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A MONOGRAPH OF CARYODAPHNOPSIS A. SHAW

A. J. G. H. KOSTERMANS

ABSTRACT

Of the genus *Caryodapknopaia* 7 6pecie3 are known, of which two are described here for the first time. The genus ocenrs from Yunnan to Indochina, with the exception of *C. tonkinensis*, which goes as far as the Philippines and Borneo. Apparently most species are distributed by water and *C. towkinensis* is assumed to have spread from the mainland to Borneo during the glacial period, when a land connection existed.

The genus is related to *Nothaphoebe* and *Alseodaphne* and hence belongs to Perseae.

ABSTRAK

Marga *Caryodapknopsis* meliputi tujuh jenis, dua di antaranya dipertelakan di sini untuk pertama kali. Marga ini terdapat dari Yunnan sampai Indocma, kecuali C. *tonkin&K&is* yang teraebar sampai Filipina dan Borneo. Kebanyakan jenianya kemongkinan disebarkan oleh air dan *C. towkinensls* diduga menyebar dari daratan Asia ke Borneo dalam aaman es waktu hubungan daratan ma3ih ada.

Marga ini berkerabat dekat dengan *Natkaphoebe* dan *Atseodapltne* dan karenanya termasuk puak Persene.

INTRODUCTION

The small entirely Asiatic genus *Caryodaphnopsis* was created by Airy Shaw (Kew Ball. 1940), who thought, that it might belong to *Apolloniea* (it belongs to *Perseae)* and created the name because of similarities between its leaves and those of some species of *Cryptocarya.* Unluckily *Caryodaphne* ia another name for *Cryptoearya,* the genus ia not at all related to *Cryptocarya* and triplinerved leaves are found in practically all genera of Lauraceae. Superficially the leaves and their position are like those of many *Cinnamomum* species.

The species C. *tonkinertAis* and *baviensis* had been originally described by Lecomte under *Nothaphoebe,* which was the correct disposition. In 1960 Shaw added C. *laotica.* W.F. Wang added in 1957 C.latifo*lia.*

In 1952 (J. sci. Research Indon. 1: 151) I had included *Nothaphoebe,* together with *Alseodaphne* and *Caryodaphnopsis* in the genus *Persea,* with which these genera are very closely related and hence it ia not

amazing, that Elmer described *Nothaphoebe tonkinensis* from the Philippines as *Persea pyriformis.*

There are, however, slight, but constant differences between *Alseodaphne, Nothaphoebe* and *Caryodaphnopsis (Machilus* has been referred definitely to *Persea).* All three have a fruit, attached to a naked pedicel (or when persistent or subpersistent, the tepals are not enlarged, as in *Phoebe* and *Apollonias)* They have unequal tepals, the outer three being much smaller, and large staminodeg (large is of course relative, they are large as compared to other Lauraceous genera).

Alseodaphne differs from *Persea* by its swollen, fleshy fruit pedicel. *Nothapkoebe, Caryodaphnopsis* and *Persea* have an unaltered pedicel.

The flower structure in the 3 genera is similar. *Persea* has long and slender filaments (also the staminodes), while *Caryodaphnopsis* and *Nothaphoebe* have short filaments (in *Nothaphoebe* sometimes lacking completely).

The differences between *Nothaphoebe* and *Caryodaphnopsis* are:

1. The filaments are longer than in *Nothaphoebe,* but shorter than in *Persea.*
2. The anthers are relatively large in *Caryodaphnopsis* resembling those of *Persea, Nothaphoebe* has minute and depressed anthers, as in *Alseodaphne.*
3. The staminodes are hardly visible in *Nothaphoebe,* they are relatively large, sagittate, cordate in *Caryodaphnopsis* (as in Persea), but they are, contrarily to *Persea* very shortly stalked.
4. *Caryodaphnopsis* has opposite (or almost so) leaves, which is found neither in *Persea,* nor in *Nothaphoebe* or *Alseodaphne*
5. Most *Nothaphoebe* species have a whitish, cork-like fruit pedicel, *Caryodaphnopsis* has the fruit stalk of a *Persea.*

It is pointed out here that complete references to the species are found in Kostermans, Bibliographia Lauracearum (1964); these are not repeated here.

DISCUSSION ON MORPHOLOGICAL CHARACTERS

Branches. All species have slender, stiff branches, which are either cylindrical or quadrangular, as a rule both are found in the same species. The branchlets are usually thickened and laterally flattened at the nodes and if the branchlets initially are pilose, the pubescence persists on the nodes. In species with a pilose inflorescence and even

those with a glabrous one (the base is always pilose), the pubescence extends to the axillar area of the branchlets.

Leaves. The leaves are always opposite or nearly so and perhaps also distichous. In all species the leaves arc chartaceous to thinly chartaceous and have a very uniform shape (subovate to elliptic) and texture. The upper surface is smooth, dull with usually impressed main nerves (or they are prominulous in a groove); the lower surface (in sicco) is yellowish brown (pale green in vivo). The leaves are always triplinerved, the basal veins vary in length from 1/2 to 2/4 the length of the leaf blade; accessory laterals number 2—3 pairs, are always arcuately ascendent.

The only difference in the leaves is perhaps the leaf-size (but this is variable), the length and diameter of the petiole, but especially the prominence of the secondary, horizontal (scalariform) nerves. The tertiary nerves form in all species a lax, inconspicuous reticulation. The leaf apex ia always acuminate, the acumen being either broad and gradually tapered to a sharp point or slender. Both types occur in the same specimen. The very minute and sparse pilosity of the leaves is a distinctive characteristic.

Flower. The inflorescences are mostly axillary, sometimes axillary and terminal (C. *laotica).* They are thyrsoid, slender, the branches opposite, the terminal flowers in groups of 3 and more; ramifications and flowers are subtended by small, acute, ultimately deciduous bracts. Sometimes the axils of the branches bear short branches or single flowers. The panicles may be pyramidal, but in *N. tonkinensis* and *metallica* the lateral branches are very shortened and the flowers are in glomerules of heads.

The flowers always have well developed, slender pedicels. The flowers itself look very much the flowers of some Annonaceae with the small, often scale like three outer petals and the large ovate-deltoid inner petals, initially coalescent in a pointed bud. The outside of the flower is either pilose or glabrous, the inside of the fleshy inner tepala is always densely pilose (in *C. henryi* more sparsely).

The 6 fertile stamens are arranged in 3 whorls, the 4th whorl is staminodial, the staminodes being relatively large, ovate or ovate-sagittate or cordate, often with a thickened rim and with short filaments. The outer 2 whorls have large, flattened, oblong or rectangular anthers with 4 large introrse cells in pairs above each other (as in *Persea),* the inner are usually narrower with the lower cells extrorse, the upper lateral. All stamens have distinct filaments, which are about as long

as the anthers. The outer filaments are concave and hence look smaller than the erect inner ones. The inner ones have two well-developed sessile glands an either side the filament base. In *C. tonkinensis* the anthers are more elongate and acuminate or apiculate and differ in this way considerably from the other species. The ovary is always glabrous, ellipsoid to ovoid-ellipsoid and merges into a slightly shorter style with very small, often lobed stigma. The flower receptacle is shallow.

Fruit. The fruit is large, soft, green or yellow-green, glossy, the mesocarp soft and pulpy (like avocado), the large seed covered by a thin, testa is at maturity separated from the endocarp by an air containing[1] space. The fruit of most (or all) species are distributed by fresh water and hence the trees are found mostly along streamlets on alluvials. *C. tonknensis* in Borneo is also found farther away from the rivers and rivulets, because of the rising of the water during the rainy season followed by inundation of enormous areas.

Bole. The bole of *C. tonknensis,* the only species, which I could study in the field, has a smooth, redbrown bark and is partially or entirely fluted, the flutes merging- into numerous thin, hard not very conspicuous buttresses, which spread over the soil, typical for many tree species growing in similar habitats. The wood is pale yellowish, hard with a faint cigarbox wood smell; the heartwood is darker, very dense and not very thick.

The tree flowers and fruits already at an early stage, when it is still ahrubtike and abundant and regular fruit setting accounts for its extensive distribution. Along streams the shrubs have often pendulous branches, similar to other rheophytes.

KEY TO THE SPECIES

1. Leaves pubescent underneath, the scalariform secondary nerves very conspicuous
   2. Flowers glabrous. Inner tepale 2-2.5 mm long. Stamens 1 mm long 1. *C. baviensis*
   2. Flowers pubescent. Inner tepals 1.8—2 mm long. Stamens 0.5 mm long 2. *C. laotica*
1. Leaves glabrous
   3. Young inflorescence densely rufous tomentose 3. *C. poilanei*
   3. Inflorescence glabrous or nearly BO
      4. Lower leafsurface rather dull. Inflorescence pyramidal. Inside of inner tepals sparsely pilose 4. *C. henryi*
      4. Lower leafsurface very glossy. Inflorescence a very narrow panicle with widely spaced very short branches. Inner tepals fimbriate, inside densely pilose E. C. *metallic**

3. Inflorescence sparsely pilose
   5. Leaves up to 7 X 18 cm long. Panicles up to 10 cm long. Inner tepala 3—3.5 mm long 6. *C. tonkinensis*
   5. Leaves 25-30 cm long. Panicles 14-25 cm long, inner tepals 1.7-2.5 mm long 7. *C. latifolia*

CARYODAPHNOPSIS A. Shaw

A. Shaw *in* Kew Bull. 1940: 74; Kostermans *in* Reinwardtia 4: 225. 1957; Bibl. Laur. 211. 1964.

Shrubs or trees. Branchlets cylindrical to quadrangular. Leaves entire, opposite or sub-opposite, thinly chartaceous to rigidly chartaceous, elliptic to ovate-elliptic, acuminate, base contracted into the petiole, triplinerved. Upper surface dull with impressed main nerves; lower surface pale brown (in sicco), light green (in vivo), glabrous or sparsely pubescent; the sub-basal laterals arcuately ascending to ½—⅔ the blade lenth, other laterals 2—3 pairs, arcuately ascendent; secondary nerves parallel, subhorizontal (scalariform), more or less prominent. Petioles rather slender. Panicles slender, narrow or pyramidal, axillary or/and terminal, the branches sub-opposite, sometimes very short and widely spaced. Bracts and bracteoles minute, ultimately caducous. Pedicels slender, conspicuous. Flowers bisexual, trimerous. Tube very shallow. Outer tepals much smaller than the inner ones, both somewhat fleshy. Fertile stamens 9 in three whorls, anthers 4-celled, elliptic or subrectangular to narrowly elliptic, truncate or acuminate, outer 6 ones with introrse, large cells, inner ones with extrorse, the upper cells often lateral. Filaments as long as the anthers. Inner 3 stamens with basal glands. Staminodes of whorl 4 relatively large, cordate to sagittate, stipitate. Ovary glabrous with a shorter style and minute stigma. Fruit large, consisting of a glossy green or yellow green exocarp, a thin, pulpy mesocarp and a very thin endocarp. Seed large, testa separated from the endocarp by an air space. Fruit pedicel slightly obconical, short, not thickened, the tepals deciduous or subpersistent, unaltered.

DISTRIBUTION: Yunnan to Indochina, one species (*C. tonkinensis*) also in the Philippines and Borneo.

1. CARYODAPHNOPSIS BAVIENSIS (Lee.) A. Shaw

A. Shaw *in* Kew Bull. 1940: 76: Kostermans, Bibl. Laur. 211. 1964; *Nothapkoebe baviensU* Lecomte in Nouv. Areh. Mus. Paris, Sér. 5, 5; 107. 1013; KoEtermans, Le. 1054; *Persia baviensis* (Lee.) Kostermans in J. sci. Res. Indon. 1: 39. 1853; Bibl.. Le. J205. - Typus: *Balansn, 2445* (BO, K, P), Mt. Bavi, Tonkin.

Shrub. Branchiets quadrangular, glossy, stiff, glabrous, at the (often broadened) nodes minutely, densely rusty tomentellous (hairs curved). Leaves chartaceous or thinly chartaceous, elliptic to subovate-elliptie, 7 x 11—11 x 22 cm, with a slender, sharp acumen, up to 1.5 cm

Fig. 1- *Cnryodayhnopsis poilunei* Kosterm.; liolotypaa (BO).

long, base shortly acutish; upper surface glabrous with slightly impressed, slender main nerves, lower surface very sparsely, minutely rusty pubescent, dull, secondary scalariform nerves very conspicuous, slender, prominent, in between them a very lax, prominulous, fine reticulation. Petiole 5—15 mm long, densely, minutely pilose, somewhat glabrescent. Panicles axillary, narrow, rather few-flowered, 5—15 cm long, densely minutely rusty pilose, later more sparsely pilose, branches usually very short, rarely one or two up to 5 cm long. Bracts up to 2 mm long, narrow, acute. Pedicel slender, up to 2 mm long, sparsely pilose. Bads glabrous. Tepals ovate, acute, outer ones 0.75 mm long, inner ones 2—2.5 mm long, both rather fleshy, inside densely pubescent. Stamena 1 mm long, anthers rectangular, as long as the densely pilose filaments, outer ones with introrse, very large slanting cells, occupying the entire anther; inner ones with one extrorse and one lateral pair of large cells; glands large, sessile. Staminodes 0.5 mm long, ovate-cordate to saggittate with thickened rim, very shortly stipitate. Ovary glabrous, ovoid-ellipsoid, merging into a slightly shorter style with minute, threelobed stigma.

There are some slight differences with Lecomte's description. No difference exists between the position of the basal nerves in *C. baviensis* and *tonkinensis.* The petioles in *C. baviensis* are sometimes glabrescent, The length of the panicles varies in both species; considerably. The staminodes are either obtuse or sagittate.

Although *C. baviensis* has the same kind of narrow panicle as *G. tonkinensis,* it may be easily differestiated by the smaller, glabrous flowers. Furthermore the leaf pubescence and the conspicuous scalariform secondary nerves on the lower leaf surface distinguish the two species.

TONKIN, between Hoa Binb and Vu Ban, Prov. Hiia Binh, May, fl., *Pettlct 6S99* 'BO, P); Lat Son, Mt. Veton Dang, Aug., young fr., *Bon s.n.* (P), leaves small, 2 X 5.5 — 6 x 14 cm, this might be *C. laotiea;* sine loc., f], *Poilane 25502* (BO, P); Mt. Bavi, fl., *Balnnsa, 2445* (P).

2. CARYODAPHNOPSIS LAOTICA A. Shaw

A. Shaw in Kew Ball. 14: 250. 1960; Kostermans, Bibl. Laur. 211. 1931. — Typus:kerr 20ISW (BM, BO, K).

Shrub or treelet, 5—*1* m high. Branchlets subcylindrical or angular, glabrescent (tardily on the nodes), the young branchlets minutely, densely strigose. Leaves membraneous to thinly chartaceous, elliptic to subovate-elliptic, 2.5 X 7—10 x 16 cm with a slender 0.5—2 cm long acumen, base contracted into the slender, 1—1.5 cm long, glabrescent petiole; upper surface glabrous, lower with very sparse, fine, minute pubescence, the secondary nerves conspicuously prominent, slender. Panicles axillary and terminal, up to 11 cm long, pyramidal, many-flowered, densely, minutely,

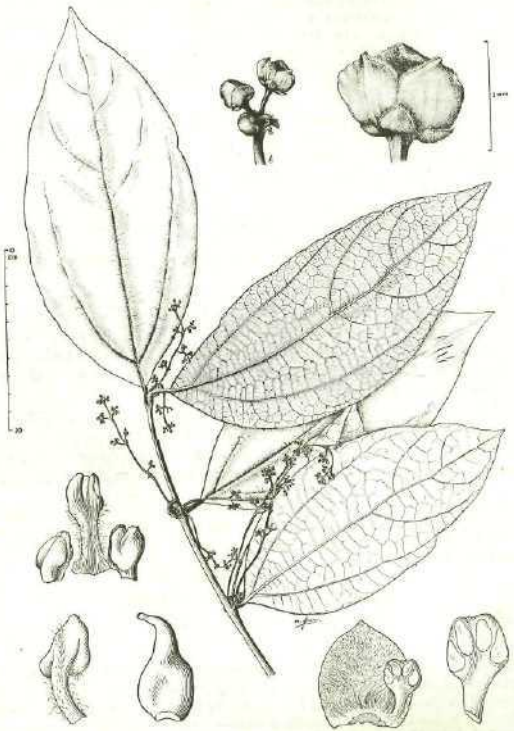

Fig. 2. *Cr^a^ovtis metdlica* Ko^rn,. - After *Poilane SU51* (BO).

finely rusty pubescent. Pedicels up to 2—3 mm long, pilose. Flowers outside densely, very minutely pilose. Outer tepals ovate, 0.75 mm long, inner ones ovate, acutish, 1.5—2 mm long, 2 mm wide at the base, both inside densely pubescent. Stamens 0.5 mm long; anthers quadrangular, slightly longer than the filaments, dater ones with small, introrse, inner ones with extrorse-lateral cells. Staminodes small, cordate, almost sessile. Ovary 1 mm long.

TONKiN. Between M. Toung and B. me, trail from Lai Chan to Phong Saly-, alt. 4-500 m, March, fl., *Poilane 25760*(BO, P), ahrub of 5 m, diam. 10 cm. LAOS. Tathom, Chieng Kwang, alt. 1300 m, April, fl., *Kerr 20893*(BM, BO, K).

3. Caryodaphnopsis poilanei Kosterm., *spec. nov.* - Fig. 1

Arbor ramulis glabris laevis nitidis foliis oppositis rigide chartaceis glabris ellipticis conspicue acuminatis basi acutiusculis supra perobscure minute reticulata nervo mediano costisque impress is subtus pallida opaca sublaevia (in sicco flava) nervo mediano prominentibus costis basalibus vel subbasalibus 3/4 laminorum attingentibus costis caeteribus paucis arcuatis prominentis venis secundariis gracilis laxis parallelis horizontals connectis, paniculis axillaris dense rufo-tomentosis ioliis reductis munitia bracteis bracteolisque sat magnis.

TYPUS: *Poilane 18803* (BO).

Tree 8—15 m high and 50 cm diam. Branchlets stiff, rather thick, smooth, glabrous. Leaves opposite, rigidly chartaceous, glabrous, elliptic, 8 x 15—10 x 24 m, conspicuously acuminate, with sharp tip, base shortly acute; upper surface very obscurely minutely reticulate, midrib and lateral nerves impressed, lower surface dull, smooth, in sicco yellow, midrib prominent, the 2 basal or sub-basal lateral nerves reaching 3/4 of the lamina length, prominent, other lateral nerves ca 3 pairs, arcuate, prominent, the outside of the basal nerves with a few, strong lateral nerves: secondary veins slender, prominuloua, lax, parallel. Petiole 1.5 cm, channeled above. The (very immature) panicles axillary, 7 cm long, densely rufous tomentose, stout, bearing reduced leaflets; branches opposite. Fruit globular (according to collector), in sicco ellipsoid, 3 x 5.5 cm.

Although the flowers are far too young to be analysed, their tomentum makes it very easy to recognize this species. The tree had only a single globular fruit (according to Poilane), the dried one is ellipsoid, 5 X 3.5 cm with a thin pericarp and a large seed.

TONKIN. between Trinh Thuong and Muong Him, Prov. of Lao Thay, alt. 1000-1500 m, rocky soil, Jan., fr., *Poilane 18103* (BO); between Nam Long and Phong Tah near Lao Key, alt. 600 m, April, buds, *Poilane 25502* (P).

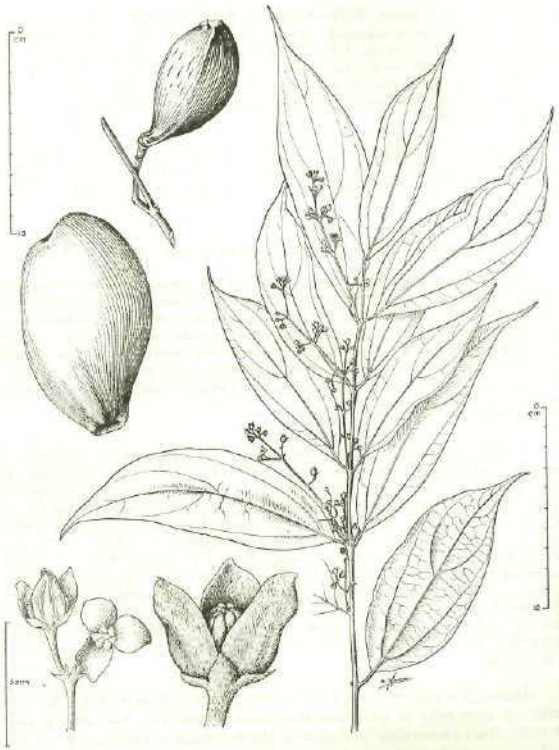

Fig. 3. *Caryodaphnopsis tonkinensis* (Lec.) A. Shaw — After *K 38* (BO), fruit after *Kostermans 5220* (BO).

i. CABYODAPHNOPSIS HENHYI A. Shaw

AA. Shaw *in* Kew Bull. 1940: 75; Kostermans, Bibl. Laur. 211. 1964; p*ersea* Henryi (A. Shaw) Kostermana *in* J. sci. Research lndon. 1: 151. 1952; Bibl., I.e. 1228. — Typus: *Henry 10692* (K, NT).

Nothaphoehe tonkinenais forma *brevipedicellata* Liou Ho, Laur. Chine *et* Indoehine 77. 1932; KoEtermana, Bibl., I.e. 1059. - Typus: *Henry loess* (K, NY).

Tree, 3—4.5 m high. Branchlets slender, cylindrical and subangular, glabrous. Leaves chartaeeous, glabrous, ovate to elliptic, 4.5 x 6.5—4 X 10—9 X 15 cm, acumen slender, up to 1 tm or gradually acuminate, upper surface with prominulous nerves, lower surface with very slender, not conspicuous secondary nerves. Petiole 10—2 mm long, slender. Panicles axillary, pyramidal, not very many-flowered, branches 5—8 mm long-, initially sparsely, minutely rusty pubescent, soon glabrous. Pedicels 2—3 mm long, glabrous. Outer tepals deltoid, 0.4—0.4 mm long (immature), inner ones broadly ovate-triangular, 2 mm lony, outside glabrous, inside densely, very minutely pilose. Outer stamens 1 mm long; anthers ovate-quadrangular, apex truncate. Filaments as long as the anthers, sparsely pubescent; inner stamens 1.5 mm long-. Stiminodes 0.S mm long, shortly sagittate; filaments glabrous or pilose, very short. The single collection has immature flowers.

CHINA. Yunnan: Feng Chen Lin, S. of the Red Ki-ver, mountain forest, It. 2100 m fl., *Henry 106H3* (K, NY).

5. Caryodaphnopsis metalliea Kosterm., *spec. nov.* — Fig. 2.

Arbor ramulis gracilis laevis glabris teretes, foliis chartaceis glabris cllipticis acuminatis basi acutisculis, supra laevia nerviis principalie subimpressis subtus nitidissima nerviis secundariis gracilis vix prominulis, paniculis angustis axillaris gracilis subglabris apicem versus minutissime perlaxe pilosis, floribus glabris, tepalibus intus pubescentis, staminibus exterioribus plerumque quadratis emerginatis cellulis magnis introrsis, interioribus anteribus angustioribus cellulis lateralis, filamentis omnino pubescentis, staminodiis sagittato-cordatis stipitatis.

TYPUS: *Eberhardt 4813* (BO).

Tree 9—10 m high and 30 cm diam. Branchlets rather slender, glabrous, smooth, cylindrical. Leaves opposite, chartaceous, glabrous, elliptic, 5 x 10-9 X 21 cm, acuminate, base shortly acute; upper surface dull with slender, slightly impressed main nerves, lower surface very glossy, pale, the secondary, parallel veins very slender, prominulous, not very conspicuous. Petiole glabrous, ca 1 cm long, concave above. Panicles as a rule axillary, slender, glabrous (except a few, minute hairs at the nodes), up to 10 cm long, the few branches widely spaced, very short. Pedicels slender, glabrous, 2 mm long. Buds and flowers glabrous outside, the tepals inside densely minutely pubescent, outer ones

0.5 mm, inner ones 2 mm long. Stamens 1 mm long, anthers as long as the slender densely pilose filaments; outer anthers quadrangular, emarginate, cells introrse; inner anthers rectangular, emarginate, lower cells extrorse, upper lateral; basal glands large, sessile; staminodes almost as long as the inner stamens sagittate on a short, pilose filament. Ovary ovoid-ellipsoid, glabrous, merging into a shorter style with minute stigma.

The species is manifestly related to *C. latifolia*, from which it differs by the shorter petioles and leaves and its pubescence. As the type material of *C. latifolia* is not available for examination, the possibility is not excluded, that both are conspecific. This belongs with *C. tonkinensis baviensis* and *latifolia* to the group with very narrow panicles with widely spaced, very short branches, in which character it is different from *C. henryi.*

TONKIN. Prov. Thuen Quang, Bach-Ngoc, fl. white, *Eberhardt 1813* (BO, P); Annam: S.W. of Tranuy, border of Quang Nam Prov., granite soil, alt. 500 m, Febr., fl., *Poilane 31422* (BO, P); near Moi village of Go-goe, S.W. and near the border of Quang Nam Prov., alt. 500 in, Febr., buds, *Poilane S1151* (BO, P).

6. CARYODAFHNOPSIS TONKINENSIS (Lee.) A. Shaw. — Fig. 3

A. Shaw m Kew Bull. 1910; 75; Hooker's Icon, fi: 3436. 1943; W.T. Wang in Aeta phytotax. Sinica 6 (2): 212. 1957 (quoad nomen); Kostermans, Bibl. Laur. 211. 1964; *in* Reinwardtia 7: 451. 1969 (quoad nomen tantumi; *Notkaphoebe tonkmensi** Lecomte *in* Nouv. Arch. Mus. Paris, 5e Sér. 5: 50 et 106. 1913; Kostermans, Bibl., *le.* 1059 (exeluB. forma *brevipedicellata* Liou Ho); *Persia tonkinensia* (Lee.) Kostermana *in* J. Sci. Research Indonesia 1: 151. 1952; Bibl., Laur. 1261. - Typus: *Balanaa 2441* (K, L, P).

Persia pyrifarmis Elmer, Leaflets Philip. Bot. 8: 2727. 1D15: Kostcrmans, Bibl. Lour. 1261; *Notluiphoebe pyriformis* (Elmer) Merrill in Univ. Calif. Publ. Bot. 15: 77. 1929; Kostermans, Bibl., Laur. 1058. - Typus: *Elmer 1S311* (K, LE, NY).

Shrub or tree, up to 30 m high and 60 cm diam. Bole up to 15 m long, fluted or only basal part fluted, merging into the thin, small or up to 1.5 m high buttresses, which may be out 50—100 cm. Bark smooth, dark redbrown, 1 mm thick; live bark S mm, light orange brown. Sapwood yellowish, 8—15 cm thick, heartwood dark brown with cigarbox wood smell. Branchleta slender, glabrous. Leaves chartaeeous, glabrous, narrowly to broadly elliptic, 3 x 10—5 X 12—7 x 18 cm, gradually acuminate, acumen short, 0.5—2 em long, base sometimes obtuse; upper surface with main nerves prominulous in a groove; secondary veins on the lower surface faint, very slender. Petiole slender, 1—1.5 cm lons:.

Panicles axillary, very narrow, up to 10 cm long, main peduncle slightly pilose. Branches short to very short (flowers sometimes attached directly to the main peduncle). Pedicels up to 1 cm long, densely pilose. Flowers very densely pubescent. Outer tepals 1 mm long, inner ones ovate,

acute, 3—3.5 mm long, both densely pilose inside. Stamens 2 mm long, outer ones with oblong, apiculate, obtuse anthers with large, introrse cells, the pilose filaments shorter than the anthers; inner stamens slightly longer with narrow, acutish anthers with extrorse cells, the filament as long as the anthers. Basal glands large. Staminodes 0.5 mm long, cordate or ovate-cordate, almost sessile. Fruit ellipsoid, up to 6 × 11 cm, smooth, green, light; mesocarp 5 mm thick, bitter aromatic. Testa dull brown, thin. Between testa and endocarp a thin air space. Fruit stalk slightly obconical, 5—10 mm long, at apex slightly wider. Tepals subpersistent.

This species, which I had the opportunity to observe in the field many times, occurs in Borneo on alluvial along streams and rivulets or in areas which are periodically inundated. The floating rather light fruit look somewhat like an avocado, but the pulp is thin and rather bitter and the seed much lighter.

The tree starts already flowering and fruiting when it is small. It produces fruit regularly, hence its wide distribution. The sharp well-developed, but short buttresses it has in common with several other species, growing along rivers.

Wang's specimen *(W.S. Lion 175),* as described *in* Aeta phytotax. Sinica, differs from *C. tonkinensis* by its coriaceous leaves and the description of the fruit does not fit either (mesocarpio dissoluto et reriucto, endocarpio cartilagineo). Without access to this specimen, it is impossible to ascertain its identity.

The species could have easily spread from the mainland to Borneo during the glacial period, when a land connection and connecting river systems exsisted.

TONKIN. Prov. Sontay, Mt. Bavi, May, fl., *Petelot 2649* (BO, MO, P); ibid., April, buda, *Piulat 688S* (BO, P|; road Hanoi - Hoa Binh, Kuong Than, along rivulet, April, fl., *Petelot 6794* (BO), leaves abnormally small; ibid., savannah with sparsely distributed trees on schistes, April, fl, *Petelot 4886*(P); between Hoa Binh and Clio Bo, Mn.rch, fl, *PUelot nsn* (BO, P|; N. of Plio Lu, Prov. Lao Kay, Red R. bunk, L. Chac, along rivulet, ster., *Poilane 25225* (BO, P); Anuam. Prov. Thua tü'en, May, fl., *Poilane 1406* (K); Prnv. Thanh Hoa, Hoi Xuan, Aug., fr., *Poilane 1784 (*BO, P). PUJPPINES. Tawi-tawi, Sulu Prov, July-Aug., fr, *Ramos & Edane B.Sc. 43955* (K, NY); SilHgao, ster, *Wemel 3658* (K, NY); April, fl, *Wenzel 2S38* IK, NY); April, young fr, *Wenzel 3296*(K, NY); June, fl., *Wenzel 2717* (K, NY); Mindanao, Bukidnon Prov, March, fl., *Oblaza F.B. 30282* (NY); Prov. Agusan, Cabadbaran, Mt. Urdantta, July, fr., *Elmer 13311* (K, LE, NY); Taumu, ster., *Warburg 14226* (NY); Surigao. April, fl. *Ponce F.B. 23897*(K, NY, P); Samar, April, fl., *Ramos B.Sc. 1687* (BM, L, NY, P), distributed as *Didlnekmiedia trmervm; Distr.* Zumboanga, Jan., fl. *Franco F.B. 24955* (K, NY); Leyte, Mt. Abueayan, Febr, fl, *Edano* B.Sc. 41720 (K). BORNEO. Sarawak, Gunung Matang, let Div.,

mixed Dipterocarp forest, alt. 600 m, Aug., f1., S. *20804* (A, BO, K, KEP, L, SAN, SING); *(i.* Sdabor, Ulu Kedap, Kerian Subdistr., limestone, alt. 150 m, tree 25 cm diam., abundant, Sept., fl., *S. 20828* (A, K, L, SAM, SING); Sabah (N. Borneo), Lahad Datu near Sg. Taun (10 miles W. of Segam Tobaeco Estate), alt, 10 m, April, fl., fr., *San 16065* (BO, K); ibid., Diwata For. Res., alt. 30 m, Nov., young fr., *San 39886* (K); Tawao, £1., *Elmer 21857* (BM, BO, C, K, L); Elopura, Sandakan, Lung Tolang BBT Co Camp, shrub 4 m, Dec, fl, San *A 1158* (BO, K); Sekong Gomp, alt. 40 m, near river, tree 23 m, diam. I m, Pebr., buds, *San 34917* (BO, K); Gumanting For. Res., Sg. Lambak, alt, 80 m, Oct., fl., *San 1,7252* (K), tree 16 ni, bole 4 m, diam 65 cm; Segaliud, along river bank, tree 4 m, diam. 10 cm, ater., Keith *F.D\ 9310* (K); Sandaknn, mile 17, Phang area, July, fr., San 26379 (K); W. Kalimantan, Sg. Landak, fl., *Teiismavit e.n.* (BO, L, P); E. Kalimantan, Biilungan, Mara, alt. 150 m, tree 19 m, ster., *hb. 10825* (BO); Bcrau, Tdg. Redeb, alt. 0 m, periodically flooded, tree 5 m, Nov., ripe green fruit, *Kostermaws 21705* (A, BO, CANB, C, K, L, P); Inaran, alt. 75 m, Oct., fl., *bb. 13123* (BO, L>; Sg. Pulai, alt, 400 m, ster., *bb. 19191* and *19210* (BO); foot of Mt. Njapa, periodically flooded, tree 5 m, Nov., rip« green fruit, *Kostermana 21705* (A, BO, CANB, G, K, L, P); foot of Mt. Njapo, periodically flooded, tree 35 nl., strongly fluted, dintn. 40 cm, Oct., fls. white, *Kostermaiw 21SSG* (A, BO, K, L); ibid., tree 10 in, ster., *Kostermans HiSX* (A, BO, CANB, G, K, L, US); Sangkulirang Distr., Menubar R., G. Tepianlobang, alt. 150 m, tree 25 m, diem. SO cm, Deo., fr. green (up to 6 x 11 cm), *Roster-maw 5820* (A, BO, K, KEP, L, LAE, NY, P, PNH, SING, SYD); G. Sekrat, S. of Sangkulirang, alt. 150 m, tree 30 m, diam. 60 cm, July, buds, *KnsUrmans 5005* (A, BO, K, L, LAE, P, PNH, SYD); Sangkuliran^, Mt. Medadem, alu-vium along Mandu R., alt. 100 m, tree 20 *m,* diam. 25 em, buttresses 2 m, out 50-100 cm, thin, bark smooth, redbrown, common, fla. white, *Kostermans 13482* (A, BO, K, L, SING); Central Kutei, Telen R., Kiham Batu Bong, alt. 25 m, tree 25 m, July, fls. white, fragrant, from the stem short dov.-nward aerial roots, *Endert 3017* (A, BO, K, L) and *2360* (BO); E. Kutei, Takat, 25 m alt., tree 10 m, ster., *bb. 13556* (BO, L); Loa Haur, S.W. of Samarinda, low sandy ridge, alt. 40 m, May, fr., *Koste.tw.ane B51S* (A, BO, K, L); ibid., tree 30 m, diam., 50 cm, buttresses 1 m tall, merging into the strongly fluted bole, bark rough, pale rusty, peeling off profusely, cracked, strips 5 mm wide, 2 mm thick, living bark pale orange brown, 8 mm, sapwood 8 cm, honeycoloured, heartwood darkbrou-n, May, fr. yellow green, *KoBter«wn* BS9K* (A, BM, BO, BRI, CAL, CANB, K, L, LAE, MEL, P, PNH, SING); Balikpapan Distr., Kambodja, low, Oct., fl., *Sauveur* s.n. (A, BO, BRI, K, L, PNH, SING) and *K SS* (A, BO, K, L. PNH, SING).

7. CARYODAPHNOPSIS LATIFOLIA W.T. Wang

W.T. Wang in Arts phytolax. Sinica 6(2): 213, fig. 47, 5. 1957; Kostemians IB Reinwardtis B: 2R3, 1962; Bibl Laur. 211. 1961. - Typus: *Exped. Sino* - Rossicn oil *Prov. Yunnan 801* (LE, isotypus).

Tree 15 m high, 30 cm diam. Branchlets subglabrous, quadrangular. Leaves chartaceous, glabrous, alternate and subopuosite, elliptic to rotundate-elliptic, 10 x 20—16.5 x 28 cm, rarely oblong, 8—11 x 25—30 cm, shortly acuminate, base cuneate, secondary nerves not conspicuous

on on the lower leaf surface. Petiole 2—3 cm long, sub-glabrous. Panicles terminal and axillary, 14—25 cm long, lax with widely spaced, short branchlets, patently, minutely pilosa. Pedicels 2—5 mm long, laxly pubescent. Tepals outside pubescent, inside fulvous-tomentellous, outer ones 1.2 mm long, inner ones 1.7—2.5 mm long, at base 2—2.5 mm wide, outer 6 stamens 1.8 mm long, inner ones 1.2 mm long; all filaments pilose, staminodes stipitate, sagittate, 0.75—1.1 mm long, outside pilose. Fruit ellipsoid, 2.9 x 4,3 cm. Pericarp 2 mm thick, hard, exocarp hard, 0.5 mm thick, mesocarp lacunair, 1 mm thick, endocarp consisting of lax fibres, 0.5 mm thick.

Wang compares this species with *0. tonkinensis,* to which, it is certainly related. As I had no access to the type specimen, I have copied and modified his description, combining it with characters gleaned from the plate. Nothing is said of the prominence of the secondary, horizontal veins, in the picture they are not very clear. The panicle is indeed similar to that of *C. toTikinensis.* The flowers seem to be smaller. The length of the leaf certainly exceeds that of *C. tonMnensis,* but this is a variable character.

YUNNAN. Chin-ping, Tau-Men-Shan, alt. RCD m, April, flowers yellowish, *Exped. Sino-Ross. ad Prov. Yunnan ml* (LE, CHINA).

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