

## GOLDBACHIA AND TETRACME (CRUCIFERAE) IN IRAN

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Flora Iranica is a very important reference treatment for the vascular flora of Iran. Two genera, *Goldbachia* DC. and *Tetracme* Bunge (Cruciferae), are mentioned in Flora Iranica with only one species each for Iran. Additional species of these genera recorded from Iran since the publication of Flora Iranica are listed and discussed here.

For *Goldbachia*, up to now, the only species recorded for Iran in Flora Iranica is *Goldbachia laevigata* (M. Bieb.) DC.; but here two other *Goldbachia* species are recorded for the country for the first time: *G. pendula* Botsch. and *G. verrucosa* Komarov. For *Tetracme* the only species recorded for Iran in Flora Iranica is *Tetracme recurvata* Bunge. *T. quadricornis* (Steph.) Bunge was recorded later with only one specimen from Semnan province; and *T. contorta* Boiss. was recorded from Isfahan province. Here more specimens of *T. contorta* are recorded for the first time from Khorassan province. Identification keys are given for both genera in Iran.

Key words: Cruciferae, *Goldbachia*, Iran, taxonomy, *Tetracme*

### INTRODUCTION

Flora Iranica (Rechinger 1963–2010) is the most important and valuable reference treatment for the flora of Iran. Another suitable and useful reference work is Flora of Iran (Assadi *et al.* 1988–2010). The family Cruciferae was published in a separate volume of Flora Iranica more than 40 years ago (Rechinger 1968), while it has not been treated in the series of Flora of Iran, yet. Thus, here we discuss the two genera, *Goldbachia* and *Tetracme*, each of them with only one species in Iran according to Flora Iranica.

### *Goldbachia*

*Goldbachia* DC. (Cruciferae: Hesperideae) with 6 species (Mabberly 2008) contains two species in the Iranian plateau, one of which is common in Iran (Rechinger 1968). Altogether three *Goldbachia* species are treated here for Iran. The two new records are from Khorassan province, E Iran.

#### Identification key for *Goldbachia* in Iran

- 1a Siliques verrucose on surface (Fig. 1); pedicels much (2–3 times) longer than the siliques *G. verrucosa*
- 1b Siliques laevigate on surface (Fig. 1); pedicels *ca* as long as or shorter than the siliques 2
- 2a Siliques pointed downward (Fig. 1), siliques and pedicels usually form a straight line (180 degree) or angled up to 120 degrees *G. pendula*
- 2b Siliques pointed upward (Fig. 1), siliques and pedicels usually form a distinct angle 30–120 degrees *G. laevigata*

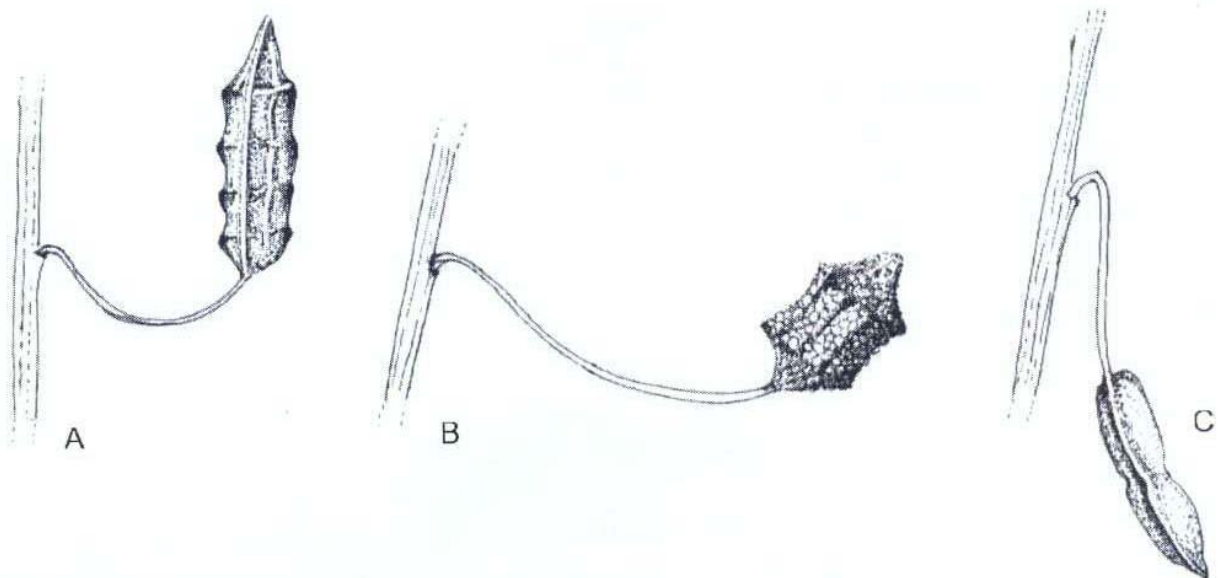


Fig. 1. Fruits of the *Goldbachia* species: A = *G. laevigata*, B = *G. verrucosa*, C = *G. pendula*

*Goldbachia laevigata* (M. Bieb.) DC.

Reg. Veg. Syst. Nat. 2: 577 (1821)

(Fig. 1)

Annual herbs, 10–40 cm tall, glabrous, rarely very sparsely hispid below and on the margin of leaves. Stems branched basally and above. Basal leaves rosulate, petiole 10–30 mm long, leaf blade oblong or oblong-elliptic to oblanceolate, 25–45 × 8–30 mm, margin sinuate-dentate, dentate to subentire. Middle cauline leaves sessile, amplexicaul, ovate-lanceolate, lanceolate to linear-oblong, 10–60 × 2–15 mm, widest at base, sagittate, margin entire. Flowers ca 2–3 mm across, pedicels slender, 5–15 mm long, reflexed, forming with silique a distinct angle of 30–120 degrees, auriculate at base. Sepals oblong or narrowly lanceolate, 2.5–4 × 1 mm, densely pubescent with crisped trichomes, base of lateral pair slightly saccate. Petal pale purplish or pink, spatulate, 5–8 × 1–5 mm. Siliques (1)2(3) locular, 8–13 × 3–4 mm, oblong or botuliform, glabrous or puberulous, pointed upward, quadrangular, rugose, constricted at middle when more than 1-loculed, base subrounded, beak-like apex 1–2.5 mm long, ascending. Seeds yellow-brown, oblong.

Flowering (fruiting) period: April–June.

Habitat: Fields, roadsides, hillsides and deserts, 300–2,000 m.

Distribution: Afghanistan, Caucasia, Central Asia, China, India, Iran, Pakistan, Russia, Syria and Turkey. This weed species is widespread in Iran (N, W, S, E, C).

*Goldbachia pendula* Botsch.

Bot. Mater. Gerb. Bot. Inst. Komarova, Akad. Nauk SSSR 22: 140 (1963)

(Figs 1, 2)

Annual herbs, 25–40 cm tall. Stems branched basally and above. Basal leaves with petiole, 5–20 mm long; leaf blade obovate or oblanceolate, 20–50 × 5–15 mm, margin sinuate-dentate or dentate, apex obtuse or acute. Cauline leaves sessile, auriculate, oblong, narrowly lanceolate, or oblanceolate, 15–40 × 1–15 mm, margin denticulate: pedicels slender, 3–7 mm long, reflexed, forming a straight line with siliques, articulate at both ends. Sepals oblong, 1–2 mm long, purple. Petals pale purple, narrowly oblanceolate, 3–4 mm long, Siliques ovoid or narrowly oblong, 4–9 mm long, pointed downward, terete or slightly 4-angled, constricted at middle when more than 1-loculed, base subrounded, narrowed into a beak-like apex. Seeds yellow, oblong.

Flowering (fruiting) period: April–May.

Habitat: Hillsides, 1,900–2,000 m.

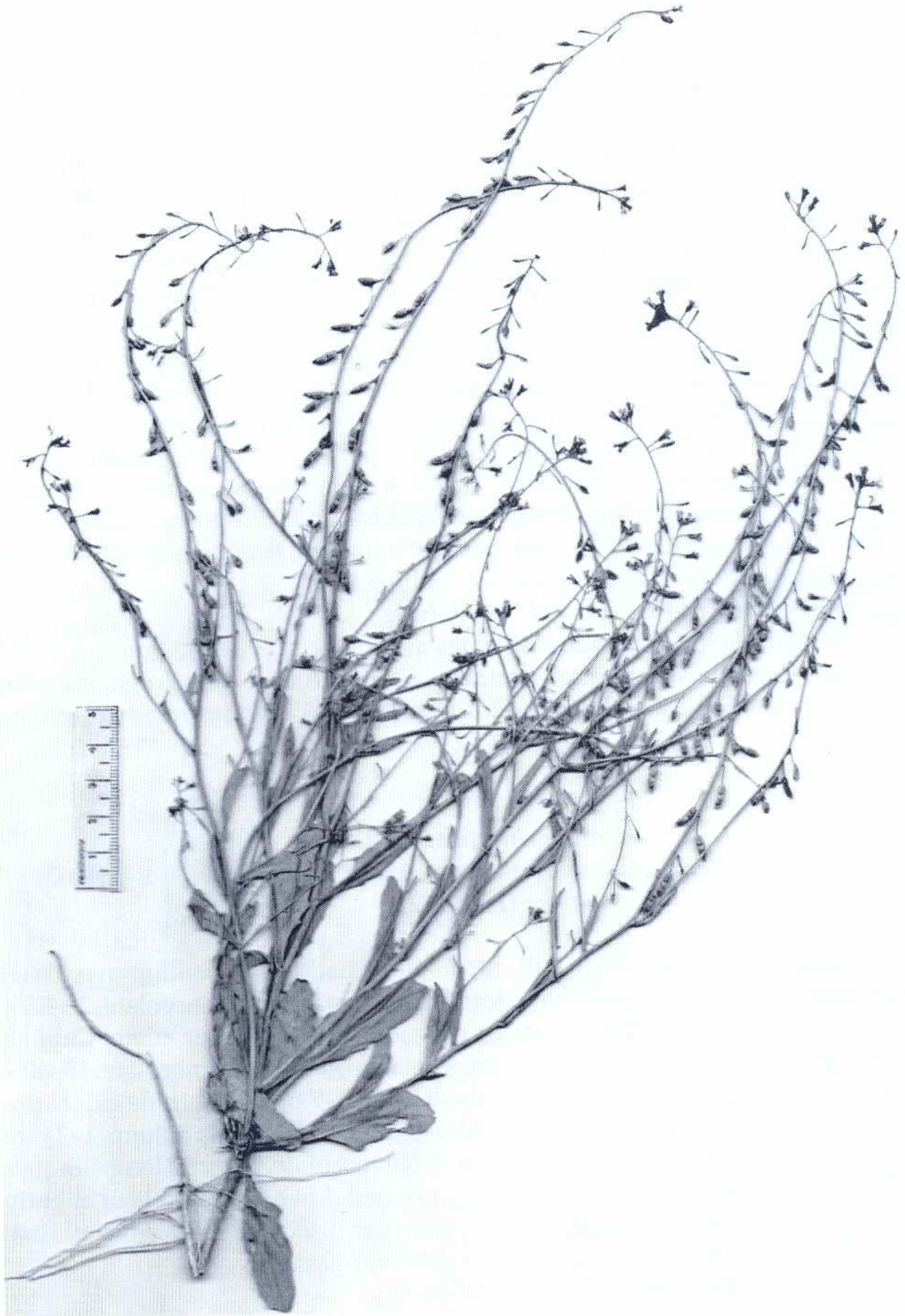


Fig. 2. *Goldbachia pendula* Botsch. (Faghihnia and Zangoeei 25217, FUMH)

Distribution: Central Asia, China, Iran, Mongolia and Russia. Here, this species is recorded for the first time from Iran.

Specimens examined: Iran: Prov. Khorassan, N Kashmar, Kuhsorkh, between Tajrud and Kharw, 1,900 m. Coll.: Faghihnia and Zangooei (25327c), 8.5.1995 [FUMH!]. – NE Birjand, between Marak and bifurcation of Sarchah, 2,100 m. Coll.: Faghihnia and Zangooei (25217), 2.5.1995 [FUMH!].

*Goldbachia verrucosa* Komarov

Trav. Soc. Nat. Petersb. Bot. 26: 98 (1896)

(Figs 1, 3)

Annual slender herbs, 10–35 cm tall, usually glabrous; with branching stems. Leaf bases cuneate, not amplexicaul, very sparsely hispid on the margins; lower leaves lyrate-pinnatilobate, petiolate; upper leaves narrowly oblong to sublinear, ± dentate or subentire, sessile to subsessile. Flowers racemos, lilac; pedicels 5–15 mm long, deflexed or subspreading. Sepals 1–2 mm long. Petals 3–4 mm long. Siliques nut-shaped, 3–6 mm long, 1–3 mm wide, rugose or subrugose, covered with verrucae and vesicles, usually tetragonal, walls thin, slightly tuberculate, with conical apex, unilocular, rarely bilocular, in this case slightly constricted in the middle.

Flowering (fruiting) period: April–May.

Habitat: Mountain slopes, 1,400–2,000 m.

Distribution: Afghanistan, Central Asia, Iran and Pakistan. Here this species is recorded for the first time from Iran.

Specimens examined: Iran: Prov. Khorassan, S Daregaz, between Rishkhar and Darbandi, Kalateh Gorni, 1,800 m. Coll.: Joharchi and Zangooei (18670), 28.5.1990 [FUMH!]. – NW Chenaran, Radkan, southern mountains of Merichgan, 1,400 m. Coll.: Ayatollahi and Zangooei (12793), 12.5.1985 [FUMH!]. – NE Chenaran, Radkan, Barou Mts, 1,500 m. Coll.: Ayatollahi and Zangooei (12737), 12.5.1985 [FUMH!]. – NW Mashhad, Talghur, 1,550 m. Coll.: Ayatollahi and Joharchi (13010), 18.5.1985 [FUMH!]. – SE Torbat-e Heydariyeh, between Roshtkhar and Khaf, Pir-e Yahoo, 2,000 m. Coll.: Ayatollahi and Zangooei (12406), 30.4.1985 [FUMH!]. – N Kashmar, Kuhsorkh, between Tajrud and Kharw, 1,900 m. Coll.: Faghihnia and Zangooei (25327b, 25338), 8.5.1995 [FUMH!].

*Tetracme*

*Tetracme* Bunge (Cruciferae: Matthioleae), with 10 species (Mabberly 2008) includes 6 species in the Iranian plateau, of which 1 is widespread in Iran (Rechinger 1968): *T. recurvata* Bunge. *Tetracme quadricornis* (Steph.) Bunge is recorded later only by one specimen from Semnan province (Esfandiari 1978);

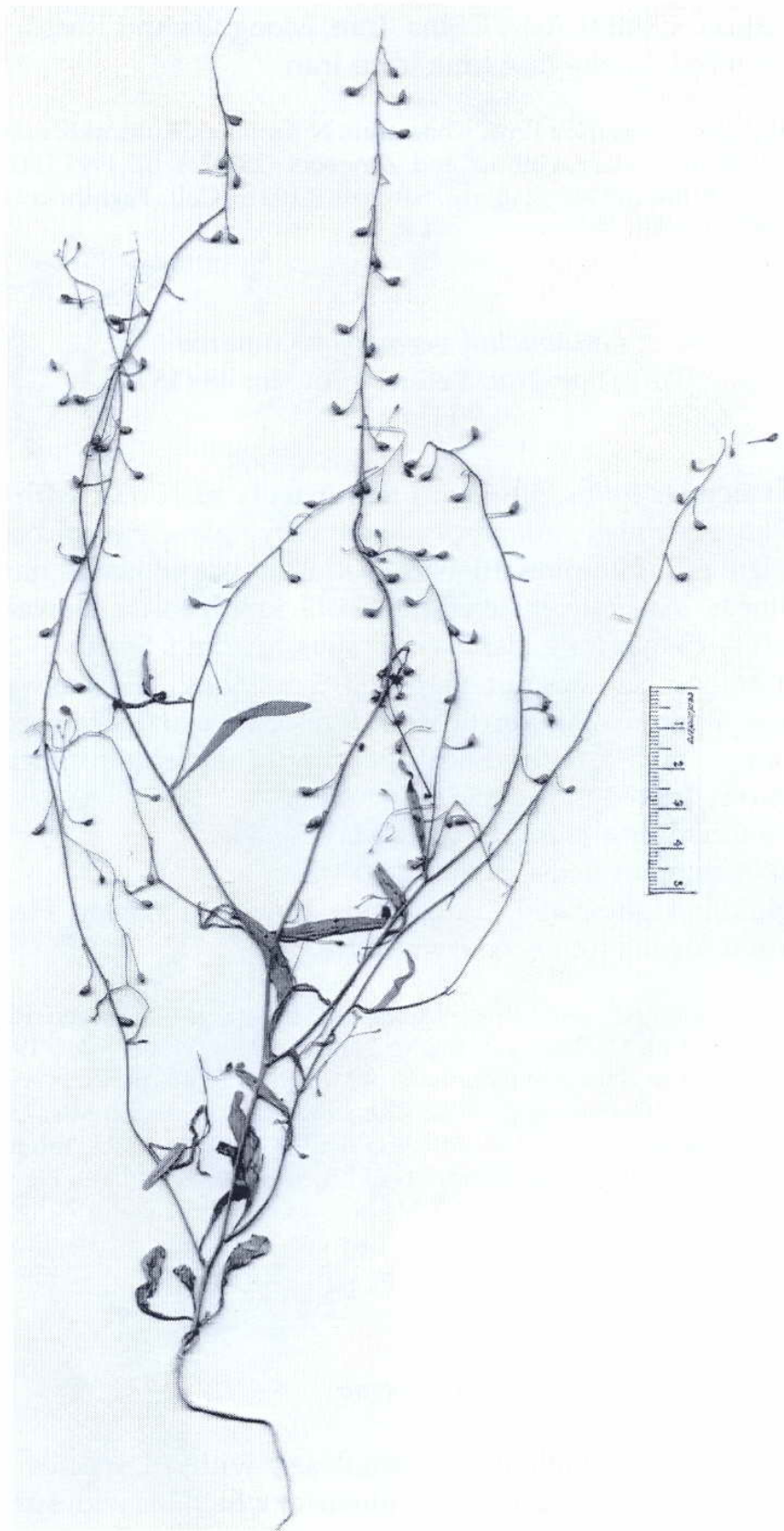


Fig. 3. *Goldbachia verrucosa* Komarov (Ayatollahi and Joharchi 13010, FUMH)

and *Tetracme contorta* Boiss. is recorded by Leonard (1983) from Isfahan province (Fig. 4). Here, specimens of this species are recorded for the first time from Khorassan. An identification key is given for the genus in Iran (Fig. 5).

An identification key for species *Tetracme* Bunge in Iran

- 1a Lower leaves entire or repand; siliques 6–8 mm long, subapical horns 1–2 mm long, erect or divaricate-ascending, straight; style indistinct  
*T. quadricornis*
- 1b Lower leaves pinnatifid or sinuate-dentate; style distinct 2
- 2a Siliques 3–5 mm long, downward contorted, recurved above; subapical horns 0.5–1 mm long, recurved  
*T. contorta*
- 2b Siliques 4–12 mm long, downward arcuate; subapical horns 2.5–6 mm long, spreading-recurved  
*T. recurvata*

*Tetracme contorta* Boiss.

Fl. Or. 1: 317 (1867)

(Fig. 5)

Annual herbs, 5–35 cm tall, erect, suberect or ascending, branched at base or to middle of stems. Indumentum soft canescens, somewhat densely pubescent with short branched hairs. Leaves linear, oblong-linear or oblong-lanceolate, pinnatifid or pinnatifid to distantly sinuate-dentate, rarely entire, 5–55 mm long, 1–12 mm broad. Racemes 5–25 flowered, 5–15 cm long, lax and very elongate. Flowers 2.5–5 mm across, whitish yellow; pedicels 3–4 mm long in fruit, thickened, erect, appressed. Sepals 1–2 mm long, sometimes purplish-green on outer sides. Petals 2–4 mm long, 1–2 mm broad. Stamens 0.75–1.5 mm long. Siliques 3–5 mm long, 0.25–1 mm broad, recurved above, somewhat contorted, densely pubescent; horns 0.5–1 mm long, often recurved. Stigma short, subsessile; seeds 4–5 in each locule, 0.5–1 mm long, suborbicular, brown.

Flowering (fruiting) period: April–May.

Habitat: Deserts, 450–500 m.

Distribution: Afghanistan, Iran and Pakistan (Baluchistan). Endemic for the Iranian plateau. This species is mentioned from Iran only with one specimen: "Esfahan: NE Naein, Dasht-e Kavir, 890 m, Leonard 5389, 5.4.1972"; here more localities are added. The following specimens are the first records for the province Khorassan.

Specimens examined: Iran: Prov. Khorassan, E Ghayen, Yazdan towards Afghanistan border, 500 m. Coll.: Joharchi and Zangooui (16003), 10.4.1988 [FUMH!]. – *ibid.*, between Yazdan and Petergan, 450 m. Coll.: Joharchi and Zangooui (16012), 10.4.1988 [FUMH!].

*Tetracme quadricornis* (Steph.) Bunge  
Delect. Sem. Hort. Bot. Dorpat. 7 (1836)  
(Fig. 5)

Annual herbs, 5–20 cm tall, tomentose throughout. Stem ascending, branched at or near base. Basal and lower leaves with petioles 2–8 mm long; leaf blade oblong-linear or narrowly oblanceolate, 10–50 × 2–6 mm, base attenuate, margin entire or rarely repand-dentate, apex obtuse. Upper leaves similar to basal ones, but smaller, subsessile, entire. Pedicels 1–1.5 mm long, subclavate, stout, about as wide as silique base, appressed to rachis. Sepals ovate, white. Petals white, narrowly oblanceolate, not clawed. Siliques linear, 5–8 mm long, compressed, torulose, distal half arcuate or recurved; apex not extended beyond horns; subapical horns 1–2 mm long, erect or divaricate-ascending, straight; style absent. Seeds yellow or light brown.

Flowering (fruiting) period: April–May.

Habitat: Deserts, saline clay soils, 1,200–1,300 m.

Distribution: Afghanistan, Central Asia, China, Iran, Mongolia and Russia.

Specimens examined: Iran: Prov. Semnan, W Semnan, between Sorkheh and Dahaghin, 1,250 m. Coll.: Mozzafarian (48842) [TARI!].



Fig. 4. Distribution map of *G. verrucosa* (triangle), *G. pendula* (diamond), *T. quadricornis* (square), *T. contorta* (six-point star), and *T. recurvata* (circle)



*Tetracme recurvata* Bunge  
 Arb. Naturf. Ver. Riga 1: 158 (1848)  
 (Fig. 5)

Annual herbs, 10–30 cm tall, tomentose throughout. Stems arcuate-ascending, several branched at or near base. Basal and lower leaves with petioles, 0.5–20 mm long; leaf blade oblong-linear or linear-lanceolate, 20–50 × 3–8 mm, base attenuate, margin pinnatifid, pinnatipartite, or sinuate-dentate, apex obtuse. Upper leaves similar to basal ones, but smaller, subsessile, sometimes entire pedicels 1–2 mm long, subclavate, stout, about as wide as silique base, appressed to rachis. Sepals ovate, 0.5–1 mm, purple or glaucescens; margin membranaceous petals white, spatulate or linear spatulate, 0.8–1.2 × 0.4–0.5 mm, attenuate to claw-like base. Siliques linear, 5–12 × 1–1.5 mm, compressed, tetragonous, not torulose, base appressed to rachis, distal half arcuate or recurved; apex extend beyond horns into flattened triangular, subapical horns 2.5–6 mm long, divaricate-reflexed, or recurved. Styles distinct to 1 mm long. Seeds grayish-yellowish or light brown, oblong.

Flowering (fruiting) period: April–June.

Habitat: Deserts, 450–1,350 m.

Distribution: Central Asia, China and Iran. From Iran only two specimens (Bunge s.n.!, Rechinger 3220 !) are recorded in Flora Iranica (from Khorassan: Sar Chah).

Specimens examined: Iran: Prov. Khorassan: S Torbat-e Heydariyeh, 18 km from Feyzabad to Bejestan, 1,000 m. Coll.: Hojjat and Zangoeei (28397), 13.5.1997 [FUMH!]. – N

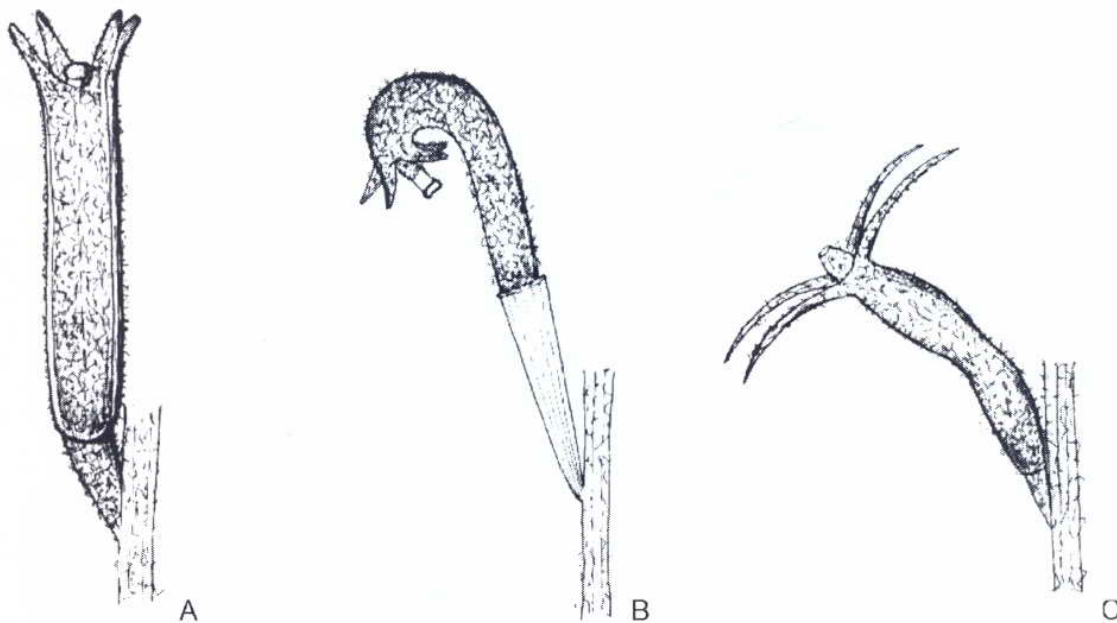


Fig. 5. Fruits of the *Tetracme* species: A = *T. quadricornis*, B = *T. contorta*, C = *T. recurvata*

Gonabad, Lout-e Omrani, 880 m. Coll.: Joharchi and Zangooei (17228), 13.5.1989 [FUMH!]. – SW Sabzevar, Parvand, 800 m. Coll.: Faghihnia and Zangooei (32459), 17.5.1999 [FUMH!]. – SW Kashmar, Nozar, 900 m. Coll.: Faghihnia and Zangooei (22882), 22.4.1993 [FUMH!]. – Khaf, Alinaghi towards Dochahi, 850 m. Coll.: Ayatollahi and Zangooei (14111), 5.5.1986 [FUMH!]. – NE Gonabad, 35 km from Bimorgh to Ahangaran, 900 m. Coll.: Faghihnia and Zangooei (23007), 27.4.1993 [FUMH!]. – E Ghayen, Mohammad abad, 1,050 m. Coll.: Joharchi and Zangooei (17376), 15.5.1989 [FUMH!]. – W Birjand, towards Khosf, Shahzileh hills, 1,350 m. Coll.: Zokaei (465), 14.4.1981 [FUMH!]. – N Tabas, towards Eshghabad, 800 m. Coll.: Ayatollahi and Zangooei (13832), 22.4.1986 [FUMH!]. – NE Tabas, between Deyhook and Boshrouyeh, 1,250 m. Coll.: Raafeei and Zangooei (26218), 14.4.1996 [FUMH!]. – W Tabas between Robot-e Khan and Robot-e Kalmard, 1,000 m. Coll.: Raafeei and Zangooei (26377), 16.4.1996 [FUMH!].

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