

AMARYLLIDACEAE

(including Hypoxidaceae)

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Perennial herbs with bulbs, tubers or rhizomes. *Leaves* simple, with parallel nerves. *In-florescences* terminal or axillary, in cymes, spikes or umbels (in *Amaryllidoideae*), or flowers solitary, bracteate and often with one or few spathes (in *Amaryllidoideae*). *Flowers* bisexual, actinomorphic or zygomorphic, sometimes marcescent. Tepals in 2 whorls, free or united into a tube, sometimes with a conspicuous corona. Stamens 6, free or sometimes united into a false corona, often inserted at the mouth of the perigone-tube; anthers basifixed, dorsifixed or medifixed, often versatile. Ovary inferior, 3-celled with axillary placentas; ovules 1 to numerous per cell. *Fruit* capsular, dehiscing either loculicidally or irregularly, or fruit a berry. *Seeds* globose or flattened, sometimes winged.

Distribution — Cosmopolitan, with c. 80 genera and around 1000 species. In *Malesia* only 6 genera are indigenous or naturalized, but many others are cultivated in botanic and private gardens (see the list on p. 371).

Taxonomy — The family is treated here in a broad sense, comprising the genera with an inferior ovary, i.e. excluding the *Allioideae* (= *Alliaceae*), which are characterized by a superior ovary. In *Malesia* there are no indigenous species of the latter family, which is treated elsewhere in this instalment (p. 375).

The *Agavoideae* (partly with an inferior ovary and partly with a superior one) are also excluded. The family *Agavaceae* has one indigenous genus in *Malesia* (*Dracaena*, including *Pleomele*).

In the *Amaryllidaceae* two subfamilies are here recognized which are often considered to be distinct families: the *Amaryllidoideae* (= *Amaryllidaceae* s. str.), with umbellate inflorescences and spathes, and the *Hypoxidoideae* (= *Hypoxidaceae*) which are never umbellate and are without spathes.

Haemodoraceae were treated by Van Steenis in *Flora Malesiana* I, 5 (1955) 111–113 [and see Additions in *Fl. Males.* I, 10 (1989) 717].

Palynology — Pollen of *Amaryllidaceae* has been studied in detail by Radulescu (1972), Schulze (1983), Meerow (1987, 1989), and Meerow & Dehgan (1988). *Amaryllidaceae* pollen grains are small to very large (largest equatorial axis 14–158 µm). Small grains (usually < 30 µm) are found in the *Galanthaceae* (*Galanthus*, *Leucojum* p.p.). Very large pollen (> 100 µm) occurs only in *Hymenocallis* p.p. Tetragonal tetrads are known in *Stenomesson elwesii* (Meerow et al. 1986).

The apertural system is monosulcate or dicolpate. Sulci are nearly as long as the longest equatorial axis, or extend slightly on the proximal grain side. The position of the colpi in dicolpate pollen with respect to the distal and proximal poles is unknown.

Exine stratification is generally distinct. Electron micrographs show a columellate, tectate or semitectate sexine in monosulcate pollen. Zavada (1983) has demonstrated a very thin, finely granular infratectum and a thick nexine traversed by minute channels in the dicolpate pollen of *Crinum americanum* (*Amaryllidaceae*). An intectate, gemmate sexine was found in the tetrads of *Stenomesson elwesii*.

Ornamentation is reticulate or sparsely scabrate-microechinate, rarely psilate/punctate (*Galantheae*) to verrucate/fossulate (*Eucrosia*). The lumina in reticulate patterns are small to very large (up to c. 10 μm in *Hymenocallis*). Usually lumen size decreases towards the aperture, and often it is distinctly less at the apocolpial ends of a grain. In several *Hymenocallis* species these parts ('auriculae') have an ornamentation quite different and clearly separated from that of the main part of the grain (Ravikumar & Nair 1982; Meerow & Dehgan 1985).

Two main pollen types may be distinguished in the family: 1) monosulcate reticulate pollen, and 2) dicolpate scabrate-microechinate pollen. Infratectum structure might be another important feature separating both types (see above). The latter characterizes all genera of the *Amaryllideae* (sensu Dahlgren et al. 1985; see also Schulze 1983 and Snijman 1991), and *Pauridia* of the *Hypoxidoideae* (Thompson 1979; Simpson 1983). The former type is found in all other *Amaryllidaceae*. The two colpi in *Amaryllideae* pollen are on opposite grain sides, whereas in *Pauridia* pollen they are situated in the same hemisphere. Also the nature of the scabrate ornamentation is different in *Pauridia*. Other *Hypoxidoideae* have monosulcate, finely reticulate pollen, more or less the same as in most *Amaryllidoideae* and many other monocots.

References: Dahlgren, R.M.T., H.T. Clifford & P.F. Yeo, The families of the Monocotyledons (1985) 199. — Meerow, A.W., Syst. Bot. 12 (1987) 460–492; Ann. Missouri Bot. Gard. 76 (1989) 136–220. — Meerow, A.W. & B. Dehgan, Amer. J. Bot. (1985) 540–547; Amer. J. Bot. 75 (1988) 1857–1870. — Meerow, A.W., N.B. Dehgan & B. Dehgan, Amer. J. Bot. 73 (1986) 1642–1644. — Radulescu, D., Acta Bot. Hort. Bucur. 1970–71 (1972) 245–273. — Ravikumar, C. & P.K.K. Nair, J. Palynol. 18 (1982) 43–54. — Schulze, W., Wiss. Z. Fr.-Schiller-Univ. Jena, Math.-Naturwiss. R. 32 (1983) 985–1003. — Simpson, M.G., Grana 22 (1983) 79–103. — Snijman, D.A., Bothalia 21 (1991) 125–128. — Thompson, M.F., Bothalia 12 (1979) 621–625. — Zavada, M.S., Bot. Review 49 (1983) 331–379.

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Phytochemistry — Difficulties in demarcating families in *Liliales* are aptly discussed by Cronquist (1981, 1988). He accepted *Iridaceae*, *Haemodoraceae*, *Alo(e)aceae*, *Agavaceae*, *Xanthorrhoeaceae* and *Smilacaceae* as distinct families, but united *Amaryllidaceae* s. str. and all modern segregates from *Liliaceae* and *Amaryllidaceae* sensu Pax et Hoffmann (e.g. *Agapanthaceae*, *Alliaceae*, *Alstroemeriaceae*, *Asparagaceae*, *Asteliaceae*, *Anthericaceae*, *Aphyllanthaceae*, *Calochortaceae*, *Colchicaceae*, *Convallariaceae*, *Dianellaceae*, *Hemerocallidaceae*, *Hyacinthaceae*, *Hypoxidaceae*, *Herreriaceae*, *Melianthiaceae*, *Ruscaceae*, *Tecophilaeaceae*, *Tricyrtidaceae*, *Trilliaceae* and others) in *Liliaceae* sensu Cronquist, because there seem to be no characters available for an unequivocal demarcation of such smaller families. In some instances phytochemistry may be able to assist taxonomists in delimitating taxa of subfamily or family rank. This seems exactly to be the case with *Alliaceae*, *Amaryllidaceae* s. str., *Hypoxidaceae* and *Haemodoraceae* [the latter already

treated in *Flora Malesiana* I, 5 (1954) 111–115, but without a paragraph on phytochemistry]. Therefore the taxonomically most promising secondary metabolites of the four taxa mentioned will be discussed shortly sub *Alliaceae* and *Amaryllidaceae*. The chemistry and chemotaxonomy of all four taxa was treated more comprehensively by Hegnauer (1963, 1986). Chelidonic acid seems to be a major organic acid in all of them and in most *Liliaceae* sensu Cronquist.

Amaryllidaceae s.str. (= *Amaryllidoideae* sensu Melchior 1964). — *Alkaloid* production and storage is a key character of this taxon (Hegnauer 1990). Amaryllidaceous or lycorine-type alkaloids seem to be present in every species of *Amaryllidoideae* and have never been found outside this taxon. Lycorine-type alkaloids represent a biosynthetically distinct type of alkaloids. They originate by condensation of a hydroxybenzaldehyde (C₆-C₁-moiety) derived from phenylalanine with tyramine (C₆-C₂-moiety) derived from tyrosine. The resulting dicyclic belladine-type bases are intermediates on the way to the more numerous tri- and tetracyclic amaryllidaceous alkaloids. These alkaloids are toxic and are stored often in combined forms such as glycosides, as glycosides acylated by fatty acids and as phospholipids (Ghosal et al. 1985, 1991). Moreover, oxidation to quaternary compounds (e.g. anhydrolycorinium, ungeremine) which may be subsequently transformed to Schiff bases [R₁, R₂ = C = N–R₃ like crinasiatine (Ghosal et al. 1988)] occurs under certain conditions. Ghosal et al. (1990, 1991) described an astonishingly perfect co-evolution between the specialised moth *Polytela gloriosa* and its host plants *Amaryllis belladonna* and *vittata* (= *Hippeastrum vittatum*), *Crinum asiaticum* and *latifolium* and *Pancratium biflorum*. The moth makes use of toxic amaryllidaceous alkaloids for defensive purposes and transforms ingested bases for storage in its own glycosides and acylated glycosides, and the plant responds to the stress of herbivory by releasing free, more toxic alkaloids from stored combined forms in young fruits. Moreover, both the moth and several of its host plants respond to certain stress conditions with synthesis of one and the same alkaloidal conjugate termed telastaside (Ghosal et al. 1991). Kumar & Roy (1985) recorded a strong allelopathic effect for lycorine; this alkaloid inhibits germination of fern spores and kills prothallia.

Phenolic compounds are represented by several classes. Caffeic acid and glycosides of the flavonols kaempferol and quercetin seem to be nearly ubiquitous. Acetophenone derivatives were isolated from species of *Buphane* (acetovanillone), *Lycoris* (trimethyl ether of phloracetophenone) and from *Pancratium biflorum* [several derivatives of phloracetophenone (Ghosal et al. 1989)]. Oddly substituted flavans, flavan-3-ols, chalcones and 2-methylchromones were reported for *Hippeastrum ananuca*, *Narcissus pseudonarcissus* and isolated from bulbs and flowering stalks of *Pancratium biflorum* (Ghosal et al. 1989). Chromones and flavans were reported also for bulbs of *Pancratium maritimum* (Ali et al. 1990) and flavans and chalcones are present in bulbs of *Crinum augustum* (Abd El-Hafiz et al. 1990). Obviously these phenolic compounds are phytoalexins in some instances (*Narcissus pseudonarcissus*). A strange type of parasitism was described by Ghosal et al. (1986). Stolons of the grass *Imperata cylindrica* penetrate bulbs of *Pancratium biflorum*, cause cell necrosis and initiate synthesis of red coloured stress compounds (flavans, chalcones) and release of cytotoxic free alkaloids from their conjugates. Piscidic acid is known from *Narcissus poeticus*, and *Lycoris radiata* yielded a deoxy Piscidic acid. These two aro-

matic acids may be connected with tyrosine metabolism and may have *p*-hydroxyphenylpyruvic acid and acetic acid or an equivalent C₂ compound as building stones.

Saponins seem to be totally lacking in true *Amaryllidaceae*.

Amaryllidaceae store starch in vegetative storage organs. In many taxa starch is accompanied by water-soluble carbohydrates, fructans or glucomannans. The latter may become the main carbohydrate reserve in a number of taxa. A tendency to replace starch by water-soluble carbohydrates in vegetative storage organs of perennial plants is perceptible in many other more or less cosmopolitan families of monocotyledons, e. g. *Agavaceae*, *Gramineae*, *Iridaceae*, *Liliaceae* s.l.

Hypoxidaceae (*Hypoxidoideae*) — Glycosidic 1,5- and 1,3-diarylpentanes seem to be key metabolites of *Hypoxidaceae*, which comprise many species of importance to traditional medicine in Africa and Asia including China and Japan. Rooperol, an 1,5-diarylpenta-1-en-4-yn with four phenolic hydroxyls is the aglycone of hypoxoside and the obtusosides of *Hypoxis nyasica*, *obtusoides*, *rooperi* and others. Nyasol, 1,3-diaryl-1,4-pentadien with two phenolic hydroxyls is the aglycone of several glycosides from *H. angustifolia* (Sibanda et al. 1990) and nyasicol, a 1,5-diaryl-1,2-dihydroxypenta-4-yn with four phenolic OH's, is the aglycone of several glycosides of *H. nyasica* (Galeffi et al. 1987), *H. angustifolia*, *interjecta* and *multiceps* (Sibanda et al. 1990; Marini-Bettolo et al. 1991). Nyasicoside was also isolated from rhizomes of an African species cited as *Curculigo recurvata* (Chifundera et al. 1991). Biosynthetically these C₆-C₅-C₆ phenolic aglyca are probably related to lignans which arise by condensation of two phenylpropane (C₆-C₃) building stones and have a C₆-C₃ + C₃-C₆ skeleton. Because one C-atom is lost, such C₆-C₅-C₆ compounds are also termed norlignans, norneolignans or even nonlignans or coniooids; they were formerly studied intensively in conifers (see Hegnauer 1986: 479, 481, 496).

Acuminatoside from rhizomes of *Hypoxis acuminata* (Bredenkamp et al. 1989) and whole plants of *H. obtusa* (Msonthi et al. 1990) is the apiosylglucoside of geraniol.

Flavonoids are represented in the family by glycosides of kaempferol and quercetin. Rhizomes and tuberous roots of *Curculigo orchoides* yielded a derivative of 2,3-dihydromyricetin.

Simple phenolic glycosides seem to be rather common in *Hypoxidoideae*. From whole plants of *H. obtusa* Msonthi et al. (1990) isolated also obtusaside, a glucoside of gentisyl alcohol which has OH-6 of its glucose esterified by 2,6-dimethoxy-3-hydroxybenzoic acid. Rhizomes of *C. orchoides* contain curculigoside, which is 2',6'-dimethoxysalireposide, and corchioside-A, which is a xyloglucoside of orcinol (Garg et al. 1989).

Curculigo orchoides is a famous medicinal plant from India and China known in Ayurvedic medicine as 'Kali Musli' (Pandey et al. 1983) and in China as 'Xiao Mao' (Jun-Ping Xu et al. 1992). The lipid fraction of this crude drug (rhizomes + roots) yielded interesting alkanones, the cycloartane derivative curculigol (Misra et al. 1990), a new pentacyclic triterpene (Mehta & Gawarikar 1991) and several phytosterols. Yun-Ping Xu et al. (1992) isolated a saponin mixture containing curculigosaponins-A to -J, all with the same saponenin, curculigenin, which is a cycloartane derivative. Obviously in contrast to many *Liliaceae* s.l. (see e. g. sub *Alliaceae*), *Dioscoreaceae* and other families of monocotyledons, *Hypoxidoideae* do not produce steroidal C₂₇-sapogenins, but triterpenic sapogenins with the tetracyclic skeleton of cycloartane.

Haemodoraceae — Yellow to red 9-phenylphenalenones and biogenetically related pigments are chemical markers of true *Haemodoraceae*. They are deposited in subterranean parts, leaf bases, flowers, fruits and seeds and occur free (e.g. haemodorum) and as glycosides (e.g. haemocorin). Phenalenone pigments were isolated from species of *Anigozanthos*, *Conostylis*, *Haemodorum*, *Lachnanthes*, *Macropidia*, *Phlebocarya*, *Wachendorfia* and *Xiphidium*. Quite recently a new phenalenone pigment, thyrsiflorin, was isolated from the yellow flowers of *Wachendorfia thyrsiflora*, which contains two other phenalenones in its roots (Dora et al. 1990). Obviously the North American genus *Lophiola* does not belong to *Haemodoraceae*; its two species do not produce phenalenone pigments. Phenalenones also occur in some Fungi; fungal phenalenones have a polyketide origin, whereas *Haemodoraceae* produce their pigments from one phenylalanine, one tyrosine and one acetate.

References: Abd El-Hafiz, M. A., et al., *J. Nat. Prod.* 53 (1990) 1349. — Ali, A. A., et al., *Phytochemistry* 29 (1990) 625. — Breidenkamp, N. W., et al., *Phytochemistry* 28 (1989) 263. — Chifundera, K., et al., *Tetrahedron* 47 (1991) 4369. — Cronquist, A., *An integrated system of classification of flowering plants*, Columbia Univ. Press (1981); *The evolution and classification of flowering plants*, 2nd ed., New York Bot. Garden (1988). — Dora, G., et al., *Planta Medica* 56 (1990) 569. — Galeffi, C., et al., *Tetrahedron* 43 (1987) 3519. — Garg, S. N., et al., *Phytochemistry* 28 (1989) 1771 (also alkanols, phytoosterols, cycloartenol). — Ghosal, S., et al., *Phytochemistry* 24 (1985) 1825 (glucoalkaloid kalbreclazine), 2141 (chemistry and biology of *Crinum* alkaloids: review), 2703 (acyloxy alkaloid palmilycorine and acylglucosyloxy alkaloid lycoriside from *Crinum asiaticum*); *ibid.* 25 (1986) 1097; *ibid.* 27 (1988) 1849 (new types of alkaloids, e.g. craugsodine, isocraugsodine, crinasiatine from fruits of *Crinum asiaticum*); *ibid.* 28 (1989) 3193; *ibid.* 29 (1990) 805; *Indian J. Chem.* 30B (1991) 260 (telastaside). — Hegnauer, R., *Chemotaxonomie der Pflanzen* 2 (1963); 7 (1986): *Alliaceae* 281, 315–325, 488–489, 501, 685–731, 803; *Amaryllidaceae* s.str. 53–70, 475, 573–580; *Haemodoraceae* 228–230, 657–660; *Hypoxidaceae* 234–236, 661–663. — Hegnauer, R., in P. Baas, R. Geesink & C. Kalkman, *The plant diversity of Malesia*, Kluwer Acad. Publ., Dordrecht (1990) 97. — Kumar, G. & S. K. Roy, *Indian J. Exp. Biol.* 23 (1985) 356. — Marini-Bettolo, G. B., et al., *Tetrahedron* 47 (1991) 6717. — Mehta, B. K. & R. Gawarikar, *Indian J. Chem.* 30B (1991) 986. — Melchior, H. in Engler, *Syll. Pflanzenfam.* 2 (1964) 528. — Misra, T. N., et al., *Phytochemistry* 29 (1990) 929. — Msonthi, J. D., et al., *Phytochemistry* 29 (1990) 3977. — Pandey, H. C., et al., *Intern. J. Crude Drug Res.* 21 (1983) 33. — Sibanda, S., et al., *Biochem. Syst. Ecol.* 18 (1990) 481. — Xu, Jun-Ping, et al., *Phytochemistry* 31 (1992) 233; *Planta Medica* 58 (1992) 208.

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KEY TO THE GENERA

(Genera of cultivated species included)

- 1a. Inflorescence always an umbel with 1 to few spathes (*Amaryllidoideae*) 2
- b. Inflorescence not an umbel, spathes absent (*Hypoxidoideae*) 18
- 2a. Filaments inserted on the throat of the perigone-tube, with a thin membrane sometimes 1- or 2-toothed between the filaments (false corona). True corona absent . . . 3
- b. Filaments free from the perigone-tube, false corona absent. True corona present or not 6
- 3a. Leaves distinctly petiolate, subcircular to elliptic, cuneate to slightly cordate at base . . 4
- b. Leaves sessile or subpetiolate, linear to narrowly elliptic, attenuate into the petiole . . 5

- 4a. Perigone-tube up to 3.5 cm long, straight. Ovules 2 per cell . . . **Proiphys** (*p.* 363)
 b. Perigone-tube at least 3.5 cm long, often curved. Ovules usually 6 or more per cell
 Eucharis (*cult.*, *p.* 371)
- 5a. Ovary with 10 or more biseriate ovules in each cell. Fruit dry, 3-loculicid. Seeds black **Pancreatium** (*p.* 362)
 b. Ovary with 1–9 ovules near the bottom in each cell. Fruit fleshy, finally rupturing laterally. Seeds green **Hymenocallis** (*p.* 361)
- 6a. Flowers with a corona **Narcissus** (*cult.*, *p.* 373)
 b. Flowers without a corona 7
- 7a. Inflorescences always 1-flowered 8
 b. Inflorescences 2- to many-flowered 10
- 8a. Perigone zygomorphic with free tepals; the outer ones much broader than the inner, the latter connate into a channel enveloping stamens and style
 Sprekelia (*cult.*, *p.* 373)
 b. Perigone actinomorphic with tepals united at the base 9
- 9a. Perigone-tube less than 3 cm long. Longest filaments more than 10 cm long. Style bent out of the flower **Zephyranthes** (*cult.*, *p.* 373)
 b. Perigone-tube more than 5 cm long. Longest filaments less than 8 cm long. Style erect in the centre of the flower **Cooperia** (*cult.*, *p.* 371)
- 10a. Tepals free, brilliant white with a small green blotch below the top
 Leucojum (*cult.*, *p.* 372)
 b. Tepals at base united into a tube 11
- 11a. Flowers distinctly zygomorphic. 12
 b. Flowers actinomorphic or nearly so 14
- 12a. Leaves petiolate, 2 or 3 times as long as wide. Perigone violet. Ovules 2 per cell
 Griffinia (*cult.*, *p.* 372)
 b. Leaves sessile, more than 5 times as long as wide. Perigone red, reddish, pink or white. Ovules numerous in each cell 13
- 13a. Peduncle solid **Amaryllis** (*cult.*, *p.* 371)
 b. Peduncle fistular **Hippeastrum** (*cult.*, *p.* 372)
- 14a. Perigone-tube more than 5 cm long **Crinum** (*p.* 359)
 b. Perigone-tube up to 5 cm long 15
- 15a. Peduncle fistular. Stamens inserted in the perigone-tube. Fruit a capsule 16
 b. Peduncle solid. Stamens inserted at the throat or on the segments of the perigone. Fruit a berry. 17
- 16a. Perigone-tube funnel-shaped **Cyrtanthus** (*cult.*, *p.* 371)
 b. Perigone-tube narrow **Vallota** (*cult.*, *p.* 373)
- 17a. Perigone-tube funnel-shaped, segments wide, orange-coloured
 Clivia (*cult.*, *p.* 371)
 b. Perigone-tube narrow, segments linear, reddish to purple **Scadoxus** (*cult.*, *p.* 373)
- 18a. Tepals very shortly to distinctly united into a tube. Fruit fleshy, indehiscent or irregularly dehiscent, often persistently beaked **Curculigo** (*p.* 366)
 b. Tepals free. Fruit dry, regularly dehiscent, never beaked **Hypoxis** (*p.* 370)

Subfamily Amaryllidoideae

Inflorescence umbellate, or flowers solitary, and always with one or few spathes. *Flowers* actinomorphic or zygomorphic. Tepals free or united into a tube, sometimes with a conspicuous corona. Stamens free or sometimes united into a false corona.

The majority of the genera and species belong to this subfamily.

CRINUM

Crinum L., Sp. Pl. (1753) 290. — Type species: *Crinum americanum* L.

Bulbous herbs. *Leaves* radical, rarely biseriate, sessile or subpetiolate. *Inflorescences* umbellate, many- to 1-flowered, with 2 spathes; scape lateral, solid. *Flowers* white or pinkish, sometimes with a red keel. Tepals subequal, united at the base into a long and narrow tube. Stamens inserted in the throat; filaments free; anthers dorsifixed. Ovary with 1 to many ovules per cell; style filiform; stigma entire. *Fruits* indehiscent or irregularly dehiscent, with a fleshy or membranous wall. *Seeds* globose or somewhat flattened, greenish or greyish. — **Fig. 1.**

Distribution — About 100 species in the tropics; 2 indigenous species in *Malesia*. Other species are cultivated in gardens and may escape sometimes.

KEY TO THE SPECIES

- 1a. Leaves narrowly to broadly elliptic, wider than 3.5 cm. Anthers 12–35 mm long
1. *C. asiaticum*
 b. Leaves oblong to narrowly elliptic, to 3.5 cm wide. Anthers 7–9 mm long
2. *C. gracile*

1. *Crinum asiaticum* L., Sp. Pl. (1753) 292; Ker-Gawl., Curt. Bot. Mag. 27 (1808) t. 1073; Miq., Fl. Ned. Indië 3 (1859) 580; Blanco, Fl. Filip. ed. 3, 1 (1877) 314, t. 168; Naves, Nov. App. (1880) 254; Baker, Handb. Amaryll. (1888) 75; Koord., Meded. Lands Plantent. 19 (1898) 309; Ridley, Mat. Fl. Mal. Penins. 2 (1907) 68; Hallier, Nova Guinea 8 (1913) 899; Laut., Bot. Jahrb. 50 (1913) 302; Ridley, Fl. Mal. Penins. 4 (1924) 301; Merr., Enum. Philipp. Flow. Pl. 1 (1925) 210; Henderson, Mal. Wild Fl. (1954) 164; Backer & Bakh. f., Fl. Java 3 (1968) 136 (s.l.). — Types: India, Malabar Coast and Sri Lanka in LINN.

Crinum amabile Donn, Hort. Cantabr. ed. 6 (1811) 83; Ker-Gawl., Curt. Bot. Mag. 39 (1814) t. 1605; Miq., Fl. Ned. Indië 3 (1859) 580; Naves, Nov. App. (1880) 254; Baker, Handb. Amaryll. (1888) 75. — Type: *Hort. Kew*, Sumatra.

Crinum sumatranum Roxb., Hort. Beng. (1814) 23; Miq., Fl. Ned. Indië 3 (1859) 581; Lindley, Edw. Bot. Reg. 13 (1887) t. 1049; Naves, Nov. App. (1880) 254; Baker, Handb. Amaryll. (1888) 75. — Type: *Campbell*, Sumatra.

Crinum macrantherum Engler, Bot. Jahrb. 7 (1886) 448; Peekel, Fl. Bismarck Arch. Natur. (1984) 87. — Type: *Naumann* 75, Bismarck Archipelago.

Crinum northianum Baker, Gard. Chron. 1 (1882) 671; Handb. Amaryll. (1888) 82; Ridley, Agr. Bull. 3 (1904) 310; Fl. Mal. Penins. 4 (1924) 301. — Type: *North* 424, Borneo, Sarawak.

Crinum cortifolium Hallier, Nova Guinea 8 (1913) 900. — Type: *von Römer* 189, New Guinea.

Crinum macrophyllum Hallier, Nova Guinea 8 (1913) 899. — Type: *Versteeg* 1219, New Guinea.



Fig. 1. *Crinum asiaticum* L. Habit of flowering plant. New Guinea, bank of Merau R., NE of Merauke, Irian Jaya (Photograph P. van Royen, 1954).

Crinum rumphii Merr., Interpr. Rumph. Herb. Amboin. (1917) 141. — Type: *Robinson Pl. Rumph. Amb. 131*, Ambon.

Haemanthus pubescens auct. non L. f.: Blanco, Fl. Filip. (1837) 253.

Crinum giganteum auct. non Andr.: Blanco, Fl. Filip., ed. 2 (1845) 175.

Crinum defixum auct. non Ker-Gawl.: Ridley, Mat. Fl. Mal. Penins. 2 (1907) 68; Fl. Mal. Penins. 4 (1924) 301.

Herb to 200 cm tall. *Leaves* narrowly to broadly elliptic, 50–150 by (3–)3.5–20 cm. *Umbels* 10–50-flowered; peduncle 3.5–12.5 cm long; spathes 9–16 cm long; pedicels 1–5 cm. *Flowers* white, fragrant at night. Perigone-tube 7.5–13 cm; lobes 6–12.5 by 4–12 mm. *Stamens* pink to pur-

ple; filaments 3.5–7 cm long; anthers straight, 12–35 mm long. *Seeds* 1–5 per cell. — Fig. 1.

Distribution — Continental Asia (India, Burma, Thailand, Laos, Cambodia, Vietnam), Cocos Is. (Indian Ocean), Mascarenes, NW Australia, Pacific Is. (Guam, Carolines, Marshalls, Solomons, New Caledonia, Fiji, Samoa); *Malesia*: Sumatra, Malaya, Singapore, Borneo (Brunei, Sarawak), Java, Madura, Philippines (Luzon, Mindoro, Palawan, Mindanao), N Celebes, Timor, Moluccas (Ambon, Seram), New Guinea (Merauke, Sepik, Milne Bay), Bismarck Archipelago.

Habitat — Sandy places, also coastal; riverine forests.

Uses — Leaves and bulbs have medicinal uses as emetic, etc. in India (Quisumbing, Medic. Pl. Philipp. 1951, 171).

2. *Crinum gracile* E. Meyer in Presl, Rel. Haenk. 1 (1827) 120; Naves, Nov. App. (1880) 255; Baker, Handb. Amaryll. (1888) 81; Merr., Enum. Philipp. Flow. Pl. 1 (1925) 210. — Type: *Haenke*, Luzon.

Crinum cumingii Baker, Gard. Chron. 2 (1881) 72; Handb. Amaryll. (1888) 81; Vidal, Phan. Cuming. Philipp. (1885) 152; Rev. Pl. Vasc. Filip. (1886) 275. — Type: *Cuming* 1382, Luzon.

Herb to 80 cm tall. *Leaves* oblong to narrowly elliptic, 30–60 by 1–3.5 cm. *Umbels* 5–12-flowered; peduncle 15–30 cm long; spathes 5–7 cm long; pedicels 0.5–2 cm long. *Flowers* white. Perigone-tube 5–12 cm long; lobes 5–8 by 5–10 mm. Stamens purple; filaments 5–7 cm long; anthers slightly curved, 7–9 mm long. Style purple. *Seeds* unknown.

Distribution — *Malesia*: Sumatra (Palembang), Philippines (Luzon, Mindoro, Mindanao), New Guinea.

Habitat — Primary and savanna forests at low altitudes.

CULTIVATED SPECIES

Crinum fimbriatum Baker — Backer & Bakh. f., Fl. Java 3 (1968) 137.

Native to tropical Africa; cultivated as an ornamental. Umbel 3–8-flowered; perigone whitish to purplish.

Crinum jagus (Thomps.) Dandy — *Crinum giganteum* Andr.; Backer & Bakh. f., Fl. Java 3 (1968) 137.

Native to tropical Africa; cultivated as an ornamental. Umbel 2–12-flowered; flowers fragrant; perigone white.

Crinum kirkii Baker — Backer & Bakh. f., Fl. Java 3 (1968) 137.

Native to tropical Africa; cultivated as an ornamental. Umbel 12–20-flowered; perigone greenish.

Crinum latifolium L. — Merr., Enum. Philipp. Flow. Pl. 1 (1925) 210; Steiner, Philipp. Ornam. Pl. (1960) 137; Peekel, Fl. Bismarck Arch. Natur. (1984) 87. — *Crinum moluccanum* Roxb.; Miq., Fl. Ned. Indië 3 (1859) 581.

Native to tropical Asia; cultivated as an ornamental and perhaps escaped. Umbel 10–20-flowered; flowers fragrant; perigone green tinged with red.

Crinum longiflorum Thunb. — Backer & Bakh. f., Fl. Java 3 (1968) 136.

Native to South Africa; cultivated as an ornamental. Umbel 6–16-flowered; flowers fragrant; perigone greenish.

Crinum moorei Hook. f. — Backer & Bakh. f., Fl. Java 3 (1968) 136.

Native to South Africa; cultivated as an ornamental. Umbel 6–12-flowered; perigone pinkish.

Crinum* × *powellii Baker — Backer & Bakh. f., Fl. Java 3 (1968) 136.

Hybrid between the two preceding species; cultivated as an ornamental.

Crinum pusillum auct. non Herbert? — Miq., Fl. Ned. Indië 3 (1859) 581.

Doubful species.

Crinum sanderianum Baker — Backer & Bakh. f., Fl. Java 3 (1968) 136.

Native to tropical Africa; cultivated as an ornamental. Umbel 3–6-flowered; perigone white with a pink top.

Crinum zeylanicum L. — Merr., Enum. Philipp. Flow. Pl. 1 (1925) 211; Backer & Bakh. f., Fl. Java 3 (1968) 137.

Native to tropical Africa and Asia; cultivated as an ornamental and subnaturalized. Umbel 6–25-flowered; flowers fragrant; perigone white with wide pink bands.

HYMENOCALLIS

Hymenocallis Salisb., Trans. Hort. Soc. Lond. 1 (1812) 338. — Type species: *Hymenocallis littoralis* (Jacq.) Salisb.

Bulbous herbs. *Leaves* radical, sessile or subpetiolate. *Inflorescences* umbellate, many- to 2-flowered, with 2 spathes. *Flowers* white. Tepals equal, united into a long tube; segments erect to patent. Stamens inserted in the throat, basally connected by a thin membrane (false corona) which is entire to deeply incised between the filaments. Ovary with 1–9

ovules near the bottom of each cell; style filiform; stigma entire and small. *Fruits* fleshy, finally rupturing laterally. *Seeds* spongy, green.

Distribution — About 50 species in tropical and subtropical America, a few cultivated; in *Malesia* there is one naturalized species.

Hymenocallis littoralis (Jacq.) Salisb., Trans. Hort. Soc. Lond. 1 (1812) 338; Merr., Sp. Blanc. (1918) 98; Enum. Philipp. Flow. Pl. 1 (1923) 211; Backer & Bakh. f., Fl. Java 3 (1968) 138; Peekel, Fl. Bismarck Arch. Natur. (1984) 89. — *Pancratium littorale* Jacq., Select. Stirp. Amer. Hist. (1763) 99; Ker-Gawl., Curt. Bot. Mag. 21 (1805) t. 805; Safford, Contr. U.S. Nat. Herb. 9 (1905) 342. — Type: *Jacquin*, West Indies.

Hymenocallis adnata Herbert, Amaryll. Suppl. (1837) 215, nom. illeg.; Naves, Nov. App. (1880) 256.

Hymenocallis tenuiflora Herbert, Amaryll. Suppl. (1837) 215; Naves, Nov. App. (1880) 149. — Type: *Hilton 143*, New Granada.

Pancratium illyricum auct. non L.: Blanco, Fl. Filip. ed. 3, 1 (1877) 316.

Pancratium maritimum auct. non L.: Blanco, Fl. Filip. ed. 3 (1877) 316; Naves, Nov. App. (1880) 256.

Bulb spherical, 7.5–10 cm in diameter. *Leaves* 2-ranked, stalkless, oblong, 40–120 cm by 1.5–5 (–7) cm, acute. *Inflorescences* 6–11-flowered; peduncle 45–60 cm long; spathes 6–7 cm long; pedicel none to very short. *Flowers* fragrant. Perigone-tube 14–17 cm long; segments linear, channelled, 7.5–12 cm long and 2–3 mm wide, tipped. False corona 2.5–3 cm high; free part of filaments c. 6 cm. Ovules 4–5 per cell, style slightly exceeding the stamens.

Distribution — South to Central America; cultivated and naturalized in tropical Africa, tropical Asia, Malesia and the Pacific Islands. *Malesia*: Java, Philippines (Luzon), Bismarck Archipelago.

Habitat — Along the seashore and in moist sandy places at low altitudes.

CULTIVATED SPECIES

Hymenocallis caribaea (L.) Herbert — Backer & Bakh. f., Fl. Java 3 (1968) 138.

Native of the West Indies; cultivated as an ornamental. Flowers fragrant; perigone greenish; false corona 2–3 cm long.

Hymenocallis* × *macrostephana Baker — Backer & Bakh. f., Fl. Java 3 (1968) 138.

A hybrid between the two following species; cultivated as an ornamental. Flowers fragrant; perigone white to greenish; false corona 5.5–6 cm long.

Hymenocallis narcissiflora (Jacq.) MacBr. — Backer & Bakh. f., Fl. Java 3 (1968) 138.

Native of South America; cultivated as an ornamental. Flowers fragrant; perigone green and white; false corona 6–7.5 cm long.

Hymenocallis speciosa (Salisb.) Salisb. — Backer & Bakh. f., Fl. Java 3 (1968) 138.

Native of the West Indies; cultivated as an ornamental. Flowers fragrant; perigone greenish and white; false corona 2.5–5 cm long.

PANCRATIUM

Pancratium L., Sp. Pl. (1753) 290. — Type species: *Pancratium maritimum* L.

Bulbous herbs. *Leaves* radical, biserial, sessile. *Inflorescences* umbellate, few- to 1-flowered, with 1 or 2 spathes. *Flowers* white. Tepals subequal, united at the base into a long and narrow tube. Stamens inserted in the throat, basally connected by a thin membrane (false corona) which is sometimes 1- or 2-toothed between the filaments; anthers dorsifixed. Ovary with 10 or more biserial ovules filling each cell; style filiform; stigma entire. *Capsules* loculicidal, 3-valved. *Seeds* angular by pressure, black. — Fig. 2.

Distribution — About 15 species in S Europa, tropical Africa and Asia, a few cultivated; in *Malesia* one indigenous species and a few others cultivated.

Pancratium zeylanicum L., Sp. Pl. (1753) 290; Hooker, Curt. Bot. Mag. 52 (1825) t. 2528; Miq., Fl. Ned. Indië 3 (1859) 582; Blanco, Fl. Filip., ed. 3, 1 (1877) 317; Naves, Nov. App. (1880) 256; Baker, Handb. Amaryll. (1888) 48; Koord., Meded. Lands Plantent. 19 (1898) 310;

Merr., Fl. Manila (1912) 148; Sp. Blanc. (1918) 99; Enum. Philipp. Flow. Pl. 1 (1925) 212; Backer & Bakh. f., Fl. Java 3 (1968) 141. — Type: Probably from Sri Lanka, but perhaps of garden origin.

Glabrous herbs. *Leaves* linear to narrowly elliptic, acute, 12–40 cm by 8–30 mm. *Inflorescences* 1-flowered; peduncle 4–15 cm long; spathe 1, 2-nerved, apically bilobed, 4–5 cm long; pedicel absent or very short. *Flowers* with 2.5–3.5 cm long perigone-tube, lobes linear, 6.5–8 cm long and 4–7 mm wide, acuminate. False corona toothed, 3.5–4 cm high; free part of filaments 2.5–4 cm. Style exceeding the stamens. — Fig. 2.

Distribution — *Malesia*: Borneo (Pandan), Java, Philippines (Luzon, Palawan, Biliran), Celebes (Minahasa), Moluccas (Ambon, Gorontala). Also cultivated in gardens.

Habitat — Grasslands, light forest and plantations, up to 600 m altitude.

CULTIVATED SPECIES

Pancratium longiflorum Roxb. — Miq., Fl. Ned. Indië 3 (1859) 583.
Doubtful species.

Pancratium maritimum L. — Backer & Bakh. f., Fl. Java 3 (1968) 141.
Native to the Mediterranean region; cultivated as an ornamental. Free part of the filaments 6–10 mm long.

Pancratium verecundum Ait. — Backer & Bakh. f., Fl. Java 3 (1968) 141.
Native of SE Asia; cultivated as an ornamental. Free part of the filaments 2–3 cm long.



Fig. 2. *Pancratium zeylanicum* L. Flower without ovary (Korthals s.n., L 897.324-159).

PROIPHYS

Proiphys Herbert, App. (1821) 42; Mabberley, Taxon 29 (1980) 597. — *Eurycles* Salisb. ex Schult. in Roem. & Schult., Syst. Veget. 7/2 (1830) 909, nom. illeg., superfl. — Type species: *Proiphys amboinensis* (L.) Herbert.

Bulbous herbs. *Leaves* radical, petioled, subcircular to elliptic, with numerous parallel nerves. *Inflorescences* umbellate, many-flowered; spathes 2–4. *Flowers* pedicellate, white. Tepals united into a narrow tube; segments subequal, erect to patent, elliptic to obovate, apiculate. Stamens inserted in the throat, basally connected by a membrane (false corona) which is deeply bilobed between the filaments and shorter than the perigone; anthers medifixed. Ovary with 2 ovules in each cell; style filiform; stigma entire, small. *Fruits* dry or slightly fleshy, rupturing irregularly. *Seeds* globose, green. — Figs. 3, 4.

Distribution — In Australia 3 species, two of them also indigenous in *Malesia*.



Fig. 3. *Proiphys amboinensis* (L.) Herbert. Cultivated in the Hortus Botanicus Leiden, 1961 (Photograph Rijksherbarium Leiden).

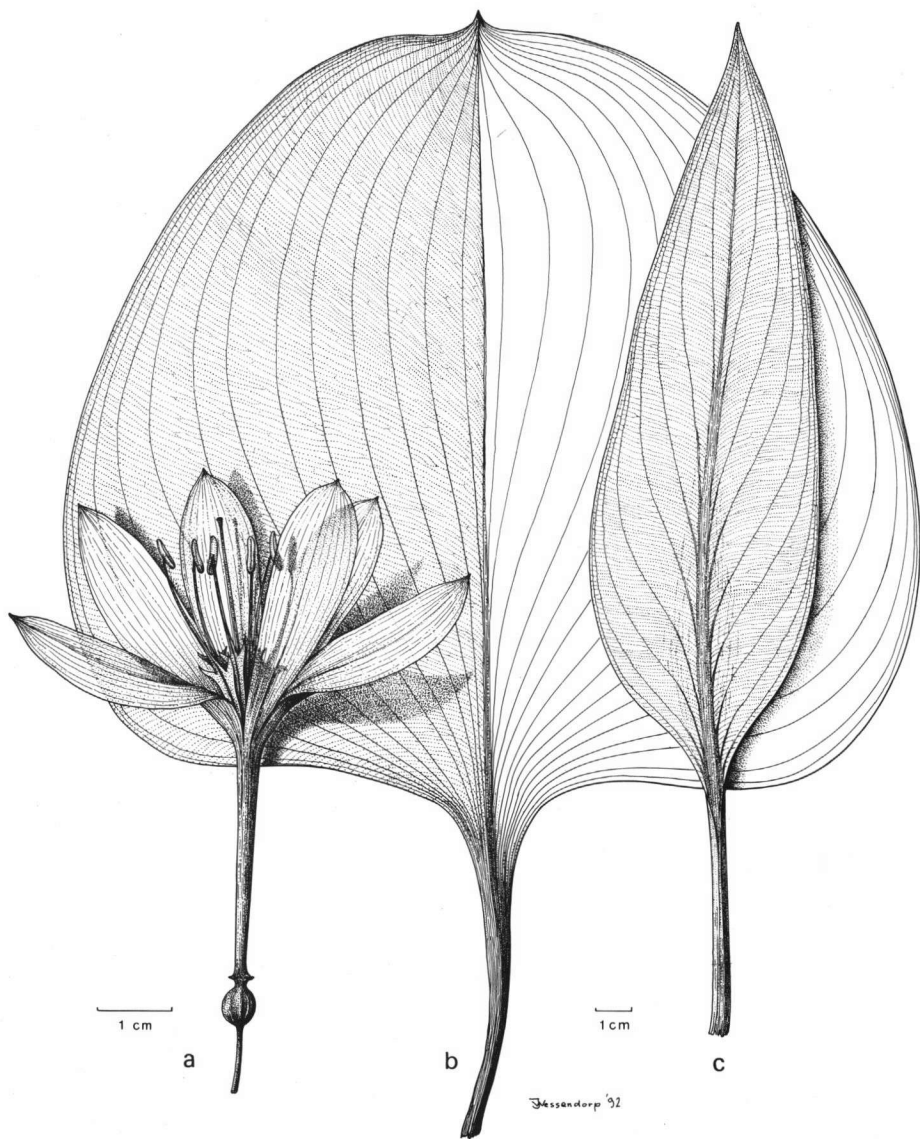


Fig. 4. *Proiphys amboinensis* (L.) Herbert. a. Flower; b. leaf. — *P. alba* (R. Brown) Mabberley. c. Leaf (a, b: de Boer bb 2225; c: McKee 1713).

KEY TO THE SPECIES

- 1a. Leaves elliptic to ovate, less than 15 cm wide, cuneate at base. Spathes 2–3 cm long. Perigone-tube 8–15 mm long; segments less than 25 mm long 1. **P. alba**
- b. Leaves subcircular to broadly ovate, slightly cordate at base, 15 cm or more wide. Spathes 3–10 cm long. Perigone-tube 22–35 mm long; segments 25 mm long or more 2. **P. amboinensis**

1. *Proiphys alba* (R. Brown) Mabblerley, *Taxon* 29 (1980) 601. — *Eurycles alba* (R. Brown) F. Muell., *Sec. Cens. Austral. Pl.* (1889) 196. — Type: *R. Brown*, Queensland.

Bulb 2–4 cm diam. *Leaves*: petiole 7–35 cm long; limb elliptic to ovate, cuneate at base, 10–35 cm long and 2–10 cm wide, margin flat. *Umbel* 10–30-flowered; spathes 3 or 4, 2–8 cm long; pedicels 7–30 mm long. *Flowers* with 8–15 mm long perigone-tube, lobes 6–24 mm long. False corona 5–12 mm long; free part of filaments 2–3 mm. *Fruits* unknown. — **Fig. 4c.**

Distribution — Australia; *Malesia*: New Guinea (Merauke). Also cultivated in gardens.

Habitat — Woodlands at low altitudes.

2. *Proiphys amboinensis* (L.) Herbert, *Appendix* (1821) 42. — *Pancretium amboinense* L., *Sp. Pl.* (1753) 291; Blanco, *Fl. Filip.* ed. 3, 1 (1877) 317. — *Eurycles amboinensis* (L.) Lindley in Loud. *Encycl. Pl.* (1829) 242; Miq., *Fl. Ned. Indië* 3 (1859) 582; Naves, *Nov. App.* (1880) 255; Vidal, *Phan. Cuming. Philipp.* (1885) 152; *Rev. Pl. Vasc. Filip.* (1886) 276; Koord., *Meded. Lands Plantent.* 19 (1898) 310; Merr., *Fl. Manila* (1912) 149; *Sp. Blanc.* (1918) 99; Hallier, *Nova Guinea* 8 (1913) 900; Merr., *Enum. Philipp. Flow. Pl.* 1 (1925) 211; Henderson, *Mal. Wild Fl., Monocot.* (1954) 166; Backer & Bakh. f., *Fl. Java* 3 (1968) 140; Peekel,

Fl. Bismarck Arch. Natur. (1984) 89. — Type: Indonesia, illustration in Commelin, *Hort. Med. Amstel. Pl.* 1 (1697) t. 39, as *Narcissus amboinensis*.

Eurycles sylvestris Salisb. ex Schult., *Syst. Veget.* 7 (1830) 909, nom. illeg.; Salisb., *Trans. Hort. Soc. Lond.* ed. 1, 1 (1812) 337, nomen; Ridley, *Fl. Mal. Penins.* 6 (1924) 303. — Type: Rumph., *Herb. Amb.* 6, t. 70, as *Caepa sylvestris*.

Eurycles javanica Roemer, *Prospect. Fam. Nat. Syn. Monogr.* 4 (1847) 157, nom. illeg.; Miq., *Fl. Ned. Indië* 3 (1859) 582.

Bulb to 8 cm diam. *Leaves*: petiole 15–60 cm long; limb subcircular to broadly ovate, hardly cordate at base, emarginate to shortly apiculate, 20–30 cm long and 15–35 cm wide, margin undulate. *Umbel* 5–25-flowered; peduncle 15–90 cm long; spathes 3 or 4, 3–10 cm long; pedicels to 4.5 cm long. *Flowers* with 22–35 mm long perigone-tube, lobes 25–40 mm long. False corona 7–10 mm long; free part of filaments 10–12 mm long. *Fruits* 15–30 mm diam. — **Figs. 3, 4a, b.**

Distribution — Continental Asia (Thailand), Australia; in *Malesia*: Philippines (Luzon, Mindoro, Palawan), Celebes (Minahasa, Butung), Lesser Sunda Islands (Bali, Timor), Moluccas (Ambon), New Guinea (Merauke, Milne Bay, Fly River), Bismarck Archipelago. Also cultivated in gardens.

Habitat — Seashores and rocky places, up to 500 m altitude.

Subfamily Hypoxidoideae

Inflorescence a raceme, occasionally head-like or flowers solitary, with bracts but never spathes. *Flowers* actinomorphic. Tepals free or united into a tube. Stamens free or inserted on the perigone-tube.

Six genera.

CURCULIGO

Curculigo Gaertn., *Fruct. Sem. Pl.* 1 (1788) 63. — Type species: *Curculigo orchioides* Gaertn.

Gethyllis L., *Sp. Pl.* (1753) 442. — Type species: *Gethyllis afra* L.

Molineria Colla, *Hort. Ripul., App.* 2 (1826) 331. — Type species: *Molineria plicata* Colla, nom. illeg.

Thickly rhizomatous herbs, hairy or glabrous. *Leaves* radical, often petiolate, linear to broadly elliptic. *Inflorescences* racemes or spikes, sometimes head-like, many- to few-flowered. *Flowers* with the tepals united in a very short to elongate tube. Stamens free,

inserted at the mouth of the perigone-tube. *Fruits* fleshy, indehiscent or irregularly dehiscent, often with a persistent beak. — **Fig. 5.**

Distribution — About 20 species in the tropics; in *Malesia* 5 indigenous species and 1 variety; perhaps one species cultivated.

KEY TO THE SPECIES AND VARIETIES

- 1a. Leaves up to 20 cm long. Inflorescences lax, up to 8-flowered 4. *C. orchioides*
- b. Leaves usually longer than 20 cm. Inflorescences compact 2
- 2a. Inflorescences sessile or with scape to 4(-10) cm long. Fruit beaked 3
- b. Inflorescences with scape 5-30 cm long. Fruit beaked or not 4
- 3a. Perigone-tube 8-15 mm long 3a. *C. latifolia* var. *latifolia*
- b. Perigone-tube 20-40 mm long 3b. *C. latifolia* var. *megacarpa*
- 4a. Bracts glabrous or ciliate at the top. Perigone-tube 7-8 mm long. Fruit beaked 2. *C. erecta*
- b. Bracts villous to glabrescent. Perigone-tube to 2 mm long. Fruit not beaked 5
- 5a. Inflorescences head-like and deflexed 1. *C. capitulata*
- b. Inflorescences elongate and erect 5. *C. racemosa*

1. *Curculigo capitulata* (Lour.) Kuntze, Rev. Gen. Pl. 1 (1891) 703; Backer, Handb. Fl. Java 1 (1925) 104; Merr., Enum Philipp. Flow. Pl. 1 (1925) 213. — *Leucojum capitulatum* Lour., Fl. Cochinch. (1790) 199. — *Molineria capitulata* (Lour.) Herbert, Amaryll. (1837) 84; Backer & Bakh. f., Fl. Java 3 (1968) 209. — Type: unknown.

Curculigo recurvata Dryand. in Aiton, Hort. Kew., ed. 2, 2 (1814) 253; Miq., Fl. Ned. Indië 3 (1859) 585; Naves, Nov. App. (1880) 253; Koord., Meded. Lands Plantent. 19 (1898) 310; Ridley, Mat. Fl. Mal. Penins. 2 (1907) 65; Koord., Exk. Fl. Java 1 (1911) 304; Elmer, Leafl. Philipp. Bot. 5 (1913) 1645; Hallier, Nova Guinea 8 (1913) 901; Laut., Bot. Jahrb. 50 (1913) 304; Ridley, Fl. Mal. Penins. 4 (1925) 299; Peekel, Fl. Bismarck Arch. Natur. (1984) 91. — *Molineria recurvata* (Dryand.) Herbert, Amaryll. (1837) 84. — Type: *Hort. Kew.*, Bangladesh.

Curculigo glabra Merr., Philipp. J. Sc., Bot. 2 (1907) 267; Enum. Philipp. Flow. Pl. 1 (1925) 213. — Type: *Merrill 5750*, Mindoro.

Hairy herb. *Leaves* long-petiolate, elliptic to broadly elliptic, 60-150 cm long and 5-15 cm wide, nearly glabrous. *Inflorescence* a deflexed and head-like raceme, 2.5-7 cm long and wide; peduncle 7-30 cm long, tomentose to glabrescent at fructification; bracts brownish, 1.5-5 cm long,

villous to glabrescent at fructification. *Flowers* subsessile, yellow, villous. Perigone-tube 1-2 mm long; lobes 6-8 mm long. *Fruits* whitish to green, 10-15 mm long, not beaked. — **Fig. 5a.**

Distribution — Continental Asia (Nepal, India, Sri Lanka, Bangladesh, Thailand), Taiwan, Australia, Pacific Islands (Solomon Islands, Hawaii); *Malesia*: Sumatra, Malaya, Singapore, Java, Philippines (Luzon, Negros, Biliran, Mindanao), Celebes, Moluccas (Halmahera, Talaud, Ternate, Ambon), New Guinea, Manus I.

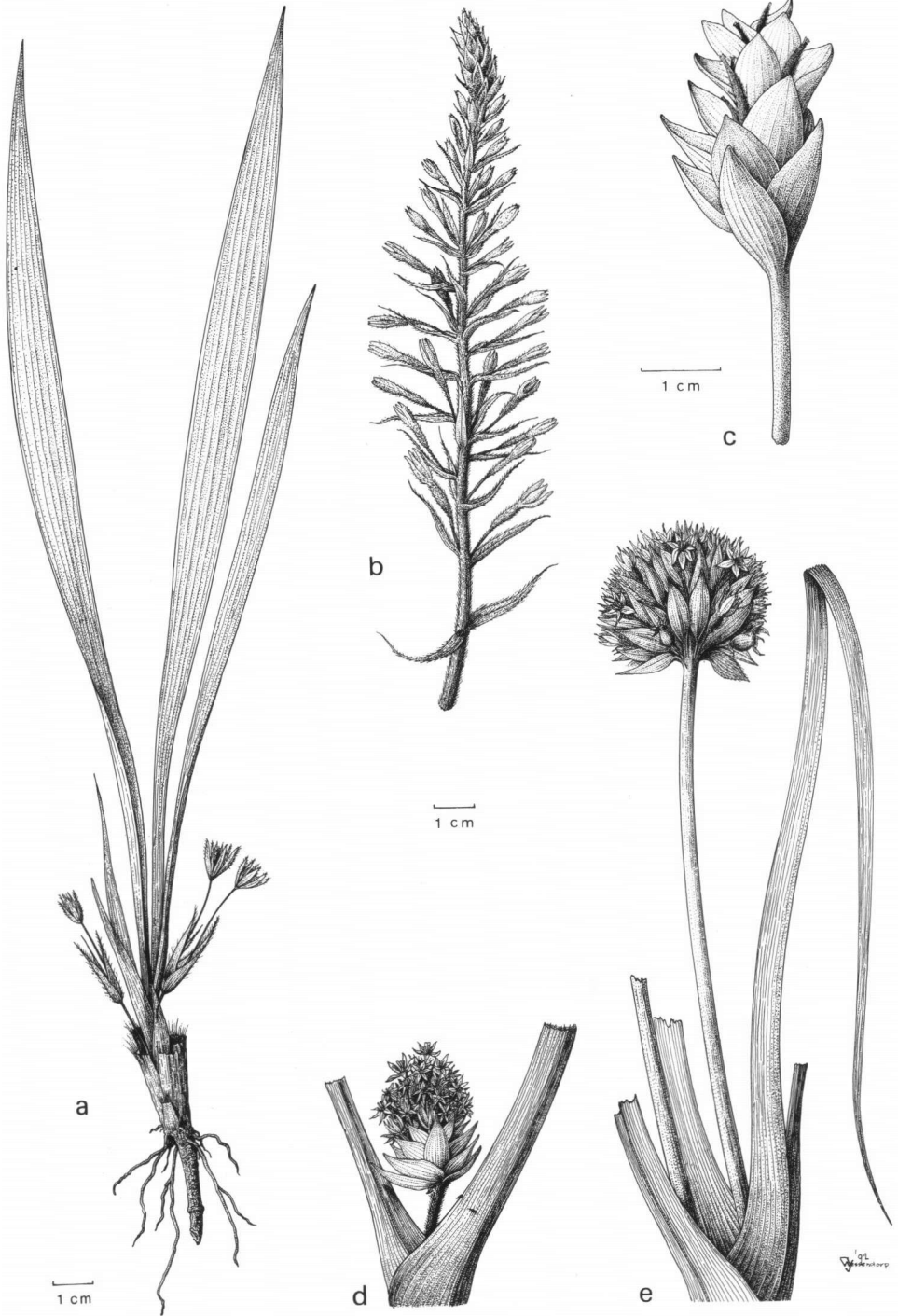
Habitat — Primary and secondary forests, from sea-level up to c. 2000 m altitude.

Uses — The fruits are edible. Leaf fibres are (or were) used in the Philippines, according to Burkill, Dict. Econ. Prod. Malay Penins. 1 (1935) 703.

2. *Curculigo erecta* Laut., Bot. Jahrb. 50 (Aug. 1913) 304. — Type: *Schulze 179*, Papua New Guinea, Sepik River.

Curculigo scapigera Hallier, Nova Guinea 8 (Sept. 1913) 901. — Type: *Versteeg 1084*, New Guinea.

Hairy herb. *Leaves* to 120 cm long and 6 cm wide. *Inflorescences* head-like, compactly ovoid to cylindrical, 2-4 cm long and 1-2 cm wide; peduncle tomentose to glabrescent, 5-30 cm long; bracts glabrous or ciliate at the top, to 2 cm long and 8 mm wide; pedicels c. 6 mm long. *Flowers* yellow. Perigone-tube 7-8 mm long. *Fruits* 10-18 mm long, beaked. — **Fig. 5b.**



Distribution — *Malesia*: E Sumatra, Philippines (Luzon), New Guinea (Irian Jaya). Not (yet) seen from Borneo and Celebes.

Habitat — Primary forest, montane forest, also in swamps. Altitudinal range uncertain.

3. *Curculigo latifolia* Dryand. in Aiton, Hort. Kew. ed. 2, 2 (1811) 253; Miq., Fl. Ned. Indië 3 (1859) 595; Ridley, Mat. Fl. Mal. Penins. 2 (1907) 66; Fl. Mal. Penins. 4 (1925) 300; Backer, Handb. Fl. Java 1 (1925) 104; Henderson, Mal. Wild Fl., Monocot. (1954) 167. — *Molineria latifolia* (Dryand.) Herbert ex Kurz, Nat. Tijds. Ned. Indië 27 (1864) 232; Backer & Bakh. f., Fl. Java 3 (1968) 209. — Type: Hort. Kew, India.

Curculigo glabrescens (Ridley) Merr., J. Str. Br. Roy. As. Soc. 85 (1922) 163. — *Curculigo latifolia* var. *glabrescens* Ridley, Mat. Fl. Mal. Penins. 2 (1907) 67. — Type: Ridley, Malaya. *Curculigo sumatrana* Roxb., Fl. Ind. 2 (1824) 146; Ridley, Mat. Fl. Mal. Penins. 2 (1907) 66; Fl. Mal. Penins. 4 (1925) 300 — *Molineria sumatrana* (Roxb.) Herbert, Amaryll. (1837) 84. — Type: Hort. Kew, India.

Molineria plicata Colla, Hort. Ripul., App. 2 (1826) 331, pl. 18, nom. illeg.; Kurz in Miq., Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 176. — Type: Sumatra.

Curculigo villosa Wall. ex Kurz in Miq., Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 176; Ridley, Fl. Mal. Penins. 4 (1925) 300. — *Curculigo latifolia* var. *villosa* (Wall. ex Kurz) Baker, J. Linn. Soc. 17 (1878) 125. — Type: Wallich 5163A, Singapore.

Curculigo agusanensis Elmer, Leaf. Philipp. Bot. 5 (1913) 1645; Merr., Enum. Philipp. Flow. Pl. 1 (1925) 213. — Types: Elmer 13584, Mindanao, Mt Urdaneta.

Curculigo weberi Elmer, Leaf. Philipp. Bot. 5 (1913) 1646; Merr., Enum. Philipp. Flow. Pl. 1 (1925) 213. — Type: Elmer 14304, Mindanao, Mt Urdaneta.

Curculigo brevipedunculata Elmer, Leaf. Philipp. Bot. 5 (1918) 1647; Merr., Enum. Philipp. Flow. Pl. 1 (1925) 213. — Type: Elmer 13164, Palawan, Mt Pulgar.

Curculigo borneensis Merr., J. Str. Br. Roy. As. Soc. 85 (1922) 162. — Type: Ramos 1712, Borneo, Sandakan.

Hairy herb. *Leaves* long-petiolate, elliptic to broadly elliptic, 30–100 cm long and 5–10 cm wide, glabrous or nearly so. *Inflorescences* ovoid to cylindrical, compact, 2–6 cm long and wide, sessile or peduncle to 4(–10) cm long, glabrescent; bracts green, glabrous or ciliate at margins, 1–6 cm long. *Flowers* subsessile, yellow, villous. *Perigone-tube* 8–40 mm long; lobes 8–12 mm long. *Fruits* 10–25 mm long, beaked, white to green.

a. var. *latifolia*

Perigone-tube 8–15 mm long. — Fig. 5c.

Distribution — Continental Asia (India, Burma, Thailand); *Malesia*: Sumatra, Lingga, Bangka, Malaya (Pahang), Borneo (Sarawak, Sabah, Kalimantan), Java, Philippines (Palawan, Balabac, Samar), Celebes.

Habitat — Forests, at high altitudes.

Uses — The fruits are edible. Burkill, Dict. Econ. Prod. Mal. Penins. 1 (1935) 704 and Heyne, Nutt. Pl. Indonesië 1 (1950) 451 report the (former) use of rolled leaves as string and of extracted leaf-fibres for fishing nets etc. in Borneo and Malaya. Medicinal uses are also mentioned for Malaya (Burkill, l.c.).

Note — The specimen *Jacobs 5549* from Borneo shows three subsessile inflorescences and one with a peduncle 10 cm long.

b. var. *megacarpa* (Ridley) Geerinck, *comb. nov.* — *Curculigo megacarpa* Ridley, J. Str. Br. Roy. As. Soc. 41 (1904) 33; Mat. Fl. Mal. Penins. 1 (1907) 67; Fl. Mal. Penins. 4 (1925) 300. — Type: Ridley, Malaya, Perak, Thaiping Hills.

Perigone-tube 20–40 mm long.

Distribution — Continental Asia (Thailand); *Malesia*: Malaya (Perak), Borneo (Sandakan), Java (also Panaitan I.).

Habitat — Rain forest, at high altitudes.

Note — Further material is necessary to confirm the rank of this taxon.

Fig. 5. *Curculigo capitulata* (Lour.) Kuntze. a. Inflorescence. — *C. erecta* Laut. b. Inflorescence. — *C. latifolia* Dryand. var. *latifolia*. c. Inflorescence. — *C. orchoides* Gaertn. d. Flowering plant. — *C. racemosa* Ridley. e. Inflorescence (a: de Wilde & de Wilde-Duyffjes 13539; b: Brass 6994; c: Geesink & Hatink 6401; d: Zippel 272; e: Jacobs 5610).

4. *Curculigo orchoides* Gaertn., Fruct. Sem. Pl. 1 (1788) 63; Miq., Fl. Ned. Indië 3 (1859) 585; Backer, Handb. Fl. Java 1 (1925) 103; Merr., Enum. Philipp. Flow. Pl. 1 (1925) 213; Backer & Bakh. f., Fl. Java 3 (1968) 209. — Type: unknown.

Gethyllis acaulis Blanco, Fl. Filip. (1837) 260; Merr., Dep. Int. Bur. Gov. Labor. 27 (1905) 85. — Type: *Blanco*, Philippines, Manila.

Hairy herb. *Leaves* subpetiolate, linear to elliptic, to 20 cm long, 8 cm wide. *Inflorescence* lax, up to 8-flowered; bracts long-acuminate, 2–3.5 cm long, long-ciliate; pedicels 2–3 cm long. *Flowers* bright yellow. Perigone-tube 5–20 mm long; lobes c. 6.5 mm long. *Fruit* green, beaked. — **Fig. 5d.**

Distribution — Continental Asia (India, Laos, Cambodia, Vietnam, Thailand), Taiwan, Pacific Islands (Marianes, New Caledonia); *Malesia*: Sumatra, Borneo (Kalimantan), Java, Philippines (Luzon, Samar, Mindanao), Celebes, Lesser Sunda Islands (Sumba, Flores, Timor), Moluccas (Amboin), New Guinea, Misima I.

Habitat — Grassland, at low altitudes.

Uses — Medicinal use of roots is mentioned by Burkill (Dict. Econ. Prod. Malay Penins. 1, 1935,

703) and Quisumbing (Medic. Pl. Philipp. 1951, 172) on the strength of Indian literature.

5. *Curculigo racemosa* Ridley, J. Str. Br. Roy. As. Soc. 44 (1805) 198. — Type: *Ridley*, Borneo, Mt Matang.

Hairy herb. *Leaves* 50–100 cm long and 8–10 cm wide. *Inflorescence* elongate and erect; peduncle (10–)20–40 cm, tomentose; bracts to 2.5 cm long, 3 mm wide, villous; pedicels 8–15 mm long. *Flowers* bright yellow. Perigone-tube 1–2 mm long; lobes 6–12 mm long and 1.5–2 mm wide. *Fruits* green, 8–12 mm long, not beaked. — **Fig. 5e.**

Distribution — *Malesia*: Borneo (Sarawak, Sabah, Kalimantan).

Habitat — Rain forest, old secondary forest, at high altitudes.

Note — The specimen *Jacobs 5610* is said to be an epiphyte on a hollow tree trunk.

CULTIVATED SPECIES

***Curculigo ensifolia* R. Br. — Laut., Bot. Jahrb. 50 (1913) 304.**

Native of Australia; perhaps a synonym of *C. orchoides* Gaertn.

HYPOXIS

Hypoxis L., Syst. Nat., ed. 10 (1789) 986.

Hairy or glabrous herbs, bulbous or thickly rhizomatous. *Leaves* radical, linear to narrowly elliptical. *Inflorescence* a 1- to many-flowered raceme; bracts narrow. *Flowers* with free tepals. Stamens free. *Fruit* a dry capsule, regularly dehiscent. — **Fig. 6.**

Distribution — About 100 species, predominantly in tropical Africa; one indigenous species in Malesia and one cultivated.

***Hypoxis aurea* Lour., Fl. Cochinch. (1790) 200; Ridley, Mat. Fl. Mal. Penins. 1 (1907) 64; Koord., Exk. Fl. Java 1 (1911) 305; Laut., Bot. Jahrb. 50 (1913) 305; Backer, Handb. Fl. Java 1 (1925) 105; Merr., Enum. Philipp. Flow. Pl. 1 (1925) 214; Backer & Bakh. f., Fl. Java 3 (1968) 209. — Type: *Loureiro*, Cochinchina, So Koung.**

***Hypoxis franquevillei* Miq., Fl. Ned. Indië 3 (1859) 586; Naves, Nov. App. (1880) 253. — Type: *Franqueville*, Java, Penangoen.**

Plant hairy; rootstock globose to elongate. *Leaves* linear to narrowly elliptic, acuminate, 8–25 cm long and 1–4 mm wide. *Inflorescences* 4–8 cm long, shorter than the leaves, 1- to few-flower-

ed; bracts linear; pedicels 1.5–4 mm long. *Flowers*: tepals 5–6 mm long and about 1.5 mm wide. *Capsules* about 7 mm long. — **Fig. 6.**

Distribution — Continental Asia (China, India, Cambodia, Thailand), Japan, Taiwan; *Malesia*: Sumatra, Malaya, Java, Philippines (Luzon, Mindanao), Celebes, Flores, New Guinea (Irian Jaya).

Habitat — Grassland and other sunny places, not at very low altitudes.

CULTIVATED SPECIES

***Hypoxis hygrometrica* Labill. — Laut., Bot. Jahrb. 50 (1913) 305.**

Native of Australia; cultivated in New Guinea. Plant sparsely hairy; inflorescence 1–2-flowered.

CULTIVATED SPECIES
OF NON-MALESIAN GENERA

Amaryllis belladonna L. — Backer, Handb.

Fl. Java 1 (1925) 85; Steiner, Philipp. Ornam. Pl. (1960) 136; Backer & Bakh. f., Fl. Java 3 (1968) 133.

Native of South Africa; cultivated as an ornamental. Umbel 6–12-flowered; perigone dark red or pink to white.

Clivia miniata (Lindley) Bosse — Backer, Handb. Fl. Java 1 (1925) 84; Backer & Bakh. f., Fl. Java 3 (1968) 133.

Native of South Africa; cultivated as an ornamental. Umbel 12–20-flowered; perigone usually orange.

Cooperia drummondii Herbert — Backer, Handb. Fl. Java 1 (1925) 87; Backer & Bakh. f., Fl. Java 3 (1968) 135.

Native of N America; cultivated as an ornamental. Perigone white, often tinged with violet.

Cyrtanthus mackenii Hook. f. — Backer, Handb. Fl. Java 1 (1925) 90; Backer & Bakh. f., Fl. Java, 3 (1968) 137.

Native of South Africa; cultivated as an ornamental. Umbel 4–10-flowered; flowers fragrant; perigone 3.5–5 cm long, white to yellowish.

Cyrtanthus pallidus Sims — Backer, Handb. Fl. Java 1 (1925) 90; Backer & Bakh. f., Fl. Java 3 (1968) 137.

Native of South Africa; cultivated as an ornamental. Umbel 4–7-flowered; perigone pale pink, 4–5.5 cm long.

Eucharis amazonica Linden ex Planch. — Backer, Handb. Fl. Java 1 (1925) 92; Backer & Bakh. f., Fl. Java 3 (1968) 139. — *Eucharis grandiflora* auct. non Planch. & Linden: Merr., Enum. Philipp. Flow. Pl. 1 (1925) 211; Peekel, Fl. Bismarck Arch. Natur. (1984) 89.

Native of Colombia; cultivated as an ornamental. Leaves several per bulb; umbel 4–8-flowered; flowers fragrant; false corona white with greenish or yellowish stripes.

Eucharis candida Planch. & Linden — Koord., Exk. Fl. Java 1 (1911) 303; Backer, Handb. Fl. Java 1 (1925) 92; Backer & Bakh. f., Fl. Java 3 (1968) 139.

Native of Colombia; cultivated as an ornamental. Leaf 1 per bulb; umbel 6–10-flowered; flowers fragrant; false corona yellow.



Fig. 6. *Hypoxis aurea* Lour. Flowering plant (Brass 11783).

Eucharis mastersii Baker — *Eucharis grandiflora* auct. non Planch. & Linden: Koord., Exk. Fl. Java 1 (1911) 303; Backer, Handb. Fl. Java 1 (1925) 92; Steiner, Philipp. Orn. Pl. (1960) 137; Backer & Bakh. f., Fl. Java 3 (1968) 139.

Native of Colombia; cultivated as an ornamental. Leaves several per bulb; umbel 2–5-flowered; flowers fragrant in the evening; false corona green and yellow.

Eucharis sanderi Baker — Backer, Handb. Fl. Java 1 (1925) 92; Backer & Bakh. f., Fl. Java 3 (1968) 139.

Native of Colombia; probably a hybrid between the two preceding species; perhaps cultivated as an ornamental. Umbel 2–3-flowered.

Eucharis subedentata Baker — Backer, Handb. Fl. Java 1 (1925) 92; Backer & Bakh. f., Fl. Java 3 (1968) 139.

Native of Colombia; cultivated as an ornamental. Leaves several per bulb; umbel 6–8-flowered; false corona not toothed.

Griffinia ornata Moore — Backer, Handb. Fl. Java 1 (1925) 84; Backer & Bakh. f., Fl. Java 3 (1968) 133.

Native of Brazil; cultivated as an ornamental. Umbels 10–16-flowered; perigone violet.

Hippeastrum advenum Ker-Gawl. — Backer, Handb. Fl. Java 1 (1925) 96; Backer & Bakh. f., Fl. Java 3 (1968) 142.

Native of Chile; cultivated as an ornamental. Perigone-lobes 3.5–4.5 cm long, red, pink or yellow.

Hippeastrum aulicum (Ker-Gawl.) Herbert — Laut., Bot. Jahrb. 50 (1913) 303; Backer, Handb. Fl. Java 1 (1925) 96; Backer & Bakh. f., Fl. Java 3 (1968) 142; Peekel, Fl. Bismarck Arch. Natur. (1984) 89.

Native of Brazil; cultivated as an ornamental. Perigone-lobes 9–15 cm long, red with darker veins.

Hippeastrum pratense (Poepp.) Baker — Backer, Handb. Fl. Java 1 (1925) 96; Backer & Bakh. f., Fl. Java 3 (1968) 142.

Native of Chile; cultivated as an ornamental. Perigone-lobes 6–6.5 cm long, bright red to purplish.

Hippeastrum puniceum (Lam.) Kuntze — Backer & Bakh. f., Fl. Java 3 (1968) 143. — *Hippeastrum equestre* (Ait.) Herbert: Koord., Exk. Fl. Java 1 (1911) 303; Backer, Handb. Fl. Java 1 (1925) 97; Steiner, Philipp. Orn. Pl. (1960) 137.

Native of Central America and West Indies; cultivated as an ornamental. Perigone-lobes red to orange-red and greenish to whitish at base.

Hippeastrum reginae (L.) Herbert — Backer, Handb. Fl. Java 1 (1925) 97; Backer & Bakh. f., Fl. Java 3 (1968) 142. — *Amaryllis atamasco* auct. non L.: Blanco, Fl. Filip. (1837) 254. — *Hippeastrum miniatum* auct. non Herbert: Merr., Enum. Philipp. Flow. Pl. 1 (1925) 212.

Native of tropical America; cultivated as an ornamental. Perigone-lobes 8–12 cm long, red with greenish 5-pointed star at base.

Hippeastrum reticulatum (L'Hér.) Herbert — Laut., Bot. Jahrb. 50 (1913) 302; Backer, Handb. Fl. Java 1 (1925) 97; Steiner, Philipp. Orn. Pl. (1960) 137; Backer & Bakh. f., Fl. Java 3 (1968) 142; Chin, Malays. Fl. Col. (1974) 145; Peekel, Fl. Bismarck Arch. Natur. (1984) 87.

Native of Brazil; cultivated as an ornamental. Perigone-lobes 10–12.5 cm long, red-mauve with darker veins.

Hippeastrum rutilum Ker-Gawl. — *Hippeastrum splendens* Herbert: Backer, Handb. Fl. Java 1 (1925) 97; Backer & Bakh. f., Fl. Java 3 (1968) 142.

Native of Brazil; cultivated as an ornamental. Perigone-lobes 8–12 cm long, greenish and apically red.

Hippeastrum stylosum Herbert — Backer, Handb. Fl. Java 1 (1925) 97; Backer & Bakh. f., Fl. Java 3 (1968) 142.

Native of Guyana and Brazil; cultivated as an ornamental. Perigone-lobes c. 10 cm long, bright red with a pale median band.

Hippeastrum vittatum (L'Hér.) Herbert — Backer, Handb. Fl. Java 1 (1925) 97; Backer & Bakh. f., Fl. Java 3 (1968) 299.

Native of Peru and Brazil; cultivated as an ornamental. Perigone-lobes 7.5–15 cm long, white with red stripes.

Leucojum aestivum L. — Backer & Bakh. f., Fl. Java 3 (1968) 144.

Native to S Europe; cultivated as an ornamental. Umbel 3–5(–7)-flowered; perigone-lobes 1–1.5 cm long.

Narcissus jonquilla L. — Backer, Handb. Fl. Java 1 (1925) 94; Backer & Bakh. f., Fl. Java 3 (1968) 140. — *Narcissus pseudonarcissus* auct. non L. (?): Koord., Exk. Fl. Java 1 (1911) 303.

Native of S Europe; cultivated as an ornamental. Umbel 2–5-flowered; flowers fragrant; perigone green and yellow.

Narcissus tazetta L. — Backer, Handb. Fl. Java 1 (1925) 94; Backer & Bakh. f., Fl. Java 3 (1968) 140. — *Narcissus poeticus* auct. non L. (?): Koord., Exk. Fl. Java 1 (1911) 303.

Native to S Europe and temperate Asia; cultivated as an ornamental. Umbel 3–20-flowered; perigone whitish.

Scadoxus multiflorus (Martyn) Raf. — *Haemanthus multiflorus* Martyn: Backer, Handb. Fl. Java 1 (1925) 83; Steiner, Philipp. Orn. Pl. (1960) 137; Backer & Bakh. f., Fl. Java 3 (1968) 132; Chin, Malays. Fl. Col. (1974) 143. — *Haemanthus puniceus* auct. non L.: Koord., Exk. Fl. Java 1 (1911) 302.

Native of tropical Africa; cultivated as an ornamental. Umbel spherical or hemispherical; perigone red to pink.

Sprekelia formosissima (L.) Herbert — Backer, Handb. Fl. Java 1 (1925) 96; Backer & Bakh. f., Fl. Java 3 (1968) 141.

Native of Mexico and Guatemala; cultivated as an ornamental. Perigone usually dark red, 9–12 cm long. Poisonous.

Vallota speciosa (L. f.) Dur. & Schinz — Backer, Handb. Fl. Java 1 (1925) 85; Backer & Bakh. f., Fl. Java 3 (1968) 133.

Native of South Africa; cultivated as an ornamental. Umbel 4–9-flowered; perigone red to white.

Zephyranthes atamasco (L.) Herbert — Backer, Handb. Fl. Java 1 (1925) 86; Steiner, Philipp. Orn. Pl. (1960) 138; Backer & Bakh. f., Fl. Java 3 (1968) 135.

Native of N America; cultivated as an ornamental. Perigone about 7.5 cm long, white.

Zephyranthes brachyandra (Baker) Backer — Backer & Bakh. f., Fl. Java 3 (1968) 134.

Native of Paraguay. Cultivated as an ornamental. Perigone 3–3.5 cm long, violet.

Zephyranthes candida (Lindley) Herbert — Backer, Handb. Fl. Java 1 (1925) 86; Backer & Bakh. f., Fl. Java 3 (1968) 135; Peekel, Fl. Bismarck Arch. Natur. (1984) 87.

Native of S America; cultivated as an ornamental and subnaturalized. Perigone about 1.5 cm long, white slightly tinged with red.

Zephyranthes carinata Herbert — Backer, Handb. Fl. Java 1 (1925) 86; Steiner, Philipp. Orn. Pl. (1960) 138; Backer & Bakh. f., Fl. Java 3 (1968) 134.

Native of S America; cultivated as an ornamental. Perigone 2.5–4.5 cm long, light pink.

Zephyranthes citrina Baker — Backer, Handb. Fl. Java 1 (1925) 85; Backer & Bakh. f., Fl. Java 3 (1968) 134.

Native of British Guyana; cultivated as an ornamental. Perigone 2–2.5 cm long, bright yellow.

Zephyranthes grandiflora Lindley — Backer, Handb. Fl. Java 1 (1925) 86; Backer & Bakh. f., Fl. Java 3 (1968) 135. — *Zephyranthes carinata* Herbert: Backer, Handb. Fl. Java 1 (1925) 86; Backer & Bakh. f., Fl. Java 3 (1968) 134.

Native of Central America; cultivated as an ornamental. Perigone 6–7.5 cm long, light pink.

Zephyranthes mesochloa auct. non Herbert (?): Koord., Meded. Lands Plantent. 19 (1898) 311.

Zephyranthes rosea (Sprengel) Lindley — Backer, Handb. Fl. Java 1 (1925) 86; Koord., Exk. Fl. Java 1 (1911) 302; Laut., Bot. Jahrb. 50 (1913) 302; Steiner, Philipp. Orn. Pl. (1960) 138; Backer & Bakh. f., Fl. Java 3 (1968) 134; Peekel, Fl. Bismarck Arch. Natur. (1984) 85. — *Atamasco rosea* (Sprengel) Greene: Merr., Enum. Philipp. Flow. Pl. 1 (1925) 210.

Native of Cuba. Cultivated as an ornamental and subnaturalized. Perigone 3–3.5 cm long, pink.

Zephyranthes tubispatha (L'Hér.) Herbert — Backer, Handb. Fl. Java 1 (1925) 87; Backer & Bakh. f., Fl. Java 3 (1968) 135; Peekel, Fl. Bismarck Arch. Natur. (1984) 87.

Native of Central and South America; cultivated as an ornamental. Perigone 4–5 cm long, white, tinged with green.

Zephyranthes verecunda Herbert — Backer, Handb. Fl. Java 1 (1925) 86; Backer & Bakh. f., Fl. Java 3 (1968) 135.

Native of Mexico; cultivated as an ornamental. Perigone 3.5–5 cm long, white, tinged with pink.