

Status of Turcicum Leaf Blight (*Exserohilum turcicum*) of Maize in Kashmir

T. A. Wani, Mushtaq Ahmad

Received 22 July 2016; Accepted 26 August 2016 ; Published online 12 September 2016

Abstract The present study on status of Turcicum leaf blight of maize in Kashmir valley was conducted during 2012 and 2013. The disease was characterized by long spindle shaped necrotic lesions on leaves measuring upto 12.5 × 2.2 cm. An extensive survey conducted in four districts of Kashmir valley viz. Anantnag, Baramulla, Ganderbal and Kupwara revealed that disease was prevalent in all the four districts. Mean disease incidence and intensity of 41.75 and 19.66% were recorded in the year 2012 and that of 48.08 and 23.13% during the year 2013 respectively. The highest pooled mean disease incidence and intensity of 58.72 and 28.38% respectively, was recorded in Anantnag district and lowest pooled mean disease incidence and intensity of 25.78 and 12.14% respectively, was recorded in Ganderbal district of Kashmir valley.

Keywords *Exserohilum turcicum*, Disease incidence, Disease intensity, Maize, Turcicum leaf blight.

Introduction

Maize (*Zea mays* L.) is one of the important cereal crops of the world and major crop of Jammu and Kashmir, being cultivated under rain fed and irrigated conditions. USA ranks first in area, production and productivity (34 million ha, 317 million tonnes and 9.3 t/ha respectively) followed by China (33 million ha, 178 million tonnes and 5.4 t/ha respectively) and the total world production of maize during the year 2011-12 was 854.67 million tonnes from the total cultivated area of 168.40 million hectares and as such the average world productivity of the maize is 5.0 t/ha [1]. During the same year 2011-12, India produced 21.76 million tonnes from the cultivated area of 8.78 million hectare with an average productivity of 2.5 t/ha [2]. Maize is the major crop of Jammu and Kashmir in terms of acreage under any crop. During 2012-13, maize in J and K was cultivated over an area of 0.31 million hectares with total production of 0.51 million tonnes and as such the productivity of maize is low (1.65 t/ha) in J and K than national average (2.5 t/ha). Further the Kashmir region has much lower productivity of 1 t/ha than jammu region having 1.8 t/ha [3]. Amongst the different diseases of maize, Turcicum leaf blight is a major foliar disease, caused by *Exserohilum turcicum* (Pass). Leonard and Suggs. This disease is popularly known as Northern corn leaf bight (NCLB) in the United States of America. Welz and Geiger [4] described that symptoms of the disease can range from small cigar-shaped lesions to complete destruction of the foliage and mid-altitude regions, about 900-1600 m above sea level, have particularly favorable climate for the disease as dew periods are

T. A. Wani*
Department of Plant Pathology, FOA, SKUAST-K,
Wadura Sopore, J and K 193201, India

Mushtaq Ahmad
Directorate of Extension, SKUAST-K, Shalimar,
J and K 190025, India
e-mail : tnvrwani@gmail.com
*Correspondence

long and temperature moderate. Oligari et al. [5] described that temperature between 20°C and 25°C, relative humidity from 90 to 100% and low luminosity favor the disease. Babu et al. [6] reported severe incidence of turcicum leaf blight of maize in Uttranchal, attaining epidemic proportions which resulted in 83% yield reduction. Emanu [7] reported high incidence and severity of 73 and 61.2% respectively, of Turcicum leaf blight of maize from darolebu district of Ethiopia. Lack of detailed information on status of the disease in Kashmir made an impetus to undertake the present investigation.

Materials and Methods

Symptomatology

Susceptible Turcicum leaf blight maize cultivar (C 15) leaves, from five randomly selected plants growing in field, were tagged for symptomatological studies under natural epiphytotic conditions. First observation was taken as soon as the disease symptoms appeared. Periodic observations were made with respect to changes in size, shape and color of the lesions on leaves.

Survey for status

Survey for assessment of turcicum leaf blight of maize was conducted during *kharif* of 2012 and 2013 seasons, in four major maize growing districts of Kashmir valley viz. Anantnag, baramulla, Ganderbal and Kupwara. Observations were recorded at silk drying stage. Each district was represented by three locations and each location by three sites. Mean of three fields represented disease incidence and intensity of respective site. Five plants each at four corners and center of the fields were randomly selected and their leaves were examined to record disease incidence and intensity. Percent disease incidence was recorded by counting the number of diseased leaves and total number of leaves examined, using the formula.

$$\text{Percent disease incidence} = \frac{\text{Number of diseased units (leaves)}}{\text{Total number of units (laves) examined}} \times 100$$

The disease intensity was recorded by visual observations using 0-5 scale, adopted by maize pathology unit, CIMMYT, where : 0 = No symptoms; 1 = One to few scattered lesions on leaves covering upto 10% leaf area; 2 = Lesions on leaves covering 10 to 25% leaf area; 3 = Lesions on leaves covering 25 to 50% leaf area; 4 = Lesions abundant on leaves covering 50 to 75% leaf area; 5 = Lesions abundant on almost all leaves, plants prematurely dried or killed with 75 to 100% leaf area covered. The percent disease intensity (PDI) was calculated as per the following formula.

$$\text{Percent disease intensity} = \frac{\sum (NV)}{NG} \times 100$$

Where, N = Number of leaves in a grade/category; V = Numerical value of grade/ category; N = Total number of leaves examined; G = Maximum grade/category value.

Results and Discussion

Symptomatology

The symptoms started appearing as slightly oval, water soaked, small, elliptical, greyish green color spots on the leaves. But in due course such spots extended along the length of the leaf becoming elongated. The elongated spindle shaped necrotic lesions were straw colored in the center with dark margins. These lesions first appeared on the lower leaves and later on spread to upper leaves and continued to increase in size as the plant developed. Under humid conditions the straw colored center of the lesion became darker and spores developed abundantly on both sides. Spores produced in the lesion were olive-green to black, and usually produced concentric rings, giving the entire spot a target like appearance. The individual lesions measured 2.5 to 12.5 cm in length and 0.5 to 2.2 cm in width. Severely infected leaves turned to sickle shape and leaves broke at the point of midrib. Growth of such plants was found to be very much stunted. The disease progressed upwards till maturity and destroyed large photo synthetically active leaf area, giving the plant a scorched or burnt appearance and led to premature killing of leaves (Fig.1). Observations recorded in disease

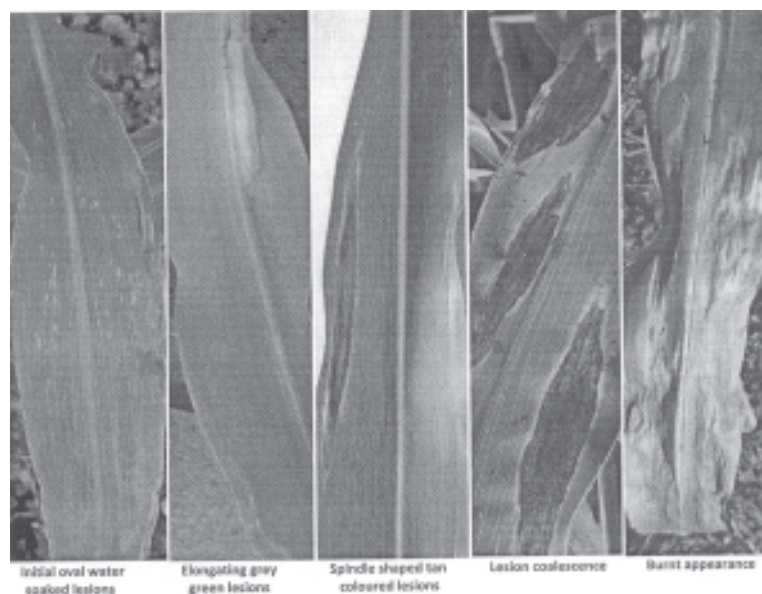


Fig. 1. Symptomatology of Turcicum leaf blight of maize in field.

development revealed that disease symptoms on leaves first appeared in first week of July as small oval water soaked spots on lower leaves measuring 0.2 cm in size which gradually increased and attained

maximum elongated size of 12.5 cm × 2.2 cm in first week of September. Up to 4th week of July elongated grey green lesions measuring about 2.5 cm × 0.7 cm were found on lower leaves. Beyond third

Table 1. Symptomatology of Turcicum leaf blight of maize caused by *Exserohium turcicum*.

| Time of observation | | Symptoms | Lesion size (cm) |
|---------------------|------|--|------------------|
| Month | Week | | |
| | | | |
| Jul | 1 | Small, oval, water soaked spots on lower leaves | 0.2 dia |
| | 2 | -do- | 0.4 dia |
| | 3 | Spots enlarge length wise | 1.2 × 0.5 |
| | 4 | Elongated grayish green lesions | 2.5 × 0.7 |
| Aug | 1 | -do- | 5.2 × 1.0 |
| | 2 | Spindle shaped, tan coloured, necrotic lesions | 10.6 × 1.5 |
| | 3 | Numerous lesions, Under moist conditions produced dark grey conidia giving them dirty appearance. Lesions spread to upper leaves | 11.4 × 1.8 |
| Sep | 4 | Chlorotic region around the lesions and lesion coalescence | 12.3 × 2.0 |
| | 1 | Blight covering major portion of leaves | 12.5 × 2.2 |
| | 2 | Severe blight giving burnt appearance | - |

week of August numerous lesions, under moist conditions produced dark grey conidia giving the leaf a dirty appearance and lesions spread to upper leaves. Due to coalescence of lesions, blight covered major portion of leaves, giving them a burnt appearance (Table 1).

Survey for status

The disease survey conducted revealed that *Turcicum* leaf blight of maize was prevalent in all the locations during both the years 2012 and 2013 with varying degrees of incidence and intensity. Disease incidence of all the sites surveyed ranged between 18.33% at Gotlibagh to 58.33% at Larnoo and 22.88% at Tulmulla to 66.66% at Larnoo during 2012 and 2013 respectively. Pooled data pertaining to the locations revealed that highest disease incidence of 60.00% was recorded in Kokernag followed by Pahalgam (58.89%), Shangus (57.28%) and Rajwar (51.90%). Lowest disease incidence (22.05%) was recorded in Ganderbal location. Overall average disease incidence of the four districts surveyed during the year 2012 revealed that maximum disease incidence of 55.05% was recorded in Anantnag followed by district Kupwara (47.18%), Baramulla (40.85%) and Ganderbal (23.92%), with an overall average disease incidence of 41.75% in the Kashmir valley. Similar trend was exhibited during the year 2013 with the district Anantnag, Kupwara, Baramulla and Ganderbal recording disease incidence of 62.39, 54.79, 47.49 and 27.64% respectively. Overall average disease incidence of Kashmir valley was 48.08% recorded during the year 2013. Pooled data reveal that district Anantnag recorded highest disease incidence of 58.72% followed by Kupwara (50.98%), Baramulla (44.14%) and Ganderbal (25.78%) with an overall average disease incidence of 44.91% in Kashmir valley (Table 2).

Disease intensity of all the sites surveyed ranged between 8.42% at Gotlibagh to 28.26% at Larnoo and 10.93% at Gotlibagh to 32.07% at Larnoo during 2012 and 2013 respectively. Pooled data pertaining to the locations revealed that highest disease intensity of 29.15% was recorded in Kokernag, followed by Pahalgam (28.67%), Shangus (27.33%) and Kralpora (25.11%). Lowest disease intensity

(10.27%) was recorded in Ganderbal location. Overall average disease intensity of the four districts surveyed during the year 2012, revealed that maximum disease intensity of 26.65% was recorded in district Anantnag followed by district Kupwara (22.46%),

Table 2. Incidence of *Turcicum* leaf blight of maize in various locations of Kashmir valley during year 2012 and 2013. * Data presented are average of the observations recorded in three fields at each sit.

| District | Location | Site | Per cent disease incidence | | | |
|-------------|-----------|---------------|----------------------------|------------|--------|-------|
| | | | 2012 | 2013 | Pooled | |
| Kokernag | | Larnoo | 58.33* | 66.66 | 62.50 | |
| | | Nowbugh | 56.66 | 63.33 | 60.00 | |
| | | Gawran | 53.33 | 61.66 | 57.50 | |
| | | Mean | 56.11 | 63.88 | 60.00 | |
| | | Movera | 55.66 | 62.44 | 59.05 | |
| Anantnag | Pahalgam | Laripora | 54.66 | 63.22 | 58.94 | |
| | | Fraslana | 56.22 | 61.11 | 58.67 | |
| | | Mean | 55.51 | 62.26 | 58.89 | |
| | | Ranipora | 51.11 | 58.33 | 54.72 | |
| | | Shangus | Rakhbrah | 55.00 | 64.44 | 59.72 |
| | | Shiekh Gund | 54.44 | 60.33 | 57.39 | |
| | | Mean | 53.52 | 61.03 | 57.28 | |
| | | District Mean | 55.05 | 62.39 | 58.72 | |
| | | Kakothal | 36.66 | 46.66 | 41.66 | |
| | | Kreeri | Kalantra Bala | 38.33 | 48.33 | 43.33 |
| | | Chandoosa | 33.33 | 43.33 | 38.33 | |
| | | Mean | 36.11 | 46.11 | 41.11 | |
| | | Chatoosa | 42.22 | 49.33 | 45.78 | |
| | | Bara-mulla | Rafiabad | 41.66 | 51.66 | 46.66 |
| | | | | Kangroosa | 43.55 | 47.22 |
| Mean | 42.48 | | | 49.40 | 45.94 | |
| Chandiloora | 42.88 | | | 48.44 | 45.66 | |
| Tangmarg | Ferozpora | | | 44.22 | 45.00 | 44.61 |
| | | | | Hardshoora | 44.77 | 47.44 |
| | | Mean | 43.96 | 46.96 | 45.46 | |
| | | District Mean | 40.85 | 47.49 | 44.17 | |
| | | Gotlibagh | 18.33 | 23.33 | 20.83 | |
| | | Ganderbal | Wayul | 21.66 | 26.66 | 24.16 |
| | | Tulmulla | 19.44 | 22.88 | 21.16 | |
| | | Mean | 19.81 | 24.29 | 22.05 | |
| | | Chuntwaliwar | 26.66 | 31.66 | 29.16 | |
| | | Lar | Dangerpora | 25.00 | 28.33 | 26.67 |
| | | Ganderbal | | Pahlipora | 23.33 | 25.22 |
| Mean | 25.00 | | | 28.403 | 26.70 | |
| Chatergul | 26.88 | | | 28.44 | 27.66 | |
| Kangan | Cheerwan | | | 25.66 | 30.00 | 27.83 |
| | | | | Satrina | 28.33 | 32.22 |
| | | Mean | 26.96 | 30.22 | 28.59 | |
| | | District Mean | 23.92 | 27.64 | 25.78 | |
| | | Aloosa | 50.00 | 55.88 | 52.94 | |
| | | Kralpora | Dardpora | 46.66 | 57.00 | 51.83 |
| | | Panzgam | 45.00 | 56.33 | 50.67 | |
| | | Mean | 47.22 | 56.40 | 51.81 | |
| | | Adoora | 43.33 | 54.44 | 48.89 | |

Table 2. Continued.

| District | Location | Site | Percent disease incidence | | |
|----------|---------------|-------------|---------------------------|-------|--------|
| | | | 2012 | 2013 | pooled |
| Kupwara | Langate | Bicharwari | 47.77 | 52.22 | 50.00 |
| | | Sopur Nagam | 46.77 | 50.88 | 48.83 |
| | | Mean | 45.96 | 52.51 | 49.24 |
| | Rajwar | Chogul | 45.11 | 51.77 | 48.44 |
| | | Kulangam | 48.33 | 55.44 | 51.89 |
| | Zachaldara | 51.66 | 59.11 | 55.39 | |
| | Mean | 48.37 | 55.44 | 51.90 | |
| | District mean | 47.18 | 54.79 | 50.98 | |
| | Overall mean | 41.75 | 48.08 | 44.91 | |

Baramulla (18.49%) and Ganderbal (11.04%), with an overall average disease intensity of 19.66% in the Kashmir valley. Similar trend was exhibited during the year 2013 with district Anantnag, Kupwara, Baramulla and Ganderbal recording disease intensity of 30.11, 26.38, 22.80 and 13.23% respectively. Overall average disease intensity of Kashmir valley was 23.13% recorded during the year 2013. Pooled data reveal that district Anantnag recorded highest disease intensity of 28.38% followed by Kupwara (24.42%), Baramulla (20.92%) and Ganderbal (12.14%) with an overall average disease intensity of 21.40% in Kashmir valley (Table 3). The high disease severity 2013 may be due to prevalence of environmental and/ or pathogen factors.

Table 3. Intensity of Turicum leaf blight of maize in various locations of Kashmir valley during 2012 and 2013. * Data presented are average of the observations recorded in three fields at each site.

| District | Location | Site | Percent disease intensity | | |
|-------------|---------------|----------|---------------------------|-------|--------|
| | | | 2012 | 2013 | pooled |
| Anantnag | Kokernag | Larnoo | 28.26* | 32.07 | 30.17 |
| | | Nowbugh | 27.71 | 30.84 | 29.28 |
| | | Gawran | 26.08 | 29.93 | 28.01 |
| | | Mean | 27.35 | 30.95 | 29.15 |
| | Pahalgam | Movera | 27.84 | 30.4 | 29.12 |
| | | Laripora | 25.88 | 30.04 | 27.96 |
| | | Fraslana | 27.66 | 30.2 | 28.93 |
| | | Mean | 27.13 | 30.21 | 28.67 |
| | Shangus | Ranipora | 25.35 | 28.11 | 26.73 |
| | | Rakhbrah | 25.82 | 29.42 | 27.62 |
| Shiekh Gund | | 25.26 | 30.02 | 27.64 | |
| | Mean | 25.48 | 29.18 | 27.33 | |
| | District Mean | 26.65 | 30.11 | 28.38 | |

Table 3. Continued.

| District | Location | Site | Percent disease intensity | | |
|------------|---------------|---------------|---------------------------|-------|--------|
| | | | 2012 | 2013 | Pooled |
| Baramulla | Kreeri | Kakothal | 17.71 | 22.57 | 20.14 |
| | | Kalantra Bala | 18.51 | 23.51 | 21.01 |
| | | Chandoosa | 15.8 | 20.73 | 18.27 |
| | | Mean | 17.34 | 22.27 | 19.81 |
| | Rafiabad | Chatoosa | 18.22 | 23.13 | 20.68 |
| | | Balhama | 20.26 | 25.15 | 22.71 |
| | | Kangroosa | 18.33 | 22.24 | 20.29 |
| | | Mean | 18.94 | 23.51 | 21.22 |
| | Tangmarg | Chandiloora | 19.55 | 23.46 | 21.51 |
| | | Ferozpora | 18.11 | 22.57 | 20.34 |
| Hardshoora | | 19.93 | 21.88 | 20.91 | |
| | Mean | 19.2 | 22.64 | 20.92 | |
| | District Mean | 18.49 | 22.8 | 20.65 | |
| Ganderbal | Gotlibagh | 8.42 | 10.93 | 9.675 | |
| | Wayul | 10.04 | 12.6 | 11.32 | |
| | Tulmulla | 8.48 | 11.13 | 9.805 | |
| | Mean | 8.98 | 11.55 | 10.27 | |
| Lar | Chunt-waliwar | 12.66 | 15.11 | 13.89 | |
| | Dangerpora | 11.91 | 13.8 | 12.86 | |
| | Pahlipora | 10.66 | 12.62 | 11.64 | |
| | Mean | 11.74 | 13.84 | 12.79 | |
| Kangan | Chatergul | 12.82 | 15.06 | 13.94 | |
| | Cheerwan | 10.84 | 13.66 | 12.25 | |
| | Satrina | 13.57 | 14.15 | 13.86 | |
| | Mean | 12.41 | 14.29 | 13.35 | |
| | District Mean | 11.04 | 13.23 | 12.14 | |
| Kralpora | Aloosa | 24.11 | 27.68 | 25.9 | |
| | Dardpora | 22.6 | 26.95 | 24.78 | |
| | Panzgam | 21.91 | 27.4 | 24.66 | |
| | Mean | 22.87 | 27.34 | 25.11 | |
| Kupwara | Adoora | 21.04 | 25.66 | 23.35 | |
| | Langate | 22.04 | 25.06 | 23.55 | |
| | Sopur Nagam | 20.62 | 24.31 | 22.47 | |
| | Mean | 21.23 | 25.01 | 23.12 | |
| Rajwar | Chogul | 21.57 | 25.37 | 23.47 | |
| | Kulangam | 23.22 | 26.71 | 24.97 | |
| | Zachaldara | 25.02 | 28.28 | 26.65 | |
| | Mean | 23.27 | 26.79 | 25.03 | |
| | District mean | 22.46 | 26.38 | 24.42 | |
| | Overall mean | 19.66 | 23.13 | 21.4 | |

Of the locations surveyed, the highest disease incidence (60.00%) and intensity (29.15%) was recorded at Kokernag locality followed by Pahalgam and Shangus exhibiting a disease incidence of 58.89 and 57.28% and intensity of 28.67 and 27.33% respectively. Higher disease status in these localities could probably be due to closer spacing from plant to plant and adoption of faulty cultural practices. Considering the disease severity, the locations, viz. Kokernag, Pahalgam and Shangus are identified as

hot spots for turcicum leaf blight. High altitude, low temperature, high relative humidity and non adoption of disease management practices could be a reason for higher disease in several areas of Anantnag district.

References

1. Anonymous (2014) Maize statistics at a glance : International : World maize area and production 2011-12. Maize Monthly Rep 08 Oct 2011, USDA, 2014.
2. Anonymous (2014) Agricultural Research Data Book 2014. ICAR <http://www.iasri.res.in>
3. Anonymous (2013) Digest of statistics 2012-13. Director and Stat govt of J and K.
4. Welz HG, Geiger HH (2000) Genes for resistance to Northern corn leaf blight in diverse maize populations. *Pl Breed* 119 : 1—4.
5. Oligari JB, Guimaraes MA, Geraldi IO, Camargo LEA (2005) New resistance genes in the *Zea mays - Exserohilum turcicum* pathosystem. *Genet and Mol Biol* 28 : 435—439.
6. Babu R, Mani VP, Pandey AK, Pant SK, Kundu RS, Gupta HS (2004). Maize research at Vivekanand Parvatiya Krishi Anusandhan Sansthan — An overview. Vivekanand Parvatiya Krishi Anusandhan Sansthan, Almora. *Tech Bull* 21 : 31.
7. Emanu BT (2015) Survey of diseases of major crops in Darolebu district, West Hararge, Ethiopia. *Int J Pl Breed and Crop Sci* 2 : 43—45.