

THE GENUS *ANTHEMIS* L. (COMPOSITAE-ANTHEMIDEAE) IN ARABIAN PENINSULA: A TAXONOMIC STUDY

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Abstract

The genus *Anthemis* L. (Compositae-Anthemideae) from Arabian peninsula is revised. In all 19 species belonging to sections *Odontostephana*, *Maruta*, *Anthemis*, and *Rascheyana* are recognised including *A. tenuicarpa* is recorded as new to Saudi Arabia. Artificial key for species identification, detailed description of each species and ecological information has also been furnished.

Introduction

Anthemis L., the second largest genus of the tribe *Anthemideae*, as currently defined, comprises of nearly 210 species (Bremer, 1994; Bremer & Humphries, 1993), distributed widely across Europe, SW Asia, N and NE Africa and extending into extreme southern Arabia and tropical east Africa. It is a heterogenous assemblage of annual and perennial herbs or dwarf shrubs with beautiful and attractive heads. It is closely related to the genera *Matricaria* L., *Chamaemelum* Mill., *Tripleurospermum* Schultz. Bip., and like those genera, known by the common name Chamomile; some species are also called Dog-fennel or Mayweeds. *Anthemis* can be easily distinguished by the paleaceous receptacle of its mostly radiate capitula and the achene morphology. Some species of *Anthemis* are economically important being used as herbal tea to cure anxiety, flatulence, stomach disorders, insomnia and toothache; some yield yellow dye and are insecticidal.

A survey of taxonomic literature of last four decades reveals that hitherto neglected *Anthemis* L. has received considerable attention in Europe and some parts of SW Asia (Abid & Qaiser, 2009; Bremer, 1994; Chehregani & Mahenfar, 2000; Fernandez, 1976; Feinbrun-Dothan, 1978; Grierson & Yavin, 1975; Ghafoor & Al Turki, 1997a, b; Ghafoor & Al Turki, 1999; Ghafoor & Al Turki, 2000; Ghafoor & Ali, 2002; Ghafoor, 2002; Greuter *et al.*, 2003; Iranshahr, 1986; Khandjian, 1990; Oberprieler, 1998, 1999, 2001; Tackholm, 1974; Turland, 2008; Yavin, 1970, 1972) as to its taxonomy, achene morphology, palynology and ethnobotany. However, this genus is imperfectly known from Middle East and Central Asian States despite of the fact that Eig (1938) monographed it from the Orient and described many new taxa. From Saudi Arabia Migahid (1989) reported four species, while Collenette (1985) presented photographs of two taxa and Chaudhary & Akram indicated weedy nature of four species of *Anthemis*. Heemstra *et al.*, (1990) and Mandaville (1990) reported four species each from northern and eastern regions of Saudi Arabia, a major country of the Gulf States. A better understanding of the genus *Anthemis* from Saudi Arabia was presented by Ghafoor & Al Turki (1997) who recognized and reported 12 species along with their illustrations and distribution maps. Later (Ghafoor, 1997 and Ghafoor & Al Turki, 1999) published accounts of two new species from Saudi Arabia, thus raising the number of *Anthemis*

species to 14. Thirst to study more material while the author was working in Saudi Arabia resulted to discover the presence of three more species in that country and accounts of 17 species were presented (Ghafoor & Al Turki, 2002) in the first ever accurate and illustrated "Flora of the Kingdom of Saudi Arabia" under guidance and editorship of Dr Shaukat A. Chaudhary who spent more than 30 years in the region and established Herbarium at the Ministry of Agriculture in Riyadh.

The aim of the present study, which reveals the presence of 19 species, including one new record, was to contribute to a better understanding of the genus *Anthemis*, a confused and actively evolving component of the Arabian flora and vegetation, in which specimens of quite distinct species, recognized here, were lumped together under *A. melampodina* Del. Undoubtedly more collecting on a larger scale in the species-rich wadis may reveal presence of a few more species.

The size, surface features (smooth, tuberculate or minutely pitted), number of ribs and presence or absence of auricles on mature cypselas are the most important characters for species delimitation. Collectors of specimens of *Anthemis* should not ignore to note the dimensions of capitula with well spread ray floret limbs or ligules, which in some species are extremely variable. The shape, size and hairiness of phyllaries, fertility and colour of ray-florets, shape of receptacle, shape of paleae and swollen nature of disc and ray-floret corolla and their hairiness also have considerable taxonomic significance in addition to slender versus thickened fruiting peduncles.

Materials and Methods

This study is based upon herbarium material obtained on loan from herbaria at Royal Botanic Gardens, Kew (K) and Edinburgh (E) housing invaluable collections from Arabian Peninsula. In addition specimens present in the herbaria of Ministry of Agriculture, Riyadh (RIY), National Commission for Wildlife Conservation and Development, Riyadh (NSWCD) King Saud University (KSU), and King Abdulaziz City for Science and Technology, Riyadh (KACST) were examined. The material is, however, still insufficient and further collecting in remote, inaccessible valleys may reveal novelties of fundamental significance for a better understanding of the genus in the Gulf region.

All the measurements were made directly from dried specimens and fresh material of some taxa, using Leica Wild M10 stereoscope at magnifications varying between x 8 and x20. Morphological terms used in taxonomic descriptions are according to Stearn (2004) and the herbarium abbreviation according to Holmgren *et al.*, (1990).

The infrageneric classification of *Anthemis*, followed in this study, is after Yavin (1970, 1972) and adopted by Feinbrun-Dothan (1978).

***Anthemis* L.**, Sp. Pl.: 893. (1753); Gen. Pl. ed. 5: 381. (1754); Boiss., Fl. Orient. 3:: 278 (1875); Iranshahr in Rech. f., Fl. Iran. 158 (4): 5 (1986); Bremer & Humphries in Bull. Nat. Hist. Mus. Lond. (Bot.) 23 (2): 132 (1993);

Type species: *A. maritima* L.

Annual or perennial, hairy herbs with alternate, pinnatisect to variously lobed or sometimes pinnatifid or entire leaves. Capitula radiate or discoid, pedunculate, solitary or laxly corymbose. Phyllaries (2-)-3-seriate, imbricate, with narrow to broad scarious entire or lacerate margins. Receptacle convex to conical or hemispherical, paleate all over or in

the lower half, rarely naked. Paleae subulate, linear-lanceolate or oblanceolate to spathulate, truncate to acute or acuminate-spinescent with excurrent midrib. Ray florets uniseriate, female, fertile or neuter; limb white or rarely yellow or reddish, basally glabrous or hairy, rarely indurated. Disc florets numerous, 5-lobed, yellow or occasionally reddish-purple, tube basally not or much swollen in fruit, rarely hairy, lobes rarely with acute appendages. Anther bases entire. Style branches flattened, truncate and penicillate at the apices. Cypselas terete to oblong, or obpyramidate, 4-5-angled or dorsiventrally compressed, smooth or tuberculate, sulcate and striate-costate, apically beakless, bald or beset with a minute dentate-lacerate rim or corona or an adaxial auricle. Vernacular names: *Chamomille* (English); *Qahwiyan*, *Rebyan* (Arabic).

A genus of ca. 210 species (Bremer & Humphries 1993, Bremer 1994), occurring in Europe, SW Asia, N & NE Africa; some species introduced and naturalized in other parts of the world (North America, Australia)

Key to the species of *anthemis* in the Arabian peninsula

- 1 + Paleae linear-subulate to bristle-like $\pm$ persistent 2
 - Paleae linear-oblanceolate or oblong-oblanceolate to narrowly oblong-spathulate 5
- 2 + Paleae present on the upper half of receptacle only 3
 - Paleae present all over the receptacle 4. **A. bornmuelleri**
- 3 + Cypselas persistent at maturity. Fruiting peduncles either filiform and slightly thickened or much thickened and strongly arcuate. Ray-florets fertile 4
 - Cypselas readily deciduous at maturity. Fruiting peduncles neither thickened nor arcuate. Ray florets sterile 3. **A. cotula**
- 4 + Peduncles filiform, 8-10 cm long, slightly thickened in fruit. Cypselas 2.5-3 mm long. Paleae deciduous 1. **A. odontostephena**
 - Peduncles 3-6 cm long, much thickened and strongly arcuate in fruit. Cypselas 1-1.5 mm long. Paleae persistent 2. **A. pseudocotula**
- 5 + Inner phyllaries with broad hyaline margins and brown, shiny, obtuse appendages at the apices 5. **A. hyalina**
 - Inner phyllaries with narrow membranous margins and without appendages at the apices 6
- 6 + Inner phyllaries 6-7 mm long. Ray flower limbs indurated and persistent on maturity 6. **A. haussknechtii**
 - Inner phyllaries 5 mm or less long. Ray floret limbs deciduous on maturity 7
- 7 + Cypselas clavate, pale to whitish, scrobiculate along ribs 8
 - Cypselas oblong-cylindrical or obconical-obpyramidate, or curved (falcate), smooth or tuberculate 9
- 8 + Plants ash-grey. Ray-floret tubes glabrous. Leaves 1-2-pinnatisect. Disc corollas not inflated in fruit 7. **A. scrobicularis**
 - Plants green. Ray-floret tubes hairy. Leaves 2-3-pinnatisect. Disc corollas inflated in lower half in fruit 8. **A. sheilae**
- 9 + Phyllaries almost glabrous, with broadly scarious, $\pm$ lacerate margins. Receptacle Hemispherical 10
 - Phyllaries hairy, with broadly scarious, hyaline to pale-brown sub-entire margins. Receptacle convex to conical 11

- 10 + Capitula 1-1.5 cm across. Paleae oblong lanceolate, carinate. Disc corollas inflated and compressed in fruit 18. *A. rascheyana*
 - Capitula 2.5-4 cm across. Paleae oblong spathulate, flat. Disc corollas not inflated in fruit 15. *A. leptophylla*
- 11 + Receptacle convex. Ray-floret tubes hairy 9. *A. dicksoniae*
 - Receptacle conical. Ray-floret tubes glabrous 12
- 12 + Cypselas obpyramidate, all slightly curved, tuberculate on dorsal side only, with deeply triangular lacerate, acute-lobed auricle 10. *A. zoharyana*
 - Cypselas narrowly cylindric to obconical, or falcate, tuberculate or smooth, bald or with shortly lobed auricle 13
- 13 + Perennial with a woody rootstock. Paleae linear-lanceolate. Disc flowers purple in upper half. Cypselas purplish-black 14
 - Annual or biennial. Paleae lanceolate - oblanceolate. Disc florets yellow. Cypselas black 15
- 14 + Capitula 2 cm or more in diameter. Ray-florets sterile, with 7-8 mm long limb. Receptacle 6-7 mm long 11. *A. tigrensis*
 - Capitula 1-1.5 cm in diameter. Ray-florets fertile, with 3-4 mm long limbs. Receptacle 2-3.5 mm long 12. *A. yemenensis*
- 15 + Peduncles gradually thickened in fruit 16
 - Peduncles not thickened in fruit 17
- 16 + Disc corollas inflated and indurated in fruit. Cypselas tuberculate. Paleae keeled, not stiffly acuminate 13. *A. melampodina*
 - Disc corollas not or very slightly inflated, deciduous. Cypselas smooth. Paleae flat, stiffly acuminate 14. *A. arvensis*
- 17 + Paleae oblong or oblong-lanceolate. Cypselas tuberculate 18
 - Paleae oblong-spathulate or lanceolate-oblanceolate. Cypselas smooth 19
- 18 + Receptacle hemispherical. Cypselas obpyramidate. Disc corollas inflated towards the base in fruit 16. *A. desertii*
 - Receptacle conical. Cypselas curved, nearly falcate, shortly auricled. Disc corollas cylindric, not inflated towards the base in fruit 17. *A. endumea*
- 19 + Cypselas obconical, not curved. Paleae broader apically, stiffly acuminate. Receptacle convex, becoming elongate conical in fruit 14. *A. arvensis*
 - Cypselas narrowly cylindrical, slightly curved. Paleae narrowly oblong-spathulate. Receptacle not elongating in fruit 19. *A. tenuicarpa*

Taxonomic Descriptions

Sect. 1. *Odontostephana* Eig, Palest. Journ. Bot. Jer. Ser. 1: 203 (1938). Type: *A. odontostephana* Boiss.

Annual herbs with petiolate leaves. Phyllaries deciduous. Receptacle conical. Paleae subulate, beset in upper part of receptacle, deciduous. Disc cypselas long cylindrical, dilated towards the base and apices, persistent. Ray cypselas deciduous.

Represented in Arabian Peninsula by the following species

1. *Anthemis odontostephana* Boiss., Diagn. Pl. Or. Nov. ser. 1(6): 85 (1846); Fl. Orient. 3: 319 (1875); Hook. f., Fl. Brit. Ind. 3: 312 (1882); Iranshahr in Rech. f., Fl. Iran. 158: 10. Tab. 1 (1986). Type: Habitat in collibus et rupestribus Persiae australis circa Persepolin et prope Gere, *Th. Kotschy* 51 (G holo.; LE Iso.).

Illustration.: Ghafoor, Fl. Pak. 207: 18. Fig. 1, A - C (2002).

A small annual, up to 15 (-20) cm tall, appressed greyish-hairy herb with suberect branches. Leaves short petioled, lamina ovate, 15-20 x 6-10 mm, 1 (-2)-pinnatisect into 2-3 mm long, acute ultimate segments. Peduncles filiform, 8-10 cm long, slightly thickened upwards in fruit. Capitula radiate, 10-12 mm across. Phyllaries oblong, 2-3 x c. 1 mm, appressed hairy outside, broadly membranous margined, obtuse, deciduous. Receptacle conical, c. 2 mm long, paleaceous in the upper half. Paleae subulate, 2.5-3 mm long, less than 0.75 mm wide, hyaline, deciduous. Ray florets 5-6, female, fertile; ligules white, elliptic, 4-5 mm long, 3-4 mm wide, apex tridentate. Disc florets yellow, c. 2 mm long, corolla tube terete, $\pm$ inflated in fruit. Cypselas cylindrical, 2.5-3 mm long, somewhat curved, 10-15-ribbed, outer tuberculate to muricate, truncate, deciduous, with a 10-15-dentate rim, the inner ones with a unilateral, $\pm$ lacerate auricle. *Fl.Per.*: March - April.

Specimens examined

Oman: Musandam, north Oman, 15 km NW of Dibba, High rocky limestone slopes, c. 1500 m, tender herb to 15 cm, 5.4.90, R. A. *Western* 1211 (E!); Jabal al-Aswad, 23° 10' 58" 37', summit, 6000', 23.4.1975, flat on side of rock ravine, J. P. *Mandaville* Jr. 6163 (BM; ON); Musandam, Sid Wadi As Sayh, 25° 59' 56" 12', 1150 m, 14.2.86, R. A. *Braund* 117 (E, ON); Ashawaq, off Khasab to Bayah, nr. Road, 23° 59' 56" 13', 1200 m, aromatic, 19.4.1985, R. A. *Braund* 74 (E, ON); Old cultivation on Khasab-Bayah rd., 26° 02' N 56° 13' E, 500 m, R. A. *Braund*, 108 (E!, ON!); Wadi Sih, Waliyat Khasab, 25° 59' N 56° 12' E, seen in nearly all fields and unfenced and heavily grazed wadi floor, 28.3.84, R. E. *Ash* 15 (E!, ON!); As Sih, Musandam region, 25° 59' N 56° 18', 1100 m, 14 April 1983, M. O. *Gallagher* 6716/5 (E!); Slope on north side of Jabal Qawah, Rus al Jibal, in abandoned terrace field, among grass, very fine silty soil, c. 5000 ft., to 15 cm tall, 5.3.88, R. A. *Western* 1105 (E!).

United Arab Emirates: Wadi Beeh, Feb. 1996, B. *Boer* 524 (RIY # 14260).

Distribution: Afghanistan, Iran, Iraq, Oman, United Arab Emirates and Pakistan.

Ecology: A Fairly common species, grows from 500-1800 m on rocky slopes and open fields.

Section 2. Maruta (Cass.) Reichenb., *Deutsch. Botniker* ed.2, 2: 139 (1844). Type: *A. cotula* L.

Annual herbs. Paleae subulate to bristle-like, $\pm$ persitent. Cypselas obconical or turbinate, rounded in cross-section, not compressed, twice or three times as long as broad. In the Arabian Peninsula, it is represented by three species.

2. Anthemis pseudocotula Boiss., *Diagn. ser. 1*, 6: 86 (1846) emend. Eig, *Palest. Journ. Bot. Jer. ser. 1*: 196 (1938). Type: Persia australi ad Shiraz et prope Dalechi et Gere, *Kotschy* 75 (holotype G-BOIS; Isotype K!).

Illustrations: Boul., *Fl. Lib. Syr. t.* 223 (1930); Davis, *Fl. Turk. 5*: 179. fig. 8.18 & 19 (1975); Ghafoor & Al Turki, *Candollea* 52: 472. Fig. 6 A- G (1997); (Fig. 1, B-D).

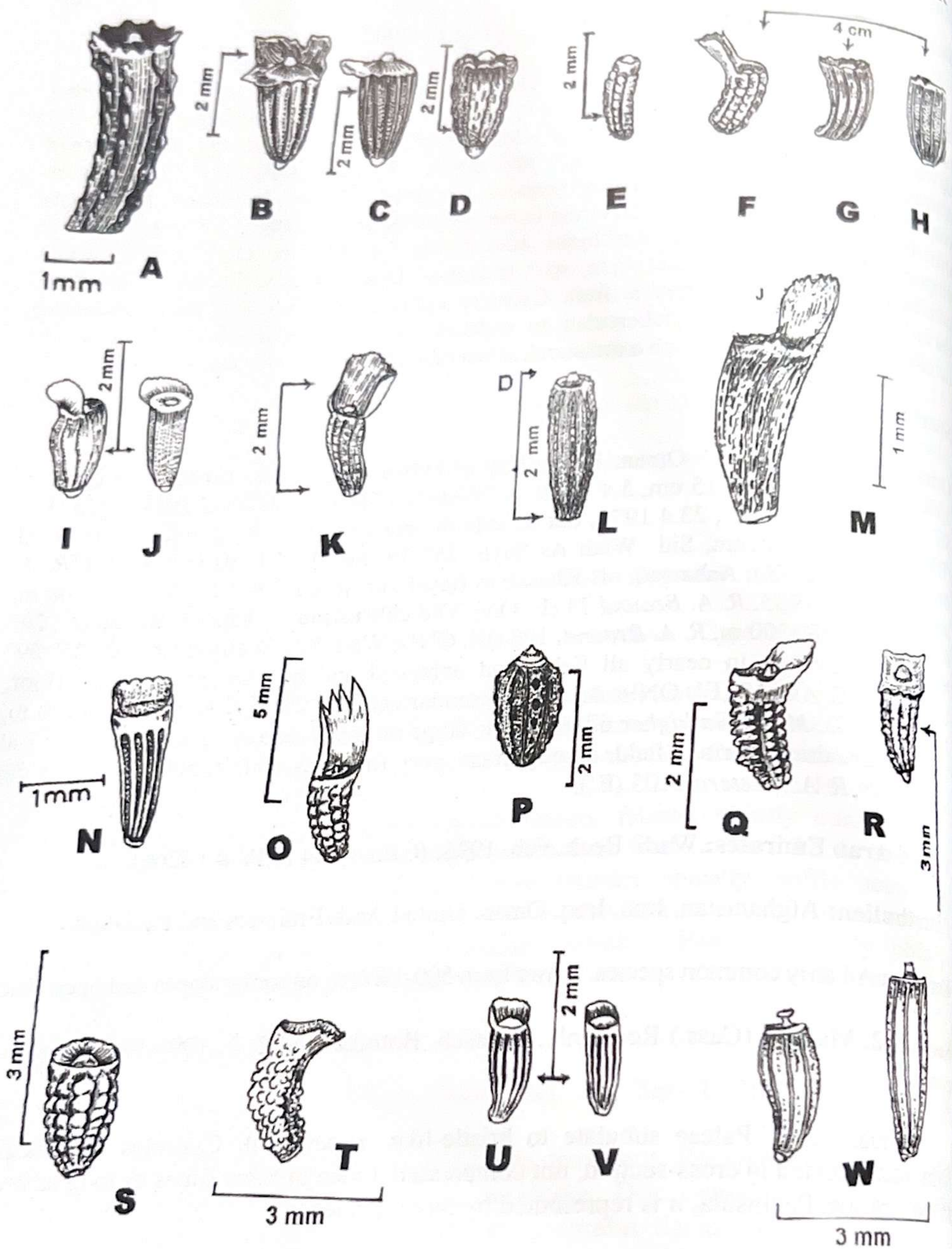


Fig. 1. Cypselas of Arabian *Anthemis* species: A, *A. odontostephan*; B-D, *A. pseudocotula*; E, *A. cotula*; F-H, *A. bornmuelleri*; I-J, *A. hyalina*; K, *A. haussknechtii*; L, *A. scrobicularis*; M, *A. sheilae*; N, *A. dicksoniae*; O, *A. zoharyana*; P, *A. yemensis*; Q, *A. melampodina*; R, *A. arvensis*; S, *A. desertii*; T, *A. endumea*; U-V, *A. rascheyana*; W, *A. tenuicarpa*.

Annual, 15-50 cm tall, appressed hairy or glabrescent herb with erect or ascending shoots from the base. Leaves ovate-oblong to oblanceolate, 1.5-3.5 x 1-1.5 cm, 2(-3)-pinnatisect into linear-oblanceolate, 1-3 x c. 0.5 mm, acute lobules. Capitula 1.5-2.5 cm across, on 3-6 cm long, gradually thickened and strongly arcuate fruiting peduncles. Phyllaries ovate-oblong, 3-4 x 1-2 mm, pubescent, scarious margined, subacute. Receptacle elongate-conical, 6-8 x 3-4 mm. Paleae linear-subulate, 2.5-3 mm long, cuspidate, persistent. Ray-florets female, fertile, 10-12, limbs oblong, 4-7 x 2.5-3.5 mm, white. Disc-corollas glabrous. Cypselas turbinate-obpyramidate, $\pm$ tetragonous, 1-1.5 mm long, distinctly 10-ribbed, oblique, truncate or rounded at the apices, auricle absent or nearly up to half as long as achene.

Fl. Per.: March-May

Specimens Examined

Kuwait: Kuwait city, growing on rubbish heap, sea level, A white daisy with deep green leaves growing all up the stem & very finely dissected, yellow centres are cone-shaped when nearly over, name of collector not legible, Herb. Kew # 276 (K!). Khalidiah University Campus, 40 m, 13th March 1982, growing as a weed, A. Rawi 10, 1979 (E).

Saudi Arabia: Jabal Aja near Hail, Headwater of wadi Masher, upland meadows, carpeting the ground, 3600 ft., very feathery bright green foliage with faint chamomille scent, white flowers 3 cm wide, 28.3.93, I. S. Collenette 8604 (E!); Tapline, between Rafha and Badanah, 1000 ft., 23.3.1966, eaten by sheep & goats, Mrs. V. Dickson 1030 (K!); 10-20 km south of Rumah, E Province, 3.3.79 - 14.3.79, R. J. White 67 (K!); Raudah Al-Khram, 28.3.1983, S. Chaudhary 8269-A, 8269-B & 8269-C *pro parte* (RIY); Wadi Ar'ar, 23.11.1987, Abdul Razzaq Arif Al-Sooqi 63 (RIY # 11514); Raudat Al-Khram, April 1980, S. Chaudhary 11512 (RIY); Wadi Mayaala 30° 53' N, 41° 02' E, 29.3.1988, H. H Heemstra 7525 (RIY); Raudha Al-Khram, in a raudah in *Rhanterium* zone, April, 1980, S. Chaudhary E-256 (E!); Beyond Jarrara near Shamlul, in a raudah in *Hammada* zone, April 1980, S. Chaudhary E-257 (E!).

Distribution: Cyprus, Egypt, Iran, Iraq, Jordan, Saudi Arabia, Kuwait, Pakistan and Turkey

Ecology: Grows in wadis, upland meadows and also as a weed, upto 1500 m.

3. *Anthemis cotula* L., Sp. Pl.: 894 (1753). (Fig. 1, E)

Type: "Habitat in Europae ruderalis, praecipue in Ucraina", Herb. Linn. 1016.16 (LINN!).

Illustrations: Hegi, Ill. Fl. Mittel-Eur. 6(3): 303. f. 134 (1968); Davis, Fl. Turk. 5: 138. fig. 10.21 (1975); Fl. Palaest. 3: 337. Pl. 569 (1978); Ghafoor & Al Turki, l. c. Fig. 6, P - S.

Annual, up to 60 cm tall, foetid, sparse hairy to almost glabrous herb with erect or ascending basal shoot and corymbose branches above. Leaves short petioled to sessile, obovate-oblong, 1.5-5.5 x 1-3 cm, finely 2-3-pinnatisect, with narrowly linear, 1.5-3 x c. 1 mm, entire or 2-3-dentate, acute-mucronate lobules. Capitula 1.2-3 cm across,

on up to 15 cm long, slender fruiting peduncles. Phyllaries ovate-oblong, 3-4 mm, whitish hairy, $\pm$ obtuse. Receptacle oblong-conical, 5-8 x 3-4 mm. Paleae linear-subulate, c. 2.5-3 mm long, bristly. Ray-florets female, 14-16, sterile, limbs oblong-elliptic, 5-12 x 3-6 mm, white. Disc corolla tube terete, glabrous, $\pm$ inflated below. Cypselas subcylindrical-turbinate, 1-1.5 mm long, obscurely 8-10-ribbed, tuberculate non-auriculate to rarely crenulate-rimmed.

Fl. Per.: March-May

Specimens Examined

Saudi Arabia: Wadi Lozia, 25-30 km NW of Ar'ar, 4.5.1969, *Morwood Leyland* B-33 (K!); Jabal Dabbagh, 1800 m, 27° 52' N & 35° 45' E, 4.3.1988, *Y. Al-Wetaid* s.n. (NCWCD); Riyadh, 20.4.1981, *S. Chaudhary* E-858 (RIY).

Distribution: SW Asia, North Africa and almost all European countries; introduced into N & S America, Australia and New Zealand.

Differs from *A. arvensis* L. in more stiffly erect stems, more or less glabrous, linear leaf lobules, reflexed limbs and exauriculate, tubercled cypselas.

Ecology: Found on damp, alluvial soils in stony coarse ground in northern and central Saudi Arabia

4. *Anthemis bornmuelleri* Stoj. & Acht., Notizbl. Bot. Gart. Berlin 13: 522 (1937). (Fig. 1, F-H).

Type: Palestine: in arenosis siccis ad Jaffam, 20 Maio 1897, *J. Bornmueller*, sub *A. kaharica* Vis. (WRS� holo.)

Illustrations: *Feinbrun-Dothan*, Fl. Palaest. 3: 336. Pl. 568 (1978); *Ghafoor & Al Turki*, l. c. Fig. 6, H-K.

Erect, up to 50 cm tall herb with suberect shoots from the base. Leaves ovate-oblong, 2-3-pinnatisect into linear to narrowly lanceolate, acute, $\pm$ remote, mucronate, ultimate lobes basal leaves petiolate. Capitula 1.5-2 cm across, on unthickened fruiting peduncles. Phyllaries membranous, inner oblong-obovate, obtuse, inner $\pm$ acute. Receptacle acute-conical, c. 4 mm long. Paleae linear-subulate, c. 3 mm long, bristly, present all over the receptacle. Ray florets female, fertile, tube glabrous, limb oblong-elliptic, 4-6 x 2-4 mm, white. Disc corollas basally inflated or very slightly inflated. Cypselas whitish, turbinate-cylindrical, 1-1.5 mm long, thickly ribbed, $\pm$ smooth or obscurely tubercled, auriculate to almost bald.

Fl. Per.: March-May

Specimens examined

Saudi Arabia: Taif region, 1985, *A. Fayed* 160-S (K!); Taif, May 1950, 5500 ft., hilly country near stream, *Simmonds* 64 via *A. C. Trott* 1498 (K!); Majma'a, spring 1981, *Robert Alexander* 3392 (RIY!); Taif, 5500 ft., hilly country, near stream, *Trott* 1498 (K!).

Distribution: Cyprus, Egypt, Lebanon, Saudi Arabia and Syria.

Ecology: A Plant of higher attribute grows between 1500- 2000 m in hill trocts.

This species very closely resembles and may even be easily confused with *A. pseudocotula* and *A. cotula* but can be distinguished by its broadly conical receptacle, thickly ribbed, almost smooth or obscurely tuberculate, whitish cypselas. Yavin (1970) confused it with *A. galilea* Eig.

Sect. 3. Anthemis

Perennial or annual herbs. Paleae oblong to oblanceolate, persistent. Cypselas obconical or obpyramidate, slightly compressed dorsiventrally, usually twice or three times as long as broad.

Represented in the Arabian Peninsula by thirteen species.

5. *Anthemis hyalina* DC., Prodr. 6: 4 (1838); Ghafoor & Ali in Comp. Newsl. 38: 9 (2002). (Fig.1, 1-J)

Type: Iraq, near Baghdad, *Rousseau* s. n. (holotype G-DC photo seen).

Illustrations: Boul., Fl. Lib. Syr. t. 224. f. 4 (1930); Davis, Fl. Turk. 5: 181. fig. 9. 26 (1975). Ghafoor & Al Turki in Candollea 52: 466. Fig. 4, L-O (1997).

Annual, up to 35 cm tall, densely to sparsely greyish hairy herb with suberect, divaricate branches from near the base. Leaves short-petioled, ovate, 2-3 cm long, 2-3-pinnatisect into ovate-oblong or oblanceolate, acute lobules. Capitula 2.5-3.5 cm across, on thickened, arcuate fruiting peduncles. Phyllaries 5-7 mm long, all obtuse, inner with broad, hyaline margins and brown, shiny obtuse appendage, nearly as long as or longer than the lower hairy part. Receptacle broadly conical, 5-7 mm long. Paleae lanceolate to oblanceolate, 3-3.5 mm long, $\pm$ keeled, abruptly and short acuminate, persistent. Ray-florets female, 14-16, fertile, with glabrous tube, limbs 7-12 x 3-5 mm, white. Disc corollas terete in fruit. Cypselas obpyramidate, 2-2.5 mm long, smooth, obscurely ribbed to ribless, auricle unilateral, short, opaque.

Fl. Per.: March-April.

Specimen Examined

Saudi Arabia: Turayf, *S. Abedin* 12168 (KSU)

Distribution: Iran, Iraq, Lebanon, Palestine, Saudi Arabia and Syria.

Not a common species in Arabian peniusula.

A species, which can be easily recognised by appendages of the inner phyllaries.

6. *Anthemis haussknechtii* Boiss. & Reut. in Boiss., Fl. Orient. 3: 310 (1875); Ghafoor and Ali in Comp. Newsl. 38: 10 (2002). (Fig.1, K.)

Syn types: Syria, ad Aleppo, *C. Haussknecht* s. n.; Iraq, ad Tscharmelik (Cermelik) atque in deserto inter fl. Chabur et Montem Sindjar, *C. Haussknecht* s.n. (K!, F & W).

Syn.: *A. damascena* Boiss. & Gaill., Fl. Orient. 3: 315 (1875).

Illustrations: Fl. Palaest. 3: t. 551 (1978); Ghafoor & Al Turki, Candollea 52: 462. Fig. 1, E - L.

Annual, silvery to greyish, up to 25 cm tall herb with divaricate, erect or ascending branches from near the base. Leaves short-petioled, ovate, 1.5-4.5 x 1-2.5 cm, 2-3-pinnatisect into linear-oblongate, 1.5-3 x c. 0.5 mm, acute lobules. Capitula 1.5-2.5 cm across, on 4-5 cm long, on slightly thickened fruiting peduncles. Phyllaries with pale-brown scarious margins, hairy, outer triangular-lanceolate, c. 4-5 mm, acute, inner oblong-oblongate, 6-7 x 1.5-2 mm, obtuse. Receptacle conical, 6-8 mm long. Paleae oblongate, c. 4 mm long, $\pm$ keeled, eroded-fimbriate to sometimes lacerate, abruptly mucronate. Ray-florets female, fertile, 15-20, with indurated, glabrous, persistent corolla tube; limbs elliptic-oblong, 5-8 x 3.5-5 mm, deciduous. Disc-corollas glabrous, globose inflated in its lower part. Cypselas cylindrical, 1.75-2 mm, white, finely striate, tuberculate, straight or outer ones curved and bald, inner cypselas crowned by a unilateral, erose-dentate auricle as long as or nearly half of achene.

Fl. Per.: March-April.

Specimen Examined

Saudi Arabia: Wadi Mayaal, 30°53' N, 41° 02' E, 29.3.1988, *H. H. Heemstra* 7526 as *A. desertii* (RIY).

Distribution: Iran, Iraq, Lebanon, Palestine, Turkey, Saudi Arabia and Syria.

Ecology: A western Irano-Turanian species. Grows well in clay-loam soils of wadi beds or fields.

7. *Anthemis scrobicularis* Yavin in Israel J. Bot. 21: 174 (1972). (fig.1, L.)

Type: Jordan: Kurnub and Umm Sahm, sandstone area, road to Mudawara, 2.4.1955, *Hunting Aero Survey*, as *A. desertii* Boiss. (holotype E!).

Illustrations: Fl. Palaest. 3: 334. Pl. 561 (1978). Ghafoor & Al Turki, Candollea 52: 460. Fig. 1, A-D (1997).

Annual, 10-25 cm tall, ash-grey, appressed hairy herb with erect to ascending branches. Leaves oblong, 1-2-pinnatisect into narrowly oblongate, acute ultimate lobes, upper ones almost sessile, petiole not pectinate. Capitula (1-)1.5-2.5 cm across, on up to 4.5 cm long, not or hardly thickened fruiting peduncles. Phyllaries lanceolate to oblong, externally hairy, mostly acute, scarious on margins, sometimes fimbriate or brownish at apices. Receptacle conical, c. 3-4 mm long. Paleae narrowly linear-oblongate, c. 4 mm long, acuminate, scarious, pale-green in mid part when young. Ray-florets female, fertile, 15-20, deciduous, tubes glabrous; limbs elliptic-oblong, 5-10

x 3-4 mm, white. Disc corollas glabrous, not inflated in fruit. Cypselas pale to whitish, oblong-obconical to clavate, $\pm$ curved, (1.75-) 2-2.4 mm long, ribbed, scrobiculate or beset with gland-like tubercles along ribs, rounded and exauriculate.

Fl. Per.: March-May

Specimens Examined

Saudi Arabia: Red sand dunes, SW of Zabirah, 200 km N of Buraydah, A tongue of the great Nafud, 1800 ft., 22.4.1981, half-buried in sand, crowded bush grey-green herb, 13 cm high, downy leaves, white fls. 2.5 cm across, aromatic, *I. S. Collenette* 2498 (E!); Hail, 22-23/3/1982, *S. Chaudhary* E-579 (E!); 7 km S of Unayzah, steep red sand dunes, white fls. to 2 cm wide, aromatic grey-green foliage, 2.5.85, *Collenette* 5349 (E!).

Distribution: Jordan, Palestine and Saudi Arabia

Ecology: A Plant of sand dunes and sandy areas, not very common in Arabian peninsula.

8. *Anthemis sheilae* A. Ghafoor & T. A. Al-Turki in *Edinb. Journ. Bot.* 56: 55-59. fig. 1 (1999).

Holotype: Jabal Umm al Wual, NNE of Turayf, 2900 ft., in gulley, NE aspect black basalt, 25.4.1994, *I. S. Collenette* 9112 as *Anthemis* sp. aff. *scrobicularis* (E!).

Annual, up to 30 cm tall, basally branched, green herb with hairy stem. Leaves bright green, hairy, oblong-ovate, 3-4.5 x 2-2.5 cm, 2-3-pinnatisect into linear-oblong, 3-5 x < 1 mm, acute ultimate segments; petiole pectinate. Capitula 3-3.5 cm across, on 10-15 cm long, filiform, purplish, unthickened fruiting peduncles. Involucre $\pm$ campanulate, 8-10 mm across; phyllaries 3-seriate, outermost narrowly ovate, c. 2 x 1 mm, hairy, acute, median narrowly ovate, c. 3.5 x 1.75 mm, narrowly membranous on margins in upper half, sparsely hairy, acute, innermost oblong-ovate, 4.5-5 x c. 2 mm, membranous on margins, $\pm$ hairy externally, acute. Receptacle hemispherical, paleate all over. Paleae oblong-ob lanceolate, 3.5-4 x c. 1.5 mm, $\pm$ carinate, $\pm$ mucronate. Ray-florets female, 10-14, fertile, tube hairy, limb oblong, 8-10 x c. 4 mm, white, trifid. Disc-florets as long as paleae, yellow, tube glabrous, swollen and purplish in lower half, 5-lobed, lobes acute. Cypselas pale to whitish, oblong-obconical, 1.75-2 x 0.4-0.5 mm, slightly curved, scrobiculate along ribs with oblong pits, unilaterally auriculate, auricle 0.5-0.75 mm long, irregularly shallowly lobed.

Fl. Per.: April-May

Distribution: Endemic to Saudi Arabia and known only from type locality.

9. *Anthemis dicksoniae* A. Ghafoor in *Feddes Repert.* 108(5-6): 319. Fig. 1 (1997). (Fig. 1, O).

Type: Saudi Arabia, Wadi Badanah, *V. Dickson* 689 (K!)

Annual, up to 20 cm tall herb, with sub-erect to ascending, whitish pilose, light purple stem. Leaves subsessile, pectinate, 2-pinnatisect, 1.5-2.5 cm long, 5-10 mm wide, densely whitish pilose, primary segments oblong, 4-5 mm long, secondary linear-oblong, 2.5-3.5 mm long, ca. 1 mm wide, obtuse, minutely whitish mucronate. Capitula radiate, 2-2.5 cm across, on leafless, 5-8 cm long, unthickened fruiting peduncles. Involucre 3-seriate, cup-shaped, ca. 1 cm across; phyllaries hairy, outermost triangular-ovate, ca. 3 mm long, narrowly whitish membranous on margins, median oblong-ovate, ca. 3 mm long, innermost oblong-obovate, ca. 4.5 mm long, 1.25 mm wide, margins broadly white membranous, erose-dentate, apex obtuse, whitish-translucent in upper half. Receptacle convex. Paleae oblanceolate, 3.5-4.25 mm long, 1.25-1.5 mm wide, apically 3-fid, mucronate-acuminate. Ray-florets 10-15, female, fertile, with hairy tubes, limbs oblong, 6-8 mm long, 3.5-4.5 mm wide, obscurely 3-fid, white. Disc-florets yellow, sparsely glandular, ca. 3 mm long, not inflated in fruit. Ray cypselas $\pm$ compressed, rhombic, $\pm$ 4-angled, 10-costate, smooth. Disc cypselas obpyramidate, ca. 2 mm long, 10-costate, smooth, auricle unilateral, 0.25-0.5 mm long, hyaline, brittle, obtusely toothed.

Fl. Per.: April-May

Specimen Examined

Saudi Arabia: Wadi Badanah vicinity, in depressions, 1500 ft., growing in profusion with *A. pseudocotula* no. 688, 17.4.1950, V. Dickson 689 (K!).

Distribution: Endemic to Saudi Arabia and known only from type gathering.

10. Anthemis zoharyana Eig, Palest. Journ. Bot. Jer. ser. 1: 178 (1938). (Fig. 1, O.)

Type: Palestine, Negeb, 10 km S of Beersheba, 1928, Eig, Feinbrun & Zohary s.n. (HJ).

Illustrations: Fl. Palaest. 3: 333. Pl. 558 (1978). Ghafoor & Al Turki, Candollea 52:465. Fig. 2, L-P & Fig. 5 (1997).

A sparsely hairy to nearly glabrous, up to 20 cm tall, green herb, with erect rigid branches from near the base. Leaves oblong, 3-5 x 1-2 cm, with pectinate petiole, 1-2-pinnatisect in to linear, remote, mucronulate ultimate segments. Capitula 2-3 cm across, on hardly thickened fruiting peduncles. Phyllaries sparsely hairy, outer lanceolate-oblanceolate, inner oblong-spathulate, nearly twice as long as outer, broadly scarious-margined, obtuse. Receptacle conical, 4-5 mm long. Paleae narrowly oblong-spathulate, 3-3.5 x 1-1.5 mm, mucronate. Ray-florets female, fertile, tube glabrous, limb elliptic-oblong, 4-6 x 2.5-3 mm, white. Disc corollas basally inflated in fruit, glabrous. Cypselas obpyramidate, 1.5-2 mm long, slightly compressed and curved, conspicuously tuberculate on dorsal side, ventrally $\pm$ ribbed, unilateral auricle deeply lacerate in to acute triangular lobes, as long as to slightly longer or shorter than achene.

Fl. Per.: March-May

Saudi Arabia: Northern Nejd, district, on or about the Shammar plains, alt., 2-3000 ft., March 1968, *Hugh Leach* s.n. (K!); Jabal Al-Lowz, 38° 28' N, 19° 35' E, 1900 m, 25.2.1988, *S. Solimon* s.n. (NCWCD!); Rodah Al-Khram, 28.3.1983, *S. Chaudhary* 8269-D, pro parte (RIY!).

Distribution: Iraq, Palestine, Saudi Arabia and Syria (?).

Ecology: An East Saharo-Arabian species grows in sandy-clay soils. It can be easily distinguished from all other *Anthemis* taxa by its rigid leaves with much narrower and longer acute lobes.

11. *Anthemis tigrensis* J. Gay ex A. Rich., Tent. Fl. Abyss. 1: 418 (1847).

Syntypes: Ethiopia, near Adwa (Adua), Schimper Ill. 1848 (P, syn., BM, K!), and Chire Abba-Garima, Nov. 1839, *Quartin-Dillon* s. n. (P, syn., K!).

Illustration: Beentje *et al.*, Fl. Trop. E. Afr. (Compoistae 1) 315. Fig. 108 (2002).

Perennial, much branched from the creeping, woody rootstock, with suberect or ascending, terete, pilose shoots. Leaves obovate, 2-4 cm long, glabrescent, (2-) 3-pinnatisect into linear-oblong lobules. Peduncles leafy near to the capitula, insignificantly thickened in fruit. Capitula radiate, 2-2.5 cm across. Phyllaries oblong-obovate, blackish scarious on margins, obtuse. Receptacle hemispherical, becoming conical in fruit, 6-7 mm long. Paleae linear-lanceolate, 2.5-3 mm long, acute, persistent. Ray-florets female, sterile, with 7-8 x 2-3 mm, white limbs. Disc corolla yellow, glandulose, inflated below, deciduous. Cypselas purplish-black, ± terete to obconical, obtusely ribbed, bald and concave at the apices.

Fl. Per.: March-April

Specimen Examined

Yemen: Thula road, near Sana'a, 29.4.1977, *S. Chaudhary* 36 (RIY # 3402).

Distribution: Kenya, Uganda, Eritrea, Ethiopia and Yemen,

12. *Anthemis yemenensis* Podlech, Mitt. Bot. Munchen 18: 427 (1982). (Fig. 1, P)

Holotype: Yemen, Westhang des Passes 33 km W Alarm an der Strasse nach Hajjah, 2450 m, 4.10.1981, *Podlech* 36310 (M).

Illustration: Ghafoor & Al Turki, Candollea 52: 462. Fig. 2, A-D (1997).

Perennial, with sparse hairy, decumbent to ascending branches from the ± woody rootstock. Leaves with a pectinate, short petiole, oblong, 1-2 (-2.5) cm long, 2-3-pinnatisect into oblong, whitish mucronate lobules, laxly hairy to glabrous. Capitula

small to mediocre, 1-1.5 cm across, on 3-5 cm long, slender fruiting peduncles. Phyllaries oblong, hairy outside, scarious and light brown on margins, obtuse. Receptacle dome-shaped, up to c. 3.5 mm long. Paleae linear-lanceolate, 2-3 mm long, acute. Ray-florets female, fertile, 12-15 with 3-3.5 mm long limbs. Disc corollas greenish-yellow, inflated below, light purple in upper half, glandulose. Cypselas tetragonous, 1-1.5 x 0.7 mm, purplish black, ribbed, tuberculate, apically truncate, exauriculate.

Fl. Per.: March-August

Specimens Examined

Saudi Arabia: Jabal Soodah, Asir, March 1982, *S. Chaudhary* 3898 (RIY); Saudah, Abha, August 1975, *Abdallah El-Sheikh* s. n. (KSU # 10117); Al-Taif, Abha, *AsSalam Mahmood* s. n. (KSU # 10010).

Distribution: Saudi Arabia and Yemen.

This species is very closely allied to *A. tigrensis* from which it differs in having smaller (1-1.5 cm across) capitula, dome-shaped (3-4 mm long) receptacle, fertile female ray-florets with 3-3.5 mm long limbs.

More material, from different localities along with field observations, is needed to investigate its variability and relationship to East tropical African relative *A. tigrensis* which also occurs in Southern Saudi Arabia.

13. *Anthemis melampodina* Del., Fl. Egypte 268, t. 45. f. 11. (1813-1814). (Fig. 1, Q.)

Type: Described from Egypt (Holo MPU, photo!).

Illustrations: Fl. Palaest. 3: 332. Pl. 557 (1978); Ghafoor & Al Turki, Candollea 52: 469 A-D (1997).

Annul, 15-25 cm tall, densely appressed canescent herb with ascending branches from near the base. Leaves shortly petiolate, oblong to ovate-oblong, 1.5-3 cm long, 1-2-pinnatisect into linear-oblong, mucronate lobules. Capitula 2-3 cm across, on gradually slightly thickened fruiting peduncles. Phyllaries lanceolate to ovate-oblong, hairy outside, scarious on margins and apex, subobtuse to obtuse. Receptacle ovate-conical. Paleae oblong-ob lanceolate, c. 3 mm long, $\pm$ keeled, usually mucronate. Disc corollas inflated and dark brown in lower half. Cypselas obpyramidate, c. 1.5-1.75 mm long, auricle scarious, unilateral, 1/6 to as long as to longer than the achene.

Fl. Per.: March-May. **Vern.:** Qahwiyan

Specimens Examined

Saudi Arabia: Harrat al-Harrah, S. of Turayf, Jabal Amid, in rocky sand of wide shallow runnel, tufted herb, 20 cm tall with deeply dissected downy almost non-aromatic leaves, white fls. 4 cm wide, sweet scent, 14.3.88, *I. S. Collenette* 6579 (E!); Al-Harra, northern Saudi Arabia, 2-5 April 1987, *S. Chaudhary & Abdallah El-Shaikh* 11138 (RIY, KUH &

KSU); Hail, 5.4.1983, S. Chaudhary 8268 (RIY); King Khalid International Airport, Riyadh, 13.1.1983, S. Chaudhary 6914 (RIY); *Sine loc.*, bulk collection of College of Pharmacy, Dr. M. Al-Yahya 6822 (RIY); Al-Mazara, N of Doumat Al-Jandal, 29° 53' N, 39° 50' E, area surrounding silt plain, sandy laom soil, 9.4. 1984, H. O. Al-Hassan 126 (RIY # 8536).

Distribution: Egypt, Israel, Palestine, Saudi Arabia.

Ecology: An east Saharo-Arabian species, grows profusely in sandy soils in northern, central and eastern Saudi Arabia.

14. *Anthemis arvensis* L., Sp. Pl.: 894 (1753). (Fig.1, R.)

Type: Described from Sweden, Herb. Linn. 1016.15 (LINN!).

Illustrations: Fl. RPR t. 66. f. 1 (1964); Davis, Fl. Turk. 5: 181. fig. 9.20 (1975); Ghafoor & Al Turki in Candollea 469. Fig. 2, G-K (1997).

Annual or biennial, sometimes perennating, up to 50 cm tall, sparsely to densely hairy herb. Leaves obovate-oblong, 1-3-pinnatisect into linear-oblong or linear-lanceolate slightly to distinctly thickened fruiting peduncles. Capitula 1-4 cm across, on slender, not or outer acute, inner subacute to subobtuse, hyaline to pale-brown scarious on margins and apex. Receptacle convex, becoming shortly to elongate conical in fruit, 2-10 mm long. Paleae lanceolate-oblong, broadening toward $\pm$ stiffly acuminate apex, sub-persistent. Ray-florets fertile, with glabrous tube, deciduous, limb elliptic-oblong, 4-8 x 3-4 mm, white. Disc corolla basally not or slightly inflated, glabrous. Cypselas obconical, 1.5-2.5 mm long, smooth, with an undulate rim or lacerate hyaline auricle.

Fl. Per.: March-April

Specimens Examined

Saudi Arabia: Beyond Jarrara, near Shamlul, April 1980, S. Chaudhary E-859 (RIY); Khafs, 15.4. 1980, S. Chaudhary 11511 (RIY); Harrat Al-Harra, south of Turayf, 17.3.1988, alt. 2500 ft., Collenette 6601 (RIY # 13152)

Distribution: Throughout Europe, C Asia, Egypt, Iran, Iraq, Palestine, Saudi Arabia, Syria, and Turkey; introduced in the New World, Australia, and New Zealand.

Probably a native of S. Europe, but introduced and established in other parts of S. Asia.

A highly variable taxon, especially in size of capitula, receptacle, limb size and cypselas. The specimens of this species are easily confused with *A. cotula* L., but can be distinguished by its obtuse inner phyllaries with pale-brown or hyaline margins and lanceolate-oblong, not bristle-like paleae having $\pm$ abrupt acuminate tips.

15. *Anthemis leptophylla* Eig, Palest. Journ. Bot., Jer. ser. 1: 162 (1938); Ghafoor & Ali in Comp. Newsletter 38:14. (2002).

Type: Iraq, N. W. Qalat Shergat (ad tigredem infra urbem a Mosul quatuor horas in circuitu, substrata calcareo, c. 170 – 300 m), 1912, P. Maresh (sub *A. hyalina* DC. det. Hand. Mazzetti in Herb. Vindobon).

Annual, erect, up to 40 cm tall, appressed hairy, unbranched or basally few-branched herb. Lower leaves with pectinate-dentate short petiole, median and upper ones sessile, broadly lanceolate-oblong to oblong-ovate, 1-4 cm long, 0.8-1.8 (-2) cm wide, finely bi- or $\pm$ tripinnatisect, lobes remote, ultimate segments linear, shortly acuminate. Peduncles 5-8 cm long, gradually thickened upwards in fruit. Capitula radiate, 2.5-4.5 cm across. Involucre 10-12 mm across, phyllaries smooth or nearly so, outermost narrowly triangular, c. 3 x 2 mm, hyaline margined, inner oblong-spathulate, c. 5-6 x 3-4 mm, obtuse, broadly hyaline and $\pm$ lacerate margined. Receptacle hemispherical, c. 3-4 x 4-5 mm, chaffy all over. Paleae oblong-spathulate, 3-3.5 x 1.5-2 mm, almost flat, membranous with a whitish nerve running through and forming a short mucro at the $\pm$ erose obtuse-truncate apices. Ray florets female, 15-20, tubes glabrous, $\pm$ winged at the base, with oblong-obovate to oblanceolate, 10-16 x 5-8 mm, white limbs. Disc corollas glabrous, basally not swollen in fruit. Cypselas oblong-cylindrical, 1.5-2 mm long, 10-ribbed, smooth, straw coloured, shortly unilaterally marginate at the apices.
Fl. Per.: April-May.

Specimen Examined

Saudi Arabia: North Hijaz, sand dune among large steep red sandstone buttes, 10 km north of Shiqri, Off Tabuk road, 3500 ft., squat semi-prostrate herb, pure white fls., chamomille aromatic, 7.3.1979, *I. S. Collenette* 980 (K!)

Distribution: Iran, Iraq and Saudi Arabia

16. *Anthemis desertii* Boiss., Fl. Orient. 3: 305 (1875). (Fig. 1, S).

Type: Habitat in arenosis desertorum Arabiae Petraeae, *Schimper* 399 (sub *A. peregrina* Boiss.) (holotype G-BOIS, Photo!).

A. melampodina Del. ssp. *desertii* (Boiss.) Eig, Palest. J. Bot. Jer. ser. 1177 (1938).

Illustration: Ghafoor & Al Turki in *Candollea* 52: 467. Fig. 4, I-K & Fig. 5 (1997).

Annual, greyish-tomentose, herb with ascending branches from near the base. Leaves with 3-6(-8) mm long petiole, oblong or linear-oblong, 2-3 x 1-1.5 cm, unipinnatifid into linear or oblong, entire or 3-fid lobules. Capitula 2-2.5 (-3) cm across, on slender, unthickened fruiting peduncles. Phyllaries lanceolate, narrowly scarious margined, acute. Receptacle hemispherical, 2.5-3 mm long, Paleae oblong-lanceolate, c. 3 mm long, carinate, acute. Ray-florets female, fertile, tube glabrous, limb 4-6(-7) x 2.5-3.5 mm, white. Disc corollas glabrous and inflated at the base. Cypselas $\pm$ obpyramidal, slightly curved or not, 1.5-1.75 mm long, longitudinally tuberculate on ridges, exauriculate.

Fl. Per.: March-May. **Vern.:** Qahwiyan, Ribyan

Specimens Examined

Saudi Arabia: Eastern Province, Shadgum wadi, c. 100 km SW of Dhahran, annual, growing in loose sand, 4.3.1983, *K. Naylor* 205 (E); Near exit to Dagla, c. 80 km from Riyadh on road to Qassim, 7.3.96, *Al-Turki & A. Ghafoor* 1378 (KACST; E); Hail-Nafud, 22-23.3.1981, *S. Chaudhary* E-578 (RIY); 200 km W of Sakaka, 7.5.1981, *Mohammad Al-Yahya* 11510 (RIY); Hail, 22.3.1981, *S. Chaudhary* E-579-B (RIY); Eastern Agricultural Development Company Farm, near Nuariyah, 14.3.1989, *Saud Al-Eyyed* 13202 (RIY); Riyadh, April 1979, *S. Chaudhary* 11513 (RIY); Raudah Al-Khram, 28.3.1983, *S. Chaudhary* 8269-D pro part (RIY); Jabal Aja, 955 m, 2.3.1988, 33° 27' N, 25° 41' E, *S. Soliman* s.n. (NCWCD); Road between Hail and Buraidah via wadi Shaiba, 10-20.4.1949, *Mr. George Mandis* 626 (K!); Wadi Al-Huraimla, 4.3.1983, *Migahid* 251M (KSU # 10091); Jabal Tuwayq, 19.4.1968, *Migahid* s.n. (KSU # 10097); Salbukh road, 21.4.1975, *Sabri Awad* s.n. (KSU # 10102).

Kuwait: Wadi Al-Batin, 12 km N of Al-Salmi border station with Saudi Arabia, carbonaceous sandstone, alt. 280 m, 17th April, 1990, *L. Boulos & T. A. Cope* 17649 (E!); 5 km south of Al-Abdali border station with Iraq, run off near the highway, sandy soil, alt. 45 m, 30° N, 47° 40' E, 28 Feb. 1985, *L. Boulos & R. Al-Hassan* 15218 (RIY); Kuwait, March 1933, *Mrs. V. Dickson* 93 (K!); Mutlaa Ridge, Dried river bed, 200 m, prolific, Arabic name "Jahowian", 10 Feb. 1978, *V. Arnet* 27 (E!).

Distribution: Egypt (rare), Iraq, Jordan, Lebanon, Palestine, Saudi Arabia and Syria.

This has often been treated as a subspecies of *A. melampodina* by number of workers but the present author has noted pure populations in central Saudi Arabia in which capitula have outer phyllaries acute and the mature cypselas exauriculate, a combination of characters used to separate them from each other. Experimental work involving cultivation under controlled conditions, palynology, phytochemistry and numerical methods may yield interesting results in understanding the *A. melampodina-desertii* complex.

Ecology: A fairly common species, found in gravel-mixed sandy-loam soils in northern, central and eastern Saudi Arabia and Kuwait.

17. *Anthemis edumea* Eig, Palest. Journ. Bot. Jer. ser., 1: 173 (1938); *Feinbrun-Dothan*, Fl. Palaest. 3: 332 (1978). (Fig. 1.T.).

Type: Described from Palestine: Edom, between Ziza and Qatrani, 1929. *Eig & Zohory* s.n. (HJ).

Annual, up to 20 cm tall, appressed hairy herb with ascending branches. Leaves petiolate, ovate-oblong, 2-3 cm long, bipinnatisect into 2-3 mm long, linear, mucronulate lobules. Peduncles 5-8 cm long, filiform, unthickened in fruit. Capitula radiate, ca. 2 cm across. Involucre 6-8 mm across, phyllaries hairy, oblong, c. 3 x 1.75 mm, hyaline margined, inner nearly twice as long as outer, sub-obtuse. Receptacle conical. Paleae oblong, c. 2.5 x 1.25 mm, mucronate. Ray-florets female, 12-15, tubes compressed, with 5-6 mm long, white limbs. Disc corollas cylindrical, glabrous, not inflated in fruit,

glandulose. Cypselas $\pm$ falcate, c. 2 mm long, tuberculate, unilaterally shortly auricled brown.

Fl. Per.: March-April

Specimen Examined

Saudi Arabia: Wadi El-Mottadel, 91 km from Sakakah, 20.4.1982, *H. H. Hemstra* 7061 (RIY # 3501).

Distribution: Palestine, Jordan (?), Saudi Arabia

Sect. 4. Rascheyana Yavin in Israel J. Bot. 21: 176 (1972).

Annual herbs. Paleae oblong to lanceolate, cuspidate or mucronate, persistent. Cypselas cylindrical, slightly compressed dorsoventrally, 4-5-times as long as broad. Represented in Arabian Peninsula by two species.

18. Anthemis rascheyana Boiss., Diagn. Pl. Nov. ser. 1, 11: 8 (1849); Boiss., Fl. Orient. 3: 307 (1857)(Fig.1, U-V)

Type: Syria, Inter Rascheyana et Damascus, *Boissier* s.n. (holotype G-BOIS Photo !)

Illustrations: Fl. Palaest. 3: 334. Pl. 562. (1978); Ghafoor & Al Turki in Candollea 52: 469. Fig. 4, E-H (1997); Photo: <http://www.wildflowers.il>.

Annual, up to 15 (-20) cm tall, ash-grey, appressed hairy herb with upright or ascending branches from near the base. Leaves with pectinate petiole, oblong, somewhat 2-pinnatisect, into linear-oblong, acute lobules. Capitula small, 10-15 mm across, on slender, not or only slightly thickened fruiting peduncles. Phyllaries ovate-oblong, almost glabrous, obtuse, with a broad, $\pm$ lacerate margins. Receptacle hemispherical. Paleae oblong-lanceolate, carinate, obtusely denticulate and mucronate-acuminate, persistent. Ray-florets female, fertile, tube glabrous, deciduous, limbs oblong, 3-4.5 x 2-3 mm, white. Disc corolla tubes glabrous, inflated and somewhat compressed. Cypselas thin, cylindrical, 1.5-2 mm long, dorsiventrally slightly compressed, striate, smooth, truncate to minutely auricled at the apices.

Fl. Per.: March-April

Specimen Examined:

Saudi Arabia: Harrat Al-Harra, 900 m, 12.3.1987, 30° 31' N-31° 30' N, 38° 00' E-39° 31' E, *S. Chaudhary & Abdul Aziz Al-Juid* s. n. (RIY).

Distribution: Iraq, Palestine, Saudi Arabia and Syria.

19. Anthemis tenuicarpa Eig, Palest. Journ. Bot. Jer. ser., 1:166. Pl. 7, f. 27 (1938).Feinbrun-Dothan, Fl. Palaest. 3: 334 (1978). (Fig. 1, W).

Type: Palestine: Transjordan, Belka and Edom, between el-Muakkar and el-Kharane, 1927 Eig & Zohary s. n (HUJ).

Illustration: Feinbrun-Dothan, Fl. Palaest. 3: t. 563.

Annual, appressed hairy, up to 15 (-20) cm tall herb with erect or ascending branches from near the base. Leaves oblong, 1.6-2 cm long, bipinnatisect into linear-oblong, acute remote lobules. Peduncles 6-8 cm long, unthickened in fruit. Capitula radiate, c. 2 cm across. Involucre 6-8 mm across, phyllaries ovate-oblong to oblanceolate, hyaline margined, inner ca. twice as long as outer, hairy. Receptacle conical, paleae narrowly oblong-spathulate, c. 3 x 1 mm, abruptly mucronate, persistent. Ray florets female, fertile, 10-12, tubes compressed, with 5-6 mm long, white limbs. Disc corollas cylindrical, glandulose, not inflated in fruit. Cypselas narrowly cylindrical, 1.5-2 mm long, prominently ribbed, smooth, exauriculate.

Fl. Per.: March-April.

Specimen Examined

Saudi Arabia: North Hijaz, "Shangrila" wide valley in granite, west side of Jebbal Dabbagh, near wadi Sanwan in B. S. C. Camp, 4.3.1979, among boulders, 10" branching herb, white fls. pleasant chamomille aromatic, I. C. Collenette 942 (K!)

Distribution: Israel, Palestine, Jordan and Saudi Arabia. A western Irano-Turanian element, a new record for Saudi Arabia.

Acknowledgements

The author expresses deep gratitude to the Directors, and Curators of E, K, KSU, KACST, NCWCD, and RIY for loan of herbarium specimens. The Director and Curator of G, kindly provided photos of some types from G-BOISS. Gratitude is due to Dr. Shaukat Ali Chaudhary who encouraged and provided guidance during the course of this study and made useful comments to improve the manuscript.

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