The clubroot pathogen, *Plasmodiophora brassicae* is now established as a pest of canola in central Alberta and may be spreading to other regions of the province. Researchers have developed a simple, reliable method for the molecular detection of the clubroot pathogen in plant and soil samples and are working on developing an integrated clubroot management strategy.

Clubroot caused by *Plasmodiophora brassicae*, has traditionally been a problem in vegetable cole crop production in eastern Canada and in British Columbia. However, in 2003 the first report of clubroot in western Canada occurred in Central Alberta and research shows it is spreading to other regions.

Clubroot is a devastating soil-borne disease of cruciferous crops including canola (oilseed rape), broccoli, brussels sprouts, cabbage, kale, kohlrabi, radish, rutabaga, cauliflower, turnip, and black mustard. The pathogen induces root galls on infected plants, reducing the capacity for water and nutrient uptake, resulting in stunting, wilting, lodging, and finally major yield losses of 50% or more. Clubroot poses a serious threat to the oilseed and cole crop industries, because of the long persistence of the disease in the soil.

In 2003, researchers initiated a project to evaluate clubroot management strategies that would provide effective control of the disease on the prairies. With additional funding in 2007, the main objectives were revised to focus on the characterization of the clubroot disease problem in Alberta and on the development of an efficient technology to detect *P. brassicae* in soil and plant samples. The development of an integrated clubroot management strategy was also initiated in 2007.

Research, conducted at the University of Alberta between 2004 and 2008, confirmed that the clubroot pathogen is an established pest of canola in central Alberta and may be spreading to other regions of the province. In 2003, clubroot was found on 12 fields of *Brassica napus* in Sturgeon County in Alberta, but by 2007 at least 250 clubroot-infested fields had been identified in 10 counties in central Alberta, 1 county in southern
Alberta, and a rural area in northeast Edmonton. The primary mechanism of spread between fields is the movement of infested soil on farm machinery. Yield losses ranging from 30% to 100% have been reported in severely infested canola fields.

An effective strategy for managing the disease is to avoid planting cruciferous crops in *P. brassicae* infested soil, because the pathogen produces resting spores that can remain infectious for many years. Although the occurrence of clubroot is not restricted to fields with acidic soils (low pH), disease severity is impacted by soil pH. Research shows that currently available canola cultivars are susceptible to clubroot, but sources of resistance exist. The genetic resistance from these sources will be transferred into spring canola germplasm for the Canadian market.

**Pathogen Populations and Pathotypes**

Pathogen populations are diverse, and resistance (when available) will have to be well managed. Physiologic specialization (the existence of different strains or pathotypes of a pathogen) has long been known in *P. brassicae* and has important implications for breeding efforts. The choice of appropriate sources of resistance and the durability of that resistance will be influenced by the number and relative prevalence of pathotypes in a particular region.

Because populations of *P. brassicae* often consist of a mixture of different pathotypes, a simple method to isolate single resting spores of the pathogen was developed. Testing of populations and isolates in Alberta has confirmed that the predominant strain of the pathogen is pathotype 3 or P2. However, the occurrence of other pathotypes at lower frequencies suggests that caution should be used in any breeding strategy, since rare pathotypes of *P. brassicae* may quickly become predominant if susceptible host cultivars are continuously grown.

**Molecular Detection of *P. brassicae* in Plant and Soil Materials**

Researchers have developed a reliable method for the molecular detection of the clubroot pathogen in plant and soil samples. This simple, one-step polymerase chain reaction (PCR) protocol can provide a reliable diagnosis for routine detection of *P.*
brassicae in plant and soil materials in a specific and rapid manner. However, caution should be used when extrapolating the results obtained for a particular sample to an entire field. The canola industry is continuing to work towards the development of an integrated clubroot management strategy.

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