Fungi detected on *Acroptilon repens* (Russian knapweed) during surveys from 1981 to 1988

K. Mortensen and M.M. Molloy[1]

Five fungi, *Physarum cinereum, Phomopsis* sp., *Sclerotinia sclerotiorum, Puccinia acroptili,* and *Alternaria* cichoriiwere detected on *A. repens* in western Canada and investigatedfor biological control. This is the first record of *A. cichorii* on *A. repens* in Canada, and the pycnia stage of *P. acroptili* was found for the first time. *P. acroptili* has some potential for classical biological control. None of the fungi are promising as bioherbicides.

Can. Plant Dis. Surv. 69:2, 143-145, 1989.

Cinq agents pathogenes, *Physarum cinereum, Phomopsis* sp., *Sclerotinia sclerotiorum, Puccinia acroptili,* et *Alternaria cichorii* ont ete décelés sur *A. repens* dans l'ouest du Canada et évalués comme agents de lutte biologique. C'est la premiere mention de *A. cichorii* sur *A. repens* au Canada et du stage pycnia de *P. acroptili.* Il a ete démontré que *P. acroptili* pourrait être un agent classique de lutte biologique. Aucun des champignons semble prometteur comme herbicide biologique.

Introduction

Acroptilon repens (L.) DC. *(Centaurea repens* L.; Russian knapweed) is an introduced persistant perennial weed, which is commonly found in western Canada and to a lesser extent in Ontario (15). It originated from southern Russia and Asia Minor, and was introduced to Canada with Turkestan alfalfa in the early 1900's (5). Patches of *A. repens* were visited regularly during the period from 1981 to 1988 as a result of a biological control attempt with the nematode, *Subanguina picridis* (Kirjanova, 1944) Brzeski, 1981, syn.: *Paranguina picridis* (Kirjanova, 1944) Kirjanova and Ivanova, 1968 (16, 17). Diseased plants of *A. repens* were diagnosed, disease causing organisms identified, and potential of fungi for biological control evaluated. The following is a summary of the results.

Materials and methods

Diseased *A. repens* samples were collected by the authors unless stated otherwise, and analysed using common plant pathology procedures. Plants of ***A. repens*** used for testing were grown from root stocks in a sandy loam mixed with peat moss and vermiculite (3:2:1, v/v/v) on greenhouse benches at 18 to 24°C with a 14-h day extended with incandescent and fluorescent light (280 μmol.m^{-2}.s^{-1}). *Phomopsis* sp. (Sacc.) Sacc. was isolated and single spore cultures increased on potato dextrose agar (PDA). Inoculation was done either by spraying a spore suspension on plants to runoff using an air brush (Paasche Airbrush (Canada) Ltd. Type H-5), or slightly wounding stem areas, placing spores and mycelium in the wound and covering it up with wet cotton. Inoculated plants were kept in a cool mist chamber for 48 h. The mist chamber was constructed on a greenhouse bench and enclosed with transparent polyethylene. Light and temperature in the chamber were similar to those of the greenhouse. For *Alternaria cichorii* Nattrass, inoculation was only done by spraying a water suspension of spores, mycelial fragments and chlamydospores on *A. repens* and incubating for 48 h in the cool mist chamber. The host range of *A. cichorii* was tested using well-established plants of *Centaurea diffusa* Lam., *C. pannonica* (Heuff.) Simon., *C. nigrescens* Willd., *C. rocheliana* (Heuff.) Dost., *C. nigra* L., *C. weldeniana* Reichenb., *C. sadlerana* Janka, *Arctium minus* (Hill.) Bernh., and *Onopordum acanthium* L.; and on *Carthamus tinctorius* L., *Helianthus annuus* L., *Chichorium intybus* L., *C. endivia* L., and *Zinnia elegans* Jacq. in the 4-8 leaf stages, grown from seeds in the greenhouse. Inoculated plants were removed from the mist chamber and kept on greenhouse benches. Inoculated plants were inspected for disease symptoms at least once weekly and a final disease rating was given 14 to 30 days after inocullation.

Results and discussion

Physarum cinereurn (Batsch.) Pers. (Myxomycetes)

Physarum cinereum were observed on a stem of *A. repens* in irrigated alfalfa-brome hayland (S 112 24-23-27 W. of 3rd) at Leader, Sask., along the South Saskatchewan River, August 23, 1988 (collected by P. Harris). Grayish blue fruiting bodies occurred abundantly on the centre part of a stem (about 5 cm) at a branch axil on a somewhat stunted plant (only observed on one plant in the area, identified by J.A. Parmelee, Sept. 7, 1988). This fungus has no plant pathological importance.

Phomopsis sp. (Sacc.) Sacc. (Coelomycetes)

Wilting shoots of *A. repens* were first observed in a weed garden at Agriculture Canada, Research Station, Regina, Sask., in October of 1981, but the cause was not detected, only saprophytic bacteria and fungi were isolated. In 1982, wilting shoots occurred in June. Again several saprophytic bacteria and fungi *(Alternaria* spp. and *Fusarium* spp.) were isolated, but were not identified to species. A *Phomopsis sp.* was frequently isolated, and when inoculated back on wounded *A. repens* stems, it caused wilting of inoculated

[1] *Agriculture Canada, Research Station, Box 440, Regina, Saskatchewan S4P 3A2.*

Accepted for publication June 9, 1989.

stems, but new shoots were healthy. A culture (CMI No. 274636, 10 March 1983) was identified as *Phomopsis* by J.E.M. Mordue. In June 1986, scattered wilting shoots were observed in a natural infestation of *A. repens* 6.4 km west and 8 km north of Leader, Sask. (S 1/2 24-23-27 W. of 3rd) along the South Saskatchewan River. A *Phomopsis* sp. identical to the 1982 isolate was consistently recovered. Pathogenicity tests showed that it only caused infections when inoculated into a wound. In July 1986, *A. repens* plants showing similar symptoms were submitted by A.D. Muir from Cache Creek, BC, and the same *Phomopsissp.* was isolated from the roots.

Since infections on *A. repens* were obtained only through wounds and new shoots from inoculated plants were healthy, the fungus has little potential for biological control.

Sclerotinia sclerotiorum (Lib.) de Bary (Helotiales)

A few wilting plants of *A. repens* were observed in an irrigated wheat field 3.2 km south and 4.8 km east of Pike Lake, Sask., along the west side of the South Saskatchewan River in June of 1986. Browning lower part of stems that showed some shredding, cultured on PDA, resulted in typical growth and sclerotia formation of *Sclerotinia sclerotiorum.* Due to the wide host range of S. *sclerotiorum* (7), it has not been tested as a biological control agent.

Alternaria cichorii Nattrass (Hyphomycetes)

An *Alternaria* sp. was isolated from leaf spots on *A. repens* plants collected in rangeland at Cache Creek, BC, by A.D. Muir, July 1986. Conidia produced singly were somewhat narrowly obclavate with long, narrow colourless to pale beaks. Conidia transferred to PDA produced a dark greenish-black culture with very little aerial mycelium and few spores. Chlamydospore like structures were produced readily in culture. Inoculation of the *Alternaria* sp. resulted in severe leaf spots on older as well as younger leaves of inoculated ***A.*** *repens* plants. Conidia were produced readily on inoculated leaves when detached and placed on moist filter paper in a petri dish. A culture was identified as *Alternaria cichorii* Nattrass by M.P. Corlett. *A. cichorii* has not previously been reported from Canada (1, 4), but has been reported from the U.S.A. (3, 14). In none of the above references and others checked (6, 8, 10, 11, 12, 13) have *Alternaria* spp. been reported from *A. repens.* Thus, this is the first report of *A. cichorii* on *A. repens.*

Host range tests with *A. cichorii* showed that *Centaurea diffusa, C. pannonica, C. nigrescens, C. rocheliana, C. nigra, C. weldeniana, C. sadlerana, Arctium minus,* and *Onopordum acanthium* plants did not show any signs of infection by ***A.*** *cichorii* when well-established plants were inoculated. *Carthamus tinctorius, Helianthus annuus*, *Chichorium intybus, C. endivia,* and *Zinnia elegans* showed some slight leaf spotting on older leaves after onset of senescing. *Alternaria cichorii* did not cause leaf spots on healthy and developing leaves except on *A. repens.* This indicates that our isolate of *A. cichorii* is specific to *A. repens.*

Under greenhouse conditions, inoculated leaves of ***A.*** *repens* wilted severely, but none of the plants died. A small plot of *A. repens* at Leader, Sask., was inoculated with a spore and mycelial suspension of *A. cichorii* May 21, 1987. Dry conditions occurred the following two weeks after inoculation and when inspected three weeks later and again at the end of the season, no symptoms of *A.* cichoriiwere detected. With no plant kill under greenhouse conditions and no infection at all in the field plot, *A. cichorii* would not be sufficiently effective as a bioherbicide on dry rangeland.

Puccinia acroptili P. Syd. and H. Syd. (Uredinales)

This rust (*P. acroptili*) was observed on *A. repens* from four locations in Saskatchewan and from two locations in British Columbia:

1. Agriculture Canada, Research Station, Regina, Sask., in an established patch of *A. repens* about 20 m^2, August, 1984 (DAOM 192620).

2. Leader, Sask. (S 1/2 24-23-27 W. of 3rd), occurring in patches of *A. repens* (up to 0.4 ha) in a pasture, along the South Saskatchewan River, May 22, 1985 (DAOM 192619), and August 30,1985 (DAOM 194911). In May, both pycnia and uredinia were present on older leaves of about 5% of the plants which were bolting, and few pustules occurred on the upper leaves. In August, primarily telia were present on upper leaves of mature plants. In June, 1987, *P. acroptiliwas* observed on galls of the nematode *(Subanguina picridis)* in a site where the nematode had been released on *A. repens* the previous year by P. Harris. Nearly all galls were heavily infected with the rust, both outside and in the cavities inside the galls. Only urediniospores were observed. It appeared as though the gall tissue was exceptionally susceptible to *P. acroptili.*

3. Saskatchewan Landing Provincial Park, Sask., on *A. repens* in a camping area, August 30, 1985, collected by **P.** Harris (DAOM 194912). Primarily telia were present on upper leaves of mature plants.

4. Pike Lake, Sask. (3.2 km south and 4.8 km east), on *A. repens* in an irrigated wheat field, along the west side of the South Saskatchewan River, June, 1986. Only uredinia were present on leaves.

5. Campbell Creek, LaFarge Yard, Kamloops, BC, on *A. repens* in rangeland, September 5, 1985, collected by **P.** Harris (DAOM 194913). Primarily telia were present on upper leaves.

6. McQueen Creek, Lac du Bon, BC, on *A. repens* in rangeland September 22, 1986, collected by A.D. Muir. Primarily telia were present on leaves (about 50% of leaf area covered with pustules).

Samples (indicated by DAOM No.) were identified as *P. acroptili* P. Syd. and H. Syd. by J.A. Parmelee. Both Savile (9) and Cummins (2) reported that pycnia are unknown for *P. acroptili.* Therefore, this is the first time that pycnia of *P. acroptili* have been reported. *P. acroptiliwas* only reported from California and from Grand Forks, BC, in North America (9). According to Savile (9), only light infections occurred on the specimens, and he suggests that perhaps more aggressive types of *P. acroptili* should be imported for biological control of *A. repens.* Since *P. acroptili* has now spread to several other areas in British Columbia and Saskatchewan and appears to be well-established on

A. repens, there is no need to import new types of the rust. However, distribution of the rust as a classical biological control agent to uninfested areas would be worthwhile, because it appears to inflict considerable stress on ***A. repens*** in heavily infected patches.

Acknowledgements

The authors acknowledge Dr. P. Harris, Agriculture Canada, Research Station, Regina, Sask., and Dr. A.D. Muir, Agriculture Canada, Research Station, Saskatoon, Sask., for submitting diseased samples of ***A. repens;*** and Dr. J.A. Parmelee, Dr. M.P. Corlett, Agriculture Canada, Biosytematics Research Institute, Ottawa, ON, and Dr. J.E.M. Mordue, Commonwealth Mycological Institute, Kew, England, for identification of the fungi.

Literature cited

1. Conners, I.L. 1967. An annotated index of plant diseases in Canada and fungi recorded from plants in Alaska, Canada and Greenland. Can. Dept. Agr., Ottawa, Publ. No. 1251. 381 pp.
2. Cummins, G.B. 1978. Rust fungi on legumes and composites in North America. University of Arizona Press, Tucson, Arizona. 424 pp.
3. Ellis, M.B. 1971. Dematiaceous Hyphomycetes. C.A.B., C.M.I. Kew, Surrey, England. 608 pp.
4. Ginns, J.H. 1986. Compendium of plant disease and decay fungi in Canada 1960-1980. Agric. Can. Res. Branch, Publ. No. 1813. 416 pp.
5. Groh, H. 1940. Turkestan alfalfa as a medium of weed introduction. Sci. Agric. 21:36-43.
6. Neergaard, P. 1945. Danish species of Alternaria and Stemphylium. Munksgaard, Copenhagen. 560 pp.
7. Purdy, L.H. 1979. *Sclerotinia sclerotiorum*: History, diseases and symptomatology, host range, geographic distribution, and impact. Phytopathology 69:875-880.
8. Rao, V.G. 1969. The genus *Alternaria*–from India. Nova Hedwigia 17:219-258.
9. Savile, D.B.O. 1970. Autoecious *Puccinia* species attacking Cardueae in North America. Can. J. Bot. 48:1567-1584.
10. Simmons, E.G. 1967. Typification of Alternaria, Stemphylium, and *Ulocladium*. Mycologia 59:67-92.
11. Simmons, E.G. 1981. *Alternaria* themes and variations (1-6). Mycotaxon 23:16-34.
12. Simmons, E.G. 1982. Alternaria themes and variations (7-10); (11-13). Mycotaxon 24:17-43; 44-57.
13. Simmons, E.G. 1986. Alternaria themes and variations (14-16); (17-21). Mycotaxon 25:195-202; 203-216.
14. U.S.D.A. 1960. Index of plant diseases in the United States. U.S.D.A. Crops Res. Div., A.R.S. Agric. Handbook No. 165. 531 pp.
15. Watson, A.K. 1980. The biology of Canadian weeds. 43. ***Acroptilon (Centaurea)*** repens (L.) DC. Can. J. Plant Sci. 60:993-1004.
16. Watson, A.K. 1986. Biology of *Subanguina* picridis, a potential biological control agent of Russian knapweed. J. Nematology 18:149-154.
17. Watson, A.K., and P. Harris. 1984. Acroptilon repens (L.)DC., Russian knapweed (Compositae). Pages 105-110. *In*: Biological control programmes against insects and weeds in Canada 1969-1980. J.S. Kelleher and M.A. Hulme, eds., Commonwealth Agricultural Bureaux, Slough, England.