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Stinknet: a Weed Advancing in Southern Arizona

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Fig. 1 Stinknet in bloom

Fig. 2 Stinknet competing with native vegetation in South Mountain Park, Phoenix Arizona

Description

Stinknet, also known as globe chamomile, is a relatively new weed in Arizona that has quickly spread (Fig. 1). The first herbarium collection for Arizona was made in the spring of 1997 and the first published account of its presence in Arizona was by Landrum et al. (2005). By 2019 the plant had risen to public attention due to its conspicuous presence. Stinknet is now common in the Phoenix metro area and across much of Maricopa County. It is spreading south along the I-10 corridor, becoming well established in Pinal County. Outbreaks have occurred within the Tucson metro area, and also in rural parts of Pima County. Recent observations show stinknet has found its way into Mexico (SEINet Portal Network, 2020).

Many references list stinknet as *Oncosiphon piluliferum* (L.f.) Källersjö, however the correct construction of the Latin name has been questioned (International Plant Names Index, 2020). *Oncosiphon pilulifer* (L.f.) Källersjö is suggested as the correct Latin name (P. Hedrick, pers. com). The name *Oncosiphon piluliferus* is also encountered in the literature (Kolokoto and Magee, 2018).

Habit

In the Phoenix area, stinknet occurs widely on disturbed soil in residential areas, vacant lots, soil piles, along roadsides and major highways, and in cracks in pavement and sidewalks. The plant can compete with native desert vegetation and is spreading into South Mountain Park (Fig. 2) north Scottsdale and the Tonto National Forest. Stinknet is prevalent in the Phoenix area at 1000 ft. elevation. It is anticipated to have no low elevation limit in Arizona. Large stands are established at 2000 ft. elevation in Anthem, Arizona. Recent observations around Sedona place it as high as 4220 ft. elevation (SEINet Portal Network, 2020). Stinknet's potential upper elevation limit is not known.

Fig. 3 Stinknet seedlings fourteen days after germination


Fig. 5 Initiation of stinknet flower heads


Fig 4. Young stinknet plant with bolting stems

Fig. 6 Stinknet flower heads in blooming stage, with metric scale

Lifecycle

Stinknet is a cool-season annual member of the sunflower family (Asteraceae). Seeds germinate with the onset of cool-season rains (Fig. 3). Germination can start in late October or November, with additional germination from the soil seedbank if moisture continues through the winter. Plants begin growth as a basal rosette of deeply lobed deep green leaves. The leaves have scattered hairs and small oil glands which are the likely source of volatile chemicals responsible for the plant's aroma. Crushed foliage releases a pungent odor which has been compared to turpentine. As the rosette matures, the plant sends out longer shoots horizontally and vertically (the latter particularly in crowded situations) (Fig. 4). After approximately two months of growth small flower heads are initiated at the tips of bolting stems (Fig. 5). It may require another month or more before the first flowers on these heads begin to open (Fig. 6).

The flower heads are bright yellow spheres without ray petals, hence the alternate name, globe chamomile. Each sphere is comprised of numerous tiny yellow flowers. Each flower in the globe has the potential to form one seed. Flowering begins at the base of the globe and proceeds to the apex. Seed maturation will begin in early to mid-April and can continue into May after all flowers in the head have been opened. Seed maturation usually corresponds with the drying out and death of the plants, but late season rainfall may extend the life of plants and result in a few later-blooming flower heads. Seed maturation is indicated by the yellow spherical flower heads drying out and transitioning

Fig. 7 Stinknet flower heads turning tan color as seeds mature

Fig. 9 Close-up of stinknet seed heads with some seeds dislodged

Fig. 8 Dead and dry stinknet plants with seed heads

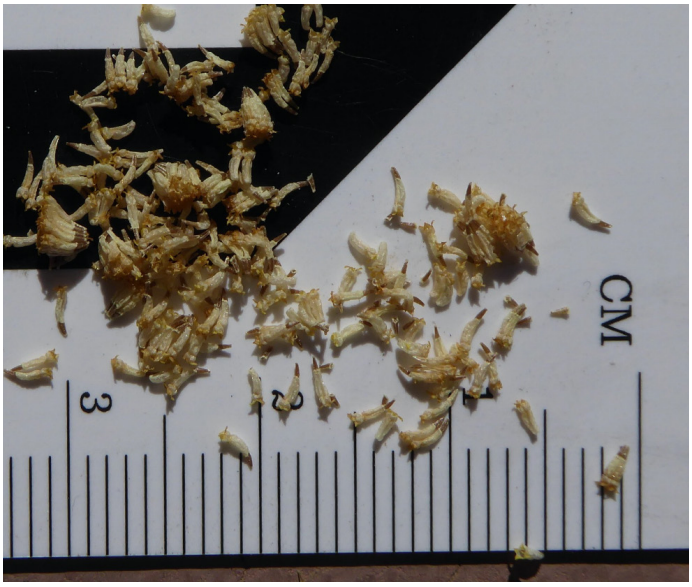

Fig. 10 Stinknet seeds, with dried flower petals attached

into tan spheres of equal size and shape (Fig. 7). These spherical seed heads remain intact at the top of the stems as the plants dry out and die at the end of the growing season (Fig. 8). Adjacent plants tend to flower and set seed in synchrony, with drifts of plants sharing the same phenology. Flower and seed phenology can be expected to be variable depending on temperature and rainfall at the site. There have been observations of some stinknet plants persisting into early summer, and others germinating in late summer.

The seed heads are delicately held together. Blunt force applied to a seed head causes the sphere to break up into its component seeds (Fig. 9). In spite of their fragility, seed heads may remain attached and intact for many months, through wind and rain, and even into the next winter rainy cycle without dispersing seeds.

The seeds have none of the bristles, hooks or other structures which can facilitate seed distribution in many members of the sunflower family. The seeds are seemingly unspecialized, miniscule tiny cones with the dried tan corolla (flower petals) remaining attached (Fig. 10). Seeds are less than 0.5 millimeter long, with the attached dried petals to 2 mm in length. Stinknet seeds are tiny and lightweight. Seed dispersal is responsible for spread of the plant. The dried corolla, which remains attached to the seed, may aid in seed dispersal in ways which are not obvious. Wind, animals, vehicles and water all have potential to disperse the tiny seeds. The seeds may adhere to smooth surfaces through a static electric charge. Stinknet's habit of retaining seeds on the dried plant for an extended time no doubt keeps the seeds ready in position until a force with potential to disperse the seeds dislodges them.

Stinknet is an annual which will die with the start of hot dry conditions in early summer, leaving no perennial structures. Only the seeds remain to start the next generation. During dry years stinknet can be expected to show little germination and seeds will remain in wait within the soil seed bank. Data from Australia has shown that stinknet seeds can remain viable in the soil seed bank for at least five years (Douglas & Nicholson, 2019).

The Problem

Stinknet is native to South Africa (Kolokoto and Magee, 2018). It was found occurring in Riverside County, California in 1981 (UCR Herbarium Projects, 2019) and has since become a widespread weed, chiefly on disturbed sites in coastal shrub and chaparral regions of Orange, Riverside and San Diego Counties (Baldwin et al. 2012). Stinknet is also documented as invasive in Australia (Landrum et al. 2005). The source of stinknet's introduction into Arizona is not known. In early 2020 the Arizona Department of Agriculture added stinknet to the state's Noxious Weed List as a Class B noxious weed.

Stinknet has been reported to grow in agricultural fields (Landrum et al. 2005). While it may be controlled through standard weed control measures employed in some agricultural crops, it could present an issue for the management of specialty crops.

Stinknet may degrade rangeland as it crowds out other desirable cool-season plants. Stinknet is reported to be unpalatable to livestock, and shows little sign of damage by herbivory (McDonald, 2019). We lack observations of the interaction of wildlife with stinknet or its seeds. The movement of animals, people and vehicles through seed-laden stinknet infested areas has potential to dislodge seeds and may be a significant factor in their spread.

The lifecycle of stinknet is the same as that of most cool-season growing Sonoran Desert wildflowers. Wildflower blooms support ecotourism due to an interest in visiting southern Arizona when mild, wet spring weather, abundant outdoor recreation opportunities and colorful spring blooms come together for a "superbloom" event. Stinknet forms dense patches or drifts of vegetation which can overtop and smother native wildflower diversity.

People differ in their reaction to the odor of stinknet, which is pungent and similar to turpentine. Some consider it pleasant while others regard it as "nauseating". Stinknet has been implicated in cases of respiratory distress. There are other reports of allergic contact dermatitis from exposure to stinknet (Baltazar et al. 2022). Stinknet's alternate name globe chamomile has led some people to believe it can be used in the manner of herbal chamomile. Some vendors at Phoenix area farmers' markets have been observed selling bundles of stinknet as "wild chamomile." The public health hazards of stinknet require further study.

Fig. 11 Dense stinket cover, Tonto National Forest

Stinknet dries and dies as Arizona enters its hot dry early summer cycle, which is also wildfire season. Stinknet has been described as a low level ladder fuel. It can catch and spread fire from an initial ignition source and carry that fire to higher rungs in the fire ladder, such as shrubs or trees. Stinknet is considered a "flash fuel" meaning it is easy to ignite from a spark or discarded cigarette. The plant has been implicated in summer of 2020 brush fires north of Phoenix, in the Cave Creek area. Green plants prior to drying out have not been noted to be a fire hazard (T. Cooper, pers. com.). Stinknet is one of several cool-season annual invasive exotic weeds, including Saharan mustard (*Brassica tournefortii*) and red brome (*Bromus rubens*), which dry out and form tinder for wildfire. Stinknet's habit of forming thick drifts of plants is a particular problem, as it bridges the gaps between plants (McDonald, 2019) which are typical for native Sonoran Desert vegetation (Fig. 11).

Management

Stinknet has a long period of growth prior to the reproductive stage, compared to many annual weeds. This offers an extended opportunity for mechanical control of plants, provided the area infested is not prohibitively large. Seedling rosettes of stinknet can potentially be confused with some native and exotic plants found in southern Arizona. The odor of stinknet may help distinguish it. Once stems initiate bolting, their identity as stinknet can be confirmed, well before flower initiation.

Flowering plants of stinknet cannot be easily confused with any Arizona native plants (there are no North American members of the genus *Oncosiphon*). Stinknet may be confused with pineappleweed (*Matricaria discoidea*) or Australian waterbuttons (*Cotula australis*). These are both invasive exotic species with a smaller presence in Arizona.

Fig. 12 Stinknet root structure

Stinknet may be pulled, uprooting the entire plant, when growing in moist or loose soil. It does not resprout from root fragments (Fig. 12). Plants must bolt before they can bloom, and this provides a handhold for pulling plants at this stage. Wearing gloves and long sleeves is advisable due to sensitivity some people have experienced from contact with stinknet.

Stinknet spends a prolonged time in its flowering stage and does not seem to set seed until all flowers in the head have blossomed. It is not prone to precocious seed set. If stinknet plants have come into bloom, the stems may be pulled or weed-whacked and left on the ground. The flower heads will not mature into seeds after the stems are severed. The base of a weed-whacked plant will regrow however, some time is bought before it can flower again. Note, mechanical controls which break apart plant tissue will release volatile chemicals (the stink for which stinknet is named) and this may irritate sensitive people.

The most important goal in stinknet management is to prevent plants from going to seed. Once plants have set seed, they are prone to dropping seeds during any physical attempt to remove the plants. Plants which have gone to seed should not be sprayed with an herbicide. The plants are dead, or will be dead soon naturally without the application of herbicides. Herbicides will not clear dried brush or kill seeds on standing plants.

Even if stinknet is removed from a property, there is a high likelihood that seeds remain. Repeated mechanical removal or chemical treatments over multiple years will probably be needed. Windblown seed can arrive from adjacent properties - therefore it is important to be vigilant against re-emergence of stinknet.

Combatting stinknet, especially larger infestations, and those in wildland situations, will require a long-term integrated weed management plan. Take precautions to preventatively avoid spreading stinknet seed while engaged in the process of eradicating the plant. Clean off soil and remove seeds from tools, clothing, boots and vehicles. This is especially important with advancing weeds like stinknet which have a high potential for establishing in new areas when provided a point of introduction.

Chemical Controls – Preemergent Control

Preemergent herbicides are applied to the soil and will stop the emergence of seedlings. Preemergent herbicides generally have no effect on growing plants, they only impact emerging seedlings. Most of these herbicides are not species-specific and may affect other plants, including desert wildflowers.

Preemergent herbicides are usually sold as a liquid concentrate, which must be added to water at the labeled rate, and sprayed on the ground. Some preemergents are sold as granules and spread on the ground. With both herbicide application techniques, rainfall or overhead irrigation must be applied to activate the herbicide in the soil zone where the weed seeds germinate. For stinknet, this can be expected to be shallow, at or near the surface.

A good time to apply would be just prior to the late fall/early winter rains, prior to weed seed germination. Preemergent herbicides remain active in the soil for a period of several weeks to several months. Due to the staggered germination of stinknet seeds through the course of the winter, a second application may be needed.

Several preemergent herbicide products show promise for management of stinknet. Products with an extended active period in the soil can suppress stinknet germination through the entire cool season. Choice of herbicide product should follow the site suitability specified on the product label to avoid environmental harm. Always read and follow instructions on the herbicide label and wear personal protective equipment. Homeowners should consider hiring a licensed herbicide applicator.

Chemical Controls – Postemergent Control

Postemergent herbicides kill actively growing weeds when applied to the foliage. Good coverage of the plant surface is important for effectiveness. Most herbicides must be absorbed into the plant to have effect. A contact

or burndown herbicide affects the leaves that are treated immediately. Other herbicides enter the plant and move up to new emerging shoots and leaves and/or down to the roots. A plant's leaf surface is usually protected by a waxy cuticle - and in the case of stinknet, an oily secretion from oil glands.

Postemergent herbicides are most effective when applied to small and young actively growing healthy plants. Avoid applying during very cold weather or on drought-stressed wilted plants. Postemergent herbicides are best applied to seedlings or small plants.

A variety of herbicides have shown effectiveness against stinknet (Umeda, 2021). Glyphosate, the active ingredient in Roundup® and many other products, is commonly used. Glyphosate may be slow-acting, especially in cold weather. If stinknet is being controlled late in the flowering cycle, glyphosate products might not effectively kill the plants before seed is set. In these cases an herbicide with a quicker-acting burndown effect has better promise in killing the plants before seed is produced.

Keep in mind these herbicides will kill most other plants! Always follow the instructions on the herbicide label and wear personal protective equipment. Consider hiring a licensed herbicide applicator for difficult situations.

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