

# New Species of *Licuala* (Palmae) from Vietnam

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Eleven new species of *Licuala* from Vietnam are described and their relationships discussed.

*Licuala* contains about 137 species (Govaerts & Dransfield 2005), occurring from Bhutan and northeastern India throughout southern and southeastern Asia and into the western Pacific (Vanuatu). The two main centers of diversity are the Sunda Shelf in Peninsular Malaysia and Borneo with about 80 species, and the Sahul Shelf on the island of New Guinea with about 40 species (Saw et al. 2003).

The most recent taxonomic treatment of the Indochinese species is that of Gagnepain and Conrard (1937), based on previous works by Beccari (1910, 1933) and Magalon (1930). Gagnepain and Conrard recognized ten species from Vietnam, and subsequently two more were described by Burret (1940, 1941) and one by Barfod and Borchsenius (2000). Of these, we currently recognize ten species for Vietnam – *L. bracteata* Gagnep., *L. calciphila* Becc. (with

its synonyms *L. fatua* Becc., *L. tonkinensis* Becc. and *L. tomentosa* Burret), *L. dasyantha* Burret, *L. glaberrima* Gagnep., *L. hexasepala* Gagnep., *L. paludosa* Griff., *L. radula* Gagnep., *L. robinsoniana* Becc., *L. spinosa* Thunb. and *L. taynguyensis* Barfod & Borchs.

Recent field work in Vietnam, and study of herbarium material at A, AAU, FI, HN, HNU, K, LE, MO, NY, P, SYS and VNM (herbarium acronyms from Holmgren et al. 1990; VNM is the acronym of the Institute for Tropical Biology in Ho Chi Minh City), has shown that the genus is more diverse in Vietnam than previously suspected. We estimate that at least 30 species occur there, including previously described species. Unfortunately, several undescribed species are represented by fragmentary specimens, and their description awaits further field work, particularly in the

plateau regions of south-central Vietnam (Kon Tum, Play Ku, Dac Lac, Da Lat plateaus). In this paper, 11 new species are described, those for which there are adequate, recently-collected specimens. We follow the terminology of Saw et al. (2003) in describing these new species.

Notable among Vietnamese *Licuala* is the large number of dioecious and dimorphic species, a condition previously considered rare in the genus (Saw et al. 2003, Henderson et al. 2007). Of the estimated 30 species of *Licuala* in Vietnam, approximately one-third are thought to be dioecious and dimorphic, including the previously described *L. calciphila*, *L. dasyantha* and *L. hexasepala*, as well as four species described here (*L. acaulis*, *L. centralis*, *L. magalonii* and *L. manglaensis*). These dioecious

species are characterized by a central segment that is usually split to the apex of the costa, the costa with an abaxial "gland," reduced, dimorphic inflorescences with only one or a few partial inflorescences, scarcely developed floral stalks, small flowers, clustered staminate flowers and solitary pistillate flowers, staminate flowers with gibbous sepals and non-versatile anthers, pistillate calyces splitting at or after anthesis into 6 lobes, very short styles and globose fruits with reflexed perianths.

***Licuala acaulis*** Henderson, N. K. Ban & N. Q. Dung **sp. nov.**, a speciebus ceteris generis *Licualae* habitu dioecio, segmentis viridibus 26–32 et perianthio pistillato glabro differt. Typus: Vietnam. Da Nang City: Hoa Vang District, Ba Na-Nui Chua Nature Reserve, road

1. *Licuala atroviridis*, showing inflorescence and flowers with pedicelliform calyces.



to summit, 16°00'N, 108°01'E, ca. 500 m, 19 Apr 2007, A. Henderson, Nguyen Quoc Dung, Nguyen Canh & Le Van Bo 3302 (Holotypus: HN! Isotypi: K! NY!).

Stems solitary, to 0.4 m tall, diameter not known, often short and subterranean. Leaf number and leaf sheaths not known; petiole length not known, the entire length with widely spaced, recurved, brown thorns to 0.5 cm long; blades to 108 cm wide, split into 26–32 segments, these with straight sides; costa terminating at base of split of the middle segment, with a “gland” abaxially; middle segment only slightly wider than the others, split almost to the base of the blade (to costa apex) into 2 lobes, these ca. 50 cm long, ca. 5 cm wide at the apex; segments scarcely indented at the apices. Plants dioecious. Inflorescences to 50 cm long, recurved below the leaves after anthesis; prophylls 25 cm long; peduncles 30 cm long; rachis 6–25 cm long with 1 partial inflorescence, this branched to 2 orders, subtended by a swollen, densely brown tomentose bract splitting laterally; staminate rachillae ca. 21 on each partial inflorescence, 20–30 cm long, 1.5–2.5 mm diam., densely covered with brown, felty tomentum, floral stalks scarcely developed; pistillate rachillae 9–16, 8–13 cm long, 2.5–3 mm diam., tomentum and floral stalks similar to those of the staminate rachillae; staminate flowers 6 mm long; calyx 2.5 mm long, tubular, gibbous, 3-lobed at the apex, glabrous; corolla 4.5 mm long, split for two-thirds its length into 3 valvate petals, glabrous; stamens 6; staminal ring scarcely developed; filaments free for 1.6 mm; anthers 0.5 mm long, oblong, dorsifixed, non-versatile; pistillate flowers solitary, spirally arranged; buds 8–10 mm long, ellipsoid; calyx 4–4.5 mm long, cupular, briefly 6-lobed at the apex at anthesis, glabrous; corolla 6–8 mm long, split for about two-thirds its length into 3 valvate petals, glabrous; staminal ring scarcely developed, with vestigial filaments, anthers absent; pistil 3–3.5 mm long including a 1 mm long style, glabrous. Fruits not known.

**Local names and uses:** *la non*. No uses recorded.

**Distribution and habitat:** Endemic to central Vietnam near Da Nang City, on steep slopes in primary, evergreen, broad-leaved, wet forest at 500 m elevation.

**Notes:** The specimens cited here will not key in either Gagnepain and Conrard (1937) or Magalon (1930), and this species was

apparently unknown to these authors. Among the dioecious Vietnamese species, *Licuala acaulis* is similar to *L. dasyantha* in inflorescence and floral morphology. Both species have inflorescences which curve down after anthesis, thick, fleshy rachillae 1.5–5 mm diam., and pistillate calyces briefly 6-lobed at the apices at anthesis. However, the leaves of the two are quite different, with those of *L. acaulis* having 26–32 green segments with the middle segment only slightly wider than the others, and *L. dasyantha* having 5–10 mottled light and dark green segments with the middle segment much wider than the others. The pistillate perianth of *L. acaulis* is glabrous and that of *L. dasyantha* is densely covered with felty, brown hairs.

**Additional specimens examined. VIETNAM.** DA NANG CITY: Hoa Vang District, Ba Na-Nui Chua Nature Reserve, road to summit, 16°00'N, 108°01'E, ca. 500 m, 20 Apr 2007, Henderson et al. 3309 (HN, NY).

***Licuala atroviridis*** Henderson, N. K. Ban & N. Q. Dung, **sp. nov.**, a speciebus ceteris generis Licualae habitu monoecio, inflorescentiis partialibus rachillis glabris praeditis, floribus glabris, calycibus pedicelliformibus, differt. Typus. Vietnam. Da Nang City: Hoa Vang District, Ba Na-Nui Chua Nature Reserve, road to summit, 16°00'N, 108°01'E, ca. 500 m, 19 Apr 2007, A. Henderson, Nguyen Quoc Dung, Nguyen Canh, & Le Van Bo 3303 (Holotypus: HN! Isotypi: K! NY!). (Fig. 1.)

Stems solitary, to 0.3 m tall, 14 cm diam., covered with persistent leaf bases, often short and subterranean. Leaves 23; leaf sheaths not known, extended above the petioles into 20 cm long ocreas; petioles 135 cm long, 0.5 cm wide near the apices, the proximal ca. half with widely spaced, recurved thorns to 0.5 cm long; blades 82–115 cm wide, split into 22–28 segments, these with straight sides; middle segment not wider than the others, not split, petiolulate, 46–55 cm long, 4.5–5.5 cm wide at the apex; indentations leading to adaxial folds 0.8 cm deep, those leading to abaxial folds 0.5 cm deep, indentations deeper on lateral segments. Plants monoecious. Inflorescences 71–100 cm long, erect among the leaves; prophylls 33–38 cm long; peduncles 40–62 cm long; rachis 6–11 cm long, with 1 or 2 partial inflorescences, these branched to 1 order, subtended by a tubular, glabrous bract; rachillae 7–9 on each partial inflorescence, 12–16 cm long, 2 mm diam., glabrous, the



2. *Licuala bachmaensis*, leaf showing deep indentations and middle few segments remaining joined at their apices.

floral stalks giving them a bumpy appearance; flowers solitary or paired, when paired the pedicelliform base longer in one flower of a pair; flower buds 6–9 mm long, club-shaped; calyx 5–7.5 mm long including a 2–4 mm long pedicelliform base, tubular, briefly 3-lobed at the apex, glabrous; corolla 3–4 mm long, split for two-thirds its length into 3 petals, the apices remaining together but the margins opening to give lateral slits, glabrous; stamens 6; staminal ring 0.5 mm long; filaments free for 0.5 mm; anthers oblong, dorsifixed, versatile; pistil 1.5–2 mm long including a 0.5 mm long style, glabrous. Fruits not known.

**Local names and uses:** *la non*. No uses recorded.

**Distribution and habitat:** Endemic to central Vietnam near Da Nang City, on steep slopes in primary, evergreen, broad-leaved, wet forest at 350 m elevation.

**Notes:** The specimens cited here will not key in either Gagnepain and Conrard (1937) or Magalon (1930), and this species was apparently unknown to these authors. It differs from all other monoecious Vietnamese *Licuala*, except *L. glaberrima*, in its inflorescences with glabrous rachillae and glabrous flowers with

pedicelliform calyces. *Licuala atroviridis* differs from *L. glaberrima* in its 1 or 2 (versus ca. 5) partial inflorescences, and longer pedicelliform calyces (2–4 mm versus 1 mm).

**Additional specimens examined.** VIETNAM. DA NANG CITY: Hoa Vang District, Ba Na-Nui Chua Nature Reserve, road to summit, 16°00'N, 108°02'E, ca. 350 m, 19 Apr 2007, *Henderson et al.* 3300 (HN, NY), *Henderson et al.* 3310 (HN, NY), 4 Jul 2002, *V. X. Phuong* 4847 (HN).

***Licuala averyanovii*** Henderson, N. K. Ban & N. Q. Dung, **sp. nov.**, a *L. spinosa* rachillis brevioribus atque floribus solitariis differt. Typus. Vietnam. Kon Tum: Sa Thay Dist., Sa Son commune, Chu Mon Ray Nature Reserve, 14°25'N, 107°44'E, 600–700 m, 28 Apr 2000, *L. Averyanov et al.* VH 5799 (Holotypus: HN! Isotypus: MO!).

Stems to 2 m tall, branching and diameter not known. Leaf number not known; leaf sheaths not known; petioles to 300 cm long, 1.5 cm wide near the bases, 0.6–0.7 cm wide near the apices, almost the entire length with widely spaced, recurved, yellowish-brown thorns 0.5–0.7 cm long; blades to 120 cm wide, split into 22–26 segments, these with straight sides; middle segment only slightly wider than the others, not split, 50–63 cm long, 3.5–4.5 cm wide at the apex; indentations leading to adaxial folds 0.5 cm deep, those leading to abaxial folds 0.2 cm deep, indentations deeper on lateral segments. Plants monoecious. Inflorescences not known in their entirety, erect among the leaves; prophylls and peduncles not known; rachis not known in its entirety, with at least 6 partial inflorescences, these branched to 1 order, subtended by tubular, inflated bracts briefly split at the apices; rachillae 2–5 on each partial inflorescence, 3.5–11 cm long, 2–2.5 mm diam., densely covered with short, golden-brown hairs, with prominent floral stalks giving the rachillae a bumpy appearance; flowers solitary, spirally or irregularly arranged; flower buds 4.8–5 mm long (post-anthesis), bullet shaped; calyx 2.5–3 mm long, tubular, briefly 3-lobed at the apex, densely to moderately covered with golden brown, appressed hairs; corolla 3 mm long, split for almost half its length into 3 valvate petals, these remaining erect, densely hairy as the calyx; stamens 6; staminal ring 1–2 mm long, fused to corolla; filaments free for 0.5 mm; anthers 0.8 mm long, oblong, dorsifixed, versatile; pistil 3 mm long including a 1 mm

long style, glabrous. Fruits 0.9–1 cm long, 0.6–0.7 cm diam., ellipsoid, with perianth appressed to base of the fruit, color not known.

**Local names and uses:** None recorded.

**Distribution and habitat:** Endemic to south-central Vietnam in Kon Tum, in primary, wet, broadleaf, closed, evergreen, mountain forest on granite at 700–900 m elevation.

**Notes:** The specimens cited here will key in Gagnepain and Conrard (1937) and Magalon (1930) to *Licuala spinosa*. *Licuala averyanovii* is similar to *L. spinosa* but differs in its shorter rachillae (3.5–11 cm long versus 20–40 cm long), and solitary rather than clustered flowers. It also occurs in a different habitat. *Licuala averyanovii* occurs in primary, wet, broadleaf, closed, evergreen, mountain forest on granite at 700–900 m elevation whereas *Licuala spinosa* occurs in open, wet places, often associated with mangroves or in disturbed habitats, at low elevations.

**Additional specimens examined.** VIETNAM. KON TUM: Sa Son, Chu Mon Ray Nature Reserve, 14°25'N, 107°44'E, 28 Feb 2000, *Harder et al.* 4560 (MO); Dak Glei, Dak Mon, 27 Mar 1978, *Bien* 563 (HN); Dak Glei, 23 Mar 1978, *N. H. Hien* 266 (HN).

***Licuala bachmaensis*** Henderson, N. K. Ban & N. Q. Dung, **sp. nov.**, a speciebus ceteris generis Licualae incisuris profundis ad plicaturas adaxiales ducentibus, segmentis mediis paucis ad apices vestri adhuc coalitis, ovulis pilosis differt. Typus. Vietnam. Thua Thien-Hue: Phu Loc Distr., just outside Bach Ma National Park, 16°15'N, 107°52'E, ca. 50 m, 12 Apr 2007, *A. Henderson, Nguyen Quoc Dung, Nguyen Canh, & Le Van Bo* 3254 (Holotypus: HN! Isotypi: K! NY!). (Fig. 2.)

Stems solitary, to 1.5 m tall, 15 cm diam., covered with persistent leaf bases, often short and subterranean. Leaves 20; leaf sheaths not known; petioles 160–177 cm long, 0.6 cm wide near the apices, almost the entire length with widely spaced, straight, dark brown thorns to 0.5 cm long; blades 122–127 cm wide, split into 12–18 segments, these with straight sides; middle segment not split, petiolulate, not wider than the others, 63–64 cm long, 12–13 cm wide at the apex, the middle few segments remaining joined at their apices; indentations leading to adaxial folds 14–20 cm deep, those leading to abaxial folds 0.5 cm deep, indentations not deeper on lateral segments. Plants monoecious. Inflorescences to 340 cm

long, erect above the leaves; prophylls 17 cm long; peduncles and rachis not known in their entirety, with to 11 partial inflorescences, these branched to 1 order, each subtended by a tubular, glabrous bract briefly split at the apex; rachillae 5–11 on each partial inflorescence, 13–33 cm long, 0.8 mm diam., densely covered with golden-brown hairs, with floral stalks giving the rachillae a bumpy appearance; flowers solitary or in groups of 2 or 3; flower buds 2 mm long, depressed-globose; calyx 2 mm long, briefly 3-lobed at the apex, densely covered with brown hairs; corolla 1.5–1.8 mm long, split for one-half to one-third its length into 3, triangular petals, densely covered with appressed, silvery-brown hairs; stamens 6; staminal ring 0.5 mm long; filaments free for 0.1 mm; anthers 0.4 mm long, oblong, dorsifixed, versatile; pistil 1 mm long including a 0.5 mm long style, the ovules sparsely hairy near the apices. Fruits 1 cm long, 0.5 cm diam., ellipsoid, with perianth appressed to base of the fruit, red at maturity.

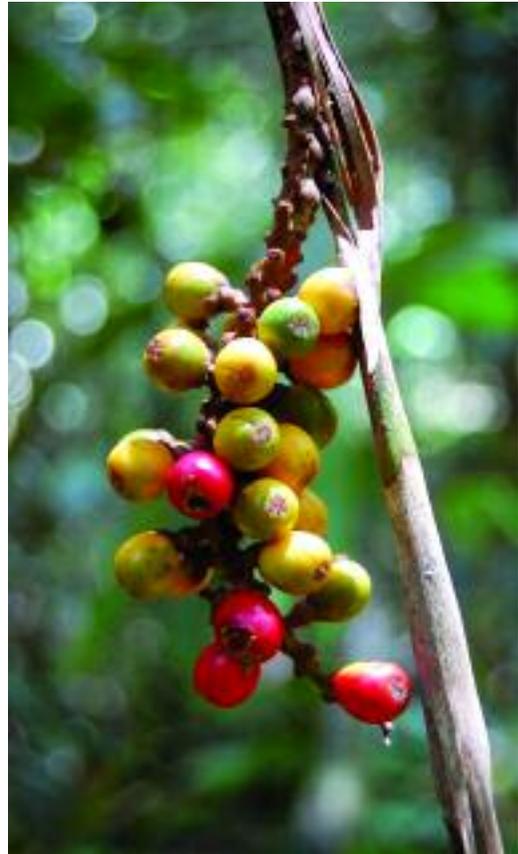
**Local names and uses:** *la non*. The leaves are used to make rain coats.

**Distribution and habitat:** Endemic to central Vietnam in Quang Nam and Thua Thien-Hue, on slopes of mountains in broad-leaved, evergreen, primary closed forest on sandstone, shale, or granite rock, to 1150 m elevation, persisting in disturbed areas and grown in villages.

**Notes:** It is not clear that either Magalon (1930) or Gagnepain and Conrard (1937) were aware of this distinctive species, and it will not key in either work. It is distinguished from all other Vietnamese monoecious *Licuala* by its unique combination of leaves with deep (14–20 cm long) indentations leading to the adaxial folds, middle few segments remaining joined at their apices, and hairy ovules.

**Additional specimens examined. VIETNAM. QUANG NAM:** Cu Lao Cham, 28 Mar 1987, *Anon 403* (HN, LE). **THUA THIEN-HUE:** Phu Loc Distr., just outside Bach Ma National Park, 16°15'N, 107°52'E, ca. 50 m, 21 July 2007, *Henderson & N. K. Ban 3449* (HN, NY); Route number 1, Hai Van Pass, 16°13'N, 108°05'E, ca. 100 m, 21 Jul 2007, *Henderson & N. K. Ban 3450* (HN, NY); Phu Loc Distr., Bach Ma National Park, S slope of Bach Ma mountain below Hai Vong Dai Peak, Khe Su, 16°11'N, 107°51'E, ca. 1150 m, 20 Apr 2003, *V. V. Dung HLF 1185* (HN).

***Licuala bidoupensis*** Henderson, N. K. Ban & N. Q. Dung, *sp. nov.*, a *L. spinosa* floribus



3. *Licuala cattiensis*, showing partial infructescence with 1 rachilla and fruits with the perianth appressed to base.

*spinosis corollis glabris praeditis differt. Typus. Vietnam. Lam Dong: Lac Duong District, Bi Dup-Nui Ba National Park, road from Da Lat to Dac Lac, montane forest, 12°11'N, 108°22'E, 1200 m, 1 Jun 2007, A. Henderson, Bui Van Thanh, Ton Thien An, & Duong Thanh Tuyet 3419* (Holotypus: HN! Isotypi: K! NY!).

Stems clustered, with basal shoots and two main stems, to 2.5 m tall, 3.3–4.5 cm diam., rough with persistent leaf bases. Leaves 10–21; leaf sheaths 8–17 cm long, extended above the petioles into 30–43 cm long ocreas; petioles 98–127 cm long, 0.7 wide near the bases, 0.5 cm wide near the apices, the proximal ca. half with widely-spaced, recurved thorns to 0.3 cm long; blades 77–87 cm wide, split into 21–25 segments, these with straight sides; middle segment not wider than the others, not split, briefly petiolulate, 37–47 cm long, 3.8–4 cm wide at the apex; indentations leading to adaxial folds 0.5 cm deep, those leading to abaxial folds 0.2 cm deep, indentations deeper on lateral segments. Plants monoecious. Inflorescences 150–176 cm long, erect above

the leaves; prophylls and peduncles not known; rachis ca. 100 cm long, with 7–8 partial inflorescences, these branched to 1 order, subtended by tubular, glabrous bracts briefly split at the apices; rachillae 7–14 on each partial inflorescence, 12–14 cm long, 1.2–1.5

mm diam., sparsely covered with brown hairs, with floral stalks giving the rachillae a bumpy appearance; flowers solitary; buds 3.5–4 mm long, ellipsoid; calyx 2 mm long, briefly 3-lobed at the apex, sparsely covered with brown hairs; corolla 3 mm long, split for ca. half its

4. *Licuala centralis*, showing habit and leaves split into numerous, more or less equal segments.



length into 3 valvate petals, glabrous; stamens 6; staminal ring 1 mm long; filaments free for 0.2 mm; anthers 0.6 mm long, oblong, dorsifixed, versatile; pistil 2 mm long including a 1 mm long style, glabrous. Fruits ca. 1 cm long, ellipsoid, with perianth appressed to base of the fruit, red at maturity.

**Local names and uses:** None recorded.

**Distribution and habitat:** Known only from Lam Dong in Bi Dup-Nui Ba National Park in montane forest on steep slopes, at 1200 m elevation.

**Notes:** The specimens cited here will key in Gagnepain and Conrard (1937) and Magalon (1930) to *Licuala spinosa*. *Licuala bidouensis* differs from this and other monoecious Vietnamese *Licuala* by its hairy, non-zigzag rachillae, branched partial inflorescences, and solitary flowers with glabrous corollas.

**Additional specimens examined. VIETNAM. LAM DONG:** Lac Duong District, Bi Dup-Nui Ba National Park, road from Da Lat to Dac Lac, montane forest, 12°11'N, 108°22'E, 1200 m, 1 Jun 2007, *Henderson et al.* 3420 (HN, NY).

***Licuala cattienensis*** Henderson, N. K. Ban & N. Q. Dung, **sp. nov.**, a *L. radula* segmentis lateralibus strictis praeditis, rachillis non flexuosis, pilis sparsis, brevissimis glandulosis tectis differt. Typus. Vietnam. Dong Nai: Cat Tien National Park, road along Dong Nai river, 11°26'N, 107°26'E, 150 m, 28 May 2007, *A. Henderson, Bui Van Thanh, Vu Van Duy, Nguyen Ngoc Quynh, & Phan Van Phuc* 3407 (Holotypus: HN! Isotypus: NY!). (Fig. 3)

Stems solitary or with basal shoots, to 2 m tall, 4 cm diam. Leaves 18; leaf sheaths not known in their entirety, extended above the petioles into 20 cm long ocreas; petioles 136 cm long, 0.4 cm wide at the apices, with widely-spaced, recurved, thorns; blades 80 cm wide, split into 12 segments, these with straight sides; middle segment not wider than the others, not split, not petiolulate, 46.5 cm long, 6.5 cm wide at the apex; indentations leading to adaxial folds 0.5 cm deep, those leading to abaxial folds 0.3 cm deep, indentations deeper on lateral segments. Plants monoecious. Inflorescences 120 cm long, erect among the leaves; prophylls and peduncles not known; rachis 50 cm long, with 2–4 partial spicate inflorescences, subtended by tubular bracts; rachillae 1 on each partial inflorescence, 16–22 cm long, 1.5–2 mm diam., covered with scattered, very short, glandular hairs, with prominent floral

stalks giving the rachillae a bumpy appearance; flowers not known, borne in pairs. Fruits 0.8 cm long, 0.6 cm diam., globose to ellipsoid, with the perianth appressed to base of the fruit, ripening from green to yellow to bright red.

**Local names and uses:** *la toi*. No uses recorded.

**Distribution and habitat:** Endemic to southern Vietnam in Dong Nai, in lowland rainforest in flat areas near rivers at low elevations.

**Notes:** In Gagnepain and Conrard (1937) the specimen cited here keys to *Licuala radula* (it will not key in Magalon (1930) and *Licuala radula* was not known to him). *Licuala cattienensis* differs from *L. radula* in its segments which have straight sides (versus curved) and rachillae which are not zigzag and are covered with scattered, very short, glandular hairs (versus zigzag and densely covered with golden brown hairs). It also differs in habitat. *Licuala cattienensis* occurs in lowland forest at low elevations in flat areas near rivers in Dong Nai; *L. radula* occurs on steep slopes in montane forest more than 500 km to the north, in Thua Thien-Hue.

***Licuala centralis*** Henderson, N. K. Ban & N. Q. Dung, **sp. nov.**, a speciebus ceteris generis Licualae habitu dioecio, segmentis folii 13–26, segmento centrali vix quam aliis latiore differt. Typus. Vietnam. Da Nang City, Hoa Vang District, Ba Na-Nui Chua Nature Reserve, road to summit, 16°00'N, 108°02'E, ca. 350 m, 19 Apr 2007, *A. Henderson, Nguyen Quoc Dung, Nguyen Canh, & Le Van Bo* 3299 (Holotypus: HN! Isotypi: K! NY!). (Fig. 4.)

Stems clustered, to 5 m tall, 2–4 cm diam.. Leaves 9–13; leaf sheaths 14–19 cm long, extended above the petioles into 12 cm long ocreas; petioles 82–127 cm long, 0.6–0.7 cm wide near the bases, 0.4–0.5 cm wide near the apices, the proximal ca. quarter with widely spaced, recurved, black or brown thorns to 0.5 cm long; blades 63–99 cm wide, split into 13–26 segments, these with straight sides; costa terminating at base of split of the middle segment, with a 'gland' abaxially; middle segment only slightly wider than the others, split almost to the base of the blade (to apex of costa) into 2 lobes, these 40–45 cm long, 4.5–8 cm wide at the apices; indentations leading to adaxial folds to 0.5 cm deep, those leading to abaxial folds 0.2 cm deep, indentations deeper on lateral segments. Plants dioecious. Inflorescences to 65 cm long, erect

among the leaves; prophylls 15 cm long; peduncles 35 cm long; rachis 17 cm long, with 2–4 partial inflorescences, these branched to 2 orders, subtended by flat, densely brown tomentose bracts not splitting except apically; staminate rachillae 5–14 on each partial inflorescence, 9–17 cm long, 1 mm diam., moderately covered with brown, felty hairs, scarcely bumpy, spine-like at the apices; pistillate rachillae similar, to 2 mm diam.; staminate flowers solitary or in pairs; buds 2.7–3 mm long, bullet-shaped; calyx 1.5–2.5 mm long, glabrous (or with scurfy brown tomentum at the bases), shallowly lobed at the apex; corolla 2.5–3 mm long, glabrous, split to the base into 3, valvate petals; stamens 6; staminal ring 0.2 mm long around base of pistil; filaments free for 0.5 mm long; anthers 0.5 mm long, oblong, dorsifixed, non-versatile; pistillate flowers solitary; buds 2–3.5 mm long, oblong; calyx 1.5–2 mm long, cupular, 3-lobed at the apex with each lobe splitting again as the fruits develop and becoming 6-lobed, glabrous or with scurfy brown tomentum at the base; corolla 1.5–2.7 mm long, split almost to the base into 3 valvate petals, these reflexed at and after anthesis, glabrous; staminal ring 0.2 mm long at base of pistil, with vestigial filaments, anthers absent; pistil 1 mm long including a 0.3 mm long style, glabrous. Fruits 0.6–0.8 cm diam., globose, with reflexed perianth, whitish at maturity.

**Local names and uses:** *la non*. The leaves are widely used in the manufacture of hats.

**Distribution and habitat:** Endemic to central Vietnam in Ha Tinh, Khan Hoa, Kon Tum, Ninh Thuan, Quang Binh, Quang Nam, Quang Tri, and Thua Thien-Hue and near Da Nang City, in broad-leaved, evergreen, closed forest on steep slopes on shale, sandstone, or limestone rocks, and persisting in secondary forest, at low elevations.

**Notes:** In Magalon (1930) the specimens examined here key to *Licuala spinosa* and in Gagnepain and Conrard (1937) to *L. paludosa*. *Licuala centralis* differs from both those species in being dioecious. Among dioecious Vietnamese species it differs in its erect inflorescences (versus curved down below the leaves in *L. acaulis* and *L. dasyantha*), lack of dense black tomentum on sheaths and petioles (versus with black tomentum in *L. hexasepala*), and 13–26 leaf segments with the central one scarcely wider than the others (versus 3–11 segments with the central one wider than the others in *L. calciphila*, *L. magalonii*, and *L.*

*manglaensis*). *Licuala centralis* bears a close resemblance to the Chinese *L. hainanensis* Henderson, Guo & Barfod, differing in its densely brown tomentose (versus sparsely tomentose) partial inflorescence bracts, and whitish (versus orange or red) fruits.

**Additional Specimens examined. VIETNAM.**

**DA NANG CITY:** Hoa Vang District, Ba Na-Nui Chua Nature Reserve (“Mount Bana”), 15 Jun 1927, *Clemens et al.* 3356 (A, NY, P); “Annam: col de Nuages, près Tourane,” 17 Sep 1923, *Poilane* 8022 (P). **HA TINH:** Vu Quang District, Vu Quang National Park, road from Park Headquarters to Border Army Post, 18°20'N, 105°26'E, ca. 100 m, 17 Jul 2007, *Henderson & N. K. Ban* 3428 (HN, NY), 18°19'N, 105°22'E, 18 Jul 2007, *Henderson & N. K. Ban* 3434 (HN, NY); Huong Son Distr., Son Kim Commune, Rao Bun, 18°23'N, 105°15'E, 300–400 m, 4 May 2004, *P. K. Loc* HAL 5112 (HN); Huong Son Distr., Rao An-Ngam, 18°21'N, 105°13'E, 900–1150 m, 15 May 1998, *N. T. Hiep* VA540 (HN, MO); Huong Son Distr., Nga Doi, 18°29'N, 105°13'E, 19 May 1998, *N. T. Hiep et al.* VA753 (HN, MO); 2.6 km from Cat Bin to Khe Gat, 21 Jan 1990, Newman 226 (AAU). **KHANH HOA:** Nhatrang, montagne de Dong Bo, 5 Mar 1922, *Poilane* 2720 (P); Nhatrang, 19 May 1922, *Poilane* 3444 (P); Hui Han Heo près de Nhatrang, 5 Oct 1922, *Poilane* 4913 (P); Annam: La Mere et l'Enfant, province Nhatrang, 4 Nov 1922, *Poilane* 5016 (P); Annam, km 25 route de Nhatrang a Ninh Hoa, *Poilane* 8255 (P). **KON TUM:** Kon Plong Distr., Hieu Commune, Mang La, 14°39'N, 108°25'E, 21 Apr 2000, *Averyanov et al.* VH5462 (HN); *Averyanov et al.* VH5492 (HN, MO). **NINH THUAN:** Ninh Hai District, Nui Chua National Park, near summit of mountain, near 11°48'N, 109°10'E, ca. 800 m, 27 Jul 2007, *Henderson & Ninh Khac Ban* 3470 (HN, NY); Ninh Hai District, Vinh Hai Commune, E slopes of Nui Chua, 11°43'N, 109°08'E, 800–900 m, 27 Mar 2004, *Regalado et al.* HLF 4201 (HN), 28 Mar 2004, *Regalado et al.* HLF 4313 (HN). **QUANG BINH:** Minh Hoa District, 72 km NNW of Dong Hoi, Yen Son village, 17°40'N, 105°57'E, 450–500 m, 17 Apr 1997, *Averyanov et al.* VH4766 (HN, K, MO); Rung Dong San, Dong Hoi, 10 Feb 1979, *V. V. Duic* 15A (HN); Phong Nha Ke-Bang National Park, road near park entrance, 17°34'N, 106°18'E, ca. 20 m, 5 Apr 2007, *Henderson et al.* 3222 (HN, NY); *Henderson et al.* 3227 (HN, NY); Phong Nha-Ke Bang National Park, west branch of Ho Chi Minh trail, 17°28'N, 106°19'E, ca. 600 m, 6 Apr 2007, *Henderson et al.* 3229 (HN, NY);

Henderson et al. 3230 (HN, NY), V. X. Phuong 4265 (HN). QUANG NAM: Nam Giang district, Thanh My, no date, *Cuong 10* (HN). QUANG TRI: massif de Dong Che, no date, *Poilane 11323* (P). THUA THIEN-HUE: Bach Ma National Park, ca. 8 km from the summit, 16°13'N, 107°51'E, ca. 530 m, 13 Apr 2007, Henderson et al. 3274 (HN, NY), 11 Mar 1997, Boyce 1176 (K), 28 Apr 2003, N. T. Hiep et al. HLF1399 (HN), 22 Apr 2003, V. X. Phuong et al. HLF1286 (HN); A Luoi, 7 Sep 1980, N. K. Khoi 243 (HN).

***Licuala ellipsoidalis*** Henderson, N. K. Ban & N. Q. Dung, **sp. nov.**, a *L. paludosa* atque *L. spinosa* segmentis folii paucis, rachillis brevibus, fructibus ellipsoideis differt. Typus. Vietnam. Kon Tum: Kon Plong Distr., Hieu Commune, Mang La Forest Enterprise, 14°39'N, 108°25'E, 1100–1200 m, 24 Apr 2000, Averyanov et al. VH 5698 (Holotypus: HN! Isotypi: K! MO!).

Stems not known, palms to 1 m tall. Leaf number and leaf sheaths not known. Petioles 37–56 cm long, 0.3–0.4 cm wide near the bases, 0.2 cm wide near the apices, without thorns or the basal ca. half with widely spaced, straight, brown thorns to 0.5 cm long; blades 22–32 cm wide, split into 4 segments, these with straight sides; middle segment wider than the others, split for about half its length into 2 lobes (but not split to the apex of the costa), these 20–24 cm long, 4–4.5 cm wide at the apices; indentations leading to adaxial folds 1 cm deep, those leading to abaxial folds 0.2 cm deep, indentations not deeper on lateral segments. Plants monoecious. Inflorescences to at least 30 cm long; prophylls, peduncles, and rachis not known in their entirety; rachis at least 30 cm long, with 3 partial inflorescences, these branched to 1 order, subtended by swollen, tomentose bracts; rachillae 2–8 on each partial inflorescence, 3.5–5 cm long, 0.9–1.2 mm diam. (thickening in fruit), densely covered with branched, wooly, brown hairs, the prominent floral stalks giving the rachillae a bumpy appearance; flowers solitary or paired; buds 4 mm long, club-shaped; calyx 3 mm long, deeply 3-lobed at the apex, tomentose; corolla 3 mm long, split for almost its entire length into 3 valvate petals, densely covered with appressed, silvery hairs; stamens 6; staminal ring 0.5 mm long; anthers oblong, dorsifixed, versatile; pistil 2 mm long including a 1 mm long style, glabrous. Fruits 1.2–1.5 cm long, 0.6 cm diam., ellipsoid, with the perianth appressed to base of the fruit, color at maturity not known.

**Local names and uses:** None recorded.

**Distribution and habitat:** Central Vietnam in Kon Tum in primary, broad-leaved, closed, evergreen forest on sandstone slopes at 1100–1200 m elevation.

**Notes:** The specimen cited here will not key in Magalon (1930) or in Gagnepain and Conrard (1937). *Licuala ellipsoidalis* is a distinctive species in its leaf splitting. In most dioecious species of *Licuala*, the central segment of the leaf is split into 2 lobes, and the base of the split coincides with the apex of the costa. There is a distinctive “gland” at the apex of the costa on the abaxial surface in all these species (except in *L. manglaensis*, which has a non-split central segment). In most monoecious species of *Licuala* the central segment is not split, but often petiolulate, with the petiolule representing the costa of the leaf. The only exceptions to this in Vietnam are *L. ellipsoidalis*, *L. paludosa*, and *L. spinosa*, in which the central segment is split, but not to the apex of the costa. In these species, the costa continues into one of the two lobes, and there is no abaxial “gland.”

*Licuala ellipsoidalis* differs from *L. paludosa* and *L. spinosa* in its 4 (versus 6–19) leaf segments, 3.5–5 cm long (versus 12–40 cm long) rachillae, and its 1.2–1.5 cm long and 0.6 cm diam. ellipsoid (versus 0.6–0.8 cm diam., globose) fruits.

***Licuala longiflora*** Henderson, N. K. Ban & N. Q. Dung, **sp. nov.**, a speciebus ceteris monoeciis Vietnamensibus generis *Licuala* floribus elongatis differt. Typus. Vietnam. Ninh Thuan: Nui Chua National Park, near summit of mountain, near 11°48'N, 109°10'E, ca. 800 m elevation. 27 Jul 2007, A. Henderson & Ninh Khac Ban 3471 (Holotypus: HN! Isotypi: K! NY!).

Stems solitary, to 3 m tall, 4 cm diam.. Leaf number not known; leaf sheaths 12 cm long, extended above the petioles into 12–14 cm long ocreas; petioles 80 cm long, 0.7 cm wide near the bases, 0.4 cm wide near the apices, the proximal ca. half with widely spaced, recurved, brown thorns to 1 cm long, these sometimes bifid apically; blades to 80 cm wide, split into 19–29 segments, these with straight sides; middle segment only slightly wider than the others, not split, petiolulate, 35 cm long, 3.5 cm wide at the apex; indentations leading to adaxial folds 2 cm deep, those leading to abaxial folds 0.5 cm deep, indentations not deeper on lateral segments. Plants monoecious.



5. *Licuala magalonii*, habit showing leaves split into 3 or 4 segments, the middle one much wider than the others and deeply split into 2 lobes.

Inflorescences to 250 cm long, erect above the leaves; prophylls ca. 20 cm long; peduncles 114–116 cm long; rachis 40–67 cm long, with 7–8 partial inflorescences, these branched to 1 order, subtended by tubular, glabrous bracts; rachillae 1–7 on each partial inflorescence, 4–10 cm long, 0.7–0.8 mm diam., densely covered with golden-brown hairs, with

prominent floral stalks to 2.5 mm long giving the rachillae a bumpy appearance; flowers solitary; buds 6.5–7.5 mm long, ellipsoid; calyx 6 mm long including a 1–2 mm long pedicellate base, 3-lobed at the apex, ciliate, densely covered with golden-brown hairs; corolla 5.5–6 mm long, split for 4 mm into 3 non-valvate petals, densely covered with

appressed, golden-brown hairs; stamens 6; staminal ring 1.5–3 mm long, free from corolla; filaments free for 0.8 mm long; anthers ca. 3 mm long, oblong, dorsifixed, versatile; pistil 10 mm long including a 8.5 mm long style, glabrous. Fruits immature, with perianth appressed to base of the fruit.

**Local names and uses:** *la non duc*.

**Distribution and habitat:** Endemic to Nui Chua National Park in Ninh Thuan, in lowland forest on steep slopes at 800 m elevation.

**Notes:** These specimens will not key in Magalon (1930) or in Gagnepain and Conrard (1937), and this species was apparently not known to these authors. It differs from all other monoecious Vietnamese species in its elongate flowers.

**Additional Specimens Examined. VIETNAM. NINH THUAN:** Ninh Hai District, Vinh Hai Commune, NEE slopes of Nui Chua mountain, 11°43'N, 109°08'E, 800–950 m, 31 Mar 2004, *Regalado et al. HLF 4420* (HN).

***Licuala magalonii* Henderson, N. K. Ban & N. Q. Dung, sp. nov.**, a speciebus aliis dioeciis generis *Licualae* rachillis tenuibus, vaginis petiolisque viridibus, segmentis folii 3, inflorescentiis non dimorphicis et segmento medio fisso differt. Typus. Vietnam. Da Nang City: Hoa Vang District, Ba Na-Nui Chua Nature Reserve, 20 Apr 2007, *A. Henderson, Nguyen Quoc Dung, Nguyen Canh, & Le Van Bo 3304* (Holotypus: HN! Isotypi: K! NY!). (Fig. 5.)

Stems solitary or clustered, to 1.5 m tall, 2–2.5 cm diam., sometimes short and subterranean. Leaves 6–12; leaf sheaths 14–15 cm long, extended above the petioles into 10 cm long ocreas; petioles 16–56 cm long, 0.6–0.8 cm wide near the bases, 0.5–0.6 cm wide near the apices, the proximal ca. half with widely spaced, recurved, brown thorns to 0.2 cm long; blades 44–48 cm wide, split into 3 or 4 segments, these with straight sides; costa terminating at base of split of the middle segment, with a 'gland' abaxially; middle segment much wider than the others, deeply split (to apex of costa) into 2 lobes (sometimes not split), these 33–41 cm long, 13–20 cm wide at the apices; indentations leading to adaxial folds 1 cm deep, those leading to abaxial folds 0.2 cm deep, indentations deeper on lateral segments. Plants dioecious. Inflorescences to 54 cm long, erect or arching among the leaves; prophylls 11.5–18 cm long; peduncles 26–45 cm long; rachis 0–(14) cm long, with 1–(2)

partial inflorescences, these branched to 2 orders, subtended by tubular, tomentose bracts; staminate rachillae 9, 10–14 cm long, 1–1.5 mm diam., moderately covered with brown, felty hairs, scarcelly bumpy; pistillate rachillae 2–7, 4.5–15 cm long, 1.5 mm diam., scarcelly bumpy; staminate flowers borne in clusters; buds 3–3.5 mm long, oblong; calyx 1.5–2.7 mm long, gibbous, 3-lobed at the apex, glabrous; corolla 2.5–3 mm long, split for ca. two thirds its length into 3 petals, glabrous; stamens 6; staminal ring 0.5 mm long; filaments free for 0.5 mm; anthers 0.5 mm long, oblong, dorsifixed, non-versatile; pistillate flowers solitary; buds 2.5–3.5 mm long, oblong; calyx 1.5–2 mm long, 3-lobed at the apex with each lobe splitting again as the fruits develop and becoming 6-lobed, glabrous; corolla 2–2.5 mm long, split for 1.5 mm into 3 petals, these spreading horizontally as the fruits develop, glabrous; staminal ring vestigial; pistil 1.5 mm long including a 0.2 mm long style, glabrous. Fruits 0.9 cm long, 0.7 cm diam., irregularly globose, with reflexed perianth, color at maturity not known.

**Local names and uses:** *cay la ma ca, la non, la non nham*.

**Distribution and habitat:** Endemic to central Vietnam near Da Nang City and in Thua Thien-Hue, in primary, broad-leaved, evergreen, closed, montane forest on steep slopes on granite rocks, at 1000–1500 m elevation.

**Notes:** The first known specimen (*Magalon 6*) of this species was identified by Magalon (1930) as "*Licuala ternata* ou *L. triphylla* Griff." *Licuala ternata* is now considered a synonym of *L. triphylla*, a monoecious species from Peninsular Thailand, Peninsular Malaysia and Borneo. Gagnepain and Conrard (1937) mistakenly identified *Magalon 6* as *Licuala hexasepala*, a species otherwise known only from the southern part of Vietnam.

*Licuala magalonii* differs from all other dioecious Vietnamese species in its slender, 1–1.5 mm diam. rachillae (versus 1.5–5 mm diam. in *L. acaulis* and *L. dasyantha*), more or less green sheaths and petioles (versus with dense, black tomentum in *L. hexasepala*), leaves with 3 or 4 segments (versus 13–26 in *L. centralis*), non-dimorphic inflorescences (versus dimorphic in *L. calciphila*), and split middle segment (versus non-split in *L. manglaensis*).

**Additional specimens examined. VIETNAM. DA NANG CITY:** Hoa Vang District, Ba Na-Nui

Chua Nature Reserve, 20 Apr 2007, *Henderson et al.* 3305 (HN, NY), May-Jul 1927, *Clemens & Clemens* 4444 (NY, P), Jan-May 1927, *Squires* 203 (NY); "Mt. Bana, environs Tourane" [Da Nang City, Hoa Vang District, Ba Na-Nui Chua Nature Reserve], 24 Jan 1940, *M. Magalon* 6 (ITB, P). THUA THIEN-HUE: Bach Ma National Park, no date, *T. P. Anh* 107 (HN); 27 Oct 2004, *Anon* 4 (HN), 13 Apr 2007, *Henderson et al.* 3268 (HN, NY), 26 Apr 2003, *N. T. Hiep et al.* HLF 1336 (HN), 4 May 2003, *N. T. Hiep et al.* HLF 1623 (HN), 30 Jan 1990, *Newman* 177 (AAU, K), *Newman* 179 (AAU, K), 18 Apr 2003, *V. X. Phuong et al.* HLF 951 (HN).

***Licuala manglaensis*** Henderson, N. K. Ban & N. Q. Dung, **sp. nov.**, a speciebus ceteris generis *Licualae* habitu dioecio et segmento rhomboideo centrali non fisso differt. Typus. Vietnam. Kon Tum: Kon Plong Distr., Hieu Commune, Mang La Forest Enterprise, 14°39'N, 108°25'E, 1100–1200 m, 16 Apr 2000, *Averyanov et al.* VH 5201 (Holotypus: HN! Isotypus: MO!).

Stems to 1 m tall, diameter and branching not known. Leaf number not known; leaf sheaths 8–10 cm long, extended above the petioles into 6–7 cm long ocreas; petioles 33–38 cm long, 0.4–0.5 cm wide near the bases, 0.2–0.3 cm wide near the apices, the proximal ca. half with widely spaced, straight, brown thorns to 0.7 cm long; blades 20–24 cm wide, split into 5 segments, these with straight sides; middle segment wider than the others, not split, rhomboidal, the costa continuing to the apex of the middle segment, 14–17 cm long, 9–11 cm wide at the apex; indentations leading to adaxial folds 0.8–1.5 cm deep, those leading to adaxial folds 0.3–0.4 cm deep, indentations not deeper on lateral segments. Plants dioecious. Inflorescences to 75 cm long, erect among the leaves; prophylls 14.5 cm long; peduncles 57 cm long; rachis absent, partial inflorescence 1, this branched to 2 orders, subtended by tubular bracts; staminate rachillae 12–15 on each partial inflorescence, 7–10 cm long, 0.6–0.7 mm diam., densely covered with short, whitish-brown hairs; pistillate rachillae number not known, length, diameter, and hairs similar to staminate; staminate flowers borne in groups of 2 or 3; buds 1.2–1.5 mm long, globose; calyx 1 mm long, tubular, shallowly 3-lobed at the apex, densely covered with spreading, whitish-brown hairs; corolla 1–1.2 mm long, glabrous, split completely to the base into 3, valvate petals; stamens 6; staminal ring absent;

filaments 0.2 mm long, fused to the base of the vestigial pistil; anthers oblong, 0.5 mm long, dorsifixed, non-versatile; pistillate flowers solitary; buds 1.7 mm long, globose; calyx 1.5 mm long, 3-lobed at the apex, densely covered with spreading, whitish-brown hairs; corolla 1 mm long, split completely to the base into 3 valvate petals, glabrous; staminal ring absent, 6 vestigial filaments at base of petals; pistil 0.5 mm long including a 0.2 long style, glabrous. Fruits ca. 0.8 cm diam., globose, with reflexed perianth, color at maturity not known.

**Local names and uses:** None recorded.

**Distribution and habitat:** Endemic to southern-central Vietnam in Kon Tum, on steep slopes in primary, evergreen, broad-leaved, wet forest at 1100–1200 m elevation.

**Notes:** *Licuala manglaensis* is dioecious. All other dioecious species of *Licuala* known from Vietnam have the central segment split. In *L. manglaensis*, however, the central segment is not split and has a rhomboid shape, although the costa is well-developed and reaches almost to the apex of the central segment. The staminate flowers, with the petals split completely to the base, scarcely developed staminal ring, and very short filaments inserted at the base of the vestigial pistil, are also distinctive.

**Additional Specimens Examined. VIETNAM.** KON TUM: Kon Plong Distr., Hieu Commune, Mang La Forest Enterprise, 14°39'N, 108°25'E, 1100–1200 m, 23 Apr 2000, *Averyanov et al.* VH 5614 (HN, MO).

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