

## Short Communication

### Prevalence of Clubroot on Canola in North Dakota

Chapara V<sup>1</sup>, Kalwar N<sup>1</sup>, Lubenow L<sup>1</sup> and Chirumamilla A<sup>2</sup>

<sup>1</sup>Langdon Research Extension Center, North Dakota State University, Langdon, USA

<sup>2</sup>NDSU Extension Service, Langdon, ND-58249, USA

#### Abstract

Clubroot on canola was regular and more prevalent than expected in Cavalier County in the current survey. Prevalence of clubroot on canola has been increasing at rapid pace in North Dakota and has been confirmed in 33 fields in Cavalier County in 2018, which is five times more than it was in 2017. Contrastingly, no clubroot positive fields were found in any other canola growing counties of North Dakota that were surveyed. Continuous survey in coming years is required to prevent the spread and to design management plan of clubroot along with extensive outreach activities throughout North Dakota. Extensive education of growers in identifying clubroot disease, the biology of the pathogen, its prevalence and prevention is needed.

**Keywords:** Canola; Clubroot; *Plasmodiophora brassicae*

Clubroot of canola caused by *Plasmodiophora brassicae* (Woronin) is the new emerging disease in North Dakota since its identification on canola in 2013 (Chittam et al. 2014). Clubroot is a soil borne disease that causes swellings, or galls on the plant roots of Brassicaceae family (Dixon 2009). These galls cause on farm premature ripening of canola plants and yield loss in the canola (Strelkov et al. 2005). Examination of roots for galls by digging up from the affected areas is the quick identification of clubroot incidence (Khangura and Wright 2012). Clubroot disease incidence and development is favored by acidic soils (Tewari et al. 2005). However, later research proved that clubroot on canola is not only limited to acidic soils but can also occur in alkaline soils (Strelkov et al. 2007). The highest degree of clubroot disease infestation was observed at pH 6.6 (Palm 1963). *P. brassicae* is soil-borne obligate parasite, thrives in the soil as resting spores that can remain viable in the soil up to 17.3 years indicating

**\*Corresponding author:** Venkataramana Chapara, Langdon Research Extension Center, North Dakota State University, ND-58249, Langdon, USA, Tel: +91 7012562582; Fax +91 7012562580; E-mail venkata.chapara@ndsu.edu

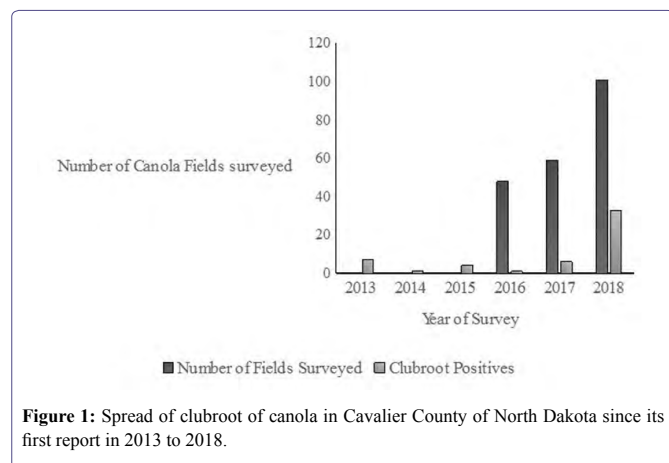
**Citation:** Chapara V, Kalwar N, Lubenow L, Chirumamilla A (2019) Prevalence of Clubroot on Canola in North Dakota. J Agron Agri Sci 2: 008.

**Received:** February 11, 2019; **Accepted:** February 14, 2019; **Published:** March 01, 2019

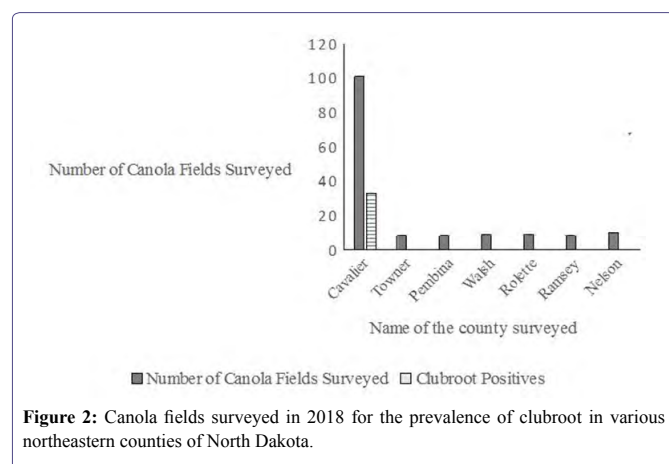
**Copyright:** © 2019 Chapara V, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

crop rotation of 3-4 years may not be a viable option and can spread from field to field on both agricultural and non-agricultural equipment (Wallenhammar 1996). Three-year survey was conducted by a survey group consisting one plant pathologist, two extension specialists of Langdon Research Experiment Station, Langdon, North Dakota and one NDSU Extension personnel of Cavalier County, North Dakota. Current objective of determination of clubroot spread and prevalence was done by visual inspection of canola plant roots for galls at two phases in the growing season; once at flowering (10 -100%) stage and at swathing of canola in seven northeastern counties (Pembina, Walsh, Nelson, Ramsey, Towner, Rolette and Cavalier) of North Dakota. The survey was done from the main entrance of the field, where the survey group walked along in a "W" pattern by stopping at 10 spots and uprooting 10 consecutive stems from the ground at each spot. Excess soil was shaken off. Roots then were visually examined for presence of galls. The three-year data prior to 2016 was obtained from North Dakota State University, industry and commodity group surveys done in Cavalier County North Dakota (Figure 2). Selection of counties to survey was done based on canola acreage planted in that particular year and on assumptions of *P. brassicae* resting spore disseminated in all directions through equipment, soil, and water to neighboring counties of Cavalier. In each county, one field in every 5,000 acres was scouted. Soil samples were collected from the clubroot positive and likely positive fields with an intent to know the pH of the infected soil at which clubroot infections were found. In all, a minimum of 5-10 fields per county were targeted for scouting. The survey results indicated that clubroot on canola was more prevalent in Cavalier County than expected in low pH soils that ranged from 4.5 to 6.4 (Data not shown). Likewise, the current survey results indicated that the prevalence of clubroot on canola has been increasing at rapid pace in North Dakota and has been confirmed in 33 fields in 2018, which is five times more than it was in 2017 (Figure 1), apart from Cavalier County there were no clubroot findings in any other counties surveyed (Figure 2). Disease surveys has been very crucial worldwide in managing a newly emerging disease like clubroot. Research reports of canola survey in central Sweden indicated that 78% of 190 fields surveyed were infested with clubroot (Wallenhammar 1996). Survey reports of clubroot in Alberta and Manitoba provinces of Canada confirmed over 3000 and 600 canola fields respectively were clubroot positives (Strelkov, 2018 Personnel communication at Clubroot International workshop). Spread of clubroot can be reduced by thorough sanitation and through adopting integrated disease management consisting disease resistant cultivars, longer crop rotations, and soil reclamation (Donald and Porter 2009). Extensive crop survey, determination of soil pH of canola fields with clubroot was found to be an important arsenal in educating growers about the prevalence of clubroot in North Dakota on Canola. The prevalence data will be more fruitful when integrated with other available clubroot management practices. Survey and prevalence data can be used in outreach activities to educate producers in identifying the disease, inform of potential risks and to encourage clubroot monitoring and adoption of sanitation practices. Removal of potentially contaminated soil from field equipment is an ideal one if practiced (Strelkov et al. 2011). Likewise, length of crop rotation with canola can be determined with the knowledge of detection of clubroot in a field.

Finally, clubroot on canola may be more prevalent than expected in North Dakota. Catching it early and being proactive is crucial to manage such a yield robbing and difficult to control disease. Likewise, extensive research needed to develop a better understanding of clubroot risk and its management in canola in North Dakota conditions.



**Figure 1:** Spread of clubroot of canola in Cavalier County of North Dakota since its first report in 2013 to 2018.



**Figure 2:** Canola fields surveyed in 2018 for the prevalence of clubroot in various northeastern counties of North Dakota.

## Acknowledgements

The authors acknowledge funding support from North Central Canola Research Program USDA/NIFA, North Dakota Crop Protection Product Harmonization Board and Northern Canola Growers Association. Special thanks to Ron Benada, Drs. Chittem and Del Rio for their help in survey and Randy Mehlhoff for reviewing this article, all the growers with phone call requests to visit their fields for clubroot diagnosis and to the agriculture extension agents, commodity groups and industry personnel that helped in the survey and in conducting clubroot awareness meetings in respective counties.

## References

1. Chittem K, Mansouripour SM, Del Río Mendoza LE (2014) First Report of Clubroot on Canola Caused by *Plasmodiophora brassicae* in North Dakota. Plant Dis 98: 1438.
2. Dixon GR (2009) The Occurrence and Economic Impact of *Plasmodiophora brassicae* and Clubroot Disease. Plant Growth Regul 28: 194-202.
3. Donald C, Porter I (2009) Integrated control of clubroot. J Plant Growth Regul 28: 289.
4. Khangura RK, Wright DW (2012) First Report of Club Root Caused by *Plasmodiophora brassicae* on Canola in Australia. Plant Dis 96: 1075.
5. Palm ET (1963) Effect of minimal nutrition on the invasion and response of turnip tissue to *Plasmodiophora brassicae* Wor. Contributions from Boyce Thompson Institute 22: 91-112.
6. Strelkov SE, Tewari JP, Hartman M, Orchard D (2005) Clubroot on canola in Alberta in 2003 and 2004. Plant Dis Surv 85: 72-73.
7. Strelkov SE, Manolii VP, Cao T, Xue S, Hwang SF (2007) Pathotype Classification of *Plasmodiophora brassicae* and its Occurrence in *Brassica napus* in Alberta, Canada. J Phytopathol 155: 706-712.
8. Strelkov SE, Hwang SF, Howard RJ, Hartman M, Turkington TK (2011) Progress towards the Sustainable Management of Clubroot (*Plasmodiophora brassicae*) of Canola on the Canadian Prairies. Prairie soils and crop Journal 4: 114-121.
9. Tewari JP, Strelkov SE, Orchard D, Hartman M, Lange RM, et al. (2005) Identification of clubroot of crucifers on canola (*Brassica napus*) in Alberta. Can J Plant Pathol 27: 143-144.
10. Wallenhammar AC (1996) Prevalence of *Plasmodiophora brassicae* in a spring oilseed rape growing area in central Sweden and factors influencing soil infestation levels. Plant Pathol 45: 710-719.



- Journal of Anesthesia & Clinical Care  
Journal of Addiction & Addictive Disorders  
Advances in Microbiology Research  
Advances in Industrial Biotechnology  
Journal of Agronomy & Agricultural Science  
Journal of AIDS Clinical Research & STDs  
Journal of Alcoholism, Drug Abuse & Substance Dependence  
Journal of Allergy Disorders & Therapy  
Journal of Alternative, Complementary & Integrative Medicine  
Journal of Alzheimer's & Neurodegenerative Diseases  
Journal of Angiology & Vascular Surgery  
Journal of Animal Research & Veterinary Science  
Archives of Zoological Studies  
Archives of Urology  
Journal of Atmospheric & Earth-Sciences  
Journal of Aquaculture & Fisheries  
Journal of Biotech Research & Biochemistry  
Journal of Brain & Neuroscience Research  
Journal of Cancer Biology & Treatment  
Journal of Cardiology: Study & Research  
Journal of Cell Biology & Cell Metabolism  
Journal of Clinical Dermatology & Therapy  
Journal of Clinical Immunology & Immunotherapy  
Journal of Clinical Studies & Medical Case Reports  
Journal of Community Medicine & Public Health Care  
Current Trends: Medical & Biological Engineering  
Journal of Cytology & Tissue Biology  
Journal of Dentistry: Oral Health & Cosmesis  
Journal of Diabetes & Metabolic Disorders  
Journal of Dairy Research & Technology  
Journal of Emergency Medicine Trauma & Surgical Care  
Journal of Environmental Science: Current Research  
Journal of Food Science & Nutrition  
Journal of Forensic, Legal & Investigative Sciences  
Journal of Gastroenterology & Hepatology Research  
Journal of Gerontology & Geriatric Medicine  
Journal of Genetics & Genomic Sciences  
Journal of Hematology, Blood Transfusion & Disorders  
Journal of Human Endocrinology  
Journal of Hospice & Palliative Medical Care  
Journal of Internal Medicine & Primary Healthcare  
Journal of Infectious & Non Infectious Diseases  
Journal of Light & Laser: Current Trends  
Journal of Modern Chemical Sciences  
Journal of Medicine: Study & Research  
Journal of Nanotechnology: Nanomedicine & Nanobiotechnology  
Journal of Neonatology & Clinical Pediatrics  
Journal of Nephrology & Renal Therapy  
Journal of Non Invasive Vascular Investigation  
Journal of Nuclear Medicine, Radiology & Radiation Therapy  
Journal of Obesity & Weight Loss  
Journal of Orthopedic Research & Physiotherapy  
Journal of Otolaryngology, Head & Neck Surgery  
Journal of Protein Research & Bioinformatics  
Journal of Pathology Clinical & Medical Research  
Journal of Pharmacology, Pharmaceutics & Pharmacovigilance  
Journal of Physical Medicine, Rehabilitation & Disabilities  
Journal of Plant Science: Current Research  
Journal of Psychiatry, Depression & Anxiety  
Journal of Pulmonary Medicine & Respiratory Research  
Journal of Practical & Professional Nursing  
Journal of Reproductive Medicine, Gynaecology & Obstetrics  
Journal of Stem Cells Research, Development & Therapy  
Journal of Surgery: Current Trends & Innovations  
Journal of Toxicology: Current Research  
Journal of Translational Science and Research  
Trends in Anatomy & Physiology  
Journal of Vaccines Research & Vaccination  
Journal of Virology & Antivirals  
Archives of Surgery and Surgical Education  
Sports Medicine and Injury Care Journal  
International Journal of Case Reports and Therapeutic Studies

Submit Your Manuscript: <http://www.heraldopenaccess.us/Online-Submission.php>