



Yellow Starthistle, *Centaurea solstitialis*: There's A Fungus Amongus!

Economic and Ecological Impact: Yellow starthistle (*Centaurea solstitialis*, YST; Fig. 1) was introduced into California as a seed contaminant over 150 years ago. YST infests 10-15 million acres in California alone (in 56 of the 58 counties), and is still spreading. It occurs in 23 of the contiguous 48 states, with the heaviest infestations in Arizona, California, Idaho, Oregon, and Washington. Damage from YST in the U.S. is estimated to be many millions of dollars. YST displaces desirable plants in both natural and agricultural areas. It is of low forage value. The spiny flowers deter feeding by grazing animals and lower the value of recreational lands. Consumption of YST by horses may be fatal. Conventional control strategies have been inadequate because of the size of the infestation, economic and environmental cost of herbicides, and the relatively low monetary return from grazing and recreational land use. Five biological control agents have been established for YST (Fig.2): two flies, *Urophora sirunaseva* (released in 1984) and *Chaetorellia australis* (1988); and three weevils, *Bangasternus orientalis* (1985), *Eustenopus villosus* (1990), and *Larinus curtis* (1992). This complex of natural enemies is widely established, and contributes to reducing YST, but additional agents are needed that attack the foliage and young plants. The YST rust fungus, *Puccinia jaceae* var. *solstitialis* (Fig. 3) is just such an agent.



Fig. 1. YST flower.



Fig. 2. Insect biological control agents released for YST (photographs from www.invasive.org).



Fig. 3. *Puccinia jaceae* pustules attacking YST.

Significant Accomplishments: From 1978 to 1999, ARS scientists at the Foreign Disease-Weed Science Research laboratory in Frederick, Maryland, conducted basic mycological ecology studies and host-specificity testing for *P. jaceae*. They tested 68 plant species from 10 plant families. Key test species included plants in the family Asteraceae that are closely related to YST. It was particularly important to determine if the 19 native *Cirsium* species in California (eight of which are considered rare), and safflower, *Carthamus tinctorius* (the only closely related crop species), would be at risk from *P. jaceae*. The tests showed that only plants from three genera within the Asteraceae, all from one tribe (Cardueae), were symptomatic after inoculation (a few species of *Centaurea*, *Cirsium*, and *Carthamus*). Very few pustules developed on these species, and the infections could not be maintained. Thus, it was determined that the risk to

any other plant species was negligible. Additionally, it was determined that *P. jaceae* causes significant damage to YST in the laboratory, so efficacy should be high. A petition for release in Northern California was prepared and sent to the Animal and Plant Health Inspection Service. After reviewing the data, APHIS issued a permit for release of *P. jaceae*. Releases were made at one field site in Northern California in 2003, and additional releases were made in 2004.

APHIS' release approval of the rust caps over years of laboratory and field research by ARS on this fungus. Significantly, *P. jaceae* is the first pathogen to be fully approved, and the first to be permitted for release as a weed biological control agent in the Continental U.S. for 16 years!

Future: Impact of *P. jaceae* on YST will be monitored for several years by ARS and our partners and stakeholders, particularly the California Department of Food and Agriculture (CDFA). Permits have been requested for release in other locations in California, and other States have requested material for release. Other strains of *P. jaceae* may be released in the future if needed.

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