Tribulus terrestris L.

Puncturevine

Family: Zygophyllaceae
Range: Most contiguous states, including all western states. Also found nearly worldwide.
Habitat: Disturbed places, roadsides, railways, cultivated crops, orchards, vineyards, waste places, and walkways. Prevalent in areas with a hot summer. Grows best on dry, sandy soils, but tolerates most soil types. Killed by freezing temperatures.
Origin: Native to the Mediterranean region.
Impacts: Typically found along roadsides or in waste areas. Impacts in wildlands and rangelands are probably minor. More of a nuisance to humans or a threat to livestock due to its toxicity. During the first half of the 1900s, puncturevine was one of the most problematic roadside weeds in the U.S., as its burs easily punctured the tires of early cars. The foliage contains a number of saponin compounds that can be toxic to livestock, especially sheep, when ingested in quantity. It is also a noxious weed in many regions of Australia.
Western states listed as Noxious Weed: Arizona, California, Colorado, Idaho, Nevada, Oregon, Washington

Puncturevine is a prostrate summer annual with green to reddish-brown stems, spreading radially from a central crown. It has even-pinnate-compound leaves, with 3 to 7 pairs of leaflets per leaf.

Plants produce small, solitary yellow flowers, which develop into burs with stout spines that can injure people and animals, as well as puncture bicycle tires. Puncturevine reproduces only by seed. It produces 5-sided woody burs, about 5 to 12 mm in diameter, which separate into wedge-shaped nutlets, each with 2 stout spines and several short prickles. These spiny nutlets–with seeds inside–disperse on vehicle tires, shoes and clothing, and the fur, feathers, and feet of animals. Puncturevine seed germination requires warm temperatures. Buried seed usually remain viable for 3 to 6 years. Seedlings emerge from early spring through summer, often in flushes following increased soil moisture. Seedlings develop a deep taproot within a few weeks. Flowers may be produced within 3 weeks and burs within 6 weeks of germination.

NON-CHEMICAL CONTROL

Mechanical (pulling, cutting, disking)	Hand-pulling is feasible when the population is low, especially when soils are moist and the vines are sufficiently long to allow pulling. However, plants should be pulled before the spiny fruit develop. Mowing is ineffective because of the low growth form of the plant. Hoeing and shallow cultivation are effective at killing existing plants, and should be initiated before flowering and seed production. Shallow tilling to 1 inch or less is sufficient, particularly when plants are small. Deep tillage is not recommended, because it may bury seed deep in the soil profile, where they will survive longer.
Cultural	Neither grazing nor burning are recommended practices as plants are poisonous and the low growing habit precludes fire as a management option. Planting competitive vegetation or the application of 4 to 6 inches of mulch have been used to suppress puncturevine infestations. Areas with bare ground are idea sites for puncturevine growth, even with only limited amounts of rainfall. In areas with an existing seed bank, seed can be harvested by placing carpet or other “sticky” material on boards or a roller that are then applied to or rolled over the soil. With several passes, most of the seed on the soil can be removed.

Biological	In 1961, the stem weevil (*Microlarinus lypriformis*) and seed weevil (*Microlarinus lareynii*) were introduced from Italy as biocontrol agents. They have proved to be a successful management tool for puncturevine. A resurgence of the weed occurred again in central California in the mid-1990s, prompting the rearing and reintroduction of the seed weevil. Today, the insects help to maintain puncturevine populations at low levels. However, the insects are sensitive to prolonged periods of frost. Thus, populations of puncturevine may increase after years with cold winters. This is more prevalent in northern states.

CHEMICAL CONTROL

The following specific use information is based on published papers and reports by researchers and land managers. Other trade names may be available, and other compounds also are labeled for this weed. Directions for use may vary between brands; see label before use. Herbicides are listed by mode of action and then alphabetically. The order of herbicide listing is not reflective of the order of efficacy or preference.

GROWTH REGULATORS	
2,4-D Several names	**Rate:** 2 to 4 pt product/acre (0.95 to 1.9 lb a.e./acre) **Timing:** Postemergence every 3 weeks during the growing season or when new seedlings appear. **Remarks:** 2,4-D is a broadleaf herbicide with no soil activity. Seeds will germinate throughout summer when moisture is available. Retreatment may be necessary if new germination occurs. Avoid drift to sensitive crops.
Aminocyclopyrachlor + chlorsulfuron *Perspective*	**Rate:** 4.75 to 8 oz product/acre **Timing:** Postemergence, to rapidly growing young plants. **Remarks:** *Perspective* provides broad-spectrum control of many broadleaf species. Although generally safe for grasses, it may suppress or injure certain annual and perennial grass species. Do not treat in the root zone of desirable trees and shrubs. Do not apply more than 11 oz product/acre per year. At this high rate, cool-season grasses will be damaged, including bluebunch wheatgrass. Not yet labeled for grazing lands. Add an adjuvant to the spray solution. This product is not approved for use in California and some counties of Colorado (San Luis Valley).
Dicamba *Banvel, Clarity*	**Rate:** 1 to 2 pt product/acre (0.5 to 1 lb a.e./acre) **Timing:** Postemergence, to rapidly growing young plants. Older plants are more difficult to control. **Remarks:** Dicamba is a broadleaf-selective herbicide often combined with other active ingredients. Retreat as needed, but do not exceed 2 qt product/acre during growing season. Dicamba may leach in sandy soils. Do not apply when outside temperatures exceed 80°F. *Overdrive,* a premix of dicamba with diflufenzopyr, has been reported to be effective on puncturevine. Diflufenzopyr is an auxin transport inhibitor which causes dicamba to accumulate in shoot and root meristems, increasing its activity. *Overdrive* is applied postemergence at 4 to 8 oz product/acre rapidly growing plants. Higher rates should be used on large annuals. Add a non-ionic surfactant to the treatment solution at 0.25% v/v or a methylated seed oil at 1% v/v solution.
Fluroxypyr *Vista XRT*	**Rate:** 22 oz product/acre (7.7 oz a.e/acre) **Timing:** Postemergence, before budding when plants are still small and rapidly growing. **Remarks:** Do not apply more than 22 oz product/acre per year.
Picloram + 2,4-D *Tordon 101M*	**Rate:** 2 to 4 pt product/acre **Timing:** Postemergence, before flowering when plants are growing rapidly. **Remarks:** Picloram has long soil residual activity. *Tordon 101M* is a federally restricted use pesticide. Picloram is not registered for use in California.
AROMATIC AMINO ACID INHIBITORS	
Glyphosate *Roundup, Accord XRT II,* and others	**Rate:** Broadcast treatment: 2 to 4 pt product (*Roundup ProMax*)/acre (1.1 to 2.25 lb a.e./acre). Spot treatment: 0.5% to 1% v/v solution. **Timing:** Postemergence, to rapidly growing young plants. Older plants are more difficult to control. **Remarks:** Glyphosate is a nonselective herbicide. It has no soil activity and its effectiveness is increased by the addition of ammonium sulfate to prevent the active ingredient from precipitating with cationic salts. Add non-ionic surfactant.

BRANCHED-CHAIN AMINO ACID INHIBITORS	
Chlorsulfuron *Telar*	**Rate:** 1 to 2.6 oz product/acre (0.75 to 1.95 oz a.i./acre) **Timing:** Preemergence or early postemergence. **Remarks:** Chlorsulfuron has mixed selectivity, but is generally safe on grasses. Use a surfactant for postemergence applications. It has long soil residual activity.
Imazapic *Plateau*	**Rate:** 8 to 12 oz product/acre (2 to 3 oz a.e./acre) **Timing:** Early postemergence when plants are growing rapidly. **Remarks:** Imazapic is primarily active on annual grasses. Add 1 qt/acre methylated seed oil. Do not exceed 25 gal/acre spray volume. Imazapic is not registered for use in California.
Imazapyr *Arsenal, Habitat, Stalker, Chopper, Polaris*	**Rate:** 2 to 3 pt product/acre (8 to 12 oz a.e./acre) **Timing:** Preemergence or postemergence. **Remarks:** Imazapyr is a nonselective herbicide and has long soil residual activity. Treatments often result in more bare ground than other treatments, even 1 year after application.
Rimsulfuron *Matrix*	**Rate:** 4 oz product/acre (1 oz a.i./acre) **Timing:** Preemergence to postemergence, when target plants are 1 to 3 inches wide. **Remarks:** Rimsulfuron controls several annual grasses and broadleaves. Perennial grasses are tolerant to fall applications when established and grown under dryland conditions. Application to rapidly growing or irrigated perennial grasses may result in their injury or death. It provides soil residual control in cool climates but degrades rapidly under warm conditions. Rimsulfuron will not control summer annual weeds when applied in fall or spring. Add a surfactant when applying postemergence. It must be activated by rainfall or irrigation of at least half an inch. For the best results, rainfall should occur within 2 to 3 weeks of application and under cooler temperatures. Do not apply more than 4 oz product/acre per year.
CONTACT PHOTOSYNTHETIC INHIBITORS	
Paraquat *Gramoxone*	**Rate:** Broadcast treatment: 1.33 to 2.67 pt product/acre (5.3 to 10.7 oz a.i./acre). Spot treatment: 0.25% to 0.5% v/v solution. **Timing:** Postemergence, to rapidly growing young plants. Older plants are more poorly controlled. Activity appears to be better when applied under cloudy conditions and worst under full sunlight. **Remarks:** Paraquat is a contact herbicide that is nonselective on annuals. Good coverage is necessary for effective control. It has no soil activity and is a restricted-use herbicide.

RECOMMENDED CITATION: DiTomaso, J.M., G.B. Kyser et al. 2013. *Weed Control in Natural Areas in the Western United States*. Weed Research and Information Center, University of California. 544 pp.