

THE DIVERSITY OF TERRESTRIAL ARACEAE IN MT. WATUWILA COMPLEX, SOUTH-EAST OF SULAWESI

Ina Erlinawati

Herbarium Bogoriense, Pusat Penelitian Biologi, Lembaga Ilmu Pengetahuan Indonesia (LIPI)

Jl. Raya Jakarta-Bogor Km 46, Cibinong 16911, Bogor, Indonesia

Email: ina_erlinawati@yahoo.com

ABSTRACT

The arums comprise the family of Araceae, including the numerous aroids subfamily, monocotyledonous flowering plants, in which flowers are borne on a type of inflorescence called a spadix. The diversity of terrestrial Araceae in Sulawesi is very poorly documented and understood and remains critically threatened. The aims of this study were to understand the diversity of terrestrial Araceae on Mount Watuwila Complex and to add the number specimen collection in Herbarium Bogoriense. The exploration was conducted by used exploring method, including collection, identification and description. The exploration on Mount Watuwila Complex (170–800 m alt.), May 7–29, 2008 was got 22 number collections of Araceae, consist of 12 numbers of terrestrial Araceae, 10 species, those are *Aglaonema simplex* Bl., *Alocasia macrorrhizos* (L.) G. Don, *Alocasia suhirmaniana* Yuzammi & A. Hay, *Colocasia esculenta* (L.) Schott, *Homalomena* spp. (3 species), *Schismatoglottis calyptрата* (Roxb.) Zoll. & Moritzi, *S. plurivenia* Alderw and *Spathiphyllum commutatum* Schott. *Schismatoglottis calyptрата* (Roxb.) Zoll. & Moritzi is dominant species and *Alocasia suhirmaniana* Yuzammi & A. Hay is endemic species. The descriptions of each species were made.

Key words: diversity, terrestrial Araceae, Mt. Watuwila Complex, South-East of Sulawesi

INTRODUCTION

Araceae is a family of monocotyledonous flowering plants in which flowers are borne on a type of inflorescence called a spadix. The spadix is usually accompanied by, and sometimes partially enclosed in, a spathe or leaf-like bract. The group also goes by the name of Arum family and species in this family are often colloquially known as aroid. This family consists of 107 genera and over 3700 species is most diverse in the New World tropics, although also distributed in the Old World tropics and north temperate regions. The most important food aroids are from tribes *Colocasieae* and *Caladieae*, i.e. *Colocasia* and *Xanthosoma*. The great majority of Araceae are poisonous when fresh and in almost all cases, edible species must be cooked or processed in some way before they can be used as food. The major crop species are *Colocasia esculenta* (taro), *Xanthosoma sagittifolium* (cocoyam), *Cyrtosperma merkusii* (swamp taro), *Alocasia macrorrhizos* (giant taro), *Amorphophallus paeoniifolius* (elephant yam) and *Amorphophallus konjac* (konjac). Beside these, the member of Araceae can be used for medical, toxic, medical uses, fibres and ornamental uses (Mayo *et al.*, 1997). The various medicinal uses of aroids described by Bown (1988) include external healing of stings, wounds, skin complaints and arthritis, expectorants and decongestants, contraceptives, parasite insecticides, anti cancer agents and hallucinogens. Bown (1988) reported

the use of fibres from species of *Anthurium*, *Heteropsis*, *Philodendron*, *Cercetis* and *Gymnostachys*.

Sulawesi (formerly known as Celebes) is one of the four larger Sunda Islands of Indonesia and is situated between Borneo and the Maluku Islands. In Indonesia, only Sumatra, Borneo, and Papua are larger in territory. Sulawesi is the world's eleventh-largest island, covering an area of 174,600 km² (67,413 sq mi). The island is surrounded by Borneo to the west, by the Philippines to the north, by Maluku to the east, and by Flores and Timor to the south. It has a distinctive shape, dominated by four large peninsulas: the Semenanjung Minahassa; the East Peninsula; the South Peninsula; and the South-east Peninsula. The central part of the island is ruggedly mountainous, such that the island's peninsulas have traditionally been remote from each other, with better connections by sea than by road. The island is subdivided into six provinces: Gorontalo, West Sulawesi, South Sulawesi, Central Sulawesi, Southeast Sulawesi, and North Sulawesi (Anonim, 2001).

Sulawesi is part of Wallacea, meaning that it has a mix of both Asian and Australasian species. According to plate reconstructions, the island is believed to have been formed by the collision of terranes from the Asian Plate (forming the west and southwest), from the Australian Plate (forming the southeast and Banggai), and from island arcs previously in the Pacific (forming the north and east peninsulas). The lowland forests on the island are, unfortunately, almost

gone. Because of the relative geological youth of the island and its dramatic and sharp topography, the lowland areas are naturally limited in their extent. The past decade has seen dramatic conversion of this rare and endangered habitat (Cannon *et al.*, 2007). The island also possesses one of the largest outcrops of serpentine soil in the world, which support an unusual and large community of specialized plant species. Overall, the flora and fauna of this unique center of global biodiversity is very poorly documented and understood and remains critically threatened (Whitten *et al.*, 1987).

The aims of this study were to understand the diversity of terrestrial *Araceae* in Mount Watuwila complex and to add the number of specimen collection, especially *Araceae* in Herbarium Bogoriense. Mount Watuwila is located on latitude 3°4660 S and longitude 121°340 E in Kolaka regency, South-East Sulawesi province.

MATERIALS AND METHODS

The study on diversity of terrestrial *Araceae* has been carried out in surrounding Mount Watuwila complex, South-East Sulawesi, May 7–29, 2008. The plants collection were done according to the method of Rugayah, *et al.* (2005). The morphological description used Veldkamp method (1987).

The equipment used in collecting, preserving and studying specimens were scissor and scateurs, double flimsy (“specimen folder”), press frames, press straps, corrugated sheets, paper or mesh bags, cardboard support, plastic bottles, polytene bags, adhesive tape and string, alcohol, hand lens, compass, altimeter, fine mounted needles, fine forceps, sharp scalpel with fine point, small paint brush and watch-glass or petridish (Forman and Bridson, 1989).

Identification species was done based on the herbarium specimens deposited in Herbarium Bogoriense and literature studies in order to complete the information for each species.

RESULTS

The terrestrial *Araceae* species can be found in Mount Watuwila complex are *Aglaonema simplex* Bl., *Alocasia macrorrhizos* (L.) G. Don, *Alocasia suhirmaniana* Yuzammi & A. Hay, *Colocasia esculenta* (L.) Schott, *Homalomena* spp, *Schismatoglottis calyptata* (Roxb.) Zoll. & Moritzi, *S. plurivenia* Alderw. and *Spathiphyllum commutatum* Schott.

These are the descriptions for each species.

1. *Aglaonema simplex* Bl.

An erect herb up to 120 cm tall; leaves obtuse, rounded or subtruncate at base, not variegated, margin of petiole usually with a membranous margin, with ca. 7–9, on lower surface not prominent lateral nerves and several to numerous, thinner secondary ones, veinless, 10–30 cm by 2.5–8 cm; petiole 4–15 cm; peduncle 2.5–6 cm, fruiting ones up to 11 cm, at first partly or entirely enveloped by afterwards withering and reflexed leaves which are reduced to up to 3 cm long petiolar sheaths, in anthesis erect, later erecto-patent and often flexuous; spathe lanceolate, outside white, inside yellowish-greenish white; stalk of the spadix 0.5–1 cm, after anthesis slightly elongate, spadix erect, 2.5–4.5 cm; ovary globose, tapering into a very short style; fruit ellipsoid, obtuse, crowned by persistent stigma, ripe 1.5–1.75 cm, orange to red; pericarp thin; well developed fruits in each spadix 2 to many; staminodes with a roundish upper surface (Backer and Bakhuizen, 1965).

Distribution: Southern Myanmar, Malaysia peninsula through Sumatra, Java (Central and East of Java), Madura and Bali, Kalimantan, Sulawesi, Sula Islands and part of the Philippines (Yuzammi, 2000).

Habitat: Lowland forest, on forest floor, primary, secondary and teak forest, jungles also on lime stone (Backer and Bakhuizen, 1965).

Use: Commonly used as ornamental foliage plant. Several medicinal applications have been recorded (Yuzammi, 2000).



Figure 1. *Aglaonema simplex* Bl.

2. *Alocasia macrorrhizos* (L.) G. Don

Massive pachycaul with the stem decumbent or erect, to 4 m tall; petioles to 1.3 m long, sheathing in lower 1/3–1/2, blades ovato-sagittate, bluntly triangular in general outline, held more or less erect, with the margin entire to

very slightly; anterior lobe ca. 70 cm to over 1 m long, ca. 60–90 cm at base, with ca. 9 rather distant primary lateral veins on each side of the anterior costa diverging ca. 60°; glands in axils of primary veins on abaxial side distinct; secondary venation flush with the lamina or but slightly raised abaxially, not forming interprimary collective veins or these poorly defined; posterior lobes ca. 1.3–1/2 the length of the anterior; inflorescences paired among the leaf bases, subtended by membranous cataphylls; peduncle barely exceeding the cataphylls at anthesis; spathe rather variable in length, ca. 13–35 cm long, constricted about 1/6th of the way from the base; lower part green, ovoid; limb broadly oblong-lanceolate, membranous, pale yellow; spadix slightly shorter than the spathe, shortly stipitate; female zone 1–2 cm long, ca. 1.5 cm diam.; ovaries pale green, ca. 3 mm diam.; stigma sessile, 3–5 lobed, the lobes conic, yellow; sterile interstice slightly shorter than to equaling the female zone, whitish, very slightly narrowed corresponding to the spathe constriction, composed of rhombo-hexagonal synandria ca. 2.5 mm diam., the lower ones paler, incompletely connate or with the central hole, the upper ones resembling synandria; male zone cylindrical ca. 3–7 cm long, ca. 2 cm diam., whitish; synandria rhombo-hexagonal, ca. 2 mm diam.; appendix yellowish, slightly thicker than the male zone at the base; fruiting spathe ca. 8 cm long; fruit berries, scarlet (Hay, 1998).

Distribution: IndoMalesia to Oceania. It is not clear where, if anywhere, this species occurs wild. It has evidently been distributed widely in tropical Asia in prehistoric times as a subsistence crop and is now pantropical by introduction as an ornamental (Hay, 1998).



Figure 2. *Alocasia macrorrhizos* (L.) G. Don

Habitat: road sides, waste places, gardens, mostly in wet sites at low to medium elevation (Hay, 1998).

Use: Tuber can be used as food (Heyne, 1987).

3. *Alocasia suhirmaniana* Yuzammi & A. Hay

Terrestrial herb to ca. 65 cm tall; rhizome 13–15 cm long, ca. 3 cm diam.; leaves 1–3 together; petiole to ca. 60 cm long, sheathing in the lower 1/5–1/4; yellowish green, densely longitudinally and obliquely mottled purple-brown, minutely and densely puberulous, subtended by papery membranous cataphylls; blade broadly ovato-sagittate, to ca. 55 cm long, peltate, pendent, thinly lathery, with the margin somewhat undulate, glossy dark green adaxially with the major venation pale grey-green, dark purple abaxially; anterior lobes widest about 1/4 of the way from the base, the tip broadly acute to obtuse, shortly apiculate; anterior costa with up to 8 primary lateral veins on each side, diverging at 80–45°, with conspicuous purple glands in their axils abaxially; subsidiary veins frequent in the outer part of the blade; secondary venation otherwise inconspicuous, forming undulating interprimary collective veins; posterior lobes acute, about 1/2–2/3 the length of the anterior; posterior costae more or less straight, diverging at ca. 35–45°; inflorescence pairs solitary, subtended by papery membranous cataphylls to ca. 11 cm long; peduncle to ca. 24 cm long, minutely puberulent in the upper part, purple-brown; spathe ca. 12 cm long, deep purple, slender, glabrous, abruptly constricted at ca. 2 cm from the base, lower spathe subcylindrical; limb narrowly lanceolate; spadix somewhat shorter than the spathe, ca. 10 cm long, slender, very shortly stipitate for 4 mm, stipe ivory; female zone ca. 12 cm long; ovaries greenish yellow; stigma bluntly 2–4 lobed, subsessile, yellow, sterile interstice synandrodia strongly lobed, rhombo-hexagonal, ca. 1.5 mm diam.; male zone ca. 2 cm long, 1 cm diam., yellowish ivory; appendix ca. 6 cm long, 8 mm diam. at base, slightly constricted at



Figure 3. *Alocasia suhirmaniana* Yuzammi & A. Hay

junction with male zone, the rest cylindrical, then tapering in the upper 1/3, yellowish, somewhat rugose in the lower half (Hay, 1998).

Distribution: endemic to SE Sulawesi (Hay, 1998).

Habitat: In dam shady spots in lowland rain forest on slopes, sometimes over limestone (Hay, 1998).

Use: Because of the beautiful of leaf, this species can be used for ornamental plants.

4. *Colocasia esculenta* (L.) Schott

Stoloniferous herb forming colonies or clump-forming, terrestrial; 1–1.5 m tall; petiole 35–40 cm long, glabrous; leaf shape peltate, glaucous; anterior lobe widest at base, the tip of anterior lobe acuminate; posterior lobe 0.25–0.5 anterior lobes, the tip of posterior lobe obtuse; inflorescence forming a cluster; peduncle 10–15 cm long; spathe 8–9 cm long, yellow to golden; spadix 4–5 cm long; female zone 1–1.5 cm; ovary ovoid, 1–2 mm in diam., green; style 0.5 mm long; stigma 2–3 lobes, lobe rounded; sterile interstice 0.5–1 cm long; male zone 2–3 cm long, cylindrical; synandria rhombo-hexagonal, 1–2 in diam.; appendix 2–3 cm long; fruit ovoid.

Distribution: Pantropical and pansubtropical (in areas with adequate water). The range prior to human distribution is unknown, but may have been widespread from Indo-China to southern Japan, through Malesia and northern Australia (Hay, 1996).

Habitat: Wild form occur as colonies on river banks, in open swampy places, on seepage slopes and on rocks and banks in the splash zone of waterfalls from the lowlands to ca. 1700 m altitude in the tropics (Hay, 1996).

Use: Tuber can be used for food, young leaf and stem also can be used for delicious food (Heyne, 1987).

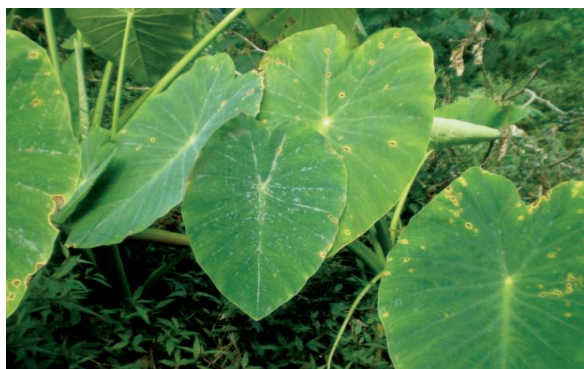


Figure 4. *Colocasia esculenta* (L.) Schott

5. *Homalomena* spp. (3 species)

Minute to very large evergreen herbs, erect to decumbent, usually strongly aromatic (terpenoids-frequently reminiscent of mango or citrus peel or ginger in Asian tropics; anise in the Neotropics); stems solitary, shortly aerial; leaves spirally arranged, less often spiro-distichous, very rarely distichous, sometimes together with petioles with conspicuous reddish extrafloral nectaries; petioles longer to shorter than the lamina, channeled to terete or D-shaped, the lower part sheathing, petiolar sheath persistent to marginally marcescent; lamina simple cordate to oblanceolate, glabrous in tropical Asia (but spiny and/or pubescent in most Neotropical species); inflorescences several together, terminal but displaced as to appear to be arising from the axils of the leaves, individual sinflorescences erect before and during anthesis, then becoming decumbent to declinate during fruit development; spathe persistent, mostly simple boat shaped; spadix divided into female proximally, male distally with the zone occasionally separated by a naked to staminode bearing interstice; ovary 2–4 locular, style apparently absent or extremely short; stigma smaller than to exceeding the ovary diam., button like to discoid; placentation basal to central, ovules anatropous, several per locule; male flower with 2 to 4 stamen; fruit where known, a small translucent greenish berry, usually smelling of overripe fruits; seeds albuminous, very small, ca 1 mm or less long, longitudinally ridged (Boyce and Wong, 2008).

Distribution: IndoMalesia to southern China eastwards to the Solomon Islands with centres of diversity in Sumatra, Borneo, New Guinea (Boyce and Wong, 2008).

Habitat: Primarily understory herbs in lowland evermoist tropical forest, but also reaching mid-montane zone; sometimes rheophytic, very rarely helophytic, occasionally relictual in regrowth and along road cuttings (Boyce and Wong, 2008).



Figure 5. *Homalomena* sp. 1.



Figure 6. *Homalomena* sp. 2.



Figure 7. *Homalomena* sp. 3.

Use: as medicinal plants because of terpenoids and flavonoids occurring in the plant tissue (Boyce and Wong, 2008).

6. *Schismatoglottis calyprata* (Roxb.) Zoll. & Moritzi

Stoloniferous herb forming colonies or clump-forming, 15–60 cm tall; stems hypogaeal, hapaxanthic, 1–2 cm diam.; petiole smooth, ca. 5–50 cm long, sheathing for ca. 1/3 its length; wings of sheath fully attached, persistent, shortly and bluntly ligular at the apex; blade usually dull mid-green, sometimes variegated with 1–2 bands or irregularly spotted grey-green to yellowish green, ca. 7–35 cm long, widest at the base or 1/3 along its length, ca. 4–18 cm wide, mostly cordate to sagittate, posterior lobes rounded to rather sharply triangular and 1–10 cm long; midrib somewhat abaxially prominent, with primary lateral veins 6–15 per side, irregularly alternating with lesser interprimaries, diverging at 45–70°, nearly always raised adaxially towards the midrib, marginally impressed, entirely raised abaxially; secondary venation arising mostly from the midrib; tertiary venation inconspicuous; inflorescences 1–8 together, with the strong esteric odour at female anthesis, exposed part of peduncle 2–14 cm, erect at anthesis and then deflected; spathe 3.5–12 cm long, lower spathe narrowly ovoid; limb differentiated from lower spathe by an abrupt constricted corresponding to the base of the male zone of spadix, at

female anthesis much inflated, narrowing and turbinate, the apex conspicuously mucronate, creamy to pale greenish-yellow, caduceus immediately after female anthesis; spadix ca. $\frac{3}{4}$ the length of the spathe, narrowly hourglass-shaped; female zone about a half the length of the whole spadix, sessile, ca. 5–8 mm diam. below, distally tapering to 3–4 mm diam., pistils pale green, close-packed, ca. 1 mm tall, ca. 0.5 mm diam., flask-shaped and close-packed below, distally becoming more widely spaced and subglobose, finely rather widely scattered and squashed by the constricting spathe; stigma button-like, papillate, raised on a short style; interpistillar staminodes white, mostly conspicuously taller than pistils, few in number, scattered, stalked, clavate, rarely absent in very small form; sterile zone between female and male zone absent save sometimes for a relative concentration of interpistillar staminodes amongst the distal pistils; male zone narrowly obconic, ca. half the length of the female zone, distally ca. 0.5–1 cm diam., ivory; anthers dumbbell-shaped from above, ca. 0.5 × 1 mm, with thecae apically impressed; the connective shorter than to very slightly elevated above the thecae; appendix bullet-shaped to hemispherical, basally nearly always somewhat wider than apex of male zone, creamy yellow; staminodes of appendix columnar, irregularly polygonal, flat to slightly round-topped, ca. 0.5 mm diam; fruiting spathe declinate, urceolate (Hay and Yuzammi, 2000).

Distribution: Tropical southwestern China to Indo-China east to Vanuatu; Malesia: throughout except for extremely seasonal areas (Hay and Yuzammi, 2000).

Habitat: In lowland and lower montane rainforest (occasionally reaching upper montane forest) and forest margin in both wet and well-drained sites, from sea level to c. 1700 m alt. (Hay and Yuzammi, 2000).

Use: -



Figure 8. *Schismatoglottis calyprata* (Roxb.) Zoll & Moritzi

7. *Schismatoglottis plurivenia* Alderw.

Robust herb to ca. 70 cm tall; stem pleionanthic, at first flowering when hypogeal, then becoming rather shortly epigeal, erect to creeping to ca. 25 cm long, ca. 3 cm diam. Petiole 20–50 cm long, sheathing in the lower half; blade cordato-sagittate, 22–38 cm long × 12–25 cm wide; posterior lobes about a quarter of the length of the anterior lobes, rounded, sometimes almost overlapping; midrib with ca. 12 primary lateral veins on each side, diverging at 60–80°, alternating with somewhat thinner interprimary veins and sometimes directly bearing subsidiary veins of similar thickness to the interprimaries, especially near the base of the anterior lobe; primary, interprimary and subsidiary venation prominent abaxially; secondary venation finely striate, forming a rather inconspicuous tessellate pattern with the tertiary venation on the abaxial side; inflorescence several to ca. 12 together, interspersed with lanceolate cataphylls; peduncle much shorter than petioles, to ca. 7 cm long at flowering; spathe ca. 6–8 cm long, constricted at about 1/3 of the way from the base; lower spathe narrowly ovoid; limb turbinate then acuminate; spadix sessile, to ca. 5 cm long, considerably shorter than the spathe; female zone ca. 2 cm long, adnate to the spathe in the lower ca. 1/3; interpistilar staminodes sparse to absent; pistils bottle-shape, close-packed, ca. 0.25 mm diam.; style very short; stigma punctiform; male zone ca. 1.5 cm long; sterile in the lower ca. 2 mm, contiguous with the female zone or separated by a very short naked zone ca. 1.5 mm long, obconic, distally ca. 5 mm diam.; appendix bluntly conic to subhemispheric, as thick as to slightly wider than the male zone at the base, appendical staminodes more or less flat-topped; fruiting spathe ca. 4 cm long, asymmetric, subcylindric (Hay and Yuzammi, 2000).

Distribution: Malesia: Philippines, widespread, extending via the Talaud Islands south of Mindanao to central Sulawesi



Figure 9. *Schismatoglottis plurivenia* Alderw.

(Hay and Yuzammi, 2000). From this expedition, this species can be found in South-East Sulawesi.

Habitat: Lowland rainforest, especially in wet ravines and river banks, to ca. 600 m alt. (Hay and Yuzammi, 2000).

Use: -

8. *Spathyphyllum commutatum* Schott.

Evergreen herbs usually with short, erect stem; leaves broadly elliptic-oblong, with acutely decurrent base, shortly acutely acuminate, with numerous side nerves, widely cancellate-veined on lower surface; rather thin when dry, 36–45 cm by 17–26 cm; petiole 45–50 cm long, about as long as leaf blade; sheath extending upwards to far beyond the middle of the petiole; spathe at first white on both sides, at last becoming entirely green, narrowly ovate, with decurrent base, acutely acuminate, 15–20 cm by 6–8 cm; ovary cells containing more than 2 ovules; peduncle 60–70 cm or longer; spadix cylindric, obtuse, white and afterwards becoming greenish, 3.5–10 cm; stalk of the spadix 2.5–4 cm; stigma flat; berry white, ca. 2 mm; seeds ca. 1.5 cm.

Distribution: From the Philippines, North Celebes and the Moluccas (Backer and Bakhuizen, 1965).

Habitat: In Mount Watuwila, this species can be found at near the river flows, lowland area, young secondary forest.

Use: In Java cultivated as an ornamental (Backer and Bakhuizen, 1965).



Figure 10. *Spathyphyllum commutatum* Schott.

DISCUSSION

The diversity of *Araceae* in Mount Watuwila complex (170–800 m asl.) are dominated by *Schismatoglottis calyptrata* (Roxb.) Zoll. & Moritz. In Silui Mountain (SE of Sulawesi), *S. calyptrata* also becomes dominant plant

(Nugroho and Santika, 2008). It usually grows along the river flow or the wall of the river and waterfall. Mount Watuwila have many river flow such as Akikima river, Uwitalambéh and Iwoimohalo river. *Schismatoglottis plurivenia* can be distinguished from the closely allied *S. calyptrata* by the more robust proportions, the numerous abaxially prominent primary, interprimary and subsidiary veins and by the pleioanthic shoots (Hay and Yuzammi, 2000).

This exploration also found the endemic species in SE of Sulawesi that is *Alocasia suhirmaniana* Yuzammi & A. Hay. In Mount Watuwila complex, this species can be found at near the river Iwoimohalo at about 300–500 m alt.

Aglaonema simplex Bl. relative can be found easily. In Ulisimbone forest, SE of Sulawesi, this species becomes dominant in the undergrowth of the forest (Nugroho and Santika, 2008). According to Backer and Bakhuizen (1965), *A. simplex* only found in lowland forest, no more than 200 m above sea level, but according to Yuzammi (2000), this species can be found from 90–1200 m alt. Based on exploration in Mount Wilis (East of Java), *A. simplex* found at 1200 m alt. (Erlinawati, 2010). In Mount Watuwila complex, this species can be found at 170–500 m alt.

The growth of *Araceae* is dependent on abundant available water and prevailing atmospheric humidity. They are not well adapted structurally and physiologically for growth in arid or cold conditions. Hence here, they do not occur in the most extreme environments (Mayo *et al.*, 1997).

Colocasia esculenta (L.) Schott maybe cultivated. *C. esculenta* and *Alocasia macrorrhizos* are used for food in there. *Aglaonema simplex*, *Spathyphyllum commutatum*, *Alocasia suhirmaniana* as ornamental plants and *Homalomena* spp as medicinal plants needs further investigation.

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REFERENCES

- Backer CA and Bakhuizen RC, 1965. *Flora of Java*. Vol. III. The Rijksherbarium, Leyden: 109, 116.
- Bown D, 1988. *Aroids*. Plants of the Arum Family. Timber Press. Portland. Oregon. 256.
- Boyce PC and Wong SY, 2008. Studies on Homalomeneae (Araceae) of Borneo I. Four new species and preliminary thoughts on informal species groups in Sarawak. *The Gardens' Bulletin Singapore*. 60 (1): 1–30.
- Cannon CH, Summers M, Harting JR and Kessler PJA, 2007. Developing conservation priorities based on forest type, condition and threats in a poorly known ecoregion: Sulawesi, Indonesia. *Biotropica* 39 (6).
- Erlinawati I, 2010. Keragaman Araceae di Sekitar Gunung Wilis, Jawa Timur. Berkala Penelitian Hayati. Edisi Khusus. No. 4A: 13–7.
- Forman L and Bridson D, 1989. *The Herbarium Handbook*. Royal Botanic Garden Kew.
- Hay A, 1996. *A New Bornean Species of Colocasia Schott (Araceae: Colocasieae), With a Synopsis of the Genus in Malesia and Australia*. Sandakan. No. 7. Forest Research Centre, Forestry Department, Sabah. Malaysia. 31–48.
- Hay A, 1998. The Genus *Alocasia* (Araceae-Colocasieae) in West Malesia and Sulawesi. *Garden's Bulletin Singapore*; 50. Singapore Botanic Garden. Singapore. 221–34.
- Hay A and Yuzammi, 2000. Schismatoglottideae (Araceae) in Malesia I – *Schismatoglottis*. *Telopea*. 9(1): 106–117, 139–140.
- Heyne K, 1987. *Tumbuhan Berguna Indonesia*. Jilid I. Badan Litbang Kehutanan. Jakarta. 491–503.
- Anonim, 2001. http://www.gl.rhul.ac.uk/searg/current_research/plate_tectonics/sea_2001_svga.mov
- Mayo JS, Bogner J, and Boyce PC, 1997. *The Genera of Araceae*. London: The Trustees, Royal Botanic Garden, Kew.
- Nugroho BTA and Santika Y, 2008. Exploration and Inventory of Araceae Genera in Silui Mountain and Uluisimbone Forest, Kolaka Regency, South East Sulawesi. *Biodiversitas*. 9(4): 288–91.
- Rugayah, Widjaja EA, and Praptiwi, 2005. *Pedoman Pengumpulan Data Keanekaragaman Flora*. Bogor: Pusat Penelitian Biologi LIPI.
- Whitten AJ, Mustafa M and Henderson GS, 1987. *Ekologi Sulawesi*. Gadjah Mada University Press, Yogyakarta.
- Yuzammi, 2000. A Taxonomic Revision of the Terrestrial and Aquatic Aroids (Araceae) in Java [thesis]. New South Wales: Univ. of New South Wales.

Reviewer: **Tim Reviewer**