

Prospective New Agents for Biological Control of Yellow Starthistle.

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Six species of insects that attack yellow starthistle flowerheads have become established in California (Rees et al., 1996; Balciunas, 1998); however, they do not appear to be sufficient to control the plant in most parts of the state (Pitcairn et al., 1998; 2000). A rust pathogen (*Puccinia jaceae* var. *solstitialis*) was approved in 2003 for experimental release in California, and the first release was made last July by CDFA and ARS scientists. A weevil (*Ceratopion basicorne*) that develops inside the root crown of rosettes is being evaluated in quarantine. So far, it appears to be safe with respect to commercial crops such as artichoke and safflower and to native species of thistles and knapweeds. We expect to complete evaluation of plants on our test list (Table 1) and submit a petition this year requesting permission for release. Adults feed on the rosette leaves in late winter, larvae develop inside the root crown, and complete development by the time the plant bolts. This weevil is abundant in Turkey, attacking up to 100% of plants at a site, and many larvae can be found developing within one plant. A flea beetle (*Psylliodes* sp. nr. *chalcomera*) from southern Russia that develops in young stems has passed preliminary host specificity tests and will be studied further to see if it will be safe enough to release. Several other prospective agents are in early stages of evaluation, including: a blister mite (*Aceria solstitialis*), a lace bug (*Tingis grisea*), a rosette fly (*Botanophila turcica*), a seedhead weevil (*Larinus filiformis*), and fungal pathogens (*Synchytrium solstitiale* and *Phoma exigua*). Rapid progress to develop new agents is being accomplished through the efforts and cooperation of many scientists and a variety of institutions from many regions including California, Maryland, Montana, France, Italy, Greece, Turkey and Russia. The diversity of prospective agents greatly increases our chances of finding some that will greatly impact yellow starthistle populations in the U.S.

Table 1. List of plants to test for safety of prospective biological control agents of yellow starthistle

Family: Asteraceae

Subfamily: Cichorioideae

Tribe: Cardueae

Subtribe: Centaureinae

Acroptilon repens

Carthamus tinctorius (safflower varieties: CW-88 OL, S-518 OL, S-730 L and others)

Crupina vulgaris

Centaurea americana (native), *Ce. calcitrapa*, *Ce. cineraria*, *Ce. cyanus*, *Ce. dealbata*, *Ce. diffusa*, *Ce. maculosa*, *Ce. melitensis*, *Ce. montana*, *Ce. rothrockii* (native), *Ce. solstitialis*, *Ce. sulphurea*, *Ce. virgata* var. *squarrosa*, *Ce. x pratensis*

Table 1. (continued)

Subtribe: Carduinae

Carduus pycnocephalus

Cirsium brevistylum, *Ci. ciliolatum* (endangered CA), *Ci. cymosum*, *Ci. fontinale*, *Ci. hydrophilum*, *Ci. loncholepis*, *Ci. occidentale*, *Ci. pitcheri*, *Ci. rhotophilum*, *Ci. vinaceum*

Saussurea americana

Cynara scolymus (globe artichoke)

Onopordum acanthium

Subtribe: Carlininae

Xeranthemum cylindraceum

Subtribe: Echinopsidinae

Echinops exaltatus

Tribe: Mutiseae

Leibnitzia lyrata, or *Adenocaulon bicolor*, or *Trixis californica*

Tribe: Lactuceae

Agoseris grandiflora

Stephanomeria sp.

Latuca sativa (lettuce)

Tribe: Vernoniaeae

Stokesia laevis, or *Veronia fasciculata*

Subfamily: Asteroidae

Tribe: Gnaphalieae

Antennaria parvifolia, or *Gnaphalium californicum*

Tribe: Anthemideae

Artemisia californica, or *A. ludoviciana*

Tribe: Senecioneae

Packera macounii, or *Senecio vulgaris*

Senecio multilobatus (if available)

Tribe: Eupatorieae

Liatris punctata, or *Brickellia californica*

Table 1. (continued)

Tribe: Helenieae (test 3 genera)

Hemizonia, or
Madira, or
Eriophyllum, or
Layia, or

Tribe: Heliantheae

Echinacea purpurea
Helianthus annuus (sunflower)
Tagetes patula (French marigold)

Tribe: Astereae

Aster biglovi, or *A. chilensis*
Erigeron compositus, or *E. linearis*

References

- Balciunas, J., 1998. The future of biological control for yellow starthistle. In: M.S. Hoddle (ed), Proceedings, California Conference on Biological Control: Innovations in Biological Control Research, 10-11 June 1998, University of California, Berkeley, CA. pp. 93-95.
- Bruckart, W.L. and F. Eskandari, 2002. Factors affecting germination of *Puccinia jaceae* var. *solstitialis* teliospores from yellow starthistle. *Phytopathology* 92: 355-360.
- Pitcairn, M.J., D.B. Joley and D.M. Woods, 1998. Impact of introduced insects for biological control of yellow starthistle. In: M.S. Hoddle (ed), Innovation in Biological Control Research. California Conference on Biological Control, June 10-11, 1998, University of California, Berkeley. pp. 88-92.
- Pitcairn, M.J., J.M. DiTomaso and V. Popescu, 2000. Integrating chemical and biological control methods for control of yellow starthistle. In, D.M. Woods (ed), Biological Control Program Annual Summary, 1999. California Department of Food and Agriculture, Plant Health and Pest Prevention Services, Sacramento, CA. pp. 58-61.
- Rees, N.E., P.C. Quimby, G.L. Piper, E.M. Coombs, C.E. Turner, N.R. Spencer and L.V. Knutson (eds.), 1996. Biological Control of Weeds in the West. Western Society of Weed Science., USDA-ARS, Montana State University, Bozeman, MT. World Color Printers, Bozeman, MT.
- Smith, L., 2002. New Developments in the Biological Control of Invasive Weeds. In: Proceedings of the California Weed Science Society. 54: 159-165.