

## THREE NEW SPINY *EUPHORBIA* (*EUPHORBIACEAE*) SPECIES FROM WESTERN SAUDI ARABIA

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Three shrubby, succulent, spiny *Euphorbia* (*Euphorbiaceae*) species from western Saudi Arabia are described and illustrated as new: *Euphorbia madinahensis* Fayed & D.Al-Zahrani, *Euphorbia saudiArabica* Fayed & D.Al-Zahrani and *Euphorbia taifensis* Fayed & D.Al-Zahrani. Diagnostic characters, descriptions and taxonomic comments on each are given, and they are compared with closely related species. The geographical distribution of the three new species is shown.

*Keywords.* Arabian Peninsula, distribution, *Euphorbia*, Saudi Arabia, taxonomy.

In preparation for an account of the genus *Euphorbia* L. (*Euphorbiaceae*) in the Arabian Peninsula, three new shrubby, succulent, spiny species from western Saudi Arabia are here described.

### NEW SPECIES

***Euphorbia madinahensis* Fayed & D.Al-Zahrani, sp. nov. Figs 1, 2, 5.**

*Euphorbia* aff. *cactus* Ehrenb.: Collenette, Ill. Guide Fl. Saudi Arabia 239 (1985); Collenette, *Euphorbia* J. 4: 102–122 (1987); Collenette, Wildfl. Saudi Arabia 309–310 (1999).

Frutex succulentus spinosus usque ad 1.5 m altus, in omni parte glaber; caules copiose ramosi, praesertim a basi, fasciculos densos ramorum usque ad 3 m vel plus latos facientes; rami flavovirentes fere erecti usque ad 35(–45) cm in circumscriptio, manifeste constricti in segmenta pyriformia (9–15 cm longa et prope basin 20–25 cm in circumscriptio), 3–5-anguli lateribus fere parallelis, angulis spinis gemellis in margine continuo corneo griseo 17 mm distantibus et circa 11 mm longis, interdum ad basin aculeolis parvis rudimentalibus instructis. Foliorum rudimenta simplicia sessilia cordata 5 × 3 mm, apice mucronato, margine integro, mox decidua. Cyathia terna aggregata, centrale masculo (raro bisexuali) sessili primum florente, lateralibus bisexualibus in pedicellis 5–7 mm longis, crescentibus masculum centram occultantibus; cymae involucre

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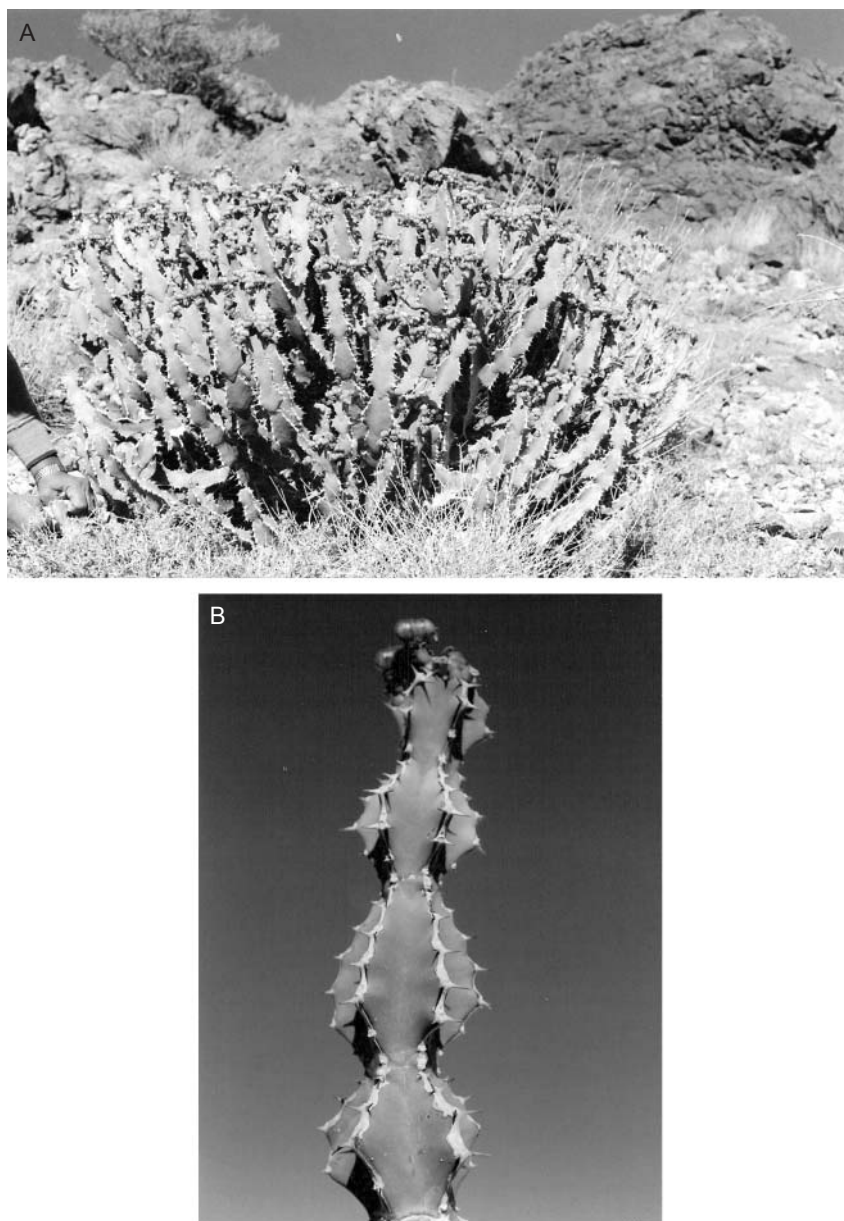


FIG. 1. *Euphorbia madinahensis* Fayed & D.Al-Zahrani: mature plant (A) and close-up of branch (B) at Jabal Al-Ahmar.

bracteata, bracteis triangularibus 3–5.5 × 6–8 mm apice acuto margine fimbriato. Involucrum campanulatum, 6–7 mm latum 5–6 mm profundum; glandulae cyathiorum flavae patentes transverse elliptico-oblongae 2–2.5 × 5–7 mm, lobis marginalibus margine breviter fimbriatis. Flores masculi pedicello 4.2 mm longo,

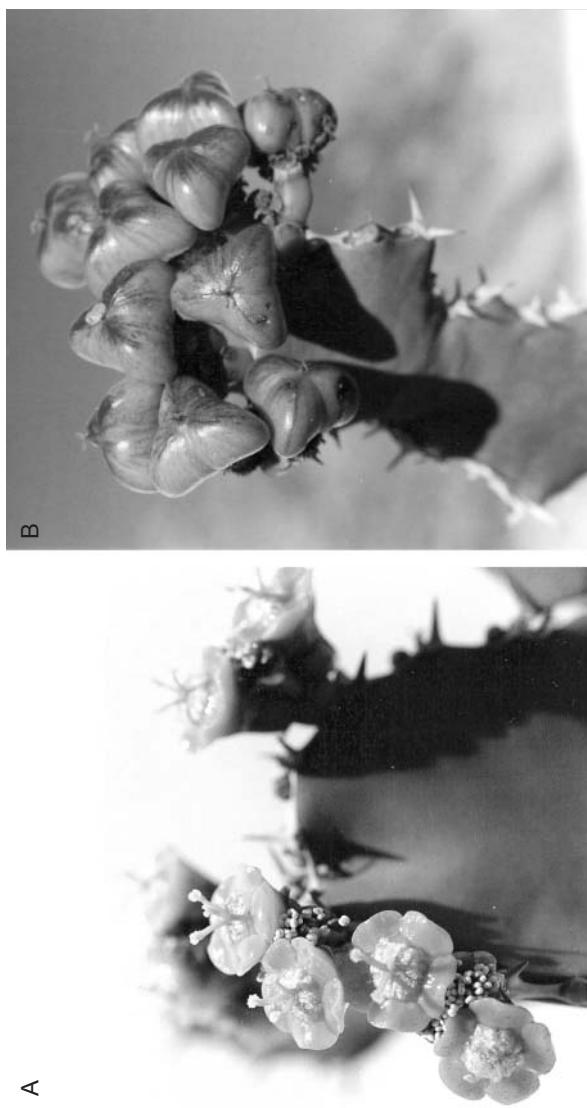


FIG. 2. *Euphorbia madinahensis*: close-up of flowering branch (A) and fruiting branch (B) at Jabal Al-Ahmar.

bracteolis circa 3.5 mm longis, in dimidio superiore dissectis. Flore feminei sessiles vel subsessiles, ramis stylosum circa 3 mm longis infra connatis per circa 1 mm, ad apicem bifidis. Capsula lobis 3 rotundatus, circa 1.8 cm lata, matura e rubro viridis. Semina grisea subglobosa 3.5–4 mm longa laevia. – Type: Saudi Arabia: Al-Figrah highland, 95 km west of Madinah, 2000–2200 m alt., 16 xi 1998, *D. Al-Zahrani* 185 (holo M; iso BM, CAI, E, K, KAAU<sup>1</sup>, KSU).

Succulent spiny shrub, up to 1.5 m tall, glabrous in all parts; stems branching freely, especially from the base, to form dense clumps up to 3 m or more in diameter; branches yellow-green, almost erect, up to 35(–45) cm in circumference, distinctly constricted into pear-shaped segments (9–15 cm long and 20–25 cm in circumference near the base), 3–5-angled, with nearly parallel sides; angles with paired spines on continuous horny grey margins; spines 17 mm apart and c.11 mm long, with occasional small rudimentary prickles at the base. *Leaf* rudiments simple, sessile, cordate, 5 × 3 mm, apex mucronate, margin entire, soon deciduous. *Cyathia* in groups of three; the central male, rarely bisexual, sessile, flowering first; the lateral bisexual, with 5–7 mm long pedicel, obscuring the male cyathium as they develop; cymes and involucre bracteate; bracts triangular, 3–5.5 × 6–8 mm, with acute apex and fimbriate margin. *Involucre* campanulate, 6–7 mm across, 5–6 mm deep; cyathial glands yellow, patent, transversely elliptic-oblong, 2–2.5 × 5–7 mm; marginal lobes with short fimbriate margin. Pedicel of *male flowers* 4.2 mm long; bracteoles c.3.5 mm long, dissected in the upper half. *Female flower* sessile to subsessile; style arms c.3 mm long, connate for c.1 mm below, bifid at apex. *Capsule* with 3 rounded lobes, c.1.8 cm across, ripening reddish green. *Seeds* grey, subglobose, 3.5–4 mm long, smooth.

*Distribution.* *Euphorbia madinahensis* is named after Madinah city where the species is endemic to the nearby highlands (Fig. 5), namely Figrah, Al-Ahmar, Anagayn, Auf and Reem (1050–2350 m alt.). These highlands appear to be the northern limit for spiny euphorbias in Arabia (Collenette, 1987).

*Habitat and flowering times.* On granite mountains with sparse rainfall, from 1050 to 2350 m alt. Flowering and fruiting from September to February.

*Vernacular names.* Karath, Karathah.

*Conservation status.* According to the IUCN Red List Categories and Criteria, version 3.0 and 3.1 (IUCN, 2001, 2003), this new species should be considered Vulnerable (VU) under criteria B1ab (i,ii,iii,iv,v) + 2ab (i,ii,iii,iv,v) based on observations and inferences that it has both an extent of occurrence of less than 20,000 km<sup>2</sup> and an area of occupancy of less than 2000 km<sup>2</sup>. It is known to exist at no more than 10 locations and is in continuing decline.

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TABLE 1. Comparison of morphological characters in *Euphorbia madinahensis* and *E. cactus*

Character	<i>E. madinahensis</i>	<i>E. cactus</i>
Habit	Up to 1.5 m tall, 1.5–3 m in width	Up to 3 m tall, 2 m in width
Branches		
– Colour	Yellow-green	Dark green
– Angles	3–5, rounded, or subacute	3 rarely 4, acute
– Shape	Pear-shaped segments	Wing-like, compressed angles
– Circumference	20–25 cm	25–35 cm
– Width of angle	5–8 cm	15–20 cm
Spine size	2–11 mm long, 17 mm apart	10–25 mm long, 40 mm apart
Bracts	3–5.5 × 6–8 mm	2.5–3.5 × 5 mm
Capsule		
– Size	10 × 18 mm	8–9 × 15–16 mm
– Shape	Triangular, rounded	Triangular, acute
– Pedicel	2 mm	2–5 mm

*Euphorbia madinahensis* is closely related to *Euphorbia cactus* Ehrenb. It has correspondingly very stout, fleshy, yellow-green stems, with subacute angles and distinct pear-shaped segments. They are not mottled with radiating yellow streaks (a characteristic of *Euphorbia cactus* Ehrenb.). In addition, the branch margins of the new species are almost without undulations, while the spines are white and stout, being linked by a contiguous, grey band. The cymes cover the entire apical segments, so that the plants appear to carry balls of flowers. Moreover, the cyathia are subsessile and are subtended by triangular, obviously larger bracts. A morphological comparison between *Euphorbia madinahensis* and *E. cactus* is given in Table 1. Collenette (1985, 1987, 1999) was aware of most of the abovementioned differences and named the plants of these populations *Euphorbia* sp. aff. *cactus* Ehrenb.

*Specimens examined.* SAUDI ARABIA. Figrah highland, 95 km W of Al-Madinah, 2000–2200 m alt., *D. Al-Zahrani* 176 (BM, E, K, KAAU, M); idem, 1 xi 1998, *D. Al-Zahrani* 184 (KAAU, KSU, RIY); Jibal Reem, c.20 km N of Al-Musayjid, Madinah–Badr Hunain road, 1560 m alt., 7 viii 1998, *D. Al-Zahrani* 174 (BM, E, KAAU, KSU, M, RIY); Jibal Anagayn, c.15 km NW of Al-Musayjid, Madinah–Badr Hunain road, 1900 m alt., 9 viii 1998, *D. Al-Zahrani* 177 (K, KSU); Jabal Auf, 80 km SSW of Madinah, 1170 m alt., 26 xi 1986, *Collenette* 5945 (K, RIY); Jabal Al-Ahmar, c.100 km SW of Madinah, on a barren rocky hillside, 2300 m alt., 24 ii 1998, *D. Al-Zahrani* 152 (BM, CAI, E, K, KAAU, KSU, M, RIY).

### ***Euphorbia saudiarabica* Fayed & D.Al-Zahrani, sp. nov. Figs 3, 5.**

Frutex vel arbor parva candelabriformis succulenta spinosa, non magis quam 3 m alta, in omni parte glabra, caule principali unico (45–60 cm in circumscriptione); rami flavovirentes vel flavi, longi crassi graciles simplices 3–5-anguli 15–19 cm in circumscriptione, inferiores declinantes, terram verrentes, dein assurgentes,



FIG. 3. *Euphorbia saudiarabica* Fayed & D.Al-Zahrani: mature plant (A) and close-up of fruiting branch (B) at Thahban (between Al-Birk and Al-Qahmah).

superiores fere erecti, lateribus fere parallelis, spinis gemellis in scutis parvis non contiguus, apice nigro, 1 cm longis, interdum ad basin aculeolis parvis rudimentalibus instructis. Foliorum rudimenta sessilia simplicia ovata, interdum lamina oblique truncata, apice acuto, margine integro, mox decidua. Cyathia terna aggregata, centrale masculo (raro bisexuali) sessili primum florente, lateralibus bisexualibus in pedicellis 2–4 mm longis, crescentibus masculum

centralem occultantibus; cymae involucreaque bracteata, bracteis 1.5–2 × 1–1.5 mm, apice rotundato, margine fimbriato. Involucrum campanulatum, 4.5 mm latum 3.5 mm profundum; glandulae cyathiorum flavae transverse oblongae 2.5–3.5 × 1–1.5 mm, lobis marginalibus margine breviter fimbriatis. Flores masculi pedicello 3.5 mm longo, bracteolis 3 mm longis, supra dissectis. Flore feminei pedicellati, pedicello 2–4 mm longo, ovario in stipite notabiliter reflexo, ramis stylosum 2 mm longis, infra connatis per 1 mm, ad apicem bifidis. Capsula lobis 3 rotundatus, 4 × 6–6.5 mm, in stipite 14 mm longo notabiliter reflexo. Semina subglobosa 2.5–3 × 2–2.3 mm grisea laevia. – Type: Saudi Arabia: Between Al-Birk and Al-Qahmah, 55 km N of Shoqaiq–Muhayil junction, Al-Qunfudhah–Jizan road, 10 m alt., 5 vi 1998, *D. Al-Zahrani* 164 (holo M; iso BM, E, K, M).

A candelabra-like succulent spiny shrub or small tree, not exceeding 3 m tall, glabrous in all parts, with a single main stem (45–60 cm in circumference); branches yellow-green to yellow, long, stout, slender, simple, 3–5-angled, 15–19 cm in circumference, the lower branches arching down to sweep the ground then turning upwards, the upper ones almost erect; branch (sides) nearly parallel, with paired spines on small, non-contiguous spine shields; spines black-tipped, 1 cm long, with occasional small rudimentary prickles at the base. *Leaf* rudiments sessile, simple, ovate, sometimes with obliquely truncate lamina, apex acute, margin entire, soon deciduous. *Cyathia* in groups of three; the central male, rarely bisexual, sessile, flowering first; the lateral bisexual, with 2–4 mm long pedicel, obscuring the male cyathium as they develop; cymes and involucre bracteate; bracts 1.5–2 × 1–1.5 mm, with rounded apex and fimbriate margin. *Involucre* campanulate, 4.5 mm across, 3.5 mm deep; cyathial glands yellow, transversely oblong, 2.5–3.5 × 1–1.5 mm; marginal lobes with short fimbriate margin. Pedicel of *male flowers* 3.5 mm long; bracteoles 3 mm long, dissected above. Pedicel of *female flowers* 10–14 mm long; ovary on remarkably reflexed stalk; style arms 2 mm long, connate for 1 mm below, bifid at apex. *Capsule* with 3 rounded lobes, 4 × 6–6.5 mm, on 14 mm long, remarkably reflexed stalks. *Seeds* subglobose, 2.5–3 × 2–2.3 mm, grey, smooth.

*Distribution.* Endemic to the southwestern corner of Saudi Arabia along the Qunfudhah–Jizan road (Fig. 5).

*Habitat and flowering times.* In full sun at sea level and low-lying sites (0–30 m alt.) in fine drifting clay sand among black basalt blocks. Flowering from March to July.

*Vernacular names.* Saab, Suoiab.

*Conservation status.* *Euphorbia saudiarabica* has both an extent of occurrence estimated to be less than 5000 km<sup>2</sup> and an area of occupancy estimated to be less than 500 km<sup>2</sup>. Moreover, the population size is estimated to number fewer than 250 mature individuals and it is known to exist at no more than three locations. The population at one location has been severely damaged by roadworks, which have reduced it by half. Other populations contain fewer than 30 plants, including

juveniles. For these reasons, it should be considered that *Euphorbia saudiarabica* is an Endangered (EN) species based on the IUCN Red List Categories and Criteria, version 3.0 and 3.1 (IUCN, 2001, 2003) under criteria B1ab (i,ii,iii,iv,v), B2ab (i,ii,iii,iv,v), c (i,ii,iii,iv) and D. This is a precautionary preliminary assessment and further research is needed to clarify the habitat requirements and population size of the species. It is likely to become more threatened in the future, and additional ecological and biological studies should be undertaken towards effective conservation.

This new species is closely related to *Euphorbia parcircamulosa* Schweinf. However, *Euphorbia saudiarabica* is readily separated by its branch margins which are almost without undulations, while the small spine shields are non-contiguous. The spines of the new species are small, white, black-tipped and resemble buffalo horns when young. Moreover, the capsules are borne on long (14 mm) and remarkably reflexed stalks (much more strongly reflexed than in *Euphorbia parcircamulosa*). The capsules are smooth and relatively large (4–5 × 6–6.5 mm). The glands are oblong and close to each other. A morphological comparison between *Euphorbia saudiarabica* and *E. parcircamulosa* is given in Table 2.

*Specimens examined.* SAUDI ARABIA. Thahban, between Al-Birk and Al-Qahmah, 65 km N of Shoqaiq–Muhayil junction, Al Qunfudhah–Jizan road, 4 m alt., 5 vi 1998, *D. Al-Zahrani* 163 (KAAU); Near Thahaban, between Qahmah and Al-Birk, Qunfudhah–Jizan road, 3 m alt., 9 v 1985, *Collenette* 4724 (E, K, RIY); Between Al-Birk and Al-Qahmah, Al-Qunfudhah–Jizan road, 10 m alt., 7 viii 1997, *D. Al-Zahrani* 126 (E, KAAU); *idem*, 5 vi 1998, *D. Al-Zahrani* 164 (BM, E, K, M); 25 m alt., 10 xi 1998, *D. Al-Zahrani* 181 (KAAU); Between Baysh and sabia-Jizan road, 35 m alt., 7 v 1985, *Collenette* 5195 (E, RIY); Coastal area on to Yemen border from Abu-Arish, 8 iv 1983, *Chaudhary* 8106 (RIY).

TABLE 2. Comparison of morphological characters in *Euphorbia saudiarabica* and *E. parcircamulosa*

Character	<i>E. saudiarabica</i>	<i>E. parcircamulosa</i>
Habitat	At sea level and low-lying sites at 0–30 m alt.	On the high mountains at 2000 m alt.
Habit	Usually shrub to small tree, up to 3 m tall	Tree up to 6 m tall
Branches		
– Colour	Yellow-green to yellow	Dark green
– Angles	3–5	3–4
– Margins	Without undulation	Undulated (with wavy edges)
Spine shields	Non-contiguous	Contiguous
Glands	Oblong, close together	Ovate to oblong-ovate, spaced
Capsule		
– Size	4 × 6–6.5 mm	3–4 × 5 mm
– Pedicel	10–14 mm, totally reflexed	2–4 mm, erect to slightly reflexed
– Surface	Grey, smooth	Mottled



***Euphorbia taifensis* Fayed & D.Al-Zahrani, sp. nov. Figs 4, 5.**

*Euphorbia* aff. *ammak* Schweinf.: Collenette, Ill. Guide Fl. Saudi Arabia 237 (1985); Collenette, *Euphorbia* J. 4: 102–122 (1987); Collenette, *Wildfl. Saudi Arabia* 307 (1999).

Arbor ramosissima succulenta spinosa usque ad 10 m alta, in omni parte glabra, caule principali 65–90 cm in circumscriptio; rami vivide virentes



FIG. 4. *Euphorbia taifensis* Fayed & D.Al-Zahrani: mature plant (A) and close-up of branches (B) at Bani Salim District, near Taif city.

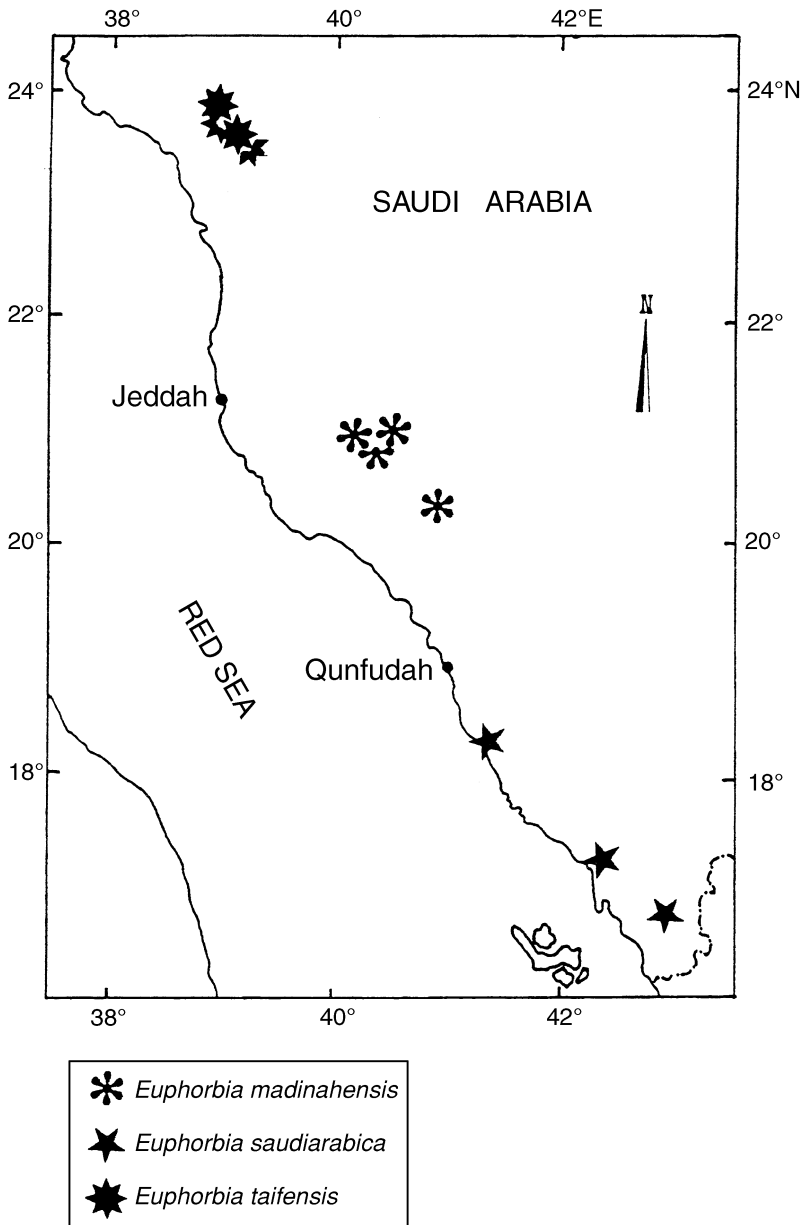


FIG. 5. Distribution of *Euphorbia madinahensis*, *E. saudiarabica* and *E. taifensis*.

erecti 20–40(–50) cm in circumscriptione, 3–6(–7)-anguli, angulis acutis, spinis validis gemellis secus cristas striatas, scutis spinarum fere contiguis. Foliorum rudimenta, praecipue juvenilia, e rubro viridia, simplicia sessilia suborbiculata 5–5.5 mm longa, apice mucronato, margine fimbriato, mox decidua. Cyathia terna aggregata, centrale masculo sessili primum florente, lateralibus bisexualibus

pedicellatis pedicellis circa 4 mm longis, crescentibus masculum centralem occultantibus; cymae involucreaque bracteata, bracteis sessilibus suborbicularibus vivide virentibus circa  $4 \times 3$  mm. Involucrum poculiforme, 7–8 mm latum circa 5 mm profundum; glandulae cyathiorum flavae patentes transverse elliptico-oblongae vel oblongo-triangulares  $3.5 \times 1.8$  mm, lobis marginalibus margine fimbriatis. Flores masculi pedicello 5–7 mm longo, bracteolis 3.5–4 mm longis, in dimidio superiore dissectis. Flores feminei pedicellati, pedicello circa 1.4 cm longo, ovario laevi, ramis styliorum circa 3 mm longis, infra connatis per 2 mm, ad apicem bifidis. Capsula lobis 3 rotundatus,  $8 \times 18$  mm, in stipite 14–22 mm longo, matura vivide rubra. Semina subglobosa circa 3 mm longa grisea. – Type: Saudi Arabia: Taif city, Bani Salim District, about 15 km SE of Taif, 1750 m alt., 18 xii 1998, *D. Al-Zahrani* 198 (holo M; iso BM, CAI, E, K, KAAU, KSU, RIY).

A much branched, succulent, spiny tree, up to 10 m tall, glabrous in all parts; main stem 65–90 cm in circumference; branches bright green, upright, 20–40(–50) cm in circumference, 3–6(–7)-angled; angles acute, with pairs of stout spines up the fluted ridges; spine shields almost contiguous. *Leaf* rudiments reddish-green especially when young, simple, sessile, suborbicular, 5–5.5 mm long, apex mucronate, margin fimbriate, soon deciduous. Cyathia in groups of three; the central male, sessile, flowering first; the lateral bisexual, pedicellate, pedicel c.4 mm long, obscuring the male cyathium as they develop; cymes and involucre bracteate; bracts sessile, suborbicular, bright green,  $c.4 \times 3$  mm. *Involucre* cup-shaped, 7–8 mm across, c.5 mm deep; cyathial glands yellow, patent, transversely elliptic-oblong to oblong-triangular,  $3.5 \times 1.8$  mm; marginal lobes with fimbriate margin. Pedicel of *male flowers* 5–7 mm long; bracteoles 3.5–4 mm long, dissected in the upper half. Pedicel of *female flower* stout, c.14 mm long; ovary smooth; style arms c.3 mm long, connate for 2 mm below, bifid at apex. *Capsule* with 3 rounded lobes,  $8 \times 18$  mm on 14–22 mm long stalk, ripening bright red. *Seeds* subglobose, c.3 mm long, grey.

*Distribution.* *Euphorbia taifensis* is named after Taif city where the species is endemic (Fig. 5).

*Habitat and flowering times.* The plants are very localized, occurring on the stony and rocky slopes of wadis and near farms at elevations ranging between 1700 and 2100 m. The new species is well established and occurs in large colonies with good regeneration. Flowering and fruiting from October to February.

*Vernacular names.* Amaq, Amaqah, Amaqat al-ghanam.

*Conservation status.* The new species has both an extent of occurrence of less than 20,000 km<sup>2</sup> and an area of occupancy of less than 2000 km<sup>2</sup>. It is known to exist at no more than 10 locations and continuing decline has been observed. It is therefore to be considered as Vulnerable (VU) under criteria B1ab (i,ii,iv,v) + 2ab (i,ii,iv,v) according to the IUCN Red List Categories and Criteria, version 3.0 and 3.1 (IUCN, 2001, 2003).

TABLE 3. Comparison of morphological characters in *Euphorbia taifensis* and *E. ammak*

Character	<i>E. taifensis</i>	<i>E. ammak</i>
Habit	Up to 10 m tall	Up to 6 m tall
Leaf		
– Colour	Reddish-green	Green
– Size	5 × 5.5 mm	6 × 10–20(30) mm
– Apex	Mucronate	Acute
– Margin	Fimbriate	Entire
Capsule		
– Size	8 × 18 mm	7–10 × 12(–14) mm
– Shape	Triangular, rounded	Triangular, acute
– Pedicel	14–22 mm	9–11 mm

This new species is similar in its growth form and involucre characters to *Euphorbia ammak* Schweinf. However, *Euphorbia taifensis* is easily distinguished through its leaf characters: reddish-green, 5–5.5 mm long, suborbicular, with mucronate apex and fimbriate margins. In addition our species is taller (attaining 10 m). Moreover, the capsule lobes are rounded and the inflorescence size is quite different. A morphological comparison between *Euphorbia taifensis* and *E. ammak* is given in Table 3.

*Specimens examined.* SAUDI ARABIA. Taqif, Sakharah village, 9 vii 1946, *Vesy-FitzGerald* 16560 (BM); Near Haritha, Wadi Wahht, SW of Taif, 2170 m alt., 21 xi 1986, *Collenette* 5928 (E, RIY); Taif, Bani Salim District, 15 km SE of Taif, 1750 m alt., 18 xii 1998, *D. Al-Zahrani* 198 (BM, CAI, E, K, KAAU, KSU, M, RIY); Taif, Bani Salim District, 15 km SE of Taif, 1750 m alt., 25 xii 1998, *D. Al-Zahrani* 199 (KAAU); Jebal Amudh, by wadi Aoff wadi Wiji, 18 km from Taif, 2000 m alt., 9 iv 1978, *Collenette* 627 (K); Taif, wadi Sakarah, between Misan and Al-Baha, 28 xi 1992, *Collenette* 8433 [spirit sample no. 62829 (K)]; Wadi Sakarah, 4 iii 1993, *Collenette* 7940 [spirit sample no. 57329 (K)].

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