

# Incidence of Clubroot Disease in Crucifer Vegetables at Madhyapur Thimi, Bhaktapur

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## ABSTRACT

*Crucifers are important winter vegetables in Nepal. Many of the crops suffer from clubroot disease affecting yield drastically. In Madhyapur area of Bhaktapur, observations were made for four years continuously with farmer participation. Depending upon the vegetable species, on an average, the intensity of clubroot disease ranged from 15% to as high as 98%. On an average, the incidence was 34% in 2002, 45% in 2003, 57% in 2004 and 57% in 2005. The disease has been increasing in all crucifer crops. Cabbage was affected the most followed by cauliflower, knolkhol, mustard and turnip in order. Broccoli had least incidence of the disease in the study area. However, some farmers reported the disease to affect the crop as much by over 90% in 2010.*

**Key words:** Cole crops, disease incidence, *Plasmodiophora brassicae*

## INTRODUCTION

Vegetable growing is the major provocation of the farmers of Madhyapur (Thimi) area, Bhaktapur. This is a famous area for vegetable production in Nepal reflecting its name as Kitchen garden of Kathmandu Valley. It also used to supply different vegetables to other city areas of the country. In 1999, during the visits of vegetable farms, an unusual pattern of root bulging (i.e. swollen roots forming galls) in several cole crops was observed; this disease in cole crops is called clubroot. In fact, in Kathmandu Valley, the disease was noticed in cauliflower in Kalimati-Sitapaila area in 1993 with a loss of 9% to 55% of the crop depending upon the fields of cauliflower. In 1994, the loss was increased to 62%. (Shrestha *et al.*, 1998). The disease was also observed in Shankhamul and Balkot area (PPD, 2002). In several farmers' fields in Madhyapur Thimi, disease was observed the closely in 2000. In mild cases, plants wilt and get stunted during day time and become normal at night when transpiration rate goes down. In severe cases, the plant dies. In 2001, we made lively group interaction and discussion regarding clubroot disease with 20 farmers of Madhyapur Thimi who grow cole crops. These farmers reported that it was becoming a serious problem in their cauliflower and cabbage fields.

Not only the farmers of Madhyapur area but also the farmers of other places of Bhaktapur district have faced tremendous economic loss threatening sustainability of crucifer vegetable production in the district. Lately, severity of this problem has also been reported from other districts, such as Makawanpur, Kavre, Nuwakot, etc. Clubroot disease, the most devastating disease of Brassica crops worldwide, is caused by the pathogen *Plasmodiophora brassicae* affecting cabbage, cauliflower, turnip, mustard, and Chinese cabbage. The disease invades plant's root system affecting water and nutrient absorption and transport (Narisawa *et al.*, 1998). This study aimed to know severity of the disease in several of crucifer vegetable species and quantify the percentage loss of different cruciferous vegetables grown at Madhyapur area of Bhaktapur district from 2002 to 2005.

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## METHODOLOGY

Among the many vegetable species grown in the Madhyapur area, crucifers are major crops in winter and spring seasons. So, selected crops for this study were broadleaf mustard/mustard, broccoli, cabbage, cauliflower, knolkhol and turnip.

Twenty farmers who grew one or more of these vegetables were included in the study program. The selected site was the river basin area situated at the south of the highway between Thimi Chowk and Hanumante Bridge to the north of the Hanumante River. Although planting dates of the said crops were somewhat different, however, the selected farmers have had similar dates of planting. The growing techniques adopted by all these farmers were essentially the same. Participant farmers' plots for mustard were 20, broccoli 5, cabbage 12, cauliflower 10, knolkhol 7, and turnip 15. Two of the 5 broccoli growers were contacted in January 2011 to review the disease incidence in their fields.

In all the years of study period, the farmer fields of these cruciferous crops were visited two times; first at one month after planting and the second at one month after the first visit. Three participant farmers and the researcher made critical observations of the clubroot disease occurrence inspecting all fields included in the study. Where necessary, some plants were uprooted carefully to confirm the disease incidence. The selected plant populations of each crop in each farmer were 100; so, included plant populations for this study totaled 6900 in every year.

## RESULTS AND DISCUSSION

The study indicated that all the crops under the critical observation were affected by the disease and the average incidence was ranged from 15.35% to 98.1% (Table 1) showing the seriousness of the clubroot problem for the production of crucifer vegetables at Madhyapur Thimi in coming years. The attack was highest in cabbage in all four years of study, giving the mean value of 83.69%. In 2003, the disease incidence recorded in one farmer's cabbage field was as high as 100% infection. The cabbage growers were very disappointed with the incidence and they asked for an immediate control measures for appropriate solutions.

Table 1. Four-year observations on the average incidence of clubroot in various crucifer vegetables at Madhyapur Thimi (Percent of plant population)

Crops	Plants	2002	2003	2004	2005	Mean
Broccoli	500	18.2	34.35	25.8	30.6	27.24
Cabbage	1200	80.25	98.1	75.65	80.75	83.69
Cauliflower	1000	40.1	66.6	67.6	80	63.58
Knolkhol	700	25.08	48.5	95.1	75.5	61.05
Mustard	2000	25	40.5	34.35	35.8	33.91
Turnip	1500	15.35	25.2	45.5	40.35	31.6
Mean	1150	34	48.88	57.33	57.12	

The mean values of 4 years study indicated that cauliflower received the second highest infection recording a figure of 63.58%. In 2002, the incidence was 40.1%, which increased in subsequent years also leading to 80.0% incidence in 2005 (Table 1). The difference in the disease occurrence between 2003 and 2004 was although insignificant but the figures are still very high to show significant loss in cauliflower production.

The mean value was lowest (27.24%) in broccoli, because the incidence in every year of study was comparatively low which ranged from 18.20% in 2002 (lowest) to 34.35% in 2003 (highest). Discussions with two broccoli growers in January of 2011, these farmers

were quite unhappy as they observed the disease over 90% in their fields. Mr Raj Krishna Shrestha planted broccoli in one-twentieth hectare of land and he was disappointed seeing all his plants infected with the disease. This indicates that clubroot in broccoli is getting more severe than some years before. The broccoli is a new and an emerging vegetable crop in Madhyapur area; its incidence must be minimized so as to reduce high economic loss from this disease.

Broadleaf mustard is very popular winter cruciferous vegetable in this area. Every participant farmers has grown this crop in his vegetable block due to very remunerative and continuous pay offs for long duration for almost two months. The Table 1 shows that this crop has also substantial incidence of the disease giving the mean value of 33.91%. The incidence in 2002 was 25.0%, which increased to 40.5% in 2003, but remained near to 35% in later years.

The situation was quite different in knolkhol which had variable year to year differences in clubroot incidence. In 2002, the clubroot-affected plants were 25.08% of the population, which increased greatly in later years, giving as high as 95.1% in 2004. In this year, the turnip had also highest incidence (45.5%) among the four years and the least incidence was in 2002. Considering the mean values of 4-year period in all important crucifer vegetables, the crop susceptibility to the pathogen infection was quite variable at the study sites of Madhyapur area. Based on the incidence percentage, these vegetables can be placed in order of cabbage > cauliflower > knolkhol > mustard > turnip broccoli (Table 1).

Careful observations to the yearly mean values of incidence, irrespective of vegetable species, in general, it appears that the intensity of clubroot disease is increasing every year. It was 34.0% in 2002, which increased over 57% by 2005. This is a very high percentage of loss in vegetable crop production in winter and spring seasons.

It appears that the clubroot has been a devastating disease in cruciferous vegetable crops reducing the production of vegetables and hampering the income of growers in every year. The disease is difficult to eliminate from the fields but can be managed effectively using different tactics. Farmers need to be alerted with this disease and they need to adopt available control measures timely such as cultural (PH correction with the use of lime) and chemical (use of Nebijin) in integrated manner. Nebijin can be used in transplanting hole during transplanting for cost effectiveness.

Concerning the management of this disease, no host resistance is available. Fungicides have been recommended for the chemical control (Singh, 1985) but the effects were variable and depended on several production factors. Biological control has been indicated using *Heteroconium chaetospora*, which was effective to suppress the disease in field (Narisawa *et al.*, 1998). Significant reduction in clubroot index was also observed in plots treated with *Trichoderma harzianum* (Timila and Shrestha, 2000).

A management trial consisting of different treatments revealed that there are significant differences among the treatments in the incidence of club-affected plants (PPD, 2001). Lowest incidence was found in benlate treatment followed by *Trichoderma harzianum* application. Lime applications also reduced the disease over the control treatment. Seedling age could also affect the incidence as the 7-week old seedling when transplanted had low clubroot as compared to 3 or 4 weeks old seedlings (PPD, 2002). Pandey (2009) reported that planting of clubroot-free seedlings would be better alternative approach over the fungicidal treatments in grown up plants in the field. He has given some techniques to produce such disease-free seedlings in the nursery.

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