AMARYLLIDACEAE
(including Hypoxidaceae)
(D.J.L. Geerinck, Brussels, Belgium)

Perennial herbs with bulbs, tubers or rhizomes. Leaves simple, with parallel nerves. Inflorescences 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), Meierow (1987, 1989), and Meierow & 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 Galcetheae (Galanthus, Leucojum p.p.). Very large pollen (> 100 μm) occurs only in Hymenocallis p.p. Tetragonal tetrads are known in Stenomessson elwesi (Meierow 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 infractectum and a thick nexine traversed by minute channels in the dicolpate pollen of *Crinum americanum* (Amaryllidaceae). An infractectum, gemmate sexine was found in the tetrads of *Stenomesson elwesi*.

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. Infractectum structure might be another important feature separating both types (see above). The latter characterizes all genera of the *Amaryllidaceae* (sensu Dahlgren et al. 1985; see also Schulze 1983 and Snijman 1991), and *Pauridia* of the *Hypoxidioideae* (Thompson 1979; Simpson 1983). The former type is found in all other *Amaryllidaceae*. The two colpi in *Amaryllidaceae* 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 *Hypoxidioideae* have monosulcate, finely reticulate pollen, more or less the same as in most *Amaryllidoideae* and many other monocots.


R.W. J.M. van der Ham

Phytochemistry — Difficulties in demarcating families in *Liliales* are aptly discussed by Cronquist (1981, 1988). He accepted *Iridaceae, Haemodoraceae, Alo(e)aceae, Agaveaceae, 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, Herreriacese, Melianthiaceae, Rusciaceae, 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 lycoreine-type alkaloids seem to be present in every species of Amaryllidoideae and have never been found outside this taxon. Lycoreine-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 lycorein; 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 (acetovanillione), 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 deoxypiscidic 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-diaryl-penta-1-en-4-yn with four phenolic hydroxyls is the aglycone of hypoxoside and the obtusosides of Hypoxis nyasica, obtusa, 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, normelignans or even nonlignans or coniods; 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 orchioides yielded a derivative of 2,3-dihydroxyphenolic aglycone. Simple phenolic glycosides seem to be rather common in Hypoxidaceae. 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. orchioides contain curculigoside, which is 2',6'-dimethoxy salireposide, and cochioside-A, which is xyloglucoside of orcinol (Garg et al. 1989).

Curculigo orchioides 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 alkalones, 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 sapogenin, 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, Hypoxidaceae 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. haemodorin) and as glycosides (e.g. haemocorin). Phenalenone pigments were isolated from species of *Anigozanthos, Conostylis, Haemodorum, Lachenanthes, Macropidia, Phlebocarya, Wachendorfia* and *Xiphidium*. Quite recently a new phenalenone pigment, thrysiflorin, 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 *Lophostola* 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.


R. Hegnauer

**KEY TO THE GENERA**

(Genera of cultivated species included)

1a. Inflorescence always an umbel with 1 to few spathes (*Amaryllidoideae*) .... 2
1b. Inflorescence not an umbel, spathes absent (*Hypoxidioideae*) .... 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
2b. 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
3b. 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 ........................................ Pcratium (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


**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.

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

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


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; spathe 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 purple; 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, Malay, 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).


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; spathe 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.


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


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


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.


Doubtful species.


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


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**


Bulbous herbs. Leaves radical, sessile or subpetiolate. Inflorescences umbellate, many-to 2-flowered, with 2 spathe. 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.


**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.


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


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


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


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, biseriate, 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 biseriate 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.

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 (Pandaran), 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


Native to the Mediterranean region; cultivated as an ornamental. Free part of the filaments 6–10 mm long.

Native of SE Asia; cultivated as an ornamental. Free part of the filaments 2–3 cm long.

PROIPHYS


Bulbous herbs. Leaves radical, petioled, subcircular to elliptic, with numerous parallel nerves. Inflorescences umbellate, many-flowered; spathe 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).
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

1b. 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

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. 4.c.

Distribution — Australia; Malesia: New Guinea (Merauke). Also cultivated in gardens.
Habitat — Woodlands at low altitudes.


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.


Bulb to 8 cm diam. Leaves: petiole 15–60 cm long; limb subcircular to broadly ovate, hardly corrugate 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, 4.a, 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


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. orchiodes

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


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 Burkhill, Dict. Econ. Prod. Malay Penins. 1 (1935) 703.


Curculigo scapiadera 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.


*Curculigo sumatrensis* Roxb., Fl. Ind. 2 (1824) 146; Ridley, Mat. Fl. Mal. Penins. 2 (1907) 66; Fl. Mal. Penins. 4 (1925) 300. — *Molineria sumatrensis* (Roxb.) Herbert ex Kurz, Amaryll. (1837) 84. — Type: *Hort. Kew*, India.


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. 5e.

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. Indonesia 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 sub sessile inflorescences and one with a peduncle 10 cm long.


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.


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. 5 d.

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 (Ambon), 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.


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. 5 e.

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


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

HYPOXIS


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.


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; pedicels 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


Native of Australia; cultivated in New Guinea. Plant sparsely hairy; inflorescence 1–2-flowered.
CULTIVATED SPECIES OF NON-MALESIAN GENERA


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.


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


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


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


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.


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

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

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.


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


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.


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


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


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


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


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


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


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


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


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.

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


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


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


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


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


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


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


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


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


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


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.


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


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


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