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## Controlling Yellow Woodsorrel in Greenhouse Container Production

Yellow woodsorrel (*Oxalis stricta*), also known as oxalis, is one of the most common broadleaves weed species in greenhouse container production. It is an annual weed species in cool climates, such as the northern United States, and a perennial weed in warmer regions. Oxalis is native to North America and is widely distributed throughout the world including the eastern and central United States, Europe, Africa, Asia, Japan, and New Zealand (Lollar and Marble, 2015).



Figure 1. A mature yellow woodsorrel (*Oxalis stricta*) growing on container media surface inside a greenhouse. Photo by Debalina Saha, MSU Horticulture.

It is difficult to control because oxalis can spread by rhizomes, stolons, and by seeds which have no dormancy requirement. According to Neal and Derr (2005), oxalis populations can negatively affect the growth rates of ornamental crops. In this alert, growers will learn how to identify and control yellow woodsorrel in their greenhouses.

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**Habitat:** Oxalis naturally grows in woodlands, grasslands, disturbed areas and in turf. It can be found growing in the drain holes of containers or on the surface of container media (Figure 1) in nurseries and greenhouses under full-sun and partial-sun conditions. Oxalis can also be found growing in side-walk cracks, alongside trails, flower beds, in lawns, cultivated fields, and even in container nursery stock.

**Growth Habit:** Oxalis is herbaceous and usually grows upright with extensive branching but may also grow prostrate along the soil surface (Lollar and Marble, 2015). Branches or unbranched stems arise from fleshy rhizomes in the soil or substrate. The underground rhizomes can overwinter depending upon the severity of the weather (Marshall, 1987). The plant height ranges from 6 to 20 inches.

**Seedling:** The cotyledons have a pinkish tint with alternate trifoliolate leaves. Leaves are very thin, herbaceous, with three heart-shaped leaflets. The upper surface of the leaflets is smooth, while there is minimal pubescence (hair) on the lower leaf surfaces and margins (Lollar and Marble, 2015).

**Roots:** The tap root is the main root system of this plant. The rhizomes (underground stems) can also form secondary fibrous root structure.

**Shoot:** The stems are soft, herbaceous, and light green with slight pubescence (hair). The leaves are alternate, palmately compound, light green in color, with smooth margins and heart-shaped (cordate) leaflets (Figure 2.). Leaflets are generally 0.2 to 0.4 inches long and 0.2 to 0.4 inches wide.



Figure 2. Palmately compound leaf with heart-shaped leaflets. Photo by Debalina Saha, MSU Horticulture.



Figure 3. Bright yellow five-petaled flower of yellow woodsorrel (*Oxalis stricta*). Photo by Debalina Saha, MSU Horticulture.



Figure 4. Seed capsules of yellow woodsorrel (*Oxalis stricta*) resemble the shape of okra pods. Photo by Debalina Saha, MSU Horticulture.



Figure 5. Teardrop-shaped and brown colored seeds of yellow woodsorrel (*Oxalis stricta*) under 10X magnification. Photo by Debalina Saha, MSU Horticulture.



Figure 6. Purple colored flower of pink sorrel (*Oxalis debilis* var. *corymbosa*). Photo credits: United States Department of Agriculture Natural Resources Conservation Service, Plants Database <https://plants.usda.gov/core/profile?symbol=OXDEC>

**Inflorescence:** The inflorescence is an open branched cluster (a cyme) of 2 to 5 long-stalked flowers. Flowers are bright yellow in color with 5 petals (Figure 3). They are approximately 0.5 inches in diameter and blooms from spring through fall (Lollar and Marble, 2015).

**Seedpods (Fruit):** The seedpods (fruit) of oxalis are in form of capsules which resemble the shape of okra pods (Figure 4). The capsules have 5 ridges and are approximately 0.5 inches in length. The seedpods which are produced from the spring through the fall explosively burst when touched thereby spreading seeds out rapidly up to 16 feet away from the parent plant (Neal and Derr, 2005).

**Seeds:** The seeds are very tiny, teardrop-shaped (Figure 5), and brown (Lollar and Marble, 2015). A single oxalis plant can produce up to 5,000 seeds per year and have an almost 100 percent germination rate immediately after dispersal (Holt and Elmore, 1985). Oxalis seeds are photoblastic (require light for germination) and the optimum temperature requirement for germination ranges from 50° F to 84° F; however, seeds have a broader germination temperature range when produced in warmer months than seeds produced during cooler months (Holt and Elmore, 1985).

**Similar Species:** Creeping woodsorrel (*Oxalis corniculata*) is a similar species that often has darker green to purplish leaves, grows more prostrate, and produces stolons (aboveground plant stem that roots at nodes) (Hall, Vandiver, and Sellers, 2012). The foliage of creeping woodsorrel is more pubescent than yellow woodsorrel, especially along leaf margins (Lollar and Marble, 2015). Pink sorrel (*O. debilis* var. *corymbosa*) is another species of oxalis which has larger leaves, purple flowers, and reproduce by bulbs and seeds (Figure 6) (Lollar and Marble, 2015). Other species of oxalis including *Oxalis purpurea* cultivars (which have large pink flowers) are commercially propagated as ornamentals. White clover (*Trifolium repens*) has similar shaped leaves, but the flowers are produced in ball shaped clusters and whitish in color.

Clover belongs to completely different plant family. Black medic (*Medicago lupulina*) also has similar leaves. However, the distinguishing features of black medic are dark green leaves, flowers are yellow in color and grouped in tight bunches, and fruit is a single-seeded pod. Birdsfoot trefoil (*Lotus corniculatus*) is another plant species which has similar leaves and can be misidentified as oxalis and some clovers. In birdsfoot trefoil, leaves are compound with five oval leaflets and flowers develop in clusters of 2-8 on a long stalk.

### Management of Yellow Woodsorrel

#### Physical and Cultural Control:

Sanitation is one of the most effective methods to control oxalis in greenhouses (Neal and Derr, 2005). Growers need to regularly check all the incoming liners and plants for oxalis before placing them in containers and regularly scout for this weed in both crop and non-crop areas (Lollar and Marble, 2015). Oxalis can propagate from cut rhizomes and stems, therefore mature oxalis should not be rototilled (Halvorson and Guertin, 2003). Growers can achieve the best control by hand weeding young oxalis plants prior to the seed capsule development (usually 6 weeks or younger). According to Halvorson and Guertin (2003), hand weeding should be done when soil is moist to avoid displacing small ornamentals and to ensure that all vegetative portions including roots and rhizomes are removed. The use of a shallow layer of organic mulch can also reduce oxalis populations by blocking the light required for germination (Holt and Elmore, 1985).

### Chemical Control

**Preemergence control:** The only preemergent herbicide that can be used in a greenhouse, or a fully enclosed structure is indaziflam (Marengo). Indaziflam also provides some control on emerged oxalis until the four-leaf stage (Marble et al., 2013). Indaziflam needs to be applied as directed application, avoiding contact with ornamental foliage.

**Early Postemergence control:** There are several postemergence herbicides that have showed successful control of oxalis in field or outdoor container production. According to Saha et al. (2018), isoxaben (Gallery), dithiopyr + isoxaben (Dimension + Gallery), dithiopyr (Dimension), and prodiamine + isoxaben (Gemini) have shown acceptable (> 80%) control of oxalis during its earliest growth stages: from cotyledon up to 6 leaf stage. Whereas indaziflam (Specticle) has shown excellent control until the oxalis plants have 12 leaves. Other herbicides that have shown significant early postemergence control of oxalis are sulfentrazone (Dismiss) and flumioxazin (Sureguard). However, none of these postemergence herbicides are labeled for use in a greenhouse or other fully enclosed structure.

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