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New Species and Notes on Related Taxa in *Chamaedorea* Subgenus *Stephanostachys*

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Recent studies in support of a work on the genus *Chamaedorea* in cultivation that will be published by the International Palm Society in 1991 have resulted in diagnostic information about subgenus *Stephanostachys*. This subgenus is set well apart and easily distinguished, at least when fertile, from other subgroups of *Chamaedorea* by a combination of characters, the most obvious being the staminate flowers densely crowded and contiguous in bud (Fig. 1). In addition, the petals of staminate flowers are spreading or erect and free apically. Petals of both sexes are distinct and thickened and those of pistillate flowers are persistent in fruit. Inflorescences are usually solitary although in a few species they are multiple at a node. Fruits are mainly black, less commonly red or orange. Some species of subgenus *Stephanostachys* have pinnae which are heavily nerved, the nerves being prominent and keeled and drying a distinct yellow.

Subgenus *Stephanostachys* includes about 10, or perhaps more, species widely or locally distributed on both the Atlantic and Pacific slopes from México to Colombia. They occur in moist or wet forests from sea level to 1,500 meters elevation. Some are well adapted to growing on limestone outcroppings and, in some instances, are more common on that substrate than on adjacent, more fertile soils.

With the exception of *C. casperiana*, all the named species of subgenus *Stephanostachys* are cultivated to some extent. A few are common and occur in gardens

and collections wherever palms can be grown while others are quite rare. Because of their unusual, distinctive inflorescences, they always attract attention when in flower or fruit and are favorites of palm growers everywhere. In addition to the showy staminate inflorescences with their densely packed, contiguous flowers, several species of subgenus *Stephanostachys* have pistillate inflorescences of a similar nature. Pistillate flowers are densely crowded or contiguous on a thickened spicate, furcate, or few-branched axis. These species are outstanding in the infructescence, appearing somewhat similar to an ear of corn with the fruits densely packed and often angled by mutual pressure.

Recent work has resulted in much new information about subgenus *Stephanostachys* including the circumscription of two new species. This information is made available largely because we have been fortunate in establishing in the greenhouse in Los Angeles wild-collected plants of several key taxa from known localities. We have been able to collect and observe flowers of both sexes easily and hand-pollinate them to produce fruits. Some of this information, especially as it pertains to flowers, is presented here for the first time, even for previously named species.

Here I provide a key to and citations for the species of subgenus *Stephanostachys*, but full descriptions are given only of the two new species and those for which I have new data. Complete descriptions of all named species in subgenus

Stephanostachys will be included in the forthcoming treatment of *Chamaedorea* in cultivation.

Chamaedorea subgenus **Stephanostachys** Klotzsch, Otto & Dietr. Allg. Gartenzeit. 20: 363, 1852.

Chamaedorea sect. *Stachyophorbe* Liebm. ex Mart., Hist. Nat. Palm. 3: 309, 1849.
Stachyophorbe (Liebm. ex Mart.)

Liebm. ex Klotzsch, Otto & Dietr. Allg. Gartenzeit. 20: 363, 1852; name only in Liebm., 1846. *Spathoscaphe* Oerst., Vidensk. Meddel. Kjoeb. 1858: 29, 1859. *Stephanostachys* (Klotzsch) Klotzsch ex Oerst., Vidensk. Meddel. Kjoeb. 1858: 26, 1859. *Dasystachys* Oerst., Vidensk. Meddel. Kjoeb. 1858: 25, 1859. *Chamaedorea* sect. *Stephanostachys* Burret, Notizbl. Bot. Gart. Berlin 11: 760, 1933.

Key to the Species of Subgenus *Stephanostachys*

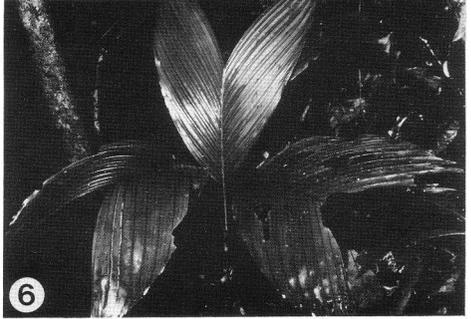
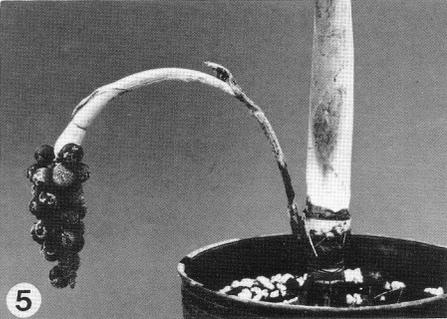
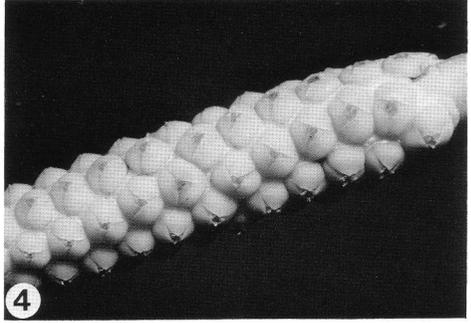
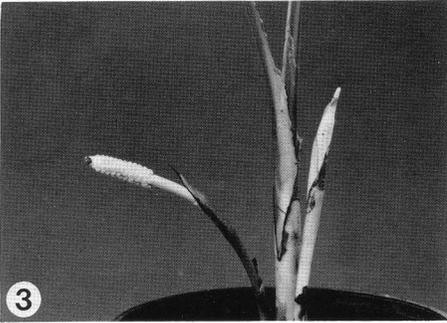
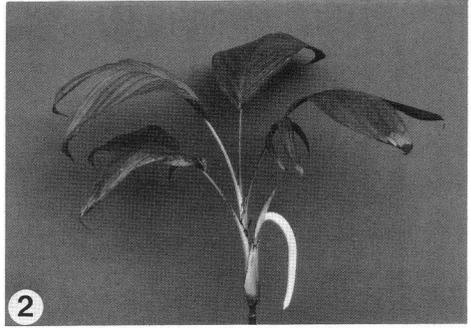
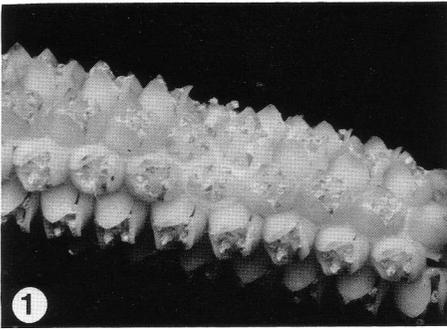
This key is adapted and modified from one developed by the late Harold E. Moore, Jr.

1. Pistillate flowers densely crowded, contiguous, on a thick spicate, furcate, or few-branched axis, calyx prominent; staminate calyx well developed in bud. 2
1. Pistillate flowers borne at distinct intervals or crowded in a definite spiral or vertical arrangement; calyx a low membranous ring; staminate calyx not prominent. 7
2. Pistillate inflorescence spicate or furcate. 3
2. Pistillate inflorescence with about 8 rachillae. *C. casperiana*
3. Staminate inflorescence spicate or furcate. 4
3. Staminate inflorescence with 8-10 rachillae. *C. arenbergiana*
4. Staminate and pistillate flowers green; staminate inflorescences multiple at a node. *C. deckeriana*
4. Staminate flowers yellow or white; pistillate flowers yellow; staminate inflorescences solitary at a node. 5
5. Staminate flowers yellow, sepals joined in a cupule half as high as the petals, stamens not as high as the petals. *C. allenii*
5. Staminate flowers white, sepals free nearly to the base, stamens equalling or exserted beyond the petals. 6
6. Staminate flowers with the anthers exserted above the petals; pinnae 9-11 on each side of the rachis. *C. crucensis*
6. Staminate flowers with the anthers not protruding beyond the petals; pinnae 1-6 on each side of the rachis with the terminal pair as broad or broader than the others combined. *C. zamorae*
7. Staminate and pistillate inflorescences spicate, stamens exserted beyond the petals or nearly so; fruit red-orange. *C. oreophila*
7. Staminate inflorescences branched, pistillate inflorescences branched or spicate, stamens mostly included; fruits black. 8
8. Stems short, creeping, branching in a dichotomous manner; pinnae decurrent at the base. *C. cataractarum*
8. Stems erect, not creeping or branching in a dichotomous manner; pinnae not decurrent. 9
9. Inflorescences usually 2-several at a node, more rarely, especially the pistillate, solitary; pistillate rachillae few, short, erect; pistillate flowers closely placed; margin of the leaf sheath whitish with green nerves. *C. alternans*
9. Inflorescences solitary at the nodes, pistillate with several long and spreading rachillae; pistillate flowers more widely spaced at distinct intervals; margin of the leaf sheath green. *C. tepejilote*

Chamaedorea allenii L. H. Bailey, Gentes Herb. 6: 241, fig. 126, 1943.
Type: Panama, *P. H. Allen* 1909 (holotype, MO).

Stem solitary, erect or decumbent, to 2 m tall or more but sometimes flowering

when acaulescent or nearly so, 1.5-2 cm diam., green, smooth, conspicuously ringed, internodes 3-10 cm long. Leaves 4-6, spreading, pinnate but sometimes flowering when leaves simple and bifid or variably pinnate (Fig. 2); sheath 25 cm long, white-margined apically, light green inside



1. Portion of staminate inflorescence of *Chamaedorea allenii*, D. R. Hodel 769A, showing the densely packed flowers characteristic of all members of subgenus *Stephanostachys*. 2. A staminate plant of *Chamaedorea allenii*, D. R. Hodel 769A, cultivated in Los Angeles, California that was collected originally from the type locality near El Valle, Panama. Note staminate inflorescence and that some leaves are simple and bifid and others pinnate. 3. *Chamaedorea allenii*, D. R. Hodel 769B, showing spicate pistillate inflorescences. 4. Pistillate inflorescence of *Chamaedorea allenii* showing densely packed flowers. 5. Inflorescence of *Chamaedorea allenii* with fruits densely packed at the terminal end. 6. A simple-leaved form of *Chamaedorea allenii* at the type locality near El Valle, Panama.

of this and dark green beyond, splitting opposite the petiole and there long-open, very faintly longitudinally striate-nerved; petiole slender, 25–35 cm long, 5–7 mm thick, lightly grooved and green adaxially, rounded and with a light green band abax-

ially; rachis 30–45 cm long or more, green and obtusely angled adaxially, rounded and with a light green band abaxially extending onto the sheath; blade 60–70 cm long, firm textured, glossy; pinnae alternate or subopposite, 7–9 per side, equally spaced,

25–30 × 3–6 cm, narrowly lanceolate, slightly sigmoid or falcate, acute-acuminate to caudate and drooping at the tip, somewhat narrowed at the base, 8–10 nerved, these light-colored and pronounced abaxially, end pair confluent and wider, if the blade simple and bifid then to 50 × 30 cm, rachis to 30 cm long, lobes to 25 cm long, 50 prominent nerves on each side of the rachis.

Inflorescences interfoliar, erect, but often infrafoliar and horizontal in fruit, solitary, spicate or less often furcate. Staminate inflorescence with the peduncle 15–25 cm long, 5–8 mm wide at the base and there ± flattened, rounded and 5 mm diam. at the apex, pale or white, ascending or horizontal; bracts 4, light green at anthesis, tightly sheathing basally, ± inflated apically, thin-leathery, acute-acuminate, bifid, the uppermost exceeding the peduncle, prophyll 2 cm long, 2nd bract 7 cm long, 3rd 12 cm long, 4th 15 cm long; rachis or flower-bearing portion pendulous, flaccid, 10–20 × 1 cm. Pistillate inflorescence to 30 cm long, erect or horizontal (Fig. 3); peduncle 20 cm long, 8 mm wide at the base and there ± flattened, 6–8 mm diam. at the apex and there rounded, light green in flower, orange in mature fruit; bracts 4, similar to those of the staminate only becoming tattered and brown and ± fallen away in fruit, upper one about equalling the peduncle; rachis or flower-bearing portion to 10 × 1 cm, straight at anthesis, stiffish and curved, swollen and red-orange in fruit.

Staminate flowers contiguous in bud, densely spiralled in 8 rows (Fig. 1), 3.5 × 2.5 mm, bright yellow; calyx prominent, sepals united in a sheathing hyaline tube 2 mm high, whitish; corolla with the petals distinct, 3 × 2 mm, thickened, thicker distally, slightly grooved on the inside; stamens with the filaments thick, 1.5 × 0.5 mm, anthers in a close ring around the pistillode and about half the height of the petals, very small, 1 × 0.5 mm, latrorse; pistillode extending just above the anthers,

2 × 0.5 mm, swollen basally. Pistillate flowers (Fig. 4) spirally and densely arranged in 8 rows, contiguous in bud, immersed in shallow pits but so densely packed as to appear to be completely immersed in the rachis, bright yellow, 2.5 × 3.5 mm; calyx shallowly undulate, sepals forming a tight hyaline sheath around the base of the flower, 1.5 mm high; corolla with the petals distinct, broadly imbricate, hooded, 2.5 × 2.5 mm, margins rounded, apically acute; staminodes lacking; pistil 3-lobed, triangular, conical, 2 × 2 mm, fleshy, stigmas spreading or erect, prominent, sessile. Fruits black, densely packed (Fig. 5), globose but angled from mutual pressure, 7–10 mm diam., exocarp rough; seeds brown, globose but slightly angular, 5–7 mm diam.

Distribution: PANAMA. Coclé. Darién. Dense, wet forest on the Pacific slope, 500–1,000 m elevation. Endemic but, perhaps, also in Colombia.

Specimens Examined: PANAMA. Coclé: El Valle, *P. H. Allen* 1909 (holotype, MO); *J. Duke & B. Lallathin* 14970 (MO); *A. Gentry* 3633 (MO); *S. Mori & J. Kallunki* 2967 (MO); *D. R. & M. A. Hodel* 742 (BH, PMA). Darién: El Real, *J. Duke* 5042, 5078 (MO, BH); Río Tuquesa, *S. Mori* 6988 (MO). CULTIVATED. United States. California: Los Angeles, in greenhouse, *D. R. Hodel* 769A, 769B (BH), originally collected at the type locality, El Valle, Panama.

Chamaedorea allenii is an attractive, single-stemmed palm with a striking, bright yellow, spicate or furcate staminate inflorescence. Discovered by Paul Allen near El Valle, Coclé Province in Panama and described and named by Bailey (1943), it occurs predominantly in mountain forests at middle elevations on the Pacific slope usually at or near the Continental Divide. Bailey described *C. allenii* from a pistillate collection only; fruits and staminate flowers were not seen. We were successful in establishing plants in the greenhouse in Los Angeles from the type locality. These have

flowered and, fortunately, we have plants of both sexes and have successfully hand-pollinated them and set fruits.

Chamaedorea allenii seems to exhibit two vegetative phases. The first consists of simple, deeply bifid leaves (Fig. 6). Later, plants develop leaves that are pinnate. Flowering and fruiting is most closely associated with the pinnate-leaved phase. However, the two phases cannot be considered strictly juvenile and adult since flowering and fruiting have been observed on some plants with simple and bifid leaves.

Simple-leaved forms of *C. allenii* are similar vegetatively and in fruit to *C. deckeriana*. This latter species is found mainly on the Atlantic slopes from low to middle elevations. Their ranges do not seem to overlap greatly. *C. deckeriana* is clearly distinct in the leaf sheaths, green rather than yellow-margined, the green rather than yellow staminate flowers, the multiple rather than solitary staminate inflorescences at the nodes, and the fruit maturing smooth and red-orange rather than rough and black.

Galeano and Bernal (1987) report *C. deckeriana* from northwestern Colombia, but the accompanying description seems to refer to *C. allenii*. Chazdon (1989) reports *C. allenii* from Braulio Carrillo National Park on the Atlantic slope of Costa Rica but this is probably an unnamed, yet related, taxon.

Chamaedorea alternans H. A. Wendl.,
Regel Gartenfl. 29: 104, 1880. Type:
Cult., *Wendland s. n.* (GOET).

Nunnezharia alternans (H. A. Wendl.)
O. Kuntze, Rev. Gen. Plant. 2: 730,
1891.

Chamaedorea alternans is a handsome plant with large leaves and broad, dark green pinnae. It was first discovered in Chiapas, México, and introduced to European gardens in 1875 by J. Linden, the famous horticulturist of Ghent, Belgium

(Guillaumin, 1923). Wendland named the species from cultivated material growing at Herrenhausen near Hannover, Germany that he had obtained from Linden. An interesting feature of this species is the manner in which the inflorescences occur at the nodes, usually in multiples but occasionally alternating to solitary on the same individual, hence the specific epithet. *C. alternans* is endemic to México, occurring in wet forests in the states of Chiapas and Veracruz.

Chamaedorea arenbergiana H. A.
Wendl., Index Palm. 66, 1854. Type:
Cult., *Wendland s. n.* (GOET).

Spathoscaphe arenbergiana (H. A.
Wendl.) Oerst., Vidensk. Meddel.
Kjoeb., 1858: 30, 1859.

Nunnezharia arenbergiana (H. A.
Wendl.) O. Kuntze, Rev. Gen. Plant. 2:
730, 1891.

Chamaedorea densiflora Hort.

Wendland (1854) described and named *C. arenbergiana* from plants cultivated in the gardens of the Duke d'Arenberg-Niepen in Belgium. It was discovered by Oersted, apparently in Guatemala, who introduced it to European gardens prior to 1850. Wendland was unsure of its provenance, but tentatively listed its origin as Guatemala. According to Guillaumin (1923), it was cultivated at the Musée de Paris in France as early as 1862 under the name *C. densiflora*.

Chamaedorea arenbergiana occurs in moist and wet forest from México through Guatemala, Honduras, El Salvador and, perhaps, Nicaragua. Some of the collections identified as *C. arenbergiana* which have extended its range to Costa Rica, Panama, and Colombia are probably *C. allenii*, *C. crucensis*, or closely related, yet unnamed, taxa.

Chamaedorea arenbergiana is very close to *C. casperiana* from which it differs mainly in its larger leaves and pinnae and

pistillate spadices being generally simple or furcate (Wendland 1854; Standley and Steyermark 1958). Also, photographs of the type specimens of *C. casperiana* (Dahlgren, pl. 99, 1959) show the staminate inflorescence to have an elongated rachis, more like that of *C. tepejilote*. Further study may prove *C. arenbergiana* to be conspecific with *C. casperiana*; if so, the latter name would have priority.

Chamaedorea casperiana Klotzsch in Otto & Dietr. Allg. Gartenzeit. 20: 363, 1852. Type: Cult., *Klotzsch s. n.* (HAN, destroyed).

Stephanostachys casperiana (Klotzsch) Oerst., Vidensk. Meddel. Kjoeb. 1858: 27, 1859.

Nunnezharia casperiana (Klotzsch) O. Kuntze, Rev. Gen. Plant. 2: 730, 1891.

The only species of subgenus *Stephanostachys* apparently not presently in cultivation, *Chamaedorea casperiana* was named by Frederick Klotzsch (1852) from plants cultivated at the botanic gardens in Schonhausen near Berlin. These plants were grown from seeds collected by Warscewicz in Guatemala and sent to Europe in 1849. Its provenance is uncertain, however, since Guatemala then was a term rather loosely applied to areas from the present-day nation to as far south as Costa Rica. Standley and Steyermark (1958) noted that it has not appeared in recent collections from Guatemala. However, material from Costa Rica, *Moore 6689* and *6690* (BH) from near Moravia and Tuis, may be referable to *C. casperiana*, although it differs slightly from the description of the type in the fewer pinnae and yellow-green staminate flowers.

Material of *C. casperiana* distributed as such by Wendland and pictured by Dahlgren (1959, pl. 99) appears very similar to *C. tepejilote*. However, Standley and Steyermark (1958), citing Dahlgren's plate, note that the staminate calyx is con-

spicuously cupular in bud. This distinguishes it easily from *C. tepejilote* which has a low, annular calyx.

Chamaedorea cataractarum Mart., Hist. Nat. Palm. 3: 309, 1849. Type: México, *Liebmann 10808* (C).

Stachyophorbe cataractarum (Mart.) Liebm. ex Klotzsch, Allg. Gartenzeit. 20: 363, 1852; name only in Liebmann, 1846.

Chamaedorea martiana H. A. Wendl., Otto & Dietr. Allg. Gartenzeit. 21: 137, 1853. Type: Cult., *Wendland s. n.* (GOET).

Stephanostachys martiana (H. A. Wendl.) Oerst., Vidensk. Meddel. Kjoeb. 1858: 29, 1859.

Nunnezharia cataractarum (Mart.) O. Kuntze, Rev. Gen. Plant. 2: 730, 1891.

Nunnezharia martiana (H. A. Wendl.) O. Kuntze, Rev. Gen. Plant. 2: 730, 1891.

Vadia jotalana O. F. Cook, Nat. Hort. Mag. 26: 12, figs. 1-3, 5-8, 1947, name of no botanical standing.

Vadia atrovirens O. F. Cook, Nat. Hort. Mag. 26: 26, 1947, name of no botanical standing; not *C. atrovirens* Mart.

Fairly common in cultivation, *C. cataractarum* was introduced to Europe in the 1840s, probably by Frederick Liebmann who collected it during his travels in México along streams and cataracts near Joco-tepec in Oaxaca. Later, Martius (1849) formally described and named the species. A few years after Martius named *C. cataractarum*, Wendland (1853) described and named *C. martiana* from material introduced by Linden to European gardens from Chiapas, México. Wendland (1854) reported *C. martiana* growing in several gardens in Europe while Guillaumin (1923) stated that it had been growing at the Musée de Paris since 1850 from Linden's introduction.

I have examined Liebmann's type of *C. cataractarum* from Copenhagen (*Lieb-*

mann 10808) and seen photographs of Wendland's type of *C. martiana* from Göttingen. I see no significant differences and hold them to be the same.

In horticulture, *C. cataractarum* has been confused with *C. atrovirens*. In 19th-century Europe, this latter name was erroneously applied to material of *C. cataractarum* and, in many instances, this is still the case today in Florida, California, Hawaii, and Australia. On the other hand, some material grown as *C. cataractarum* is actually *C. oreophila*.

Chamaedorea cataractarum is unusual in its habitat and habit. One of the few rheophytes in the palm family, it inhabits the banks of rivers and streams of the Atlantic slope of México in the states of Oaxaca, Tabasco, and Chiapas, often occurring in the water and being wholly or partially submerged during heavy rains and floods. It was originally found near waterfalls and cataracts, hence the specific epithet. In Chiapas, I observed large clumps several meters across growing along the banks of streams or small rivers. These clumps, like giant bull rushes, tended to capture and trap debris during times of high water. The debris line on the clumps of the palms was an indication of how high the water rose.

Chamaedorea cataractarum is also unusual in its habit of dichotomous branching. With age, plants tend to creep along the ground with their horizontal stems branching in a dichotomous manner. Fisher (1974) provides a thorough and well illustrated account of this stem form. This dichotomous branching habit results in thick clumps with a sturdy network of thick, horizontal stems which grow along the ground, anchoring the clump securely. Along with flexible leaves and leaflets that tend to bend and sway with an opposing force, the creeping and securely anchored stem enables *C. cataractarum* to grow and survive in and along streams where it is occasionally inundated by swiftly moving water.

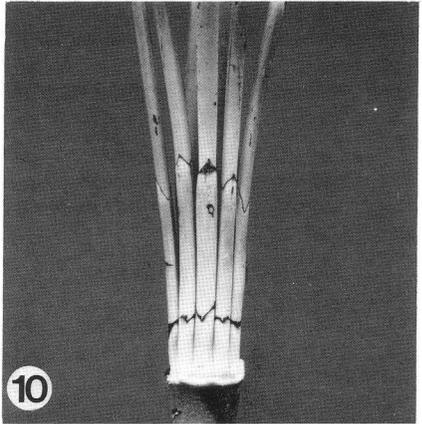
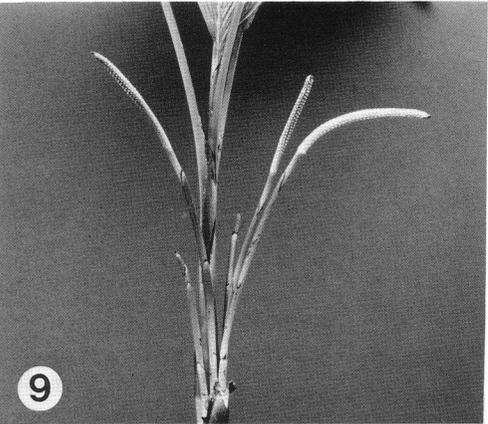
***Chamaedorea crucensis* D. R. Hodel
sp. nov.** (Fig. 7).

C. allenii affinis sed floribus masculinis albidis, antheris exsertis differt; *C. zamorae* affinis sed antheris exsertis, fructibus nigris, segmentis 9–11 utrinsecus differt. Typus: Costa Rica, D. R. & M. A. Hodel 706A (holotypus, BH; isotypus, CR).

Stem solitary, erect or rarely decumbent, 1–2 m tall, 1.8–2 cm diam., green, smooth, ringed, basally with prominent brown stilt roots to 10–15 cm high, internodes 4–8 cm long. Leaves 5, erect-spreading, pinnate; sheath to 30 cm long, obliquely open at the apex and split opposite the petiole, green but distinctly pale or yellow-margined, longitudinally striate-nerved; petiole to 50 cm long, slightly grooved adaxially toward the base, rounded and pale-banded abaxially; rachis to 80 cm long, green and angled adaxially, rounded and pale abaxially; pinnae 9–11 on each side of the rachis, shining green, subopposite, regularly arranged, lanceolate, to 35 × 6.5 cm, sigmoid, falcately long-acuminate, slightly drooping at the tip, slightly contracted at the base, 9 prominent and equidistant primary nerves adaxially, the apical pinnae slightly wider.

Inflorescences interfoliar but often infrafoliar in fruit, erect, long-pedunculate, spicate or sometimes the staminate furcate; peduncles to 30 cm long, pale at anthesis, orange in fruit; bracts 5–6, green, deciduous; staminate with the rachis or flower-bearing portion to 10–15 cm long, pendulous; pistillate with the rachis or flower-bearing portion to 10 cm long, straight and stiff at anthesis, curved, swollen and red-orange in fruit.

Flowers densely packed, contiguous in bud. Staminate flowers white; calyx prominent, sepals 3 × 1 mm, joined in a very low rim with narrow lobes to 2 mm long, lobes ± double along the truncate upper margins; corolla with the petals distinct, valvate, opening distally, 3.5 × 2.25 mm; stamens with the filaments 4 × 0.75 mm,



7. *Chamaedorea crucensis*, D. R. & M. A. Hodel 806A, the individual from which the type specimen was collected, grows in rain forest near San Vito, Costa Rica. Note the staminate inflorescence below the hand. 8. *Chamaedorea deckeriana*, D. R. & M. A. Hodel 718, grows in dense, wet rain forest along the Río Sarapiquí near San Miguel, Costa Rica. Note the simple, bifid leaves and infrutescence with densely packed fruits. 9–10. The spicate, staminate inflorescences of *C. deckeriana* are multiple at a node. Figure 10 shows the basal portions of the inflorescences with the leaf base removed from that node. Both photographs are of a plant cultivated in Los Angeles, D. R. Hodel 797, grown from seeds originally collected near the Río Sucío, Costa Rica.

curved distally, anthers 1×0.5 mm, borne at the tips of the filaments and exerted above the petals at anthesis, forming a stellate pattern on the surface of the flower; pistillode columnar, 2.5×0.5 mm, at a

lower level than the anthers. Pistillate flowers irregular, $2.5\text{--}3.5 \times 2.5$ mm, yellowish; calyx prominent, sepals forming a complete ringlike sheath around each flower, 1.5 mm high, no definite sepal tips

but very low notches between some sepals; corolla with the petals not open, imbricate, hooded, flat distally; staminodes lacking; pistil nearly globose, 2 mm diam. Fruits densely packed, angled by mutual pressure, 8–10 mm long, green when immature changing to red or orange near maturity and then black when completely ripe; seeds ellipsoid, 5–7 mm long.

Distribution: COSTA RICA. Puntarenas: dense, wet forest on the Pacific slope, 1,000 m elevation. Probably endemic.

Specimens Examined: COSTA RICA. Puntarenas: San Vito de Coto Brus, in forest remnants adjacent to Jardin Botanico Robert y Catherine Wilson, 1,000 m elev., *D. R. & M. A. Hodel 706A* (holotype, BH; isotype, CR); *706B* (BH, CR); *H. E. Moore, Jr. 9430, 9991* (BH); *H. E. Moore, Jr. & M. V. Parthasarathy 9444* (BH). CULTIVATED. United States. California: Huntington Beach, in the garden of Frank Ketchum, received as seedlings grown by R. Wilson from seeds collected at the type locality, *D. R. Hodel 776* (BH).

The epithet is taken from the type locality near the Jardin Botanico Robert y Catherine Wilson (JBRCW), formerly well known to botanists and horticulturists as Las Cruces Tropical Botanical Garden. *C. crucensis* occurs in forest remnants adjacent to JBRCW near San Vito, Puntarenas in southeastern Costa Rica (Fig. 7). Wilson established the species in his garden and over the years distributed seeds and seedlings to palm collectors and hobbyists.

Chamaedorea crucensis is similar to *C. allenii* but can be distinguished by the white staminate flowers with the stamens (anthers) protruding beyond the corolla at anthesis. It can be distinguished from *C. zamorae* in the anthers protruding beyond the corolla at anthesis, black fruit, and 9–11 pinnae on each side of the rachis with the end pair not as broad as the others combined.

Apparently not widely distributed, *C. crucensis* has been collected with certainty

only at or near the type locality. It is unfortunate that numerous, similar collections from the Pacific slope of Costa Rica are pistillate specimens since staminate material is better for diagnosing this species and related taxa. Future collections of staminate material may result in a broadening of the range of *C. crucensis*.

Chamaedorea deckeriana (Klotzsch) Hemsl. in Godman & Salvin, Biol. Centr. Amer., Bot. 3: 404, 1885.

Stachyophorbe deckeriana Klotzsch, Otto. & Dietr. Allg. Gartenzeit. 20: 364, 1852. Type: Cult., *Klotzsch s. n.* (HAN, destroyed).

Dasystachys deckeriana (Klotzsch) Oerst., Vidensk. Meddel. Kjoeb. 1858: 25, 1859.

Nunnezharia deckeriana (Klotzsch) O. Kuntze, Rev. Gen. Plant. 2: 730, 1891.

Stem solitary, 0.3–2 m tall, erect but sometimes procumbent for a short distance, green, smooth, conspicuously ringed, internodes 2–5 cm long. Leaves 4–5, simple and bifid (Fig. 8), 90–125 cm long; sheath 15–25 cm long with an oblique and \pm elongated opening, only about the lower $\frac{2}{3}$ tightly clasping the stem in a circular manner; petiole 15–25 cm long, green and flattened adaxially with the lower margins of the leaf faintly visible as they extend on either side to the sheath, rounded and pale abaxially; rachis 20–35 cm long, angled adaxially, rounded and pale abaxially; blade thin, 50–70 \times 25–35 cm, obovate in outline, cuneate at the base, deeply incised at the apex, lobes broadly lanceolate, 25–35 \times 15–20 cm, outer margins coarsely serrate, primary nerves 20 on each side of the rachis.

Inflorescences interfoliar, emerging from behind the leaf bases although sometimes infrafoliar in fruit, spicate, erect although pendulous when heavily laden with fruits. Staminate inflorescences 4–10 per node (Figs. 9, 10), the middle one developing and opening first; peduncle 20–25 \times 0.5–1

cm, rounded, green in flower; bracts 4-5, green when young becoming brownish with age, longitudinally striate-nerved, \pm loosely sheathing, becoming progressively larger distally, slightly inflated, the terminal one equalling or exceeding the peduncle, acute-acuminate, bifid, slightly flattened, prophyll 3 cm long, 2nd bract 8 cm long, 3rd 15 cm long, 4th 15-20 cm long; rachis or flower-bearing portion 10 cm long. Pistillate inflorescence solitary at the nodes (Fig. 13); peduncle to 30 cm long, erect and then arching downward in fruit, greenish in flower, flattened and orange in fruit, 1 cm wide at the base, 1-1.5 cm wide at the apex; bracts 5, green in flower, fibrous and tattered in fruit, longitudinally striate-nerved, acute-acuminate, bifid, prophyll 3 cm long, 2nd bract 8-10 cm long, 3rd, the longest, to 18 cm long, bifid, 4th 13 cm long, uppermost very short and \pm rudimentary; rachis or flower-bearing portion to 15 cm long, green and erect in flower, \pm flattened, 1 cm wide, 5 mm diam., swollen and orange in fruit, hanging downward, 2 cm diam.

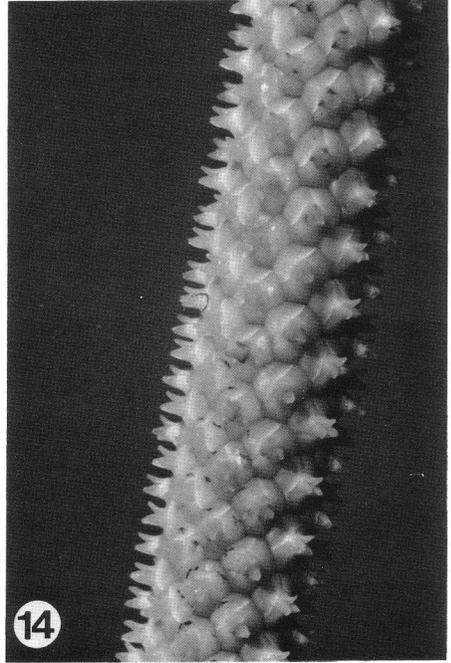
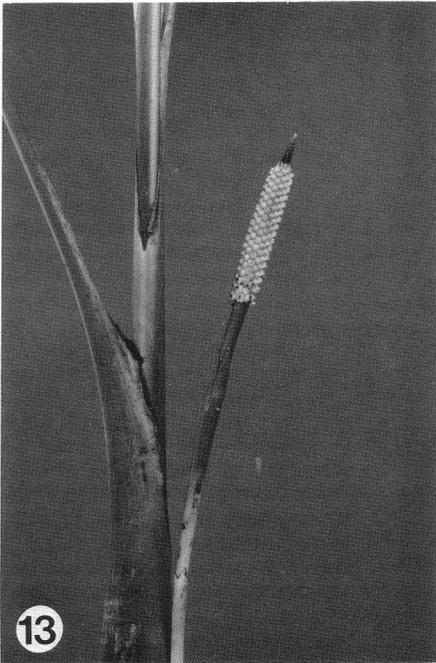
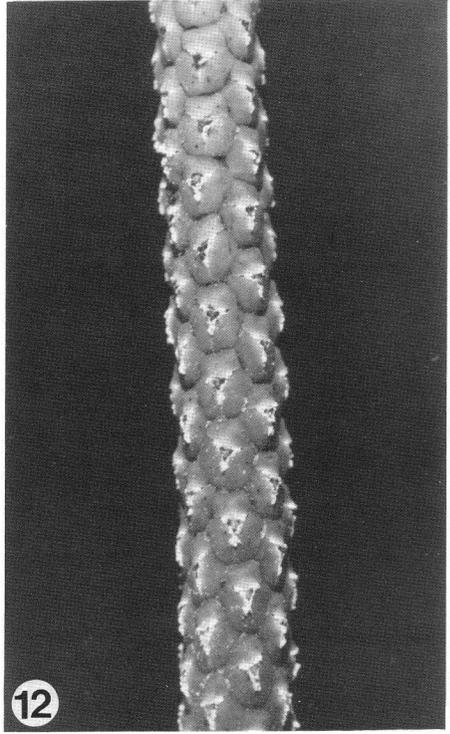
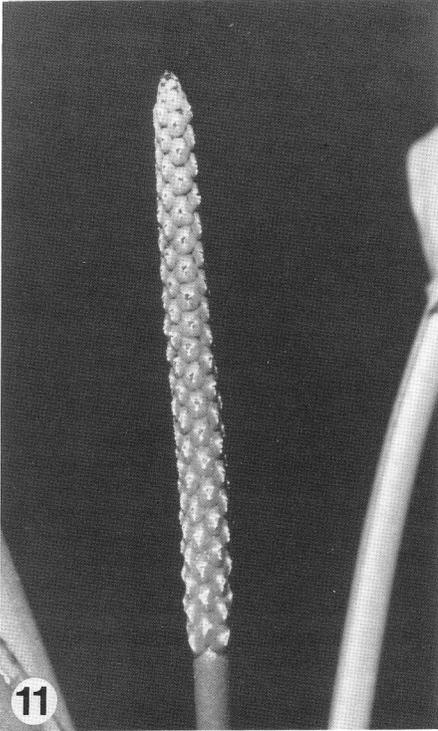
Staminate flowers immersed in the axis and borne in 6-10 very densely appressed rows (Figs. 11, 12), contiguous, green, 1.5-2 \times 2.5-3 mm, emitting a distinct spicyanise odor at anthesis; calyx prominent, sepals joined basally to form a very shallow thin ringlike cupule with 3 erect apically rounded lobes 1 \times 0.5-0.75 mm, membranous; corolla with the petals irregularly 6-angled apparently from mutual pressure of close packing, distinct, valvate, thick-fleshy, green, varying in width from 1-2 mm, usually 2 wider and 1 narrower per flower, erect for 1.5 mm then abruptly inflexed and tapering to flat pointed tips, the tips of adjacent petals closely appressed in bud, opening as slits through which the anthers are exerted at anthesis; stamens with the filaments flattened, short, 1 \times 0.75 mm, fleshy, tapering abruptly at the tip, anthers very short, 0.75 \times 0.3 mm, latrorse, dorsifixed, \pm versatile at anthesis, exerted from between petal slits on the

distal flat top of the flower; pistillode columnar, fleshy, 3-lobed, the rounded tip exposed in the center of the flower at anthesis. Pistillate flowers densely packed in 10-12 rows of up to 30 flowers per row (Fig. 14), contiguous, slightly immersed in the rachis, 3 \times 3 mm, greenish changing to greenish-yellow, angled by close packing as those of the staminate; calyx with the sepals connate in a cupule 1 mm high; corolla with the petals distinct, imbricate, subreniform, 2 \times 2.5 mm, tips inflexed to 1 mm, the distal margins rounded to truncate; pistil ovoid, 3 \times 2.5 mm, \pm 3-sided, stigmas separate, exerted well beyond the corolla, 1 mm long, open, erect and only very slightly if at all reflexed, light yellow; ovules 3, laterally attached.

Fruits green when immature becoming red-orange when soft ripe (Fig. 15) and finally aging blackish, contiguous, densely packed, flattened and/or angled by mutual pressure, \pm obovoid-globose and stalked in appearance, 1-1.5 \times 0.5-1 cm, exocarp smooth, mesocarp fleshy, endocarp thin; seeds obovoid, 10 \times 7 mm, endosperm homogeneous; embryo lateral; abortive carpels basal; perianth persistent, sepals 1 mm long, petals 2 mm long.

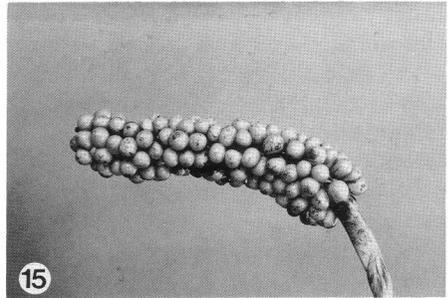
Distribution: COSTA RICA. Alajuela. Cartago. Limón. PANAMA. Bocas del Toro (Fig. 16). Colón. Panama. Dense, wet forest on the Atlantic slope, 0-900 m elevation.

Specimens Examined: COSTA RICA. Cartago: Moravia, *H. E. Moore Jr.* 6688 (BH); Pavones, *H. E. Moore Jr.* 6741 (BH). Alajuela: San Miguel, Río Sarapiquí, *D. R. & M. A. Hodel* 717 (BH, CR), 718 (BH); Río Peje, *G. de Nevers & B. Hammel* 7811 (MO); *G. de Nevers* 7809 (MO); San Ramón, *G. de Nevers et al.* 7804 (MO). Limón: Quebrada El Molinete, *M. Grayum & B. Jacobs* 3537 (MO). PANAMA. Colon: Río Guanche, *T. Croat* 26178 (MO); *S. Mori & J. Kallunki* 3017 (MO); *S. Knapp* 1420 (MO); Santa Rita Ridge, *G. de Nevers* 6877 (MO). Panama: headwaters of the Río Chagres, Río Esperanza,



and Río Piedras, *G. de Nevers* 4062 (MO). Bocas del Toro: Chiriquí Grande, *D. R. & R. J. Hodel* 660 (live plant taken to Los Angeles, California). CULTIVATED. Costa Rica: San Vito de Coto Brus, Jardín Botánico Robert y Catherine Wilson, *D. R. Hodel* 618A, 618B (BH), originally collected near Moravia, Cartago, Costa Rica. United States. California: Los Angeles, in greenhouse, *D. R. Hodel* 780, 797 (BH), grown from seeds originally collected by J. Folsom along the Río Sucío, Costa Rica. Germany. Hannover: Herrenhausen, plant grown by H. Wendland, probably from Warscewicz's original introduction (photo in Dahlgren, pl. 178, 1959).

With large, simple and bifid leaves and spicate inflorescences heavily laden with densely packed, bright red-orange fruits, *Chamaedorea deckeriana* is a spectacular plant. It was reportedly found in Guatemala by Warscewicz who sent seeds of it to Europe in 1849. Klotzsch described and named it from cultivated plants grown from these seeds. It is doubtful if its origin is Guatemala, though, since it has never been recollected there (Standley and Steyermark 1958) and has apparently never been recorded north of Costa Rica. In the 19th Century, the term Guatemala was rather loosely applied to the area from that present-day state south to Costa Rica. Furthermore, Hermann Wendland found it in the valley of the Río Sarapiquí in Costa Rica (Dammer 1904) where it still occurs today. Although a type has not been located, Klotzsch's original description (1852), especially as it pertains to the green flowers, is adequate for diagnostic purposes. Other than Klotzsch's description, the only other clue to its habit is Dahlgren's photo (pl. 178, 1959) of a specimen grown



15. Inflorescence of *Chamaedorea deckeriana* heavily laden with densely packed, mature fruits, *D. R. Hodel* 780. 16. *Chamaedorea deckeriana*, *D. R. Hodel* 660, in dense, wet rain forest near Chiriquí Grande, Bocas del Toro, Panama.

at Herrenhausen by Wendland probably from Warscewicz's original introduction.

We have successfully established plants of *C. deckeriana* in the greenhouse in Los Angeles. These were grown from seeds collected along the Río Sucío on the Atlantic slope of Costa Rica and agree well with Klotzsch's description and photographs of Wendland's cultivated material. Fortunately, we have plants of both sexes and have successfully hand-pollinated them and set fruits. At anthesis, flowers of both sexes emit a fragrance best described as spicy-anise. Filling the entire greenhouse with its distinctive odor, it conjures up images of a deep, dark, primeval rain forest, just

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11-12. Staminate inflorescence of *Chamaedorea deckeriana* showing densely packed flowers. 13. The spicate, pistillate inflorescences of *Chamaedorea deckeriana* is solitary at a node, *D. R. Hodel* 780. Cultivated but grown from seeds originally collected along the Río Sucío, Costa Rica. 14. Portion of pistillate inflorescence of *Chamaedorea deckeriana* with crowded flowers.

the sort of habitat in which one finds *C. deckeriana*.

Chamaedorea oreophila Mart., Hist. Nat. Palm 3: 309, 1849. Type: México, *Liebmann 10810* (C).

Stachyophorbe montana Liebm. ex Oerst., Vidensk. Meddel. Kjoeb. 1858: 10, 1859; name only in Liebmann, 1846; not *C. montana* Mart.

Nunnezharia oreophila (Mart.) O. Kuntze, Rev. Gen. Plant. 2: 730, 1891.

Chamaedorea monostachys Burret, Notizbl. Bot. Gart. Berlin 11: 761, 1933. Type: México, *Seler 5183* (B, destroyed).

Stachyophorbe oreophila (Mart.) O. F. Cook, Nat. Hort. Mag. 22: 146, 1943.

Stachyophorbe filipes O. F. Cook, Nat. Hort. Mag. 22: 145, fig. 15, 1943, name of no botanical standing.

Chamaedorea oreophila was described and named by Martius from material collected by Liebmann in the 1840s in Oaxaca, México. Liebmann (1846) had suggested the name *Stachyophorbe montana* for the material he had collected. However, Martius (1849) felt that *Stachyophorbe* was simply the same as *Chamaedorea* and, accordingly, used this latter name. Martius was precluded from using the epithet *montana* since in the same paper he had already used it for another Liebmann collection from Oaxaca, México. Martius did, though, respect Liebmann's intent for the epithet *montana* since he replaced it with *oreophila*, derived from a Greek word meaning mountain-loving. Oersted (1859) continued to maintain *Stachyophorbe* separate from *Chamaedorea*.

Later, Burret (1933) named *Chamaedorea monostachys*, based on collections in Veracruz, México by Seler and Galeotti. Burret admitted that he was not confident of the differences between it and *C. oreophila*, especially since he had not seen

staminate material of the latter. The two species have been separated mainly on slight differences in the shape of leaflets and the number of staminate inflorescences per node, both variable characters. I have examined Liebman's type of *C. oreophila* from Copenhagen (*Liebman 10810*). Unfortunately, Burret's type of *C. monostachys* was destroyed during the Second World War but, based on his description and analysis, I can find no important differences. Some material of *C. oreophila* in cultivation is erroneously referred to as *Chamaedorea cataractarum* or, more infrequently, *C. atrovirens*.

Chamaedorea tepejilote Liebm. ex Mart., Hist. Nat. Palm. 3: 308, 1849; name only in Liebman, 1846. Type: México, *Liebmann s. n.* (C).

Stephanostachys tepejilote (Liebm. ex Mart.) Oerst., Vidensk. Meddel. Kjoeb. 1858: 28, 1859.

Stephanostachys wendlandiana Oerst., Vidensk. Meddel. Kjoeb. 1858: 28, 1859. Type: Cult., *Wendland s. n.* (C).

Chamaedorea wendlandiana (Oerst.) Hemsl. in Godman & Salvin, Biol. Cent. Amer. Bot. 3: 407, 1885.

Nunnezharia tepejilote (Liebm.) O. Kuntze, Rev. Gen. Plant. 2: 731, 1891.

Nunnezharia wendlandiana (Oerst.) O. Kuntze, Rev. Gen. Plant. 2: 730, 1891.

Chamaedorea exorrhiza H. A. Wendl. ex Guillaum., Bull. Mus. Hist. Nat. Paris 28: 542, 1922. Type: Cult., *Wendland s. n.* (P).

Chamaedorea anomospadix Burret, Notizbl. Bot. Gart. Berlin 11: 763, 1933. Type: Guatemala, *Tuerckheim 4042* (B, destroyed).

Chamaedorea sphaerocarpa Burret, Notizbl. Bot. Gart. Berlin 11: 762, 1933. Type: Nicaragua, *Preuss 1365* (B, destroyed).

Chamaedorea columbica Burret, Notizbl.

Bot. Gart. Berlin 12: 42, 1934. Type: Colombia, *Dryander 13* (B, destroyed). *Edanthe veraepacis* O. F. Cook & C. B. Doyle, Nat. Hort. Mag. 18: 174, figs. 1-9, 1939, name of no botanical standing.

Discovered by Liebmann at Matlaluca, Veracruz, México and described and named by Martius (1849), *Chamaedorea tepejilote* is widely cultivated today, appearing in gardens and collections in California, Hawaii, Florida, Australia, Europe, and elsewhere. In Europe, it has been cultivated since prior to the middle of the 19th Century where it was introduced by several collectors including Liebmann, Linden, and Oersted.

Chamaedorea tepejilote is an extremely variable species throughout its very wide range. The most widely distributed species of *Chamaedorea*, it occurs in moist or wet forests on a variety of substrates from México to northern Colombia. Separate taxa have been proposed based principally on size, number of parts, and nervature of pinnae. According to Standley and Steyermark (1958), it is difficult to find constant distinguishing features and, essentially, differences are of size, not of character. They placed *Chamaedorea wendlandiana* and *C. anomospadix* in synonymy with *C. tepejilote*. I have examined Liebmann's type of *C. tepejilote* from Copenhagen and the type of *C. exorrhiza* from Paris. I can see no outstanding differences and thus hold these to be the same. Unfortunately, the types of Burret's *C. sphaerocarpa* and *C. columbica* were destroyed at Berlin. However, from Burret's descriptions and discussions, these do not appear to be significantly different from *C. tepejilote*.

***Chamaedorea zamorae* D. R. Hodel sp. nov.** (Figs. 17-21).

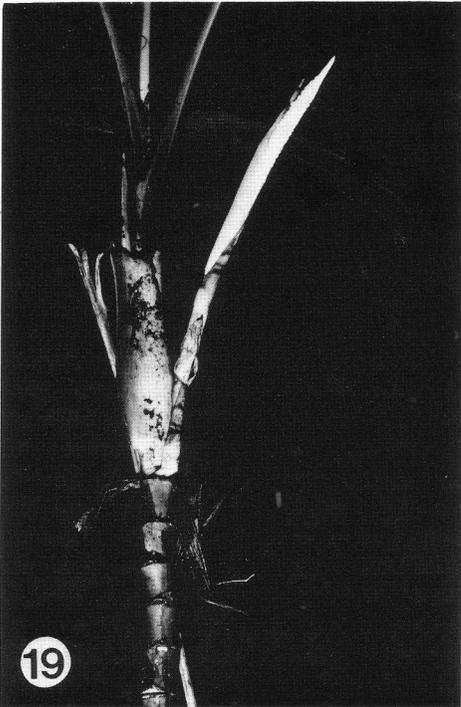
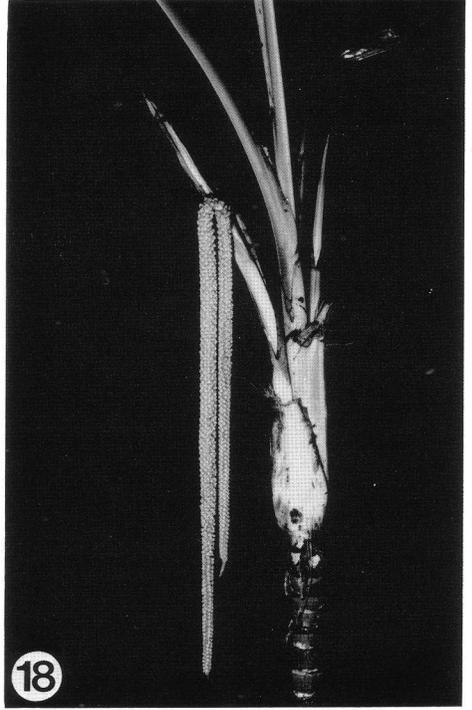
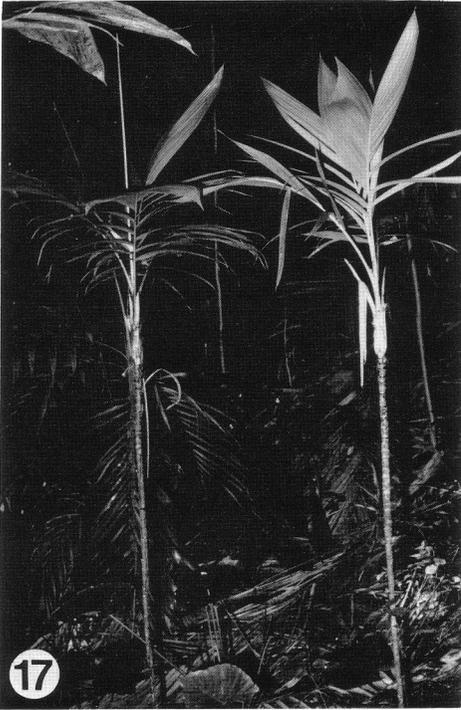
C. crucense et *C. allenii* affinis sed fructibus rubris, segmentis 1-6 utrinsecus,

apicalibus quam ceteris segmentis combinatus latioribus differt; a *C. crucense* antheris non exsertis differt; a *C. allenii* floribus masculinis albidis differt. Typus: Cult., D. R. Hodel & H. Bornhorst 830 (holotype, BH).

Stem solitary, erect, 2-3 m tall although flowering when acaulescent or nearly so, 2-2.5 cm diam., green, ringed, internodes 3-8 cm long (Fig. 17). Leaves 3-5, erect-spreading, pinnate or simple and bifid, shining green; sheath 15-20 cm long, obliquely open at the apex and there light green or nearly white and lightly striate-nerved; petiole 10-50 cm long, green and grooved adaxially, rounded abaxially with a pale band extending from the rachis onto the sheath; the rachis 40-60 cm long, green and angled adaxially, rounded and pale-banded abaxially; pinnae 3-6 on each side of the rachis, opposite or subopposite, all except the apical pair long-lanceolate, 20-30 × 2-3 cm, weakly sigmoid, falcately long-acuminate and drooping slightly at the tips, slightly contracted at the base, a midrib and 4-5 prominent nerves on each side of this adaxially, the apical pair of pinnae very broad, as broad or broader than the others combined, 12-18 cm wide and with more nerves, exterior margin coarsely toothed toward the apex.

Inflorescences interfoliar but often infrafoliar in fruit, erect; peduncles 15-30 cm long, erect or sometimes curved when laden with fruits, pale or greenish in flower, red-orange in fruit; bracts 5-6, green, thin-papery, turning brown in fruit, the uppermost opening long-oblique at the apex and exceeding the peduncle; staminate inflorescence furcate (Fig. 18) with a very short rachis 1-2 cm long or perhaps spicate, rachillae (or rachis if spicate) pendulous, 20-30 cm long, 1 cm wide with flowers at anthesis; Pistillate inflorescence spicate (Fig. 19); rachis or flower-bearing portion 10-15 cm long, stiff and erect in bud and in flower, becoming downward-pointing and curved in fruit.

Staminate flowers densely packed and



contiguous in 8 rows, brownish-white; calyx prominent, sepals joined shortly at the base, \pm rectangular, 2×1.5 mm, the tips broad, nearly truncate, rounded, thickened below across the tip, about one-half the height of the petals; corolla with the petals valvate, 4×2 mm, \pm fleshy, thickened along the margins; stamens with filaments 2.5 mm long, longer than the pistillode, terete, anthers 1×0.5 mm, medifixed and \pm versatile, at least at right angles to the filament, just inside the open petals and not protruding; pistillode columnar, 1.5×0.5 mm, the tips slightly expanded and with 3 rounded lobes, one-half as high as the stamens. Pistillate flowers densely packed and contiguous in irregular rows, 3.5×2.5 – 3.5 mm, yellow at anthesis; calyx prominent, sepals joined in a hyaline cupule, 2 mm high, the tips widely truncate, 2×0.5 mm, thicker than the cupule; corolla with the petals distinct, broadly imbricate, hooded with a short tip in the center of the "hood," 3×2.5 mm; staminodes lacking; pistil subglobose, 2.5×2.25 mm, stigmas closed but \pm triangular. Fruits green, maturing red and perhaps aging black, densely packed (Fig. 21), contiguous, angled by mutual pressure, conical-globose, 10 – 15×10 – 12 mm.

Distribution: COSTA RICA. Guanacaste. Alajuela. Dense, wet forest on the Atlantic slope, 800 m elevation or, perhaps, higher. Probably endemic.

Specimens Examined: COSTA RICA. Alajuela: near San Miguel along the Río Sarapiquí, *D. R. & M. A. Hodel 719* (BH, CR) (Fig. 20). CULTIVATED. United States. Hawaii: Honolulu, Wahiawa Botanic Garden of the Honolulu Botanic Gardens, *HBG 66.915*, grown from seeds collected in 1966 near Laguna de Arenal, Guana-



21. Infructescence of *Chamaedorea zamorae* showing densely packed fruits.

caste, Costa Rica, *D. R. Hodel & H. Bornhorst 830* (holotype, BH); *D. R. Hodel & H. Bornhorst 830B* (BH).

The epithet honors Costa Rican botanist Nelson Zamora, collector of exemplary specimens of many kinds of plants from his country.

The type of *C. zamorae* is from cultivated plants grown at Wahiawa Botanic Garden of the Honolulu Botanic Gardens in Hawaii. They were grown from seeds collected in 1966 by Harold Koopowitz near Laguna de Arenal in Costa Rica. By 1974 and up until at least 1978, they were fruiting with simple, bifid leaves and were nearly acaulescent. In 1987, they were flowering and fruiting, had erect stems about 2 m tall, and, for the most part, had leaves with 3–5 narrow basal pinnae on each side of the rachis and a pair of very broadly lobed apical pinnae.

Chamaedorea zamorae is similar to *C. crucensis* and *C. allenii*. In fruit, it may be difficult to distinguish between *C. deckeriana* and simple-leaved forms of *C. zamorae* and *C. allenii*. Some differences between these four species are summarized in the table below.

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17. The type specimen of *Chamaedorea zamorae*, *D. R. Hodel & H. Bornhorst 830*, was taken from the plant on the right cultivated in Hawaii. 18. Furcate staminate inflorescence of *Chamaedorea zamorae*. 19. Spicate pistillate inflorescence of *Chamaedorea zamorae*. 20. *Chamaedorea zamorae*, *D. R. & M. A. Hodel 719*, in dense, wet forest along the Río Sarapiquí near San Miguel, Costa Rica.

	<i>Chamaedorea zamorae</i>	<i>Chamaedorea allenii</i>	<i>Chamaedorea crucensis</i>	<i>Chamaedorea deckeriana</i>
pinnae/side	1-6; rarely simple, bifid	7-9; rarely simple, bifid	9-11	simple, bifid
sheath margin	whitish	whitish	whitish	green
inflor.	solitary	solitary	solitary	multiple
flowers	white	yellow	white	green
fruit	red > black	black	red > black	red > black

Acknowledgments

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