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MATERIALS TOWARDS A MONOCOT FLORA OF ASSAM—II.* (ZINGIBERACEAE & MARANTACEAE)

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ABSTRACT

The families Zingiberaceae and Marantaceae in the above series are presented in this paper.

Zingiberaceae Lindley, Key Struct. Phys. Syst. Bot. 69. 1835.

Terrestrial or epiphytic, perennial or sometimes annual herbs. *Rhizomes,* when present, sympodial, creeping, more or less aromatic. *Leaves* clustered at the base or scattered along a distinct stem, alternate, sessile or petiolate, sheathing, linear, lanceolate or oblong, usually caudate-acuminate, pinnately-nerved, ligulate, in several species appearing after flowering. *Flowers* terminal on a leafy stem or on a separate peduncle, spicate or panicled, sessile or subsessile, bisexual, zygomorphic; bracts (primary bracts) enclosing a solitary or 2-several flowers in cincinni; bracteoles (secondary bracts) usually present; *calyx* tubular or campanulate, 3-lobed or -toothed, frequently split on one side; *corolla* tubular or campanulate, 3-lobed, the dorsal lobe usually somewhat larger and hooded over the rest in buds; *stamen* 1 (the dorsal of the inner whorl); filament short or long, or rarely absent; connective sometimes spurred at base or produced above forming an anther-crest or produced on sides forming wings; anther 2-celled; lateral staminodes (the two lateral stamens of the outer whorl) 2, petaloid, subulate or absent, the rest of the 3 stamens, in whole or in part, modified into a petaloid lip; *ovary* inferior, 3(rarely 2)-celled with axile placenta, or 1-celled with parietal (rarely basal) placenta; style more or less within the staminal groove; ovules usually numerous. *Fruit* a dehiscent capsule or rarely indehiscent; seeds arillate.

Zingiberaceae includes a group of plants which requires a more detailed study and treatment than usually accorded to them in the conventional Floras. Since, in several of them the vegetative and flowering phases are at different times (*e.g. Mantisia* spp., *Kaempferia* spp., *Curcuma* spp., *Amomum* spp.), and also since many show confusing variations in posture and sizes of various parts and flower colour depending upon age, a study of live plants along with the historical material is almost essential to supplement the previous descriptions and re-valuate former taxonomic judgements. While over the last several years we have introduced and studied many species in our experimental garden at Shillong (see Rao & Verma in *Bull. Bot. Surv. Ind.* 11: 120-128, 245-248. 1969), the non-availability to us of some of the historical material has often been deterrent in our efforts to critically review, particularly in cases of species like *Hedychium gratum* Baker described only from a line drawing and *Zingiber*

*Since communication of the first part of this series, the region has been politically reorganised. Thus, North East Frontier Agency (N.E.F.A.) is now known as Arunachala Pradesh; Mizo Hills dist. of the erstwhile Assam State now forms a separate State, Mizoram; United Khasi & Jaintia Hills and Garo Hills dists. of Assam together now form another State, Meghalaya.

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marginatum Roxb. described from very inadequate material, and these have been omitted from the following account. A few others like *Globba siamensium, Boesenbergia rubrolutea, Hedychium hookeri, Zingiber intermedium* and *Alpinia bracteata* have been included here even though we have not seen any specimen.

1a. Leaves spirally arranged, sheaths closed. Inflorescence compact, terminal on a leafy stem. Lateral staminodes absent ... *Costus* 17.
1b. Leaves distichous, sheaths open. Inflorescence compact or lax, terminal on a leafy stem or directly from the rhizome. Lateral staminodes petaloid, tooth-like or absent.
2a. Inflorescence compact with a terminal plume of barren bracts; bracts laterally, partially adnate forming pouches ... *Curcuma* 6.
2b. Inflorescence compact or lax, without a terminal plume of barren bracts; bracts not adnate.
3a. Inflorescence terminal on a leafy elongated stem.
4a. Lateral staminodes petaloid, free from the lip.
5a. Lip deflexed, confluent with the filament for some length; filament longer than the lip ... *Globba* 2.
5b. Lip erect or suberect, free from the filament; filament shorter than the lip (except in some *Hedychium* spp. but the filament not confluent with the lip).
6a. Connective spurred at the base.
7a. Flowers purple or white. Capsules subdehiscent ... *Roscoea* 4.
7b. Flowers yellow. Capsules dehiscing with recurved valves ... *Cautleya* 5.
6b. Connective not spurred at the base.
8a. Leaves 4.5-14 cm long. Anthers with a petaloid crest ... *Caulokaempferia* 10.
8b. Leaves usually longer than 14 cm (rarely shorter). Anthers not crested.
9a. Inflorescence compact; bracts with prominently recurved tips, white, greenish tinged. Staminodes rotundate, exceedingly shorter than the lip ... *Hitchenia* 12.
9b. Inflorescence compact or lax; bracts with straight tips, uniformly green or brown. Staminodes linear, oblong or spathulate, about as long as the lip ... *Hedychium* 13.
4b. Lateral staminodes absent, tooth-like or adnate to the lip.
10a. Lip almost obsolete ... *Rhynchanthus* 19.
10b. Lip well developed, as long as or longer than the corolla lobes.
11a. Leaves oblong-lanceolate. Flowers in lax racemes or panicles ... *Alpinia* 18.
11b. Leaves linear. Flowers in compact spikes ... *Zingiber* 16.
3b. Inflorescence on a leafless peduncle or in between radical leaves.
12a. Lateral staminodes petaloid, free from the lip.
13a. Filament longer than the lip, staminodes attached to it some length above the corolla mouth ... *Mantisia* 1.
13b. Filament shorter than the lip, staminodes inserted at the corolla mouth.
14a. Anther with a petaloid crest.
15a. Leaves in a basal cluster, often produced after flowering ... *Kaempferia* 9.
15b. Leaves scattered along a stem, contemporaneous with the flowers *Parakaempferia* 11.
14b. Anther without a petaloid crest.
16a. Lateral staminodes, lip and filament confluent at the base, forming a campanulate tube ... *Curcumorpha* 8.
16b. Lateral staminodes, lip and filament free to the base.
17a. Corolla lobes 10-15 mm long; staminodes 9-12 mm long; ovary 1-celled ... *Hemiorchis* 3.
17b. Corolla lobes about 25 mm long; staminodes 25-30 mm long; ovary 3-celled ... *Boesenbergia* 7.
12b. Lateral staminodes tooth-like, adnate to the lip or absent.
18a. Lip ligulate ... *Hornstedtia* 15.
18b. Lip oblong-obovate or suborbicular.
19a. Connective appendage at the tip broad, petaloid ... *Amomum* 14.
19b. Connective appendage at the tip beak like ... *Zingiber* 16.

1. Mantisia Sims in Curtis, Bot. Mag. t. 1320. 1810.

Rhizomes short, creeping. *Leaves* appearing after flowering is over but sometimes also appearing in the later phase of flowering, sessile or subsessile, lanceolate. *Flowers* in peduncled panicles; bracts and bracteoles oblong or suborbicular; calyx campanulate, 3-toothed; corolla lobes ovate-oblong, dorsal erect, laterals spreading; staminodes confluent with the filament for some distance above the corolla mouth; lip deflexed 2-lobed; anther winged on either side; ovary 1-celled; placentae 3, parietal. *Capsules* globose.

The shape and posture of the flower with the spread out arm-like staminodes and the skirt-like flared lip has earned these plants the popular name of 'Dancing girls' This has also earned them a place in home gardens as a curious plant.

1a. Peduncle and panicle-branches villous. Staminodes spathulate ... *M. spathulata* 2.
1b. Peduncle and panicle-branches glabrous or puberulus. Staminodes linear.
2a. Peduncles 7-10 cm long ; bracts broadly ovate-oblong, purplish brown. Calyx purplish brown ; staminodes 13-17 mm long ... *M. saltatoria* 1.
2b. Peduncles 1.5-3 cm long ; bracts suborbicular, yellowish green. Calyx greenish yellow ; staminodes 8-13 mm long ... *M. wengeri* 3.

1. M. saltatoria Sims in Curtis, Bot. Mag. t. 1320. 1810. (Plates 1 & 2)

Stems 3-6 dm high, purplish at base. *Leaves* 10-20 × 2.5-4 cm, glabrous or ciliolate along nerves above, purplish beneath when young becoming green in age. *Panicles* 10-15 cm long, branches few, distant ; bracts 1.5-2 cm long ; bracteoles *ca* 5 mm long. *Calyx* 6-8 mm long, sparsely hairy, lobes rounded ; corolla yellow, hairy outside, tube 15-20 mm long, lobes 5-6 mm long, dorsal *ca* 5 mm broad, laterals *ca* 3.5 mm broad ; staminodes attached to filament *ca* 5 mm above the corolla mouth, *ca* 0.5 mm broad ; lip obovate, 11-18 mm long, yellow, base cuneate, hairy, apex deeply divided into two 5-7 mm broad lobes ; filament 18-20 mm long, curved or coiled with age, brownish yellow ; anthers *ca* 2 mm long, with broadly ovate, *ca* 1.5 mm long, brown wings and quadrate, *ca* 1 mm long, brown crest ; ovary subglobose, *ca* 1.5 mm diam., brownish green, glabrous. (Fig. 1)

Flrs. : April-June. At *ca* 1300 m.

MIZORAM : Mizo Hills. MEGHALAYA : K. & J. Hills (cultivated).



Plate 1 : *Mantisia saltatoria* Sims, 'The dancing girl'. Habit. The leaves have appeared rather prematurely.

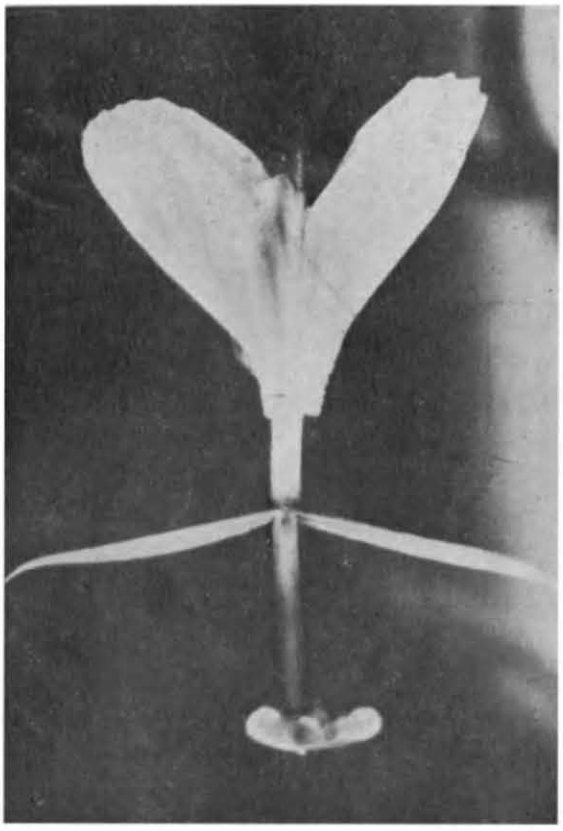


Plate 2 : *Mantisia saltatoria* Sims, 'The dancing girl'. A single flower, × 2.

In cultivation it has been noticed that some abnormal flowers have the lip with a tooth-like structure in between the two lobes, still others have an ovate corolla-lobe-like structure underneath the lip at base.

2. **M. spathulata** (Roxb.) Schult. in R. & S. Mant. 1: 49. 1822. *Globba spathulata* Roxb. Fl. Ind. 1: 83. 1820.

Stems 3-6 dm high, purplish at base. *Leaves* 10-25 × 3.5-5.5 cm, glabrous, purplish beneath when young, becoming green in age. *Panicles* 10-25 cm long, on *ca* 5 cm long peduncle; branches numerous, approximate, villous; bracts *ca* 1 cm long, pale violet; bracteoles *ca* 7 mm long, pale violet. *Calyx ca* 6 mm long, lobes ovate, acuminate, *ca* 2 mm long; corolla hairy outside, tube 15-18 mm long, lobes 4-5 mm long, dorsal *ca* 4 mm broad, laterals *ca* 3 mm broad; staminodes attached to the filament *ca* 3 mm above the corolla-mouth, *ca* 6 × 3 mm; lip obovate, 6-8 mm long, yellow, base cuneate, hairy, apex divided into two 2-3 mm broad lobes; filament 15-17 mm long, curved; anther *ca* 2 mm long, wings semi-lunar, *ca* 1.5 mm long, crest quadrate, *ca* 0.8 mm long; ovary oblong, pale violet.

Flrs.: April-June. *ca* 1300 m.

ASSAM: Cachar. MEGHALAYA: K. & J. Hills. MIZORAM: Mizo Hills; often cultivated.

3. **M. wengeri** Fischer in Kew Bull. 1931: 283. 1931.

Stems upto 10 dm high. *Leaves* 8-20 × 2-3.5 cm, glabrous or ciliolate along nerves above; sheaths puberulus. *Panicles* 1.5-3 cm long; bracts suborbicular, *ca* 1 cm long, glabrous or puberulus, yellowish green; bracteoles 5-8 mm long. *Calyx* 7-8 mm long; corolla yellow, hairy, tube *ca* 17 mm long, lobes 4-5 mm long; staminodes attached to the filament *ca* 5 mm above the corolla-mouth, 8-13 mm long; lip obovate, cuneate, 13-15 mm long, yellow, deeply bifid; filament *ca* 15 mm long, curved; anther wings oblong; ovary oblong. *Seeds ca* 1.5 mm long.

Flrs. & frts.: April-May. In shade, near streams; 1250 m.

MIZORAM: Mizo Hills.

Fischer (*l.c.*) has suspected this to be a hybrid between *M. saltatoria* and *M. spathulata*.

2. **Globba** L. Mant. 2: 143. 1771 p.p.; A. S. Rao & D. M. Verma in Bull. Bot. Surv. Ind. 11: 246-47. 1969.

Perennial herb. *Rhizomes* slender, creeping. *Leaves* sessile or subsessile, oblong-lanceolate, caudate-acuminate. *Panicles* terminal on a leafy stem; bracts early caducous. *Flowers* frequently replaced by bulbils; calyx campanulate, subequally tridentate; corolla lobes ovate-oblong, dorsal erect, laterals spreading; staminodes petaloid, lanceolate; lip connate with the filament for a short distance above the corolla-mouth forming a slender tube and its free blade deflexed with two small auricles at base; filament long, slender, curved; anthers not or obscurely crested, sometimes winged on sides; ovary 1-celled; placentae 3, parietal; ovules many. *Fruits* rather rare, subglobose-oblong, irregularly dehiscing; seeds ovoid-globose; aril small, white.

1a. Corolla tube *ca* 6 mm long, scarcely longer than the calyx; anther winged on either side ... *G. siamensium* 4.
1b. Corolla tube 15-30 mm long, 2-3-times longer than the calyx; anther not winged.
2a. Rhachis and panicle branches villous ... *G. multiflora* 3.
2b. Rhachis and panicle branches glabrous.
3a. Calyx purplish brown; corolla lobes 7-10 mm long; staminodes 9-13 mm long; lip 15-19 mm long; filament 20-27 mm long; anther 4-7 mm long. Flowers almost all replaced by bulbils ... *G. clarkei* 2.
3b. Calyx yellow; corolla lobes 5-6 mm long; staminodes 4-5 mm long; lip 7-8 mm long; filament 15-22 mm long; anther 1.8-2.2 mm long. Flowers not replaced by bulbils (sometimes 1-3 lower panicle branches transformed into bulbils) ... *G. racemosa* 1.

1. G. racemosa J. E. Smith, Exot. Bot. 2:115. t. 117. 1804.

Herbs, 3-8 dm high. *Leaves* usually lanceolate, sometimes oblong, 7-27 × 2-8.5 cm, glabrous or hairy at the base beneath. *Panicles* 6-25 cm long; bracts 1-1.5 cm long. *Flowers* 2-5 together, usually yellow or orange-yellow with the mouth tinged with deeper orange-yellow or sometimes purplish; calyx 5-9 mm long; corolla hispidulous outside, tube 15-20 mm long; lobes 3-4 mm broad; staminodes *ca* 2 mm broad; lip obovate, *ca* 5 mm broad with *ca* 2 mm deep sinus and *ca* 0.5 mm long basal auricles; anthers ovate-oblong; ovary glabrous, smooth or tubercled. *Fruit* globose, *ca* 1 cm in diam.; seeds ovoid, *ca* 1.5 mm long. (Fig. 2)

Flrs. & frts.: May-September. 100-1300 m.

ASSAM: Goalpara; Kamrup; N. Cachar & Mikir Hills. MEGHALAYA: K. & J. Hills. MIZORAM: Mizo Hills.

The flowers are generally lemon-yellow or orange-yellow. However, populations at Barapani, near Shillong, have been observed to show variations from yellow, orange-yellow to more or less reddish brown tinged and in extreme cases deep purple, leading to erroneous suggestion of belonging to a distinct species.

2. G. clarkei Baker in Hook. f. Fl. Brit. Ind. 6: 201. 1890; A. S. Rao & D. M. Verma in Bull. Bot. Surv. Ind. 11: 246. 1969.

Herbs, 5-15 dm high. *Leaves* 17-30 × 3-6 cm, hairy at base beneath. *Panicles* 20-45 cm long; bracts linear-lanceolate, 2-3 cm long; bracteoles oblong, scarious, 3-5 mm long. *Flowers* 1-3 together, pale yellow or brownish yellow, deeper yellow at mouth, ultimately many replaced by bulbils; calyx 6-10 mm long; corolla hispidulous outside, tube 18-30 mm long, lobes 4-5 mm broad; staminodes 2.5-3.5 mm broad; lip obovate, 10-15 mm broad, bilobed, with *ca* 1 mm long basal auricles; anther lanceolate. *Fruit* oblong, faintly 3-lobed, wrinkled, 1.5-2 cm long, green. After a fortnight after flowering has commenced, bulbils initially appear as tiny white dots, ultimately becoming ovoid, greenish brown, *ca* 10 × 5 mm. They easily fall off, but rarely germinate into tiny saplings while still on the panicle. (Fig. 3)

Flrs. & frts.: June-October. 500-1700 m.

ASSAM: Kamrup. MEGHALAYA: K. & J. Hills. MANIPUR. NAGALAND. ARUNACHALA PRADESH: Subansiri.

Plants from Subansiri introduced in the experimental garden at Shillong, showed for two years the yellow flower lip with twin brown dots at base, but in subsequent years the lip was uniformly yellow, lacking the twin dots.

3. G. multiflora Wall. ex Baker in Hook. f. Fl. Brit. Ind. 6: 202. 1890.

Herbs, 5-10 dm high. *Leaves* oblong or oblong-lanceolate, 12-35 × 4-7 cm hairy beneath, sometimes the upper surface also ciliolate along the nerves. *Panicles* 10-50 cm long, rarely the main rhachis producing a secondary rhachis bearing few to several flowering branches; sometimes a few flowering-branches transformed into ovoid bulbils; bracts 2-6 cm long. *Flowers* 6-9 together, yellow; calyx 3-5 mm long; corolla hispidulous outside, tube *ca* 15 mm long, lobes 3-3.5 × 2.5 mm; staminodes 2.5 × 1.7 mm; lip broadly obovate, 5 × 3.7 mm, bilobed, sinus *ca* 1.5 mm deep; filament 13-15 mm long; anther 1.5-2.5 mm long; ovary smooth or verruculose. *Fruits* subglobose, 1.5-2 cm diam.

Flrs. & frts.: May-September. 100-1200 m.

ASSAM: Kamrup; Lakhimpur; N. Cachar & Mikir Hills; Nowgong; Sibsagar. MEGHALAYA: Garo Hills; K. & J. Hills. MANIPUR. NAGALAND. ARUNACHALA PRADESH: Kameng; Siang; Subansiri; Tirap.

4. G. siamensium (Koenig) A. S. Rao & D. M. Verma, *comb. nov. Hura siamensium* Koenig in Retz. Observ. 3: 49. 1783. *G. versicolor* J. E. Smith, Exot. Bot. t. 117 A, B, C. 1804; Baker l.c. 205.

Stems 3-6 dm high. *Leaves* 10-30 × 4-6 cm.

Panicles broad, lax, 10-20 cm long, rhachis and branches very slender, lowest branch upto 9 cm long; bracts *ca* 3 mm long. *Flowers* 5-6 together; calyx *ca* 4 mm long, green; corolla yellow or lilac tinged, tube *ca* 6 mm long, lobes *ca* 3 mm long; staminodes slightly longer than the corolla lobes; lip small, narrow; filament *ca* 15 mm long, yellow; anther wings sub-quadrate, bilobed or dentate, yellow, deflexed. *Fruits* cylindric, *ca* 20×6 mm, smooth.

ASSAM: *s.l.*, *Jenkins* (*n.v.*); *Simon* (*n.v.*).

3. Hemiorchis Kurz in J. As. Soc. Beng. 42: 108. t. 8. 1873; *non* Ehrenb. ex Schweinf. Beitr. Fl. Aethiop. 241. 1867, *nomen*.

Rhizomes short, creeping. *Leaves* produced after flowers, petioled, oblong or oblong-lanceolate. *Flowers* in peduncled spikes, usually concentrated at the tips of elongating tomentose rhachis; calyx campanulate, lobes ovate, acute; corolla tube slightly dilated at the mouth, lobes oblong-lanceolate; staminodes obovate or suborbicular; lip as broad as or broader than long, emarginate; filament short, curved; anther linear; ovary 1-celled; placentae 3, parietal. *Capsules* 3-valved.

1a. Rhachis and corolla purplish red. Capsule globose ... *H. rhodorrhachis* 1.
1b. Rhachis and corolla pale yellow. Capsule fusiform ... *H. pantlingii* 2.

1. H. rhodorrhachis Schum. in Engl. Pflanzenrch. heft 20: 128. 1904. *H. burmanica* Baker in Curtis, Bot. Mag. t. 7120. 1890 et in Hook. f. Fl. Brit. Ind. 6: 207. 1890; *non* Kurz, 1873.

Rhizomes 5-7 mm thick. *Leaves* oblong-lanceolate, *ca* 20×6 cm. *Peduncles* with inflorescence 8-23 cm high, clothed with 5-6 reddish, oblong, hairy, upto 5 cm long sheaths; rhachis 3-5 mm thick. *Flowers* ebracteate; calyx 8-10 mm long, hairy; corolla tube subequalling the calyx, lobes *ca* 15 mm long, dorsal lobe hispidulous outside; staminodes obovate-oblong, *ca* 12×8 mm yellowish white; lip broadly ovate, *ca* 15 mm, long and equally broad, yellowish white with reddish brown dots; filament *ca* 5 mm long; anther 4-4.5 mm long, muticous or apiculate; ovary tomentose. (Fig. 4)

Flrs. & frts.: February.

MEGHALAYA: K. & J. Hills.

2. H. pantlingii King in Ann. Bot. Gard. Cal. 5: 163. t. 198, 199. 1896.

Rhizomes 2-3 mm thick. *Stems* 7-8 dm high. *Leaves* oblong-lanceolate, 15-40×3-6 cm, margins and nerves above ciliolate. *Peduncles* with inflorescence 6-20 cm high, clothed with 4-6, oblong, hairy, upto 3 cm long sheaths; rhachis *ca* 1 cm thick. *Flowers* ebracteate or with *ca* 1 mm long bract; calyx 6-8 mm long; corolla hispidulous outside, tube exceeding the calyx by *ca* 4 mm, lobes *ca* 10 mm long; staminodes obovate-oblong, *ca* 9×6 mm, yellow with brown margins; lip obovate, *ca* 10 mm long and equally broad, yellow with purplish median line and orange tip; filament *ca* 5 mm long; anther *ca* 4.5 mm long; ovary tomentose. *Capsules* 3-valved, *ca* 3 cm long, puberulus, 8-10-costate.

Flrs.: March.

MEGHALAYA: K. & J. Hills.

4. Roscoea J. E. Smith, Exot. Bot. 2: 97. t. 108. 1804.

R. purpurea J. E. Smith, l.c. *R. exilis* Horan. Prodr. 21. 1862. *R. purpurea* var. *exilis* Baker in Hook. f. Fl. Brit. Ind. 6: 208. 1890.

Slender or robust, 2-4.5 dm high. *Roots* fusiform. *Leaves* sessile, lanceolate or oblong-lanceolate, 6-17×0.3-3 cm; sheaths closely imbricating. *Spikes* terminal, sessile, 2-4-flowered; bracts 1-flowered. *Flowers* purplish violet; calyx tubular, 4-7 cm long, split on one side; corolla tube dilated at the mouth, as long as or upto 1.7 cm longer than the calyx, lobes 2.5-3.5 cm long, dorsal 8-10 mm broad, laterals 3-4 mm broad; staminodes spathulate, 13-25×4-6 mm; lip obovate, cuneate, 25-45×15-20 mm deeply bilobed; stamen subequal with the staminodes; anther spurred; ovary 3-celled. *Fruits* mem-



Zingiberaceae. Figs. 1-7a : 1. *Mantisia saltatoria* Sims. 2. *Globba racemosa* J. E. Smith. 3. *G. clarkei* Baker. 4. *Hemiorchis rhodorrhachis* Schum. 5. *Roscoea purpurea* J. E. Smith. 6. *Cautleya gracilis* (J. E. Smith) Dandy. 7. *Curcuma zedoaria* (Berg.) Rosc. 7a. Stamen.

branaceous, cylindric, 2.5-4 cm long; seeds ovoid. (Fig. 5)

Flrs. & frts.: May-September. 1400-2000 m.

MEGHALAYA: K. & J. Hills.

5. Cautleya Royle, Illustr. 361. 1839.

C. gracilis (Smith) Dandy in Journ. Bot. 70: 328. 1954. *Roscoea gracilis* J. E. Smith in Trans. Linn. Soc. 13: 460, 1822. *C. lutea* Royle, *l.c.* t. 89.

Terrestrial or epiphytic, 3-5 dm high. *Rhizomes ca* 1 cm thick. *Leaves* sessile, lanceolate, 10-20 × 1-4 cm, glabrous or pubescent beneath. *Spikes* terminal, lax, upto 7 cm long, 1-6-flowered; rhachis flexuous, purplish green; bracts 7-12 mm long, 1-flowered, purplish green. *Flowers* yellow; calyx 13-20 mm long, purplish, split on one side; corolla tube subequalling the calyx, lobes 12-18 mm long; staminodes linear-lanceolate, 10-15 mm long; lip obovate, cuneate, 15-20 × 10-13 mm, bilobed or rarely entire and wavy; filament *ca* 5 mm long; anther *ca* 8 mm long; ovary 3-celled. *Capsules* globose, 8-13 mm in diam., red; seeds conical, ridged, *ca* 2 mm long, dark blue or black, aril minute. (Fig. 6)

Flrs. & frts.: June-September. 700-2000 m.

MEGHALAYA: K. & J. Hills. MIZORAM: Mizo Hills. NAGALAND. ARUNACHALA PRADESH: Tirap.

var. **robusta** Schum. in Engl. Pflanzenrch. heft 20: 125. 1904.

Robust herbs. *Leaves* larger. *Spikes* longer, upto *ca* 20-flowered; rhachis stout.

MEGHALAYA: K. & J. Hills, *s.l. Hook. f. & Thom.* (*n.v.*).

6. Curcuma L. Sp. Pl. 2. 1753 *et* Gen. Pl. 3. 1754.

Rhizomes profusely branched; roots stout, often ending in ellipsoid tubers. *Leaves* in basal bunches, enveloped at base by bladeless sheaths forming a spurious stem, suberect, oblong-lanceolate; petioles of inner leaves usually longer than the outer. *Spikes* pedunculate, compact, subcylindric, either central amidst leaves with its peduncle enclosed within leaf-sheaths or lateral, separate from the leafy shoot; bracts obovate-oblong, each connate in its lower part to the adjacent one forming pouches containing flowers, the free ends more or less spreading, lower green, upper most differently coloured, some of these sterile (plume or coma); bracteoles scarious. *Flowers* 2-7 in each pouch; calyx cylindric, split on one side; corolla tube inflated at tip, hairy in the throat; lobes oblong-lanceolate; staminodes petaloid, base slightly connate with the filament; lip obovate with a fleshy deep yellow median band and thinner whitish yellow sides; stylodes 2, subulate; filament short and broad, constricted at the tip; anther versatile, spurred; ovary 3-celled. *Fruits* seldom formed, globose-ellipsoid; seeds elliptic-oblong.

While the genus is easily recognised by its spikes with several pouches containing flowers and more or less coloured coma-bracts, infrageneric distinctions need more careful and critical study.

1a. Spikes central, amidst leaves, with its peduncle enclosed within leaf-sheaths.
  2a. Rhizomes pale yellow inside ... *C. montana* 4.
  2b. Rhizomes deep orange yellow inside ... *C. domestica* 5.
1b. Spikes lateral, separate from the leafy shoot, usually produced before the leaves appear, sometimes persisting and found with the leaves.
  3a. Leaves with a persistent purple flush above on either side of the midrib ... *C. zedoaria* 3.
  3b. Leaves uniformly green.
    4a. Leaves 15-30 × 5-8 cm. Corolla lobes white or yellowish ... *C. angustifolia* 1.
    4b. Leaves 50-80 × 18-28 cm. Corolla lobes pink ... *C. aromatica* 2.

1. C. angustifolia Roxb. in Asiat. Res. 11: 338. t. 3. 1810.

Rhizomes stramineus outside, pale yellow and aromatic inside; root-tubers *ca* 3 × 1.5 cm, white inside. *Leaf-bunch* 3-5 dm high; leaves glabrous or young pubescent beneath; sheaths green or purple. *Peduncles ca* 10 cm long; spikes 8-15 × 6 cm; plume bracts 3.5-4 × 1 cm, purple. *Flowers* as long as or slightly longer than the bract; calyx

ca 13 mm long ; corolla tube *ca* 2 cm long, lobes *ca* 2.3 cm long ; staminodes *ca* 2.8 cm long ; lip *ca* 2.8 × 1.5 cm, emarginate ; filament *ca* 15 mm long, anther *ca* 4 mm long ; ovary villous.

Flrs.: May-July. Along roadsides ; 300-1700 m.

ASSAM: Kamrup. MEGHALAYA: K. & J. Hills. NAGALAND.

2. C. aromatica Salisb. Parad. Lond. t. 96. 1807.

Rhizomes greyish stramineus outside, yellow and strongly aromatic inside. *Leaf-bunch ca* 1 m high ; leaves silky pubescent beneath ; sheaths green. *Peduncles* 15-23 cm long ; spikes *ca* 20 × 6 cm ; bracts 4-5 cm long, lower green, middle mauve-tipped, upper mauve. *Flowers* as long as the bract ; corolla tube *ca* 25 mm long ; lip emarginate.

Flrs.: May-June. Along roadside and deforested areas ; 100-1000 m.

ASSAM: Goalpara ; Kamrup ; Lakhimpur ; N. Cachar & Mikir Hills ; Sibsagar. MANIPUR. NAGALAND.

Rhizomes sometimes used as medicine or perfume.

3. C. zedoaria (Berg.) Rosc. Monandr. Pl. t. 109. 1828. *Amomum zedoaria* Berg. Mat. Med. 41. 1788.

Rhizomes brownish outside, pale or deep yellow and faintly aromatic inside, sometimes brown tinged with age ; some of the roots ending in ellipsoid tubers. *Leaf-bunch* 5-10 dm high ; leaves 5-7, oblong, 20-45 × 9-15 cm, glabrous, upper surface with about 10-15 mm broad purple flush on either side of the midrib, lower with narrower purple band ; sheaths purple. *Peduncles* 10-20 cm long ; spikes 12-20 × 6-8 cm ; lower bracts *ca* 5 × 4.5 cm, green, middle purple tipped, upper purplish green, topmost few purple. *Calyx ca* 8 mm long, pinkish ; corolla tube *ca* 27 mm long, lobes *ca* 15 × 10 mm, white with pink tips ; staminodes *ca* 12 × 8 mm, pale yellow ; lip *ca* 12 × 14 mm, emarginate, pale yellow, median band deeper yellow, red-margined at base ; filament *ca* 4.5 mm long ; anther *ca* 6 mm long, basal spur *ca* 3 mm long ; ovary villous. (Fig. 7)

Flrs.: April-May. 100-2000 m.

ASSAM: Goalpara ; Kamrup ; Lakhimpur. MEGHALAYA: K. & J. Hills, Garo Hills. MIZORAM: Mizo Hills. ARUNACHALA PRADESH: Kameng.

The purple flush on the leaves sometimes disappear in old leaves.

C. zedoaria Rosc. (1828) is a later homonym of *C. zedoaria* Roxb. (in Asiat. Res. 11 : 333. 1810 and Fl. Ind. 1 : 23. 1820), and thus according to current Code, Roscoe's name must be rejected. Due to existing confusion in the taxonomy of this genus and hence in the synonymy of *C. zedoaria* Rosc., it has not been possible to select another name for it. We have thus preferred to continue the application of this widely used name in monographic and floristic treatments to the plants described above.

4. C. montana Roxb. Coroman. Pl. t. 115. 1802 ; Fl. Ind. 1 : 35. 1820.

Rhizomes pale yellow or white inside, strongly aromatic. *Leaves* oblong-lanceolate, 20-50 × 10-15 cm, uniformly green, glabrous ; sheaths green. *Peduncles* 15-25 cm long ; spikes 7-12 × 4-5 cm ; lower bracts 2.5-3 cm long, green, plume bracts pink or pale rosy. *Flowers* about as long as the bracts, pale yellow.

Flrs.: July-September. 100-1000 m.

ASSAM: Kamrup. MEGHALAYA: K. & J. Hills, Garo Hills. ARUNACHALA PRADESH: Siang.

5. C. domestica Valet. in Bull. Buitenz. ser. 2. 27 : 31. 1918. *C. longa Auctt. non* L.

Rhizomes brownish outside, pale to very deep orange-yellow inside, strongly aromatic. *Leaf-bunch* of 5-7 leaves, 5-12 dm high ; leaves 30-70 × 10-25 cm, glabrous, uniformly green ; sheaths green. *Peduncles* 10-30 cm long ; spikes 10-17 × 5-10 cm ; bracts oblong, lower 5-6 cm long, green, middle ones green or with purplish or white tips ; plume bracts

white or purplish. *Flowers* 3-4 in each pouch, as long as the bract; corolla tube *ca* 35 mm long, lobes 13-15 × 12 mm, white; staminodes 13-15 × 9 mm, white; lip *ca* 18 × 15 mm, emarginate, creamy white with deep yellow band; filament *ca* 5 × 4 mm, white; anther *ca* 4 mm long, spur *ca* 3 mm long; ovary villous.

Flrs.: July-August. 100-1700 m.

Cultivated throughout Assam for its rhizomes that are being used as a dye and spice (Turmeric or Haldi).

7. Boesenbergia Kuntze, Rev. Gen. Pl. 685. 1891; Holttum in Gard. Bull. Singapore 13: 106. 1950. *Gastrochilus* Wall. Pl. Asiat. Rar. 1: 22. t. 24. 1829 *p.p. non* D. Don, 1825.

B. rubrolutea (Baker) Kuntze, *l.c. Gastrochilus rubrolutea* Baker in Hook. f. Fl. Brit. Ind. 6: 218. 1890.

Perennials. *Stems* 1.5-3 dm high. *Leaves* sessile or shortly petioled, oblong, 15-20 cm long. *Spikes* terminal on the stem or on a radical scape, 5-7.5 cm long, narrow, many-flowered, on 5-7.5 cm long peduncle or scape; bracts small, closely sheathing. *Corolla* tube subequalling the bract; lobes *ca* 25 mm long, red; staminodes rather longer than the corolla lobes, *ca* 8 mm broad, yellow; lip oblong, cuneate, upper half red, lower yellow; stamen nearly as long as the staminodes.

MEGHALAYA: K. & J. Hills, *Hook. f. & Thom.* (*n.v.*); *Clarke* (*n.v.*).

8. Curcumorpha A. S. Rao & D. M. Verma in Bull. Bot. Surv. Ind. 13: 339. 1974.

C. longiflora (Wall.) A. S. Rao & D. M. Verma, *l.c. Gastrochilus longiflora* Wall. Pl. Asiat. Rar. 1: 22. t. 25. 1829. *Boesenbergia longiflora* Kuntze, Rev. Gen. Pl. 685. 1891.

Rhizomes short, faintly aromatic. *Leaves* 3-4 in a basal bunch forming spurious stem, contemporaneous with the flowers; petioles 2-25 cm long; lamina oblong-lanceolate, 10-45 × 4-13 cm, rounded and rather cordate at base. *Spikes* 1-several, radical, around the stem, narrow, cylindrical, 3-7 cm long, on 0.5-4 cm long peduncle; bracts 2-5, spiral, lanceolate, 6-8.5 × 1-1.8 cm, purplish green, 1-flowered. *Flowers* fugaceous, successively opening from apex downwards; calyx 2-2.8 cm long, deeply split on one side; corolla pinkish white; tube 7.5-12.5 cm long; lobes oblong-lanceolate, 2.5-3.5 × 0.5-1 cm; staminodes fused at the base with the lip and the filament forming an inflated 1-1.5 cm long staminodial cup, free part obovate-oblong, 20-25 × 14-17 mm, white; lip obovate, cuneate, 35-55 × 25-48 mm, entire, crumpled at margins, white with a fleshy, glossy, red median band gradually broadening and merging upwards into a purplish red flush which ultimately becomes almost pale violent in age, the base with dense streaks of red on either side of the median band; filament *ca* 2 mm long; anther 10-15 mm long, connective inflexed, produced into a *ca* 1 mm large, notched crest; ovary cylindric, 7-10 mm long, 3-celled; placentae axile; ovules many.

Flrs.: April-September. Along forest margins, in shady places; 150-1850 m.

ASSAM: Darrang; Kamrup; Lakhimpur; N. Cachar & Mikir Hills; Sibsagar. MEGHALAYA: Garo Hills; K. & J. Hills. MIZORAM: Mizo Hills. ARUNACHALA PRADESH: Kameng. MANIPUR.

9. Kaempferia L. Sp. Pl. 2. 1753 *et* Gen. Pl. 3. 1754; Holttum in Gard. Bull. Singapore 13: 117. 1950.

Rhizomes short, creeping, tuberous; roots stout, often ending in ovoid-ellipsoid tubers. *Leaves* two-several in a basal cluster, sometimes produced after flowers. *Inflorescence* various. *Flowers* generally fugacious; calyx tubular, split on one side; staminodes petaloid; lip bilobed; filament short or obsolete; connective broad, produced above into an entire or variously lobed anther-crest; ovary 3 (sometimes 1)-celled; placentae axile. *Capsules* oblong, thin-walled; seeds ellipsoid or subglobose; aril small, lacerate.

1a. Flowers within a partially adnate pair of large, oblong bracts forming a cupular involucre ... *K. involucrata* 2.

1b. Flowers without a cupular involucre.

2a. Leaves 2(rarely 1 or 3) lying flat on the ground, subsessile, suborbicular, uniformly green, contemporaneous with the flowers. Lip white or purplish white with purplish dots towards the base ; anther-crest 2-lobed ... *K. galanga* 1.

2b. Leaves several (rarely two), suberect, forming a spurious stem, petioled, oblong-lanceolate, variegated with pale and deep green on the upper surface, produced after the flowers. Lip purple-lilac with yellowish-white band towards base ; anther-crest 3-4-lobed ... *K. rotunda* 3.

1. K. galanga L. Sp. Pl. 2. 1753.

Rhizomes aromatic ; roots often ending in tubers. *Leaves* usually suborbicular, rarely ovate-orbicular, 5·5-8(-15) × 5-7(-8) cm, with undulate pinkish red margins, puberulus beneath, base rounded or subcordate, apex rounded, deltoid or acuminate. *Flowers* 4-12, clustered in between the leaves, fragrant ; bracts linear-lanceolate, 2.5-3.5 cm long ; calyx subequalling the bract ; corolla white, tube 2.5-4 cm long, lobes linear, *ca* 2.5 cm long ; staminodes obovate, 1.8-3 × 0.8-1.5 cm, white ; lip obovate, cuneate, 2-3.5 cm long and equally broad, deeply bilobed ; anther subsessile, *ca* 3 mm long.

Flrs. : June. *ca* 1000 m.

MEGHALAYA : K. & J. Hills.

2. K. involucrata King ex Baker in Hook. f. Fl. Brit. Ind. 6 : 221. 1890.

Tubers subglobose, 1.5-2 cm across. *Leaves* oblanceolate, 10-22 × 1.5-5 cm, on 5-15 cm long petioles, though usually produced after flowering, sometimes start sprouting with late flowering. *Peduncles* 2.5-10 cm long, terminated by a 2-lipped cup-like structure with spreading tips, enclosing the flowers, the cup formed of two oblong bracts adnate for about half to three-fourths its length, 3-3.5 cm high, *ca* 1.5 cm in diam. *Flowers* several on a flat receptacle, white ; calyx *ca* 1 cm long ; corolla tube *ca* 2 cm long, lobes oblong, *ca* 12 × 5 mm ; staminodes obovate, *ca* 17 × 7 mm ; lip shortly clawed, suborbicular, *ca* 20 × 18 mm, white with a yellow blotch in the centre, bifid ; filament *ca* 2 mm long and equally broad, anther *ca* 3.5 mm long, crest suborbicular, 3-4 mm, usually entire, rarely deeply bifid ; ovary oblong, glabrous. (Fig. 8)

Flrs. : May-June. 100-1000 m.

ASSAM : Goalpara ; Kamrup. MEGHALAYA : K. & J. Hills. ARUNACHALA PRADESH : Kameng.

3. K. rotunda L. Sp. Pl. 3. 1753.

Rhizomes aromatic ; roots sometimes ending in tubers. *Leaves* oblong, 10-35(-45) × 3-9(-11) cm, appressed hairy beneath. *Spikes* subsessile ; bracts lanceolate, 2-3.5 cm long, purplish white. *Flowers* 5-10(-16) ; calyx 4-6 cm long, purplish dotted ; corolla white, tube subequalling the calyx, lobes linear, 5-7.5 cm long ; staminodes oblong, 3.5-5 × 1.2-1.7 cm, white ; lip obovate, 3.7-5(-7) × 1.5-3(-4) cm, deeply bilobed ; filament 3-5 mm long ; anther *ca* 6 mm long ; crest 8-12 mm long, white with scattered purple dots, cleft into 3-4 linear lobes, sometimes also with 1-2 additional teeth in between. (Fig. 9)

Flrs. : May.

ASSAM : Sibsagar. MEGHALAYA : K. & J. Hills. MIZORAM : Mizo Hills. TRIPURA.

Usually known in cultivation, sometimes running wild. Rhizomes are said to be used medicinally and for flavouring food.

10. Caulokaempferia Kai Larsen in Saertryk Af Botanisk Tidsskrift 60 : 166. 1964.

Annuals. *Stems* slender. *Leaves* sessile or shortly petioled, linear, lanceolate or ovate-oblong. *Spikes* terminal, few-flowerd. *Flowers* fugaceous ; calyx tubular, split on one side, shorter than the bract ; corolla tube equalling or exceeding the bract ; lobes oblong-lanceolate ; staminodes petaloid ; lip obovate, cuneate, entire or notched ; filament short or obsolete ; connective produced into an entire, suborbicular, petaloid anther crest ; ovary 3-celled ; placentae axile. *Capsules* oblong.

1a. Leaves linear-lanceolate, 0.5-1.5 cm broad. Bracts lanceolate, 2.5-3.5 × 0.5-1 cm. Flowers white ... *C. linearis* 1.
1b. Leaves ovate-oblong, 2-5 cm broad. Bracts oblong-lanceolate, 2.5-5 × 1-1.8 cm. Flowers pink-red ... *C. secunda* 2.

1. C. linearis (Wall.) Larsen, *l.c.* 170. *Kaempferia linearis* Wall. in Roxb. Fl. Ind. 1: 20. 1820.

Roots slender, tips usually swollen. *Stems* 1-2(-3) dm high. *Leaves* sessile, 5-10 cm long, acuminate, glabrous or puberulus beneath. *Bracts* usually 2, sometimes 1, acuminate, 1-2-flowered. *Flowers* white; corolla lobes 7-10 × 3 mm; staminodes oblong, as long as the corolla lobes; lip 1-2 cm long and equally broad, white with a yellowish base, entire or notched; anther crest orbicular, 3-4 mm. *Capsules ca* 2 cm long. (Fig. 10)

Flrs. & frts.: August.

MEGHALAYA: K. & J. Hills.

2. C. secunda (Wall.) Larsen, *l.c.* 170. *Kaempferia secunda* Wall. *l.c.* 19.

Roots slender or fusiform. *Stems* 0.5-3 dm high. *Leaves* sessile or shortly petioled, 4.5-14 cm long, caudate-acuminate, glabrous, young purplish beneath. *Bracts* 1-8, caudate-acuminate, 1-2-flowered. *Flowers* pink-red (Baker in Hook. f. Fl. Brit. Ind. 6: 223. 1890 states white or red); corolla tube as long as or upto 15 mm longer than the bract, lobes 10-12 × 3-4 mm; staminodes oblong, 10-15 × 8-10 mm; lip 23-26 × 16-18 mm, notched; anther *ca* 2 mm long, crest ovate-orbicular, 3-5 mm long. *Capsules ca* 1 cm long; seeds whitish.

Flrs. & frts.: June-September. 800-1200 m.

MEGHALAYA: K. & J. Hills.

11. Parakaempferia A. S. Rao & D. M. Verma in Bull. Bot. Surv. Ind. 11: 206. 1971.

P. synantha A. S. Rao & D. M. Verma, *l.c.*

Rhizomes creeping, *ca* 5 mm thick. *Stems* 4-6 dm high. *Leaves* contemporaneous with the flowers, 13-24 × 3.3-7 cm, pubescent beneath. *Spikes* 1-3, radical, around the stem; peduncles 3-6 cm long, villous; rhachis slender, villous; bracts 7-11, lanceolate, 20-26 × 6-8 mm, convolute, 1-flowered. *Flowers* fugacious, successively opening from base upwards; calyx *ca* 1 cm long, 3-lobed, split on one side; corolla tube as long as the bract, white; lobes oblong-lanceolate, 15-19 × 6-9 mm, white with pinkish veins; staminodes oblong, 17-20 × 6-7 mm, white with pinkish veins; lip obovate, 25-28 × 22-25 mm, emarginate, white with pinkish veins and median fleshy band of twin close yellow lines from base to about centre; filament *ca* 2 mm long; connective *ca* 6 mm broad with inflexed edges, purple-red; anther *ca* 8 mm long, crest subreniform, *ca* 6 × 8 mm, entire, with deflexed tip, purple-red; ovary ellipsoid, villous, 3-celled, placentae axile, ovules many.

Flrs.: May. At *ca* 150 m.

ASSAM: Lakhimpur.

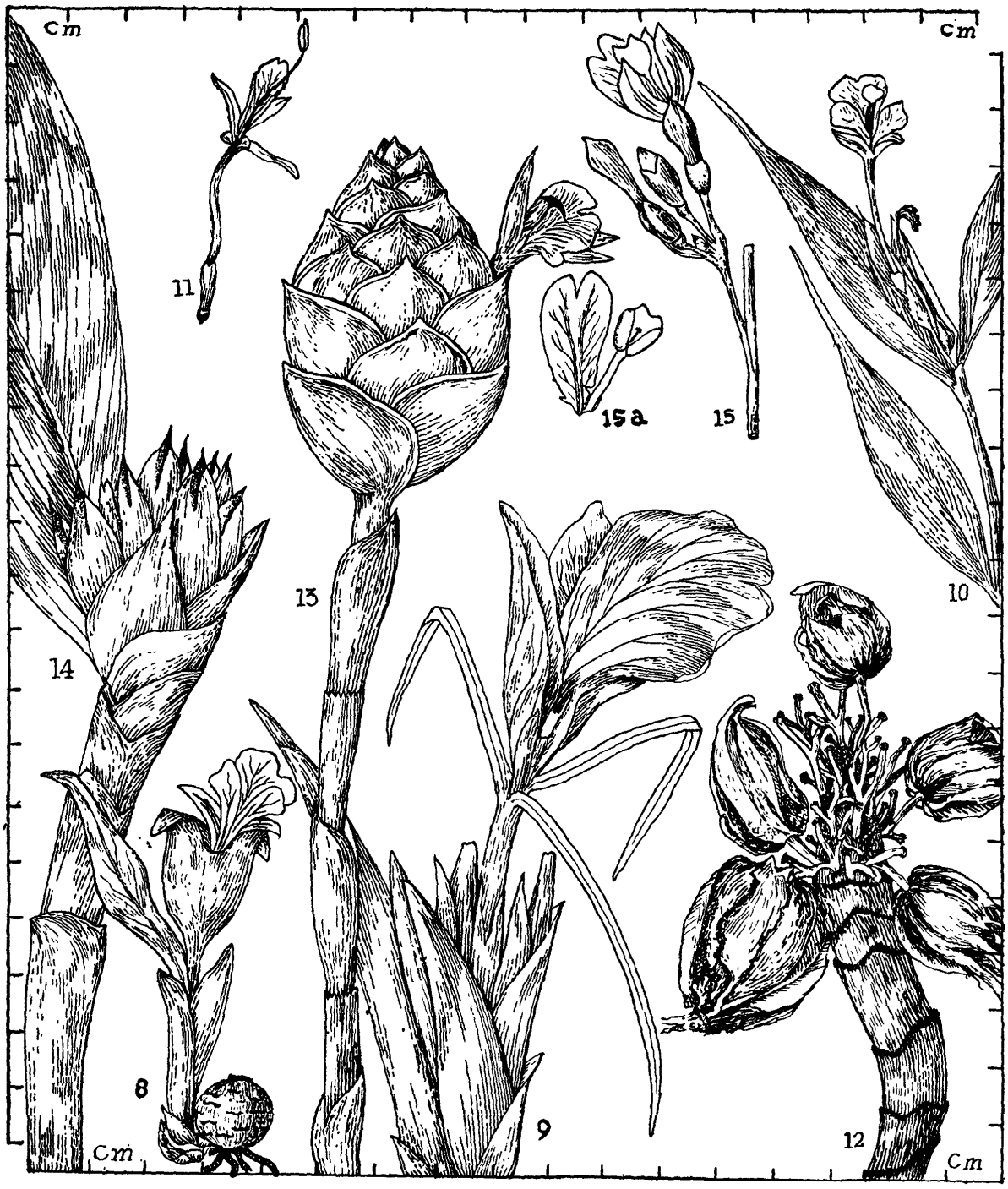
12. Hitchenia Wall. in Trans. Med. Phys. Soc. Calc. 7: 215. 1834.

H. careyana Benth. in B. & H. Gen. Pl. 3: 643. 1883.

Stems 1-2 dm high. *Leaves* subsessile, 40-60 × 8.5-15 cm, glabrous or puberulus along midrib beneath; margins membranaceous or fringed with hairs. *Spikes* terminal, cylindric, cone-like, 12-21 cm long; bracts obovate-oblong, obtuse, acuminate or cuspidate, with recurved trips, lower 1-2 puberulus-tomentose, 5-6.5 cm long, greenish, the rest 2.5-3.5 cm long, glabrous, white with pale green along middle only, 3-6-flowered; bracteoles white, tightly rolled. *Calyx* cylindric *ca* 10 mm long, 3-lobed, split on one side; corolla white, tube as long as the bract, lobes linear, 12-15 × 2 mm; staminodes petaloid, small, rotundate and may be easily overlooked, *ca* 2 mm long, white or creamy; lip oblanceolate, shallowly 3-lobed above, notched at the tip, *ca* 20 × 6 mm, white or yellowish at base; filament *ca* 22 mm long; anther *ca* 5 mm long. *Capsules* oblong, *ca* 15 mm long; seeds subglobose, 4-5 mm in diam. (Fig. 11)

Flrs. & frts.: July-November. 150-1000 m.

ASSAM: Darrang; Lakhimpur; Sibsagar.



Zingiberaceae. Figs. 8-15a : 8. *Kaempferia involucrata* King ex Baker. 9. *K. rotunda* L. 10. *Caulokaempferia linearis* (Wall.) Larsen. 11. *Hitchenia careyana* Benth. 12. *Amomum dealbatum* Roxb. 13. *Zingiber zerumbet* (L.) J. E. Smith. 14. *Costus speciosus* (Koen.) J. E. Smith. 15. *Alpinia allughas* (Retz.) Rosc. 15a. Lip & stamen.

MEGHALAYA: K. & J. Hills. MANIPUR. ARUNACHALA PRADESH: Siang.

13. Hedychium Koenig in Retz. Observ. 3: 73. 1783; A. S. Rao & D. M. Verma in Bull. Bot. Surv. Ind. 11: 120-28. 1971.

Terrestrial or epiphytic, perennial, rhizomatous herbs. *Leaves* cauline, usually sessile, sometimes shortly petiolate, usually oblong-lanceolate, sometimes linear. *Spikes* terminal, lax- or very dense-flowered; bracts 1-several-flowered; bracteoles somewhat tubular at the base. *Calyx* tubular, split on one side; corolla tube as long as or exceeding the bract, lobes linear, curled, ultimately reflexed; staminodes petaloid, linear, oblanceolate or obovate; lip various, entire or 2-lobed; stamen shorter than to exceeding the lip; anther neither spurred nor crested, cells usually close, parallel; *ovary* 3-celled; placentae 3, axile; ovules many. *Capsules* usually subglobose, sometimes oblong, dehiscing by recurved valves; valves usually orange-red inside; seeds subglobose, aril lacerate, usually bright red.

1a. Filament absent, shorter than, equal to or sometimes 1-3 mm longer than the lip (up to 10 mm longer in *H. dekianum*) ... *H. wardii* 5.
2a. Filament absent.
2b. Filament present.
3a. Flowers 7-14 cm long.
4a. Spikes lax so that the rhachis is distinctly visible; bracts convolute.
5a. Bracts 1-flowered. Lip oblong, cuneate, orange-red at the base; steminodes almost linear.
6a. Stamen *ca* 10 mm shorter than the lip; filament curved ... *H. spicatum* var. *acuminatum* 7.
6b. Stamen 7-12 mm longer than the lip; filament straight ... *H. griffithianum* 16.
5b. Bracts several-flowered. Lip suborbicular, distinctly clawed, yellow at the base; staminodes oblong-obovate ... *H. dekianum* 2.
4b. Spikes very dense, cone-like, so that the rhachis is not visible; bracts, except sometimes the upper few, all flatly imbricating, never convolute.
7a. Flowers uniformly deep red. Lip fan-shaped, crumpled-margined, emarginate *H. greenii* 6.
7b. Flowers white or yellow, sometimes with an orange-yellow patch at the mouth; lip oblong or suborbicular, not crumpled-margined, usually distinctly bilobed.
8a. Bracts reddish-brown. Lip obovate, cuneate, *ca* half as broad as long ... *H. marginatum* 4.
8b. Bracts green. Lip suborbicular, clawed, *ca* as broad as long.
9a. Flowers orange-yellow, with an orange red blotch at the mouth; stamen 2-10 mm shorter than the lip ... *H. elwesii* (?) 3.
9b. Flowers white or yellow, with a yellow blotch at the mouth, or if the flowers somewhat orange-yellow at the mouth, the stamen 5-10 mm longer than the lip. ... *H. coronarium* 1.
3b. Flowers 2.5-3 cm long.
10a. Staminodes spathulate.
11a. Calyx *ca* as long as the bract; corolla lobes staminodes and lip 15-17 mm long ... *H. longipedunculatum* 9.
11b. Calyx *ca* half as long as the bract, corolla lobes, staminodes and lip 7-8 mm long *H. hookeri* 18.
10b. Staminodes linear.
12a. Leaves sessile. Stamen *ca* as long as the lip ... *H. densiflorum* 8.
12b. Leaves petioled. Stamen *ca* one and a half times as long as the lip ... *H. aureum* 13.
1b. Filament more than 10 mm longer than the lip.
13a. Anthers 1.5-2 mm long, the cells diverging at the base.
14a. Flowers large; corolla lobes 3-3.7 cm long; lip 3-3.5 cm long; filament *ca* 6 cm long ... *H. villosum* 11.
14b. Flowers small; corolla lobes *ca* 1.5 cm long; lip *ca* 1 cm long; filament *ca* 2 cm long ... *H. tenuiflorum* 12.
13b. Anthers 6-12 mm long, the cells parallel.
15a. Flowers red or organe-red.
16a. Leaves linear. Filament more than twice the length of the lip ... *H. coccineum* 22.
16b. Leaves lanceolate. Filament less than twice the length of the lip.
17a. Rhachis and bracts villous; bracts purplish-green. Corolla tube as long as the bract; staminodes spathulate, *ca* 8 mm broad ... *H. rubrum* 23.
17b. Rhachis and bracts glabrous; bracts green. Corolla tube 10-15 mm longer than the bract; staminodes narrowly oblanceloate, *ca* 3 mm broad ... *H. aurantiacum* 24.

15b. Flowers white or yellow.
18a. Lip 3-5 mm broad.
19a. Spikes dense, cone-like, so that the rhachis is not visible ; bracts flatly imbricating. Lip and staminodes 2.5-3 cm long ; filament 5.5-6.5 cm long ... *H. ellipticum* 10.
19b. Spikes lax, so that the rhachis is distinctly visible ; bracts convolute. Lip and staminodes *ca* 1.5 cm long ; filament 2.5-3.5 cm long.
20a. Corolla tube as long as or upto 1 cm longer than the bract ; staminodes linear ; filament red ... *H. gracile* 14.
20b. Corolla tube *ca* 3 cm longer than the bract ; staminodes spathulate ; filament white ... *H. gracillimum* 15.
18b. Lip 10-33 mm broad.
21a. Leaves white pulverulent beneath. Flowers bright yellow; filament red ; lip entire or notched ... *H. gardnerianum* 19.
21b. Leaves appressed hairy beneath. Flowers white or pale yellow ; filament white or yellowish ; lip distinctly bilobed, the sinus *ca* 1 cm deep.
22a. Flowers pale yellow ; lip *ca* 33 mm broad ... *H. luteum* 25.
22b. Flowers white ; lip 10-20 mm broad.
23a. Corolla tube exceeding the bract by *ca* 2.8 cm ; staminodes spathulate, *ca* 1.5 × 0.5 cm ; filament *ca* 3.2 cm long ... *H. calcaratum* 21.
23b. Corolla tube exceeding the bract by 1-1.5 cm ; staminodes linear or narrowly oblanceolate, 2-3 × 0.2-0.35 cm ; filament 5-6 cm long.
24a. Spikes 10-20 cm long ; bracts 1-, rarely 2-flowered, lower 1-2 empty, flat, the rest flowering, convolute ... *H. thyrsiforme* 17.
24b. Spikes 40-60 cm long ; bracts 2-4 flowered, all flowering and convolute ... *H. stenopetalum* 20.

1. H. coronarium Koen. in Retz. Observ. 3: 73. 1783 ; A. S. Rao & D. M. Verma in Bull. Bot. Surv. Ind. 11: 121. 1971.

Stems 1-2 m high. *Leaves* oblong-lanceolate, 25-45 × 10-16 cm, appressed hairy beneath. *Spikes* cone-like, 10-18 cm long ; bracts 4-9 × 2.5-6 cm, obtuse or acuminate, 3-9-flowered. *Flowers* fragrant, white with a pale yellow blotch at the mouth ; calyx 3-5 cm long ; corolla tube 3-6 cm longer than the bract, lobes 3.5-6 × 0.3-0.5 cm ; staminodes obliquely spathulate, 4-5.5 × 1.8-3.4 cm, entire or notched ; lip suborbicular, with 5-10 mm long claw, blade 4-6 cm long and equally broad, base subcordate, apex bifid ; stamen 3-5 mm shorter than the lip ; filament white, anther 15-18 mm long. *Capsules* subglobose, *ca* 2 cm in diam.

Flrs.: June-October. Wild and also cultivated in gardens ; 100-1300 m.

ASSAM: Lakhimpur. MIZORAM: Mizo Hills. MEGHALAYA: K. & J. Hills. NAGALAND. ARUNACHALA PRADESH: Tirap.

var. **chrysoleucum** (Hook.) Baker in Hook. f. Fl. Brit. Ind. 6: 226. 1892. *H. chrysoleucum* Hooker in Curtis, Bot. Mag. t. 4516. 1850.

Leaves lanceolate, 25-30 × 4.5-6 cm. *Flowers* white with a deep yellow or orange-yellow blotch at the mouth ; calyx 2-5 mm longer than the bract ; corolla tube *ca* 4 mm longer than the bract ; staminodes spathulate, *ca* 3.5 × 1.5 cm ; lip suborbicular or obovate, rather gradually clawed ; stamen 5-10 mm longer than the lip, filament pinkish-yellow.

Flrs.: May-October. wild (?), usually found in cultivation ; 100-1600 m.

ASSAM: Lakhimpur. MEGHALAYA: K. & J. Hills. NAGALAND.

var. **urophyllum** (Lodd.) Baker, *l.c. H. urophyllum* Lodd. Bot. Cab. t. 1785. 1833.

Leaves oblong-lanceolate, 30-55 × 10-13.5 cm. *Flowers* yellow with a deeper yellow blotch at the mouth ; calyx shorter than the bract ; corolla tube exceeding the bract by 2-5 cm ; staminodes spathulate, 3.5-4.5 × 1.5-2.5 cm ; lip suborbicular, 4.5-5 cm broad,

abruptly clawed, usually bilobed, rarely subentire; stamen 3-4 mm shorter than the lip; filament yellow.

Flrs.: May-September. Wild and cultivated in gardens; 700-1500 m.

MEGHALAYA: K. & J. Hills.

var. **subditum** (Turill) Naik in Bull. Bot. Surv. Ind. 3: 71. 1961. *H. subditum* Turill in Kew Bull. 1914: 370. 1914.

Leaves oblong-lanceolate, *ca* 30 × 6-9 cm. *Flowers* yellow; calyx about half as long as the bract; corolla tube exceeding the bract by *ca* 1.5 cm; staminodes oblanceolate, *ca* 3.5 × 0.5 cm; lip suborbicular, clawed, *ca* 3.5 cm broad, bilobed; stamen exceeding the lip by *ca* 7 mm; filament yellow.

Flrs.: July-August.

MEGHALAYA: K. & J. Hills.

2. H. dekianum A. S. Rao & D. M. Verma in Bull. Bot. Surv. Ind. 11: 122. 1971.

Stems 1.2-2 m high. *Leaves* 30-50 × 5.5-13 cm, appressed hairy beneath. *Spikes* 10-17 cm long, moderately dense-flowered; rhachis villous; bracts 4-6 × 1.2-2 cm, convolute 3-9-flowered. *Flowers* white, fragrant; calyx subequalling the bract; corolla tube exceeding the bract by 12-23 mm, lobes 35-47 mm long; staminodes spathulate, 25-37 × 10-16 mm; lip suborbicular, abruptly clawed, 30-37 × 23-34 mm, white with a pale yellow blotch at the mouth, bilobed, sinus 15-20 mm deep; stamen 1-2 cm longer than the lip; filament 32-45 mm long, anther 10-12 mm long. *Capsules* oblong-cylindric, trigonous, 4-6 cm long.

Flrs.: August. 700-1000 m.

MEGHALAYA: K. & J. Hills.

3. H. elwesii(?) Baker in Hook. f. Fl. Brit. Ind. 6: 226. 1892; A. S. Rao & D. M. Verma in Bull. Bot. Surv. Ind. 11: 123. 1971. *H. coronarium* var. *elwesii* Naik in Bull. Bot. Surv. Ind. 3: 71. 1961.

Stems 5-12 dm high. *Leaves* oblong-lanceolate, 20-40 × 5-12 cm, appressed hairy beneath. *Spikes* cone-like, 8-16 cm long; bracts ovate-lanceolate, all flat or sometimes a few rather convolute, 5-8 × 2-6 cm, 2-3-flowered. *Flowers* mildly fragrant, deep yellow with orange yellow or orange red at mouth; calyx *ca* half as long as the bract; corolla tube *ca* as long as the bract, lobes 2.5-3.3 × 0.3-0.5 cm; staminodes very narrowly oblanceolate, 2.5-3.5 × 0.5-0.8 cm; lip suborbicular, abruptly clawed, 3-4 cm broad, usually bilobed, sometimes almost entire with wavy margins, sometimes with an additional tooth in the sinus; stamen shorter than or subequalling the lip; filament *ca* 2 cm long, orange-red at base, yellowish upwards, anther *ca* 1 cm long.

Flrs.: August-September. 1000-1300 m.

MEGHALAYA: K. & J. Hills.

Baker described this species on a solitary collection of Elwes from Bishop falls, near Shillong, in Khasi hills. The Type could not be located, and we also failed in our attempts to collect plants from the Type locality. However, almost similar plants were collected from the adjoining areas, the nearest about 10 km from the Type locality, and these have been tentatively identified to *H. elwesii* and described above. The few points of differences being that in the original description of *H. elwesii* Baker, the filament is stated to be bright red and anther only *ca* 8 mm long.

4. H. marginatum Clarke in J. Linn. Soc. 25: 75. t. 31. 1890; A. S. Rao & D. M. Verma in Bull. Bot. Surv. Ind. 11: 126. 1971.

Stems ca 15 dm high. *Leaves* lanceolate, 20-40 × 3-6.5 cm, villous beneath, sometimes the upper surface also hairy at the base. *Spikes* cone-like, 7-10 × 4 cm, usually erect, sometimes cernuous; bracts oblong, flat, 4-4.5 × 1.5 cm, membranous-margined throughout when young, becoming fibrous at tip in age, 2-3-flowered. *Flowers* fragrant, yellow when fresh, turning orange-yellow on drying; calyx *ca* 2.5 cm long; corolla tube *ca* 5 cm long, lobes *ca* 2.5 cm long; staminodes oblanceolate, *ca* 2 × 0.2 cm; lip obovate, cuneate, *ca*

2 × 1 cm, bilobed; stamen *ca* 5 mm longer than the lip; filament *ca* 1.5 cm long.

Flrs.: September-October. *ca* 1300 m.

NAGALAND: Kohima.

The original description states bracts to be 1-flowered. However, observations on some live plants in the Type locality constantly showed each bract to be enclosing 2-3 successively opening flowers.

5. H. wardii Fischer in Kew Bull. 1936: 283. 1936; A. S. Rao & D. M. Verma in Bull. Bot. Surv. Ind. 11: 128. 1971.

Stems 7-15 dm high. *Leaves* 30-50 × 5.5-9 cm, appressed hairy beneath. *Spikes* cone-like, 8-20 cm long; peduncle villous; bracts 4-5 × 3.5-4.5 cm, lower flatly imbricating, upper few sometimes convolute, 3-5-flowered. *Flowers* white, fragrant; calyx 2.7-3.1 cm long; corolla tube 6.5-7.5 cm long, lobes 2-3 cm long; staminodes spathulate, 1.8-2.5 × 1-1.6 cm; lip suborbicular, abruptly clawed, 2.2-3 × 2.5-3.2 cm, glossy at the base, bilobed, sinus *ca* 5 mm deep; stamen sessile; anther 8-10 mm long.

Flrs.: August-October. 800-1000 m.

MEGHALAYA: K. & J. Hills.

6. H. greenii W. W. Smith in Rec. Bot. Surv. Ind. 4: 272. 1913.

Stems 5-18 dm high. *Leaves* oblong, 20-25 × 5 cm, persistently purple-red and sparsely hairy beneath. *Spikes* cone-like, 8-12 cm long, bearing few to several bulbils; bracts flatly imbricating, 4-7 × 2-4 cm, 2-3-flowered. *Flowers* red; calyx *ca* 1 cm shorter than the bract; corolla tube equalling the bract, lobes *ca* 4 cm long; staminodes narrowly oblanceolate, 4-4.5 × 0.5 cm; lip fan-shaped, cuneate, 4.5-5 cm long and equally broad, notched, with crumpled margins; stamen *ca* 5 mm shorter than the lip; filament 3-3.5 cm long.

Flrs.: July-August.

MEGHALAYA: K. & J. Hills. In cultivation at *ca* 1650 m.

Originally described from the lower hills of Bhutan, this is the only bulbil producing species of *Hedychium*.

7. H. spicatum Buch.-Ham. *ex* J. E. Smith var. **acuminatum** (Rosc.) Wall. in Kew Journ. 5: 328. 1853. *H. acuminatum* Rosc. Monandr. Pl. t. 47. 1828. *H. spicatum* var. *khasianum* Clarke *ex* Baker in Hook. f. Fl. Brit. Ind. 6: 227. 1892.

Stems 7-10 dm high. *Leaves* 25-32 × 4-9 cm, lower surface hairy along midrib towards base only or throughout. *Spikes* 10-25 cm long, lax flowered; bracts 2.5-3 × 1-1.2 cm, convolute, 1-flowered. *Flowers* white or yellow with age, with a red blotch at mouth; calyx as long as or exceeding the bract by upto 12 mm; corolla tube 6-7 cm long, lobes 3-3.5 × 0.2 cm; staminodes linear, 3.5-4.5 × 0.2 cm; lip oblong, cuneate, 4-4.5 × 1.5-2 cm, bilobed, divided to about half way down, with acute lobes; stamen *ca* 1 cm shorter than the lip; filament 2-2.5 cm long, red, curved. *Capsules* subglobose, *ca* 1 cm diam.

Flrs.: June-Sept. 600-2000 m.

MEGHALAYA: K. & J. Hills. NAGALAND.

8. H. densiflorum Wall. in Kew Journ. Bot. 5: 368. 1853.

Stems 6-10 dm high. *Leaves* linear-lanceolate or oblong, 20-30 × 2.5-8 cm, glabrous. *Spikes* 8-15 cm long, moderately dense-flowered; bracts ovate-oblong, 13-15 × 5 mm, convolute, 1-flowered. *Flowers* orange-yellow, turning reddish in age; calyx and corolla tube 1-1.5 mm longer than the bract; corolla lobes 12-14 mm long; staminodes linear-oblong, 10-13 × 3.5-4 mm; lip broadly obovate, cuneate, 9-10 × 7-8 mm, bilobed, sinus 2-3 mm deep, sometimes also with a tooth in the sinus; stamen exceeding the lip by 2-6 mm; filament 9-11 mm long, orange-red.

Flrs.: August.

ARUNACHALA PRADESH: Kameng.

9. H. longipedunculatum A. R. K. Sastry & D. M. Verma in J. Bomb. Nat. Hist. Soc. 6: 293-295. 1968.

Epiphytic. *Stems* 2.5-4 dm high. *Leaves* subsessile or on upto 16 mm long petiole, 4-23 × 1.5-10 cm, glabrous, purplish beneath.

Spikes 4-6 cm long, dense-flowered, on 5-14 cm long peduncle; rhachis hairy; bracts *ca* 11 mm long, convolute, 1-flowered. *Flowers* creamy yellow, fragrant; calyx *ca* 11 mm long, villous; corolla tube as long as the calyx, lobes 16 × 3 mm, red-brown dotted (more conspicuous when dry); staminodes spathulate, *ca* 17 × 7 mm; lip elliptic, clawed, *ca* 15 × 6 mm, bilobed almost to the base; filament *ca* 15 mm long, anther *ca* 7 mm long, the cells rather diverging at the base. *Capsules* subglobose, *ca* 15 mm in diam.

Flrs.: May. 1200-2500 m.

ARUNACHALA PRADESH: Subansiri. NAGALAND: Konoma hills.

10. H. ellipticum Buch.-Ham. *ex* J. E. Smith in Rees, Cyclop. 17.n.2. 1811.

Terrestrial, rarely epiphytic. *Stems* 7-13 dm high. *Leaves* sessile or with upto 3 cm long petiole, 25-30 × 8-14 cm, glabrous. *Spikes* cone-like, 5-11 cm long; bracts 1.7-3 × 0.8-1 cm, obtuse or acuminate, navicular, 1-flowered. *Flowers* white, turning yellow in age, fragrant; calyx *ca* 25 mm long; corolla tube 35-50 mm long, lobes 40-45 mm long; staminodes oblanceolate, 30-35 × 5 mm; lip oblong, cuneate, 25-30 × 5 mm, divided into two acute lobes, sinus usually *ca* 2 mm deep, sometimes much more, even upto the base, sometimes the lip 3-notched; filament 55-65 mm long, pinkish-yellow at base, pink-red above. *Capsules* subglobose, *ca* 12 mm in diam.

Flrs.: June-September. Wild and cultivated; 1200-1700 m.

MEGHALAYA: K. & J. Hills. NAGALAND.

11. H. villosum Wall. in Roxb. Fl. Ind. 1: 12. 1820.

Terrestrial or epiphytic. *Stems* 1-2 dm high. *Leaves* 30-43 × 5·5-8.5 cm, glabrous. *Spikes* 20-25 cm long, moderately lax-flowered; rhachis villous; bracts 2-3 × 0.8-1.5 cm, convolute, brownish, villous, 2-3-flowered. *Flowers* white, fragrant; calyx *ca* 35 mm long; corolla tube 50-60 mm long, lobes 30-37 mm long; staminodes linear, 30-35 × 3 mm; lip oblong, cuneate, 28-33 × 20 mm, bilobed; filament *ca* 60 mm long, red, anther *ca* 2 mm long.

Flrs.: January-April. 100-1900 m.

ASSAM: Lakhimpur. MEGHALAYA: K. & J. Hills. MIZORAM: Mizo Hills. MANIPUR. NAGALAND. ARUNACHALA PRADESH: Siang; Tirap.

This, and probably the following species, is the only *Hedychium* flowering in winter, the rest of them all flowering during the rains, between May-October.

12. H. tenuiflorum (Wall. *ex* Baker) Schum. in Engl. Pflanzenrch. heft 20: 51. 1904. *H. villosum* var. *tenuiflorum* Wall. *ex* Baker in Hook. f. Fl. Brit. Ind. 6: 229. 1892.

Epiphytic. *Stems ca* 1 m high. *Leaves* 17-33 × 2.5-6.5 cm, glabrous, greyish-green. *Spikes* 25-30 cm long, rather dense-flowered; rhachis and bracts shiny brown tomentose; bracts 1-2 cm long, convolute, 1-3-flowered. *Flowers* yellowish white, fragrant; calyx 16-25 mm long; corolla tube *ca* 8 mm longer than the bract, lobes 15-18 mm long; staminodes similar to the corolla lobes; lip oblong, cuneate, 12-15 mm long, shallowly bilobed; filament 20-27 mm long, red, anther *ca* 1 mm long.

Flrs.: November.

MEGHALAYA: K. & J. Hills.

13. H. aureum Clarke & Mann *ex* Baker in Hook. f. Fl. Brit. Ind. 6: 229. 1892.

Terrestrial or epiphytic. *Stems* 3-5 dm high. *Leaves* with 5-7 mm long petiole, lanceolate, 10-20 × 1.5-3.5 cm, glabrous or puberulus beneath. *Spikes* 4-6.5 cm long, dense-flowered; bracts *ca* 15 × 4 mm, slightly convolute, 1-flowered. *Flowers* yellow; calyx *ca* 10 mm long; corolla tube 11-13 mm long, lobes *ca* 10 mm long; staminodes linear, *ca* 9 × 1.5 mm; lip oblong, cuneate, *ca* 8 × 4 mm, bilobed to about half way down; filament as long as the lip, anther *ca* 5 mm long.

Flrs.: June-October. 1000-2000 m.

MEGHALAYA: K. & J. Hills. NAGALAND. ARUNACHALA PRADESH: Kameng; Tirap.

14. H. gracile Roxb. Fl. Ind. 1: 14. 1820; A. S. Rao & D. M. Verma in Bull. Bot. Surv. Ind. 11: 123. 1971. *H. glaucum* Rosc. Monandr. Pl. t. 53. 1828. *H. gracile* var. *glaucum* Baker in Hook. f. Fl. Brit. Ind. 6: 229. 1892.

Stems 2-6 dm high. *Leaves* sessile or with upto 2 cm long petiole, lanceolate or oblong, 11-25 × 3-8 cm, 2-6-times longer than broad, glabrous or puberulus beneath. *Spikes* 12-20 cm long, moderately dense-flowered; rhachis glabrous or hairy; bracts 15-24 × 4-6 mm, convolute, 1-flowered. *Flowers* white or yellow-tinged; calyx 14-20 mm long, as long as or exceeding the bract by upto 10 mm; corolla tube 22-37 mm long, lobes 25-32 mm long; staminodes linear, 16-23 × 1-1.5 mm; lip oblong, cuneate, 15-21 × 4 mm, bilobed, sinus *ca* 7 mm deep; filament 27-33 mm long, red; anther *ca* 8 mm long.

Flrs.: August-September. 1000-1600 m.

MEGHALAYA: K. & J. Hills.

15. H. gracillimum A. S. Rao & D. M. Verma in Bull. Bot. Surv. Ind. 11: 124. 1971.

Stems 2.5-6 dm high. *Leaves* subsessile or with upto 6 mm long petiole, 9-22 × 2-5.5 cm, glabrous. *Spikes* 5-11 cm long; bracts 9-15 × 3-5 mm, convolute, 1-flowered. *Flowers* white or yellowish in age; calyx 10-17 mm long, exceeding the bract by 3-5 mm; corolla tube 30-38 mm long, lobes 20-29 mm long; staminodes spathulate, 13-15 × 2-4 mm; lip oblong, clawed, 13-15 × 4-5 mm, bilobed, sinus *ca* 1.5-3 mm deep; filament 28-31 mm long, whitish, anthers *ca* 10 mm long, orange-red.

Flrs.: May-August. 900-1100 m.

MEGHALAYA: K. & J. Hills.

16. H. griffithianum Wall. in Kew Journ. 5: 369. 1853; A. S. Rao & D. M. Verma in Bull. Bot. Surv. Ind. 11: 125. 1971.

Stems 5-10 dm high. *Leaves* 15-35 × 4-8 cm, glabrous or hairy along midrib beneath, surfaces somewhat glandular. *Spikes* erect, 8-20 cm long; bracts 15-27 × 5-8 mm, convolute, 1-flowered. *Flowers* white turning yellowish in age, reddish at mouth, sparsely glandular, fragrant; calyx 2-4 cm long; corolla tube 3-5.5 cm long, lobes 3-4 cm long; staminodes linear to narrowly oblanceolate, 30-43 × 3-7 mm; lip oblanceolate, cuneate, 27-41 × 11-22 mm, bilobed, sinus 12-16 mm deep; stamen pink-red, exceeding the lip by 7-12 mm; filament 3-4 cm long.

Flrs.: August. 700-1000 m.

MEGHALAYA: K. & J. Hills.

17. H. thyrsiforme Buch.-Ham. *ex* J. E. Smith in Rees, Cyclop. 17. n.4. 1811.

Stems 7-15 dm high. *Leaves* 35-54 × 8-12 cm, villous beneath. *Spikes* 10-20 cm long, compact; bracts 3-4 cm long, lower 1-2 navicular, empty, the rest convolute, 1- or sometimes 2-flowered. *Flowers* white, fragrant; calyx subequalling the bract; corolla tube 10-15 mm longer than the bract, lobes 3-4 cm long; staminodes linear, 20-26 × 2 mm; lip obovate, clawed, 20-26 × 10-18 mm, with a yellow blotch at the base, divided about half way down into two acute lobes; filament 5-6 cm long, white; anther 8-10 mm long.

Flrs.: August-September.

MEGHALAYA: Garo Hills; K. & J. Hills. ARUNACHALA PRADESH: Subansiri. TRIPURA.

18. H. hookeri Clarke *ex* Baker in Hook. f. Fl. Brit. Ind. 6: 230. 1892.

Stems 30-45 cm high. *Leaves* with upto 7 mm long petiole, 13-20 × 4-6 cm, glabrous. *Spikes* 2.5-5 cm long, lax-flowered; bracts oblong, 10-12 mm long, 1-flowered. *Flowers* sulphur yellow; calyx 6 mm long, truncate; corolla tube slightly longer than the bract, lobes linear, *ca* 8 mm long; staminodes oblong, *ca* 8 mm long, lip obovate, abruptly clawed, slightly shorter than the staminodes, bifid; filament 8-12 mm long, anther *ca* 4 mm long. *Capsules* globose, *ca* 8 mm in diam.

MEGHALAYA: K. & J. Hills, 1300-1600 m, *Hook. f. & Thom.* (*n.v.*).

19. H. gardnerianum Rosc. Monandr. Pl. t. 62. 1828.

Stems 1-2 m high. *Leaves* 30-45 × 10-13 cm, white pulverulent beneath. *Spikes* 20-30 cm long, lax-flowered; rhachis and bracts white pulverulent; bracts 3.5-4.5 × 1-1.3 cm, pinkish inside, convolute, 1-2-flowered. *Flowers* bright yellow; calyx *ca* 5 mm shorter than the bract; corolla tube exceeding the bract by 1.5-2 cm, lobes 3-4.5 cm long; staminodes narrowly oblanceolate, 3-3.5 × 0.6 cm; lip obovate, 2.5-3 × 1.5-1.7 cm, emarginate or 2-3-notched; filament 5-6.5 cm long, bright red, anther *ca* 1 cm long, orange-red.

Flrs.: July-September. 900-1600 m.

MEGHALAYA: K. & J. Hills. ARUNACHALA PRADESH: Siang.

20. H. stenopetalum Lodd. Bot. Cab. t. 1902. 1833.

Stems 2-3 m high. *Leaves* 50-65 × 9-15 cm, appressed white hairy beneath. *Spikes* 40-60 cm long, lax-flowered; bracts 3.5-4.5 × 1.3-1.5 cm, convolute, 2-4-flowered. *Flowers* white with pale yellow blotch in mouth, fragrant; calyx equalling the bract; corolla tube 10-15 mm longer than the bract, lobes 4-5 cm long; staminodes narrowly oblanceolate, *ca* 30 × 3.5 mm, notched; lip obovate, cuneate to a short claw, *ca* 3 × 1-1.5 cm, deeply bilobed; filament 5-6 cm long, anther *ca* 1 cm long. *Capsules* oblong-cylindric, *ca* 3 × 1 cm.

Flrs.: June-September. 150-1600 m.

ASSAM: Lakhimpur. MEGHALAYA: K. & J. Hills. MIZORAM: Mizo Hills. ARUNACHALA PRADESH: Kameng; Lohit; Siang; Tirap.

21. H. calcaratum A. S. Rao & D. M. Verma in Bull. Bot. Surv. Ind. 11: 120. 1971.

Stems ca 1 m high. *Leaves* 20-32 × 3-5.5 cm, appressed hairy beneath. *Spikes* 8-10 cm long, moderately lax-flowered; bracts lanceolate, 3.3-4 × 1 cm, 1-flowered. *Flowers* white; calyx exceeding the bract by 5-10 mm; corolla tube 5.7-6 cm long, lobes *ca* 32 mm long; staminodes spathulate, *ca* 15 × 5 mm; lip obovate, clawed, *ca* 22 × 15 mm, bilobed, sinus *ca* 12 mm deep; filament *ca* 32 mm long, anther *ca* 10 mm long.

Flrs.: July. *ca* 900 m.

MEGHALAYA: K. & J. Hills.

22. H. coccineum Buch.-Ham. *ex* J. E. Smith var. **longifolium** (Rosc.) Baker in Hook. f. Fl. Brit. Ind. 6: 631. 1892. *H. longifolium* Rosc. Monandr. Pl. t. 59. 1828.

Stems 15-20 dm high. *Leaves* linear, 28-52 × 4.3-8.3 cm, about 7-times longer than broad, purplish and villous throughout beneath when young, becoming green and villous only along midrib in age. *Spikes* 20-30 cm long, lax-flowered; bracts diverging, 3-4.2 × 1.3-1.8 cm, convolute, 2-flowered. *Flowers* red; calyx 25-28 mm long; corolla tube equalling the bract, lobes 38-44 mm long; staminodes spathulate, *ca* 25 mm long; lip orbicular, abruptly clawed, *ca* 25 × 20 mm, deeply bilobed; filament 55-58 mm long, anther *ca* 8 mm long. *Capsules* ellipsoid, *ca* 3 cm long.

Flrs.: June-September. 120-1600 m.

ASSAM: Lakhimpur; N. Cachar & Mikir Hills. MEGHALAYA: Garo Hills; K. & J. Hills. NAGALAND. ARUNACHALA PRADESH: Tirap.

var. **squarrosum** Buch.-Ham. *ex* Wall. in Hook. Kew Journ. Bot. 5: 372. 1853.

Stems 9-12 dm high. *Leaves* 20-38 × 1.6-2.6 cm, about 14-15-times longer than broad.

Flrs.: June-August. 300-1600 m.

ASSAM: Kamrup. MEGHALAYA: K. & J. Hills. NAGALAND.

23. H. rubrum A. S. Rao & D. M. Verma in Bull. Bot. Surv. Ind. 11: 127. 1971.

Stems 5-12 dm high. *Leaves* 17-32 × 3-6.2 cm, lower surface hairy along midrib, purplish when young. *Spikes* 6-14 cm long, rather dense-flowered; rhachis villous; bracts 37-47 × 15-20 mm, purplish green, pubescent, 2-flowered, ultimately fibrous at tips. *Flowers* red; calyx 24-28 mm long; corolla tube

equalling the bract, lobes linear, 35-38 mm long; staminodes spathulate, 28-33 × 8 mm; lip suborbicular, abruptly clawed, 30-35 × 30-37 mm, bilobed; filament 43-47 mm long, anther *ca* 10 mm long. *Capsules* subglobose, 15-20 mm long, pink-red.

Flrs.: July-September. 600-1600 m.

MEGHALAYA: K. & J. Hills.

24. H. aurantiacum Wall. *ex* Rosc. Monandr. Pl. t. 39. 1828.

Stems ca 8 dm high. *Leaves* lanceolate, acuminate, 30-45 × 4.5-7.5 cm. *Spikes* 15-30 cm long, lax-flowered; bracts *ca* 35 × 15 mm, convolute, 2-flowered. *Flowers* mildly fragrant; orange-coloured with a deep orange-red blotch in mouth; calyx *ca* 25 mm long, hispidulous; corolla tube 45-53 mm long, exceeding the bract by 10-15 mm, lobes *ca* 25 mm long; staminodes narrowly oblanceolate, *ca* 28 × 3 mm; lip suborbicular, clawed, 28-30 × 20 mm, bilobed, sinus *ca* 10 mm deep; stamen *ca* 15 mm longer than the lip; filament *ca* 35 mm long, orange-red, anther *ca* 10 mm long.

Flrs.: August. 1000-1600 m.

MEGHALAYA: K. & J. Hills.

25. H. luteum Baker in Hook. f. Fl. Brit. Ind. 6: 232. 1892.

Stems ca 1 m high. *Leaves* 30-40 × 7.5-9.5 cm, hairy beneath. *Spikes ca* 11 cm long, lax-flowered; bracts *ca* 5 cm long, convolute, several-flowered. *Flowers* pale yellow with a deeper yellow blotch in the mouth, mildly fragrant; calyx *ca* 33 mm long, hispidulous with tufts of hairs at the tips; corolla tube *ca* 6 cm long, lobes 4.5-5 cm long; staminodes oblanceolate, *ca* 4 × 0.8 cm, sometimes with a petaloid ridge on the upper surface; lip orbicular, clawed, *ca* 3.3 × 3.3 cm, bilobed, sinus *ca* 12 mm deep; stamen *ca* one and a half-times longer than the lip; filament *ca* 4.5 cm long, anther *ca* 1.5 cm long.

Flrs.: August.

MEGHALAYA: K. & J. Hills.

14. Amomum L. Sp. Pl. 1. 1753 *et* Gen. Pl. ed. 5: 1. 1754; Roxb. Fl. Ind. 1: 40. 1820.

Perennial herbs. *Rhizomes* long, creeping. *Leaves* cauline, sessile or petiolate, usually oblong-lanceolate, usually contemporaneous with the flowers, sometimes produced afterwards. *Spikes* radical, pedunculate, compact, one-many-flowered. *Calyx* cylindric, 3-toothed; corolla tube usually as long as the calyx, lobes suberect; staminodes subulate or absent; lip obovate, cuneate, subentire or bilobed; stamen shorter than the lip, connective produced above into a petaloid anther-crest; ovary 3-celled; placentae 3, axile; ovules many. *Fruits* usually a capsule, sometimes a berry, smooth, ridged or winged.

1a. Leaves produced after flowers ... *A. pauciflorum* 1.
1b. Leaves and flowers contemporaneous.
  2a. Leaves villous beneath ... A. *dealbatum* 3.
  2b. Leaves glabrous.
    3a. Bracts dark brown with a horny cusp at the tip ... *A. subulatum* 4.
    3b. Bracts pale yellowish brown, obtuse, acute or mucronulate.
      4a. Flowering peduncles 15-30 cm, long elongating in fruits to 40 cm. Anther crest suborbicular ...*A. corynostachyum* 2.
      4b. Flowering peduncles scarcely upto 3 cm long, sometimes elongating in fruits to 10 cm. Anther crest 3-4-lobed ... *A. aromaticum* 5.

1. A. pauciflorum Baker in Hook. f. Fl. Brit. Ind. 6: 238. 1892; A. S. Rao & D. M. Verma in Bull. Bot. Surv. Ind. 11: 245. 1971.

Rhizomes 1-2 m long, *ca* 6 mm thick, pinkish-white. *Stems ca* 6 dm high. *Leaves* on 2-4 cm long petiole, oblanceolate, 29-31 × 5-6 cm, sericeous beneath. *Spikes* several, distant, bearing 6-7 successively opening flowers on a very short rhachis appearing as though in a cluster; peduncles *ca* 3.5 cm long; bracts lanceolate, upto 7.5 × 1.2 cm, white with a reddish cusp at the tip, 1-flowered. *Flowers* white; calyx 3-6 cm long, split on one side; corolla lobes 3.5-4.5 cm long; staminodes subulate, *ca* 3 mm long, pinkish, hairy; lip 4.8-5.2 × 3.5-4 cm, white with a fleshy orange median band towards base, margined with purple dots and yellow

central blotch, margins crumpled, apex notched; filament 5-8 mm long, reddish, anther *ca* 15 mm long, crest transversely oblong, faintly 3-lobed, sides involute, tip revolute, 4-5 mm high, 6-7 mm broad, white. *Fruits* (young) white, hairy, ribbed.

Flrs.: July, 1000 m.

MEGHALAYA: K. & J. Hills.

2. A. corynostachyum Wall. Pl. Asiat. Rar. 1:48. t. 58. 1830; A. S. Rao & D. M. Verma in Bull. Bot. Surv. Ind. 11: 245. 1971.

Stems 10-13 dm high. *Leaves* with 5-8 mm long petiole, lanceolate, 30-45 × 5-10.5 cm, glabrous. *Peduncles* villous above; sheaths 2-2.5 × 1 cm; spikes subglobose-ovoid, 5-6 × 3.5 cm; bracts 2-2.5 × 1 cm, brownish. *Calyx* 10-14 mm long; corolla lobes oblong, 10-15 × 5-10 mm, pinkish white; staminodes subulate, *ca* 2 mm long, lip subrhomboid, cuneate, 12-15 × 7 mm, shallowly bifid, white with a yellow median band and red streaks at the base; filament *ca* 3 mm long, anther 6-8 mm long, crest suborbicular, 3-4 mm broad, entire, wavy, white; ovary villous. *Capsules* ellipsoid, faintly many-ridged, hairy.

Flrs.: June.

NAGALAND.

3. A. dealbatum Roxb. Fl. Ind. 1: 43. 1820.

Stems 10-25 dm high. *Leaves* subsessile or with upto 4 cm long petiole, oblong or lanceolate, 60-140 × 9-16 cm, brown pubescent beneath. *Spikes* 1-2, around each stem, subglobose, 4-7 cm broad; flowering peduncles 4-7 cm long, elongating to 10 cm in fruits, villous; bracts oblong, 4-6 × 1.8-2.2 cm, red, soon disintegrating. *Flowers* white; calyx 3-3.5 cm long; corolla tube slightly shorter than the calyx, lobes 3-4 cm long; staminodes subulate, *ca* 3 mm long; lip obovate, 3-4 cm long, white with a yellowish blotch at the base; filament 5-7 mm long, anther *ca* 15 mm long, crest truncate, *ca* 4 mm high, *ca* 7 mm broad. *Capsules* oblong-subglobose, *ca* 2.5 cm long, with 9 crenulate winged ribs, pinkish-red at maturity; seeds blackish, aril white. (Fig. 12)

Flrs.: April-May. 500-1500 m.

ASSAM: Lakhimpur; N. Cachar & Mikir Hills. MEGHALAYA: K. & J. Hills. MIZORAM: Mizo Hills. NAGALAND. ARUNACHALA PRADESH: Kameng; Siang; Tirap.

var. **sericeum** (Roxb.) Baker in Hook. f. Fl. Brit. Ind. 6: 239. 1892. *Amomum sericeum* Roxb. Fl. Ind. 1: 46. 1820.

Leaves sericeous beneath. *Flowers* white, centre of the lip variegated with pink veins on a yellow ground. *Capsules* ovate-oblong, smooth, not winged.

MEGHALAYA: K. & J. Hills (*n.v.*).

4. A. subulatum Roxb. Pl. Corom. t. 227. 1815 *et* Fl. Ind. 1:44. 1820.

Stems ca 12 dm high. *Leaves* subsessile, 30-80 × 8-10 cm, glabrous. *Spikes* clavate, *ca* 5 cm broad; bracts *ca* 3 cm long. *Calyx ca* 4.5 cm long, white; corolla tube *ca* 3 cm long, white, lobes 2-3 cm long, yellowish; lip oblong, cuneate, *ca* 3 cm long, narrowed at tip and often bifid, yellow with deeper yellow veins; filament *ca* 5 mm long, anther *ca* 1 cm long, crest *ca* 4 mm long and as broad, entire, wavy, with inflexed sides. *Capsules* ellipsoid, flattened, *ca* 2.5 cm long, longitudinally striate with narrow crenulate wings; seeds roundish, *ca* 2.5 mm broad, black.

Flrs.: April-May; *frts.*: August-November. Cultivated & ?wild.

ARUNACHALA PRADESH: Siang; Tirap.

The fruits, locally called *'Bora Elaichi'* are commonly used for flavouring food.

5. A. aromaticum Roxb. Fl. Ind. 1:45. 1820.

Stems 3-10 dm high. *Leaves* subsessile, linear-lanceolate, 15-30 × 2-7.5 cm, glabrous, aromatic on crushing. *Spikes* clavate, 4-6 cm long; peduncles villous; bracts oblong, 3-4 × 0.8-1.2 cm. *Flowers* white; calyx as long as the bract, villous, pinkish; corolla tube equalling the calyx, villous, lobes lanceolate, 2.5-3 × 1-1.5 cm; lip obovate, cuneate, 4-4.5 × 2.5-3 cm, white with a median yellowish

band and few pink streaks towards base, margins crumpled; filament *ca* 5 mm long, anther *ca* 15 mm long, crest suborbicular, *ca* 7 mm broad, 3-5-lobed with deflexed tip; ovary villous. *Capsules* ovoid, *ca* 2.5 cm long, somewhat fleshy and rugose.

Flrs.: April-June. 150-1500 m.

ASSAM: Kamrup; N. Cachar & Mikir Hills; Nowgong. MEGHALAYA: K. & J. Hills. MIZORAM: Mizo Hills. NAGALAND. ARUNACHALA PRADESH: Lohit.

15. Hornstedtia Retz. Observ. 6: 18. 1791.

H. loroglossa (Gagnep.) Schum. in Engl. Pflanzenrch. heft 20: 196. 1904; A. S. Rao & D. M. Verma in Bull. Bot. Surv. Ind. 11: 247. 1971. *Amomum loroglossum* Gagnep. in Bull. Soc. Bot. Fr. 49: 258. 1902. *A. linguiforme* Baker in Hook. f. Fl. Brit. Ind. 6:235. 1892. *p.pl. Khasia.*

Rhizomes long, creeping. *Stems* 15-25 dm high. *Leaves* subsessile, oblong-lanceolate, 40-60 × 6-15 cm, glabrous. *Spikes* ellipsoid, 6-9 cm long, on 3-7 cm long curved peduncles; bracts 4-6 × 2.5-3 cm, closely imbricating, red-tinged with age, the outer sterile (involucral) bracts clasping the inflorescence and enclosing the floral bracts with a small aperture at the tip through which 1-3 flowers emerge at a time; floral bracts 1-flowered. *Flowers*, except the lip, red; calyx tubular, 3-lobed, split on one side, 5.5-7 cm long, lobes caudate-acuminate; corolla tube 2.8-4 cm long, lobes suberect, lanceolate, 2.3-3 × 0.6-1 cm; lip ligulate, 5.5-6.2 × 1-1.8 cm, yellow with a bright red, fleshy median band, margins crumpled, base cordate, apex entire, rarely notched; filament *ca* 1.3 cm long, fused with the lip for *ca* 1 cm, anther *ca* 8 mm long, white; ovary villous, stigma red.

Flrs.: July-August. 900-1500 m.

MEGHALAYA: Garo Hills; K. & J. Hills.

16. Zingiber Boehmer in Ludwig, Def. Gen. Pl. 89. 1760, *nom. conserv.*

Terrestrial, perennial, rhizomatous herbs. *Leaves* cauline, sessile or subsessile, linear-lanceolate or oblong, contemporaneous with the flowers. *Spikes* usually radical, sometimes terminal, compact; bracts densely imbricating, 1-flowered; bracteoles split to the base. *Flowers* fugaceous; calyx cylindric or spathaceous, 3-toothed; corolla tube about as long as the bract, lobes lanceolate; lip linear-oblong or obovate, cuneate, 3-lobed, about as long as the corolla tubes; the midlobe representing the lip proper, the two lateral lobes representing the two lateral staminodes adnate to the lip; filament short and broad; anther cells contiguous; connective produced above like a beak, of about the length of the anther; ovary 3- celled, ovules many. *Fruit* oblong or globose, tardily dehiscing; seeds ellipsoid, arillate.

1a. Spikes terminal ... *Z. capitatum* 7.
1b. Spikes radical.
  2a. Flowering peduncles upto 3 cm long.
    3a. Bracts green. Lip bright yellow, unspotted ... *Z. chrysanthum* 1.
    3b. Bracts red. Lip yellowish white, copiously spotted and streaked with yellow and red-purple ... *Z. rubens* 2.
  2b. Flowering peduncles 15-55 cm long.
    4a. Bracts lanceolate, convolute. Corolla lobes pale red ... *Z. intermedium* 3.
    4b. Bracts broadly ovate or suborbicular. Corolla lobes greenish or whitish.
      5a. Leaves linear-lanceolate, 15-30 x 1.5-2 cm. Spikes subcylindric. Lip purplish black ... *Z. officinale* 4.
      5b. Leaves oblong-lanceolate, 22-40 x 3-8 cm. Spikes ovoid or globose. Lip white or yellow.
        6a. Leaves oblong, 22-35 x 5-8 cm; ligule 10-25 mm long. Spikes globose or ovoid, rounded at the top ... *Z. zerumbet* 5.
        6b. Leaves lanceolate, 30-40 x 3-4 cm; ligule scarcely 1-2 mm long. Spikes ovoid, acute at the top ... *Z. cassumunar* 6.

1. Z. chrysanthum Rosc. Monandr. Pl. t. 86. 1828.

Stems ca 3 m high. *Leaves* oblong-lanceolate, *ca* 27 × 7 cm. *Spikes* ovoid-globose, *ca* 5 cm broad; outer bracts ovate, inner lan-

ceolate, acuminate, tips hairy. *Calyx* pubescent; corolla lobes red; lip *ca* 2.3 cm long, midlobe orbicular, side lobes ovate; stamen orange; ovary pubescent. *Capsules* ellipsoid; seeds subglobose, *ca* 6 mm in diam.

Flrs.: July-September.

MEGHALAYA: K. & J. Hills. AURUNACHALA PRADESH: Kameng. TRIPURA.

2. Z. rubens Roxb. in Asiat. Res. 11: 348. 1810.

Stems 4-20 dm high. *Leaves* oblong-lanceolate, 20-60 × 7-12 cm, puberulus along midrib beneath. *Spikes* globose, 5-9 cm long; bracts ovate-oblong, 3-5 cm long; bracteoles lanceolate, 4.5-5.5 cm long. *Calyx* 3-4 cm long, reddish, pubescent; corolla tube 3.5-4.5 cm long, slightly inflated, lobes 3-4 cm long, red, the lateral two fused at the base; lip linear-oblong, 2.5-3.7 × 0.7-1.5 cm, midlobe slightly bifid, side-lobes obscure; anther subsessile, 1.5-2 cm long, beak 10-13 mm long, red. *Capsules* ellipsoid, 4 × 1.7 cm, reddish.

Flrs.: August-September. 1000-1500 m.

MEGHALAYA: K. & J. Hills, MANIPUR.

3. Z. intermedium Baker in Hook. f. Fl. Brit. Ind. 6: 246. 1892.

Stems ca 1 m high. *Leaves* lanceolate or oblanceolate, puberulus along midrib beneath. *Peduncles* 18-20 cm long; spikes globose, 4-5 cm in diam.; bracts membranaceous, *ca* 3.7 cm long; corolla tube as long as the bract, lobes *ca* 3 cm long, pale red; lip suborbicular, *ca* 2.5 cm long, reddish black, yellow spotted, lateral lobes oblong; anther beak reddish black.

MEGHALAYA: K. & J. Hills: Bhorlassa (1100 m), *Clarke* (*n.v.*).

4. Z. officinale Rosc. in Trans. Linn. Soc. 8: 348. 1807.

Rhizomes aromatic, pale yellow inside. *Stems* 4-10 dm high, *ca* 5 mm thick. *Leaves* glabrous or puberulus along midrib beneath. *Spikes* 5-7 × 2.5 cm; peduncle 15-30 cm long; bracts suborbicular, *ca* 2.5 cm long, cuspidate. *Calyx* inflated, *ca* 12 mm long; corolla tube *ca* 2 cm long, lobes 22-25 mm long, greenish; lip *ca* 2 cm long, purplish black, midlobe orbicular, lateral lobes ovate; stamen dark purple, filament *ca* 3 mm long, anther *ca* 8 mm long, beak *ca* 6 mm long.

Flrs.: September-October. 100-1200 m.

MEGHALAYA: K. & J. Hills. NAGALAND.

Commonly cultivated for its rhizomes, Ginger, locally called *'Adrak'*, used for flavouring food. In Nagaland, the flowers are also sold in market for preparing *'chutney'*.

5. Z. zerumbet (L.) J. E. Smith, Exot. Bot. 2: 105. t. 112. 1804. *Amomum zerumbet* L. Sp. Pl. 1. 1753.

Stems 3-12 dm high. *Leaves* glabrous or puberulus beneath. *Spikes* 6-12 × 4-6 cm; bracts suborbicular, 2.5-4 cm long, filled with odorous watery mucilage, cuspidate, glabrous or puberulus, green or red-brown in age. *Flowers* cream-coloured; calyx spathaceous, *ca* 2 cm long; corolla lobes 2-2.3 cm long; lip 2-2.5 cm long, with a yellow blotch at base, midlobe orbicular, *ca* 1.5 cm broad, bifid, lateral lobes rotundate, *ca* 5 mm long; filament *ca* 7 mm long, anther *ca* 10 mm long, beak *ca* 7 mm long. *Capsules* oblong, *ca* 2 cm long, white; seeds *ca* 6 mm long, black.

Flrs.: August-October. 200-1500 m.

ASSAM: Kamrup; Nowgong. MEGHALAYA: K. & J. Hills. MANIPUR. TRIPURA.

Some tribals rub the spike-mucilage in headaches.

6. Z. cassumunar Roxb. in Asiat. Res. 11: 347. t. 5. 1810.

Rhizomes deep yellow inside. *Stems* 1-2 m high. *Leaves* sessile, pubescent along midrib beneath. *Spikes* 7-15 × 2-4 cm, on 20-30 cm long peduncles; bracts broadly ovate, 3-4.5 × 2-3 cm, acuminate, glabrous or pubescent, greenish-red, becoming bright red in age. *Flowers* yellow; corolla lobes *ca* 25 mm long; lip 2-3 × 1.8-2.5 cm, midlobe suborbicular, bifid, lateral lobes ovate; stamen shorter than the lip. *Capsules* globose.

Flrs.: July-August. 300-1500 m.

ASSAM: Nowgong. MEGHALAYA: K. & J.

Hills. MANIPUR. ARUNACHALA PRADESH: Siang.

7. Z. capitatum Roxb. in Asiat. Res. 11: 348. 1810.

Stems 1-1.5 m high. *Leaves* sessile, linear, 40-50 × 1-1.8 cm, pubescent beneath. *Spikes* terminal, subcylindric, 9-11 × 2-3 cm, on short, hairy peduncles; bracts lanceolate, 3-6.5 × 1-1.5 cm, pubescent, ultimately red. *Flowers* yellow; calyx 2-3 cm long; corolla lobes *ca* 3 cm long; midlobe of the lip orbicular, *ca* 1.5 cm broad, lateral lobes oblong; anther *ca* 1 cm long, beak curved; ovary villous. *Capsules* oblong, *ca* 2 cm long; seeds bright brown.

Flrs.: July-September. 100-1100 m.

ASSAM: Goalpara; Kamrup; N. Cachar & Mikir Hills. MEGHALAYA: K. & J. Hills. NAGALAND.

17. Costus L. Sp. Pl. 2. 1753 *et* Gen. Pl. 2. 1754.

C. speciosus (Koen.) J. E. Smith in Trans. Linn. Soc. 1: 249. 1791. *Banksia speciosa* Koen. in Retz. Observ. 3: 75. 1784.

Stems 1-3 m high, usually spirally twisted, rarely straight, sometimes bearing 1-2 branches. *Leaves* oblanceolate-obovate, 12-25 × 4.5-7.5 cm, upper surface usually glabrous, rarely strigulose, lower surface pubescent to villous. *Spikes* terminal, compact, ovoid or ellipsoid, 3.5-11 cm long; bracts ovate-oblong, 2-3.5 × 0.8-1.5 cm, cuspidate, glabrous or pubescent, greenish-red, becoming bright red in age, 1-flowered; bracteoles *ca* 17 × 5 mm. *Calyx* campanulate, 2-2.5 cm long, 3-toothed, glabrous or hairy, pale greenish to red in age; corolla white, tube 12-23 mm long, lobes oblong, 2-5 × 1-1.5 cm, sometimes pubescent; staminodes absent; lip obovate-suborbicular, cuneate, 3-8 cm long, white with a median yellow, hairy band towards base, margins crumpled; stamen shorter than the lip; connective petaloid, oblong, 5-10 mm broad, anther cells 8-10 mm long; ovary glabrous. *Capsules* globose or oblong, 15-20 mm long, red; seeds numerous, 4-5-angled, *ca* 3 mm long, black. (Fig. 14)

Flrs.: June-October. 150-1300 m.

ASSAM: Goalpara; N. Cachar & Mikir Hills. MEGHALAYA: Garo Hills; K. & J. Hills. NAGALAND. TRIPURA.

In an abnormal flower, the lip bore an extra petaloid flap on its upper surface.

18. Alpinia Roxb. in Asiat. Res. 11: 350. 1810; *nom. conserv.*

Rhizomes creeping. *Leaves* cauline, sessile or petiolate. *Inflorescence* terminal, subspicate, racemose or paniculate; bracts large and almost enveloping the young inflorescence or small, sometimes soon falling, or absent; bracteoles small, or large and then enveloping the bud. *Calyx* loosely tubular, 3-toothed; corolla tube usually as long as the calyx, lobes linear-oblong; staminodes a pair of subulate processes at the base of the lip or absent; lip usually bifid; stamen shorter than the lip, anther neither crested nor spurred; ovary 3-celled; ovules few or many. *Fruits* globose, dry or fleshy, usually indehiscent; seeds globose or compressed, aril membranaceous.

The taxonomic treatment here follows the wider concept of the genus *Alpinia* Roxb., based upon our examination of the Assam material only. However, it is to be mentioned that the genus is also viewed in a more restricted way, being split into four different genera, with several of their species distributed outside India. When so treated, along with the taxonomic aspects, a nomenclatural problem also creeps in. Thus, while *Alpinia* Roxb. has been conserved and typified with *A. galanga*, another genus *Languas* Koenig, recognised as distinct, is also typified (see Holttum in Gard. Bull. 13. 1950) by *L. vulgare* Koenig, which is synonymous with *A. galanga* only. Hence, pending monographic revision of this complex, we have treated all the Assam spp. under *Alpinia* Roxb. only.

1a. Inflorescence a panicle; bracteoles small, not enclosing the flower buds to a late stage.
  2a. Panicles broad with at least the lower few branches 5-15 cm long. Lip white with a median pair of pink lines. Capsules black ... *A. allughas* 2.
  2b. Panicles narrow with its branches hardly 0.5-1 cm long. Lip white, streaked and dotted with pink-red in the centre. Capsules orange-red.
    3a. Leaves 30-60 x 10-15 cm, not aromatic. Panicles 15-35 cm long ... *A. galanga* 1.
    3b. Leaves 20-30 x 2.5-4.8 cm, strongly aromatic. Panicles 10-12 cm long ... *A. calcarata* 3.

1a. Inflorescence a raceme; bracteoles 2.5-4 cm long, completely enclosing the flower-buds to a late stage.
  4a. Bracteoles green ... *A. bracteata* 4.
  4b. Bracteoles pale brownish white ... *A. malaccensis* 5.

1. A. galanga (L.) Swartz, Obs. Bot. 8. 1791. *Maranta galanga* L. Sp. Pl. ed. 2: 2. 1762. *Languas galanga* Stuntz in U.S. Dept. Agr. Bull. 261: 21. 1912.

Stems 2-2.5 m high. *Leaves* on 4-7 mm long petiole, puberulus beneath. *Panicles* narrow; rhachis tomentose; bracts whitish, about equalling the bracteoles on the upper branches, shorter or lacking on the lower, soon caducuous; bracteoles oblong, *ca* 1 cm long, white, enclosing the bud only when very young. *Calyx* 6-13 mm long, pubescent; corolla lobes oblong, *ca* 2 cm long; lip elliptic, 1.5-2.5 × 1.2 cm, bifid, white with few radiating pink veins on either side of the midrib, margins irregularly toothed; staminodes a pair of 3-5 mm long reddish subulate processes; filament *ca* 13 mm long, anther *ca* 10 mm long. *Fruits* globose, *ca* 15 mm in diam., yellowish-green to orange-red on ripening; cells 1-2-seeded.

Flrs.: June. 300-900 m.

ASSAM: Lakhimpur; N. Cachar & Mikir Hills. MEGHALAYA: K. & J. Hills.

Roots reported to be medicinal.

2. A. allughas (Retz.) Rosc. in Trans. Linn. Soc. 8: 346. 1807. *Heritiera allughas* Retz. Observ. 6: 17. t. 1. 1791.

Stems 1-2 m high. *Leaves* sessile or subsessile, 25-50 × 4-15 cm, glabrous. *Panicles* 10-63 cm long; rhachis pubescent; bracteoles 5-7 mm long. *Calyx* 7-13 mm long, pinkish, pubescent; corolla pinkish white, lobes oblong, 8-16 × 3-6 mm; staminodes a pair of subulate processes; lip obovate, cuneate, 1.5-2 × 1-1.5 cm, bilobed, white with a pair of close median pink lines, pink-margined; stamen pinkish, filament 10-12 mm long, anther *ca* 7 mm long; ovary pilose. *Fruits* globose, 10-15 mm in diam.; cells 2-seeded. (Fig. 15).

Flrs.: May-October. 150-1000 m.

ASSAM: Goalpara; Kamrup; Lakhimpur; N. Cachar & Mikir Hills. MEGHALAYA: Garo Hills. MANIPUR. ARUNACHALA PRADESH: Kameng; Siang; Tirap.

Young shoots sometimes eaten as vegetable.

3. A. calcarata (Haworth) Rosc. in Trans. Linn. Soc. 8: 347. 1807. *Renealmia calcarata* Haworth in Andr. Bot. Rep. t. 421. 1805.

Stems 5-7 dm high. *Leaves* sessile, lanceolate, glabrous. *Rhachis* hairy; branches 1-3-flowered; bracts large, navicular; bracteoles *ca* 8 mm long. *Calyx* 8-9 mm long, campanulate, pubescent; corolla white or pinkish, lobes oblong, 15-20 × 5-8 mm; staminodes a pair of about 3 mm long, red, hairy, subulate processes; lip obovate-oblong, cuneate, bifid, *ca* 3 × 1.8 cm, the basal three quarter white with red streaks and dots in middle bordered with yellow, red-margined, upper quarter pinkish with radiating red streaks; filament *ca* 15 mm long; anther *ca* 8 mm long; ovary villous.

Flrs.: July.

MEGHALAYA: K. & J. Hills (introduced).

4. A. bracteata Roxb. Fl. Ind. 1: 63. 1820.

Stems ca 1 m high. *Leaves* with upto 2 cm long petiole, 12-45 × 3-10 cm, villous beneath. *Racemes* erect, dense-flowered, 12-22 cm long; rhachis pubescent; bracteoles navicular, *ca* 25 mm long, pale green. *Calyx ca* 12 mm long, split on one side; corolla tube *ca* 8 mm long, lobes oblong, *ca* 22 mm long, white; staminodes a pair of subulate processes; lip *ca* 3 cm long, emarginate, edges

white, centre variegated with red and yellow, margins incurved; ovary sericeous. *Fruits* large, globose; seeds many in each cell.

ASSAM: Cachar (*n.v.*).

5. A. malaccensis (Burm. f.) Rosc. in Trans. Linn. Soc. 8: 345. 1807. *Maranta malaccensis* Burm. f. Fl. Ind. 2. 1768. *Catimbium malaccensis* Holttum in Gard. Bull. Singapore 13: 155. 1950.

Stems 1.5-2 m high. *Leaves* with 15-25 mm long petiole, 25-70 × 5-13 cm, villous beneath, sometimes with a fringe of hairs on the margins. *Racemes* erect or sometimes cernuous, 25-30 cm long; rhachis stout, villous; bracts absent; bracteoles oblong, navicular, 3-4 × 2-2.5 cm. *Flower-buds* oblong, obtuse; calyx campanulate, *ca* 17 mm long, split on one side, pubescent; corolla tube 8-13 mm long, lobes oblong, 3-4 × 1-2 cm, white staminodes a pair of *ca* 5 mm long subulate processes; lip ovate, 2-4 cm long and equally broad, emarginate, or sometimes entire, yellow with the centre variegated with deep yellow and red; sides inrolled, margins crisped; filament 8-19 mm long; anther *ca* 1 cm long; ovary villous. *Fruits* globose, 1.5-2 cm in diam., hairy, yellow to orange-red on ripening; cells many-seeded; seeds ovoid, *ca* 5 mm long.

Flrs.: March-May. 100-700 m.

ASSAM: Goalpara; Kamrup; Lakhimpur; N. Cachar & Mikir Hills; Sibsagar. MEGHALAYA: Garo Hills; K. & J. Hills. MIZORAM: Mizo Hills. MANIPUR. NAGALAND. ARUNACHALA PRADESH: Kameng; Siang; Subansiri; Tirap.

19. Rhynchanthus Hook. f. in Curtis, Bot. Mag. t. 6861. 1885.

R. longiflorus Hook. f., *l.c.*

Rootstock tuberous. *Stems ca* 5 dm high. *Leaves* cauline, oblong-lanceolate, 13-18 × 3-3.5 cm, red-margined. *Spikes* terminal, 4-5-flowered; bracts linear, *ca* 4 cm long, reddish; calyx slightly shorter than the bract, orange-red; corolla yellowish-green, tube subcylindric, *ca* 5 cm long, lobes oblong-lanceolate; staminodes obsolete; lip nearly obsolete; filament *ca* 4 cm long, swollen in the middle, yellow, anther orange, cells contiguous; neither spurred nor crested; ovary 3-celled, ovules many, superposed.

Flrs.: September. 1300 m.

MIZORAM: Mizo Hills, *Wenger* 353 (*n.v.*).

Marantaceae Petersen in Engl. & Prantl, Nat. Pflanzenfam. II. 6: 33. 1888.

Perennial, rhizomatous, caespitose herbs or shrubs. *Leaves* either clustered at the base and on peduncle of the inflorescence (peduncular leaf) or all cauline, petioled, ovate, oblong or lanceolate, pinnately nerved; petiole usually with an elongate thickening towards the apex (leaf-articulation; pulvinus); sheaths open. *Inflorescence* paniculate or capituliform; flowers bisexual, zygomorphic, bracteate, pair-wise, the flower-pairs usually with a distinct common peduncle which is divided into two unequal branches, each terminating in a subsessile or pedicelled flower; flower-pairs solitary or few together in axils of a bract (primary bract) and a 2-3-keeled prophyll, sometimes between the flower pairs and the primary bract an unkeeled bract (mesophyll) also present. *Sepals* 3; corolla tubular, 3-lobed; stamen and staminodes connate below forming a staminal tube; staminodes 3-4, outer 1 or 2 larger, one of them cucullate; stamen 1; anther with a solitary fertile cell, the other cell forming a petaloid appendage; ovary inferior, 1-or 3-celled; ovule solitary, basal, erect; style curved, sometimes dilated at the tip; stigma 3-lobed. *Fruit* dehiscent or indehiscent, dry or fleshy; seeds arillate.

1a. Dichotomously branched shrubs. Inflorescence paniculate ... *Schumannianthus* 1.
1b. Unbranched, caespitose herbs. Inflorescence capituliform ... *Phrynium* 2.

1. Schumannianthus Gagnep. in Bull. Soc. Bot. France 51: 169. 1904.

S. dichotomus (Roxb.) Gagnep. *l.c.* 176. *Phrynium dichotomum* Roxb. in Asiat. Res. 11: 324. 1810. *Clinogyne dichotoma*

Salisb. in Trans. Hort. Soc. 1: 276. 1812; Baker in Hook. f. Fl. Brit. Ind. 6: 258. 1892.

Shrubs 1-2 m high; branches glossy, knotted at the joints. *Leaves* ovate-oblong, 8-20 × 3.3-6.8 cm, acute or acuminate, glabrous; petioles *ca* 5 mm long, terete, hairy. *Panicle-branches* 5-15 cm long with 3-7 pairs of flowers; bracts lanceolate, convolute, 4-6 × 0.8-1 cm; prophylls linear, 2-2.5 cm long; peduncle *ca* 2 cm long bearing the first flower, the second flower borne *ca* 7 mm above it; pedicels 3-4 mm long with *ca* 2 mm long gland at the base. *Flowers* white; sepals lanceolate, 5-6 mm long; corolla tube 8-10 mm long, lobes lanceolate, 15-20 × 4 mm; staminal tube *ca* 15 mm long; staminodes *ca* 15 mm long; cucullum *ca* 10 mm long; ovary villous, 3-celled. *Fruits* indehiscent, subglobose, *ca* 1 cm long; seeds subglobose, *ca* 5 mm, brown, dorsal face faintly grooved. (Fig. 3)

Flrs. & frts.: May-June. 100-700 m.

ASSAM: Kamrup; Lakhimpur; Nowgong; Sibsagar.

Sometimes the stems are split and fashioned into mats ('*Sitalpati*'; '*patidai*').

2. Phrynium Willd. Sp. Pl. 1: 17. 1797.

Caespitose herbs. *Leaves* radical and peduncular; peduncular leaves similar to the radical leaves but with shorter petioles. *Inflorescence* at first spiciform, later a subglobose head by the development of spikes in axils of spirally arranged bracts. *Flower-pairs* 2-5 in axil of a keeled prophyll; mesophyll usually present; corolla lobes oblong, subequal; outer staminodes 2, obovate, unequal, inner 2 small; cucullum short with a pendulous appendage; ovary 3-celled. *Capsules* 3-seeded or 1- or 2-seeded by abortion; seeds ellipsoid, trigonous, grooved.

1a. Bract apices fibrously splitting ... *P. pubinerve* 1.
1b. Bract apices acute-acuminate, never splitting.
2a. Capitulae 3.5-5 cm long, many-flowered. Capsules 1-seeded ... *P. parviflorum* 2.
2b. Capitulae *ca* 2 cm long, 4-flowered. Capsules 2-seeded ... *P. tetranthum* 3.

1. P. pubinerve Bl. Enum. Pl. Java 38. 1827. *P. capitatum* Baker in Hook. f. Fl. Brit. Ind. 6: 258. 1892; *non* Willd.

Leaves oblong or ovate-oblong, 18-60 × 7-25 cm, cuspidate, glabrous or hairy along midrib beneath; petioles 5-60 cm long. *Capitulae* subsessile or sometimes in fruits on upto 6 cm long peduncle, 3-7 cm across; apical part of the peduncle of the inflorescence and insertion of peduncular leaf distinctly separated by a transverse, rather broad, hairy constriction; spikes 4-7; bracts few to numerous, oblong-lanceolate, 2.5-4 × 1.3-2.5 cm, coriaceous, greenish or brownish-red in age, pubescent or ultimately glabrescent, soon fibrous above the middle; prophylls *ca* 18 mm long. *Flowers* white or pink-red; sepals linear, 10-14 mm long; corolla tube 8-11 mm long, lobes clawed, *ca* 7 × 2 mm; staminal tube *ca* 10 mm long; outer staminodes obovate, *ca* 7 mm long, inner *ca* 5 mm long. *Capsules* ellipsoid, 10-15 mm long, reddish-brown, usually 3-, sometimes 2-seeded. (Fig. 1)

Flrs. & frts.: April-May. 300-1000 m.

ASSAM: Darrang; Lakhimpur; N. Cachar & Mikir Hills. MIZORAM: Mizo Hills. MEGHALAYA: Garo Hills; K. & J. Hills. MANIPUR. NAGALAND. ARUNACHALA PRADESH: Kameng; Lohit; Tirap.

2. P. parviflorum Roxb. Fl. Ind. 1: 17. 1820.

Leaves lanceolate, oblong or ovate-oblong, 25-50 × 5.5-26 cm, cuspidate or acuminate, glabrous; petioles 45-90 cm long. *Capitulae* sessile, 3.5-5 cm across; bracts oblong-lanceolate, 2.3-3 × 0.7-1 cm, stramineus, glabrous; prophylls *ca* 10 mm long. *Sepals* lanceolate, 5-7 mm long, white with pinkish tips; corolla white, tube 8-10 mm long, lobes 5-7 × 3 mm; staminal tube *ca* 2 mm long, outer staminodes obovate, *ca* 5 mm long, orange-yellow. *Capsules* ellipsoid, 13-18 mm long, reddish-brown. (Fig. 2)

Flrs. & frts.: July. 400-1100 m.

ASSAM: Lakhimpur; N. Cachar & Mikir Hills; Sibsagar. MEGHALAYA: K. & J. Hills.



Marantaceae. Figs. 1-3 : 1. *Phrynium pubinerve* Bl. 2. *P. parviflorum* Roxb. 3. *Schumannianthus dichotomus* (Roxb.) Gagnep.

NAGALAND. ARUNACHALA PRADESH: Lohit; Subansiri; Tirap.

3. P. tetranthum Schum. in Engl. Pflanzenrch. heft 11: 55. 1902.

Leaves ovate-lanceolate, *ca* 25 × 3 cm, caudate-acuminate, glabrous, drying greyish-green; petioles upto 25 cm long. *Capitulae* sessile, scarcely 2 cm long and broad; bracts oblong, *ca* 2 cm long, glabrous; prophylls linear-lanceolate. *Sepals* membranaceous, *ca* 6 mm long, white.

MEGHALAYA: K. & J. Hills, *Hook. f. & Thom.* (Type—*n.v.*).