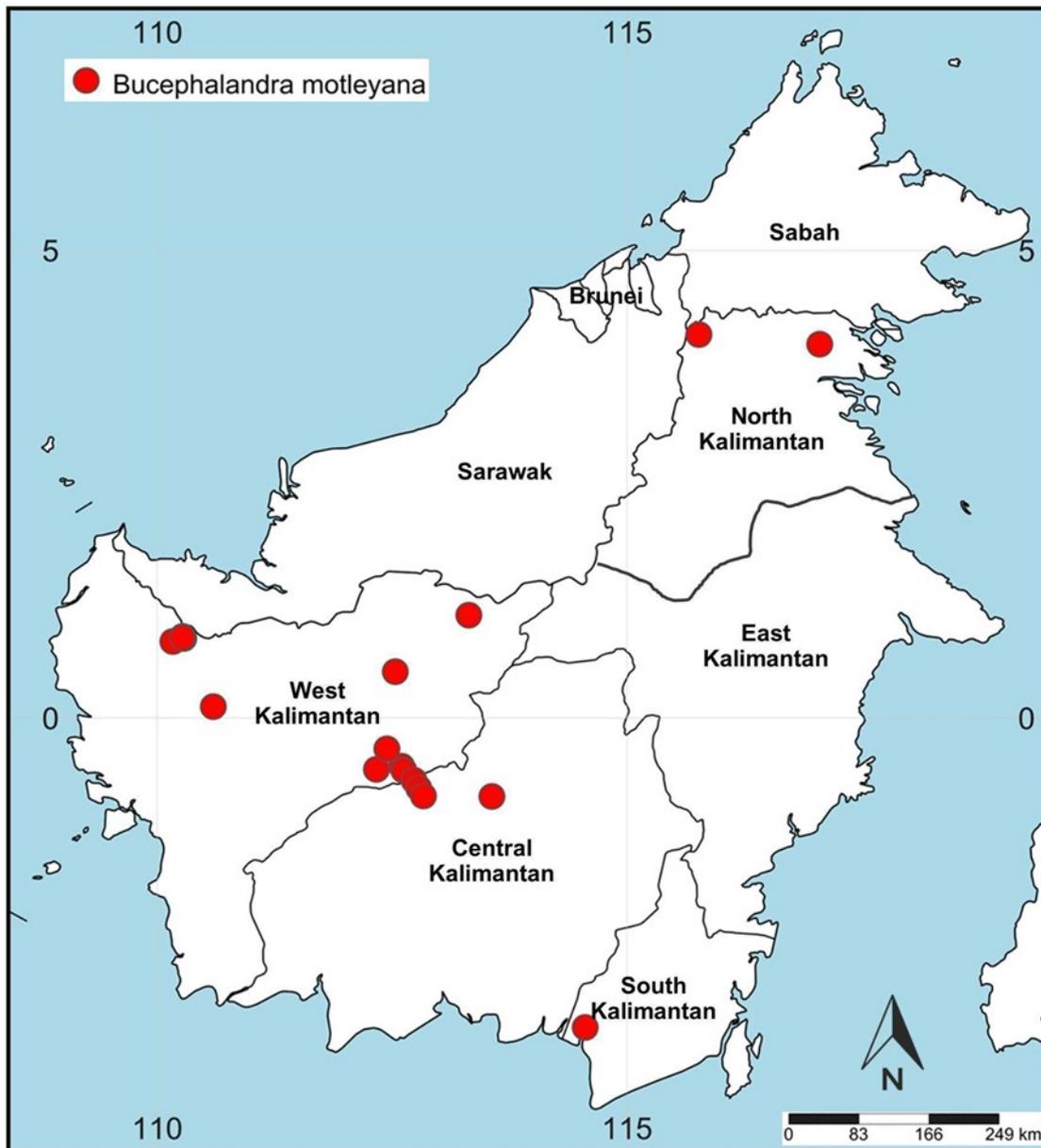


Fig. 5. Distribution of *Bucephalandra motleyana* in Kalimantan.

18. BUCEPHALANDRA OBLANCEOLATA (M.Hotta) S.Y.Wong & P.C.Boyce, = *Microcasia oblanceolata* M.Hotta in Mem. Coll. Sci. Kyoto Imp. Univ., Ser. B, Biol. 32(1): 21. — Type: BRUNEI DARUSSALAM, Temburong Prov., vicinity of Labu, Bukit Peradayan, 25 Jan. 1964, *M. Hotta* 13586 (holotype: KYO, isotypes: L, SAR).

North Kalimantan: Kabupaten Nunukan, Pa Api, Taman Nasional Kayan Mentarang (Fig. 6).

19. BUCEPHALANDRA ONCOPHORA S.Y. Wong & P.C.Boyce, Willdenowia 44: 181 (2014). — Type: INDONESIA, Kalimantan Barat, Kabupaten Sekadau, Kecamatan Nanga Taman, nickel mine, 22 May 2012, *K. Nakamoto* AR-3932 (holotype: BO!, isotypes: SAR, SBC, SING).

West Kalimantan: Kabupaten Sekadau, Kecamatan Nanga Taman (Fig. 6).

20. BUCEPHALANDRA PUBES S.Y.Wong & P.C.Boyce, Willdenowia 44: 181 (2014). — Type: INDONESIA, Kalimantan Barat, Kabupaten Sekadau, Kecamatan Sekadau, 3 Feb. 2012, *K. Nakamoto* AR-3760 (holotype: BO!, isotypes: SAR, SBC, SING).

West Kalimantan: Kabupaten Sekadau, Kecamatan Sekadau (Fig. 6).

21. BUCEPHALANDRA PYGMAEA (Becc.) P.C.Boyce & S.Y.Wong, Webbia 67: 142 (2012). = *Microcasia pygmaea* Becc. in Bull. Reale Soc. Tosc. Ortic. 4: 180. 1879; Engl. in Beccari,

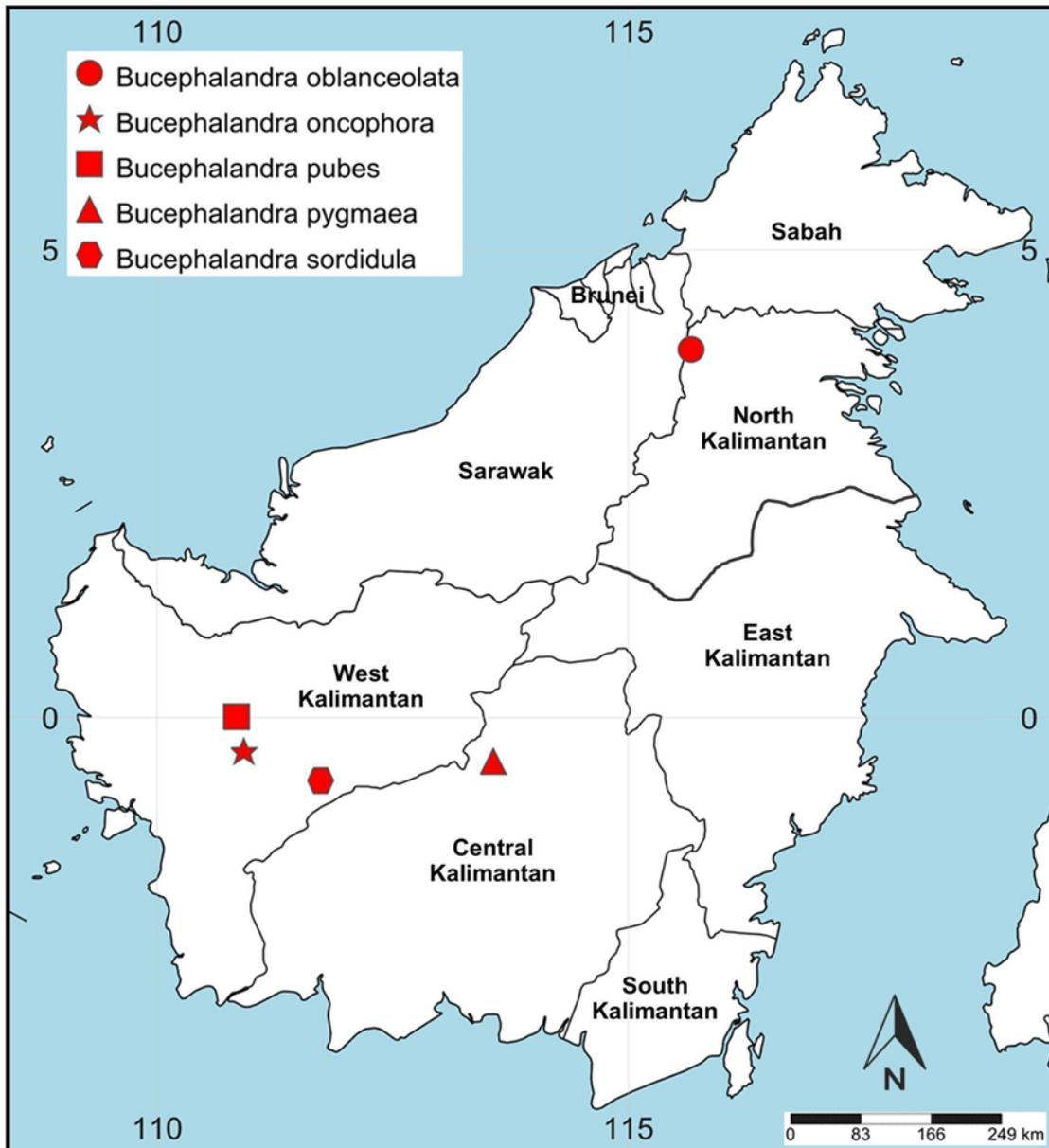


Fig. 6. Distribution of *Bucephalandra oblancoolata*, *B. oncophora*, *B. pubes*, *B. pygmaea*, and *B. sordidula* in Kalimantan.

Malesia 1: 290, t. 22, f. 21–24. 1883; Nat. Pflanzenfam. 2(3): 132, fig. 85. 1889; Pflanzenr. 55 (IV.23Da): 128, fig. 77A–D. 1912. — Type: MALAYSIA, Sarawak, Sarikei Division, Julau, Sungai Entabai, 28 Oct. 1867 (annotated on FI sheet), or Sept. 1867 (annotated on B sheet, and stated in Beccari, 1879), or 26 Oct. 1867 (stated in Beccari, 1902, 1904), *O. Beccari* PB 3883 (holotype: FI, isotype: B).

Central Kalimantan: Headwaters of S. Kahayan, 5 km NE of Haruwu Village, ridge of N. Nyoochoy River (Fig. 6).

22. BUCEPHALANDRA SORDIDULA S.Y. Wong & P.C.Boyce, Willdenowia 44: 184 (2014). — Type: INDONESIA, Kalimantan Barat, Kabupaten Melawi, Kecamatan Nanga Pinoh, 33 km S of Nanga Pinoh and 11 km before Kotabaru junction of logging road to Kalimantan Tengah, 00° 40'21.6"S, 111°44'03.4"E, 16 Oct. 2012, *K. Nakamoto* AR-4042 (holotype: BO, isotypes: SAR, SBC, SING).

West Kalimantan: Kabupaten Melawi, Kecamatan Nanga Pinoh (Fig. 6).

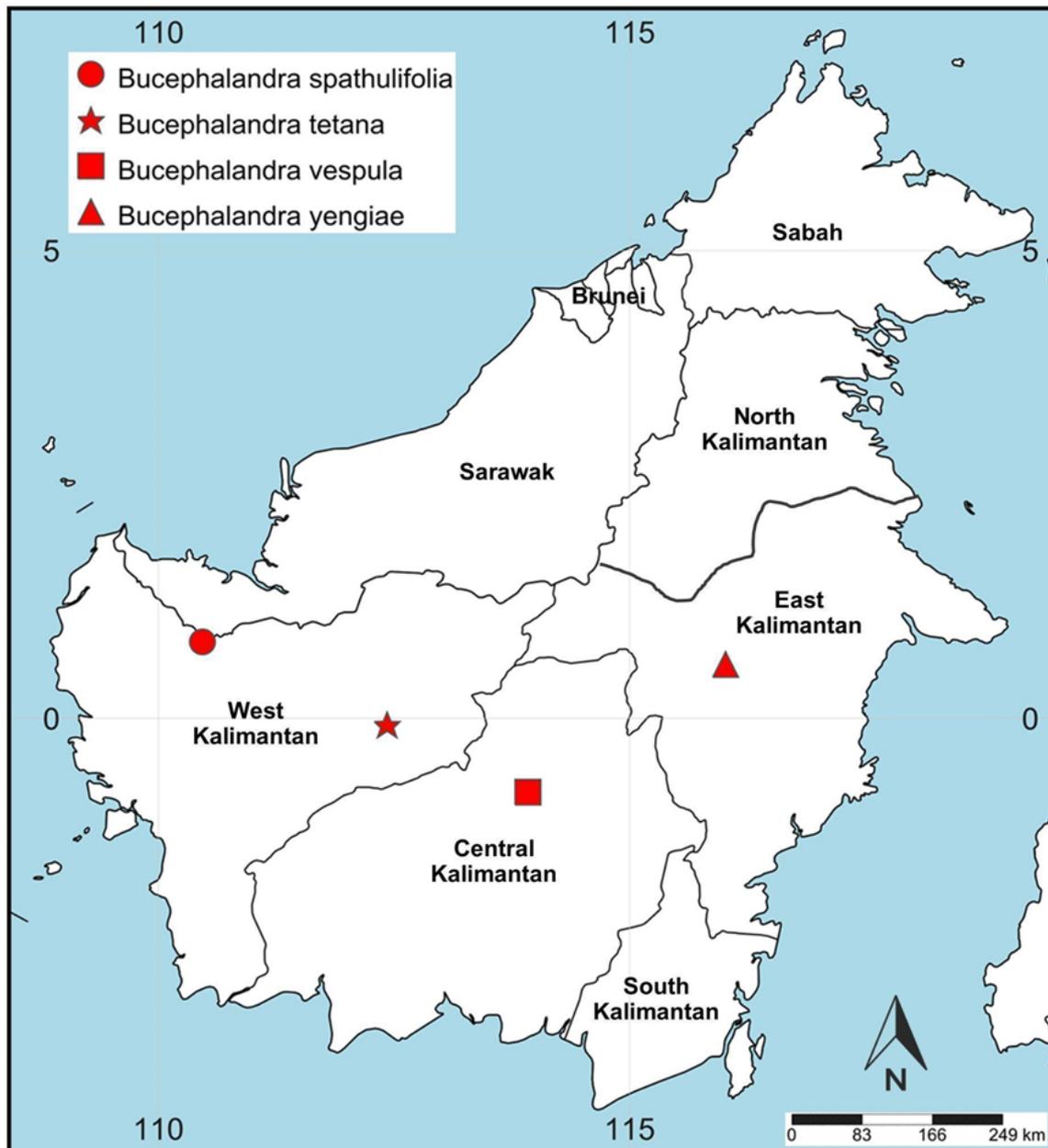


Fig. 7. Distribution of *Bucephalandra spathulifolia*, *B. tetana*, *B. vespula*, and *B. yengiae* in Kalimantan.

23. **BUCEPHALANDRA SPATHULIFOLIA** Engl. ex S.Y.Wong & P.C.Boyce, Willdenowia 44: 417 (2014). — Type: INDONESIA, “Borneo, Exp. Nieuwenhuis, 1898–1899”, Soengai Boeleng [? Sungai Boeloengan = Sungai Kajan, see Nieuwenhuis 1900: 262], 28 Oct. 1898, *Amdjah* 127 (holotype: BO!).

West Kalimantan: Kabupaten Sanggau, Sekayam, Balai Karangam (Fig. 7).

24. **BUCEPHALANDRA TETANA** S.Y.Wong & P.C.Boyce, Willdenowia 44: 186 (2014). — Type: INDONESIA, Kalimantan Barat, Kabupaten Sintang, Kecamatan Serawai, Gunung Alat, N of

Nanga Serawai and 120 km E of Nanga Pinoh, 00° 04'09.0"S, 112°25'38.6"E, 17 May 2013, K. Nakamoto AR-4146 (holotype: BO!, isotypes: SAR, SBC, SING).

West Kalimantan: Kabupaten Sintang, Kecamatan Serawai, Gunung Alat (Fig. 7).

25. **BUCEPHALANDRA VESPULA** S.Y.Wong & P.C.Boyce, Willdenowia 44: 190 (2014). — Type: INDONESIA, Kalimantan Barat, Kabupaten Sekadau, Kecamatan Sekadau Hilir, Kayu Lapis, S of Kayu Lapis, 00°47'21.3"S, 113°55'15.7"E, 20 Sep. 2011, K. Nakamoto AR-3664 (holotype: BO!, isotypes: SAR, SBC, SING).

West Kalimantan: Kabupaten Sekadau, Kecamatan Sekadau Hilir, Kayu Lapis (Fig. 7).

26. BUCEPHALANDRA YENGLIAE P.C.Boyce, Willdenowia 44: 192 (2014). — Type: INDONESIA, Kalimantan Timur, Kabupaten Kutai Kartanegara, Kecamatan Tabang, 00°34'33.2"N, 116°01'05.9"E, 17 Oct. 2012, K. Nakamoto AR-4050 (holotype: BO, isotypes: SAR, SBC, SING).

East Kalimantan: Kabupaten Kutai Kartanegara, Kecamatan Tabang (Fig. 7).

CONCLUSION

There are 26 species of *Bucephalandra* in Kalimantan, Indonesia. The majority are found growing in aquatic areas all across Kalimantan, with most species concentrated in West Kalimantan. The number of valid *Bucephalandra* species is likely to grow as ongoing research uncovers new ones.

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REFERENCES

- ASIH, N. P. S., ERLINAWATI, I., YUZAMMI & HADIAH, J. T. 2024. The Araceae of Sumatra I: a new species of *Alocasia* from Aceh, Indonesia. *Phytokeys* 249: 223–229. DOI: 10.3897/phytokeys.249.133737.
- BOGNER, J. 1984. Two new aroids from Borneo. *Plant Systematics & Evolution* 145: 159–164. DOI: 10.1007/BF00983944.
- BOGNER, J. & HAY, A. 2000. Schismatoglottideae (Araceae) in Malesia 2: *Aridarum*, *Bucephalandra*, *Phymatarum* and *Piptospatha*. *Telopea* 9(1): 179–222. DOI: 10.7751/telopea20002009.
- BOYCE, P. C. 1995. 272. *Bucephalandra motleyana*. *Curtis's Botanical Magazine* 12(3): 131–134.
- BOYCE, P. C., BOGNER, J. & MAYO, S. 1995. *Bucephalandra catherineae*, a new species from Kalimantan. *Curtis's Botanical Magazine* 12(3): 150–153.
- BOYCE, P. C. 2001. The genus *Rhaphidophora* Hassk. (Araceae–Monsteroideae–Monstereae) in New Guinea, Australia and the tropical western Pacific. *Gardens' Bulletin Singapore* 53: 75–183.
- BOYCE, P. C. & WONG, S. Y. 2012. Studies on Schismatoglottideae (Araceae) of Borneo XX: Beccari's «La Più piccola delle Aracee» (*Microcasia pygmaea*) recollected and transferred to *Bucephalandra* Schott. *Webbia: Journal of Plant Taxonomy and Geography* 67 (2): 139–146. DOI: 10.1080/00837792.2012.10670913
- BOYCE, P. C. & HAIGH, A. 2016. *Rhaphidophora bogneri* (Araceae: Monsteroideae: Monstereae) a new species from West Africa, and notes on the *Rhaphidophora africana* complex. *Aroideana* 39(2): 101–120.
- BOYCE, P. C. & CROAT, T. B. 2023. Überlist–April 2023. <https://doi.org/10.13140/RG.2.2.14382.59202/1>. (Accessed 30 January 2025).
- HAY, A. 1998. The genus *Alocasia* (Araceae–Colocasieae) in West Malesia and Sulawesi. *Gardens' Bulletin Singapore* 50: 221–334.
- HOTTA, M. 1965. Notes on Schismatoglottidinae of Borneo (I). *Memoirs of the College of Science, University of Kyoto Series B* 32 (1): 19–30.
- LOW, S. L., WONG, S. Y. & BOYCE, P. C. 2018. Naming the chaos: generic redelimitation in Schismatoglottideae (Araceae). *Webbia: Journal of Plant Taxonomy and Geography* 73 (1): 1–100. DOI: 10.1080/00837792.2017.1409940.
- NG, K. K., OTHMAN, S., BOYCE, P. C. & WONG, S. Y. 2011. Studies on Homalomenae (Araceae) of Borneo VIII: Delimitation of additional informal suprageneric taxa for Sundaic *Homalomena*. *Webbia: Journal of Plant Taxonomy and Geography* 66(1): 21–28. DOI: 10.1080/00837792.2011.10670880.
- NUGRAHA, M. F. I., ERLINAWATI, I., SAHRONI, D., ENGGARINI, W., YUNITA, R. & YAMIN, M. 2020. Tracking the morphological diversity of *Bucephalandra motleyana* Schott (1858 (Araceae) using its commercial name in the proximities of Jakarta, Indonesia. *Jurnal Biologi Universitas Andalas* 8(1): 1–8. DOI: 10.25077/jbioua.8.1.1-8.2020.
- PLANT OF THE WORLD (POWO). 2025. *Bucephalandra* Schott. <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:2729-1>. (Accessed 14 August 2025).
- SHORTHOUSE, D. P. 2010. SimpleMappr, an online tool to produce publication-quality point maps. <https://www.simplemappr.net> (Accessed

12 June 2025).

WONG, S. Y. & BOYCE, P. C. 2014. Studies on Schismatoglottideae (Araceae) of Borneo XXX — New species and combinations for *Bucephalandra*. *Willdenowia* 44(2): 149–199. DOI:

10.3372/wi.44.44201.

WONG, S. Y., BOYCE, P. C. & HII, A. Y. M. 2022. Studies on Schismatoglottideae (Araceae) of Borneo LXVIII: *Bucephalandra adei*, a new species from Kalimantan, Indonesian Borneo. *Webbia: Journal of Plant Taxonomy and Geography* 77(1): 135–144. DOI: 10.36253/jopt-12167.

THE ETHNOECOLOGY OF MALAY COMMUNITY TO SUPPORT MANAGEMENT OF FUNCTIONAL FOOD SOURCE AREAS IN BELITUNG REGENCY, INDONESIA

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ABSTRACT

PRASAJA, D., CHIKMAWATI, T., SULISTIJORINI, S., PURWANTO, Y. & DJUITA, N. R. 2025. The ethnoecology of the Malay community to support the management of functional food source areas in Belitung Regency, Indonesia. *Reinwardtia* 24(2): 199–217. — The Malay community in Belitung Regency is rich in local knowledge about the management of the Belitung community landscape, which has been passed down from generation to generation. This local knowledge enables food production from its sources, but there is no information on the diversity and composition of plants in the Belitung community's landscapes. This study aimed to analyze the diversity, composition, and conservation strategies of food plants in the Belitung community landscape. The study was conducted using the vegetation analysis method, which created tiered square plots of various sizes. Plant conservation status is determined based on the ICS and the Important Value Index (IVI). The most common family found in all landscapes (*rimba*, *bebak*, *kerangas bebak*, *kelekak*, garden, homegarden) is Myrtaceae (21 species), except in rice fields, it is Poaceae, and in *ume* is Euphorbiaceae. Food plants are most found in homegarden landscapes (136 species included in 57 families). The cultivation and development of other potentials process must be carried out for plants with low/moderate IVI and high ICS, such as *Ananas comosus*, *Arenga pinnata*, and *Cocos nucifera*. Information from this research can support efforts to diversify and provide food availability to realize food security based on local wisdom and local knowledge regarding the species diversity and the potential of local food plants in the Belitung Malay community. Traditional landscapes have an important role in providing sustainable food sources, as well as being a strong local identity, and providing economic contributions to the Belitung Malay community.

Key words: Conservation, food plant, landscape, Malay community.

ABSTRAK

PRASAJA, D., CHIKMAWATI, T., SULISTIJORINI, S., PURWANTO, Y. & DJUITA, N. R. 2025. Etnoekologi masyarakat Melayu dalam rangka mendukung pengelolaan kawasan sumber pangan fungsional di Kabupaten Belitung, Indonesia. *Reinwardtia* 24(2): 199–217. — Masyarakat Melayu di Kabupaten Belitung kaya akan pengetahuan lokal tentang pengelolaan lanskap yang diwariskan secara turun-temurun. Pengetahuan lokal tersebut memungkinkan produksi pangan dari sumbernya, namun belum ada informasi mengenai keanekaragaman dan komposisi tumbuhan pada lanskap masyarakat Belitung. Penelitian ini bertujuan untuk menganalisis keanekaragaman, komposisi, dan strategi konservasi tumbuhan pangan di lanskap masyarakat Belitung. Penelitian dilakukan dengan metode analisis vegetasi, yaitu membuat plot-plot persegi berjenjang dengan berbagai ukuran. Status konservasi tumbuhan ditetapkan

berdasarkan Indeks Kepentingan Budaya (ICS) dan Indeks Nilai Penting (INP). Suku yang paling banyak ditemukan di semua lanskap (*rimba*, *bebak*, *kerangas bebak*, *kelekak*, pekarangan, dan kebun) adalah Myrtaceae (21 jenis) kecuali di sawah yaitu Poaceae, dan *ume* yaitu Euphorbiaceae. Tumbuhan pangan paling banyak ditemukan di pekarangan (136 jenis yang termasuk dalam 57 suku). Proses budidaya harus dilakukan untuk tumbuhan dengan INP rendah/sedang dan ICS tinggi, seperti *Ananas comosus*, *Arenga pinnata*, dan *Cocos nucifera*. Informasi hasil penelitian ini dapat mendukung upaya diversifikasi dan penyediaan pangan guna mewujudkan ketahanan pangan berbasis kearifan lokal dan pengetahuan lokal mengenai keanekaragaman dan potensi tumbuhan pangan lokal pada masyarakat Melayu Belitung. Lanskap tradisional memiliki peran penting dalam menyediakan sumber bahan pangan secara berkelanjutan, selain itu, sebagai identitas lokal yang kuat, dan memberikan kontribusi ekonomi bagi masyarakat Melayu Belitung.

Kata kunci: Konservasi, lanskap, masyarakat Melayu, tumbuhan pangan.

INTRODUCTION

The community perspective regarding the environment is inseparable from the various teachings of the ancestors and the philosophy of life. Specifically, local knowledge of the Malay community in Belitung Regency, Indonesia, has contributed significantly to meeting their daily needs by utilizing plant resources obtained from various Belitung landscapes (Henri *et al.*, 2022). These include various elements that reflect the reciprocal relationship between humans and nature, as well as the cultural values that are upheld. The Malay community considers the Belitung community landscape to be a combination of physical, social, and cultural aspects that interact, creating a unique identity and local knowledge maintained from one generation to another (Sheil *et al.*, 2002; Hussain *et al.*, 2020). The Belitung community landscapes are a way of managing the community, which is highly dependent on the environment in a long and gradual process. Previous research has shown that community led environmental management can slow deforestation and maintain plant diversity (Blackman *et al.*, 2017; Lawrence *et al.*, 2019).

The community in Belitung Regency recognizes eight types of Belitung community landscapes, namely *rimba* (primary forest), *bebak* (secondary forest), *kerangas bebak* (heath forest), *kelekak*, homegarden, garden, rice field, and *ume*. The *kelekak* and homegarden are located near the house, while rice fields, *ume*, and gardens are located far from the house. Meanwhile, the forest is considered a forbidden area, serving as a place for spirits or ancestral spirits. These landscapes have been managed since ancient times by applying the local knowledge of the community in the Belitung Regency (Henri *et al.*, 2022). The Malay community lives on the coast and inland, using and managing the Belitung community landscapes in the Belitung district. Some members make a living as pepper farmers, rice farmers, fishermen, or gardeners of rubber or vegetables (BPS, 2024). One example of the knowledge related to the Belitung community landscapes includes creating *kelekak* (mixed fruit gardens) as a source of life in meeting food needs that have economic value. This is achieved by processing young rattan stems (*Calamus manan*)

to be used as a mixture of fish soup called *Gangan*. In the *kelekak* landscape, plant species are still oriented toward consumption and commodities such as sugar palm, pepper, coconut, fruit, turmeric, ginger, and galangal (Novita & Adi, 2020).

In Belitung Regency, the Malay people utilize surrounding plants for various purposes, utilizing several parts including tubers, rhizomes, stems, bark, leaves, buds, flowers, fruits, and seeds. The most widely used part of the plant is the fruit, followed by the leaves (Chikmawati *et al.*, 2023). The utilization of plants is closely related to the management of the surrounding environment. Local communities will develop various methods and technologies to obtain resources in their surroundings sustainably, which will then create ecological wisdom in certain ethnicities and locations. Ecological wisdom, informed of local community activities, can describe adaptation patterns that play crucial role in the success of agriculture (Rahayu *et al.*, 2023; Prasetyo *et al.*, 2018). Exploring ecological knowledge, particularly among the Malay community, is expected to have positive and strategic implications for maintaining the environment and natural resources.

All landscapes and other ecosystem landscapes that include ecological aspects are significant in ensuring the sustainability of life and culture of the Malay indigenous community (Oktavia *et al.*, 2021). This understanding is fundamental considering the large-scale clearing of forests in the interior for regional plantation industry projects. The impact of forest clearing threatens their lives and devalues their traditional knowledge. However, traditional belief systems and conservation have proven to maintain forest sustainability and ensure the availability of natural resources as well as ecosystem services for humans (Henri *et al.*, 2022; Wheeler & Root-Bernstein, 2020).

Due to the development of advanced science and technology, the Malay community in Belitung Regency continues to maintain local customs and wisdom that have been passed down for hundreds of years (Susiarti *et al.*, 2023; Henri *et al.*, 2022). Belitung community landscapes managed by the community provide essential ecosystem functions that describe the characteristics of rural areas as an

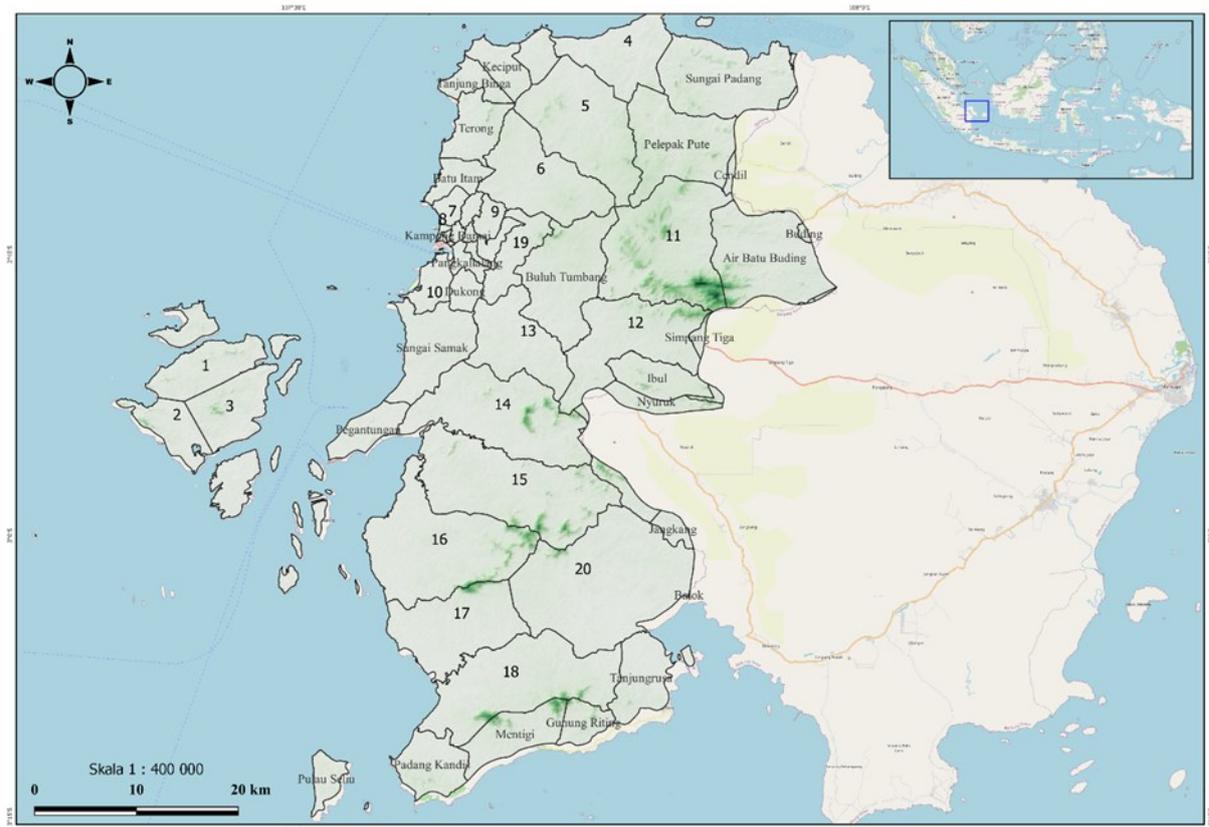


Fig. 1. Study location in Belitung District, Indonesia (1. Selat Nasik, 2. Suak Gual, 3. Petaling, 4. Sijuk, 5. Air Selumar, 6. Air Seruk, 7. Air Saga, 8. Tanjung Pandam, 9. Air Merbau, 10. Juru Seberang, 11. Kacang Butor, 12. Badau, 13. Cerucuk, 14. Bantan, 15. Simpang Rusa, 16. Lassar, 17. Perpat, 18. Membalong, 19. Perawas, 20. Kembiri villages).

effort to integrate biodiversity and cultural functions sustainably for human life (Renes *et al.*, 2019; Agnoletti & Rotherham, 2015). Despite the significant contribution, the diversity of plants that comprise the community landscapes in the Belitung District has not been explored. Therefore, this study analyzed the ethnoecology of the diversity, composition, and conservation strategies of food plants in the Malay community in Belitung district to support the management of functional food source areas.

MATERIALS AND METHODS

Study Area

This study was conducted in five sub-districts of Belitung Regency, Bangka-Belitung Island Province, namely Tanjung Pandan, Badau, Sijuk, Membalong, and Selat Nasik (Fig. 1). The research location consists of 20 villages. The main criteria for selecting the location were (1) most of the population was Belitung Malay, (2) there were traditional elders in the area, as well as (3) *rimba* (primary forests), *bebak* (secondary forests), *kerangas bebak* (heath forests), *kelekaks*, homegardens, gar-

dens, *ume*, and rice fields were still used by the community to meet their needs. In this study, 20 *kelekak*, one *rimba*, six *bebak*, and one *kerangas bebak*, 260 homegardens, 29 gardens, one *ume*, and ten rice fields were observed across all sub-districts, where vegetation analysis was conducted.

This study employed a combination of qualitative and quantitative methods, incorporating an ethnoecological method (Albuquerque *et al.*, 2014). Data were collected using the vegetation analysis method to obtain the Important Value Index (IVI) for each plant species at individual landscapes. The distribution of Belitung community landscapes was mapped using QGIS, while the population of target species was determined using vegetation analysis in the form of nested plots. Based on the experimental design, the main plot was 20 m × 20 m for the tree phase. Within the main plot, there was a subplot measuring 10 m × 10 m for the pole phase or shrub species, 5 m × 5 m for the sapling, and 2 m × 2 m for the seedling or herbaceous. Meanwhile, for the homegarden, garden, *ume*, and rice field landscapes, an inventory of plants is conducted.

The placement of observation plots was conducted through purposive sampling based on information gathered from respondents. The distance between the main plots was adjusted to field conditions (Palinkas *et al.*, 2015). The IVI values of each species were grouped into three categories: low, medium, and high for an average IVI of <10, between 10 and 20, and > 20, respectively. Plants with an average ICS value below 20 had were classified in the low ICS category, while those with values above 20 were classified in the high

category (Yamini *et al.*, 2023). Plants are recorded and documented for each species that grows in the Belitung community's landscapes for further identification using POWO (Plants of the World Online, <https://powo.science.kew.org/>). Several parameters recorded directly in the field during the vegetation analysis, including the number of individuals and the frequency of presence of each plant species to calculate the density. The calculation was performed to obtain the IVI of each plant species (Palinkas *et al.*, 2015).

$$\text{Relative Frequency (FR) of Species (i)} = \frac{\text{absolute frequency of species i}}{\text{total frequency of all species}} \times 100\%$$

$$\text{Relative Density (KR) of Species (i)} = \frac{\text{absolute density of species i}}{\text{total density of all species}} \times 100\%$$

$$\text{Relative Dominance (DR) of Species (i)} = \frac{\text{number of species dominance i}}{\text{the total number of dominant species i}} \times 100\%$$

Species Importance Index = FR(i) + KR(i) + DR(i).

Ethnobotanical quantitative data were analyzed using the Index of Cultural Significance (ICS). This index is analyzed using the Turner's formula (1988) referred to:

$$\text{ICS} = \sum_{i=1}^n (q \cdot i \cdot e) \cdot ni$$

Where q is the quality, which is the use number of a plant species, i is the intensity value, which is the value of the intensity of utilization of beneficial plant species, and e is the exclusivity value, which is the value of the level of exclusivity preference.

RESULTS

Food Plant Diversity in Each Environmental Unit in Belitung Regency

The Malay community in Belitung Regency utilizes many plant species, 189 species and three varieties, from their environment for food. The plants commonly used come from eight environmental units: *rimba*, *bebak*, *kerangas bebak*, *kelekek*, garden, rice field, *ume*, and homegarden. The environmental unit with the largest number of species is the homegarden (Fig. 2). The food plants used can be grouped into six utilization categories, namely fruits, vegetables, seasoning producers, beverages, supplementary foods, and staple foods. The highest utilization category for each environmental unit is fruits, except in rice fields and *ume*, which are more dominated by vegetable categories such as *Breynia androgyna*, *Ipomoea aquatica*, *Phaseolus vulgaris*, *Momordica charantia*, *Solanum melongena*, *Archidendron pauciflorum*, and *Vigna cylindrica* (Fig. 3). The category of fruits that are commonly utilized are those that can be consumed directly, spread across several families, including Myrtaceae, Anacardiaceae, Fabaceae, and Rubiaceae (Fig. 4). The lowest utilization ca-

tegory is staple food because all Malay communities in the Belitung Regency utilize rice (*Oryza sativa*) as a staple food. Rice is generally grown in rice fields.

Based on the similarity index, more similar environmental units are between *bebak* and *kelekek*, followed by homegarden and garden. However, there is no similarity between the *kerangas bebak* and rice field, the *kerangas bebak* and *ume*, *ume* and garden, *ume* and *rimba* (Table 1).

The plant growth categories, number of species, and the species with the highest IVI vary among environmental unit types (Tables 2 and 3). There are four plant growth categories found in the *rimba*, *bebak*, and *kelekek*, which are tree, pole, sapling, and seedling, but only two plant growth categories are found in the *kerangas bebak*, sapling, and seedling (Table 2). For example, in *rimba* and *bebak*, a tree with the highest IVI is *Bouea oppositifolia*, while in *kelekek*, it is *Durio zibethinus*; a pole with the highest IVI is *Oncosperma tigillarum* in *rimba* and *bebak*, but it is *Garcinia mangostana* in *kelekek* (Tables 2 and 3).

The level of importance of food plant species across different environmental units reflects their ecological role and cultural significance in local

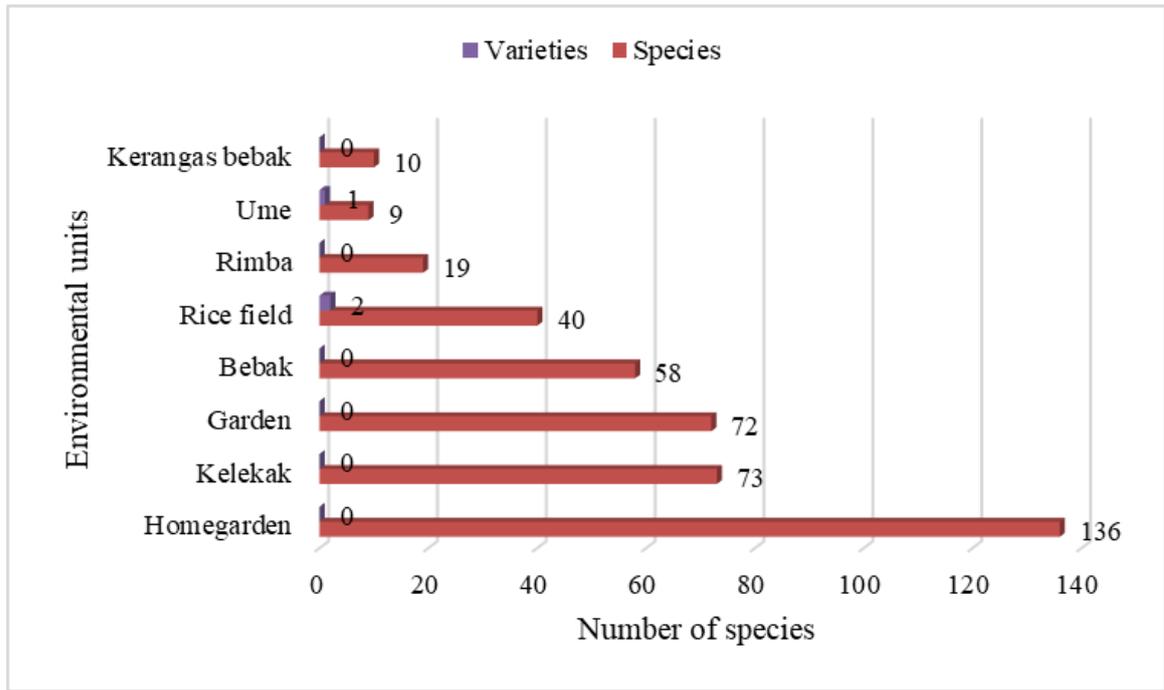


Fig. 2. Comparison of the number of food plant species in each landscape in the Belitung Regency.

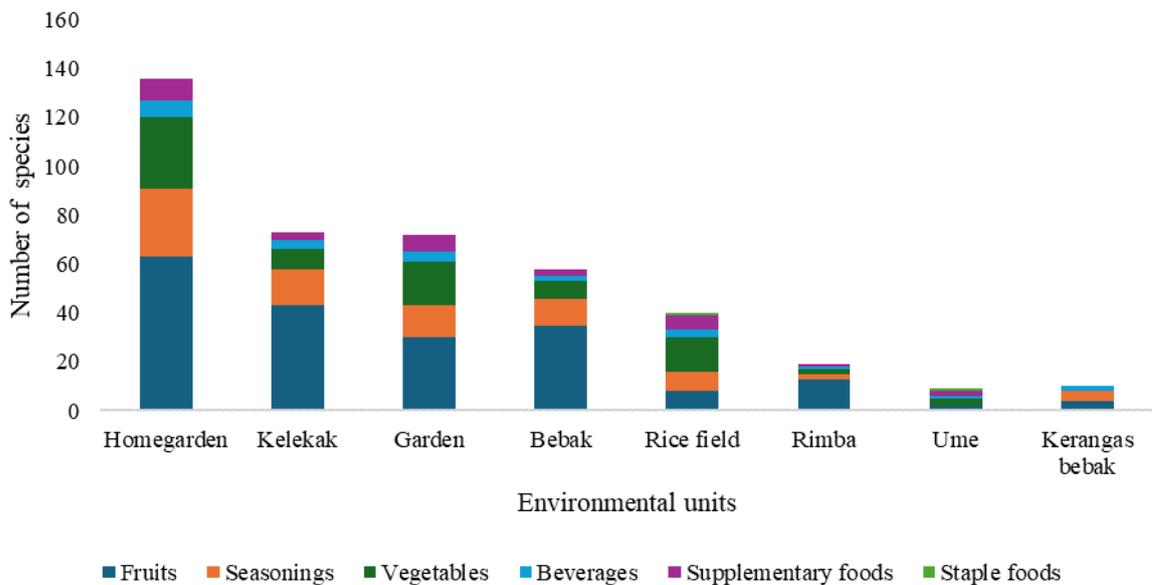


Fig. 3. Categories of food plant utilization in each landscape in the Belitung Regency.

utilization systems. The importance of value index (IVI) was used to identify the most dominant and frequently used species across various environmental setting, including the homegarden, garden, rice field, and *ume*. A higher IVI value indicates greater utilization intensity and wider distribution of a species within traditional agroecosystems. The species with the highest IVI values in each artificial environmental unit are presented in Table 3.

Conservation efforts of food plants in Belitung Regency are implemented through various strategies tailored to the ecological importance and the level of cultural knowledge associated with each species. These strategies include maintaining species availability, cultivating, studying, and developing the potential of local food plants. Based on the analysis of the Importance Value Index (IVI) and the Index of Cultural Significance (ICS), each species demonstrates different conservation priori-

Table 1. Similarity matrix of food plants among landscapes (%).

Landscape	<i>Rimba</i>	<i>Bebak</i>	<i>Kerangas bebak</i>	<i>Kelekak</i>	Homegarden	Garden	Rice field	<i>Ume</i>
<i>Rimba</i>	0	45	21	35	9	14	3	0
<i>Bebak</i>		0	17	57	23	28	8	2
<i>Kerangas bebak</i>			0	9	4	9	0	0
<i>Kelekak</i>				0	42	37	22	7
Homegarden					0	52	32	10
Garden						0	50	0
Rice field							0	30
<i>Ume</i>								0

Table 2. Highest importance index in the *rimba*, *bebak*, *kerangas bebak*, and *kelekak*.

Land- scape	Habits	Scientific name	Vernacular name	Family	IVI
<i>Rimba</i>	Tree	<i>Bouea oppositifolia</i> (Roxb.) Meisn.	Urisan	Anacardiaceae	28.30
	Pole	<i>Oncosperma tigillarum</i> (Jack) Ridl.	Nibong	Arecaceae	37.51
	Sapling	<i>Psychotria malayana</i> F.Villar ex Vidal	Meleman	Rubiaceae	24.03
	Seedling	<i>Syzygium bankense</i> (Hassk.) Merr. & L.M.Perry	Sekudong pelandok	Myrtaceae	12.54
<i>Bebak</i>	Tree	<i>Bouea oppositifolia</i> (Roxb.) Meisn.	Urisan	Anacardiaceae	16.76
	Pole	<i>Oncosperma tigillarum</i> (Jack) Ridl.	Nibong	Arecaceae	26.38
	Sapling	<i>Rhodamnia cinerea</i> Jack	Jemang	Myrtaceae	22.90
	Seedling	<i>Calophyllum pulcherrimum</i> Wall. ex Choisy	Betor padi	Calophyllaceae	13.02
<i>Kerangas bebak</i>	Sapling	<i>Rhodomyrtus tomentosa</i> (Aiton) Hassk.	Karamunting	Myrtaceae	92.91
	Seedling	<i>Syzygium bankense</i> (Hassk.) Merr. & L.M.Perry	Sekudong pelandok	Myrtaceae	71.74
<i>Kelekak</i>	Tree	<i>Durio zibethinus</i> L.	Durian	Malvaceae	73.48
	Pole	<i>Garcinia mangostana</i> L.	Manggis	Clusiaceae	62.17
	Sapling	<i>Syzygium racemosum</i> (Blume) DC.	Kelebantuan	Myrtaceae	38.18
	Seedling	<i>Curculigo latifolia</i> Dryand.	Kelingauan	Hypoxidaceae	19.89

ties. The detailed conservation strategies of food plants in Belitung Regency are presented in Table 4.

DISCUSSION

A. Taxonomy Diversity of Food Plant

In the Belitung Regency, there are three types of environmental units based on their traditional wisdom and perception. Each type has several environmental units, namely natural environmental units (*rimba*, *bebak*, and *kerangas bebak*), artificial environmental units (gardens, rice fields, *ume*, and

homegardens), and succession environmental units (*kelekak*) (Henri *et al.*, 2022). Forests in Belitung have unique and distinctive characteristics influenced by the island's tropical climate and geography. The condition of forests in Belitung is currently experiencing several challenges due to various factors, including degradation due to tin mining and land conversion for plantations and settlements, which threatens to reduce the number of endemic species, which is also a serious problem. Homegardens, *ume*, and rice fields in Belitung are areas for cultivating certain plants on land or other growing media in a suitable ecosystem, process,

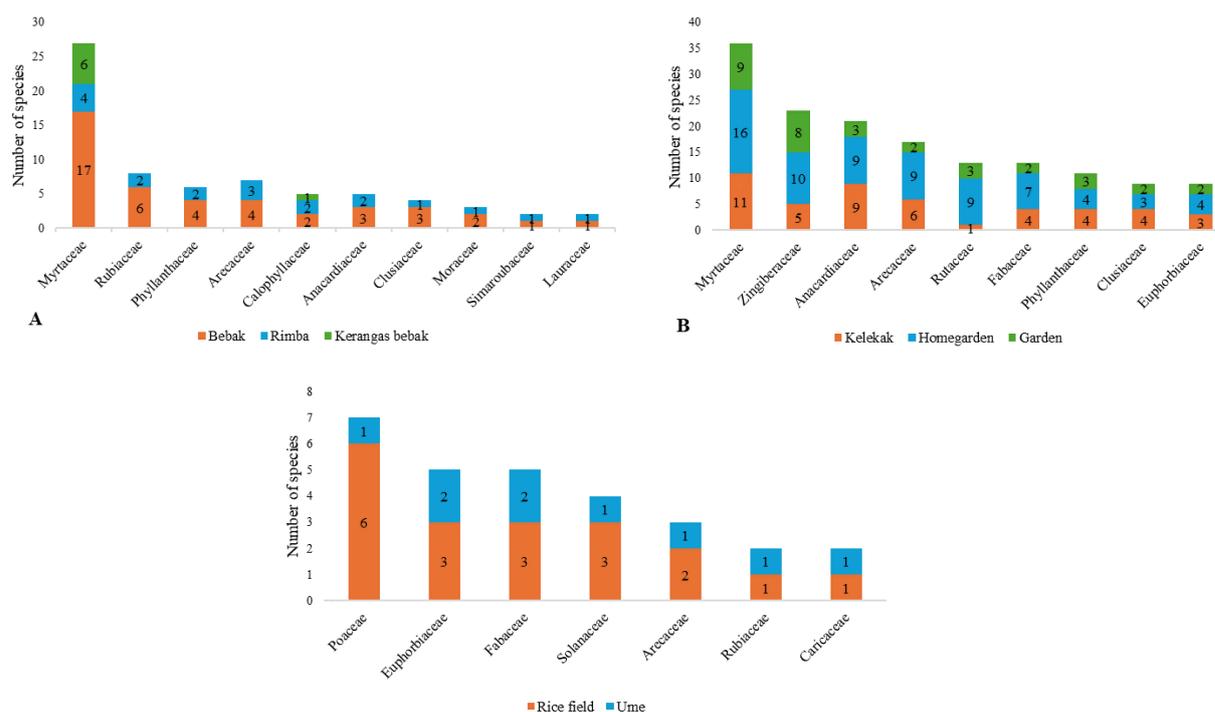


Fig. 4. Most plant families found in each landscape in Belitung Regency. A. *rimba*, *bekak*, and *kerangas bekak*; B. *Kelekek*, homegarden, and garden, C. Rice field and *ume*.

Table 3. Highest importance index in the homegarden, garden, rice field, and *ume*.

Type	Scientific name	Family	Vernacular name	IVI
Homegarden	<i>Manihot esculenta</i> Crantz	Euphorbiaceae	Menggale	12.12
	<i>Alpinia galanga</i> L.	Zingiberaceae	Lengkuas	10.5
	<i>Breynia androgyna</i> (L.) Chakrab. & N.P.Balacr.	Phyllanthaceae	Cekok manis	9.88
Garden	<i>Zea mays</i> L.	Poaceae	Jagung	30.48
	<i>Piper nigrum</i> L.	Piperaceae	Sahang	20.42
	<i>Ananas comosus</i> (L.) Merr.	Bromeliaceae	Nanas	13.35
Rice field	<i>Oryza sativa</i> L.	Poaceae	Padi	63.3
	<i>Manihot esculenta</i> Crantz	Euphorbiaceae	Menggale	7.15
	<i>Alpinia galanga</i> L.	Zingiberaceae	Lengkuas	5.00
Ume	<i>Oryza sativa</i> (L.) cv. Mirah	Poaceae	Padi mirah	93.78
	<i>Manihot esculenta</i> Crantz	Euphorbiaceae	Menggale	18.56
	<i>Cnidocolus aconitifolius</i> (Mill.) I.M.Johnst.	Euphorbiaceae	Menggale jepang	16.02

market goods, and services from these plants, with the help of science and technology, capital, and management to realize welfare for plantation business actors and the community.

The Malay community in Belitung Regency has a good understanding of the diversity and utilization of food plant species in their area. This knowledge is evident from their ability to recognize, name, utilize, and cultivate various plant spe-

cies in their environment. It can also be seen from how they take or harvest plant species in their environment. Based on the results of this study, all food plants identified across all community environmental units were 189 species and 3 varieties belonging to 57 families. The number and composition of plant species vary among environmental units. The largest number of species was found in the homegardens (136 species). In contrast, the

smallest number of species was found in the *kerangas bebak* (Fig. 2). This situation occurs because the *kerangas bebak* ecosystem is typically a poor-nutrient forest. Unfertile soil limits leaf production and positively selects long-lived leaves.

The Malay community in Belitung Regency utilizes rice as a staple food and source of carbohydrates. Local rice (*Oryza sativa* cv. Mirah) is grown in *ume* (rice grown on dry land), and the rice is usually used for daily life. After the *ume* is harvested, the owners abandon it for a few years and they will look for a new location they considered more suitable for a new *ume*. The *ume* abandoned by the owner will become *kelekak*. The *kelekak* environmental unit is formed if the owner plants fruit-bearing perennials after finishing the rice harvest, or if the fruit trees planted at the same time the rice grow well and produce fruit. In addition, they also utilize *Manihot esculenta*, *Xanthosoma sagittifolium*, *Ipomoea batatas*, and *Colocasia esculenta*. Tubers can be processed in various ways, including compote, boiled, or fried. The tubers of *I. batatas* are usually cooked into a compote and served during the rice harvest season as an expression of gratitude from the owner of the rice field to the workers who harvested the rice. *Colocasia esculenta* and *X. sagittifolium* tubers are processed by frying them into typical Belitung taro chips. *Colocasia esculenta* tubers have a high starch content of 70–80% (Temesgen & Ratta, 2015).

The most dominant family of food plants across all environmental units is Myrtaceae, except in rice fields, where it is Poaceae, and in *ume*, where it is Euphorbiaceae (Fig. 4). This pattern occurs because the species planted in the rice fields and *ume* are monocultures. Farmers are more concerned with the number of rice individuals than other species. Rice fields in Belitung are planted with three varieties of rice, namely *O. sativa* cv. Inpari 32, *O. sativa* cv. IR-36, and *O. sativa* cv. Mirah (local variety). Farmers plant crops other than paddy rice to utilize available space, thereby earning additional income by selling their products or consuming them personally. Myrtaceae is abundant in tropical rainforests and the Belitung region, and it also dominates the Atlantic Forest (Jo *et al.*, 2022). Myrtaceae is the most diverse plant family, comprising more than 1,600 species and over a quarter of the world's 5,500 species (Wilson, 2011; Wagner & Fiaschi, 2020). It also has standard, dominant, and highly diverse woody plants (Thornhill *et al.*, 2015). The important value of Myrtaceae is that members of this family have several uses. The fruit can be consumed directly, and some parts are used as wood, spices, dyes, ornamental plants, medicines, antioxidants, and antiarrhythmals (Kuspradini *et al.*, 2019). The Myrtaceae is one of the leading families of com-

mercial fruit tree worldwide. Among the 121 genera included in this family, *Syzygium* has a highly diverse fruit with great economic potential, in addition to having excellent nutritional value (Farias *et al.*, 2020). In an ethnobotanical study in the Sesaot Protected Forest, West Nusa Tenggara, Indonesia, *Syzygium* also had the highest importance value index that was widely used by the community as a medicinal plant for various diseases, a food source in the form of fruits, drinks, or jellies, and building materials (Hidayat, 2017). This family also includes the genus *Myrceugenia*, which is plentiful and has the most tree species in the highlands of Southern Brazil for the highland flora region (Wagner & Fiaschi, 2020). The diversity of food plant species, such as *Calophyllum pulcherrimum* and *E. longifolia*, was dominant in the primary forest in Belitung.

Fruit consumption carries significant risks, such as the possibility of being poisonous, bitter, pungent, or hot, or causing itching. These risks can be reduced by first peeling the skin and then washing the fruit under running water before eating. Most fruits can be consumed fresh or processed into other foods. The species of fruits and the number of species utilized by the Malay community in Belitung Regency vary among environmental units. This result is consistent with previous research, which found that the consumption of edible wild fruits in Bhutan varied significantly across districts, age groups, and levels of indigenous knowledge (Yangdon *et al.*, 2022). The highest similarity between *bebak* and *kelekak* stems from *kelekak* being an environmental unit that is less routinely maintained, allowing wild plants to thrive. Then, *kelekak* can undergo a succession stage towards the *bebak*. The high similarity between the homegardens and the gardens stems from the fact that both environmental units share as many as 60 species (52%), including *Curcuma longa*, *Br. androgyna*, and *Cymbopogon nardus*. In addition, the distance between houses and gardens is relatively close, and some gardens are even next to their houses. The closer the zones are combined, the higher the similarity. Conversely, the farther the zones are combined, the lower the level of similarity will be because the flow of plant seeds between environmental units is reduced (Wirabumi *et al.*, 2017).

Rimba (primary forest). *Rimba*, a tropical rainforest, is defined as a natural forest that has never undergone selective logging or total clear-cutting (Slade *et al.*, 2011; Audino *et al.*, 2014). Tropical rainforest is characterized by two seasons with distinct differences: the rainy and dry season. They have high air temperatures and humidity, as well as rainfall, with rainy days evenly distributed throughout the year (Audino *et al.*, 2014). The lowland forests in Sumatra have high biodiversity, including those in the Bangka Belitung Islands.

The tropical lowland forest of Gurok Beraye in Badau is characterized by a dense canopy of woody trees (Fig. 5). The food plant diversity of *rimba* comprises 19 species belonging to 11 families. The species with the highest IVI value were *Bouea oppositifolia* (tree), *Oncosperma tigillarum* (pole), *Psychotria malayana* (sapling), and *Syzygium bankense* (seedling) (Table 2).

Bebak (secondary forest). *Bebak* are forests that regrow after the *rimba* have been damaged or disturbed. The diversity of food plants found in the *bebak* consists of 58 species belonging to 27 families (Fig. 2). Myrtaceae, the most common food plant family found in this forest environmental unit, consists of 13 species, five of which are *Syzygium bankense*, *S. napiforme*, *S. pycnanthum*, *Rhodamnia cinerea* and *Rhodomyrtus tomentosa*. The food plant species in the forest can be grouped into five use categories, namely fruits, vegetables, seasonings, beverages, and additional food (supplementary foods and staple foods) (Fig. 3). The most common category is fruit (35 species), including *R. tomentosa*, *Rh. cinerea*, and *S. bankense*. At the same time, the lowest is additional food (three species), which are *Metroxylon sago*, *Xanthosoma sagittifolium*, and *Tacca palmata*. In the *bebak*, the species with the highest IVI value was *Bouea oppositifolia* (tree), followed by *On. tigillarum* (pole), *Rh. cinerea* (sapling), and *Ca. pulcherrimum* (seedling) (Table 2). Mountain forests in the Belitung Islands are in the low category, with an altitude of less than 1,500 m. Generally, low mountain forests host unique plant species due to their diverse vegetation with high humidity and air temperature (Priambudi *et al.*, 2022).

Kerangas bebak (heath forest). *Kerangas bebak* on Sumatra Island is found only on the islands of Bangka-Belitung, and a small part of the Natuna Islands (Whitten *et al.*, 1984). Belitung Island is dominated by podzol soils (white sand, quartz rock). It makes *kerangas bebak* and vegetation the most common and distinctive ecosystems on Belitung Island. During the rainy season, it often floods, and the water is usually black. This character is due to the presence of a black soil layer that is easily dissolved (Oktavia *et al.*, 2021). The *kerangas bebak* ecosystem is typically a poor-nutrient forest that limits leaf production and positively selects long-lived leaves (Fig. 5). The food plants found in the *kerangas bebak* consist of 10 species belonging to one family: Myrtaceae and Calophyllaceae. The species with the highest IVI value in the sapling strata was *R. tomentosa*, and in the seedling strata was *S. bankense* (Table 2). In the *kerangas bebak* areas that have been opened, there is high dominance by one species, resulting in a decrease in the diversity of food plant species. In addition, environmental conditions are quite extreme and restrictive, such as nutrient-poor soil, low soil pH (acidic), limited water supply, and limited plant adaptation (Oktavia *et al.*, 2021).

Kelekak. *Kelekak* is a growing farming culture that has become a tradition in Belitung, particularly in rural settlements. It can be interpreted as a forest containing fruit plants having owners (Prasaja *et al.*, 2023). The term forest refers to the condition of the diversity of plant species in this environmental unit. *Kelekak* has usually been given to family members for generations. There were 73 species of food plants belonging to 30 families successfully determined in this unit. Based on the use, the plant species were grouped into five categories: fruit, spices, beverage ingredients, vegetables, and additional food. The highest number of plant species in *kelekak* was fruit (43 species). In comparison, the lowest was additional food (three species) (Fig. 3). In this environmental unit, the species with the highest IVI value were *Durio zibethinus* (tree), *Garcinia mangostana* (pole), *Syzygium racemosum* (sapling), and *Curculigo latifolia* (seedling) (Table 2). *Kelekak* has ancestral customary values from the species *durian*, *mangosteens*, and *langsats* plants, which were perennial fruit plants that produce fruits yearly (Fig. 5).

Kelekak holds profound cultural, social, and economic significance in the daily life of the Malay community in the Belitung Regency. The practice of managing *kelekak* has been passed down from one generation to another as part of the farming and gardening tradition rooted in local culture. Initially, *kelekak* was developed as a subsistence farming solution using land around the house or village to plant various food, fruit, vegetable, and medicinal plants. This practice has been developed as the primary source of daily needs in the form of adaptation to economic and environmental changes (Sheil *et al.*, 2002; Suryadin, 2023; Lisboa *et al.*, 2024). Therefore, *kelekak* is part of local wisdom in managing natural resources sustainably in the Malay community in Belitung Regency (Fakhrurrozi *et al.*, 2001).

Based on plant composition, *kelekak* contains several typical fruit families as environmental unit markers, namely the Clusiaceae, Moraceae, Anacardiaceae, and Sapindaceae. On Bangka Island, it is generally planted with species of trees whose fruits can be eaten fresh, such as durian, mango, and rambutan (Henri *et al.*, 2022). These fruits are planted and allowed to grow when the *kelekak* is first established, serving as an initial marker of settlement presence. In the early stages of *kelekak* in Belitung Regency, the environmental unit is predominantly composed of herbaceous weed species, such as *Physalis minima*, *Rh. cinerea*, and *R. tomentosa*. However, through the process of succession, the composition of plants is replaced by other species with tree habits from the Myrtaceae, including *Syzygium grande* and *Rh. cinerea* (Oktavia *et al.*, 2021).

Homegarden. Homegarden is a plot of land located in the home area planted with various spe-

cies of plants, such as annual and perennial plants, including wild plants, semi-cultivated plants, and multifunctional cultivated plants that form a multi-layered vegetation community. Homegardens play an important role across various aspects, including ecology, economy, society, and culture (High & Shackleton, 2021). Ecologically, the homegarden serves as a place to grow food and ornamental plants, as well as to provide shade and prevent erosion (Larios *et al.*, 2013; Ramli *et al.*, 2021). In this study, the size of homegardens belonging to the Malay community was relatively large. Initially, the homegarden was used by local people for social and family activities, so the homegarden size was limited. The activities undertaken in the homegarden included parenting, socializing with neighbours, and drying agricultural products (Silalahi *et al.*, 2015). The analysis results of homegarden determined 136 species of food plants belonging to 57 families. Based on use, plants were grouped into five categories: fruit, spices, beverage ingredients, vegetables, and additional food. The highest number of plant species in homegarden was fruit (63 species). In comparison, the lowest was additional food and beverages (7 species) (Fig. 3).

In the homegarden, the species with the highest IVI value was *Manihot esculenta* (12.12%) (Table 3). The Malay community in Belitung Regency also consumes *M. esculenta* and *Br. androgyne* as vegetables. The highest IVI value of *M. esculenta* is inseparable from the ease of planting and low capital allocated for planting and maintenance costs. The production of *M. esculenta* tubers in Belitung Regency in 2023 was 1,337.05 tons (BPS, 2024). The sub-regency with the highest *M. esculenta* production is Tanjung Pandan, with 464 tons, and production has increased significantly compared to 2019. *Alpinia galanga* (Zingiberaceae) has primarily used as a spice, enabling a single plant species can serve multiple functions. *Breynia androgyne* is not only used as a vegetable, thus encouraging people to cultivate it, while *C. nucifera* is not only used as fruit but also as spice (Chikmawati *et al.*, 2023).

The fruits of *C. nucifera* can also be sold, thereby increasing owner's income. In addition, *C. nucifera* is mostly found in coastal areas of the tropics and subtropics because coconut requires a hot, humid climate and alluvial soil. This species can grow up to an altitude of 1,000 m. asl, but altitude increases, growth slows (Wakhidah *et al.*, 2020). The homegarden of the Malay community greatly contribute to meeting the community of the local community's food needs (Fig. 5). This situation is indicated by the number of plant species, most of which were mostly for food. The homegarden is closely related to the life of the owner (Galluzzi *et al.*, 2010; Galhena *et al.*, 2013).

The composition of homegarden plant diversity in this study differed from that in other tropical regions, such as in the southwestern region of Bangladesh and the Vaca Brava region, Brazil, where the Fabaceae had the highest number of species (Carvalho *et al.*, 2013). These species from Zingiberaceae were frequently used as spices and medicines, and it is not easy to find alternative species with the same properties. The same plant species was used in the Malay community in Durian Sebatang Village, West Kalimantan. Thus, homegardens play an important role in conserving the source of genetic diversity of local plant species and protecting species that are not widely planted in various places as well (Wulandara *et al.*, 2018).

Garden. In the Belitung Regency, a garden is a piece of land, mostly in open areas, that has been treated by the community, especially as a place to grow plants. The results of the analysis showed that 72 species of food plants belonged to 40 families. Based on use, plants were grouped into five categories: fruit, spices, beverage ingredients, vegetables, and additional food. The highest number of plant species in the garden was fruit (30 species). In comparison, the lowest was beverages (four species) (Fig. 3). The most dominant family is Myrtaceae, followed by Zingiberaceae, Solanaceae, Poaceae, and Phyllanthaceae (Fig. 4). Species from Myrtaceae found in this environmental unit include *S. bankense*, *S. polyanthum*, *S. aqueum*, *P. guajava*, *S. malaccense*, *Rh. cinerea*, *R. tomentosa*, *S. racemosum*, and *T. marguensis*.

The species with the highest IVI value was *Zea mays* (corn), followed by *Piper nigrum*, *An. comosus*, *A. galanga*, and *Amaranthus hybridus* (Table 3). The high importance of corn in most gardens in Belitung is due to its harvest time, which runs until the end of the year, when there is a high demand for corn for the New Year's celebration. The corn planted by farmers is a type of sweet corn. The marketing opportunity for this corn is not only to meet local needs, but it can also be sent outside Belitung. In the future, it may be possible to build a small-scale feed factory that can meet local needs. However, this requires assessment and commitment from the government, farmers, and the private sector. Malay communities tend to plant and cultivate the Zingiberaceae family more often in the garden. Zingiberaceae is widely used as a food and medicinal plant worldwide. Members of this family are among the most popular herbs in many traditional medicinal systems, especially the ginger rhizome. This plant has a long history of ethnobotanical use due to its antimicrobial properties, derived from the essential oils of its rhizomes (Shahrajabian *et al.*, 2019). For example, galangal, turmeric, and ginger have been used extensively for decades and are still used for traditional and medicinal purposes today, with easy access and

low cost, allowing more people to benefit from these plants.

The crops that farmers in the Belitung Regency widely cultivate in their gardens are *Z. mays*, *P. nigrum*, and *An. comosus*. The *P. nigrum* propagates on *Gliricidia sepium*. Besides being utilized as a pillar for plant propagation, *G. sepium* roots are also useful as a nitrogen enhancer for the plant's root system, preventing soil erosion and landslides, and can kill weeds, especially the reeds that grow underneath (Alamu *et al.*, 2023). *Piper nigrum* is widely cultivated by farmers in Belitung Regency gardens because of its ease of cultivation and high economic value, which encourages people to plant it. Besides its economic value, *P. nigrum* is also used by the community as a spice. Gardens serve as farmland to meet the needs of vegetables, fruits, and herbs, as a main or secondary source of income for the farmer by selling plant products.

Rice field. Rice fields in Belitung Regency are wet environmental units that physically is on wetlands with a flat surface, bounded by bunds, planted with rice and other plants on the edges of rice fields, around huts, and bunds (Fig. 5). Farmers plant plants other than rice fields to utilize the available space so that they can earn additional income by selling their product or consuming it personally. The area of rice fields that were successfully inventoried ranged from 300 to 3,500 m². The wider the rice field, the more rice is planted. Although the rice field area is large, it does not affect the number of species other than rice found around the rice fields. This situation occurs because the species planted in the rice field are monocultural, and farmers are more concerned with the number of rice individuals than with other species. The analysis of the rice field determined 40 species of food plants belonging to 26 families. Based on use, plants were grouped into six categories: fruit, spices, beverage ingredients, vegetables, staple food, and additional food. The highest number of plant species in the rice field was vegetable (14 species), while the lowest was staple food (one species, two varieties) (Fig. 3).

The rice field inventory results show that the most dominant family is Poaceae, followed by Zingiberaceae, Solanaceae, Fabaceae, and Euphorbiaceae (Fig. 4). Species from Poaceae include *Z. mays*, *O. sativa* cv. Inpari 32, and *O. sativa* cv. IR36. This rice variety is also used in Rias Village, Toboali District, South Bangka Regency, which explains that rice farmers in the village mostly use Inpari 32 and Inpari 42 seeds. The farmers use these seeds because they are derivative from the easy-to-obtain sources (Sitorus *et al.*, 2024).

In the rice field, the species with the highest IVI value were *O. sativa*, *M. esculenta*, and *A. galanga* (Table 3). The Belitung Malay community tends to

prefer the type of rice that produces white rice rather than red rice. It is because the taste of white rice is considered better, although in terms of nutrition, red rice is superior. Efforts to intensify the increase in Inpari 32 rice production are more likely to be carried out by using superior rice varieties. Other research indicates that Inpari 32 has high production potential, making it suitable for increasing rice production (Agustian *et al.*, 2022).

On the other hand, lemongrass (*Cy. nardus*), also included in Poaceae, is useful for imparting a distinctive aroma to food. The Malay community in Belitung Regency usually uses lemongrass to make chili sauce. The community usually uses it to treat itching and often mixed it with massage oil (Chikmawati *et al.*, 2023; Mukarram *et al.*, 2021).

Ume. In Belitung Regency, *ume* is an artificial environmental unit; initially, it was a stretch of forest, then the community cut down trees in the wilderness to create *ume* for planting rice, horticultural plants (pineapple, pepper, lemongrass, ginger, turmeric, and galangal), and secondary crops (cassava, sweet potato, corn, peanuts, and green beans). When planting rice, the community also planted perennial plants that produce edible fruit, including *Durio zibethinus*, *Nephelium lappaceum*, and *Mangifera indica*. There are nine species of food plants belonging to seven families in the *ume*. Based on use, plants were grouped into five categories: fruit, spices, beverages, vegetables, staple food, and additional food. The highest number of plant species in the *ume* was vegetables (Fig. 4). In the *ume*, the species with the highest IVI value was *O. sativa* cv. Mirah, followed by *M. esculenta* and *Cnidioscolus aconitifolius* (Table 3).

After the *ume* is harvested, the owners leave it for several years, then look for a new location that is considered more fertile for *ume*. The community can also reuse the *kelekek* as *ume*, or turn it into a village and cemetery. Meanwhile, suppose the fruit plants once planted in the *ume* do not grow, and the community does not plant hardy fruit trees after the rice harvest. In that case, the abandoned *ume* will become an environmental unit overgrown with shrubs and wild plants, from stake level to pole level. Land that will be used for *ume* must first obtain approval from the village *shaman* (Henri *et al.*, 2022).

In this study, only one *ume* was successfully inventoried, having been cultivated by its owner for 2 (two) months. This *ume* land is divided into two parts for planting the main plants, which are red rice (*O. sativa*) and cassava (*M. esculenta*). In the middle of the *ume*, there is a hut used by farmers as a place to rest and temporarily store the harvest before taking it home (Fig. 5).

Table 4. Conservation strategies of food plant in Belitung Regency.

Conservation strategies/species	IVI Category	ICS Category
Maintaining the availability of species (2%)		
Kemang (<i>Mangifera caesia</i>)	High	High
Sahang (<i>Piper nigrum</i>)	High	High
Padi (<i>Oryza sativa</i>)	High	High
Cultivating, studying, and developing another potential (49%)		
Nanas (<i>Ananas comosus</i>)	Moderate	High
Aren (<i>Arenga pinnata</i>)	Low	High
Kelapa (<i>Cocos nucifera</i>)	Low	High
Cultivating, studying, and developing other potentials (49%)		
Cempedak (<i>Artocarpus integer</i>)	Moderate	Low
Rambutan (<i>Nephelium lappaceum</i>)	Low	Low
Kuweni (<i>Mangifera odorata</i>)	Low	Low

B. Conservation of Environmental Unit of the Malay Community in Belitung Regency

Sustainable management of natural resources (SMNR) is needed to support community life in an area, particularly the management of food plants in the Belitung community environmental units, such as *kelekak* and the forest. Management of SMNR in a conventional regional community based on local knowledge can preserve several potential plants, such as medicinal plants, food plants, or others (Rahayu *et al.*, 2022). Environmental unit development can be carried out by cultivating potential food plant species and by developing the *kelekak*, homegarden, *ume*, and garden environmental units as ecotourism attraction in Belitung Regency. *Kelekak*, *ume*, garden, and rice field, owned by one family and passed down through generations, support erosion prevention, water source management, and the provision of livelihoods for plants. Therefore, *kelekak*, *ume*, gardens, and rice fields can be a buffer for forest areas generally located on hills or above, providing settlements for the Malay community. Several species of food plants in the forest can only be used during the fruiting season or when abundant in nature (Suwardi *et al.*, 2020).

The community in Belitung Regency has a rule prohibiting the trading of *kelekak*, a heritage that must be guarded from one generation to another. This rule can protect the heritage from being converted into tin mining and oil palm plantations. *Kelekak* and *ume* also act as a medium for transferring knowledge about the environment in the Malay community of Belitung Regency during the fruit season. While eating fruit, family members also tell stories regarding history, forest fruits, and

other knowledge on managing nature and the surrounding environment. This transfer of knowledge continues to occur and applies not only to the family but also to the community outside the Belitung Regency. The environmental units provide the potential for diverse food and non-food plants, including medicine and rituals, to meet daily economic needs. The community has a variety of local food plants that are continuously used and maintained.

The Malay community in Belitung Regency has little knowledge of the ecological values of several food plants, including the critical value of fruits, spices, vegetables, additional foods, and staple foods. These results are in line with a previous study on the Minangkabau community in Lima Puluh Kota Regency, which used 154 plant species belonging to 51 families as sources of carbohydrates, proteins, fats and oils, fruits, vegetables, spices, and drinks (Agesti *et al.*, 2023). The existence and availability of food plants are attributed to various environmental units, including homegardens, gardens, *kelekak*, rice fields, *rimba*, *bebak*, and *ume*. Each plant has cultural value for the community due to the diverse values of intensity, quality, and exclusivity of each plant species, depending on its use, processing method, and existence in nature (Chikmawati *et al.*, 2023). The plant IVI can be used to determine the conservation strategy for food plants utilized by the Belitung community. The importance of preserving plants is an essential principle in sustainable conservation efforts that impact the regeneration of a species. The Belitung Malay community has essential values and high local wisdom in maintaining a plant species, including prohibiting the cutting



Fig. 5. Traditional landscapes in Belitung Regency. A. *Rimba*. B. *Bebak*. C. *Kerangas bebak*. D. *Kelekek*. E. Homegarden. F. Garden. G. Rice field. H. *Ume*. Photos by Dimas Prasaja.

down young trees near water sources or springs, which can damage the ecosystem and affect the quality of the water needed daily. Another study also described a similar regulation, in which the Madurese community was prohibited from cutting down trees near water sources (spring area) (Yamini *et al.*, 2023).

The surrounding community's harvesting and retrieval processes influence the existence of food plants in nature. Species with high importance will also tend to have high harvest rates, suggesting that continuous harvesting without replacement can lead to extinction (Yamini *et al.*, 2023). Therefore, plants with high cultural importance (ICS) and availability (IVI) must be maintained in their habitat to meet daily needs. For plants with high ICS and low levels of availability, cultivation efforts are needed to meet the species' needs. The Belitung community harvests food crops from gardens, including *P. nigrum* and other non-cultivated plants, to meet daily needs. During the abundant season, plants, such as *Archidendron pauciflorum* are often sold in the market, thereby increasing a family's income. Communities usually sell cultivated and non-cultivated plants that have economic value to the market, either as fresh or processed products into food (Moksia *et al.*, 2019; Karabak, 2017).

Plant species that need conservation efforts to maintain species availability are *Mangifera caesia*, *P. nigrum*, and *O. sativa* (Table 4). These three plant species, with high ICS and IVI values, should be maintained in their habitat to ensure continuous availability. *Ananas comosus*, *A. pinnata*, and *C. nucifera* are plant species with a moderate to low level of availability in nature but high use value (Table 4). Conservation efforts through cultivation are essential for plant species with low or moderate availability with high cultural value, such as *An. comosus*, *C. nucifera*, and *A. pinnata* (Table 4). *Arenga pinnata* is used for palm sugar production, underscoring the need to explore and develop other potentials uses of these three species, which grow in *kelekak* and garden in Belitung. The low to moderate presence of plant species shows that the number of individuals in nature is also small. Specifically, *An. comosus* and *A. pinnata* used as spice mixture for cooking foods in the Belitung Regency. The Belitung Malay community harvests it in the homegarden, garden, or *kelekak*, for a cooking spice to process fish soup (*gangan*).

Several plant species, *A. integer*, *N. lappaceum*, and *M. odorata*, require conservation efforts in the form of cultivation, studies, and other potential development due to low or moderate availability in nature and use value (Table 4). *Artocarpus integer* has moderately available in nature, as the fruit is typical for fresh and rarely found in forests or homegarden. When harvesting and cultivation activities in nature are unbalanced, they threaten the

availability of plants and the unmet needs of plants (Suwardi *et al.*, 2020).

Most food plants used by the community are available every year. The Malay community in Belitung Regency obtains several species of food plants from *kelekak* and forest sources. Several species of alternative food plants can meet their needs during the lean season. Wild food plants are often used to meet subsistence food needs and survive during famine, serving as a basis for maintaining and preserving the sustainability of traditional ecological knowledge in managing food plants in *kelekak*, *rimba*, *bebak*, and *kerangas bebak*. The presence of wild species in the surrounding environment motivates the community to recognize the benefits of plant species, such as fruits, vegetables, and spices.

Various fruit species can be available throughout the year, such as *Musa paradisiaca*, *A. integer*, and *An. comosus*. Several species of other fruit-producing plants bear fruit in certain seasons, including *D. zibethinus*, *Mangifera indica*, *N. lappaceum*, *L. domesticum*, and *G. mangostana*. The community obtains several vegetable plants from homegardens, gardens, and rice fields, such as *Cucumis sativus* and *Amaranthus* sp. This study shows that the Malay community in Belitung Regency has food diversification and security for traditional communities that need to be maintained and sustainably available.

Ecological value. Malay communities in Belitung Regency who depend on natural resources in the form of food plants that can be obtained from the environmental unit show the ecological role of the environmental unit as a provider of ecosystem services, such as helping pollination, contributing to the formation of microclimates, reducing soil erosion, playing a role in the energy cycle, and controlling pests. For example, homegardens can provide habitat for birds, insects, and reptiles. High plant diversity also provides genetic sources for various plant species, especially for food crops. Regarding rice fields, although no research has examined the role of rice field environmental units in pest management, several researchers indirectly suggest that species diversity and interactions among organisms can reduce pests and plant disease populations (Mohri *et al.*, 2013). This statement is reinforced by the discovery of species with potential as refugia and as organic pesticides. Based on the experience of rice field owners in the Membalong sub-district, planting *Allamanda cathartica* can protect secondary crops from pests by becoming a habitat for predators of these pests (Fig. 5).

Belitung's natural beauty and ecological richness offer great potential for ecotourism development. By sustainably managing the environment, local communities can develop an environmentally friendly tourism industry, which in turn can boost

their economy without damaging the ecosystem. Community-based management involving local stakeholders can ensure the sustainability of the ecosystem and provide direct benefits to them. Ecosystem damage that often occurs due to deforestation or land conversion can be restored through ecosystem restoration such as the restoration of mangrove forests and primary forests which can provide great benefits for the restoring lost or disturbed ecosystems, improving ecological balance, and improving ecological functions such as water absorption, pollution control, and increasing the food crops cultivation so that it remains sustainable in its habitat.

Economic value. The environmental unit of Belitung society plays a role in fulfilling nutritional needs by supplying food in the form of beverage ingredients, tubers, vegetables, and fruits. *Rimba, bebak, kerangas bebak, kelekak, ume*, homegardens, gardens, and rice fields are food sources that meet food needs and maintain food security for rural and urban communities. In addition to being a food source, the Malay community used food plants in the *rimba, bebak, kerangas bebak, kelekak, ume*, homegardens, gardens, and rice fields as additional sources of income. Excess harvests are sold to intermediaries or local markets, enabling the owners of a single environmental unit to earn additional household income. Sources of fulfillment of food needs socio-economically contribute to maintaining food availability for their own needs and for neighbours who feel the benefits. The use of plant species as food ingredients is an important link in increasing the availability of functional food for a community (Silalahi *et al.*, 2015; Zhang *et al.*, 2020). In addition, research indicates that several plants in each environmental unit contain secondary metabolites with medicinal properties that can be used to treat common diseases in the community (Galhena *et al.*, 2013).

Food plants that serve as a source of food also have economic value, useful as a source of income for the Belitung Malay community. An observation of the economic value of the plant species was conducted to determine the direct contribution of the species to the survival of the Malay community. The food plant species that has economic value for the Malay community is pepper (*P. nigrum*). This species is used for its fruit to meet the needs of spices and herbs. Pepper is usually harvested once a year during the dry season. Pepper production in Belitung involves a lengthy process and requires specialized skills. Pepper is planted in fertile plantation lands, usually in the highlands with a tropical climate that supports its growth. Pepper farmers in Belitung have passed down pepper cultivation techniques from generation to generation, ensuring the quality and distinctive taste of the pepper they produce.

The pepper harvesting process is usually carried out after the pepper fruit is ripe, and the fruits are then dried using traditional methods to maintain its distinctive aroma and taste. Pepper is more often used to provide a warm taste to various dishes. Economically, pepper provides significant added value, especially with stable demand in the national and international markets. Pepper plantations are one of the agricultural sectors that continue to grow and make a major contribution to the welfare of the people in Belitung. One important aspect of the production of pepper commodities in Belitung is sustainability. Local farmers are increasingly aware of the importance of environmentally friendly agricultural practices to maintain the sustainability of pepper production. This practice includes the use of organic fertilizers, good water management, and crop rotation to maintain soil fertility. These sustainable practices not only protect the environment but also ensure that Belitung pepper production remains of high quality and can meet future market demand.

Socio-cultural value. Studies from a socio-cultural perspective illustrate that the Malay community plants various species of plants on the edge of the land or the front of the homegarden. At the same time, the middle part is used to dry various crops, such as vegetable seeds, coffee, and rice. It is a characteristic of the homegarden environmental unit of local people who work as farmers or gardeners. In addition, food crops planted in the homegarden can be useful to the owner or shared with neighbours who need them to be processed into daily food. The cultivation of plant species used as food ingredients in the homegarden helps conserve the species. Thus, the local community will ensure the sustainability of these plant species so that they remain available for daily cooking. Apart from the homegarden, the community can harvest it from the *rimba, bebak, kerangas bebak, kelekak*, gardens, *ume*, or rice fields. From this culture emerge patterns of behavior for maintaining, using, and managing natural resources so that they remain sustainable, ultimately leading to harmony between humans and nature. The plant species utilized by the Malay community of Belitung Regency has development potential. The use of these types is local knowledge and wisdom obtained by the community from their ancestors. The community wealth of local knowledge and wisdom needs to be preserved because it aligns with its customary, cultural, and socio-economic background.

CONCLUSION

Food plant diversity varies among the eight environmental unit types studied (*rimba, bebak, kerangas bebak, kelekak*, homegarden, garden, *ume*, and rice field). The highest food plant diver-

sity was found in the homegarden environmental unit (136 species belonging to 57 families), while the least was in the *ume* (nine species belonging to seven families). The food plants used can be grouped into six utilization categories, namely fruits, vegetables, seasoning producers, beverages, supplementary foods, and staple foods. The highest utilization category for each environmental unit is fruits. The most common food plants found in homegardens are *M. esculenta*, *Alpinia galanga*, *Br. androgyna*, *C. nucifera*, and *Cy. nardus*. The most common family across all environmental units is Myrtaceae, except in rice fields where it is Poaceae (six species), and in *ume*, where it is Euphorbiaceae (two species). Conservation strategy management related to the management and development of food plants must be implemented in accordance with the ecological status and cultural interests of each species. Moreover, the cultivation process should be carried out for plants with low to moderate IVI and high ICS, such as *An. comosus*, *Arenga pinnata*, and *C. nucifera*. There are five important commodities in Belitung Regency whose economic value is evident, namely *P. nigrum*, *A. pinnata*, *D. zibethinus*, *G. mangostana*, and *An. comosus*. *Piper nigrum* is used for its fruit to meet the needs of a spice and herb. Pepper (*P. nigrum*) from Belitung has unique characteristics that distinguish it from pepper from other regions of Indonesia. Belitung white pepper is known to have for its rounder and denser grains. Its aroma is stronger and sharper, making it highly sought after for culinary and industrial uses. Belitung has sandy and red-yellow podzolic soils and is rich in minerals, which give the pepper a unique taste and aroma. Environmental units have ecological value as providers of ecosystem services, such as pollination, microclimate formation, reduced soil erosion, and pest control. The economic value of environmental units is that they are a source of food that supplies food needs and maintains food security for rural and urban communities, as well as being a source of additional income. The socio-cultural value of environmental units is that food crops planted in the yard can be useful for their owners or can also be shared with neighbours who need them to be processed into daily food.

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REFERENCES

- AGESTI, A. R. A., ARIYANTI, N. S., CHIKMAWATI, T. & PURWANTO, Y. 2023. Ethnobotany of food plants used by Minangkabau community in Lima Puluh Kota District, West Sumatra, Indonesia. *Biodiversitas* 24(5): 2023. DOI: 10.13057/biodiv/d240529.
- AGNOLETTI, M. & ROTHERHAM, I. D. 2015. Landscape and biocultural diversity. *Biodiversity and Conservation* 24 (3): 3155–3165. DOI: 10.1007/s10531-015-1003-8.
- AGUSTIAN, A., ALDILLAH, R., NURJATI, E., YAUMIDIN, U. K., MUSLIM, C., ARININGSIH, E. & RACHMAWATI, R. R. 2022. Analysis of the utilization of rice seeds of improved variety (Inpari 32) in Indramayu District, West Java. *IOP Conference Series: Earth Environmental Science* 1114 012098. DOI: 10.1088/1755-1315/1114/1/012098.
- ALAMU, E. O., ADESOKAN, M., FAWOLE, S., MAZIYA-DIXON, B., MEHRETEAB, T. & CHIKOYE, D. 2023. *Gliricidia sepium* (Jacq.) Walp applications for enhancing soil fertility and crop nutritional qualities: A review. *Forests* 14(3): Art. 635. DOI: 10.3390/f14030635.
- ALBUQUERQUE, U. P., da CUNHA, L. V. F. C., LUCENA, R. F.P. & ALVES, R. R. N (Eds). 2014. *Methods and techniques in Ethnobiology*. Springer Science-Business Media, New York.
- AUDINO, L. D., LOUZADA, J., & COMITA, L. 2014. Dung beetles as indicators of tropical forest restoration success: Is it possible to recover species and functional diversity?. *Biological Conservation* 169: 248–257.
- BADAN PUSAT STATISTIK (BPS) Kabupaten Belitung. 2024. *Belitung District in Figures*. CV Sejati, Belitung. Vol 24, 2024. ISSN 0215-4005.
- BLACKMAN, A., CORRAL, L., LIMA, E. S. & ASNER, G. P. 2017. Titling indigenous communities protects forests in the Peruvian Amazon. *PNAS* 114: 4123–4128. DOI: 10.1073/pnas.1603290114.
- CARVALHO, T. K. N., DE OLIVEIRA ABREU, D. B., DE LUCENA, C. M., PEDROSA, K. M., NETO, C. F. A. V., ALVES, C. A. B., ... & DE LUCENA, R. F. P. 2013. Structure and floristics of home gardens in an altitudinal marsh in northeastern Brazil. *Ethnobotany Research and Applications* 11: 029–047.
- CHIKMAWATI, T., SULISTIJORINI, DJUITA, N. R., PRASAJA, D., YAMINI, T. H. A.,

- MIFTAHUDIN, & FAKHRURROZI, Y. 2023. Ethnobotany of food plants utilized by Malay Ethnic in Belitung District, Indonesia. *Biodiversitas* 24(5): 2977–2987. DOI: 10.13057/biodiv/d240552.
- FAKHRURROZI, Y. 2001. *Satuan-satuan Lanskap dan Keanekaragaman Tumbuhan Buah-buahan Liar Edibel dalam Kehidupan Masyarakat Melayu Belitung*. IPB Press. [Undergraduate thesis].
- FARIAS, D. D. P., NERI-NUMA, I. A., ARAUJO, F. F. & PASTORE, G. M. 2020. A critical review of some fruit trees from the Myrtaceae family as promising sources for food applications with functional claims. *Food Chemistry* 15(306): Art. 125630. DOI: 10.1016/j.foodchem.2019.125630.
- GALHENA, D. H., FREED, R. & MAREDIA, K. M. 2013. Home gardens: a promising approach to enhance household food security and well-being. *Agriculture and Food Security* 2(1): Art. 8. DOI: 10.1186/2048-7010-2-8.
- GALLUZZI, G., EYZAGUIRRE, P., & NEGRI, V. 2010. Home gardens: neglected hotspots of agrobiodiversity and cultural diversity. *Biodiversity and Conservation* 19(13): 3635–3654. DOI: 10.1007/s10531-010-9919-5.
- HENRI, FATANSYAH, F., ALITA, LESTARI, Y., SONIA, A., PUTRI, J. E. & RAHMASARI. 2022. Community's local wisdom and its relationship with environmental conservation efforts in Bangka Belitung, Indonesia. *IOP Conference Series: Earth Environmental Science* 1115: Art. 012036. DOI: 10.1088/1755-1315/1115/1/012036.
- HIDAYAT, S. 2017. The use by local communities of plants from Sesaot Protected Forest, West Nusa Tenggara, Indonesia. *Biodiversitas* 18(1): 238–247. DOI: 10.13057/biodiv/d180130.
- HIGH, C. & SHACKLETON, C. M. 2021. The comparative value of wild and domestic plant in home garden of South African rural village. *Agroforestry Systems* 48: 141–156.
- HUSSAIN, M. A., YUNOS, M. Y. M., ISMAIL, N. A., ARIFFIN, N. F. M. & ISMAIL, S. 2020. A review of the elements of nature and the Malay cultural landscape through Malay literature. *Sustainability* 12: Art. 2154. DOI: 10.3390/su12062154.
- JO, I., BELLINGHAM, P. J., MCCARTHY, J. K., EASDALE, T. A., PADAMSEE, M., WISER., S. K. & RICHARDSON, S. J. 2022. Ecological importance of the Myrtaceae in New Zealand's natural forests. *Journal of Vegetation Science* 33: Art. e13106. DOI: 10.1111/jvs.13106.
- KARABAK, S. 2017. Economic and socio-cultural importance of edible wild species. *ANADOLU Journal of Aegean Agricultural Research Institute* 27(2): 26–38.
- KUSPRADINI, H., PUTRI, A. S., EGRA, S. & YANTI, Y. 2019. In vitro antibacterial activity of essential oils from twelve aromatic plants from East Kalimantan Indonesia. *Biodiversitas* 20(7): 2039–2042. DOI: 10.13057/biodiv/d200733.
- LARIOS, C., CASAS, A., VALLEJO, M., MORENO-CALLES, A. I. & BLANCAS, J. 2013. Plant management and biodiversity conservation in Náhuatl homegardens of the Tehuacán Valley, Mexico. *Journal of Ethnobiology* 9 (74): 1–16.
- LAWRENCE, T. J., STEDMAN, R. C., MORREALE, S. J. & TAYLOR, S. R. 2019. Rethinking landscape conservation: linking globalized agriculture to changes to indigenous community-managed landscapes. *Tropical Conservation Science* 12: 1–19. DOI: 10.1177/194008291988950.
- LISBOA, M. A. N., DA SILVA, L. V. A., NASCIMENTO, A. S., SILVA, A. O., TEIXEIRA, M. R. A., FERREIRA, M. F. R., FERREIRA, S. C., DA SILVA, A. C. V., COLARES, A. V. & JUNIOR, J. T. C. 2024. Diversity, structure, and carbon sequestration potential of the woody flora of urban squares in the Brazilian semiarid region. *Trees, Forest and People* 16: Art. 100561. DOI: 10.1016/j.tfp.2024.100561.
- MOHRI, H., LAHOTI, S. SAITO, O. MAHALINGAM, A. GUNATILLEKE, N. IRHAM, HOANG, V. T. HITINAYAKE, G. TAKEUCHI, K. & HERATH, S. 2013. Assessment of ecosystem services in homegarden systems in Indonesia, Sri Lanka, and Vietnam. *Ecosystem Services* 5: 124–136. DOI: 10.1016/j.ecoser.2013.07.006.
- MOKSIA, F., YOUNG, H., JEANNE FLORE, N., KONSALA, S., TCHOBSALA, M., SIEGFRIED DIDIER, D., LOUIS, Z. & PIERRE MARIE, M. 2019. Diversity and socio-economic value of wild edible plants in the mounts Mandara Region, Cameroon. *International Journal of Science* 8 (10): 13–25. DOI: 10.18483/ijSci.2168.
- MUKARRAM, M., SADAF, C., MO, A. K., PALMIRO, P. 2021. Lemongrass essential oil components with antimicrobial and anticancer activities. *Antioxidants (Basel)* 11 (1): 20. DOI: 10.3390/antiox11010020.
- NOVITA, A. & ADI, A.M. W. 2020. Geoarchaeological aspects of subsistence strategies of communities on the South Coast of Belitung from the 19th century to the early 20th century AD. *Naditira Widya* 14 (2): 155–168. DOI: 10.24832/nw.v14i2.425.
- OKTAVIA, D., PRATIWI, S. D., MUNAWAROH, S., HIKMAT, A. & HILWAN, I. 2021. Floristic composition and species diversity in three habitat types of heath forest in Belitung

- Island, Indonesia. *Biodiversitas* 22 (12): 5555–5563. DOI: 10.13057/biodiv/d221240.
- PALINKAS, L. A., HORWITZ, S. M., GREEN, C. A., WISDOM, J. P., DUAN, N. & HOAGWOOD, K. 2015. Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health* 42(5): 533–544. DOI: 10.1007/s10488-013-0528-y.
- PRASAJA, D., CHIKMAWATI, T., SULISTIJORINI, S., PURWANTO, Y. & DJUITA, N. R. 2023. Homegarden ethnobotany of three Malay villages in Belitung District, Indonesia. *IOP Conference Series: Earth Environmental Science* 1271: Art. 012051. DOI: 10.1088/1755-1315/1271/1/012051.
- PRASETYO, B., CHIKMAWATI, T., WALUJO, E. B. & ZUHUD, E. A. M. 2018. Ethnoecology: The traditional landscape of Osing Tribe in Banyuwangi Indonesia. *Biodiversitas* 19(6): 2003–2009. DOI: 10.13057/biodiv/d190604.
- PRIAMBUDI, A. S., CHIKMAWATI, T., SULISTIJORINI, FAKHRURROZI, Y. 2022. Diversity and ecology of Pteridophytes in Cendil heath forest and Gurok Beraye tropical rainforest, Belitung, Indonesia. *Biodiversitas* 23(9): 4775–4782. DOI: 10.13057/biodiv/d230945.
- RAHAYU, M., SUSAN, D., KEIM, A. P., SUSIARTI, S. & SUJARWO, W. 2021. The diversity of plant species used in traditional herbal massage oil in Indonesia. *Pacific Conservation Biology* 28(6): 505–516. DOI: 10.1071/PC21022.
- RAHAYU, M., SUSIARTI, S., PURWANTO, Y., KALIMA, T., MUNAWAROH, E., SETIAWAN, M., NIKMATULLAH, M., SUJARWO, W. & MARSANDI, F. 2023. Ethnoecology of local communities at the Buffer Area of the Mount Gede Pangrango National Park, West Java, Indonesia. *J. of Namibian Studies: History Politics Culture* 39: 282–294. DOI: 10.59670/y8c4p835.
- RAMLI, M. R., MILOW, P. & MALEK, S. 2021. Species composition, diversity and traditional uses of plants in homegardens in Kampung Masjid Ijok, Perak, Malaysia. *Biodiversitas* 22 (4): 1902–1911. DOI: 10.13057/biodiv/d220437.
- RENES, H., CENTERI, C., KRUSE, A. & KUCERA, Z. 2019. The future of traditional landscapes: discussion and visions. *Land* 8(6): 98. DOI: 10.3390/land8060098.
- SHAHRAJABIAN, M. H., WENLI, S. & QI, C. 2019. Clinical aspects and health benefits of ginger (*Zingiber officinale*) in both traditional Chinese medicine and modern industry. *Acta Agriculturae Scandinavica Section B — Soil & Plant Science* 69 (6): 546–556. DOI: 10.1080/09064710.2019.1606930.
- SHEIL, D., PURI, R. K., BASUKI, I., VAN HEIST, M., WAN, M., LISWANTI, N., RUKMIYATI, SARDJONO, M. A., SAMSOEDIN, I. & SIDIYASA, K. 2002. *Exploring Biological Diversity, Environment and Local People's Perspectives in Forest Landscapes: Methods for A Multidisciplinary Assessment*. Center for International for Forestry Research, Ministry of Forestry and International Tropical Timber Organization, Bogor.
- SILALAH, M., SUPRIATNA, J., WALUJO, E. B. & NISYAWATI. 2015. Local knowledge of medicinal plants in sub-ethnic Batak Simalungun of North Sumatra, Indonesia. *Biodiversitas* 16 (1): 44–54.
- SITORUS, R., ZULKARNAIN, I. & WAHYUNI, W. 2024. The ethnic diversity of farmer groups in environmental management of lowland rice farming in Rias village, Toboali District, South Bangka Regency. *IOP Conf. Ser.: Earth Environ. Sci.* 1419: Art. 012064. DOI: 10.1088/1755-1315/1419/1/012064.
- SLADE, E. M., MANN, D. J., & LEWIS, O. T. 2011. Biodiversity and ecosystem function of tropical forest dung beetles under contrasting logging regimes. *Biological Conservation* 144: 166–174.
- SURYADIN, A. 2023. Nilai-nilai kearifan lokal tanaman kekekak dalam literasi sastra di Bangka Belitung. *Prosiding Seminar Nasional dan Internasional HISKI* (3): 254–263 (In Indonesian).
- SUSIARTI, S., ORYZANTI, P., DJARWANINGSIH, T., SULISTIARINI, D. 2023. The potential of Taka plants (*Tacca leontopetaloides* (L.) Kuntze) as food sources in Bangka Belitung Archipelago, Indonesia. *Journal of Namibian Studies: History Politics Culture* 39: 102–122. DOI: 10.59670/8dq7478.
- SUWARDI, A. B., NAVIA, Z. I., HARMAWAN, T., SYAMSUARDI & MUKHTAR, E. 2020. Ethnobotany and conservation of indigenous edible fruit plants in South Aceh, Indonesia. *Biodiversitas* 21(5): 1850–1860. DOI: 10.13057/biodiv/d210511.
- TEMESGEN, M. & RATTA, N. 2015. Nutritional potential, health and food security benefits of taro *Colocasia esculenta* (L.): A review. *Food Science and Quality Management* 36: 23–31.
- THORNHILL, A. H., HO, S. Y., KÜLHEIM, C. & CRISP, M. D. 2015. Interpreting the modern distribution of Myrtaceae using a dated molecular phylogeny. *Molecular Phylogenetics and Evolution* (93) 29–43. DOI: 10.1016/j.ympev.2015.07.007.
- TURNER, N. J. 1988. The importance of a rose: Evaluating the cultural significance of plants in Thompson and Lillooet Interior Salish. *Journal of American Anthropologist* 90 (2): 272–290. DOI: 10.1525/aa.1988.90.2.02a00020.

- WAGNER, M. D. A. & FIASCHI, P. 2020. Myrtaceae from the Atlantic forest subtropical highlands of Sao Joaquim Park (Santa Catarina, Brazil). *Rodriguesia* 71: Art. e04032017. DOI: 10.1590/2175-7860202071006.
- WAKHIDAH, A. Z., CHIKMAWATI, T., PURWANTO, Y. 2020. Homegarden ethnobotany of two Saibatin villages in Lampung, Indonesia: Species diversity, uses, and values. *Forest Society* 4 (2): 338–357. DOI: 10.24259/fsv4i2.9720.
- WHEELER, H. C. & ROOT-BERNSTEIN, M. 2020. Informing decision-making with indigenous and local knowledge. *Journal of Applied Ecology* 57(9): 1634–1643. DOI: 10.1111/1365-2664.13734.
- WHITTEN, A. J., DAMANIK, S. J., ANWAR, J. & HISYAM, N. 1984. *The Ecology of Sumatra*. Gadjah Mada Univ. Press, Yogyakarta
- WILSON, P. G. 2011. *Myrtaceae*. In: KUBITZKI, K. (Ed.). *The Families and Genera of Vascular Plants. Volume X. Flowering Plants Eudicots: Sapindales, Cucurbitales, Myrtaceae*. Springer-Verlag, Heidelberg
- WIRABUMI, P., SUDARSONO & SUHARTINI. 2017. Struktur komunitas plankton di perairan waduk Wadaslintang Kabupaten Wonosobo. *Jurnal Prodi Biologi* 6(3): 183–184 (In Indonesian).
- WULANDARA, F. D. & RAFDINAL, L. R. 2018. Etnobotani tumbuhan obat suku Melayu Desa Durian Sebatang Kecamatan Seponti Kabupaten Kayong Utara. *Jurnal Protobiont* 7(3): 36–46 (In Indonesian).
- YAMINI, T. H. A., DJUITA, N. R., CHIKMAWATI, T. & PURWANTO, Y. 2023. Ethnobotany of wild and semi-wild edible plants of the Madresse Tribe in Sampang and Pamekasan Districts, Indonesia. *Biodiversitas* 24(2): 947–957. DOI: 10.13057/biodiv/d240234.
- YANGDON, P., ARAKI, T., RAHAYU, Y. Y. S. & NORBU, K. 2022. Ethnobotanical study of wild edible fruits in eastern Bhutan. *Journal of Ethnobiology and Ethnomedicine* 18 (27): 1–17. DOI:10.1186/s13002-022-00526-8.
- ZHANG, Y., YANG, L. X., LI, M.X., GUO, Y. J., LI, S., WANG, Y. H. 2020. The best choices: The diversity and functions of the plants in the home gardens of the Tsang-la (Motuo Menba) communities in Yarlung Tsangpo Grand Canyon, Southwest China. *Journal of Ethnobiology and Ethnomedicine* 16 (1): 1–23. DOI: 10.1186/s13002-020-00395-z.

ETHNOBOTANY OF FLOWER TRADING IN TRADITIONAL MARKETS OF BANYUMAS, CENTRAL JAVA, INDONESIA

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ABSTRACT

ALFIAN, R. L., HARAHAP, J., ISKANDAR, B. S. & HYUNG-JUN, K. 2025. Ethnobotany of flower trading in traditional markets of Banyumas, Central Java, Indonesia. *Reinwardtia* 24(2): 219–236. — Flower trading has long been present in society. Particularly in Javanese society, flowers hold significant biological importance in social and cultural life. Flowers are imbued with various symbolic meanings and are used in various life events and religious rituals. This study aims to explore the existence of flower trading within the community, especially in the Banyumas region. In addition to delving into the trade itself, this research also investigates the types of flowers being traded, how they are sourced for sale, the meanings attached to these flowers, how each type of flower and plant is sold, and how the classification of flower types according to the community is divided. This study employs a qualitative ethnographic method to gather research data. The findings of this research indicate that the existence of Rampe flower traders must be distinct from the community's cultural traditions, particularly in Banyumas. Rampe flower traders typically sell several flowers used as essential components in religious and cultural ceremonies. These flowers include roses (*Rosa hybrid* L.), ylang-ylang (*Cananga odorata* (Lam.) Hook.f. & Thomson), white magnolia (*Magnolia × alba* (DC.) Figlar & Noot.), and several other flowers. Most Banyumas people use these flowers for the tradition of grave pilgrimage. White and yellow magnolia flowers have a higher economic value as traders sell them in seed form. Rampe flower traders classify plants into those with high economic value and those with regular value. The high economic value of a flower is usually influenced by its availability (rarity) and the specific functions of certain types of flowers. Meanwhile, plants with regular economic value are typically complementary plants (not core plants) in the community's cultural and religious traditions.

Key words: Ethnobotany, flower traders, interpretation of symbols, religious traditions, traditional market.

ABSTRAK

ALFIAN, R. L., HARAHAP, J., ISKANDAR, B. S. & HYUNG-JUN, K. 2025. Etnobotani perdagangan bunga di pasar tradisional Banyumas, Jawa Tengah, Indonesia. *Reinwardtia* 24(2): 219–236. — Perdagangan bunga sudah cukup lama hadir di masyarakat. Khususnya pada masyarakat Jawa, bunga merupakan entitas biologis yang penting dalam kehidupan sosial budaya. Bunga disematkan dengan berbagai makna simbolis dan digunakan dalam berbagai kehidupan dan ritual keagamaan. Penelitian ini berupaya untuk menggali keberadaan perdagangan bunga di masyarakat khususnya masyarakat Banyumas. Tidak hanya mendalami perdagangan, penelitian ini juga menggali lebih dalam jenis bunga apa saja yang diperdagangkan, bagaimana cara mereka memperoleh bunga untuk diperjualbelikan, apa makna yang melekat pada bunga tersebut, bagaimana masing-masing jenis bunga dan tanaman tersebut dijual, serta bagaimana pembagian klasifikasi jenis bunga menurut masyarakat. Penelitian ini menggunakan metode kualitatif etnografi untuk menggali data penelitian. Penelitian ini menunjukkan eksistensi pedagang bunga rampe tidak bisa dilepaskan dari tradisi budaya masyarakat khususnya masyarakat Banyumas. Pedagang Bunga Rampe biasanya menjual beberapa jenis bunga yang digunakan sebagai salah satu syarat wajib dalam upacara keagamaan dan budaya masyarakat. Jenis bunga tersebut antara lain mawar (*Rosa hybrid* L.), ylang-ylang (*Cananga odorata* (Lam.) Hook.f. & Thomson), white magnolia (*Magnolia × alba* (DC.) Figlar & Noot.), dan beberapa bunga lainnya. Kebanyakan masyarakat Banyumas memanfaatkan bunga ini untuk melaksanakan tradisi ziarah kubur. Bunga magnolia berwarna

putih dan kuning me-miliki nilai ekonomi yang lebih tinggi karena pedagang menjualnya dalam bentuk bibit. Pedagang bunga rampe mengklasifikasikan tanaman bernilai ekonomi tinggi dan biasa. Tingginya nilai ekonomi suatu bunga biasanya dipengaruhi oleh ketersediaan bunga (kelangkaan) dan fungsi tertentu dari suatu jenis bunga. Sedangkan tanaman yang mempunyai nilai ekonomi rendah biasanya karena tanaman tersebut merupakan tanaman pelengkap (bukan tanaman inti) dalam tradisi budaya dan agama masyarakat serta kesediaannya yang melimpah dan mudah ditemui.

Kata kunci: Etnobotani, interpretatif simbolik, pasar tradisional, pedagang bunga, tradisi keagamaan.

INTRODUCTION

Traditional markets are dynamic spaces that are always interpreted by their owners (Aliyah *et al.*, 2017; Hermawan *et al.*, 2018). Talking about markets is like kinship or religion because traditional markets are always a cultural construction. Traders in Java themselves planned, implemented, and justified economic actions within Javanese cultural concepts (Alexander, 1987). In other words, traditional markets are not just an economic space but also a social space for the stakeholders who "make a living" (Sadilah *et al.*, 2011; Seligmann, 2018). The relationships between actors who support traditional markets are not only oriented toward economic calculations; intimate personal relationships mean that calculations of profit and loss no longer burden the relationships that exist but are more focused on social exchange (Granovetter, 2017).

On the other hand, more recent research explains that markets play a very important role in providing food and non-food commodity needs in society (see Iskandar *et al.*, 2021, 2022; Supangkat *et al.*, 2021). Various commodities are sold in the market, ranging from daily food needs to other needs outside of food needs, where each commodity receives different meanings and uses from its owners (Alfian *et al.*, 2020; Iskandar *et al.*, 2021). The commodities traded include on edible commodities as well such as flowers. Being a part of the Austronesian people, flowers play a significant role in the Austronesian civilization from the daily lives to religious related ceremonies (Matthews, 1995; Swain & Trompf, 2005; Baldick, 2013). This is even more conspicuous in Indonesia which is now widely accepted as both the origin and backbone of the Austronesian civilization (Bellwood *et al.*, 2006). This can be seen throughout Indonesia, including in Java and Kalimantan (the Indonesian Borneo, see Iskandar *et al.*, 2022).

Ethnobotanically, the relationship between plants and humans is apparent and has begun even since the dawn of human civilization. For thousands of years, plant and human communities have been intertwined through domestication, cultivation, and consumption processes. Plants are in homes, backyards, gardens, farms, and the human diet. Plants provide sustenance, solace, friendship, and health to human communities (Miller, 2019).

Over long periods, indigenous peoples developed and maintained their knowledge systems through direct and indirect interactions with various biophysical processes and biological species. This means that the knowledge possessed by indigenous peoples about their environment develops gradually and accumulates throughout their history (Tame-ne *et al.*, 2024). This knowledge developed into various medical tools, religious traditions, and community life practices, such as people in Mexico who use plants for treatment (García-González *et al.*, 2024).

In the Austronesian context, the use of flowers is prominently featured in various cultural practices among the Sundanese, Javanese, Balinese, and Betawi communities. In Balinese society, flowers serve as a crucial and formal element in numerous Hindu religious rituals (Ristanto *et al.*, 2020; Sujarwo *et al.*, 2020; Darma *et al.*, 2021; Ratnani *et al.*, 2021; Andila *et al.*, 2022). In contrast, among the Sundanese and Betawi, flowers are primarily utilized for decorative purposes and aesthetic ornaments; several types of flowers are also used as edible plants (Iskandar & Fasta, 2015; Erawan *et al.*, 2018; Iskandar *et al.*, 2020; Soemarwoto & Iskandar, 2021; Iskandar *et al.*, 2023; Pratami *et al.*, 2024; Alfinandah *et al.*, 2025). Meanwhile, in Javanese society, flowers are present in a wide range of cultural and religious practices, carrying profound symbolic meanings (Imaduddin *et al.*, 2023; Darmastuti *et al.*, 2024; Kartika & Wicaksono, 2024; Mukarromah *et al.*, 2024; Santhyami *et al.*, 2024; Afrianto, 2025; Ramadhan *et al.*, 2025).

In the last few decades, there has been an increasing number of ethnobiological studies, especially ethnobotany, which studies plants in practice and their position in religion (Cvitković, 2021). Several studies on plants show that the existence of plants is closely related to religion, especially Islam. For example, studies on plants are listed in the Koran (Qamariah, 2019; Ahmad *et al.*, 2022). In another study, ethnobotanical studies also focused on using plants as medicines listed in the Koran (Muneeb *et al.*, 2022; Dery *et al.*, 2023; Saradar *et al.*, 2024). Moreover, few focus on fruit and aromatic plants found in the Koran (Ali *et al.*, 2023; Royyani *et al.*, 2024).

Studies on the usages of flowers in relation with cultures or in the other words the ethnobotany of flowers in Indonesia have been proceeded prior to

this current study, such as by Hestiyana, 2020; Ristanto *et al.*, 2020; Sutrisno *et al.*, 2020; Ramadhani *et al.*, 2021; Latifah & Ami, 2022. This research include the study of the ethnobotany of plants and flowers at several cultural ceremonies (Hestiyana, 2020; Ristanto *et al.*, 2020; Sutrisno *et al.*, 2020; Ramadhani *et al.*, 2021; Latifah & Ami, 2022), the cultural uses of plants and flowers (Alfian *et al.*, 2020), use of flowers as material in religious ceremonies (Darma *et al.*, 2021; Ratnani *et al.*, 2021; Mukarromah *et al.*, 2024), symbolism of flower plants (Wiyono *et al.*, 2024) and also a little about the use of flowers in the form of creative imagination (Anggoro *et al.*, 2020). Through these various studies, it can be seen how the utilization and position of plants, especially flowers, in Indonesian society.

In Javanese culture, descriptions of flowers and their traditional usages have been previously studied by Woodward (1988; 1999), Geertz (2014), and Beatty (2003). Geertz, for example, gives many descriptions of how the *slametan* rites are performed, which are quoted as follows:

"The *slametan* is simple, consisting of rice, chicken or a small amount of wet fish, soy-bean cakes, plus flowers. The caretaker will receive the dish, burn the incense and sprinkle flowers on the head of the Ganesha statue. Then she gathered the wilted flowers that someone had sown earlier and put them in a bag to give to the child. These flowers are brought home, then put in water, and the person giving the *slametan* will drink it or use it as an antidote for the general welfare or full safety." (Geertz, 2014: 23).

The use of flowers in Javanese ritual traditions has been deeply rooted in cultural practices for generations. This enduring presence is reflected in the work of Clifford Geertz, who, in his depiction of the *slametan* ritual among the group he identifies as the *abangan*, notes the inclusion of flowers as part of the ceremonial offerings. Similar accounts are found in the writings of Beatty (2003) and Woodward (1988), both of whom emphasize the central role of flowers in the *slametan* rituals within Javanese society (Woodward, 1988; Beatty, 2003). Although these records do not represent the origins of the practice, they provide valuable insights into the consistent integration of flowers into meaningful ritual contexts. These descriptions make it evident that flowers have long held symbolic and spiritual significance in the ritual life of the Javanese people.

Extending this further, several classical manuscripts, such as the Old Javanese *Ramayana* and *Bujangga Manik*—a pre-Islamic Sundanese text from the 15th century—also reference various types of flowers known to and utilized by the Javanese and Sundanese in earlier periods. Among them are *kenanga* (ylang-ylang) and *mawar* (rose), which are mentioned as culturally significant (see Mulyanto *et al.*, 2023; 2024).

Other ethnographic works that describe and address ritual customs among Javanese Muslims include those by Muhaimin (2006) and Nakamura (2012). Muhaimin provides a detailed account of religious traditions among Cirebonese Muslims. One such account concerns the ritual practice of *ngembang* or *nyekar* during the celebration of Eid al-Fitr, in which specific types of flowers—particularly *selasih* (*Ocimum sanctum*)—are used as part of the offering and remembrance at ancestral gravesites (Muhaimin, 2006).

Although Nakamura's study does not focus primarily on ritual practices, his work on the movements and transformations within the Muhammadiyah organization includes considerable references to Javanese Muslim rituals, especially in the area surrounding Kota Gede, the burial site of Panembahan Senapati, founder of the Islamic Mataram Kingdom. In his description of this historic city, Nakamura provides rich detail on local ceremonies and the everyday religious practices of the Muslim population. He notes, for instance, that Kota Gede holds a market every *Legi* day (one of the Javanese market days), where various commodities are sold—including batik cloth, kitchen utensils, birds, and flowers intended for royal tomb offerings (Nakamura, 2012).

In examining the culture of flowers and its close association with Javanese Muslim communities, an important connecting entity also emerges: the flower vendors in traditional markets. In various ethnographic works, flowers have been portrayed as commodities whose presence is integral to traditional markets, serving as essential elements in communal rituals and cultural practices (see Beatty (2003), Muhaimin (2006), Nakamura (2012), and Geertz (2014), as discussed in the previous paragraph). Traditional markets, therefore, constitute a significant cultural space, as they are dynamic arenas continuously imbued with meaning by those who manage and inhabit them (Aliyah *et al.*, 2017; Hermawan *et al.*, 2018).

In other words, speaking of the market is akin to speaking of kinship or religion, as traditional markets are always culturally constructed. Javanese vendors plan, carry out, and justify their economic actions within the framework of Javanese cultural concepts (Alexander, 1987). Thus, the traditional market is not merely an economic space but also a social space for stakeholders who "live" within it (Sadilah *et al.*, 2011; Seligmann, 2018). The relationships among actors that sustain the traditional market are not solely based on economic calculation. Intimate personal relationships mean that interactions are often guided not by profit and loss considerations, but by patterns of social exchange (Granovetter, 2017).

This understanding underpins the present study's objective: to explore more deeply how flowers are traded as commodities with specific

economic value, what types of flowers are sold, how vendors classify them, and which critical times or periods influence flower sales. Furthermore, the study seeks to examine more broadly the cultural use of flowers in community practices and to uncover the meanings ascribed to such uses.

MATERIALS AND METHODS

Study Site

The traditional markets selected as the study sites were Pasar Manis and Pasar Wage, both of which are general-purpose traditional markets rather than specialized floral markets. While numerous traditional markets in Purwokerto accommodate vendors specializing in flower bouquets, their presence remains limited. Specifically, Pasar Manis hosts two floral vendors, whereas Pasar Wage has five. These markets were selected based on their distinct characteristics: Pasar Wage represents the largest traditional market in Purwokerto, while Pasar Manis exemplifies a semi-modern traditional market. See Fig. 1 for the locations of Pasar Manis and Pasar Wage. Both markets are located within the city area of Purwokerto, with an approximate distance of 3 km between them.

This study employs Gary J. Martin's (1995) Rapid Ethnobotany Appraisal (REA) approach to investigate botanical data traded by flower bouquet vendors in two traditional markets in Purwokerto. This method was selected due to its effectiveness in collecting data on the inventory of plant species traded by flower vendors, as well as the associated local knowledge regarding plant and flower usage (Martin, 1995). The REA approach was also chosen for its strong emphasis on qualitative data collection, particularly concerning the function and local classification of flowers. Additionally, this method was integrated with ethnography to deepen the analysis and further explore underlying meanings. This ethnographic method is used to understand traditional markets as a locus that is lived by community members from the community's point of view. We argue that connectedness is central to an anthropological perspective in viewing traders and their trading practices and takes the form of (1) sociocultural ties between people, (2) the relationship between the micro, meso and macro levels, and (3) the relationship between the past and the present. (Verver & Koning, 2024). The use of ethnography as a research method was chosen because ethnography can tell or also describe stories rooted in local people's points of view when they live their daily lives in their communities (Fetterman, 2010).

In ethnographic research, at least several steps and practices are important in gathering data from people in the field. Commitments that need to be built include: committed fieldwork (even if the fieldwork period is short), trusting relationships

between researchers and participants, and, importantly, attentiveness to subtle, ambiguous, or absent-present data (van Voorst & Ahlin, 2024).

Ethnographic methods adopt a cultural lens to interpret observed behavior, ensuring the behavior is placed in a culturally relevant and meaningful context (Fetterman, 2010). In this study, the reading of the concept of culture is understood as an active and constitutive dimension of social life rather than just a guarantee mechanism for social integration, culture being a blueprint for a person and society to create their world which is meaningful on two levels at once: emotional and cognitive (Geertz, 1973). The culture formed is then seen as a differential culture that grows out of continuous interactions between people, groups, and the environment, which is constantly changing.

The unit of analysis is the elements in the study to be carried out, such as studying the variations between; and, as well as comparing against one another (Bernard & Gravlee, 2015). In most research on social behavior, the unit of analysis is the individual. The unit of analysis in this study is rampe traders at several traditional markets in Purwokerto. This unit analysis is studied through individual traditional market administrators in Purwokerto. Informants who became the unit of analysis included rampe flower traders, traditional market traders, market managers, and offices related to traditional market management in Purwokerto and the general public.

Data collection techniques in this study use several methods such as observation methods, in-depth interviews, and also using documentation techniques. In the observation method, researchers will make observations by mingling in the activities of rampe traders and other traders in several traditional markets in Purwokerto. Things that will be observed in this study include:

1. Interaction or communication relationships carried out by traders in traditional markets,
2. Buying and selling mechanisms that occur in traditional markets, and
3. Daily activities of traders in traditional markets.

Researchers make observations almost every time because observations can be made at any time and under any conditions. Researchers will use observation as a method to dig deeper into everyday language. This choice was made because, through observation or observation, researchers can learn the use of language and communication patterns by the community in a natural way. In addition, observation also provides flexibility for researchers or the community being studied. Often data that is not explored optimally at the interview finally emerges when making direct observations, like the choices of words in everyday conversations that are difficult to explain through interviews. Observation is also a method



Fig. 1. Location of Pasar Manis and Pasar Wage (Source: Prakerta.co.cc, 2024).

used by researchers to obtain data validity. For example, when conducting interviews with informants telling information, researchers get many stories about practices and their meanings, but researchers can only imagine these stories. Observations provide a real picture of the data described earlier. Observation leads researchers to create feelings, like what the community feels when the community carries out an activity.

Data analysis is inseparable, so it is interconnected between one stage and another. The analysis itself is looking for patterns (Spradley, 1980). In addition to finding patterns and organizing meaning structures, the analysis also determines the basis of the social meaning of these structures (Geertz, 2016). Data analysis will be conducted since the data collection process is in the field. Data analysis in this study followed the model developed by Miles & Huberman (1992). The purpose of using various analytical models is to lead to the discovery of cultural knowledge frameworks (Spradley, 2007). Qualitative data analysis consists of four activity lines: data collection, data reduction, data presentation, and drawing conclusions or verification. Thus, this combined flow of data analysis begins with selecting problems, collecting data, reducing data, analyzing cultural data, writing ethnography or presenting data, and drawing conclusions (Miles & Huberman, 1992).

RESULTS

Overview of Traditional Markets, Trading Activities, and Commodities

Pasar Manis is a traditional market located in the center of Purwokerto, the capital city of Banyumas Regency. It is located on the Jln. Jendral Gatot Subroto, Kedungwuluh village, West Purwokerto

District about 1 km East of the Purwokerto station is in a crowded urban area and within the vicinity of the office of Banyumas Regency and Purwokerto Station.

Prior to 2016 Pasar Manis was simply a traditional market that commonly found throughout Indonesia with stereotype of dirty, unorganized unsafe, chaotic, and outstandingly smelly. Nevertheless, a lot of people are still insisting to shop in these traditional markets regardless the inconvenience atmosphere. Prior to revitalization Pasar Manis unorganized, where the traders were random and recognized only by how long they had occupied the place. Vendor stalls are made of simple and low quality of wood as informed by one the senior traders at the Pasar Manis named Mrs. Sukarti (not actual name, approximately 68 years old). He said that Pasar Manis used to be a simple small market; traders only used wooden tables as a medium to display their wares. In some occasion the traders only used sack of rice or tarpaulin and directly trade on the floor. Nevertheless, the market is located of the city Purwokerto and numerous people shopped there; thus, both traders and buyers seemed to know each other well.

The government revitalized the Pasar Manis in 2016, and the impression of a market that previously seemed rundown had changed drastically into a pilot market that is clean and very conducive. The construction of the new Pasar Manis building took approximately three years, from transferring the art building to land acquisition negotiations. Pasar Manis is now transformed into a traditional market with adequate infrastructure management.



Fig. 2. Pasar Manis from outside. Photos by Rahman Latif Alfian.

The traders in Pasar Manis are organized according to the type of merchandise. On the first floor are vegetable traders, food traders, market snack traders, gold traders, fruit traders, meat traders, ketupat traders, and flower traders. While on the second floor, there are traders of groceries traders, snack, furnitures, and clothes.

Daily Activities of Traders at Pasar Manis Purwokerto

Market activities at Pasar Manis started at 05.00 WIB. At this hour, vegetable traders and vegetable Pasar Manis opens daily from 05.00 AM. UTC +7 to 01.00 PM. UTC +7; in contrast to other traditional markets which have started active trading activities before 05.00 AM. UTC +7, especially traders who are outside the market, in the Manis Market activities only occur in opening hours because there are almost no traders selling outside the market. Two potpourri traders trade in the Pasar Manis, located near the east entrance of the Pasar Manis.

On the first floor are sellers of vegetables, market snacks, crackers, traditional herbs, fruits, *ketupat*, and *bunga rampe*. The booths used for trading are rectangular and made of cast or brick covered with white ceramic on the outside. Then each stall is described with the stall number to facilitate data collection. All floors on first floor are covered in ceramic, giving a clean and neat impression. The categories (Table 1) of Traders in the Pasar Manis are as follows:

- Vegetables
- Groceries
- Meat (chicken, beef, fish)

- Spices (herbs and spices, onions, chilies and dry seasonings)
- Boiled fish
- Grains (peanuts, green beans, soybeans, etc.)
- Fruits
- Banana
- Clothes
- Food stalls
- Pottery/furniture
- Sandals and shoes
- Various plastic packaging
- Market snacks (Indonesian traditional cake)
- Light snacks (crisp)
- Tempeh and tofu
- Leaf seller (teak leaf and banana leaf)
- Flower merchant
- Gold seller

Compared to other traditional markets, log and unloading at Pasar Manis tends to be short because there are fewer commodities to trade. This is because Pasar Manis is a traditional market in the city center where most consumers are households. This is certainly different from the condition of other traditional markets in the center of Purwokerto, such as Pasar Wage. Activities at the Wage Market tend to continue for almost 24 hours, where trade commodity shipments are in the morning and evening. Meanwhile, Pasar Manis, at night, especially in the courtyard area, is used as a night culinary center in the city of Purwokerto.

The morning after dawn becomes a busy time for meat sellers, beef or chicken. Buyers of meat at this time are meatball sellers or food sellers, so shopping time is in the morning. Entering the market operating time, the traders in the Manis Market are ready to trade. Market visitors (buyers) are more crowded on holidays or weekends than on weekdays. Especially morning culinary hunters and market snacks, which are one of the attractions of the Pasar Manis Purwokerto.

Table 1. Commodities sold by traders.

Category	Common Name	Scientific Name (<i>Italicized</i>)	Notes	
Vegetables	Cassava leaves	<i>Manihot esculenta</i> Crantz		
	Cassava (root)	<i>Manihot esculenta</i> Crantz		
	Sweet potato	<i>Ipomoea batatas</i> (L.) Lam.		
	Spinach	<i>Spinacia oleracea</i> L.		
	Chayote	<i>Sechium edule</i> (Jacq.) Sw.		
	Eggplant	<i>Solanum melongena</i> L.		
	Papaya leaf	<i>Carica papaya</i> L.		
	Bitter gourd (Pare)	<i>Momordica charantia</i> L.		
	Long beans	<i>Vigna unguiculata</i> (L.) Walp. subsp. <i>sesquipedalis</i>		
	Chinese cabbage	<i>Brassica rapa</i> L. subsp. <i>pekinensis</i> (Lour.) Hanelt.		
	Carrot	<i>Daucus carota</i> L.		
	Cabbage	<i>Brassica oleracea</i> L. var. <i>capitata</i>		
	Red onion	<i>Allium cepa</i> L.		
	Garlic	<i>Allium sativum</i> L.		
	Tomato (red)	<i>Solanum lycopersicum</i> L.		
	Green tomato	<i>Solanum lycopersicum</i> L. <i>Solanum lycopersicum</i>		
	Cherry tomato	L. var. <i>cerasiforme</i> (Dunal) Spooner, G.J.Anderson & R.K.Jansen		
	Potato	<i>Solanum tuberosum</i> L.		
	Broccoli	<i>Brassica oleracea</i> L. var. <i>italica</i>		
	Dogfruit	<i>Archidendron pauciflorum</i> (Benth.) I.C.Nielsen		
Moringa	<i>Moringa oleifera</i> L.			
Curly red chili/green cayenne pepper/big green chili/big red chili	<i>Capsicum annum</i> L.	Same species, cultivar variation		
Devil's chili	<i>Capsicum frutescens</i> L.			
Peanuts	<i>Arachis hypogaea</i> L.			
Spices & Herbs	Nutmeg	<i>Myristica fragrans</i> Houtt.		
	Cumin	<i>Cuminum cyminum</i> L.		
	Cardamom	<i>Elettaria cardamomum</i> (L.) Ma- ton		
	Black pepper	<i>Piper nigrum</i> L.		
	Candlenut	<i>Aleurites moluccanus</i> (L.) Willd.		
	Coriander	<i>Coriandrum sativum</i> L.		
	Cloves	<i>Syzygium aromaticum</i> (L.) Merr. & L.M.Perry		
	Fruits	Mango	<i>Mangifera indica</i> L.	
		Durian	<i>Durio zibethinus</i> L.	
		Rambutan	<i>Nephelium lappaceum</i> L.	
Matoa		<i>Pometia pinnata</i> J.R.Forst. & G.Forst.		
Banana		<i>Musa</i> spp.	Multiple cultivars	
Jackfruit		<i>Artocarpus heterophyllus</i> Lam.		
Dragon fruit		<i>Selenicereus undatus</i> (Haw.) D.R.Hunt	Formerly <i>Hylocereus</i> <i>undatus</i>	
Papaya fruit	<i>Carica papaya</i> L.			
Fish & Seafood	Milkfish	<i>Chanos chanos</i>		
	Tilapia	<i>Oreochromis niloticus</i>		

Table 1. Commodities sold by traders (continued)

Category	Common Name	Scientific Name (<i>Italicized</i>)	Notes
	Pomfret	<i>Pampus argenteus</i>	
	Crab	<i>Brachyura</i> (infraorder)	Refers to group, not single species
	Shrimp	<i>Penaeus</i> spp. or <i>Macrobrachium</i> spp.	
	Mackerel tuna	<i>Euthynnus affinis</i>	
	Mackerel	<i>Scomber scombrus</i>	
	Blood clam	<i>Tegillarca granosa</i>	
Meat	Chicken (free-range)	<i>Gallus gallus domesticus</i>	
	Chicken (broiler)	<i>Gallus gallus domesticus</i>	
	Beef	<i>Bos taurus</i> or <i>Bos indicus</i>	



Fig. 3. Commodities sold by rampe traders. Rampe sellers also provide ingredients for *nginang*, a kind of masticatory, which is characteristic of Austronesian tradition (Fitzpatrick *et al.*, 2003; Zumbroich, 2008); thus, the selling of *Areca* seeds is common including in Pasar Manis and usually bought by older people as nowadays the custom of masticatory using *Areca* seeds are no longer. Photos by Rahman Latif Alfian.

Traders (vegetables, groceries, fruit, onions, rice, grains, and various household needs) at Pasar Manis Purwokerto trade daily. At Pasar Manis itself, there is no specific market day, although the name Manis is taken from one of the Javanese market days, so traders trade daily. After the busy morning, the traders usually arrange to sort or sort the merchandise to be resold the next day. So that the activities of traders in the market last all day until noon. When the time showed 13.00, the traders in the Pasar Manis began to close their stalls. The buying and selling activities at the Pasar Manis ended at 14.00 WIB. After that time, the market officials cleaned the market and closed the doors in the market. Market activities will continue with food vendors opening after Asr or around 16.00 WIB.

Rampe Traders at Pasar Manis and Pasar Wage Purwokerto

"Rampe" is a term referring to a collection of flowers or cultural practice paraphernalia (such as grave offerings, floral arrangements, and ritual equipment) in certain communities, particularly among the Javanese and Sundanese people. In Javanese society, *rampe* is often closely associated

with the concept of *ubo rampe*, whereas in Sundanese society, it is generally referred to simply as rampe. At Pasar Manis Purwokerto, two flower sellers are selling in the market, to be precise, on the 1st floor near the front door of the eastern market. These flower sellers are not related to each other but are related to one another. The florist is called Mbah Sukarti (\pm 68 years), and Mrs. Juminah (\pm 51 years). Sukarti has been selling flowers at the Pasar Manis since it was not rebuilt as it is today. At least that was made by Mbah Sukarti still gets stalls to sell even though the market is experiencing development. Mbah Sukarti started selling flowers when she had to continue selling to her parents; she said that her parents were also ramped flower sellers (flower baskets), so Mbah Sukarti is so familiar with the flowers that are sold. Mbah Sukarti gained knowledge from the past when she often helped her mother sell at the market. This knowledge starts from where to get flowers (distributors) and how to sell flowers to consumers.

The flowers sold by Mbah Sukarti are purchased from a flower supplier (distributor) originating

Table 2. Plants sold by rampe traders.

No	Local name	Scientific name
1.	Kamboja	<i>Adenium obesum</i> (Forssk.) Roem. & Schult.
2.	Kantil kuning, cempaka	<i>Magnolia champaca</i> (L.) Baill. ex Pierre
3.	Kantil putih	<i>Magnolia</i> × <i>alba</i> (DC.) Figlar & Noot.
4.	Kenanga	<i>Cananga odorata</i> (Lam.) Hook.f. & Thomson
5.	Mawar merah, mawar putih	<i>Rosa</i> spp.
6.	Melati, mlati	<i>Jasminum sambac</i> (L.) Aiton
7.	Pandan wangi	<i>Pandanus amaryllifolius</i> Roxb.
8.	Sirih, suruh	<i>Piper betle</i> L.
9.	Gambir	<i>Uncaria</i> sp.
10.	Jambe/pinang	<i>Areca catechu</i> L.
11.	Secang	<i>Biancaea sappan</i> L. Tod.
12.	Serai/sereh	<i>Cymbopogon citratus</i> (DC.) Stapf.
13.	Pisang raja	<i>Musa acuminata</i> × <i>M. balbisiana</i> (Group AAB Group) cv 'Pisang raja'
14.	Kapulaga	<i>Elettaria cardamomum</i> (L.) Maton
15.	Cengkeh	<i>Syzygium aromaticum</i> (L.) Merr. & L.M.Perry
16.	Jeruk nipis	<i>Citrus</i> × <i>aurantiifolia</i>
17.	Kunyit	<i>Curcuma longa</i> L. syn. <i>Curcuma domestica</i> Valetton
18.	Jahe	<i>Zingiber officinale</i> Roscoe
19.	Bunga sedap malam	<i>Polianthes tuberosa</i> L.
20.	Bunga lawing	<i>Illicium verum</i> Hook.f.
21.	Kayu manis	<i>Cinnamomum verum</i> J.Presl
22.	Jinten	<i>Cuminum cyminum</i> L.

from Banteran Village in the Sumbang District, Banyumas Regency, at the foot of Mount Slamet. Banteran is a lowland area with an elevation of 2.25 m alt., where the soil is suitable for flower cultivation, particularly roses. Mbah Sukarti employs several flower procurement systems to secure her flower supply. For instance, rompel roses (partially wilted petals) are sold by suppliers in sacks containing a mix of red and white roses, while intact roses—whether red or white—are typically sold in smaller baskets. Meanwhile, ylang-ylang flowers are sold in plastic bags in smaller quantities, and white champaca (kantil) flowers are packaged in even smaller amounts. This is because roses are used in greater quantities, such as for nyekar (grave pilgrimages). As Mbah Sukarti explained, "Usually, more roses are purchased because they are needed for nyekar and

other ritual requirements" (Interview with Mbah Sukarti, November 4, 2022).

These two *rampe* traders at Pasar Manis, besides selling flowers, also sell *ubo rampe* (ritual or traditional equipment) for religious rituals and other customs, such as flowers for events (weddings and other celebrations) and also *ubo rampe* after giving birth (such as *parem*¹ powder or *wedak adem*, and *kembang macan kerah*²). Apart from that, *rampe* traders also sell spices such as cardamom, cloves, cinnamon, star anise, and others, as detailed in the Table 2.

Rampe sellers also provide ingredients for *nginang*, a kind of masticatory, which is characteristic of Austronesian tradition (Fitzpatrick *et al.*, 2003; Zumbroich, 2008); thus, the selling of *Areca* seeds is common including in Pasar Manis and usually bought by older people as nowadays the



Fig. 4. *Rampe* traders in Pasar Wage prepares *kinang* for buyers. Photo by Rahman Latif Alfian.

custume of masticatory using *Areca* seeds are no longer practiced by young people. It is common believe in Austronesians that masticatory using *Areca* seeds is good for the teeth, eliminate bad breath, heal wounds in the mouth, stop bleeding gums, and act as a mouthwash.

The *rampe* traders were found to have almost the same trading system at the Pasar Manis and the Pasar Wage. Traders usually ask the kind of *rampe* the customers would like to buy and for what purpose. Traders will pick up the ingredients consumers need according to the purpose and how many IDR they would like to purchase. Consumers will usually purchase started from IDR 2,000 to unspecified flowers for pilgrimages to graves. The price will affect the amount of interest received by consumers. Flowers will be measured using hand-held measurements or merchant estimates. There is no specific weighing system or standard size in flower sales, so the number of flowers obtained from various traders will vary. However, the benchmark used is usually the benchmark of propriety/*ngumumi/lumrahe* (This refers to a Javanese term denoting propriety or appropriateness in giving. Consequently, the measurement is not conducted using instruments but rather relies on intuitive judgment or customary practice), so the trader's subjectivity determines the amount of interest. Meanwhile, spices are sold in wrapped form at prices ranging from IDR 2,000 to IDR 10,000.

The quantity of flowers purchased from a vendor at Pasar Wage for Rp 10,000 was intended for grave pilgrimage purposes, as conveyed by the researcher. The *rampe* vendor provided a greater number of red and white *rompel* roses, supplemented with a few pieces of pandan leaves. This composition is commonly used for grave pilgrimage rituals. The arrangement would differ if the buyer specified the flowers were intended for other traditional purposes.

Figure 5 illustrates a bundle of flowers purchased from a traders at Wage Market for IDR 10,000, intended for grave pilgrimage purposes, as reported by the researcher. The *rampe* vendor provides a greater quantity of red and white rose petals, complemented with a few pieces of pandan leaves. This composition is commonly used for grave pilgrimage rituals. The arrangement would differ if the buyer specified that the flowers were intended for other customary purposes.

DISCUSSION

The Traditional Usage of Flowers by the People in Purwokerto.

The presence of *rampe* vendors in several traditional markets in Purwokerto is inherently linked to the use of floral arrangements. In Purwokerto, characterized as an urban area, flower usage among the community demonstrates considerable diversity. Community members hold varying perspectives regarding the use of flowers in different

¹*Parem* powder or wedak adem (cool powder) is made from rice, kencur, and sawanan (dlingo and bangle leaves), which mothers usually use after giving birth. This cool powder is believed to regenerate the skin and relax the muscles after giving birth.

²*Kembang Macan Kera* consists of various flowers such as roses, jasmine, ylang-ylang, kantil, and spices such as turmeric, dlingo, bangle, secang wood, kaffir lime, sliced pandan leaves, and various other types of empon-empon. This flower concoction is usually used for bathing to cleanse oneself of various negative energies. It provides other benefits, such as avoiding convulsions/ulcer convulsions (virus disease) or non-medical convulsions. Apart from that, it also functions as aromatherapy and relaxation. This herb also relieves fatigue and tiredness so that the body will feel fresh and fit again.



Fig. 5. The number of flowers purchased from one of the traders at the Wage Market for IDR 10,000. Photos by Rahman Latif Alfian.



Fig. 6. The practice of grave pilgrimage performed by the people in Karanglewas. Photos by Rahman Latif Alfian.

activities. Some individuals report infrequent use of flowers for certain practices; for instance, during grave visitation rituals, some residents simply come to pray for the deceased without floral offerings. However, for other community members, flowers constitute an essential ritual item that must be brought during grave visitation ceremonies - a tradition deeply embedded in their cultural practices.

a. Complementary to Religious Activities

A frequently discussed notion is that flowers constitute an essential item to bring when visiting

graves or conducting death-related rituals. Among Purwokerto residents, several reasons account for the use of flowers as ritual complements:

1. Symbolism of Respect and Remembrance

Flowers symbolize respect and memorialization of the deceased. The fragrant aroma of floral arrangements is perceived as a means to commemorate and honor all virtuous conduct from the departed's life.

2. Cultural Significance

The Javanese community, particularly in Purwokerto, consistently develops symbols carrying profound meaning within their cultural traditions. Flowers represent hopes that both the

Table 2. Types of flowers used in life cycle traditions.

No	Local name	Scientific name	Chemical composition	Use in life cycle tradition			
				Birth	Circumcision	Wedding	Funeral
1	Bugenvil, Kembang Kertas	<i>Bougainvillea</i> sp.	Saponin, polyphenols	√			√
2	Kamboja	<i>Adenium obesum</i> (Forssk.) Roem. & Schult.	Geraniol, citronellol, linalol, farnesole, phenyl alcohol				√
3	Kantil Kuning, Cempaka	<i>Magnolia champaca</i> (L.) Baill. ex Pierre	Volatile oils (cheraniol, linalol, methyleugenol, eugenol isoeugenol)				√
4	Kantil Putih	<i>Magnolia × alba</i> (DC.) Figlar & Noot.	Essential oil (Minyak atsiri)				√
5	Kenanga	<i>Cananga odorata</i> (Lam.) Hook.f. & Thomson	Benzoic acid, farnesol, geraniol, linalool, eugenol, safrole, kadinen, pinen	√	√	√	√
6	Mawar Merah, Mawar Putih	<i>Rosa hybrida</i> E.H.L.Krause	Essential oil (citral, citronellol, geraniol, linalol, nerol, eugenol, phenylethylalcohol, farnesol, nonylaldehyde)	√	√	√	√
7	Melati, Mlati	<i>Jasminum sambac</i> (L.) Aiton	Indole, benzyl, livalyl acetate, formic acid, acetic acid, benzoic acid, salicylic acid, benzyl linalol			√	
8	Pandan Wangi	<i>Pandanus amaryllifolius</i> Roxb.	Volatile Compounds (2-Acetyl-1-pyrroline, Linalool, Terpenoids), Phenolic Acids, Flavonoids, Tannins, Carotenoids, Sterols, Saponins				√
9	Soka, Asoka	<i>Ixora</i> sp.	Saponin, flavonoida				√

bereaved family and deceased family members may receive blessings and have their virtuous deeds recorded.

The Purwokerto community also purchases floral water, typically derived from processed or distilled rose extracts. This floral water serves as a symbolic medium for prayers offered to Allah SWT, intended to benefit the deceased's family. The practice involves sprinkling the floral water on graves, embodying the hope that it will provide "spiritual solace" (*kesejukan*) for the departed. In essence, community members believe these ritual prayers will bring comfort to the bereaved family.

During grave visitation rituals, community members typically employ various types of flowers. In some communities, a composition of roses (both red and white) mixed with pandan leaves serves as the foundational floral arrangement for grave pilgrimage practices. However, other groups utilize *Ixora* (*soka*) and ylang-ylang (*kenanga*) flowers for such rituals, as illustrated in Fig. 6. Different communities maintain no standardized floral composition, as each carries distinct symbolic meanings.

The preference for red and white roses primarily stems from their fragrant aroma, making them particularly suitable for scattering during grave visitation processions. Consequently, flower vendors commonly combine roses with pandan leaves. In rural communities where yards often contain various flowering plants, various types of flowers are used as symbols of fragrance. In Javanese culture, fragrance symbol of goodness and goodwill or in Javanese known as "sekar arum" (Lestari, 2019).

Notably, rural residents frequently utilize locally available flowering plants, typically cultivating multiple species around their homes. These serve dual purposes: aesthetic enhancement and personal ritual requirements. This practice reflects the integration of practical horticulture with cultural traditions in rural settings.

b. Flowers as *Ubo Rampe* in Cultural Traditions

Rampe flowers are also used as a complement (*ubo rampe*) in various cultural traditions of the people of the Banyumas Regency. Various traditions related to cultural rites in the people of



Fig. 7. Heirloom purification procession in the *Jamasan Pusaka* tradition by the people of Dawuhan. Photos by Rahman Latif Alfian.

Banyumas Regency rarely leave flowers as a compliment. Flowers are not used as offerings to spirits. However, flowers symbolize prayers for goodness towards the ancestors and good hopes for society in the future. One community that uses flowers to complement tradition is the Dawuhan District community, Banyumas. The Dawuhan community has an annual tradition, namely the *Jamasan Pusaka* tradition. The *Jamasan Pusaka* tradition is an annual tradition of the Dawuhan people, which focuses on purifying their heritage in the form of heirloom objects.

As seen in Fig. 7, flowers complement the traditional *jamasan pusaka* performed by the people of Dawuhan. The use of *rampe* flowers is intended so that after wearing the heirloom will be cleaned and purified, symbolized by the fragrant aroma surrounding it.

Chemical Composition of Flowers Used in Tradition

The cultural traditions practiced by the people of Banyumas Regency extensively incorporate flowers as *ubo rampe* (ceremonial accessories), serving as primary and supplementary components. The use of these flowers significantly influences the sales and trade cycles among vendors in traditional markets. While the selection of flower types is primarily guided by the symbolic meanings associated with each flower, botanical elements also unconsciously contribute to and support these

choices. Several types of flowers commonly used in various traditions within the Banyumas community are presented in Table 2. Table 3, especially regarding chemical composition, is referenced from several secondary sources; in other words, the researchers did not directly test them in the laboratory.

Referring to the chemical content of each flower, we can find out more about the reasons for choosing these flower plants in several previously explained traditions. Referring to the book *Aneka Manfaat Bunga untuk Kesehatan* (Nuraini, 2014) explains that the essential oil content in roses (*Rosa hybrida*) and several other flowers function to provide freshness and relaxation for those who inhale the aroma of the flowers. In other types of flowers, such as the *kenanga* flower, the flower is used not only for death ceremonies but also for birth and post-natal ceremonies for the people of Purwokerto. The ylang-ylang flowers (*Cananga odorata*) complements the *separar* and *selapan* celebrations; the flowers will be soaked in water and prayed for. After the prayer is finished, the water and flowers will be sprinkled on the place where the baby's placenta is buried. In some practices, *kenanga* flowers are also made into *parem* or a topical concoction for women after giving birth. The community believes the concoction consisting of *kenanga* flowers, turmeric, *kencur*, and tamarind can prevent postpartum fever. The application of the potion is not drunk but rubbed on the back

and placed on the scar in the corset or *stagen*. Referring to the content of the *kenanga* flower itself, which consists of benzoic acid, farnesol, geraniol, linalool, eugenol, safrole, cadinene, and pinene, it can be seen that the content has antimicrobial, anti-inflammatory, or antioxidant properties that contribute to the treatment of the body (Putri *et al.*, 2020).

Apart from being used in various life cycle ceremonies ranging from birth, coming of age ceremonies, and weddings to death, several types of flowers are also widely used for several health functions. For example, there are several concoctions that potpourri sellers also sell in traditional markets. These concoctions are a combination of dried flowers and herbs that can be used by women before and after giving birth, called *sawanan dadah* herb and tiger collar herb. Tiger collar concoction is one of the concoctions sold by potpourri traders at the Purwokerto traditional market. The concoction contains a combination of dried plants with a composition of several plants, for example rose flowers (*Rosa hybrida*), jasmine flowers (*Jasminum sambac*), cananga flowers (*Cananga odorata*), *kantil* flowers (*Magnolia champaca*) (optional), *dlingo* (*Acorus calamus*), *bengle* (*Zingiber montanum*), *sappan wood* (*Biancaea sappan*), *cardamom* (*Elettaria cardamomum*), *sandalwood* (*Santalum album*), *cinnamon* (*Cinnamomum verum*), and *turmeric* (*Curcuma longa*). Users of this concoction will usually add lime and salt to the potion. This potion is believed to have properties that increase fertility and accelerate pregnancy. In addition, this potion is also efficacious to restore stamina and cleanse the body. Residents usually use the potion in two applications: drinking it and using it for bathing or soaking. The chemical content in the flower confirms that the selection of flower types in a tradition is not only based on philosophical meaning. The flowers chosen unknowingly also support the smoothness, solemnity, and sacredness of a tradition practiced by cultural practitioners.

CONCLUSION

The *rampe* trade in Purwokerto has experienced a long period of dynamics. The culture of the Javanese people, especially in Purwokerto, has a big role in the continuity and sustainability of *rampe* traders in Purwokerto. The survival of *rampe* and flower traders is due to the need for the community to carry out cultural practices such as religious practices. The existence of *rampe* traders in traditional markets has an important role in providing for the community's needs. However, flower traders need help partly due to the increasingly diverse understanding of religions (especially Islam) in interpreting and using flowers. On the other hand, the interruption of the transfer of knowledge

from the "older" generation to the "younger" generation regarding knowledge of the use of flowers and the meaning of the flowers themselves also has a significant influence on the *rampe* trade. The layout of *rampe* traders in traditional markets is no less important, as those found in the field are mostly located on the "edge" in the market location plan, making market traders increasingly marginalized and rarely getting visitors' attention to traditional markets. The difficulty of *rampe* traders trading *rampe* in traditional markets also requires these *rampe* traders to look for alternatives to meet their daily economic needs. For example, one of the flower traders at Purwokerto's wage market, apart from selling flowers, also sells vegetables, tempeh, fruit, and cassava tape. This is done so the trader's income can meet daily needs and be used as trading capital the next day. However, *rampe* traders still exist amidst various difficulties because of necessity (both traders and consumers). Thus, flower culture in Javanese society plays a vital role in the *rampe* trade, and *rampe* traders are also important in maintaining the preservation of flower culture in Javanese society, especially in Purwokerto.

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REFERENCES

- AFRIANTO, W. F. 2025. Ethnobotanical documentation of home gardens in relation to Javanese basic life needs in Kediri District, East Java, Indonesia. *Asian Journal of Ethnobiology* 8(1): 79–91. DOI: 10.130 57/asianjethnobiol/y080107.
- AHMAD, M., JABEEN, M. & HASNAIN, M. 2022. Importance of vegetables plant species mentioned in the Holy Quran and, Ahadith's books. *International Research Journal of Management and Social Sciences* 3(1): 107–114. DOI: 10.53575/irj mss.v3.1(22)11.107-114.
- ALEXANDER, J. 1987. *Trade, Traders and Trading in Rural Java*. Oxford University Press, Oxford.
- ALFIAN, R. L., ISKANDAR, J. & ISKANDAR, B. S. 2020. Fish species, traders, and trade in

- traditional market: case study in Pasar Baru, Balikpapan City, East Kalimantan, Indonesia. *Biodiversitas* 21(1): 393–406. DOI: 10.13057/biodiv/d210146.
- ALFIAN, R. L., SUPANGKAT, B. & ISKANDAR, J. 2020. Coffee and identity: consume coffee, build identity, maintain variety on Palintang community West Java. *Sosiohumaniora* 22(1): 8. DOI: 10.24198/sosiohumaniora.v22i1.24424.
- ALFINANDAH, A., IRAWAN, B. & ISKANDAR, J. 2025. Ethnobotany of wild edible plants by the community of Cijambu village, Sumedang District, West Java, Indonesia. *Biodiversitas* 26(5): 2235–2252. DOI: 10.13057/biodiv/d260521.
- ALI, S., MUNAZIR, M., SHER, H., QURESHI, R. & AKRAM, M. 2023. An ethnobotanical study of aromatic medicinal plants of Swat Valley, Pakistan. *Asian Journal of Ethnobiology* 6(2): 163–172. DOI: 10.13057/asianjethnobiology/y060207.
- ALIYAH, I., SETIOKO, B. & PRADOTO, W. 2017. City, culture and society spatial flexibility in cultural mapping of traditional market area in Surakarta: a case study of Pasar Gede in Surakarta. *City, Culture and Society* 10(36): 41–51. DOI: 10.1016/j.ccs.2017.05.004.
- ANDILA, P. S., WARSENO, T., SYAFITRI, W. & TIRTA, I. G. 2022. Ethnobotanical study of Hindu society in Tabanan Bali and the conservation efforts. *Proceedings of the 7th International Conference on Biological Science (ICBS 2021)* 22: 590–597. DOI: 10.2991/absr.k.220406.085.
- ANGGORO, P. W., YUNIARTO, A. T., TAUVIQIRRAHMAN, M., JAMARI, J., BAYUSENO, A. P., PURWANTO, K. B. & WIDYANARKA, O. K. W. 2020. Puzzle Islamic floral patterns product tiles for wall and ceiling to decorate of Al Huda mosque Indonesia design, manufacturing, and fabrication. *Proceedings of the 6th International Conference and Exhibition on Sustainable Energy and Advanced Materials* January: 549–562. DOI: 10.1007/978-981-15-4481-151.
- BALDICK, J. 2013. *Ancient Religions of the Austronesian World: from Australasia to Taiwan*. I. B. Tauris & Co., London.
- BEATTY, A. 2003. *Varieties of Javanese Religion: An Anthropological Account*. Cambridge University Press, Cambridge. DOI: 10.1525/ae.2001.28.4.937.
- BELLWOOD, P., FOX, J. J. & TRYON, D. 2006. *The Austronesians Historical and Comparative Perspective*. ANU E Press. DOI: 10.22459/a.09.2006.03.
- BERNARD, H. R. & GRAVLEE, C. C. 2015. *Handbook of Methods in Cultural Anthropology*. Rowman & Littlefield, London
- CVITKOVIĆ, I. 2021. Trees and animals in world religions. *Socijalna Ekologija* 30(1): 131–155. DOI: 10.17234/SocEkol.30.1.7.
- DARMA, I. D. P., SUTOMO, HANUM, S. F., IRYADI, R. & RAHAYU, A. 2021. Flowers and value of conservation in the culture of Hindu community in Bali. *Biosaintifika* 13(1): 34–40. DOI: 10.15294/biosaintifika.v13i1.27054.
- DARMASTUTI, S. A., NAZAR, I. A. & SETYAWAN, A. D. 2024. Plant diversity and its use in Javanese urban home garden: An ethnobotanical study in Central Java, Indonesia. *Asian Journal of Ethnobiology* 7(1): 32–42. DOI: 10.13057/asianjethnobiology/y070104.
- DERY, G., DZITSE, S. & TOM-DERY, D. 2023. Ethnobotanical survey of medicinal plants in Sissala East municipality of the upper West region, Ghana. *Phytomedicine Plus* 3(3): 100461. DOI: 10.1016/j.phyflu.2023.100461.
- ERAWAN, T. S., ALILLAH, A. N. & ISKANDAR, J. 2018. Ethnobotany of traditional rituals in the Karangwangi village, Cianjur District, West Java, Indonesia. *Asian Journal of Ethnobiology* 1(2):53–60. DOI: 10.13057/asianjethnobiology/y010201.
- FETTERMAN, D. M. 2010. *Ethnography: Step-by-Step*. Sage Publications, Los Angeles.
- FITZPATRICK, S. M., NELSON, G. C. & REEVES, R. 2003. The prehistoric chewing of betel nut (*Areca catechu*) in Western Micronesia. *People and Culture in Oceania* 19: 55–65.
- GARCÍA-GONZÁLEZ, G., MUÑOZ-TEJADA, N. & TORRES-MONTÚFAR, A. 2024. Flowers vs. devils: plants used against witchcraft in the urbanized Sonora Market, Mexico City. *Boletín Latinoamericano y del Caribe de Plantas Medicinales y Aromaticas* 23(3): 371–381. DOI: 10.37360/blacpma.24.23.3.25.
- GEERTZ, C. 1973. *Thick Description: toward an Interpretive Theory of Culture*. In: GEERTZ, C. *The Interpretation of Cultures: Selected Essays*. Basic Books, New York.

- GEERTZ, C. 2014. *Agama Jawa: Abangan, Santri, Priyayi dalam Kebudayaan Jawa*. Komunitas Bambu, Depok.
- GEERTZ, C. 2016. *Tafsir Kebudayaan*. Pustaka Jaya, Jakarta.
- GRANOVETTER, M. 2017. *Society and Economy: Framework and Principles*. The Belknap Press of Harvard University Press, Cambridge, Massachusetts and London.
- HERMAWAN, F., KRISTIANI, F. & ISMIYATI. 2018. Model of Indonesian traditional market revitalisation: case study of five Metropolitan Cities in Java Island. *Advanced Science Letter* 24: 3146–3151.
- HESTIYANA. 2020. Leksikon etnobotani tumbuhan bunga dalam pengobatan tradisional dan cerminan kultural masyarakat Banjar. *Gramatika* 8(1): 23–37 (In Indonesian).
- IMADUDDIN, M., DZOFIR, M., AL HARIS, M., WIJAYA, T. D. A. & HAFIDH, A. A. 2023. Folklore and science concepts: constructed education about ethnobotany in the Mount Muria area, Indonesia. *AIP Conference Proceedings* 2595. DOI: 10.1063/5.01 23792.
- ISKANDAR, B. S., IRAWAN, B., MULYANTO, D., ISKANDAR, J., AFINANDA, A. & RAJAB, B. 2023. Gastronomic ethnobotany of traditional vegetables among the Sundanese in rural West Java, Indonesia. *Biodiversitas* 24 (7): 3932–3950. DOI: 10.13057/ biodiv/ d240732.
- ISKANDAR, B. S., ISKANDAR, J., MULYANTO, D., ALFIAN, R. L. & SUROSO. 2021. Traditional market, social relations, and diversity of edible plants traded in Beringharjo Market, Yogyakarta, Indonesia. *Biodiversitas* 22 (4): 2045–2057. DOI:10.13057/biodiv/ d220453.
- ISKANDAR, B. S., ISKANDAR, J., SUROSO, ALFIAN, R. L. & MULYANTO, D. 2022. Non-edible plants traded in traditional markets of Beringharjo, Yogyakarta and Pasar Baru, East Kalimantan, Indonesia: The role of bi-cultural system. *Biodiversitas* 23(9): 4657–4669. DOI: 10.13057/biodiv/ d230932.
- ISKANDAR, D. & FASTA, F. 2015. *Discourse of Flowers in Contemporary Betawi Culture*. Second International Conference on Media, Communication and Culture (ICMCC 2015), 30 Nov.– 2 Dec. 2015, Vistana Hotel, Penang, Malaysia.
- ISKANDAR, J., ISKANDAR, B. S., MULYANTO, D., ALFIAN, R. L. & PARTASASMITA, R. 2020. Traditional ecological knowledge of the bird traders on bird species bird naming, and bird market chain: A case study in bird market pasty Yogyakarta, Indonesia. *Biodiversitas* 21(6): 2586–2602. DOI: 10.13057/biodiv/ d210631.
- KARTIKA, E. & WICAKSONO, H. 2024. The philosophy of ethnobotany and the transformation of Jamasan Pusaka tradition in the Pendopo of Batang District. *Humaniora* 36(2): 188–206 (In Indonesian).
- LATIFAH, S. & AMI, M. S. 2022. Ethnobotani dalam ritual pernikahan masyarakat Desa Sidomulyo, Kecamatan Megaluh, Kabupaten Jombang Jawa Timur. *Jurnal Inovasi Penelitian* 3(3): 5227–5238 (In Indonesian).
- LESTARI, N. S. 2019. Jasmine flowers in Javanese mysticism. *International Review of Humanities Studies* 4(1): 192–199. DOI: 10.7454/ irhs.v4i1.119.
- MARTIN, G. J. 1995. *Ethonobotany: A Methods Manual*. In: WALTERS, M. (Ed.). *People and Plants Conservation Manuals*. Chapman & Hall, London.
- MATTHEWS, P. 1995. Aroids and the Austronesians. *Tropics* 4(2): 105–126. DOI: 10.3759/ tropics.4.105.
- MILES, M. B. & HUBERMAN, A. M. 1992. *Analisis Data Kualitatif: Buku Sumber tentang Metode- Metode Baru*. UI Press, Jakarta.
- MILLER, T. L. 2019. *Plant Kinn: a multispecies ethnography in indigenous Brazil*. University of Texas Press, Austin. DOI: 10.7560/317396.
- MUHAIMIN, A. G. 2006. *The Islamic Traditions of Cirebon Ibadat and Adat among Javanese Muslims*. ANU E Press, Canberra.
- MUKARROMAH, A. N., DZIHNI, A., AZZAM, A. K., ADININGSIH, A. R., UTAMI, A. S., NAZAR, I. A., SUNARTO, ISKANDAR, J., SAENSOUK, S. & SETYAWAN, A. D. 2024. Ethnobotany of traditional rituals of Javanese in the city of Surakarta, Central Java, Indonesia. *Asian Journal of Ethnobiology* 7(1): 22 – 31. DOI: 10.13057/asianjethnobiol/ y070 103.
- MULYANTO, D., ISKANDAR, B. S., ISKANDAR, J., INDRAWARDANA, I. & AUFA, A. A. 2023. Ethnobotanical analysis of phytonyms and plant related glosses mentioned in Bujangga Manik, a pre-islamic Sundanese text (15th Century Java, Indonesia). *Reinwardtia* 22 (2): 131–143. DOI: 10.55981/reinwardtia.2023.
- MULYANTO, D., ISKANDAR, B. S., ISKANDAR, J. & WIYANTI, D. T. 2024. Flora of ancient Java: identification of species, landscape distribution, and cultural association of plants mentioned in old Javanese Ramayana. *Rein-*

- wardtia* 23(2): 85–103. DOI: 10.55981/reinwardtia.2024.4821.
- MUNEEB, A., AHMAD, I., AHMAD, M. S. A., FATIMA, S., HAMEED, M., AHMAD, F., ASGHAR, A., BASHARAT, S., SHAH, S. M. R., SHAFQAT, J. & HASSAN, I. F. Z. 2022. Ethnobotanical and economic uses of some medicinal plants from native saline areas. *International Journal of Applied and Experimental Biology* 2 (2): 147–154. DOI: 10.56612/ijaeb.v1i1.45.
- NAKAMURA, M. 2012. *The Crescent Arises Over the Banyan Tree: A Study of the Muhammadiyah Movement in a Central Javanese Town*. Gadjah Mada University Press, Yogyakarta. (2nd enlarged edition, ISEAS, Singapore).
- NURAINI, D. N. 2014. *Aneka Manfaat Bunga untuk Kesehatan*. Penerbit Gava Media, Yogyakarta.
- PRATAMI, M. P., ANGGRAENI, A. & SUJARWO, W. 2024. Ethnobotany of medicinal plants in Leuwiliang (Bogor), Indonesia. *Ethnobotany Research and Applications* 27 (August). DOI: 10.32859/era.27.1.1-40.
- PUTRI, A. M., MUHAM, A. O., ANGGRAINI, S., MAISARMAH, S. & YULIS, P. A. R. 2020. Analisis kualitatif kandungan bunga kenanga (*Cananga odorata*) secara fitokimia dengan menggunakan pelarut etanol. *Journal of Research and Education Chemistry* 2(1): 43–48 (In Indonesian). DOI: 10.25299/jrec.2020.vol2(1).4783.
- QAMARIAH, N. 2019. Ethnobotanical study of Qur'an plants. *Pharmacognosy Journal* 11(5): 919–928. DOI: 10.5530/pj.2019.11.147.
- RAMADHAN, A. N., ANTONY, M. K., PRADANA, S. P., & DEWIYETI, S. 2025. *Michelia alba*: A Review on Its Biological Profile and Ethnobotany in Java. *Indonesian Journal of Social Technology* 6(1): 69–89.
- RAMADHANI, L., OKTAVIANI, T., ANDRIANI, A., NAFSIAH, N., SIHITE, R. J. & SUWARDI, A. B. 2021. Studi etnobotani ritual adat pernikahan suku Tamiang di Desa Menanggini Kabupaten Aceh Tamiang Provinsi Aceh. *Bioma: Jurnal Ilmiah Biologi* 10(1): 80–92 (In Indonesian). DOI: 10.26877/bioma.v10i1.6090.
- RATNANI, D. A. S., JUNITHA, I. K., KRISWIYANTI, E. & DHANA, I. N. 2021. The ethnobotany of Ngusaba ceremonial plant utilization by Tenganan Pegringsingan community in Karangasem, Bali, Indonesia. *Biodiversitas* 22(4): 2078–2087 (In Indonesian). DOI: 10.13057/biodiv/d220457.
- RISTANTO, R. H., SURYANDA, A., RISMA-YATI, A. I., RIMADANA, A. & DATAU, R. 2020. Etnobotani: tumbuhan ritual keagamaan Hindu-Bali. *JPBIO (Jurnal Pendidikan Biologi)* 5(1): 96–105. (In Indonesian). (DOI: 10.31932/jpbio.v5i1.642).
- ROYYANI, M. F., KEIM, A. P., EFENDY, O., IMADUDIN, I., MAHMUD, I., SY, P., SETYAWATI, T., NURALIA, L., HIDAYAT, A. & SUJARWO, W. 2024. Incense and Islam in Indonesian context: An ethnobotanical study. *Ethnobotany Research and Applications* 28: 1–11. DOI: 10.32859/era.28.17.1-11.
- SADILAH, E., ARIANTI, C., HERAWATI, I., MOERTJIPTO & SUKARI. 2011. *Eksistensi Pasar Tradisional: Relasi dan Jaringan Pasar Tradisional di Kota Semarang Jawa Tengah*. Balai Pelestarian Sejarah dan Nilai Tradisional Yogyakarta. Yogyakarta.
- SANTHYAMI, ISNAENI, F. R., AGUSTINA, L. & AGUSTINA, P. 2024. Urban ethnobotany of Surakarta, Indonesia: a case study of non-edible plants in Gede Hardjonagoro and Kembang Markets. *Ethnobotany Research and Applications* 27(47): 1–18. DOI: 10.32859/era.27.47.1-18.
- SARADAR, B., MANDAL, S., & KUMAR, S. 2024. Ethnobotanical inventory and medicinal potential of mangrove flora in the Ethnobotanical inventory and medicinal potential of mangrove flora in the Sundarbans, West Bengal, India. *Journal of Biodiversity and Conservation* 8(1): 1–6.
- SELIGMANN, L. J. 2018. *Space, Place and Contentious Politics of Market Redevelopment*. In: ENDRES, K. W. & LETHKOWICH, A. M. (Eds.). *Traders in Motion: Identities and Contestation in the Vietnamese Marketplace*. Cornell University Press, New York.
- SOEMARWOTO, R. & ISKANDAR, J. 2021. Plant knowledge richness in the Sundanese upland village: a case study in Sindangsari, West Java, Indonesia. *Biodiversitas* 22(9): 3722–3735. DOI: 10.13057/BIODIV/D220916.
- SPRADLEY, J. P. 1980. *Participant Observation*. Holt, Rinehart and Winston, Austin.
- SPRADLEY, J. P. 2007. *Metode Etnografi*. Tiara Wacana, Yogyakarta.
- SUJARWO, W., CANEVA, G. & ZUC-CARELLO, V. 2020. Patterns of plant use in

- religious offerings in Bali (Indonesia). *Acta Botanica Brasiliica* 34(1): 40–53. DOI: 10.1590/0102-33062019abb0110.
- SUPANGKAT, B., ALFIAN, R. L. & ISKANDAR, J. 2021. Traditional market and women's work in the Beringharjo market of Yogyakarta. *Sosiohumaniora: Jurnal Ilmu-Ilmu Sosial dan Humaniora* 23(1): 1–11. DOI: 10.24198/sosiohumaniora.v23i1.29807.
- SUTRISNO, I. H., AKOB, B., NAVIA, Z. I., NURAINI & SUWARDI, A. B. 2020. Documentation of ritual plants used among the Aceh tribe in Peureulak, East Aceh District, Indonesia. *Biodiversitas* 21(11): 4990–4998. DOI: 10.13057/biodiv/d211102.
- SWAIN, T. & TROMPF, G. 2005. *The Religions of Oceania Library of Religious Beliefs and Practices*. Taylor & Francis e-Library, London. DOI: 10.4324/9780203977620.
- TAMENE, S., NEGASH, M., MAKONDA, F. B. & KARLTUN, L. C. 2024. Influence of sociodemographic factors on medicinal plant knowledge among three selected ethnic groups in south-central Ethiopia. *Journal of Ethnobiology and Ethnomedicine* 20(1): 1–49. DOI: 10.1186/s13002-024-00672-1.
- VAN VOORST, R. & AHLIN, T. 2024. Key points for an ethnography of AI: an approach towards crucial data. *Humanities and Social Sciences Communications* 11(1): 1–5. DOI: 10.1057/s41599-024-02854-4.
- VERVER, M. & KONING, J. 2024. An anthropological perspective on contextualizing entrepreneurship. *Small Business Economics* 6(2): 649–665. DOI: 10.1007/s11187-023-00774-2.
- WIYONO, E., DAMAYANTI, N. Y., DESTIARMAND, A. H. & SUNARYA, Y. Y. 2024. Symbolic meanings in mosques and churches: fusion of the padma flower ornament into the worship structures in Java, Indonesia. *Journal of International Society for the Study of Vernacular Settlements* 11(2): 137–150. DOI: 10.61275/isvsej-2024-11-02-12.
- WOODWARD, M. R. 1988. The “slametan”: textual knowledge and ritual performance in Central Javanese Islam. *History of Religions* 28(1): 54–89. DOI: 10.1086/463136.
- WOODWARD, M. R. 1999. *Islam Jawa: Kesalehan Normatif Versus Kebatinan*. LKiS., Yogyakarta.
- ZUMBROICH, T. J. 2008. The origin and diffusion of betel chewing: a synthesis of evidence from South Asia, Southeast Asia and beyond. *E-Journal of Indian Medicine* 1: 87–140.

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- Journal : KRAENZLIN, F. 1913. *Cyrtandraceae* novae Philippinenses I. *Philippine Journal of Science* 8: 163–179.
MAYER, V., MOLLER, M., PERRET, M. & WEBER, A. 2003. Phylogenetic position and generic differentiation of *Epithemateae* (Gesneriaceae) inferred from plastid DNA sequence data. *American Journal of Botany* 90: 321–329.
- Proceedings : TEMU, S. T. 1995. Peranan tumbuhan dan ternak dalam upacara adat “Djoka Dju” pada suku Lio, Ende, Flores, Nusa Tenggara Timur. In: NASUTION, E. (Ed.). *Prosiding Seminar dan Lokakarya Nasional Etnobotani II*. LIPI & Perpustakaan Nasional. Pp. 263–268. (In Indonesian).
SIMBOLON, H. & MIRMANTO, E. 2000. Checklist of plant species in the peat swamp forests of Central Kalimantan, Indonesia. In: IWAKUMA, T., INOUE, T., KOHYAMA, T., OSAKI, M., SIMBOLON, H., TACHIBANA, H., TAKAHASHI, H., TANAKA, N. & YABE, K. (Eds.). *Proceedings of the International Symposium on: Tropical Peatlands*. Pp. 179 – 190.
- Book : RIDLEY, H. N. 1923. *Flora of the Malay Peninsula 2*. L. Reeve & Co. Ltd, London.
- Part of Book : BENTHAM, G. 1876. *Gesneriaceae*. In: BENTHAM, G. & HOOKER, J. D. (Eds.). *Genera Plantarum 2*. Lovell Reeve & Co., London. Pp. 990–1025.
- Thesis : BAIRD, L. 2002. *A Grammar of Kéo: An Austronesian Language of East Nusantara*. Australian National University, Canberra. [PhD. Thesis].
- Website : <http://www.nationaalherbarium.nl/fmcollectors/k/KostermansAJGH.html>. (Accessed 15 February 2012).



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