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A synopsis of the genus *Anthemis* L. (Compositae-Anthemideae) in Saudi Arabia

ABDUL GHAFOOR
&
T. A. AL-TURKI

RÉSUMÉ

GHAFOOR, A. & T. A. AL-TURKI (1997). Synopsis du genre *Anthemis* L. (Compositae-Anthemideae) en Arabie saoudite. *Candollea* 52: 457-474. En anglais, résumés français et anglais.

Le synopsis du genre *Anthemis* L. (Compositae-Anthemideae) pour l'Arabie saoudite est présenté, avec une clé des taxons, leurs descriptions, des illustrations et des cartes de distribution. Douze taxons sont reconnus appartenant aux sections *Anthemis*, *Rascheyana* et *Maruta* en incluant sept nouveautés pour la dition, *A. arvensis*, *A. bornmuelleri*, *A. haussknechtii*, *A. hyalina*, *A. rascheyana*, *A. yemenensis* et *A. zoharyana*.

ABSTRACT

GHAFOOR, A. & T. A. AL-TURKI (1997). A synopsis of the genus *Anthemis* L. (Compositae-Anthemideae) in Saudi Arabia. *Candollea* 52: 457-474. In English, French and English abstracts.

A synopsis of the genus *Anthemis* L. in Saudi Arabia, including a key, taxonomic descriptions, illustrations and distribution maps is presented. In all 12 species belonging to the sections *Anthemis*, *Rascheyana*, and *Maruta* are recognized, including seven new records viz., *A. arvensis*, *A. bornmuelleri*, *A. haussknechtii*, *A. hyalina*, *A. rascheyana*, *A. yemenensis* and *A. zoharyana*.

KEY-WORDS: COMPOSITAE – *Anthemis* – Saudi Arabia.

Introduction

Anthemis L., the second largest genus of the tribe *Anthemideae*, as currently defined, contains around 211 species (BREMER, 1994; BREMER & HUMPHRIES, 1993), distributed widely in Europe, SW Asia, N and NE Africa and extending into extreme south west Arabia. It is a heterogenous genus consisting of annual and perennial herbs or dwarf shrubs with attractive heads. Some species are economically important being used as herbal tea, insecticide and source of yellow dye while some are taxonomically intricate. *Anthemis* is very closely related to the genera *Matricaria* L., *Chamaemelum* Mill. and *Tripleurospermum* Schultz-Bip., but can be easily separated by the paleaceous receptacle of its mostly radiate capitula and achene morphology.

A survey of taxonomic literature reveals that the hitherto neglected *Anthemis* has received considerable attention in Europe and some parts of SW Asia (FERNANDEZ, 1976; FEINBRUNDOTHAN, 1978; YAVIN, 1970, 1972; GRIERSON & YAVIN, 1975; IRANSHAHR, 1986),

during the last three decades. However, this genus is imperfectly known from Saudi Arabia, Iraq, Jordan, Syria and NE subtropical Africa. From Saudi Arabia, MIGAHID (1989) reported four species, while COLLENETTE (1985) presented photographs of two taxa and CHAUDHARY & AKRAM (1987) indicated weedy nature of four species of *Anthemis*. HEEMSTRA & al. (1990) and MANDAVILLE (1990) reported four species each from northern and eastern regions of Saudi Arabia.

The aim of the present study, which reveals the presence of 12 species, including seven new records, was to contribute to a better understanding of the genus *Anthemis*, a confused component of the flora of Saudi Arabia, in which specimens of various distinct taxa, recognized here, were lumped together under *A. melampodina* Del. Undoubtedly, the results of the present investigation will have to be revised in the future, particularly if field studies on a larger scale can be carried out in the species-rich areas.

The size, surface features (smooth, tuberculate or minutely pitted), number of ribs and presence or absence of auricle or corona of mature achenes are the most important characters for species delimitation. Those collecting specimens of *Anthemis* should not ignore to note the diameter of capitula, with well spread ray limbs, 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 corollas and their hairiness also have considerable taxonomic significance in addition to slender versus thickened fruiting peduncles.

Materials and methods

This work is based on herbarium material obtained on loan from the herbaria at Royal Botanic Gardens, Kew (K) and Edinburgh (E), housing invaluable collections from the Gulf region. In addition, specimens present in the herbaria of Ministry of Agriculture, Riyadh (RIY), National Commission for Wildlife Conservation and Development, Riyadh (NCWCD) and King Saud University (KSU) were examined. The specimens collected by the authors during 1994-96 were also studied and are lodged in the herbarium, King Abdul Aziz City for Science and Technology, Riyadh (KACST). 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 present study area.

All the measurements were made directly from dried specimens and fresh material of some taxa, using a Leica Willd M10 stereoscope at magnifications varying between $\times 8$ and $\times 20$. The distribution maps have been drawn by placing a symbol in each locality from where the species was collected. Morphological terms used in taxonomic descriptions are according to STEARN (1973) and the herbarium acronyms according to HOLMGREN & al. (1990).

The infrageneric classification of *Anthemis* followed in this revision, is after YAVIN (1970, 1972) and adopted by FEINBRUN-DOTHAN (1978).

Generic diagnosis

Anthemis L., Sp. Pl.: 893 (1753); Gen. Pl. ed. 5: 381 (1754).

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 spatulate, 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. Achenes 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).

Key to the Anthemis species in Saudi Arabia

- 1a. Paleae linear-subulate to bristle-like, more or less persistent 2
- 1b. Paleae linear-oblongate or oblong-oblongate to narrowly oblong-spathulate 4
- 2a. Paleae present on the upper half of receptacle only 3
- 2b. Paleae present all over the receptacle **10. *A. bornmuelleri***
- 3a. Achenes persistent at maturity. Fruiting peduncles thickened and strongly arcuate. Ray-florets fertile **11. *A. pseudocotula***
- 3b. Achenes readily deciduous at maturity. Fruiting peduncles neither thickened nor arcuate. Ray-florets sterile **12. *A. cotula***
- 4a. Inner phyllaries with broad hyaline margins and brown, shiny, obtuse appendages at the apices **6. *A. hyalina***
- 4b. Inner phyllaries with narrow membranous margins and without appendages at the apices 5
- 5a. Inner phyllaries 6-7 mm long. Ray-floret limbs indurated and persistent on maturity **2. *A. haussknechtii***
- 5b. Inner phyllaries less than 5 mm long. Ray-floret limbs deciduous on maturity 6
- 6a. Achenes clavate, pale to whitish, scrobiculate along ribs. Paleae linear-oblongate **1. *A. scrobicularis***
- 6b. Achenes cylindrical or obconical-obpyramidate, smooth or tuberculate. Paleae lanceolate or oblong-oblongate to spatulate 7
- 7a. Phyllaries almost glabrous, with broadly scarious, ± lacerate margins. Receptacle hemispherical **9. *A. rascheyana***
- 7b. Phyllaries hairy, with broadly scarious, hyaline to pale-brown sub-entire margins. Receptacle conical 8
- 8a. Achenes obpyramidate, all slightly curved, tubercled on dorsal side, with deeply lacerate, acute-lobed auricle **5. *A. zoharyana***
- 8b. Achenes obconical, tuberculate or smooth, bald or with entire or shortly lobed auricle 9
- 9a. Perennial. Paleae linear-lanceolate. Disc-florets purple in upper half. Achenes purplish-black **3. *A. yemenensis***
- 9b. Annual or biennial. Paleae lanceolate-oblongate. Disc-florets yellow. Achenes black 10
- 10a. Peduncles gradually thickened in fruit 11
- 10b. Peduncles not thickened in fruit 12
- 11a. Disc corollas inflated and indurated in fruit. Achenes tuberculate. Paleae keeled, not stiffly acuminate **8. *A. melampodina***
- 11b. Disc corollas not or very slightly inflated, deciduous. Achenes smooth. Paleae flat, stiffly acuminate **4. *A. arvensis***

- 12a. Receptacle convex, becoming short to elongate conical in fruit. Paleae broader apically, flat, stiffly acuminate. 4. *A. arvensis*
- 12b. Receptacle hemispherical in fruit. Paleae oblong-lanceolate, carinate, acute. Achenes tuberculate 7. *A. desertii*

Taxonomic descriptions

Sect. 1. *Anthemis*

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

Represented in Saudi Arabia by eight species.

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

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, tab. 561 (1978). Fig. 1, A-D.

Annual, 10-25 cm tall, ash-grey, appressed hairy herb with erect to ascending branches. Leaves oblong, 1-2-pinnatisect into narrowly oblanceolate, 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, ca. 3-4 mm long. Paleae narrowly linear-oblanceolate, ca. 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 × 3-4 mm, white. Disc corollas glabrous, not inflated in fruit. Achenes pale to whitish, oblong-obconical to clavate, ± 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, *Collenette 2498* (K!); Qassim, Al-Awshazayah, ca. 15 km NE of Unayzah, 11.5.95, *Al-Turki & A. Ghafoor 958* (KACST); Unayzah, *Al-Turki & A. Ghafoor 525* (KACST; E); 7 km S of Unayzah, steep red sand dunes, 1800 ft., 2.5.1985, *Collenette 5349* (E); Hail, 22-23.3.1981, *S. Chaudhary E-569-B & E-579-A* (RIY); Ibid, 22.3.1981, *S. Chaudhary 11509* (RIY); Al-Kharj, Spring 1984, *s. coll., s.n.*, (RIY); Dirab, 8.3.1983, *Abdul Rehman Al-Rabiyya 7648* (RIY; KUH); Wadi Al-Baqr, ca. 250 km N from Riyadh on way to Unayzah (Qassim), frequent along roadside, *Al Turki & A. Ghafoor 657-A* (KACST; E); Jabal Tuwayq, 12.4.1968, *Migahid s.n.* (KSU # 10118); Al Kharj-Al Dalim, 12.4.1982, *M. Nasir Rashid Al-Yemeni s.n.* (KSU # 10114); Al-Safaniyah – Dammam road, 24.2.81, *Migahid & Abdallah El Sheikh, s.n.* (KSU # 10108); Al-Ahsa, *Collector ?, s.n.* (KSU # 10114); Riyadh, Al-Mansuria – wadi Al-Ha'ir, 22.3.1969, *Abdallah Nasir Abu Haila s.n.* (KSU # 10099); Id, *Ahmad Jawed Amin s.n.* (KSU # 10094); Unaizah, Hama Al-Quda'a, Spring 1985, *Dr. Hamza Al-Amin 11883* (RIY); Hafirat Al-Nissah, 5.2.1983, *S. Chaudhary 6772* (RIY); Durma, 16.4.1984, *S. Chaudhary 8382* (RIY).

Distribution: Jordan, Palestine and Saudi Arabia.

This species seems to be more common in Saudi Arabia (central and eastern regions) as far south as Al-Kharj and south east to Al-Ahsa (Fig. 3). It prefers to occupy deeper sands and remained confused with *A. melampodina* and *A. desertii* which are found in silty and sandy-loam soils.

The variation in this species has been studied in Palestine in detail by YAVIN (1972) who described several infraspecific taxa. To understand the pattern of infraspecific variation and subspeciation in Saudi Arabia, more material and field as well as experimental work is required. Presently all the material examined can be attributed to the type subspecies and subsp. *fungosa* Yavin var. *fungosa*.

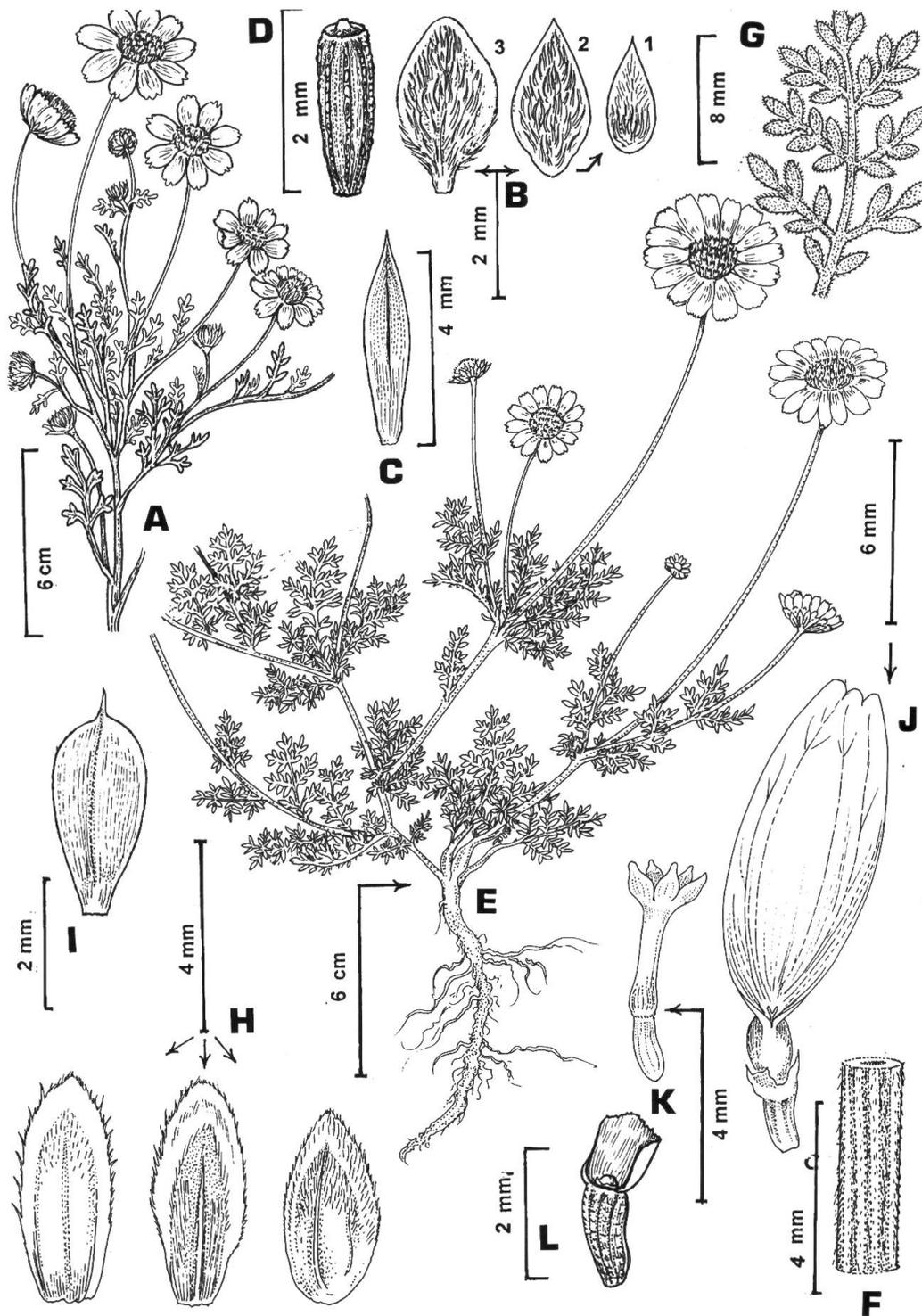


Fig. 1. – *Anthemis scrobicularis* Yavin (Al-Turki & A. Ghafoor 657A).

A, habit; B, phyllaries; C, palea; D, achene.

A. haussknechtii Boiss. & Reut. (Heemstra 7526).

E, habit; F, enlarged part of peduncle; G, leaf; H, phyllaries; I, palea; J, ray-floret; K, disc-floret; L, achene.

2. *Anthemis haussknechtii* Boiss. & Reut. in Boiss., Fl. Orient. 3: 310 (1875).

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

Illustrations: Fl. Palaest. 3: 330, tab. 551 (1978). 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 × 1-2.5 cm, 2-3-pinnatisect into linear-oblongate, 1.5-3 × ca. 0.5 mm, acute lobules. Capitula 1.5-2.5 cm across, on 4-5 cm long, slightly thickened fruiting peduncles. Phyllaries with pale-brown scarious margins, hairy, outer triangular-lanceolate, ca. 4-5 mm, acute, inner oblong-oblongate, 6-7 × 1.5-2 mm, obtuse. Receptacle conical, 6-8 mm long. Paleae oblongate, ca. 4 mm long, ± 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 × 3.5-5 mm, deciduous. Disc corollas glabrous, globose inflated in its lower part. Achenes cylindrical, 1.75-2 mm, white, finely striate, tuberculate, straight or outer ones curved and bald, inner achenes crowned by a unilateral, erose-dentate auricle as long as or nearly half of achene. *Fl. Per.:* March-April.

Specimens 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.

A western Irano-Turanian species, in which EIG (1938) recognized several varieties, has been recorded from Saudi Arabia (northern region) for the first time (Fig. 3). It grows well in clay-loam soils of wadi beds or fields.

3. *Anthemis yemenensis* Podlech in Mitt. Bot. Staatssamml. München 18: 427 (1982).

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

Illustration: Fig. 2, A-D.

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, purplish. Phyllaries oblong, hairy outside, scarious and light brown on margins, obtuse. Receptacle dome-shaped, up to ca. 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 and inflated below, light purple in upper half, glandulose. Achenes tetragonous, 1-1.5 × 0.75 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); Jabal Saudah, Abha, August 1975, *Abdallah El-Sheikh s.n.* (KSU # 10117); Al-Taif, *Abd AsSalam Mahmood s.n.* (KSU # 10010).

More material, collected in different seasons from different sites, is needed to determine the pattern of variation in this species, which is frequently grazed and is said to be a weed of cultivated areas in the south western mountainous regions of Saudi Arabia.

Commonly it grows in clay-loam soils of cultivated fields in SW Saudi Arabia (Fig. 3) and is recorded for the first time.

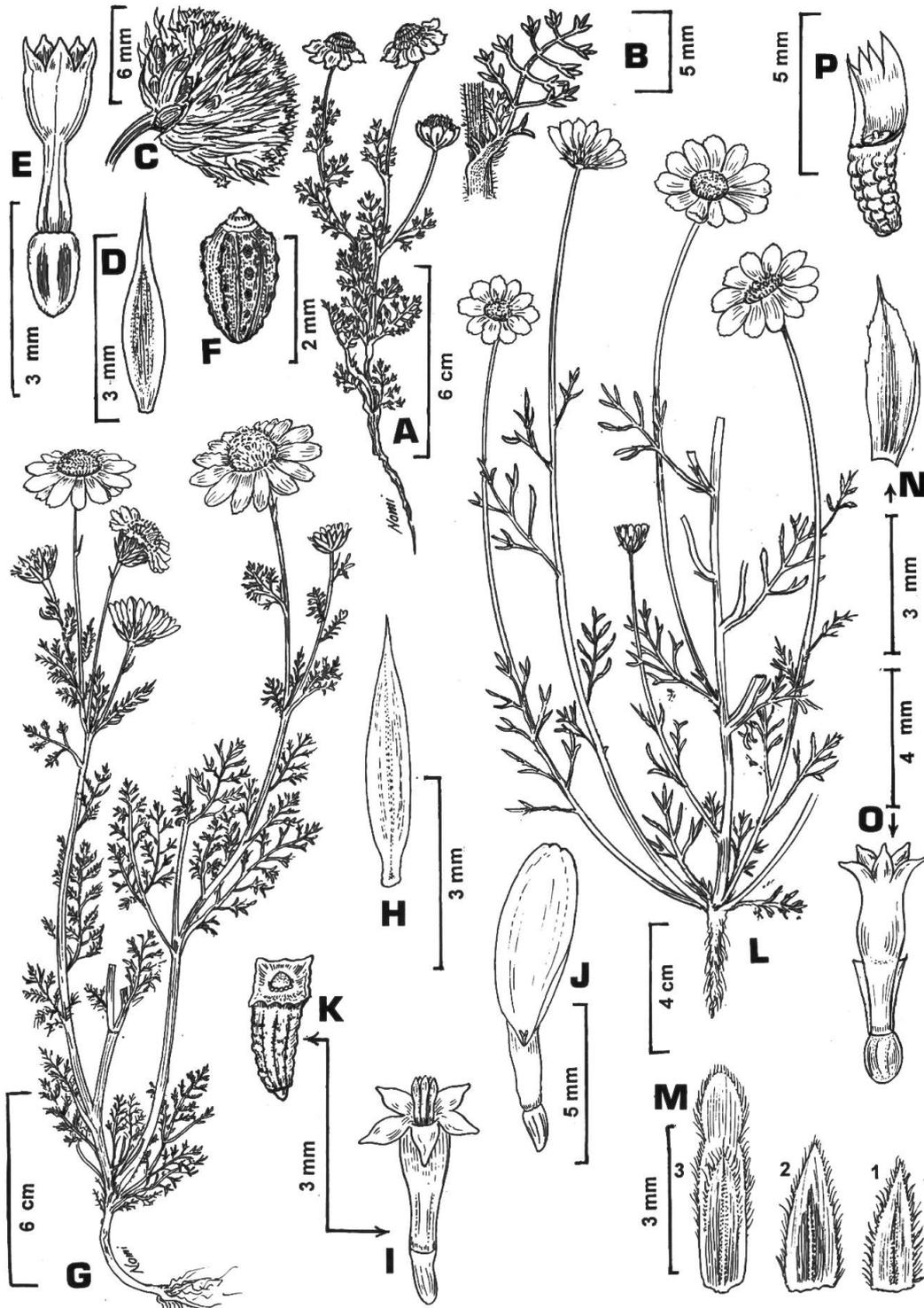


Fig. 2. – *Anthemis yemenensis* Podlech (S. Chaudhary 3898).
 A, habit; B, enlarged disc-floret with immature achene; C, mature fructing head; D, palea; E, disc-floret; F, achene.
A. arvensis L. (S. Chaudhary E-859).
 G, habit; H, palea; I, disc-floret; J, ray-floret; K, achene.
A. zoharyana Eig (S. Chaudhary 8269-D, p.p.).
 L, habit; M, phyllaries; N, palea; O, disc-floret; P, achene.

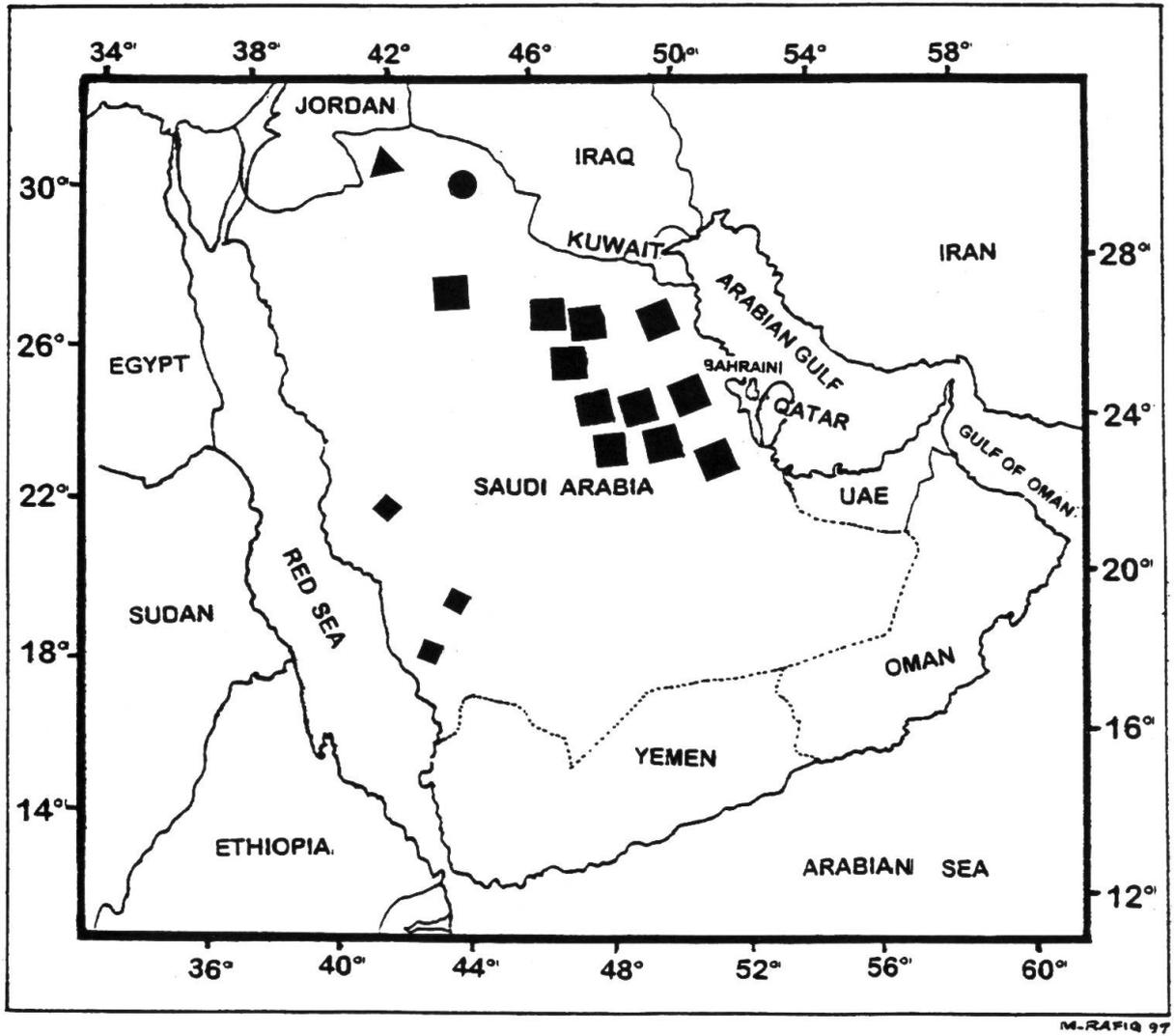


Fig. 3. – Map showing distribution of *Anthemis scrobicularis* Yavin (■), *A. haussknechtii* Boiss. & Reut. (●), *A. yemensis* Podlech (◆) and *A. arvensis* L. (▲) in Saudi Arabia.

4. *Anthemis arvensis* L., Sp. Pl.: 894 (1753).

Type: “Habitat in Europae praesertim Sueciae agris”, Herb. Linn. 1016.15 (LINN!).

Illustrations: Fl. RPR tab. 66, fig. 1 (1964); Davis, Fl. Turkey 5: 181, fig. 9-20 (1975). Fig. 2, G-K.

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 to elliptic, acute-mucronate ultimate lobules. Capitula 1-4 cm across, on slender, not or slightly to distinctly thickened fruiting peduncles. Phyllaries oblong or oblong-obovate, 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 \times 3-4 mm, white. Disc corolla basally not or slightly inflated, glabrous. Achenes 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. It is a new record from NW Saudi Arabia (Fig. 3) and may extend its distribution further to south west.

A highly variable taxon, especially in size of capitula, receptacle, limb size and achenes. 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.

5. *Anthemis zoharyana* Eig in Palestine J. Bot., Jerusalem Ser. 1: 178 (1938).

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

Illustrations: Fl. Palaest. 3: 333, tab. 558 (1978). Fig. 2, L-P.

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 \times 1-2 cm, with pectinate petiole, 1-2-pinnatisect into linear, remote, mucronulate ultimate segments. Capitula 2-3 cm across, on hardly thickened fruiting peduncles. Phyllaries sparsely hairy, outer lanceolate-oblong, 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 \times 1-1.5 mm, mucronate. Ray-florets female, 10-14, fertile, tube glabrous, limbs elliptic-oblong, 4-7.5 \times 2.5-3 mm, white. Disc corollas basally inflated in fruit, glabrous. Achenes obpyramidate, 1.5-2 mm long, slightly compressed and curved, conspicuously tuberculate on dorsal side, ventrally \pm ribbed, unilateral auricle deeply lacerate into acute triangular lobes, as long as to slightly longer or shorter than achene. *Fl. Per.*: March-May.

Specimens examined: **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 (?).

An East Saharo-Arabian species is a new record from Saudi Arabia. and has been found in sandy-clay soils in Hail and Central province (Fig. 5). It can be easily distinguished from all other taxa by its rigid leaves with much narrower and longer acute lobes.

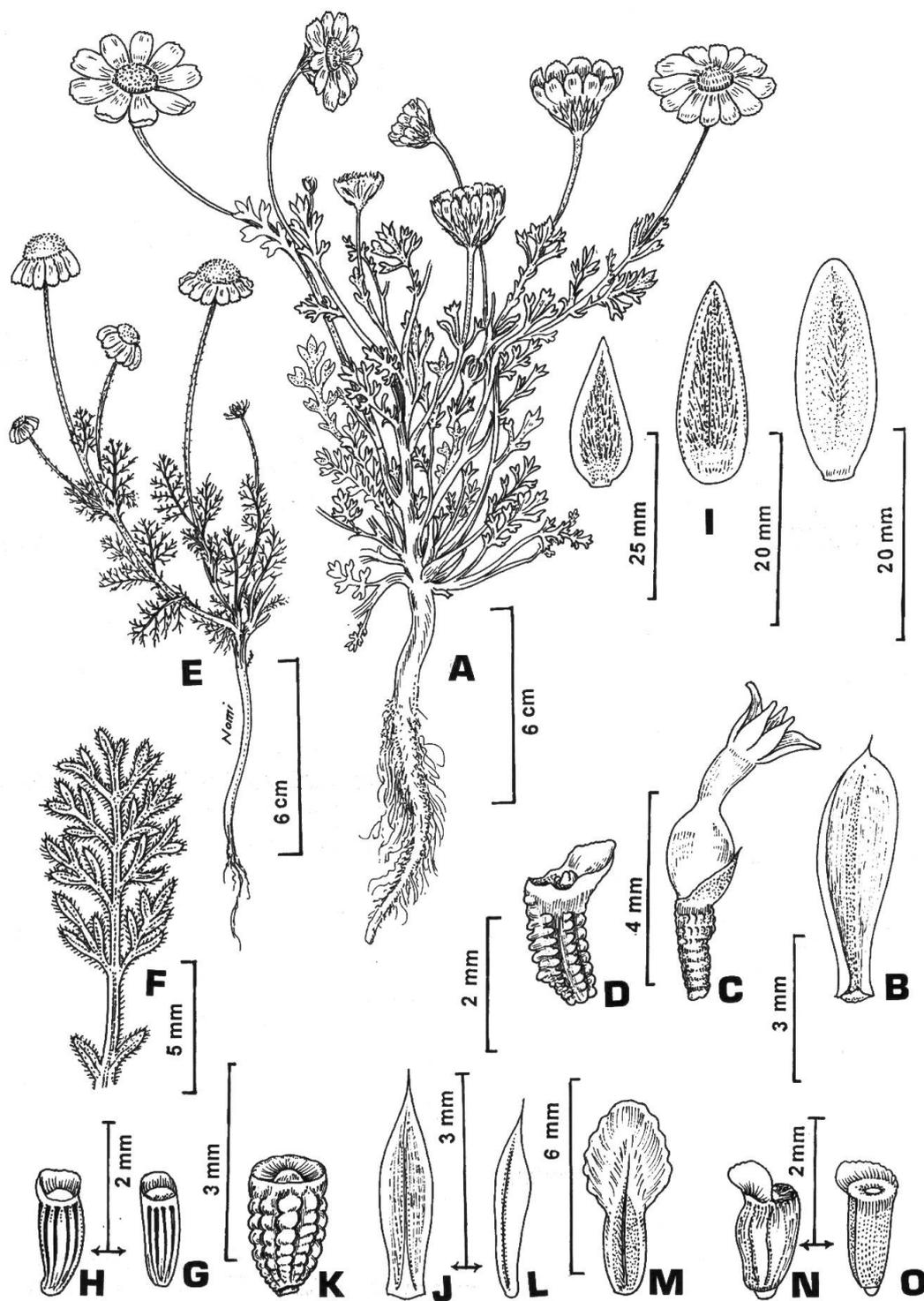


Fig. 4. — *Anthemis melampodina* Del. (S. Chaudhary 8268).
 A, habit; B, palea; C, disc-floret with partly mature achene; D, achene.
A. rascheyana Boiss. (S. Chaudhary & A. Aziz Al-Juid s.n.).
 E, habit; F, enlarged leaf; G et H, achenes.
A. desertii Boiss. (Al-Turki & A. Ghafoor 1378).
 I, phyllaries; J, palea; K, achene.
A. hyalina DC. (S. Abedin 12168).
 L, palea; M, inner phyllary; N et O, achenes.

6. *Anthemis hyalina* DC., Prodr. 6: 4 (1838).

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

Illustrations: Boul., Fl. Liban Syrie: tab. 224, fig. 4 (1930); Davis, Fl. Turkey 5: 181. fig. 9-26 (1975). Fig. 4, L-O.

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 \times 3-5 mm, white. Disc corollas terete in fruit. Achenes obpyramidate, 2-2.5 mm long, smooth, obscurely ribbed to ribless, auricle unilateral, short, opaque. *Fl. Per.:* March-April.

Specimen examined: Turayf, *S. Abedin 12168* (KSU).

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

A species, which can be easily recognised by appendage of the inner phyllaries, recorded for the first time for flora of Saudi Arabia seems to be rare and confined to NW region (Fig. 5).

7. *Anthemis desertii* Boiss., Fl. Orient. 3: 305 (1875).

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

\equiv *A. melampodina* subsp. *desertii* (Boiss.) Eig in Palestine J. Bot. Jerusalem Ser. 1: 177 (1938).

Illustration: Fig. 4, I-K.

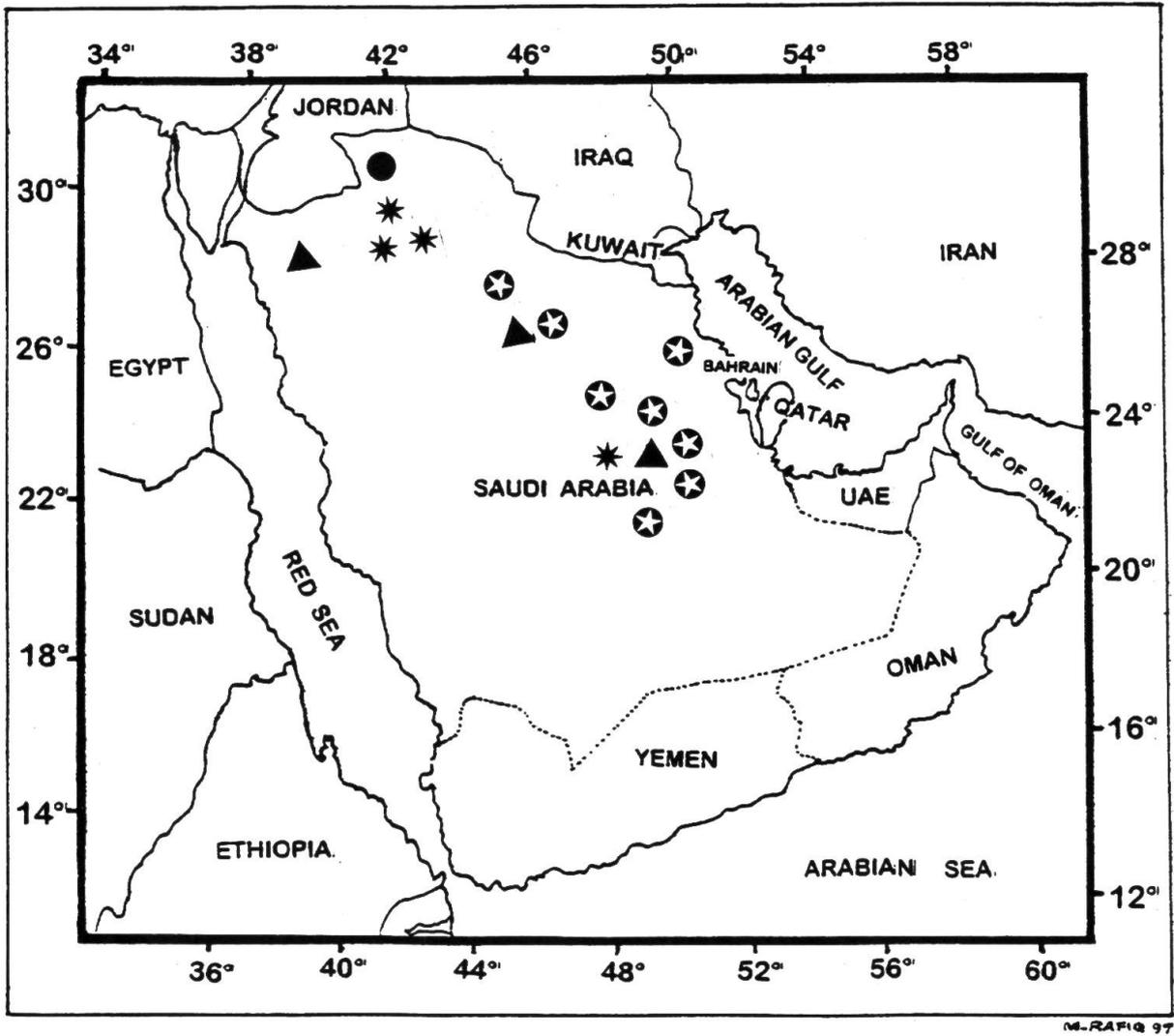
Annual, greyish-tomentose, herb with ascending branches from near the base. Leaves with 3-6(-8) mm long petiole, oblong or linear-oblong, 2-3 \times 1-1.5 cm, unipinnatifid into linear or oblong, entire or 3-fid lobules. Capitula 2-2.5(-3) cm across, on slender, unthickened fruiting peduncles. Phyllaries lanceolate, narrowly scarious margined, acute. Receptacle hemispherical, 2.5-3 mm long. Paleae oblong-lanceolate, ca. 3 mm long, carinate, acute. Ray-florets female, 10-15, fertile, tube glabrous, limb 4-6(-7) \times 2.5-3.5 mm, white. Disc corollas glabrous and inflated at the base. Achenes \pm obpyramidate, slightly curved or not, 1.5-1.75 mm long, longitudinally tuberculate on ridges, exauriculate. *Fl. Per.:* March-May. *Vern.:* Qahwiyah, Rebyan.

Specimens examined: Near exit to Dagla, ca. 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-Khaim, 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); Near Zabirah, 200 km north of Buraydah, 1800 ft., *Collenette 1879* (E).

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

This has often been treated as a subspecies of *A. melampodina* but the authors have noted pure populations in central Saudi Arabia in which capitula have outer phyllaries acute and the mature achenes 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.

Commonly found in gravel-mixed sandy-loam soils in northern, central and eastern Saudi Arabia (Fig. 5).



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Fig. 5. – Map showing distribution of *A. zoharyana* Eig (▲), *A. hyalina* DC. (●), *A. desertii* Boiss. (☆) and *A. melampodina* Del. (*) in Saudi Arabia.

8. *Anthemis melampodina* Del., Descr. Egypte, Hist. Nat.: 268, tab. 45, fig. 11 (1813-1814).

Type: Described from Egypt, *Delile* (holotype MPU).

Illustrations: Fl. Palaest. 3: 332, tab. 557 (1978). Fig. 4, A-D.

Annual, 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-oblongeolate, ca. 3 mm long, ± keeled, usually mucronate. Ray-florets female, 9-15, fertile, limbs elliptic, 8-12 × 4-6 mm, deciduous, white. Disc corollas inflated and dark brown in lower half. Achenes obpyramidate, ca. 1.5-1.75 mm long, auricle scarious, unilateral, 1/6 to as long as or longer than the achene. *Fl. Per.:* March-May. *Vern.:* Qahwiyan, Zamluq.

Specimens examined: Saudi Arabia: 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 loam soil, 9.4.1984, *H. O. Al-Hassan 126* (RIY # 8536).

Distribution: Egypt, Israel, Palestine, Saudi Arabia.

An east Saharo-Arabian species, grows profusely in silty sands in northern, central and eastern Saudi Arabia (Fig. 5).

Sect. 2. *Rascheyana* Yavin in Israel J. Bot. 21: 176 (1972).

Annual herbs. Paleae oblong to lanceolate, cuspidate or mucronate, persistent. Achenes cylindrical, slightly compressed dorsiventrally, 4-5-times as long as broad.

In Saudi Arabia, it is represented by the following species.

9. *Anthemis rascheyana* Boiss., Diagn. Pl. Orient. 11: 8 (1849); Boiss., Fl. Orient. 3: 307 (1857).

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

Illustrations: Fl. Palaest. 3: 334, tab. 562 (1978). Fig. 4, E-H.

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, ± 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 × 2-3 mm, white. Disc corolla tubes glabrous, inflated and somewhat compressed. Achenes thin, cylindrical, 1.5-2 mm long, dorsiventrally slightly compressed, striate, smooth, truncate to minutely auricled at the apex. *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.

A west Irano-Turanian element, is recorded for the first time from Saudi Arabia in dry northern region (Fig. 7).

Sect. 3. *Maruta* (Cass.) Reichenb., Deutsch. Botaniker ed. 2, 2: 139 (1844).

Annual herbs. Paleae subulate to bristle-like, ± persistent. Achenes obconical or turbinate, rounded in cross-section, not compressed, twice or three times as long as broad.

Represented in Saudi Arabia by three species.

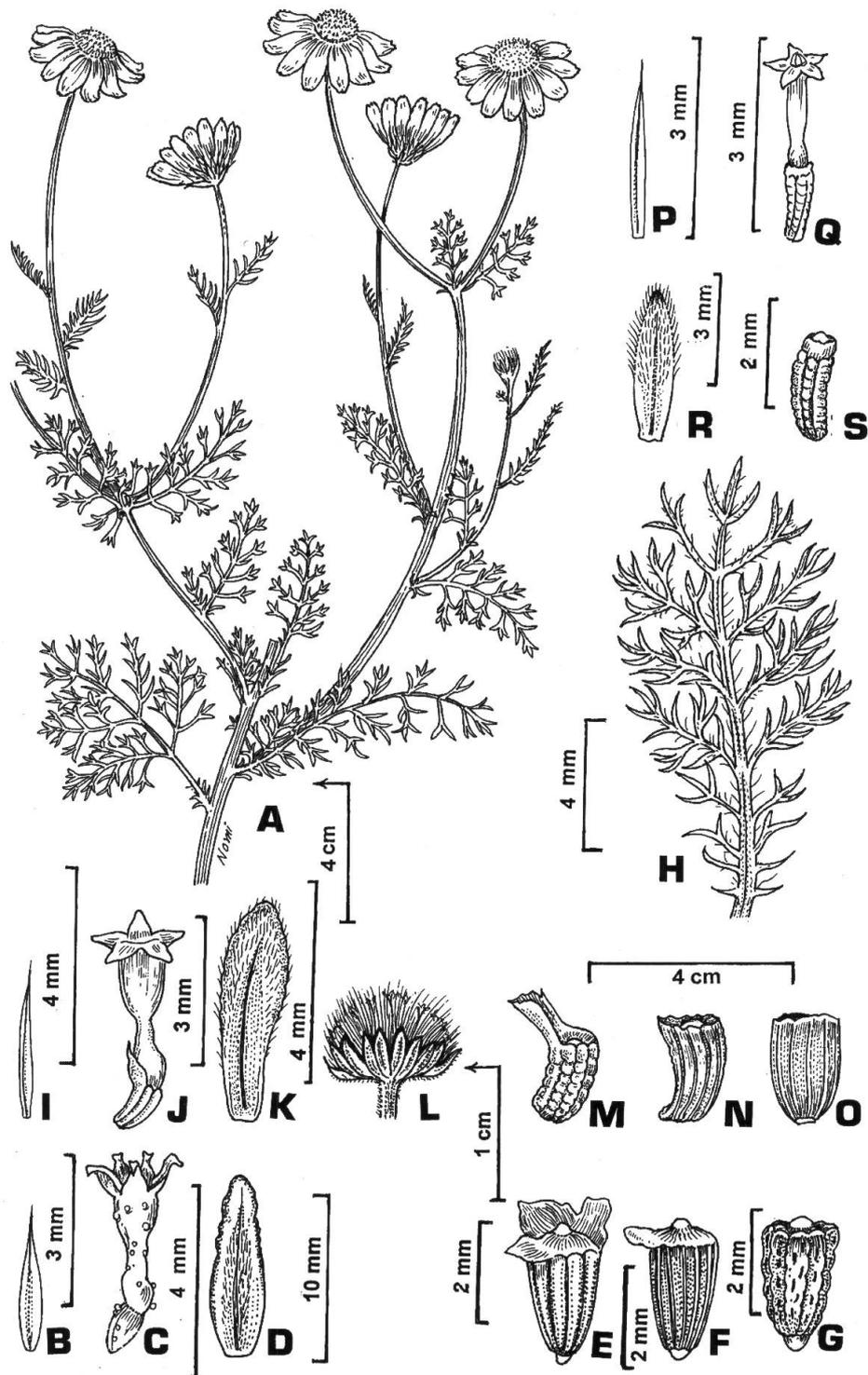


Fig. 6. – *Anthemis pseudocotula* Boiss. (S. Chaudhary 8269-B).

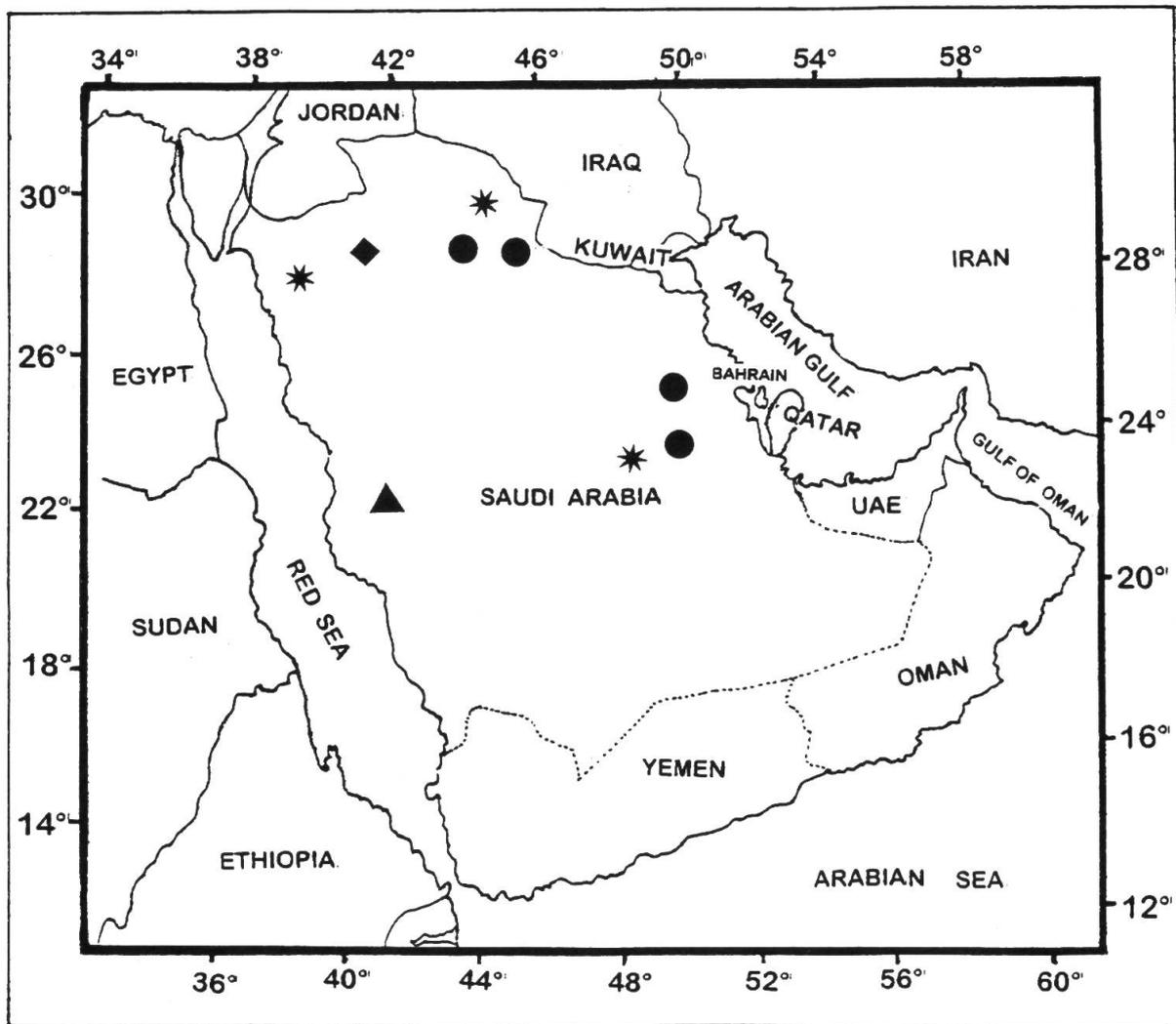
A, flowering twig; B, palea; C, disc-floret; D, phyllary; E et G, achenes.

A. bornmuelleri Stoj. & Acht. (Robert Alexander 3392).

H, leaf (enlarged); I, palea; J, disc-floret; K, phyllary; L, mature fruiting head; M-O, achenes.

A. cotula L. (S. Chaudhary E-858).

P, palea; Q, disc-floret; R, phyllary; S, achene.



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Fig. 7. – Map showing distribution of *Anthemis rascheyana* Boiss. (◆), *A. bornmuelleri* Stoj. & Acht. (▲), *A. pseudocotula* Boiss. (●) and *A. cotula* L. (*) in Saudi Arabia.

10. *Anthemis bornmuelleri* Stoj. & Acht. in Notizbl. Bot. Gart. Berlin 13: 522 (1937).

Type: Palestine: in arenosis siccis ad Jaffam, 20 Maio 1897, *J. Bornmueller*, sub *A. kahirica* Vis. (holotype WRSL).

Illustrations: Fl. Palaest. 3: 336, tab. 568 (1978). 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, ca. 4 mm long. Paleae linear-subulate, ca. 3 mm long, bristly, present all over the receptacle. Ray-florets female, fertile, tube glabrous, limb oblong-elliptic, $4-6 \times 2-4$ mm, white. Disc corollas basally inflated or very slightly inflated. Achenes 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: 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.

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 achenes. YAVIN (1970) confused it with *A. galilea* Eig.

A species, new to the flora of Saudi Arabia, growing in hilly sandy-clay soils in western region (Fig. 7).

11. *Anthemis pseudocotula* Boiss., Diagn. Pl. Orient. 6: 86 (1846); Eig in Palestine J. Bot., Jerusalem Ser. 1: 196 (1938).

Type: Persia australi ad Shiraz et prope pagos Dalechi et Gere, *Kotschy 75* (holotype G-BOIS; isotype K!).

Illustrations: Boul., Fl. Liban Syrie: tab. 223 (1930); Davis, Fl. Turkey 5: 179, fig. 8-18 & 19 (1975). Fig. 6, A-G.

Annual, 15-50 cm tall, appressed hairy or glabrescent herb with erect or ascending shoots from the base. Leaves ovate-oblong to oblanceolate, $1.5-3.5 \times 1-1.5$ cm, 2(-3)-pinnatisect into linear-oblanceolate, $1-3 \times$ ca. 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, $3-4 \times 1-2$ mm, pubescent, scarious margined, subacute. Receptacle elongate-conical, $6-8 \times 3-4$ mm. Paleae linear-subulate, 2.5-3 mm long, cuspidate, persistent. Ray-florets female, fertile, 10-12, limbs oblong, $4-7 \times 2.5-3.5$ mm, white. Disc corollas glabrous. Achenes 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: **Saudi Arabia:** 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 $30^{\circ}53'N$, $41^{\circ}02'E$, 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, Pakistan and Turkey.

An excessively variable species, specimens of which cannot be assigned to their infraspecific categories, if mature achenes are lacking. However, specimens cited here can be ascribed to subsp. *pseudocotula* var. *radiata* and subsp. *rotata* var. *rotata*.

It is believed to be a common weed (CHAUDHARY & AKRAM, 1987), occurring in northern and central Saudi Arabia, preferring clay-loam or silty soils (Fig. 7).

12. *Anthemis cotula* L., Sp. Pl.: 894 (1753).

Type: “Habitat in Europae ruderatis, praecipue in Ucraina”, *Herb. Linn. 1016.16* (LINN!).

Illustrations: Hegi, *Ill. Fl. Mittel-Eur.* 6(3): 303, fig. 134 (1968); Davis, *Fl. Turkey* 5: 138, fig. 10-21 (1975); *Fl. Palaest.* 3: 337, tab. 569 (1978). 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 × 1-3 cm, finely 2-3-pinnatisect, with narrowly linear, 1.5-3 × ca. 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, ± obtuse. Receptacle oblong-conical, 5-8 × 3-4 mm. Paleae linear-subulate, ca. 2.5-3 mm long, bristly. Ray-florets female, 14-16, sterile, limbs oblong-elliptic, 5-12 × 3-6 mm, white. Disc corolla tube terete, glabrous, ± inflated below. Achenes subcylindrical-turbinate, 1-1.5 mm long, obscurely 8-10-ribbed, tuberculate, exauriculate 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, tuberculate achenes.

It is found on damp, alluvial soils in stony coarse ground in northern and central Saudi Arabia (Fig. 7).

Dubious taxa

MIGAHID (1978, 1989) reported *Anthemis indurata* Del. from Nejd, probably based on a specimen gathered from Wadi Al-Jafi, *Qadri & Khudair 199* (KSU). The above identification seems doubtful as label on the sheet bears a mark of interrogation. According to TÄCKHOLM (1974), *A. indurata* Del., is a small annual sparingly pubescent herb with linear, fleshy, basally pectinate, pinnate leaves, radiate capitula with lanceolate pales and ultimately thickened and indurated peduncles. It is endemic to Egypt.

The above noted specimen examined by the authors, however, has all parts glabrous except for the sparse whitish glands on the peduncles that are neither thickened nor indurated. The leaves are bipinnatisect, capitula lacking ray-florets and immature achenes. More collections are needed especially fruiting material to determine the exact nature of *Anthemis indurata* sensu MIGAHID (1978).

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