Acta Societatis Botanicorum Poloniae

Article ID: 915
DOI: 10.5586/asbp.915

Publication History
Received: 2021-12-21
Accepted: 2022-03-21
Published: 2022-06-29

Handling Editor
Edyta Gola; University of Wrocław, Poland; https://orcid.org/0000-0002-4111-6785

Authors' Contributions
MML and HBM designed the research; MML, ARUW, and HBM collected data and reviewed the manuscript; MML wrote the original version of the manuscript, prepared figures, and edited the manuscript

Funding
The publication was financed by a budget subsidy of the Department of Plant Taxonomy and Nature Conservation (Faculty of Biology, University of Gdańsk) for research potential.

Competing Interests
No competing interests have been declared.

SHORT COMMUNICATION in TAXONOMY AND PHYTOGEOGRAPHY

Notes on the Genus *Nervilia* (Orchidaceae, Nervilieae) in Bali With New Records

Monika M. Lipińska [1,2*], Aninda R. U. Wibowo [3], Hanna B. Margońska [1]

[1] Department of Plant Taxonomy and Nature Conservation, Faculty of Biology, University of Gdańsk, Wita Stwosza 59, 80-308 Gdańsk, Poland
[2] Foundation Polish Orchid Association, 81-825 Sopot, Poland
[3] Eka Karya' Bali Botanical Garden – Indonesian Institute of Sciences (LIPI), Indonesia

[*] To whom correspondence should be addressed. Email: monika.lipinska@ug.edu.pl

Abstract

Nervilia is an orchid genus of approximately 80 ephemeral taxa that are widely distributed throughout the subtropical and tropical regions of Africa, Asia, Australia, and Oceania. Scientific information and research materials gathered from Bali are scarce. While trekking around Bali, we encountered a few representatives of this taxon. This led to further investigation of the genus and its occurrence in Bali, which is summarized in this article. New records of *N. concolor* and *N. punctata* from Central Bali have enriched previously known sites, and as species that appear ephemeral often go unnoticed this is a valuable contribution to the understanding of the geographic distribution of this genus.

Keywords

Bali; Indonesia; *Nervilia*; orchids; phytogeography

1. Introduction

The genus *Nervilia* Comm. ex Gaudich. was described in 1829. It comprises approximately 80 taxa and is distributed throughout the tropical, subtropical, and warm temperate regions of Africa, Asia, Australia, and the Southwest Pacific Islands (Pridgeon et al., 2005). Its representatives are terrestrial herbs, which mostly grow in small colonies. One of the most interesting aspects of their biology is that these plants do not usually bear leaves and flowers simultaneously. The dormant tuber, when ready for new growth, produces an inflorescence, and after the flowering period is complete, the leaf.

Almost all *Nervilia* species grow in shallow soils. They depend on a fairly regularly distributed precipitation during the growing period. Their root systems are rather rudimentary, but the superficial position of the tubers in the soil allows them to benefit from the precipitation from dew and mist. The tubers enable them to survive the short dry periods during their active season and to survive hibernation over several months without rain, as they are effective water storage organs. An important property of species of this genus is their shade tolerance, which consists of the ability to utilize low light intensities for photosynthesis and the capacity for photosynthesizing more efficiently in short-lived sun-flecks (Pettersson, 1991, with references therein).

The ephemeral pattern of emergence means that these plants are easy to be overlooked in the field and that they are under-represented in herbaria, while the temporal separation of the flowering and leafing phases makes complete or correctly matched collections rather rare (Gale et al., 2015; Seidenfaden, 1978). Therefore, knowledge of floral morphological variations across the distribution range of the species and its correlation to pollination ecology or patterns of genetic variation remain unexplored (Gale et al., 2018).

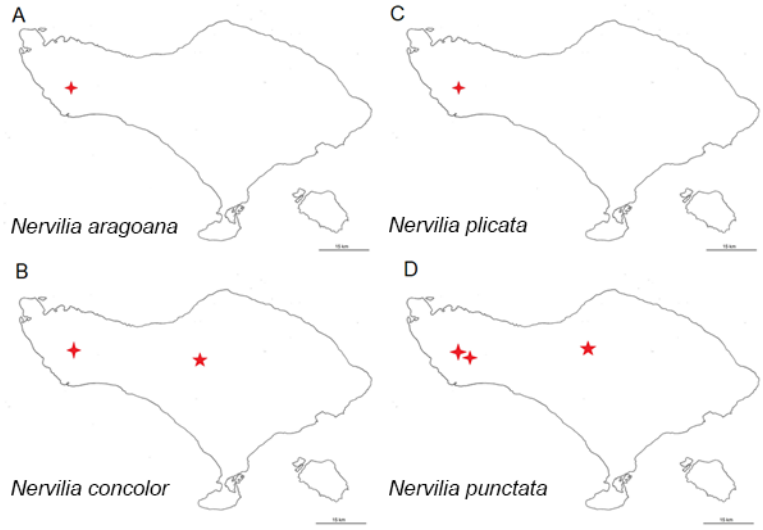

Figure 1 Approximate distribution maps of each species in Bali (a red asterisk stands for a new record reported in this paper; scale bar: 15 km). (**A**) Dewasana Forest, Jembrana Regency. (**B**) Mt Merbuk, Jembrana Regency (left) and Pura Pucak, Mt Batukaru (right). (**C**) Dewasana Forest, Jembrana Regency. (**D**) Pasatan Forest in Mendoyo District and Dewasana Forest, Jembrana Regency (right), Mt Batukaru and Bedugul, northeast of Lubang Nagaloka, Tebanan Regency (left).

The orchid diversity of several large islands in Indonesia is well researched, and several comprehensive studies have been published. The flora of Balinese orchids remains to be studied and described. Scientific information and research materials collected in Bali are extremely scarce (the orchid collection of the Herbarium Hortus Botanicus Balinese, for instance, has 138 specimens in total and just 52 are from Bali), and only a few orchid checklists have been published to date (Girmansyah et al., 2013; Rysy, 1997). According to the data they provide approximately 150 orchid species are found on the island.

During treks around Bali, we encountered a few flowering plants of *Nervilia punctata* Schltr. This led to further investigation of the genus and its occurrence in Bali. The data presented here summarize the available information regarding the genus *Nervilia* in Bali. New records of *N. concolor* Schltr. and *N. punctata* (Figure 1) from Central Bali were added to the currently known sites. Ephemeral species often go unnoticed; hence, each new record is extremely valuable.

2. Taxonomic Notes

The genus *Nervilia* in the orchid flora of Bali appears to be represented by the following four species.

2.1. *Nervilia aragoana* Gaudich., Voy. Uranie, Bot. 422, t. 35 (1829) (Figure 2A–C, Figure 3)

Type: Mariana Islands. Guam. *Gaudichaud* s.n. (Holotype: P)

Pogonia nervilia Blume, Mus. Bot. Lugd. Bat. 1: 32 (1839).

Pogonia flabelliformis Lindl., Gen. Sp. Orchid. Pl.: 415 (1840).

Pogonia gracilis Blume, Coll. Orch. Arch. Ind. Jap.: 155 (1858).

Aplostellis flabelliformis (Lindl.) Ridl., Fl. Malay. Penin. 4: 203. (1924).

Description: **Tubers** about 2 cm in diameter, subglobose, white. **Leaf** cordate, broadly ovate, acuminate, variable in size, usually 8–15 cm in diameter, with 15–20 cm long dark petiole, plicate when young, green, with or without a concentric semi-circle of chocolate brown blotches which merge into one another, these blotches fade after approx. 3 months and they presence is correlated with light

Figure 2 Species of the genus *Nervilia* found in Bali. (**A–C**) *N. aragoana*; (**D–G**) *N. punctata*; (**H**) *Nervilia* sp. 1; (**I**) *Nervilia* sp. 2. Photo credits: Hanna Margońska (**A–C,G**); Monika Lipińska (**D–F**); Aninda Wibowo (**H–I**).

condition (absent in shaded conditions). **Inflorescence** 20–35 cm tall, lax-flowered. **Flowers** greenish with usually more yellowish lip, 4 to 10 mm. **Bracts** 14 × 2 mm, linear-lanceolate, subacuminate. **Sepals** 20 × 4 mm, oblanceolate, acute. **Petals** 20 × 5 mm, similar to sepals. **Lip** 22 × 5 mm, three-lobed, obovate. Lateral lobes oblong, acute. Middle lobe ovate, acute, crenulate, crimped, incurved, 8 mm long. **Gynostemium** short, calvate, with deep clinandrium. **Anther** acuminate and small two-dentate. **Ovary** obconically ribbed.

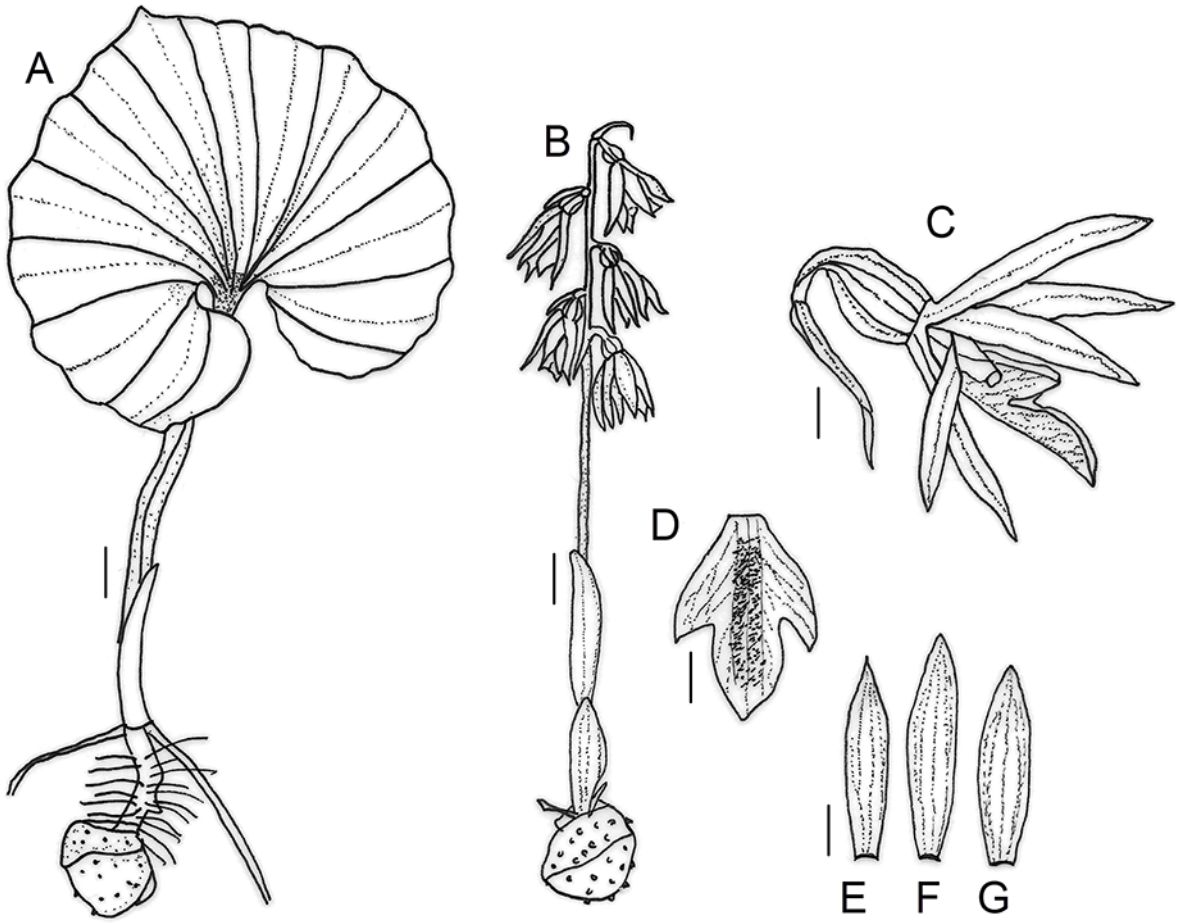

Figure 3 *Nervilia aragoana*. (**A**) Habit in the leafy stage. (**B**) Inflorescence. (**C**) Single flower. (**D**) Lip. (**E**) Dorsal sepal. (**F**) Lateral sepal. (**G**) Petal. Scale bars: 1 cm (**A,B**); 3 mm (**C–F**). Drawn by M. Lipińska.

General distribution: Africa; S and SE Asia: China, Taiwan, Japan, India, Nepal, Bhutan, Bangladesh, Burma, Laos, Thailand, Vietnam, Philippines, Malaysia, Indonesia; Australia; Oceania: Marian Is., Solomon Is., Vanuatu, New Caledonia, Horne Is., Fiji, Niue, Samoa, Society Is. Alt. 0–1,800 m (Lewis & Cribb, 1989; Rokaya et al., 2013).

Notes: The presence of this species was recorded by Dodo and Hartini (2019). It has been found in Dewasana Forest, a secondary forest in Jembrana Regency, at an altitude of 297 m. This is the only record of this species in Bali to date. Some databases have reported different taxonomic approaches to this taxon. According to the Plants of the World Online (POWO), this species is a synonym of *N. concolor*; however, Tropicos.org, which is generally considered more reliable and objective, does not list it as such. Both species are clearly differentiated by the shape of the tepals (oblanceolate in *N. aragoana* and linear lanceolate, pointed in *N. concolor*), lip shape and surface, and general leaf outline (see Figure 3 and Figure 4). The leaf outline might be a source of confusion since in *N. aragoana* the leaf characteristics are strongly influenced by growing conditions and age. Based on our own expertise and in the agreement of other authors, such as Comber (2001) and Silveira et al. (2008), we do not treat these species as synonymous.

2.2. *Nervilia concolor* (Blume) Schltr., Bot. Jahrb. Syst. 45(3): 404 (1911) (Figure 4)

Type: Java. Mt Salak. *Blume* s.n. (Holotype: L?)

Cordyla concolor Blume, Bijdr. Fl. Ned. Ind. (8): 416 (1825).

Pogonia concolor (Blume) Blume, Mus. Bot. 1: 32 (1849).

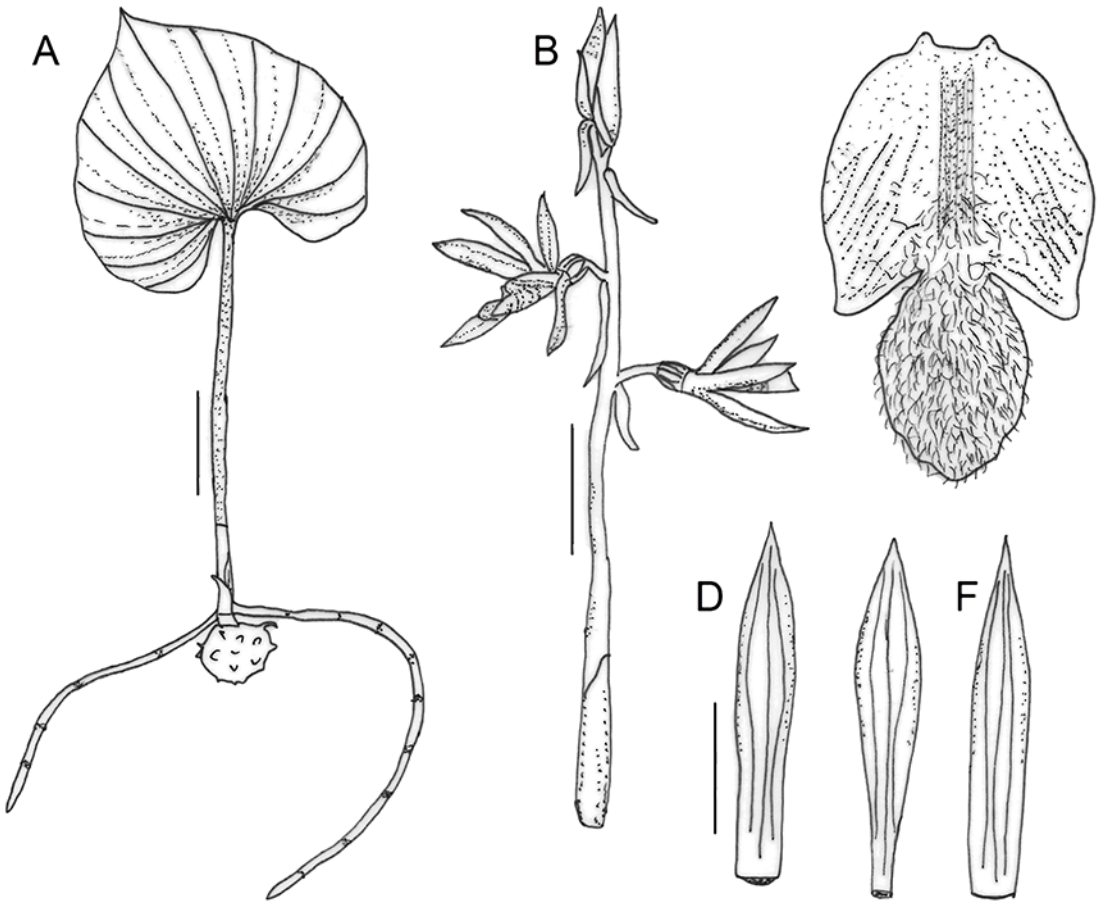

Figure 4 *Nervilia concolor*. (**A**) Habit in the leafy stage. (**B**) Inflorescence. (**C**) Lip. (**D**) Dorsal sepal. (**E**) Lateral sepal. (**F**) Petal. Scale bars: 1 cm (**A,B**); 5 mm (**C–F**). Drawn by M. Lipińska.

Description: **Tubers** spherical. **Leaf** stalked, deeply heart-shaped, pointed, crooked nerves, with nerves protruding alternately on abaxial and adaxial side, glabrous, green, paler below, 15–18 cm, wide. Stem purple, 9–19 cm long. **Inflorescence** upright, loose, eight flowered, 24–36 cm high. Pedunculus pale purple, with a few tubular sheaths at the base. **Bracts** knocked back, linear, pointed. **Flowers** green. **Sepals** and **petals** linearly lanceolate, pointed, the sepals keeled on the outside. **Lip** partially encompassing the column, three-lobed. Lateral lobes short, pointed. Middle lobe pointed, veiny. **Gynostemium** thickened at the top, with a deep clinandrium. **Anther** fleshy, heart-shaped. Roundish scar. **Ovary** inverted, sharp six ribs.

General distribution: S and SE Asia: China (South-Central), Taiwan, Pakistan, India (Andaman Is.), Nepal, Assam, Bangladesh, Burma, Laos, Thailand, Vietnam, Philippines, Malaysia, Indonesia (Sumatra, Java, Sulawesi, Lesser Sunda Is., Maluku); Australia; Oceania: Papua New Guinea, Bismarck Archipelago, Solomon Is., Vanuatu, New Caledonia, Wallis-Futuna Is., Samoa, Fiji, Tonga, Niue, Cook Is. Alt. 0–2,300 m (Atthanagoda et al., 2021).

Notes: The presence of this species was recorded by Sulistiarini et al. (2016). It has been found on Mt Merbuk (Jembrana Regency, Bali) in an open area within a lowland forest at an altitude of 400–600 m. In 2018, on the way to Pura Pucak, Mt Batukaru, we found representatives of this species at an altitude of 1,007 m, despite it not being in flower at the time (vouchers in Ach. Orch. TIIMLD201853-54-HBM1032). During a trek around Bedugul (Central Bali), we found plants of this species (in the leafy stage), which is a new record for this species in Bali.

Three other representatives of the genus *Nervilia* were recorded during fieldwork conducted by the Bali Botanic Garden in 2015 by Wenni Lestari et al. WN241 (E2015060306). One was found in Pasatan Forest, Banjar Pasatan, Pohsanten Village, Mendoyo District, Jembrana Regency, Bali, Indonesia, at an elevation of 399 m. Two were recorded in Sepang, Bali: Sepang Village, Busungbiu District, Buleleng Regency, Bali Province at an altitude of 661 m. Because of the leaf shape and general habit, it is possible that they are representatives of *N. concolor*; however, for now, their taxonomic identification remains uncertain and requires further investigation (Figure 2H–I).

2.3. *Nervilia plicata* (Andrews) Schltr., Bot. Jahrb. Syst. 45(3): 403 (1911) (Figure 5)

Type: Java. *Blume 652* (Holotype: L)

Arethusa plicata Andrews, Bot. Rep. 5: 321 (1803).

Cordyla discolor Blume, Bijdr. FI. Ned. Indië: 417 (1825).

Epipactis plicata (Andrews) Roxb., Fl. Ind. Ed. 1832, 3: 454 (1832).

Pogonia discolor (Blume) Blume, Mus. Bot. Lugd. Bat. 1: 32 (1849).

Nervilia discolor (Blume) Schltr., Bot. Jahrb. Syst. 45: 403 (1911).

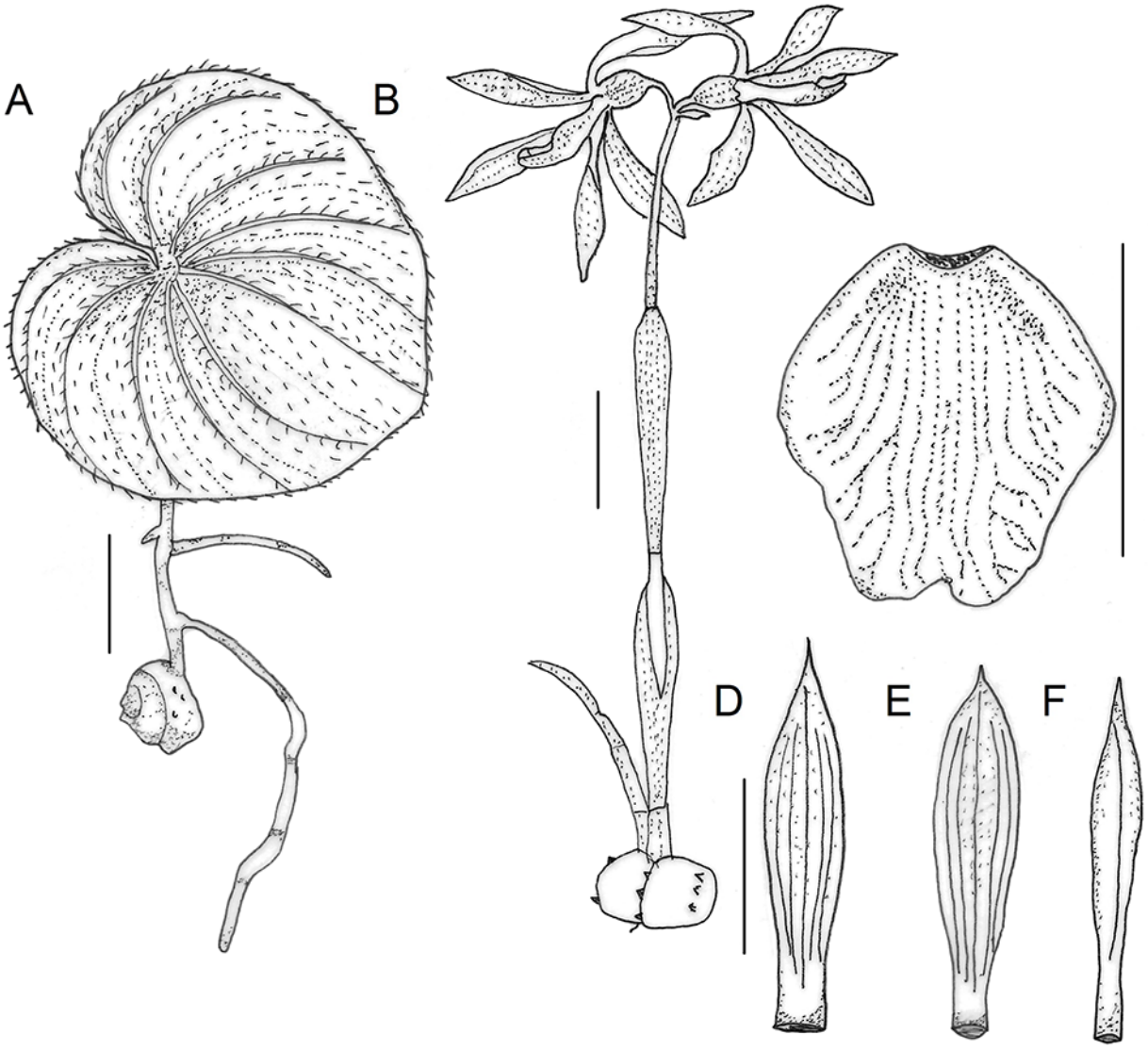

Figure 5 *Nervilia plicata*. (**A**) Habit in the leafy stage. (**B**) Inflorescence. (**C**) Lip. (**D**) Dorsal sepal. (**E**) Lateral sepal. (**F**) Petal. Scale bars: 2 cm (**A,B**); 1 cm (**C**); 5 mm (**D–F**). Drawn by M. Lipińska.

Description: **Tuber** spherical, about 10–18 mm in diameter. **Leaf** heart-shaped to kidney-shaped, 10–14 cm broad. Leaf petiole 1–3 cm long, very dark brownish green, with or without large grey blotches, grows after flowering, orbicular-cordate, interveinal areas and margin hirsute, base cordate, margin entire, apex acute. **Inflorescence** 8–12 cm tall, lower part with tubular sheaths, two–three flowered. **Flowers** half opened, brownish-yellow with purplish-red veins. **Bracts** triangular, 3 mm long. **Sepals** and **petals** subequal, linear-oblong, 2 cm, apex acuminate. **Lip** concave, sub-rhombic, 2 cm long, glabrous, near middle obscurely three-lobed. Lateral lobes erect, apex obtuse. Middle lobe ovate, apex emarginated. **Gynostemium** 10 mm, apex clavate. **Anther** broad. **Ovary** 6 mm, elliptic, ridged, glabrous.

General distribution: S and SE Asia: China, Taiwan, India, Bhutan, Bangladesh, Burma, Laos, Thailand, Vietnam, Philippines, Malaysia, Indonesia; Australia; Oceania: Papua New Guinea. Alt. 1,100 m (Atthanagoda et al., 2021; Rokaya et al., 2013).

Notes: The presence of this species was reported by Dodo and Hartini (2019). It was found in Dewasana Forest, a secondary forest in Jembrana Regency, at an altitude of 463 m. This is the only record of this species in Bali to date.

2.4. *Nervilia punctata* (Blume) Schltr., Bot. Jahrb. Syst. 45(3): 402 (1911) (Figure 2D–G, Figure 6)

Type: Sumatra. *Korthals* s.n. (Syntypes: L0061723)

Pogonia punctata Blume., Mus. Bot. Lugd. 1: 32 (1849).

Aplostellis punctata (Blume) Ridl., Fl. Malay Penins. 4: 204 (1924).

Description: **Tubers** globose, about 1 cm in diameter. **Leaf** petiole 3–10 cm long, blade 4–9 cm wide, heart-shaped, with seven main veins, edge slightly angled at the

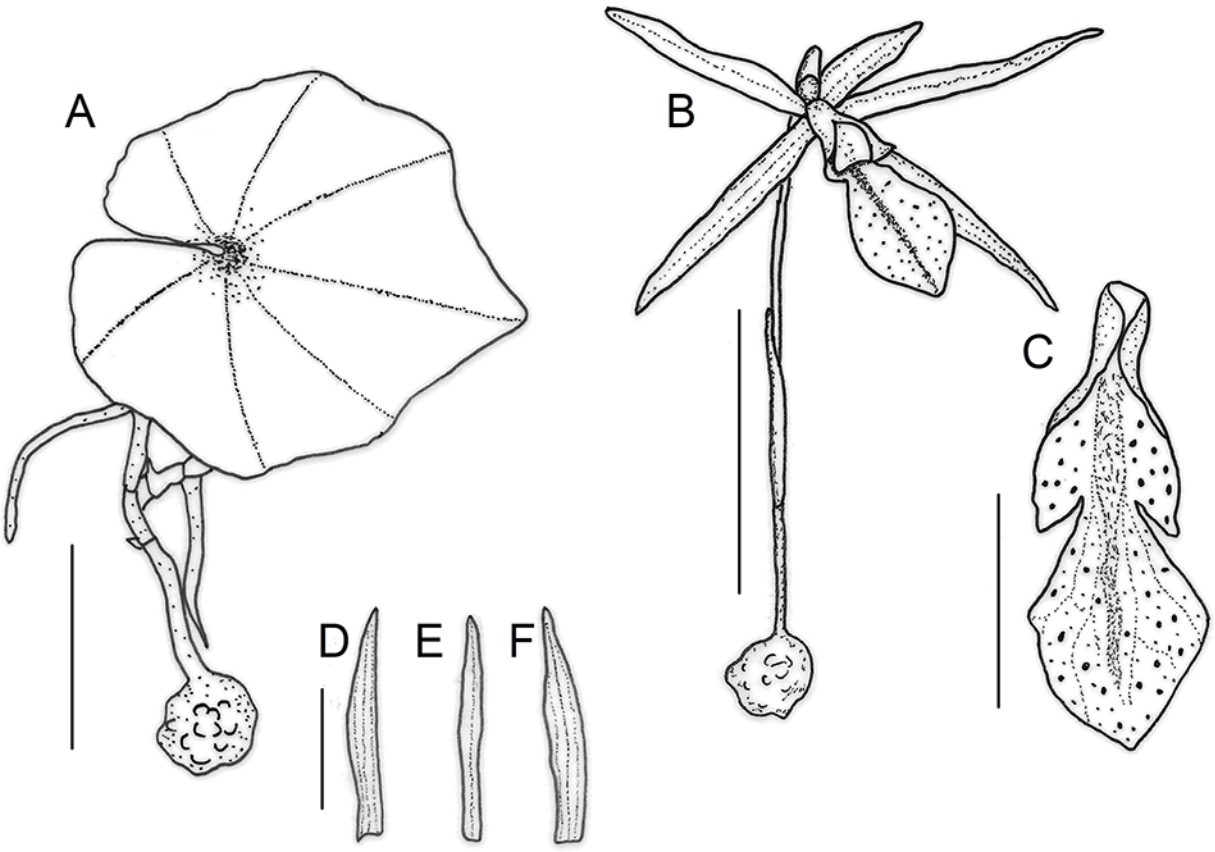

Figure 6 *Nervilia punctata*. (**A**) Habit in the leafy stage. (**B**) Inflorescence. (**C**) Lip. (**D**) Lateral sepal. (**E**) Petal. (**F**) Dorsal sepal. Scale bars: 2 cm (**A,B**); 5 mm (**C–F**). Drawn by M. Lipińska.

ends of the veins, green. **Inflorescence** about 5–14 cm tall, one-flowered, with three sheaths spaced out. **Bracts** linear, acute, 6 mm long. **Flowers** opening widely, about 2 cm broad, petals and sepals greenish brown, the lip white liberally speckled with purple. **Sepals** and **petals** linear, concave, acute, 1.3–2.5 cm long by 1.5 mm broad, spreading, very pale yellowish with copious dull purple marks, about 10 cm long. **Lip** shorter, with base enveloping the column, with small slightly incurved acute side-lobes at the level of the top of the column. Midlobe bent back, lanceolate, acute, with a raised longitudinal ridge in the middle, about 7 mm long. Wide, acute, white, or pale mauve with small purple spots. **Gynostemium** straight, club-shaped, 6 mm. tall. **Anther** broad. **Ovary** ovoid, 5–6 mm long.

Distribution: SE Asia: India, Thailand, Vietnam, Malaysia, Indonesia; Oceania: Papua New Guinea, Fiji. Alt. 0–1,500 m (Comber, 2001).

Notes: The presence of this species was first recorded during fieldwork conducted by the Bali Botanic Garden in 2015 by Wenni Lestari et al. WN195 (E2015060260). The species was found in Pasatan Forest, Banjar Pasatan, Pohsanten Village, Mendoyo District, Jembrana Regency, at an altitude of 465 m. In 2019, Dodo and Hartini (2019) reported this species again after finding it in Dewasana Forest, a secondary forest in Jembrana Regency, at an altitude of 463 m. We also found this species in 2019, in several locations and in different stages of the life cycle. For example, it was found in a forest within a mountain valley, southwest of Mt Batukaru, at an elevation of 1,087 in the leafy stage (series of vouchers in Ach. Orch. TIIIMLD2019157-HBM2137-2142; OrchidBase MM180723); in a forest within a mountain valley near Bedugul, northeast of Lubang Nagaloka, at an elevation of 1,712 m in the leafy stage (series of vouchers in Ach. Orch. TIIMLD2019114-HBM1992-1993, OrchidBase MM180734); and at an elevation of 1566 m as flowering plants (series of vouchers in Ach. Orch. TIIMLD2019133-HBM2013-2015; OrchidBase MM180745). This constitutes a new record for this species in Bali. From our observations, we may assume that in Bali it flowers from August to November, whereas it can be found in the leafy stage from April to May. In August, plants with flowers and leaves may occur simultaneously.

3. Conclusions

The loss of habitat due to agricultural and urban development is considered one of the most important threats to orchid diversity in Bali, with representatives of *Nervilia* being no exception. Given that Bali is a relatively small territory, the pace of its environmental destruction is proportionally fast, and its scale is much greater than that of other islands in the region. In our opinion, however, the lack of scientific data from Bali may be even more dangerous for *Nervilia* species, as it means a lack of knowledge about Balinese representatives of *Nervilia*.

Acknowledgments

The authors are grateful to Piotr Dobrzyński, Jeffrey Champion, Putu Sutrawan, Wayan Suwidiada, and Gede Ardika for their kind assistance during our treks. Part of the data was collected during botanical exploration funded by the Bali Botanic Garden, Indonesian Institute of Sciences. Research was conducted using the first author's (OrchidBase) and last author's (Archivum Orichdalium) digital databases.

References

Atthanagoda, A. G., Aberathna, N., Bandara, C., & Kumar, P. (2021). Taxonomic notes on the genus *Nervilia* (Nervilieae: Epidendroideae: Orchidaceae) in Sri Lanka. *Rheedea*, *31*(3), 161–174. https://doi.org/10.22244/rheedea.2021.31.03.05

Comber, J. B. (2001). *Orchids of Sumatra*. Royal Botanic Gardens.

Dodo, D., & Hartini, S. (2019). Inventory and characteristics habitats of wild orchids in West Bali forest. *Prosiding Seminar Nasional Masyarakat Biodiversitas Indonesia*, *5*(1), 1–6.

Gale, S. W., Duangjai, S., Li, J., Ito, Y., Watthana, S., Termwutthipreecha, P., Cheuk, M. L., & Suddee, S. (2018). Integrative analyses of *Nervilia* (Orchidaceae) section *Linervia* reveal further undescribed cryptic diversity in Thailand. *Systematics and Biodiversity*, *16*(4), 377–396. https://doi.org/10.1080/14772000.2017.1415233

Gale, S. W., Li, J., Kinoshita, A., & Yukawa, T. (2015). Studies in Asian *Nervilia* (Orchidaceae) V: *Nervilia futago*, a cryptic new species from southwest Japan confirmed by morphological, cytological, and molecular analyses. *Systematic Botany*, *40*(2), 413–425. https://doi.org/10.1600/036364415X688772

Girmansyah, D., Santika, Y., Retnowati, A., Wardani, W., Haerida, I., Widjaya, E. I., & van Balgooy, M. M. J. (2013). *Flora of Bali: An annotated checklist*. Research Center for Biology-LIPI dan Yayasan Obor Indonesia.

Lewis, B., & Cribb, P. (1989). *Orchids of Vanuatu*. Royal Botanic Gardens, Kew.

Pettersson, B. (1991). The genus *Nervilia* (Orchidaceae) in Africa and the Arabian Peninsula. *Orchid Monographs*, *5*(1), 1–68.

Pridgeon, A. M., Cribb, P. J., Chase, M. W., & Rasmussen, F. N. (2005). *Genera Orchidacearum. Epidendroideae* (Vol. 4, Pt. 1). Oxford University Press.

Rokaya, M. B., Raskoti, B. B., Timsina, B., & Münzbergová, Z. (2013). An annotated checklist of the orchids of Nepal. *Nordic Journal of Botany*, *31*(5), 511–550. https://doi.org/10.1111/j.1756-1051.2013.01230.x

Rysy, W. (1997). Beitrag zur Orchideenflora von Bali (Teil 1) [Contribution to the orchids of Bali (Part 1)]. *Die Orchidee*, *48*(1), 10–15.

Seidenfaden, G. (1978). Orchid genera in Thailand VI. *Dansk Botanisk Arkiv*, *32*, 147–169.

Silveira, P., Schuiteman, A., Vermeulen, J. J., Sousa, A. J., Silva, H., Paiva, J., & De Vogel, E. (2008). The orchids of Timor: Checklist and conservation status. *Botanical Journal of the Linnean Society*, *157*(2), 197–215. https://doi.org/10.1111/j.1095-8339.2008.00796.x

Sulistiarini, D., Arifiani, D., & Santika, Y. (2016). New records of Orchidaceae from Bali, Indonesia. *Gardens' Bulletin Singapore*, *68*(1), 87–95.