

Salsola tragus

Biological Control:

Hasan *et al.* (2001) report that, "The rust fungus *Uromyces salsolae* Reichardt (Isolate MW338; IMI No. 372660) was found on *S. tragus* in western Turkey. The attacked plants were covered with a powdery brown mass of unicellular, globular to oval-shaped urediniospores produced in round to elongated sori on the leaves and stems, and showed much reduced growth. Later in the season, the plants produced unicellular, thick-walled, dark teliospores borne in round to elongated telia. Similarly, the *S. tragus* plants from the USA, when inoculated in the greenhouse with a water suspension of the urediniospores of *U. salsolae*, developed brown uredinia and then telia as the disease advanced. The rust has been reported on several species of *Salsola* in the former-USSR, Israel, Iran, Romania, Australia, France, Pakistan, and Portugal (CAB International Report, unpublished). IMI records also show that the rust has been recorded on other genera of Chenopodiaceae from former USSR, Cyprus, and Romania. During our host specificity studies, the strain of *U. salsolae* collected by S. Hasan in Turkey was restricted to *S. tragus* and did not infect any of the other 16 plant species or varieties belonging to six different families that were tested. The fungus severely infected *S. tragus* plants not only from the USA but also those from Montpellier (France) and Turkey, showing that the rust may not be restricted only to certain biotypes of the weed. The rust fungus, which is highly damaging and effective in killing or severely reducing the growth of the weed under greenhouse conditions, has recently been imported into the USA for further host specificity testing under quarantine conditions. If, as expected, it proves to be host specific, its use for biological control of *S. tragus* in the USA would be recommended."

Sobhian *et al.* (2003) state that, "Field surveys on *S. tragus* in Turkey, France, Uzbekistan and China, yielded several promising natural enemies for the biological control of the *S. tragus*. Among these were arthropods *Desertovelum stackelbergi* Mamaev (Dipt., Cecidomyidae) in Uzbekistan;

Piesma salsolae (Becker, 1867) (Hem., Heteroptera, Piesmatidae) in Turkey, France and Uzbekistan; *Aceria salsolae* Delillo & Sobhian (Acari, Eriophyidae) in Turkey and Uzbekistan, and *Gymnancyla canella* Dennis & Schiffermüller (Lep., Pyralidae) in Turkey and France. Preliminary studies on the biology and host specificity of the fungus indicated that its host range is restricted to *S. tragus* (Hasan *et al.*, 2001). Studies on the biology and host specificity of the above-mentioned arthropods are ongoing."

Sobhian *et al.* (2003) state that, "The weevil, *Lixus salsolae* Becker (Col., Curculionidae) was found in France, Turkey, Uzbekistan, and China and was considered a promising biological control agent because damage from larval feeding was substantial." During their study, Sobhian *et al.* (2003) discovered that, "It appears that *L. salsolae* would attack plants from several genera of Chenopodiaceae. Most practitioners of biological control feel that these kind of tests can indicate a broader host range than the insect will actually use in the field (Zwölfer and Harris, 1971; Wapshere, 1989). In previous studies by Sobhian *et al.* (1999), *L. salsolae* attacked only *S. tragus*. It is likely that *L. salsolae* will have a much narrower host range under field conditions. However, because of the large number of adults feeding on all plants and because of the successful larval development on most of the test species, we no longer consider this insect an agent for biological control of *S. tragus* in North America."

Ryan and Ayres (2000) report that, "Two lepidopterous agents were introduced to control *S. tragus* in California, *Coleophora parthenica* Meyrick in 1973 and *Coleophora klimeschiella* Toll in 1977. Although both agents became established, neither apparently had a measurable effect on the populations of the plants. This was ascribed to the effects of native hymenoptera on these moths and to asynchrony between their life histories and that of their host plants. *C. parthenica* originated in Egypt, Pakistan, and Turkey, while *C. klimeschiella* was from Pakistan, but the taxonomic relationship of the host Salsola in these regions to the species found in California is not known."

