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CHENOPODIACEAE

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CHENOPODIACEAE

S.M.H. JAFRI & F.B. RATEEB

Herbs or shrubs, mostly halophytic; leaves usually small, succulent, exstipulate. Flowers often greenish, 1-2-sexual, small, solitary or in clusters, often arranged in spicate or paniculate inflorescences, mostly bracteolate. Perianth segments (tepals) 3-5, rarely 0, persistent. Stamens (1-) 2-5, opposite the tepals, free or united below into a ring, sometimes with alternating staminodes. Ovary 1-celled, with a single basal ovule, usually superior; styles with stigmas 2(-4), free or united at base. Fruit an utricle or achene, rarely a dehiscent capsule, free or adherent to perianth; segments of fruiting perianth sometimes winged or appendiculate; seed horizontal or vertical, with or without endosperm; embryo arcuate, circular or spiral.

A family of c. 100 genera and nearly 1400 species, almost cosmopolitan but mostly of saline and arid regions; represented by 23 genera and 55 species in Libya, where it is one of the common families occurring almost all over the country.

A difficult family with highly variable species which need careful examination.. Indumentum, seed position, embryo shape and « fruit » wings etc. have proved useful taxonomic characters but still to formulate a key for taxa in this family results in practical difficulties beacuse of superficial resemblances in many cases.

Taxa marked with an asterisk (*) are known only from cultivation in our area. Specimens cited are present in the Herbarium, Department of Botany, Faculty of Science, Al-Faateh University, Tripoli, Libya (ULT); those present elsewhere but seen and cited here are so indicated.

1.	+	Stems and branches or both jointed. Leaves mostly opposite, often reduced to scales	2
	—	Stems and branches not jointed. Leaves mostly alternate, (sometimes opposite or reduced)	7
2.	+	Fruiting perianth with transverse, scarious wings on the back	3
	—	Fuiting perianth without wings	5
3	+	Seeds vertical; wings of fruiting perianth 3-5	21. **Anabasis**
	—	Seeds horizontal; wings 5	4

4.	+	Tall shrubs or small trees with very thin, glabrous, spartoid, almost leafless branches; wings of fruitting perianth near the apex; staminodes not glandular	20. **Haloxylon***
		Low shrubs with hairy or glabrous, not spartoid branches; wings of fruiting perianth at the middle; staminodes glandular	19. **Hammada**
5.	+	Leaves small, succulent, scale-like, globular or broadly ovoid, forming small decurrent cupules. Flowers in cone-like or globular or very short cylindrical spikes	12. **Halocnemum**
	—	Leaves 0 or reduced to triangular ends of joints. Flowers in ± elongated spikes	6
6.	+	Annuals; all branches terminating into spike; middle flower larger, subtended by 2 smaller flowers, one on each side, ± at its base in each axil; stamens maturing before gynoecium; stigmas tufted	14. **Salicornia**
	—	Perennials; all branches not ending in spike; 3 axillary flowers arranged ± horizontally; gynoecium maturing before stamens; stigmas 2-3-fid	13. **Arthrocnemum**
7.	+	Plants with short spiny branches. Leaves filiform or linear (sometimes as long as broad); (fruiting perianth winged)	22. **Noaea**
	—	Branches not spiny (except in var. *spinescens* of *Salsola vermiculata*). Leaves spiny or unarmed	8
8.	+	Leaves spiny or spine-tipped, rigid, ± falcate (attenuate with axillary tuft of hairs concealing 5-fid perianth, not winged in fruit)	23. **Cornulaca**
	—	Leaves not spiny (rarely spine-tipped but succulent)	9

9.	+	Flowers unisexual; pistillate flowers without perianth but with 2 enlarged bracteoles enclosing the fruit	10
	—	Flowers usually hermaphrodite (rarely unisexual but fruit not enclosed in brateoles); perianth usually 3-5-parted	13
10.	+	Bracteoles free at least in the upper half	8. **Atriplex**
	—	Bracteoles connate almost to the apex	11
11.	+	Bracteoles connate up to the apex, leathery or spongy in fruit, not spiny-tipped	12
	—	Bracteoles free above, hardened and spiny-tipped in fruit	7.**Spinacia**
12.	+	Leaves alternate, rhomboid. Valves (bracteoles) spongy, inflated, obtriangular	9. **Blackiella**
	—	Leaves opposite, elliptic-oblong. Valves flattened, leathery, neither inflated nor spongy, ± 3-dentate or short-lobed above	10. **Halimione**
13.	+	Flowers in groups of 2-4, connate at their perianth bases. Fruits connate in pairs or triplets, each adnate to indurated perianth (dispersal unit made of a group of fruits)	1. **Beta**
	—	Flowers and fruits not as above	14
14.	+	Fruiting perianth with 3-5, conspicuous, membranous wings; (staminodes absent)	18. **Salsola**
	—	Fruiting perianth wingless (sometimes with minute tubercles or spines, very rarely with minute wing but then plants annual, green with leaves not succulent)	15
15.	+	Perianth lobes hairy or fleecy. Stem and leaves pubescent or tomentose	16
	—	Perianth lobes glabrous or covered with mealy scales or rudimentary protuberances (rarely lobes velvety or glandular)	19

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16.	+	Flowers in dense spikes, hidden by long fleece or petianth provided with spines or conspicuous tubercle on the back	3. **Bassia**
	—·	Flowers neither hidden in fleece nor perianth spiny (sometimes with a minute tubercle)	17
17.	+	Fruiting perianth lobes suborbicular or hemispherical, fleshy, without appendages	18
	—·	Fruiting perianth lobes not hemispherical, but with or without minute wings or tubercles at back	4. **Kochia**
18.	+	Perianth segments 4, usually ± alternately unequal in size	6. **Camphorosma**
	—·	Perianth segments 5, ± equal in size	5. **Chenolea**
19.	+	Fruiting perianth with rudimentary protuberances; leaf shortly spine-tipped, axils fleecy	16. **Traganum**
	—·	Fruiting perianth without protuberances. Leaf not spine-tipped, axils glabrous	20
20.	+	Dwarf annuals. Flowers 3 together, connate with each other and with the subtending fleshy, scale-like bract. Inflorescence composed of oblong, cone-like, alternate spikes. Stamens 1-2 in each flower. Leaves almost globular, clasping	11. **Halopeplis**
	—·	Not as above	21
21.	+	Leaves terete or almost so, strongly succulent, entire	22
	—·	Leaves flat, not succulent; often lobed or dentate	2. **Chenopodium**
22.	+	Leaves alternate	15. **Suaeda**
	—·	Leaves opposite	17. **Nucularia**

CHENOPODIACEAE

1. BETA

L., SP. Pl. 222. 1753; Gen. Pl. ed. 5: 103. 1754

Herbs with furrowed stem and alternate, usually entire leaves. Inflorescence with spike-like branches, composed of (1-) 2-4- flowered clusters; each cluster united at their bases; bracts small to abortive, herbaceous. Flowers small 2-sexual, sessile, greenish; perianth 5-lobed, thickening in fruit; stamens 5, inserted on the rim of glandular, perigynous disk; ovary adherent at base to perianth, 3-carpellary, ± 3-gonous with 2-3 stigmas. Utricles enclosed in perianths that are connate by their swollen bases to form a pseudocarp which becomes detached at maturity; seed horizontal, lenticular or reniform, glossy; embryo annular or almost so.

About 10 species in the Euro-Siberian and the Mediterranean regions; represented by 1, very polymorphic species in Libya.

Beta vulgaris L., Sp. Pl. 222. 1753; Durand & Barratte, Fl. Lib. Prodr. 201. 1910; Pamp., Pl. Trip. 68. 1914; Prodr. Fl. Cir. 175. 1931; Maire, Fl. Afr. Nord. 8: 13, fig. 911. 1962; Zohary, Fl. Palest. 1: 139. fig. 196. 1966; Keith, Prelim. Check List Lib. Fl. 287. 1965. (Fig. 1).

Annual to perennating, stout herb, glabrous to hirsute, up to 100 cm long, decumbent to erect, branched and leafy, green to purplish-violaceous. Leaves usually up to 12 x 6 cm, petiolate, dark-green to reddish-violaceous; radical leaves mostly rosulate, ovate, cuneate to subcordate, obtuse; cauline leaves rhombic-oblong to linear-lanceolate. Clusters (1-) 2-4-flowered, arranged in long, slender, ± interrupted spikes; bracts very variable, longer to shorter than flower clusters, often abortive towards the apex, sometimes suppressed below also, linear-lanceolate. Perianth lobes 2-5 mm long, as long as or exceeding the diameter of the fruit, often incurved and ± keeled in fruit.

A very polymorphic species in habit, flower and fruit size etc. and upon naturalization cultivated beet may produce slender tap root; 2 subspecies can be recognized as follows from our area.

+ Flowering glomerules smaller, usually 1-2 (-3)-flowered, bracteate nearly to the top; perianth lobes c. 2 (-3) mm long; mostly

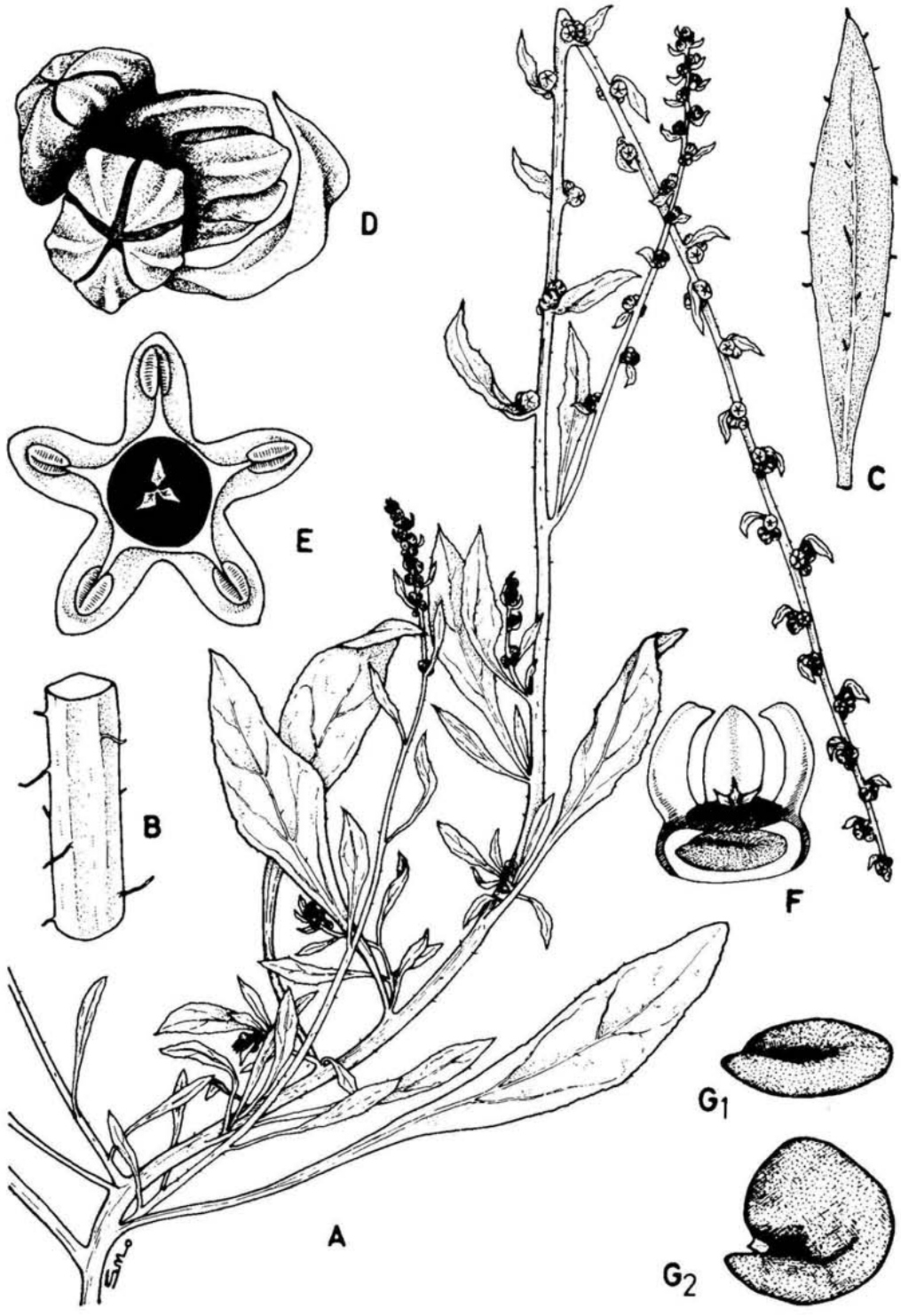

Fig. 1 **Beta vulgaris:** A, flowering and fruiting branch x 1; B, portion of stem x 5; C, upper leaf x 3; D, flowers in one axil x 10; E, flower (dorsal view) x 10; F, V.S. of the same in fruit, showing horizontal seed also x 10; G_1, horizontal seed x 15; G_2 seed (upper view) x 15.

perennial — a) subsp. **vulgaris**

— Flowering glomerules larger, usually 3-4-flowered, irregularly bracteate or bracts abortive; perianth lobes up to 5 mm long; mostly annual — b) subsp. **macrocarpa**

a) subsp. **vulgaris**

B. vulgaris var. *perennis* L., Sp. Pl. 222. 1753; *B. maritima* L., Sp. Pl. ed. 2: 322. 1762; *B. perennis* (L.) Freyn in Wesh. ZBG Wien. 27: 414. 1877; Maire, l.c. 14; *B. vulgaris* var. *maritima* (L.) Boiss., Fl. Or. 4: 899. 1879; *B. vulgaris* ssp. *maritima* (L.) Batt. in B. et T., Fl. Alg. 751. 1890; Maire, l.c. 14; *B. vulgaris* var. *cicla* L., l.c. 222; Maire, l.c. 14; *B. hortensis* Mill., Gard. Dict. ed. 8. no. 2. 1768; *B. sativa* Bernh., Syst. Veg. Erf. 162. 1800; *B. esculenta* Salisb., Prodr. 152. 1796.

Simple to tuberous tap root; stem sturdy, often much branched from the base; inflorescences often elongated and leafy (densely bracteate), and flowers usually smaller with smaller glomerules of fruits.

Type: « Habitat in Angliae & Belgii litoribus maris ».

A-2 13 km from El-kaleba, rocky soil, annual, 10.4.1974, *M. Godeh* 208; c. 10 km before Garian, mountainous valley, 29.3.1972, *Ali & Faruqi* 117; 15 km before Garian, c. 74 km from Tripoli, 27.3.1977, *S.A. Alavi* 1156; **A-3** Sharshara, erect, c. 50 cm tall, 20.3.1974, *G. Faris* 139; Sharshara-Tarhuna, 25.3.1976, *Fathi, B.R.* 30; *id.* 9.4.1974, *Amina, A.A.* 35; before Abugilan, 29.4.1976, *Fathi, B.R.* 60; Lebda, 19.4.1975, *Zenab, A.R.* 203; **A-7** Wadi Lathrun, between Derna and Susa, coastal road, near a ditch, not far from the sea, 19.1.1967, *L. Boulos* 1207; Wadi Derna, 20.1.1967, *L. Boulos* 1245; Susa, prostrate, 28.2.1973, *S.I. Ali* 1059; c. 5 km from Susa on way from Shahat, 20.6.1972, *S.I. Ali* 471; c. 55 km from Baida towards El Merj, roadside, *S.I. Ali* 875; c. 5 km from Ras al Hilal, 19.6.1972, *S.I. Ali* 694; 1 km from Tukrel (Tukra), 17.6.1972, *S.I. Ali* 559; Shahat, prostrate, flowers sessile in leafy spikes, 18.6.1972, *S.I. Ali* 653; Taknes, *S.I. Ali* 557; 20 km from Taknes, 17.6.1972, *S.I. Ali* 576.

A common plant of our coastal areas belonging to the var. *perennis* L. (=*B. maritima* L.).

b) subsp. **macrocarpa** (Guss.) Thell. in Mem. Soc. Sc. Cherb. 190. 1912; Zohary, Fl. Palest. 1: 139. 1966.

B. macrocarpa Guss., Fl. Sic. Prodr. 1: 302. 1827; Pamp., Pl. Trip. 68. 1914; Maire, l.c. 16. fig. 912. 1962; Keith, l.c. 287; *B. bourgaei* Coss., Not. Crit. 44. 1849.

Simple tap root, annual, glabrous; perianth up to 5 mm long, cartilaginous at base, ± subulate, exceeding the fruit; clusters 3-4- flowered.

Type: Described from Sicily.

Reported from Tripolitania (Ouadi Kaam, *Trotter*) by Maire (l.c.). We have not seen any authentic specimen from our area but it occurs in Algeria and may be found here also. Keith (l.c.) records it as cultivated exotic.

Distribution: N. Africa, Europe, Micronesia, Russia, W. Asia.

A widely distributed, polymorphic species. It has often been suggested to call the cultivated forms as *B. vulgaris* and the naturalized and wild ones with separate names but taxonomically it is not sound. It is difficult to separate infra-specific taxa also. Often cultivated for its tuberous roots and leaves for vegetable in our area but its importance for making sugar is well known. However, Keith (l.c.) records the following « varieties » except the last one, cultivated as vegetable etc. from Libya:

var. 1. *cicla* L. - Leaves large, used as vegetable, root hardly fleshy - 'leaf beet'.
var. 2. *rapacea* Koch - 'Garden beet'
var. 3. *rubra* L., - 'Beet root or red beet'
var. 4. *esculenta* (Salisb.) Fiori (=*B. rapa* Dua) 'Sugar beet'.

Fl. March-June *Vern.* Selg, Selk, Banger

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2. CHENOPODIUM

L., Sp. Pl. 218. 1753; Gen. Pl. ed. 5: 103. 1754.

Herbs or small shrubs, glabrous or mealy with usually grooved or angular stems. Leaves mostly alternate and petiolate, frequently lobed or dentate. Flowers small, greenish, in cymose clusters arranged in spike-like or panicled racemes, 2-sexual or pistillate, sessile and bractless. Perianth segments 5, rarely 2-3, free or variously united, sometimes nearly to the apex; stamens 5 (rarely 1-4), free or connate at base. Stigmas 2 (rarely 3-5), simple (rarely 2-lobed). Fruit an utricle with thin, membranous pericarp, usually depressed-globular, free, often included; seed mostly horizontal, lenticular with peripheral embryo.

About 200 species, cosmopolitan but mainly in temperate regions; 7 species are known from Libya.

1. + Seed vertical; perianth 3(-5)-lobed, becoming red and fleshy in fruit — **1. C. foliosum**
   — Seed horizontal; perianth (4-) 5-lobed, remaining green in fruit — 2

2. + Plants usually aromatic and glandular; leaves oblongish — 3
   — Plants odorless or with evil odour, glandless; leaves broader, usually ± ovate — 4

3. + Tall, robust plants, leaves oblong-lanceolate, usually with yellowish sessile glands (or glandless) — **3. C. ambrosioides**
   — Small annuals with darkish, short-stalked glands all over — **2. C. botrys**

4. + Leaves predominantly entire (rarely with 1 or 2 lateral lobes; plants covered with mealy scales, smelling like decaying fish) — **4. C. vulvaria**
   — Leaves almost all dentate or lobed (rarely subentire or entire in *C. album* but then not smelling like decaying fish) — 5

5. + Plants often dark-green, glabrous (farinose on youngest leaves and parts); perianth segments

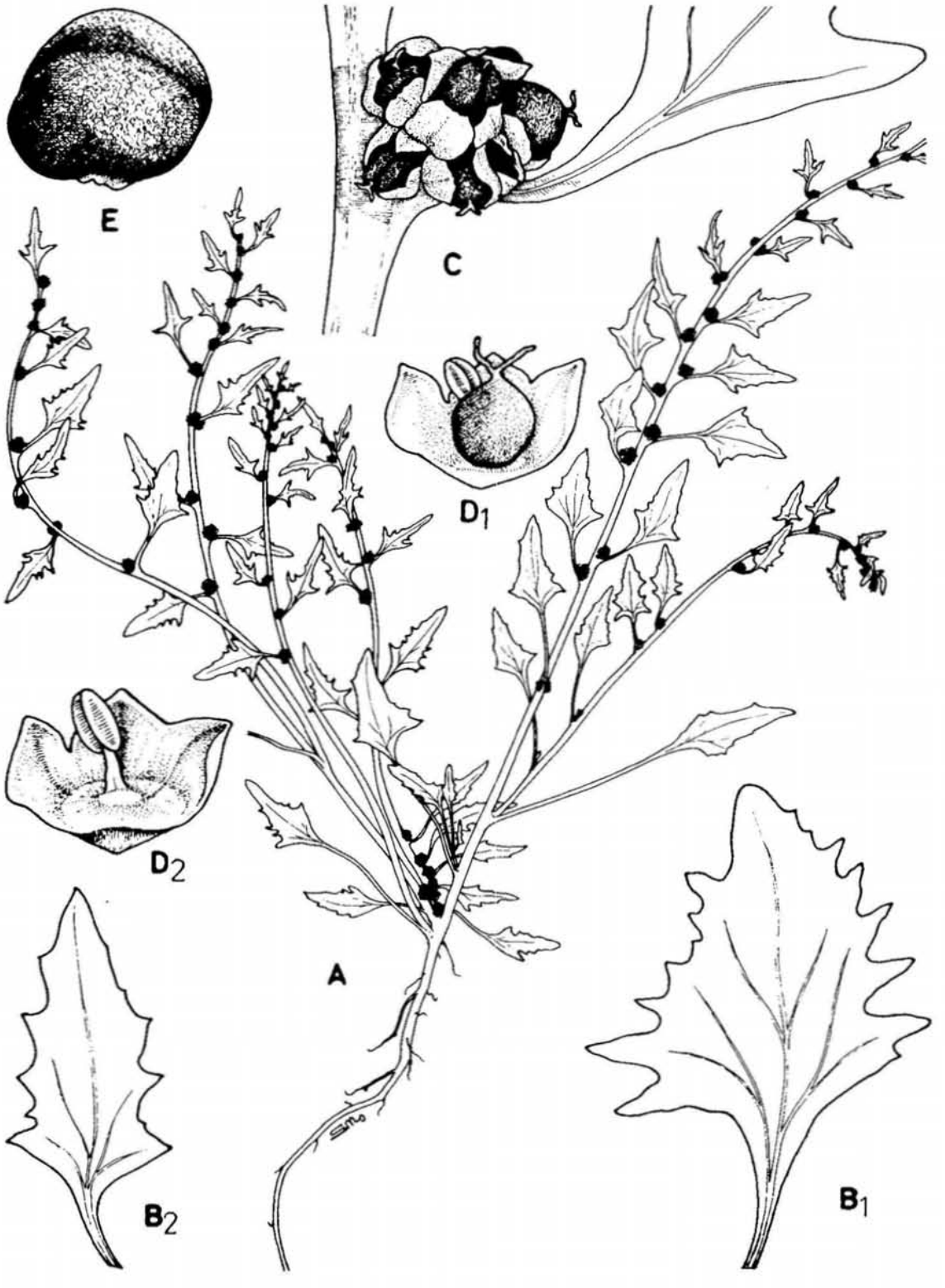

Fig. 2 **Chenopodium foliosum:** A, habit x 0.5; B_1-B_2, leaf variations; C, flowers at fruiting stage x 10; D_1, flower exposed to show a single stamen and fruit (gynoecium) x 20; D_2, the same with fruit removed x 20; E, seed x 25.

		usually with a ± green swelling on the back near the apex	5. **C. murale**
	—	Plants farinose, ± whitish in appearance; perianth segments keeled but not as above	6
6.	+	Tall robust plants with large, triangular to triangular-deltoid leaves, up to 15 cm and coarsely many dentate	7. **C. giganteum**
	—	Smaller or moderate size plants with smaller leaves, ovate-deltoid to oblong-deltoid (sometimes almost lanceolate), up to 5 cm long with few obtuse teeth	6. **C. album**

1. **Chenopodium foliosum** (Moench) Aschers., Fl. Brandenb. 1: 572. 1863; Maire, l.c. 42, fig. 920; Keith, l.c. 358; Aellen in Davis, Fl. Turk. 2: 301. 1966. (Fig. 2)

Blitum virgatum L. Sp. Pl. 4. 1753; Durand & Barratte, lc. 202; Pamp., Pl. Trip. 68. 1914; *Morocarpus foliosus* Moench, Meth. 342. 1794; *C. virgatum* (L.) Ambrosi, Fl. Tyrol. austr. 2: 179. 1857, non Thunb. (1815).

Annual (to perennating?) herb, erect, 20-30 (-70) cm tall, glabrescent, leafy. Lower leaves traingular to hastate or rhomboid, coarsely dentate-serrate, petiolate, with blade up to 5 x 5 cm; upper ones becoming smaller and forming linear-lanceolate bract. Flowers in sessile, dense globose, axillary glomerules. Perianth segments 3 (-5), turning fleshy and red in fruit (submembranous in arid areas); stamen usually 1. Seed vertical (rarely sub-horizontal), dark red-brown, flat or grooved at the margin, densely punctate-pitted, 1-1.3 mm in diameter.

Type: Described from Tatary & Spain, Herb. Linn. 14/2 (LINN).

A-2 Jado, Tarmisa, 6.6.1974, *B. Faris* 424; Seffeat, 13 km before Jefren, 1.5.1974, *G. Faris* 339; **G-8** Gebel Uweinat, 7.11.1968, *L. Boulos* 3237. Also reported from Tripoli by Durand & Barratte (l.c.).

Distribution: Europe, N. Africa, W. & C. Asia.

Dense axillary glomerules of flowers (usually becoming reddish in fruit) distinguishes it from *C. murale* L., with which it may be sometimes confused.

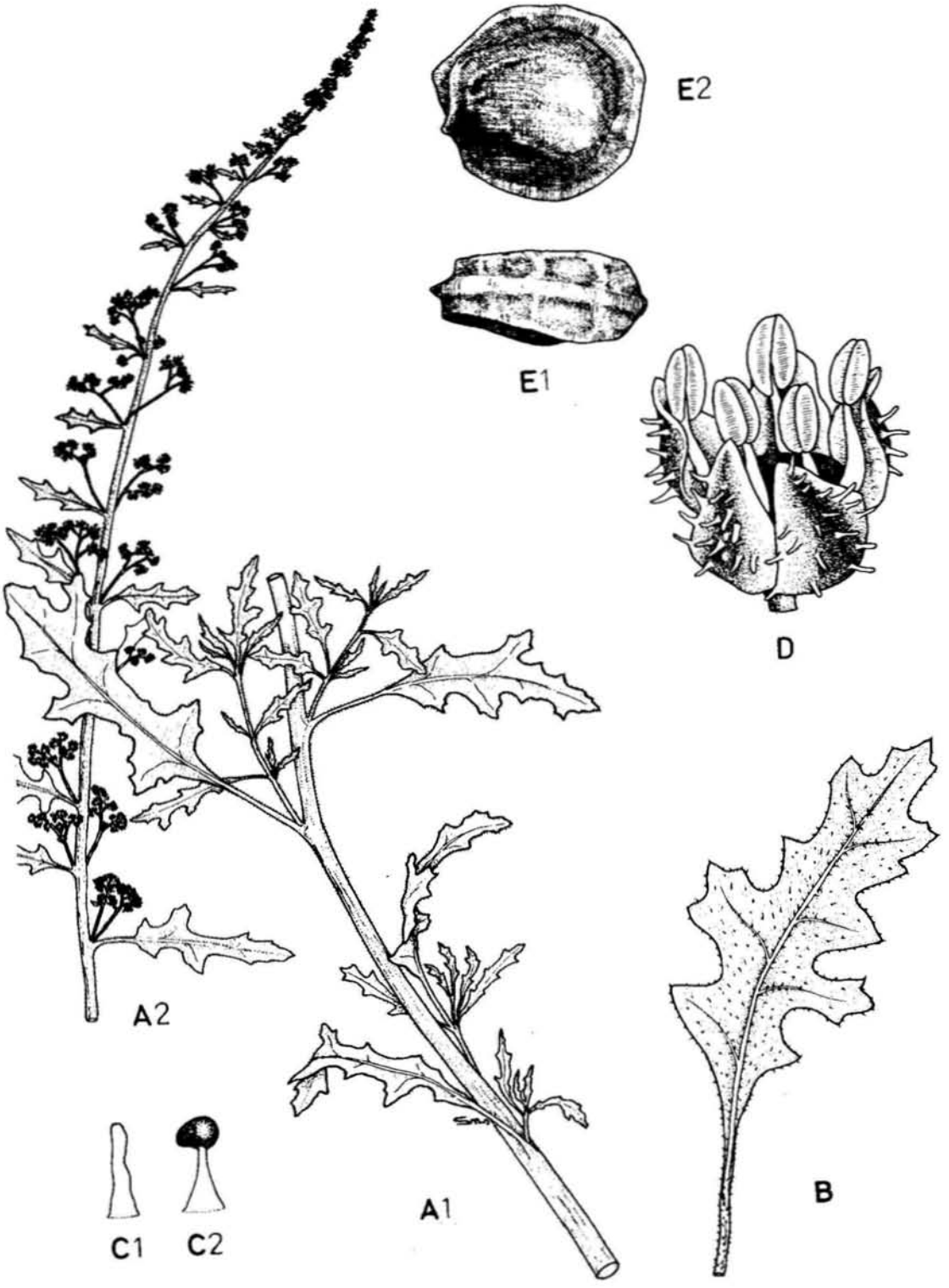

Fig. 3 **Chenopodium botrys:** A_1, leafy portion of a branch x 1; A_2, flowering and fruiting portion of the same x 1; B, leaf x 2; C_1, eglandular hair x 50; C_2, glandular hair x 50; D, flower x 30; E_1 horizontal seed x 40; E_2, the same, dorsal view x 40.

2 **Chenopodium botrys** L., Sp. Pl. 219. 1753; Allen in Davis, l.c. 300; Maire, l.c. 27. (Fig. 3).

Annual, glandular hairy herbs, up to 30 (-50) cm tall, aromatic. Leaves 20-50 x 10-30 mm, oval or oblong, pinnatifid with 4-6 pair of lobes. Flowers in long, terminal, leafless cymes or few and axillary, 2-sexual or pistillate. Perianth segments usually 5, acuminate, nearly keelles; stamens 1-3 (-4); stigmas 2, filiform. Seeds usually horizontal, smooth or almost so with obtuse margins, c. 0.6 mm in diam., blackish-brown with whitish specks.

Type: Described from Europe, Herb. Linn. 313/12 (LINN).

A-3 Tripoli, roadside, 3.8.1969, *I.I. Chaudhri* 15409.

Distribution: Mediterranean area, C. & E. Europe, Asia.

Probably introduced in our area and very rare. Easily recognized by its annual and glandular habit. This is a new record for our area.

Fl. April-July.

2. **Chenopodium ambrosioides** L., Sp. Pl. 219. 1753; Durand & Barratte, Fl. Lib. Prodr. 202. 1910; Pamp., Pl. Trip. 69. 1914; Maire, l.c. 25, fig. 915; Keith, l.c. 358. (Fig. 4)

C. anthelminticum L., l.c. 220; *C. suffruticosum* Willd., Enum. Hort. Berol. 290. 1800; *C. ambrosoides* ssp. *suffruticosum* (Willd.) Thell., Fl. Adv. Montpell. 191. 1912; *C. ambrosioides* var. *dentatum* Fenzl in Mart., Fl. Brasil. 5 (1): 145. 1865; Maire, l.c. 26.

Annual to perennating, green, tall herb, 30-100 cm, puberulent to almost glabrous, erect or suberect, usually aromatic. Leaves shortly petioled, oblong-lanceolate, rarely ovate-oblong, up to 8 x 3 cm, sinuate-dentate, usually with broad shallow, ± obtuse teeth; upper leaves entire or subentire, usually with sessile yellowish glands on the lower surface. Flowers in dense clusters, forming a panicle. Perianth c. 1.5 mm long enclosing fruit, 4-5-lobed, not keeled, glandular to almost glabrous; stamens 4-5; seeds mostly horizontal, glossy, c. 0.6 mm in diam. 2n=32

Type: « Habitat in Mexico, Lusitania », Herb. Linn. 313/13 (LINN).

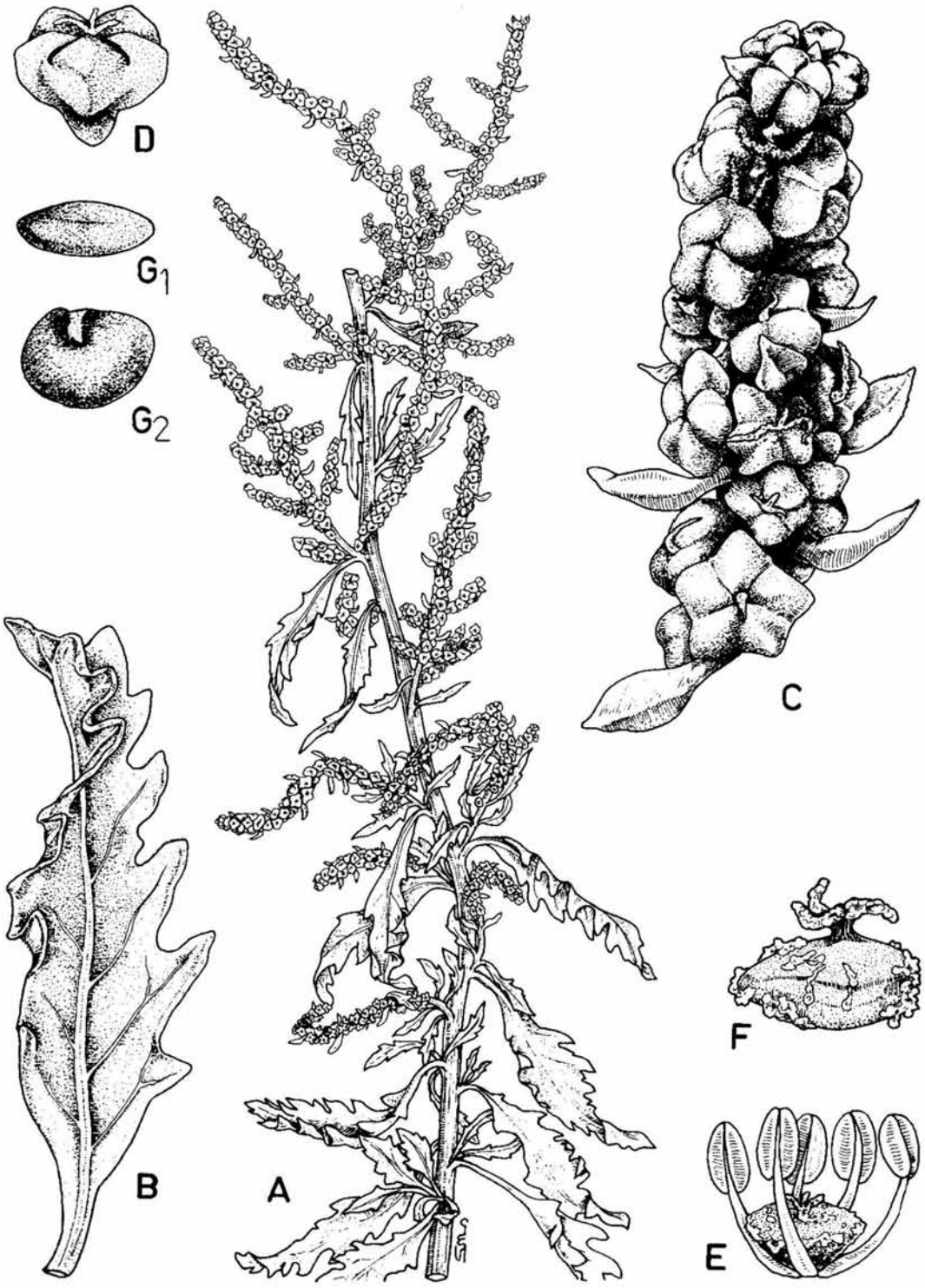

Fig. 4 **Chenopodium ambrosioides:** A, a portion of flowering and fruiting stem x 1; B, upper leaf x 3; C, portion of inflorescence x 10; D, flower x 20; E, flower with perianth removed x 30; F, fruit x 30; G_1, horizontal seed x 20; G_2, upper view of seed x 20.

A-3 8 km from Tripoli University Campus, in orange orchard, 20.11.1975, *Fathi, B.R.* 19; Faculty of Science, in barley field, 6.3.1974, *S. El-Jaley* 4; University campus, near the nursery, tall herb, inflorescence large, 17.3.1977, *S.M.H. Jafri* 6739.

Distribution: Almost cosmopolitan.

A very widely distributed and variable species, growing as weed of cultivated fields or orchards in Tripoli; probably introduced here. Sometimes cultivated elsewhere for its colourless or faintly yellowish anthelmintic essential oil (from its yellowish glands) with unpleasant odour.

Fl. Jan.-May.

4. **Chenopodium vulvaria** L., Sp. Pl. 220. 1753; Durand & Barratte, l.c. 201; Pamp., Pl. Trip. 69. 1914; Prodr. Fl. Cir. 176. 1931; Maire, l.c. 29, fig. 916; Keith, l.c. 358. (Fig. 5)

C. vulvaria var. *incisum* Maire; Maire, l.c. 30.

Annual herb, up to 30 (-50) cm long, often decumbent, branched mostly from the base with evil odour of decaying fish. Leaves petiolate, rhomboid or deltoid-ovate, (5-) 10-25 (-30) mm long, and almost equally broad, entire or with 2 lobes near base, rarely sinuate-dentate, mealy especially beneath. Flowers 2-sexual, rarely with pistillate ones, clustered in short terminal or axillary, leafless panicles. Perianth segments 5, c. 1 mm long, united below, hardly or not keeled, mealy, enclosing fruit; stamen filament dilated at base; style short with filiform stigmas. Pericarp very thin, easily detached; seed 1-1.3 mm in diam., black, lustrous, faintly papillose-verrucose.

Type: Described from Europe, Herb. Linn. 313/18 (LINN)

A-3 Tripoli, University Campus, Faculty of Science, offensive smell, 6.6.1968, coll. ign.; **A-7** 5 km from Baida towards Shahat, erect c. 30 cm, some branches prostrate, 20.6.1972, *S.I. Ali* 757.

Also reported from Tibesti as var. *incisum* by Maire (l.c.)

Distribution: Euro-Siberian, Canaries, N. Africa, to W. Asia; introduced in Australia and N. America.

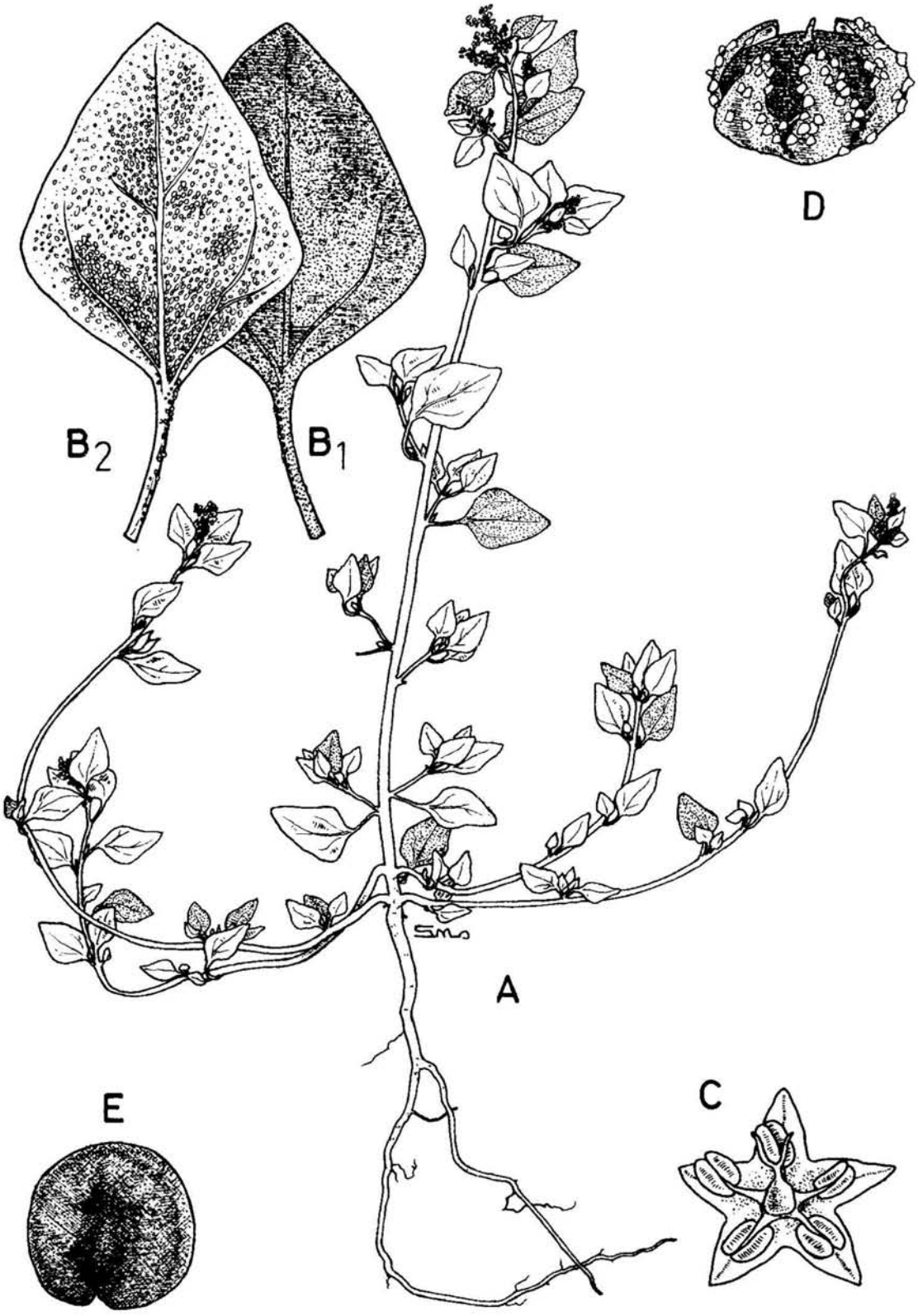

Fig. 5 **Chenopodium vulvaria:** A, habit x 0.65; B_1, leaf (dorsal view) x 3; B_2, the same (ventral view) x 3; C, flower (dorsal view) x 20; D, fruit with perianth x 20; E, horizontal seed (upper view) x 20.

Easily confused with *Atriplex* but fruit not enclosed by 2 valves (bracteoles). Obnoxious odour is due to the presence or trimethylamine in the plants; formerly used medicinally for treatment of rheumatism, colds and hysteria. The plant is also rich in potassium and phosphates and contains ammonium salts.

Fl. April-Aug. *Vern.* Effena

5. **Chenopodium murale** L., Sp. Pl. 219. 1753; Durand & Barratte, l.c. 201; Pamp. Pl. Trip. 69. 1914; Prodr. Fl. Cir. 177. 1931; Corti, Fl. Veg. Fezzan 77. 1942; Maire, l.c. 31. fig. 917. (Fig. 6).

Annual, erect or suberect herb, (10-) 25-70 cm tall, usually dark-green, sparingly mealy, branched, leafy, with ± angular stem thickened at base. Leaves petiolate, deltoid-ovate or rhombic-ovate to rhombic-oblong, ± cuneate at base, (10-) 20-80 x (5-) 10-60 mm, coarsely and irregularly many toothed with teeth usually acute and somewhat incurved, acute to acuminate, glabrous or slightly mealy, mainly on lower surfaces. Flowers 2-sexual, in clusters on terminal or axillary divaricately branched panicles. Perianth segments 5, green bluntly heeled and often with a dorsal swelling near the apex, ± enclosing fruit. Pericarp membranous but hardly separable from seed; seed 1-1.5 mm in diam., lenticular, acutely keeled at margin, minutely pitted, black.

Type: Described from Europe, Herb. Linn. 131/6 (LINN).

A-2 Garian, 12.4.1974, *S.I. Ali* 2110; Wadi el-Hira, 29.4.1976, *A.M. Dlango* 60; c. 15 km from Shakshuk on way to Jado, hilly area, erect herb, c. 15 cm, flowers green, *Alavi, Ghafoor, & Fathi* 201; **A-3** 10-20 km E. Tripoli, along the coastal road to Khoms, in sand, 22.11.1966, *L. Boulos* 1002; Tripoli, University Campus, behind Science Faculty, common, 15.2. 1976, *S.M.H. Jafri* 6289; Hadba Sharquia, under shade, 25.3.1976, *S.M.H. Jafri* 6465; Al Khoms, 7.4.1977, *S.A. Alavi* 1324; 8 km from Tripoli University, 5.12.1976, *Fathi, B.R.* 35; Leptis Magna, 1.5.1974, *G. Faris* 547; *id.* 29.3.1975, *A. Gammudi* 246; 29.4.1975; *Zenab, A.R.* 76; Misrata, weed in field, 15.1.1967, *L. Boulos* 1049; **A-6** Dariana, c. 40 km from Benghazi, 16.2.1972, *S.I.Ali* 452; **A-7** c. 5 km from Susa on way to Shahat, 20.6.1972, *S.I. Ali* 796; Wadi Lathrun, midway along the coastal road between Derna and Susa, ditch near the sea coast, 19.1.1967, *L. Boulos* 1210; Derna beach, *Ali & Faruqi* 1181; Susa, along stony roadside, 26.10.1975, *S.M.H. Jafri* 6133a; **B-4** Abugrain, 12.3.1975, *K. Sifaw* 83; Waddan, c. 17 km from Bougrain, 27.3.1975, *Ali & Faruqi* 2450.

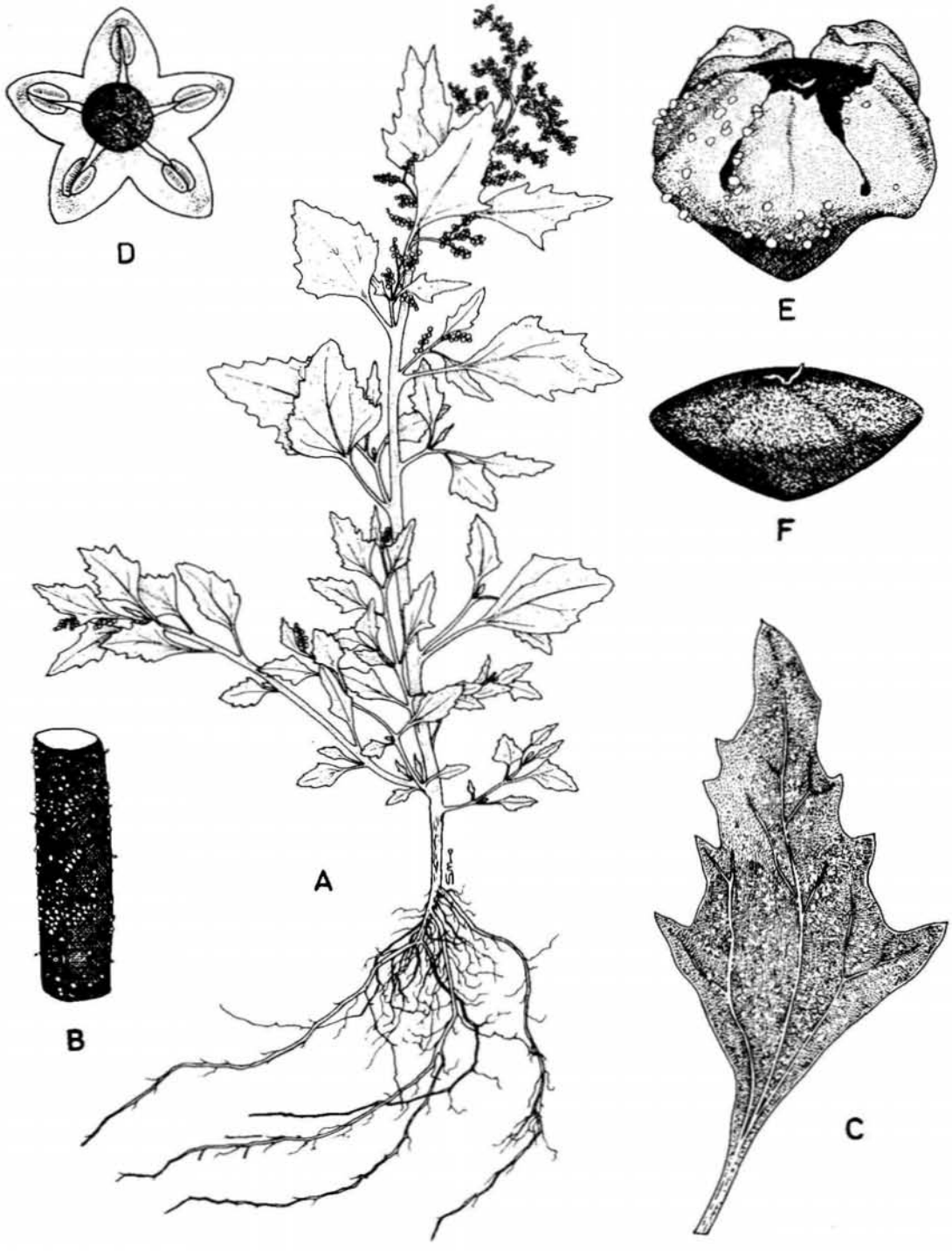

Fig. 6 **Chenopodium murale:** A, habit x 0.5; B, portion of stem x 5; C, leaf x 2; D, flower (dorsal veiw) x 10; E, fruit with perianth x 25; F, horizontal seed x 25.

Distribution: Almost cosmopolitan, introduced in N. America and Australia.

A useful weed of waste places and of wide occurrence in Libya. It has been used as salad and seeds for bread in some European countries during famine by poorer people. Said to hybridize with *C. album*, producing intermediate forms (Maire, l.c. 38).

Fl. February-May *Vern.* Effena, Buzenzer, Aggaouit, Bu-Zenzer.

6. **Chenopodium album** L., Sp. Pl. 219. 1753; Durand & Barratte, l.c. 201; Pamp., Pl. Trip. 69. 1914; Maire, l.c. 34, fig. 618; Keith, l.c. 357. (Fig. 7).

Annual, often greyish or whitish-greenish, ± mealy herbs, up to 60 (-80) cm tall. Leaves petiolate very variable, rhombic-ovate (middle and lower) to lanceolate or linear (upper), 3-lobed or shallowly dentate to entire, 10-80 × 3-50 mm, glabrous or mealy mainly on lower surfaces. Flowers 2-sexual, (very rarely pistillate), clusters densely crowded and arranged in paniculately branched, elongated inflorescences, usually leafy below. Perianth segments 5, keeled outside, mealy, enclosing fruit; pericarp free; seed c. 1.5 mm in diam., lenticular with obtuse margins, smooth or very finely furrowed, blackish.

Type: Described from Europe, Herb. Linn. 318/8 (LINN).

A-2 Gharian town, 12.4.1974, *B. Faris* 538; Bougilan, prostrate, 29.4.1976, *M.M. Shuehdi* 73; **A-3** Tripoli, Hadba sharquia, 25.3.1976, *S.M.H. Jafri* 6454; Sidi el Misri, 16.4.1967, *L. Boulos* 1655; 8 km from Tripoli University to the east, 20.11.1975, *Fathi, B.R.* 18; 10-20 km E. Tripoli, along coastal road to Khoms, in sand, 22.11.1966, *L. Boulos* 1003; University Campus, near students' hostel, 5.10.1977, *Fathi, B.R.* 116; Ghaddaim (Juddaim), c. 35 km from Tripoli, 19.5.1972, *S.I. Ali* 432 & 433; **A-6** Dariana, c. 40 km before Bengazi, weed of cultivation, 16.6.1972, *S.I. Ali* 454.

Distribution: Europe, Asia, N. Africa, introduced in N. America and elsewhere.

A very variable and complex species of wide distribution, often split into a number of taxa on leaf, inflorescence, mealiness, seed size and colour of stem variations etc. The following species is hardly different from it.

A common weed of cultivation, gardens, waste grounds etc., used as salad or vegetable in some countries. Seeds are said to have nutritive value and have also

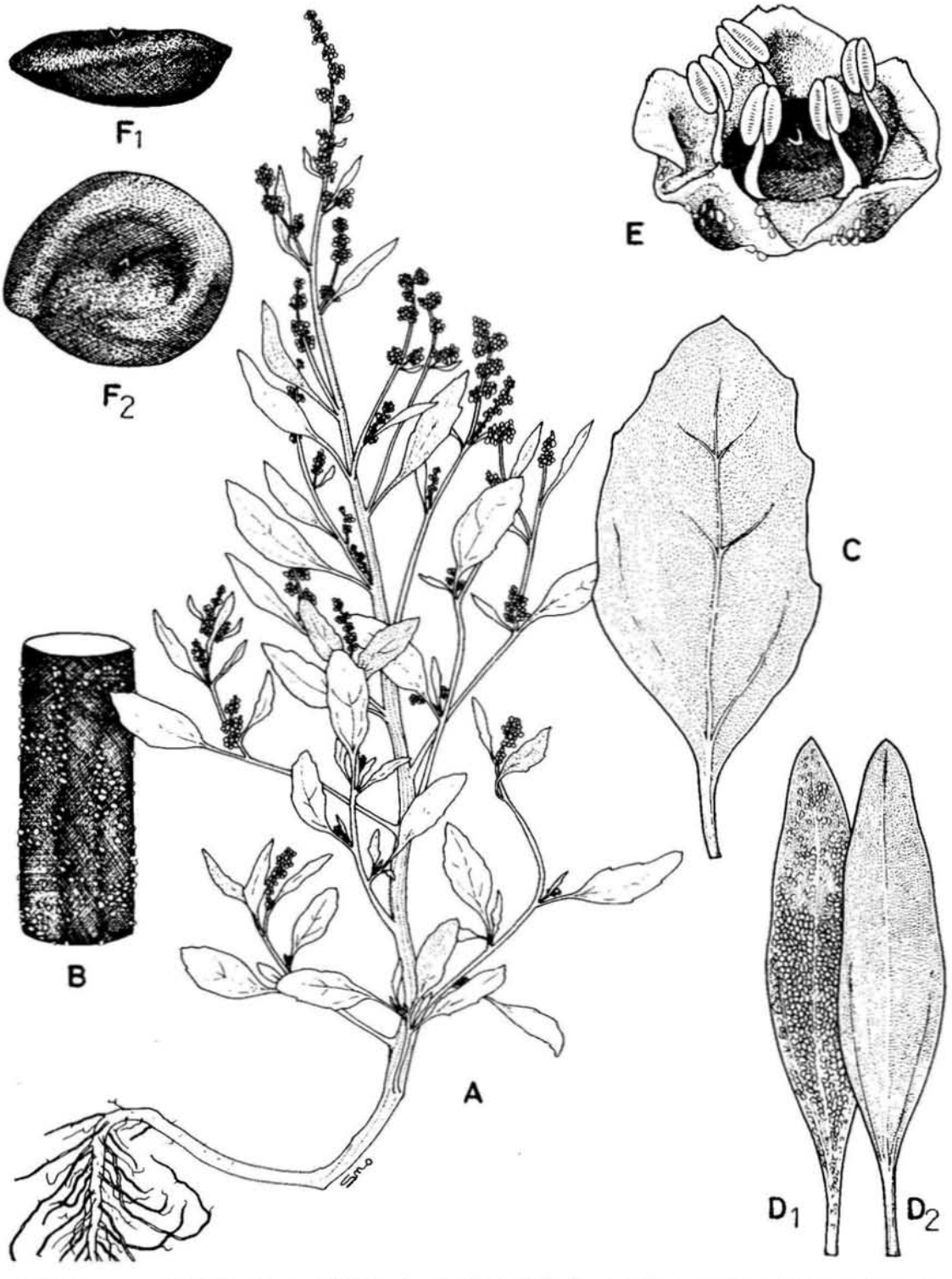

Fig. 7 **Chenopodium album:** A, habit x 0.5; B, portion of stem x 3; C, lower leaf x 2; D_1, upper leaf (dorsal view) x 2; D_2, the same (ventral view) x 2; E, flower x 20; F_1, horizontal seed x 20; F_2, the same (dorsal view) x 20.

been used as bread plant in the past; also used medicinally.

Fl. March-October *Vern.* Bu-Zenzer

7. **Chenopodium giganteum** D. Don, Prodr. Fl. Nepal 75. 1825; Maire, l.c. 39, fig. 919 *bis*.

Like the previous species but plants robust, tall up to 1.5 m, with young parts of the plants conspicuously tinged with vivid reddish-purple and with large rhombic-deltoid leaves up to c. 14 cm long and equally wide.

Type: Described from Nepal.

A-3 Tripoli, Faculty of Science, Sidi El-Misri, 22.4.1967, *L. Boulos* 1751.

Distribution: A plant of N. India, naturalized in S. France and elsewhere.

Probably introduced from France in Libya; recorded for the first time from here.

3. **BASSIA**

All., Misc. Taur. 3: 177. t. 4. 1766.
Echinopsilon Moq. in Ann. Sc. Nat. Ser. 2. 2: 127. 1834; in DC., Prodr. 13. 2: 134. 1849; Durand & Barratte, Fl. Lib. Prodr. 203. 1910.

Pubescent herbs with usually alternate, linear, flat or semiterete, entire, sessile leaves. Flowers 2-sexual or pistillate by abortion, axillary or arranged in terminal panicled cymes, without bracteoles. Perianth segments 5, ± pubescent, becoming somewhat enlarged in fruit and developing a spine or at least a tubercle at the back; stamens (3-) 5; stigmas 2-3, filiform. Utricle depressed with membranous pericarp, included within the persistent perianth; seed horizontal with membranous testa and annular embryo.

About 10 species, mainly Saharo-Arabian and Irano-Turanian, only 1 species is recorded from Libya.

Bassia muricata (L.) Aschers. in Schweinf., Beitr. Fl. Aethiop. 1: 187. 1867; Corti, l.c. 82; Maire, l.c. 51, fig. 923; Keith, l.c. 283. (Fig. 8)

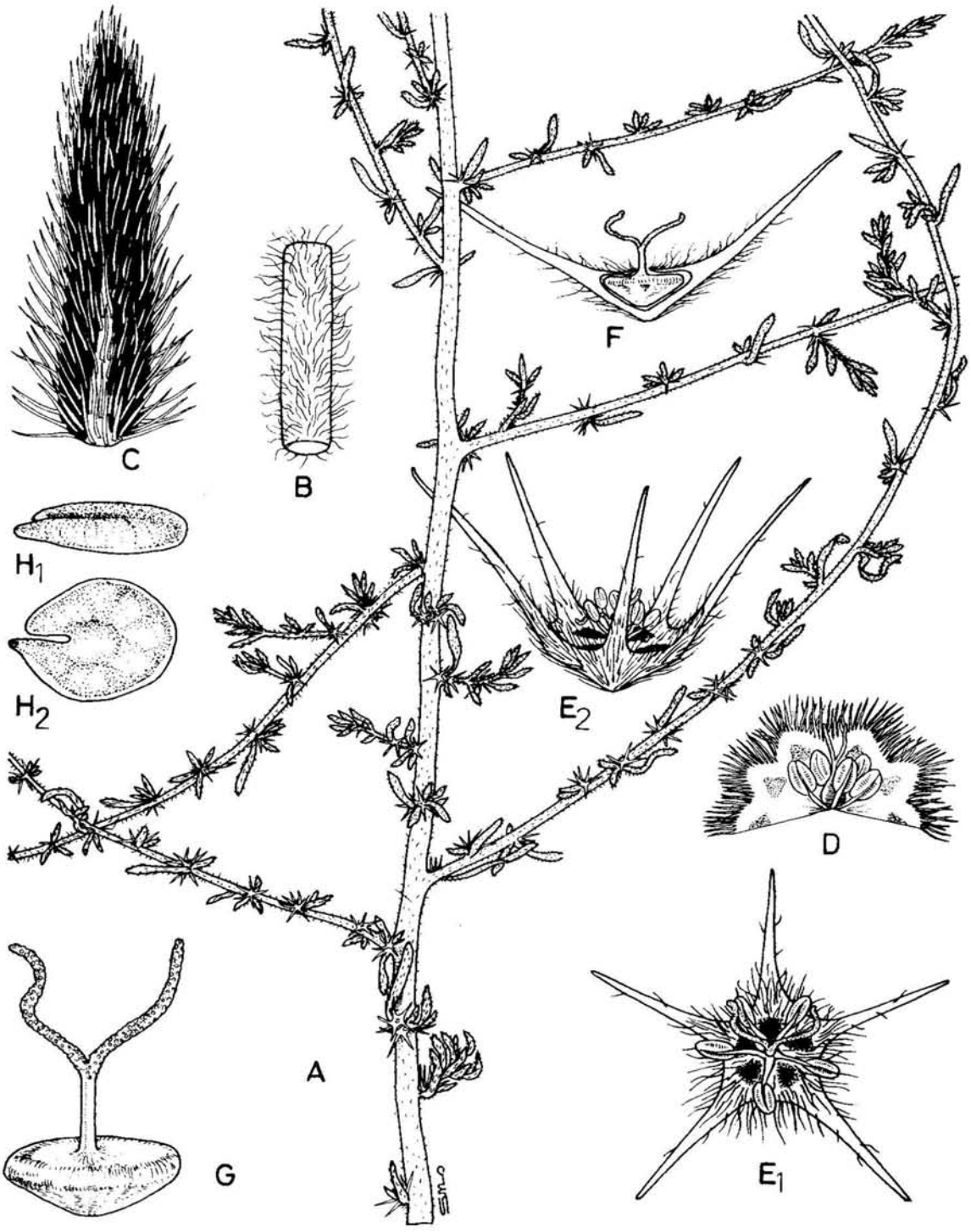

Fig. 8 **Bassia muricata:** A, habit x 1; B, portion of stem x 5; C, leaf x 10; D, opened young flower (dorsal view) x 10; E_1, fruiting flower (dorsal view) x 10; E_2, the same (side view) x 10; F, V.S. of the same showing fruit and spinous perianth x 10; G, fruit x 20; H_1, horizontal seed x 20; H_2, the same (dorsal view) x 20.

CHENOPODIACEAE

Salsola muricata L., Mant. 54. 1767; *Echinopsilon muricatus* (L.) Moq. in DC. Prodr. 13. 2. 134. 1849; Durand & Barratte, l.c. 203; Pamp., Pl. Trip. 69. 1914; *Kochia muricata* (L.) Schrad in Neu Journ. Bot. 3. 3: 86. 1809; *Chenolea muricata* (L.) Hutch. & Dalz., Fl. W. Trop. Afr. 1: 122. 1927.

Annual herb, up to 50 cm long, villous, branched from below, decumbent to erect. Leaves 5-25 x 1-2 mm, linear-lanceolate to oblanceolate, densely hairy. Flowers in clusters subtended by oblong bracts and forming loose leafy spikes; each cluster consisting of 1 pistillate and 1-2 hermaphrodite flowers; perianth segments 5, connate to middle, each becoming indurated and furnished with a 3-4 mm long spine at the back, 2-3 times as long as fruit, very rarely shorter, spreading, straight, yellowish, needle-like; seed 1 mm in diam., discoid, greenish-grey, opaque, smooth.

Types: Herb. Linn. 315/22 (LINN).

A-1 Wazen, Libyan-Tunisian border, 9.6.1974, *B. Faris* 906; Alghazaya, c. 28 km from Nalut, on way to Wazen, 25.1.1977 *Siddiqi & Fathi* 276; Wazen, *Siddiqi & Fathi* 289; **A-2** c. 10 km W. of Zuara, 25.11.1976, *Alavi, Ghafoor & Fathi* 111; Goddeim (Juddaim), c. 7 km before Azzawia, 11.5.1972, *S.I. Ali* 427; c. 35 km after Al Hbabelia (Al Hbalia) on way to Al Josh, sandy plain, 26.11.1976, *Alavi, Ghafoor & Fathi* 161; **A-3** Tripoli, University Campus, opposite Science Faculty, sandy reddish soil, prostrate to suberect, small herb, common, 15.2.1977, *S.M.H. Jafri* 6278; 10 km east of Tripoli, roadside, 13.4.1977, *Fathi, B.R.* 107; Wadi Ka'am near Khoms, c. 1 km from sea, sandy soil, bush 30-40 cm tall, 19.11.1976, *Alavi, El-Gadi & Fathi* 1026; **B-4** 10 km before Sirte, 22.10.1975, *S.M.H. Jafri* 6009; Bougrain, 28.3.1975, *Gammudi, A.* 142; *Fauzia* 94; c. 28 km after Al-Bourat, c. 55 km before Sirte, *Siddiqi & Fathi* 152; 15 km before Sirte, *Siddiqi & Fathi* 109; **B-6** Ajdabia, roadside, sandy soil, 21.10.1977, *Siddiqi & Fathi* 143; **E-1** 70 km before Ghat towards Algerian border, wadi Agegae (Eghighi), 19.2.1977, *Siddiqi & Ahmad* 113.

Distribution: N. Africa, Palestine, Arabia-Petrea

A species of sandy saline habitats, especially along the sea coast in Libya; said to be an important forage for camels and other livestocks (Keith, l.c.).

Fl. Febraury-Aug. *Vern.* Chouleta, Ghabbir, Ouhas

4. KOCHIA

Roth in Schrad., Journ. Bot. 1: 307. 1801.

Similar to **Bassia** but flowers neither hidden in hairs nor spiny, sometimes with a short flat wing on the back of ± coriaceous fruiting perianth segments.

About 60 species, mainly in temperate zones and N. America; 2 species are recorded from Libya.

+ Plants with spreading open branches; leaves and flowers densely soft-hairy with long shining hairs; perianth densely hairy, wings flat, scarious (sometimes suppressed), up to 1 mm long	1. **K. indica**
— Plant erect, bushy, with ascending branches, greenish or reddish, ± glabrous; perianth not so hairy, wings very short or reduced to a tubercle (cultivated ornamental)	2. **K.scoparia***

1. **Kochia indica** Wight, Ic. Pl. Or. 5. 2: 5. t. 1791. 1852; Zohary, Fl. Palest. 1: 153, fig. 221. 1966; Tackh., St. Fl. Egypt. ed. 2: 118. 1974. (Fig. 9).

K. griffithii Bunge ex Boiss., Fl. Or. 4: 924. 1879.

Annual herb, up to 2 m tall, densely hairy with long shining hairs; stem pale, brown to yellowish or whitish, pubescent. Leaves 5-15 (-30) x 1-5 mm, lanceolate, oblong or linear, entire, acute or subacuminate at apex, cuneate sessile or subsessile, soft hairy, especially below, to subglabrous. Flowering branches usually whitish, with scattered 1-3-flowered clusters arranged in loose, leafy spikes; bracts linear, leaf-like, longer than clusters, softly hairy. Perianth ± woolly, connevent and up to 3 mm in fruit, usually winged at the back with very variable wing-shape, rudimentary (or almost suppressed) to triangular ovate to suborbicular, up to 1 mm long or in diam., mostly scarious; seed c. 2 mm in diam.

Type: Described from India.

A-3 Nigaza, 11.5.1977, *Karima, Z.* 2; *Fauzi, A.O.* 9; *Bashir, A.M.* 21; Al-Nigaza, 32 km before Khoms, 19.11.1976, *El-Gadi, Alavi & Fathi* 1016; **A-6** 5 km before Benghazi, 27.10.1975, *S.M.H. Jafri* 6166; Dariana, c. 35 km W. of Benghazi,

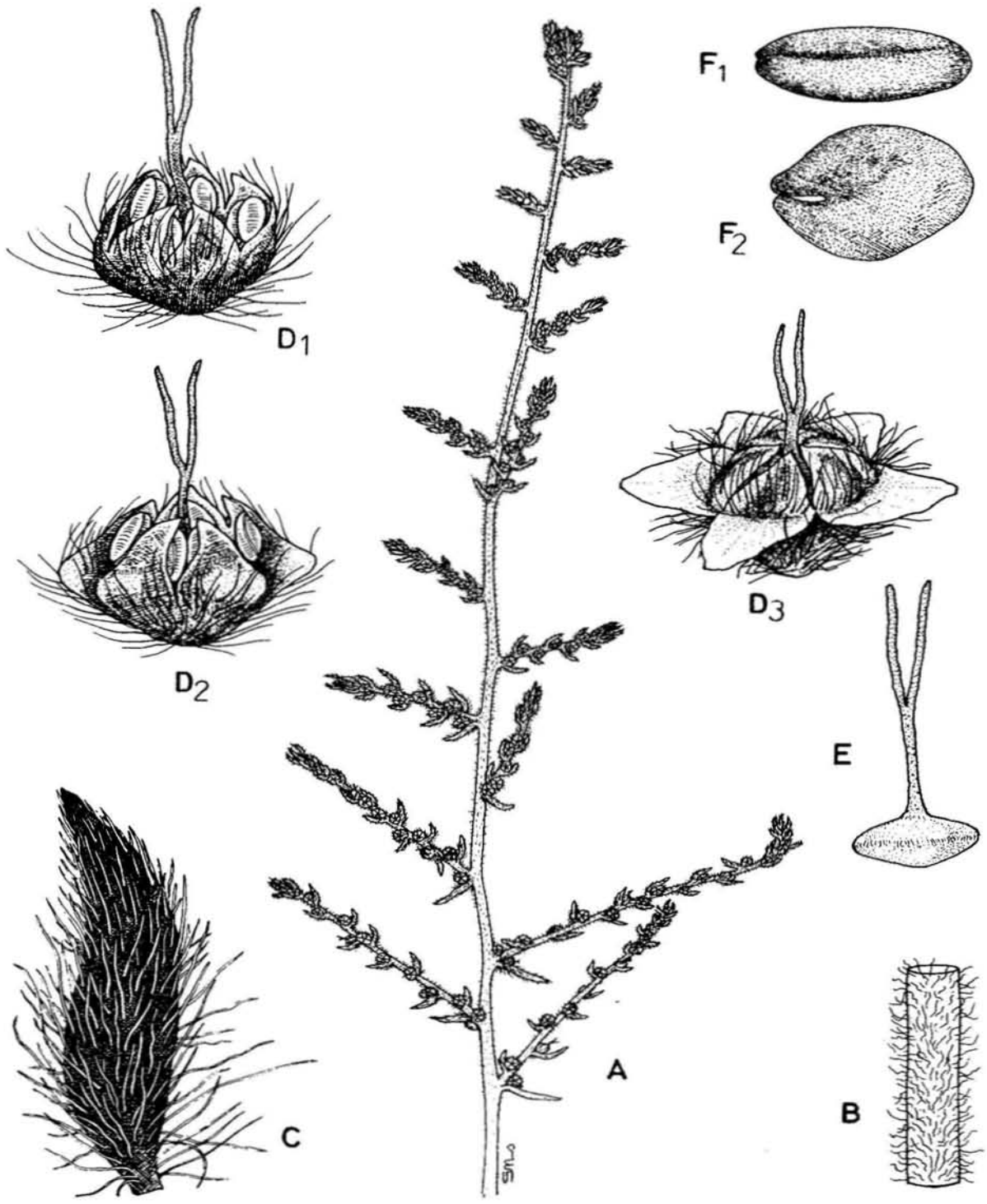

Fig. 9 **Kochia indica:** A, flowering and fruiting branch x 1; B, portion of stem x 5; C, leaf x 15; D_1, flower x 15; D_2-D_3, fruiting perianth variations (without or with wings) x 15; E, fruit with style and stigma x 15; F_1, horizontal seed x 20; F_2, the same (dorsal view) x 20.

21.10.1977, *Siddiqi & Fathi* 113 and 121; Alhowarg, S. of Bengazi, 21.10.1977, *Siddiqi & Fathi* 125; **A-7** Derna beach road, 18.10.1977, *Siddiqi & Fathi* 47; **A-8** Tobruk, 25.10.1975, *S.M.H. Jafri* 6087; 18.10.1977, *Siddiqi & Fathi* 74.

Distribution: N. Africa (Libya, Egypt), Sudan, Palestine, S.W. Asia to Pakistan and India.

A variable species, seems to be recently introduced here and a new record for our area. A good pasture herb in desert areas. Some forms of this species with suborbicular perianth wings may be mistaken for **K. prostrata** (L.) Schrad or **K. laniflora** (Gmelin) Borbas, but plants annual, wings much smaller and leaves flat. However, **K. prostrata** may also be found within our area.

Fl. July-Oct.

2. ***Kochia scoparia** (L.) Schrad, N. Journ. Bot. 3. 4: 85. 1809; Maire, l.c. 48, fig. 922 bis; Keith, l.c. 586.

Chenopodium scoparia L., Sp. Pl. 221. 1753; *K. trichophila* Hort. ex Voss., Deutsch. Gart. 1904.

Erect, annual, up to 150 cm tall, green usually turning pinkish or reddish at the end of the season with narrow, linear-lanceolate, flat leaves, up to 5 cm long; perianth wing very short or tubercle-like.

Type: Described from Greece & Japan, Herb. Linn. 313/20 (LINN).

A-2 Azzaowya, gardens, ornamental, 22.11.1977, *Fathi, B.R.* 128.

Distribution: Eurasia; widely introduced as an ornamental.

Sometimes cultivated as an ornamental in Libya.

Fl. July-Oct.

5. CHENOLEA

Thunb., Nov. Gen. Pl. 9.1781; Wright in T. Dyer, Fl. Cap. 5 (3): 447. 1912

Low, woolly-canescent shrubs with small, oblong-linear, alternate, fleshy

leaves. Flowers 2-sexual, rarely polygamous, solitary or in small clusters, sessile, without bracteoles. Perianth 5-merous, small, fleshy, woolly, persistent but neither coriaceous in fruit nor producing spine or appendage, rarely with a minute tubercle at back. Stamens 5, inserted at bottom of perianth but anthers ± exserted; style divided into 2-3, short, filiform, stigmas. Utricle with membranous pericarp, included within the perianth; seed horizontal with membranous testa and peripheral embryo.

Differs from *Bassia* by the absence of spine or conspicuous corns or tubercles on the fruiting perianth back and from *Kochia* by its pubescent, unappendaged perianth lobes and shorter stigma.

3 species; 2 in Saharo-Arabian region and 1 in S. Africa; only 1 species is recorded from Libya.

The type species, **C. diffusa** Thunb. from Cape has minute tubercle on the fruiting perianth back (vide Benth. & Hook. f., Gen. Pl. 3 (1); 60. 1880) reaching close to some species of *Bassia*, but the following species does not have any such character. How far it would be justified to create another genus as done by Botschanzev (J. Bot. URSS 61 (10): 1408.1976) to accommodate the following species needs further studies.

Chenolea arabica Boiss, Diagn. Ser. 1. 12: 97. 1853; Durand & Barratte, Fl. Lib. Prodr. 203. 1910; Pamp., Prodr. Fl. Cir. 179. 1931; Corti, Fl. & Veg. Fezzan & Ghat 81. 1942; Zoh., Fl. Palest. 1: 152. fig. 218. 1966; Keith, l.c. 357. (Fig. 10, A-B).

Bassia arabica (Boiss.) Maire et Weiller in Maire, Fl. Afr. Nord. 8: 54, fig. 925. 1962; *Chenoleoides arabica* (Boiss.) Botsch. l.c.; Tack. in Pub. Cairo Univ. Herb. nos. 7 & 8: 212. 1977.

Dwarf, prostrate or ascending shrub, 10-30 (-40) cm long, woolly-canescent, with stems woody at base and numerous soft branches. Leaves sessile, alternate, 5-10 x 1-2 mm, linear-oblong to oblong, entire, obtuse, puberulent. Flower clusters forming dense, leafy, (2-) 5-10 cm long spikes. Flowers 2-sexual; perianth segments 5, hemispherical, obtuse, subglabrous, c. 3 mm long, woolly. Utricle c. 3 mm in diam., included within the unchanged closed perianth; style divided into 2, filiform stigmas.

Type: Hab. in desertis jugi Tih Arabia petrea, *Boissier*

A-6 Uadi Faregh Maaten Giofer a sud di el Agheila, 13 Mar. 1933, *R. Pampanini*

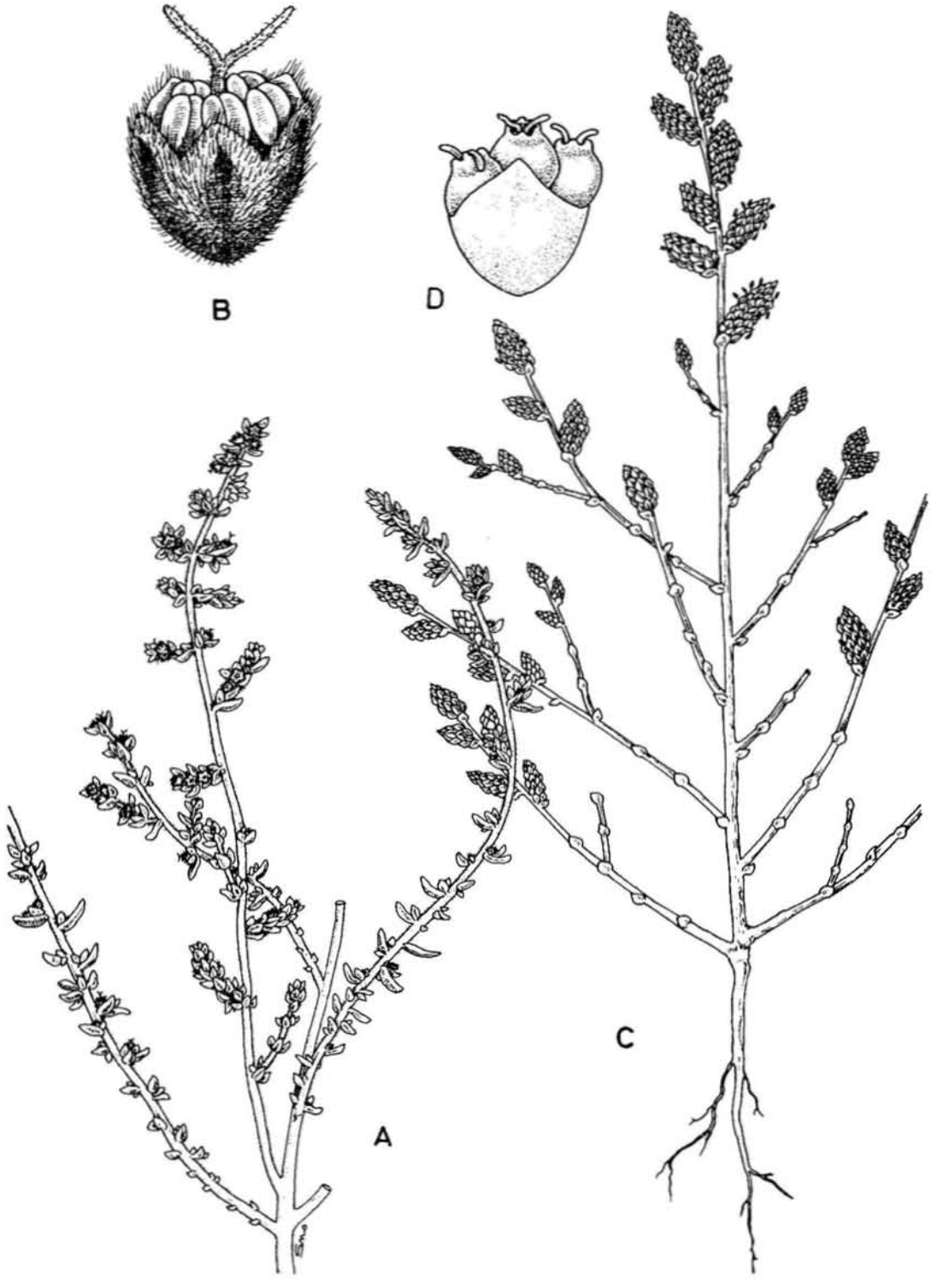

Fig. 10 **Chenolea arabica:** A, habit x 0.5; B, flower, showing perianth, anthers and stigmas x 10; **Halopeplis amplexicaulis:** C, habit x 1; D, group of 3 flowers x 8.

No. 2050 (FI); el Gtafia a sud di Agedabia, 13 Mar. 1933, *R. Pampanini* No. 2048 and 2049 (FI) B.el Giocch tra Agedabia e Seumnu, 10 Apr. 1934, *R. Pampanini e R. Pichi-Sermolli* 2053 (FI); Uadi Faregh ad al Haseiat, 9 Apr. 1934, *R. Pamp. e R. Pichi-Serm.* No.2052 (FI); **A-8** Uadi es-Sahel tra Tobruk e Bardia, 23 Mar.1933, *R. Pampanini* No. 2051 (FI); Tobruk, 1918, *F. Cassinera* (FI); **C-8** Oasi di Giarabub, June-July, 1926, *G. Krueger* (FI).

Also reported from Bardia (*Schweinfurth* 101) by Durand & Barratte (l.c.), from Tobruk and Aljugbub by Maire (l.c.), and Fezzan by Corti (l.c.)

Distribution: Libya, Egypt, Palestine, Arabia-Petrea.

A desert species, seems to be confined in the N.E. parts of Libya.

6. CAMPHOROSMA

L., Sp. Pl. 122. 1753; Gen. Pl. ed. 5:58. 1754.

Dwarf shrubs or herbs, stems ± thickly pubescent and leaves alternate, rigid, linear, subulate to acicular, pubescent to glabrous. Flowers hermaphrodite or female, without bracteoles, solitary axillary, often forming short, pseudo-spikes. Perianth segments 4 (-5), with the 2 lateral segments larger, united from base to above the middle, hairy or glabrous towards the base, membranous with green apex. Stamens 4 (-5), usually ± exserted. Stigmas 2 (-3), filiform, papillose. Utricle adpressed, obovate or elongate, erect; seed vertical with hook-shaped to nearly circular embryo.

About 10 species, mainly S. European, E. Mediterranean and C. Asian regions, only 1 species is recorded for the first time from our area.

Camphorosma monspeliaca L., Sp. Pl. 122. 1753; Fiori & Paoletti, Icon. Fl. Ital. 127, fig. 1019. 1933; Maire, l.c. 44, fig. 921; Aellen in Davis, Fl. Turk. 2: 314. 1966.(Fig. 11)

C. lessingii Litw. in Trav. Mus. Bot. Acad. St. Petersb. 2: 96. 1905; *C. polygamum* Bunge ex Boiss., Fl. Or. 6:921.1879.

Small shrub, up to 60 cm tall, erect, hairy with woody stems, densely pubescent, villous-tomentose above. Leaves linear, up to 10 (-14) x 1 (-1.5) mm, stiff, often fasciculate, usually hirsute or pubescent. Perianth 2-3 (-3.5) mm long,

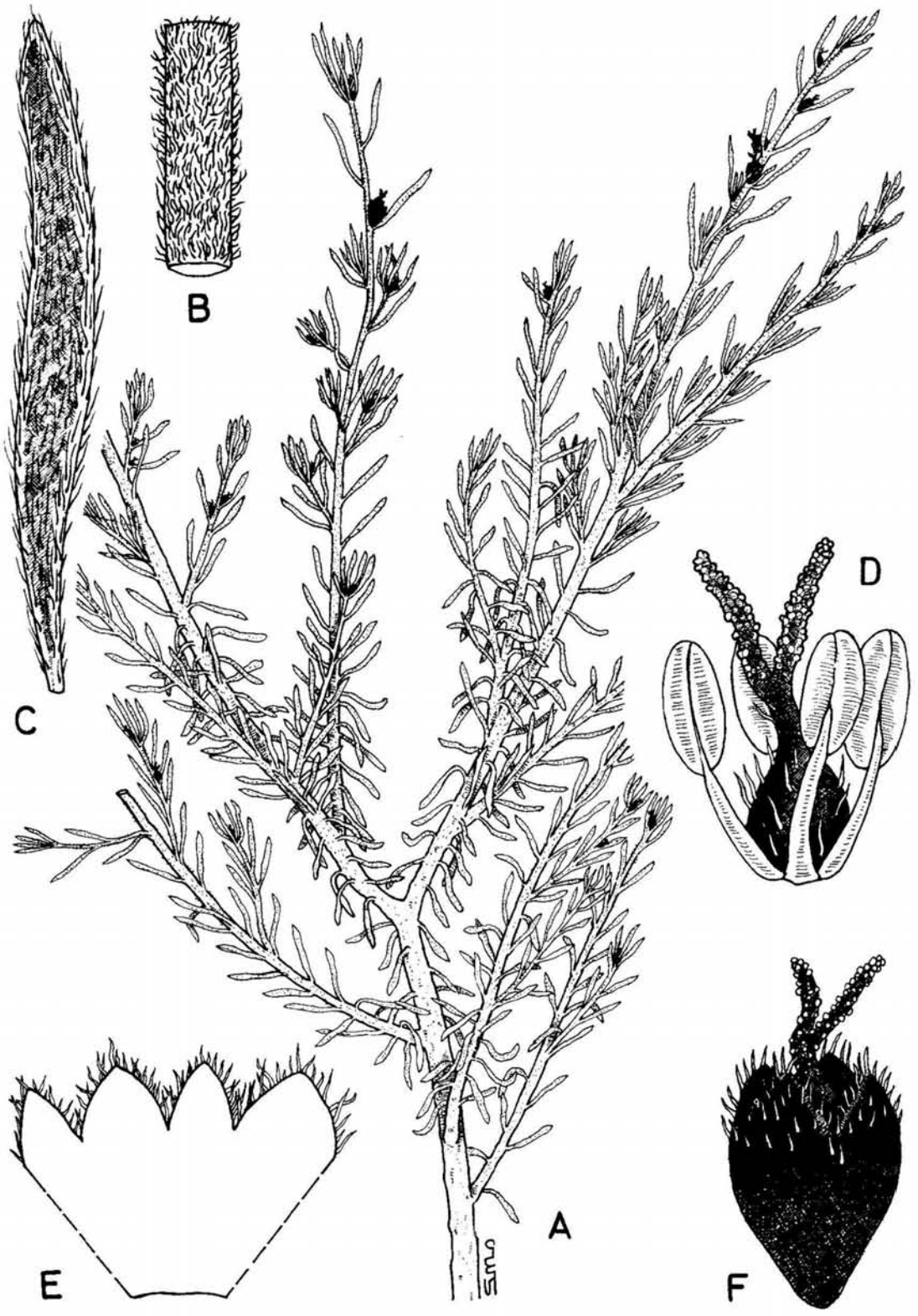

Fig. 11 **Camphorosma monspeliaca:** A, portion of flowering stem x 1; B, portion of stem x 6; C, leaf x 10; D, flower with perianth removed x 20; E, perianth spread open with alternately smaller and larger lobes x 20; F, fruit x 20.

subequal, pubescent or villous, at least at the apex, sometimes almost glabrous. Stamens 4, ± exserted; seeds oval or oblong-oval, 1.5 mm, brown or brownish black.

Type: Habitat in Hispaniae, Narbonae, Tatariae arenosis, Herb. Linn. 165/2 (LINN).

A-2 Sabrata, ruins, stony and sandy ground, 12.6.1976, *S.M.H. Jafri* 6702.

Distribution: S. Europe, N. Africa (Tunisia and Libya), S.W. & C. Asia, Iran, Afghanista & Pakistan.

A variable species in hairiness, especially on the perianth segments. It is often split into 2 or 3 subspecies; the type subspecies has smell of camphor, while ssp. *lessingii* (Litw.) Aellen has no smell. Aellen (in Davis, l.c.) has pointed out that the characters used to separate out the taxa, by previous authors, are neither constant nor correlated. More gatherings are needed for further studies on our plants. It is sometimes used medicinally.

Fl. May-June

7. **SPINACIA***

L., Sp. Pl. 1027. 1753; Gen. Pl. ed. 5: 452. 1754.

Herbs, dioecious, glabrous or mealy, with ususally alternate, flat leaves. Male flowers 4-5-merous, in glomerules forming a dense spicate-paniculate inflorescence; stamen exserted; female flowers axillary, without perianth but with 2 (-4) persistent bracteoles which become enlarged, connate and hardened in fruit; stigmas 4-5, protruding; seeds vertical.

***Spinacia oleracea** L., Sp. Pl. 1027. 1753; Durand & Barratte, l.c. 203; Keith, l.c. 930. (Fig. 12)

Annual or biennial, dioecious herb, 20-60 cm tall, erect, light green. Leaves ovate to triangular-hastate, entire or dentate, lower long-petiolate, usually entire. Staminate flowers in interrupted spiciform panicles, with 4 (-5) perianth segments and stamens; pistillate flowers in dense axillary sessile clusters, each separated and falling so in fruit; bracteoles in fruit orbicular-obovate, usually broader than long,

Fig. 12 **Spinacia olearacea:** A, female plant x 0.5; B, female flower enclosed within the bracteoles x 5; C, style and stigmas x 10.

free, with or without divergent spine at the apex.

Type: Not designated.

A-3 c. 7 km E. Tripoli (Ain Zara area), 15.12.1977, *Fathi, B.R.* 135.

Also reported as cultivated from Fezzan and Cyrenaica by Durand & Barratte (l.c.).

Distribution: Probably originated in W. Asia, spinach is widely cultivated and sometimes naturalized or found as an escape from cultivation.

It is commonly used as vegetable and contains a considerable amount of vitamins A, B and C, iron and phosphorus. As regards protein contents it is inferior only to meat.

Fl. February-May *Vern.* Spanak

Another species, **S. tetrandra** Stev., with fruiting bracteoles united into spiny corniculate aggregates and sessile half-clasping cauline leaves, is reported from N. Africa by Aellen in Davis (Fl. Turk. 2: 305. 1966) and may be found here also.

8. ATRIPLEX

L., Sp. Pl. 1052. 1753; Gen. Pl. ed. 5: 472. 1754.

Herbs or shrubs, farinose or glabrous, often whitish, with usually flat opposite or alternate leaves, monoecious rarely dioecious. Flowers polygamous, usually unisexual, in terminal or axillary clusters forming spike-like or paniculate inflorescence; male flowers mostly with 5 perianth segments and 5 stamens; pistillate flowers usually without perianth but enclosed within 2, free or partly united bracteoles or valves (rarely a few flowers with 4-5-lobed perianth); style and stigmas 2. Utricle enclosed within the bracteoles, pericarp membranous, free or almost so; seed usually vertical, rarely horizontal or pendulous (especially in those with perianth), often dimorphic, smooth; fruit often heterocarpous.

About 200 species, mainly in deserts or saline habitats: 6 species are recorded from Libya.

1. + Perennial herb or shrub 2
   — Annual 5

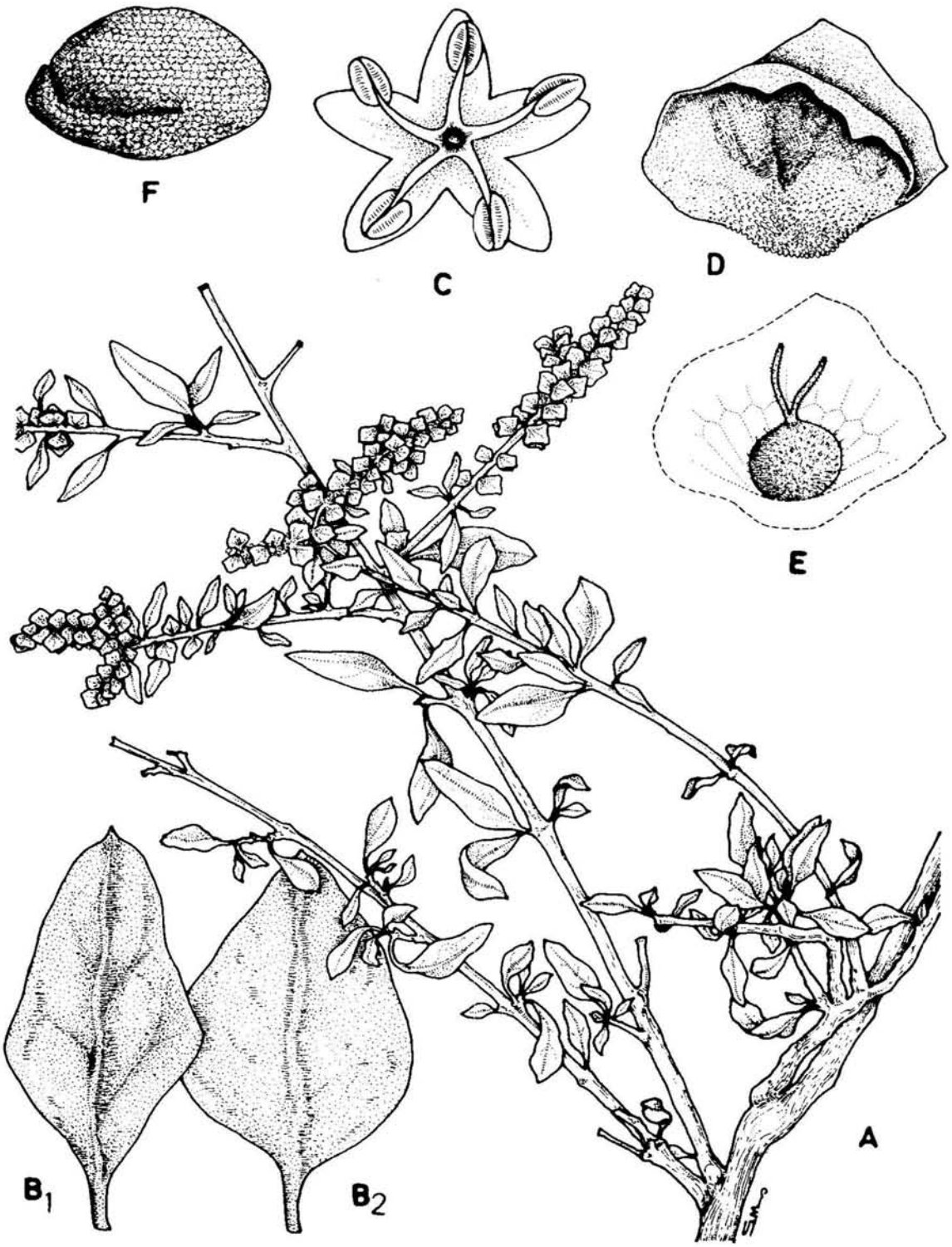

Fig. 13 **Atriplex halimus:** A, habit x 1; B_1-B_2, leaf variation x 3; C, male flower x 15; D, female flower enclosed by the bracteoles x 8; E, the same exposed to show gynoecium (or fruit) x 8; F, seed x 20.

2.	+	Shrubs; terminal panicles usually leafless. Leaves coriaceous, silvery white	3
	—·	Low shrubby perennials, often decumbent or suberect, with leafy terminal spikes. Leaves (usually oblong, sessile or subsessile, greenish) not coriaceous; bracteole with ovate, often elongated middle lobe above and tubercled at the back (variable)	4. **A. stylosa**
3.	+	Small shrubs, up to 60 (-70) cm tall with narrow, lanceolate, dense leaves, 2-6 mm broad. Valves or bracteoles 5-6 (-11) mm in diam., suborbicular, ± smooth, papyraceous	3. **A. mollis**
	—·	Robust shrubs, up to 2 (-3) m tall or long, erect decumbent with broader leaves, usually more than 8 mm broad	4
4.	+	Plants yellowish-white in appearance; fruiting bracteoles small, ± square, 3-dentate at apex and somewhat tubercled at the back	2. **A. coriacea**
	—·	Plants greenish-white in appearance. Fruiting bracteoles smooth at back, sub-orbicular or reniform, entire to rarely dentate	1. **A. halimus**
5.	+	Fruiting valves dimorphic, smaller and larger, submembranous, without crest or tubercles on the back	5. **A. dimorphostegia**
	—·	Fruiting valves monomorphic, leathery and often tuberculate at the back	6. **A. rosea**

1. **Atriplex halimus** L., Sp. Pl. 1052. 1753; Durand & Barratte, Fl. Lib. Prodr. 202. 1910; Pamp., Pl. Trip. 68. 1914; Prodr. Fl. Cir. 177. 1931; Maire, Fl. Afr. Nord. 8: 81, fig. 936. 1962; Keith l.c. 274. (Fig. 13)

Shurbs, up to 2 m tall, stout, erect, woody, silvery white with vesicles, much branched. Leaves ovate-rhombic, or deltate, entire or shallowly repand-lobed or toothed, almost coriaceous, 1-4 (-6) x 0.5-4 (-4.5) cm, silvery-white, without prominent nerves; petiole 3-12 mm. Flower clusters densely spicate, in terminal, almost leafless inflorescences. Staminate flowers very small, with 5 tepals, at top of

clusters. Pistillate flowers at base of clusters; bracteoles 4-5 mm long and almost equally broad, sessile, orbicular-ovate to semi-orbicular or reniform to short-cuneate at base, entire or dentate, smooth or reticulate but never tuberculate; stigmas filiform, free; seed 1-2 mm in diam., vertical, lenticular, dark-brown. 2n=18.

Type: Habitat in Hispaniae, Lusitaniae, Virginiae sepibus maritimis, Herb. Linn. 1221/1 (LINN).

À-2 Ginawon, between Jado and Shakshuk, 27.11.1976, *Alavi, Ghafoor & Fathi* 204; **A-3** Tripoli, University campus, c. 2 m tall, flowers greenish, 26.12.1977, *Fathi, B.R.* 137; **A-7** 30 km before Derna, coastal road, 17.10.1977, *Siddiqi & Fathi* 24; Wadi El Ramlah, 5 km N. Mkhili, 2.1.1967, *L. Boulos* 1365; **A-8** Tobruk, 25.10.1977, *S.M.H. Jafri* 6086; 60 km before Tobruk, 18.10.1977, *Siddiqi & Fathi* 468; **B-4** 13 km before Sirte, 6.1.1977, *Siddiqi & Fathi* 149 and 150; 28 km after Al-Buayrat on way to Sirte, 8.1.1977, *Siddiqi & Fathi* 148; 7 km to Bugrain, along the way to Al Buayrat, 15.1.1967, *L. Boulos* 1072; 2 km east Bugrain, 27.1.1967, *L. Boulos* 1494.

Distribution: Mediterranean region: N. Africa (Morocco to Egypt), W. Asia.

A wide spread and variable species of sandy and saline habitats of the coastal areas of Libya, said to be a good sand binder. Controversial views exist about its being browsed by camel and other livestock.

Fl. Jan.-Oct. *Vern.* Gatf, qatf.

2. **Atriplex coriacea** Forsk., Fl. Aeg.-Arab. 175. 1775; Maire, Fl. Afr. Nord. 8: 66, fig. 928. 1962; Tackh., St. Fl. Egypt. ed. 2. 114. 1974.

Shrub, robust, decumbent to suberect, closely tomentose of yellowish-white appearance. Leaves alternate, ovate or oblong, thick, coriaceous, entire, subsessile or shortly petioled, with rounded to tapering base, obtuse at apex, up to 2.5 cm long. Flowers mixed in glomerules, arranged in terminal or axillary panicles; male flowers with 5 tepals, 5 stamens and a pistillode; bracteoles of female flower furfuraceous, whitish, usually ± square with 3 , irregular teeth above and tubercles on the faces in fruiting conditions; seed lenticular, vertical, c. 1.5 mm in diam., brown-maroon, obtuse at margin.

Type: Egypt, Alexandria, *Forskal* (C).

A-1 Al Ghazayeh, between Nalut and Wazen. 25.1.1977, *Siddiqi & Fathi* 281; **A-2** Bir Aiad, Agricultural project, 32 km after Bir Ghanum on way to Nalut, 31.1.1977, *Siddiqi & Fathi* 460; **A-3** Al Hadba Sharqia, near the University, 25.3.1976, *S.M.H. Jafri* 6048; **A-8** 24 km before Al Tamimi on way to Tobruk, 18.1.1977, *Siddiqi & Fathi* 49; c 1 km from Ras Atteen, 21.6.1972, *S.I. Ali* 869.

Distribution: N. Africa (Egypt, Libya, Tunisia) and Arabia.

It may be confused with *A. halimus* but fruit valves smaller, ± square with usually 3 dents or lobed above and somewhat tubercled on back, and plants usually yellowish-white in appearance.

Fl. Aug.-Nov. *Vern.* Gaft, qatf.

3. **Atriplex mollis** Desf., Fl. Atl. 2: 931. 1800; Durand & Barratte, l.c. 203; Pamp., Pl. Trip. 68. 1914; Prodr. Fl. Cir. 178. 1931; Keith, l.c. 275; Maire, l.c. 87, fig. 938. (Fig. 14)

Shrub, 30-70 cm tall, much branched, with greyish stem and whitish branches, erect or suberect, monoecious. Leaves 7-20 x 2-6 mm, alternate, lanceolate, elliptic to linear-lanceolate, entire, coriaceous, sessile or subsessile, narrowed below, obtuse at apex, whitish-grey. Male and female flowers on the same axillary or terminal panicles. Male flowers with 5 tepals, 5 stamens and small pistillode. Fruiting bracteoles suborbicular, papyraceous, entire or sometimes emarginate at apex, free, 5-8 (-11) mm in diam., usually conspicuously reticulate-veined and with vague protuberances or papillae; stigmas 2, filiform; pericarp membranous; seed vertical, brown, 1.5-2 mm in diam., lenticular-ovate, finely reticulated.

Type: Habitat in arenis desertis, *Desfontanies*

A-2 Jado, 24.1.1977, *Siddiqi & Fathi* 198, c. 30 km from Sabrata, on way to Zwara, 25.11.1976, *Alavi, Ghafoor & Fathi* 72; Chambun, between Alassa & Alwatia, 26.11.1976, *Alavi, Ghafoor & Fathi* 167; **A-8** Tobruk, along roadside, common, 25.10.1975, *S.M.H. Jafri* 6098; 60 km before Tobruk, 18.10.1977, *Siddiqi & Fathi* 67; **B-4** 10 km before Sirte, 22.10.1975, *S.M.H. Jafri* 6010; 55 km before Sirte, 8.1.1977, *Siddiqi & Fathi* 148.

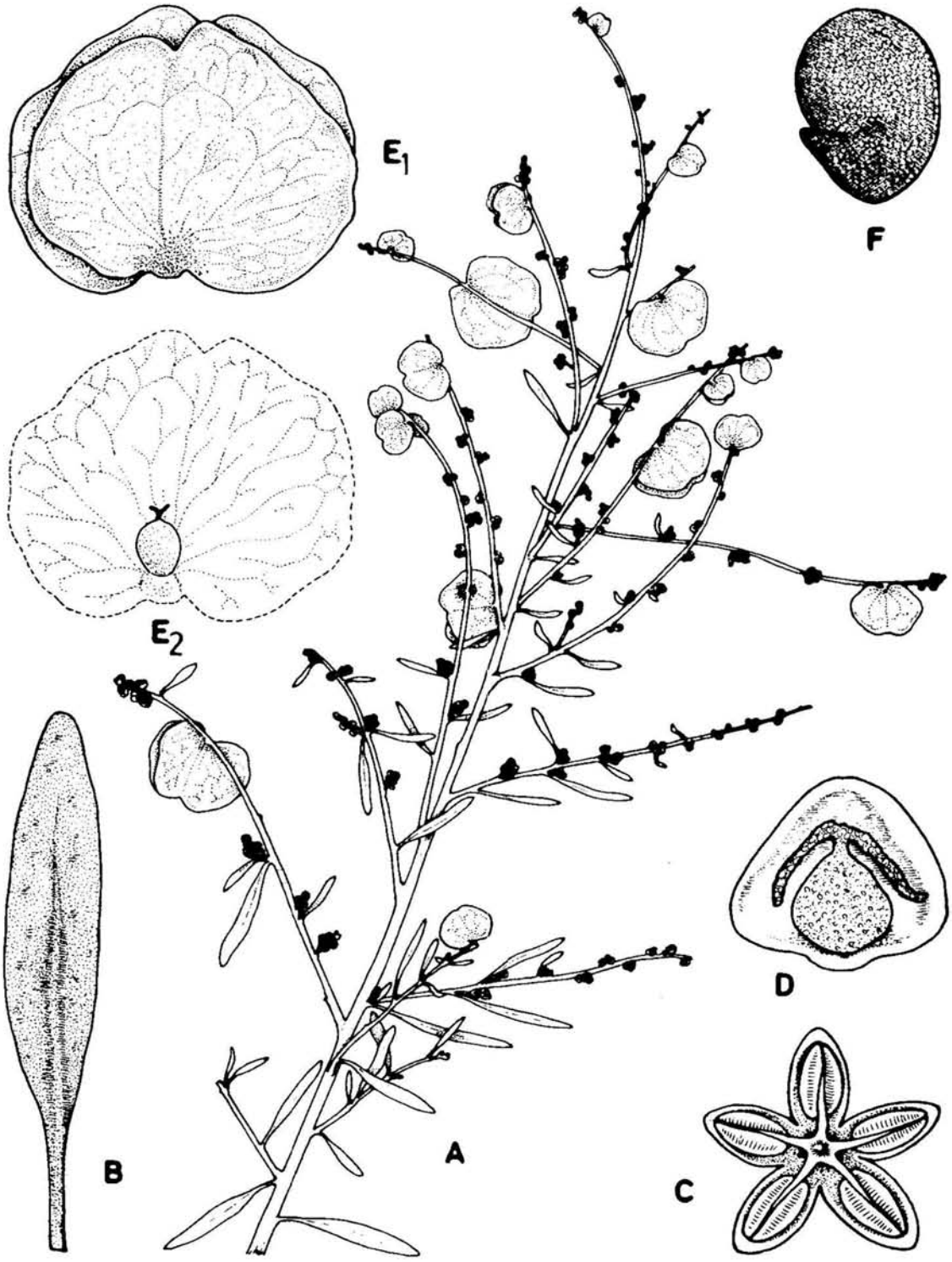

Fig. 14 **Atriplex mollis:** A, flowering and fruiting branch x 1; B, leaf x 4; C, male flower (dorsal view) x 20; D, female flower with one bracteole removed to expose gynoecium x 20; E_1, fruiting bracteole enclosing fruit x 3; E_2, the same exposed to show the fruit inside x 3; F, seed x 10.

Distribution: N. Africa, Canaries, Malta.

A maritime plant usually occurring in the coastal sandy and saline areas of Libya, easily recognized by its narrow leaves, large teminal panicles and orbicular fruit valves.

Keith (l.c.) considers it to be an excellent forage plant but he also mentions that sap of this plant is reputed to cause sterility in humans.

Fl. Aug.-November *Vern.* Gatf, Zell.

4. **Atriplex stylosa** Viv. Pl. Aeg. 2. 3. fig. 21. 1831; Zohary, Fl Palest. 1: 146. fig. 205. 1966; Tackh., St. Fl. Egypt ed. 2: 111. 1974. (Fig. 15)

A. parvifolia auct. non H.B. & K. (1817): Lowe in Trans. Camb. Phil. Soc. 4: 16. 1831; Durand and Barratte, Fl. Lib. Prodr. 202. 1910; Pamp., Pl. Trip. 68. 1914; Prodr. Fl. Cir. 178. 1931; Keith, l.c. 275; *A. galauca* L. var. *palestina* (Boiss.) Maire; Eig. in Palest. J. Bot. Ser. 3: 123. 1945; Maire, l.c. 86; *A. palestina* Boiss., Diagn., ser. 1. 12: 96. 1853; *A. parvifolia* var. *palestina* (Boiss.) Beg. et Vacc., Contr. Fl. Libia 1: 40. 1912; *A. alexandrina* Boiss., Fl. Or. 4: 914. 1879; *A. glauca* var. *alexandrina* (Boiss.) Maire. l.c.: *A. stylosa* var. *alexandrina* (Boiss.) Zoh., Fl. Palest. 1: 146. 1966.

A dwarf, papillose, mealy, erect to ascending or decumbent shrub, up to 30 (-40) cm long, much branched, leafy with terete, whitish stems. Leaves 5-20 (-40) x 5-10 mm, oblong or oblong-linear, rarely ovate or suborbicular, sessile or subsessile, tapering or not at base, entire or sinuate-repand, obtuse or the upper ones acute, greenish, not coriaceous. Flowers arranged in clusters of 2 kinds; those mixed of pistillate and staminate flowers form terminal spike-like or paniculate inflorescences; those consisting of pistillate flowers only are crowded in the leaf axils. Fruiting bracteoles up to 5 (-7) x 3-5 mm, free up to the middle, deltoid or triangular to rhombic-cuneate at base, very variable on surfaces, usually 1-dentate on each side and with tubercles, scales or appendages in back near the base; stigmas free; seed c. 1.5 mm in diam., brownish.

Type: Described from Egypt

A-2 Talil, sandy saline soil, common, 12.6.1976, *S.M.H. Jafri* 6716; Near Farwa, sea coast, 19.11.1975, *S.M.H. Jafri* 6221 and 6222; Sabrata ruins, stony and sandy ground, shrubby, fls. yellowish, common, fruiting perianth usually appendaged,

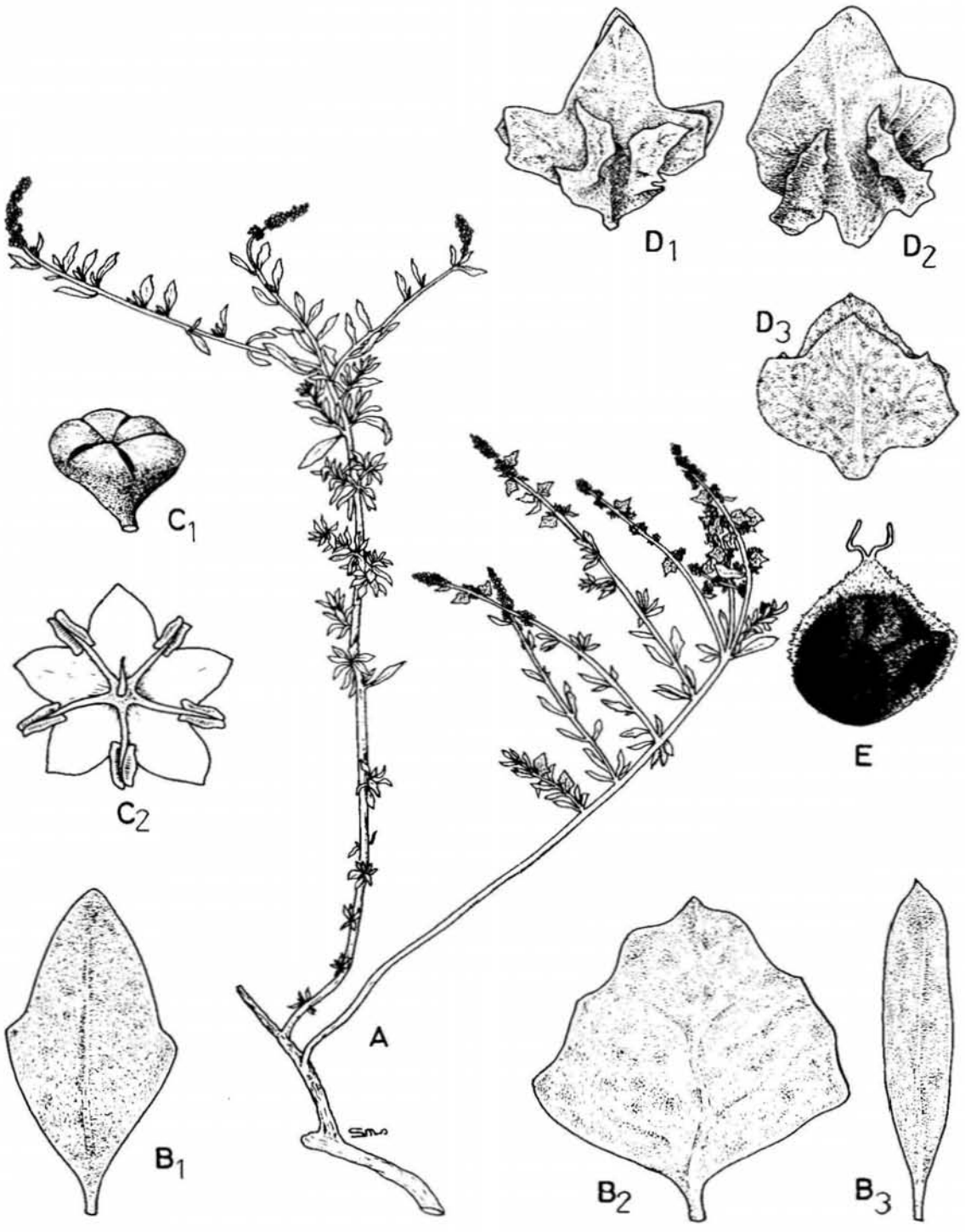

Fig. 15 **Atriplex stylosa:** A, portion of flowering and fruiting branch x 0.5; B_1-B_2, leaf variations x 4; C_1, male flower (side view) x 15; C_2, the same (dorsal view) x 15; D_1-D_3, fruiting bracteole variations x 5; E, fruit x 15.

tubercled at base, 12.6.1976, *S.M.H. Jafri* 6715; **A-3** Malaha coastal road, 5 km E. Tripoli, 15.4.1967, *L. Boulos* 1646; Near Andir hospital, shrubs with prostrate branches, 19.11.1977, *Fathi, B.R.* 120; **A-4** 300 km before Tripoli, on way back from Bengazi, sandy ground, roadside, very common, 28.10. 1975, *S.M.H. Jafri* 6173; **A-6** Road between Bengazi and Al Kuwayfiah, 17.1.1967, *L. Boulos* 1084; **A-8** Tamimi to Om-Rezem, sandy wadis flooded last autmn, suffruticose perennial, ascending, 30.3.1970, *P.H. Davis* 50259; **B-1** 38 km before Ghadames, shrublet, 28.1.1977, *Siddiqi & Fathi* 405.

Distribution: N. Africa to W. Asia.

A rather weak shrub with suberect branches and stem, smaller greenish leaves and variable fruiting bracteoles. Maire (l.c.) considers most of the taxa, cited in the synonymy above, as varieties of **A. glauca** L. The true *A. glauca* occurs in Morocco and the adjoining areas with 5-10 mm long ovate or oblong, sessile crowded leaves and fruiting bracteoles very tuberculate at base. However, our plants seem lax and with highly variable fruiting valves. The 2 species need critical studies with adequate material.

A variable and widely distributed taxon, in the coastal areas of Libya.

Fl. March-May

An Australian species, **A. semibaccata** R. Br. with high fodder value and closely resembling this species in appaearance but different bracteoles and flowering glomerules axillary only, was introduced in N. African countries including Libya (vide Keith, l.c. 276) but perhaps not in existence here now.

5. **Atriplex dimorphostegia** Kar. et Kir. in Bull. Soc. Nat. Mosc. 15: 4. 38. 1842; Durand & Barratte, l.c. 202; Pamp., Pl. Trip. 68. 1914; Maire, l.c. 79, fig. 935; Keith, l.c. 274. (Fig. 16).

Annual, monoecious herb, prostrate to ascending, up to 50 cm long, much branched from the base, whitish glabrous. Leaves 10-60 x 10-30 mm, alternate, ovate or deltoid, truncate or short-cuneate at base, entire to subirregularly sinuate-dentate, scurfy-mealy beneath, almost glabrous above. Flowers-clusters axillary, or arranged in terminal spicate inflorescences; lower clusters pistillate-flowered, upper ones mixed. Male flowers with 4-5, membranous, yellowish segments, 4-5 stamens and pistillode. Bracteoles of pistillate flowers dimorphic, conspicuously stipitate; those of lower clusters orbicular-cordate, up to 15 x 10 mm, entire or slightly sinuate-lobed, ± smooth; those of upper ones smaller,

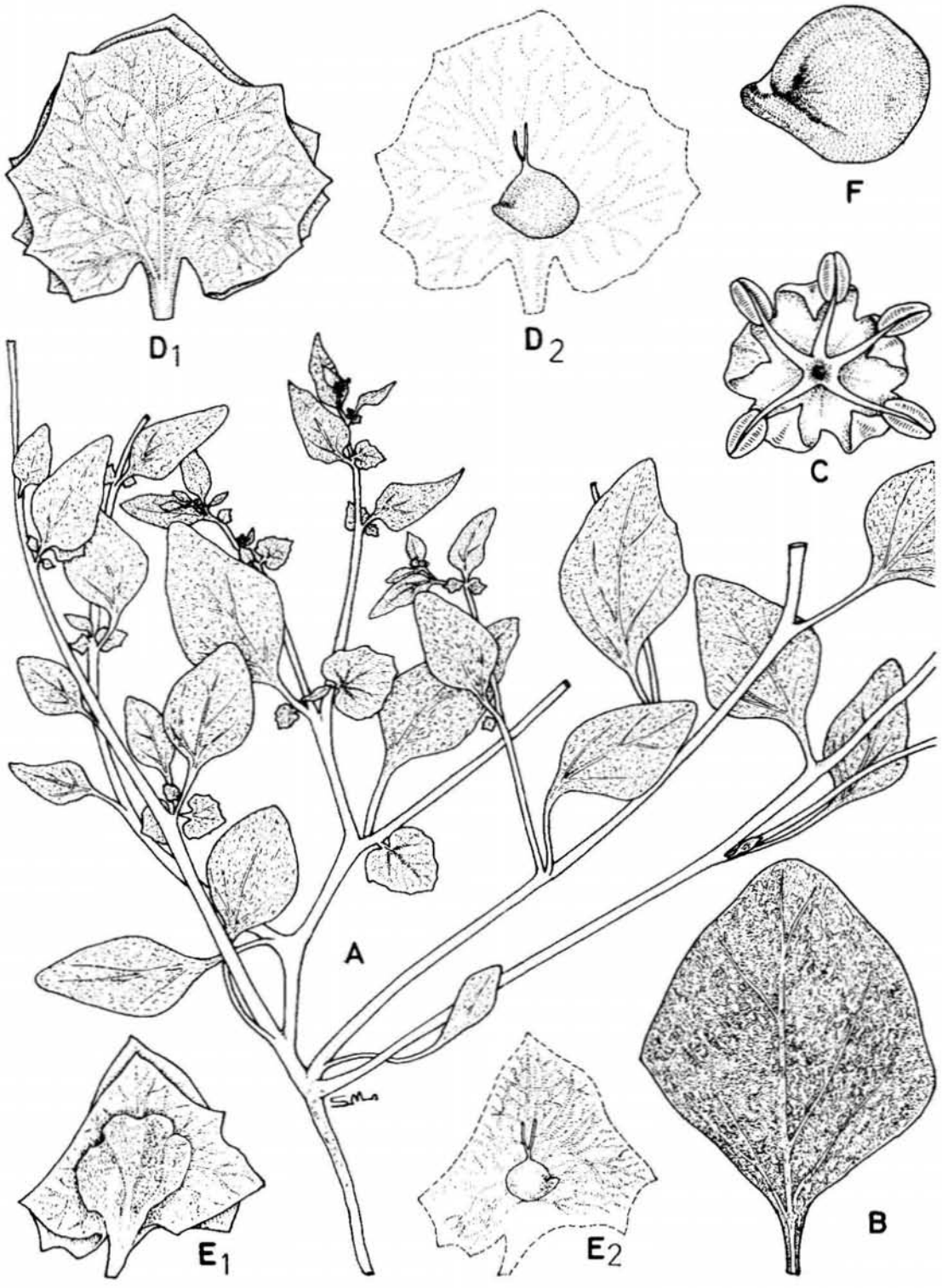

Fig. 16 **Atriplex dimorphostegia:** A, habit x 1; B, leaf x 2; C, male flower (dorsal view) x 15; D_1, larger fruiting bracteoles (female flower enclosed within) x 6; D_2, the same exposed showing fruit x 6; E_1, smaller fruiting bracteoles x 6; E_2, the same exposed to show fruit x 6; F, seed x 15.

c. 5 x 3 mm, triangular-ovate with 1-3 teeth on each side, with crested back; stigmas free to base; seeds of 2 sizes, of larger ones 2-2.5 mm in diam., yellowish-brown, opaque; of smaller ones 1-2 mm in diam., shining, dark-brown.

Type: Described from Central Asia: the vicinity of Lake Kli near Sassykpastau spring (LE).

B-3 Wadi Zamzam project, fleshy green herb, 23.12.1977, *Fathi & El Tiafe* 185; **C-4** Socna, Hamam, 26.4.1932, *O.B. Petrucci* (FI); **C-6** Uadi Faregh, Sud di el-Agheila, 15.3.1933, *R. Pampanini* No. 1966 (FI).

Distribution: C. & W. Asia and N. Africa

Fl. Feb.-May.

6. **Atriplex rosea** L., Sp. Pl. ed. 2. 1493. 1762; Durand & Barratte, l.c. 202; Pamp., Pl. Trip. 68. 1914; Prodr. Fl. Cir. 177. 1931; Maire, l.c. 74, fig. 932 bis; Keith, l.c. 276.

Annual, erect or ascending, divaricately much branched leafy herb, up to 60 (-80) cm tall, ± mealy or lepidote and canescent, later indurated. Leaves up to 60 x 30 mm, triangular-deltoid to ovate-rhombic, unequally sinuate-dentate, shortly petiolate; upper leaves ovate-oblong. Flower clusters axillary, forming leafy, raceme-like terminal or axillary inflorescences. Lower clusters of pistillate flowers only; upper ones staminate mixed with some pistillate ones. Fruiting bracteoles 4-10 mm, triangulate-deltoid or rhombic, subcuneate at base, leathery, whitish, irregularly toothed-lobed, reticulately veined with large, smooth or tuberculate appendages on the back; stigmas 2, free to base; pericarp membranous; seeds 1.5-3 mm in diam., lenticular, dark-brown, shining.

Type: Described from S. Europe.

A-3 Ad rupes maritimas: Tripoli a Sciara Sciat, 23.3.1931, *G. Zodda* (FI); Tripoli, Sciara Sciat, 17.11.1919, *D. & R. Pampanini* 59 (FI); *id. D. & R. Pampanini* 3514 (FI).
Also reported from Cyrenaica by Durand & Barratte (l.c.), and Benghazi by Maire (l.c.).

Distribution: Mediterranean area, S.W. & C. Asia.

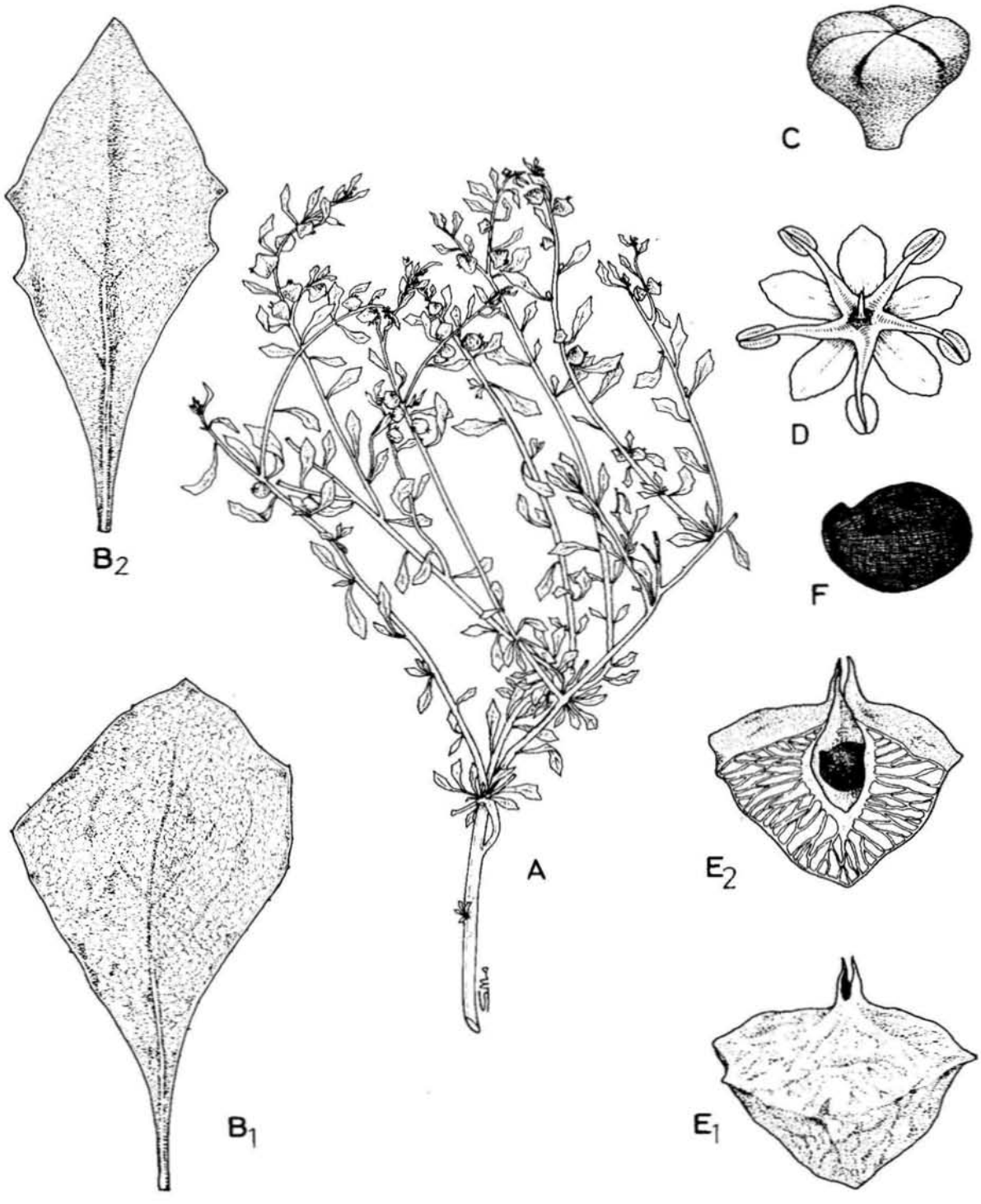

Fig. 17 **Blackiella inflata:** A, habit x 0.5; B_1-B_2, leaf variation x 5; C, male flower (side view) x 20; D, the same (dorsal view) x 15; E_1, fruiting perianth enclosing fruit x 5; E_2, V.S. of the same showing fruit hanging from apex with seed inside it x 5; F, seed x 10.

In addition to **A. semibaccata** R. Br., mentioned before, two more cultivated or exotic species are reported from Libya by Keith (l.c.). These are, **A. hortensis** L. (an annual, often cultivated as an ornamental with purplish flowers and bracteoles) and **A. vesicaria** Howard ex Benth., an Australian species, introduced at Hoscian in 1962. We do not have specimens of these with us, and the latter do not seem to be in existence here now.

9. BLACKIELLA

Aellen in Engler, Bot. Jahrb. 68: 423. 1938.

Similar to *Atriplex* but fruiting perianth much spongy, swollen and completely joined into an obconical body, flat-topped or umbo-shaped above, with a small, apiculate mouth-like opening in the centre; fruit a small utricle, 1-seeded, hanging like a small basket in the upper part and completely enclosed within the fruiting perianth; seed lenticular, shining, blackish or dark-coloured.

3 species in Australia, represented by the following species, introduced and now naturalized in the coastal areas of Tunisia, Libya and Egypt. A new generic record for our area.

Blackiella inflata (F. Muell.) Aellen in Engler, Bot. Jahrb. 68: 426. 1938; Tackh., St. Fl. Egypt ed. 2: 108, fig. 25 A. 1974. (Fig. 17).

Atriplex inflata F. Muell. in Trans. Phil. Inst. Vict. 2: 75. 1858; Maire, l.c. 91, fig. 938.

Annual, decumbent or suberect, monoecious herb, up to 40 cm tall, branched with whitish branches, covered with greyish mealy or scaly indumentum. Leaves ± rhombic, with elongated cuneate base, and few broad teeth to subentire, 1-2.5 (-3) x 0.5-1.5 cm. Male flowers in terminal clusters. Female flowers axillary, solitary, more common; fruiting perianth up to 6 x 7 mm; seeds lenticular, blackish, shining.

Type: Described from Australia.

A-2 Ras-ejadir, Libyan-Tunisian border area, sandy and saline soil, common, fruiting perianth obtriangular, inflated, spongy, greenish-whitish, 24.11.1977, *S.M.H. Jafri & A. El-Gadi* 6759; **B-4** End of Tawargha, Wadi Sofigin, common, 2.5.1978, *El-Gadi, Jafri & others* 1199.

Distribution: An Australian species, probably seeds introduced unintentionally with *Eucalyptus* and *Acacia* seeds, and now naturalized and common in the coastal areas of Libya.

10. **HALIMIONE**

P. Aellen in Verh, Nat. Ges. Basel 49: 121. 1938.

Silvery-lepidote or mealy herbs like **Atriplex** but pistillate flower or fruit with 2 strongly and almost completely united bracteoles; pericarp thin, membranous, adnate to the bracteoles.

3 species, in the Mediterranean, Euro-Siberian and Irano-Turanian regions, only 1 species is recorded from Libya.

Helimione portulacoides (L.) Allen in Verh. Nat. Ges. Basel 49: 126. 1938; in Davis, Fl. Turk. 2: 312. 1966. (Fig. 18)

Atriplex portulacoides L., Sp. Pl. 1053; Durand & Barratte, Fl. Lib. Prodr. 203. 1910; Pamp., Prodr. Fl. Cir. 179. 1931; Maire l.c. 60, fig. 926; Keith, l.c. 275; *Obione portulacoides* (L.) Moq., Chenop. Enum. 75. 1840.

Decumbent, monoecious shrubby perennial, woody at base, up to 90 (-150) cm long, silvery-farinose with often rooting stems. Lower leaves opposite, oblong-elliptic to obovate, entire, fleshy, up to 6 x 1.5 cm, shortly petioled, upper narrowly elliptic-oblong to linear-lanceolate, tapering cuneate at base, slightly acuminate to obtuse at apex. Flower clusters arranged in loose or dense terminal and axillary paniculate spikes. Fruiting bracteoles (2.5)3-4 mm long, obdeltoid-cuneate with, ± triangulate terminal teeth or lobes, leathery; seed c. 1.5 mm in diam. 2n=36.

Type: Described from N. Europe, Herb. Linn. 1221/4 (LINN).

A-2 Near Farwa, sea coast, common, prostrate, obcordate fruits, 4.11.1975, *S.M.H. Jafri* 6217.

Also reported from Gulf of Bomba and Tobruk by Durand & Barratte (l.c.).

Distribution: Europe, W. Siberia, N. Africa; also in S. Africa & N. America.

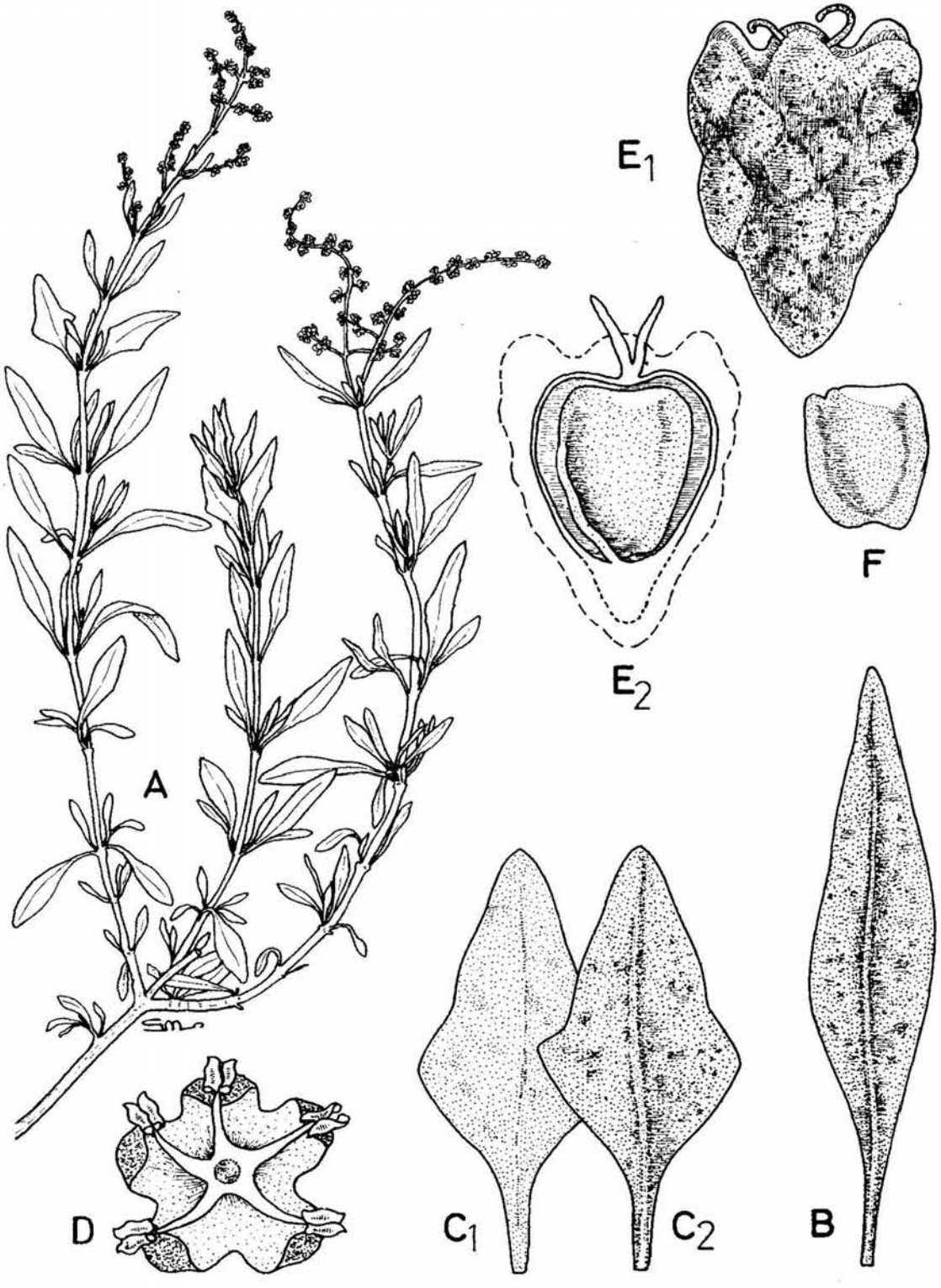

Fig. 18 **Halimione portulacoides:** A, habit x 0.65; B, leaf x 3; C_1, leaf (dorsal view) x 3; C_2, the same (ventral view) x 3; D, male flower (dorsal view) x 20; E_1, fruiting perianth enclosing fruit x 20; E_2, V.S. of the same showing fruit and seed inside it x 20; F, seed x 20.

A maritime plant, occurring in the coastal areas of Libya.

Fl. Nov.-Dec.

11. HALOPEPLIS

Bunge, ex Ung. Sternb. in Atti Cong. Bot. Firenz. 322. et 273, et 327, 1874.

Herbs or shrubs with succulent, ± aplexicaul, rudimentary clasping leaves, subglobular to ovoid, alternate or subopposite in the lower parts. Flowers 2-sexual or some pistillate, clustered in group of 3, ± connate with each other and adnate to the subtending bract, arranged in short, dense spicate inflorescence. Perianth small, obconical, of 3 segments, wingless. Stamens 1-2. Ovary pear-shaped, somewhat laterally compressed; stigams 2, subulate. Utricle included, with membranous pericarp; seed ellipsoidal, endospermous, with hook-shaped embryo.

About 3 species in the Mediterranean and Irano-Turanian region; 1 species is recorded from Libya.

Halopeplis amplexicaulis (Vahl) Ung.-Sternb. ex Ces. Pass. & Gib., Comp. Fl. Ital. 271. 1874; Pamp., Prodr. Fl. Cir. 179. 1931; Maire, l.c. 93, fig. 939; Keith, l.c. 529. (Fig. 10, C-D)

Salicornia amplexicaulis Vahl, Symb. Bot. 2 (1): 1. 1791; *Salsola nodulosa* Del., Fl. Egypte, 147. 1813; *H. nodulosa* (Del.) Bunge in Linnaea, 28: 573. 1854.

Annual herb, glabrous, glaucous, with whitish procumbent to ascending, thin branches from base, 10-30 cm long; stem often indurated below. Leaves with rudimentary blade, c. 3 mm in diam., alternate, clasping, almost globular or semi-globular, obtuse. Flower connate, in clusters, on short, 5-15 mm long, lateral and terminal, alternate, sessile, dense, oblong spicate inflorescences; subtending bracts fleshy, ovate-orbicular, acute or acuminate; stamen 1; seed c. 0.5 mm with cylindrical papillae on back.

Type: Described from Tunisia.

A-6 Bengazi, *V. Zanon* 159 (FI); Bengazi, Giuliana, 4.6.1916, *V. Zanon* 648 (FI).

Distribution: Mediterranean region, extending to some Saharo-Arabian territories.

A rare species in our area, probably confined to Benghazi area.

Fl. May-Aug.

12. **HALOCNEMUM**

M. Bieb,., Fl. Taur.-Cauc. 3: 3. 1819.

Richly branched, low shrubs with jointed stem, glabrous, whitish-green. Leaves rudimentary, opposite, connate at base, scale-like. Bracts deciduous, opposite, free, concave, scaly, acute. Flowers 2-sexual or polygamous, usually 3 in a cluster, free, arranged in short, dense lateral and terminal spicate inflorescences. Perianth segments 3, broadly ovate, blunt, united below, membranous, brownish, inflexed at tip; stamen 1; stigmas 2, subulate on a thick style. Utricle ovoid-compressed, tapering; pericarp membranous; seeds vertical with arcuate embryo.

A monotypic genus of the Mediterranean and Irano-Turanian region.

Halocnemum strobilaceum (Pall.) M. Bieb., Fl. Taur.-Cauc. 3: 3. 1819; Durand & Barratte, Fl. Lib. Prodr. 204. 1910; Pamp., Pl. Trip. 69. 1914; Podr. Fl. Cir. 179. 1931; Maire, l.c. 95, fig. 940; Keith, l.c. 528. (Fig. 19).

Salicornia strobilacea Pall., Reise 1: 412. 1771; *S. cruciata* Forsk., Fl. Aeg.-Arab. 2. 1775.

Low, fleshy, glabrous, yellowish-green shrub, 20-60 (-100) cm, prostrate to suberect, much branched; branches with short, thick, cylindrical internodes ending with 2, c. 1 mm, obovate, ± obtuse, scarious-margined leaves, connate at base, often subtending, short, sterile, globular, bud-like branches with 4 rows of rudimentary leaves. Bracts of flower clusters reniform to orbicular, shed after flowering. Spikes short, dense, sessile, opposite and terminal, globular to oblong. Perianth c. 1.5 mm; seed 0.5-1 mm, compressed, brown smooth to minutely tuberculate.

Type: Described from Trans-Caspian region.

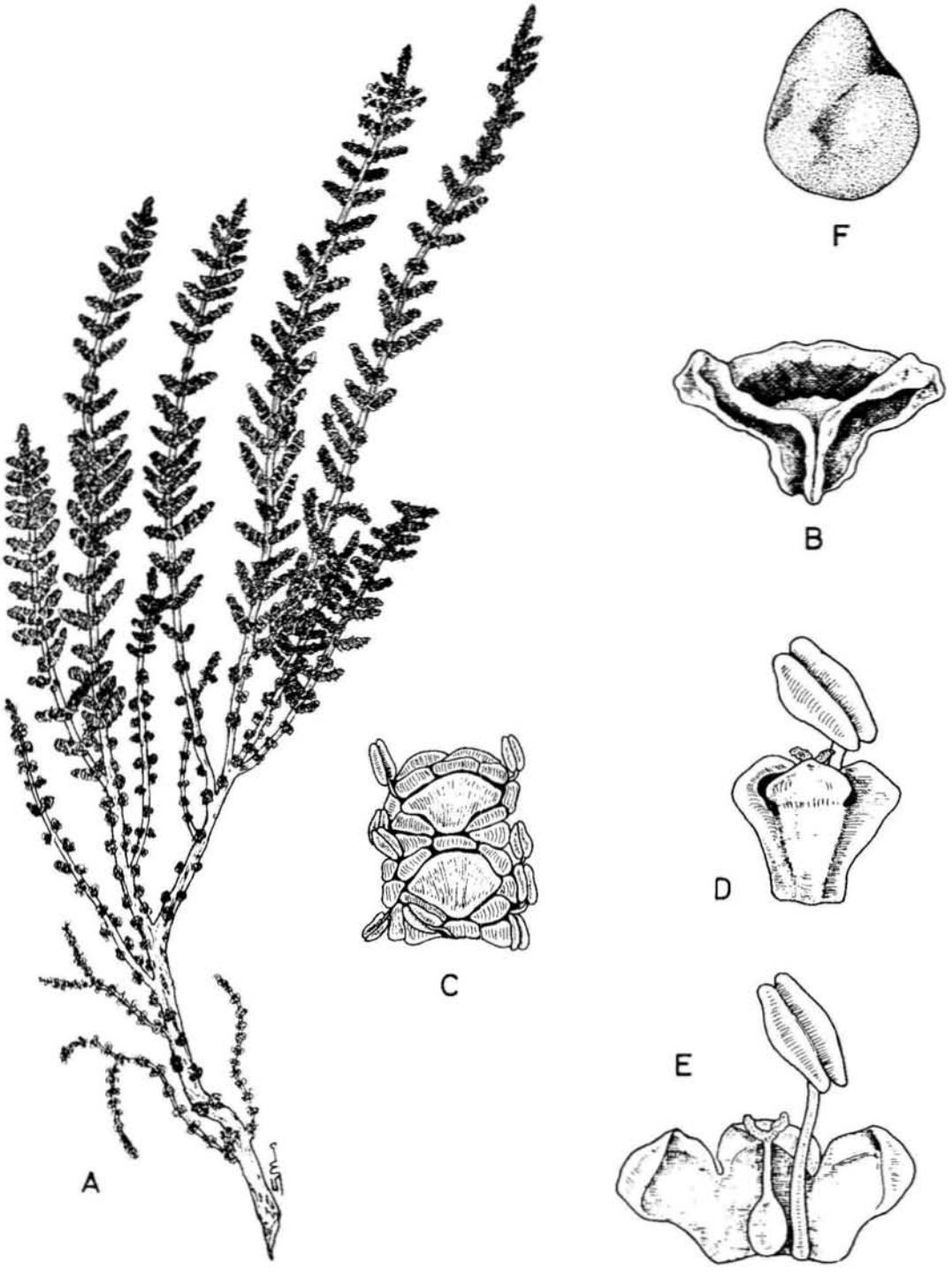

Fig. 19 **Halocnemum strobilaceum:** A, habit x 0.5; B, opposite connate leaves x 15; C, portion of inflorescence x 6; D, flower x 20; E, flower perianth opened to expose stamen and gynoecium x 20; F, seed x 25.

A-2 Sorman, 14.11.1975, *Gammudi, A.* 21; *Zenab, A.* 21; **A-3** Al Khoms, Wadi Ain Khemm, 27.12.1969, *I.I. Chaudhri* 15388; **A-6** Dariana, 35-40 km before Bengazi, 16.6.1972, *S.I. Ali* 450; Bengazi marshes near the stadium, 21.10.1977, *Siddiqi & Fathi* 132; **A-8** Tobruk, 18.10.1977. *Siddiqi & Fathi* 78; **B-4** Sirte, 28.10.1975, *S.M.H. Jafri* 6175; 8.1.1977, *Siddiqi & Fathi* 119; Bougrain, 23.3.1975, *K. Sifaw* 86; **B-5** 80 km from Ras Lannof to east, 22.10.1977, *Siddiqi & Fathi* 147.

Distribution: Mediterranean region (S. Europe, N. Afrca), W. & C. Asia.

A plant of saline or marshy coastal areas, forming rounded clumps, sometimes grazed by camel or sheep and is considered a source of potash.

Fl. May-Sept. *Vern.:* Hdidat, Rehsal, Shenin.

13. **ARTHROCNEMUM**

Moq., Chenopod. Monogr. Enum. 111. 1840.

Halophytic, succulent, much branched shrubs or perennials with jointed seemingly leafless stem, sometimes rooting at nodes; internodal-tube usually club-shaped, shrivelling and usually falling away from the stem ultimately (hence interpreted as bladeless connate bases of opposite leaves), each with a pair of vague opposite, terminal cups embracing the base of the next segment, becoming very short in the flowering region and subtending a group of 3 flowers (hermaphrodite or unisexual) each, ± immersed in the cup. Perianth 3-4-fid, becoming somewhat swollen and spongy in fruit. Stamens 1-2. Style rather long with 2 (-3) stigmas. Fruit an utricle with membranous or indurated pericarp. Seed laterally compressed usually endospermous with arcuate embryo.

About 12 species, chiefly of marshy places and sea coasts in the Mediterranean and Irano-Turanian regions, N. America and Australia; represented by 3 species in Libya.

1. \+ Plants stout, ± erect; fertile segments broad — 2
   — Plants with prostrate main stem, rooting at nodes; fertile segments narrowed — 3. **A. perenne**

2. \+ Flowers of each cyme protruding, ultimately falling to leave an undivided hollow in the segment; seeds black, testa hard tuberculate — 1. **A. macrostachyum**

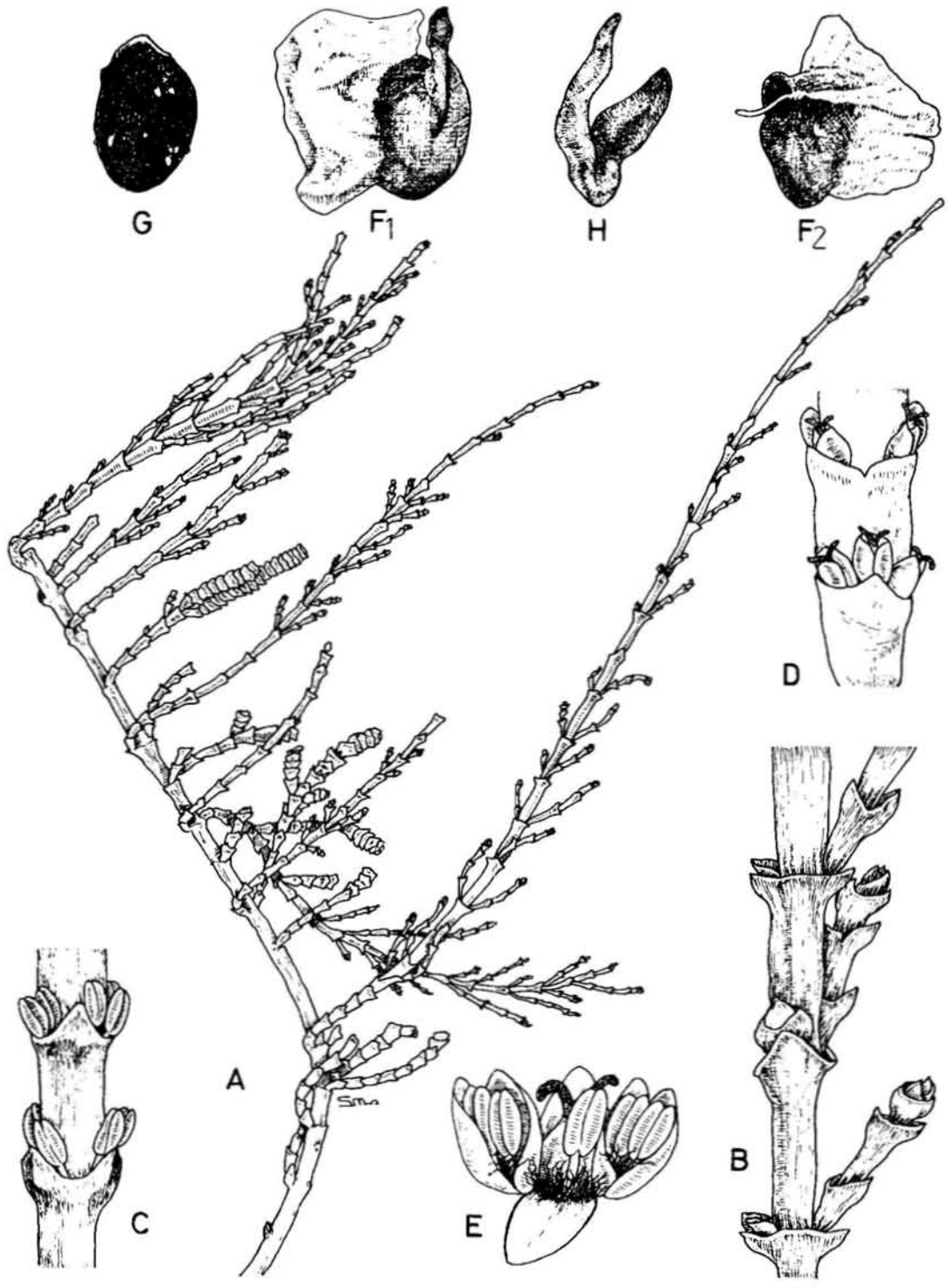

Fig. 20 **Arthrocnemum macrostachyum:** A, habit x 0.5; B, a portion of branch x 3; C, protruding stamens from nodes x 5; D, protruding perianth and stigmas x 5; E, group of three flowers separated and exposed, the central with 1 stamens and a gynoecium, the laterals with 2 stamen each x 10; F_1-F_2, fruits with seeds x 20; G, seed x 20; H, embryo x 20.

— Flowers of each cyme immersed, ultimately falling to leave 3-partite hollow in the segment; seeds greenish-brown to greyish; testa thin membranous, covered with subconical hairs. 2. **A. fruticosum**

1. **Arthrocnemum macrostachyum** (Moric) Moris et Delponte in Ind. Sem. Hort. Taur. 35, t. 2. 1854; Durand & Barratte, l.c. 204; Zoh., Fl. Palest. 1: 156, fig. 226. 1966. (Fig. 20)

Salicornia macrostachya Moric, Fl. Vente. 1: 2. 1820; *S. glauca* Del. Fl. Aeg. Ill. 69. 1813 *(nom. illegit.)* - non Stokes (1812); *A. glaucum* (Del.) Ung.-Sternb. in Atti Congr. Bot. Firenze 283. 1876 *(nom. conf.)*; Pamp., Pl. Trip. 68. 1914; Prodr. Fl. Cir. 180. 1931; Keith, l.c. 257; Aellen et al in Davis, Fl. Turk. 2: 320. 1966; Ball in Tutin et al, Fl. Europ. 1: 101. 1964; Tack., St. Fl. Egypt ed. 2: 119. 1974; *A. indicum* auct. non (Willd.) Moq. (1840): Maire, Fl. Afr. Nord. 8: 97, fig. 941. 1962; *S. radicans* auct. non Sm. (1807); Viviani, Fl. Lib. Spec. 1. 1824.

Erect to ascending, succulent, glabrous, glaucous, much branched shrub, up to 1 m tall, becoming yellowish-green or reddish, often rooting from basal joints; joints ± club-shaped, with ± horizontal, connate, decussate, leaf-rudiments, subhyaline at the margin and obtusish or rounded tips; sterile branches with longer joints than the flowering ones; flowering branches erect, ending to thick, cylindrical, obtuse spikes, 20-50 (-60) x 3-4 mm, with close joints and decussately arranged subtending bracts. Flowers in threes, almost free, erect, protruding from the undivided cavity to up to 1/3 the length of joints. Perianth 2-4 mm long, usually 3-dentate, obpyramidal. Pericarp membranous; seed c. 1 mm, black, shining with indurated testa, verrucose on back, short-papillose.

Type: Described from Europe (Venice).

A-2 c. 2 km after Sorman, 14.11.1975, *Zenab, A.* 15; **A-6** 5 km before Bengazi, saline & sandy ground, 27.10.1976, *S.M.H. Jafri* 6167; **A-8** Tobruk, salty marshes, 18.10.1977, *Siddiqi & Fathi* 79; **B-4** Road between Bougrain and Al-Buayrat, in salt marshes, 15.1.1967, *L. Boulos* 1081; **B-5** 80 km from Ras Lannouf, along roadside, 22.10.1977, *Siddiqi & Fathi* 145.

Distribution: Mediterranean coasts of S. Europe, N. Africa, Egypt, Palestine and W. Syria.

Maire (l.c.) considered it to be conspecific with **A. indicum** (Willd.) Moq., a species of the Arabian sea coast of Pakistan, India and E. Tropical Africa. *A. indicum* differs from this species by its female flowers (except the stigmas) hidden in the segments and connate with each other, and male flowers, still little known (see Brenan in Turrill and Milne-Redhead, Fl. Trop. E. Africa (Chenopodiaceae) 20.1954). However, Jafri (Fl. Karachi 97. 1966) describes the male flower as « stamen usually 1 and anther c. 0.8 mm long in spikes bearing male flowers » from plants collected at Karachi (Pakistan) where it grows abundantly. However, the 2 species need further critical studies with adequate materials from the entire range of their occurrence. Maire described 2 stamens in male flowers in his « *A. indica* » (i.e. the plants of the Mediterranean coast of N. Africa). The present senior author has seen the plants of both the areas, and in field *A. indicum* looks more robust and stout as compared to the *A. macrostachya* (=*A. glaucum*) of the present area, with single stamen in male flower in the former and usually 2 stamens in the latter. The female flowers are almost free in our plants but they are connate in *A. indicum*.

It differs from the following species by the cymes protruding and free from the segment, falling to leave one hollow, seeds black with hard and tuberculate testa.

Fl. May-Sept. *Vern.* Balbal-jemal, h'mada

2. **Arthrocnemum fruticosum** (L.) Moq., Chenop. Monogr. Enum. 111. 1840; DC., Prodr. 13: 2. 151. 1849; Zoh., l.c. 156, fig. 224; Aellen et al in Davis, l.c. 320. (Fig. 21, F-I).

Salicornia europaea L. var. *fruticosa* L. , Sp. Pl. 3. 1753; *S. fruticosa* (L.) L. Sp. Pl. ed. 2: 5. 1762; Durand & Barratte, l.c. 204; Pamp., Pl. Trip. 70. 1914; Prodr. Fl. Cir. 180. 1931; Keith, l.c. 853; Tack., l.c. 119; *S. arabica* auct. non L. (1753): Maire, l.c. 104, fig. 945.

Shrubby, glabrous, glaucous perennial, up to 1 m, with ascending to erect, caespitose stems, ± decussately branched, rarely rooting at base; joints cylindrical 6-15 mm with leaf-rudiments c. 12 mm, ± membranaceous margined, forming a cupular sheath. Flowers in threes, immersed, ± outcurved above, with stigmas protruding out, ultimately falling (after fruiting) to leave a tripartite hollow (difficult to see in dried material), perianth of middle flower rhomboidal or trapezoidal at top; stigmas (2-) 3. Seeds subglobular, greyish with thin testa covered with thin, relatively long, somewhat conical or slightly curved hairs.

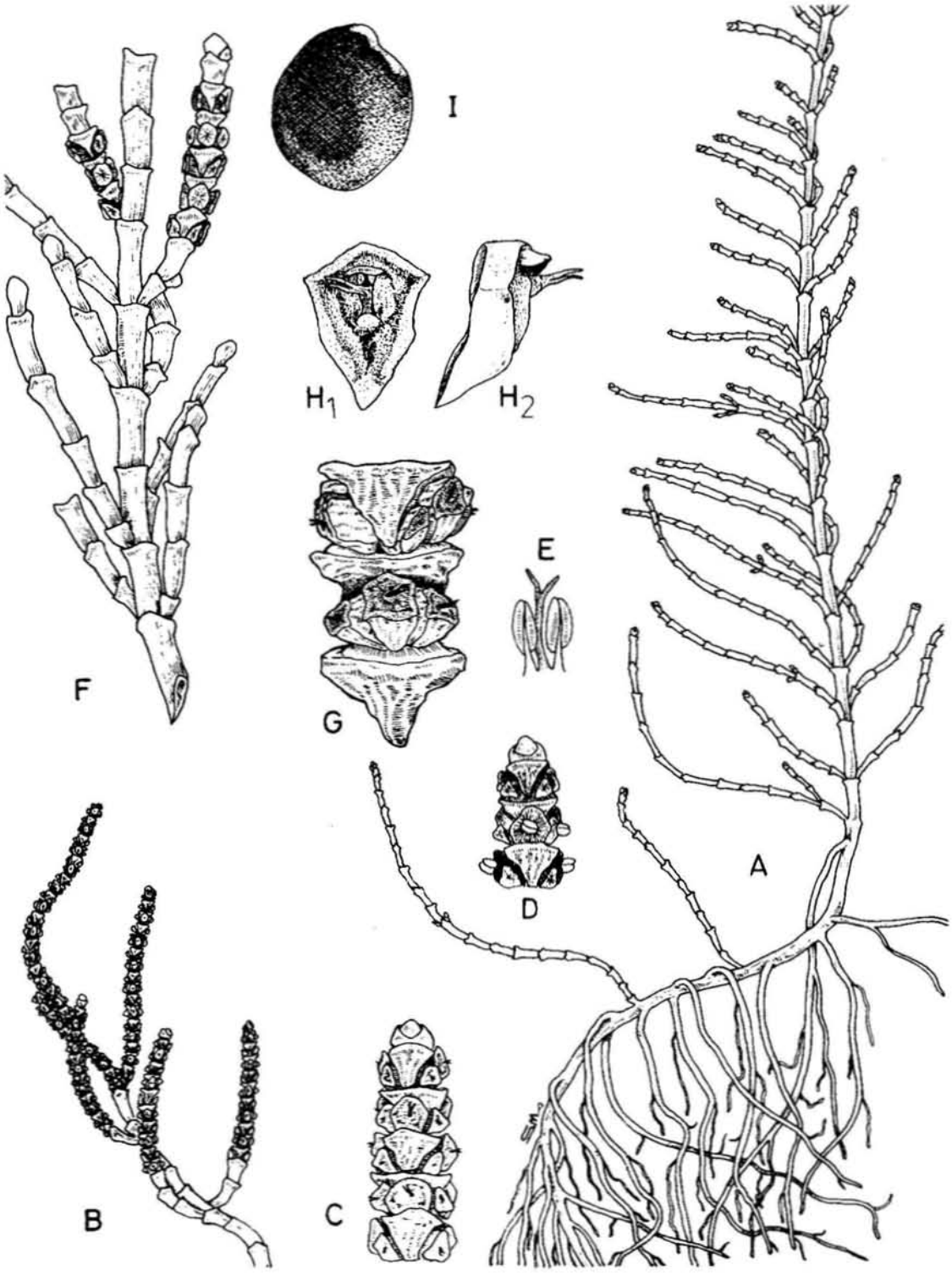

Fig. 21 **Arthrocnemum perenne:** A, habit x 1, B, inflorescences x 1; C, portion of inflorescence without stamens x 4; D, portion of inflorescence with protruding stamens x 4; E, stamen and style with stigmas x 10; **A. fruticosum:** F, portion of flowering branch x 1; G, portion of inflorescence x 4; H_1, flower (front view); H_2, the same (side view) x 4; I, seed x 15.

Type: Habitat in Europae litoribus maritimis.

A-2 2 km after Sorman, 14.11.1975, *Gammudi, A.* 22; *Zenab, A.* 22; 29 km after Sabrata, creeping to ascending plant, fleshy, in salty soil, 22.11.1977, *Fathi, B.R.* 129; **B-1** 39 km from Gadames, near salt lake, 25-30 cm tall, 26.2.1975, *S.I. Ali* 2151.

Distribution: Mediterranean coasts of Europe, France, N. Africa, Arabia, W. Syria, Iran, Africa & N. America.

Very much like *Salicornia* but 3 flowers of the cyme arranged horizontally or almost so and plants perennial, shrubby. It is difficult to keep this and the next species out of *Salicornia* and the taxonomic treatments vary. Further studies are needed on these taxa and *Salicornia* (with annual species only but with ± the same appearance of cymes or flowers).

Fl. May-Sept. *Vern.* Ghedem, Rhadam, Hamd

3. **Arthrocnemum perenne** (Mill.) Moss., J. South Afr. Bot. 14: 40. 1948; Zoh., l.c. 156, fig. 225; Ball in Tutin et al, Fl. Europ. 1: 101. 1964. (Fig. 21, A-E).

   Salicornia perennis Mill., Gard. Dict. ed. 8. no. 2. 1786; Maire, l.c. 102, fig. 944; *S. radicans* Sm., Eng. Bot. tab 1691. 1807.

Small, creeping shrub, with prostrate, rooting main stem and thin ascending branches; leaves c. 2 mm, forming a cupular sheath, spikes narrower and thinner than those in the previous species. Seeds covered with hooked hairs.

Type: Described from Europe.

A-6 Bengazi, salty marshes, 21. 10.1977, *Siddiqi & Fathi* 129 and 130; **B-4** 10 km before Sirte, 22.10. 1975, *S.M.H. Jafri* 6006.

Distribution: Same as the previous species.

Differs from *A. fruticosum* by usually having an underground or prostrate stem rooting at nodes and seeds covered with hooked hairs. This is a new record for our area.

14. SALICORNIA

L., Sp. Pl. 3. 1753 (p.p.); Gen Pl ed. 5: 4. 1754.

Very similar to **Arthrocnemum** but plants annual and the 3 flowers of each cyme arranged in a triangle, the laterals smaller and meeting below the central flower.

About 50 species in the moist and saline habitats in temperate and subtropical regions; represented by 1 species in Libya. We lack specimens of this genus in our herbarium, and proper collection is needed for adequate treatment of the genus from our area.

A difficult genus and characters should be studied and written when the plants are freshly collected. It is better to collect the plants in the fruiting stage during August-September.

Salicornia europaea L., Sp. Pl. 3. 1753 (p.p. and excluding var. *fruticosa*); Zoh., l.c. 157 fig. 227; Ball in Davis, l.c. 321; Maire, l.c. 100, fig. 942.

S. europaea var. *herbacea* L., Sp. Pl. 3. 1753; *S. herbacea* (L.) L., Sp. Pl. ed. 2: 5. 1762; Durand & Barratte, l.c. 204; Pamp., Pl. Trip. 70. 1914; Prodr. Fl. Cir. 181. 1931; Keith, l.c. 854; Tack., l.c. 119.

Annual, robust, glabrous, succulent herb, up to 40 cm, prostrate to erect, ± decussately and divaricately branched, with a simple tap root; main stem distinctly jointed to the base; branches green often turning purplish in fruit; leaf-rudiments c. 1.5 mm, membranous margined. Spikes cylindrical, slightly tapering at top, up to 5 (-10) cm, rarely more long. Middle flower of each cyme projecting above lateral ones; perianth of middle flower obovoid-rhomboidal; stamen mostly 1. Stigmas 2; seed ovoid, 1-2 mm, with short ± hooked hairs.

Type: Described from Gotland, Herb. Linn. 10/1 (LINN).

Reported from Tripoli (Bab Djedid, *Letourneux*) by Durand & Barratte (l.c.), Sebkas (*Cavara*) by Maire (l.c.).

Distribution: Mediterranean, Euro-Siberian region, introduced elsewhere.

A variable species and often split into a number of taxa. It may easily be confused with *Arthrocnemum fruticosum*, a perennial shrubby plant with woody stem, if not properly examined and entire plant with root not collected. Occurrence

of this species in our area needs confirmation.

15. SUAEDA

Forsk. ex Scopoli. Intr. 333. 1777 *(nom. cons.) Schanginia* C.A. Mey. in Ledeb., Fl. Alt. 1: 394. 1829; Tack. St. Fl. Egypt ed. 2.119.1974.

Herbs or shrubs, glabrous or farinose with small, fleshy or sapy, usually alternate leaves. Flowers 2-sexual and pistillate, solitary or in few-flowered (2-3) cymules or glomerules, minute-bracteolate. Perianth-segments 5, usually fleshy, greenish; stamens 5, inserted on perianth segments. Ovary sessile, free or rarely adnate to perianth; stigmas 2-3 (-5); seed vertical or horizontal, with hard and dark brown testa or thinner and lighter (in late autumn fruits), almost exalbuminous with spirally coiled embryo.

About 100 species, almost cosmopolitan, in sandy and saline habitats; represented by 6 or 7 species in Libya.

1.	+	Annual. Ovary adnate to the base of perianth lobes which become ± spongy in fruit	6. **S. aegyptiaca**
	−·	Low shrubs,woody at base. Ovary free from the perianth	2
2.	+	Upper leaves tapering below into a very short petiole or subsessile, suboblong to globular	3
	−·	Upper leaves ± linear, sessile or subsessile	4
3.	+	Leaf blade articulated or almost so with very short petiole, usually reflexed, turning black on drying	1. **S. vermiculata**
	−·	Leaf blade not so articulated, usually upcurved, not turning black when dried	2. **S. monodiana**
4.	+	Leaves almost acicular, 2-6 x 0.5 mm; bracts not exceeding the flowers	4. **S. pruinosa**
	−·	Leaves longer and broader, 5-15 (-20) x 1-2 mm; bract slightly to conspicuously exceeding the flowers	5

5.	+	Stigmas discoid or capitate with more than 3, very short lobes. Leaves often turning blackish when dried, sessile, broader at base	3. **S. vera**
	−-	Stigmas 3, linear, leaves usually abruptly ending into an obscure petiole or sessile, not turning blackish when dried	6
6.	+	Leaves obtuse, reflexed; flowers usually 3-5 in a cluster	**S. fruticosa**
	−-	Leaves acutish, upcurved; flowers usually solitary, axillary	5. **S. palestina**

1. **Suaeda vermiculata** Forsk. ex J.F. Gmelin. in L., Syst. ed. 13. 2: 503. 1791; Durand & Barratte, l.c. 204; Pamp., Pl. Trip. 71. 1914; Prodr. Fl. Cir. 181. 1931; Zohary, Fl. Palest. 1: 160, fig. 231. 1966; Cufodontis, Enum. Pl. Aethiop, 53. 1953. (Fig. 22)

Salsola mollis Desf., Fl. Atl. 1: 218. 1798; *Suaeda mollis* (Desf.) Delile, Fl. Egypte t. 63 fig. 12. 1824; Maire, l.c. 107, fig. 947 p.p. (excl. syn. *S. volkensii* Clarke).

Shrubby perennial, somewhat woody and glabrous below, papillose or minutely pubescent to almost glabrous above or on younger parts, up to 50 cm tall, much branched, usually turning black when dried except the branches which remain whitish or greyish. Leaves 3-10 x 1-4 mm, succulent, lower obovate-oblong, upper nearly globular, obtuse, very shortly petiolate with articulation to almost sessile or obscurely petioled, obtuse or rounded at apex, with rounded margins, often ± reflexed or deflexed. Bracts short, leaf-like, equalling or slightly exceeding the axillary, sessile, 1-3-flowered cluster, forming a loose, short, spike-like inflorescence. Flowers small, hermaphrodite or female, c. 3 (-4) mm across; perianth segments 5, obtuse, c. 1 mm in diam., ovoid, incurved; stamens 5, included; filaments subulate; anthers c. 1 mm, ovoid. Stigmas 3, free, subulate. Pericarp membranous; seed c. 1 mm in diam., vertical or horizontal, not beaked, reniform, shining.

Type: Egypt, Alexandria, *Forskal* (C).

A-2 Between Zilten and Abu Kammash, after Zwara, erect shrub with fleshy leaves, c. 25 cm, green flowers, 26.11.1976, *Alavi, Ghafoor & Fathi* 137; **B-4** 55 km before

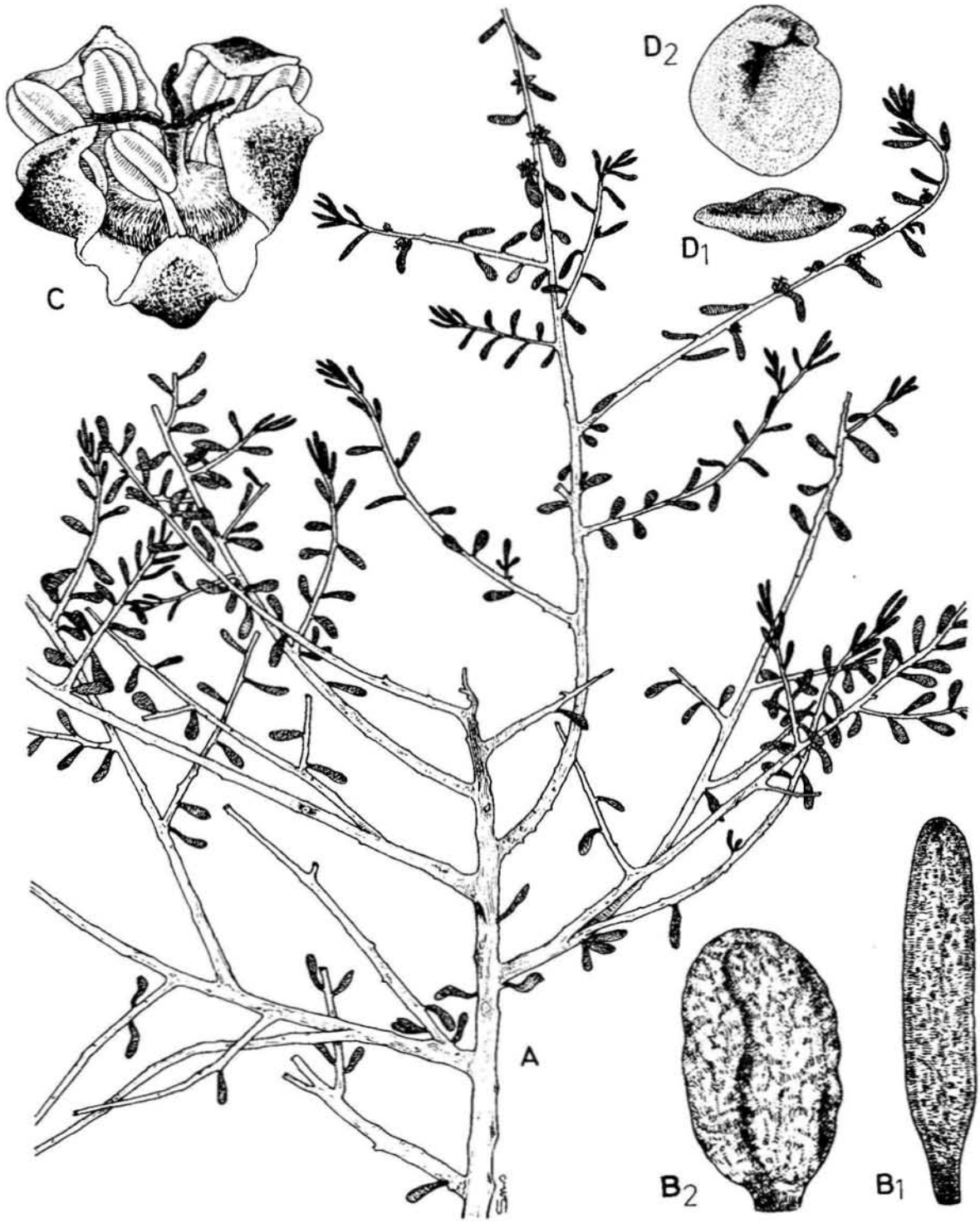

Fig. 22 **Suaeda vermiculata:** A, habit x 1; B_1-B_2, leaf variations x 10; C, flower x 15; D_1, horizontal seed x 20; D_2, seed (dorsal view) x 20.

Sirte, 8.1.1977, *Siddiqi & Fathi* 147; **G-8** Gebel Uweinat, 7.11.1968, *L. Boulos* 3129.

Distribution: N. Africa, Sudan, Aethiopia, Palestine, Arabia Petraea, Iraq to Pakistan & India.

A variable species and among few gatherings, cited above, we have plants with branches brownish (without shine and not smooth) and whitish or yellowish (with some shine and smooth); the latter condition is on flowering branches only (present in *Siddiqi & Fathi* 147). We need more gatherings to decide the identity of *S. mollis* from *S. vermiculata*. But even if they are separated as 2 taxa, we have both of them in our area.

Fl. Jan.-April *Vern.* Shefshaf, Souida

2. **Suaeda monodiana** Maire in Bull. Soc. Hist. Nat. Afr. Nord. 30: 361. 1940; Fl. Afr. Nord. 8: 109. fig. 948. 1962. (Fig. 23)

Small shrub, up to 60 cm tall, glabrous, glaucous, not turning black on drying with somewhat angular stems, whitish in colour. Leaves alternate, obovoid-subglobose, narrowed below into a stalk-like base, but not articulated, upper ones usually upcurved, spoon-like, fleshy, with rounded apices and margins, up to 10 x 3 mm. Flowers c. 3 mm across, in axillary glomerules with usually central hermaphrodite flowers and lateral pistillate ones; bracts and bracteoles scarious, hyaline, ovate-lanceolate. Perianth-segments 5. Stamens 5, exserted; anthers c. 1.5 mm. Stigmas usually 3, free; fruiting perianth hardly thickened. Pericarp membranous; seed ovoid-subreniform, 1-1.5 x c. 1 mm.

Lectotype: Described from Sahara: Sahara espagnol, Touf, 7.8.1938 *Maire* 2570 (MPU).

E-1 10 km before Ghat, sandy ground, common, 24. 2. 1976, *S.M.H. Jafri* 6352; Ghat, sandy, saline soil near the Rest House, common, 24.2.1976, *S.M.H. Jafri* 6320; 30 km from Ghat towards wadi Aghaghe, 19.2.1977, *Siddiqi & Mohamed Ahmad* 86.

Distribution: Endemic to Mid and W. Sahara (Libya, Algeria & Morocco).

A desert species, confined to Ghat area in Libya. Similar to the previous species in leaf but not turning black on drying and leaves upcurved, without an

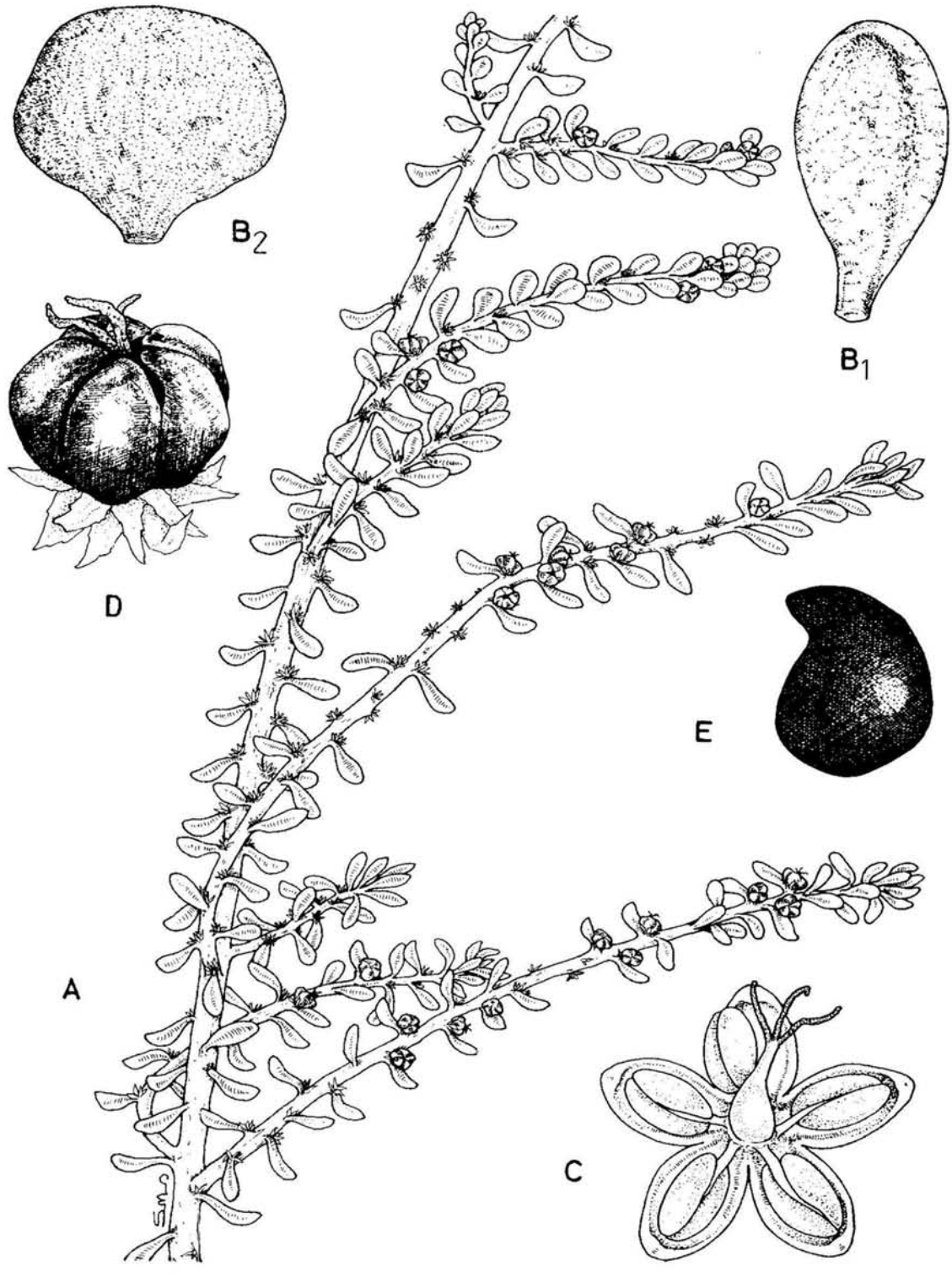

Fig. 23 **Suaeda monodiana:** A, a flowering and fruiting branch x 2; B_1-B_2, leaf variation x 10; C, flower (dorsal view) x 15; D, fruit with perianth x 15; E, seed x 25.

articulation on the very short petiole-like base. It may also be an extreme desert form of *S. fruticosa* complex and may be considered as a subspecies of that in our area, (see note under *S. vera* also). It is recorded for the first time from Libya.

Fl. Feb.-April

3. **Suaeda vera** Forsk. ex J.F. Gmelin in L., Syst. Nat. ed. 13. 2: 503. 1791; P.W. Ball in Tutin et al, Fl. Europ. 1: 103. 1964; Zohary, Fl. Palest. 1: 159. fig. 229. 1066. (Fig. 24).

Chenopodium fruticosum L., Sp. Pl. 221. 1753; *Salsola fruticosa* auct. non Forsk. ex Gmelin, l.c. 503 (*nom. conf.*); Durand & Barratte, l.c. 205; Pamp., Pl. Trip. 112. 1914; Prodr. Fl. Cir. 181. 1931; Maire, l.c. 112, fig. 950 (p.p.); Keith, l.c. 943; *Suaeda fruticosa* var. *vera* (Forsk.) Maire & Weiller in Maire, l.c. 114.

Low shrub, up to 60 cm, ±glabrous or somewhat mealy, erect to prostrate, often much branched, with whitish or yellowish stem and blackish leaves when dried. Leaves 5-15 (-20) x 1-1.5 mm, ± sessile, linear, oblong-linear to sublanceolate, fleshy, glaucous, semiterete to almost flat, ± rounded or obtuse at apex and base. Bracts exceeding the flowers, leaf-like, smaller than leaves; bracteoles scarious or membranous, irregularly denticulate to entire (looking like stipules), much shorter than bracts. Flowers hermaphrodite, 1.5-2 mm long, usually solitary, sometimes 2-3 in a cluster, forming dense, elongated leafy spikes. Perianth segments ovate, obtuse to lanceolate, connivent in fruit. Style obscure, dilated in more than 3, very short-lobed, capitate or club-shaped, papillose stigmas. Seed smooth, usually vertical.

Type: Egypt, *Forskal* (C).

A-3 Mallaha coastal road, 5 km east Tripoli, 15.4.1967, *L. Boulos* 1650; Tripoli, near Andir hospital, fleshy bluish-green shrublet, 19.11.1977, *Fathi, B.R.* 121; **A-7** c. 1 km from Ras Ettin, near cult. field, 21.6.1962, *S.I. Ali* 868; Wadi Derna, 50-100 m, shingle terraces, 2-3 ft. shrub, 31.3.1970; *P.H. Davis* 50379; Derna beach, 1.3.1973, *A. El-Tiafe* s.n.; 14.3.1968, *L. Boulos* 2394; **A-8** Between Tobruk and Tamimi, 25.10.1975, *S.M.H. Jafri* 6096; **B-6** 5 km west of Gmenis, 58 km before Bengazi, 22.10.1977, *Siddiqi & Fathi* 139.

Distribution: Europe, N. Africa, Arabia, eastwards to India.

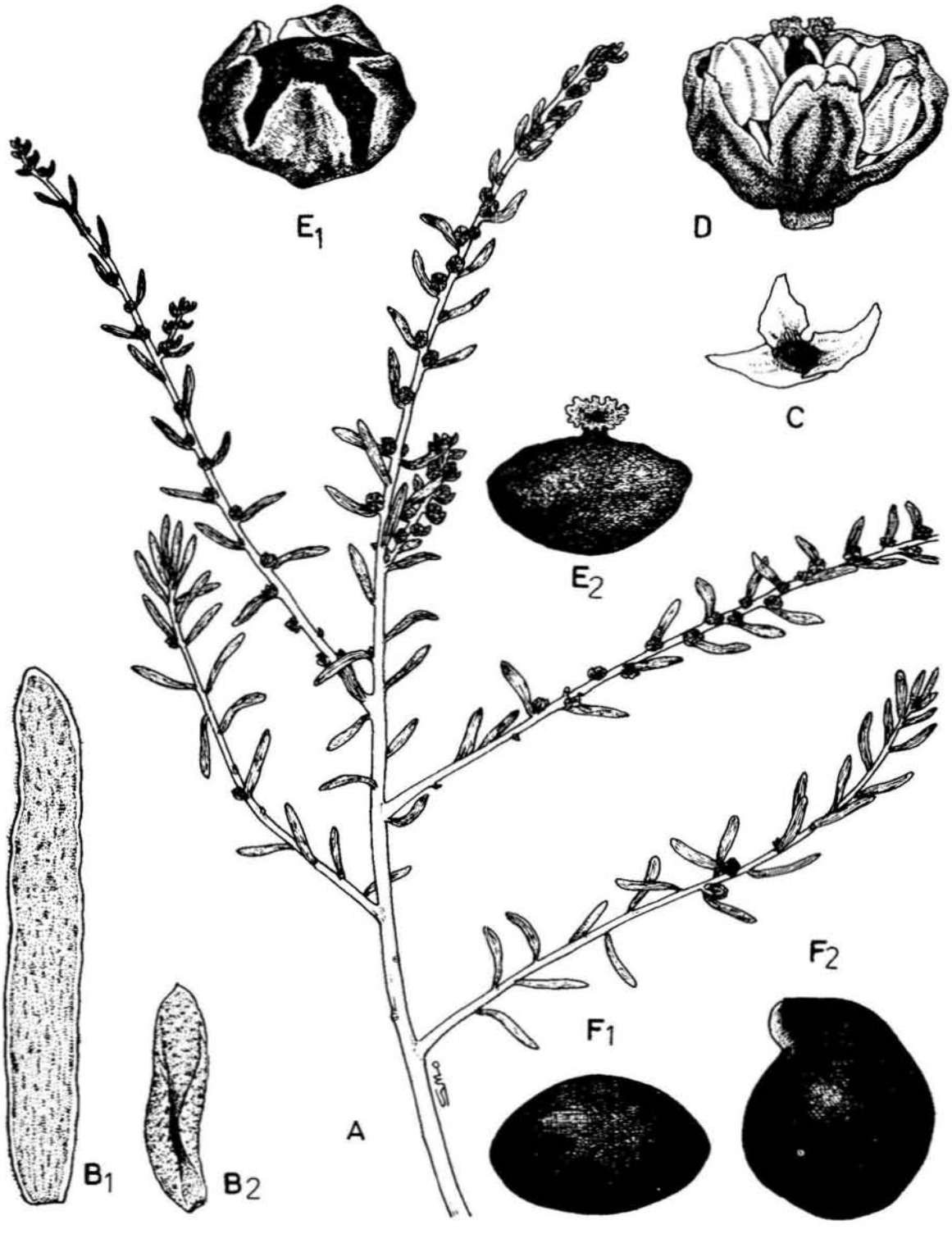

Fig. 24 **Suaeda vera:** A, portion of flowering and fruiting branch x 1; B_1-B_2, leaf variation x 8; C, bract and bracteoles x 15; D, flower x 15; E_1, fruit with perianth x 15; E_2, fruit with stigma x 15; F, seed x 25.

Easily recognized by its flat, capitate or disc-shaped, shortly lobed or papillose stigma (usually with more than 3, very small or minute lobes). *S. fruticosa* is a confused name and differs from *S. vera* Forsk. ex Gmelin by its 3, filiform stigmas. Its publication was validated only with reference to Gmelin (in L., Syst. Nat. 13. 2: 503. 1791, the genus being validly published by Scopali with reference to Forskal in 1777). However, citing *Chenopodium fruticosum* L. as a basionym of *S. fruticosa* was again a mistake, beacuse it is synonymous with *S. vera* and thus anything recognized as *S. fruticosa* (L.) Forsk. until now becomes illegitimate. I have still to find a specimen of true *S. fruticosa* Forsk. ex Gmelin, mainly a Sudanian species (see Zohary, l.c. 159, fig. 230) and 3-5 axillary flowers, from our area, but *S. monodiana* Maire (l.c.) could be an extreme desert form of this species in our area, or is represented by *S. palestina* Eig. & Zoh. and *S. pruinosa* Lange, very allied species (and sometimes considered conspecific or infra-specific taxon of *S. fruticosa*).

Probably eaten by camel (see Keith, l.c. 943).

Fl. Feb.-April *Vern.* Souida, Tirbar, Essabta.

4. **Suaeda pruinosa** Lange in Vid., Med. Nat. For, Kjobenhaven 45. 1861; Durand & Barratte, l.c. 205; Pamp., Prodr. Fl. Cir. 181. 1931; Maire, l.c. 111., fig. 949; Keith, l.c. 944; Ball in Tutin et al, l.c. 103.

   S. fruticosa var. *brevifolia* Moq., Chenop. Enum. 122. 1840; in DC., Prodr. 13.2. 157. 1849; Maire, l.c. 114.

Similar to *S. fruticosa* Forsk. ex Gmelin but leaves very narrow, 2-6 x 0.5, mm, ± cylindrical, obtuse, minutely apiculate, bracts not exceeding the cymules. Differs from *S. vera* Forsk. ex Gmelin by its 3, filiform or subulate stigmas, similar to *S. fruticosa*.

Type: Described from Europe.

Reported by Durand & Barratte (l.c.) from Bengazi, Kufra and Ajdabia and Maire (l.c.) from S. Misrata, Benghazi, Derna and Bardia, but these specimens need verification and confirmation because Maire has treated var. *brevifolia* Moq. under *S. fruticosa* and *S. pruinosa* Lange separately.

Distribution: Spain, Sicily and N. Africa.

Fig. 25 **Suaeda aegyptiaca:** A, a portion of flowering stem x 1; B, leaf x 5; C, a portion of infructescence x 1; D, flower x 8; E, the same in V.S. x 8; F, seed x 20; **S. palestina:** G, flowering branch x 1; H, leaf x 5; I, flower x 15; J, the same in V.S. x 15.

5. **Suaeda palestina** Eig & Zoh. in Eig, Palest. Journ. Bot. Jerus. Ser. 3: 126, fig. 232. 1945. (Fig. 25, G-J).

Similar to *S. fruticosa* Forsk. ex Gmelin but with samller leaves (4-) 5-10 (-12) x 1-2 mm, sessile and acutish at apex, mostly arcuate or ± upcurved, flowers hermaphrodite, solitary, axillary (3-5 in true *S. fruticosa*). Bracteoles very small, lanceolate, scarious; perianth c. 2 mm, with (4-) 5, ovate-oblong, narrowly white margined segments; stigmas (2-) 3; seeds vertical, beaked, glossy.

Type: Described from Palestine.

A-8 70 km from Derna on way to Tobruk, small shrub, pinkish above, 24.10.1975, *S.M.H. Jafri* 6049; **B-4** Salt marshes near Al Kararim, 8.3.1968, *L. Boulos* 1919.

Distribution: N. Africa (Libya, Egypt), Palestine, E. Sudan.

Differs from *S. pruinosa* Lange by its broader (1-2 mm), usually ± upcurved to arcuate longer leaves and bracts. Probably only a form of *S. monodiana* Maire, with smaller, arcuate, acutish leaves. Further studies are needed on *S. fruticosa* complex, to which all these taxa resemble closely in 2-3-lobed stigmas, especially on the regional variations and range of variations in leaves and flowers.

6. **Suaeda aegyptiaca** (Hasselq.) Zohary in Journ. Linn. Soc. Bot. 55: 636. 1957; Fl. Palest. 1: 161. Fig. 235. 1966. (Fig. 25, A-F).

Chenopodium aegyptiacum Hasselq., It. Palest. 460. 1757; *S. baccata* Forsk. ex Gmelin in L., Syst. Nat. ed. 13. 2: 503. 1791; *Schanginia baccata* Moq., Chenop. Enum. 119. 1840; *S. aegyptiaca* (Hasselq.) Aellen in Rechinger f., Fl. Lowland Iraq. 195. 1964; Tack., l.c. 1222.

Annual, subshrubby herb, up to 30 (-40) cm, erect to procumbent, glabrous or somewhat mealy, glaucous-green, branching from base. Leaves linear, sappy or fleshy, up to 20 x 2 mm, obtuse, often incurved, sessile or subsessile. Bracts leaf-like, much longer than flowers; bracteoles very small, scarious. Flowers c. 2 mm or more, sessile or subsessile, hermaphrodite, clustered, arranged in long, leafy spikes which become dense, thichened and elongated when mature. Perianth lobes becoming spongy-baccate, ± gibbous-inflated above in fruit and fruit adnate to it in the basal part; seed lenticular, 1 mm, black, smooth-shining.

Type: Described from Palestine.

A-6 5 km before Benghazi, saline and sandy ground, common, 27.10.1975, *S.M.H. Jafri;* Benghazi city, near the stadium, salty soil, 21.10.1977, *Siddiqi & Fathi* 133.

Distribution: N. Africa (Libya, Egypt), Arabia, Palestine.

A plant of saline soil and marshes, a new record for our area, and an addition to the Maire's, Fl. Afr. Nord. vol. 8. (Chenopodiaceae) 1962.

16. **TRAGANUM**

Delile, Fl. Aeg. 204, t. 22. 1813.

Low shrubs with much branched, usually whitish-glossy stem, villose-woolly at nodes. Leaves small, alternate, sessile, fleshy, ± terete and usually mucronate. Flowers small, 2-sexual, axillary, solitary, 2-bracteolate. Perianth 5-lobed, membranous but indurated and thickened in fruit, usually furnished with hard protuberances. Stamens 5, exserted; filaments broad; anthers linear-sagittate; staminodes 0 or rudimentary; style 2-partite into 2, subulate stigma. Utricle included in the woody persistent perianth, ± globular, somewhat depressed with membranous, free pericarp; seed horizontal.

Some 2 or 3 species, mainly Saharo-Arabian and N. African; represented by 1 species in Libya.

Traganum nudatum Del., Fl. Aeg. 111. 60. and 230. t. 22, fig. 1. 1813; Durand & Barratte, Fl. Lib. Prodr. 205. 1910; Pamp., Pl. Trip. 71. 1914; Prodr. Fl. Cir. 182. 1931; Corti, Fl. Veg. Fezzan 84. 1942; Maire, l.c. 119. fig. 954. (Fig. 26).

T. acuminatum Maire & Weiller in Bull. Soc. Hist. Nat. Afr. Nord. 30: 300. 1939; Keith, l.c. 969; *T. nudatum* var. *acuminatum* (Maire & Weill.) Maire & Weill. in Maire, Fl. Afr. Nord. 8: 121. 1962.

Low shrub, divaricately branched, 20-50 cm long with whitish-glossy, glabrous or scabrous, stems. Leaves 5-10 x 1 mm, oblong-linear, fleshy, ± mucronate, slightly recurved, villous at axils, papillose. Flowers axillary, solitary, c. 4 mm long; bracteoles 2, longer than flower, ± leaf-like, fleshy. Perianth-lobes erect, oblong-lanceolate, ± acuminate, 3-5 mm long in fruit, with rudimentary protuberances on back, anthers exserted. Seed horizontal, subglobose, 1 mm in diam., with membranous testa.

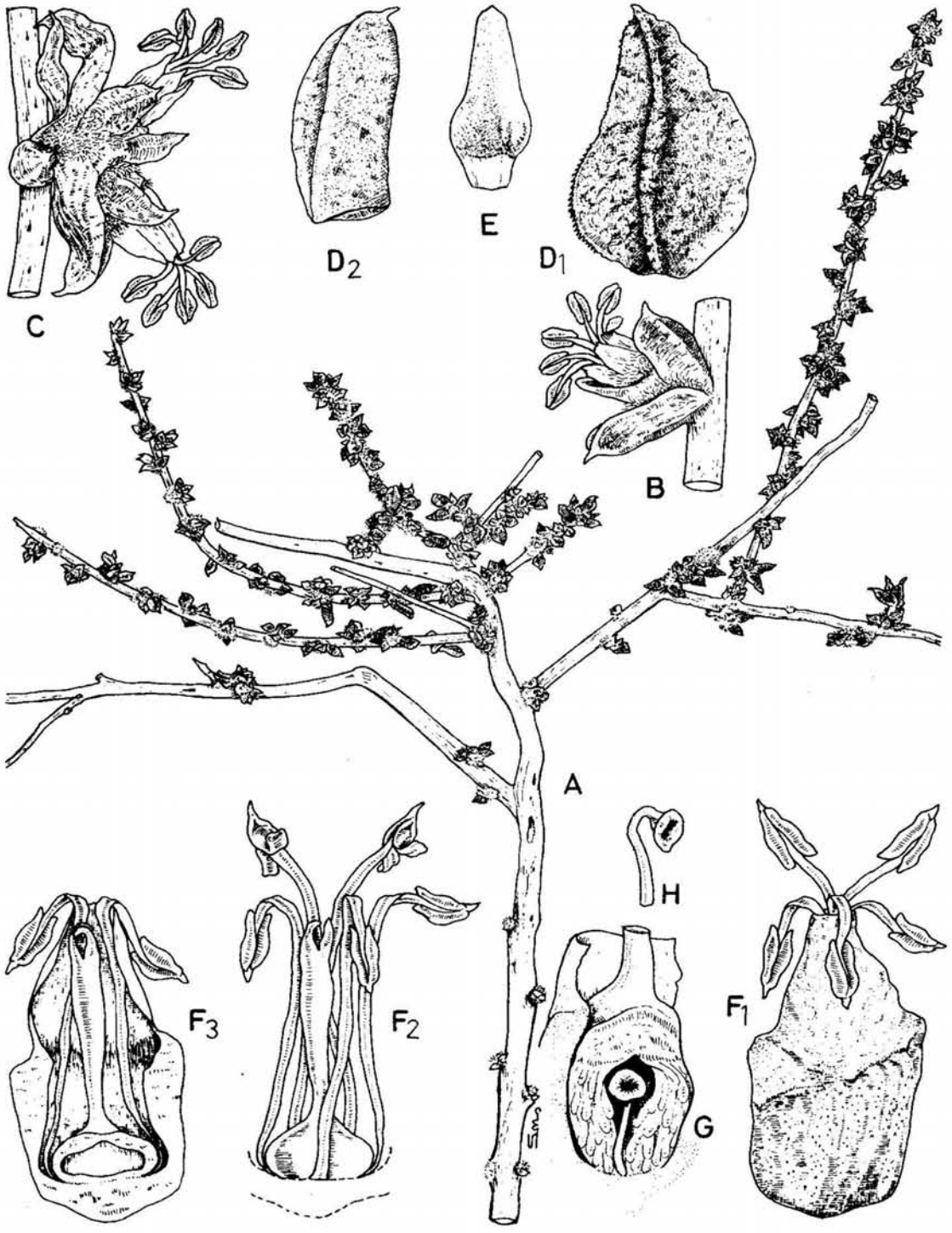

Fig. 26 **Traganum nudatum:** A, habit x 1; B, flowering node with a single flower x 5; C, node with 2 flowers; D_1, bract x 10; D_2, bracteole x 5; E, perianth segment x 10; F_1, fruiting perianth and exserted stamens x 10; F_2, flower with perianth removed to expose stamnes and gynoecium x 10; F_3, V.S. of flower x 10; G, V.S. fruit to show horizontal seed x 10; H, seed with long funicle x 10.

Type: Egypt, *Delile*

B-1 c. 184 km from Nalut towards Ghadames, 25.2.1975, *S.I. Ali* 2161 and 2164; **B-4** c. 15 km from Sirte towards Tripoli, 1.7.1977, *Siddiqi & Fathi* 95; Bu-Ngim, 2.4.1973, *Gammudi, A.* 96; **C-3** c. 136 km from Bir Esshwerif towards Brak, 15.2.1977, *M.A. Siddiqi* 392; **C-4** 17 km from Hun towards Bugrain, 2.4.1973, *S.I. Ali* 1543; **D-3** 15-20 km from Sebha towards Al Abiad, 20.3.1973, *S.I. Ali* 1321; 7.5 km from Um Laraneb, 21.3.1973, *S.I. Ali* 1359; 15 km from Sabha towards Bougrain, roadside, 30.3.1973, *S.I. Ali* 1390; **E-1** 91 km from highway towards Ghat, 30.3.1973, *S.I. Ali* 1045; **G-8** Gebel Uweinat, 7.11.1968, *L. Boulos* 3131 and 3138.

Distribution: N. Africa (Morocco eastwards to Egypt), Palestine, Arabia Petrea. (Saharo-Arabian element).

Sometimes the axillary flowering branch becomes so stunted and short that it gives an appearance of a glomerule, containing more than 1 flower. *Traganopsis* Maire & Wilozek, with a single species, *T. glomerata* having flowers in glomerules, said to be endemic to Morocco, may not be different from this.

A desert species, more common in the Central and Southern parts of Libya. Much eaten by camel and said to be an indicator for gypsum.

Fl. Feb.-April *Vern.* Damran, Bagil

17. **NUCULARIA**

Batt. in Bull. Soc. Bot. France 1: 469. 1903.

Low shrubs with opposite leaves, glabrous except the nodes or axils of leaves, glaucous, whitish or yellowish. Leaves small, fleshy, sessile, semi-amplexicaul, linear-oblong with obtuse or rounded apices, entire, densely villose in the axils. Flowers paired, sessile, hermaphrodite; bracts and bracteoles leaf-like. Perianth membranous-papyraceous, 5-lobed, thickened and indurated at base, not winged in fruit. Stamens 5 with sagittate anther and linear filaments. Ovary subglobular-depressed; style filiform with 2 stigmas. Seed vertical, rarely horizontal, with membranous whitish testa, exalbuminous with spiral embryo.

A monotypic genus and similar to *Traganum* but leaves opposite at nodes.

Nucularia perrini Batt in Soc. Bot. France 50: 496. 1903; Corti, l.c. 83;

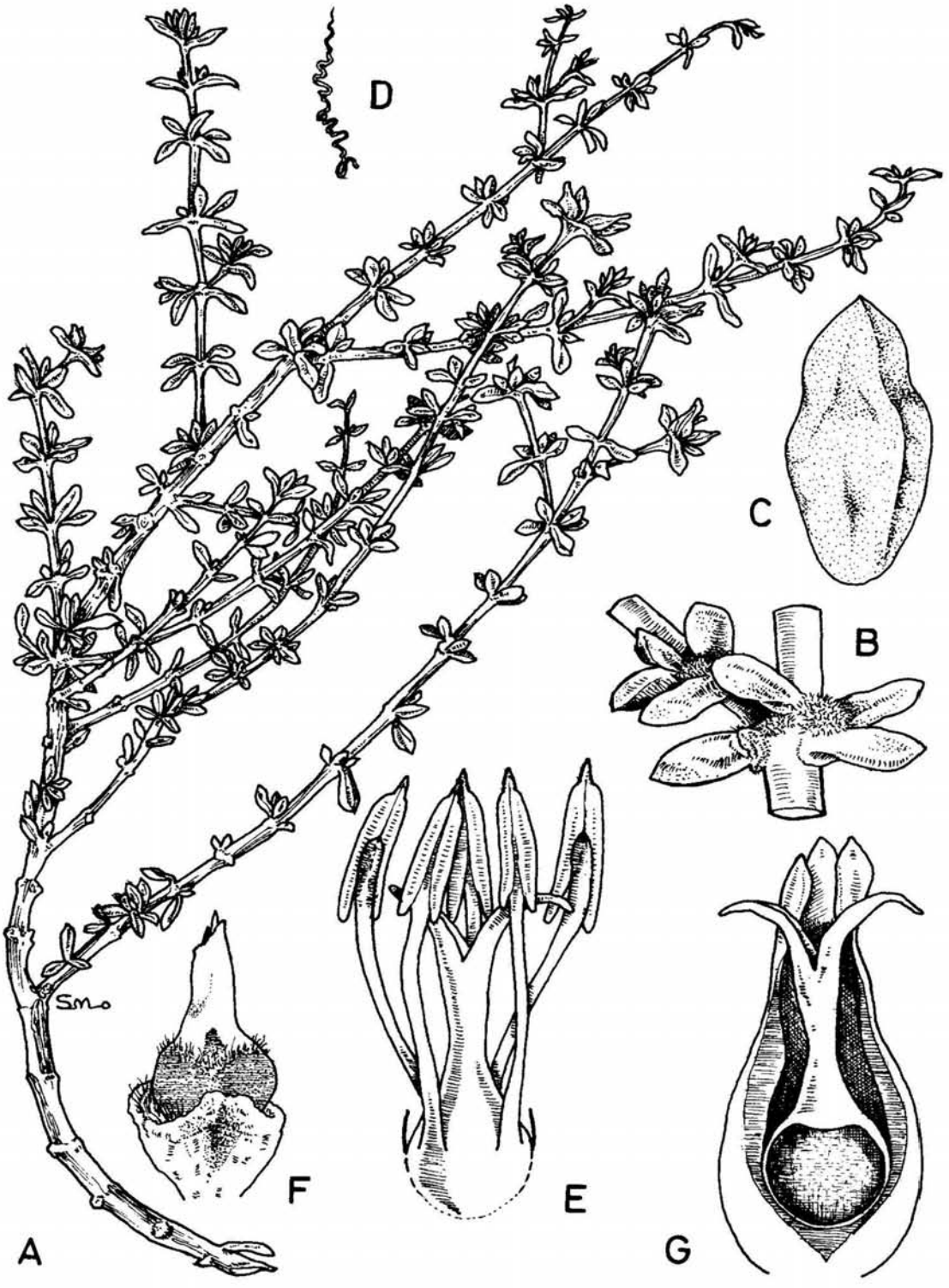

Fig. 27 **Nucularia perrini:** A, habit x 0.65; B, a portion of branch with leaves x 4; C, leaf x 10; D, an axillary hair x 20; E, flower with perianth removed showing stamens & gynoecium x 8; F, fruit exposed x 6; G, V.S. fruiting perianth and fruit x 6.

Ozenda, Fl. Sahara, 239, fig. 65. 1958; Quezel & Santa, Nouv. Fl. Alg. 1: 297, fig. 759. 1962; Keith, l.c. 692; Maire, l.c. 124, fig. 956. (Fig. 27).

Low shrub, 20-60 (-70) cm, woody, stem brownish, much branched, glabrous with usually opposite branches, villous at node or leaf axils. Leaves opposite, up to 10 x 4 mm, obtuse, trigonous-fleshy, greenish, sessile, semi-amplexicaul or broad-based. Flowers c. 4 mm long, 5-lobed; stamens 5 as long as the perianth with anthers about as long as the filament or shorter. Fruiting perianth accrescent. Fruit subglobose-depressed, included in the cupule formed by perianth; pericarp membranous-indurated, not adhering to seed; seed 2-3 mm in diam. with whitish membranous testa.

Type: Described from N. Africa (Algeria).

D-3 c. 15-20 km from Sabha towards Al-Abiad, dry sand area, bush c. 60 cm, 20.3.1973, *S.I. Ali* 1317 and 1322; c. 40 km from Wegh, 2 km before Tajarhi, among boulders, 26.3.1973, *S.I. Ali* 1362.

Also reported from Ghat by Corti (l.c.).

Distribution: Mauritania, Algeria, S. Libya.

A desert species confined to the southern parts of Libya, said to be eaten by camels.

Fl. Feb.-April *Vern.:* Askaf, Tassak

18. SALSOLA

L., Sp. Pl. 222. 1753; Gen. Pl. ed. 5: 104. 1754

Herbs or shrubs with mostly small, alternate, fleshy or scale-like entire, sessile leaves. Flowers usually hermaphrodite, small, axillary, solitary or rarely more, sessile and 2-bracteolate, arranged in spiciform inflorescences. Perianth segments (4-) 5, ovate, oblong or lanceolate, usually developing transverse, scarious wings (sometimes reduced to pectinate ridges) on the back in fruit. Hypogynous disc present. Stamens (4-) 5, filaments mostly exserted, anthers muticous, mucronate or unappendaged at apex; staminodes usually absent. Ovary ovoid to subglobular; stigmas 2 (-3), sessile or on long style. Utricle dry (rarely berry-like) included in

perianth; seed orbicular, horizontal, rarely vertical with membranous testa and spiral embryo.

About 100 species mainly Eurasian and African but also in America and Australia; represented by 7 or 8 species in Libya.

1. + Leaves and bracteole spiny-tipped. Annual — 1. **S. kali**
   −- Leaves and bracteoles not spiny-tipped (smaller branches spinescent in *Salso vermiculata* var. *spinescens*). — 2

2. + Leaves opposite (sometimes some subopposite or alternate in *S. longifolia* but stem not glossy-white) — 3
   −- Leaves alternate (rarely opposite or subopposite in *S. schweinfurthii* but stem glossy-white) — 5

3. + Leaves long, at least twice as long as broad, glabrous — 4. **S. longifolia**
   −- Leaves almost scale-like, much shorter, hairy to villose — 4

4. + Hairs smaller, silky-whitish. All flowers hermaphrodite, with winged perianth in fruits; stamens ± included; stigmas exserted — 3. **S. tetragona**
   −- Hairs crisp, often longish. Flowers functionally staminate with stamens conspicuously exserted, pistillode always present with included stigmas, neither producing perianth wings nor fruits (in our plants) — 2. **S. tetrandra**

5. + Leaves on flowering branches at least twice as long as broad, alternate to subopposite (sometimes some opposite) glabrous with ± villous axils; stems and branches white, glossy — 5. **S. schweinfurthii**
   −- Leaves on flowering branches short, scale-like, (lower longer, linear) alternate, villose (rarely almost glabrous in *S. baryosma*); stems and branches not as above — 6

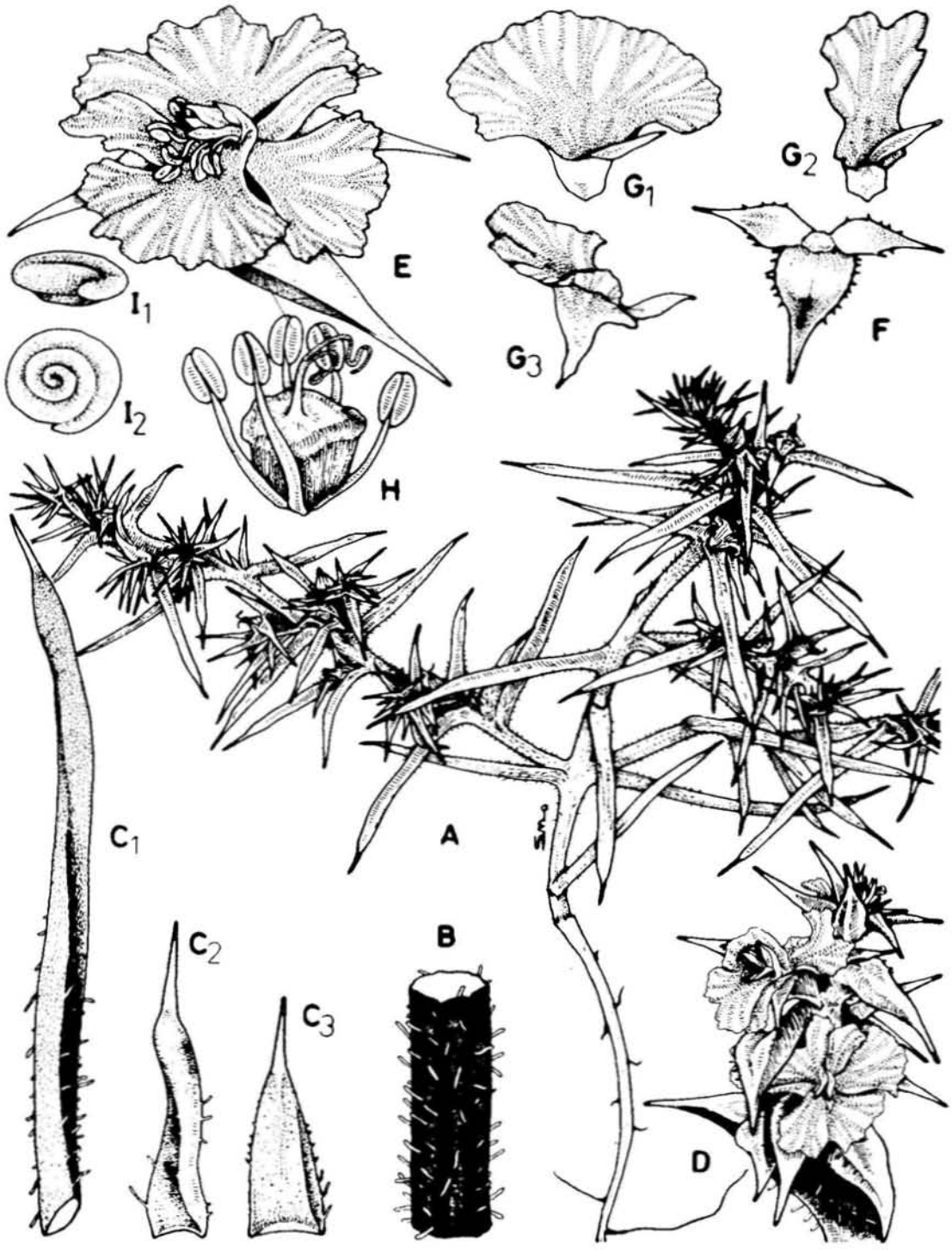

Fig. 28 **Salsola kali:** A, habit x 1; B, portion of stem x 5; C_1-C_3, leaf variation x 3; D, inflorescence x 3; E, flower at fruiting stage (dorsal view) x 5; F, bract and bracteoles x 2; G_1, fruiting perianth with large wing x 5; G_2, perianth with smaller wing x 5; G_3, perianth wing (side view) x 5; H, flower with perianth removed to expose fruit and stamens x 8; I_1, horizontal seed x 8; I_2, seed (dorsal view) x 8.

6. + Lower leaves terete-linear or filiform; fruiting perianth wing usually c. 10 mm across (pink, red, white or yellowish) — 6. **S. vermiculata**
   −- Lower leaves short, ovate; fruiting perianth 3-4 (-5) mm across, whitish or greenish — 7. **S. baryosma**

1. **Salsola kali** L., Sp. Pl. 222. 1753; Durand & Barratte, l.c. 206; Pamp., Pl. Trip. 70. 1914; Prodr. Fl. Cir. 183. 1931; Maire, l.c. 132, fig. 958; Aellen in Tutin et al, Fl. Europ. 1: 105. 1964; Keith, l.c. 856. (Fig. 28).

Erect or suberect, hispid or glabrous, robust annual up to 60 (-100) cm tall, succulent. Leaves linear-subulate, rarely filiform, somewhat clasping at base, (5-) 10-30 (-40) x 2-3 mm, semiterete, spiny-tipped, entire, lower usually opposite, the upper alternate. Bracts and bracteoles ± exceeding the flower oblong-ovate to triangular, keeled, spiny-tipped. Flowers hermaphrodite, 1-3 in an axil, forming lax and leafy spikes. Perianth segments 3-4 mm long, free, membranous, ovate-oblong, subacute, usually stiffly acuminate or pointed, usually developing obovate to reniform, striate, membranous erose-margined, pink wings on the back, then up to 10 mm across (including wing). Stamens (4-) 5. Stigmas 2-3, longer than style, filiform. Seed horizontal, subspherical-turbinate.

Type: Described from European sea coasts, Herb. Linn 315/1 (LINN).

A-2 2 km after Sorman, saline soil, 14.11.1975, *Zenab, A.* 14; 8 km after Zwara, *A. El Rubi* s.n.; 10 km from Zwara on way to Farwa, sandy soil, erect, c. 80 cm, flowers pink and winged, 25.11.1976, *Alavi, Ghafoor & Fathi* 123; 98 km from Tripoli, Al Nagaza, small, very fleshy plant, 5.4.1977, *S.A. Alavi* 1244; Nagaza, 11.5.1977, *Fauzi, A.* 12; **A-3** west of Tripoli, near the sea shore, 22.11.1977, *Fathi, B.R.* 122; **A-6** 5 km before Bengazi, wings red in the centre, 27.10.1975, *S.M.H. Jafri* 6169; Dariana, c. 40 km before Bengazi, sand near cultivated fields, 16.6.1972, *S.I. Ali* 456; **A-7** c. 5 km from Susa, on way to Shahat, *S.I. Ali* 800; Derna, beach, 1.3.1973, *S.I. Ali & S.A. Faruqi* 1175; **A-8** Tobruk, saline soil, 25.10.1975, *S.M.H. Jafri* 6085.

Distribution: Europe, N. Africa, Asia.

A very polymorphic species, sometimes split into 2 or 3 taxa (species or subspecies) on mucronate and thin membranous, crumpled perianth segments without a pointed mucro. *S. ruthenica* Iljin (=*S. kali* ssp. *ruthenica* (Iljin) Soo) without a swollen base in bracts and bracteoles may be found here also because it

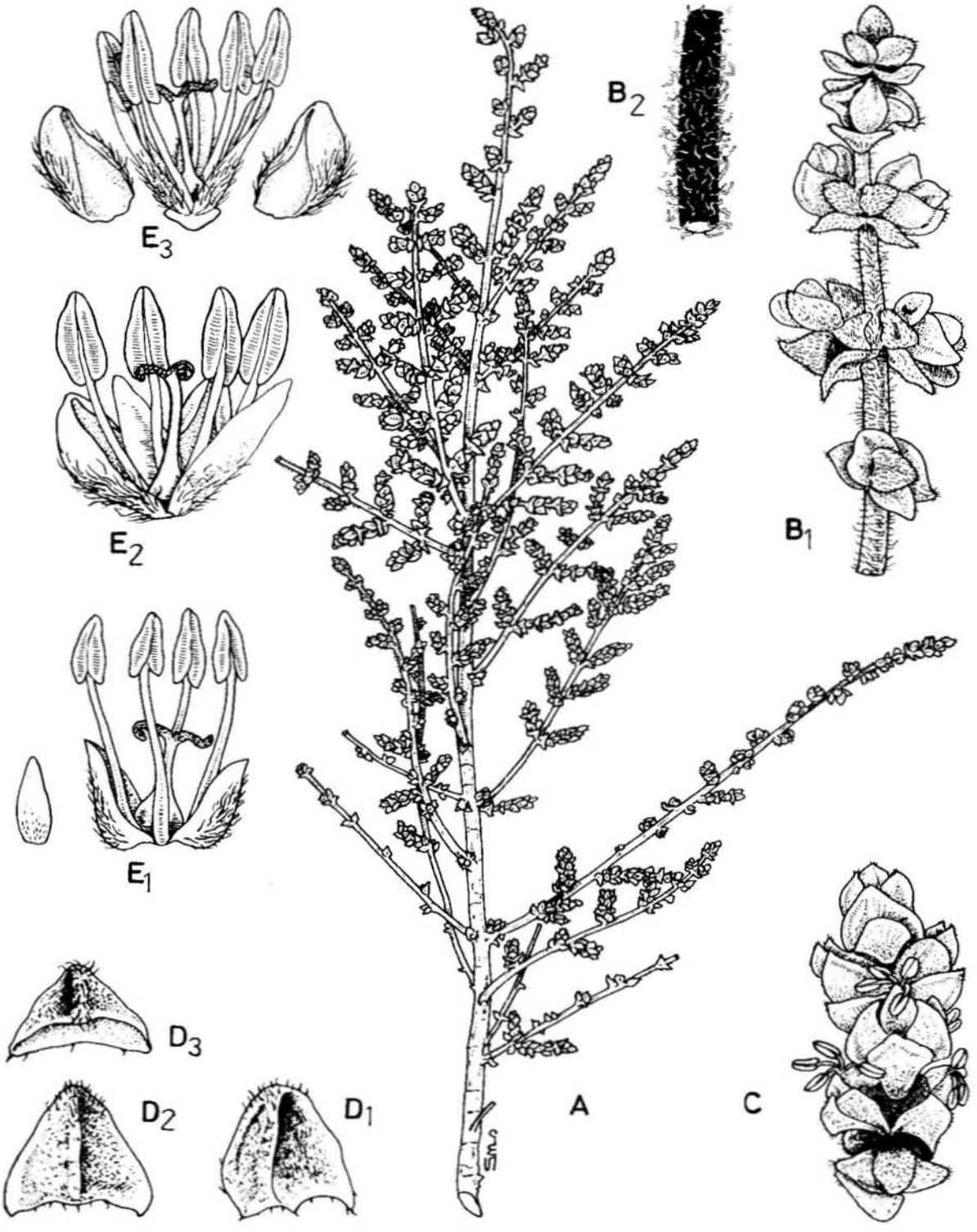

Fig. 29 **Salsola tetrandra:** A, habit x 1; B_1, portion of branch x 5; B_2, portion of stem showing crisp hairs x 10; C, portion of inflorescence showing exserted stamens x 5; D_1, leaf (side view) x 10; D_2, leaf (ventral view) x 10; D_3, leaf (apical view) x 10; E_1, flower showing 4 exserted stamens and included stigmas x 10; E_2, flower showing 4 exserted stamens and 1 small stamen x 10; E_3, flower showing 5 exserted stamens x 10.

occurs throughout the range of *S. kali* ssp. *kali* but rarely, (vide Aellen in Tutin et al, l.c.). *S. tragus* L., (=*S. Kali* ssp. *traqus* (L.) Nyman) has bracts and bracteoles swollen at base but perianth like those in *S. ruthenica* and said to be confined to the coasts of Europe; this is not present in Libya, but Maire (l.c. 135) under his var. *glabra* Forsk (including *S. tragus* L. in synonymy) cites specimens from Bengazi *(Pampanini)*, Derna *(Maire & Weiller)* and littoral zones of Tripoli. This is probably a misidentification of *S. tragus* L. and our plants are mostly hispid or scabrous and glabrous forms are very few from Gebel Akhdar area but no doubt they are *S. kali*. The occurrence of *S. tragus* L., therefore, needs confirmation from our area.

Keith (l.c. 857) records *S. pestifer* A. Nelson (1909) as an exotic. It is a glabrous plant, considered allied to *S. ruthenica* Ilijin (1934) and has become a weed in the European part of USSR (see Fl. USSR. (Eng. ed.) 6: 164. 1970).

2. **Salsola tetrandra** Forsk, Fl. Aeg.-Arab. 58. 1775; Durand & Barratte, l.c. 205 (in the synonymy of *S. tetragona* Delile); Corti, l.c. 87 (excl. syn. *S. tetragona*); Maire, l.c. 139, fig. 961; Zohary, Fl. Palest. 1: 172, fig. 252. 1966. (Fig. 29).

   S. tetragona Del. var. *tetrandra* (Forsk) Boiss., Fl. Or. 4: 957. 1879; *Muratina zolotarevskyana* Maire in Bull. Soc. Hist. Nat. Afr. Nord 29: 122 and 446. 1938.

Small shrub, up to 30 (-50) cm tall, shortly villose-tomentose with ± crisped hairs; stem woody with many, usually opposite branches. Leaves opposite, sessile, very small, c. 2 mm, scale-like, fleshy, ovate-triangular, densely hairy with villous margins, often densely imbricated along the flowering branches giving it a somewhat tetragonous cylindrical look, usually densely hairy in the axils. Bracteoles leaf-like, ovate, concave. Flowers staminate or hermaphrodite (not seen by us), arranged in dense, catkin-like spikes, Hermaphrodite flowers rare, 5-merous and said to be similar as in the following species; perianth portion above the wings pyramidate elongated, villous; wings usually pink or reddish, each 3-4 mm in diam. Staminate flowers very common, 4-merous with 4 conspicuously exserted stamens, alternating with 4, tubercle-like staminodes, very rarely a fifth, short or long exserted stamen also present. Fruiting perianth with wings not seen in our material.

Type: Egypt, Alexandria, Ras-el-Tin, *Forskal* (C).

B-4 7 km to Bugrain, along the way to Buayrat, 15.1.1967, *L. Boulos* 1065; 2 km east

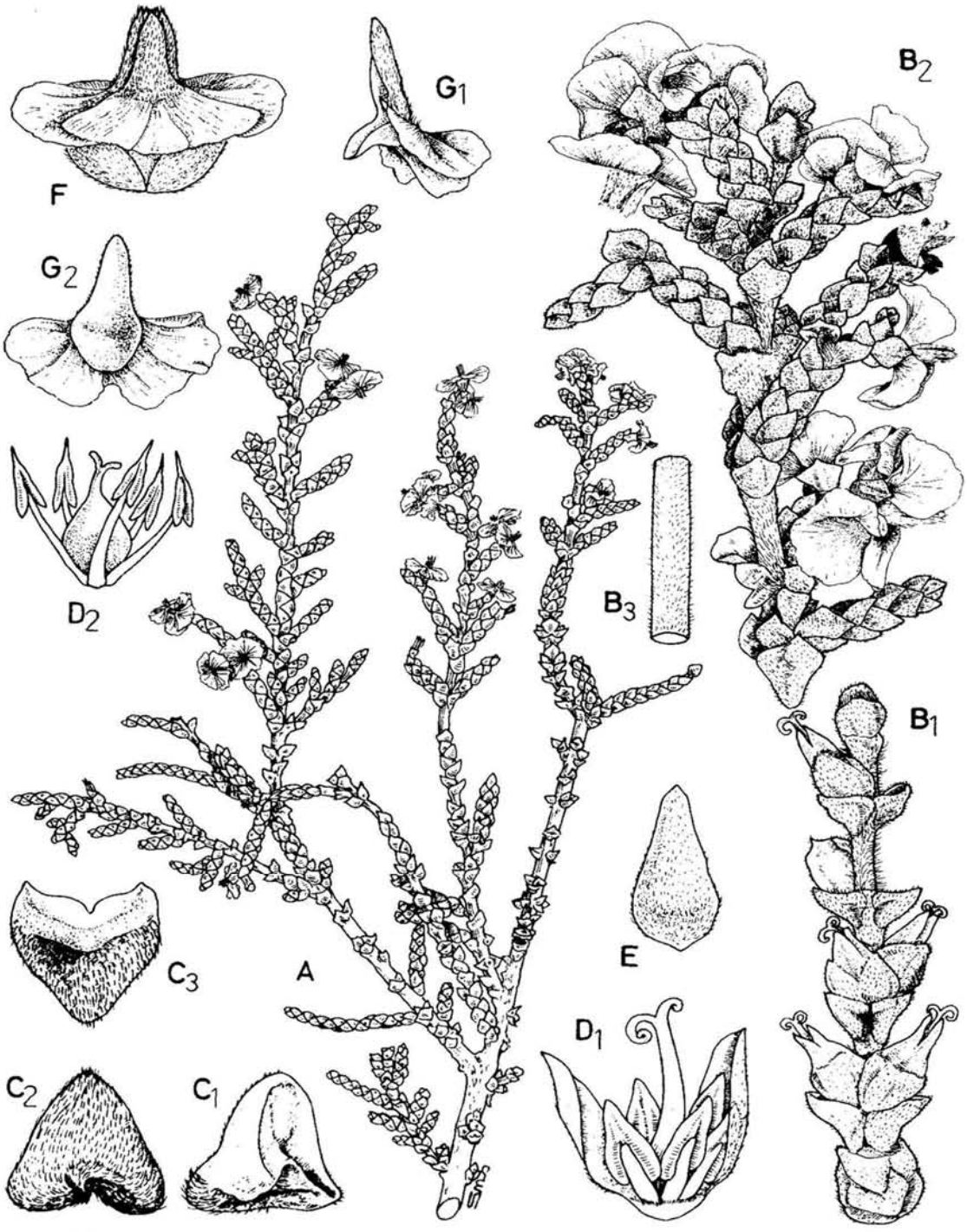

Fig. 30 **Salsola tetragona:** A, habit x 1; B_1, portion of young inflorescence with exserted stigmas x 5; B_2, portion of old inflorescence showing winged perianth segments x 3; B_3, portion of stem showing hairs x 5; C_1-C_3, various views of a leaf x 10; D_1,flower with young perianth, included stamens and exserted stigmas x 10; D_2, flower with perianth removed x 5; E, young perianth segment x 10; F, fruiting perianth segment (side view) x 5; G_2, the same (back view) x 5.

Bougrain, 27.1.1967, *L. Boulos* 1492; 25 km W. Sirte 8.3.1968, *L. Boulos* 1951; **C-4** c. 50 km from Hun towards Bougrain sandy ground, roadside, common, 24.2.1976, *S.M.H. Jafri* 6388; c. 87 km from Bunjim, sandy loam, bushes 30-40 cm, *S.I. Ali* 2440 (with *S. baryosma*); **C-8** Gebel Uweinat, 7.11.1968, *L. Boulos* 3143.

Distribution: N. Africa, Palestine, Arabia.

A common desert species, tolerating both drought and salinity and may be found almost throughout Libya. It has been much confused with *S. tetragona* in all the previous works on Flora of Libya, because of the tetragonous appearance of flowering or young branches with leaves.

Identifications of plants from Libya, collected by Italian botanists need checking; they have been mostly named « *S. tetragona* » by them (see Maire l.c.). However, even if this and the following species are considered conspecific, the correct name will be *S. tetrandra* Forsk., according to rules as followed by Corti (l.c.). However, as in our area *S. tetrandra* bears usually 4-merous staminate flowers with exserted stamens only and *S. tetragona* 5-merous hermaphrodite flowers producing fruit and winged perianth, we have kept them separate. Furthermore, this species is ± crisp-hairy with somewhat longer hairs, while the following one is soft-silky, hairy, with dense short hairs.

Fl. March-April *Vern.* Feres

3. **Salsola tetragona** Delile, Fl. Egypt, tab. 21, fig. 3. 1813; Durand & Barratte, l.c. 205 (excl. syn); Maire, l.c. 137, fig. 960; Keith, l.c. 857; Zoh., l.c. 172, fig. 251. (Fig. 30).

S. pachoi Volk. et Aschers. in Aschers. & Scheweinf., 111 Fl. Egypt 130. 1887.

Very similar to *S. tetrandra* Forsk. but all flowers similar, hermaphrodite, producing wings on the fruiting perianth, and stamens not exserted; plants white in appearance, with dense, soft silky hairs on leaves. Flowering perianth villous, including wings c. 8 mm across, pink or reddish. Stamens 5, ± included, opposite the perianth; anthers smaller with smaller pollen grains than in the previous species.

Type: Egypt, *Delile*

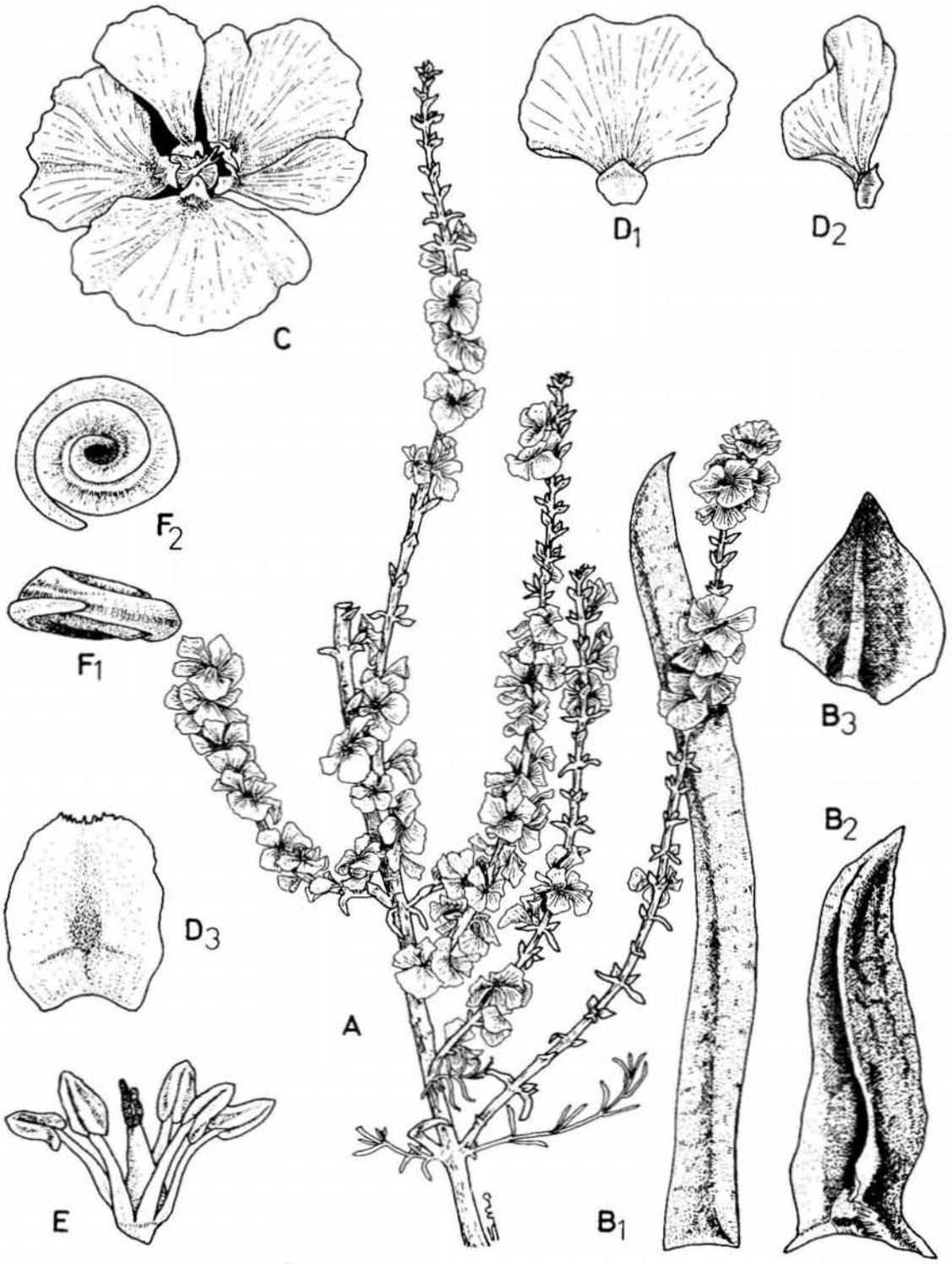

Fig. 31 **Salsola longifolia:** A, portion of the fruiting branch x 0.5; B_1-B_2, leaf variation x 10; B_3, bracteole x 10; C, winged perianth segments (top view) x 3; D_1, fruiting perianth segment (front view) x 3; D_2, the same (side view) x 3; D_3, young perianth segment without wing x 10; E, flower with perianth removed showing stamens and gynoecium x 5; F_1, horizontal embryo (seed) x 7; F_2, the same (dorsal view) x 7.

A-8 c. 2 km before al Tamimi on way to Tobruk, 18.10.1977, *Siddiqi & Fathi* 61; Bir Acheim Bir Belamed, 26.3.1933, *R. Pampanini* 2151; **B-1** Ain Migzim (Mjazzim), c. 10 km from main road and turning off main road from Ghadames 39 km, near salt lake, 26.2.1975, *S.I. Ali* 2149.

Distribution: N. Africa and Palestine.

The plants cited above are ± like those of the previous species but white in appearance with soft hairs, and bear profusely hermaphrodite flowers with 5, included stamens and fruiting perianth conical elongated above the wings.

Fl. Sept.-Oct. *Vern.* Belbal

4. **Salsola longifolia** Forsk., Fl. Aeg.-Arab. 55. 1775; Durand & Barratte, l.c. 206; Pamp., Pl. Trip. 70. 1914; Prodr. Fl. Cir. 182; Maire, l.c. 142, fig. 962; Zoh., Fl. Palest. 1: 173, fig. 253. 1966; Keith, l.c. 856. (Fig. 31).

   S. oppositifolia Desf., Fl. Atl. 1: 219. 1798, *nom. illeg.* (non Pallas 1773); Durand & Barratte, l.c. 204; Tack., St. Fl. Egypt ed. 2. 125; Keith, l.c. 856; *S. verticellata* Schousboe, Wextr. Morokko 123. 1800; *S. sieberi* Presl. Bot. Demerk. 108. 1844; Maire, l.c. 145, fig. 963; Keith, l.c. 85; *S. zygophylla* Batt. et Trab. Fl. Alg. app. 2: 15. 1890; *Darniella cyrenaica* Maire & Weill. in Bull. Soc. Hist. Nat. Afr. Nord. 30: 301. 1939; Keith, l.c. 426; *S. gymnomaschata* Maire ex Zolotar & Murat in Bull. Soc. Hist. Nat. Afr. Nord. 29: 100. 1938.

   Ascending to erect, shrubby perennial, up to 60 cm tall, glabrous or sparingly mealy with dull-brown or greenish stem and branches, woody at base. Leaves 5-25 (-30) x (1-) 2 mm, opposite, rarely upper ones subopposite or alternate, fleshy, semiterete-linear, somewhat broadened at base, obtuse or mucronulate, ± canaliculate above. Bracts leaf-like, oblong-linear, smaller; bracteoles shorter than bracts, ovate-orbicular, concave. Flowers axillary, 2-bracteolate, usually solitary, opposite along the spicate inflorescences. Perianth segments free, 2.5-3.5 mm long, whitish, ovate, obtuse, usually developing wings in fruit (then (8-) 10-15 mm across), almost globular and 5-angled at base; wings ± obovate, sinuate; stamens usually 5, exserted, anthers c. 1.5 mm long, ovate-subsagittate; seed 2-3 mm in diam., subglobose with membranous testa.

   Type: Egypt, Alexandria, *Forskal* (C).

A-1 Talil, sandy and saline soil, bushes, common, stamens exserted in the upper flowers, 12.6.1976, *S.M.H. Jafri* 6701; wadi Malah, c. 10 km from Nalut, 11.5.1972, *S.I. Ali* 286; **A-2** Between Sabrata and Zwara, erect c. 50 cm, 25.11.1976, *Ghafoor, Alavi & Fathi* 93; c. 8 km from Al Assa, erect shrub, c. 45 cm, fruit wings pinkish, 26.11.1976, *Ghafoor, Alavi & Fathi* 145 and 202; 10 km from Zwara on way to Farwa, sandy soil, wings white to red, 25.11.1976, *Alavi, Ghafoor & Fathi* 111; Sabrata, around the roman ruins, 2.12.1976, *L. Boulos* 1031; **A-8** c. 60 km before Tobruk, stony and sandy mound, shrub, common, fruit wings large, c. 1.5 cm across, 24.10.1975, *S.M.H. Jafri* 6061; **B-4** 2 km east Bugrain, 27.1.1967, *L. Boulos* 1053.

Distribution: N. Africa (Morocco eastwards to Egypt), Palestine.

A very polymorphic species in the coastal area of Libya. Further work is needed to define the status of *S. verticillata* Schousboe (l.c.) and *S. sieberi* Presl (l.c.); the former is said to be confined to Spain and Sicily with linear or linear-oblong leaves, attenuate towards the base and scarcely amplexicaul; the latter is said to have cylindrical or claviform, glaucous leaves, sometime sub-alternate above and is N. African, but integrading forms are not lacking. Sometimes gatherings with flowers having not developed perianth wings may confuse it.

Fl. April-Sept. *Vern.* Semomed

5. **Salsola schweinfurthii** Solms-Laub. in Bot. Zeit. 59. 173. 1901; Zohary, Fl. Palest. 1: 173, fig. 254; 1966; Tack., l.c. 125.

Shrublet, up to 30 cm tall, with ascending stem, woody, with white, glossy, alternate or subopposite branches. Leaves 5-30 x 1-2 mm, with ± hairy axils, alternate to subopposite, fleshy, linear, subterete, glabrous, ± arcuate with a caducous, short bristle tip. Bracts and bracteoles short, oblong to suborbicular, concave above. Flowers 1-2 in each axil, forming loose to dense spicate inflorescences. Flowers and perianth-wings ± similar to the previous species. Staminodes well-developed. Fruiting perianth (including wings) usually 6-10 mm across, whitish or pinkish.

Type: Described from N. Africa.

A-3 3 km before Misrata, 7.1.1977, *Siddiqui & Fathi* 51; **B-1** c. 20-25 km before Derj, 28.1.1977, *Siddiqi & Fathi* 393; **B-4** c. 60 km before Bugrain, 22.10.1975, *S.M.H. Jafri* 6002; **B-8** Amsaid, very common in sandy ground, 25.10.1975, *S.M.H.*

Jafri 6067; Derna, 25.4.1938, *Maire & Weiller* 1323 (MPU).

Distribution: Palestine, Egypt, Libya (Saharo-Arabian).

Very similar to *S. longifolia* Forsk. but stem and branches white, glossy and leaves usually subopposite or alternate, green. A coastal species, in Libya, reported for the first time from here. It seems to integrade with the previous species through the variety *sieberi* (Presl) (=*S. sieberi* Presl.), which has some subopposite or alternate leaves above but very fleshy and claviform and the stems are slightly whitish or pale-whitish to dull. The two taxa need further study and may represent one and the same species, even then the correct name for this psecies will be *S. schweinfurthii* beacause according to Tackholm (l.c.) *S. sieberi* Presl is an *illegitimate name*, the epithet being preoccupied by Forskal's *S. sieberi* and she cited in the synonymy of **S. longifolia** Forsk, *S. sieberi* Presl, non Forsk. However, it needs checking.

6. **Salsola vermiculata** L., Sp. Pl. 223. 1753; Durand and Barratte, l.c. 206; Pamp., Pl. Trip. 71. 1914; Prodr., Fl. Cir. 182. 1931; Maire, l.c. 152, fig. 965; Keith, l.c. 858. (Fig. 32).

S. brevifolia Desf., Fl. Atl. 1: 218. 1798; *S. microphylla* Cavan., Icon. 3: 45. tab. 287. 1794; *S. flavescens* Cavan., l.c. tab. 288; *S. villosa* Del., ex Roem. & Schult., Syst. ed. 15. 6:232.1820; *S. spinescens* Moq. in DC., Prodr. 13.2:179.1849; *S. vermiculata* var. *spinescens* (Moq.) Maire & Weill. in Maire, l.c. 155. *S. delileana* Botsch. in Novit. Syst. Pl. Vasc. 371.1964.

Shrubby perennial with ascending to erect stem, much branched, up to 60 cm, grey- or yellowish-villous or pubescent, with long denticulate hairs; sometimes branches becoming ± spinescent at tips. Lower leaves alternate, filiform, terete or semiterete, half-clasping at base, 3-15 mm long, villous; upper leaves or those of the shorter branches ovate, scale-like, ± densely imbricated, alternate, obtuse. Bracts ovate to short-cuspidate, concave, scarious margined; bracteoles c. as long as the bract, suborbicular, concave, ± keeled beneath, scarious margined. Flowers as long as or exceeding the bract, solitary, forming ± dense spikes. Perianth segments usually 5, almost free, ± connivent, ovate-triangular, ± hairy, broadly scarious-margined; usually developing obovate to semi-orbicular, imbricated wings at back, (7-) 8-12 mm across, pink, red, white or yellowish in colour; seed horizontal, c. 2.5 mm in diam., with membranous testa.

Two varieties can be recognized from our area.

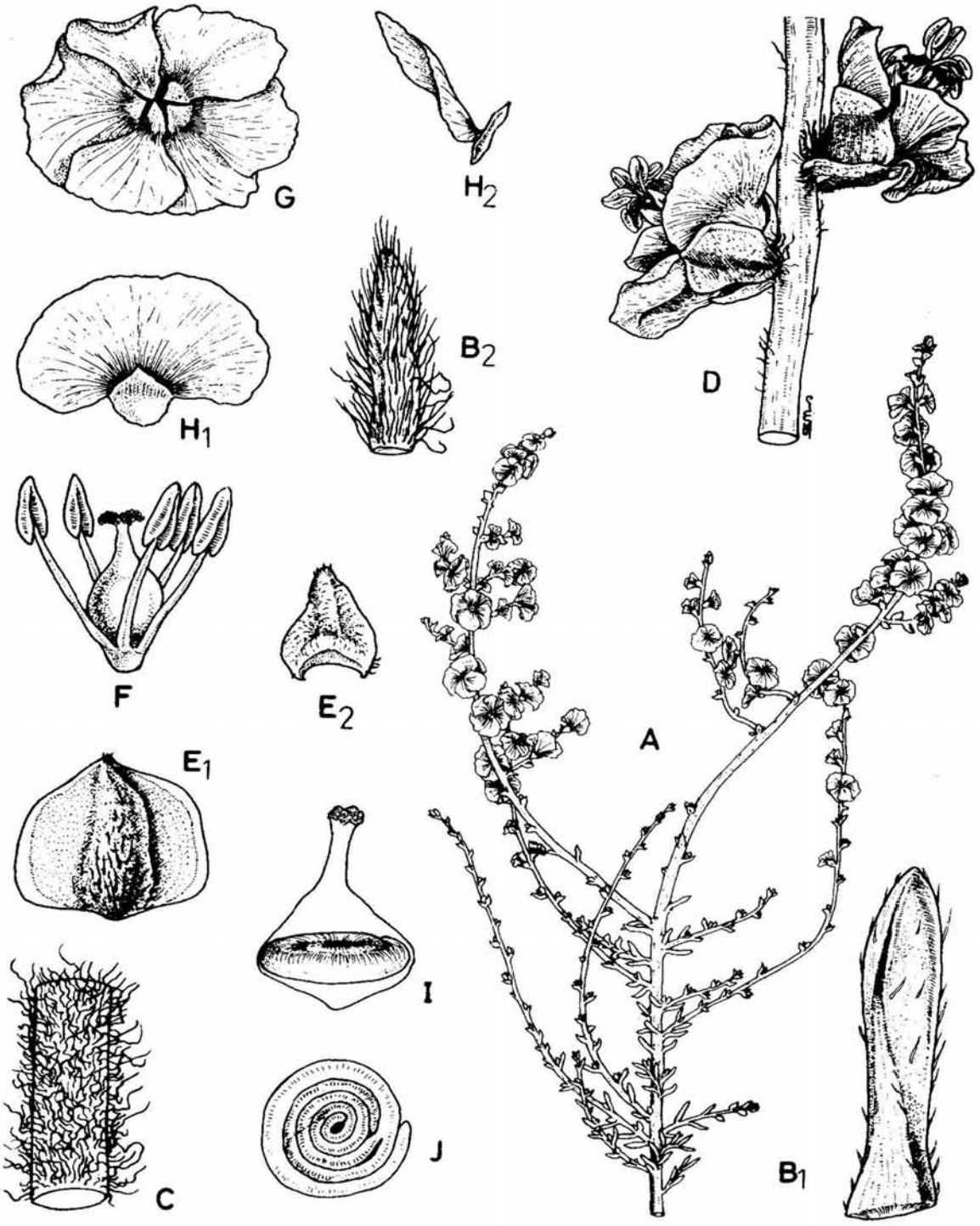

Fig. 32 **Salsola vermiculata:** A, portion of fruiting stem x 0.5; B_1-B_2, leaf variation x 10; C, portion of branch showing hairs x 10; D, portion of inflorescence x 5; E_1, bract x 10; E_2, bracteole x 10; F, flower with perianth removed showing stamens and gynoecium x 8; G, fruiting perianth segments on a flower (top view) x 4; H_1,fruiting perianth segment (front view) x 4; H_2, the same (side view) x 4; I, fruit with horizontal seed x 10; J, seed (embryo) (dorsal view) x 10.

(a) var. **vermiculata**

Type: Described from Spain, Herb. Linn. 315/19.

Branches not spiny, often elongated.

A-2 S. Zwara, July 1975, *M. Feisal* s.n.; **A-6** 17 km W. of Benghazi, 22.10.1977, *Siddiqui & Fathi* 138; Near Assedra, *Siddiqi & Fathi* 151; **A-8** 2 km after Tamimi towards Tobruk, small plants, almost entirely flowering with pinkish-red flowers, 24.10.1975, *S.M.H. Jafri* 6053; between Tobruk and Derna, shrub, c. 60 cm tall, red flowers, 25.10.1975, *S.M.H. Jafri* 6089; *id.* flowers white, *S.M.H. Jafri* 6090; *id.* flowers pinkish, *S.M.H. Jafri* 6091; *id.* flowers yellowish, *S.M.H. Jafri* 6092; 60 km before Tobruk, pink winged fruits, 18.10.1977, *Siddiqui & Fathi* 65; *id.* white flowers, *Siddiqui & Fathi* 66; 2 km before Al Tamimi, 18.10.1977, *Siddiqi & Fathi* 61.

b) var. **spinescens** (Moq.) Maire & Weiller in Maire, Fl. Afr. Nord. 8: 155. 1962.

Salso spinescens Moq. in DC., Prodr. 13. 2: 179. 1849.

Branches shorter, ending into spinescent tips.

Type: Without locality (P).

A-2 between Shakshuk and Sinawon, c. 20 km west Jado, 24.1.1977, *Siddiqi & Fathi* 233; c. 10 km from Zwara on way to Farwa, erect shrub, c. 45 cm, 25.11.1976, *Alavi, Ghafoor & Fathi* 84; **A-3** Wadi Kaam, 27.12.1969, *I.I. Chaudhri* 15317.

The plants seem to be more common towards west of Tripoli and may be confused with *Noaea mucronata* but thinner and seeds horizontal.

Distribution: S. Europe, N. Africa, Palestine and Syria.

A desert species, seems to be confined to the coastal areas of Libya, from Zwara to Tobruk and eastwards. A very polymorphic species and perianth-wing colour varies from white to pink, red or yellowish on separate plants, growing side by side; said to be a good pasture plant.

Fl. Almost throughout the year, but mainly Sept.-Oct.

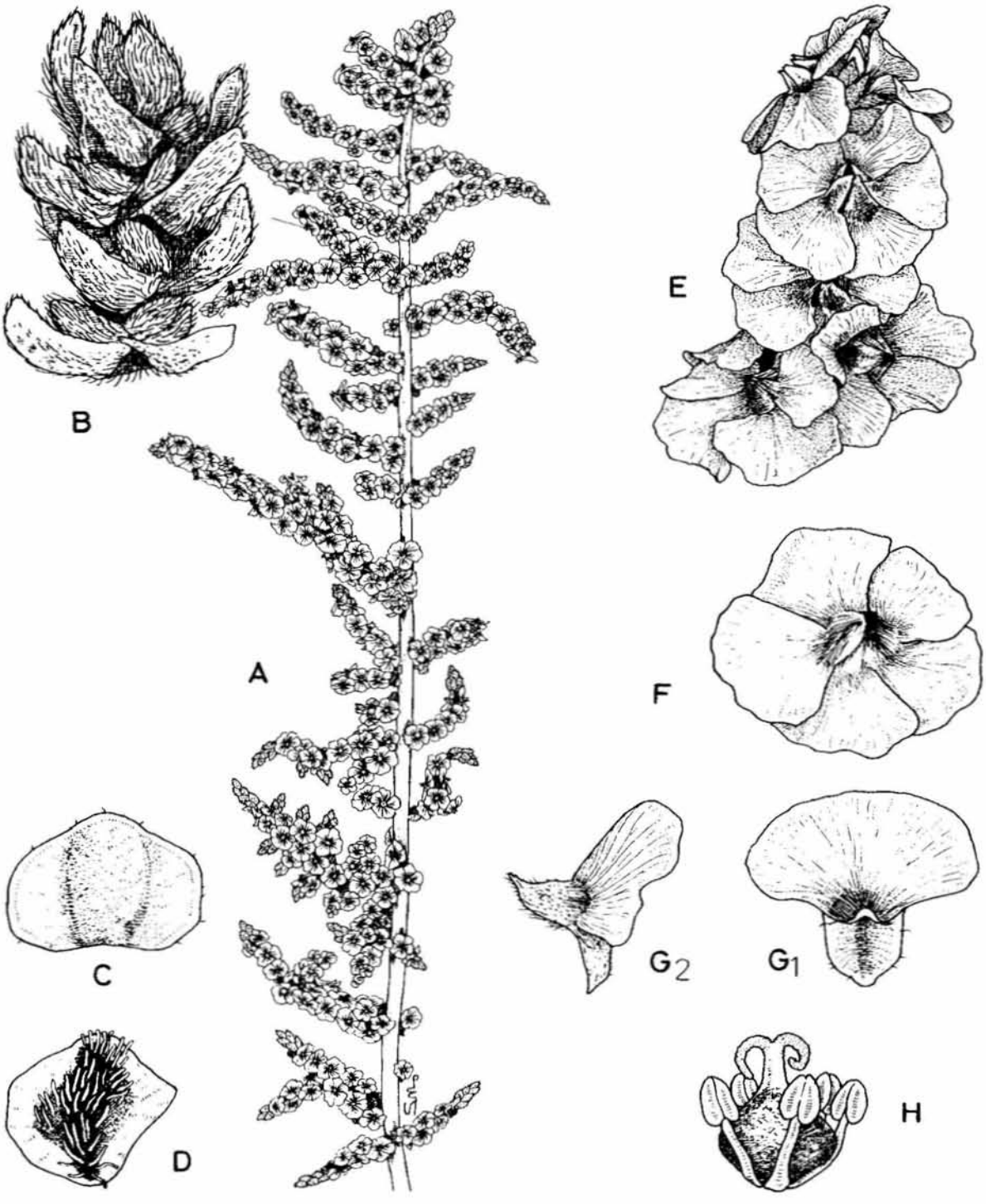

Fig. 33 **Salsola baryosma:** A, a fruiting branch x 1; B, leaves on a portion of branch; C, bract x 20; D, bracteole x 20; E, a portion of infructescence x 8; F, fruiting perianth segments (dorsal view) x 10; G_1, a perianth segment with wing (front view) x 15; G_2, the same (side view) x 15; H, fruiting flower with perianth removed x 15.

Vern. Gheddam, Asierwahi, Rhadam.

7. **Salsola baryosma** (Roem. & Schult.) Dandy in Andrews, Fl. Pl. Anglo-Egypt. Sudan, 1: 111. 1950; Jafri, Fl. Karachi 100, fig. 97. 1966; Zohary, Fl. Palest. 174. fig. 256. (Fig. 33)

Chenopodium baryosmum Roem. & Schult., Syst. Veg. (ed. 15) 6: 269. 1820; *S. foetida* Del., Fl. Egypt. 310. 1813 - *nom. nud.*, ex Spreng., Syst. Veg. ed. 16. 1: 925. 1825 *(nom. illegit.)* non Pallas ex Vest. in Roem. & Schult. l.c. 238; Durand & Barratte, l.c. 156, fig. 966; Corti, l.c. 87; Keith, l.c. 855; *Caroxylon foetidum* Moq. in DC., Prodr. 13. 2: 178. 1849.

Shrub, up to 60 cm tall, erect, usually foetid, shortly tomentose-pubescent to almost glabrous-greenish. Leaves minute, 1-3 x 1-2 mm, alternate, fleshy, ovate-orbicular or suborbicular, narrowly scarious-margined. Flowers solitary, subtended by 2 bracteoles similar to bract, suborbicular, leaf-like, arranged in spike-like, ± densely flowered inflorescence. Fruiting perianth smaller, ovate-triangular, glabrous, 2-4 mm across (including wings); wings whitish or greenish-white, membranous. Stamens 5, not exserted; anthers c. 0.8 mm long, oblong, obtuse, 2-fid below. Utricle lenticular with membranous pericarp, included; seed c. 1 mm diam., horizontal.

Type Described from Egypt.

A-3 West of Tripoli port, near the sea shore, bushy plant yellowish in colour with white perianth wings in fruit, 22.11.1976, *Fathi, B.R.* 123; **B-1** c. 5 km from Ghadames, towards Berber castle, dry stony ground, woody bush, c. 25 cm., 25.3.1975, *S.I. Ali* 2148; **D-3** c. 43 km from Weshka, roadside, sandy soil, c. 15 cm tall, 25.3.1975, *S.I. Ali* 2283; c. 45 km from the high way towards Brak, c. 25-30 cm, spreading in sand, 30.3.1973, *S.I. Ali* 1404; Wadi Atiq, c. 150 km from Wegh, c. 30 cm or less, growing in sand, 26.3.1973, *S.I. Ali* 1366; Weshka, 25.3.1975, *Fawzia* 43.

Distribution: India, Pakistan, Iran, Arabia, Palestine, Syria, Senegal, Sudan and N. Africa.

A desert species, extending to the coastal areas in Libya, easily recognized by its smaller whitish perianth-wings, about half in size than in the previous species. It is eaten by camel and probably other livestock.

Fl. Almost throughout the year, but mainly in Sept.-Nov.

Vern. Ressal, Talizza.

S. subaphylla C.A. Mey has been recorded by Keith (l.c. 857) as an exotic; glabrous shrub, with linear-terete, thickish, alternate leaves and large fruiting perianth wings (10-20 mm across) (see Fl. USSR (Eng. ed.) 6: 190, pl. 11, fig. 13. 1970).

None of the *Salsolas*, *Haloxylon* etc., introduced from the USSR seems to have survived or established here.

19. HAMMADA

Iljin in J. Bot. URSS. 33: 582. 1958

Small, halophytic shrubs with jointed, opposite branches. Leaves opposite, oblong, subulate or scale-like, often reduced to a triangular tip at end of joints. Flowers small, hermaphrodite, axillary, solitary, 5-merous, arranged in spicate or paniculate inflorescences. Perianth segments 5, free, somewhat shaffy, developing horizontal wings on the back (± near the middle) in fruit. Anthers not or slightly appendiculate; staminodes 0-5, semiorbicular, thick, papillose-glandular. Utricle included in perianth; stigmas 2-3, on short style, subulate, recurved, papillose on the inner side. Seed horizontal with spirally coiled embryo.

The taxonomy of this group of plants (now split into 3 genera) needs critical studies to decide generic limitations; their size and geog. distr. at present are as follows: *Arthrophytum* Schrenk (1845) with some 20 species (mostly C. Asian), *Haloxylon* Bunge (1851) with 5 species (C. & W. Asian), and *Hammada* Iljin (1948) with c. 12 species in W. Irano-Turanian, Saharo-Arabian (N. African) and E. Sudanian territories. The taxonomy is based on fine technical characters, hardly justifying the separation of the 3 genera. However, *Haloxylon* Bunge seems more commonly used generic name but *Arthrophytum* Schrenk seems to have priority. It would be better if *Haloxylon* is made a conserved name.

Komorov (Fl. USSR. 6: 10. (English Trans. ed. 1970)) distinguishes *Arthrophytum* from *Haloxylon* as follows:

+	Flowering branchlets borne on branches of the preceding year; flowers in lower nodes of these branchlets, sometimes all the way up; staminodes thin, eglandular; mostly trees or small shrubs	**Haloxylon**

–· Flowering branchlets borne on green shoots of the current years or arising directly from the base; flowers in the upper nodes of the shoots; steminodes always thickened at the margin and mostly glandular-fringed; under shrubs or small shrubs **Arthrophytum**

Zohary (Fl. Palest. 1: 163. 1966) distinguishes *Hammada* from *Haloxylon* as follows: Very close to **Haloxylon** but differs from it in the wings being attached to the middle and not to the apex of the fruiting perianth, as well as the thick papillose-glandular staminodes.

These differences hardly justify generic distinction and need further studies about their constancy and correlation to establish absolute identity of these genera. Till such information is available we have treated our plants under *Hammada*.

About 12 species in W. Irano-Turanian, Saharo-Arabian and E. Sudanian territories; 2 or 3 species are found in Libya.

1. + Branches dark-coloured or black when dried or older; joints ± tapering at base. Flowers with fruiting perianth (including wings) 4-6 (-8) mm across 1. **H. scoparia**
   –· Branches pale greenish drying whitish (or yellowish); joints uniformly cylindrical. Flowers with fruiting perianth (including wings) 6-10 mm across 2

2. + Flowering branches arising irregularly from the current years green shoots. Flowers and fruits mostly at ends of branches. Fruiting perianth with wings 7-8 mm across, usually slight brownish or livid and unequal 3. **H. salicornica**
   –· Flowering branches arising ± regularly from at least one year old stem or branches. Flowers and fruits all along branches. Fruiting perianth with wings usually 8-10 mm across, white, usually equal 2. **H. schmitiana**

1. **Hammada scoparia** (Pomel) Iljin in J. Bot. USSR, 33: 583. 1943; Zoh., Fl. Palest. 1: 165, fig. 238. 1966; Tack., St. Fl. Egypt. ed. 2: 127. 1974. (Fig. 34).

Haloxylon scoparium Pomel, Nouv. Mat. Fl. Atl. 335. 1875; *Salsola articulata* Cav. Ic. 3: 43. t. 284. 1794 *(nom. illeg.)*, non Forsk (1775); *Haloxylong articulatum* (Cav.) Bunge in Mem. Sav. Etr. Petersb. 469. 1854 *(nom. conf.)*; in Act. Hort. Petrop. 6: 439. 1879; Durand & Barratte, l.c. 206; Pamp., Pl. Trip. 69. 1914; Prodr. Fl. Cir. 183. 1931; Corti, l.c. 92; Keith, l.c. 530; *H. articulatum* ssp. *scoparium* (Pomel) Batt. in B. & T., Fl. Alg. 765. 1890; *Arthrophytum scoparium* (Pomel) Iljin ex Jeh. & Maire, Cat. Maroc. 975. 1941; Fl. Afr. Nord. 8: 161. fig. 968. 1962; *Caroxylon articulatum* (Cav.) Moq. in DC., Prodr. 13. 2. 175. 1849 *(nom. illegit.)*; *Haloxylon articulatum* (Moq.) Bunge, Mem. Sav. Etr. Petersb. 7: 469. 1854 *(nom. illeg.)*; Ball in Tutin et al. Fl. Europ. 1: 107. 1964.

Small, erect shrub, 20-40 cm tall, intricately much branched, woody below; branches articulated, grey-brown, usually turning darker or blackish when dried. Leaves reduced to very small triangular scales, connate, forming a cup, ± minutely villous within. Flowers usually solitary, axillary, with 2 bracteoles, arranged in short, spike-like flowering branches. Perianth 5-lobed, subglobular, herbaceous, scarious at margins; stamens 5, alternating with 5, semiorbicular, marginally densely papillose staminodes; stigmas 2-3, papillose. Fruiting perianth with membranous wings 4-6 (-8) mm across; wings almost equal, spreading, suborbicular to broadly obovate with slightly erose margin.

Type: Described from Algeria.

A-2 Zwara, *A. Razeq* 467; 35 km from Alhbelliah on way to Josh, 26.11.1976, *Alavi & Ghafoor* 160; 10 km before Zentan, 24.1.1977, *Siddiqi & Fathi* 187; Turmeza in Jado, 6.6.1974, *B. Faris* 431; Gebel Nafousa, *L. Boulos* 3560; **A-6** 17 km west of Bengazi, 22.10.1977, *Siddiqi & Fathi* 138; **A-7** Wadi Al Ramlah, 5 km north of Al Mkhili, 22.1.1967, *L. Boulos* 1347; **A-8** 70 km from Derna on way to Tobruk, flowers with perianth wings of different shades, white, pink & red on different plants, 24.10.1975, *S.M.H. Jafri* 6048; Almasiad, near the border of Egypt, very common, perianth wings whitish, 25.10.1975, *S.M.H. Jafri* 6068; **B-1** 26 km from Nalut, c. 2 km from the main highway, 27.2.1975, *S.I. Ali* 2217; **B-1** Alghazaya, c. 28 km from Nalut on way to Wazen, 28.1.1977, *Siddiqi & Fathi* 273; Wazen, 2.6.1974, *B. Faris* 612; **B-4** 7 km from Bugrain, along the way to Al-Buayrat, 15.1.1967, *L. Boulos* 1067; 2 km east Bugrain, 27.1.1967, *L. Boulos* 1495; **B-6** Uadi Faregh, 9.4.1934, *R. Pampanini & R. Pichi-Sermolli* 2104; **C-4** Between Hun and Bu Ngem, sandy ground, common 27.2.1976, *S.M.H. Jafri* 6383 and 6384.

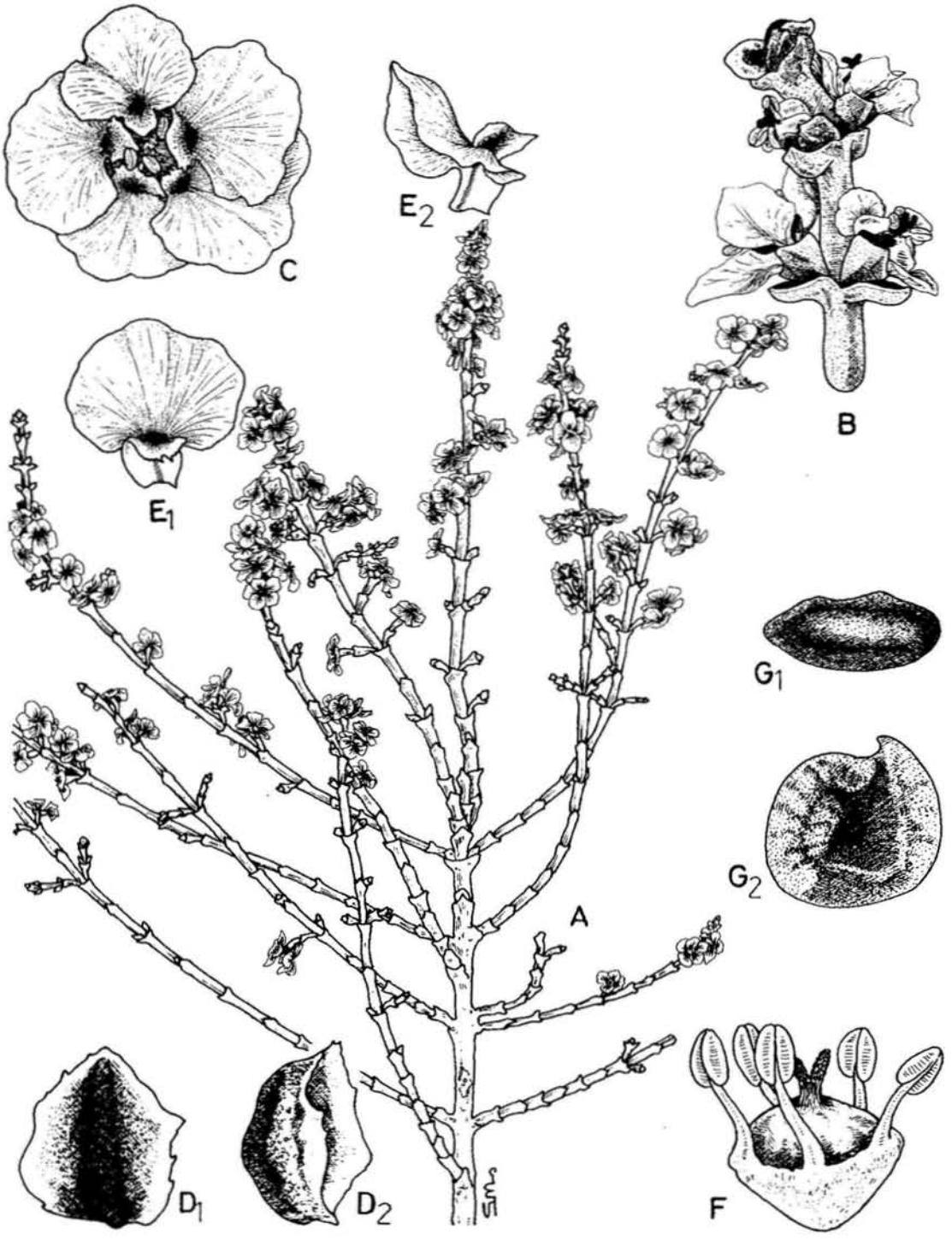

Fig. 34 **Hammada scoparia:** A, fruiting stem and branches x 1; B, portion of inflorescence x 7; C, fruiting perianth segments on a flower x 7; D_1, bracteole (ventral view) x 20; D_2, bracteole (side view) x 20; E_1, fruiting perianth with wing (front view) x 7; the same (side view) x 7; F, flower with perianth removed showing stamens and gynaecium x 20; G_1, horizontal seed x 20; G_2, the same (dorsal view) x 20.

Distribution: S.E. Spain, N. Africa, extending to Irano-Turanian region.

Botschantzev (in Nov. Syst. Pl. Vas. 363. 1964) considers Spanish plants different than our *Hammada scoparia* and gives it a new name *Hammada hispanica* Botsch. (l.c. 363 in adnot.). However, although we have considered this species to be present in Spain but we need Spanish plants to decide their taxonomic status.

A common species in slightly saline sandy and stony places, occurring almost throughout Libya. It is said to be poisonous to livestock, but some authors say it is eaten by camel.

Fl. Oct.-Nov. *Vern.* Rimt, Rimmt, Bessit, Wan idehan.

2. **Hammada schmitiana** (Pomel) Botsch. in Nov. Syst. Pl. Vasc. Acad. Sc. URSS. 362. 1964 (in adnot.); Zoh., Fl. Palest. 1: 165, fig. 240. 1966. (Fig. 35).

Haloxylon schmitianum Pomel, Nouv. Mat. Fl. Atl. 334. 1875; *H. salicornicum* Bunge in Act. Hort. Petrop. 6: 439. 1879 non *Caroxylon salicornicum* Moq. (1849)): Durand & Barratte, l.c. 207 (excl. syn.) p.p.; Pamp., Pl. Trip. 70. 1914; Prodr., Fl. Cir. 183. 1931; Corti, l.c. 90; Keith, l.c. 530; *H. schweinfurthii* Asch. in Asch. & Schweinf., Ill. Fl. Egypt, 128. 1887; *Arthrophytum schmitianum* (Pomel) Maire & Weiller in Maire, Fl. Afr. Nord. 8: 164. fig. 969. 1962. (?) p.p.

Low shrub, strict, usually erect, 30-50 (-70) cm tall, with current years shoots arising from erect branches which become pale yellowish or whitish when older. Leaves opposite, reduced to very small, triangular, acute scales, connate to form a short cup, woolly within. Inflorescences ± compact, consisting of numerous laterals (arising from the main shoot of previous years), the lower often longer, the upper shorter so as to form an elongated pyramidal panicle; flowering lateral branches spreading, usually bearing flowers all along. Bracteoles 2, ovate-orbicular with woolly base. Perianth lobes ovate oblong, with broad membranous margin in the upper part, developing lateral wings on back, 8-10 mm across in fruit; wings equal white, spreading, membranous, suborbicular; stamens 5; stigmas 2-3.

Type: Described from Algeria.

A-2 c. 35 km after Elhbelia, on way to Shakshuk, 26.11.1976, *Alavi, Ghafoor & Fathi* 191; 21 km between Sabrata and Zwara, bushy whitish plant with long branches, c. 80 cm, 22.11.1977, *Fathi, B.R.* 131; 7 km from Shakshuk, on way to Jado, plains and base of

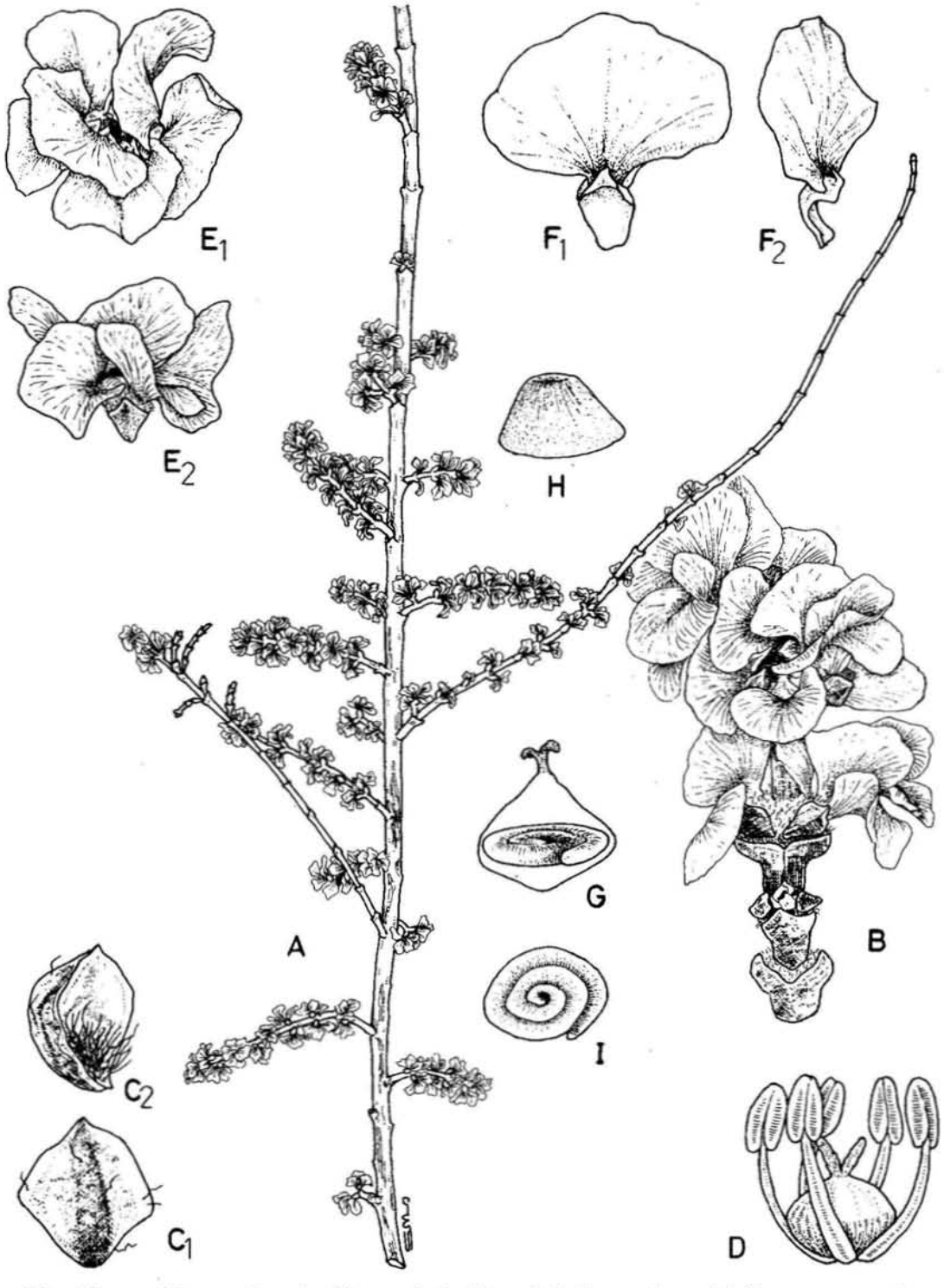

Fig. 35 **Hammada schmitiana:** A, habit x 0.5; B, portion of inflorescence x 5; C_1, bracteole (ventral view) x 10; C_2, bracteole (side view) x 10; D, flower with perianth removed showing stamen and gynoecium x 10; E_1, fruiting perianths on a flower (top view) x 5; E, the same (side view) x 5; F_1, fruiting perianth (from view) x 5; F_2, the same (side view) x 5; G, fruit with horizontal seed (diagramatic) x 10; H, fruit x 10; I, embryo (seed) (dorsal view) x 10.

mountains, sandy dry soil with gravel, 27.11.1976, *Alavi, Ghafoor & Fathi* 191; c. 20 km West of Jado, *Siddiqi & Fathi* 219; **A-1** Alghazaya, on way to Wazen, 25.1.1977, *Siddiqi & Fathi* 278; **B-4** 15 km West of Sirte, 8.1.1977, *Siddiqi & Fathi* 107; 22 km West of Ben Jaowad, 22.10.1977, *Siddiqi & Fathi* 157; 22 km West of Sirte, 23.10.1977, *Siddiqi & Fathi* 169.

Distribution: N. Africa (Morocco to Egypt), Palestine. (Saharo-Arabian element).

A common species of dry sandy places with pebbles in Libya, and said to be poisonous to livestocks and even not eaten by camels. Very similar to the following species, but flowering spikes develop from older, at least previous year's branches; sometimes the older part of the branch may have flowers and the terminal portion extends as a long shoot bearing no flowers or flowering shoots during the current year.

This has been considered conspecific with *Anabasis articulata* by Tackholm (l.c. 128), while Zohary (l.c.) has kept it here. It has horizontal seeds as mentioned by Maire and correctly placed here.

Fl. Sept.-Nov. *Vern.* Baghel

3. **Hammada salicornica** (Moq.) Iljin in J. Bot. URSS. 33; 583. 1948; Zoh., l.c. 164, fig. 239.

Caroxylon salicornicum Moq. in DC., Prodr. 13. 2: 174. 1849; *Haloxylon salicornicum* (Moq.) Bunge ex Boiss., Fl. Or. 4: 949. 1879.

Shrubby, with annual shoots arising irregularly from old, woody low stems, ascending, 25-50 cm long, green, turning light-coloured to white-glaucous or waxy-yellow when dry or old. Inflorescences diffuse, consisting of 2-4 (-6) cm long, scattered spikes, mostly at the ends of green, main or lateral shoots of the current year. Staminodes papillose at tips. Fruiting perianth (including wings) 6-8 mm across, usually unequal, somewhat brownish or livid.

Type: Afghanistan, *Griffith* 1796 (K).

Distribution: Pakistan, Afghanistan, S.W. Asia, Arabia, Palestine to N. Africa.

There is every possibility of its occurrence in our area. However, *Hammada elegans* (Bunge) Botsh. (l.c. 362) is probably not different from it. Zohary (l.c.)

gives the distribution of *H. salicornica* to Egypt also while Tackholm (St. Fl. Egypt ed. 2. 127. fig. 318. 1974) considers the Egyptian plants to be *H. elegans*. However, some of our gatherings (such as *Siddiqi & Fathi* 278) included in the previous species, may belong here, but before we decide the occurrence of this species in our area, field observations and more collections are necessary. We have yet to see authentic specimens of *H. salicornica* and *H. elegans* and we agree with the remarks of Zohary about Palestinian plants (l.c. 165): « some specimens included in this species may belong to *H. elegans*. The occurrence of intermediate forms makes it difficult to distinguish the latter from *H. salicornica* ».

20. HALOXYLON*

Bunge, Reliq. Lehman. 291. 1851.

Small trees or shrubs with jointed brittle stems, spartoid branches and very reduced or obsolete opposite leaves. Flowers and fruits as in *Hammada* but perianth wing developing from the apex of its back in fruit (and not from the middle).

About 5, C. & W. Asian species, the genus is known by a single introduced and cultivated species in Libya.

***Haloxylon aphyllum** (Minkw.) Iljin in J. Bot. URSS. 19: 2. 1934; Keith, l.c. 529 (with photo of the plant).

Arthrophytum ammodendron var. *aphyllum* Minkw. in Fedde, Repert. 9: 478. 1912; *A. haloxylon* Litw. in Trav. Mus. Bot. Acad. Sc. Petersb. 9: 45. 1913; *A. aphyllum* (Minkw.) Litw. l.c.

Syntypes: from Central Asia (LE)

Keith (l.c.) reported, « Introduced (from seed) in 1957 from Uzbekistan (URSS), for afforestation trials. At Agilat flowered and fruited one year after planting... Direct seeding in prepared dune sites at Hescian and Ain Zara in 1961 and growth good in 1962. A further 200 kg. imported on 18 February, 1963 to the F.D. »

A central Asian species, probably failed to establish in Libya. A search to find a specimen of this species from the sites mentioned above, was in vain.

Differs from **H. ammodendron** (C.A. Mey.) Bunge by its small tree habit (not shrub) with fruiting perianth wings rounded or cuneate at base (not cordate).

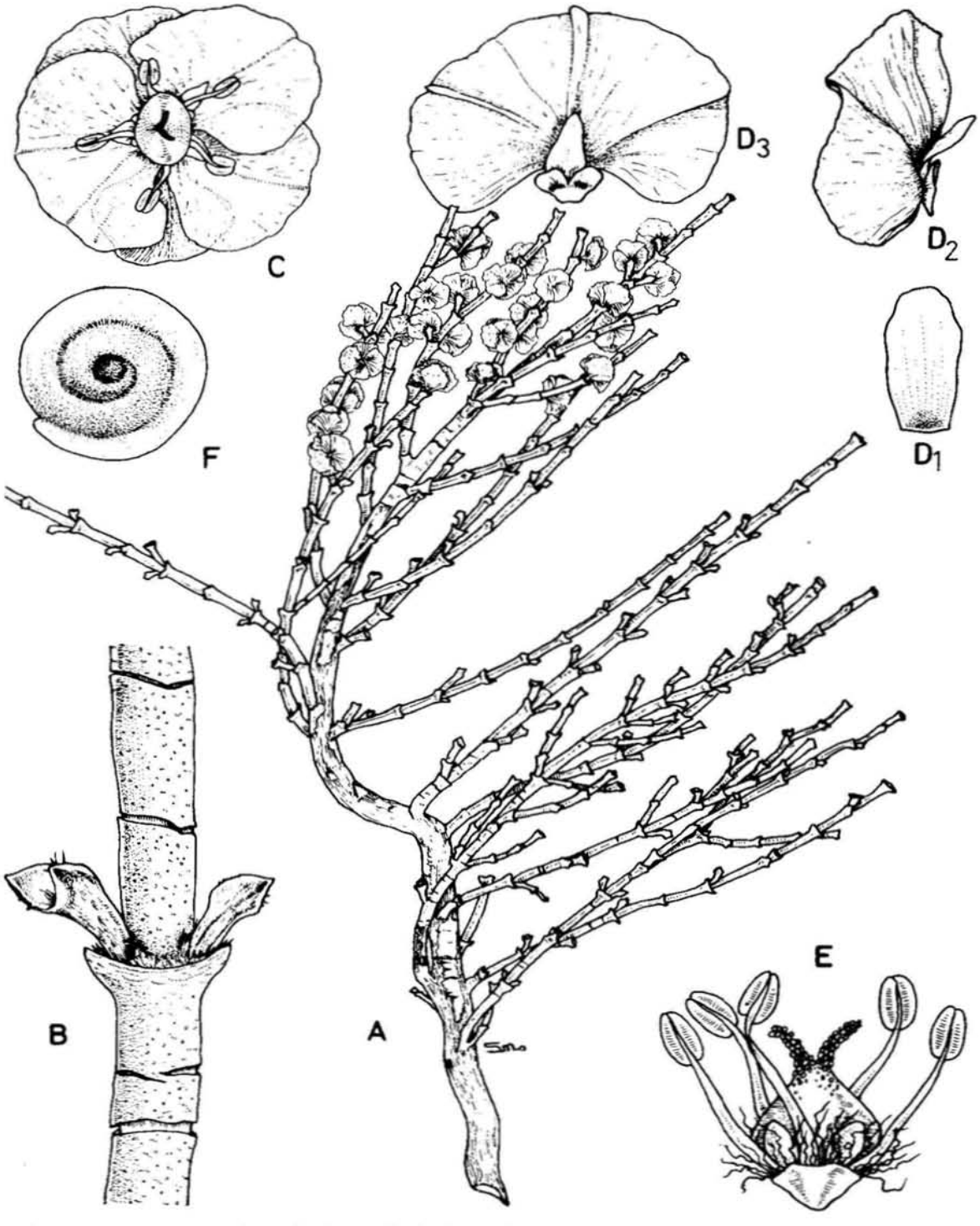

Fig. 36 **Anabasis articulata:** A, habit x 0.5; B, portion of branch x 4; C, fruiting perianth segments with wings (dorsal view) x 3; D_1, bracteole x 5; D_2, fruiting perianth with wing (side view) x 5; D_3, the same (front view) x 5; E, flower with perianth removed to show stamens and gynoecium x 10; F, erect seed x 10.

21. ANABASIS

L., Sp. Pl. 223. 1753; Gen. Pl. ed. 5: 104. 1754.

Perennial herbs or shrubs, succulent with articulated stems and opposite, often reduced scale-like leaves. Flowers 2-sexual, usually solitary, axillary, subtended by 2, pubescent, short bracteoles, arranged in lateral and terminal spikes; perianth segments 5, free to base, at least 3 of them developing wings in fruit; stamens 5, alternating with the 5 staminodal lobes; anthers not appendiculate or only minutely apiculate; stigmas 2, short, obtuse on very short or obscure style. Utricle membranous, sometimes berry-like, included in the winged perianth; seeds vertical, compressed, lenticular, exalbuminous with membranous testa and spiral embryo.

Distinguished from *Hammada* by its vertical seed.

About 25 species, mainly in Irano-Turanian and Saharo-Arabian regions; represented by 1 species in Libya.

Anabasis articulata (Forsk.) Moq. in DC., Prodr. 13. 2: 212. 1849; Durand & Barratte, Fl. Lib. Prodr. 207. 1910; Pamp., Pl. Trip. 68. 1914; Prodr. Fl. Cir. 184. 1931; Corti, Fl. Veg. Fezzan 23. 1942; Maire, l.c. 173, fig. 972; Keith, l.c. 225. (Fig. 36).

Salsola articulata Forsk., Fl. Aeg.-Arag. 55, tab. 8a. 1775.

Dwarf shrub, erect or tortuous, with woody stem, much branched; branches 2-3 (-4) mm thick, greenish-glaucous, yellowish or whitish when dried, with internodes up to 10 x 2-3 (-4) mm long, older with whitish peeling bark below. Leaf cupule short, villous or pubescent within. Flowers up to 5 mm long, usually solitary, opposite, or sometimes more than 1 in an axil, upper arranged in spikes at end of branches. Perianth segments 5, unequally 5 winged in fruit, wings white to pink, membranous, up to 5 x 7 mm, suborbicular. Stamens 5, exserted; staminodes thick, orbicular-obovate, papillose or villous. Ovary papillose, with thick papillose usually 2 stigmas, darker in colours when dried. Utricle erect, with vertical (erect) seed and spirally coiled embryo, testa membranous.

A variable species, differentiated into 2 subspecies in our area on fleshiness and leaf characters:

+ Branches conspicuously fleshy, with ± cylindrical branches, pale-whitish when dried, 2.5-3.5 (-4) mm broad above; leaves very short, obtuse or blunt at apex, rarely with obscure

mucro, cupule ± clasping the base of the upper segment	a) **A. articulata** ssp. **articulata**
— Branches slender not so fleshy above, greenish or yellowish when dried, 2-2.5 mm broad above; leaves short but distinct, acute-mucronate, often recurved at tips, cupule not clasping the base of the upper segment	b) **A. articulata** ssp. **oropediorum**

a) subsp. **articulata** (Fig. 36)

Type: Egypt, Pyramids, *Forskal* (C).

A-3 20 km from Zilletin on way to Misrata, 5.1.1977, *Siddiqi & Fathi* 53; **A-7** Wadi Al Ramlah, 5 km N. Al Makili, 22.1.1967. *L. Boulos* 1353; **A-8** Sidi Bu Amud tra Tobruk e Bardia, 23.3.1933, *R. Pampanini* 1949; 2 km before Al Tmemi on Tobruk road, 16.10.1977, *Siddiqi & Fathi* 63; **B-1** c. 65 km from Derj, on way to Nalut, c. 41 km before Sinown, sandy roadside with small stones, 26.2.1975. *S.I. Ali* 2160; c. 20 km before Derj, 28.1.1977, *Siddiqi & Fathi* 398; 184 km from Nalut, c. 64 km from Sinawon, sandy soil, dry area, 25.2.1975, *S.I. Ali* 2135; **B-4** 15 km before Sirte, 8.1.1977, *Siddiqi & Fathi* 105; **B-8** Amsaid, near the border of Egypt, branches, c. 30-40 cm, flowers yellowish, 25.10.1975, *S.M.H. Jafri* 6064; **C-4** Between Hun and Bugrain, sandy ground, common, 27.2.1976. *S.M.H. Jafri* 6385 and 6390; 2 km east Bugrain, 27.1.1967, *L. Boulos* 1496; 60 km from Bougrain, 14.4.1977, *A. Gammudi* 117; **G-8** Uweinat, 7.11.1968, *L. Boulos* 3137 and 3140.

Distribution: Saharo-Arabian: N. Africa (Algeria to Egypt), Palestine, Syria, Arabia Petraea and Spain.

A desert taxon, fairly common in the drier parts of Libya.

Browsed by camel and goats and also collected as fuel and contains potassium.

Fl. Spet.-Nov. *Vern.* Ageram, Bagel

b) subsp. **oropediorum** (Maire) Ozenda, Fl. Sahara 235. 1958.

Anabasis oropediorum Maire in Bull. Soc. Hist. Nat. Afr. Nord. 29: 447. 1938; Fl. Afr. Nord. 8: 177, fig. 971. 1962.

A less fleshy low shrub, with more woody stem and slender ± rigid branches, turning yellowish-green when dried; leaves small, not clasping the base of upper segment, mucronate and somewhat recurved at the apex.

Syntypes: Described from Morocco and Algeria.

A-2 Abu Gheilan, 22.11.1969, *A.M. Abughnia* s.n.; near Gharian, on the mountain slopes, 21.11.1969, *I.I. Chaudhri & M.M. Khalifa* 15311; Shakshuk, 26.11.2976, *Ghafoor, Alavi & Fathi* 190; **A-6** Dariana, roadside, 17.10.1975, *S.M.H. Jafri* 6162; Dariana, c. 35 km east of Benghazi, 21.10.1977, *Siddiqi & Fathi* 115; 24 km west of Benghazi, 22.10.1977, *Siddiqi & Fathi* 137; **A-7** 22 km east of Taknes, 19.1.1977, *Siddiqi & Fathi* 84.

Distribution: Morocco, Algeria, Tunisia and Libya.

A rather coastal plant, not so fleshy as the type subspecies but more woody with slender, often elongated branches, much flowering but perianth wings usually developing late. Economic importance probably the same as of the type subspecies. Further studies are needed as to find out its absolute specific identity. Maire (l.c.) cites part of the Forskal's *S. articulata* under its synonymy, but the actual aspect of leaf must be found on the type specimen as to definitely say whether it is like this subspecies or that of the type subspecies. It is difficult to find out this from the microfische, seen by us, on the hopeless type specimen. We have followed Ozenda (l.c.) for the time being. Specimens from Gebel Uweinat (*Boulos* 3137 and 3140) have the appearance of this subspecies but leaves obtuse, like in the type subspecies. Small mucro have also been observed in some cases of the type subspecies.

22. NOAEA

Moq. in DC., Prodr. 13. 2: 207. 1849.

Herbs or low shrubs, usually glabrous; stems rigid with divaricating usually spine-tipped branches. Leaves filiform, alternate, sessile. Flowers 2-sexual, solitary, axillary, 2-bracteolate. Perianth segments 5, short-connate at base, developing wing below the middle at the back in fruit. Stamens 5, inserted in a fleshy, lobed,

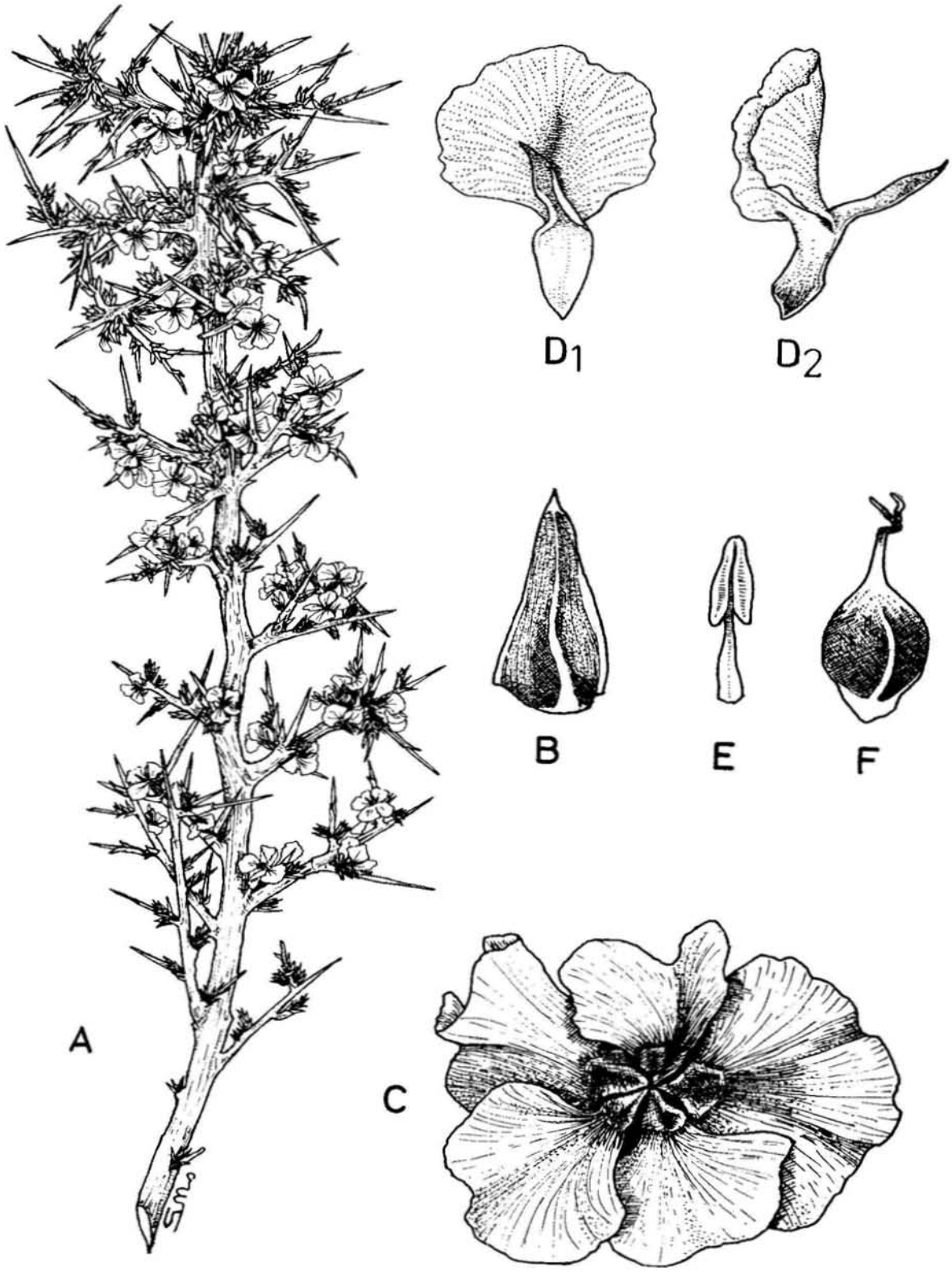

Fig. 37 **Noaea mucronata:** A, a fruiting branch x 0.65; B, bract x 8; C, fruiting perianth with wings on a flower (dorsal view) x 6; D, fruiting perianth segment (front view) x 6; D_2, the same (side view) x 6; E, stamen x 8; F, gynoecium (fruit) x 8.

papillose disc; anthers linear-sagittate, terminating in a small, rather firm appendage; staminodes absent. Ovary ovoid; style elongated with 2, lanceolate-recurved stigmas. Utricle membranous, included in perianth but free; seeds vertical, orbicular, laterally compressed, exalbuminous with spiral embryo.

About 7 species mostly in the Irano-Turanian region; one species is recorded from Libya.

Noaea mucronata (Forsk.) Aschers. & Schweinf., Ill. Fl. Egypte. 131. 1887; Maire, Fl. Afr. Nord 8: 167, fig. 970; Aellen in Davis, Fl. Turk. 2: 336. 1966. (Fig. 37).

Salsola mucronata Forsk, Fl. Aeg.-Arab. 56. 1775; *Anabasis spinosissima* L.f., Suppl. 173. 1781; *S. camphorosmoides* Desf., Fl. Atl. 1: 218. 1798; *N. spinosissima* (L.f.) Moq. in DC., l.c. 209; Durand & Barratte, l.c. 207; Pamp., Pl. Trip. 70. 1914; Prodr. Fl. Cir. 183. 1931; Keith, l.c. 689.

Erect shrub, up to 50 cm tall, much branched with usually spine-tipped, divaricating branches, glabrous, papillose or bristly. Leaves 5-20 (-25) x 3-5 mm, with an ovate base, subulate or linear-filiform above, upper ones shorter, somewhat decurrent, semiterete, mucronate, ± papillose-scabrous at margin. Bracts and bracteoles ovate at base, triquetrous-subulate. Flowers axillary, alternate along the branches; perianth lobes c. 4 mm; wings in fruit unequal, 5-6 mm in diam., membranous, white or purplish, obovate to oblong, with usually erose margins; style thick, elongated; seed vertical, with spiral embryo.

Type: Described from Egypt, Alexandria at the catacombs.

A-7 c. 45 km east of old Merj, Gebel Akhdar, wings yellowish, 19.10.1977, *M.A. Siddiqi & Fathi, B.R.* 92.

Distribution: N. Africa, W. & C. Asia.

A polymorphic species in leaf and spine characters and *N. tournefortii* (Spach) Moq. with longer leaves (3-4 cm long) and longer bracts has also been considered as a subspecies of this species by Allen (in Davis, l.c.).

23. CORNULACA

Delile, Fl. Egupte (folio ed.) 206, t. 22. f. 3. 1813.

Herbs or low shrubs with short, alternate, closely placed, sessile leaves, usually spiny or spinulose at apex. Flowers 2-sexual or polygamous, solitary or usually in 3-flowered glomerules, in the axils of bract. Perianth-segments 5, free nearly to base, hyaline, the anterior segment usually developing a long prickle at back in fruit. Stamens usually 5; anthers not appendaged; filaments linear-subulate, inserted on an obscure, non-papillose, ± 5-lobed disc; anthers oblong, cordate. Stigmas 2, on a style, mostly filiform, papillose. Utricle included in perianth, ovoid, laterally compressed, free from perianth; seed vertical with spiral embryo.

About 6 species, N. Africa to C. Asia; 1 species is recorded from Libya.

Cornulaca monacantha Del., Fl. Egypte (folio ed.): 206, t. 22. f. 3. 1913; Durand & Barratte, l.c. 208; Pmap., Pl. Trip. 69. 1914; Prodr. Fl. Cir. 184. 1931; Corti, l.c. 95; Ozenda, l.c. 279; Keith, l.c. 387; Maire, l.c. 182, fig. 976. (Fig. 38).

Low, intricately branched, woody shrub, up to 60 cm tall, greenish, turning yellowish or whitish when dried, glabrous-glaucous, except the leaf axils. Leaves alternate, up to 10 x 2 (-2.5) mm, recurved, tapering from a clasping base into a rigid spine, woolly in the axils. Flowers 1-3 (-5) in each axile, exceeding the bracteoles; bracts up to c. 4 mm, spinescent, leaf-like but shorter. Perianth-segment c. 5 mm, linear, subspathulate, obtuse, ± denticulate at apex, coriaceous below, membranous above, the anterior one usually developing up to 8 (-10) mm long spine at the back. Utricle ovoid, laterally compressed, erect, included, with membranous pericarp free from the perianth; seed vertical, with membranous testa and spiral embryo.

Type: Egypt, *Delile*

D-3 Fekkim, c. 130 km from Brak, sand among graphite boulders, 23.3.1973, *S.I. Ali* 1360; c. 16 km from the main road towards Brak, sandy and stony soil, 30.3.1973, *S.I. Ali* 1392; 15-20 km from Sabha, between Sebha and Al Abiad, dry sand area, bush c. 50-70 cm, 20.3.1973, *S.I. Ali* 1316; **F-3** Wadi Tumb, c. 22 km from the army post, sandy and stony ground, 27.3.1973, *S.I. Ali* 1383 and 1384; **G-8** Gebel Uweinat, 17.11.1968, *L. Boulos* 3137, 3167, 3412 and 3413.

Distribution: N. Africa (Algeria, Tunisia, Libya, Egypt), Nubia, Arabia and Iran.

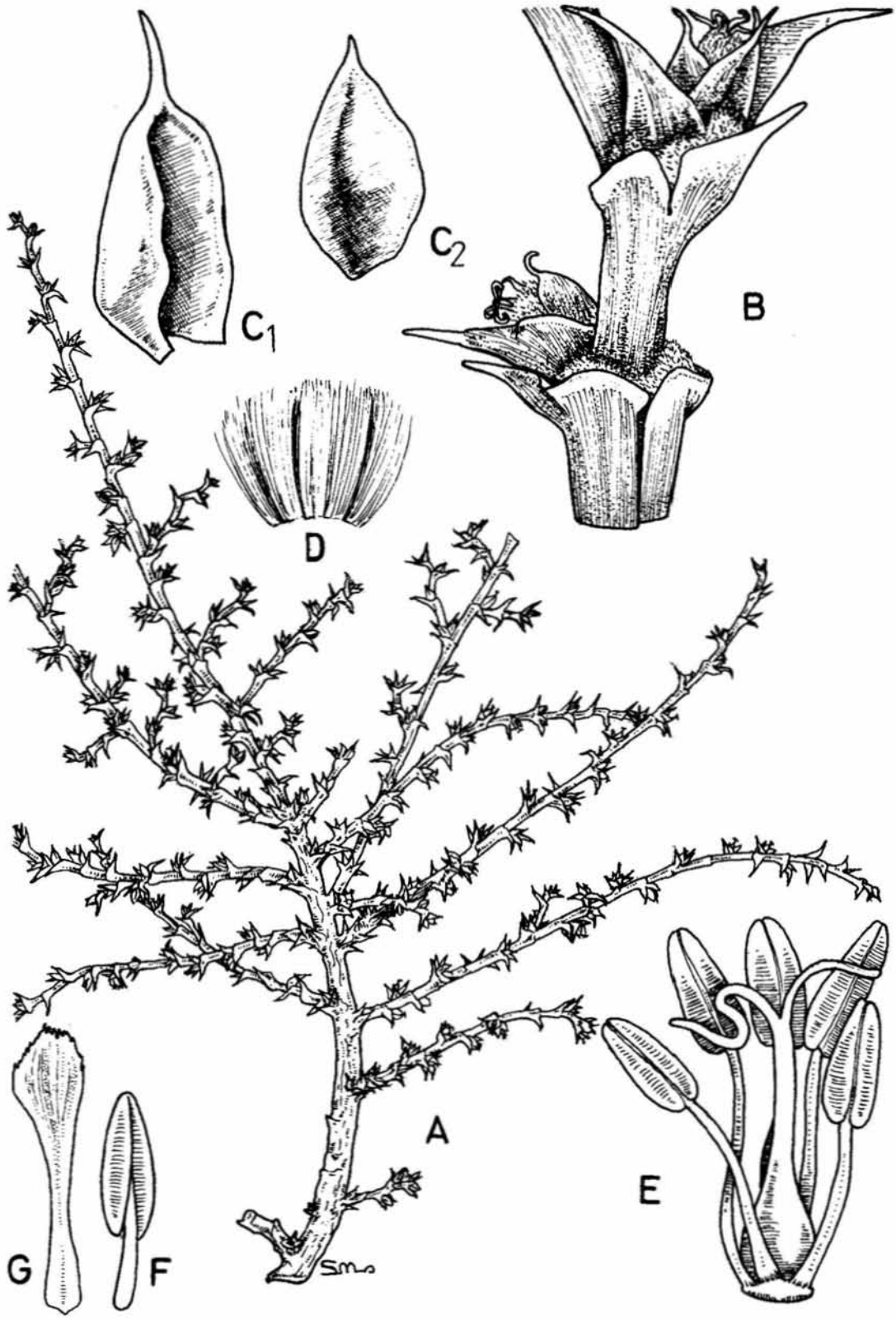

Fig. 38 **Cornulaca monacantha:** A, habit x 0.65; B, portion of inflorescence x 6; C_1, bract x 16; C_2, bracteole x 16; D, tuft of axillary hairs x 10; E, flower with perianth removed showing stamens and gynoecium x 20; G, perianth segment x 20; F, stamen x 20.

A desert species, confined to the Southern parts of Libya; eaten by camel.

Fl. Oct.-Nov. *Vern.* Hadd; Suada, Tahara.

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