

Chapter

Ethnobotany of Conifers in the Philippines

Richard Clemente

Abstract

Gymnosperms are a few of the groups of plants that are often neglected. Primary and secondary literature have been consulted to establish listings of the recognized gymnosperms in the Philippines. About seven known gymnosperm families and thirteen genera of conifers are found in the Philippines. To wit, two genera from Araucariaceae, one genus from Cycadaceae, one from Gnetaceae, one from Pinaceae, six from Podocarpaceae, one from Phyllocladaceae, and one from Taxaceae. *Agathis dammara* (Lamb.) Poir. And *Agathis philippinensis* Warb. (Araucariaceae), *Pinus kesiya* Royle ex Gordon and *Pinus merkusii* Jungh. & de Vriese (Pinaceae), *Gnetum gnemon* L. and *Gnetum latifolium* Blume. (Gnetaceae), *Dacrycarpus imbricatus* (Blume) de Laub., *Podocarpus macrocarpus* de Laub. and *Sundacarpus amarus* (Blume) C. N. Page (Podocarpaceae) and *Phyllocladus hypophyllus* Hook.f. (Phyllocladaceae) are gymnosperms documented with ethnobotanical knowledge. Other species warrant further research on their economic value and must be explored. The conservation status of these conifers should be known to all.

Keywords: native, endemic, conservation status, gymnosperms, economic value

1. Introduction

It is widely agreed that gymnosperms can resolve many environmental problems, such as pollution, soil erosion, and desertification. In achieving the United Nations Sustainable Development Goals (SDGs), ethnobotanical knowledge can play a vital role in addressing global concerns such as poverty alleviation, food security, food safety and availability, sustainable consumption and production, mitigate climate crisis and its impacts, biodiversity conservation and establishing networks between indigenous peoples. Ethnobotanists have played in unraveling and documenting plant-people interactions and unlocking the knowledge by research. People has been utilizing plants since ancient times, primarily on food and medicinal purposes and yet few are still undocumented. Gymnosperms are among the plant groups often neglected in research in the Philippines. About seven known gymnosperm families and thirteen genera of conifers are found (**Table 1**). Most of its economic value has no information available and can be a big area of interest. This chapter aims to review the ethnobotany of conifers in the Philippines.

Families, Genera		Number of species
Family Araucariaceae	Genus <i>Agathis</i>	2
	Genus <i>Araucaria</i>	2
Family <i>Cycadaceae</i>	Genus <i>Cycas</i>	14
Family Gnetaceae	Genus <i>Gnetum</i>	4
Family Pinaceae	Genus <i>Pinus</i>	2
Family Podocarpaceae	Genus <i>Dacrycarpus</i>	2
	Genus <i>Dacrydium</i>	4
	Genus <i>Falcatifolium</i>	1
	Genus <i>Nageia</i>	1
	Genus <i>Podocarpus</i>	10
	Genus <i>Sundacarpus</i>	1
Family Phyllocladaceae	Genus <i>Phyllocladus</i>	1
Family Taxaceae	Genus <i>Taxus</i>	1
Total		45

¹Includes all the native and cultivated, not naturalized species.

Table 1.
List of species of gymnosperms found in the Philippines.¹

2. Materials and methods

Descriptive method was employed by consulting primary and secondary literature to established listings of the recognized gymnosperms in the Philippines. Online resources, *The Gymnosperm Database* [1] and *Co's Digital Flora of the Philippines* [2], an authority in listing all the vascular plants in the country served as the framework of this paper. Research articles, book chapters, current news and compilations provide additional information.

3. Results

A taxonomic checklist of conifers were presented based on their family names with description, distribution, conservation status and ethnobotanical information.

3.1 Family Araucariaceae Henkel & W. Hochstetter

Family Araucariaceae has two genera, namely, *Agathis* and *Araucaria*.
Genus *Agathis* Salisb.

Agathis is Greek word meaning ‘a ball of thread’, an allusion of its globose female cone. The word ‘kauri’ is of Maori origin, applied by that people to *Agathis australis*, a common species and generalized in term to all species of *Agathis* [3]. Throughout its distribution, *Agathis* is one of the highly sought after sources of straight-grained, easily worked timber [4]. Nowadays, it is relativity scarce but still of premium value, it has been largely logged out. Its current production is usually derived from plantations. Genus *Agathis* has two species, namely *Agathis dammara* and *A. philippinensis*.

Agathis dammara (Lamb.) Rich. & A.Rich. ex A.Rich. a native species is distributed in Palawan and Samar as well as in the Moluccas and Sulawesi. Locally known as *almaciga* or *almasigia*. This plant is possibly also in other parts of Southern Philippines. It is forest emergent and locally common, up to 1200 masl. Its conservation status is currently vulnerable [5]. Leaves are oval and acute, on vigorous shoots need to be narrower (**Figure 1**). It is known as a source of resin [6]. The resin was burned in the Cordillera Region of Northern Luzon that emit smoke that was inhaled to relieve bronchial asthma [7, 8]. The resins are sold in the Internet and known in its trading names of gold or black copal.

Agathis philippinensis Warb. is found in Babuyan Islands, Cebu, some parts of Luzon, and Mindanao, particularly in Bukidnon, Davao del Sur, and occurs mainly in montane forests to 2200 masl. *A. philippinensis* is a native species with a vulnerable conservation status [5]. Locally known as *almaciga*, it can be a source of resin, or Manila copal has been a valuable income source for indigenous peoples [9]. Various products can be made from wood, such as veneer and plywood, pulp and paper, and sources of construction materials [6].

Genus *Araucaria* Juss.

The genus is named after one of the provinces in Chile, Arauco [10].

Many species of *Araucaria* have been important sources of timber due to their massive size. *Araucaria* has two species not native to the Philippines, *Araucaria bidwillii* and *A. heterophylla*, which is more common.

Araucaria bidwillii Hook. is naturally distributed in Australia. Its large seeds are nutritious and was an important food source for aboriginal peoples and remain a popular delicacy.

Araucaria heterophylla (Salisb.) Franco. originated from Norfolk Island, an island territory of Australia cultivated, not naturalized, and not native in the Philippines. *A. heterophylla*, also called Norfolk Island pine, is used as a Christmas tree and whose leaves are used in Advent wreath.



Figure 1.
Leafy shoot of *Agathis dammara* (©MK Torres).

3.2 Family Cycadaceae

Genus *Cycas* L.

The genus name was derived from the Greek *koikas*, which was used by Theophrastus to describe a type of palm. Later, it was transliterated to *kykas* and thence became *Cycas*. *Cycas* is the most primitive cycad genus.

All plant parts are poisonous, but people learned how to avoid this and its seeds are used as a food source. Such use is documented throughout the range of *Cycas* and its relatives in some parts of the world. In the natives of Africa, Australia and other countries, stem starch or *sago* has been used as a food source. Poisons derived from its parts have used to capture fish in Southeast Asia. Leaves are used as a substitute for palm fronds. Most species are popular ornamentals.

In Palawan, various *Cycas* spp. are found, like *Cycas aenigma* K.D.Hill & A. Lindstr., a native, endemic species known only in cultivation in Puerto Princesa. Its conservation status is critically endangered [5].

Another endemic species, *Cycas curranii* (J.Schust.) K.D.Hill. is confined to lowland ultramafic rocks, occurring in the understory of mixed closed forest, common on steep slopes, and occasionally on alluvial outwash from ultramafic hills in Palawan. Native and its current conservation status is critically endangered [5].

A critically endangered [5] known only from St. Paul's mountain massif, in crevices of vertical limestone cliffs with no soil, *Cycas saxatilis* K.D.Hill & A. Lindstr. is a significant outcrop to the Southeast, pendulous on limestone cliff face. In Culion Island,

Cycas wadei Merr. is found growing with seasonally dry *Imperata* grassland periodically subjected to fire. It is endangered [5].

Cycas nitida K.D.Hill & A. Lindstr. is an endangered species in the littoral forests of Rapu-rapu and Polillo Islands of Quezon Province and some parts of Luzon.

Endemic to Zambales, Luzon island is *Cycas zambalensis* Madulid & Agoo which grows in seasonally dry hilly grassland over chromite-rich ultramafics, scattered throughout but critically endangered [5].

Other endemic species, namely *Cycas riuminiana* Porte ex Regel. found in the understory of lowland rain forests, forested areas on ridges and mountains, in closed mixed evergreen forests usually on steep slopes, and disturbed areas, often on limestone, 0–1030 masl.

Cycas vespertilio A.Lindstr. & K.D.Hill grows in hill forests seasonally deciduous forests; both are vulnerable in conservation status and are distributed in some provinces in Luzon and Visayas islands.

In Mindanao, *Cycas flabellata* Agoo, Madulid & J.R. Callado is an endemic species of Bukidnon.

Cycas lacrimans A.Lindstr. & K.D.Hill., is found in forests over ultramafic rocks on serpentine soil in Davao Oriental. It is now endangered [5].

Another native, *Cycas mindanaensis* Agoo, Madulid & J.R. Callado, an endemic also found in Davao Oriental.

A cycad endemic to Mindanao, *Cycas sancti-lasallei* Agoo & Madulid found in Misamis Oriental, Cagayan de Oro, Cugman River Watershed found in disturbed lowland forests is critically endangered [5]. Interestingly, *C. sancti-lasallei* is named by its discoverers after the Saint John Baptist de La Salle.

Cycas edentata de Laub. is distributed in Luzon and Mindanao Islands, Philippines, but is also found in Andaman Islands, Borneo, Java, Lesser Sunda Islands, Malay Peninsula, Sulawesi, Sumatra, Thailand. This vulnerable species [5] thrives in coastal

vegetation and lowland rainforests immediately behind it and rarely ventures far from the coast.

The most common but not naturalized, though cultivated in the country, is *Cycas revoluta* Thunb, used in traditional landscaping and popular during Palm Sunday every Lenten season.

3.3 Family Gnetaceae

Genus Gnetum L.

Gnetum is an insect-pollinated plant. A dioecious, both male and female strobili are aromatic that vary from with species. The strobili opens in the morning, while some species in the evening. The female strobilus produces a droplet of sticky sugary fluid that in time retracts into the strobilus, carrying any captured pollen to the nucellus. This extraordinary mechanism thrives best in high humidity conditions and has been seen as one of the reasons why *Gnetum* is restricted to rainforests.

Recent ethnopharmacological studies have found C-glycosyl-flavones, while a group of complex stilbenes and stilbene-substituted benzofurans are present.

Gnetum arboreum Foxw. is endemic to the Philippines and is distributed in Camarines Sur, Nueva Ecija, Quezon, and Zambales in Luzon.

The most common species is *Gnetum gnemon* L., which is found in Bataan, Batangas, Bulacan, Cagayan, Camarines Norte, Camarines Sur, Isabela, Kalinga, Laguna, Quezon, Rizal, Sorsogon in Luzon Island and Agusan del Norte, Davao, Davao Oriental, Davao del Sur, Lanao, Misamis Occidental, South Cotabato, Surigao, Surigao del Norte, Zamboanga, and Zamboanga Sibugay in Mindanao in the Philippines. Female flowers are shortly tipped as compared to axillary male flowers (**Figure 2**).



Figure 2.
Leafy branch of *Gnetum gnemon* showing female ♀ and male ♂ inflorescence (© MK Torres).

In other countries, its inner bark was used for fiber while some parts are edible, where it is cultivated as a fruit tree.

One variety, *G. gnemon* var. *gnemon*, is found in Fiji and Solomon Islands to Malesia, from Sumba and Sulawesi through the Philippines to New Guinea, the Malay Peninsula, and possibly elsewhere, often planted and frequently naturalized in secondary forests, even in the western part of Malesia.

The specific epithet *gnemon* is from the word *genemo*, the species' vernacular name in the Moluccas [11].

Gnetum gnemonoides Brongn. is a native species distributed in the Bismarck Archipelago, Borneo, Java Sea, Malay Peninsula, Moluccas, New Guinea, and Sulawesi. In the Philippines, it is found in Quezon, Zambales, and Agusan del Norte in Mindanao.

Gnetum latifolium Blume is found in many provinces in north of Luzon, some parts of Visayas, and areas in Mindanao. This native species has four recognized varieties: var. *latifolium*., forma *latifolium*, and var. *longipes* (Markgr.) T. H. Nguyễn, forma *longipes* Markgr., var. *laxifrutescens* (Elmer) Markgr. and var. *minus* (Foxw.) Markgr. It was documented that the bark fiber of *G. latifolium* var. *minus* is used in making ropes and nets [6].

3.4 Family Pinaceae

Genus *Pinus* L.

The generic name *Pinus* was the Roman name for pine. *Pinus* is one of the oldest extant conifer genera and are economically important as timber, pulp, tar, and turpentine. For many years, it is a principal source of timber for many purposes, including firewood, construction, woodworking and others. Leaves in bundles of three needles (rarely two) differs *Pinus kesiya* (Figure 2) from *Pinus merkusii* with leaves in bundles of two needles (Figure 3).

Pinus kesiya Royle ex Gordon is found in Albay, Aurora, Benguet, Ifugao, Ilocos Norte, Mountain Province, Nueva Ecija, Nueva Vizcaya, Pangasinan, Zambales Mindoro and Negros Island. One variety, var. *langbianensis* (A. Chev.) Gaussen ex Bui is distributed in Albay, Benguet, Ifugao, Mountain Province, Nueva Ecija, Nueva Vizcaya, Pangasinan, Zambales that often occurs in pure stands, often on steep slopes, (300-)700–2700 masl. This native is forming a natural hybrid in Zambales. Female cones are dried and used as Christmas accent décor. Timber is used in various materials in construction. Oleoresin is an important component of insect-repellent products [6]. Pine needles were gathered on top of graves by locals of Sagada, Mountain Province remembering the dead during November 1. An annual tradition called *Panag-apoy*, which in *Kankana-ey* (South-Central Cordilleran language) means 'to light a fire'.

Pinus merkusii Jungh. & de Vriese can be seen in the provinces of Bulacan, Rizal, Zambales, and Mindoro. This vulnerable [5] and native pine has one recognized subspecies, ssp. *merkusii* is found in China, Indochina, Myanmar, Sumatra, and Thailand. They thrive in strongly seasonal areas from 100 to 2000 masl. In the Philippines, turpentine was once extracted from this species. However, the extraction rate was lesser than that of *P. kesiya* [12, 13]. It is a source of oleoresin. Wood is used in construction and pulp for paper manufacture [6]. The resin is generally higher in α - than β -pinene, which makes it contribute to production being used primarily for internal consumption for solvents rather than for export to the expanding aroma industry (Figure 4) [9].

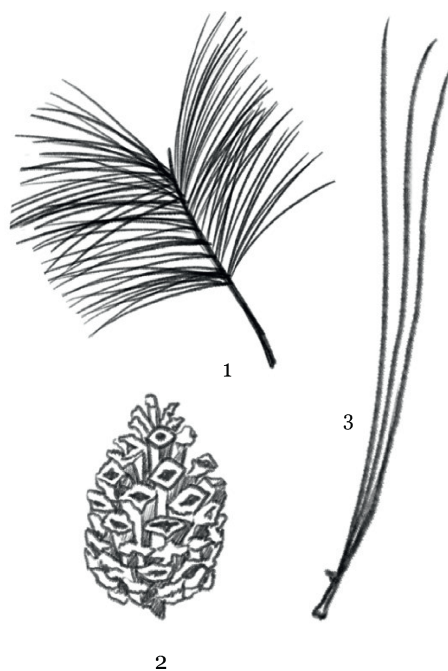


Figure 3.
Pinus kesiya showing (1) sterile twig (2) mature female cone (3) bundle of needle leaves in 3's (© MK Torres).

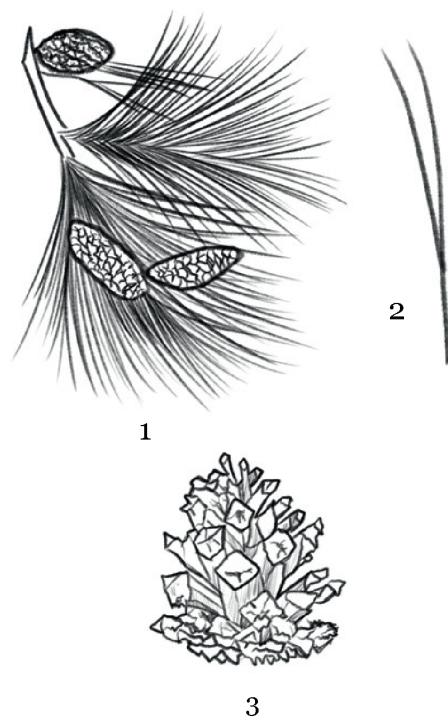


Figure 4.
Pinus merkusii showing (1) twig with young female cones (2) pair of needle leaves (3) mature female cone (© MK Torres).

3.5 Family Podocarpaceae

Genus *Dacrycarpus* (Endl.) de Laub.

The genus name came from the Greek words meaning ‘tears’ and ‘fruit’, describing the shape of its seed cones. *Dacrycarpus* spp. are dioecious shrubs or trees.

Both native species, *Dacrycarpus cumingii* (Parl.) de Laub. and *Dacrycarpus imbricatus* (Blume) de Laub. are found in some provinces in Luzon and Mindanao as well as in neighboring countries of the Philippines. *D. imbricatus* is another threatened species [5]. and has two varieties, namely, var. *imbricatus*. is common in montane cloud forests, 1300–2500 masl, and var. *robustus* de Laub. Wood is used to manufacture many products and can be a potential source of pulp for paper [6].

Genus *Dacrydium* Sol. ex G.Forst.

Dacrydium is derived from the Greek word which means ‘tear’, which refers to resinous exudations from the wood, [14, 15] but seemingly to the weeping habit of the trees [16].

Wood is yellowish to reddish in color, very resinous and known for its durability. It is used for building purposes, furniture making and woodworking [14].

This genus has four species found in certain provinces of Luzon and Mindanao, namely, *Dacrydium beccarii* Parl. in DC. *Dacrydium elatum* (Roxb.) Wall. ex Hook; one identified as other threatened species [5]. *Dacrydium pectinatum* de Laub., and *Dacrydium xanthandrum* Pilg. which is known from one collection from Mindanao also thrives in neighboring country islands of the Philippines.

Genus *Falcatifolium* de Laub.

Species are dioecious shrubs to large trees with thin smooth brownish bark with scattered lenticels, reddish and somewhat fibrous within. They are loosely and irregularly branched trees. No ethnobotanical information was documented.

Falcatifolium gruezoii de Laub. is a native species found in exposed sites along ridges or on borders of open areas, 1600–2200 masl. is distributed in Moluccas and Sulawesi and some parts of Luzon, Panay Island, and Mindanao.

Genus *Nageia* Gaertn.

The genus name is a Latinized form of ナギ (*nagi*). Some species are exploited for its high oil content of their seeds aside from its valuable wood.

One native species is *Nageia wallichiana* (C. Presl) Kuntze found in Borneo, China, India, Indochina, Java, Lesser Sunda Isls, Malay Peninsula, Moluccas, Myanmar, New Guinea, Philippines, Sulawesi, Sumatra and Thailand. In Luzon, they are distributed in the provinces of Apayao, Bataan, Benguet, Cagayan, Laguna, and Nueva Ecija, while in Mindanao in Misamis Occidental and Surigao del Sur. This other threatened species [5] is also found in Mindoro, Panay, Samar, and Sibuyan islands.

Genus *Podocarpus* L'Hér. ex Pers.

Podocarpus is derived from two Greek words *poús*, ‘foot’ and *karpós*, ‘fruit’ referring to its fleshy fruit stems. *Podocarpus* species are evergreen shrubs or trees with very limited distribution, often found at high elevation, and the majority of taxa have no recorded human use. However, human use is usually confined to relatively large individuals that thrives in proximity to populated areas.

Ethnopharmacological uses of leaf and bark extracts that treat a variety of ailments are reported for many species. Wood is strong, straight-grained and can use for construction, boat-building, furniture and household tools.

Endemic to the Philippines are *Podocarpus lophatus* de Laub., a vulnerable species [5] and sometimes shared in cloud forests, 2000–2100 masl.

Podocarpus macrocarpus de Laub. is distributed in Benguet, Ilocos Norte, Mountain Province, Quezon, Zambales, and Davao Oriental. Wood from *P. macrocarpus* can be

used in airplane construction and manufacture of sounding boards, pencil slats and tennis racket handles [6].

Podocarpus palawanensis de Laub. & Silba found only in Palawan is critically endangered [5].

Podocarpus costalis C. Presl. is an endangered species [5] found in coastal bluffs near sea level to at least 300 m in Babuyan Islands, Batanes, Ilocos Norte, Isabela, and Polillo Islands.

Other native species include *Podocarpus glaucus* Foxw., *Podocarpus neriifolius* D. Don in Lamb., *Podocarpus pilgeri* Foxw., *Podocarpus polystachyus* R. Br. ex Endl. and *Podocarpus rumphii* Blume were declared vulnerable [5]. The wood of *P. rumphii* has economic potential for its local community [6].

Podocarpus ramosii R. R. Mill., found in Camarines Sur, Laguna, and Quezon, thrives in stunted mossy forests up to 2200 masl. is endangered [5].

Genus *Sundacarpus* (J.Buchholz & N.E.Gray) C.N.Page.

Sundacarpus amarus (Blume) C. N. Page is a native species in Australia, Borneo, Java, Lesser Sunda Islands, Moluccas, New Guinea, Sulawesi and Sumatra. It is distributed in Benguet, Ifugao, Ilocos Sur, Mountain Province in Luzon, and Davao del Sur in Mindanao. It is locally important for lumber [6].

Leaves are reported as bitter, to which also the Sundanese name ‘*pait*’ refers, bittersweet ‘*dulcamara*’, or sweet tasting. Thus, the specific epithet is from the Latin *amarus*, ‘bitter’, referring to its leaves.

3.6 Family Phyllocladaceae

Genus *Phyllocladus* Rich. ex Mirb.

Phyllocladus is differentiated from podocarps (formerly under one family) with a structure resembling an aril and possessing an epimatium, aside of having a different number of chromosomes and distinct pollination mechanism. It was documented that almost all species have been exploited for their timber although no conservation status is reported.

Phyllocladus hypophyllus Hook. f. is a native species that grows in the mossy forest on the higher mountains, 1200–2400 masl. in Borneo, Moluccas, New Guinea and, Sulawesi. In Luzon, it is distributed in Abra, Benguet, Ifugao, Ilocos Sur, Isabela, Mountain Province, Nueva Vizcaya, Mindoro, Palawan, and Sibuyan Island. In Mindanao, it thrives in Agusan del Norte, Bukidnon, Cotabato, Davao, Davao del Sur, Lanao, Misamis Occidental, and Zamboanga del Sur. Leaves spaced along branches, spiral and simple (Figure 5).

3.7 Family Taxaceae

Genus *Taxus* L.

This genus is named from the Greek *toxus*, reflective of *tóxon*, ‘bow’ and *toxikon*, ‘poison’. As its extract was used as an arrow poison [17].

Commonly known as yew, *Taxus* spp. had many interesting uses in both traditional and modern culture, and its most noteworthy use is being a tree of profound spiritual significance. Nowadays, yew is known for being able to cure cancer [18]. Specifically, *paclitaxel*, a compound found in its vegetative parts, provides a very effective treatment for breast and ovarian cancer, and even reported in treating certain other cancers. Its discovery in the 1990s led quickly to its worldwide overexploitation to extract paclitaxel from its bark and foliage, making a number of species toward endangered status.



Figure 5.
Phyllodes of Phyllocladus hypophallus (© MK Torres).



Figure 6.
Twig of Taxus wallichiana (© MK Torres).

The only *Taxus* sp. found in the Philippines is *Taxus wallichiana* Zucc. It is located in moist subtropical forests, tropical highland ridges, and mossy forests in the canopy and is locally dominant; 1400–2300 masl in Benguet, Laguna, Mountain Province, Quezon, and Davao. Leaves are linear to linear-lanceolate (**Figure 6**). It is vulnerable (described as *Taxus sumatrana* (Miq.) de Laub. [5]).

4. Discussion

Unlike many other countries, Philippines is an archipelago with “tropical rainforest climate” rich with gymnosperm biodiversity. **Figure 7** shows the distribution

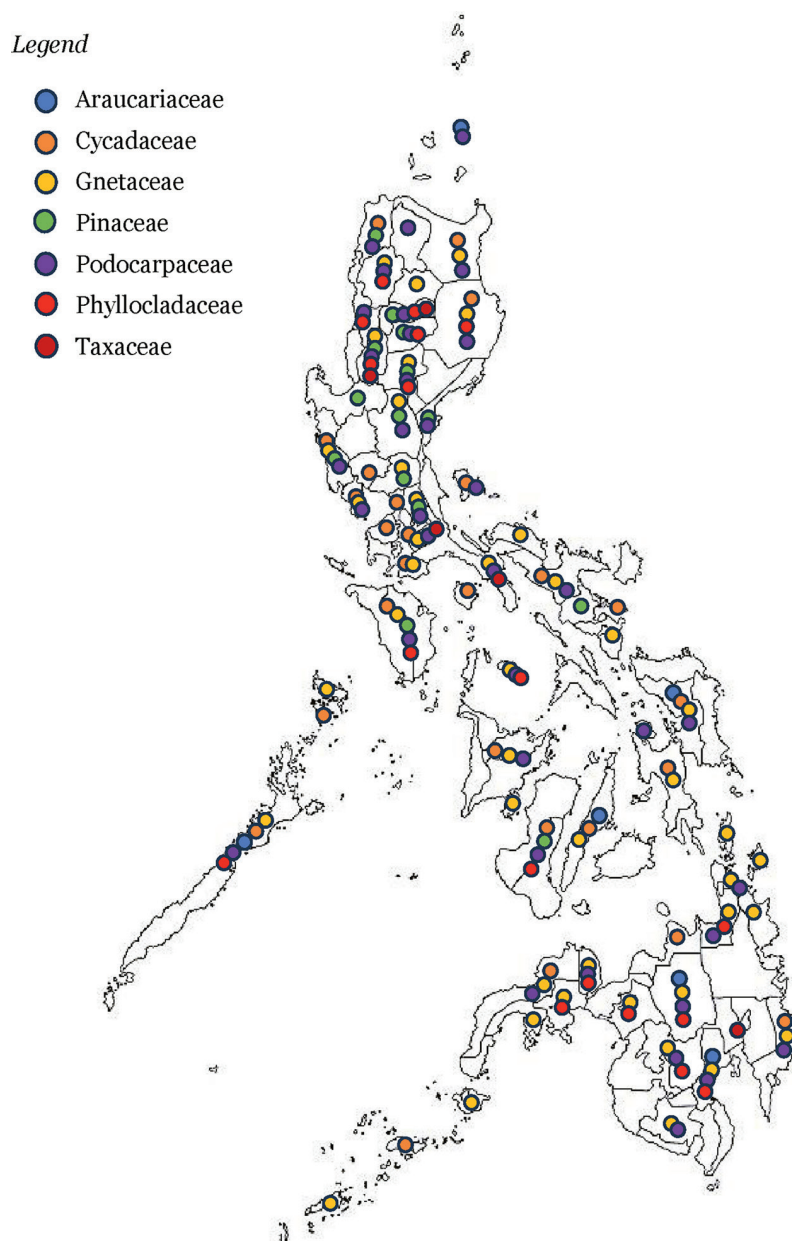


Figure 7.
 Distribution map of gymnosperms in the Philippines.

of gymnosperms in the country. It is noticeable that some provinces showed the absence or few species from the different families. It was known that many species are rare and remote. *Agathis dammara* is considered the most widespread found in major islands of the Philippines. *Pinus kesiya* and *Pinus merkusii* have been observed inhabit forests areas of considerable extent. *P. kesiya* occurs primarily in the Cordillera Mountain range in Northern Luzon while *P. merkusii* is found mainly in Zambales, Luzon and Mindoro Island. Cycads occur across the country and thrive relatively at

low elevations, relatively sparse in comparison to Indochina and northern Australia, both of which show extensive radiations [19]. *Gnetum* species are found in tropical forests. The Philippines is considered as one of the centers of diversity for the Podocarpaceae along with nearby geographical regions [20]. Geographical distribution of taxonomic groups remains poorly documented. On a global scale, only broad conclusions about the patterns of gymnosperm diversity and its vulnerability can be formulated [21].

Among the presented species, only few conifers have economic use. In the presented data, *A. dammara*, *Agathis philippinensis*, *Gnetum gnemon*, *P. kesiya*, *P. merkusii* and *Dacrycarpus imbricatus* exhibit the outstanding economic potentialities. The rest of the gymnosperms have no information available.

5. Conclusion

The ethnobotany of conifers in the Philippines showed few or little information. The Philippines is evidenced with diverse gymnosperms. However, it is necessary to harness the economic potential of conifers widely distributed in the country. Research in the field of ethnobotany particularly in this group of plants still needs to be filled. Immediate analysis of its distribution and biodiversity conservation of these group of plants should be established.

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