A STUDY OF THE GENUS CRINUM (AMARYLLIDACEÆ) IN CAMEROUN

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Abstract: A taxonomic revision of the genus *Crinum* shows that seven species are represented in the flora of Cameroun: *C. purpurascens* Herb., *C. natans* Bak., *C. jagus* (Thomps.) Dandy, *C. glaucum* A. Chev., *C. zeylanicum* (L.) L., *C. distichum* Herb., *C. humile* A. Chev. The karyotypes ($2n = 22$) are presented for all species except for *C. distichum* and *C. humile*. The karyotype of *C. zeylanicum*, including triploid specimens, shows characteristic differences from those of the other species.

Résumé : Une révision taxonomique du genre *Crinum* indique l'existence de 7 espèces au Cameroun : *C. purpurascens* Herb., *C. natans* Bak., *C. jagus* (Thomps.) Dandy, *C. glaucum* A. Chev., *C. zeylanicum* (L.) L., *C. distichum* Herb. et *C. humile* A. Chev. Les caryotypes ($2n = 22$) ont été étudiés pour toutes les espèces, sauf pour *C. distichum* et *C. humile*. Le caryotype de *C. zeylanicum*, y compris celui des individus triploïdes, diffère de celui des autres espèces.

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The genus *Crinum* is pantropical including about 40 species in Africa. For a more detailed introduction to the genus is adviced to the regional revisions by Verdoorn (1973) and Nordal (1977) for South and East Africa respectively.

The present work is a preliminary study for Flore du Cameroun. It is based on material collected by Nordal during an expedition to Cameroun in April 1977 and cultivated in Oslo, together with herbarium material from B, BM, BR, G, K, O, P, WAG and Herbier National Camerounais (HNC).

CRINUM Linné

Sp. Pl. : 291 (1753); Baker, Amaryll. : 74 (1888); Verdoorn, Bothallia 11 : 27 (1973); Nordal, Norw. Journ. Bot. 24 : 179 (1977).

The Camerounian representatives of the genus are bulbous plants with leaves in basal rosette or distichously arranged. Leaves strap-shaped, lanceolate or linear with a more or less thickened midrib. Scape lateral, solid. Inflorescence with 1-15 large flowers, subtended by 2 free bracts.

Flowers regular to slightly irregular, white with red or greenish keel, pure white or pinkish, hypocrateriform or infundibuliform, with a long narrow cylindrical tube always longer than 8 cm. Filaments filiform and anthers versatile. Ovary oblong, with many ovules per locule; integuments lacking; style long (up to 30 cm) with undivided stigma. Fruit a large green to red many-seeded baccate capsule with fleshy wall, indehiscent or bursting irregularly, often with an elongated beak. Seeds globose, somewhat flattened or irregularly shaped, greenish, often germinating in the fruit.

KEY TO THE SPECIES

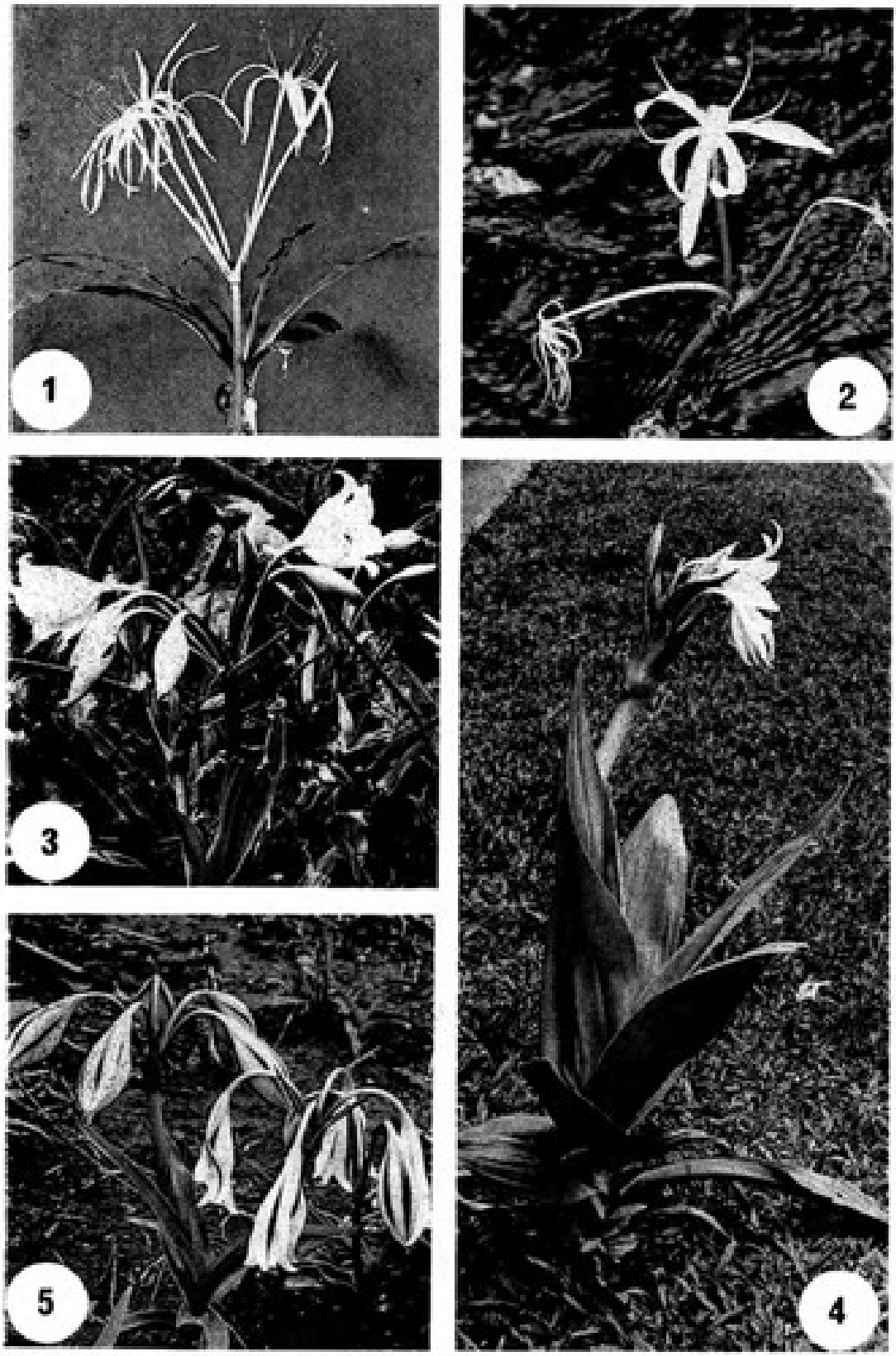
1. Flowers regular, hypocrateriform; perianth tube straight at anthesis; perianth segments linear to narrowly lanceolate, narrower than 1.6 cm (" *Stenaster* ").
   2. Plants with selfsupporting leaves, usually not submerged, margin rarely denticulate; perianth segments inside white, outside reddish, 0.3-0.7 cm broad; filaments purple distally ..... 1. *C. purpurascens*
   2'. Plants with submerged leaves floating like ribbons, margin sparsely denticulate; perianth segments white or with cream dorsal streak, 0.9-1.6 cm broad; filaments white ..... 2. *C. natans*

1'. Flowers irregular, infundibuliform; perianth tube curved during anthesis; perianth segments lanceolate, broader than 1.5 cm (" *Codonocrinum* ").
   3. Flowers pure white or green tinged; perianth tube (10-)13-22 cm long; fruits with a long beak.
      4. Leaves not glaucous, often petiolate, thin in texture, 2.5-8(-12) cm broad, with up to 30 discretely arranged longitudinal nerves with distinct transverse, obliquely angled nerves, margin often undulate ..... 3. *C. jagus*
      4'. Leaves glaucous, not petiolate, subsucculent, 5-15(-20) cm broad, more than 50 closely arranged longitudinal nerves, margin not undulate ..... 4. *C. glaucum*
   3'. Flowers white with a red dorsal streak on the perianth segments; perianth tube 9-12(-15) cm long; fruits with very short or no beak.
      5. Rather robust plants with leaves 1.5-6 cm broad; (1-)3-6(-9) flowers ..... 5. *C. zeylanicum*
      5'. Slender plants with leaves up to 1.3(-2.0) cm broad; 1-2 flowers.
         6. Bulb neck with papery sheaths; leaves distichously arranged, 0.8-1.3(-2.0) cm broad; perianth segments about 2 cm broad ..... 6. *C. distichum*
         6'. The tunics of the bulb breaking up into stiff fibers at the top of the neck; leaves multifariously arranged, 0.2-0.8 cm broad ..... 7. *C. humile*

Crinum sp. A, supposed to be of hybrid origin (? *C. natans* × *C. jagus*), is not included in the key.

1. **Crinum purpurascens** Herbert

Amaryllid. : 250 (1837); BAKER, Curt. Bot. Mag. 106 : *tab. 6525* (1880) & Fl. Trop. Afr. 7 : 396 (1898); DE WILDEMAN, Ann. Mus. Congo, Bot. ser. 5, 2 : 21 (1907); A. CHEVALIER, Rev. Bot. Appliq. 30 : 616 (1950); ANDREWS, Fl. Pl. Sudan 3 : 287 (1956); MOR-



Pl. 1. — **Crinum** from Cameroun: **1, C. purpurascens** from Nyong and Sô Region, Zamakoé, 9 km north of Mbalmayo, *Nordal 902*, after cultivation in Oslo; **2, C. natans** from Nyong and Sô Region, in a river near Mbalmayo, *Nordal 906*; **3, C. jagus** from Adamoua Region, just east of Ngaoundéré, *Nordal 952*; **4, C. glaucum** cultivated at the University of Yaoundé, *Nordal 901*; **5, C. zeylanicum** from Haut Sanaga Region, 5 km northeast of Njoré, *Nordal 909*.

TON, W. Afr. Lil. Orch. : 25 (1961); BERHAUT, Fl. Sencg. : 310 (1967); HEPPER, Fl. W. Trop. Afr., ed. 2, 3 : 134 (1968); AKÉ ASSI, Bull. I.F.A.N., ser. A, 34 : 526 (1972); GEERINCK, Fl. d'Afr. Centr. : 11 (1973).

— *C. purpurascens* HERB. var. *angustilobium* DE WILD., Ann. Mus. Congo, Bot. ser. 5, 1 : 18 (1903).

— *C. koutiense* A. CHEV., Étud. Fl. Afr. Centr. : 306 (1913), *nom. nud.*

TYPE : Specimen in the *herbarium of Herbert*, Fernando Poo (not seen, lost?).

Bulb subglobose, 3-5 cm in diameter, often with a distinct neck and often stoloniferous from the rhizomateous part of the bulb.

Leaves, contemporary with the flowers, multifariously arranged, dark green, paler at the base, rather thin in texture, often sheathed, suberect, linear to strap-shaped, 20-70(-100) cm long, 1-4 cm broad, acute, with prominent midrib, margin glabrous to slightly denticulate, undulate.

Scape red tinged, slender, 20-50 cm long. Bracts membranaceous, early drooping, subtending 2-10 subsessile flowers with faintly sweet scent.

Flowers deep purple and nodding before expansion, later the colour fades. Perianth tube purple tinged, erect at anthesis, 12-20 cm long; segments inside white, outside reddish tinged, spreading or reflexed, linear, 5-9 cm long, 0.3-0.7 cm broad. Filaments purple distally, arcuate, radially arranged, somewhat shorter than the segments. Anthers deep purple to purplish black, 1.2-1.5 cm long. Style purple overtopping the anthers.

Fruits greenish tinged red, distinctly veined, subglobose, diameter 1-3 cm, with a slender beak 8-15 cm long (Pl. 3, *10*). Seeds green, irregular, angular, up to 10 per fruit. — Pl. 1, *1*; 3, *10*.

SELECTED SPECIMENS: *Bates 1283*, Yaoundé, BM; *Letouzey 15045*, près Mundongo, 30 km WNW Muyuka, HNC; *Nordal 902*, Zamakoé, 9 km N Mbalmayo, HNC, O, P; *J. & A. Raynal 10262*, Maan, 24 km ESE Nyabesan, HNC, P; *de Wilde & de Wilde-Duyfjes 1998 & 1998B*, ca. 15 km S Ebolowa, P, WAG.

Crinum purpurascens is bound to the Guinea-Congolean forests and distributed from Gambia east to the Sudan and south to Angola. It is often found in marecageous habitats and near, or even in, rivers. It tolerates disturbed or secondary vegetation and may be found in plantations of e.g. cocoa or banana. In Cameroun it has so far only been collected in the south-western parts (Pl. 4, *14*) from the sea level up to 750 m. According to the vegetation classification by LETOUZEY (1968) *C. purpurascens* is mainly distributed in « forêt littorale » and « forêt biafréenne ».

2. **Crinum natans** Baker

Fl. Trop. Afr. 7 : 396 (1898); HOOKER, Curt. Bot. Mag. 128 : *tab. 7862* (1902); MILDBRAED, Wiss. Ergebn. zweit. Deutsch. Zentr. Afr. Exp. : 52 (1922); A. CHEVALIER, Rev. Bot. Appliq. 30 : 624 (1950); MORTON, W. Afr. Lil. Orch. : 27 (1961); HEPPER, Fl. W. Trop. Afr., ed. 2, 3 : 134, *fig. 364* (1968); AKÉ ASSI, Bull. I.F.A.N., ser. A, 34 : 526 (1972); GEERINCK, Fl. d'Afr. Centr. : 9 (1973); EXELL, Bull. Brit. Mus. Bot. 4 : 392 (1973).

TYPE : *Mann 1416*, Fernando Poo, in fresh water streams (lecto-, K!; isolecto-, P!).

Bulb subglobose, 1-4.5 cm in diameter, often with an elongated rhizomateous part.

Leaves, contemporary with the flowers, multifariously arranged, submerged, shiny, dark green, often semitransparent, unable to support themselves and floating like ribbons in the stream, strap-shaped, up to 140 cm long, 1-5 cm broad, lamina distinctly undulate or not, with a midrib more or less prominent, margin denticulate.

Scape erect, green, paler towards the base, 20-75 cm long. Bracts membranaceous, pale whitish green, erect or drooping, subtending 1-5 sessile to subsessile flowers, faintly to sweetly scented, emerging a few to about 30 cm above the water surface.

Perianth tube greenish, erect, 11-18 cm long; segments pure white or with cream dorsal streak, spreading or drooping, narrowly lanceolate, 5-9 cm long, 0.9-1.6 cm broad. Filaments white, arcuate, radially arranged, somewhat shorter than the segments. Anthers dark green, brown green to black, 1.0-2.0 cm long. Style greenish, overtopping the anthers.

Fruit at water level or submerged, green or reddish, glossy, globose, with a beak of very variable length, 0.5-2(-6) cm. Seeds green, irregular, 5-20 per fruit. — Pl. 1, *2*; 3, *11*.

SELECTED SPECIMENS: *Bamps 1584*, Manengole, 10 km SW Nkongsamba, HNC; *Bos 3727*, Mpolongwe River, 15 km N Kribi, HNC, WAG; *Leeuwenberg 5243*, Bolobo River, 17 km E Kopongo, HNC, WAG; *Letouzey 14441*, Balondo, 25 km SSW Nkongsamba, HNC; *de Wilde & de Wilde-Duyfjes 1749*, Kelé River, 40 km NW Eséka, HNC, K, P, WAG.

Crinum natans grows submerged in rather shallow, running water, firmly rooted in sandy or gravelly soil between rocks. It is distributed in West Africa from Guinea east to Cameroun and south to Zaire. In Cameroun it is bound to the southern and southwestern forests (Pl. 4, *15*). It has been collected from sea level up to about 650 m, and belongs to the « forêt littorale », « forêt biafréenne » and « forêt congolaise » of LETOUZEY (1968).

Different forms are represented in Cameroun. One of them is mainly found in the coastal areas. This form has heavily undulated leaves most often broader than 2 cm with a very prominent, protruding midrib. The other is more common inland and at higher altitudes and has leaves narrower than 1.5 cm, not undulate and without the prominent midrib. The mentioned characters are not modified when the forms are cultivated in aquaria under similar conditions, showing that the features are genetically fixed. Transitional forms occur in nature, and we have chosen to interpret the forms as different ecotypes, without giving formal taxonomic rank.

3. **Crinum jagus** (Thomps.) Dandy

Journ. Bot. 77 : 664 (1939); A. Chevalier, Rev. Bot. Appliq. 30 : 623 (1950); Robyns & Tournay, Fl. Sperm. Parc Nat. Alb. 3 : 387 (1955); Andrews, Fl. Pl. Sudan 3 : 286 (1956); Morton, W. Afr. Lil. Orch. : 24 (1961); Hepper, Fl. W. Trop. Afr., ed. 2, 3 : 136 (1968); Aké Assi, Bull. I.F.A.N., ser. A, 34 : 528 (1972); Geerinck, Fl. d'Afr. Centr. : 8 (1973); Exell, Bull. Brit. Mus. Bot. 4 : 391 (1973); Nordal, Norw. J. Bot. 24 : 181 (1977).
— *Amaryllis jagus* Thomps., Bot. Displ. : *tab. 6* (1798).
— *Crinum giganteum* Andr., Bot. Rep. 3 : *tab. 169* (1801).
— *C. vanillodorum* Welw. ex Bak., J. Bot. 1878 : 196 (1878).
— *C. podophyllum* Bak., Curt. Bot. Mag. 106 : *tab. 6483* (1880).
— *C. laurentii* Durand & De Wild., Rev. Hort. Belg. 23 : 97 (1897).
— *C. congolense* De Wild., Miss. E. Laurent (1903-1904) 1 : 370 (1905-07).
— *C. suaveolens* A. Chev., Mém. Soc. Bot. France 2 (8) : 212 (1912).
— *C. bequaertii* De Wild., Pl. Bequaert. 1 : 46 (1921).

Type: Plant from Sierra Leone cultivated in Hackney, England 1798, no specimen preserved. *Table 6 of Bot. Displ.* (1798); lectotype (according to Nordal, 1977).

Bulb globose to elongated, 3-8(-14) cm in diameter, with a distinct neck 5-25 cm long, often with an elongated rhizomateous part (up to 20 cm), and often stoloniferous.

Leaves contemporary with the flowers, multifariously arranged, bright to dark green, rather thin in texture, more or less petiolate, sheathing or not, lanceolate, of very variable length, 15-75(-130) cm long, 2.5-8(-12) cm broad, all leaves usually with intact apex, acute; prominent midrib and up to 30 discrete longitudinal nerves obliquely connected with distinct transverse nerves; margin glabrous to slightly scabrous, often undulate.

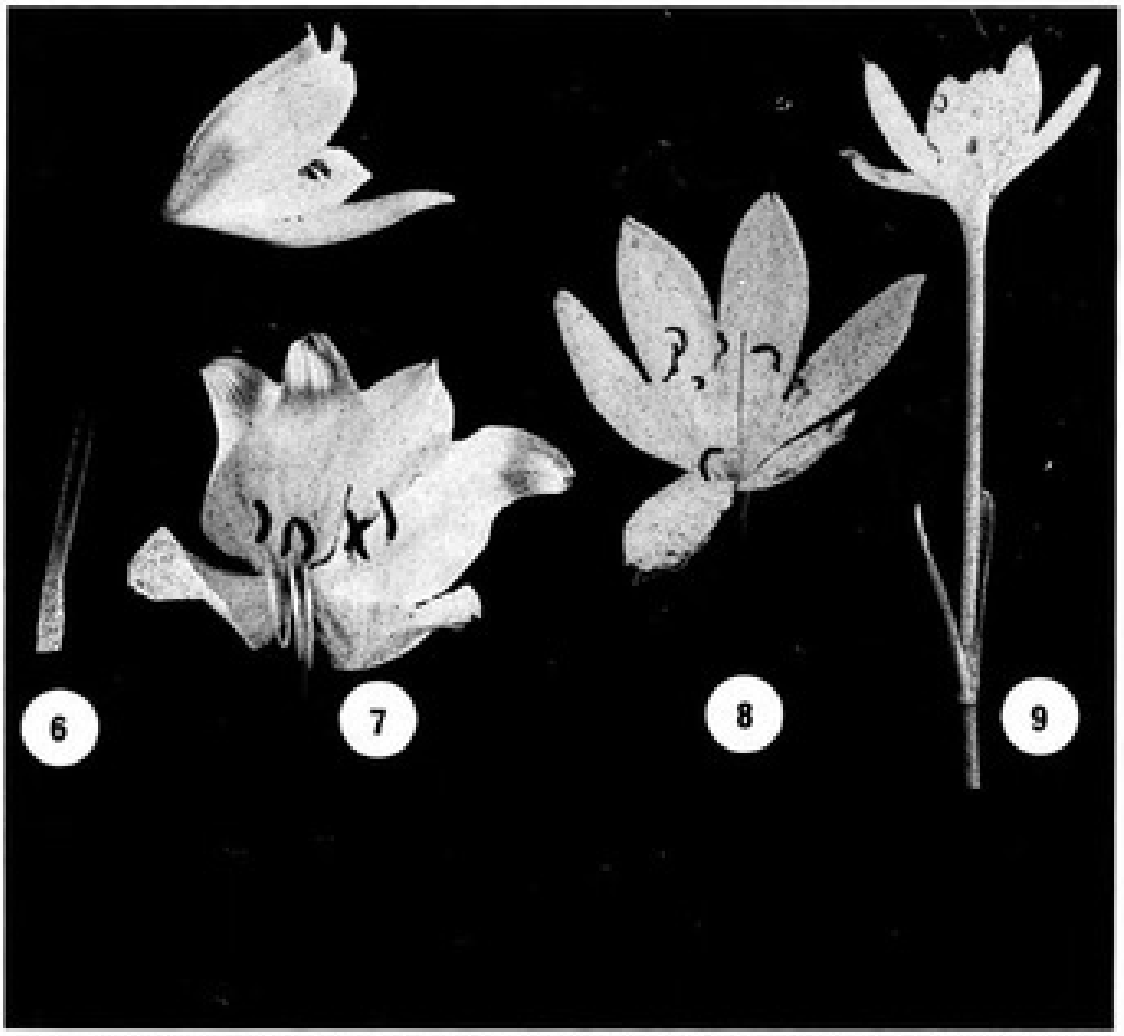
Scape pale green or reddish tinged, stout, 10-75(-90) cm long. Bracts firm, green, erect, subtending 1-7(-17) sessile, sweetly scented flowers.

Perianth tube greenish, slightly curved, (10-)13-22 cm long; segments white, often green-tipped and with greenish dorsal streak, lanceolate, 5-10 cm long, 2-4.5 cm broad, the inner somewhat broader than the outer, spreading during anthesis, with apical part reflexed, forming a rather open bell (Pl. 2, *6*, *7*). Filaments white, zygomorphically declinate, reaching about two thirds of the length of the segments. Anthers black, curved, 0.7-1.0 cm long. Style greenish distally, overtopping the anthers.

Fruit green or red tinged, subglobose, 4-5 cm long and 3-4 cm broad, with a distinct beak 5-9(-13) cm long. Seed greenish, irregularly shaped, largest diameter about 1 cm, 15-30 per fruit. — Pl. 1, *3*; 2, *6*, *7*; 3, *12*.

Selected specimens: *Letouzey 9886*, Elon (route Ebelowa - Mvangan via Biwong Boulou), 60 km ESE d'Ebolowa, HNC, K, P; *Mildbraed 8849*, Deng Deng, K; *Nordal 952*, Adamaoua Reg., just E of Ngaoundéré, HNC, O, P; *J. & A. Raynal 10238*, Maan, 24 km ESE Nyabessan, HNC, P; *de Wilde 2407*, Loum, ca. 10 km W Bangangte HNC, P, WAG.

Crinum jagus is distributed in West Africa from Guinea east to the Sudan and western Uganda and south to Angola. In Cameroun it is rather common from the southern border north to Adamaoua (Pl. 4, *16*).



Pl. 2. — Flower morphology of **Crinum jagus** and a supposed hybrid: **6**, **C. jagus** from Nyong and Sô Region, near Mbalmayo, *Nordal 904*, side view of a flower; **7**, The same flower in front view; **8**, **C. sp. A** (probably hybrid) from Sanaga Maritime Region, Nyong river, *Nordal 978*, flower from above view; **9**, The same flower in side view.

It is bound to rather wet habitats and is especially frequent in riverine vegetation and can even tolerate inondation. It also occurs as a difficult weed (due to the vegetative propagation) in plantations of cocoa, oil palm or banana. It has been collected from sea level up to about 1900 m, and occurs in a wide range of vegetation types: « forêt littorale », « forêt biafréenne », « forêt semi-décidue », « savanes périforestières » and « savanes de l'Adamaoua » (LETOUZEY, 1968). In the savanna *C. jagus* is always restricted to riverine vegetation.

4. **Crinum glaucum** A. Chevalier

Mém. Soc. Bot. France 2 (8) : 212 (1912); HEPPER, Fl. W. Trop. Afr., ed. 2, 3 : 136 (1968); AKÉ ASSI, Bull. I.F.A.N., ser. A, 34 : 528 (1972).

TYPE: *Chevalier 23581*, Dahomey, entre Savé et le pont du chemin de fer sur l'Ouémé (holo-, P!; iso-, K!).

Bulb globose to subglobose, 10-20 cm in diameter, most often without a neck.

Leaves contemporary with the flowers, multifariously arranged, glaucous green, thick almost succulent in texture, not petiolate, erect, lanceolate, up to 100 cm long and 5-15(-20) cm broad, usually all leaves with intact apex; with a distinct midrib and more than 50 close longitudinal nerves with not very distinct transverse connection; margin glabrous and not undulate.

Scape green, very stout, 50-100 cm long. Bracts firm, erect, green, subtending 7-15 sessile and sweetly scented flowers.

Perianth tube greenish, curved, 14-20 cm long; segments pure white or tinged green along the dorsal median part, lanceolate, 7-10 cm long and 3-4.5 cm broad, forming a bell with apical parts reflexed during anthesis. Filaments, anthers and style like *C. jagus*.

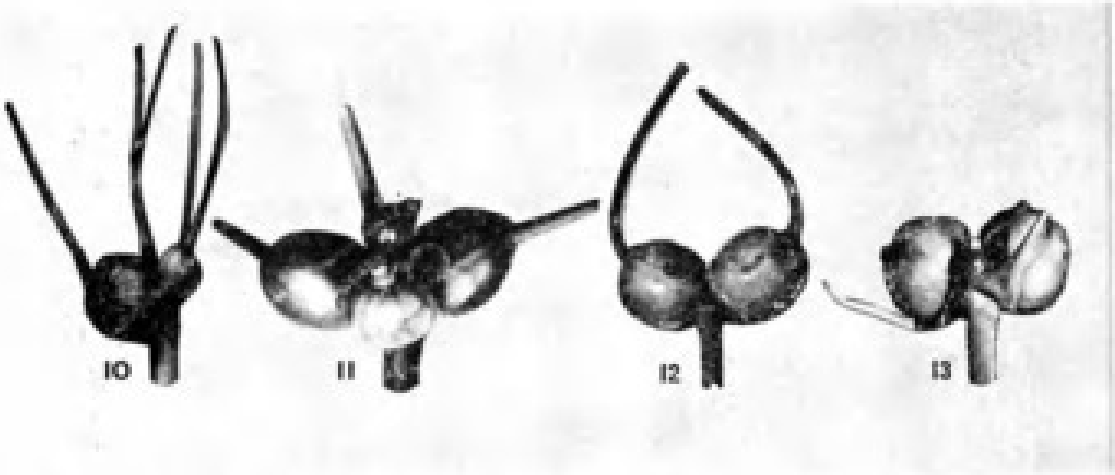
Fruits green, subglobose, diameter 3-5 cm, with a beak up to 15 cm long. Seeds have not been available for study. — Pl. 1, *4*.

SELECTED SPECIMENS: *Dang 140*, Jardin du Lycée Leclerc à Yaoundé, cultivated, P; *Jacques-Félix 4311*, chutes du Ngou Ngoleie, env. Meiganga, P; *Nordal 920, 953*, Adamaoua Reg., near Lac Massot, ca. 10 km E Ngaoundéré, HNC, O, P; *Nordal 971*, Lom et Kadei Reg. : Banbouti, HNC, O, P; *Raynal 10874*, Linté, 1 km NE Bourg, HNC, P.

Crinum glaucum is distributed in West Africa from Guinea to West Uganda. In Cameroun it has been collected in the central parts of the country from the regions Haut Sanaga and Lom et Kadei, north to Adamaoua (Pl. 4, *17*). It is often found cultivated in the Yaoundé area. Naturally the species occurs in swamps, marshy places or riverine vegetation in the savanna areas, from 600 to about 1100 m. According to the vegetation classification of LETOUZEY (1968) it has mainly been collected in « savanes périforestières » and « savanes de l'Adamaoua ».

5. **Crinum zeylanicum** (L.) L.

Syst. Nat., ed. 13, 2 : 236 (1770); BURY, Hexandr. Pl. : *tab. 29* (1831-34); BAKER, Fl. Trop. Afr. 7 : 401 (1898); NORDAL, Norw. J. Bot. 24 : 188 (1977).
— *Amaryllis zeylanica* L., Sp. Pl., ed. 1 : 236 (1753).
— *A. ornata* L. f. ex AIT., Hort. Kew., ed. 1, 1 : 418 (1789).
— *Crinum ornatum* (L. f. ex AIT.) BURY, Hexandr. Pl. : *tab. 18* (1831-34).
— *A. broussonetii* REDOUTÉ, Liliac. : *tab. 62* (1802-16).
— *C. broussonetii* (REDOUTÉ) HERB., Curt. Bot. Mag. 47 : *tab. 2121* (1820).
— *C. spectabilis* ANDR., Bot. Rep. 6 : *tab. 390* (1804).
— *C. yuccæflorum* SALISB., Parad. Lond. 2 : *tab. 52* (1805-08).
— *C. scabrum* HERB., Curt. Bot. Mag. 47 : *tab. 2180* (1820).
— *C. broussonetianum* HERB., Amaryll. : 260 (1837).
— *C. kirkii* BAK., Curt. Bot. Mag. 106 : *tab. 6512* (1880).
— *C. sanderianum* BAK., Gard. Chron. 1884 (2) : 102 (1884).
— *Brunswigia massaiana* L. LIND. & E. ROD., L'Illustr. Hort. 34 : 55 (1887).



Pl. 3. — Infrutescences of **Crinum** : **10, C. purpurascens** from Nyong and Sô Region, Zamakoé, 9 km north of Mbalmayo, *Nordal 902*; **11, C. natans** from Nyong and Sô Region, near Mbalmayo, *Nordal 906*; **12, C. jagus** from Nyong and Sô Region, near Mbalmayo, *Nordal 904*; **13, C. zeylanicum** from Lom and Kadei Region, Banbouti, *Nordal 972*.

— *C. massaiianum* (L. Lind. & E. Rod.) N. E. Br., Kew Bull. 1888 : 100 (1888).
— *C. tanganyikense* Bak., Fl. Trop. Afr. 7 : 400 (1898).
— *C. boehmii* Bak., Bull. Herb. Boiss., ser. 2, 3 : 666 (1903).
— *C. corradi* Chiov., Webbia 8 : 6 (1951).
— *C. lituratum* (Reichenb.) Ravenna, Plant Life 33 : 36 (1977), *syn. nov.*
— *C. toxicarium* A. Chev., Mém. Soc. Bot. France 2 (8) : 212 (1912), *non* Roxb. ex Roem., *nom. illeg.*

Type: Plant from West Africa, no specimen preserved. *Tab. 5, fig. 2 in* Ehret, *Plant. et Pap. rar. depict.* (1748); lectotype (according to Nordal, 1977).

Bulb subglobose up to 15 cm in diameter, often with a considerable neck; the bulbs often propagate vegetatively and constitute large clusters.

Leaves, contemporary with the flowers, multifariously arranged, spreading or erect, more or less firm in texture due to the occurrence of vascular sclerenchyma (appearing as white woolly fibers when a leaf is torn), not petiolate, sheathing, narrowly lanceolate to ensiform; length depending on stage up to 75 cm long, although often shorter, 1.5-6 cm broad; outer leaves without apex as if grazed (due to the fact that leaves are perennial: they wither down to the base every dry season, and all except the outer ones will grow out again from the base one more season, then without the apex intact, only the inner new ones have intact apices being acute); thickened midrib, close longitudinal nerves without distinct transverse nerves; margin scabrous, more or less undulate.

Scape green or reddish tinged, stout, 15-65 cm long. Bracts green or reddish tinged, erect, subtending (1-)3-6(-9) sessile flowers.

Perianth tube greenish to reddish, curved 9-12(-15) cm long; segments white with distinct rose to purple dorsal streak, lanceolate 9-11(-13) cm long and 2.0-3.2 cm broad, the inner slightly broader than the outer, during day connivent to a bell with apical parts reflexed, during night more open.

Filaments white, declinate, reaching about two thirds of the length of the segments. Anthers black, curved, about 0.7 cm long, style reddish towards the apex, overtopping the anthers.

Fruit red or greenish tinged with red, subglobose with diameter 3-5 cm, without or with a short beak up to 5 mm long. Seeds light green, closely stacked and irregularly compressed, 15-45 per fruit. — Pl. 1, *5*; 3, *13*.

SELECTED SPECIMENS: *Jacques-Félix 3242*, Foumban à Banyo, plaine de Koti, P; *Letouzey 4702*, près Naboubou, 35 km SE Batouri, HNC, P; *Letouzey 6324*, près Dargala, 30 km ESE Maroua, HNC, P; *Nordal 957*, Doua, about 30 km N Meiganga, HNC, O, P; *Raynal 10516*, Melen, près Yaoundé, P.

Crinum zeylanicum is widely distributed in tropical Africa from Guinea across to Ethiopia and Kenya and south to Angola and Moçambique. It also occurs in India and Sri Lanka. In Cameroun it is common between 4° and 7° N and it is also known north to the Maroua area (Pl. 5, *18*). *C. zeylanicum* seems to prefer areas in the « savane périforestière » and « forêt semi-décidue », which have been cleared or otherwise influenced by man, and is thus common on abandoned cultivations, road sides and secondary bush, on clayish soils, black, brown or red.

The Cameroun material of *C. zeylanicum* is heterogenous. In the arid areas in the north the leaves are fiber-rich, firm in texture and erect, most often not undulate. Towards south the undulate-leaved form is the more common, and the fiber content in the leaves decreases gradually. These features are reasonable to interpret as adaptions to the different drought conditions, and since the variation is transistional they will not be ascribed taxonomic weight. In the botanical literature and the herbarias the name *C. yuccæflorum* has often been used for the northern form and *C. ornatum* or *C. sanderianum* for the southern.

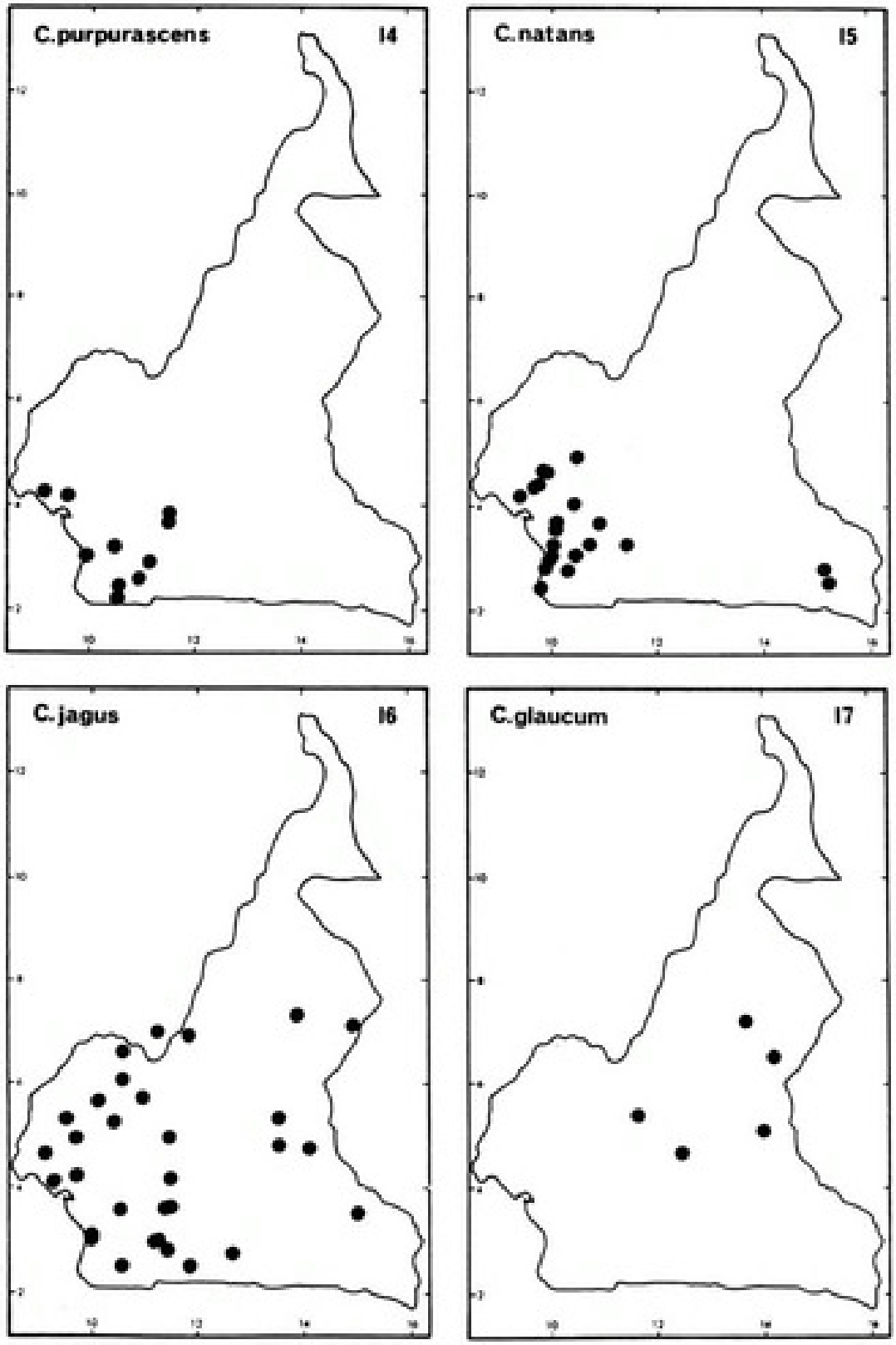
In the Adamaoua area triploids have been found (see later). These forms may be recognized on the abortive fruits.

6. **Crinum distichum** Herbert

Amaryll. : 260 (1837); BAKER, Fl. Trop. Afr. 7 : 400 (1898); A. CHEVALIER, Étud. Fl. Afr. Centr. 1 : 306 (1913) & Rev. Bot. Appliq. 30 : 618 (1950); HEPPER, Fl. W. Trop. Afr., ed. 2, 3 : 136 (1968); NORDAL, Norw. J. Bot. 26 : 150 (1979).
— *Amaryllis ornata sensu* GAWL. *non* L. f. ex AIT., Curt. Bot. Mag. 31 : *tab. 1253* (1810).
— *C. pauciflorum* BAK., Journ. Bot. 1878 : 195 (1878).

TYPE: *Afzelius s.n.*, Sierra Leone. The type is probably represented by one specimen in British Museum, but the exact typification is not clear. Due to the reference of HERBERT (1837) to an unambiguous illustration (" *Amaryllis ornata* ", Curt. Bot. Mag. 31 : *tab. 1253*, 1810), HERBERT's concept of the species is clear.

Bulb subglobose 4-8 cm in diameter with a neck surrounded by papery old leaf bases.



Pl. 4. — Distribution maps of **Crinum** in Cameroun: **14, C. purpurascens; 15, C. natans; 16, C. jagus; 17, C. glaucum.**

Leaves contemporary with the flowers or developed afterwards, most often distichously arranged, firm in texture and rich in vascular sclerenchyma, not petiolate, sheathing, erect, linear, canaliculate, length depending on stage up to about 50 cm long and 0.8-1.3(-2.0) cm broad, most leaves without intact apex as if grazed, only the few inner with obtuse apex, margin smooth to scabrous, never undulate.

Scape slender, 15-30 cm. Bracts erect, subtending 1-2 sessile flowers. Flowers and fruits very similar to *C. zeylanicum*.

EXAMINED SPECIMENS: *Geerling & Ndné 4791*, Garoua, HNC; *Letouzey 6323*, près Dargala, 30 km ESE Maroua, HNC, P; *Letouzey 6484*, près Balaza, 20 km ENE Maroua, HNC, P.

Crinum distichum is distributed through the northern parts of the West-African savanna from Senegal to the Sudan. In Cameroun it has only been collected north of 9° N (Pl. 5, *19*). It is found in seasonally flooded areas, often on thin soils in transitional grasslands. In the vegetation classification of LETOUZEY (1968) it belongs at the « savanes plus ou moins boisées de la Benoué » and « steppes sahéliennes ».

Crinum distichum is closely related to *C. zeylanicum* and probably evolved from it by adaptions to the more extreme conditions of the arid, but seasonal flooded, areas. Herbarium specimens of slender few-flowered representatives of *C. zeylanicum* from North Cameroun and *C. distichum* may be difficult to delimitate.

7. **Crinum humile** A. Chevalier

Rev. Bot. Appliq. 30 : 620 (1950) [as " *C. humilis* "]; HEPPER, Fl. W. Trop. Afr., ed. 2, 3 : 136 (1968); NORDAL, Norw. J. Bot. 26 : 150 (1979).

TYPE: *Chevalier 24530*, « Soudan Français », Gourma, de Fada à Koupela (holo-, P!).

Bulb 3-4 cm in diameter, with a neck surrounded by tunics breaking up into stiff fibers at the top.

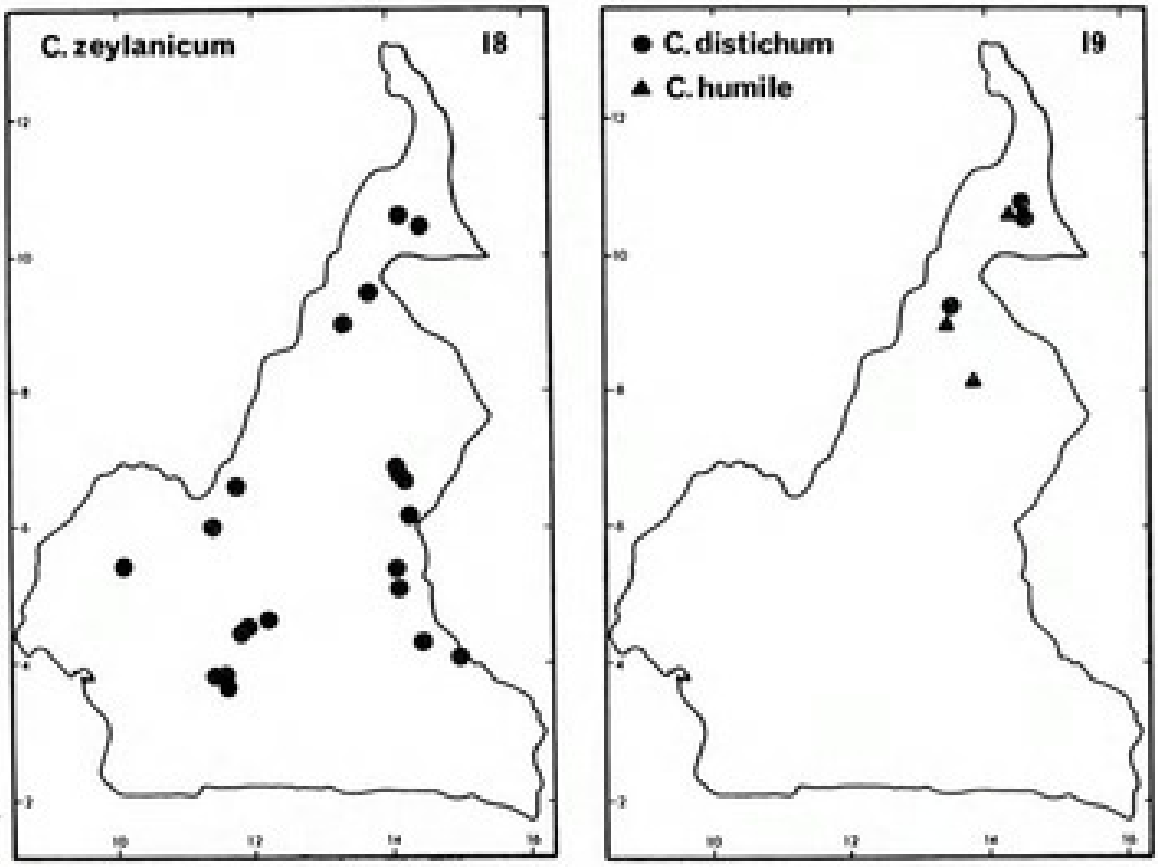
Leaves contemporary with the flowers or developed afterwards, multifariously arranged, reddish near the base, not very firm in texture, sometimes with white woolly fibers, more or less petiolate, not stiffly erect, flat to involute, up to 30 cm long and 0.2-0.8 cm broad, apex if present, rather acute, distinct midrib, margin smooth, undulate or not.

Scape slender, 10-20 cm long. Bracts erect, subtending one sessile flower.

Perianth tube curved, 9-12 cm long, segments white with pink to purple dorsal streak, lanceolate, 7.5-9 cm long, 1.5-2 cm broad, connivent to a bell. Filaments declinate. Anthers black to brownish, curved.

Fruits and seeds have not been available for study.

EXAMINED SPECIMENS: *Geerling 4513*, 2 km NW Gashiga, HNC; *Geerling 4727*, Parc Nat. de la Bénoué, HNC; *Vaillant 325*, Maroua, P.



Pl. 5. — Distribution maps of **Crinum** in Cameroun: **18, C. zeylanicum; 19, C. distichum** and **C. humile.**

C. humile is distributed in the northern parts of the West African savanna belt from Guinea to the Central African Republic. In Cameroun it has been collected in the same area as *C. distichum* (Pl. 5, *19*).

C. humile is closely related to *C. distichum*. It also resembles *C. minimum* Milne-Redhead from south tropical Africa.

C. distichum and *C. humile* are not thoroughly understood, and collection of more material is encouraged. Especially bulbs or seeds for cultivation should be welcomed.

8. **Crinum sp. A** (probably hybrid)

Bulb globose with diameter about 5 cm.

Leaves multifariously arranged, thick almost succulent in texture, erect, canaliculate, about 40 cm long and 2-2.5 cm broad, with a distinct midrib, margin slightly denticulate.

Scape 25-45 cm long. Bracts erect, green, subtending 1-2 sessile and faintly scented flowers.

Perianth tube greenish, erect, 12-14 cm long, segments pure white, green tipped, narrowly lanceolate 6-7 cm long and 1.5-2.5 cm broad. Flower shape variable, segments most often connivent to a cup (cyathiform) rather than to a bell (Pl. 2, *8*, *9*). Filaments slightly arcuate in nearly radially symmetrical arrangement. Anthers black.

Fruit green, subglobose with beak 3-4 cm.

These plants were collected on small islands near the mouth of Nyong river (*Nordal 978*, HNC, O, P). They seem to combine features of *C. jagus* and *C. natans*. Flower shape is more or less intermediate, fruits resemble those of *C. jagus*, and the leaves share features with the inland form of *C. natans*, although firmer. The ecology also is intermediate. At the time of collecting, bulbs grew submerged among stones with both leaves and flowers above the water level. Material resembling the described one has been collected in Gabon (*J. N. Davies 326*, K), although the leaves of this collect more resemble *C. jagus*. This specimen has wrongly been identified as *C. biflorum* Bak. The type specimen of *C. biflorum* from Angola, although badly preserved, has pedicellate, typical hypocrateriform flowers and cannot be conspecific.

The true nature of this *Crinum sp. A* cannot be settled until more material has been collected and studied.

CYTOLOGY

The methods used are explained in WAHLSTRØM & LAANE (1979). The investigated material and the chromosome numbers are listed in Table 1.

The karyotypes of *Crinum purpurascens* (Pl. 6, *20*), *C. natans* (Pl. 6, *21*, *22*), *C. jagus* (Pl. 6, *23*), *C. glaucum* (Pl. 6, *24*) and the presumed *Crinum* hybrid, *Crinum sp. A* (Pl. 6, *27*) consist of 11 chromosome pairs: 1 long metacentric-submetacentric, 6 medium submetacentric-subacrocentric and 4 short metacentric-submetacentric ($x = 11 = 1\ L_{m/sm} + 6\ M_{sm/sa} + 4\ S_{m/sm}$). The chromosome pair No. 7 is considered to represent the NOr-chromosome as one or both chromosomes in this pair often reveal a secondary constriction. Karyotypic heterozygosity is common in several pairs and is quite clear in the long pair and in some of the medium and small pairs.

The karyotypes of the investigated specimens of *C. zeylanicum* did not conform with the general basic *Crinum* karyotype as there is no single conspicuous long pair and all pairs are submetacentric except for the pair No. 8 which is subacrocentric-acrocentric (Pl. 6, *25*). This pair may possess a secondary, and in a few cases even a tertiary constriction and is considered to be the NOr-pair. Karyotypic heterozygosites are common in many pairs. Two ploidy levels were present in the material of *C. zeylanicum* i.e. both diploids and triploids were present (Pl. 6, *25*, *26*). A basic

Pl. 6. — Karyotypes of **Crinum** in Cameroun: **20, C. purpurascens,** *Nordal 902*; **21, C. natans,** *Nordal 906*; **22, C. natans,** *Nordal 977*; **23, C. jagus,** *Nordal 904*; **24, C. glaucum,** *Nordal 953*; **25, C. zeylanicum,** *Nordal 916*; **26, C. zeylanicum,** *Nordal 919*; **27, C. sp. A** (possibly hybrid), *Nordal 978*. Localities are given in Tab. 1.

TABLE 1. SURVEY OF THE CYTOLOGICALLY EXAMINED MATERIAL

Species	Voucher specimen	Locality	Habitat	Chromosome no.
Crinum purpurascens	I.N. 900	Yaoundé, near Ntougou. Alt. 750 m.	In banana plantation.	2n = 22
Crinum purpurascens	I.N. 902	Nyong et Sô Region: Zamakoé, 9 km N of Mbalmayo, 3° 35′ N, 11° 30′ E. Alt. 700 m.	In forest.	2n = 22
Crinum natans	I.N. 977	Region Sanaga Maritime: Rivière Grand Doume, about 8 km S of Edea.	Submerged in running water.	2n = 22
Crinum jagus	I.N. 904	Nyong et Sô Region: Mbalmayo, bord du Nyong, près de l'École Forestière, 3° 30′ N, 11° 30′ E. Alt. 630 m.	Riverine forest, submerged during rainy season.	2n = 22
Crinum jagus	I.N. 951	Adamaoua Region, E of Ngaoundéré on the Bélél Road, 7° 19′ N, 13° 37′ E. Alt. 1080 m.	Border of small river, flooded during the rainy season.	2n = 22
Crinum jagus	I.N. 952	Adamaoua Region, E of Ngaoundéré on the Bélél Road, 7° 19′ N, 13° 37′ E. Alt. 1080 m.	Growing as weed in cultivation, near river.	2n = 22
Crinum glaucum	I.N. 920	Adamaoua Region, near Lac Massot, 10 km E of Ngaoundéré, 7° 18′ N,	Heavily grazed swamp.	2n = 22

Crinum glaucum	I.N. 953	Adamaoua Region, near Lac Massot, 10 km E of Ngaoundéré, 7° 18′ N, 13° 41′ E. Alt. 1055 m.	Heavily grazed swamp.	2n = 22
Crinum glaucum	I.N. 971	Lom et Kadei Region: Banbouti.	Mixed vegetation of forest/savanna. Black soil.	2n = 22
Crinum zeylanicum	I.N. 907	Lekie Region, Njoré, 4° 24′ N, 11° 54′ E.	Savanna dominated by Borassus sp. Red soils.	2n = 22
Crinum zeylanicum	I.N. 909	Haut Sanaga Region, 5 km NE of Njoré, 4° 25′ N, 11° 55′ E.	Savanna.	2n = 22
Crinum zeylanicum	I.N. 916	Lom et Kadei Region, just N of Garga Sarali, 5° 22′ N, 14° 1′ E.	Abandoned cultivation, covered with short grass. Lateritic soil.	2n = 22
Crinum zeylanicum	I.N. 965	Adamaoua Region, Boye, about 50 km W of Garoua Bolai. Alt. 940 m.	Savanna. Lateritic soil.	2n = 22
Crinum zeylanicum	I.N. 919	Adamaoua Region, Nbolci, 3 km SE of Nyanbaka, 6° 54′ N, 14° 3′ E.	Abandoned cultivation. On bare red soil.	3n = 33
Crinum zeylanicum	I.N. 957	Adamaoua Region, Doua, about 30 km N of Meiganga.	Burnt savanna, on lateritic soils.	3n = 33
Crinum sp. A (probably hybrid)	I.N. 978	Region Sanaga Maritime, on an island where the Edea-Kribi Road crosses the Nyong River.	On a little island, certainly flooded in the rainy season.	2n = 22

karyotype formula for both ploidy levels of *C. zeylanicum* is: $x = 11 = 8\ L_{sm/sa/a} + 3\ M_{m/sm}$. Comparative chromosome-morphological analyses and meiotic studies indicate the triploids to be autotriploids (Wahlstrøm & Laane, 1979). These triploids may have originated by crosses between diploids and tetraploids, which may occur in the area, or by fusion of an unreduced gamete with a normal one.

The karyotypes of all species investigated, except for *C. zeylanicum*, are in accordance with the general basic karyotype scheme for the genus. As this karyotype is common in most of the cytologically investigated species of the genus (Flory, 1958; Jones & Smith, 1967; Khoshoo & Raina, 1968; Raina & Khoshoo, 1971 a, b, c; Fujishima, 1975), we will consider it to represent the original karyotype. The karyotype of *C. zeylanicum* has to be explained as derived from this original one. The cytotype of *C. zeylanicum* lacks the large metacentrics which is replaced by submetacentrics, and it has one pair of acrocentrics instead of a pair of submetacentrics. Further one pair of acrocentrics occur instead of a pair of submetacentrics or metacentrics. It is possible that these two deviating pairs have arisen by a change of the centromere position caused by pericentric inversions or/and unequal translocations. Therefore the species *C. zeylanicum* will cytologically be considered as more derived than the other examined species of the genus in Cameroun.

The two forms of *C. natans* which are considered as ecotypes, are very similar in both chromosome morphology and number. Thus the cytological investigations give no support for the splitting of *C. natans* in two taxa.

The karyotype of the supposed hybrid *C. sp. A.* is very similar to the karyotypes of its proposed parents *C. natans* and *C. jagus*. As there are no appropriate marker chromosomes in any of the relevant karyotypes, the cytological investigation so far does not elucidate the nature of the supposed hybrid *C. sp. A.*

It has not been possible to include the two northern taxa, *C. distichum* and *C. humile*, in the cytological investigation. Kammacher & Aké Assi (1975) have, however, shown that at least some populations of *C. distichum* is deviating within the genus in having $n = 10$. *C. humile* has never been studied cytologically.

EVOLUTIONARY CONSIDERATIONS

The genus *Crinum* is pantropical. In Africa it is distributed south of the Sahara, and the largest number of species is found in Namibia and South Africa outside Cape. With few exceptions the African species can phytogeographically be referred either to the Sudano-Zambezian region or the Guineo-Congolean region (*sensu* White, 1970). Nordal (1977) forwarded the following hypothesis on evolution in *Crinum:* Provided that the centre of variation corresponds to the centre of origin, the genus

originated in southern Africa. In that case the " older " taxa are among the Sudano-Zambezian ones. The genus may have dispersed northwards, and in the encounter with the forest vegetation, forms may have adapted to the new ecological conditions, and new species may have evolved. *Crinum zeylanicum* with its deviating cytology, was proposed to have an intermediate position and link the rain forest taxa to the savanna taxa. This hypothesis has not been confirmed by this investigation. The " old " karyotypes of the most extreme rain forest species, *C. natans* and *C. purpurascens*, indicate that they are primitive rather than derived. They both have hypocrateriform flowers and belong to the " *Stenaster* " group (formal subgeneric delimitation is not recommended, cf. NORDAL, 1977), which also is the only group of the genus extending to Madagascar, Tropical America and Asia. Further will zygomorphy (as the infundibuliform flowers of the " *Codonocrinum* " group) tend to be derived compared to radial symmetry (as in the " *Stenaster* " group). Hence the new information, especially of the rain forest taxa, seems to reverse the hypothesis of derived contra primitive based on the study of the East African taxa alone. The relationship between the Camerounian taxa might be the following: From a supposed primitive group including *C. purpurascens* and *C. natans*, the closely related *C. jagus* may have evolved and also managed to establish itself under drier climate. *C. glaucum* is further closely related to *C. jagus* and is no longer represented in the forest vegetation. Up to this point no gross cytological differentiation has taken place. The group with red streaked perianth segments consisting of *C. zeylanicum*, *C. distichum* and *C. humile* is considered to be derived. In addition to deviating morphology and cytology we also find adaption to extremely dry conditions within this group. An earlier study of *Hæmanthus* and *Scadoxus*, genera supposed to be primitive within *Amaryllidaceæ*, has concluded correspondingly: The rain forest taxa probably being the older ones (BJØRNSTAD & FRIIS, 1972; FRIIS & NORDAL, 1976). These assumptions are interesting also for the study of the descent of *Amaryllidaceæ* from *Liliaceæ*, and will be discussed on a later occasion.

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