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CHECKLIST OF HOYA SPECIES ON PALAWAN ISLAND, PHILIPPINES

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ABSTRACT – This study provided a checklist of Hoya species reported to occur in the island of Palawan, Philippines. A total of 17 species of which 11 are endemic to the Philippines are identified after extensively reviewing published articles about Hoya. Palawan is protected by various laws but despite of existing conservation policies, it is still facing threats leading to the decline of biological diversity. Hoya is not exempted to these threats and therefore this paper proposed to assess the conservation status of these species in order to avoid possible extinction in the future. Engaging the local people in conservation efforts and strict policy implementation are the crucial steps in saving Hoya and other biota in the country's "last ecological frontier".

Keywords: Hoya, Palawan, conservation, illegal logging, mining, deforestation

INTRODUCTION

Hoya, also known as wax plants belongs to the Dogbane family or Apocynaceae (Siar, 2005; Aurigue, 2013). *Hoya* species are mostly vines and epiphytic climbers (Wanntorp, 2009). It has unusual floral morphology, i.e star-shaped corona and pollinarium with 2 pollinia attached to a corpusculum (Kidyoo, 2015). *Hoya* plants are popular ornamentals owing to its waxy foliage and attractive flowers (Borlagdan et al., 2016; Widiarsih et al., 2011). Aside from being an ornamental plant, several *Hoya* species are being used as medicinal plants. For instance, *Hoya parasitica* Wall. leaf extract is used externally to treat body pain, fever or applied in bone fractured area (Biswas et al., 2010; Singh and Borthakur, 2011). *Hoya diversifolia* Blume is used to treat headache, toothache and muscle pain (Mollik et al., 2010). *Hoya lanceolata* Wall. leaves and latex are applied on boils and muscular pain (Barukial and Sarmah, 2011). *Hoya micrantha* Hook. f. is being used to treat jaundice (Chuakul, 2005) and *Hoya longifolia* Wall. ex Wight for treating burns (Gautam, 2013). In the Philippines, some of the endemic *Hoya* species were reported to contain compounds with medicinal applications such as *Hoya buotii* Kloppenb. (Ebajo et al., 2015a), *Hoya mindorensis* Schlechter (Ebajo et al., 2014), *Hoya paziae* Kloppenb. (Borlagdan et al., 2016) and *Hoya wayetii* Kloppenb. (Ebajo et al., 2015b).

Hoya plants are distributed from India to Pacific islands (Wanntorp et al., 2006). In Asia, it is believed that the southeast region is the center of diversity for *Hoya* (Rodda and Ang, 2012). The Philippines among other countries, contains one of the richest and most diverse range of *Hoya* species (Kloppenburg and Siar, 2008). There are at least 109 species of *Hoya* found in the Philippines of which 88 are endemic to the country (Panajon et al., 2016). Majority of *Hoya* species grow between 0 and 800 m altitude. *Hoya* can be seen usually on the stem, primary and secondary branches of trees located along

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rivers, lakes and sea shores (Kleijn and van Donkelaar, 2001). In the Philippines, *Hoyas* can be found all over the islands at all altitudes (Siar, 2005).

This study concerns the *Hoya* plants that are found in Palawan. Palawan is dubbed as the Philippines' "last ecological frontier" and one of the most diverse and rich islands in the Philippines (Sandalo and Baltazar, 1997). An estimated 3000-3500 flowering species mostly known can only be found in this island (Madulid, 2002). In 1991, Palawan was declared as a Biosphere Reserve in the country by UNESCO's Man and Biosphere Reserve Program due to its significant contribution to global biodiversity (Diesmos and Palomar, 2004). Paradoxically, while perceived as an island with a good condition, Palawan biodiversity is threatened by different anthropogenic activities mostly by illegal logging and mining (Sopsop and Buot, 2009; Cruz et al., 2007). Incidentally, epiphytic and forest dependent species comprised the most-extinction prone vascular species (Sodhi et al., 2008). And the myriads of *Hoya* species are very vulnerable.

This paper provides an enumeration of the IPNI listed *Hoya* species in Palawan. It created an awareness of the various *Hoya* species vulnerable to extinction should deforestation continue unregulated.

MATERIALS AND METHODS

Palawan (Fig.1) is one of the Philippine provinces composed of islands and islets located 7º47' and 12º22' north latitude and 117º00' and 119º51' east longitude, generally bounded by the South China Sea to the northwest and by the Sulu Sea to the east. Palawan is the fifth-largest island in the Philippine archipelago with an area of more than 11,000 square kilometers (Fidenci and Castillo, 2009). It has a long mountainous backbone with three peaks above 1,500 meters. The province has two types of climate: Type I that is six months of dry and six months of wet season and Type II that refers to a short dry season of one to three months and no pronounced rainy period during the rest of the year. The extreme north, south sections and in the entire northwest coast experience Type I climate while Type II prevails in the entire province (Fernandez et al., 1995). Palawan's economy is mainly supported by agriculture followed by mining, logging, fishing, natural gas exploration and tourism.

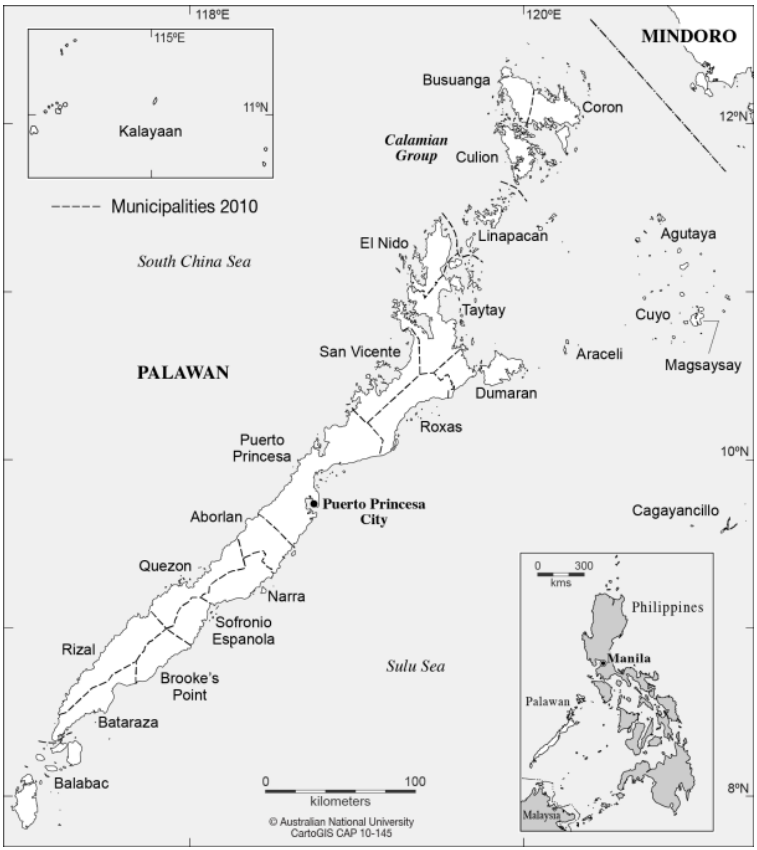

Figure 1. The island of Palawan. (Source: CartoGIS, College of Asia and the Pacific, The Australian National University).

This study made use of secondary data following the methods of Villanueva and Buot, 2016. Several literatures about *Hoya* were extensively reviewed and from these references, the *Hoya* species of Palawan were identified. The geographical distribution of the species was determined using the "The Species 2000 & ITIS Catalogue of Life, 2016 Annual Checklist" and The International Plant Name Index (IPNI). The list of Merrill (1923) was also used for those species that were not recorded in the Catalogue of life and IPNI.

RESULTS AND DISCUSSION

There are 17 species of *Hoya* that are reported to occur in Palawan. Out of 17, 11 are endemic to the Philippines while the remaining six (6) are indigenous (Table 1).

Table 1. Checklist of *Hoya* species on Palawan Island, Philippines

Species	Geographic Distribution	Conservation Status*	References
Hoya coriacea Blume	Java, peninsular Malaysia, Palawan (southern part); indigenous	NA	Fraterna 14(1): 2001 Aurigue (2013)
Hoya cumingiana Decne.	Java, Philippines (Luzon, Mindoro), Palawan (Ticao); indigenous	NA	Enum. Philipp. Fl. Pl. iii. 351 (1923) Aurigue (2013)
Hoya diversifolia Blume	Java, peninsular Malaysia, Cambodia, Myanmar [Burma] (Bago), S-Vietnam, Singapore, S-Thailand, Borneo, Sumatra, Andaman Isl. (Narcondum Isl., Barren Isl., North Andaman Isl., South Andaman Isl.), Philippines (Luzon): Quezon and Palawan; indigenous	NA	Hassler M. (2016) Aurigue (2013)
Hoya diversifolia Blume subsp. *el-nidicus* (Kloppenb.) Kloppenb.	Palawan; endemic	EN	Fraterna 14(1): 13. 2001
Hoya golamcoana Kloppenb.	Palawan; endemic	NA	Fraterna 1991(3), Philipp. Hoya Sp. Suppl.: II, 1991
Hoya imbricata Decne.	Philippines (Luzon, Busuanga), Palawan, Sulawesi; indigenous	NA	Prodr. [A. P. de Candolle] 8: 637. 1844 [mid Mar 1844]

Species	Geographic Distribution	Conservation Status*	References
Hoya imperialis Lindl.	Peninsular Malaysia (Perak, Selangor, Melaka, Johor), Borneo, Palawan, New Guinea, Australia (Cape York Peninsula, Queensland); indigenous	NA	Edwards's Bot. Reg. 32: sub t. 68. 1846
Hoya juannguoana Kloppenb.	Palawan; endemic	NA	Fraterna 15(2): 15. 2002
Hoya mcgregorii Schltr.	Philippines (Mindoro, Samar), Palawan; endemic	NA	Philipp. J. Sci. 1(Suppl. 4): 302. 1906
Hoya meliflua (Blanco) Merr.	Philippines (Luzon, Mindoro, Panay, Negros, Leyte), Palawan; endemic	NA	Enum. Philipp. Fl. Pl. iii. 351 (1923)
Hoya monetteae T.Green	Philippines (Tumarbong River delta, Palawan Island); endemic	NA	Fraterna 17(2): 10-15,2004
Hoya multiflora Blume	China (Guangdong (introduced), Guangxi, Yunnan), Java, Borneo, Sumatra, Laos, Myanmar [Burma] (Bago, Mandalay), Philippines (Babuyan, Luzon, Polillo, Mindoro, Masbate, Tablas, Panay, Samar, Dinagat, Siargao, Mindanao), Palawan, Thailand, Vietnam, Java, peninsular Malaysia, India (Nagaland); indigenous	NA	Catalogus 49.1823 Aurigue (2013)

Species	Geographic Distribution	Conservation Status*	References
Hoya palawanica Kloppen b.	Philippines (Polillo, Mindanao), Palawan; endemic	NA	Fraterna 1(3), Philipp. Hoya Sp. Suppl.: V. 1990
Hoya pulgarensis Elmer.	Palawan; endemic	EN	Leafl. Philipp. Bot. x. 3589 (1938), anglice.
Hoya taytayensis Kloppenb . & Siar	Philippines (Taytay, Palawan); endemic	NA	Hoya New 1(2): 28. 2013 [Dec 2013] [epublished]
Hoya wibergiae Kloppenb.	Palawan; endemic	NA	Fraterna 14(1): 5. 2001
Hoya wibergiae Kloppenb. subsp. *alba* Kloppenb.	Philippines (Victoria Mts. Palawan, 600 m); endemic	NA	Hoya New 4(1): 28. 2015 [Jan 2015] [epublished]

*Conservation Status is based from DENR list of threatened species (DAO No. 2007-01, also found in Fernando et al., 2008). EN= Endangered, NA=not assessed

Palawan is protected by a special law enacted in 1992 called the Strategic Environmental Plan (SEP) for Palawan Act, or Republic Act No. 7611 (Büscher and Davidov, 2013). Another law is the National Integrated Protected Areas System or Republic Act No. 7586 on which various areas in Palawan have been covered (Sopsop and Buot, 2009). Needless to say, laws are ineffective if not strictly implemented. Despite of several conservation policies, the threats to Palawan biological diversity are increasing, these include mining, illegal logging, conversion of forestlands to other uses and illegal trade of flora and fauna (Sopsop and Buot, 2009). This type of scenario is not only happening in Palawan protected areas but also in other protected areas in the Philippines such as Mount Banahaw San Cristobal Protected Landscape in Quezon and Mindoro Island wherein illegal harvesting of trees and rampant forest conversion to other land use are still prevalent (Villanueva and Buot 2016; Santiago and Buot, 2015; Villanueva and Buot, 2015; Buot, 2007).

Figure 2. *Hoya* species found in Palawan: a) *Hoya meliflua* (Blanco) Merr., b) *Hoya imperialis* Lindl., c) *Hoya multiflora* Blume, d) *Hoya coriacea* Blume, e) *Hoya imbricata* Decne. and f) *Hoya wibergiae* Kloppenb.

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Hoya being an epiphyte (Rahayu, 2012), depend on the presence of trees as their habitats. Hence, the survival of *Hoya* in the wild is directly affected by the destruction of forest and their habitats (Turner et al., 1994). One case of *Hoya* species being missing in Palawan was cited in an article titled "Where have all the Hoyas gone?" by Ted Green. He had documented the presence of *Hoya imperialis* Lindl. in the Mangrove groves, North of Puerto Princesa near milepost K42 on the year 1999 but when he returned eight years after, the species are could no longer be found. That same species were also reported to be completely loss along the river at Sabang. These are the cases where many *Hoyas* are missing at least at the lower elevations (Kloppenburg, 2007). Swamp filling for housing, typhoons, extended dry seasons, serendipity collecting and slash and burn clearing are the threats that destroy stations of certain species in Palawan (Kloppenburg, 2007).

Hoya imperialis Lindl. is just one species that had been reported to be missing in a particular area. It is notable that this species is indigenous to Palawan (Table 1) but the more pressing concern is the *Hoya* species that are endemic to Palawan only. These include *Hoya diversifolia* Blume subsp. *el-nidicus* (Kloppenb.) Kloppenb., *Hoya golamcoana* Kloppenb., *Hoya juannguoana* Kloppenb., *Hoya pulgarensis* Elmer., and *Hoya wibergiae* Kloppenb. Notably, two (2) of these species (*Hoya diversifolia* Blume subsp. *el-nidicus* (Kloppenb.) Kloppenb. and *Hoya pulgarensis* Elmer.) are now categorized as endangered species (Fernando et al., 2008).

CONCLUSION AND RECOMMENDATIONS

This study provided a list of 17 *Hoya* species reported to occur on Palawan Island. Twenty nine percent (29%) of which are endemic to Palawan. It is notable that majority of the species conservation status is not assessed. As most of the species are restricted to Palawan only, there is a need for assessment to be conducted in order to address the gaps in biodiversity knowledge. In addition, engaging 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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STATEMENT OF AUTHORSHIP

The second author conceptualized the study. The first author did the review, field work and initiated the drafting of the manuscript for publication under the guidance and mentorship of the second author.

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