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TAXONOMY OF HODGSONIA (CUCURBITACEAE), WITH A NOTE ON THE OVULES AND SEEDS

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SUMMARY

Hodgsonia, ranging from NE India through S China to Java and Borneo, was for a long time considered as monotypic, but there are two (and possibly three) species, demarcated at the Isthmus of Kra in S Thailand. The few, woody 'seeds' should be regarded as pyrenes, a condition not known elsewhere in the family Cucurbitaceae.

Key words: Flora of SE Asia, Cucurbitaceae, *Hodgsonia*, placentation, pyrenes.

INTRODUCTION

Hodgsonia is the only genus in the subtribe Hodgsoniinae C. Jeffrey, tribe Trichosantheae C. Jeffrey, subfamily Cucurbitoideae (Jeffrey, 1962). The subtribe is defined by having 12 ovules, in 6 collateral pairs, the seeds connate in pairs, one of a pair usually smaller and with an abortive embryo. The connate seeds form large seed-like pyrenes. Within the tribe, *Hodgsonia* is also palynologically distinct (Khunwasi, 1998).

Hodgsonia contains two species as presented here, both with edible oil in their seeds (Burkill, 1935; Hu, 1964). There has been confusion on the delimitation, name, and range of the two species, to such an extent that in practically all literature the concept of the used species names is contaminated. The history of the genus and the designation of its various species names has been related by Hu (1964). The two currently accepted species appear to occupy different, adjacent areas in SE Asia. Their distributions are distinct and meet somewhere in the area of S Tenasserim in S Myanmar or the Isthmus of Kra in S Thailand, but the precise demarcation line is as yet unknown because of insufficient collections from that area. There is uncertainty about the structure of the ovary and fruit, the position of the ovules, and about the nature of the woody seed-like structures, usually called 'seeds', which are embedded in firm vascularized fruit pulp. However, we believe that the woody seeds are in reality pyrenes, or stones, the hard outer shell being a putamen of carpellary origin as propounded by Hu (1964). This means that the fruit of *Hodgsonia* is a drupe, possibly a unique feature in the family.

HODGSONIA

Hodgsonia Hook.f. & Thomson, Proc. Linn. Soc. London 2, ('1853', 1854) 257; Hook.f., Ill. Himal. Pl. (1855) t. 1–3; Naudin, Fl. des Serres 2 (1857) 153, t. 1262, 1263; Hook.f. in Benth.

& Hook.f., Gen. Pl. 1 (1867) 820; Clarke in Hook.f., Fl. Brit. Ind. 2 (1879) 606; Cogn. in A.DC., Monogr. Phan. 3 (1881) 348; E.G.O. Müll. & Pax in Engl. & Prantl, Nat. Pflanzenfam. 4, 5 (1894) 32; King, Mat. Fl. Mal. Pen. 10 (1898) 25; Prain, Bengal Plants 1 (1903) 376; Gagnep., Fl. Gén. Indo-Chine 2 (1921) 1032 (in key); Ridl., Fl. Mal. Pen. 1 (1922) 843; Kundu, J. Bot. 76 (1938) 364; J. Bombay Nat. Hist. Soc. 43 (1942) 363; Chakrav., Rec. Bot. Survey India 17 (1959) 27; C. Jeffrey, Kew Bull. 15 (1962) 342; Backer in Backer & Bakh.f., Fl. Java 1 (1964) 304; S.Y. Hu, Econ. Bot. 18 (1964) 167, f. 1–7; Hutch., Gen. Fl. Plants 2 (1967) 407; Evol. & Phylogen. Flow. Plants (1969) 221, f. 190; Fam. Flow. Plants, ed. 3 (1973) 300, f. 109; Keraudren in Aubrév. & J.-F. Leroy, Fl. Camb., Laos, Viêt-nam, 15 Cucurbitacées (1975) 72; de Vogel, Seedlings of Dicotyledons (1980) 28, 74, f. 65; C. Jeffrey, The Cucurbitaceae of Eastern Asia, Roy. Bot. Gard. Kew, manuscr. (1980) 38; A.M. Lu & Zhi Y. Zhang in A.M. Lu & S.K. Chen, Fl. Reip. Pop. Sin. 73, 1 (Cucurbitaceae) (1986) 257; S.K. Chen in C.Y. Wu, J. Chen & S.K. Chen, Flora Yunnanica 6 (1995) 376. — Type species: *Hodgsonia heteroclita* (Roxb.) Hook.f. & Thomson.

Liana, to 30 m, leafy shoot 4–7 mm diam., largely glabrous. Flowering nocturnal. Dioecious. Probract c. 5 mm long, thorn-like, with glands on lower surface. *Leaves*: blade subcircular in outline, 15–25 cm diam., palmately (deeply) 3–5-lobed, tertiary veining on lower surface prominent, scattered minute glands often present. *Tendrils* 2- or 3-fid. *Flowers* large, puberulous, petals (corolla lobes) mainly white, fringed, the in bud exposed portion conspicuously veined. *Male inflorescences*: stout, bracteate, pubescent racemes; bracts elliptic or oblong, entire, 5–10 mm long, glandular abaxially, often inserted on the pedicel, subdeciduous. Female flowers solitary. *Male flowers*: pedicel short, receptacle-tube elongate, widened towards or at the apex; calyx lobes minute, with few glands abaxially (sometimes also on the tube); corolla rotate, petals free, cuneate, long-fimbriate; stamens 3, filaments short, free, inserted within the receptacle-tube, anthers 3, one 1-thecous, two 2-thecous, united into a head, largely included, thecae linear, conduplicate, connective narrow, not produced; disc consisting of 3 elongate parts, either free or largely adnate with basal portion of the tube; pistillode absent. *Female flowers*: resembling male flowers; ovary subglobose, puberulous, 3-carpellate, (secondarily) 6-locular, placentas 6, parietal; ovules 6 or about 12, erect (rarely pendent), in each locule either 1 or (1 or) 2 (or 3) collaterally attached to the bottom (rarely the apex); style filiform, stigma large, obconical, 3-lobed, partly exserted; staminodes or disc absent. *Fruit* a large drupe, hard-skinned, depressed globose, 12–25 cm diam., filled with firm pulp, containing 6 large simple or compound, subovoid, deeply veined pyrenes. *Seed* large, endopleura conspicuous, corky, albumen absent, cotyledons flat, oily, radicle small, the lobes (in *H. heteroclita*) notched.

Distribution — In lowland, foothill and lower montane forest, from E India and S China through Myanmar, Thailand, Indochina to Borneo and W Java. — Fig. 1.

Notes — 1. Related to *Trichosanthes* L., which has similar flowers, but differs in fruits containing many horizontal seeds. Palynologically *Hodgsonia* is quite different from *Trichosanthes* (Khunwasi, 1998).

2. The 'waxy patches' on the lower leaf surface, as mentioned by Kundu (1938) and Hu (1964) occur in both species. We think that these are the same as the chalk-incrustations found in many Cucurbitaceae.

3. According to Hu (1964) the pyrenes can be interpreted as adapted to transportation by fresh water.

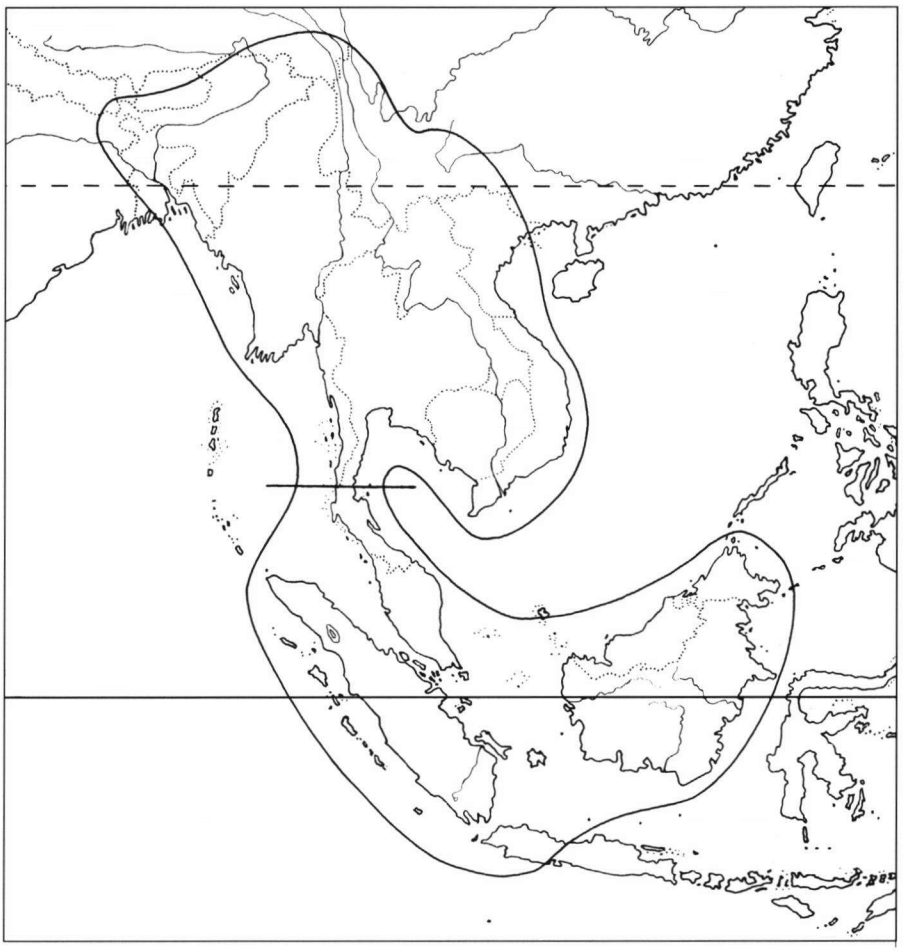

Fig. 1. Generalized distribution of the genus *Hodgsonia*. Above the short horizontal line *H. heteroclita* (Roxb.) Hook.f. & Thomson, below the short horizontal line *H. macrocarpa* (Blume) Cogn.

KEY TO THE SPECIES

1a. Leaf blades mostly 5-lobed. Male receptacle-tube narrow, 7–10(–12) cm long, dilated at very apex only; sepals 2–4 mm long; stamens inserted just below the throat, synandrium subglobose, half-exserted. Female pedicel 2–2.5(–3) cm long. Fruit smooth or shallowly (6–)10–12 grooved; pyrenes mostly compound. — Continental SE Asia, north of the Isthmus of Kra ..... **1. H. heteroclita**

b. Leaf blades mostly 3-lobed. Male receptacle-tube 5–7 cm long, dilated from near the middle upwards; sepals 1(–2) mm long; stamens inserted at the middle of the receptacle-tube, synandrium elongated, included. Female pedicel 3–4 cm long. Fruit not grooved; pyrenes simple. — Thailand south of the Isthmus of Kra, and West Malesia ..... **2. H. macrocarpa**

1. Hodgsonia heteroclita (Roxb.) Hook.f. & Thomson — Fig. 2b

Hodgsonia heteroclita (Roxb.) Hook.f. & Thomson, Proc. Linn. Soc. London 2, ('1853', 1854) 257; Hook.f., Ill. Himal. Pl. (1855) t. 1–3; Naudin, Fl. des Serres 2 (1857) 153, t. 1262, 1263; Kurz, J. As. Soc. Bengal 46 (1877) 97; Clarke in Hook.f., Fl. Brit. India 2 (1879) 606; King, Mat. Fl. Mal. Pen. 10 (1898) 25; Kundu, J. Bot. 76 (1938) 365 (in key). — *Trichosanthes heteroclita* Roxb. [Hort. Beng. (1814) 70, nom. nud.], Fl. Indica 3 (1832) 705; Wall., Numer. List. 6684 (1832); Roem., Syn. fasc. 2 (1846) 96. — Holotype: drawing no. 2399 of *Roxburgh* (K), from material of plants grown in the botanical garden at Calcutta, 1811 or before, originating from Silhet, E Bengal, India (see note 2).

Hodgsonia macrocarpa auct. non (Blume) Cogn.: Gagnep., Fl. Gén. Indo-Chine 2 (1921) 1034, f. 115, 1–3; Kundu, J. Bombay Nat. Hist. Soc. 43 (1942) 364; Chakrav., Ind. J. Agric. Sc. 16, 1 (1946) 15; Rec. Bot. Survey India 17 (1959) 27 (with map); Hara, Fl. East Himal. (1966) 323; P.H. Hô, Ill. Fl. S Viêt-Nam, ed. 2, 1 (1970) 509, f. 1276; Anon., Rec. Bot. Survey India 20, 2 (1973) 104; Keraudren in Aubrév. & J.-F. Leroy, Fl. Camb., Laos, Viêt-nam, 15 Cucurbitacées (1975) 74, pl. 12; Chakrav. in S.K. Jain et al., Fasc. Fl. India 2 (1982) 60, f. 1–6; A.M. Lu & Zhi Y. Zhang in A.M. Lu & S.K. Chen, Fl. Reip. Pop. Sin. 73, 1 (Cucurbitaceae) (1986) 258; Grierson in Grierson & Long, Fl. Bhutan 20, 1 (1991) 263; S.K. Chen in C.Y. Wu, J. Chen & S.K. Chen, Flora Yunnanica 6 (1995) 377, f. 99 [incl. var. *macrocarpa* & var. *capniocarpa* (Ridl.) A.M. Lu & Zhi Y. Zhang].

Hodgsonia capniocarpa auct. non Ridl.: Craib, Fl. Siam. Enum. 1 (1931) 750.

Trichosanthes grandiflora Wall., Numer. List 6685 (1832), non Blume.

Trichosanthes theba Buch.-Ham. ex Wall., Numer. List 6684-A (1832), nom. nud.

Leaves: blades usually 5-lobed, margin rarely coarsely serrated; lower surface (almost) glabrous, small glands few or absent; petiole 4–8 cm. *Male inflorescences* 15–25 cm long, peduncle 8–11 cm long, c. 5 mm thick, flowers 10(–20). *Male flowers*: pedicel 2–6 mm long, bract inserted up to 5 mm from the base; receptacle-tube 7–10(–12) cm long, 4–7 mm wide, at apex widened into a shallow cup c. 5 by 10–20 mm; sepals 2–4 mm long; petals 3–5 cm long, outside pale yellowish, threads to 15 cm long, yellowish, villous, pendent, spiralling. Stamens inserted just below the throat, filaments c. 5 mm long; synandrium subglobose, (5–)7–10 mm diam., partly exserted; disc parts linear, 3–5 cm long, adnate about half-way with the tube, free at apex. *Female flowers*: pedicel 2–2.5(–3) cm long; receptacle-tube 5–6 cm long, hardly widening; style c. 5 cm long, stigma 7–9 mm long, lobes 2-fid; ovary c. 10 mm diam., with scattered dark glandular pustules (always?), ovules 10–15, in each locule (1 or) 2 or 3. *Fruit* (10–)15–20 cm diam., glabrescent, reddish brown, smooth or shallowly (6–)10–12-grooved; pyrenes 3–7 cm long, containing 1–3 (partly abortive) seeds; fruiting pedicel 2–3 cm long.

Distribution — Sikkim, Bhutan, E India and S China, Myanmar (S to Tenasserim), Thailand, Laos, Cambodia, Vietnam; in Thailand north of the Isthmus of Kra.

Habitat & Ecology — Forest of hills and lower mountain slopes; 200–1200 m altitude. In E India: flowering in May; fruiting from Sept. to Dec. No records on nocturnal flowering are known; presumably flowering starts at night and continues into the next daytime. Bracts with glands, visited by ants.

Notes — 1. According to Roxburgh (1832) the female flowers may occasionally be found in short racemes.

2. The type of *H. heteroclita* is the material grown in the botanical garden at Calcutta, not *herb. Hook.f. s.n.*, from the same area, as stated by later authors.

3. Note on the treatment of *H. heteroclita* in China. — This species was accepted by Lu & Zhang (1986) and Chen (1995) under the name *H. macrocarpa*, with two

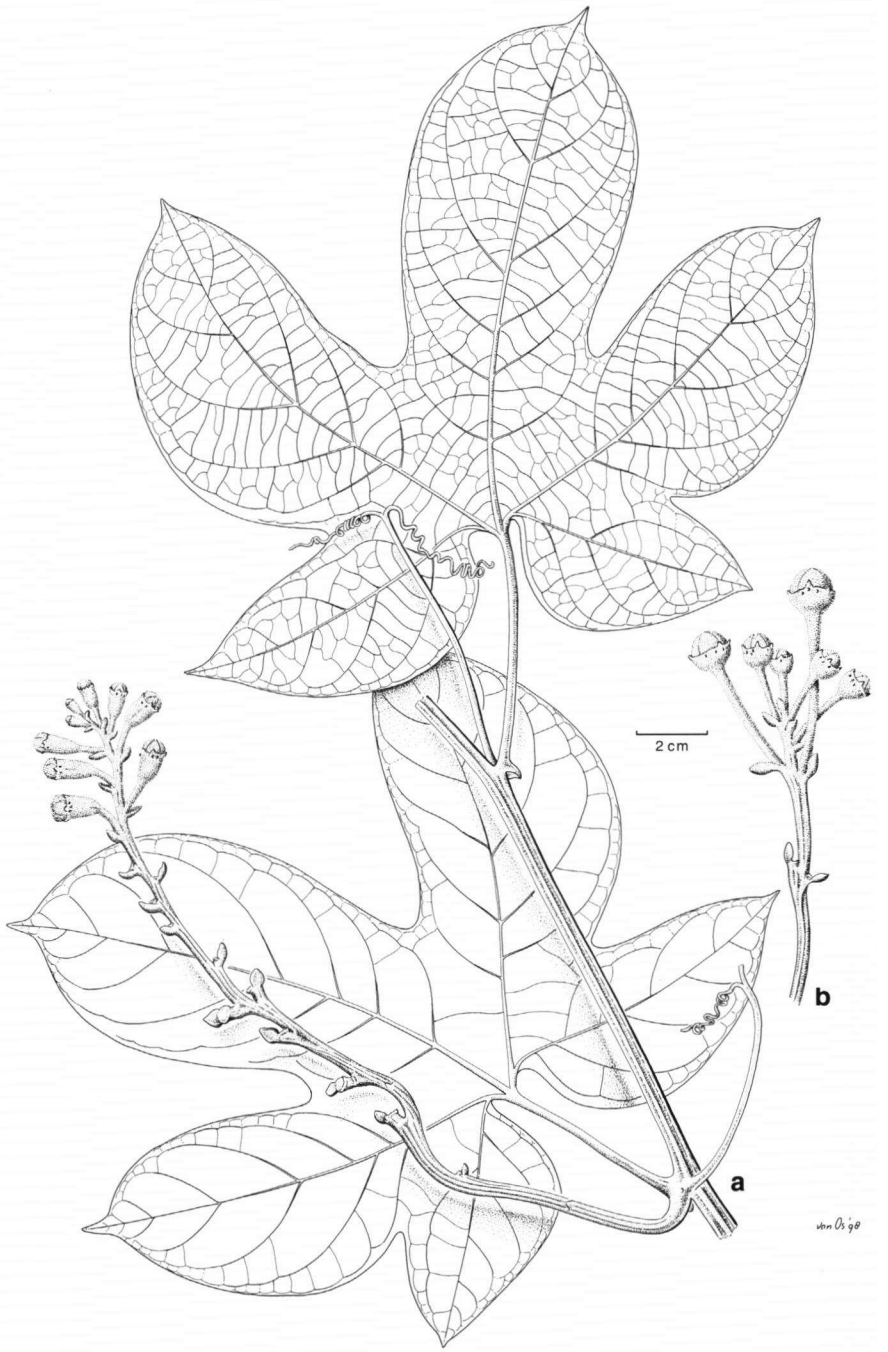

Fig. 2. *Hodgsonia macrocarpa* (Blume) Cogn. a. Habit of the twig, with male inflorescence. — *H. heteroclita* (Roxb.) Hook.f. & Thomson. b. Apex of male inflorescence (a: *De Wilde & Baya Busu FRI 41401*, L; b: *Prain's Collector 808*, E).

varieties: var. *macrocarpa* and var. *capniocarpa* (Ridl.) A.M. Lu & Zhi Y. Zhang. Variety *capniocarpa* was distinguished from the type-variety by smooth, not 12-grooved fruits, the surface with scattered dark pustular dots. The description in Flora Yunnanica is accompanied by an analytical line drawing (f. 99, 1–5) showing a quite unique set of characters: a habit of a portion of a female plant with flower and fruits, a separate male inflorescence, semi-schematic longitudinal sections of a male and a female flower (corolla removed), and an apparently single-seeded pyrene. The male inflorescence clearly depicts *H. heteroclita*. The section of the female flower shows a style with a slenderly 3-lobed stigma, as in *Trichosanthes* (not broadly obconical, sagged-out at base), different from all *Hodgsonia* material seen by us. The fruit is smooth with scattered pustules, without longitudinal furrows, and is reminiscent of the Malesian *H. macrocarpa*. Possibly the figure is drawn from mixed material or represents an as yet undescribed taxon under or allied to *H. heteroclita*, endemic to the mountainous area of S China and adjacent Indochina, where it is wild, and cultivated by the hill tribes. In the description of *Hodgsonia* in the Flora of Cambodia, Laos and Viêt-nam (l.c.), for which fairly extensive material has been used, characters as mentioned above for China were not mentioned. In China *Hodgsonia* is cultivated for medicine and oil seeds (Hu, l.c.).

2. **Hodgsonia macrocarpa** (Blume) Cogn. — Fig. 2a, 3, 4

Hodgsonia macrocarpa (Blume) Cogn. in A.DC., Monogr. Phan. 3 (1881) 349; Backer in Backer & Bakh.f., Fl. Java 1 (1964) 305; C. Jeffrey, The Cucurbitaceae of Eastern Asia, Roy. Bot. Gard. Kew, manuscr. (1980) 38. — *Trichosanthes macrocarpa* Blume, Bijdr. (1826) 935; Ser. in DC., Prodr. 3 (1828) 315; Roem., Syn. fasc. 2 (1846) 96; Miq., Fl. Ind. Bat. 1, 1 (1856) 676. — Type: *Blume s.n.*, W Java (holotype P, sterile).

Trichosanthes hexasperma Blume, Bijdr. (1826) 935; Ser. in DC., Prodr. 3 (1828) 315; Roem., Syn. fasc. 2 (1846) 95; Hassk., Pl. Jav. Rar. (1848) 192; Miq., Fl. Ind. Bat. 1, 1 (1856) 678. — Type: (*Kuhl & Van Hasselt* in) *Blume s.n.* (4 sheets: L 901.288-20–23), Java.

Trichosanthes kadam Miq., Fl. Ind. Bat., Suppl. 1 (1861) 331. — *Hodgsonia kadam* (Miq.) Greshoff, Bull. Kol. Mus. Haarlem 30 (1904) 163, with figure; Lewkowitsch, Chem. Techn. Anal. Oils 2 (1914) 515 (with references to literature on medicinal and chemical properties, mainly of the oily seed). — Type: *Diepenhorst in Teijsmann s.n. (2097 HB)*, (U; iso BO), Sumatra (Priaman).

Hodgsonia capniocarpa Ridl., J. Fed. Malay States Mus. 10 (1920) 135; Fl. Mal. Pen. 1 (1922) 843; Burkill, Dict. Econ. Prod. Mal. Pen. vol. 1 (1935) 1178; Kundu, J. Bot. 76 (1938) 366; J. Bombay Nat. Hist. Soc. 43 (1942) 364 (in key). — *Hodgsonia macrocarpa* (Blume) Cogn. var. *capniocarpa* (Ridl.) A.M. Lu & Zhi Y. Zhang. — Type: *Ridley s.n.*, from Pahang (lectotype K, here designated), Peninsular Malaysia.

Leaves: blades usually 3-lobed, margin entire; lower surface puberulous or glabrescent, small glands several, especially towards the base; petiole 3–7 cm. *Male inflorescence* 12–20(–30) cm long, peduncle (2–)10–20 cm long, 3–5 mm thick, flowers (5–)10–20. *Male flowers*: pedicel 2–10 mm long, bract inserted up to 10 mm from the base; receptacle-tube 5–7 cm long, basal part 3–4.5 cm by 3–4 mm, the tube above the middle widening into a dilated section 2–2.5 cm long, 10(–15) mm wide at the throat; sepals 1(–2) mm long; petals 2–3 cm long, white, outside at base rusty puberulous, threads c. 5 cm long, white, not pendent (?), not spiralling (?). Stamens inserted at about the middle of the receptacle-tube, i.e. where widening, filaments (5–)7 mm long; synandrium elongate, apex truncate, 10–12 by 3.5–4 mm, included; disc parts

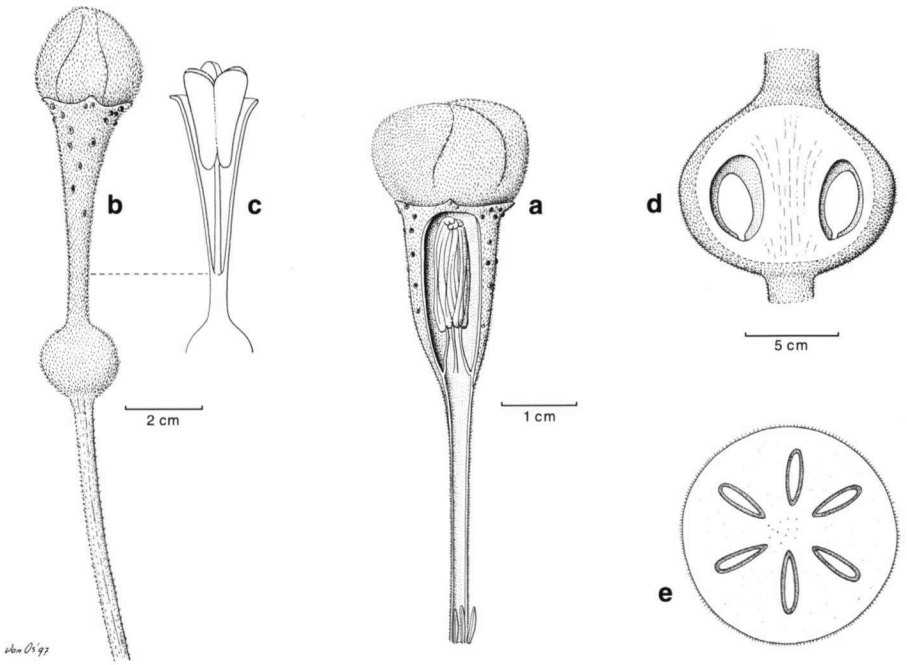

Fig. 3. *Hodgsonia macrocarpa* (Blume) Cogn. a. Opened submature male flower bud, showing androecium and disc-lobes at base of hypanthium tube; b. submature female bud; c. ditto, longitudinal section, showing style and stigma; d & e. ovary, longitudinal and cross section, showing position of the ovules (a: *De Wilde & Baya Busu FRI 41401*, L; b–e: *King's Collector 4021*, L).

oblong, inserted at base of the tube, 4–6 mm long, free. *Female flowers*: pedicel 3–4 cm long; receptacle-tube c. 3 cm long (including c. 6 mm long solid basal part which remains on the ovary after anthesis), gradually widening to c. 7(–10) mm wide throat; style 1.5–2 cm long, stigma 13–14 by 6–8 mm, lobes truncate; ovary 10–12 mm diam. (with brown hairs c. 1 mm), pustules absent (always?), ovules 6, one in each locule. *Fruit* 10–18 cm diam., greyish green, densely grey or brown pubescent, sometimes with large, scattered, dark-coloured wart-like lenticels, not grooved; pyrenes 6–9 cm long, containing 1 seed; fruiting pedicel 4–8 by 1–1.5 cm.

Distribution — Thailand (Peninsular, south of the Isthmus of Kra), Peninsular Malaysia, Sumatra, Java, Borneo; possibly not in Tenasserim, S Myanmar.

Habitat & Ecology — Forest and forest fringes at riversides in lowlands and foothills; 50–1000 m altitude. Flowering at night; fragrant.

Uses — The roasted fatty seeds of *H. macrocarpa* are edible. The empty stone-seeds (pyrenes) can be found on the forest floor, gnawed open by rodents. The ashes of burnt leaves are used in healing wounds.

Notes — 1. The germination and the seedling of *H. macrocarpa* (origin Sumatra) is described and figured by De Vogel (1980, f. 65). The seedling represents a separate type, the *Hodgsonia*-type, in which the primary root, hypocotyl, and cotyledons remain within the testa, and on germination the flexible shoot emerges from the slit at the base of the 'seed'.

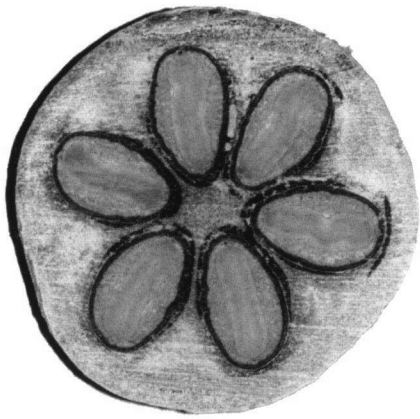

Fig. 4. *Hodgsonia macrocarpa* (Blume) Cogn. Cross section of mature fruit, the six large pyrenes each contain a single seed; diameter of fruit c. 14 cm (*Avé 124*, L, spirit).

2. Enigmatic 'seeds'. Recently (August 2000) two comparatively enormous 'seeds' of *Hodgsonia,* measuring 10.5 by 7 cm, without additional material were obtained by Ms Marintha Chawalvechai, a student of phytochemistry (*Chawalvechai* in *De Wilde 22183*, BKF and L). She got them from local people near Chumphon, in the Isthmus of Kra area. They were collected in the wild and may represent a different, as yet undescribed taxon.

NOTE ON THE POSITION OF THE OVULES, AND THE NATURE OF THE 'SEED' SHELL

With the original description of the genus, Roxburgh (1832) (for his species *Trichosanthes heteroclita*), Hooker & Thomson (1854), and Hooker (1867) mentioned the strange collateral position of the 2 (or 3) ovules and the remarkable structure of what was called the 'seed'. Hu (1964) added that the outside of the 'seed' is covered by an adherent vascular pulpy coat, and that the shell-like wrapping (covering and separating the 1, 2 or 3 seeds), mistaken for an exterior integument (Roxburgh, 1832) or a testa (Hooker & Thomson, 1854), actually is of carpellary (not integumental) origin. The outside surface is deeply channelled by vascular strands, and some channels have rows of perforations. In the shell-like wrapping, at the end of the hilum of each enclosed seed, are (1 or) 2 or 3 short slits. Hu (1964) noted that a carpellary wrapping is common in seeds of Cucurbitaceae, e.g. in *Luffa*, *Cucurbita* and *Citrullus*, where it is delicate and hyaline. The seed itself of *Hodgsonia* is flat, compressed, and somewhat alate throughout the circumference of the flattened plane. The size of a seed varies with its state of fertility, and a solitary seed is thicker than seeds wrapped in twos or threes.

The pitted-reticulate septum separating 2 or 3 seeds is depicted in Keraudren-Aymonin (1975, f. 12, 6–7). Corner (1976) investigated *Hodgsonia* not in detail, but nevertheless regarded the woody covering of seed-coat origin.

The foregoing observations mainly concerned *H. heteroclita*, the extra-Malesian species, and we can confirm them as far as applicable for *H. macrocarpa*. For our study of the ovary of the Malesian *H. macrocarpa* only three female flowering collec-

tions were available, viz. *King's Collector 4021* (L), from Perak, and the more recent collections *SAN 84830*, and *SAN 139453*, one with very immature ovaries (both in L), from Sabah. The boiled, strongly shrunken ovaries were difficult to dissect, and allowed only for the following observations and description (Fig. 3):

Ovary subglobose, 10–12 mm diam., densely minutely rusty pubescent, 6-locular, the locules equal in size, lengthwise elongated, c. 4 mm high, enclosed by firm (in the living state possibly watery) tissue being all ovary tissue. Ovules 6, one in each locule, obovoid-oblong, 3–3.5 mm long, erect, anatropous, attached to the bottom of the locule rather distant from the axis, in a ± radial position. The ovules in an ovary at anthesis are comparatively large (flat in the dried state), a single ovule almost filling a locule. The ovary in general appearance and construction already is a mini replica of the mature fruit, but the hard shells of the seed-like bodies, to be developed from the pericarp, defining the locules, are not yet formed. In mature fruit of *H. macrocarpa* the six woody bodies are tightly embedded in the rather soft fruit pulp, as shown in Figure 4. The pulp is richly vascularized, especially in the central, axial portion. In dry mature fruits the pulp has shrunken considerably, leaving the woody seed-containing bodies free, showing a densely brownish yellow pubescent surface, as already mentioned by Roxburgh (1832) for *H. heteroclita*. Hu (1964) reported the inner surface of the shell as villous, but we did not see this in *H. macrocarpa*. The seed-containing bodies are mostly attached basally in the locules, rather at a distance from the axis (see Fig. 3d; and photo, Fig. 4); only in one specimen (*De Wilde & Duyfjes 13958*, in L) they are attached at the apex of the fruit. This collection proves that occasionally the ovules may be attached apically in the locules. At the base of the woody seed-containing bodies, in *H. macrocarpa*, is a single slit, in *H. heteroclita* usually 2 or 3 slits, corresponding with the number of seeds that they contain.

CONCLUSIONS

1. The ovary of *Hodgsonia* is secondarily 6-locular. Apparently during the ontogeny of the ovary, by ingrowth of the original placental tissue and auxiliary tissues, it has become 6-locular, with which finally 6 placentas become secondarily parietal.
2. The ovules, according to the species either 1, or (1 or) 2 or 3 per locule, are erect, attached basally (occasionally apically) in the locules.
3. In *H. heteroclita*, the generally 2 or 3 ovules in each locule are collateral, and later form (see point 4) a hard-shelled compound 'seed', with 2 or 3 cells, each containing a seed. One or two of these often contain an abortive embryo. In *H. macrocarpa* the ovule is single in each locule and the woody body contains one seed.
4. What has been called the 'seed' of *Hodgsonia* consists of 1–3 true seeds tightly enclosed in a woody wrapping, of carpellary nature, which can be termed a putamen. Therefore the stony 'seeds' are pyrenes (and the fruit as a whole a drupe), comparable apparently with those in the fruit of *Ilex* L., or the European genus *Mespilus* L. Detailed study of the development of the ovary should disclose the ontogeny of the pyrenes. The seed, conforming to the general shape of the inner space(s) of the pyrene, consists of flat embryo (with large, flat, fatty cotyledons), the thick, pithy, mealy-corky endopleurum (or tegmen), and a thin outer layer or testa.

5. The pyrenes seem unique in Cucurbitaceae. They are similar to the large seeds of African *Telfairia* Hook., which are insufficiently known. The latter are described as often enclosed in a fibrous sheath derived from the endocarp (Jeffrey, 1967).

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REFERENCES

Burkill, I.H. 1935. A Dictionary of the Economic Products of the Malay Peninsula 1: 1178. London.
Chakravarty, H.L. 1959. Monograph of Indian Cucurbitaceae. Rec. Bot. Surv. India 17, 1: 27.
Chen Shu-kun. 1995. In: Wu Zheng-yi, Chen Jie & Chen Shu-kun (eds.), Flora Yunnanica 6: 376, 377, f. 99. Science Press, Beijing.
Corner, E.J.H. 1976. The seeds of Dicotyledons 1: 113. Cambridge.
De Vogel, E.F. 1980. Seedlings of Dicotyledons: 74, f. 65. PUDOC, Wageningen.
Hooker, J.D. 1867. In: G. Bentham & J.D. Hooker, Gen. Pl. 1: 820. London.
Hooker, J.D. & Th. Thomson. 1854. Proc. Linn. Soc. London 2, 1853: 257.
Hu Shiu-ying. 1964. The Economic Botany of Hodgsonia. Econ. Bot. 18: 167–179.
Jeffrey, C. 1962. Notes on Cucurbitaceae, including a proposed new classification of the family. Kew Bull. 15: 337–371.
Jeffrey, C. 1967. Cucurbitaceae. In: E. Milne-Redhead & R.M. Polhill (eds.), Flora of Tropical East Africa: 15.
Keraudren-Aymonin, M. 1975. In: A. Aubréville & J.-F. Leroy (eds.), Flore du Cambodge, du Laos et du Viêt-Nam 15: 73, pl. 12.
Khunwasi, C. 1998. Palynology of the Cucurbitaceae: 147, 158. Thesis Innsbruck.
Kundu, B.C. 1938. A note on Hodgsonia capniocarpa Ridl. J. Bot. 76: 364.
Lu An-ming & Zhang Zhi-yun. 1986. Cucurbitaceae. In: Lu An-ming & Chen Shu-kun (eds.), Flora Reipublicae Popularis Sinicae 73, 1: 257.
Roxburgh, W. 1832. Flora Indica; or, Descriptions of Indian Plants 3: 705. Serampore.

IDENTIFICATION LIST

If the number of a collection is unknown, then the collecting date is added between brackets. For more collections from India see Chakravarty (1959).

1 = *H. heteroclita*	3 = *H. species*
2 = *H. macrocarpa*	T = type material

d'Alleizette (July 1908): 1 — Ambri & Arafin AA 893: 2 — Avé 124: 2.
Balansa 4031: 1 — Beccari 806: 2 — Beumée 860: 2 — Blume s.n. (T): 2 — Bon 3921: 1 — Bünnemeijer 4255: 2.
Carrick 2394: 2 — Chand 2991: 1 — Chawalvechai (Aug. 2000): 1 — Chawalvechai in De Wilde 22183: 3 — Chevalier 37494: 1; 39549: 1; 39550: 1 — Clemens 21151: 2.
De Wilde & Baya Busu FRI 41401: 2 — De Wilde & Duyfjes 13958: 2; 21267: 2; 21898: 2; 21960: 2 — De Wilde, Tajuddin & Good SAN 143935: 2 — Diepenhorst 2097 HB: 2.
Elmer 20331: 2 — Endert 3438: 2.
Fleury in Chevalier 32329: 1; 32517: 1 — Forrest 8489: 1; 9845: 1; 13599: 1
Gage (20 April 1899): 1 — Grierson & Long 3515: 1; 3518: 1.
Hallier 3106: 2 — Hamilton 2129: 1 — Hooker f. s.n. (L 90.128-819): 1.

Jaheri 77: 2.
Kerr 12180: 1; 20781: 1 — King's Collector 4021: 2 — Koorders 23623: 2 — Korthals 27: 2 — Kostermans & Anta 8123: 2.
Lakshnakara 676: 2 — Leighton 629: 2 — Lörzing 5655: 2.
Maingay 672: 2 — Maxwell 85-1139: 2; 87-306: 2 — MK. AR (UKMB) 01315: 2.
Nur 7450: 2.
Paisooksantivatana y 246-80: 1 — Pételot 6763: 1 — Pierre 1630: 1 — Poilane 1278: 1; 1672: 1; 16504: 1; 26060: 1; 26227: 1 — Pooma 788: 1— Pooma et al. 1419: 1 — Porter (P. Pinang 1823): 2 — Prain's Collector 808: 1.
Reksodihardjo 754: 2 — Richards 2541: 2; S 39812: 2; 40965: 2; SAN 30798: 2; 34556: 2; 54345: 2; 81580: 2; 82080: 2; 84674: 2; 84830: 2; 85707: 2; 85894: 2; 87779: 2; 96584: 2; 107379: 2; 108132: 2; 117643: 2 120289: 2; 122543: 2; 129369: 2; 131914: 2; 133535: 2; 139453: 2.
Sider (30 Oct. 1983): 2 — Sterk 113: 2; 159: 2.
Teijsmann 11630: 2 — Thorenaar 105: 2 — Toppin 200: 1.
Ultée 199: 2.
Van Balgooy 2093 A: 2; 7218: 2 — Van Steenis 6080: 2 — Vidal 2613: 1; 2617: 1.
Wallich 6684 A–C: 1; 6685: 2 — Whitmore FRI 0576: 2 — Whitmore & Sidiyasa TCW 3201: 2 — Wiriadinata Dec. 1997: 2.
Yü 20518: 1.