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Geospatial Distribution of Osmoxylon Miq. (Araliaceae) in the Philippines with Taxonomic Trait Updates of Species from Northern Mindanao

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Abstract

The Philippines hosts the greatest diversity of *Osmoxylon* species globally, yet the genus remains taxonomically understudied and lacks a modern comprehensive assessment. This study provides an integrated baseline on the geospatial distribution of *Osmoxylon* across the Philippine archipelago and presents updated taxonomic insights for species documented in Northeastern Mindanao. Occurrence records from published literature and reputable online repositories (GBIF, CDFP), combined with targeted field surveys in the Caraga Region, were used to map species distributions and evaluate key morphological traits. Eighteen species were recorded nationwide, exhibiting broad but uneven distribution patterns, with three taxa restricted to highly localized areas. Most species occurred in Type II climatic zones characterized by high year-round rainfall, indicating strong ecological affinity for moisture-rich environments. Ten species were documented through field surveys, including seven endemics and three native taxa, reaffirming Northeastern Mindanao as a significant biodiversity hotspot. Preliminary conservation assessments identified two species as Endangered, one as Near Threatened, and two as Least Concern, while the remainder lack formal evaluation. Mining and other anthropogenic pressures were identified as major threats, particularly for species confined to ultramafic and limestone habitats. The study highlights the need for intensified botanical exploration and recommends a nationwide, integrative taxonomic revision to refine species boundaries and support long-term conservation planning.

Introduction

Osmoxylon Miquel (1863) is a genus of flowering plants in the Araliaceae comprising 61 recognized species of trees and shrubs distributed across southern Asia and the western Pacific, particularly in East Malesia, the Philippines, and Melanesia [11, 16]. The Philippines, a megabiodiverse archipelago, hosts the highest global diversity of the genus, with 18 documented species, 13 of which are endemic [11, 29].

Several *Osmoxylon* species have ecological, cultural, and economic significance across their range. Species such as *O. palmatum*, *O. eminens*, and *O. micranthum* are used as vegetables or traditional medicines in Southeast Asia and Papua New Guinea [20, 25, 35]. In the Philippines, indigenous communities utilize *Osmoxylon* for various ailments, including dysmenorrhea, cutaneous eruptions, and cough [13, 27, 32]. Several species, notably *O. lineare*, are also cultivated ornamentally and serve as food sources for insects and birds [1, 33]. These diverse uses highlight the ecological and socio-economic value of the genus.

Despite this importance, *Osmoxylon* remains one of the least understood groups in the Araliaceae. Knowledge gaps persist across its taxonomy, ecology, distribution, and conservation status [11, 15]. The genus has not undergone a modern, comprehensive taxonomic revision. Instead, existing knowledge is scattered among regional floristic accounts, many of which lack diagnostic detail and rely on outdated keys. In the Philippines, only a limited number of botanical inventories and ethnobotanical surveys have documented *Osmoxylon* species (e.g., [3–5, 9, 10, 22, 24]), and most studies mention the genus only

incidentally. These reports are geographically skewed, with research concentrated in Mindanao and the Visayas, while Luzon remains underexplored.

Insufficient and uneven distribution data constrain conservation planning for many Philippine plant taxa, including genus *Osmoxylon*. Reliable spatial information is fundamental for understanding species richness, ecological patterns, and habitat specialization [28]. This aspect is critical for estimating Extent of Occurrence (EOO) and Area of Occupancy (AOO) in IUCN Red List assessments (IUCN, 2012) [19]. Mapping species distributions also establishes baselines for predicting climate-driven range shifts [23] and for guiding reforestation and restoration initiatives. These needs are particularly urgent in the Caraga Region (Northeastern Mindanao), where forest ecosystems are threatened by extensive mining, land-use conversion, and infrastructure development [2].

Given the high endemism of *Osmoxylon*, the taxonomic uncertainties surrounding the group, and the accelerating threats to its habitats, a comprehensive assessment of the genus across the Philippines is overdue. This study addresses these gaps by examining the geospatial distribution of Philippine *Osmoxylon* species, characterizing their climatic associations, and providing updated morphological information from field surveys in Northeastern Mindanao. These outputs aim to support improved taxonomic resolution, inform conservation status assessments, and strengthen species-level management and protection efforts.

Materials and methods

Data Gathering

A comprehensive list of *Osmoxylon* species and their geographic distribution records was compiled from accessible online platforms and relevant published literature. Occurrence data were sourced primarily from the Global Biodiversity Information Facility (GBIF), which provides georeferenced records supported by photographic vouchers. Additional records were obtained from Co's Digital Flora of the Philippines (CDFP), a national botanical database containing provincial distribution information for Philippine vascular plants. Unlike GBIF, CDFP does not provide spatially explicit maps. However, its locality annotations were used to supplement geographic coverage. Open-access floristic assessments documenting *Osmoxylon* species were likewise reviewed to capture additional locality records. All compiled distribution data were combined with field survey results from Northeastern Mindanao to develop the most complete distribution dataset possible for the genus in the Philippines.

Species Distribution Mapping

Geospatial analyses were conducted using Quantum Geographic Information System (QGIS v.3.34.3). Field-collected GPS coordinates obtained, along with georeferenced occurrence data from GBIF, CDFP, and published literature, were assembled into a unified spatial dataset. These coordinates represent

verified *Osmoxylon* occurrences across Northeastern Mindanao and other parts of the Philippine archipelago.

Provincial boundary layers and administrative shapefiles were downloaded from DIVA-GIS. All occurrence points were saved in CSV format and integrated with the boundary layers through the attribute table in QGIS. Using these inputs, species-level and genus-level distribution maps were generated, illustrating the spatial extent and provincial richness of *Osmoxylon* throughout the country. The complete mapping workflow summarized in Fig. 1 is adapted from works of Daipan et al. [12] and Ruales and Jumawan [34].

Climatic Distribution Analysis

To assess the climatic associations of *Osmoxylon* species, occurrence data were intersected with national climatic zone layers based on the Modified Coronas' Climatic Classification. Four climate types were considered:

Type I: Two pronounced seasons, dry (Nov–Apr) and wet (Jun–Sept)

Type II: No dry season; peak rainfall from Dec–Feb

Type III: No pronounced wet season; short dry period (1–3 months)

Type IV: Rainfall evenly distributed throughout the year

The *Osmoxylon* species distribution layer was intersected with these climatic zones using the vector geoprocessing tools in QGIS. This analysis identified the climatic types in which each species naturally occurs, providing insights relevant to habitat suitability, reforestation planning, and long-term species persistence under changing environmental conditions.

Field Survey and Species Treatment

Field surveys were conducted from June to November 2024 across 16 sites in the Caraga Region (Northeastern Mindanao), specifically in the provinces of Agusan del Norte, Agusan del Sur, Surigao del Norte, Surigao del Sur, and the Dinagat Islands. Site selection was based on confirmed or potential *Osmoxylon* occurrences and included both limestone-rich and ultramafic substrates. All necessary permits including Prior Informed Consent (PIC), municipal endorsements, and a DENR Wildlife Gratuitous Permit (R.A. 9147) were secured prior to field activities. Specimens were collected through purposive and opportunistic sampling, with each record documented through GPS geotagging and in situ photography.

Morphological characterization focused on vegetative and reproductive structures following the taxonomic frameworks of Philipson [30, 31] and Costion & Plunkett [11]. Quantitative measurements

(e.g., leaf, flower, and fruit dimensions) were obtained using digital calipers, rulers, and a dissecting microscope (OEM KOPPACE Model KP 704TH-B3). Terminology for morphological traits followed Beentje [7, 8] and Ellis et al. [14].

Species identification was validated using diagnostic keys and reference materials, including GBIF, CDFP, Flora Malesiana, Plants of the World Online (POWO), and JSTOR Global Plants. Conservation and endemism assessments were performed using the IUCN Red List (2024) [18], DENR Administrative Order 2017-11, Co's Digital Flora, and GeoCAT, with provisional categories assigned based on Extent of Occurrence (EOO) and Area of Occupancy (AOO) values. The study also documented additional diagnostic and morphological features for several species, contributing updated taxonomic information not previously reported in earlier literature.

Results and discussions

Distribution of Osmoxylon Species at the Provincial Scale

The distribution maps generated from CDFP and GBIF records, published literature, and field surveys in Northeastern Mindanao provide a comprehensive overview of *Osmoxylon* occurrences across the Philippines. As shown in Table 1, two species namely, *O. eminens* and *O. luzoniense* exhibit the broadest ranges, occurring across Luzon, Visayas, and Mindanao, with *O. eminens* recorded in 28 provinces and *O. luzoniense* in 21. In contrast, several endemics such as *O. catanduanense* and *O. dinagatense* show highly restricted distributions, reflecting narrow-range endemism and greater vulnerability. Provincial richness was highest in the Dinagat Islands and Surigao del Norte, each with seven species, followed by Agusan del Norte with six, while many other provinces hosted only one or two species.

These patterns provide essential baselines for Red List assessments by enabling estimation of EOO and AOO consistent with IUCN (2024) criteria. The strong island-specific distribution of species aligns with established biogeographic principles in island ecosystems, which are known hotspots for endemism and range-restricted taxa [31, 37]. As such, natural occurrences outside documented island ranges are unlikely, emphasizing the reliability of the mapped boundaries. Molecular analyses remain necessary to clarify species-level uncertainties, particularly for taxa with overlapping morphological traits.

The observed distribution trends also mirror the geographic focus of available research. Most literature-derived records come from Mindanao and the Visayas, where forest access and research activity are comparatively higher, while Luzon especially the northern and central regions remain under-surveyed [26]. Conservation concerns are evident for endemics restricted to threatened landscapes, such as *O. dinagatense* in the mining-impacted ultramafic habitats of the Dinagat Islands [24]. This study also documented new provincial records for *O. camiguinense*, *O. pectinatum*, and *O. trilobatum* (Table 1) suggesting previously overlooked populations and highlighting the need for continued field surveys in understudied areas such as Surigao del Norte.

Table 1
The Provincial distribution of Osmoxylon species in the Philippines.

No.	Species	Provincial Distribution
1	*Osmoxylon camiguinense*	Cagayan, Camiguin, Surigao del Norte
2	*Osmoxylon catanduanense*	Catanduanes
3	*Osmoxylon caudatum*	Ilocos Norte, Sorsogon
4	*Osmoxylon dinagatense*	Dinagat Island
5	*Osmoxylon eminens*	Aurora, Cagayan, Camarines Norte, Capiz, Cebu, Davao del Sur, Davao Oriental, Dinagat Island, Iloilo, Isabela, Laguna, Lanao del Norte, Leyte, Marinduque, Occidental Mindoro, Oriental Mindoro, Negros Occidental, Negros Oriental, Quezon, Rizal, Romblon, Samar, Sibuyan Island, Siquijor, Sorsogon, Sulu, Tawi-tawi, Zamboanga del Sur
6	*Osmoxylon fenicis*	Apayao, Aurora, Cagayan, Calabarzon, Isabela, Laguna, Quezon, Rizal
7	*Osmoxylon heterophyllum*	Agusan del Norte, Agusan del Sur, Surigao del Sur, Davao Oriental, Dinagat Island, Leyte, Samar
8	*Osmoxylon humile*	Agusan del Norte, Davao del Sur
9	*Osmoxylon lineare*	Agusan del Norte, Antique, Dinagat Island, Ilocos, Negros Oriental, Surigao del Norte
10	*Osmoxylon luzoniense*	Agusan del Norte, Benguet, Bukidnon, Calabarzon, Camarines Sur, Cebu, Cotabato, Davao Oriental, Davao del Sur, Ifugao, Ilocos Norte, Lanao del Norte, Lanao del Sur, Leyte, Negros Oriental, Quezon, Rizal, Sorsogon, Sulu, Surigao del Norte, Zamboanga del Sur
11	*Osmoxylon oblongifolium*	Dinagat Island, Samar, Surigao del Norte
12	*Osmoxylon pectinatum*	Batanes, Surigao del Norte
13	*Osmoxylon pulcherrimum*	Abra, Antique, Aurora, Cagayan, Camarines Sur, Capiz, Cebu, Marinduque, Nueva Vizcaya, Oriental Mindoro, Negros Occidental, Quezon, Rizal, Romblon, Sulu
14	*Osmoxylon ramosii*	Albay, Camarines Sur, Lanao del Sur, Quezon, Sorsogon, Surigao del Norte
15	*Osmoxylon serratifolium*	Agusan del Norte, Camarines Sur, Camiguin, Capiz, Cebu, Leyte
16	*Osmoxylon simplicifolium*	Agusan del Norte, Aurora, Bukidnon, Davao Oriental, Dinagat Island, Samar, Surigao del Norte,

No.	Species	Provincial Distribution
17	*Osmoxylon trilobatum*	Abra, Aurora, Benguet, Cagayan Valley, Camiguin, Catanduanes, Laguna, Lanao del Sur, Leyte, Occidental Mindoro, Oriental Mindoro, Quezon, Samar, Surigao del Norte
18	*Osmoxylon yatesii*	Aklan, Bicol, Camarines Sur, Cebu, Dinagat Island, Samar

Climatic Types of Osmoxylon Species in the Philippines

The climatic distribution of *Osmoxylon* species across the Philippines, shown in Fig. 2, reflects the genus' strong association with humid environments. Using the Modified Coronas' Climatic Classification, the country is divided into four climate types (Types I–IV), distinguished primarily by rainfall seasonality. Most *Osmoxylon* species occur in Type II zones—characterized by the absence of a dry season and peak rainfall from December to February—followed by Type IV areas with evenly distributed rainfall. Specifically, 17 species were recorded in Type II, 10 in Type IV, 9 in Type III, and only 6 species in the more seasonally dry Type I zones. This pattern suggests that *Osmoxylon* species are best adapted to consistently moist climates and may be sensitive to prolonged dry periods.

Several endemics, including *O. catanduanense*, *O. dinagatense*, and *O. pectinatum*, were found exclusively in Type II climates, indicating narrow climatic tolerance and highlighting the need for targeted conservation measures. For example, *O. dinagatense*, restricted to the ultramafic landscapes of the Dinagat Islands, faces serious threats from mining activities [24], which may alter both habitat structure and local microclimatic conditions essential for species persistence. Conversely, species occurring in Type I zones may experience higher vulnerability to drought and water stress due to the extended dry season characteristic of this climate type.

Overall, the climatic patterns observed in this study underscore the importance of moisture availability in shaping *Osmoxylon* distribution across the archipelago and provide a valuable baseline for assessing climate-related risks, especially under projected environmental changes.

Conservation Status of Osmoxylon Species in the Philippines

The Philippines hosts a notable diversity of *Osmoxylon*, consisting of 18 species of which 13 endemic and 5 native (Annex 1). Endemic taxa include *O. camiguinense*, *O. catanduanense*, *O. caudatum*, *O. dinagatense*, *O. fenicis*, *O. heterophyllum*, *O. humile*, *O. oblongifolium*, *O. ramosii*, *O. simplicifolium*, *O. trilobatum*, and *O. yatesii*, while native species include *O. eminens*, *O. lineare*, *O. luzoniense*, *O. pectinatum*, and *O. pulcherrimum*. This high proportion of endemism highlights the ecological importance of the genus within the country's forest ecosystems.

Based on the IUCN Red List (2024), several species face varying levels of conservation concern. Three species—*O. heterophyllum*, *O. ramosii*, and *O. serratifolium*—are listed as Endangered (EN), while *O. fenicis* is classified as Vulnerable (VU). *O. eminens*, *O. pulcherrimum*, and *O. trilobatum* are considered Near Threatened (NT), and *O. luzoniense* and *O. pectinatum* are categorized as Least Concern (LC). All

remaining species are Not Evaluated (NE) and are additionally included under the “Other Wildlife Species” category of DENR Administrative Order 2017-11. Provisional assessments using GeoCAT further identified *O. dinagatense* as Endangered (EOO: 122.41 km²) and *O. oblongifolium* and *O. pectinatum* as Vulnerable.

These findings align with earlier studies emphasizing that limestone and ultramafic forests serve as refugia for narrow-range and poorly known taxa [17, 24] and corroborate observations that Mindanao’s montane forests harbor underexplored and potentially undescribed species [6, 36]. Overall, the conservation patterns observed highlight the urgent need for sustained field surveys, updated taxonomic assessments, and habitat protection to safeguard these range-restricted species.

Current inventory of Osmoxylon Species focusing in Northeastern Mindanao

Building on the nationwide patterns of distribution, endemism, and climatic associations of *Osmoxylon* across the Philippine archipelago, a more focused assessment was conducted in Northeastern Mindanao, being one of the country’s most botanically significant yet and insufficiently explored regions. The Caraga Region, encompassing Agusan del Norte, Agusan del Sur, Surigao del Norte, Surigao del Sur, and the Dinagat Islands, emerged from the

national analysis as a major spot of *Osmoxylon* diversity, particularly within its extensive limestone and ultramafic landscapes known to harbor narrow-range and highly specialized taxa. To verify species occurrences, refine taxonomic boundaries, and document intraspecific variation, targeted field surveys and morphological evaluations were undertaken across selected sites.

Figure 3 illustrates the distribution of ten *Osmoxylon* species documented across Northeastern Mindanao, with the Dinagat Islands and Surigao del Norte emerging as the primary centers of diversity. Eight species namely, *O. camiguinense*, *O. dinagatense*, *O. heterophyllum*, *O. oblongifolium*, *O. simplicifolium*, *O. trilobatum*, and *O. yatesii* are Philippine endemics occurring largely within these northern provinces, while *O. luzoniense* and *O. pectinatum* represent native but non-endemic taxa with broader regional ranges. Most species were recorded in limestone-rich and ultramafic substrates, habitats known to support highly specialized and range-restricted plant assemblages, which likely contribute to the observed patterns of localized endemism. Overall, the figure highlights Northeastern Mindanao as a key biogeographic and conservation interest for *Osmoxylon*, with the importance of these specialized habitats in influencing species distributions.

Taxonomic Trait Updates on Osmoxylon Species in Northeastern Mindanao

The combined field observations, and morphometric analyses conducted in this study provided an opportunity to reassess the diagnostic features of *Osmoxylon* species occurring in Northeastern Mindanao. Detailed examinations of vegetative and reproductive traits particularly inflorescence structure, leaf morphology, and fruit characteristics revealed both congruences and noteworthy

variations relative to previously published species descriptions. These observations are crucial given the genus' taxonomic complexity, the limited availability of updated diagnostic keys, and the high incidence of narrow-range endemism within the region. Through comparison with type descriptions, historical floristic treatments, and authoritative references, the study refined species delimitations and clarified morphological distinctions among closely related taxa. Below are the *Osmoxylon* species documented in Northeastern Mindanao, along with their corresponding taxonomic updates based on detailed morphological assessment and comparison with existing species descriptions.

1. Osmoxylon camiguinense (Merr.) Philipson, Flora Malesiana 9(1): 48 (1979). (Fig. 4A)

Type: Philippines. Camiguin Island, Jul. 1907, *E. Fenix 4135*.

Synonyms: *Osmoxylon camiguinense* (Merr.) Philipson, Blumea 23 (1976) 113. *Boerlagiodendron camiguinense* Merr. Philip. J. Sc. 3 (1908) Bot. 252; En. Philip. 3 (1923) 222.

Description

Shrub, *c*. 3 m tall, glabrous. *Leaves* alternate, spirally arranged, dextrorse, crowded near terminal; petiole 16–21 cm long, green to deep purple, the base with a stipular ligule, 1.5–1.8 cm long, with 3 ring-like crests, recurved and extending around the back of the petiole base, minute to obscurely fimbriate; blade palmately lobed with 3–5 lobes, oblong, narrowed towards base, subcoriaceous, glabrous, 15–19 cm long and 14–21 cm, sinuses narrow-rounded, upper-most leaves often reduced and simple; base truncate to rounded; apex acuminate to apiculate; margin serrate to dentate; surface slightly rugose, adaxial deep green, abaxial pale green, glabrous both sides. *Inflorescence* terminal compound umbel, 8–12 cm in diameter; peduncle short (*c*. 1 cm long) bearing green elongated triangular bracts (*c*. 1.2 cm long) attached on the bottom of each primary rays; *primary rays*, *c*. 14–16 rays, 2.0–2.3 cm long, purple-maroon, tomentose and scabrous, bearing opposite elongated triangular bracts (*c*. 5–6 mm long) at the apex, each ending in three branches; *central branch* 5–6 mm long, bearing tiny triangular bracts attached to each sterile flowers, pedicelled 3–4 mm long and 3–4mm wide, purplish-black); *two lateral branches* 2 cm long with a pair of tiny bracts (3–4 mm long) on each of the internodes, ending in 26–34 pedicelled flower buds subtended by tiny bracts (1 mm long). *Flowers* epigynous, tubular, pedicelled, orange- yellow; *calyx* rim minute to obsolete; *style* with stigmas reduced or sessile, located on the center of the floral disk; *corolla* tubular bottom part and lobed (4) upper part, yellow-orange, 4–5 mm long, 2.5–3.0 mm in diameter; *stamens* 4, exserted, orange-yellow, 4 mm long; *filament* 4, yellow, 4 mm long; *anther* 1 mm long, dorsifixed. *Infructescence* not observed.

Specimen examined

JCB 002 and 003.

2. Osmoxylon dinagatense (Merr.) Philipson, Flora Malesiana 9(1): 31–53 (1979). (Fig. 4B)

Type: Philippines, Dinagat Island, May 1919, *M. Ramos and J. Pascasio 35220*.

Synonyms: *Osmoxylon dinagatense* (Merr.) Philipson, Blumea 23 (1976) 103. — *Boerlagiodendron dinagatense* Merr. Philip. J. Sc. 17 (1920) 301; Merr. En. Philip. 3 (1923) 222. *Boerlagiodendron dinagatense* Merr., Philipp. Journ. Sci. 17 (1920) Bot. 301; Merr. En. Philip. 3 (1923) 222.

Description

Glabrous shrub to small trees, *c*. 2–5 m tall, with spreading branches. *Leaves* simple, glabrous, alternate, spirally arranged, dextrorse, crowded near terminal; *petiole* marginal, semi-terete, and measured 1.0–2.5 cm long; channeled above, with a small triangular base that bears a short stipular ligule (8–10 mm long) appressed to stem and extending on the sides of the petiole base is a single crest, narrow collar-like structures; *blade* oblanceolate to oblong-elliptic, up to 14.5–21.0 x 6.0–9.5 cm, coriaceous, with a base narrowed into the petiole or slightly rounded; *apex* acute with a very short apiculum; *margin* entire and serrate near apex and little revolute; *surface* adaxial matte deep green, abaxial shinny pale green, glabrous both sides. *Inflorescence* a terminal compound umbel, erect, 11–14 cm Ø in diameter; *peduncle* short *c*. 1 cm; primary rays 17, green, with fine minute trichomes, and each ray has 1 small triangular bracts (3–4 mm long) attached on the bottom of each primary rays; *primary rays*, 2 cm long, slightly flattened, with tiny ciliate, bearing opposite triangular bracts (2 mm long) at the apex, each bearing three branches; *central branch c*. 5–7 mm long, bearing the sterile, bacciform flowers with purplish- black *c*. 3–5 mm pedicels, each bearing bracts *c*. 1 mm long, which eventually developed into sphere-like purplish-black fleshy “pseudo-fruits” with wrinkled surface 4–6 mm long and 4–5 mm diameter; *two lateral* branches 3 cm long with two opposite small bracts (2 mm long) ending in an involucre of minute triangular bracts around a terminal umbellule of *c*. 9–11 fertile flowers with pedicels of 1–2 mm long. *Flowers* epigynous, tubular, yellow; *corolla* tubular red to maroon outside and yellow inside, 3–4 lobes in upper part, 3 mm long, 2.0–2.5 mm in wide; *calyx*, minute rim to obsolete; *style* with stigmas reduced or sessile, located on the center of the floral disk; *stamen* 4, yellow, 5 mm long, exserted; *filament*, yellow, 4 mm long; *anther*, yellow, dorsifixed, 1 mm long. *Ovary* inferior, fused to the floral receptacle. *Infructescence* ovoid to globose with slightly flat sides, 5–7 mm long, 5–6 mm wide, pedicels (4–6 mm long), pale green in color, eventually turn into purplish-black when ripe, with 3–4 seeds.

Specimen examined

JCB 014—018.

3. Osmoxylon heterophyllum (Merr.) Philipson, Flora Malesiana 9(1): 38 (1979). (Fig. 4C)

Type: Philippines. Mindanao. Agusan del Norte, Mt. Hilong-Hilong, Butuan, Mar. 29, 1911, *Weber 1126*.

Synonyms: *Osmoxylon heterophyllum* (Merr.) Philipson, Blumea 23 (1976) 106; Fl. Males. ser. 1, 9 (1979) 38; — *Boerlagiodendron heterophyllum* Merr. Philip. J. Sc. 9 (1914) Bot. 329; En. Philip. 3 (1923) 223.

Description

Shrub, erect, *c*. 3 m tall, glabrous. *Leaves* alternate, spirally arranged, dextrose, clustered near terminal; *petiole* green, 17–27 cm long, *petiole base* with a stipular ligule, 1–2 cm long, with 3–4 ring-like crests, recurved, extending around or lower part of petiole base, minute to obscurely fimbriate; digitately compound with 7 leaflets and unequal in size with young simple leaf grow under inflorescence, *blade* oblong-elliptic to lanceolate, lyrately lobed; mid-leaflet 18–27 x 6.0–11.5 cm wide, total leaf width of 26–40 cm; petiolule up to 5.5 cm, the base gradually tapered to the petiole, *apex* apiculate to acute, *margin* irregular dentate to serrate; surface rugose, adaxial deep green, abaxial green, glabrous both sides. *Inflorescence* a terminal compound umbel, erect, 10.5–17.0 cm in diameter; peduncle short (*c*. 1 cm long) bearing elongated triangular bracts (*c*. 1–2 cm long) attached on the bottom of each primary rays; *primary rays* maroon, 13–19 leaflets and unequal in size with young simple leaf grow under inflorescence, *blade* oblong-elliptic to lanceolate, lyrately lobed; mid-leaflet 18–27 cm long by 6.0–11.5 cm wide, total leaf width of 26–40 cm; petiolule up to 5.5 cm, the base gradually tapered to the petiole, *apex* apiculate to acute, *margin* irregular dentate to serrate; surface rugose, adaxial deep green, abaxial green, glabrous both sides. *Inflorescence* a terminal compound umbel, erect, 10.5–17.0 cm in diameter; peduncle short (*c*. 1 cm long) bearing elongated triangular bracts (*c*. 1–2 cm long) attached on the bottom of each primary rays; *primary rays* maroon, 13–19 rays, 1.5 cm long, tomentose, bearing opposite elongated triangular bracts (1.5 mm long) at the apex, each ending in three branches; *central branch* 1.5 cm long, bearing tiny triangular bracts attached to each sterile flowers' pedicels (3 mm long); *two lateral branches c*. 2.5–2.8 cm long with a pair of tiny bracts (3 mm long) on each of the internodes. *Ovary* inferior, fused to the floral receptacle. *Infructescence fruits* orange-yellow, not fully developed, 20–34, pedicelled (1–2 mm long).

Specimen examined

JCB 050—055.

4. Osmoxylon lineare (Merr.) Philipson, Flora Malesiana 9(1): 39 (1979). (Fig. 4D)

Type: Philippines, Luzon. Prov. Pangasinan, Dec. 1907, *M. Ramos 4953*.

Synonyms: *Osmoxylon lineare* (Merr.) Philipson, Blumea 23 (1976) 106; Fl. Males. ser. 1, 9 (1979) 39 — *Boerlagiodendron lineare* Merr. Philip. J. Sc. 3 (1908) Bot. 253; En. Philip. 3 (1923) 223.

Description

Glabrous, sparsely shrubby with a few spreading branches, *c*. 1–2 m tall. *Leaves* alternate, spirally arranged, dextrose, clustered at ends of the branches; *petiole*, green, 4–8 cm, *base* with a short stipular ligule, 1.0–1.3 cm long, with 2 deeply furrowed thin crests extending around petiole, thin edges with minute tooths; *leaf* are digitately compound, *blade* up to 10.0–25.5 cm width, 5–6 leaflets; *petiolule* up to 8 cm, *leaflets* linear, *c*. 0.9–1.2 cm wide, mid-leaflet 27 x 1.2 cm, *base* decurrent on the winged petiolule, *apex* attenuated, *margin* entire, thickened, denticulate especially above; *surface* adaxial matte deep green

(light yellowish in young leaves or near the terminal), abaxial shinny pale green, glabrous both sides. *Inflorescence* a terminal compound umbel, erect, 7.5–12.0 cm in diameter; peduncle short (*c*. 1.0–1.5 cm), bracteate; *primary rays* 12–18 rays, 1.6–2.2 cm long, purplish-black with pubescent and tiny scabrous structures, bearing opposite elongated triangular bracts (*c*. 4–6 mm long) at the apex, each ending in three branches; *central branch* 3–5 mm long bearing an elongated triangular head of numerous fimbriate bracts (sterile flowers fallen), and pseudo-fruits 5–6 mm long & 5–6 mm wide, purplish black, pedicellate (5–7 mm long), 2 *lateral branches c*. 3 cm long with a pair of minute fimbriate bracts in the middle, ending in a capitulum of 20–42 sessile flowers subtended by small fimbriate bracts, 6–7 mm. *Flowers* epigynous, tubular, sessile; *calyx* rim minute; *style* with stigmas reduced or sessile, located on the center of the floral disk; *corolla* short tubular creamy white, 4–5 lobed on upper part, 2.0–2.5 mm long, *c*. 1.5–2.0 mm in diameter; *stamens* 4–5, light purple exserted; *filament*, creamy white, .8 mm long. *Ovary* inferior, fused to the floral receptacle. *Infructescence fruits* ovoid *c*. 4–5 mm long, *c*. 4–5 mm diameter, green to purplish-black, 5-ridged (when dry).

Specimen examined

JCB 050—055.

5. Osmoxylon luzoniense (Merr.) Philipson, Flora Malesiana 9(1): 52 (1979). (Fig. 4E)

Type: Philippines. Mindanao, Province of Agusan, Cabadbaran, Mt. Urdaneta, Aug. 1912, *A.D.E. Elmer 13546*.

Synonyms: *Osmoxylon luzoniense* (Merr.) Philipson, Blumea 23 (1976) 116. — *Boerlagiodendron luzoniense* Merr. Philip. J. Sc. 3 (1908) Bot. 252; En. Philip. 3 (1923) 223. — *Boerlagiodendron clementis* Merr. Philip. J. Sc. 3 (1908) Bot. 155; En. Philip. 3 (1923) 222. — *Boerlagiodendron agusanense* Elmer, Leafl. Philip. Bot. 7 (1914) 2330; MERR. En. Philip. 3 (1923) 222. — *Boerlagiodendron diversifolium* Merr. Philip. J. Sc. 10 (1915) Bot. 333; En. Philip. 3 (1923**)** 223.

Description

Small tree, *c*. 2 m tall, glabrous. *Leaves* alternate, spirally arranged, dextrorse, crowded at terminal; *petiole* 24.0–34.5 cm long, *base* with a stipular ligule, 2.0–2.5 cm long, with 4 *crests*, recurved, extending around or lower part of petiole base with minute to obscurely fimbriate; *blade* palmately lobed with 5 lobes, subcoriaceous, upper-most leaves often reduced and simple, 18–26 cm long and extending 23–30 cm wide; *base* truncate to cordate, *apex* cuspidate to apiculate, *margin* serrate; *surface* adaxial deep green, abaxial pale green, glabrous both sides. *Inflorescence* a terminal compound umbel, 15 cm Ø, peduncle short (*c*. 1 cm long); *primary rays* 25, 4 cm long, maroon to purple, tomentose, bracts 1.5–2.0 cm long attached on the bottom of each primary rays, bearing opposite elongated triangular bracts (7–8 mm long) at the apex, each ending in three branches; *central branch* 7–10 mm long, bearing sterile flowers (3–5 mm long and 3–5 mm wide) with pedicels 4–6 mm long); the two lateral branches 5 cm long with a pair of tiny bracts (3–4 mm long) on each of the internodes, ending in 47–54 pedicellate fertile flowers subtended by tiny bracts (1 mm long). *Flowers* epigynous, tubular, pedicelled, orange-

yellow; *calyx* rim obsolete; *style* with stigmas reduced or sessile, located on the center of the floral disk; *corolla* tubular yellow yellow-orange bud, 4–5 mm long, 2.5–3.0 mm in diameter. *Infructescence* not observed.

Specimen examined

JCB 001.

6. Osmoxylon oblongifolium (Philipson) Flora Malesiana 9(1): 37 (1979). (Fig. 4F)

Type: Philippine Island. Samar. Bagacay Concord, *Sulit and Conese 2776*.

Synonyms: *Osmoxylon oblongifolium* Philipson, Blumea 23 (1976) 105.

Description

Glabrous, shrub, and small tree, *c*. 2 m tall. *Leaves* glabrous, simple, alternate, spirally arranged, dextrorse, crowded at terminal; *petiole* 4–10 cm in length with light ridges near midrib and scabrid structures scattered on petiole's surface; *stipular ligule*, short (1–2 cm long) a clasping base structures with 3–4 crests, recurved, extending around petiole base, with minute fimbriate; *blade* simple, elliptic, 25–43 x 16–3 cm; *base* rounded; *apex* acute to aristulate; *margin* entire and slightly serrate near apex, gently repand and slightly revolute with tiny spines; *surface* adaxial deep green, abaxial shiny green, glabrous both sides. *Inflorescence* a terminal compound umbel, erect, 12–14 cm Ø, attached on the bottom of each primary rays is bracts (*c.* 1 cm); *primary rays*, 16–17, 2 cm long, maroon to purple, slightly flattened, tomentose and with tiny ciliate, opposite triangular bracts (3–5 mm long) at the apex, each bearing three branches; *central branch* 5–6 mm long, bearing the sterile, bacciform sterile flowers purplish- black in color with 4–7 mm pedicels each bearing bracts (1.0–1.5 mm) and pseudo-fruits 4–5 mm long and 4–5 mm wide; *two lateral branches* 3.5 cm long with minute trichomes, terete with two opposite small bracts (2 mm long) about the middle and ending in minute triangular bracts around its terminal umbellule of 29–36 fertile flowers; pedicels 1 mm long; *calyx* minute rim to obsolete; *style* with stigmas reduced or sessile, located on the center of the floral disk; *corolla* tubular yellow, 4–5 lobed at the upper part, 4 mm long, 2.0–2.5 mm in wide; s*tamen* 4, yellow, 5 mm long, exserted; *filament* 4–5, yellow, 4 mm long; *anther*, yellow, dorsifixed, 1 mm long. *Ovary* inferior, fused to the floral receptacle. *Infructescence* oblong fruits, 7–8 mm long, *c*. 5–6 mm diameter, pale green, turn to purplish-black when ripe with tiny white spots, 3–4 seeds.

Specimen examined

JCB 045 and 046.

7. Osmoxylon pectinatum (Merr.) Philipson, Flora Malesiana 9(1): 45 (1979). (Fig. 4G)

Type: Philippines. Batan Island. Batanes Prov. Mt. Iraya, *Ramos 80025*, *80787*, *Fenix 5775*, *Barlett 15452*.

Synonyms: *Osmoxylon pectinatum* (Merr.) Philipson, Blumea 23 (1976) 111. — *Boerlagiodendron pectinatum* Merr. Philip. J. Sc. 3 (1908) Bot. 253, 424; En. Philip. 3 (1923) 224; Kanehira, Form. Trees rev. ed. (1936) 520, f. 480; Hui-Lin Li, Woody Fl. Taiwan (1963) 666, f. 273.

Description

Shrub, erect, *c*. 3 m tall, glabrous. *Leaves* alternate and spirally arranged, dextrorse, clustered at terminal; *petiole* 14–35 cm long; *base* with a stipular ligule (2.0–2.5 cm long), *crests*, 3–4, recurved, slightly slant with minute to obscurely fimbriate, extended around the back of the petiole base; *blade* palmately lobed with 3–5–7 leaflets, lanceolate-elliptic, mid-leaflet 24–44 x 21–36 cm; *base* cordate, *apex* apiculate to aristate, *margin* serrate; *surface*, adaxial deep green, rugose; abaxial pale green, glabrous both sides. *Inflorescence* a terminal compound umbel, 19 cm in diameter; bearing elongated triangular bracts (*c.* 2 cm long) attached on the bottom of each primary rays; *primary rays* 24, 4.0–4.5 cm long, maroon, tomentose and ciliate, bearing opposite elongated triangular bracts (*c*. 7–10 mm long) at the apex, each ending in three branches; *central branch* 5–10 mm long, bearing tiny triangular bracts attached to each sterile flowers' pedicels (4–6 mm long), pseudo-fruits 4–6 mm Ø, pedicellate, 5–6 mm; *two lateral branches* 4 cm long with an opposite triangular tiny bracts (3–4 mm long), ending in 34–46 pedicelled flowers subtended by tiny bracts (1 mm long). *Flowers* epigynous, tubular, yellow; *calyx* rim minute to obsolete; *style* with stigmas reduced or sessile, located on the center of the floral disk; *corolla* tubular yellow orange, 4–5 lobed in upper part, 4–5 mm long, 2.5–3.0 mm in wide; *stamen* 4–5, yellow, exserted, 4 mm long; *filament* 4–5, yellow, 4 mm long, *anther*, yellow, 1 mm long. *Infructescence* not fully developed.

Specimen examined

JCB 013.

8. Osmoxylon simplicifolium (Elmer) Philipson, Flora Malesiana 9(1): 34 (1979). (Fig. 4H)

Type: Philippines, Mindanao. Agusan Prov., Cabadbaran, *Elmer 13689*.

Synonyms: *Osmoxylon simplicifolium* (Elmer) Philipson, Blumea 23 (1976) 103. *Boerlagiodendron simplicifolia* Elmer, Leafl. Philip. Bot. 7 (1914) 2329; Merr. En. Philip. 3 (1923) 224.

Description

Small tree, to *c*. 4–6 m tall. *Leaves* glabrous, simple, coriaceous, alternate and spirally arranged, dextrorse, clustered at ends of branches; *petiole* pale green, 2.5–7.5 cm in length; channelled above, with a small base, bearing a short stipular ligule (7–10 mm long) and extending around the petiole base of the petiole is single broad concave disk-like crest with minute fimbriate structures; *blade* elliptic to oblanceolate, to 13.0–22.8 x 4.2–8.5 cm; *base* cuneate slightly to rounded, narrowed into the petiole; *apex* acute and slightly aristulate; *margin* serrate; *surface*, adaxial shinny deep green, abaxial shiny pale green, glabrous both sides. *Inflorescence* a terminal compound umbel, spherical, 7.0–9.4 cm in diameter, with fine minute trichomes; *peduncle* short *c*. 1.5–2.0 cm, with 1 small green triangular bracts (2–3 mm

long), attached on the bottom of each primary rays; *primary rays* about 17–29 rays, 0.8–1.3 cm long, green, ciliate, bearing two opposite triangular bracts (*c*. 2–3 mm long) at the apex, each bearing three branches; *central branch* up to 6 mm long, bearing the pedicellate (2–3 mm long), sterile, small bacciform flowers *c*. 4 mm long and 3 mm wide, yellow to purplish-black; *two lateral branches*, 2.0–2.5 cm long, with two opposite small bracts (1 mm long), and ending in minute triangular bracts around a terminal umbellule. *Ovary* inferior, fused to the floral receptacle. *Infructescence* globose fruits, 5–7 mm long, *c*. 5–6 mm diameter, pale green, turn to purplish-black when ripe, 3 seeds.

Specimen examined

JCB 060—065.

9. Osmoxylon trilobatum (Merr.) Philipson, Flora Malesiana 9(1): 52 (1979). (Fig. 4I)

Type: Philippines. Luzon, Tayabas Prov., *Elmer 7498*, *7724*.

Synonyms: *Osmoxylon trilobatum* (MERR.) Philipson, Blumea 23 (1976) 116. *O. cumingii* Seem. J. Bot. 6 (1868) 141, nomen. — *Boerlagiodendron trilobatum* Merr. Philip. J. Sc. 2 (1907) Bot. 289; En. Philip. 3 (1923) 224.

Description

Shrub, erect, *c*. 2.5 m tall, glabrous. *Leaves* alternate and spirally arranged, dextrorse, crowded near terminal; *petiole* 9.0–19.5 cm long, base with a stipular ligule (1 cm long) and 3 crests, recurved, extending around the petiole base with minute to obscurely fimbriate; *blade* palmately lobed, 3 lobes, 19.5–26.5 x 12.0–23.5 cm, subcoriaceous, oblong, scarcely narrowed towards base, with young simple leaf grow under inflorescence; *base* truncate, *apex* acute to apiculate, *margin* serrate to dentate; *surface*, adaxial slightly rugose, green, abaxial pale green, glabrous both sides. *Inflorescence* a terminal compound umbel, erect, 7 cm in diameter; *peduncle* short (*c*. 1 cm long) bearing elongated triangular bracts (1.0–1.2 cm long) attached on the bottom of each primary rays; *primary rays* 6, maroon, 3 cm long, tomentose and scabrous, bearing opposite elongated triangular bracts (8–10 mm long) at the apex, each ending in three branches; *central branch* 5–6 mm long, bearing tiny triangular bracts attached to each sterile flowers with pedicels (4–6 mm long); *two lateral branches* 2.5–2.7 cm long with a pair of tiny bracts (3 mm long) on each of the internodes, ending in 20–26 pedicelled fertilized flowers subtended by tiny bracts (1 mm long). *Flowers* epigynous, tubular, orange-yellow; *calyx* rim minute to obsolete; *style* with stigmas reduced or sessile, located on the center of the floral disk; *corolla* tubular, yellow-orange, 4 lobes on upper portion, 4 mm long, 2.5–3.0 mm wide. *Infructescence* not observed.

Specimen examined

JCB 050—055.

10. Osmoxylon yatesii (Merr.) Philipson, Flora Malesiana 9(1): 37 (1979). (Fig. 4J)

Type: Philippines. Luzon. Tayabas Prov., Mt. Cadig, *Yates BS 25418*.

Synonyms: *Osmoxylon yatesii* (Merr.) Philipson, Blumea 23 (1976) 106. — *Boerlagiodendron yatesii* MERR. Philip. J. Sc. 13 (1918) Bot. 44; En. Philip. 3 (1923) 225.

Description

Shrub, erect, *c*. 2.5 m tall, glabrous. *Leaves* digitately compound, alternate and spirally arranged, dextrorse, crowded near terminal; *petiole* 27.0–34.5 cm, *base* with a small stipular ligule (1.5–2.5 cm long) and 2 crests, thin, recurved, with inconspicuous fimbriate, extended around petiole base; *blade* elliptic to oblong, with 5–7 leaflets, 23–28 x 6.4–7.4 cm; *petiolule* up to 4.5 cm, *base* cuneate, gradually tapered; *apex* acute to caudate; *margin* serrate and denticulate especially at apex; *surface* smooth, adaxial green, abaxial curve, shinny, pale green, glabrous both sides. *Inflorescence* a terminal compound umbel, erect, 17 cm in diameter; *peduncle* short (*c*. 1 cm long) bearing green elongated slightly curled bracts (*c*. 1.0–1.3 cm long) attached on the bottom of each primary rays; *primary rays* 24, 3.0–3.5 cm long, tomentose and ciliate, bearing opposite elongated triangular bracts (*c*. 6–7 mm long) at the apex, each ending in three branches; the *central branch c*. 5 mm long bearing a small triangular bract attached to each pedicelled subtended by small bracts. *Flowers* epigynous, tubular, *calyx* rim minute to obsolete; *style* with stigmas reduced or sessile, located on the center of the floral disk; *corolla* tubular, yellow, 4–5 lobes on upper portion, 3–4 mm long, 3 mm in wide; *stamen* 4–5, yellow, 5 mm long; *filament* 4, yellow, 4 mm long; *anther*, yellow, dorsifixed, 1 mm long. *Ovary* inferior, fused to the floral receptacle. *Infructescence* not observed.
Specimen examined

JCB 023

Conclusions

This study produced the first comprehensive species distribution map of *Osmoxylon* in the Philippines by integrating occurrence records from published literature, reliable online repositories (GBIF, CDFP), and field surveys conducted in Northeastern Mindanao. The findings clarify the biogeographic patterns of the genus, revealing a broad but uneven distribution across the archipelago. While widespread species such as *O. eminens* and *O. luzoniense* occur in numerous provinces, narrowly distributed endemics—including *O. catanduanense*, *O. dinagatense*, and *O. pectinatum*—are confined to highly localized areas. Climatic analysis further showed that 17 species predominantly occur in Type II climatic zones, characterized by consistently high rainfall, indicating a strong ecological association with moisture-rich environments.

Declarations

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Data availability

All the data related to this research is included in the uploaded manuscript [and its supplementary information files].

Ethics approval and consent to participate

No endangered or legally protected species were involved in this study. Collection of plant material was conducted with permission from the Department of Environment and Natural Resources (DENR)-Caraga Regional Office under a Wildlife Gratuitous Permit (No. R13-2024-53), issued in compliance with Republic Act No. 9147 (2001), *the Wildlife Resources Conservation and Protection Act*. The study needs no further affirmations. The plant material was identified by Jeza Bantilan and Dr. Jess H. Jumawan, and voucher specimens were deposited at the Caraga State University Natural Science Museum.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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Figures

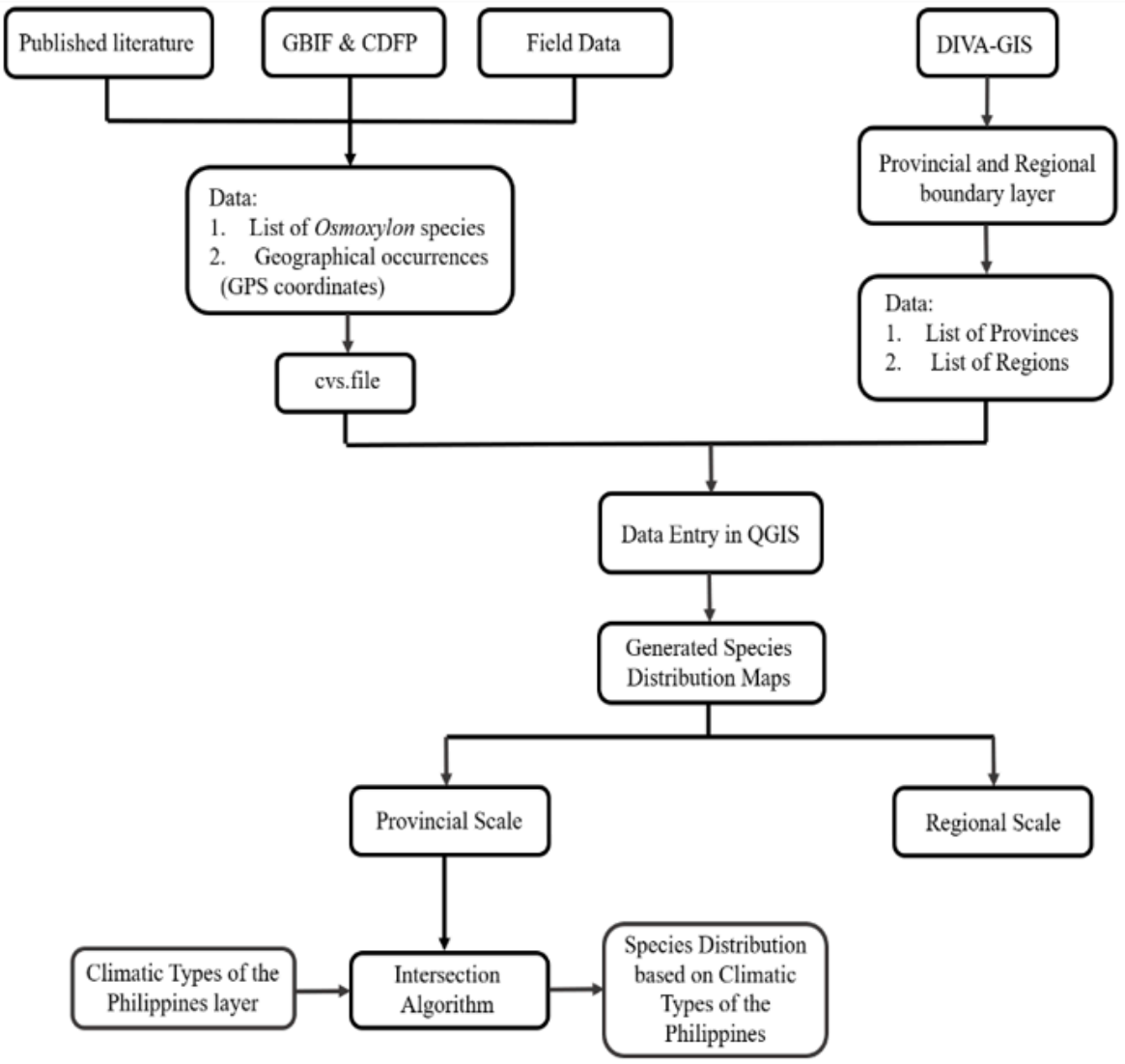
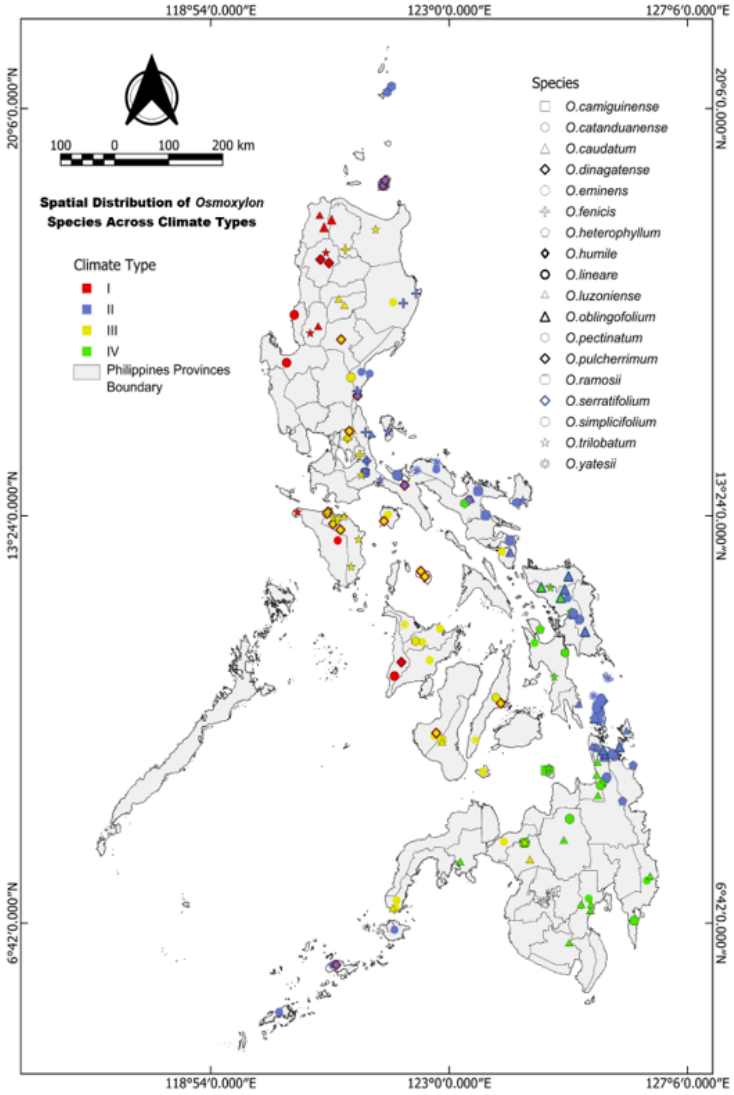


Figure 1

Flow diagram of the geospatial analysis of *Osmoxylon* species in the Philippines Islands using Quantum Geographic Information System.



	Species	I	II	III	IV
1.	*O. camiguinense*		✓		✓
2.	*O. catanduanense*		✓		
3.	*O. caudatum*	✓	✓		
4.	*O. dinagatense*		✓		
5.	*O. eminens*	✓	✓	✓	✓
6.	*O. fenicis*		✓	✓	
7.	*O. heterophyllum*		✓		✓
8.	*O. humile*		✓		✓
9.	*O. lineare*	✓	✓		✓
10.	*O. luzoniense*	✓	✓	✓	✓
11.	*O. oblongifolium*		✓		✓
12.	*O. pectinatum*		✓		
13.	*O. pulcherrimum*	✓	✓	✓	
14.	*O. ramosii*		✓	✓	
15.	*O. serratifolium*			✓	✓
16.	*O. simplicifolium*		✓	✓	✓
17.	*O. trilobatum*	✓	✓	✓	✓
18.	*O. yatesii*		✓	✓	

Figure 2

Distribution and Climatic type of *Osmoxylon*species in the Philippines based on the Corona's climatic classification.

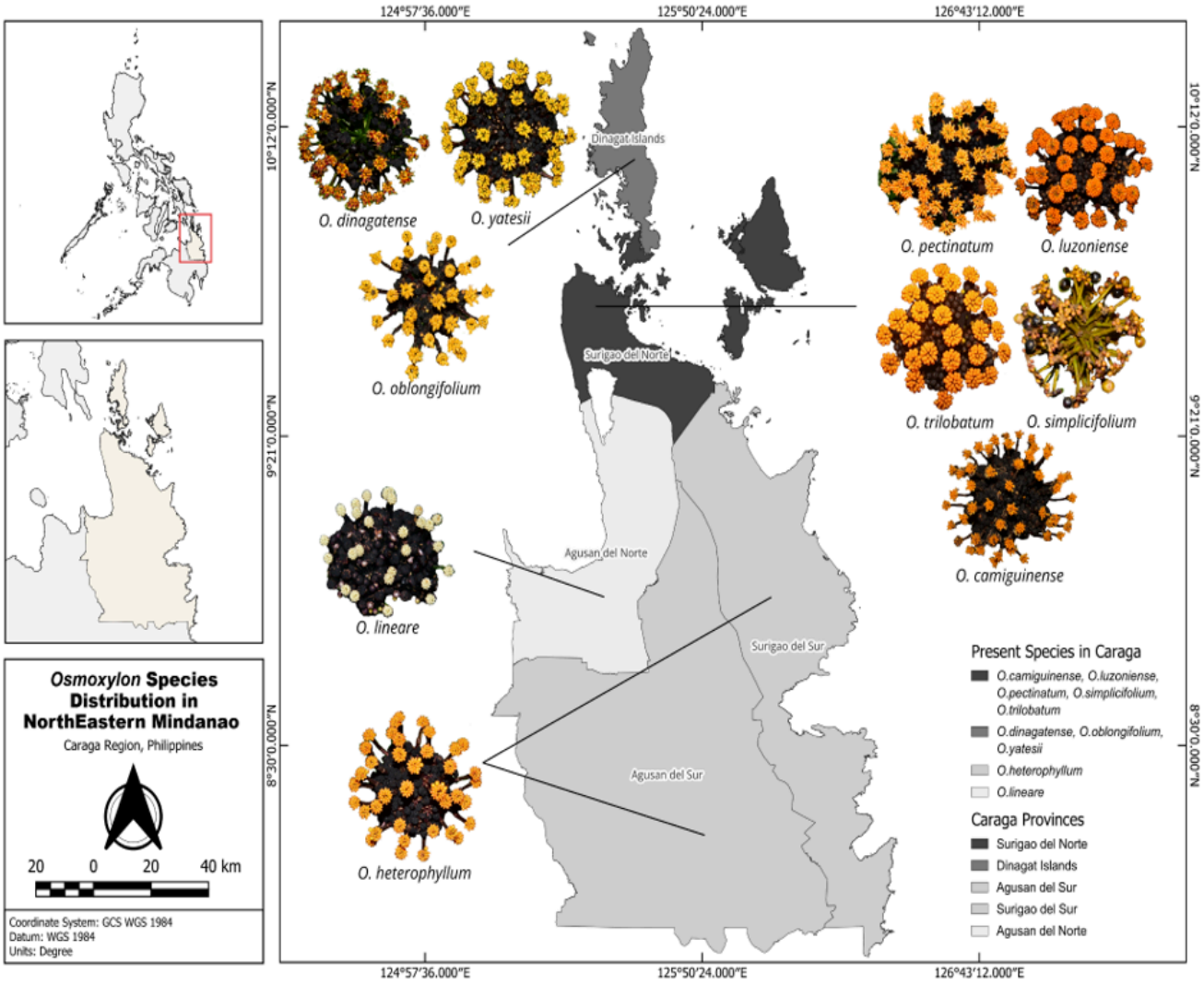


Figure 3

Current *Osmoxylon* species distribution in Northeastern Mindanao, Philippines.

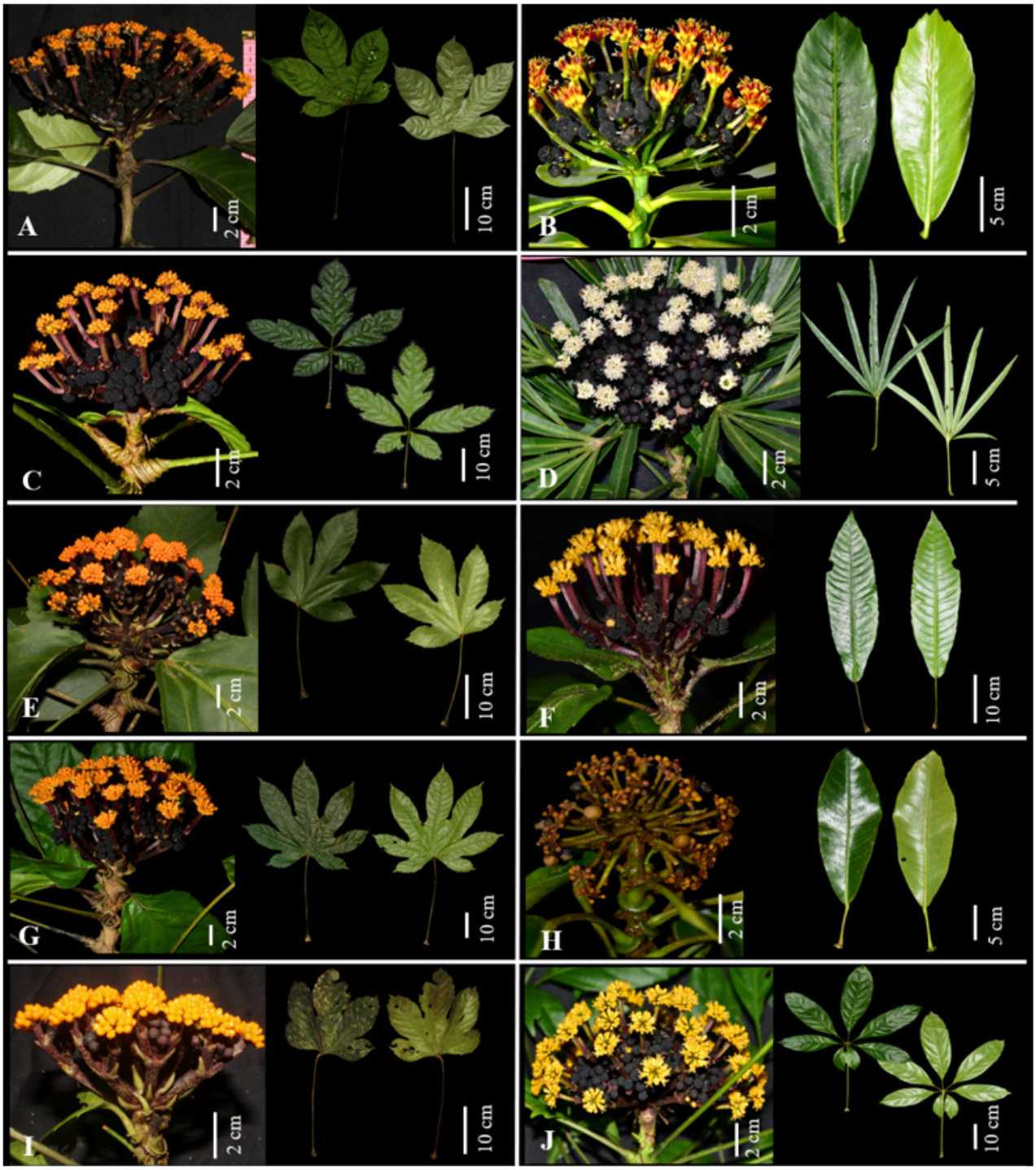


Figure 4

Inflorescences, infructescence, and mature leaves of *Osmoxylon* species documented in Northeastern Mindanao. **a** *O. camiguinense*; **b** *O. dinagatense;* **c** *O. heterophyllum*; **d** *O. lineare*; **e** *O. luzoniense*; **f** *O. oblongifolium*; **g** *O. pectinatum*; **h** *O. simplicifolium*; **i** *O. trilobatum*; **j** *O. yatesii.* (Photographs by J.C. Bantilan).

Supplementary Files

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- Annex1.docx
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