

First Report of *Hedychium flavescens* Carey ex Roscoe (Zingiberaceae) in the Philippines

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During expeditions in the province of Bukidnon, southern Philippines, populations of *Hedychium flavescens* Carey ex Roscoe – a major plant invader in New Zealand, Hawaii, and La Réunion – were documented. This paper formally reports the presence of *H. flavescens*, an escaped species with invasive potential in the country. The species was recorded in the municipalities of Impasug-ong and Maramag in Bukidnon in 2018 and 2020, respectively. *H. flavescens* is the third species of *Hedychium* in the Philippines, adding to the two previously known species – namely, *H. coronarium* Koenig and *H. philippinense* K.Schum. Information on its distribution, habitat and ecology, phenology, colored photographs, and key to different species of *Hedychium* in the Philippines are provided in this paper.

Keywords: *H. philippinense*, Hedychieae, invasive species, new record, terrestrial *Hedychium*

INTRODUCTION

Hedychium J.Koenig is one of the most fascinating genera of Zingiberaceae and was first established by Johann Gerhard Koenig (1728–1785), with *H. coronarium* as the type species. Based on the classification using the molecular characterization of Kress *et al.* (2002), the *Hedychium* is placed within the subfamily Zingiberoideae Haask. of Tribe Hedychieae. The striking and interesting features of the genus sparked the perpetuation of several publications on new species described by early botanists [e.g. Smith (1811), Roxburgh (1820), Roscoe (1824), Wallich (1853), Baker (1892), Schuman (1904), Rao and Verma (1972), Sirirugsa and Larsen (1995)]. Currently, the genus *Hedychium* comprises ca. 100 species in intercontinental Southeast Asia and the remaining half in

Malesia, China, the Himalayas, and Madagascar (Sirirugsa and Larsen 1995; eMonocot 2016). The International Plant Names Index (2023), however, listed a total of 219 scientific names under the genus published since 1783. Of these, only 101 species are accepted (POWO 2023).

Given the unique characteristics of *Hedychium*, new additions to the genus had indisputably been discovered at the start of the 21st century [e.g. Thomas *et al.* (2015), Ding *et al.* (2018), Ashokan and Gowda (2019)]. However, in the Philippines, *Hedychium* spp. remain cryptic and superfluous. The genus is represented only by two species, viz. *H. coronarium* Koenig and *H. philippinense* K.Schum. The former is an invasive species (de Castro *et al.* 2016; CABI 2022) and widely cultivated, whereas the latter species is Endangered (Fernando *et al.* 2022) and listed in CITES under Appendix II, which lists species that are not necessarily now threatened with extinction but that

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may become so unless trade is closely controlled and its derivatives are useful for ornamental purposes and medicinal use (CITES 2023).

Recently, a species of *Hedychium* was found growing profusely at Dila Falls from the Center of Ecological Development and Recreation (CEDAR), Impasug-ong on 08 Oct 2018 and Panalsalan, Maramag on 15 Jun 2020, both in the province of Bukidnon, Philippines. The specimens were then suspiciously identified as *H. philippinense* due to the presence of yellow flowers. It was first acknowledged as pseudo-epiphytic, which confused the authors about its taxonomic identity since *H. philippinense* also appears to have that kind of habit especially when its host tree fell and covered by leaf litter. After verifying its habit, the species was found to be lithophytic and terrestrial growing along the streamside. The vegetative and reproductive materials were also examined and compared to other *Hedychium* species worldwide. This confirmed that the collected species is the cream garland lily, *H. flavescens* Carey ex Roscoe, which holds its first occurrence in the Philippines. To date, the Philippines is now home to three species of *Hedychium* (Table 1). An updated distribution, habitat and ecology, phenology, notes of this species, colored photographs, and taxonomic key are provided.

TAXONOMIC TREATMENT

Hedychium flavescens Carey ex Roscoe, Monandr. Pl. Scitamin.: t. 50.1824; Drury Handb. Ind. Flora 3: 439. 1869; Trimen Handb. Flora Ceylon 4:245.1898; Lourteig Adansonia 12(1): 123.1972. *Hedychium coronarium* var. *flavescens* (Carey ex Roscoe) Baker in Hooker, Fl. Brit. Ind. 6: 226: 1894. *Hedychium subditum* Turill, Kew Bull. 370. 1914. *Hedychium coronarium* var. *subditum* (Turill) Naik & Panigrahi., Bull. Bot. Surv. Ind. 3: 71. 1961. *Hedychium emeiense* Z.Y.Zhu, Acta Bot. Yunnan. 6: 63. 1984. *Gandasulium peregrinum* (N. E. Br.) Kuntze, Revis. Gen. Pl. 2:690. 1891 (Figure 1).

Perennial herb and reached a height of 4 m tall. Rhizomes thick, fleshy, creeping, branched, 15–20 cm long, 2.6–4.4 cm diameter, yellowish-white, fragrant. Leafy shoots up to 3 m high. Leaf sheaths densely pubescent at the insertion; ligule 3.1–5.6 cm, membranous, pubescent. Leaves sessile, oblong to elliptic-lanceolate, 35–62 × 5–12 cm, green on the adaxial surface, pale green beneath, and pubescent; base attenuate, slightly hairy on both sides; apex acuminate, glabrous above, pubescent below particularly dense pubescent along the midrib beneath. Inflorescence terminal, conical, densely flowered; spikes oblong-elliptic, tapering at both ends, 16–20 × 5–12 cm;

Table 1. *Hedychium* species recorded in the Philippines.

Species	Habitat	Distribution	Conservation status
1. <i>Hedychium coronarium</i> Koenig	It occurs mostly in swampy areas, where moisture is high and well-drained soil (Plants of the World Online 2021)	Native to: Assam, China South-Central, China Southeast, East Himalaya, India, Myanmar, Nepal, Taiwan, Thailand, and Vietnam Introduced to: other countries, including the Philippines	Invasive species (CABI 2021)
2. <i>Hedychium flavescens</i> Carey ex Roscoe	Growing wild along the stream course/bank and cascades in moist and shady habitats at an elevation of 500–900 masl (Misra and Sahoo 2015)	Invasive to: New Zealand, Hawaii, and La Réunion. Introduced to: China, southern India, and Sri Lanka (Baby <i>et al.</i> 2007; Dassanayake and Fosberg 1983; eFloras 2008) Introduced and naturalized to: Asia, Africa, Europe, North and Central America, Oceania, Australia, Madagascar, Cook Islands, French Polynesia, New Zealand, <i>etc.</i> (CABI 2021; PIER 2014)	Native, invasive, introduced, and naturalized in other countries Possibly an escaped species with invasive potential in the Philippines
3. <i>Hedychium philippinense</i> K.Schum.	Lowland and medium elevation humid forests, ascending to 1100 m, often epiphytic or pseudoepiphytic (Pelsner <i>et al.</i> 2011 onward)	Philippines	Philippine endemic (Pelsner <i>et al.</i> 2011 onward) and Endangered (Fernando <i>et al.</i> 2022)

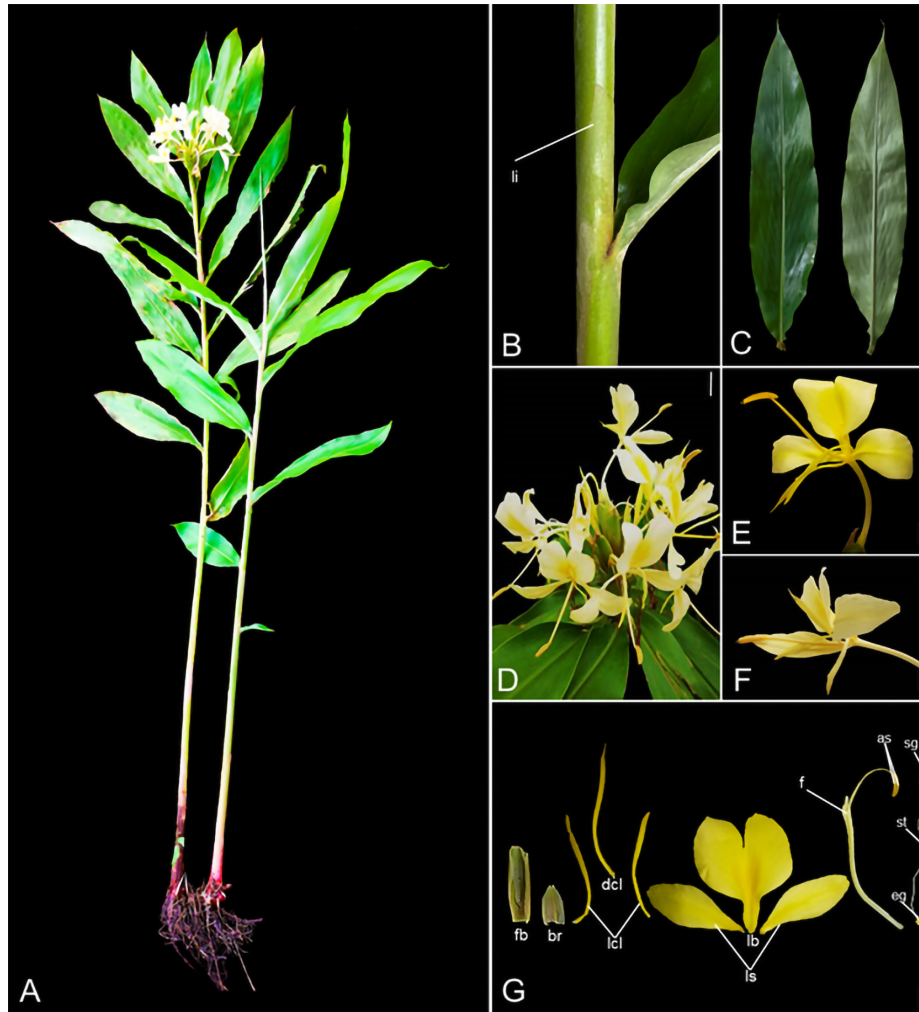


Figure 1. *Hedychium flavescens* Carey ex Roscoe: [A] habit, [B] ligule (li), [C] lamina (adaxial and abaxial surfaces), [D] inflorescence, [E] anterior view of the flower, [F] lateral view of the flower, [G] floral parts { [fb] fertile bract, [br] bracteole, [dcl] dorsal corolla lobe, [lcl] lateral corolla lobes, [lb] labellum, [ls] lateral staminodes, [as] anther sacs, [f] filament, [sg] stigma, [st] style, and [eg] epigynous gland}. Specimens from the planted collection in CMU. Scale bars: D–G (2 cm).

bracts foliaceous, densely imbricate, orbicular-ovate, obtuse, dark green, concave, sparsely pubescent, rachis concealed; basal bracts larger, broadly ovate, 4.8–7 × 3.7–5.3 cm; *upper bracts* narrow, 3.7–5.8 × 2.7–3.8 cm; margin membranous, ciliate; each bract subtends a cincinnus of 3–5 flowers; bracteoles tubular, 2.5 × 1.5 cm, membranous, slightly 2-keeled. Flowers fragrant, creamy yellow to pale yellow, turning pinkish to brown when dry, 4.5–5.2 × 4.0–4.3 cm. Calyx tubular, 5–6 cm long, puberulous, tip 3-toothed, unilaterally split; corolla tube slender, up to 10 cm long, lobes linear-lanceolate; labellum large, creamy yellow with a deep yellow patch at the base, broadly obcordate, longer than wide, 4.6–4.9 × 4.0–4.3 cm, apex 2-cleft, base tapered into a distinct claw; lateral staminodes petaloid, well developed, spatulate, 4.5–5.0

× 1.5–2.0 cm. Pistil 5.9 × 6.0 curving, yellow; stigma centrally raised, green, margin bearded and pubescent; style long, delicate, often lying in the groove in the stamen; ovary pubescent, 4 mm long. Stamen longer than labellum, 5.9–6.1 cm long, deep yellow to light orange, filament slender, anther-thecae parallel, 1.4 cm long. Fruit not observed in both populations.

Distribution. This species is a major invader of native forests in Hawaii, New Zealand, and La Réunion (Winks *et al.* 2007; PIER 2002; Baret *et al.* 2006). It is native to the eastern Himalayas including northeast India and Nepal (Sarangthem *et al.* 2013; Dassanayake and Fosberg 1983; Press *et al.* 2000; eFloras 2008; CABI 2021). *H. flavescens* has been introduced to China, southern India,

and Sri Lanka (Baby *et al.* 2007; Dassanayake and Fosberg 1983; eFloras 2008) and was then widely introduced and naturalized in various tropical countries such as parts of Asia, Africa, Europe, North and Central America, Oceania, Australia, Madagascar, Cook Islands, French Polynesia, New Zealand, *etc.* (CABI 2021; PIER 2014). Based on the Co's Digital Flora of the Philippines, The Plant List, and CABI website, and other related sources, *H. flavescens* has not been listed and reported to occur in the Philippines.

Phenology. Flowering between June and August; fruiting in September and October.

Habitat and ecology. *H. flavescens* was collected at Dila Falls (8° 15' 13.338" N, 125° 02' 08.606" E) in CEDAR, Barangay Impalutao, Impasug-ong on 08 October 2018 and Panalsalan (7° 52' 24 " N, 124° 59' 08" E), Maramag on 15 June 2020, both in the province of Bukidnon, Philippines (Figure 2). The species was observed to be growing in an open damp area near the waterfalls, and its rhizomes are either attached to the rocks (populations in the CEDAR) at elevations of 630–650 masl (Figure 3) or in the moist soil (populations in Panalsalan) found on streambanks where there is no direct contact of sunlight at

an elevation of 520 masl (Figure 4). To date, *H. flavescens* is the tallest species among Philippine *Hedychium*. Only photographic evidence and records in the two sites and no collection of individuals were done on both populations. The described species was based on the planted materials at Central Mindanao University.

Specimens examined. PHILIPPINES. Mindanao: Bukidnon, Maramag, Central Mindanao University, December 2022, *K.S.A. Dargantes with N.P. Mendez.*

This habitat preference recorded in this paper is also consistent with the earlier reports that *H. flavescens* occurs in rainforests, moist forests, along roadsides, in open habitats, and along stream sides (PIER 2002). *H. flavescens* is commonly cultivated and naturalized in moist areas (Hearly and Edgar 1980). Misra and Sahoo (2015) reported that a population of *H. flavescens* in eastern and central India was found growing wild along the stream course/bank and cascades in moist and shady habitats in semievergreen forests at elevations of 500–900 masl. This species was also found in India at elevations 1200–2000 masl (KobaKoba 2001).

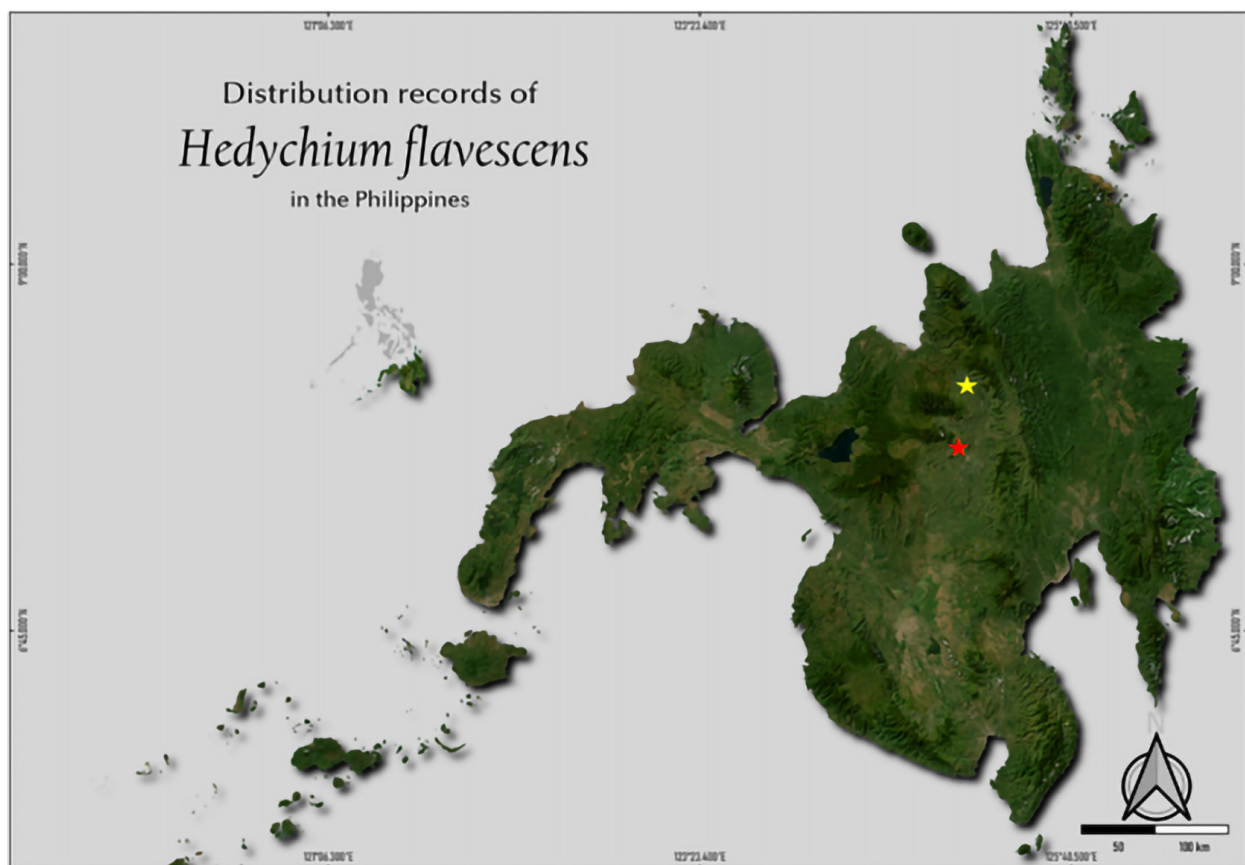


Figure 2. Distribution records of *Hedychium flavescens* Carey ex Roscoe in the Philippines. CEDAR, Impasug-ong, Bukidnon denoted by yellow star; Brgy Panalsalan, Maramag, Bukidnon denoted by red star.

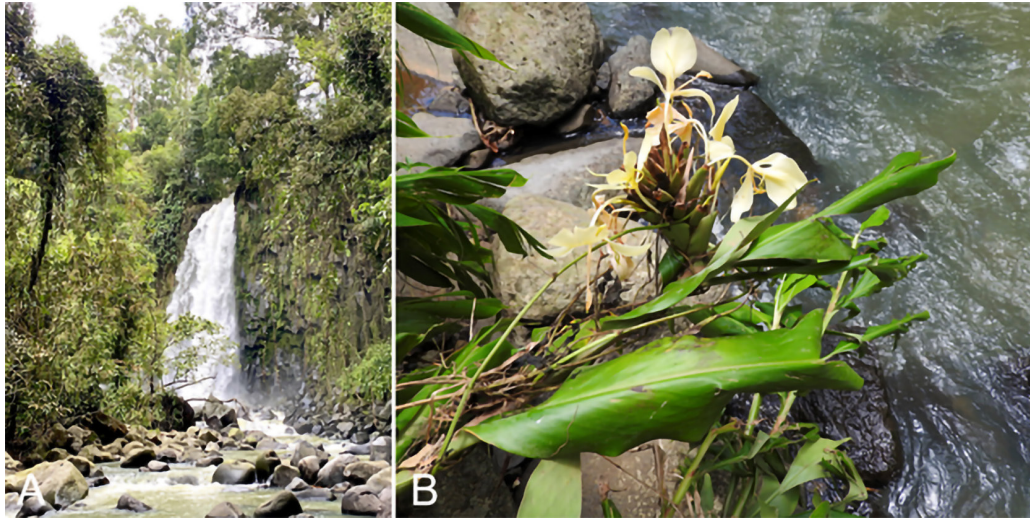


Figure 3. Habitat of *Hedychium flavescens* Carex ex Roscoe in Impasug-ong, Bukidnon: [A] Dila Falls; [B] population of *H. flavescens*.

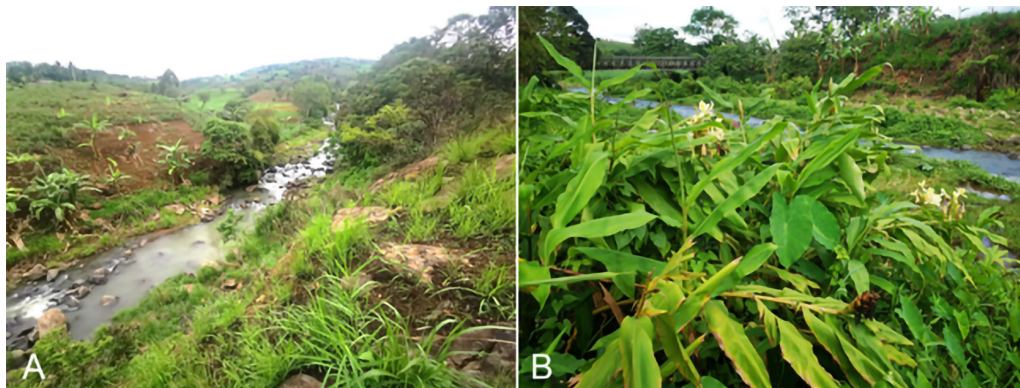


Figure 4. Habitat of *Hedychium flavescens* Carex ex Roscoe in Panalsalan, Maramag, Bukidnon: [A] streamside; [B] populations of *H. flavescens*.

Key to *Hedychium* species in the Philippines

- 1a. Bracts lax, abaxial surface glabrous
 *H. philippinense*
- 1b. Bracts imbricate, abaxial surface pubescent 2
 - 2a. Flowers white, stamen shorter than labellum
 *H. coronarium*
 - 2b. Flowers creamy yellow, stamen longer than the
 labellum *H. flavescens*

DISCUSSION

Prior to the proposed four distinct clades revealed by the phylogenetic tree based on the biogeographic pattern of Wood *et al.* (2000), Ridley (1909) recognized two groups of *Hedychium* – [1] terrestrial species frequent in

India and Myanmar and [2] epiphytic species dominant in Sumatra and the Malay Peninsula to the Philippines. The terrestrial species of *Hedychium* in the Philippines is represented only by *H. coronarium*, an invasive species scattered throughout the archipelago. This is common in the eastern islands most probably introduced from the west. Meanwhile, *H. philippinense* is the only epiphytic species of *Hedychium* in the Philippines, as observed by Tobias *et al.* (2019), Jayme *et al.* (2020), and Acma *et al.* (2020) (Figure 5). As early as 1909, it is understood that the Philippines has no indigenous or native *Hedychium* species with true terrestrial habit. This was supported by the recently proposed four clades of *Hedychium*, where only epiphytic and calciphyte *Hedychium* species (Clade 1) are present in the country. Hence, *H. philippinense* should never be confused with any introduced *Hedychium* native to the Himalayas, India, and Myanmar.



Figure 5. *Hedychium philippinense* K.Schum.: [A] habit; [B] young infructescence; [C] inflorescence. Photographs: [A and B] A.B.Tobias; [C] A. Ricohermoso.

Table 2. Morphological comparison of *Hedychium* species in the Philippines (Tobias *et al.* 2019; present study).

Character	<i>H. coronarium</i>	<i>H. flavescens</i>	<i>H. philippinense</i>
Leaf adaxial surface	Pubescent	Pubescent	Glabrous
Inflorescence	Compact	Compact	Only 1–3 flowers at a time
Bracts	Imbricate, glabrous	Imbricate with light brown hairs	Lax, glabrous
Flower color	White	Creamy yellow	Creamy white with yellow color toward the base
Stamen	4.2–5.4 cm	5.9–6.1 cm	3.9–4.5 cm

Apart from its habit, *H. flavescens* can be easily distinguished from *H. philippinense* with pubescent abaxial leaf surface, ovoid inflorescence, 3- or 5-flowered cincinni, and obcordate labellum, and can be distinguished from *H. coronarium* in terms of the flower color in which white for *H. coronarium* and creamy yellow for *H. flavescens* (Table 2). This escaped species is also native to the Himalayas, Schichuan, and northern Vietnam (eFloras 2008). The probable cause of how it was introduced in the Philippines is still unclear. Since this species occurs already in the Philippines, the species might escape from these habitats and could threaten our remaining native

forested areas. Our native flora might also be put in peril if this species forms a dense population and is left unregulated.

CONCLUSION

This paper presented another potential invasive species in the Philippines – *H. flavescens* – which was recently recorded in the two municipalities of Bukidnon, Philippines. Although the species has not been found to be invasive yet, precautionary measures must be taken to

control its population as this might displace the natural plant communities in the Philippine forests. With this species, the Philippines is now home to three species of *Hedychium* – namely, *H. coronarium*, *H. flavescens*, and *H. philippinense*.

ACKNOWLEDGMENT

The authors would like to thank their respective institutions – Biology Department of Central Mindanao University and the College of Forest Biological Sciences of the University of the Philippines Los Baños. We are also grateful to Timothy Chapman for helping us with the identification of the plant species. We would like to thank For. Gerald T. Eduarte for generating the map and Nelgriv Tan for the photograph of Figure 3B and Analeah Ricohermoso for the photograph of Figure 5C from the Laguna-Quezon land grant.

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