

Full Length Research Paper

The Genus *Licuala* Wurmb (Arecaceae) in Kalimantan Indonesian

Jati Batoro ^{1*}, Edi Guhardja ², Yohanis Palar Moga ³

¹Departement of Biology, Faculty of Mathematics and Natural Sciences, University of Brawijaya, Malang 65145

²Departement of Biology, Faculty of Mathematics and Natural Sciences, Bogor Agricultural Institute, Bogor 16680

³Herbarium Bogoriense, Botany Division, Research Centre for Biology, LIPI, Bogor, Indonesia

Abstract

Revision of Genus *Licuala* from Kalimantan, Indonesian was conducted based on morphological observations of 186 specimens in the Herbarium Bogoriensis Bogor (BO) and Herbarium Wanariset East Kalimantan. The present study shows that there are fifteen species that can be recognized, consisting of one new species namely *Licuala beruensis*, three known varieties, *Licuala petiolulata* var. *kanepajensis*, *Licuala petiolulata* var. *petiolulata*, *Licuala matanensis* var. *paucisepta* and thirteen known species namely: *Licuala arbuscula*, *Licuala bintulensis*, *Licuala borneensis*, *Licuala halleriana*, *Licuala lanata*, *Licuala mattanensis*, *Licuala olivera*, *Licuala paludosa*, *Licuala reptans*, *Licuala spinosa*, *Licuala triphylla* and *Licuala valida*.

Keywords: Revision, Genus *Licuala*, Kalimantan.

INTRODUCTION

Licuala is one of a small genus belonging to the subfamily Coryphoideae and family Arecaceae (Palmae). The genus consists of about 130 species distributed from Vanuatu, the Solomon Islands and Queensland, westward through the Islands of Indonesia, New Guinea, Borneo (Kalimantan, Sarawak), the Philippines, the Malay Peninsula, Thailand, Cambodia, Laos, Vietnam, South China, Myanmar, Bangladesh, North-East India and Andaman Islands (Uhl and Dranfield, 1987). Kalimantan (Indonesian) consists of four Provinces involved: West Kalimantan, Central Kalimantan, South Kalimantan and East Kalimantan. The Malay Peninsula, Borneo and New Guinea are the regions of richness in genus *Licuala*.

Vernacular names of genus *Licuala* are called as palas (Indonesian, Malay Peninsula), silad (Sabah), gerenis (Sarawak), balatbad (Philippines), salu (Myanmar), kapho (Thailand) and luji (Vietnam) (Whitmore, 1973; Uhl and Dranfield, 1987; Saw 1997). Some species of this genus were used as ornaments,

decoration and vegetable by local people (Beccari, 1931; Whitmore, 1973; Saw, 1997).

Licuala presents serious problems to the monographer because it displays great morphological variation, and in some regions is astonishingly varied. It is considered essential to study the Kalimantan genus *Licuala*, especially if it has taxonomical problems to be solved.

MATERIALS AND METHODS

The study is based on the examination of the herbarium material from Herbarium Bogoriense (BO), fresh material from Bogor Botanical Garden and the Herbarium material from Wanariset, forest Wanariset East Kalimantan. From the collection studied by the author, details and descriptions from dried material, except for floral and fruit sizes, which were based on dehydrated (boiled in water) material. Terminologies follows Lawrence (1964), Stearn (1966), Radford (1986), Tomlinson (1961), Vogel (1987), Uhl and Dransfield (and Keng (1989). Methods follow by Rifai (1978), Radford (1986) and Vogel (1987).

*Corresponding Author Email: jati_batoro@yahoo.co.id

RESULTS AND DISCUSSION

Key to the Kalimantan species of *Licuala*

1. a. Middle segment divided into two lobes.....2
- b. Middle segment entire.....3
2. a. Plant solitary, acaulescent, stem very short, less than 10 cm, rachilla fracti-flexuous (zig-zag).....11. *L. reptans*
- b. Plant clustered, shrub, stem more 2 m long, rachilla straight.....9. *L. paludosa*
3. a. Inflorescence much longer than leaf.....4
- b. Inflorescence much longer than leaf.....6
4. a. Spines along approximately whole length of petiole, spines more than 1 cm long near base.....12. *L. spinosa*
- b. Spines a long approximately about half of petiole, spines less than 5 mm long near base.....5
5. a. Middle segment petiolulate 8-18 cm long, fruit globose-obovate 10-20 mm diam, rachilla 30 cm long.....10. *L. petiolulata*
- b. Middle segment sessile, fruit obovate-elliptic 10-12 mm diam, rachilla 8 cm long.....1. *L. arbuscula*
6. a. Middle segment 3-7 costulate.....7
- b. Middle segment 13-18 costulate.....11
7. a. Leaf segments 7, peduncular bract absent.....5. *L. halleriana*
- b. Leaf segments 9-25, peduncular bract present.....8
8. a. Clustering palm, rachilla branched.....3. *L. bintulensis*
- b. Solitary palm, rachilla solitary.....9
9. a. Flower with pedicel 2-3 mm long, style 2-3 mm long.....2. *L. beruensis*
- b. Flower sessile, style 1 mm long.....10
10. a. Fruits clavate, apex acute.....7. *L. mattanensis* var. *paucisepta*
- b. Fruit obovate, apex rounded.....7. *L. spicata*
11. a. Flower in group of 1-3, frond peltate orbicular.....12
- b. Flower strictly solitary, frond peltate semi-orbicular.....13
12. a. Petiole up to 2 m long, rachilla covered by puberulous hairs.....8. *L. olivifera*
- b. Petiole up to 4 m long, rachilla covered by ferruginous hairs.....15. *L. valida*
13. a. Ovary hairy, middle segment petiolulate.....14. *L. triphylla*
- b. Ovary glabrous, middle segment sessile.....14
14. a. Peduncle hairy and calyx covered by ferruginous and pubescent hairs.....*L. boornensis*
- b. Peduncle glabrous by wooly hairs.....6. *L. lanata*

Species description

1. *Licuala arbuscula* Becc.

Malesia 3 (1886):79; Becc., Ann. Bot. Gard. Calcutta 8 (1933): 195-196. Type: P. B. No. 2432 (holo:Fl n.v.),

photocopy. Borneo, Serawak, Mt.Poe.

Solitary small and slender, hermaphrodite; stem to 1 m tall, 1.5-0.5 cm wide, internodus, 0.4-0.5 cm long dark brown. Leaves 13-17 in crown, sheath disintegrating into fine reticulate fibres; ligula triangular apex acute; petiole, 50-102 cm long, 2-5 mm wide near base, 2-3 mm base, 2-3 mm towards apex drying reddish brown; spines irregularly spaced and sized patent to reflexed, subulate no more than 6 mm long, approximately lower third of petiole; frond peltate orbicular 30-90 cm wide; segments 15-25 all about same size, linear, narrow; lateral segment 1-3 costulate, 22-40 by 1-3.2 cm; middle segment larger than rest, 3 costulate, 40-45 by 3 cm. Inflorescence erect to patent larger than leaves, extending beyond crown, 54-105 cm long, branched to second order with 3-5 first order branches; peduncle 32-45 cm long, 3-4 mm scross basally; prophyll tubular, 15-22 by 0.5-0.7; peduncular bracts 2, rachis somewhat rigid; rachis bract similar to prophyll, 6-10 cm by 3-5 mm; rachilla 3-9 cm long; 1-1.5 mm wide; forked; densely covered with puberulous and ferruginous hairs, reddish brown. Flowers apparently spirally arranged, sessile, bract, maturing about simultaneously, cincini 4-6 per cm; bud cylindrical with rounded apex and flate base, 3-4 by 2-3 mm, calyx urceolate to cyathiform, thick, splitting into 3 lobes with truncate apex, glabrous, tubular in lowermost, with 3 thick triangular lobes, apex acute acuminate; staminal tube epipetalous at mouth of corolla tube, to 1 mm high, with 6 well defined triangular teeth; filaments subulate 4-5 mm long; anthers, 0.6-0.8 mm by 0.4-0.5 mm, reniform, yellow brown; ovary trigonous, glabrous, 1.5 mm long apex truncate with 3 free carpels joined by common style 2 mm long fliform. Fruit green obovate-ellipsoid, smooth, glabrous, 9-12 mm by 5-7 mm; seed obovate-ellipsoid, 7-9 by 4-6 mm across.

Field notes. Leaves, segments all about the same size, by the very slender, straight, long; flower glabrous. **Distribution.** Borneo. East Kalimantan, Central Kalimantan, West Kalimantan and Serawak. Habitat and ecology. Forest a long river, low ridge of sandy loam soil; 20 m altitude.

Note. Beccari (1933) noted that *L. glabra* with *L. arbuscula* almost resemble, but differ from that from the fruiting perianth having the segments spreading under fruit. This species has the leaf blade narrow, almost equal segments, rachilla puberulous, flower cyathiform glabrous, calyx truncate and pale fruits green, obovate.

Specimen examined. Borneo. East Kalimantan, Balikpapan, Mentawir area near G. Mentawir, fl, fr, 28-2-1955, Kostermans 10136 (BO); Tanjung Bank near mouth of Mahakam river, fr, fr, 19-5-1952, Kosterman 7017 (BO, K, L, A); Balikpapan PT. ICTI Concession, Kenangan, st, 12-8-1972, Dransfield 4388 (BO); Long Iram, subdistrict, Maruwai, Nort East Lampunut to Black Pari, Bukit Ateng, fr, 14-3-1999, Kesler et al. 2570 (BO), Central Kalimantan, Kota Waringin Timur, Km. 94 from Sungai (plot camp), S. Mentaya, fr, 12-5-1995, Argent et al. 93142 (BO), Janglop Meyer s.n.; fl, fr, 1893, Jaheri

215 (BO); West Kalimantan, Ketapang, Gunung Palung National Park, Cebong Panti Research site GP 17, st, 18-3-1997, Laman et al. 887 (BO).

2. *Licuala beruensis* Batoro sp. nov (Figure 1).

Palmae acaulescens, solitaria, segmentis folii paucioribus (usqne ad 23), inflorescentia in 1 ordinem ramiconti 2-3 inflorescentis partialibus, rachilla pilis brevibus disperses 7-8 longa, 1-1.2 mm diametro. Pedicello ad 1.5-2 mm longa floribus solitaris spiraliter dispositis, calyx urceolate dense lanuginosa pilis simplicibus, ovario glabro, stylo filiformae 2-2.3 mm longa. Typus: Kohyama et al. K 10597 (holotype, BO).

Small, solitary, acaulescent, 1 m hight, leaves in crown; petiole slender, 120 cm long, 4-6 mm wide near base, 4 mm wide towards apex, reddish brown when dried; spines subulate, slender, approximately irregularly spaced and size, patent, reflexed, along lower half of petiole, no more than 4 mm long; frond peltate orbicular, 70-80 cm wide; segments linear, 23; lateral margin straight; lateral segment 1-2 costulate, 44-45 by 3-3.1 cm; middle segment about equal size or much large than lateral 5 costulatae, 46 by 3.7 cm. Inflorescence patent shorter than leaves, extending beyond crown, 40-45 cm long, branched to first order with 2-3.17 cm by 2.2 mm; prophyll, 12 cm cm by 8 mm, rachis brach tubular, 6.5-9.5 cm by 4-6 mm, flattened, mouth tightly sheathing, splitting apical into 1-3, apex acute, oblique; rachilla, 7-18 cm by 1-1.2 mm covered with scattered very densely less than 5 mm long, golden brown simple hairs. Flower solitary, pedicel 1.5-2 mm long, mature about simultaneous, apparently spirally arranged 6.5 mm by 2-3 mm some time near whorled each subtended by a narrowly triangular bract, 2-1 mm, 3-6 per cm; calyx cyathiform, 3.5-3 mm, densely covered with 0.3-0.4 mm long, golden brown hairs, base acute, apex truncate with 3 short acute lobes; corolla, 5 by 2.5 mm thick, glabrous with 3 short acute lobes, lobes 1.5 by 2 mm; staminal tube epipetalous at the mouth of the corolla tube, to 1 mm high with defined triangular teeth; filament 0.5 mm long, brown; anthers 0.4 by 0.4 mm, yellow brown; ovary trigonous, glabrous, 1.2 by 1 mm with free carpels joined by a common style 2.3 mm long, subulate, yellow brown. Fruit are unknown.

Field notes. Frond peltate orbicular pedicle 2 mm long, flowers yellowish brown 6.5 by 3 mm, style 2.3 mm long, filiform. Distribution. Borneo, West Kalimantan and Serawak. Habitat and ecology. Dipterocarp forest 50-100 m altitude.

Notes. *L. beruensis* is closely related to *L. spicata* and *L. mattanensis*, but differs from the latter by its long pedicel with calyx and rachilla very densely simple brown hairs.

Specimen examined. Borneo. West Kalimantan, Serimbu, Gunung Berui, fl, 1-11-1995, Kohyama, Tukirin, Yamada 10597 (holotype, BO).

3. *Licuala bintulensis* Becc.

Malesia 3 (1886): 75-76; Becc., Ann. Roy. Bot. Gard. Calcutta 8 (1933): 165-166. Type: P. B. No. 4032

(holotype: Fl. n.v.) photocopy fl. Borneo, Serawak, Bintulu.

Small clustering, shoots to 1.5 mm more tall, to 15 cm wide. Leaves 8-10 in crown; petiole 70-110 cm long, 4.5-7 mm wide base, 2.5-5 mm wide at apex, drying pale reddish brown; spines irregular in shape and size, along lower half of petiola, narrowly triangular and reflexed drying dark brown to black, no more than 7 mm long; frond peltate orbicular, 60-85 cm wide; segments 19-25 all about same size, linear, narrow; lateral segment 2-3 costulate, 33-45 by 1.5-3.5 cm; middle segment 3 costulate, 35-47 by 1.5-2 cm, longer than rest. Inflorescence erect to patent shorter than leaves, extending beyond crown, 45-100 cm long, branched to second order with, bearing 4-5 first order branches; peduncle, 50-78 cm long, 4-8 mm across basally; prophyll tubuler, 13, 13-15 cm long, 0.8-1 cm wide, coriaceous, flattened split mouth, densely covered with caducous ferruginous; peduncular bract present 2; rachis some what rigid, slender, rachis bract similar to prophyll 4-9 by 3-6 cm, rachis bract mouth splitting apical with a few pointed lobe, some time oblique; rachilla, 6-10 cm long, 1-1.5 cm wide, covered with scattered puberulous, simple brown hairs, 0.2-0.3 mm long. Flower solitary, apparently spirally arranged sessile, each subtended by a triangular bract 0.4 by 0.3 mm, apex rounded, maturing about simultaneously, cincini, 4-5 per cm; bud, 4-5 by 2-3 mm, ovate with conical acute, flat base; calyx urceolate to cyathiform, 3-3.5 by 2-2.5 mm, striate when dry, apex neatly lobed to about less half of the calyx, covered scattered densely, 0.2-0.3 mm long hairs brown; corolla 3 by 2.5 mm, thick, covered puberulous white hairs, tubular in lowermost, with 3 thick triangular lobe, apex acuminate; staminal of corolla tube, to 0.5 mm high; filament subulate 0.3-0.4 mm long; anthers 1 by 0.3 mm narrowly oblong, yellow; ovary glabrous, trigonous, apex rounded truncate, 1-2 by 1-1.5 mm with 3 carpels joined by common style 1.5 mm long, filiform. Fruit not know.

Field notes. Small clustering palm to 1.5 with short trunk, flower ovate, acute and corolla white. Distribution. Borneo, Serawak, West Kalimantan and Central Kalimantan. Habitat and ecology. Growing on the dry land, mixed dipterocarp forest, low land, ridge forest with many familia Myrtaceae, Sapotaceae and few genus *Agathis*, 20-600 m altitude.

Notes. Beccari (1933) described the flower with calyx cyathiform hairy, contracted a little above the base; inflorescence slender and ovary glabrous. It can be distinguished from linear segments and the rachilla calyx hairy; anthers about 1 mm long.

Specimens examined. Borneo, Central Kalimantan: Sampit region, Kuala Panjalman North of Sampit, fl, 16-3-1948, Kosterman 4740 (BO); Muara Joloi, fl, 25-4-1992, Awmack 352 (BO); West Kalimantan, Pontianak, Gunung Palung, fl, 10-6-1986, van Balgooy and van Setten 5384 (BO, L).

4. *Licuala borneensis* Becc.

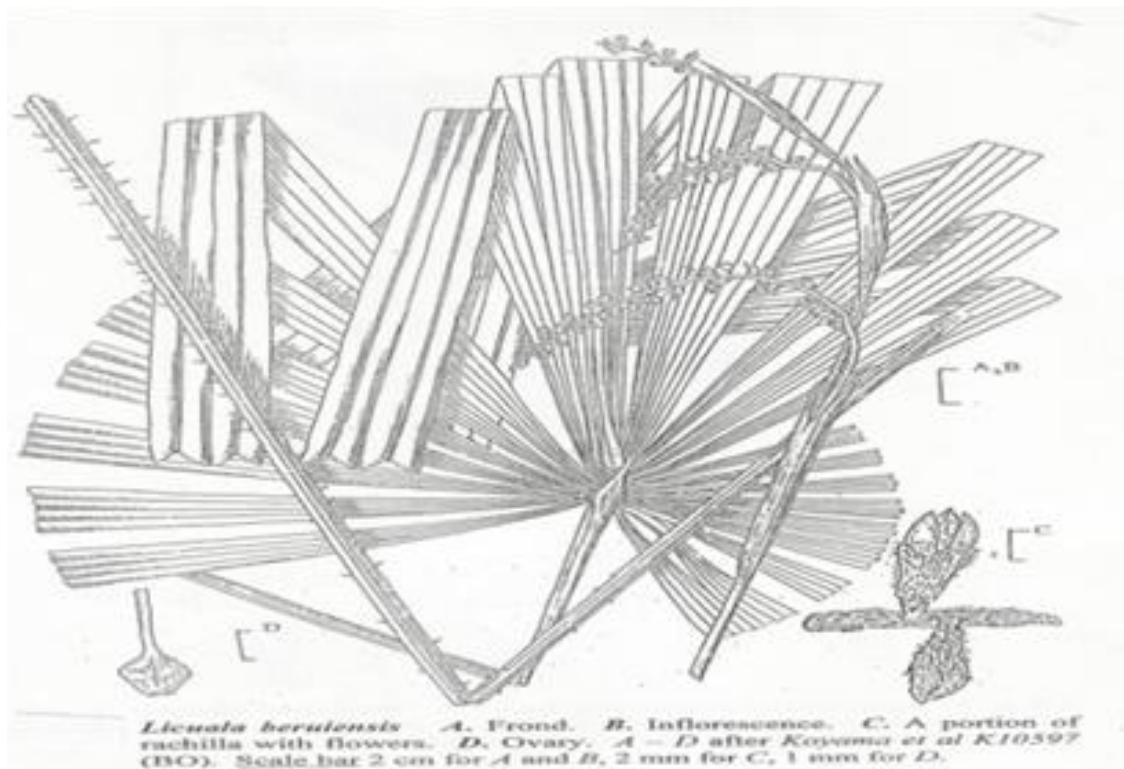


Figure 1. *Licuala beruensis* Batoro spec. nov.

Malesia 3 (1886): 85, 86; Ann, Roy. Gard. Calcutta 8 (1933): 209-210; Type: P.B. No. 4035 (holotype: Fl n.v.) photocopy. Borneo, Serawak, Bintulu.

Solitary, erect, stem to 1 m high, 2 cm diam. Leaves 8-10 in crown, sheath 4.2-5 mm wide reddish brown, petiole 65-68 cm long 4 mm near base, 2-2.3 mm wide toward apex, drying reddish brown; spines irregular in shape and size, along lower half of petiole, narrowly triangular and reflexed drying dark brown to black, no more than 3 mm long; frond peltate semiorbicircular 15-20 wide, segments, lateral, margin straight; lateral segments 5-7 costulate, 15-20 by 5-7 cm; triangular; middle segment 17-19 triangular slightly large than rest 24 by 10 cm. Inflorescence erect to patent longer than leaves 69-72 cm, comprising a single partial, peduncle 57 cm by 2-3 mm terete; rachis somewhat rigid; rachis bract absent; rachilla 12 cm long, 1.8-2.2 cm wide covered with scattered densely simple white hairs; bracteole triangular 1-1.5 by 1 mm. Flower solitary, sessile spirally arranged, maturing about simultaneously, 8-9 per cm; calyx tubular to cyathiform 2.2 by 2 mm, base thickened, apex neatly trilobed acuminate densely covered simple brown hairs; corolla 2.5 by 3 mm, tubular in lowermost, thick, triangular lobes, apex acute to acuminate. Fruit glabrous, globose to obovate ripening 0.8-0.9 by 7 mm, apex rounded, base acute.

Field notes. Frond peltate semiorbicircular, segments 5, middle segment triangular slightly large than rest. Distribution. Endemic to Borneo it is found in

Central Kalimantan and Serawak. Habitat and ecology. Ridge top lowland mixed dipterocarp forest in shade at 50 m altitude. Note. Apparently this species know as having very simple rachilla.

Specimens examined. Borneo, Central kalimantan, Kota Waringin Timur near Pondok km. 92 from Sangai, S. Mentaya, fr, 7-2-1994, Argent and Wilkie 9416 (Wanariset).

5. *Licuala halleriana* Becc.

Webbia 5 (1621): 51; Becc., Ann. Bot. Roy. Gard. Calcutta 8 (1933): 218-219. Type: Hallier H. 3374 (holotype: BO) Borneo, West Kalimantan, Amai Ambit.

Solitary small, radix terete 1.7-2.5 mm wide; stem terete like fingerman 20 cm long, 1-1.6 cm wide; internodus 3-4 cm long, white dark brown. Leaves 14-15 in crown, sheath disintegrating into coarse reticulate fibres; petiole slender, 27 cm long, 2.5-3.2 mm near base, 1.2 mm wide at apex drying reddish brown; spines irregularly spaced and sized, sparsely, small no more than 3 mm long, along lower half of petiole; frond peltate orbicular 40-50 cm wide; segments 7 unqual; lateral margin straight, lateral segments 1-3 costulate, 18-21 by 2.5-3 cm linear broadest at about their middle, middle segment much longer than lateral but more smaller 1-2 costulate, 20-25 by 1-2 cm. Inflorescence very small, patent extending beyond crown 1.5 cm long, shorter than leaves, branched to only 1 first order branches; peduncle 9 cm by 2.5 mm, subterete; prophyll tubular, 8 mm by 3.2 mm, flattened splitting on one side, acute,

mouth oblique, peduncle bract and rachis bract absent; rachilla only one up to 8 cm long, 1-5 mm wide, tapers a little at apex covered ferruginous hairs. Flower solitary sessile, spirally arranged maturing almost simultaneously, 6-8 per cm, mature bud cylindrical ovate apex acute, 2-3 by 1.5-2 mm; calyx vase shape, membranous toward apex with 3 acute lobes, base flattened, rather, wrinkled, lobed to about half of calyx length; corolla, 1.5 by 1 mm, thick tubular in lowermost with 3 thick triangular lobes, apex acute; staminal tube epipetalous at the mouth of the corolla tube with well defined triangular teeth; anthers relatively large, oblong-elliptical, equal rounded at both end; ovary relatively large, trigonous with free carpels joined by a common style. Fruit not know.

Field notes. Small, stem to 1-1.6 cm diameter, at thick at a man's little finger, inflorescence unbranched. **Distribution.** Borneo, West Kalimantan. **Habitat and ecology.** Forest dipterocarp. **Note.** This species typically has creeping stem leaflets narrowing at both end, at about their middle, inflorescence shorter than petiole, rachilla short and peduncular bract absent.

Specimens examined. Borneo, West Kalimantan, Amai Ambit, fl, 1893-1894, Hallier 3374 (BO).

6. *Licuala lanata* Dransfield

Botanical Journal of the Linnean Society 81 (1980): 27-29: Type: Chai, S, 39527 (holotype: K; isotypes: BH, Kep, L. SAN, SAR) photocopy habitus, Borneo, Serawak.

Solitary, acaulescent. Leaves 12 in crown; petiole 40-80 cm long; 6 mm wide near base 4 mm wide toward apex, drying reddish brown, scattered brown scales present along petiole; spines irregularly spaced and size, triangular patent to reflexed 1-2 mm long, sometime apex branched along half or more petiole; frond 40-60 cm wide, semiobicular; segments 7 usually 5 only lateral margin straight; lateral segments 4-6 costulate, 15-35 by 4-8 cm; middle segment much longer than laterals 16 costulate, 38 by 20 cm, triangular, the upper margin gently curved. Inflorescence reflexed, shorter than leaves, 44 cm long, extending beyond crown; prophyll tubular 18 cm by 8.4 mm, flattened with triangular apical lobes, oblique; peduncle, 36 cm by 23 mm densely wolly; rachilla 5, inserted close together, digitally displayed, the longest at anthesis to 5-6.5 by 1-5 mm covered very densely white wholly simple 0.6 mm long hairs. Flower solitary apparently spirally arranged, each subtended by narrowly triangular bract, maturing about simultaneously 5-7 per cm; bud 5.5 by 3.5 mm, ellipsoid, apex rounded; calyx cupular, toothed, densely covered with 0.6 mm long brown phinx sometime transculens hairs, 3.5 by 3 mm; corolla 4 by 3 mm tubular in lowermost with triangular lobes, covered puberulous brown hairs or hairy near tips only, on the inner surface marked with impressions of the stamens; staminal tube epipetalous at the mouth of the corolla tube to 0.5 mm hight with defined triangular teeth; anthers, 0.7-0.8 by 0.4-0.5 mm ellipsoid, yellow, filament

subulate, 0.4-0.5 mm; ovary glabrous, rather wrinkled trigonous 0.5 mm long with 3 free carpels joined by a common style 1.2 mm by 0.2 mm, margin edge, filiform fruit not know.

Field notes. Frond semiobicular, 5-7 segments, rachilla 5 inserted close together digitally displayed, calyx cupular toothed carpels densely shaggy hairs. **Distribution.** Borneo. Serawak, Central Kalimantan. **Habitat and ecology.** Primary forest. **Note.** This species is closely related to the two Malesian species *L. lanuginosa* and *L. kingiana*; all these taxa have densely hairy rachilla and flower, but can easily separated that of *L. lanata* is digitally branched with rarely fewer than 3 rachilla.

Specimens examixed. Borneo: Central Kalimantan, Bukit Raya and Upper Katingan (Mendawai) river area, Upper Katingan river, 50-100 km, WNM of Tumbang Samba, Tumbang Merak, fl, 20-11-1982. Mogea J.P.3460 (BO).

7. *Licuala mattanensis* var. *paucisecta* Becc.

Malesia 3 (1886). Becc., Ann. Roy. Bot. Gard. Calcutta. 8 (1933): 216-218. Type: Ridley, No. 12400 (holotype: K. n.v.) photocopy. Borneo, Kutching, Jambusan.

Solitary, slender, stem up to 1 m long, 1.6 cm wide; internodus 0.5 cm long, terete, dark-brown. Leaves 13 in crown, sheath disintegrating into coarse reticulate fibres; petiola slender, 60 cm long, 3 mm wide near base, 2.2-2.5 mm wide toward apex, reddish brown; hastula triangular, spines narrowly small triangular and acutely reflexed less than 3 mm long, along lower third of petiola; frond peltate orbicular, 40-50 cm wide, segmen 9 all about the same size; lateral segmen 3 costulate, 20-21 by 2.1-3 cm, their widest part being a few centimeters below the apex; central segment 3 costulate, 22 by 3 cm. Inflorescence erect to patent shorter than leaves, 21 cm long slender extending beyond crown, bearing mainly 2 first order branches; peduncle 17 cm long, subterete across basally; prophyll tubular, 9 by 0.5 cm coriaceous, flattened, neatly split mouth or pointed lobes covered with caducous ferruginous hairs; peduncle bract, 8 by 0.5 cm, apex acute or oblique, rachis bract similar to prophyll, 7 by 0.3; rachis rigid; rachilla 5-10 cm by 1-1.5 mm covered densely simple brown hairs. Flower solitary, pedicel 0.4-0.8 mm long, spirally arranged to opposite each subtended by narrowly triangular bract, maturing about simultaneously, cincini, 6-7 per cm; bud 5 by 3 mm ovoid, apex acute; calyx urceolate to cyathiform, 3.2 by 2 mm, base sparsely short hairy golden brown, thickened membranous apex neatly trilobed less half of calyx length; corolla tubular in lowermost with 3 thick triangular lobes; 2 by 3 mm, lobes acute; stamen tube epipetalous at the mouth of the corolla tube with 6 triangular teeth; filament subulate, 0.5 mm long; anthers ovate, 0.8 by 0.4 mm yellow; ovary trigonous, 1.5 by 1 mm, apex truncate, glabrous with 3 free carpels joined by common style, 1 mm long. Fruit not know.

Field notes. Solitary, stem to 1 m high, 1.5 cm wide, segments 9 all about some size. Distribution. Borneo. Central Kalimantan and Serawak. Habitat and ecology. Upper mountain forest, 1300 m altitude. Note. Same to *L. mattanensis* but differs its segment, Beccari (1933) described this specimen variety.

Specimen examined. Borneo, Central Kalimantan, Bukit Raya and Upper Katingan (Mendawai) River area, fl, 2-12-1982, Mogea J.P. 3837 (BO, L.).

8. *Licuala olivifera* Becc.

Malesiana 3 (1886): 78-79; Becc. Ann. Roy. Bot. Gard. Calcutta 8 (1933): 156-1957. Type: PB. No. 4034 (holo: Fl n.v.) Borneo, Serawak, Kayan, Bintulu river.

Clustering with many subequal basal shoots, hermaphrodite; stem to 1 m or more tall to 6 cm wide with internodes to 2 cm. Leaves 9-10 in crown, sheath disintegrating into coarse reticulate fibres; petiole, 1.2-2 mm long, 0.8-1.2 cm wide near base, 6-8 mm wide towards apex, drying reddish brown; spines along more half of petiole, narrowly triangular and patent to reflexed, drying reddish brown to black, largest near base, apex sometime branched no more than 5 mm long; frond peltate orbicular, 90-130 mm wide; segments 9-11 large; lateral segments 4-7 costulate, 60-80 by 8-13 cm; middle segment much large than lateral 13-18 costulate, 65-90 cm long, 25-40 cm wide, broad at apex. Inflorescence erect to patent, robust shorter than leaves 50-90 cm long, with second order bearing 3-5 first order branches, extending beyond crown; peduncle subterete, 16-30 cm long, 6-15 mm wide across basally; prophyll present; peduncular bract, 15-18 by 1-1.5 cm, tubular, coriaceous, flattened, neatly split mouth decouvered with caducous ferruginous hairs; rachis some what rigid, robust; rachis bract, 5-10 by 0.8-2.2 cm, tubular, flattened slightly, mouth splitting neatly in few lobes; first order branches bearing 2-15 patent secondary branches close to or slightly away from mouth of rachis bract; rachilla 15-30 cm long, 1-3 mm wide, unornamented, wiry, puberulous, covered with scattered, simple gold brown hairs. Flowers sessile, solitary to in group of 2, apparently spirally aranged, each subtended by a narrowly triangular bract; 5-7 per cm, maturing almost simultaneously; mature bud cylindrical ovate, 3-3.3 by 2-2.8 mm, apex acute; calyx cyathiform, membranous, 2 by 2.2 mm covered with scattered wolly golden brown hairs, lobed to less half of calyx lenght, apex neatly trilobed, acuminate base flattened-oblique; corolla tubular in lowermost 1 mm, with 3 thick triangular lobes to 3 mm by 2 mm covered densely simple brown hairs, staminal tube epipetalous at the mouth of the corolla tube to 0.5 mm hight with defined triangular teeth; filament subulate 0.3-0.4 mm long; anthers, 0.4-0.5 mm by 0.3 mm yellow brown; ovary glabrous trigonous, 1.3 mm by 1.1 mm with 3 free carpels joined by a common style 1 mm by 0.1 mm. Fruit olive shape or obovate, globose, smooth, dark brown, wrinkled, 1 cm by 1 cm, rounded at apex; seed globose black brown 8 mm by 8 mm.

Field notes. Stem to 1 cm hight, segmens leaves 9-

11 large and ovary glabrous. Distribution. Borneo, East Kalimantan and Serawak. Habitat and ecology. Lowland dipterocarp forest, low ridge, sandy soil 30-40 mm altitude. Note. This a very distinctive species, relatively large fruit, a light yellow color also distinguishable large inflorescence, segments, wide and segments 9-11.

Specimens examined. Borneo, East Kalimantan E. Kutei Tanjung, Bangko near M. of Mahakam river, fl, fr, 4-6-1952, Kosterman 7768 (BO, L.); Rothman Camp. S. Mentako, S. Sengata, Kutei Nature Reserve, fl, fr, 14-6-1971, Dransfield 1573 (BO).

9. *Licuala paludosa* Griff.

Mart. Hist. Nat. Palm III (1849): 237; Becc. Malesia 3 (1886): 74; Ridl., Fl. Mal. Pen. 5. (1925): 25; Becc., Ann. Roy. Bot. Gard. Calcutta 8 (1933): 159; Furtado, Gard. Bull. Saw, Straits Settlement 11 (1940); Saw, Sandakan 10 (1997): 50-52. Type: Griffith sn. 1842, Peninsular Malaysia, Malacca, Tanjong Cling (BR) (hololectotype: BR, n.v.). *L. amplifrons* Miq., J. Bot Neerlandoise 1 (1861): 12. Type: Diepenhors 2100, Sumatra, West Sumatra, Tekou (holotype BO; isotype Fl). *L. paniculata* Ridl., J. Royal Asiatic Soc. Straits Branch 41 (1904): 42; Ridl., Mat. Fl. Mal. Pen. 2 (1907): 165; Becc., 5 (1421): 29 and 43; Ridl., FL. Mal. Pen. 5 (1925): 30; Becc., Ann. Roy. Bot. Gard. Calcutta 8 (1933): 161. Type: Ridley s.n. 1892, Peninsular Malaysia, Perak, Hermitage Hill (holotype SING sn).

Clustering, coulescent with many subequal shoots. Stem up to 3 m hight or more and 5-5.6 cm in diam. Leaves 8-12 in crown, sheath desintegrating into coarse reticulate fibres; petiole 1.5-1.75 m long, 1.5-2 cm wide near base, 0.6-0.8 cm wide at apex, drying pale reddish-brown, spines along lower half of petiole, narrowly triangular and patent to reflexed, drying dark brown to black, near base no more than 3 mm long, ligula present; later splitting, triangular; frond peltate orbicular, 120-150 cm wide, segments, 9-25, all about same size; lateral segments 2-5 costulate, 35-70 by 5-12 cm; midle segment slightly large than rest, divided into two lobes, each 6-8 costulate, 40-75 by 10-14 cm, joined in basal 8-14 cm. Inflorescence erect to patent, longer than leaves, comprising a partial inflorescence, extending beyond crown, 1.5-2 m long, branched to second order bearing, 1-5 first-order branches; peduncle, 44-80 cm long; 1.5-3.2 cm wide, coriaceous, flattened, neatly split mouth densely covered with caducous ferruginous hairs; peduncular bracts present; rachis some what rigid, rachis bract similar to prophyll, 3-13 cm by 4-19 mm; rachis bract mouth splitting neatly in a few lobes, firs order branches close to or sligly away from mouth of rachis bract bearing 1-6 rather patent secundary branches; rachilla, 18-25 cm long, by 1-2 mm, terete covered with ferruginous brown hairs. Flower solitary to groups 2-3 small, sessile, apparently spirally aranged, cincini 5-9 per cm; bud 2-3.2 by 1.8-2.5 mm; calyx urceolate, 1.8-3.1 by 1.5-2 mm glabrous, striate when dry, apex neatly lobed to about half of calyx, base oblique; corolla, tubular in lowermost, 2-2.5 by 2 mm

thick, covered with puberulous hairs, lobes acuminate, 1.5 by 2 mm; staminal tube, epipetalous at the mouth of the corolla tube, 0.5 mm high; filaments subulate 0.3 mm long; ovary glabrous, trigonous, apex truncate, 1 by 1 mm dark brown, with 3 free carpels joined by a common style 0.8 mm long, yellow, filiform. Fruits globose, glabrous, young fruit green, ripening orange to red, 7-8 by 6-7 mm. Seed globose, 6-7 by 5-6 mm across.

Field notes. Clustering, stem to 6 cm diameter leaves middle divided into two lobes, flower pale white, fruits ripening orange to red, small. **Distribution.** Peninsular Malaysia, Peninsular Thailand, Sumatra and Borneo: East Kalimantan, South Kalimantan. **Habitat and ecology.** *Licuala paludosa* well drained low hill, sandy loam soil, swamp forest, in low Kerangas forest, lowland dipterocarp forest and frequently with near the mouth of the river, at 1-60 m altitude. Note. May be confused with *L. spinosa* from the same area, but the latter differ in its slightly calyx glabrous membranous, flower urceolate to cyathiform.

Specimens examined. Borneo. East Kalimantan, Tarakan, Nunukan, forest garden to bivaque, fr, 10-11-1853, Meijer 1920 (BO); West Kutei, fr, 13-11-1925, Endert 4795 (BO, L.); Balikpapan, Sg. Wain, fl, 9-10-1970, Kosterman 4088 (BO); Km 7 Semoi Road, Denplot ITTO area, fr, 10-9-1992, Ambriansyah and Arifin 588 (Wanariset, L); South Kalimantan, Batulicin, Tanah Bambu, fl, 1-11-1928, van Slooten 2239 (BO, L); Banjarmasin, Martapura, Toelong Rejo, fl. fr, 3-10-1939, Polak 422 (BO).

10. *Licuala petiolulata* var. *petiolulata* Becc.

Malesiana 3 (1886): 77-78; Becc. Ann. Roy. Bot. Gard. Calcutta 8 (1933): 162-164. Type PB No. 3985 (holotype: Fl n.v.) photocopy, Boneo, Serawak, Kuching, Sungai Dingin.

Solitary, acaulescent, up to 3 m tall. Leaves 12 in crown, sheath disintegrating into coarse reticulate fibres; petiole, 1.4-2 m long, 1.8-2.2 mm wide near base, 3.5-6 mm wide at apex, drying reddish brown, adaxial face flattened; hastula triangular, 1 by 0.5 cm; spines along approximately more half of petiole to 5 mm long, narrowly triangular and slightly reflexed to patent, irregular sized; frond peltate orbicular, 1-1.2 m wide; segments 19-29; lateral segment straight 1-3 costulate, 40-70 by 4-6 cm, truncate oblique at apex, upper margins produced into a linear tail-like lobule; middle segment large than rest 3-6 costulate, 50-75 by 5-10 cm, petiolulate 9-18 cm long. Inflorescence patent larger than leaves, 74-250 cm long, branched to second order bearing 4-6 first order branches; peduncle 8-15 mm wide, subterete, prophyll present; peduncular bract 20-24 by 1.5-2 cm, tubular, flattened, curiocious, closely sheathing, densely covered with caducous ferruginous hairs, apex mouth splitting neatly in a few lobes, oblique; rachis somewhat rigid, 1-5 mm wide; rachis branches, 3-10 by 3-9 mm, tubular flattened, mouth splitting neatly in a few lobes, first order branches close to or slightly away from mouth of rachis bract, bearing 1-9 rather

patent secondary bract; rachilla unornamented, 6-2 cm long, 1-4 mm wide, bracteole triangular, 2 by 1 mm rather wiry, puberulous covered with scattered, simple 0.2 mm long, brown hairs. Flowers mostly solitary to in group of 2 arranged, 4-6 per cm, maturing simultaneously each subtended by a narrowly triangular to cyathiform, 2 by 2 mm, base thickened, flattened, apex neatly trilobed, acuminate, lobed to about less or half of calyx length, covered with scattered 0.2-0.3 mm long brown hairs; corolla 3 by 3 mm, tubular in lowermost with thick triangular lobes, apex acuminate covered densely brown hairs; staminal tube epipetalous at the mouth of the corolla tube to 0.5 high; filament subulate 0.6 mm long; anthers 0.5 mm long, yellow. Ovary trigonous, 1 by 1 mm glabrous with 3 free carpels joined by common style 1-1.5 mm long. Fruit globose, ripening, 2 by 2 cm; seed 1.4-1.5 cm in diameter, globose.

Field notes. Middle segment, petiolulate, flower hairy. **Distribution.** Borneo; East Kalimantan, West Kalimantan and Serawak. **Habitat and ecology.** Primary forest; low and rain forest and dipterocarp forest; forest with or dominated by *Lithocarpus*, *Castanopsis*, *Quercus*, *Gynystylus*, *Schima*; 100-600 m altitude. Note. This species is distinguishable by its leaves, having the median segment petiolulate up to 16 cm in length, fruit globose ovoid relatively large 2 by 2 cm, pericarp, fleshy, neatly 3 mm, thick in the dry fruit.

Specimens examined. Borneo. East Kalimantan, Gunung Kongkat to Tuun Alut Salah, fl, 23-1-1981, Kato and Wiriadinata 4766 (BO); Long Iram, subdistrict Maruwai, Nort East Lampanut to black Pari, Bukit Ateng, fr, 9-3-1999, Kessler et al. 2474 (Wanariset, BO); Bukit Ateng, fr, 9-3-1999, Kessler et al. 2478 (Wanariset, BO); Tabang, Gunung Mendam, st. 5-7-1979, Mogea et al. 1556 (BO, K); at foot of Gunung Mendam, North of Tabang, st, 16-1-1979, Murata et al. 2401 (BO); Puyungan, Kayan Mentarang, reserve, Gong Bahou River ca. 2-3 km from confluence with Bahou river, 4-7-1992 Donald and Ismail 3517 (BO); Kalimantan Bloeoen, fl, fr, 1896-1997, Jaheri 1436 (BO); West Kalimantan, Pontianak, Kp. Anjongan, fl, fr, 5-4-1931, Mondi 249 (BO, L); Pontianak, Kp. Anjongan, fr, 10-12-1930, Polak 171 (BO).

Licuala petiolulata var. *kanepajensis* Becc.

Malesia 3 (1886): 77-78; Becc., Ann. Roy. Bot. Gard. Calcutta 8 (1933): 162-164; Webbia, V, (1920): 29, 44. Type: Hallier No. 1650 (holo: BO) Borneo, West Kalimantan, G. Kanepai.

Field notes. Fruit globose obovate 14-12 mm diam, rather acute in base. **Distribution.** Borneo, West Kalimantan. **Habitat and ecology.** Mountain about 300-500 m altitude. Note. Inflorescence with robust rachilla covered by puberulous reddish brown, distinguishable by its slightly smaller and ovoid fruit, distinctly narrowed to the base.

Specimens examined. Borneo: West Kalimantan, Gunung Kanepai, fl, fr, 1893-1894, Hallier 1650 (BO).

11. *Licuala reptans* Becc.

Webbia 5 (1921): 4; Becc., Ann. Roy. Bot. Gard. Calcutta 8 (1933): 176. Type: Hallier 1992 (holotype: BO); Borneo, West Kalimantan, Kanepai river.

Solitary, acaulescent, hermaphrodite. Stem very short 1.5-2.8 cm wide, rhizomatose, rooting from its lower surface, terete 3.4 mm wide, dark brown. Leaves 12-20 in crown, sheath disintegrating into fine reticulate fibres, ligule present, petiole, 25-35 cm long, 3.0-3.5 mm near base, 2-2.5 mm wide toward apex, rusty dots, drying reddish brown; spines along approximately whole length of petiole narrowly triangular, erect to reflexed large near base no more than 5 mm; frond peltate orbicular, 36-50 cm wide, segments 5-7 lateral, margin straight; lateral segments 1-5 costulate, 15-23 by 1-35 cm; middle segment entire, triangular slightly larger than leaves, 50-70 cm long, comprising a single partial inflorescence, branched to first order with 8-12 first order branched; peduncle 16-33 cm by 1.5-2 mm; prophyll, 7-10 cm by 1.8-2.3 mm coriaceous, flattened, neatly mouth oblique; peduncle bract present; rachis somewhat rigid; rachis bract similar to prophyll, 1-4 cm by 3-4 mm, tubular slightly flattened splitting apical irregular lobes sometime oblique at apex, densely covered with caducous ferruginous hairs; rachilla, 1.5-5 cm by 1-1.5 mm wide, relatively unornamented, fracti-flexuous (zigzag), covered with scattered densely, 0.6-0.7 mm long simple brown-gold hairs. Flower solitary, sessile, spirally arranged, maturing about simultaneously, 5-8 per cm; narrowly elliptical and acute at apex; calyx tubular cyathiform hairy all over, densely covered simple golden brown hairs, apex with 3 acuminate lobes, lobed to less half of calyx length; corolla, 4-4.5 cm by 1.5-2 mm thick, very densely covered with simple gold-brown hairs up to 0.3 mm long.

Field notes. Stem rhizomatose, the middle segment divided into two lobes, rachilla zigzag densely covered with simple light hairs. Distribution. Endemic to West Kalimantan. Habitat and ecology. Found in the forest at river bank in low hill. Notes. Beccari (1933) described two collections by Hallier no. 1992 on Sungai Kanepai and at Lanjak by Teysman no. 283 (in BO). Inflorescence branched to first order with 8-12 first branches the rachilla of this collection short 1-5 cm, zigzag.

Specimens examined. Borneo. West Kalimantan, Kanepai river, fr. 1893-1894, Hallier 1992 (BO, ISO; L, B); Lanjak, st, Teysmann 283C (BO).

12. *Licuala spinosa* Wurmb.

Verh. Bat. Genootsch 2 (1780): 474; Thunb., Kongl. Vetenskaps Nya Handlingar 3 (1782): 287; Blume, Rumphia 2 (1836): 40; Becc., Malesia 3 (1886): 74-75; Koorder, Exkursion Flora van Java Atlas 2 (1992); t. 119; Ridl., Fl. Mal. Pen. 5 (1925): 25; Furtado, Gard. Bull. Becc., Ann. Roy. Bot. Gard. Calcutta 8 (1933): 186-188; Backer, FL. of Java 3 (1968): 173; Saw, Sandakania 10 (1997): 70-71. Type: Thunberg s.n. Java (holo BO, neotype UPS, microfiche K n.v.); *L. acutifida* var. *peninsularis* Becc., Webbia 5 (1921): 44; Ann. Roy. Bot.

Gard. Calcutta 8 (1933): 169, pro parte, synon. nov. Lectotype: Ridley 10329, Peninsular Malaysia, Lumut (Fl as 10239, isolectotype SING).

Clustering, coulescent with many subequal basal shoot sometime solitary. Stem up to 3-5 high and 4-5 high and 4-5 cm in diam. Leaves 10-25 in crown, sheath disintegrating into coarse reticulate into coarse reticulate fibres; petiole 0.5-4 m long, 0.7-2 cm near base, 0.4-1.2 cm wide at apex, drying pale brown; spines along approximately almost or whole length of petiole, narrowly triangular, patent to reflexed, largest near base to 1-1.3 cm long; frond peltate-orbicular, 1-2 cm wide; segments 15-32 all about the same size; lateral segment 2-6 costulate, 60-75 by 5-12 cm; central segment slightly large than rest, sometimes petiolulate, 7-8 costulate, 56-80 by 9-18 cm. Inflorescence erect to patent, larger than leaves, extending beyond crown, comprising a single partial inflorescence, branched to second order, bearing 4-7 first order branches; peduncle, 0.5-1.3 m long, 1-1.6 cm across basally; prophyll tubular, 20-40 cm long, 3-4 cm wide coriaceous, flattened, closely sheathing, densely caducous ferruginous hairs; peduncular bract present; rachis somewhat rigid, robust 7-30 cm by 0.4-0.7 cm; rachis bract mouth splitting neatly in a few lobes, sometime fibrous at apex, first order branches bearing 4-5 rather secondary branches, close to or slightly away from mouth of rachis bract; rachilla 5-20 mm long, 1-3 mm long wide, covered with scattered densely vellutinous, simple 0.3-0.4 mm long brown hairs. Flower solitary to in groups of 2-3 sessile, apparently spirally arranged, each subtended by narrowly triangular bracteole, cincini, 5-12 per cm, mature about simultaneously; bud ellipsoid, 4 by 3 mm; calyx cylindrical to cyathiform, 1-2.5 by 1-2 mm base thickened, oblique, flattened, apex neatly trilobed, acuminate, lobed to about half of calyx length, covered with scattered, 0.4 mm long patent hairs; corolla tubular in lowermost, 2.5 by 3 mm, thick, densely covered in upper two thirds with 0.4 mm long simple, patent, white golden yellow, translucent hairs, apex acute, 2 by 3 mm; staminal tube epipetalous in mouth of the corolla tube, to 0.5 mm high; filaments subulate 0.4 mm long; anthers, 0.4-0.5 by 0.3-0.4 mm long, reniform; ovary glabrous, apex truncate, 1-2 by 0.8-1 mm dark brown, with 3 free carpels joined by a common style 0.8-1 mm long. Fruit globose, glabrous, young fruit green, ripening orange to red, 6-8 mm with smooth surface; seed globose, 6 mm across.

Field notes. Spines largest near base 1.2 cm long, fruit ripening orange to red. Distribution. Thailand, Vietnam, Java, Philippines, Singapore, Burma, Borneo, West Kalimantan, Central Kalimantan, South Kalimantan and East Kalimantan. Habitat and ecology. *L. spinosa* known to able to survive well in the open, low land, alluvial forest, fringes of fresh water, peat and mangrove swamp forest, open, *Melaleuca*, savanna vegetation and beach forest, mixed dipterocarp forest at 1-600 m altitude, red clay soil. Note. *L. spinosa* has rather large

spines distributed along the whole length of petiole and its calyx is hairy, although *L. paludosa* has more small spines mainly along the lower half of petiole and a glabrous calyx.

Specimens examined. Borneo, West Kalimantan, Sintang, Bukit Baka, Ala Saka Dua, fr, 20-10-1993, church et al. 254 (BO); Serawai, Jelundung, Batu Lintang, fr. 23-1-1995 Church and Mahyar 1529 (BO); Central Kalimantan, Bukit Raya and Upper Katingan (Mendawai), fr, 21-12-1992, Moga J.P. 4293 (BO, L); Bukit Raya and Upper Katingan (Mendawai), fr, 21-12-1992, Moga J.P. (BO, L); Bukit Raya and Upper Katingan (Mendawai), Tumbang Samba, fl, fr, 20-10-1982, Moga J.P. 3507 (BO, K, L); Bukit Raya and Upper Katingan (Mendawai), Tumbang Samba, fl, fr, 24-11-1982, Moga J.P. 3616 (BO); East Kalimantan, Batu Kenalung, Mahakam Ulu, Lebangan, fr, 15-1-1982, Kramadibrata 180 (BO); Pasir Batu Kajang, Sungai Sembrai, fr, fr, 29-11-1979, 1841 (BO, K); surrounding WWF Basecamp, Kayan Mentarang Reserve, fr, 26-11-1991, von Valkenburg, Stockdale 1094 (Wanariset, BO); Balikpapan, Wanariset, st. 28-9-1979, Affriastini 133 (BO); Semoi Road Rintis, Wartono Kadri, Wanariset, fl, 12-9-1991, Balgooy et al. 917 (Wanariset, BO); Samarinda, Air Putih, st, 1-1-1979, Moga J.P. 1550 (BO, K); Tarakan, Sekatak U.I.F.L., fl, 4-11-1979, Moga J.P. et al. 1658 (BO); Wanariset 1 area km 4 Rintis Wartono Kadri Semoi Road, fl, 31-7-1990, Ambriansyah and Arifin 277 (Wanariset, BO); South Kalimantan, Pleihari, Jarong, Danau Undang, fl, 15-7-1976 (BO).

13. *Licuala spicata* Becc.

Malesia 3 (1886): 88-90: Becc., Ann. Roy. Bot. Gard. Calcutta 8 (1933): 215-216. Type: P.B. No. 1834 (holo: Fl. n.v.) photocopy. Borneo, Serawak, Mt. Mattang.

Solitary, stem to 1.5 tall to 2-2.5 cm wide, internodus, 0.3-0.5 cm long, terete, brown. Leaves 13-16 in crown, sheath disintegrating into coarse reticulate fibres with rather prominent, ligule in younger leaves, triangular apex acute dark brown, petiole, 24-67 cm long, 1, 2.5-6.5 mm wide near base, 2-2.5 mm wide at apex drying pale reddish brown lightly, smooth, spines narrowly triangular, erect to reflexed, irregular in size, to 3 mm long near base, along lower half of petiole; frond peltate orbicular, 50-70 cm wide, hastula triangular dark, brown, segments variable in number 9-18, all about some size; lateral segments 2-3 costulate, 20-33 by 0.7-3 cm, linear, slender, middle segment larger than rest 3-6 costulate, 21-45 by 1-4 cm. Inflorescence shorter than leaves extending beyond crown, 23-49 cm long unbranched or with only 2 first order branches; peduncle, 13-35 cm long, 3-5 mm wide, subterete, across basally; prophyll tubular, 6-10 cm by 3.5-18 mm coriaceous, flattened, neatly split mouth or a pointed lobes covered with caducous ferruginous hairs; peduncular bract 8-10 cm by 5-8 mm apex acute to oblique; rachis somewhat rigid; rachis bract similar to prophyll, 5-7 cm by 3.5-4 mm; rachilla unornamented, 5-

17 cm long, 1-3 mm wide covered with scattered very densely wholly brown hairs, sometime with caducous ferruginous hairs. Flower solitary, pedicel 0.4-0.5 mm long sessile, spirally arranged to opposite each subtended by a narrowly triangular bract, 0.5 by 0.5, maturing about simultaneously, cincini 3-6 per cm; bud 4 by 3 mm, ovoid, apex acute; calyx urceolate to cyathiform, 2.5 by 2 mm base, thickened, membranous apex neatly trilobed acute, lobed to about half or more of calyx length covered with scattered brown hairs; corolla tubular in lowermost with 3 thick triangular lobes 2 by 3 mm, lobes acuminate; stamen tube epipetalous at the mouth of the corolla tube with 6 triangular teeth; filament subulate 0.4 mm long; anthers ovate, 0.4-0.5 by 0.3 mm yellow; ovary trigonous, glabrous, 1.2 by 1 mm with 3 free carpels joined by common style 1-1.5 mm long. Fruit obovate, oliveform, 9-10 by 4-6 mm apex rounded, smooth, orange. Seed 1 obovate 7-8 mm across.

Field note. Solitary, stem to 2.5 cm diameter, fruit ripening obovate, smooth, apex rounded, yellow. Distribution. Borneo. Central and West Kalimantan, Serawak. Habitat and ecology. Found in the low land to hill forest, mixed dipterocarp forest, primary forest, this species rich. Association included: *Shorea*, *Meliaceae*, *Myrtaceae*, and *Euphorbiaceae*, 100-600 m altitude. Note. Maybe confuse with *L. halleriana* from the same inflorescence branched to fist. Beccari (1933) note *L. spicata* approaches *L. mattanensis*.

Specimens examined. Borneo. Central Kalimantan, Bukit Raya and upper Katingan (Mendawai) river area, upper Katingan, 50-100 km, WNW of Tumbang, Samba, fl, fr, 20-11-1982, Moga J.P. 3461 (BO, K) Bukit Raya and upper Katingan (Mendawai) River area, upper Katingan 50-100 km WNW of Tumbang Samba, fl, fr, 24-12-1982, Moga J.P. 4419 (BO, L); Samba, Bukit Baka, Bukit Raya National Park, fr, 18-2-1995, Jarvie and Ruskandi 6210 (BO); Bukit Raya and upper Katingan (Mendawai) River area, upper Katingan 50-100 km WNW of Tumbang Samba, fl, 21-12-1982, Moga J.P. 4291 (BO, L); Bukit Raya and upper Katingan (Mendawai) River area C. 60-80 km WNW of Tumbang Samba, 11-12-1982, Moga J.P. 4079 (BO, L); Samba cutting blocks of PT Handayani, fr, 23-1-1995, Jarvie and Ruskandi 5129 (BO, L); near Muara Joloi Rekut site old shifting cultivation (ladang), st, 16-4-1992. Awmack S327 (BO); West Kalimantan, Sintang, Bukit Baka National Park Ola Suka Dua Eivrons, C. 600 km up Sungai Ella, Along Bank and surrounding area, fr, 20-10-1993, Church et al. 253 (BO).

14. *Licuala triphylla* Griff.

Calcutta J. Nat. Hist 5 (1845): 332; Ridl., Fl. Mal. Pen. 5 (1925); 28; Becc., Ann. Roy. Bot. Gard. Calcutta 8 (1933): 182-184; Furtado, Gard. Bull. Straits Settlement 11 (1940); 68; Saw, Sandakan 10 (1997): 26-29. Type: Griffith, s.n., Peninsula Malacca, Ayer Panas (holotype BR n.v.). *L. ternata* Griff. Ex Mart., Hist. Nat. Palm. 3 (1849): 238 and 318, 2 nd ed. Type: Griffith s.n. Peninsular Malacca, Ayer Panas (holotype BR, n.v.). *L.*

pygmaea Merril, University of California Publication in Botany 15 (1920); 20; Furtado, Gard. Bull. Straits Settlements 11 (1940): 68. Type Elmer 21635, Borneo, Sabah, Tawau, Elphinstone Province (holotype K, isotype L). *L. triphylla* var. *integrifolia* Ridley, Nat. Fl. Mal. Pen. 2 (1907): 164; Ridley, Nat. Fl. Mal. Pen. 5 (1925); 28; Becc., Ann. Roy. Bot. Gard. Calcutta 8 (1933): 183; Furtado, Gard. Bull. Straits Settlements 11 (1940): 68. Type: Ridley s.n. 1891, Peninsula Malaysia, Pahang, Lubok Pelang (holotype: SING n.v.).

Solitary small, acaulescent; radix terete, 2.6 mm diameter. Stem very short internodus. 1-1.5 by 1.5-2 cm. Leaves 9-12 in crown; petiola 39-96 cm long, 3.5 mm near base, 1-2 mm wide towards, apex, dry reddish brown; spines subulate, slender, irregularly spaced and size usually patent, no more than 5 mm long, along the third of petiole; frond peltate semi-orbicular, 15-20 cm wide, segments 3-5, lateral margin straight; lateral segments 3-6 costulate, 15-22 by 16-26 cm; middle segment large than rest with a petiolulate 2.5-5 cm long, segment 15-18 costulate, 15-23 by 6-11 cm. Inflorescence patent, shorter than leaves, extending beyond crown, 2.5-3 cm long, branched to second order bearing 2-3 first order branches; prophyll rather small, 2-4 cm by 4-5 mm, tubular, flattened; peduncle, 15-22 cm long, 4 mm wide near base; peduncular bract 2, tubular, slightly flattened, apical splitting into irregular lobes, 4-8 by 0.3-0.4 cm densely covered with 0.5 mm long villous hairs yellow brown; rachis similar to peduncular bract, 2-4 by 0.4-0.5 cm; first order branches, close to or slightly away from mouth of rachis bract, bearing 2-3 secondary branches; rachilla, 4-7 cm by 0.5-1.5 mm, wiry covered with scattered less than 0.6 mm long simple hairs, villous. Flower solitary, sessile, apparently spirally arranged, 4-5 cm, maturing about simultaneously; mature bud ellipsoid, 3.8 by 2.1 mm; calyx vase shape, 2.3 by 2 mm base flattened, thickened densely covered with less 0.4, simple brown hairs, membranous toward apex with 3 acute lobes 2 by 2 mm; corolla 4 by 2 mm, thick, densely covered with simple brown white hairs, lobes, 2 by 2 mm apex acute-acuminate; staminal tube epipetalous at the mouth the corolla tube, 0.5 mm high; filaments subulate, 0.5-0.6 mm long; anthers 0.3-0.4 by 0.2-0.3 mm, ellipsoid yellow; ovary trigonous, apex truncate, densely covered on upper half with appressed white hairs, with 3 free carpels joined by a common style filiform, 6-8 by 0.3 mm. Fruit globose, glabrous, young green, ripening orange, 10 mm across; seed globose, 7 mm across.

Field notes. Solitary, acaulescent, very small understorey, middle segment petiolulate 2.5-5 cm long, and ovary hairy. Distribution. Borneo. East Kalimantan, Serawak, Peninsular Malaysia and Peninsular Thailand. Habit and ecology. Found in the low land dipterocarp forest understorey species, preferring undulating terrain of up to 670 m, on sandy loam soil along river forest, 0-700 m altitude. Note. Species related to *L. triphylla* are *L. kohii*, all these are very small understorey. *Licuala* with

similar hairy ovary, acaulescent and solitary habit. In conclusion, *L. triphylla* has petiolulate midsegments, whereas the other do not.

Specimens examined. Borneo, East Kalimantan, Balikpapan, Sg. Wain region fl, 27-8-1950, Kosterman 4250 (BO); Apokayan, Sungai Hulu Telen fl, 23-7-1980, Soedjito 1695 (BO).

15. *Licuala valida* Becc (Figure 2).

Engl. Jahrb. XIVIII (1912): 90; Becc., Ann. Roy. Bot. Gard. Calcutta 8 (1933): 1957-158. Type: Jaheri No.1 (holo: BO), photocopy, Borneo, Central Kalimantan, Sampit.

Solitary or clustering, acaulescent, large and robust to 4 mm high. Leaves 15-17 in crown, sheath disintegrating into coarse reticulate fibres; ligula present; petiola 1.5-4 m long, 1.5-2 cm wide near base, reddish brown, 0.5-1 cm wide at apex, drying pale brown; spines irregular in spacing and size, along lower half or more of petiole, triangular and patent to reflexed largest near base, dark brown, robust, branched in apex, no more than 6 mm long; frond peltate orbicular, 1.5-1.6 m wide; segments 13-17, all about the same size; lateral segments 3-6 costulate 60-90 by 15-40 cm; middle segment slightly large than rest, entire, 14-18 costulate, 70-110 by 14-35 cm. Inflorescence erect to patent lower than leaves, extending beyond crown, 0.8-1 m long, branched to second order, bearing 4-5 first order branches; peduncle, 7-14 cm long, 0.5-1.5 cm across basally; prophyll tubular, 20-30 cm long, 4-5 cm wide, coriaceous, flattened, closely sheathing, densely covered caducous ferruginous hairs; peduncular bract present 20 by 2-3.7 cm; rachis somewhat rigid, robust; rachis bract similar to prophyll, 4-20 by 0.5-2 cm; rachis bract mouth splitting neatly in a few lobes or fibrous, first order branches bearing 3-5 rather patent secondary branches; rachilla terete with, 15-32 cm long, 1-3 mm wide covered with scattered caducous ferruginous hairs, brown-red apex small curved. Flowers solitary sometime to in groups of 2-3, apparently spirally arranged, each subtended by a narrowly triangular bract, apex rounded or acute, sessile, cincini, 5-7 per cm, maturing about simultaneously; bud 2.8-4 by 2-3 mm; calyx 3 by 2 mm vase shaped, base thickened covered sparsely ferruginous or puberulous, apex acuminate sometime trilobed, lobed to about half of calyx; corolla tubular in lowermost, 3-3.5 by 2-3 mm, thick, glabrous, lobes acuminate; staminal tube epipetalous at the mouth of the corolla tube to 1 mm high; truncate, filaments tubulate, 0.4 mm long; anthers yellow, 0.6 mm long ovary trigonous, 1-1.5 mm long with 3 free carpels joined by a common style 1 mm long. Fruit globose-obovate, 1.4-1.5 mm glabrous, with smooth surface. Seed globose, 11 by 10 mm across.

Field notes. Spine robust, largest near base, apex branched; rachilla to 15, fruit relatively large. Distribution. Borneo, East Kalimantan, South. Kalimantan and Central Kalimantan and Serawak. Habitat and ecology. Low land to upper hill dipterocarp, forest, 0-500 m

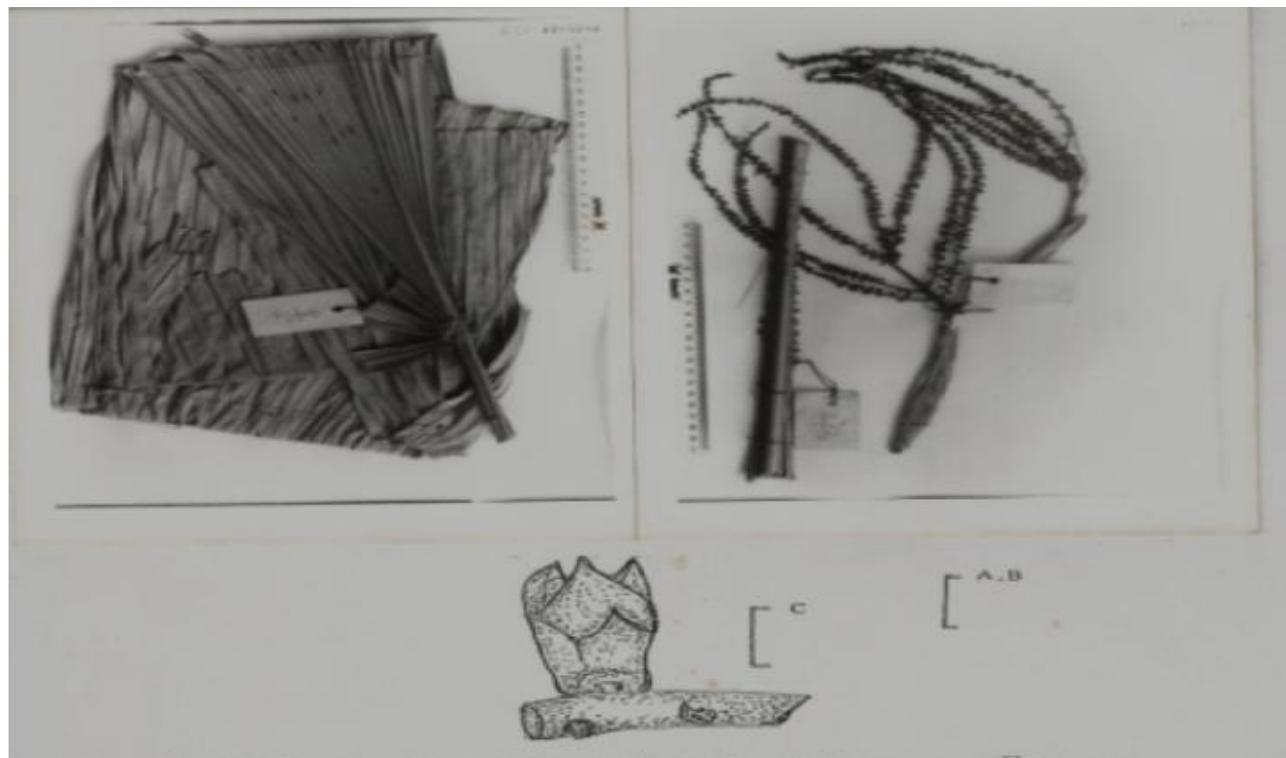


Figure 2. *Licuala valida* Becc. A. Frond. B. Petiole with inflorescence. C. A portion of rachilla with flowers. A-C after Dransfield 4436(BO).

Scale bar 4cm for A-B, 2mm for C

altitude. Note. Beccari (1933) described apparently related to *L. paludosa* largest species of the genus, but large fruit and fleshy pericarp.

Specimens examined. Borneo, East Kalimantan, PT. ITCI area, Kenangan, fl, 14-8-1974, Dransfield 4436 (BO); Bulungan, Research Forest (BRF), along side river, fr, Arifin 1808 (Wanariset, BO); Balikpapan, Wanariset, fr, 16-9-1980, Mogea J.P.2578 (BO), Balikpapan, PT, ITCI area, Kenangan, st, 10-8-1974, Dransfield 4351 (BO); Samarinda S. Mukum and Banko, fl, fr, 3-8-1952, Meijer 1060 (BO, L); West Kutei, Long Petak, fr, 3-10-1925, Endert. 3784 (BO, K, L, Arn, Arb); Pasir, Batu, Kajang, Katungai, fl, 27-11-1979, Mogea J.P. 1785 (BO, K); Gunung Sehari, Balayan river, fl. 15-8-1956, Forman 430 (BO, L); Central Kalimantan Sampit Jaheri 1, fr, 1896-1897 (holotype: BO). South Kalimantan, Djarodam, Muara Uja, fr, 11-11-1971, Dransfield and Saerudin 2117 (BO, L, K, Itacha); Datar Alai, Pegunungan Meratus food of G. Besar Barabai, fr, 26-10-1972, Dransfield 2978 (BO, L); Central Kalimantan Samba, Near the final logging camp of PT. Handayani, fr, 22-11-1995, Jarvie and Ruskandi 5050 (BO).

CONCLUSION

Based on the investigation of morphological characters

specimen herbarium were resulted that there are fifteen species are recognized, consisting of one new species name is *Licuala beruensis* Batoro spec. nov. Three known varieties, *Licuala petiolulata* var. *kanepajensis*, *Licuala petiolulata* var. *petiolulata*, *Licuala matanensis* var. *paucisepta* and thirteen known species namely: *Licuala arbuscula*, *Licuala bintulensis*, *Licuala borneensis*, *Licuala halleriana*, *Licuala lanata*, *Licuala mattanensis*, *Licuala olivera*, *Licuala paludosa*, *Licuala reptans*, *Licuala spinosa*, *Licuala triphylla* and *Licuala valida*.

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