

Systematic Revision of the Genus *Pancratium* L. (*Amaryllidaceae*) in Egypt with a New Addition

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Abstract

In Egypt, taxonomic aspects of the genus *Pancratium* L. (*Amaryllidaceae*, *Pancratieae*) were thoroughly studied to point out the most reliable characters for taxon delimitation. Here, we base our species on both geographical and morphological features. The detailed taxonomic revision of genus *Pancratium* is based on field studies and the examination of representative specimens together with the authentic types deposited in the major herbaria of Egypt and Kew. Variations in the aerial scape, spathe, perianth, corona-teeth, pistil, stamens, capsules and seeds, as well as those of leaf base and leaf orientation are good markers to separate the different species. As a result, five species are recognized, including *P. trianthum* as a new record to the flora of Egypt. It is restricted to the south-eastern corner of Egypt (Gebel Elba region) and being unique in possessing solitary spathe and long attenuate leaf base. A specific key and descriptions are given with typifications.

Keywords: Egyptian flora, new records, *Pancratieae*, *Pancratium trianthum*, taxonomy

Introduction

Amaryllidaceae is well-marked by its showy lily-like epigynous flowers as in common onion. According to Meerow and Snijman (1998), *Amaryllidaceae* is about 800 species in 59 genera. Its center of diversity is in South America (28 genera) and Africa (19 genera). Eight genera are growing in Mediterranean and temperate regions of Asia, while only *Crinum* L., is represented in both the Old and New Worlds. It forms one of the climax groups in order Asparagales (Dahlgren *et al.*, 1985; Fay and Chase, 1996). They are probably more closely related to the *Aliliaceae* (formerly *Liliaceae*) and *Hyacinthaceae* but not to *Hypoxidaceae*, *Agavaceae*, *Haemodoraceae* or *Alstroemeriaceae*, with which they have formerly been united. It is separated from *Liliaceae* by its inferior ovary, in addition to its umbellate inflorescence with the characteristic bracts (spathe); the only character formerly separating the two families (Hutchinson, 1959). Species belonged to this family are mostly bulbous rarely rhizomatous herbaceous perennials of diverse habitats.

Many species represented as endangered species like *Pancratium maritimum* in its original range, the sandy coasts of the Mediterranean displaying the Sea (Grassi *et al.*, 2005). Other species like *Pancratium sickenbergeri* is subjected to high levels of grazing. It is commonly found on sand dunes of the Negev Desert (Israel), and characterized by three phenological stages consisting, respectively, of inflorescence, leaves and no above-ground biomass: all stages are subject to herbivory by *Dorcas gazelles* (Ward and Saltz, 1994; Saltz and Ward, 2000). When there is no aboveground biomass, the gazelles dig for underground parts of *P. sickenbergeri* and may consume all or part of the

bulb, which contains most of the plant's volume (Ward and Saltz, 1994).

Within the framework of Engler and Prantl Pax (1887) and Pax and Hoffmann (1930) gave a comprehensive revision of the family *Amaryllidaceae*. According to the habit of the plant and the type of the inflorescence, they reclassified the *Amaryllidaceae* into 4 subfamilies: *Amaryllidoideae*, *Agavoideae*, *Hypoxidoideae* and *Campanematoideae*. Furthermore, they used the presence or absence of corona to subdivide *Amaryllidoideae* into 2 tribes: *Amaryllideae* and *Narcisseae*. Moreover, the former is divided into 6 subtribes; while the latter into 5 tribes. They included the genus *Pancratium* within the subtribe *Eucharidinae* of the tribe *Narcisseae*. Hutchinson's classification (Hutchinson, 1934, 1959) was the first crucial recircumscription of *Amaryllidaceae*, defining the unifying character of the family to be an umbellate inflorescence subtended by an involucre of one or more spatheaceous bracts. He used both vegetative and floral characters to classify the family into 13 tribes and included *Pancratium* within the tribe *Eucharideae*. Now, the present generic circumscription of the genus *Pancratium* within the tribe *Pancratieae* of *Amaryllidaceae* s. str., has gained wide acceptance (Dahlgren *et al.*, 1985; Meerow, 1995; Meerow and Snijman, 1998; Müller-Doblis and Müller-Doblis, 1996; Traub, 1963). This is due to the presence of conspicuous false corona formed by the basal connation of the staminal filaments.

This treatment was accepted by many authors. The works of Andrews (1956), Baker (1898), Björnstad (1973), Dinsmore (1933), El-Gadi (1978), Feinbrun-Dothan (1986), Heller and Heyn (1991), Maire (1959), Meikle (1985), Mill (1984), and Morton (1965) are among the

most useful contributions of *Pancratium*, especially for Egypt region.

In Egypt, *Amaryllidaceae* is represented by two genera *Pancratium* and *Narcissus*, the latter is more widespread and common than the former. Therefore, this study focuses on the genus *Pancratium* as little attention has been paid to its taxonomy. Forsskal (1775) and Delile (1813-1814) reported the occurrence of one species, whereas Boissier (1882) added two other species, of which *P. tortifolium* has been newly described. Sickenberger (1901) added another new species; *P. arabicum*. Altogether, four species of *Pancratium* (viz., *Pancratium maritimum* L., *P. tortuosum* Herb., *P. sickenbergeri* Asch. and Schweinf. ex Barb.-Boiss. and Barbey, and *P. arabicum* Sickenb.) are reported by Boulos (2005), El Hadidi and Fayed (1994/1995), Täckholm (1974) and Täckholm and Drar (1954). *Panocratium aegyptiacum* is conspecific to *P. arabicum* on the basis of the floral characters (especially the perianth). This study included several characters that are not used by Boulos (2005) in delimiting its species. Moreover, synonyms are improved and some others are also included. Our proposed key is not dependent on Boulos's work (2005), as it included more morphological diagnostic characters. The aim of this study is to fill the gap in our knowledge of the taxonomy of the genus *Panocratium* in Egypt, by providing a critical revision of its species, clarifying some older and neglected ones, studying in more detail the most reliable taxonomic characters for the identification of taxa, with similar habitats. This revision revealed the presence of five species, of which *P. trianthum* Herb. is a new addition to the Flora of Egypt.

Material and methods

Morphological data were scored from examinations of Egyptian herbarium specimens as well as the authentic ones kept in Kew (K); examination of fresh material during field trips; and the contribution sources of Björnstad (1973), Boulos (2005), Feinbrun-Dothan (1986), Morton (1965), Täckholm (1974) and Täckholm and Drar (1954).

Herbarium study is based on the examination over 500 herbarium specimens kept in the different Egyptian major herbaria as well as the authentic specimens related to the studied *Panocratium* species. These herbaria were annotated during this study as Cairo University (CAI), the Agricultural Museum (CAIM), the National Research Centre (CAIRC) and the Royal Botanic Gardens in England (K) (acronyms follow Holmgren *et al.*, 1998).

Field work was conducted over 4-years period (2002-2006) to obtain fresh material in their natural habitats for the *in vivo* study of the floral characters, for preparing exsiccate, as well as to gather eco-geographical data, and field observations were made in several localities. (Tab.1). The examined representative specimens were geographically arranged according to the phytogeographical territories of

Egypt proposed by El Hadidi (2000; 14-22). Local geographic distributions have been plotted exclusively using the information from herbarium sheets and field trips. Habitat, flowering period, and common names were provided using the available data on herbarium specimen labels and those reported in the protologue of each taxon. In this study, the species were arranged chronologically, and abbreviations of the authors' names followed Brummitt and Powel (1992). Type and authentic specimens for each taxon were seen by the authors and are followed by (!).

Tab. 1. Locations of the collected *Panocratium* species

Longitudes	Latitudes	Locality	Species
29° 54'	30° 89'	Burg El Arab	<i>Panocratium maritimum</i> L.
27° 85'	31° 23'	Ras El Hekma	
27° 24'	31° 34'	Mersa Matruh	
25° 91'	31° 60'	Sidi Barani	
25° 16'	31° 56'	Sallum	
33° 01'	31° 03'	Bir El Abd	<i>P. sickenbergeri</i> Asch. and Schweinf. ex Barb.-Boiss. and Barbey
33° 58'	31° 06'	El Arish	<i>P. arabicum</i> Sickenb.
34° 09'	31° 20'	Sheikh Zuwayied	
34° 16'	31° 27'	Rafah	
35° 94'	22° 06'	Wadi Yahameib (Gebel Elba)	<i>P. tortuosum</i> Herb.

Results

Panocratium L.

Sp. Pl., ed.1, 290 (1753)-Gen. Pl., ed. 5, 141 (1754).

Synonyms

Zouchia Raf., Fl. Tellur. 4: 22 (1838).

Halmyra Salisb. ex Parl., Nuovi Gen. Sp. Monocot.: 28 (1854).

Bollaea Parl., Bull. Soc. Bot. Fr. 5 (1): 509 (1858); [non *Bollea* Rchb. f., 1852].

Almyra Salisb., Gen. Pl. 108 (1866).

Chapmanolirion Dinter, Deutsch Sudw.-Afr. Fragm.: 49 (1909).

Type species: *Panocratium zeylanicum* L.

A palaeotropical genus with 16 species (Mabberley 1993) distributed from Macaronesia, Mediterranean basin and throughout Africa to Tropical Asia, also introduced and cultivated in many countries.

Key to the species of *Panocratium*

1. Perianth 16-22 cm long; perianth-tube 11-16 cm long, 2-3 times as long as the perianth-segments; coronate-teeth acuminate; style glaucous, 16-22 cm long; aerial scape dilated at the base; plants confined to Gebel Elba region.....2

1'. Perianth 6-16 cm long; perianth-tube 2-12 cm long, shorter than or up to 2 times as long as the perianth-segments; corona-teeth acute; style white, 6-16 cm long; aerial scape dilated at the tip; plants of Mediterranean and desert regions.....3

2. Spathe 1-valved, 2-4 cm diam., apex bifid, margins contorted at the base; corona-teeth 7-11 mm long; free part of filaments 10-15(-20) mm long; leaves slightly twisted developing with or after flowers, base long attenuate, sheath absent3. *P. trianthum*

2'. Spathe 2-valved, 1-2 cm diam., apex entire, margins imbricate; corona-teeth 5-7 mm long; free part of filaments 6-10 mm long; leaves spirally twisted developing with the flowers, base truncate, sheath present...2. *P. tortuosum*

3. Flowers 2-5(-6), 7-10 cm long; perianth-tube 2-4 cm long, shorter than the perianth-segments or rarely equal; free part of filament 3-5 mm long; ovary 1-2 cm long, 2-3 times as long as broad; spathe 3-5 cm long; aerial scape 0.3-0.5 cm diam. at the tip; leaves decumbent on the soil surface, 10-30 x 0.3-1.0 cm, broadest at the middle or below, conspicuously spirally twisted along its whole length; seeds 6-9 x 3-7 mm4. *P. sickenbergeri*

3'. Flowers 10-18 cm long; perianth-tube 5-12 cm long, longer than the perianth-segments; free part of filament 5-10 mm long; ovary 2-3 cm long, at least 3 times as long as broad; spathe 5-8 cm long; aerial scape 0.7-3.0 cm diam. at the tip; leaves erecto-patent above the soil surface, 15-80 x 1.0-3.0 cm, broadest at the middle or above, straight or arched to slightly twisted near the apex; seeds 10-14 x 6-10 mm.....4

4. Perianth-tube 5-8 cm long, perianth-segments 3-5 cm long, with narrow green mid-stripe (2-4 mm diam.), corona 2-3 cm long; anthers 5-10 mm long; fruit 2-3 x 1.5-2.5 cm; leaves without scarious-membranous sheath at the base.....1. *P. maritimum*

4'. Perianth-tube 8-12 cm long; perianth-segments 5-7 cm long, with broad green mid-stripe (4-6 mm diam.); corona (2.5-)3-4 cm long; anthers 10-17 mm long; fruit 3-5 x 2.5-3.5 cm; leaves with scarious-membranous sheath at the base.....5. *P. arabicum*

1. *Pancratium maritimum* L. Sp. Pl., ed. 1, 291 (1753); Boiss., Fl. Orient. 5(1): 152 (1882)-Ibid. 5 (2): 756 (1884); Asch. and Schweinf., Ill. Fl. Egypte, Mém. Inst. Égypt. 2: 149 no. 1031 (1887)-Ibid., Suppl.: 774 (1889); Asch. in Asch. and Scweinf., Ibid., Suppl.: 805 no. 242, 813 no. 48 (1889); Sickenb., Contrib. Fl. Égypte, Mém. Inst. Egypt. 4 (2): 289 (1901); Muschl., Man. Fl. Egypt 1: 235 (1912); Ramis, Tabell. Fl. Aegypt.: 59 (1929); Dinsm. in Post, Fl. Syr., Pal. et Sn., ed. 2, 2: 609 (1933); Blatt., Fl. Arab. 456 (1939); O. Schwartz, Fl. Trop. Arab. 10: 354 (1939); Täckh. and Drar, Fl. Egypt 3: 359 (1954) [excl. *P. aegyptiacum* as a synonym]; Täckh., Stud.

Fl. Egypt, ed. 1, 457 (1956); Maire, Fl. Afr. Nord 6: 35 (1959); Quézel and Santa, Nouv. Fl. Alg. 1: 215 (1962); Mouterde, Nouv. Fl. Syrie 1: 292 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 657 (1974); El-Gadi in Jafri and El-Gadi, Fl. Libya 51: 3 (1978); R. R. Mill in Davis, Fl. Turkey 8: 380 (1984); Meikle, Fl. Cyprus 2: 1577 (1985); Danin et al., Willdenowia 15 (1): 308 (1985); Feinbrun in Zohary, Fl. Palaest. 4: 108 (1986); El Hussein and Hosni, Taeckholmia 12: 83 (1989); D. Heller and Heyn, Consp. Fl. Orient. 6: 53 (1991); El Hadidi and Fayed, Taeckholmia 15: 189 (1995); El Hadidi, Fl. Aegyptiaca 1(1): 32 (2000); Boulos, Fl. Egypt 4: 87 (2005).

Type specimen : The illustration (t. 10 f. 28) of "*Narcissus maritimus*" in Morison, Pl. Hist. Univ. 2: 365 (1680) [lectotype by Wijnands, for typification see Jarvis (2007)].

Synonyms

Pancratium illyricum Forssk., Fl. Aegypt.-Arab. 209 no. 36 (1775). [non L., 1753].

Type specimen: Egypt: Alexandria garden "Alexandriae, hortensis", 1761-62; Forssk. 1542, 1543 (C) [see Hepper and Friis (1994)].

Pancratium carolinianum L., Sp. Pl. ed. 1: 291 (1753).

Type specimen: Carolina [Lectotype by Smith and Garland, 2003; Jarvis, 2007].

Glabrous herbaceous perennial, 40-70 cm high; bulb solitary or gregarious, usually deeply buried, globose or subglobose to ovoid or oblong-ovoid, 5-10 cm long, 4-9 cm diameter narrowed above into a long cylindrical neck; neck (6-) 10-30 cm long; tunic brownish. Leaves (3-)5-12, developing after flowers, glaucous, broadly linear to oblong-lanceolate or lorate, 15-50 cm long, 1-2 cm diameter, broadest at the middle or slightly above, erect, often twisted near the apex, abruptly narrowed above to a blunt or subacute apex, glabrous near the base; base truncate, without scarious membranous sheath. Aerial scape 1(-2), solid, compressed, glaucous, 10-30 cm long, dilated at the tip (1-2 cm diameter), glabrous. Spathe 2-valved, unequal, imbricate, lanceolate or ovate-lanceolate to subulate, 5-8 cm long, 1-2 cm diameter, gradually or abruptly tapering above into an acute apex. Flowers (3-)5-10(-14), medium-sized, 10-15 cm long, 2-3 times as long as the spathe, fragrant, sessile or shortly pedicelled; pedicels stout, 0.5-1.0(-1.3) cm, shorter than the ovary; perianth white, 8-13 cm long; perianth-tube 5-8 cm long, 1.5-2 times as long as the perianth-segments; perianth-segments white, with a narrow green mid-stripe outside (2-4 mm diameter), erecto-patent, 3-5 cm long, 3-10 mm diameter, outer slightly longer and broader, narrowly spatulate to lanceolate-oblong, obtuse to subacute at the mucronate or shortly cuspidate apex; inner lanceolate to oblong-lanceolate, acute or subacute, perianth-segments 1.5-2 times as long

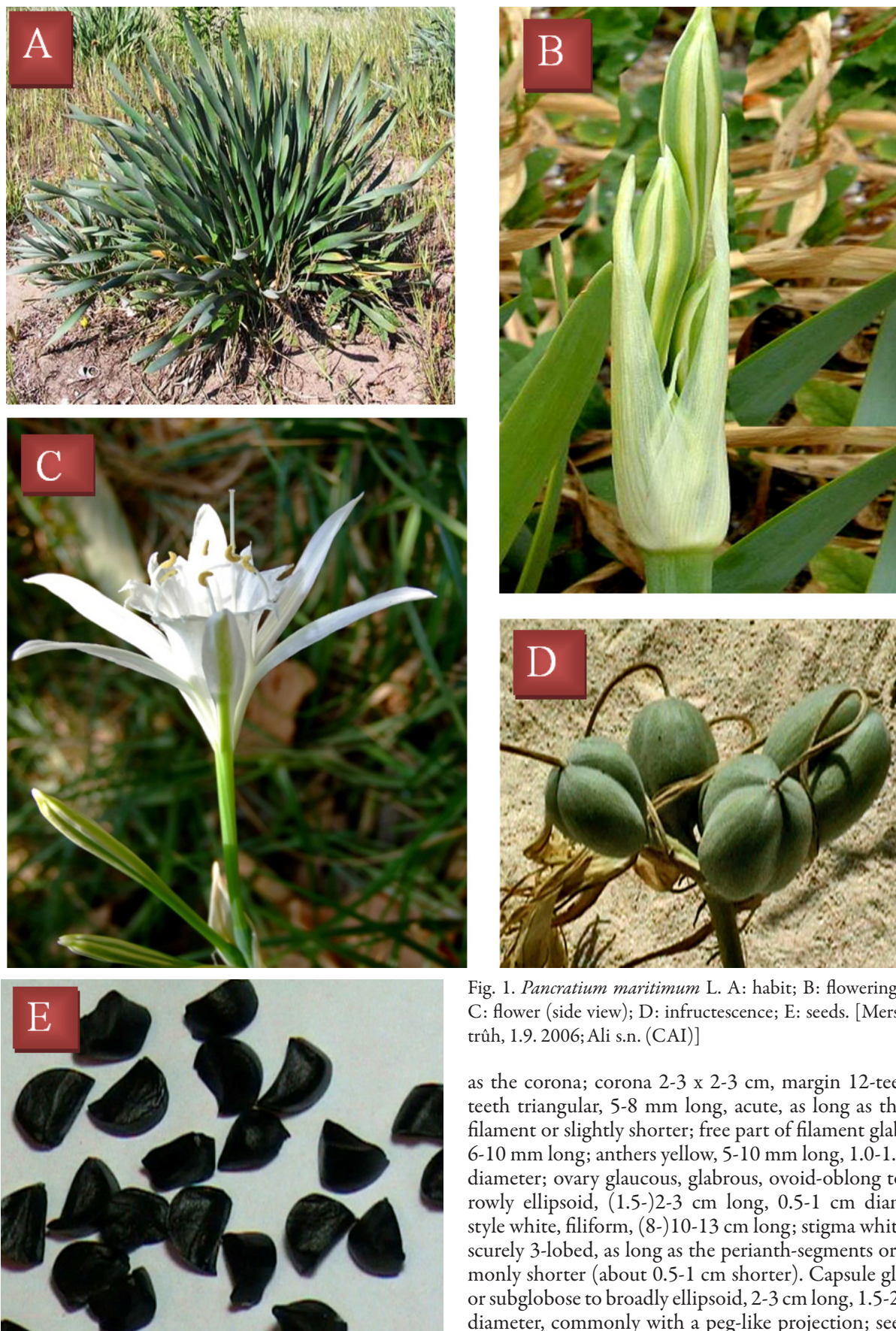


Fig. 1. *Pancratium maritimum* L. A: habit; B: flowering buds; C: flower (side view); D: infructescence; E: seeds. [Mersa Matrûh, 1.9. 2006; Ali s.n. (CAI)]

as the corona; corona 2-3 x 2-3 cm, margin 12-teethed; teeth triangular, 5-8 mm long, acute, as long as the free filament or slightly shorter; free part of filament glabrous, 6-10 mm long; anthers yellow, 5-10 mm long, 1.0-1.5 mm diameter; ovary glaucous, glabrous, ovoid-oblong to narrowly ellipsoid, (1.5-)2-3 cm long, 0.5-1 cm diameter; style white, filiform, (8-)10-13 cm long; stigma white, obscurely 3-lobed, as long as the perianth-segments or commonly shorter (about 0.5-1 cm shorter). Capsule globose or subglobose to broadly ellipsoid, 2-3 cm long, 1.5-2.5 cm diameter, commonly with a peg-like projection; seeds irregularly angular and compressed or cone-shaped, 10-13

3, 3: 13 (1989); D. Heller and Heyn, Consp. Fl. Orient. 6: 53 (1991); El Hadidi and Fayed, *Taekholmia* 15: 189 (1995); Collonette, Wildflow. Saudi Arabia 40 (1999); El Hadidi, Fl. Aegyptiaca 1(1): 74 (2000); Boulos, Fl. Egypt 4: 87 (2005).

Synonyms

Pancratium tortifolium Boiss., Diagn. Pl. Orient., ser. 1, 13: 18 (1854).

Type specimen: Described from Arabia (Hedjaz): "In planitie deserti prope Dscheddam", 20.12.1835; *Schimper* 876 (K, syntype !)-Arabia, 1837; *Fischer* 94 (K, syntype !).

Glabrous herbaceous perennial, 40-60 cm high; bulb solitary or gregarious, globose or subglobose to ovoid, 3-9 cm long, 3-7 cm diameter; neck (8-)10-21 cm long; tunic dark or blackish-brown. Leaves (3-)5-10, developing with the flowers, linear to lanceolate-linear or lorate, 10-40 cm long, 0.5-1.0 cm diameter, broadest at middle or below, erect, conspicuously spirally twisted, gradually tapering above into an acute apex, glabrous near the base; base truncate, with scarious-membranous sheath. Aerial scape 1(-2), solid, compressed, glaucous, 5-15(-20) cm long, dilated at the glabrous base (0.4-1.0 cm diameter). Spathe 2-valved, unequal, imbricate, elongated ovoid or lanceolate-subulate, (4.5-)5-8 cm long, 1-2 cm diameter, gradually tapering above into an acute apex. Flowers 2-5, large-sized, (18-)20-24 cm long, 3-4 times as long as the spathe, fragrant, pedicelled; pedicels stout, (0.5-)1-1.5 cm, commonly shorter than the ovary, rarely equal; perianth white, (16-)18-22 cm long; perianth-tube 11-16 cm long, 2-3 times as long as the perianth-segments; perianth-segments white, with a green mid-stripe outside, patent, 5-7 cm long, outer narrowly spatulate-oblong or lanceolate-oblong, gradually narrowed above to a mucronate apex; inner slightly shorter and narrower, lanceolate-linear, acute, 1.5-2 times as long as the corona; corona 2-4 x 2-3 cm, margin 12-teethed; teeth triangular-acuminate or subulate, 5-8 mm long, as long as the free filament or shorter; free part of filament glabrous, 6-10(-12) mm long; anthers yellow, 5-10 mm long, 1.0-1.5 mm diameter; ovary glaucous, glabrous, 2-3 cm long, 1.0-1.5 cm diameter; style glaucous, filiform, 16-20 cm long; stigma obscurely 3-lobed, subequal to the perianth-segments or commonly shorter (about 0.5-0.7 cm shorter). Capsule oblong-ellipsoid, 2.5-3.5 cm long, 1.5-2 cm diameter, tapering above to an inconspicuous neck; seeds irregularly angular, 4-6 mm long, 3-5 mm diameter, testa black, sublastrous, minutely foveolate (Fig. 3).

Representative specimens examined: Arabian Desert: Wadi Dagalâi, 4.2.1933; *Shabetai* z 2333 (CAIM)-Wadi Hodein, Dif and Abraq, in desert sand, 5.4.1943; *Negumi Pacha* 4726 (CAIM)-Wadi Selilo, on the hills of Hamra and the adjacent wadies, 7.2.1932; *Drar* s.n. (CAIM)-Upstream of Wadi Di-ib, affluent of Wadi

Kiraf, 60-70 km W of G. Elba, 30.1.1979; *Boulos* 12846 (CAIRC). **Red Sea coast:** Exp. to G. Elba district: Coastal plain between Abu Ramad and Mersa Na'am, 5.2.1962; *V. Täckholm et al.* s.n. (CAI)-Mersa Halâib, 22.1.1929; *G. Täckholm* s.n. (CAI). **Gebel Elba:** G. Elba, Wadi El Kil-eibat, 7 km N Wadi Shelatin, frontier station, 10.2.1967; *Osborn and Helmy* s.n. (CAI)-Wadi Aideib, sandy soil, 28.2.1938; *Shabetai* z 5515 (CAIM)-Exp. to G. Elba district: Wadi Aideib, 20.1.1962; *V. Täckholm et al.* s.n. (CAI)-Exp. to G. Elba district; Wadi Yahameib, 22.1.1962; *V. Täckholm et al.* s.n. (CAI)-Wadi Yahameib, 4.11.2005; *Ali* s.n. (CAI)-Wadi Kansisrob, 3.2.1962; *V. Täckholm et al.* s.n. (CAI)-G. Elba: Wadi Kansisrob, 1.2.1979; *Boulos* 12878 (CAIRC)-G. Elba: G. Alafot, 7.2.1962; *V. Täckholm et al.* s.n. (CAI)-Wadi Bir Akwamtra, rocky slope, 19.2.1967; *Osborn and Helmy* s.n. (CAI)-Wadi Rabdeit, on rock, 21.1.1933; *Shabetai* z 2335 (CAIM)-Wadi Rabdeit, on rock, 29.1.1933; *Shabetai* z 2335 (CAIM)-Bot. Dept. Exc. to G. Elba, 23.1-27.1.1929; *G. Täckholm* s.n. (CAI)-G. Elba, 18.1.1930; *Hassib* s.n. (CAI)-G. Elba, 1.1929; *G. Täckholm* s.n. (CAI)-Wadi Mawaw, 28.1.1962; *V. Täckholm et al.* s.n. (CAI)-Wadi El Shallal, 24.1.1962; *V. Täckholm et al.* s.n. (CAI)-Gorge across G. El Shallal, 24.1.1962; *V. Täckholm et al.* s.n. (CAI)-Exp. to G. Elba district: Wadi Oolak, 27.1.1962; *V. Täckholm et al.* s.n. (CAI)-Exp. to G. Elba district: G. Mog, 7.2.1962; *V. Täckholm et al.* s.n. (CAI).

Habitat: Red Sea sandy plains; gravelly hillsides and rocky slopes in adjacent wadies. **Flowering:** January-February.

Distribution: Egypt: Gebel Elba district (SE corner of Egypt): inner plateau of the Arabian Desert, Red Sea mountains and coastal plains (Fig. 4). It occurs in N Africa (SE Egypt), NE Tropical Africa (Sudan) and Arabian Peninsula (W Saudi Arabia, S Yemen, Dhofar) in temperate Asia.

Note: *Pancratium tortuosum* is closely allied to *P. trianthum*. However, the 2-valved spathe, short (5-8 mm) corona teeth, short (6-10 mm) free part of filaments and the base of leaves (truncate, with scarious-membranous sheath) are diagnostic characters of *P. tortuosum*.

3. *Pancratium trianthum* Herb., new to Egypt

Pancratium trianthum Herb., Ann. Nat. Hist., ser. 1, 4: 28 (1840); Maire, Fl. Afr. Nord 6: 39 (1959); Morton, Kew Bull. 19 (2): 340 (1965); Hepper, Fl. W. Trop. Afr., ed. 2, 3(1): 136 (1968); I. Björnstad, Norw. J. Bot. 20 (4): 285 (1973); D. Heller and Heyn, Consp. Fl. Orient. 6: 53 (1991) [non Baker, 1898; non Blatt., 1936; non Schwartz, 1939].

Type specimen: Senegambia, 1837; *Heudelot* 542 (K, holotype !-P, isotype).

Glabrous herbaceous perennial, 40-60 cm high; bulb solitary or gregarious, globose or subglobose to ovoid, 3-6 cm long, 2.5-5 cm diameter; neck (8-)10-13 cm long; tunic

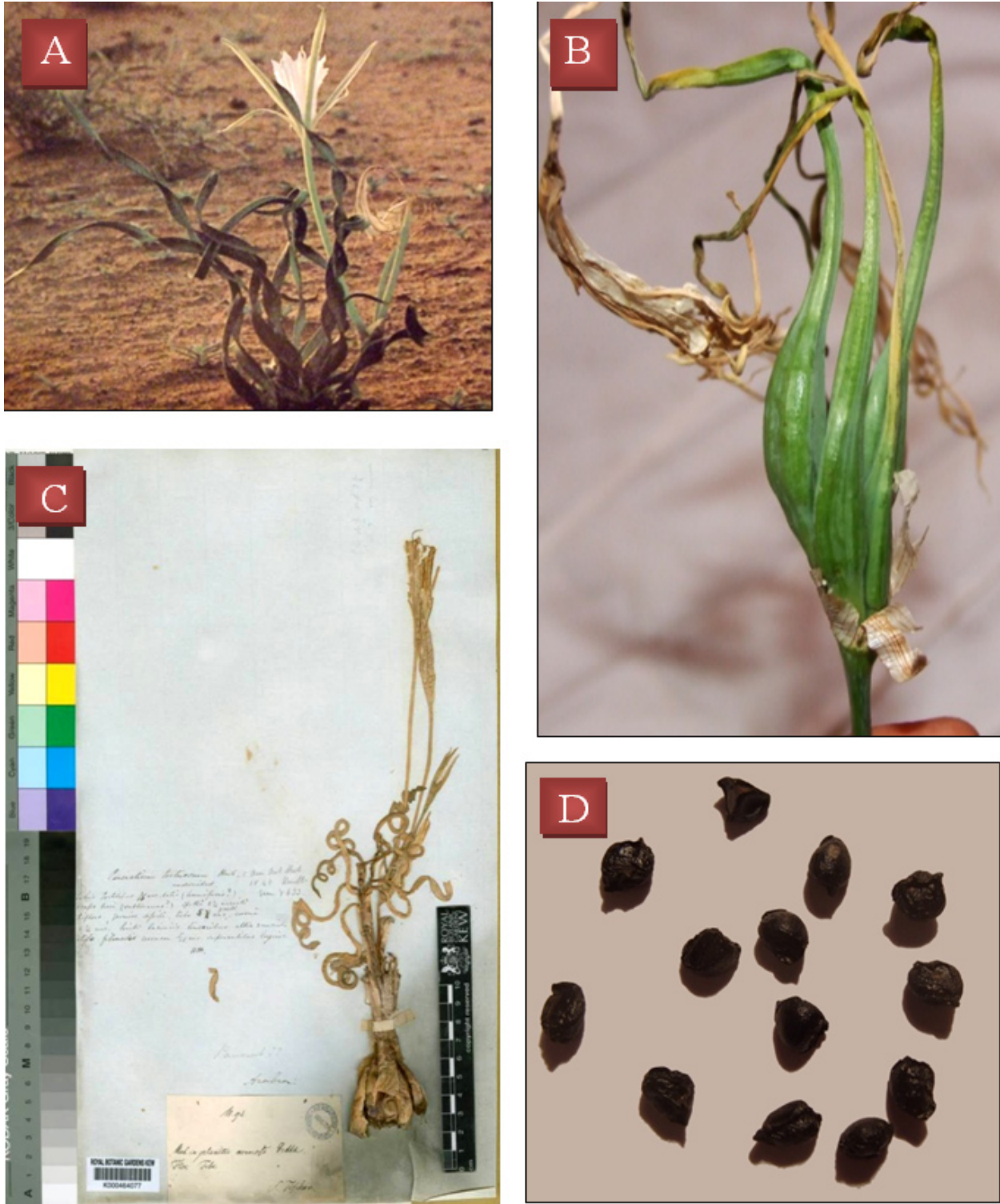


Fig. 3. *Pancratium tortuosum* Herb.; A: habit; B: gynoecium; C: syntype of Fischer 94 (K !); D: seeds. [Wadi Yahameib, 4.11.2005; Ali s.n. (CAI)]

dark or blackish-brown. Leaves (3-)5-10(-15), developing with or after the flowers, glaucous, linear to lanceolate-linear, (6.5)10-30 cm long, 0.3-1.0 cm diameter, broadest at middle or slightly below, erect, slightly twisted, gradually tapering above into an acute apex, glabrous near the base; base long attenuate, without scarious-membranous sheath.

Aerial scape solitary, solid, compressed, glaucous, (6-)10-25 cm long, dilated at the glabrous base (0.2-0.6 cm diameter). Spathe 1-valved, lanceolate or ovate-lanceolate, and with \pm contorted margins at the base, tapering above into an acute apex. Flowers (1-) 2-5, large-sized, (18-)20-24 cm long, 4-6 times as long as the spathe, fragrant, subsessile or

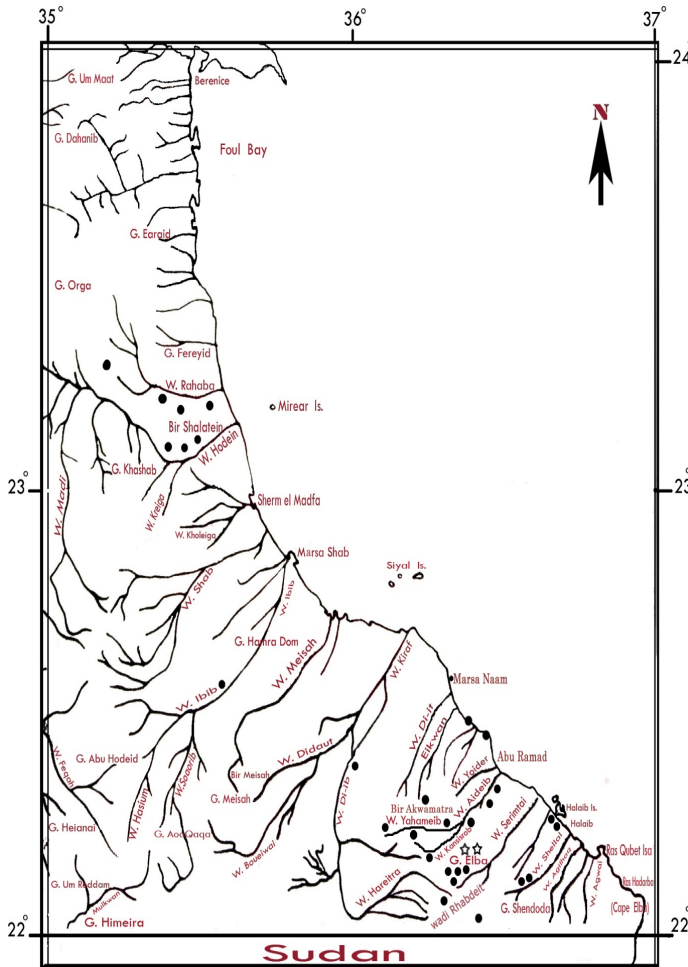


Fig. 4. Distribution map of *Pancratium tortuosum* (●) and *Pancratium trianthum* (☆); ●, ☆ specimens seen by the author

shortly-pedicelled; pedicel 0.2-0.8 (-1.0) cm, shorter than the ovary; perianth white, 17-22 cm long; perianth-tube glaucous, 11-16 cm long, 2-3 times as long as the perianth-segments, white, with a narrow green mid-stripe outside, patent, 5-7 cm long, outer slightly longer and broader, narrowly spatulate-oblong to lanceolate-linear, gradually tapering above to a mucronate apex, inner linear-lanceolate, acute or mucronulate; perianth-segments 1.5-2 times as long as the corona; corona (2.5-)3-4 x 2-3 cm, margin 12-teethed; teeth triangular-acuminate (subulate), 7-10 mm long, shorter than the free filaments; free part of filament glabrous, 10-15(-20) mm long; anthers yellow, 6-10 mm long, 1.0-1.5 mm diameter; ovary glaucous, glabrous, narrowly ellipsoid, 2-3 cm long, 0.5-1.0 cm diam.; style glaucous, filiform, (18-)20-22 cm long; stigma glaucous, obscurely 3-lobed, slightly shorter than the perianth-segments (about 0.7-1.0 cm shorter). Capsule ellipsoidal or cylindrical, c. 3 x 2 cm (from type spec.); seeds not seen (Fig. 5).

Representative specimens examined: **Gebel Elba:** Botany Department Excursion to Gebel Elba district, 23-27.10.1929; *Hefnawy and G. Täckholm* s.n. (CAI)-



Fig. 5. *Pancratium trianthum* Herb. A: Type specimen: Heudelot 542 (K, holotype !). B: Gebel Elba district, 14-16.10.1933: Fah my and Hassi b s.n. (CAI). 1-valved, bifid spathe

Botany Department Excursion to Gebel Elba district, 14-16.10.1933; *Fabmy and Hassib* s.n. (CAI). *Flowering*: October-November.

Distribution: Gebel Elba region in Egypt (Fig. 4). It occurs in North Africa (Morocco, Algeria, Tunisia, Egypt, Sahara), Tropical Africa (W, W-C, NE) eastwards to Arabian Peninsula (Saudi Arabia).

Note: In Egypt, our herbarium specimens are in flower, and the capsule is not seen. Therefore, the size of the capsule is obtained from the type specimen (*Heudelot* 542). *Pancratium trianthum* is closely allied to *P. tenuifolium* Hochst. ex A. Rich. and *P. maximum* Forssk. The three species are characterized by the presence of 1-valved spathe, narrow leaves (1 cm or less), and glaucous or green style and stigma. *Pancratium trianthum* is easily distinguished from *P. tenuifolium* by having glabrous leaves and scape (v.s. finely pubescent); (1-) 2-5-flowered inflorescences (v.s. 1(-2)); shorter (5-7 cm long) perianth-segments (v.s. longer, 7-10 cm long); and contorted margins of the spathe (v.s. not convolute). On the other hand, *P. trianthum* can be distinguished from *P. maximum* by its glaucous leaves (v.s. green); (1-)2-5-flowered inflorescences (v.s. solitary flower); shorter (5-7 cm long) perianth-segments (v.s. longer, 8-10 cm long) and shorter (2.5-4 cm long) corona (v.s. longer, 4-5 cm long). Moreover, *P. maximum* is endemic to SW Arabia.

4. *Pancratium sickenbergeri* Asch. and Schweinf. ex Barb.-Boiss. and Barbey, Herb. Levant 158 (1882); Boiss., Fl. Orient. 5: 153 (1882); Asch. and Schweinf., Garten-Zeit. (Wittmack) 2: 345 (1883)-Ill. Fl. Égypte, Mém. Inst. Égypt. 2:150 no. 1032 (1887); Asch. in Asch. and Schweinf., Ibid., Suppl.: 805 no. 243(1889); Baker, Handb. Amaryll. 118 (1888); Post, Fl. Syr., Pal. et Sn., ed. 1, 777 (1896); Sickenb., Contrib. Fl. Égypte, Mém. Inst. Égypt. 4 (2): 291 (1901); Muschl., Man. Fl. Egypt 1: 234 (1912); Ramis, Tabell. Fl. Aegypt. 59 (1929); Dinsm. in Post, Fl. Syr., Pal. et Sn., ed. 2, 2: 609 (1933); Blatt., Fl. Arab. 456 (1936); Täckh. and Drar, Fl. Egypt 3: 363 (1954); Täckh., Stud. Fl. Egypt, ed. 1, 457 (1956)-Ibid., ed. 2, 657 (1974); Abdallah *et al.*, Notes A.R.C. Herb. Egypt 6: 23 (1984); Collonette, Ill. Flow. Saudi Arabia 45 (1985); Danin *et al.*, Willdenowia 15 (1): 308 (1985); Feinbrun in Zohary, Fl. Palaest. 4: 109 (1986); El Hussein and Hosni, Tackholmia 12: 83 (1989); Migahid, Fl. SA, ed. 3, 3: 13 (1989); D. Heller and Heyn, Consp. Fl. Orient. 6: 53 (1991); El Hadidi and Fayed, Tackholmia 15: 189 (1995); Collonette, Wildflow. Saudi Arabia 40 (1999); Boulos, Fl. Egypt 4: 88 (2005).

Synonyms

P. sickenbergeri Asch. and Schweinf. ex Barb.-Boiss. and Barbey var. *desertorum* Sickenb., Contrib. Fl. Égypte, Mém. Inst. Égypt. 4(2): 292 (1901).

Type specimen: Described from Egypt [El Arich, Tell ech Cheikh et G. Ekfehn, Grande, Forêt pétrifiée et dis-

perse dans le desert a l'Est du Caire]. The illustration (fig. 1) in Asch. and Schweinf., Garten-Zeit. (Wittmack) 2: 345 (1883).

P. sickenbergeri Asch. and Schweinf. ex Barb.-Boiss. and Barbey var. *littorale* Sickenb., Contrib. Fl. Égypte, Mém. Inst. Égypt. 4(2): 292 (1887).

Type specimen: Described from Egypt [Tell ech Cheikh, pays d'el Arich, 1892]. The illustration (Fig. 2) in Asch. and Schweinf., Garten-Zeit. (Wittmack) 2: 345 (1883).

Glabrous herbaceous perennial, 30-40 cm high; bulb solitary, ovoid, 4-10 cm long, 2-5 cm diameter; neck 5-20 cm long; tunic dark or blackish-brown. Leaves 3-9(-13), developing after flowers, glaucous, linear to lanceolate-linear or lorate, (8-)10-30 cm long, 0.3-1.0 cm diameter, broadest at the middle or below, decumbent over the soil surface, spirally twisted along its whole length, gradually tapering above into acute apex, glabrous near the base; base truncate, without scarious-membranous sheath. Aerial scape solitary, solid, compressed, glaucous, 10-17 cm long, dilated at the tip (0.3-0.5 cm diameter), glabrous. Spathe 2-valved, unequal, imbricate, elongated ovoid or lanceolate-subulate, 3-5 cm long, (0.7-)1-2 cm diameter, gradually tapering above into an acute apex. Flowers 2-5(-6), short, 7-10 cm long, 2-3 times as long as the spathe, fragrant, shortly-pedicelled; pedicels stout, 0.3-1.0 cm long, shorter than the ovary; perianth white, 6-9 cm long; perianth-tube 2-4 cm long, as long as the perianth-segments or commonly shorter; perianth-segments 3-5 cm long, white, with a broad green mid-stripe outside, outer rather longer and wider, narrowly spatulate, obtuse to subacute at the mucronate or shortly cuspidate apex; inner lanceolate or ovate-elliptic, acute or subacute, perianth-segments up to 1.5 times as long as the corona; corona 3-4 x 2-3 cm, margin 12-teethed; teeth narrowly attenuate-triangular, 4-6 mm long, 2-3 mm diameter, longer than the free filament; free part of filament glabrous, 3-5 mm long; anthers yellow, 5-10 mm long, 1.0-1.5 mm diameter; ovary glaucous, glabrous, ovoid or oblong-ovoid, 1-2 cm long, 0.5-1.0 cm diameter; style white, filiform, 6-8 cm long; stigma white, obscurely 3-lobed, shorter than the perianth-segments (about 0.5-0.7 cm shorter). Capsule broadly ellipsoid or ovoid, 1.5-2.5 cm long, 1.5-2.0 cm diameter; seeds irregularly angular and compressed or cone-shaped, 6-9 mm long, 3-7 mm diameter; testa black, sublastrous, minutely and closely foveolate (Fig. 6).

Representative specimens examined: Sinaitic sector of the Mediterranean coast: N Sinai: El Arish, 20.3.1928; *G. Täckholm* z 1955 (CAI, CAIM)-N Sinai: 70 km W El Arish, near Misfak, sabkha (salt marsh), 23.2.1984; *Gibali* 26 (CAIRC)-N Sinai: Bir El Abd, 10.9.2004; *Ali* s.n. (CAI). **Isthmic Desert**, Sinai: El Midan, 20 km S El Arish, 2.2.1956; *Boulos* s.n. (CAI)-Sinai, 20 km S El Arish, 15.6.

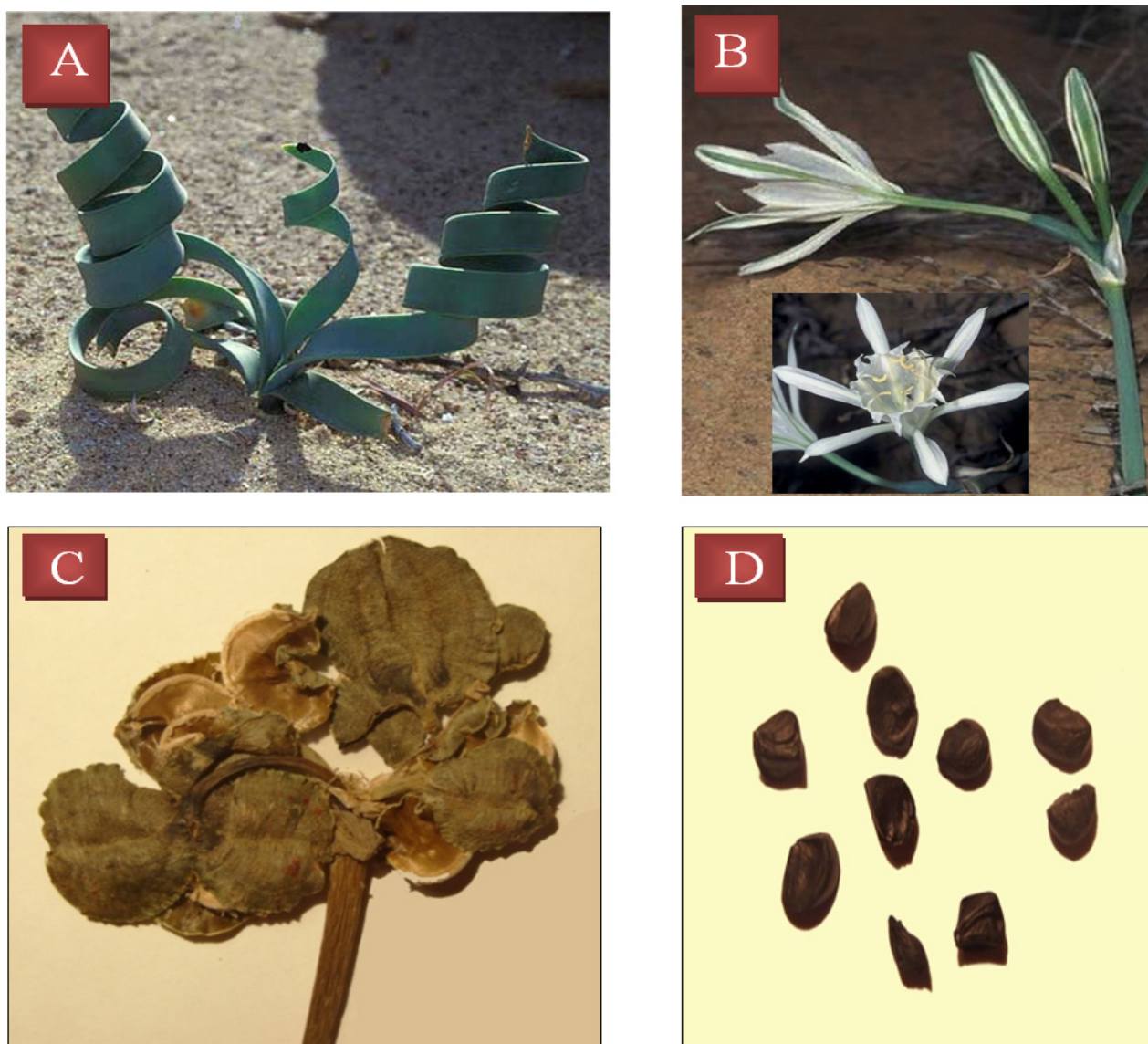


Fig. 6. *Pancratium sickenbergeri* Asch. & Schweinf. ex Barb.-Boiss. and Barbey; A: habit; B: inflorescence (side, front view); C: mature capsules; D: seeds. [N Sinai: Bir El Abd, 10.9.2004; Ali s.n. (CAI)]

1960; *Diab* s.n. (CAI)-Wadi El Arish, in sand, 10.4.1929; *Shabetai* z 810 (CAIM)-Wadi El Arish, 18.3.1955; *Boulos* s.n. (CAI)-Sinai: Rawafaa, 19.9.1965; *Eid* 37 (CAIM)-Wadi el Tih, 20.2.1930; *Oliver* s.n. (CAI). **Galala Desert**, Tell el kebir, in a wadi on the hill side, 23.2.1923; *Simpson* 1817 (CAIM)-Inshas Desert, 9.1.1953; *El Hadidi* s.n. (CAI)-Wadi el Fûl, to the left of Cairo-Suez Road, 14.10.1960; *V. Täckholm et al.* s.n. (CAI)-Cairo-Suez Road, at kilo 20, 10.3.1930; *Oliver* s.n. (CAI)-Cairo-Suez Road, at kilo 28, 17.10.1957; *Ibrahim* s.n. (CAI)-Cairo-Suez Road, at kilo 32, 22.12.1951; *Ayyad* s.n. (CAI)-Cairo-Suez Road, at kilo 32, 22.12. 1951; *Kamel* s.n. (CAI)-Suez desert Road, at kilo 35, Spring 1957; *Imam* s.n. (CAI)-Suez road, 2.3.1956; *Montasir* s.n. (CAI)-Cairo-Suez Road, 3.1.1962; *V. Täckholm et al.* s.n. (CAI)-Wadi Anqâbiya, 24 km E Cairo-Suez Road, 1.2.1945; *Davis and Shabetai* z 6294 (CAIM)-Wadi Anqâbiya, 4.1950; *Ibrahim* s.n.

(CAI)-Wadi Anqâbiya, 28.1.1956; *Imam* s.n. (CAI)-Wadi Anqâbiya near the Suez Road, 16.3.1956; *El Batanouny* s.n. (CAI)-Wadi Liblab, G. el Ahmar, 17.3.1969; *Wissa and Nabih* 3035 (CAIM)-G. El Khashab, on a calcareous hill, 25 km E El Ma'adi, 22.12.1931; *Shabetai* z3002 (CAIM)-G. Yahmûm el Asmar area, Cairo-Suez Road, 8.11.1960; *V. Täckholm et al.* s.n. (CAI)-Great Petrified Forest, red sand, 13.10.1922; *Simpson* 1668 (CAIM)-Wadi Digla, 25 km E El Ma'adi, 16.3.1969; *Abdallah, Costantin and Khattab* s.n. (CAIM)-G. Yahmûm el Abraç, 18 km E Suez Road, 5.3.1945; *Shabetai* 6542 (CAIM)-El Saff Desert: Wadi el Hay, 21.3.1960; *V. Täckholm et al.* s.n. (CAI). **Red Sea coast:** Sinai: El Shatt, sandy plain, 12.4.1937; *Shabetai* z 3961 (CAIM).

Habitat: Sandy desert wadies, waste ground and road-sides, sandy or calcareous hill slopes, gravelly plains, sometimes in red or saline soil. **Flowering:** September-October.

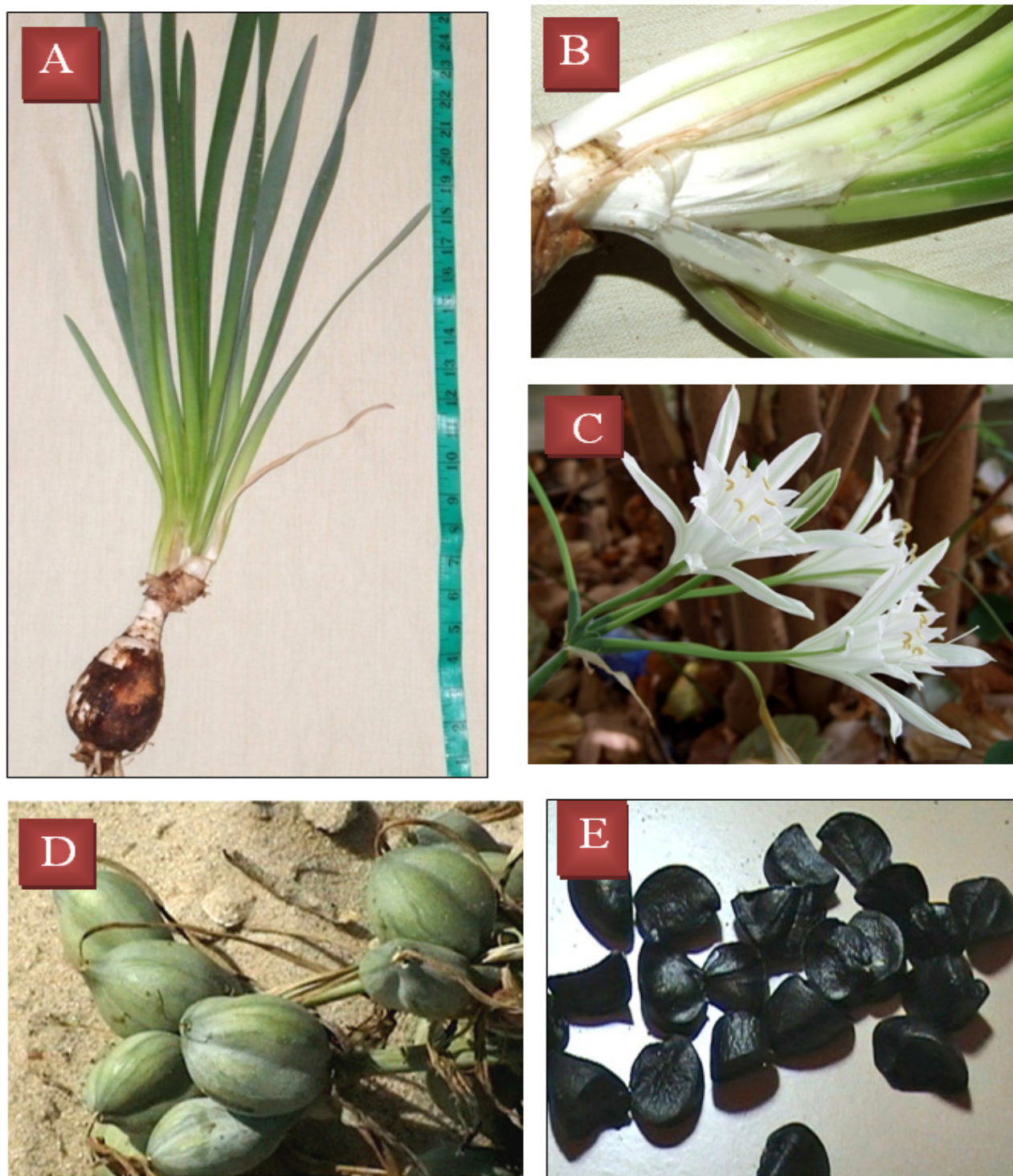


Fig. 8. *Pancratium arabicum* Sickenb. A: habit; B: scarios sheath at leaf-base; C: inflorescence; D: the infructescence; E: seeds. [N Sinai: Rafah-Sheikh Zuwayid, 23.9.2006; Ali s.n. (CAI)]

1.5-2 times as long as the corona; corona 2.5-4.0 x 2-4 cm, margin 12-teethed; teeth attenuate-triangular, 5-8 mm long, acute, as long as the free filament or shorter; free part of filament glabrous, 6-10 mm long; anthers yellow, 10-17 mm long, 1.0-1.5 mm diameter; ovary glaucous, glabrous, ovoid-oblong to narrowly ellipsoid, 2-3 cm long, 0.5-1.0

cm diameter; style white, filiform, 10-16 cm long; stigma white, obscurely 3-lobed, as long as the perianth-segments or commonly shorter (about 0.5-1.0 cm shorter). Capsule oblong-ovoid or broadly ellipsoid to broadly cylindrical, (2.5-)3-4 (-5) cm long, (2-)2.5-3.5 cm diameter, commonly with a peg-like projection; seeds irregularly angular and

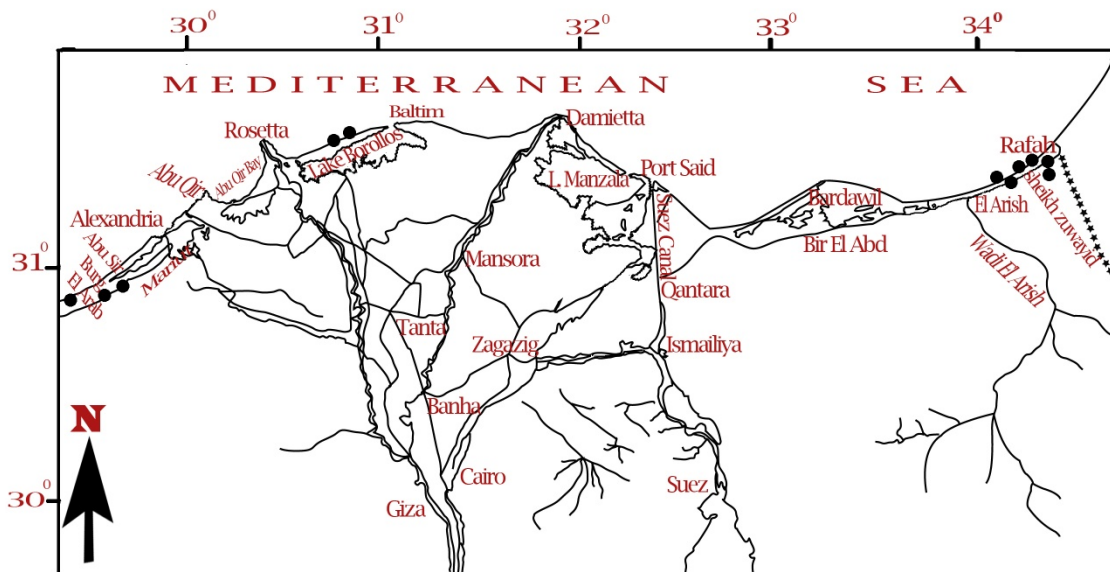


Fig. 9. Distribution map of *Pancratium arabicum*; ● specimens seen by the author

compressed or cone-shaped, 10-14 mm long, 8-10 mm diameter; testa black, sublustrous, minutely and closely foveolate (Fig. 8).

Representative specimens examined: Western Mediterranean coast: W Burg El Borollos, in the sandy dunes, 16.8.1961; *V. Täckholm, Kassas and El Hadidi* s.n. (CAI)-Emad, 3 km W Burg El Borollos, in sand, 16.8.1961; *V. Täckholm, Kassas and El Hadidi* s.n. (CAI)-Burg El Borollos, 9.1952; *Kassas* s.n. (CAI)-Burg El Borollos, 17.8.1961; *V. Täckholm and El Hadidi* s.n. (CAI)-Mariut-Burg El Arab, 15.3.1928; *G. Täckholm* s.n. (CAI). **Sinaitic sector of the Mediterranean coast:** Sinai: Rafah, near the police station, 23.3.1928; *G. Täckholm* s.n. (CAI)-N Sinai: Rafah, sandy dunes, 15.8-8.9.1951; *V. Täckholm, Kassas and Jackos* s.n. (CAI)-N Sinai: Rafah, in maritime sands, 4.3.1987; *Boulos* 786 (CAI)-N Sinai: Rafah, near the beach, 4.3.1987; *Gibali* 786 (CAIRC)-N Sinai: Rafah-Sheikh Zuwayid, 23.9.2003; *Ali* s.n. (CAI)-N Sinai: Rafah, Bir El Meleha, at the coast, 23.3.1928; *G. Täckholm* s.n. (CAI).

Habitat: Sandy maritime seashores and sand dunes. **Flowering:** July-September.

Distribution: Endemic to Egypt and occurs all along the Mediterranean coastal region and Sinai (Fig. 9). It occurs in N Africa (Egypt) and Sinai.

Notes: Several authors such as: Sickenberger (1901), Muschler (1912), Ramis (1929) treated *P. aegyptiacum* as a distinct species, while Täckholm and Drar (1954), Täckholm (1974) treated it as a synonym to *P. maritimum*. *Pancratium arabicum* is misidentified as *P. maritimum*. Therefore, we have examined at some length the diagnostic characters of *P. arabicum* from fresh material during intensive field trips and from different Egyptian herbaria. We concluded that in the absence of leaves, longer (11-16 cm) perianth with longer (8-12 cm) perianth-tube, longer (5-7 cm) perianth-segments with broader (4-6 mm) green

mid-stripe and the size of the capsule (3.5 x 2.5-3.5 cm) distinguish *P. arabicum*.

Although Täckholm and Drar (1954, p. 359) cited *P. aegyptiacum* as a synonym to *P. maritimum*, they again cited Sickenberger specimens (recorded from El Arish; "Tell el Sheikh" and identified as *P. aegyptiacum*) as well as those of Schweinfurth (recorded from Cairo; Birket el Sab' and Damietta and identified as *P. aegyptiacum*) with query as *P. arabicum* (1954, p. 361). However, the diagnostic characters of *P. aegyptiacum* emended by Sickenberger are: broad leaves, long perianth-tube (10-12 cm), long pedicel at anthesis (1.0-1.5 cm) and oblong-ovoid capsule valves are scattered throughout the range of variation in *P. arabicum* without strong geographical bias.

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