Pest Management and Identification

Tarweeds

Scientific Name: *Hemizonia* spp. (Family Asteraceae)

Click on image to enlarge.

DESCRIPTION:
Tarweeds, which include several species in the sunflower family, occur throughout California. All have sticky, heavily scented foliage. Mature plants are usually about 1 to 1.5 feet (30 - 45 cm) high. Lower leaves are deeply lobed and lancelike. Upper leaves are flattened against the stem, glandular and hairy. The petals have three-toothed edges and may be yellow or white depending on species and variable in number from 3 to many per flower. Shown here is three-rayed tarweed.

Broadleaf ID illustration.

Tarweeds

Tarweeds are delightful plants that provide fields of yellow color on the Plateau long after most plants have succumbed to heat and dryness. To our knowledge, they are the only flowers that form true **rings around the vernal pools** of the Plateau, at least in the last five years.

The Name: Tarweed, tarplant, gumweed, gum plant and rosinweed...all these names refer to the sticky substance on the surface of the leaves and stems of these plants. One reference says it "...coats the faces and legs of livestock with a tarry resin"[2] and another says "tarweed mascaras the horses' muzzles"[1] meaning the tarry substance sticks to the animals faces and the dirt sticks to that. This reference goes on further to say that the "...viscid exudation is particularly ruinous to wool and clothing, but alcohol is a solvent for it, and will generally remove it."[1]

Adaptations to California's climate: Tarweeds are "late bloomers", flowering after the grasslands and vernal pools have become dry. Because they bloom during summer they have less competition from other spring-blooming herbs and grasses for pollinators and for water, soil nutrients and light.

They are coated with resinous material that helps to retard water loss during the heat of the day. The strong smell and sticky substance also help to repel things that might eat them earlier in the spring when they are young and tender.

Tarweed relies on stored soil moisture for summer growth:

By the end of winter, the tarweed plant has developed a deep taproot and about a dozen broad leaves in a rosette. Roots of tarweed go deeper than most of the winter annual grasses, reducing competition with them for soil nutrients and moisture. The shallow-rooted, short statured, early maturing alien annual grasses use less light and water than the late successional perennial grasses or taller annual grasses. This results in a surplus of moisture that tarweed is able to utilize.[2]

We have, so far, observed two different tarweeds at the SRP:

- Slender tarweed (*Hemizonia fasciculata*)
- Sticky tarweed (*Holocarpha virgata ssp. elongata*)

The following table gives the characteristics of each species **as we have observed them on the Plateau**. A few bracketed items [...] give information from others that have not yet been verified by us.

Characteristics	Slender Tarweed	Sticky Tarweed
Common names	slender tarweed	sticky tarweed

	clustered tarweed fascicled tarweed	yellow tarweed graceful tarplant
Scientific names	*Hemizonia fasciculata* *Hemizonia ramosissima*	*Holocarpha virgata ssp. elongata*
Bloom period (seasonal)	late May to ? [May-Nov]	June to ? [Nov]
Flower	yellow	yellow
# of rays (3-lobed petal-like outer flowers)	5	3-7
# of disks (center flowers with black anthers)	6	9-25
Leaf-like structures beneath flower head (phyllaries)	keeled, barely overlapping	many, little, gland-tipped projections
Flower position	many, clustered at tips of branches	few, at tip of stalk or along branch with a short stem
Shape of plants	rounded, multi-branched	single upright stem, branching above half way up
Size	1-2' [up to 40"]	6"-2' [up to 4']
Location	ring the vernal pools	open, dry slopes, swales, edges of trails and roads
Soil	volcanic, primarily	hard-baked or heavy clay soils
Leaf shape	linear, wider at base, tapering to a slender tip	(1) linear one lower on the stem, getting smaller as they go up the stem (2) reduced, short, stubby leaflets in the axil beginning higher on the stem
Leaf margin	long pointed, indented teeth	(1) linear: widely separated, short, sharp teeth (2) short: tip truncated (cut-off) with a pit at end, difficult to see without a magnifying glass
Leaf texture	sandpapery	sandpapery
Leaf habit (1)	falls off at base when	linear leaf falls off at base when

	flowering begins	flowering begins, small leaf remains on stem
Leaf habit (2)	leaf pressed against stem	linear leaf at right angles to stem; smaller, reduced cleft leaf hugging stem; crowded on upper stem
Leaf habit (3)	[may be rosette in spring]	[may be rosette in spring]
Sticky part	stem and leaf	leaf tip
Scented part	flower	leaf
Seeds	not yet observed by us	not yet observed by us
Plant associations	downingia, button celery, grasses, sticky tarweed	vinegarweed, turkey mullein aka dove weed, grasses
Plant uses	pollen for honeybees, forage for livestock, seeds for Indians, ground squirrels, songbirds, gamebirds	
Native	yes	yes
Book references	Dale, *Flowering Plants*, p. 67 Niehaus and Ripper, *A Field Guide to Pacific States Wildflowers*, p. 192 Munz, *A California Flora* Hickman, *The Jepson Manual* Schoenherr, *A Natural History of California*, p. 522	
Other web pictures	1, 2, 3	1, 2
Web references	(1) The Scent of Summer (2) Ecology and Management of Tarweed (3) Graceful Tarplant from Craig H. Reiser's Rare Plants of San Diego County (4) Graceful Tarplant from theWestern Riverside County Multiple Species Habitat Conservation Plan	
Diagrams	Slender Tarweed	Sticky Tarweed

If anyone can positively identify any other tarweeds at the SRP or has additional information that would help to clarify the distinctions, we would be deeply appreciative if you would send us an email.

Go to:

- *Field Guide to the Santa Rosa Plateau: Plants*
- *Bloom Identification Guide For The Santa Rosa Plateau: Yellow Blooms*

The Jepson Herbarium
University of California, Berkeley

Review of name changes in California tarweeds

by Bruce G. Baldwin
Jepson Herbarium

Phylogenetic and biosystematic findings led me to revise the generic positions of some tarweed (Madiinae) taxa previously placed in *Hemizonia, Madia,* and *Raillardiopsis* [see Baldwin, Novon 9: 462--471 (1999)]. To achieve a taxonomy of monophyletic genera, the circumscriptions of *Hemizonia* and *Madia* were narrowed, *Raillardiopsis* was abandoned, and genera were erected or resurrected for taxa removed from the three genera. Additional revisions, at the species and subspecies levels, were necessary in *Blepharizonia* and *Hemizonia* [see Baldwin et al., Systematic Botany 26: 184-194 (2001)].

The following table provides the names for species and subspecies treated in *Blepharizonia, Hemizonia, Madia,* and *Raillardiopsis* in The Jepson Manual and the currently accepted names for the same groups. Please note that circumscriptions or applications of names for species and subspecies in The Jepson Manual have not changed except for the following revisions:

1. *Deinandra (Hemizonia) increscens* subsp. *increscens* has been redelimited to exclude populations from Alameda County, now treated as a distinct species, *Deinandra bacigalupii* [see Baldwin, Madroño 46: 55-57 (1999)].
2. The types of *Hemizonia congesta* subsp. *congesta* and *Hemizonia congesta* subsp. *leucocephala* have been found to belong to the same taxon, with the name *H. congesta* subsp. *congesta* having priority.
3. The name *Hemizonia congesta* subsp. *congesta* was misapplied in The Jepson Manual to representatives of *H. congesta* subsp. *lutescens*.
4. *Blepharizonia plumosa* subsp. *viscida* is now treated as *Blepharizonia laxa.*
5. *Blepharizonia plumosa* subsp. *plumosa* is now treated as *Blepharizonia plumosa* (no subsp. recognized).

Name in The Jepson Manual	Revised name
BLEPHARIZONIA plumosa (Kellogg) Greene subsp. plumosa	BLEPHARIZONIA plumosa (Kellogg) Greene
BLEPHARIZONIA plumosa (Kellogg) Greene subsp. viscida D. D. Keck	BLEPHARIZONIA laxa Greene
HEMIZONIA arida D. D. Keck	DEINANDRA arida (D. D. Keck) B.G. Baldwin
HEMIZONIA clementina Brandegee	DEINANDRA clementina (Brandegee) B.G. Baldwin
HEMIZONIA congesta DC. subsp. congesta	HEMIZONIA congesta DC. subsp. lutescens (Greene) Babc. & H. M. Hall.
HEMIZONIA congesta DC. subsp. leucocephala (Tanowitz) Keil	HEMIZONIA congesta DC. subsp. congesta.
HEMIZONIA conjugens D. D. Keck	DEINANDRA conjugens (D. D. Keck) B.G. Baldwin
HEMIZONIA corymbosa (DC.) Torr. & A. Gray	DEINANDRA corymbosa (DC.) B.G. Baldwin
HEMIZONIA corymbosa (DC.) Torr. & A. Gray subsp. corymbosa	DEINANDRA corymbosa (DC.) B.G. Baldwin subsp. corymbosa
HEMIZONIA corymbosa (DC.) Torr. & A. Gray subsp. macrocephala (Nutt.) D. D. Keck	DEINANDRA corymbosa (DC.) B.G. Baldwin subsp. macrocephala (Nutt.) B.G. Baldwin
HEMIZONIA fasciculata (DC.) Torr. & A. Gray	DEINANDRA fasciculata (DC.) Greene
HEMIZONIA fitchii A. Gray	CENTROMADIA fitchii (A. Gray) Greene

HEMIZONIA floribunda A. Gray	DEINANDRA floribunda (A. Gray) Davidson & Moxley
HEMIZONIA halliana D. D. Keck	DEINANDRA halliana (D. D. Keck) B.G. Baldwin
HEMIZONIA increscens (H. M. Hall ex D. D. Keck) Tanowitz	DEINANDRA increscens (H.M. Hall ex D. D. Keck) B.G. Baldwin
HEMIZONIA increscens (H. M. Hall ex D. D. Keck) Tanowitz subsp. increscens	DEINANDRA increscens (H.M. Hall ex D. D. Keck) B.G. Baldwin subsp. increscens
HEMIZONIA increscens (H. M. Hall ex D. D. Keck) Tanowitz subsp. foliosa (Hoover) Tanowitz	DEINANDRA increscens (H.M. Hall ex D. D. Keck) B.G. Baldwin subsp. foliosa (Hoover) B.G. Baldwin
HEMIZONIA increscens (H. M. Hall ex D. D. Keck) Tanowitz subsp. villosa Tanowitz	DEINANDRA increscens (H.M. Hall ex D. D. Keck) B.G. Baldwin subsp. villosa (Tanowitz) B.G. Baldwin
HEMIZONIA kelloggii Greene	DEINANDRA kelloggii (Greene) Greene
HEMIZONIA lobbii Greene	DEINANDRA lobbii (Greene) Greene
HEMIZONIA minthornii Jeps.	DEINANDRA minthornii (Jeps.) B.G. Baldwin
HEMIZONIA mohavensis D. D. Keck	DEINANDRA mohavensis (D. D. Keck) B.G. Baldwin
HEMIZONIA pallida D. D. Keck	DEINANDRA pallida (D. D. Keck) B.G. Baldwin
HEMIZONIA paniculata A. Gray	DEINANDRA paniculata (A. Gray) Davidson & Moxley
HEMIZONIA parryi Greene	CENTROMADIA parryi (Greene) Greene
HEMIZONIA parryi Greene subsp. parryi	CENTROMADIA parryi (Greene) Greene subsp. parryi
HEMIZONIA parryi Greene subsp. australis D. D. Keck	CENTROMADIA parryi (Greene) Greene subsp. australis (D. D. Keck) B.G. Baldwin
HEMIZONIA parryi Greene subsp. congdonii (B. L. Rob. & Greenm.) D. D. Keck	CENTROMADIA parryi (Greene) Greene subsp. congdonii (B. L. Rob. & Greenm.) B.G. Baldwin
HEMIZONIA parryi Greene subsp. rudis (Greene) D. D. Keck	CENTROMADIA parryi (Greene) Greene subsp. rudis (Greene) B.G. Baldwin
HEMIZONIA pentactis (D. D. Keck) D. D. Keck	DEINANDRA pentactis (D. D. Keck) B.G. Baldwin
HEMIZONIA pungens (Hook. & Arn.) Torr. & A. Gray	CENTROMADIA pungens (Hook. & Arn.) Greene
HEMIZONIA pungens (Hook. & Arn.) Torr. & A. Gray subsp. pungens	CENTROMADIA pungens (Hook. & Arn.) Greene subsp. pungens
HEMIZONIA pungens (Hook. & Arn.) Torr. & A. Gray subsp. laevis D. D. Keck	CENTROMADIA pungens (Hook. & Arn.) Greene subsp. laevis (D. D. Keck) B.G.

	Baldwin
HEMIZONIA pungens (Hook. & Arn.) Torr. & A. Gray subsp. maritima (Greene) D. D. Keck	CENTROMADIA pungens (Hook. & Arn.) Greene subsp. maritima (Greene) B.G. Baldwin
HEMIZONIA pungens (Hook. & Arn.) Torr. & A. Gray subsp. septentrionalis D. D. Keck	CENTROMADIA pungens (Hook. & Arn.) Greene subsp. septentrionalis (D. D. Keck) B.G. Baldwin
MADIA bolanderi (A. Gray) A. Gray	KYHOSIA bolanderi (A. Gray) B.G. Baldwin
MADIA doris-nilesiae T.W. Nelson & J.P. Nelson	HARMONIA doris-nilesiae (T.W. Nelson & J.P. Nelson) B.G. Baldwin
MADIA hallii D. D. Keck	HARMONIA hallii (D. D. Keck) B.G. Baldwin
MADIA madioides (Nutt.) Greene	ANISOCARPUS madioides Nutt.
MADIA minima (A. Gray) D. D. Keck	HEMIZONELLA minima A. Gray
MADIA nutans (Greene) D. D. Keck	HARMONIA nutans (Greene) B.G. Baldwin
MADIA rammii Greene	JENSIA rammii (Greene) B.G. Baldwin
MADIA stebbinsii T.W. Nelson & J.P. Nelson	HARMONIA stebbinsii (T.W. Nelson & J.P. Nelson) B.G. Baldwin
MADIA yosemitana Parry ex A. Gray	JENSIA yosemitana (Parry ex A. Gray) B.G. Baldwin
RAILLARDIOPSIS muirii (A. Gray) Rydb.	CARLQUISTIA muirii (A. Gray) B.G. Baldwin
RAILLARDIOPSIS scabrida (Eastw.) Rydb.	ANISOCARPUS scabridus (Eastw.) B.G. Baldwin
Taxon recently described	DEINANDRA bacigalupii B.G. Baldwin
Taxon recently described	HARMONIA guggolziorum B.G. Baldwin

The following names are still in use

HEMIZONIA congesta DC.	Name remains the same
HEMIZONIA congesta DC. subsp. calyculata Babc. & H.M. Hall	Name remains the same
HEMIZONIA congesta DC. subsp. clevelandii (Greene) Babc. & H.M. Hall	Name remains the same
HEMIZONIA congesta DC. subsp. luzulifolia (DC.) Babc. & H.M. Hall	Name remains the same
HEMIZONIA congesta DC. subsp. tracyi Babc. & H.M. Hall	Name remains the same
MADIA anomala Greene	Name remains the same
MADIA citrigracilis D. D. Keck	Name remains the same
MADIA citriodora Greene	Name remains the same
MADIA elegans Lindl.	Name remains the same

MADIA exigua (Sm.) A. Gray	Name remains the same
MADIA glomerata Hook.	Name remains the same
MADIA gracilis (Sm.) D. D. Keck	Name remains the same
MADIA radiata Kellogg	Name remains the same
MADIA sativa Molina	Name remains the same
MADIA subspicata D. D. Keck	Name remains the same

Review of name changes in Baja California tarweeds

HEMIZONIA frutescens A. Gray	DEINANDRA frutescens (A. Gray) B. G. Baldwin
HEMIZONIA greeneana Rose subsp. greeneana	DEINANDRA greeneana (Rose) B. G. Baldwin subsp. greeneana
HEMIZONIA greeneana Rose subsp. peninsularis Moran	DEINANDRA greeneana (Rose) B. G. Baldwin subsp. peninsularis (Moran) B. G. Baldwin
HEMIZONIA martirensis D. D. Keck	DEINANDRA martirensis (D. D. Keck) B. G. Baldwin
HEMIZONIA palmeri Rose	DEINANDRA palmeri (Rose) B. G. Baldwin
HEMIZONIA perennis (Greene) D. D. Keck	CENTROMADIA perennis Greene
HEMIZONIA streetsii A. Gray	DEINANDRA streetsii (A. Gray) B. G. Baldwin

Name changes in non-tarweed helenioid Heliantheae

ERIOPHYLLUM nevinii A. Gray	CONSTANCEA nevinii (A. Gray) B. G. Baldwin
LEMBERTIA congdonii (A. Gray) Greene	MONOLOPIA congdonii (A. Gray) B.G. Baldwin
WHITNEYA dealbata A. Gray	ARNICA dealbata (A. Gray) B.G. Baldwin

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Ecology and Management of Tarweed

Yellow tarweed, *Holocarpha virgata*, is a native plant that is well adapted to the hot dry summers in the Central Valley of California and the surrounding foothills. Tarweed is in the Composite family. It was first classified as *Hemizonia virgata*.

In the summer tarweed's aromatic summer growth is sometimes tall and sticky. It is not palatable to livestock, hides forage needed by livestock, and coats the faces and legs of livestock with a tarry resin.

With the arrival of Europeans, California's grasslands changed dramatically. Annual grasses and forbs from the Mediterranean area were introduced both accidentally and intentionally. These species were shorter-lived and shallower-rooted than the perennial grass that they replaced. Growing numbers of domestic livestock greatly increased the grazing pressure on the range, resulting in less soil moisture use by plants. Also, the summer fires that had swept through the perennial grasslands were controlled. These changes undoubtedly favored the spread of tarweed.

Phenology, Growth, and Reproduction

Tarweed germination starts in the fall with the first rains and continues into April. Other summer annuals such as turkey mullein (*Eremocarpus setigens*) and vinegar weed (*Trichostema lanceolatum*) germinate in the spring and appear to be restricted to open areas with low vegetative cover, thus avoiding competition with the winter annuals.

By the end of winter, the tarweed plant has developed a deep taproot and about a dozen broad leaves in a rosette. Roots of tarweed go deeper than most of the winter annual grasses, reducing competition with them for soil nutrients and moisture. Penetration rates in sand of over 1.5 inches per day have been observed. From late spring until early summer the shoots elongate and branch out with bract-like leaves on woody stems that stand 1 to 2 feet tall.

In August and September tarweed produces composite heads that have 3 to 5 ray flowers and 3 to 12 disk flowers. The ray flower is incomplete, having only a carpel, but the disk flower also has anthers that produce abundant pollen, an important food source for honeybees. The ray and disk achenes (fruiting structure containing a seed left after the flower dries) mature by the end of September. Achene dispersal is caused by rain, wind, and wildlife and continues into the winter. The achenes, which have over 20% crude protein, are eaten by ground squirrels.

The ray achenes are quite different in appearance, hardness, and the vigor of resulting seedlings, but there appears to be no morphological difference between the plants they produce. The ray achene is 3 mm long, ovate-shaped, and extremely hard. In laboratory tests no germination was achieved without scarification. The factors causing ray achenes to germinate in the field are unknown. Tarweed produces at least 5 times as many fertile ray achenes as fertile disk achenes.

The disk achene is 4 mm long and lanceolate shaped. Newly collected disk achenes with filled endosperms have 100% germination without any pretreatment, but less than one-fourth of the disk achenes are filled. Most of the germination in the fall is from disk achenes.

Achene dispersal and plant senescence starts at the end of October. By the end of spring only the woody stems and thicker branches remain, and they stand until the following rainy season.

Livestock use tarweed in winter and early spring while it is young and succulent. Use decreases rapidly as it increases in height and resin covering. It is hardly grazed at all at maturity when covered with resinous exudate, although it is still an important source of protein and moisture for ground squirrels. Summer annuals are often the only actively growing green plants, relatively high in protein, available in the summer on annual range. To discourage herbivory, summer annuals have apparently evolved mechanisms such as spines, aromatic compounds in vinegar weed (*Trichostema lanceolatum*), and aromatic resins as in tarweed. Few animals are able to feed on these plants in the summer.

Competition

Tarweed competes with winter annuals by diminishing soil moisture in late spring. Because tarweed germinates in the fall and grows in close association with dense stands of winter annuals, there is probably also some competition for light and nutrients during the growing season, but the degree of competition is unknown.

The occurrence of tarweed in the early successional stages of the annual grassland-type indicates that it is more compatible with the less productive species commonly found in these stages, thus tarweed has been designated an "invader" species. The shallow-rooted, short statured, early maturing alien annual grasses use less light and water than the late successional perennial grasses or taller annual grasses. This results in a surplus of moisture that tarweed is able to utilize.

Because tarweed relies on stored soil moisture for summer growth, it is most competitive on deep fine textured soils. Tarweed is distributed widely over the range but is more common in swales, and tarweed often dominates the better forage-producing sites.

Annual variations in climate--mainly rainfall and temperature--result in large year-to-year differences in the composition of the California annual grasslands. Annual grasses are dominant in some years, and annual forbs or annual legumes in other years. The amount

of competition between tarweed and these winter annuals is less in grass dominant years and greater in forb-dominant years. The nitrogen-fixing ability of annual legumes tends to increase soil fertility, which increases forage production and water use and therefore reduces tarweed densities.

Instead of being a highly competitive invader like some alien annual grasses, tarweed seems to have been able to invade the annual grassland by taking advantage of underused resources of moisture, nutrients, and light.

Control

Reducing Tarweed Density

These techniques can greatly reduce a population of tarweed, leaving very few plants to flower and set seed. However, the timing of these activities is critical.

Mechanical: Mowing to 4" in May reduced tarweed by 20%, mowing in July reduced tarweed by 90%, whereas mowing in late August eliminated all but a few prostrate plants. Density in the year following late summer mowing was reduced by 90%.

Chemical: University of California researchers, using 1.5 lb/acre of a low volatile ester of 2,4-D, found that tarweed was affected much more by the herbicide treatment before elongation (April 21) than after elongation (July 14). Because legal restrictions on herbicides are constantly changing, you should contact your Ag. Commissioner before using any chemical control method.

Seedbank: One of the major obstacles to mechanical or chemical removal of tarweed is the seedbank of hard ray achenes that exists on sites. After five years of summer mowing, tarweed densities were about 10% of those in unmowed plots. To be successful, the use of these methods must be long-term (over five years) to totally eliminate tarweed, otherwise the pasture will be reinfested once the eradication project ends.

Depleting Soil Moisture

Fertilization: Nitrogen fertilization increases the vigor and productivity of tarweed's competitors, making them better able to deplete soil moisture that supports tarweed survival and growth in the summer. The fertilizer should be applied in the fall to ensure that winter annuals utilize it efficiently. However, it is doubtful whether the large amounts of nitrogen fertilizer required annually to reduce tarweed density effectively

(107 lb/a) would be economical if applied to rangelands.

Annual legumes: Nitrogen fixation by annual legumes increases forage production and reduces soil moisture available to tarweed. Rose clover (*Trifolium hirtum*) fertilized with single superphosphate has been shown to reduce tarweed. Lana vetch, subterranean clover, and the annual medics should have the same affect.

Perennial grasses: Although no studies have demonstrated a reduction in tarweed, established perennial grass seedings should deplete soil moisture, making it unavailable to tarweed.

References

Perrier, G.K., W.A. Williams and J.W. Menke. 1982. Tarweed, an unloved annual-type range plant. Rangelands. 4(4):149-150.

Perrier, G.K., W.A. Williams and S.R. Radosevich. 1981. Managing range and pasture to suppress tarweed. California Agriculture 33(1)18-19.

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