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Send contributions or inquiries to The Editor-in-Chief at the following address:
SYLVATROP, The Technical Journal of Philippine Ecosystems and Natural Resources
Ecosystems Research and Development Bureau, College, Laguna, 4031, Philippines
Tel. No. (049) 536-3628; 536-2269 Fax No. (049) 536-2850
E-mail address: sylvatrop@denr.gov.ph

Cover photo : The rare *Rafflesia schadenbergiana* unfurls its massive flower on the forest floor of Mt Sinayawan, Philippines, showcasing the majesty of one of the world's largest and most elusive blooms

Photo credit : Lovermin C Villasis

Cover layout : Anne Gelli L Nuñez

ABOUT SYLVATROP

Sylvatrop, The Technical Journal of Philippine Ecosystems and Natural Resources, is the Department of Environment and Natural Resources' medium of information exchange on scientific, technological, and descriptive articles, research notes, and reviews of technical literature on ecosystems and natural resources.

Sylvatrop was first published in 1976 as the Philippine Forest Research Journal by the former Forest Research Institute (FORI). Sylvatrop served as FORI's main vehicle for documenting and disseminating research output from 1976 to 1990. In 1991, Sylvatrop was declared as the technical journal of the DENR. Also in that year, the first issue of Sylvatrop came out as the Technical Journal of Ecosystems and Natural Resources.

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A new distribution record of *Rafflesia schadenbergiana* Göppert. in Mt Sinayawan, Tangkulan Range, Bukidnon, Mindanao, Philippines
(Research note)

Andrei Von Mariano C Tirona[1*], Lovermin C Villasis[2], Guiller S Opiso[1], Jayson C Ibañez[1,3], Julie F Barcelona[4]

[1]Philippine Eagle Foundation, Philippine Eagle Center, Barangay Malagos, Baguio District, 8000 Davao City, Philippines; [2]Kibongcog Tigwahanon Ancestral Domain, Barangay Kibongcog, 8711 San Fernando, Philippines; [3]University of the Philippines, Mindanao, Bago Oshiro, Mintal, 8000 Davao City, Philippines; [4]School of Biological Sciences, University of Canterbury, Private Bag 4800, Christchurch 8140, New Zealand

*Email address: avmctirona@gmail.com

The largest flower in the Philippines, ***Rafflesia schadenbergiana****, endemic to Mindanao Island, was known only from three mountain ranges: Apo, Busa, and Kitanglad. In Nov. 2023, the forest guards of the Kibongcog Tigwahanon Ancestral Domain (KTAD) documented two populations of large-sized Rafflesia in Barangay Kibongcog, Municipality of San Fernando, Bukidnon Province. Based on overall floral size and morphology, the flower was confirmed to be* ***R. schadenbergiana*** *and its host plant is* ***Tetrastigma*** *sp., the same host species of the other* ***R. schadenbergiana*** *populations in Mindanao. This recent discovery highlights the importance of the forest fragments in Mindanao and of the power of collaboration among the Department of Environment and Natural Resources (DENR), non-governmental organizations (NGOs), the local government units (LGUs) and the indigenous people (IP) in the establishment of protected areas. The discovery is anticipated to facilitate the declaration of the habitats as a Local Conservation Area (LCA) or Indigenous Community Conserved Area (ICCA). These designations are considered interim protection measures, working towards a National Protected Area (PA) Status. To assess the likelihood of identifying additional populations in Mindanao as habitats undergo shifts due to climate change, species distribution modeling analysis of* ***Rafflesia schadenbergiana*** *and other* ***Rafflesia*** *species in Mindanao is recommended.*

Keywords: Ancestral domain, distribution, forest fragments, holoparasitic plant, key biodiversity area

RAFFLESIA CONSISTS OF ENDOPHYTIC HOLOPARASITIC PLANT SPECIES THAT grow on the liana genus *Tetrastigma* of the grape family Vitaceae (Barcelona et al. 2009; Balete et al. 2010). A total of 14 species of *Rafflesia* is currently recognized in the Philippines, all of which are endemic to the country. Four species are known for the island of Mindanao, and all are island endemics: *R. mira, R. mixta, R. schadenbergiana*, and *R. verrucosa* (Pelser et al. 2011 onwards). *Rafflesia schadenbergiana* is the largest Philippine flower reaching 80 cm in diameter (Hieronymous 1885). Populations of this threatened species (Critically Endangered by DENR-BMB DAO 2017-11; Endangered in Malabrigo et al. 2023) have recently been observed in the Kitanglad Mountain Range in Bukidnon (Barcelona et al. 2008) and within the Lake Sebu area of the Busa Mountain Range in South Cotabato (Lays 2006). However, *R. schadenbergiana* was first discovered in Mt Apo in 1882, but this population has thus far not been rediscovered (Pelser et al. 2019).

The Tangkulan Mountain Range, covering a 26462 ha area, has been identified as a candidate Key Biodiversity Area (KBA) by Conservation International Philippines, DENR-Biodiversity Management Bureau, and HARIBON Foundation (date unknown). Geopolitically, it spans Valencia City, Quezon, and San Fernando in Bukidnon, Philippines. This region falls within the ancestral domains of the Indigenous Manobo Pulanginon, Manobo Tigwahanon, and Matigsalug communities, yet it currently lacks formal protected area designation. Prior investigations into the mountain's biodiversity have been limited due to security concerns and political unrest, resulting in poorly characterized ecosystem (Lagunday et al. 2019).

The Manobo Tigwahanon community of Barangay Kibongcog, San Fernando holds a native title claim over the northeastern part of the Tangkulan range. The Philippine Eagle Foundation (PEF) is collaborating with the Kibongcog Tigwahanon Ancestral Domain (KTAD) to support the protection and sustainable management of their ancestral domain. Through a culture-based conservation approach (Ibañez and Saragena 2020), PEF assists KTAD in natural resource governance, biodiversity profiling, and focal species monitoring, leveraging the expertise of trained and organized local forest guards.

Regular foot patrols have led to the recent discovery of an active population of *R. schadenbergiana* within the Tangkulan Mountain Range. This finding increases the total number of known *R. schadenbergiana* localities in Mindanao to four thereby extending its documented distributional range to include the Tangkulan Mountain Range.

Materials and methods

On November 9, 2023, a large open *Rafflesia* flower was discovered by forest guards from KTAD during a routine 2 km transect patrol on Mt Sinayawan within the Tangkulan Mountain Range, specifically in Barangay Kibongcog, in the Municipality of San Fernando, Bukidnon Province, Mindanao, at an elevation range of 1,020–1,035 masl. The site is characterized as a lowland dipterocarp forest featuring a fairly dense undergrowth and damp, loamy soil. The Tangkulan Mountain Range is managed as an Indigenous Community Conserved Area (ICCA) by KTAD (Figure 1). Biologists from the Philippine Eagle Foundation, a conservation non-governmental organization, visited the site on November 2023 and they documented and confirmed the identity of the *Rafflesia* as *R. schadenbergiana*. No specimen collection was made.

Results and discussion

The overall floral size (73 cm diam) and morphology (perigone warts that are horizontally elongated interspersed by smaller ones, diaphragm that is almost concolorous with perigone lobes, rugose formed by deep impressions of the perigone warts, and its rim being whitish/tannish, perigone tube lacking windows, and disk processes that are laterally compressed and uniformly radially disposed) conform with *R. schadenbergiana* as described by previous authors (e.g. Barcelona et al. 2008; David et al. 2012 '2011'). A near senescent flower measured 73 cm diam (Figure 1B, D). In addition, two flowers in advanced stages of senescence, and three buds measuring 12 cm, 8 cm, and 5 cm diam., respectively, were observed (Figure 2). More recently, on 29 May 2024, an additional population of *Rafflesia* was discovered approximately 193 m from the initial site. This discovery included one open flower measuring 66 cm in diameter (Figure 3), and four accompanying buds. The host plants were identified as *Tetrastigma* sp. which exhibits morphological characteristics consistent with the hosts of other *R. schadenbergiana* populations found across Mindanao (Figures 2A and B).

Figure 1 Site of *R. schadenbergiana* in Tangkulan Mountain Range, view of the mountain range (A) forest interior habitat (B) flower in full bloom (C) flower when senescent (D) Photos by AVM Tirona (A, B, D), LC Villasis (C)

Figure 2 ***Tetrastigma*** **sp. host of the** ***R. schadenbergiana*****, climbing stem (A) leaves showing adaxial surface (B);** ***R. schadenbergiana*** **bud covered with bracts (C) very young bud with cupule arising from the root of the host liana (D) Photos by AVM Tirona (A, B, D), LC Villasis (C)**

Figure 3 Forest Guard Bentoy Suilo beside an open flower of *R. schadenbergiana* at the second site (A), a senescent flower of *R. schadenbergiana* being measured by forest guards in Mt Sinayawan (B), Tangkulan Mountain Range. Photos by LC Villasis (A), AVM Tirona (B)

For a long time, the Philippines' largest flower was presumed to have gone extinct since it has not been observed since its first discovery by Alexander Schadenberg in 1882 (Hieronymus 1885). Many botanists have attempted to find the original population in Mt Parág (near Mt Apo) but to no avail (Heaney and Regalado 1998; Nais 2001, Tan, B.C. pers. com.). In 1994, a second population of a large-sized *Rafflesia* was reported in the mountains of South Cotabato during an ethnological study of the Tasaday tribe in Southern Mindanao (Lays 2006). This observation documented a single large bud, but no open flowers were present at the time. A couple of years after Lays' sighting, another population in Baungon, Bukidnon was reported and a detailed description of the first open flower of *R. schadenbergiana* observed was provided (Barcelona et al. 2008). Unfortunately, this population, which is a few meters away between a river and a corn field has not flowered for more than a decade now. In September 2024, however, photographs of several buds and open flowers of *R. schadenbergiana* in Baungon were shared in social media by the local people in the same general area, 100 – 200 m away from the first site. Another population in nearby Municipality of Libona is also still active (PAMO, Mt Kitanglad Range Natural Park, pers. com. to GS Opiso). In Dec 2012, a team of biologists including JF Barcelona and GS Opiso were guided by local residents to an active population of *R. schadenbergiana*. This site is located within the Cinchona Forest Reserve, a part of the Kitanglad Range Natural Park in Lantapan, Bukidnon. At the time of discovery, the team observed only senescent flowers and numerous buds. Since then, this population along with another located approximately 5 km away, has become a significant attraction to the area, drawing many visitors whenever a bloom is announced. More recently, in January 2021, *R. schadenbergiana* was found in Sitio Blit, Brgy Ned, Lake Sebu, within the Multiple Use Zone of the Allah Valley

Watershed Forest Reserve by a team led by Chris John Ladiana, of the Protected Area Management Office (PAMO), Department of Environment and Natural Resources Office (DENR), South Cotabato. Further field investigation by the PAMO staff in 2022 and 2023 led to in the discovery of three additional populations, two of which are outside of and one within the strict protection zone of the Allah Valley Protected Landscape (A J Saavedra, pers. com.). These sites are about 5–8 km from the general area where Lays (2006) documented the species in 1994. An updated distribution map of *R. schadenbergiana* in Mindanao is provided (Figure 4).

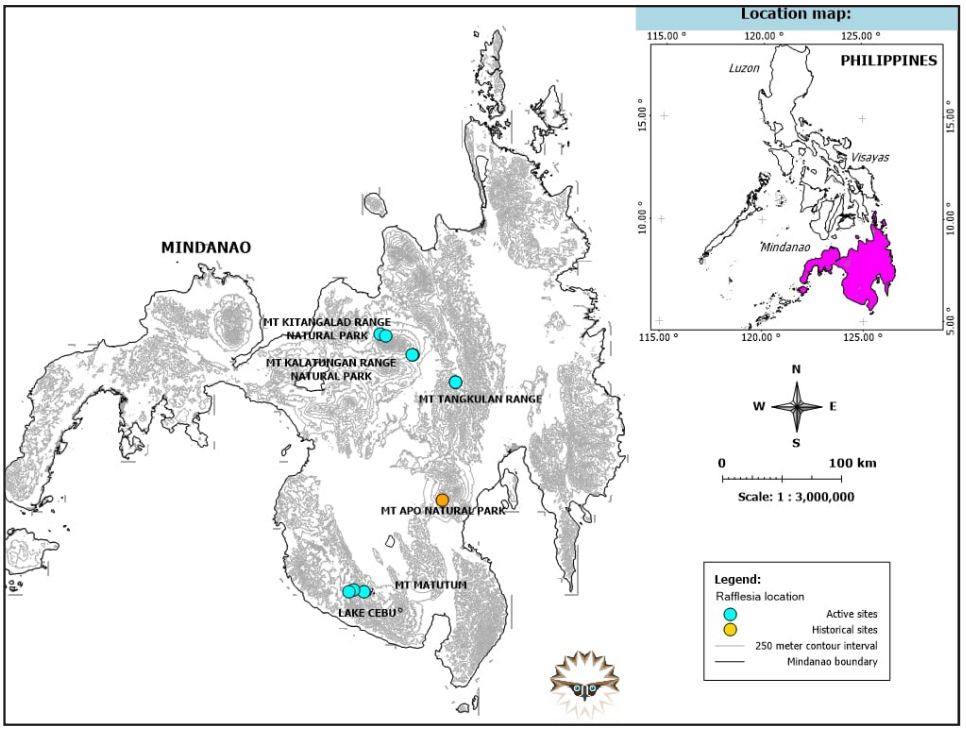

Figure 4 An updated distribution map of *R. schadenbergiana* in Mindanao

Conclusion and recommendations

This recent discovery of a new population of *R. schadenbergiana* highlights the biological significance of Mindanao's remaining forest fragments. It underscores the importance of collaborative efforts among the DENR, NGOs and LGUs working closely with indigenous ancestral domain owners in pursuing the establishment of more protected areas in the remaining forested areas in the country. The recognition of local biodiversity knowledge of those tribes living within or in the vicinity of these mountain ranges is indispensable for the successful implementation of conservation action plans by managers and policy makers.

Interestingly, the local indigenous community had known the presence of this iconic parasitic plant in the area and only brought it to the attention of the biologists when they witnessed it in full bloom. In the case of the country's largest flower, *R. schadenbergiana*, it is reassuring to know that many of its known active populations are found within protected areas (PAs). For those populations located outside PAs, such as in the Mt. Tangkulan Range, this recent discovery could hopefully facilitate efforts to safeguard the species and its habitat by converting the area to Local Conservation Areas (LCAs) or Indigenous Community Conserved Areas (ICCAs) as an interim protection measure toward formal protection under the national PA designation. It would also be interesting to see the potential of uncovering more populations of *R. schadenbergiana* in Central Mindanao. A species distribution modeling analysis could help assess this, as Obico et al. (2024) did on three other Philippine *Rafflesia* species. This discovery also highlights the importance of field studies of the remaining forest fragments by scientists/conservation biologists with indigenous co-researchers in the midst of insurgency and political instability in the region.

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from the Philippine Eagle Foundation. The project is funded by Mandai Nature and USAID-Investing in Sustainable Partnerships for Inclusive Growth and Regenerative Ecosystems (INSPIRE) Project, and the Gerry Roxas Foundation.

Consent to participate

All authors have consented to participate in this study. The field documentation and observations were conducted with the knowledge and approval of the Kibongcog Tigwahanon Ancestral Domain (KTAD) community and its designated forest guards. No specimens were collected during the study.

Author's contribution

Andrei Von Mariano C. Tirona led the manuscript preparation, field verification, and primary documentation of the findings. Lovermin C. Villasis facilitated coordination with the local ancestral domain and participated in field surveys. Guiller S. Opiso contributed to data validation, contextual analysis, and literature review. Jayson C. Ibañez provided overall project oversight and critical input on the manuscript's conceptual framework. Julie F. Barcelona conducted taxonomic confirmation and offered substantive editorial revisions. All authors contributed equally to the study, and all have reviewed and approved the final version of the manuscript.

Conflict of interest

The authors declare no conflict of interest related to the conduct of this study or the preparation of the manuscript.

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