

PUNCTUREVINE

*Tribulus terrestris* L.

HISTORY AND ECOLOGY IN NORTH AMERICA

Jennifer E. Andreas<sup>1</sup>, Kristen Bowers<sup>2</sup>, and Joseph Milan<sup>3</sup>

<sup>1</sup>Washington State University Extension, <sup>2</sup>New Mexico State University, <sup>3</sup>Bureau of Land Management

SYNONYMS

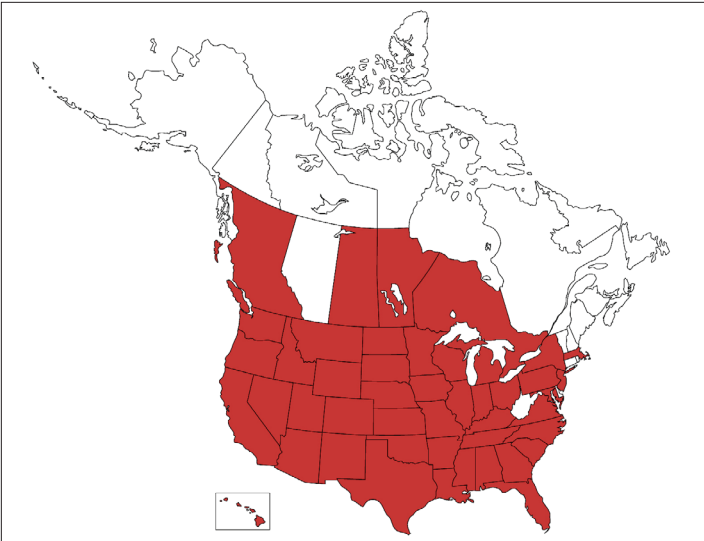
Goat head, caltrop, tackweed

CLASSIFICATION

RANKING	SCIENTIFIC NAME	COMMON NAME
Kingdom	Plantae	Plants
Subkingdom	Tracheobionta	Vascular plants
Superdivision	Spermatophyta	Seed plants
Division	Magnoliophyta	Flowering plants
Class	Magnoliopsida	Dicotyledons
Subclass	Rosidae	
Order	Sapindales	
Family	Zygophyllaceae	Caltrop family
Genus	<i>Tribulus</i>	
Species	<i>Tribulus terrestris</i> L.	Puncturevine

HISTORY AND DISTRIBUTION

Puncturevine is native to Asia, Africa, and Mediterranean Europe. It was accidentally introduced to North America as a contaminant on livestock by 1900. It subsequently spread throughout western North America and is currently present in 43 U.S. states and four Canadian provinces (Fig. 1).



**Figure 1.** Reported distribution of puncturevine in North America (Credit: EDDMapS, [www.eddmaps.org](http://www.eddmaps.org); USDA PLANTS Database, [plants.usda.gov](http://plants.usda.gov); both accessed 7 December 2023)

IMPACT

Puncturevine creates a dense, sprawling mat that excludes other plant species. Plants produce numerous spiny burs that readily puncture bicycle tires and footwear. The burs also puncture livestock feet and digestive tracts, and they contaminate wool, hay, and crop production. If consumed in large quantities, puncturevine can be toxic to grazing and foraging animals, especially sheep.

IDENTIFICATION  
At a Glance

Puncturevine (Fig. 2) is a prostrate summer annual with a deep taproot and stems that grow from a single point at the crown, creating a mat typically 2–7 ft (60–210 cm) in diameter. The leaves are opposite and compound, with 4–8 pairs of small elliptical leaflets. Flowers are up to ½ in (12 mm) across with five yellow petals. The spiny fruits are ½ in (12 mm) in diameter and break apart into five wedge-shaped, woody burs.

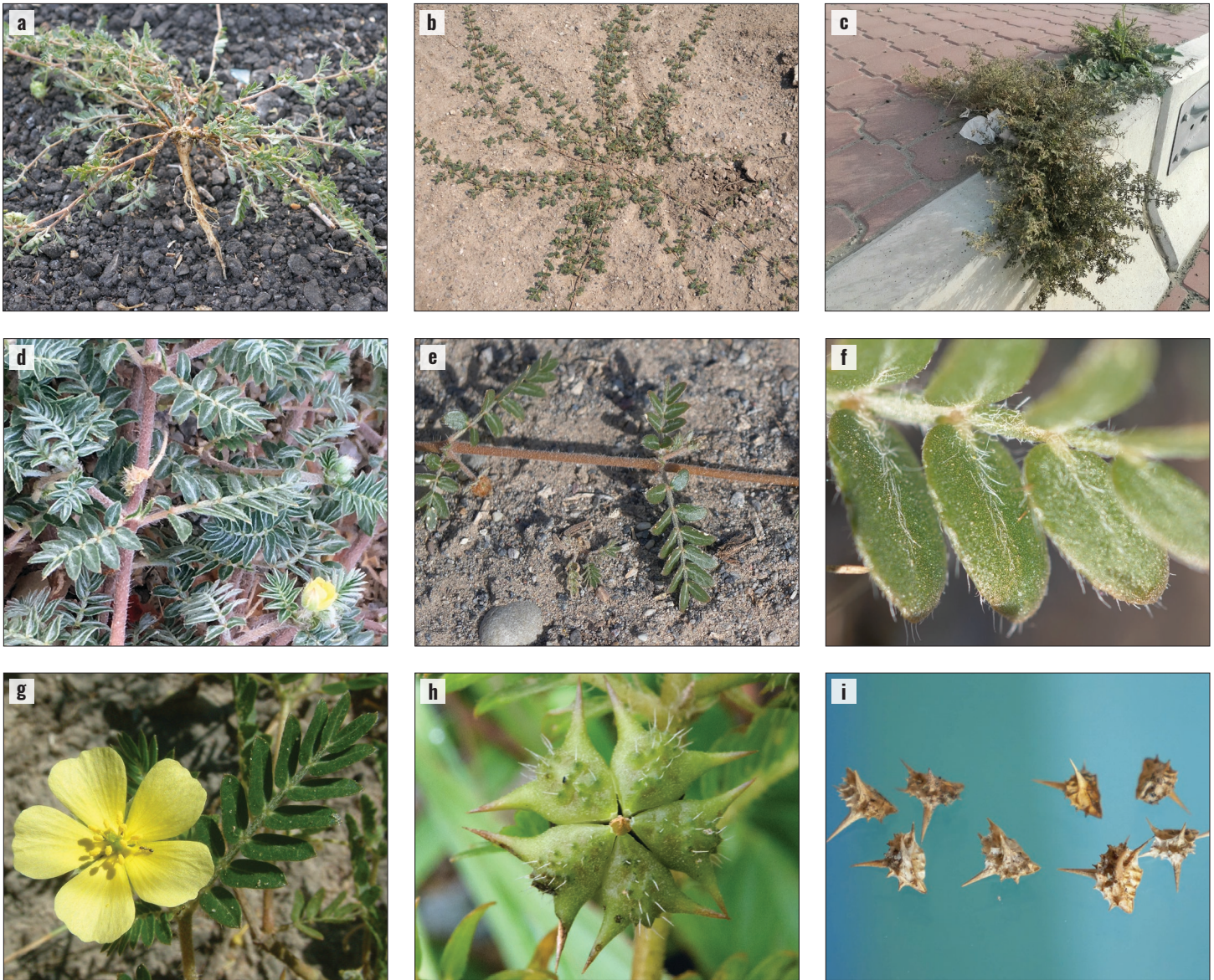
Roots

Puncturevine quickly develops a slender but deep taproot (Fig. 3a) that allows it to tolerate dry soils once it is established.



**Figure 2.** Puncturevine infestation (Travis McMahon, MIA Consulting)





**Figure 3.** Puncturevine (a) roots are slender but deep. Stems (b) radiate out from a single point at the crown and are typically prostrate, but may sometimes grow slightly vertically (c) over plants or angled spaces. Stems are often reddish and hairy (e). Leaves (f) are opposite and compound; each leaflet (f) is oval and hairy on the margins and midvein. Flowers (g) have 5 yellow petals. Fruits (h) are spiny and break into 5 burs (i) with long spines. (a,b,e,f,i: Travis McMahon, MIA Consulting; c: Mohammad Marafi, iNaturalist.org CC BY-NC 4.0; d: William Terry Hunefeld, iNaturalist.org CC BY 4.0; g: Peter Zika, iNaturalist.org CC BY-NC 4.0; h: Cheng-Tao Lin, iNaturalist.org CC BY 4.0).

### STEMS AND LEAVES

All stems grow outward from the root crown, creating a mat that is typically 2–7 ft (60–210 cm) in diameter (**Fig. 3b**). While most stems are prostrate along the ground, some stems may grow slightly vertically under certain conditions, such as in shade, in angled places (**see Fig. 4b**), or when growing over the top of other plants (**Fig. 3c**). Stems are moderately hairy and can vary in color from green to reddish-brown (**Fig. 3d**). The leaves are opposite and compoundly divided into 4–8 pairs of elliptical leaflets (**Fig. 3e**). Leaflets are generally  $\frac{1}{4}$ – $\frac{1}{2}$  in (6–12 mm) long, medium to dark green, and hairy along their margins and midveins (**Fig. 3f**).

### FLOWERS

Flowers are produced in leaf axils, where leaves attach to stems (**Fig. 3g**). They are usually less than  $\frac{1}{2}$  in (12 mm) in diameter and have five yellow, wedge-shaped petals.

### FRUITS AND SEEDS

The fruits are  $\frac{1}{2}$  in (12 mm) across and green at first (**Fig. 3h**). They become woody and brown at maturity and break apart into five angled burs. Each bur contains 1–5 seeds and has two large spines that give it a “goat head” appearance. Several short prickles, and sometimes two additional smaller spines, are also present. (**Fig. 3h,i**).



## ECOLOGY

Puncturevine spreads only by seed. In North America, plants germinate in spring and summer with sufficient soil moisture and warm temperatures. They rapidly develop taproots to ensure their survival during drier summer months. Plants can begin flowering as soon as three weeks after germination, and flowering will continue throughout the growing season. Seeds are often dormant the first year, germinating only in

the second, and may remain viable for up to five years. Most plants die back with autumn frosts, but in warm climates, a few may continue growing throughout the winter.

## HABITAT

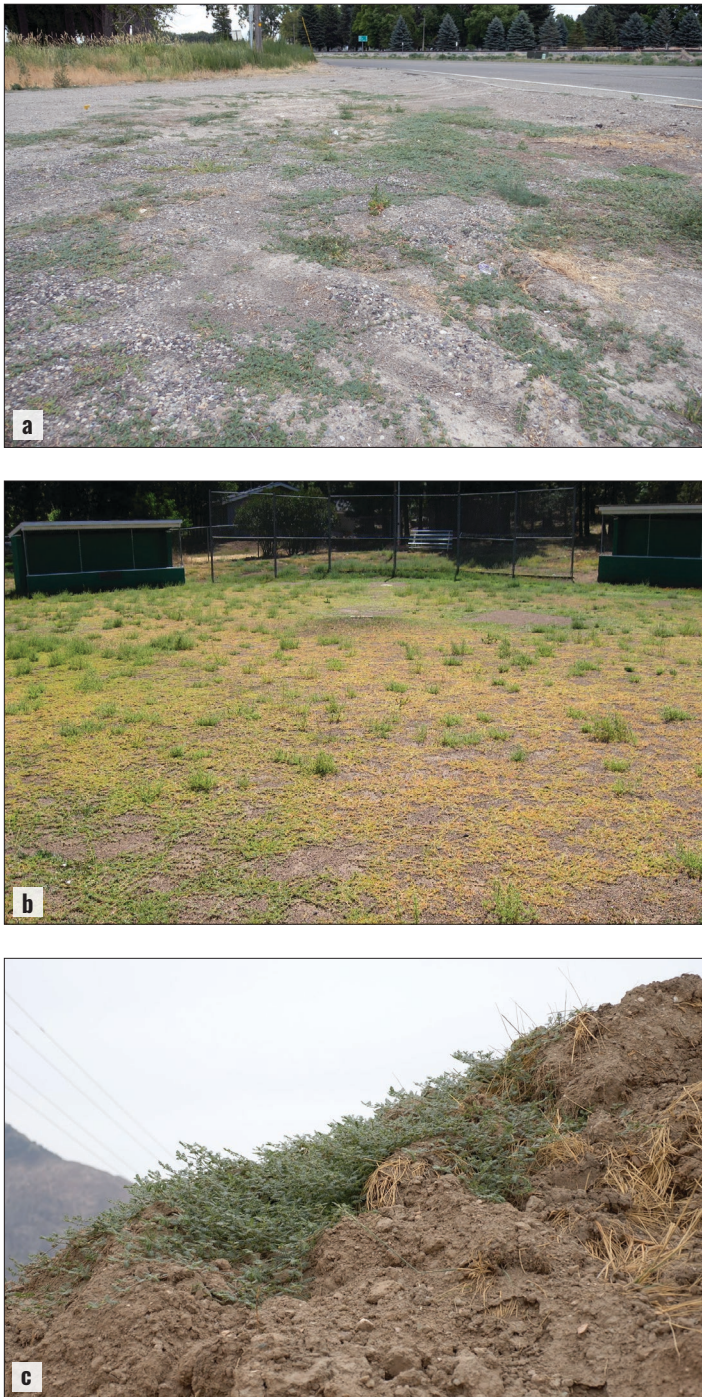
Puncturevine does well in semi-arid and Mediterranean climates with hot, dry summers and moist winters. It is most often found in areas of frequent disturbance, including roadways (Fig. 4a), recreational trails, sidewalks, crop and pasture margins, corrals, underneath power lines, and vacant or seldom-used lots (Fig. 4b). Limited plant competition and dry, sandy soil provide ideal conditions for puncturevine growth (Fig. 4c).

## SIMILAR SPECIES

Many species that are established in North America resemble puncturevine with their prostrate growth, including sandmat (*Cardionema ramosissima*), storksbill (*Erodium cicutarium*), and prostrate knotweed (*Polygonum aviculare*). However, most have different leaves and very different flowers and fruit. Common purslane (*Portulaca oleracea*) is a prostrate weed with a similar growth form and similar five-petal yellow flowers. Common purslane leaves are not compound like puncturevine. They resemble the leaflets of puncturevine except they are more succulent. Common purslane also produces a pod fruit rather than burs. Prior to fruit production, native species of caltrop (*Kallstroemia* spp.) resemble puncturevine with their prostrate growth, opposite, compound leaves, and yellowish flowers. However, their stems are typically only a few feet long, they have fewer leaflet pairs, and their fruits are beaked and break into ten burs. Species most closely resembling puncturevine are listed in Table 1, along with key characteristics that can be used for differentiation.

## REFERENCES
















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**Figure 4.** Puncturevine is often found in disturbed and dry areas with little competition from other plants (a,c: Travis McMahon, MIA Consulting; b: Todd Pfeiffer, Klamath County Weed Control, Bugwood.org CC BY 3.0 US DEED)



**Table 1.** Key traits for differentiating puncturevine from similar species. Table modified from Andreas et al. 2022.

SPECIES	SIMILARITIES	DIFFERENCES	PLANT	LEAVES	FLOWER
<b>Sandmat</b> <i>Cardionema ramosissima</i> Native to North and South America	Prostrate growth; taproot; opposite leaves; prickly leaves may resemble young spiny puncturevine fruit	Perennial; stems only up to 1 ft (30 cm) long; leaves needle-like, crowded; flowers tiny, greenish, and non-showy; fruit tiny, brown, not spiny			
<b>Storksbill, redstem filaree</b> <i>Erodium cicutarium</i> Native to Europe, Asia, and northern Africa	Annual; rosette leaves prostrate, arise from center point; taproot; stems may be reddish, hairy; leaves hairy, finely divided, resembling puncturevine compound leaves from a distance	Flower stems may be erect; leaves 4–8 in (10–20 cm) long with fern-like divisions; flowers pink to lavender; long, thin capsule fruits burst into spirals at maturity			
<b>Prostrate knotweed</b> <i>Polygonum aviculare</i> Native to Europe, Asia, and northern Africa	Annual; prostrate growth; stems up to 5 ft (90 cm) long (typically shorter); leaves alternate; some leaves similar size, shape	Leaves not compound; some leaves more lance-shaped, longer (up to 1.2 in or 3 cm); papery sheath at leaf bases; flowers tiny, whitish or pink petals; fruit tiny, brown, not spiny			
<b>Common purslane</b> <i>Portulaca oleracea</i> Native to Africa and the Mediterranean	Annual; prostrate growth; taproot; stems may be reddish; some leaves opposite; leaves similar size, shape to puncturevine leaflets; flowers with five yellow petals	Stems typically only 1 ft (30 cm) long; leaves not compound; leaves succulent, not hairy; some leaves alternate; pod fruit, not spiny			
<b>California caltrop</b> <i>Kallstroemia californica</i> Native to southwestern North America	Annual; prostrate growth; taproot; stems may be reddish, hairy; leaves opposite, compound; leaflets elliptical; flowers with five yellow petals	Stems only up to 2 ft (60 cm) long; leaflet pairs only up to six; flowers slightly smaller; fruits with beaked tip, break apart into 10 woody burs; burs not nearly as spiny			

**Photos:** sandmat plant (Tiyumq, iNaturalist.org, CC BY-NC 4.0), sandmat leaves and flower (Ken-ichi Ueda, iNaturalist.org, CC BY 4.0); storksbill plant (liddlebobeep, iNaturalist.org, CC BY-NC 4.0), storksbill leaves and flower (Bonnie Minnion, BLM, Bugwood.org, CC BY 3.0 US); prostrate knotweed plant (Norma Malinowski, CC BY-NC 4.0), prostrate knotweed leaves (megachile, iNaturalist.org, CC BY-NC 4.0), prostrate knotweed flower (Andreas Rockstein, iNaturalist.org, CC BY-SA 4.0); common purslane plant (Forest & Kim Starr, Starr Environmental, CC BY 4.0), common purslane leaves (willko5, iNaturalist.org, CC BY-NC 4.0), common purslane flower (Randy A. Nonenmacher, iNaturalist.org, CC BY-SA 4.0); California caltrop plant and leaves (Frankie Coburn, iNaturalist.org, CC BY-NC 4.0), California caltrop flower (Heriberto Avila G., iNaturalist.org, CC BY-NC 4.0).

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## SUGGESTED CITATION

Andreas, J.E., K. Bowers, and J. Milan. 2024. Puncturevine (*Tribulus terrestris*): History and Ecology in North America. In: R.L. Winston, Ed. Biological Control of Weeds in North America. North American Invasive Species Management Association, Milwaukee, WI. NAISMA-BCW-2024-9-PUNCTUREVINE-P.

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