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First Report of Genus *Plumeria* L. (1753) in Ternate Island as The Flora Ternate Database

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ABSTRACT

The genus *Plumeria* Tourn ex. Linn., family Apocynaceae Juss officially has 20 accepted species from around the world. The genus is native from Mexico to Caribbean; however, it was introduced to some part of world especially to tropical area. In this paper, we formally reported for the first time the data for the genus *Plumeria* in Ternate, North Maluku, Indonesia. The exploration research was conducted from March to June 2022 for around Ternate Island. All species of *Plumeria* spp are noted and collected from 21 villages as representative of five subdistricts in Ternate Island. Three accepted species namely *Plumeria obtusa* L., *P. pudica* Jacq., dan *P. rubra* L are validated in Ternate. All species are discovered as ornamental plant and cemetery marker. *P. obtusa* is the most common species found in many villages followed by *P. rubra*. This publication shares information about location, general utility, and key identification for every species.

Keywords: Apocynaceae, Ornamental, *Plumeria obtusa*, *P. pudica*, *P. rubra*

ABSTRAK

Marga *Plumeria* Tourn ex. Linn., Suku Apocynaceae Juss secara resmi memiliki 20 species yang valid dari seluruh dunia. Genus ini secara alamai tersebar dari Meksiko hingga ke karibian yang selanjutnya diintroduksi ke beberapa wilayah tropis. Penelitian ini secara resmi melaporkan untuk yang pertama kali data dari marga *Plumeria* di Pulau Ternate, Maluku Utara, Indonesia. Riset eksplorasi dilakukan dari Maret hingga Juni tahun 2022 diwilayah Ternate. Semua pseices yang ditemukan didata dan dicatat serta dikoleksi dari 21 kelurahan yang mewakili lima kecamatan di Pulau Ternate. Tiga species yang secara taksonomi diterima yakni *Plumeria obtusa*, *P. pudica* dan *P. rubra* tervalidasi berada di Ternate. Semua species ditemukan sebagai tanaman hias dan penanda pekuburan. *P. obtusa* merupakan jenis yang paling umum ditemukan diikuti oleh *P rubra*, sedangkan *P. pudica* tercatat lebih jarang ditemui. Artikel ini juga melaporkan lokasi rinci, manfaat umum dan kunci determinasid dari masing-masing species *Plumeria* di Ternate.

Kata kunci: Apocynaceae, Tanaman hias, *Plumeria obtusa*, *P. pudica*, *P. rubra*

INTRODUCTION

Apocynaceae is a popular plant family and well known in Indonesia as kamboja. The family consists of 378 genera and more than 5300 species (Middleton & Rodda, 2019). One of the common genera is *Plumeria* Linnaeus (1753). The genus is native to Mexico, North America and Caribbean (POWO, 2023). Apocynaceae is a popular plant family and well known in Indonesia

as *kamboja*. The family consist of 378 genera and more than 5300 species (Middleton & Rodda, 2019). One of the common genera is *Plumeria* Linnaeus (1753). The genus is native to Mexico, North America and Caribbean (POWO, 2023).

Phytochemicals from the *Plumeria* has been reported by numerous scientists. It has ethnomedicine benefits (Dey & Mukherjee, 2015). Essential oil from dry powder of *Plumeria* flower is known as mosquitos' repellent and aromatherapy (Nurcahyo & Purgiyanti, 2017). Extract of *Plumeria* leaf also decrease of mosquito's population by inhibit larval growth of *Aedes aegypti* (Utami & Cahyati 2017). Alkaloid compound, flavonoid, saponin, and tannin from *Plumeria* flower are anti-fungal and it reduce total population of *Candida albicans* on the denture (Wadianur et al., 2018). It also works as antifungal to *Aspergilus clavatus* (Oktaviana et al., 2017). Extract of *Plumeria* leaf inhibit bacterial growth in freshwater fish (Ikrom et al., 2014). Moreover, the extract at 30 ppm resist from *Staphylococus aureus* (Ningsih et al., 2014).

The genus of *Plumeria* was published in the protologue by oleh Linnaeus (1753) with three species namelay *P. alba*, *P. obtusa* and *P. rubra*. All specimens were part of Hortus Clifortianus which cultivated from North America and Caribbean. Last update, the genus is noted with 160 species and 20 of them are valid and recognized species (WFO, 2023 on word). The rest are synonyms and unverified.

Flora of Java, first references for flora in Indonesia, cited that genus *Plumeria* has four species *viz*. *Plumeria acuminata* W.T Ait., *P. alba* L, *P. hypoleuca* Gasp., dan *P. rubra* L. (Backer & Bakhuizen van den Brink, 1965). Later, two of which, *Plumeria accuminata* and *P. hypolecua* are synonym of *P. rubra* dan *P. obtusa* respectively (WFO, 2023). Flora of China, for comparison, noted only two species identified in the country (Ping-tao et al., 1995). Both species i.e., *P. obtusa* & *P. rubra*.

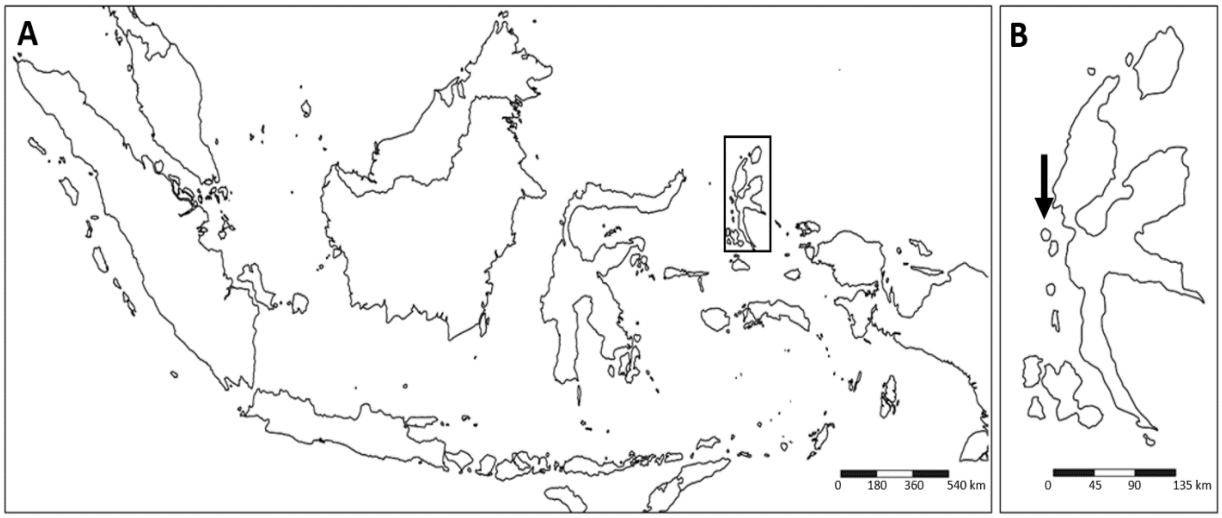
The recent publication, Hariri *et al*. (2019) reported one species as new record in Java namely *Plumeria pudica*. Finally, the total species identified and verified in Java are four namely *P. alba, P. obusa, P. pudica* dan *P. rubra*. In other places in Indonesia, the information of the genus is still lack and still need to improve the as the database and flora information.

The genus *Plumeria* is also discovered outside Java Island, specifically in Ternate Island, however the informatioan never been recorded officially. The data of *Plumeria* in Ternate is important as part of Wallaceae Island. This research intends to report formally all species of *Plumeria* discovered in Ternate and noted some usefulness of the genus.

METHODOLOGY

The research was conducted in Ternate Island (Figure 1), North Maluku province, with an area of 101,7 km^2 and separated into five subdistricts (BPS Kota Ternate, 2022). The data were collected by exploration method in all subdistricts *i.e.* Ternate Barat, Ternate Utara, Ternate Selatan, Ternate Tengah, and Pulau Ternate from March to June 2022. All *Plumeria* from each district are noted specifically from location name, GPS point, plant characteristics and picture to identify. The extinct and rare specimens were preserved and kept in local herbarium. Specimens were identified based on identification keys of genus *Plumeria* following main refences on Flora of Java (Backer & Bakhuizen van den Brink, 1965); Flora Singapore (Middleton & Rodda, 2019); (Woodson, 1938); and Hariri et al (2019). Specimens also consulted with the online database and specimen in WFO (2023) and Tropicos.org. Missouri Botanical Garden (2023).

Specimen were also compared to several herbaria online, such as A and K herbaria. All data explained descriptively for each species and finally identification key for *Plumeria* species in Ternate was created with a very simple character for common people.



(a) (b)

Figure 1. Map of research location, (a) Maluku Utara province, (b) Ternate Island, Map: modification from Shorthouse (2022)

RESULTS AND DISCUSSION

All specimens were recorded and collected. Three species were identified as *Plumera obtusa*, *P. pudica*, and *P. rubra*. These three species were verified with The Plant List and WFO (http://www.worldfloraonline.org) to eliminate all synonym name. *Plumeria* in Ternate were discovered on some similar location.

Plumeria obtusa Linn. Sp. Pl. 210. 1753. The general character is large shrub or small tree to 6 m high. Bark is pale green. Petiole puberulous. Leaves blade are obovate to oblong-obovate about 25 cm long, apex is obtuse and rounded. The leaves color is dark green with a soft shine adaxially, tertiary venation strongly prominent abaxially. Petal of corolla white with dimeter is about 4 cm. Throat yellow; lobes spreading, slightly recurved. Lectotype specimen of *Plumeria obtusa* was designated by Dandy (1958). The species has 32 synonyms (Tropicos.Org, 2023) and natural distribution of the species is from Mexico to Guatemala (POWO, 2023). It is categorized in Least Concern (LC) by IUCN (2023).

Plumeria pudica Jacq., Enum. Syst. Pl. 13. 1760. The general character is shrub or tree with maximum 3,5 m tall. Bark is dark green, with white milk sap. Leaf blade is rhomboid with lobe, apex acute or acuminate. Dark green and glabrous above, green pale beneath with pubescent veins. The petal of corolla flower is white, with bit yellow on the middle, the tube ca. 25 mm long, pubescent within, the lobes broadly ovate, ca. 30 mm long; anthers ca. 2 mm long; stigma somewhat fleshy below and slenderly bicapitate above. Follicles ca. 5-10 cm long. The leaf shaped like violin is unique and this is a special character for the species. Two species were corrected as synonym under *Plumeria pudica* namely *P. caracasana* J.R.Johnst and *P. cochleate* S.F.Blake (Woodson, 1938); WFO, 2023). *P. pudica* distributed naturally from Panama to North Venezuela (POWO, 2023).

Plumeria rubra **L.** Species Plantarum 1: 209. 1753. The character of *P. rubra* in Ternate is tree with maximum 8 m tall. Bark green, smooth, thin. Leaf blade elliptic to oblanceolate, 14–30 × 6–8 cm, both part abaxial and adaxial surfaces are glabrous, apex acute to acuminate; lateral veins 30–40 pairs. Petiole 4–7 cm; Corolla tinged with pink or purple at least outside, 4–6 cm in diam;

lobes pink, yellow, or white, with a yellow base, 3–4.5 × 1.5–2.5 cm, obliquely spreading. Follicles oblong, 11–25 × 2–3 cm.

Table 1. Location for sample collection of *Plumeria* in Ternate Island

No.	Village	GPS point	Species
1	Tafure (TU)	N 00 49′ 48. 374″, E 1270 23′ 9. 838" 1220 SE	*Plumeria rubra*
2	Tubo (TU)	N 00 49′ 26. 376″, E 1270 22′ 36. 865" 1700 S	*P. rubra, P. Obtusa*
3	Akehuda (TU)	N 00 49′ 12. 310″, E 1270 23′ 3. 063″ 1290 SE	*P. rubra*
4	Soa sio (TU)	N 00 47′ 55. 987″, E 1270 23′ 3. 681″ 70 N	*P. obtusa, P. Rubra*
5	Soa (TU)	N 00 47′ 53. 353″, E 1270 22′ 55. 081″ 2820 W	*P. obtusa*
6	Kampung Makassar (TT)	N 00 47′ 49.271″, E 1270 22′ 25.620″ 3370 NW	*P. obtusa, P. Pudica*
7	Salahudin (TT)	N 00 47′ 37.668″, E 1270 22′ 21.810″ 3570 N	*P. obtusa, P. Pudica*
8	Jati Perumnas (TS)	N 00 46′ 26.457″, E 1270 22′ 18.130″ 2500 W	*P. rubra*
9	Kayu merah (TS)	N 00 46′ 12.101″, E 1270 21′ 44.539″ 1490 SE	*P. rubra*
10	Kalumata (TS)	N 00 45′ 38.672″, E 1270 21′ 45.940″ 340 NE	*P. rubra, P. Obtusa*
11	Sasa (TS)	N 00 47′ 35.785″, E 1270 19′ 49.523″ 70 N	*P. obtusa*
12	Tabona (TS)	N 00 46′ 20.673″, E 1270 22′ 4.884″ 2670 W	*P obtusa, P. Rubra*
13	Jambula (PT)	N 00 45′ 21.871″, E 1270 19′ 19.921″ 830 E	*P. rubra*
14	Kastela (PT)	N 00 45′ 39.653″, E 1270 18′ 43.496″ 440 NE	*P. obtusa*
15	Rua (PT)	N 00 46′ 51.844″, E 1270 18′ 0.257″ 3570 N	*P. rubra*
16	Taduma (PT)	N 00 48′ 5.171″, E 1270 17′ 44.185″ 540 NE	*P. obtusa*
17	Togafo (TB)	N 00 48′ 59.859″, E 1270 17′ 42.922″ 3260 NW	*P. rubra*
18	Loto (TB)	N 00 49′ 22.973″, E 1270 17′ 57.607″ 2920 W	*P. rubra*
19	Takome (TB)	N 00 51′ 1.606″, E 1270 ′19' 22.663″ 260 NE	*P. pudica*
20	Sulamadaha (TB)	N 00 51′ 36.420″, E 1270 20′ 11.581″ 3410 N	*P. obtusa*
21	Tobololo (TB)	N 00 51′ 17.665″, E 1270 20′ 57.222″ 1490 SE	*P. rubra*

*Capital letters in parenthesis indicate subdistrict name, TU: North Ternate, TT: Central Ternate, TS: South Ternate, PT: Ternate Island, TB: West Ternate.

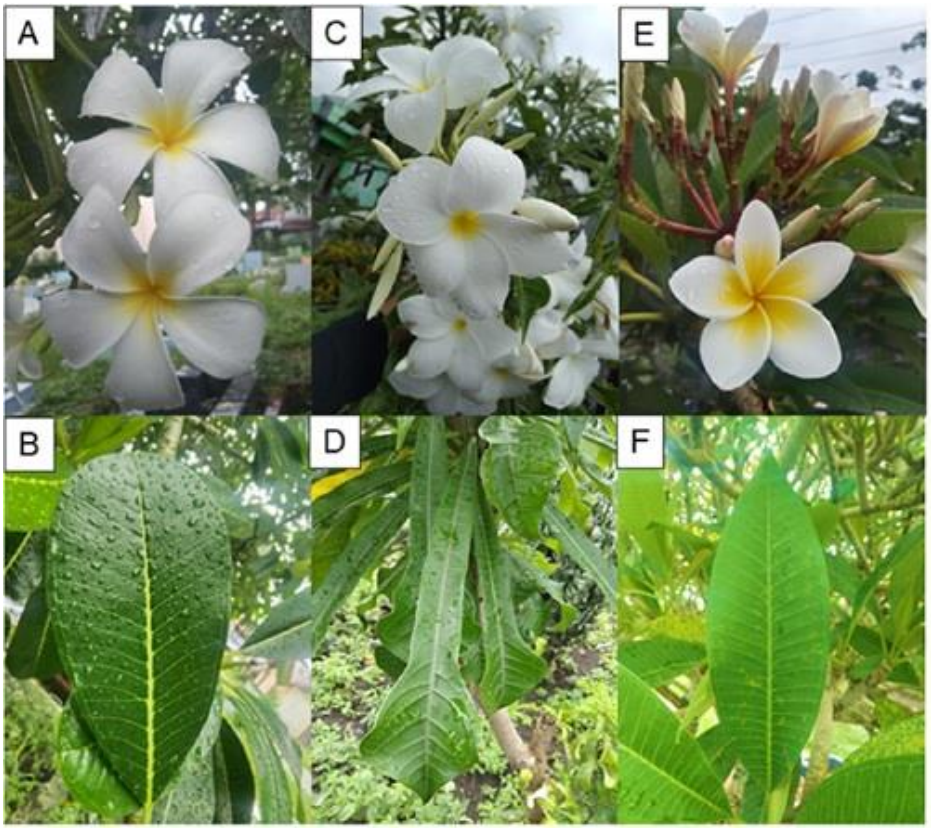


Figure 2. Photo of A-B. *Plumeria obtusa*; C-D. *P. pudica*, E-F. *P. rubra*.

Naturally, distribution of the *Plumeria* spread in Nort America and Caribbean therefore the distribution of genus *Plumeria* in Ternate is unnatural and influenced by human. This genus transported by people to Ternate as ornamental plant. In fact, the first reason for *Plumeria* grows in many countries is that *Plumeria* can propagate easily and reproducible species. Stem cuttings are the most common propagation for *Plumeria* following by seed plant (Perez, 2019). The plant produces fragrant flowers when blooming and with showy corolla. Both propagation factor and unique flower are the smiley explanation why the plant spread easily to many countries. Local cultural also contribute to the existence of the *Plumeria* in many regions in Indonesia (Surata et al., 2015; Sujarwo & Lestari, 2018; Nurchayati et al., 2020).

Interestingly, Ternate natives' plant *Plumeria obtusa* in front of the Moslem cemetery or the edge of the cemetery. The plant also indicates that the field is place for burial ground and barrier of cemetery from another field, consequently many *Plumeria* grow around the grave. Especially the *Plumeria* with white flowers. Several traditional healers in Ternate use white sap of *Plumeria* from petiole for medicine purposes. That is wound healer by dripping sap above the wound. Native housewife also uses white sap for cough suppressant by drinking a glass of mineral water mixed to few drops of sap. All these ethnomedicines treatment are literally supported by many researchers, one of which is Narwariya (2017). Copious paper also cited that *P. obtusa* contain more than 100 types of chemical compounds which isolated by scientists (Bihani et al., 2021). Nevertheless, various usefulness from the *Plumeria* in medicine need to be examined in clinical trials.

Species of *Plumeria* are applied also for ritual in funeral ceremony in another place. A district in Banten, people take some flowers and are sown on small basin with water then splashed on a

grave. Above the tomb is planted a *Plumeria* three by cutting stem as a tomb marker (Nurazizah, 2021). Some parts of the ritual also applied in ternate with different way.

Taxonomically, *Plumeria* is a problematic genus. The first reason is abundant varieties and forma. Copious scientific names in *Plumeria* are invalid and unverified (Perez, 2019). Several scientific names particularly *P. acuminata*, *acutiflia*, and *lutea* used to be used as specific epithet, unfornuatelly all are synonym and now combined as forma name of *Plumeria* rubra. All species of *Plumeria* discovered in Ternate Island also found in Java (Hariri et al., 2019). One species that is recorded in Java but absent in Ternate is *Plumeria alba*.

Our findings also introduce an identification key for three species of *Plumeria* in Ternate. The key designed for common people and student in studying taxonomy accordingly, the sentence is uncomplicated and understandable easily. The main characters for the determination are based on leaf shape. Determination keys to identify species of genus *Plumeria* in Ternate Island.

1. a. Leaf tips obtusus or rounded at apex……. *P. obtusa*
   b. Leaf blade acute or acuminate at apex...…….. 2
2. a. leaf shape arrow like or rhombus……..……..…….. *P. pubdica*
   b. leaf shape ellipse……...…… *P. Rubra.*

CONCLUSION

Three species of *Plumeria* is recorded in Ternate Island. All species namely *Plumeria obtusa, P. pudica* and *P. rubra*. All three species are determined easily based on the shape of the leaf. This study reported for the first time about *Plumeria* in Ternate, North Maluku and added informatif database for flora of Ternate. Generally, people applied the trees of *Plumeria* for medicine and ritual in funeral. The next research of anatomy and phylogenetic for the genus is highly recommended.

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REFERENCES

Acevedo-Rodríguez, P., & Strong, M. T. (2012). Catalogue of Seed Plants of the West Indies. *Smithsonian Contributions to Botany*, (98), 1-1192. https://doi.org/10.5479/si.0081024X.98.1

Backer, C. A., & Bakhuizen Van Den Brink, R. C. (1965). Flora of Java (Spermatophytes only) Vol. 2. Groningen: Wolters-Noordhoff N.V. Groningen.

Bihani, T., Tandel, P., & Wadekar, J. (2021). Plumeria obtusa L.: A Systematic Review of its Traditional Uses, Morphology, Phytochemistry and Pharmacology. *Phytomedicine Plus*, *1*(2), 100052. https://doi.org/10.1016/j.phyplu.2021.100052

BPS Kota Ternate. (2022). *Ternate Municipality in Figures* 2021. Ternate: BPS Kota Ternate.

Dandy, J. E. (1958). *The Sloane Herbarium. An Annotated List of The Horti Sicci Composing It; With Biographical Accounts of The Principal Contributors*. London: British Museum (Nat. Hist).

Dey, A., & Mukherjee, A. (2015). Plumeria Rubra L.(Apocynaceae): Ethnobotany, Phytochemistry and Pharmacology: A Mini Review. *Journal of Plant Sciences*, *10*(2), 54. https://doi.org/10.3923/jps.2015.54.62

Hariri, M. R., Irsyam, A. S. D., & Irwanto, R. R. (2019). Plumeria Pudica Jacq.: Tambahan untuk Marga Plumeria (Apocynaceae) di Jawa. *BIOTIKA Jurnal Ilmiah Biologi*, *17*(2), 1-8. https://doi.org/10.24198/biotika.v17i2.25454

Ikrom, I., TR, D. A., & Wasito, W. (2014). The in Vitro Study: Anti Aeromonas Hydrophila of Ethanol Extract of Kamboja Leaves (Plumeria Alba). *Indonesian Journal of Veterinary Science*, *32*(1), 140074. https://doi.org/10.22146/jsv.5428

IUCN. (2023). *The IUCN Red List of Threatened Species*. Version 2022-2. https://www.iucnredlist.org [January 17, 2023]

Linnaeus, C. (1753). Species Plantarum Species Plantarum, Exhibentes Plantas Rite Cognitas, Ad Genera Relatas, Cum Differentiis Specificis, Nominibus Trivialibus, Synonymis Selectis, Locis Natalibus, Secundum Systema Sexuale Digestas, Tomus I. Holmie, Impensis Laurentii Salvius Stockholm.

Middleton, D. J., & Rodda, M. (2019). Apocynaceae. In: Middelton DJ, Leong-Škorničkoă J & Lindsay S [eds.]. *Flora of Singapore vol. 13: Gentianales*. National Park Board. Singapore.

Narwariya, P. (2017). Comprehensive Overview of *Plumeria Obtusa*. *World Journal of Pharmaceutical Research, 6*(4), 664–676. https://doi.org.10.20959/wjpr20174-8212.

Ningsih, D. R., Zusfahair, Z., & Purwati, P. (2014). Antibacterial Activity Cambodia Leaf Extract (Plumeria Alba L.) to Staphylococcus Aureus and Identification of Bioactive Compound Group of Cambodia Leaf Extract. *Molekul*, *9*(2), 101-109. http://dx.doi.org/10.20884/1.jm.2014.9.2.156

Nurazizah, S., Sugiarto, A. Z., Ramadhani, A. N., Evelyn, C., Amanda, I., Khairiah, A., ... & Des, M. (2021). Etnobotani Pemanfaatan Tanaman pada Ritual Kematian di Dasana Indah RT 05 RW 16 Kelurahan Bojong Nangka, Kecamatan Kelapa Dua, Kabupaten Tangerang. In *Prosiding Seminar Nasional Biologi* (Vol. 1, No. 1, pp. 206-215).

Nurcahyo, H., & Purgiyanti, P. (2017). Pemanfaatan Bunga Kamboja (Plumeria Alba) sebagai Aromaterapi Pengusir Nyamuk. *Parapemikir: Jurnal Ilmiah Farmasi*, *6*(1), 121-123. https://doi.org/10.30591/pjif.v6i1.479

Nurchayati, N. (2020). Pengetahuan Etnobotani Tanaman Ritual Suku Using Banyuwangi dalam Upaya Konservasi Tanaman dan Membangkitkan Kearifan Lokal Masyarakat. *Jurnal Pendidikan Biologi Undiksha*, *7*(2), 105-114.

Oktaviana, B., Rahmawati, R., & Linda, R. (2017). Aktivitas Antifungi Ekstrak Metanol Bunga Kamboja Putih (Plumerica Acuminata) terhadap Apergillus Clavatus. *Jurnal Labora Medika*, *1*(2), 22-29. https://doi.org/10.26714/jlabmed.1.2.2017.22-29.

Perez, B. K. (2019). *Morphological and Molecular Approaches to Disentangling the Taxonomy of Plumeria Species (Apocynaceae)* (Doctoral dissertation, University of Hawai'i at Manoa).

Ping-tao, L., Leeuwenberg, A. J. M., Middleton, D. J. (1995). Apocynaceae In: Wu ZY, Raven PH (Eds) *Flora of China*. Volume 16. Science Press, Beijing & Missouri Botanical Garden Press, St. Louis.

POWO. (2023). *Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew*. Published on the Internet; http://www.plantsoftheworldonline.org/ [February 20, 2023].

Shorthouse DP. (2022). *SimpleMappr, An Online Tool To Produce Publication-Quality Point Maps.* https://www.simplemappr.net. [December 17, 2022]

Sujarwo, W., & Lestari, S. G. (2018). Studi Etnobotani Tumbuhan Obat dan Upacara Adat Hindu di Bali. *Buletin Kebun Raya*, *21*(2), 117-139.

Surata, I. K., Gata, I. W., & Sudiana, I. M. (2015). Studi Etnobotanik Tanaman Upacara Hindu Bali sebagai Upaya Pelestarian Kearifan Lokal. *Jurnal Kajian Bali*, *5*(2), 265-284.

Tropicos.org. (2023). *Tropicos.org. Missouri Botanical Garden.* http://www.tropicos.org/Name/40012241. [January 5, 2023]

Utami, I., & Cahyati, W. H. (2017). Potensi Ekstrak Daun Kamboja (Plumeria Acuminata) sebagai Insektisida terhadap Nyamuk Aedes Aegypti. *HIGEIA (Journal of Public Health Research and Development)*, *1*(1), 22-28.

Wadianur, F., Hidayati, L., & Rahayu, Y. C. (2018). Effectiveness of Cambodia White Flower Extract (Plumeria alba L.) as Denture Cleanser on The Growth of Candida albicans. *Base Material Of Artificial Teeth Nylon Thermoplastic (Valplast). Pustaka Kesehatan*, *6*(1), 161-166, https://doi.org/10.19184/pk.v6i1.7148.

WFO. (2023). *Plumeria* L. http://www.worldfloraonline.org/taxon/wfo-4000030426. [February 17, 2023].

Wijnands DO. (1983). *The Botany of the Commelins* 44. A.A. Balkema, Rotterdam.

Woodson, R. E. (1938). Studies in the Apocynaceae. VII. An evaluation of the genera Plumeria L. and Himatanthus Willd. *Annals of the Missouri Botanical Garden*, *25*(1), 189-224, https://doi.org/10.2307/2394479.