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Short communication

Status of tomato (*Solanum lycopersicum)* diseases in cold desert area of Ladakh, India

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Indian cold arid Himalayan region is the most elevated inhabited region of the world which has intense long winter period (Husaini*et al.,* 2013). The harsh and vagaries environmental conditions of the region does not permit abundant scope to diversify and yield potential of agricultural crops.Although, the region has harsh environmental condition but in due course of time some potential pathogens and pests also adopted which damage the crop up to significant level(Hossain *et al.,* 2010; Singh and Dhiman, 2018). Moreover, very scattered and negligible study has been reported on this aspect in this cold arid region of Ladakh.

An extensive survey of high altitudes regions was conducted ranging from 9000 ft to 14000ft above sea level.It is first documentation on status of tomato diseases in Ladkah. During survey, it was observed that many type of symptoms and disease were found in tomato in cold desert regions during two cropping season (2016, 2017) in August-September and severity and incidence varies from altitude to altitude, village to village and field to field. The study areas were Saspol, Nimmo, Lamayuru, Drass, Chanigun, Kargil (Khumbtham), Leh, Rambirpur, Kerey, Nyoma, Chumathang, Mulbug and Muthvillages. The questionnaires were answered by the farmers in the selected field and symptoms were observed by the 1-5 disease rating scale method to calculate the disease incidence and disease severity in tomato (Kumar *et al.,* 2018).In selected field area, whole plants, leaves and their fruit plant of vegetables and fruits were evaluated in the farmers' fields.Interestingly, disease incidence and severity observed up to 13862 fts of altitude. Highest foliar disease incidence in tomato was recorded in Leh(78.66 ± 3.186 at 11482 fts altitude) followed by Rambirpur (73.11 ± 1.868 at 11562 fts), Kargil (72.20 ± 1.328 at 9657 fts), Chanigun (69.55±0.790 at 11320 ft), Lamayaru (69.00 ± 1.653 at 10451ft), Saspol (68.28±1.853 at 9799 ft), Nimmo (63.00±1.267 at 10372 ft), Drass (51.00±5.630 at 10044 ft), Mulbug (42.69±2.567 at 13511 ft), Chumathang (37.66±1.965 at 12959 ft), Kerey (34.60±2.678 at 12710 ft), Muth (23.65±0.578 at 13848 ft) and Nyoma (21.50±3.846 at 13862 ft).Earlier researchers also observed disease incidence ranging from 0 to 45.6% during survey (2015-2016)of pulses crop in Ethopia(Tadesse*et al.* 2017). Similarly, highest foliar disease severity in tomato was recorded in Kargil (68.00 ± 1.754 at 9657 ft altitude) followed byLeh (65.66 ± 2.647 at 11482 ft), Rambirpur (57.22±1.854 at 11562 ft),Chanigun (58.00 ± 3.730 at 11320 ft), Lamayaru (44.50 ± 2.537 at 10451ft), Saspol (59.00±1.854 at 9799 ft), Nimmo (57.25 ± 1.965 at 10372 ft), Drass (36.57 ± 2.754 at 10044 ft), Mulbug (27.00 ± 1.643 at 13511 ft), Chumathang (21.00 ± 2.854 at 12959 ft), Kerey (19.80±0.843 at 12710 ft), Muth (13.32 ± 2.843 at 13848 ft) and Nyoma (11.60 ± 0.521 at 13862 ft). During survey, it was observed that relative atmospheric humidity directly affect the growth and sporulation in fungal plant pathogens and percentage of disease incidence and severity increase with increase in atmospheric humidity in tomato. Under field condition, different diseases in tomato crop were also identified by observing the symptoms of particular disease. Different types of symptoms on the different parts of plants like leaf spot, early blight, leaf tip burner, chlorosis, wilt, tip dieback, were found on tomato plants. Early blight, the most common disease, was observed in high atmospheric humidity and lower altitude regions.During survey, 52 infested sampleswere collected and brought to the lab for further identification. Fifteen fungal cultures were obtained from collected samples on the basis of morphological characteristics.

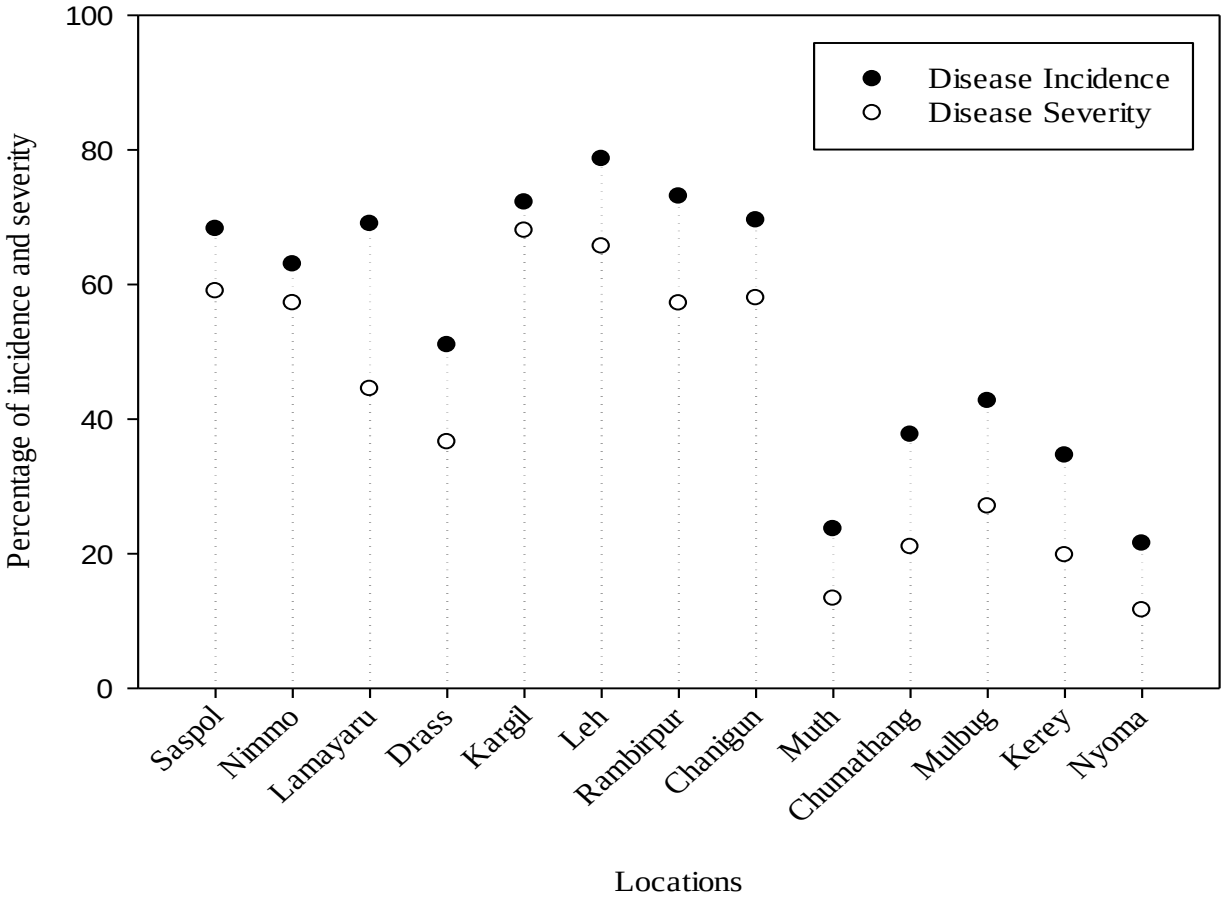

Figure 1: Disease incidence and severity on tomato at different locations of Ladakh

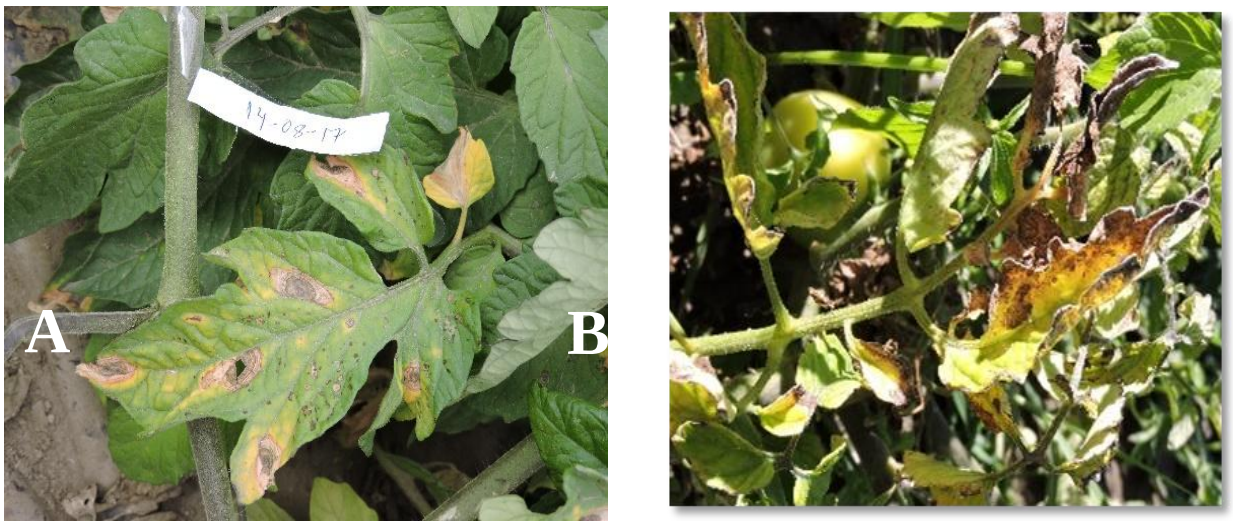

Figure 2: Illustrating different disease symptoms on Tomato in cold desert area of Ladakh Alternaria early blight (B) Sacterial canker

Different pathogenic fungal species werefound under the bright field microscopy i.e., *Alternaria* spp., *Cochliobolus* spp., *Aspergillus* spp. and*Fusarium* spp. causing various diseases were identified. Pathogen causing blight diseases was identified as *Alternaria* species (Wolters*et al.*, 2018). Pathogens causing Fusarium dry rot and Fusarium wilt were identified as *Fusarium* species (Manikandan*et al.,* 2018).Pathogen causing foliar and leaf blight causing pathogen was identified as *Aspergillus* spp., *Alternaria* spp. and *Fusarium* spp. were found to be dominated in isolated cultures.This study has shown that various types of diseases in Tomato crop were found in Eastern and Western Ladakh region of Jammu and Kashmir. Disease incidence and severity was computed for tomatocrop and the percentage varied across different regions owing to the differences in altitude and other climatic factors.Presence of atmospheric humidity directly affects growth of fungi as observed percentage of disease incidence and severity increased with an increase in atmospheric humidity.

Survey highlights the presence of phytopathogens and damage caused to the economically important tomato crop in such harsh conditions. Therefore, extensive molecular biological research should be done in order to identify the pathogens of cold arid regions of Ladakh followed by their mitigation.

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