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STUDY OF SOME FUNGAL DISEASES OF TOMATO IN KATHMANDU VALLEY

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Abstract

Tomato plants were observed and collected the infected part from Jitpurphedi of Kathmandu, Nepal. These infected parts were kept in pathology lab for fungal isolation. The isolated fungus from the infected tomato plants were as *Septoria lycopersici, Cladosporium oxysporum* were responsible for leaf spot, *Phytophthora infestans and Rhizoctonia solani* were responsible for Leaf blight, *Cladosporium cladosporioides* was responsible for fruit rot, *Leveilullataurica* was responsible for powdery mildew and *Plasmoparaviticola* was responsible for downey mildew disease. In the survey period, the highest incidence was found at leaf blight (30.08%) and lowest at stem rot (4.64%). In the case of severity, the maximum severity was found at Downey mildew (77%) and minimum was recorded at fruit rot (5.25%) on five different plastic houses.

Key words: *Lycopersicon esculentum,* Fungal diseases, Disease severity, Disease incidence

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.), flowering plant of the nightshade family (Solanaceae), cultivated extensively for its edible fruits. Labeled as a vegetable for nutritional purposes (Chapagain et al., 2011). Tomato is also known as the poor man's apple in Nepal with an average national consumption of 11.97 kg/person/year (Ghimire et al., 2017). It is cultivated in about 20,000 hectares (ha) in Nepal and around 0.3 million metric tons (MT) tomato is produced annually in the country (MoAD, 2014).There are around 7,500 tomato varieties grown for various purposes (FAOSTAT Database, 2012). Tomato is consumed in diverse ways, including raw, as an ingredient in many dishes, sauces, salads, and drinks. Tomato is a good source of energy. Besides, carbohydrates, fats, proteins, vitamins, trace elements like magnesium, potassium, phosphorus, etc, and other constituents like water and lycopene are also present (USDA, 2009).

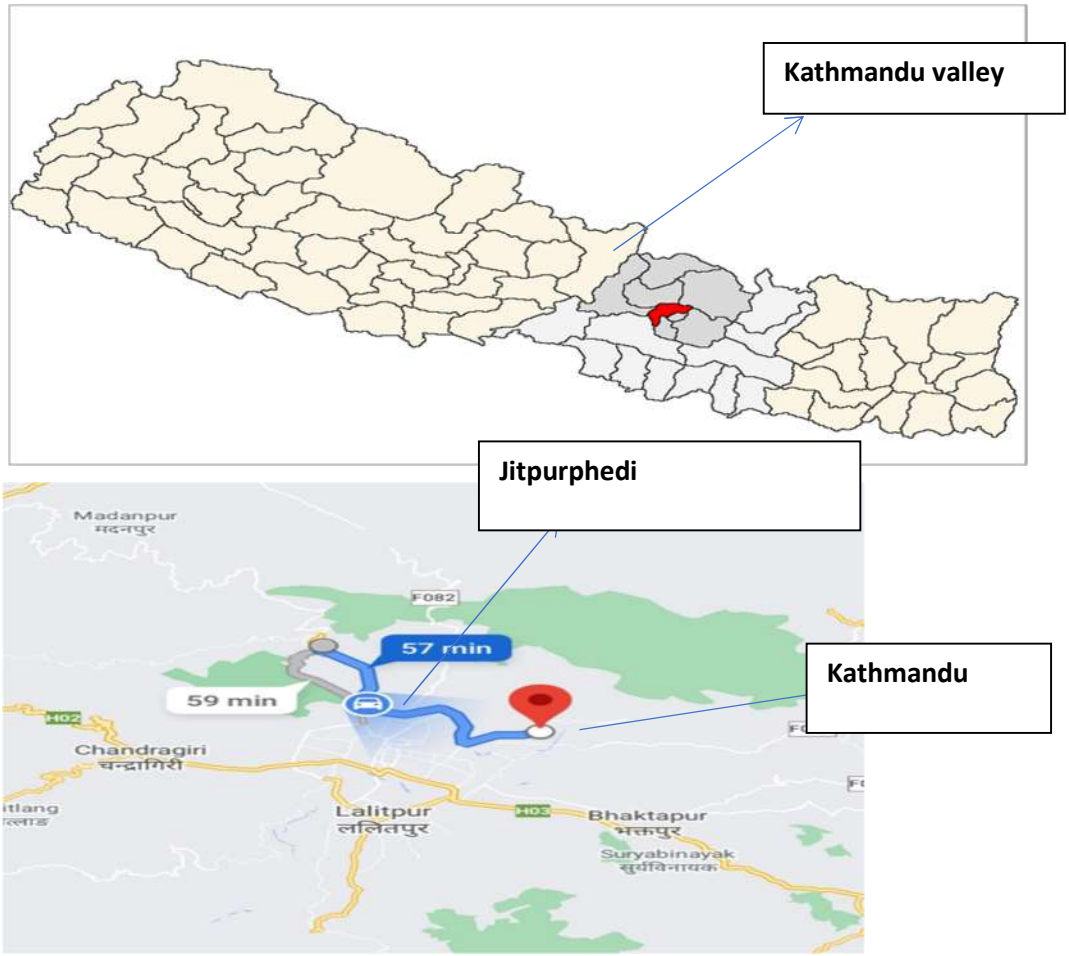
Tomatoes are affected by many fungal, Bacterial and pest pathogens. Fungi are an important group of microorganisms responsible for various diseases of plants and cause a considerable loss in yield (Kharde et al., 2010). Some species of fungus produce mycotoxins that are very toxic to humans. For e.g. Sphinganine- analog mycotoxins (SAM's) produced by *Fusarium moniliforme*of tomato inhibit de novo sphingo lipid (ceramide) biosynthesis in vitro, which leads to a variety of cellular responses, including accumulation of sphingoid bases in animal cells (Merrill et.al., 1997). Tomato diseases caused by fungi includes leaf blights, leaf spots, mildews, rots of (root, stem, fruit), wilt diseases, etc, and cause severe damage to crops. Different groups of fungi like *Alternaria, Septoria*, *Phytophthora*, etc, are responsible to cause leaf disease. Disease on leaf causes degradation of photosynthetic area and loss of crop production. Species of *Fusarium* and *Verticillium* cause wilting disease. *Colletotrichum,Stemphylium*, etc. causes fruit rot diseases. Since 2010 more than 40 tomato diseases has been studied in Nepal. Report shows that disease in tomato is caused by infectious and non -infectious agents. It also reports that majority of disease causing agent is fungal pathogens infecting different plant parts (NARC 2010).

MATERIALS AND METHOD

Study Area

Fungal disease of tomato plants were collected from the Jitpurphedi of Kathmandu valley. Jitpurphedi is a village and former Village Development Committee that is now part of Tarakeshwar Municipality in Kathmandu District in Province No. 3 of central Nepal. It lies in 27.78°N 85.28°E coordinates.

Jitpurphedi, Agricultural farm is covered 20 Ropani of land area. Various vegetables were farmed along with tomato. Tomato plants were observed in five different tunnels inside the area to calculate disease incidence and severity as well as to collect the diseased parts of plants.



Collection of Diseased Plants Parts

During research period, the infected tomato plants (leaf, stem, fruits) were recorded and collected from Jitpurphedi of Kathmandu valley Nepal and fungus was isolated in pathology laboratory.

Visual observation was conducted in five different plastic houses in same location. Hundred plants of one plastic house were observed and recorded the number of infected parts of tomato plants.

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Preparation of PDA Media

For preparing PDA media 100 gm of peeled potato was cut into small pieces and boiled for some time in 500 ml distilled water. The cooked potato pieces were filtered by muslin cloth, 20 gm dextrose was dissolved thoroughly and the volume of filtrate was maintained to 1000 ml by adding more water. Twenty gram of agar was added and stirred gently to get thoroughly mixed. The mouth of flask was covered with Aluminum foil and tied with sterilized rubber. And the media was autoclaved for 30 minutes in 121°C with 15 lbs pressure. Similarly, Water agar (WA) was prepared by mixing 20 gm agar with distilled water and final volume of mixture was made 1000 ml. These contents after mixing was sterilized in autoclave with 15 lbs pressure at 121°C for 15 minutes. Antibiotic was added after the media has cooled to 45-50°C

Isolation and Identification of the Test Fungus

Infected leaf, stem and fruit were collected from the plastic house in jitpurphedi of Kathmandu valley, by the help of sterilized needles and forceps some pieces of fungal colony from theinfected parts of tomato plants was transferred aseptically on a Petri plate containing PDA media then it was incubated in inverted position in an incubator at 25±2°C for one week. After one week the growth of fungal colony were observed in petri plate and colony of the culture was observed under the compound microscope and studied the characteristics of the pathogen.The test fungus wereidentified with the help of standard literature and also by observing the features of macroscopic characters from the Stereo-Microscope at plant pathology lab of FRTC.

Maintenance of the Pure Culture

The pure culture of isolated fungi was preserved by sub-culturing in PDA media and incubated at 25±2ºC. Similarly fungi were inoculated in agar slants and stored at <10ºC for the preservation of their vigor and long term.

Preparation of One Week Old Culture

For testing the antifungal activity of the essential oils and extracts, inoculum disc from one week old culture is required. For preparation of one week culture, the fungus from pure culture was inoculated into PDA and after seven days the inoculum disc was taken from the culture for further experiment.

Pathogenicity Test

For carrying out the pathogenicity test, the infected leaves and fruits were collected and symptoms were noted down, then *plasmoparaviticola, Septoria lycopersici, Phytophthora infestans, Cladosporium sp, Leveilullataurica, Rhizoctonia solani, Chaetomium sp*was isolated in PDA media as pure culture. Inoculum from the pure culture was transferred to the healthy leaves and fruits. When incubated at 25±2°C for 7 days, the characteristics symptoms were produced, which were found to be similar with the symptoms on fruit and leaves previously collected. The fungus was isolated and its character was compared with the previously isolated fungus.

Measurement of Conidia Size

The size of conidia was measured by using optica software, computer and microscope in plant pathology lab of FRTC.

Measurement of Disease incidence

Disease incidences is simply the percentage of plant infected in a selected area which can be obtained by dividing the infected plants by total number of plants and multiply by 100.

$$\text{Disease incidence } = \frac{\text{Number of infected parts}}{\text{Total number of plants parts}} \times 100$$

Calculation of Disease Severity

The disease severity was expressed in PDI. The PDI was computed by using standard formula (Paper et al., 1996) is giving below

$$\text{PDI}= \frac{\sum(\text{Disease grade} \times \text{no. of plant in grade})}{\text{Total no. of plants} \times \text{highest disease grade}} \times 100$$

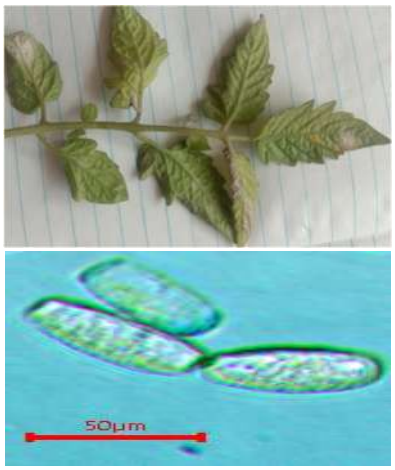
Result and Discussion

Survey and Identification of Fungal Pathogen

For observing the prevalence of disease incidence and severity of fungal disease in tomato plant, the disease was identified by symptomology of infected Tomato plants and compared with standard literature. It was found that there were six distinct symptoms prevalent at Jitpurphedi of Kathmandu valley. The seven different symptoms so far categorized are named as Leaf spot (LS), Leaf blight (LB), Downy mildew (DM), Powdery mildew (PM), Stem rot (SR), Fruit rot (FR). The development of black brown lesion on the young stem and leaf petioles as well as green ring spot developing on leaves was common and consistent with all the seven types of symptom. Yellowing of the leaf and distortion of fruits were observed in association with other symptoms.

Isolation of Test Pathogens

Seven fungal isolates were obtained from naturally occurring tomato leaves and fruits showing leaf blight (*Phytophthorasp, Rhizoctonia solani*) and leaf spot (in case of *Cladosporium oxysporum., Sepptorialycopersici*.) *Plasmoparaviticola* symptoms were found associated with *Septorialycopersici* downy mildew disease. while *Phytophthora infestans*. and *Rhizoctonia*s*olani*. were found associated with leaf blight. The pathogens were identified based on the morphological characteristics and articles (Barnett, 1960).



a.*Leveillulataurica*

b.*Rhizoctonia solani*

c.Plasmopara viticola

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d.*Cladosporium*	e.*Septoria lycopersici*	f. *Phytophthora infestance*

Incidence and Severity of Fungal Tomato Disease at Jitpurphedi in Kathmandu

Significant differences were found in disease incidence of six fungal pathogens at jitpurphedi in Kathmandu as shown in (Fig. 1). Disease incidence was calculated by visual observation part of tomato plant and applied on formula. The incidence ranged from 4.64% to 30.08% and the severity ranged from 5.25% to 77%%.

Disease incidence were significant differences found among all six fungal pathogens. The highest disease incidence showed Leaf blight (30.08%) followed by Downy mildew (24.24%), Leaf spot (22.8%), Powdery mildew (5.24%) and the lowest incidence (4.64%) was found in stem rot.

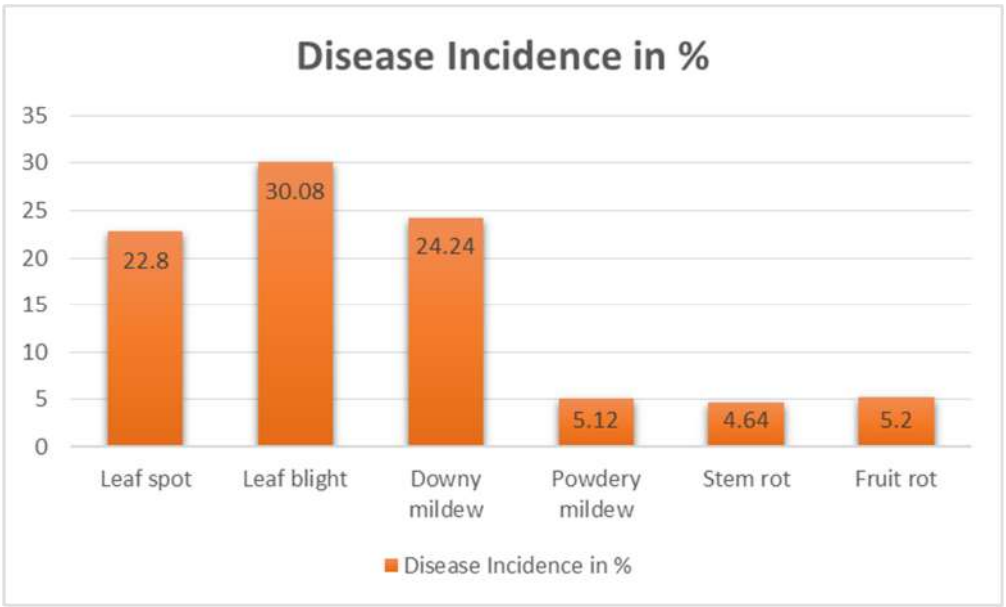

Fig. 1 Disease incidence of six different fungal pathogens

Disease Severity

Disease severity were Significant differences were found in among all six fungal disease in Jitpurphedi Kathmandu. The highest disease severity (77%) was in Downy mildew followed by (58%) leaf spot, Leaf blight (14.25%), Powdery mildew (9%), Stem rot (7%) and the lowest disease severity (5.25%) was found in fruit rot respectively.

Table1. Disease severity of six different fungal pathogens

SN		Disease grade	Disease severity %
1.	Disease severity of leaf blight	0	0
		25	3.5
		50	16
		75	14.25
		100	0
2.	Disease severity of leaf spot	0	0
		25	3
		50	17
		75	32.25
		100	58
3.	Disease severity of downy mildew	0	0
		25	4
		50	21.5
		75	39
		100	77
4.	Disease severity of powdery mildew	0	0
		25	0.5
		50	2.5
		75	5.25
		100	9
5.	Disease severity of stem rot	0	0
		25	0.25
		50	1.5
		75	3.75
		100	7
6.	Disease severity of fruit rot	0	0
		25	0.5
		50	2.5
		75	5.25
		100	3

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CONCLUSION

Tomato (*Lycopersicon esculentum*) production was decrease due to many fungal, bacterial, viral pathogens as well as by nematodes.Tomato is a very important vegetable all over the world and though its demand is increasing day by day, the production of tomato is not satisfactory. The present experiment was designed to study the surveillance and identification of fungal disease based on symptomology and to observe the disease incidence and severity of fungi at Jitpurphedi Kathmandu Nepal. In the survey period, the highest incidence was found at leaf blight (30.08%) and lowest at stem rot (4.64%). In the case of severity, the maximum severity was found at Downey mildew (77%) and minimum was recorded at fruit rot (5.25%).

Six fungal pathogens were identified and pathogenicity test of two fungi were done. The identified fungi were Leaf spot (*Septoria lycopersici* and *cladosporiumcladosporioides*), leaf blight (*Rhizoctonia solani* and *Phytophthora infestans*), Downey mildew (*Plasmoparaviticola*), powdery mildew (Leveilullataurica).

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References

Ghimire N P, Kandel M, Aryal&Bhattarai D. (2017). Assessment of tomato consumption and demand in Nepal. *Journal of Agriculture and Environment*, *18*, 83-94. Mill) from the field and market in Costa Rica. *Fitopatologia*, **23**(1): 1-4.

Borguini, R. G., &Ferraz da Silva Torres, E. A. (2009). Tomatoes and tomato products as dietary sources of antioxidants. Food Reviews International, **25**(4): 313-325.

Chapagain, T. R., Khatri, B. B., & Mandal, J. L. (2011). Performance of tomato varieties during rainy season under plastic house conditions. Nepal Journal of Science and Technology, 12, 17-22.

De Souza, L. M., Melo, P. C. T., Luders, R. R., & Melo, A. M. (2012). Correlations between yield and fruit quality characteristics of fresh market tomatoes. HorticulturaBrasileira, **30**(4):627-631.

Fajola, A. O. (1979). The post-harvest fruit rots of tomato (Lycopersicum esculentum) in Nigeria. Food/Nahrung, **23**(2):105-109.

MoAD.(2014). Statistical information on Nepalese agriculture (2013/14). Government of Nepal, Ministry of Agricultural Development (MoAD), Agri-Business Promotion and Statistics Division, Statistics Section, Singha Durbar, Kathmandu, Nepal.

Rosati, C., Aquilani, R., Dharmapuri, S., Pallara, P., Marusic, C., Tavazza, R., ... & Giuliano, G. (2000). Metabolic engineering of beta-carotene and lycopene content in tomato fruit. The Plant Journal, **24**(3): 413-420.

Shrestha, R. (2015). In Vitro Management of Four Tomato Fungal Pathogens Using Plant Extracts and Fermented Products (Doctoral dissertation, Central Department of Botany Tribhuvan University).