

A Report of Powdery Mildews on Cucumbers in Village Nomal, Gilgit Baltistan (GB) – Pakistan

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Abstract

Cucumber is the most important vine crop and widely grown in Gilgit Baltistan (GB) Pakistan. The present study was conducted in open fields of cucumbers of village Nomal of GB. Cucumbers were found to be severely infected by cucumber powdery mildews (CPM) disease. The village Nomal has been divided into five major sectors i.e. Sigal, Das, Batot, Jigot and Majini (In local language called Mohallahs). In each sector five fields were randomly selected. In each field twenty plants were randomly selected and observed for the presence of powdery mildews. The disease severity and percent disease incidence of CPM were recorded. Among the Mohallahs the highest percent disease incidence of CPM was recorded in cucumber fields of Majini Mohallah with a value of 60% followed by Batot (58%), Jigot (49%) and Das (43%) Mohallahs respectively. However the minimum percent disease incidence of CPM was recorded in Sigal (37%) Mohallah. It can be concluded that open fields of cucumbers in Majini Mohallah were severely infected by CPM diseases.

Keywords: Cucumber; Cucumber powdery mildews (CPM); Gilgit Baltistan; Nomal; % disease Incidence

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Introduction

Cucumber (*Cucumis sativus* L) is the most important vine crop among gourd family (*Cucurbitaceae*). Cucumber is consumed as a delicious raw green fruit, used in salads and pickles and also cooked as vegetable (Qudsia, *et al.* 2017). In Pakistan it was cultivated on area of 3397 ha with a total production of 142876 tones (FAO, 2016). Cucumber is also widely grown in open fields of Gilgit Baltistan (GB) region of Pakistan. Growers of GB are cultivating high-yielding local varieties of cucumbers. However, in the recent years, the severity of fungal disease in particular cucumber powdery mildews (CPM) have increased.

These cucumber powdery mildews (CPM) reduce the yield (20-40%) and quality of cucumbers by interfering with the physiological functions such as photosynthesis and respirations (Queiroga, *et al.* 2008; Lamsal, *et al.* 2011). Initially, whitish powdery growth of powdery mildews appears on the lower leaves surfaces, petioles and stems of cucumber crop (Zitter, *et al.* 1996; El-Naggar, *et al.* 2012). Later it becomes so severe, causes extensive premature defoliation of leaves, and wipes out the entire crop. These mildews also reduce the size of fruits, cause inadequate fruit ripening and poor flavor development (McGrath, 1996; Nunez-Palenius, *et al.* 2012).

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The CPM are a group of pathogen primarily caused by the two obligate biotrophic polyphagous fungi; *Podosphaera xanthii* and *Golovinomyces cichoracearum* (Braun 1995). The two species are morphologically different but can be difficult to distinguish visually (Björling, *et al.* 1991). The Polymerase chain reaction (PCR) is used for precise differentiation of both species (Chen, *et al.* 2008). *G. cichoracearum* usually cause powdery mildew at a lower temperature and therefore appears in spring or early summer (Aguiar, *et al.* 2012). However the *P. xanthii*, mostly causes severe infection in summer (Rur, *et al.* 2017).

The environmental factors which directly affect the development of CPM are temperature, humidity, and light. The disease is favored by moderate temperature, vigorous plant growth and relatively high humidity (Jarvis, *et al.* 2002).

The most favorable conditions for disease development are 35°C and high relative humidity of more than 70% (Ali, *et al.* 2013). These mildews are controlled by growing disease tolerant or resistant cucumbers varieties, however, development of such varieties need time and skillful plant breeders and appearance of new races of the pathogen may break the resistant of such varieties (Zijlstra, S, and Groot, 1992; Kusch and Ralph, 2017). Biological control involves the use of bio-pesticides or biological control agents against the powdery mildews (Tanaka, *et al.* 2017). However, due to unavailability and high-cost, biological control agents or biopesticides are not commonly used by growers of GB. Some of the growers applied fungicides as preventive (He, *et al.* 2017) prior to the appearance of powdery mildews. Most of the growers are applying ash to manage these mildew diseases however ash does not give promising results. Recently CPM have become so severe in cucumber of GB, therefore, there is an urgent need of integrated disease management (IDM) of CPM. Here we report the percent disease incidence and disease severity of CPM of cucumbers fields of village Nomal, GB Pakistan.

Materials and Methods

Survey for disease severity of powdery mildews of cucumbers was carried out in July-August, 2017 at open fields of Village Nomal, Gilgit-Baltistan Pakistan. High yielding local varieties were commonly grown. Sowing was carried out on 15 June 2017 at the density of 1 or 2 plants per meter square. The row to row and plant to plant distance was somehow maintained. Irrigation was applied directly from the water channels after 5 or 6 days interval depending on the requirement of cucumber plants. During sowing, fertilizers were broadcasted based on recommended rates. Village Nomal was divided into five Mohallahs (sectors).

Mohallah Jigot, Mohallah Batot, Mohallah Das, Mohallah Sigal and Mohallah Majini.

From each sector/mohallahs, five fields were randomly selected. Within each field twenty plants were randomly selected to observe the presence of powdery mildew. The disease severity (percentage of the leaf surface covered with powdery mildew symptoms) was evaluated based on the scale of 0 to 6 as shown in Table 1 (Yan, *et al.* 2006).

Ratings	Percent area covered by pustules of powdery mildews
0	No visible pustule
1	Pustules on less than 1% of the leaf surface
2	1 to 5% leaf surface covered with a pustule
3	6 to 20% leaf surface covered with pustule
4	21 to 40% leaf surface covered with pustule
5	41 to 60% leaf surface covered with pustule
6	> 60% of leaf surface covered with pustule

Table 1: Disease severity scale for Powdery mildews of cucumbers.

Moreover percent disease incidence of CPM was calculated by randomly selecting twenty plants from each field By the following formula:

$$\% \text{ incidence} = \frac{\text{Infected Plants}}{\text{Tested Plants}} \times 100$$

Statistical analysis

The least significant difference (LSD) between two means were calculated.

Results and Discussion

The whitish powdery fungal growth was observed on both leaf surfaces of cucumbers (Table 2). However some plants were found to be resistant and value 0 was assigned based on severity scale. The fungal growth also appeared on the petioles and stems of cucumber plants. The whitish growth are actually conidia. The whitish growth initially appeared on the lower leaves because they were covered by upper leaves and more presence of humidity, dew or water. The leaves undersurfaces were also found to be infected with powdery mildews. Finally the leaves were withered and died (Severity value 6) as seen in Table 2.

However no infection was recorded in cucumber fruits. Among different sectors or Mohallah of village the highest percent disease incidence of powdery mildew was recorded in Majini Mohallah followed by Batot, Jigot and Das Mohallah while minimum percent disease incidence of powdery mildew was recorded in Sigal Mohallah (Table 3). The Powdery mildews severely infected cucumber fields of Majini Mohallah with the percent disease incidence (60) followed by Batot Mohallah (58) (However percent disease incidence in both Mohallahs was not statistically significant as shown in Table 3) and Jigot Mohallah (49) respectively. However in Signal and Das Mohallahs the percent disease incidence was minimum with the value of 37 and 43 respectively.

Powdery mildew is a serious and common disease of cucumbers grown both in the field and green house conditions. Previously cucumber powdery mildew was considered as an occasional problem however recently powdery mildew outbreaks has increased (Roberts and Kucharek 2005). Powdery mildews cause reductions in plant growth, premature foliage loss and reduction in yield (Mossler and Nesheim 2005). If this disease is not controlled in a timely manner, it can be severe enough to wipe out the entire cucumbers crop from the fields.

Powdery mildew of cucumbers is caused by the following three fungal species *Podosphaera xanthii* (syn. *Sphaerotheca fuliginea* auct. p.p.), *Golovinomyces cucurbitacearum* (syn. *Erysiphe cichoracearum* auct. p.p.), and *Golovinomyces orontii* (syn. *Erysiphe cichoracearum* auct. p.p.) (Jahn., et al. 2002). Each fungal species has different races and these races have the potential to attack the resistant or tolerant cultivars of cucumber plants. Various environmental factors such as temperature, relative humidity and light are directly affecting the development of powdery mildew in cucumber crops. The temperature (75-85°F) and elevated levels of relative humidity (80-95%) promote the development of powdery mildews.

To manage this disease an integrated approach using combinations of several approaches will be more effective. The approaches include Genetic resistance, application of chemical and biological fungicides, biological control as well as cultural practices. Genetic resistance is the best approach to manage powdery mildews however powdery mildews have numerous number of fungal races which break down the resistant of cucumber cultivars (Zitter, et al. 1996). Most of the fungicides to control powdery mildew are primarily preventive however they cause phytotoxicity and also harmful to health of humans and environments. Biological control is safe to humans and environments but the problem many biological control agents have is that they require higher humidity for survival than the powdery mildews do (Hector, et al. 2006).








S. No	Severity Scale	Symptoms	
1	0		
2	1		
3	2		
4	3		
5	4		
6	5		
7	6		

Table 2: The disease severity based on symptoms of powdery mildews under field condition.

Sectors (Mohallahs)	Percent Disease Incidence in Fields					Percent Disease Incidence
	1	2	3	4	5	
Jigot	45	50	50	55	45	49 ^b
Batot	60	55	50	65	60	58 ^a
Das	40	40	50	40	45	43 ^c
Sigal	30	40	30	45	40	37 ^d
Majini	55	60	50	65	70	60 ^a
*LSD (0.05) = 5.5778						
Total tested plants per field = 20						

Table 3: The percent disease incidence of CMV.

Conclusion

Cucumber powdery mildew (CPM) is a common and serious disease of cucumber crops in Gilgit Baltistan (GB) Pakistan. It is concluded that CPM has severely infected cucumber fields of Majini Mohallah as compared to other Mohallahs as aforementioned. Over the past years the incidence of CPM outbreak has increased. The whole village Nomal cucumbers fields are found to be severely infected with CPM. Timely management of this disease by applying preventive fungicides or development of resistant varieties is very important.

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