

Research Article

An Annotated Checklist of Zingiberaceae Species from Mt. Hamiguitan Range Wildlife Sanctuary, Davao Oriental, Philippines

Mark Arcebal K. Naive

Department of Biological Sciences, Mindanao State University-Iligan Institute of Technology, Mindanao 9200, Philippines

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**Corresponding author:*

E-mail: arciinaive19@gmail.com

ABSTRACT

Mount Hamiguitan Range Wildlife Sanctuary is a center of botanical diversity throughout the Philippine archipelago. However, as to how many Zingiberaceae species are present in the area is still poorly known. Thus, floristic surveys were made and collections were conducted from July 2016 to September 2018. In total, 18 species belonging to eight genera representing three tribes of the family were recorded. The most species rich tribe belongs to Alpinieae with 14 species in 6 genera. This study presents an annotated checklist of Zingiberaceae species found in the sanctuary which is beneficial for its efficient biological resource management.

Keywords: Biodiversity, biological hotspot, megadiversity, tropical botany, Zingiberales

Introduction

With more than 20,000 endemic species, the Philippines are one of the 18 mega biodiversity countries. As a matter of fact, National Geographic [1] has featured the plethora of life in the Philippine rainforests, much like the richness of the Amazon jungles. However, its 7,100+ islands have not been fully explored yet, resulting in a great scarce of data regarding the distributions and identities of numerous organisms dwelling on the archipelago, most especially true to the Philippine flora. Included is the family Zingiberaceae, or commonly known as the gingers, of primarily tropical rhizomatous herbs which is represented by approximately 1,500 species over 50 genera worldwide. Autapomorphies characterizing this lineage includes the fusion of lateral staminodes of the inner staminal whorl into a labellum, presence of epigynous nectariferous glands at the base of the style, and the presence of cells that possesses essential or ethereal oil [2,3].

In the Philippines, Zingiberaceae harbours over 115 species with approximately 78% endemicity [4]. The number is increasing as new species and species previously known from neighbouring countries continued to be found [e.g. 5, 6,

7, 8, 9, 10, 11]. Many more species awaits scientific description, however, given the increasing pace of forest destruction, these species may not be known and fully explored [12]. The assessment of ginger diversity and distribution is further limited by potential problems in nomenclature that are difficult to resolve because of the lack of access to reference specimens, digital imagery and detailed collection most especially in Mindanao. Furthermore, many existing taxonomic treatments don't have keys, illustrations, or complete descriptions of species, making wild specimens in this taxon difficult to identify [12]. Thus, studies on family Zingiberaceae in the Philippines remains few and outdated at present, leading to the incomplete understanding of its taxonomy, biology, phylogeny and ecology.

Mt. Hamiguitan Range Wildlife Sanctuary (MHRWS), a protected area and a world heritage park is situated in the province of Davao Oriental, island of Mindanao hosts one of the most diverse floras in the archipelago [13]. According to Amoroso & Aspiras [14], it is home to over 878 plant species belonging to 342 genera and 136 families (698 are angiosperms, 25 gymnosperms and 155

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are ferns and lycophytes). In this study, we ground-truth the previous assessment of Acero *et al.* [15]. An annotated checklist is provided, along with photographs to aid easy identification of the species present in the sanctuary.

Material and Methods

Study site

Mt. Hamiguitan Range Wildlife Sanctuary (MHRWS) is a protected area by virtue of R.A. 9303 of July 30, 2004 following the objective of NIPAS Act of 1992 or R.A. 7586 [13]. The mountain totals an area of 169.23 km² with the highest elevation of 1,637 m a.s.l. [13] and characterized by a variety of vegetation types including a unique mossy pygmy forest [14]. It is the only mountain peak in Mindanao with a pygmy forest inhabited by unique flora and fauna thus considered as hottest of the “hotspots” [16]. The mountain is a UNESCO World Heritage Site, ASEAN Heritage Park and also a Mindanao Long Term Ecological Research (LTER) site.

Data collection

The floristic study was done in 3 field expeditions from 2016 to 2018. Purposive sampling of Zingiberaceae species were performed along and approximately 5 m on both side of the trail at the study site. Specimens were collected during their reproductive stages to ensure accurate identification up to species level, processed for herbarium preparation, and deposited vouchers in the University of Santo Tomas Herbarium (USTH). Because existing databases and updated information regarding the Zingiberaceae flora of Mindanao are lacking, specimens were identified utilizing original descriptions, taxonomic revisions, and determination keys.

Results and Discussions

Results of the study revealed that within MHRWS, 18 species of Zingiberaceae were known to occur which belongs to two subfamily (Alpinoioideae, Zingiberoideae), three tribes (Alpinieae, Globbeae, Zingibereae) and eight genera (Table 1). As shown in Figure 1 and 2, the most diverse subfamily in terms of number of species was Alpinoioideae with 14 species (78%) and Alpinieae as the most diverse tribe with 14 species (78%) in six genera. These findings were in congruence to the previous studies conducted in Bukidnon by Naive [12], Antique by Dalisay *et al.* [17] and Northeast Sarawak, Malaysia by Mohamad & Kalu [18]. Zingibereae is the second diverse tribe with two species in two genera and

Globbeae as the least diverse tribe with a single species only. *Etlintera* is the most represented genus with a total of five species followed by *Alpinia* with four species and *Hornstedtia* and *Cucuma* with two species. The remaining five genera are monotypic (Figure 3).

As shown in Figure 4, of the total recorded species, 10 (55%) are identified as endemic to the Philippine archipelago, namely: *Adelmeria alpina* Elmer, *Alpinia haenkei* C. Presl., *A. musifolia* Ridl., *A. rufa* C.Presl., *Etlintera hamiguitanensis* Naive, *E. pilosa* A.D.Poulsen & Docot, *Hornstedtia conoidea* Ridl., *H. microcheila* Ridl., *Meistera* cf. *muricarpa* (Elmer) Škorničk. & M.F.Newman and *Globba campsophylla* K.Schum (Figure 4). Three species (17%) are native to the country namely: *E. coccinea* (Blume) S.Sakai & Nagam., *E. fimbriobracteata* (K.Schum.) R.M.Sm and *Geocharis fusiformis* (Ridl.) R.M.Sm. The remaining five species (28%) are cultivated which are *A. purpurata* (Vieill.) K.Schum., *E. elatior* (Jack) R.M.Sm., *Curcuma longa* L., *Curcuma zedoaria* and *Zingiber spectabile* Griff (Figure 4). This information is summarized in Table 1.

Before the present study, 14 species of gingers were reported to occur in the MHRWS [15, 19]. Acma & Mendez [19] and Acero *et al.* [15] reported the occurrence of *E. dalican* in the said mountain, however, present study revealed that it is erroneous and the said species was misidentified. Recent investigation revealed that it is *E. fimbriobracteata* determined by having a reniform and orange anther crest, a characteristic unique to the species. *E. fimbriobracteata* is a species native to the Philippines, and have been recently reported to occur in the country by Poulsen & Docot [20]. Previously, the species was known as *E. pandanicarpa* (Elm.) A.D.Poulsen, however, recent investigation of Poulsen and Docot [20] revealed that the it is a synonym of *E. fimbriobracteata*, a species previously only known from Borneo. These only proves that, as fieldwork activities in the Philippines focused on gingers will increase in the near future, it is likely that more species already known from Sulawesi and especially Borneo will be discovered in the archipelago.

Based on the checklist of Philippine Zingiberaceae by Pelser *et al.* [4], this study has found 16% of the total 115 species. The number of species listed is higher compared to the number of gingers in Mt. Kalatungan Range Natural Park, Bukidnon with 12 species [12] and lower compared to Khao Luang National Park, Thailand with 34 species [21], Besiq Bermai forest, East Borneo with 19 species [22], province of Antique, Philippines

Table 1. Checklist of gingers present in Mt. Hamiguitan Range Wildlife Sanctuary, Davao Oriental, Philippines

Subfamily	Tribe	Species name	Endemicity	Present study	Acero et al., 2019
Alpinioideae	Alpinieae	<i>Adelmeria alpina</i> Elmer	Endemic	✓	-
		<i>Alpinia musifolia</i> Ridl.	Endemic	✓	✓
		<i>Alpinia rufa</i> C. Presl. (Fig. 5A)	Endemic	✓	✓
		<i>Alpinia haenkei</i> C. Presl.	Endemic	✓	✓
		<i>Alpinia purpurata</i> (Vieill.) K. Schum.	Cultivated	✓	-
		<i>Etingera coccinea</i> (Blume) S.Sakai and Nagam.	Native	✓	-
		<i>Etingera elatior</i> (Jack) R.M. Sm.	Cultivated	✓	-
		<i>Etingera fimbriobracteata</i> (K.Schum.) R.M. Sm. (Fig. 5B)	Native	✓	✓
		<i>Etingera hamiguitanensis</i> Native (Fig. 5C)	Endemic	✓	✓
		<i>Etingera pilosa</i> A.D.Poulsen & Docot (Fig. 5D)	Endemic	✓	✓
		<i>Geocharis fusiformis</i> (Ridl.) R.M.Sm. (Fig. 5E)	Native	✓	✓
		<i>Hornstedtia conoidea</i> Rild. (Fig. 5G)	Endemic	✓	✓
		<i>Hornstedtia microcheila</i> Rild. (Fig. 5H)	Endemic	✓	✓
Zingiberoideae	Globbeae	<i>Meistera cf. muricarpa</i> (Ridl.) Škorničk. & M.F.Newman	Endemic	✓	✓
		<i>Globba campsophylla</i> K.Schum. (Fig. 5F)	Endemic	✓	✓
	Zingibereae	<i>Curcuma longa</i> L.	Cultivated	✓	✓
		<i>Curcuma zedoaria</i> (Christm.) Rosc.	Cultivated	✓	✓
		<i>Zingiber spectabile</i> Griff.	Cultivated	✓	-

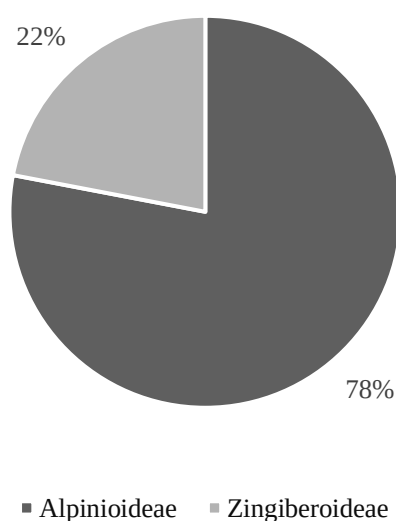
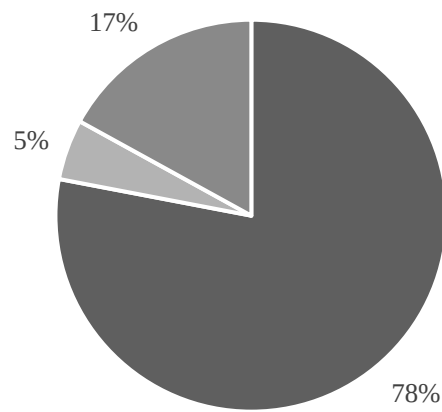


Figure 1. Dominant subfamily in terms of number of species in MHRWS



■ Alpinieae ■ Globbeae ■ Zingibereae

Figure 2. Dominant tribe in terms of number of species in MHRWS

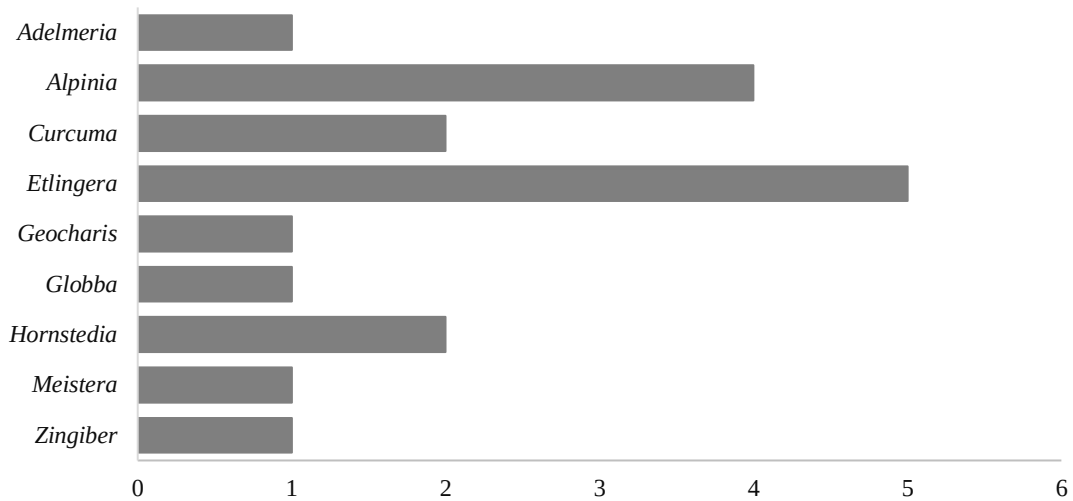


Figure 3. Dominant genera in terms of number of species in MHRWS

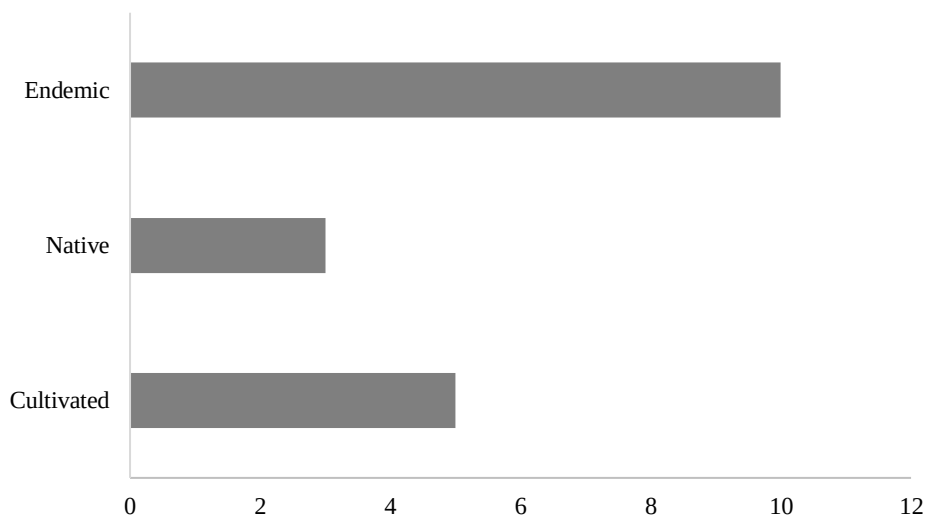


Figure 4. Endemism of the Zingiberaceae species in MHRWS



Figure 5. Selected Zingiberaceae species in MHRWS A. *Alpinia rufa*, B. *E. fimbriobracteata*, C. *E. hamiguitanensis*, D. *E. pilosa*, E. *Geocharis fusiformis*, F. *Globba campsophylla*, G. *Hornstedtia conoidea*, and H. *H. microcheila*

with 23 species [17], North East of Sarawak, Malaysia with 30 species [18].

Among these recorded taxa, only 10 species have conservation status (1 Endangered, 6 Least Concern and 3 Data Deficient). These are *Geocharis fusiformis* (Endangered), *Adelmeria alpina* (Least Concern), *Alpinia haenkei* (Least Concern), *E. alba* (Least Concern), *E. coccinea* (Least Concern), *E. fimbriobracteata* (Least Concern), *Globba campsophylla* (Least Concern), *Curcuma zedoaria* (Data Deficient), *C. longa* (Data Deficient) and *E. elatior* (Data Deficient) [23–32]. The remaining species have not yet been assessed, most especially for the endemic ones. The need to assess their conservation status are essential in order to implement more efficient conservation measures and protection.

We found several species that were previously documented only at their type localities which is outside of MHRWS, Davao Oriental such as *E. pilosa*. This Philippine endemic species has so far only been known from its type locality which is in Cuernos de Negros Mountain, Negros Oriental. Thus, these records represent important new data for both MHRWS and for understanding the geographic distributions of these Philippine endemic species. Occurrence reports of rare species, especially for narrow endemic taxa, are almost a century old. Thus, our rediscovery of these species extends their geographic distributions beyond their type localities and confirms that they are not yet extinct. Our new data on these endemic taxa are particularly important for evidence-based conservation management of the MHRWS.

At present, numerous ginger species in the Philippines are becoming rare in the wild and are threatened with extinction because of degradation or even a total destruction of their habitats. There are still numerous undiscovered and unexplained patterns in the distribution of gingers in MHRWS. The number of recorded species will almost certainly increase, with additional research and the opening up of many inaccessible locations. When collecting gingers, securing the flowers and preserve them in alcohol is essential, but it would also be useful in understanding them their taxonomy to pickle the infructescences and fruits to enable comprehensive and accurate descriptions, especially to any potential new taxa described.

Conclusion

This study provided a list of 18 Zingiberaceae species reported to occur in MHRWS which belongs to nine genera. Intensive assessment of ginger flora of MHRWS is required to further

measure the threats and assess their local conservation status. In addition, engagement of the local people in conserving the biodiversity and strict policy implementation are helpful in saving the “last ecological frontier” of the Philippines.

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References

1. Visilind P (2002) Hotspot: The Philippines. <http://ngm.nationalgeographic.com/features/world/asia/philippines/philippines-text>. Accessed date: April 2019.
2. Kress WJ. 1990. The phylogeny and classification of the Zingiberales. *Annals of the Missouri Botanical Garden* 77: 698–721.
3. Bai L, Leong-Škorničková J, Xia N (2015) Taxonomic studies on *Zingiber* (Zingiberaceae) in China I: *Zingiber kerrii* and the synonymy of *Z. menghaiense* and *Z. stipitatum*. *Gardens' Bulletin Singapore* 67(1):129–142. doi:10.3850/s2382581215000149
4. Pelsner PB, Barcelona JF, Nickrent DL (2011) Co's Digital Flora of the Philippines. <http://www.philippine-plants.org>. Accessed date: April 2019.
5. Acma FM (2014) *Amomum dealbatum* Roxb. (Alpinioideae, Zingiberaceae), a new record for the Philippine flora. *Asia Life Sciences* 23: 527–535.
6. Naive MAK (2017) *Etilingera hamiguitanensis* (Zingiberaceae; Alpinioideae), a new ginger species from Davao Oriental, Philippines. *Taiwania* 62(4):340–344. doi:10.6165/tai.2017.62.340
7. Ambida JHB, Alviar AMA, Co PSA et al. (2018) A new species of *Vanoverberghia* (Zingiberaceae) from the Philippines. *Blumea* 63:130–134.
8. Naive MAK, Alejandro GJD (2018) *Hornstedtiagarbosa* (Zingiberaceae: Alpinieae), a new species from Mindanao, Philippines. *Phytotaxa* 347: 183 – 188. doi: 10.11646/phytotaxa.347.2.6
9. Naive MAK, Pabillaran RO, Escrupulo IG (2018) *Etilingera coccinea* (Blume) S. Sakai and Nagam. (Zingiberaceae - Alpinieae): An addition to the Flora of the Philippines, with notes on its distribution, phenology and ecology. *Bioscience Discovery* 9:107–110.
10. Naive MAK, Bautista CYV, Cabra JAT et al. (2018) *Hornstedtia annadeguzmaniae* (Zingiberaceae), a new species from the Philippines. *Annales Botanici Fennici* 56: 101–105. doi:10.5735/085.056.0115

11. Acma FM, NP Mendez, NE Lagunday, VB Amoroso (2019) New record of *Plagiostachys albiflora* Ridl. (Zingiberaceae) in the Philippines. *Modern Phytomorphology* 13: 5–8.
12. Naive MAK (2017) Zingiberaceae of Kalatungan Mountain Range, Bukidnon, Philippines. *Bioscience Discovery* 8: 311–319.
13. [UNESCO] United Nations Educational, Scientific and Cultural Organization (2014) Nine new sites inscribed on World Heritage List. <http://whc.unesco.org> Accessed date: April 2019.
14. Amoroso VB, Aspiras RA (2011) Hamiguitan Range: a sanctuary for native flora. *Saudi Journal of Biological Sciences* 18: 7–8.
15. Acero KML, Amoroso VB, Lumista HP et al. (2019) Species composition and distribution of Zingiberaceae in Mt. Hamiguitan Expansion Site, Davao Oriental, Philippines. *Journal of Tropical Biology and Conservation* 16: 125–140.
16. Ong PS, Afuang LE, Rosell-Amball RG (2002) Philippine biodiversity conservation priorities: A Second Iteration of the National Biodiversity and Action Plan. DENR-Protected Areas and Wildlife Bureau, Conservation International Philippines, Biodiversity Conservation Program-UP CIDS, and the Foundation for the Philippine Environment, Quezon City, Philippines.
17. Dalisay JAGP, Bangcaya PS, Naive MAK (2018) Taxonomic studies and ethnomedicinal uses of Zingiberaceae in the Mountain Ranges of Northern Antique, Philippines. *Biological Forum – An International Journal* 10 (2): 68–73.
18. Mohamad S, Kalu M (2019) Assessment of Zingiberaceae (Tribe Alpinieae) from North East Sarawak, Malaysia. In proceedings of IOP Conf. Series: Earth and Environmental Science 269. doi: 10.1088/1755-1315/269/1/012032
19. Acma FM, Mendez NP (2018) Noteworthy records of Philippine endemic gingers (Zingiberaceae) in the buffer zone of Mt. Hamiguitan Range Wildlife Sanctuary, Davao Oriental, Philippines. *Environmental and Experimental Biology* 16: 111–115.
20. Poulsen AD, Docot RVA (2018) How many species of *Etilingera* (Zingiberaceae) are there in the Philippines? *Edinburgh Journal of Botany* 76: 33–44. doi: 10.1017/S0960428618000240
21. Nontasit N, Kanlayanapaphon C, Mekanawakul M, Nualmangsar O (2015) Taxonomic studies and traditional uses of Zingiberaceae in Khao Luang National Park, Nakhon Si Thammarat Province, Thailand. *Walailak J Sci & Tech* 12 (8):643–658.
22. Trimanto T (2017) Ginger species in Besiq Bermai forest, East Borneo: Inventory and collection. In Proceedings of AIP Conference 1844, 050002. doi: 10.1063/1.4983440
23. Olander SB (2019) *Geocharis fusiformis*. The IUCN Red List of Threatened Species. e.T117326245A124282458. <https://dx.doi.org/10.2305/IUCN.UK.2019-2.RLTS.T117326245A124282458.en>. Accessed date: April 2020.
24. Docot RVA (2019) *Alpinia alpina*. The IUCN Red List of Threatened Species. e.T117262472A124279518. <https://dx.doi.org/10.2305/IUCN.UK.2019-2.RLTS.T117262472A124279518.en>. Accessed date: April 2020.
25. Olander SB (2019) *Alpinia haenkei*. The IUCN Red List of Threatened Species. e.T117266221A124279793. <https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T117266221A124279793.en>. Accessed date: April 2020.
26. Poulsen AD, SB Olander (2019) *Etilingera alba*. The IUCN Red List of Threatened Species. e.T126975761A126980835. <https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T126975761A126980835.en>. Accessed date: April 2020.
27. Poulsen AD, SB Olander, RVA Docot (2019) *Etilingera coccinea*. The IUCN Red List of Threatened Species. e.T117318042A124282047. <https://dx.doi.org/10.2305/IUCN.UK.2019-2.RLTS.T117318042A124282047.en>. Downloaded on 03 May 2020.
28. Poulsen, AD, SB Olander, RVA Docot (2019) *Etilingera fimbriobracteata*. The IUCN Red List of Threatened Species. e.T117319117A124282102. <https://dx.doi.org/10.2305/IUCN.UK.2019-2.RLTS.T117319117A124282102.en>. Accessed date: April 2020.
29. Sangvirotjanapat S, RVA Docot (2019) *Globba campophylla*. The IUCN Red List of Threatened Species. e.T117349085A124282677. <https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T117349085A124282677.en>. Accessed date: April 2020.
30. Olander SB (2019) *Curcuma zedoaria*. The IUCN Red List of Threatened Species. e.T117311046A124281780. <https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T117311046A124281780.en>. Accessed date: April 2020.
31. Olander SB (2019) *Curcuma longa*. The IUCN Red List of Threatened Species. e.T88308047A88308057. <https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T88308047A88308057.en>. Accessed date: April 2020.
32. Poulsen AD, SB Olander (2019) *Etilingera elatior*. The IUCN Red List of Threatened Species. e.T117234456A124279013. <https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T117234456A124279013.en>. Accessed date: April 2020.

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