

RESEARCH NOTE

Investigations of *turcicum* leaf blight (TLB) and common rust (CR) of maize in northern Karnataka

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Turcicum leaf blight and common rust are major foliar diseases in all maize growing regions of Karnataka which caused severe reduction in grain yield. These diseases symptoms first appear on the leaves at any stage of plant growth, but usually they appeared at or after anthesis. Extensive survey indicated that, the disease severity of TLB and CR observed from low to severe form in all the maize growing areas of northern Karnataka. Results revealed that severity of both diseases varied from one locality to another due to number of factors like, soil type, cropping pattern, soil moisture and temperature. Maximum diseases severity was recorded in irrigated areas on black soils and at grain filling stage of the crop. The maximum disease severity was recorded in Belagavi district (TLB- 39.35 and CR- 23.15 %) and lowest disease severity (TLB- 6.59 and CR- 5.22 %) was recorded in Vijayapur district.

Key words: Common rust, Maize, Leaf blight

Maize (*Zea mays* L.) is the third most important cereal crop globally grown after wheat and rice. Due to the introduction of high yielding indigenous and exotic hybrids and along with use of fertilizers, there has been a phenomenal increase in the area and production. But, at the same time, the crop is vulnerable to several foliar diseases. Among the foliar diseases affecting maize, the *turcicum* leaf blight and common rust are considered to be major foliar diseases.

Turcicum leaf blight also called as northern leaf blight caused by *Exserohilum turcicum* (Pass.) Leonard and Suggs. (Syn. *Helminthosporium turcicum* Pass.) has of worldwide importance (Carlos, 1997). *Turcicum* leaf blight of maize is considered to be one of the most devastating diseases as its occurrence and incidence caused greater significance that resulted in reduction of grain yield by 28 to 91 per cent (Kachapur, 1988). Laxminarayana and Shankerlingam (1983) identified the hot spots of the TLB namely Arabhavi and Nagenahalli in Karnataka, Kolhapur in Maharashtra, Karimnagar in Andhra Pradesh, Dholi in Bihar and Almora in Uttarakhand. The common rust caused by *Puccinia sorghi* Schw. appeared in different forms in several basins of the country, resulted in grain yield reductions. In the present study, survey was conducted to observe the disease severity of *turcicum* leaf blight and common rust of maize in major maize growing areas of northern Karnataka.

To assess the extent of *turcicum* leaf blight and common rust disease severity, orange extensive roving survey was

conducted in major maize growing districts of northern Karnataka during *kharif* 2016. In each district important maize growing blocks were selected, in each village five fields were randomly selected on both sides of road when the crop was at flowering to grain filling stage. Such fields were assessed for both the diseases severity by recording the disease on 0-5 disease ratings scale as given by Payak and Sharma (1983). Further PDI was calculated by using the formula (Wheeler, 1969).

$$PDI = \frac{\text{Sum of the all individual disease ratings}}{\text{Total number of plants observed} \times \text{Maximum grade}} \times 100$$

Severity of the TLB and CR were recorded in all 19 blocks of northern Karnataka covering six districts. The disease severities were ranged from 0.00 to 50.80 per cent in TLB and 0.00 to 32.64 per cent in CR in different maize growing areas. The data of the results were presented in the Table 1, 2 and 3.

The mean maximum disease severity of TLB (50.80 %) was recorded from Arabhavi village of Belagavi district, whereas, minimum disease severity (02.04 %) was observed at Devargennur village of Vijayapur district. There was no occurrence of disease (0.00 %) found at Hullatti village of Herekerur block, Bankapur village of Shiggaon block and Horti village of Indi block. The mean maximum disease severity of CR (32.64 %) was recorded from Hukkeri village of Belagavi district, the mean minimum severity (02.64 %) was at Haveri village of Haveri district. There was no occurrence of disease (0.00 %) at Lokur village of Dharwad block Motebennur and Kerimattinahalli villages of Haveri taluk, Hullatti village of Herekerur taluk, Devargennur village of Vijayapur and Horti village of Indi block (Table 1).

Of the blocks, the maximum disease severity of TLB (45.42 %) was noticed in Hukkeri block of Belagavi district along with minimum disease severity (04.15 %) was recorded in Indi block of Vijayapur district. The maximum disease severity of CR (27.47 %) was recorded in Gokak taluk of Belagavi district along with minimum disease severity (02.15 %) was recorded in Haveri block of Haveri district. Among the districts surveyed, the mean maximum severity of both TLB (39.35) and CR (23.15 %) was noticed in Belagavi district followed by Bagalkot district (30.66 and 22.24 %) respectively whereas, the mean minimum severity of TLB (6.59 %) and CR (5.22 %) was noticed in Vijayapur district (Table 2).

Of the different soil types surveyed, the maximum disease severity of TLB and CR observed in black soil (27.37 and 18.01 %) respectively. The PDI was observed in red soil (7.56 and 2.16 %) respectively. Under irrigated condition maximum disease severity was recorded (26.46 and 15.88 %), due to increase in relative humidity and least was in rainfed (20.56 and 14.93 %). The minimum disease was recorded due to high RH and under rainfed conditions. The maximum disease severity was recorded at grain filling stage (22.06 and 15.50 %) and minimum at *vegetative stage* (14.31 and 9.49 %).

Table1. Severity of *turcicum* leaf blight and common rust in northern parts of Karnataka during *kharif* 2016

| District | Taluk | Villages | Agroclimatic zone | Soil type | Stage of the crop | Type of cultivation | Hybrid | Per cent disease index | |
|----------|------------|--------------|-------------------|------------|-------------------|---------------------|-----------|-----------------------------|-------------|
| | | | | | | | | <i>Turcicum</i> leaf blight | Common rust |
| Bagalkot | Bagalkot | Agasankoppa | Zone 3 | Black | Grain filling | Rainfed | CP 818 | 38.20 | 23.46 |
| | | Belavalkoppa | | Black | Grain filling | Irrigated | Virat | 40.10 | 31.00 |
| | | Kulageri | | Black | Grain filling | Rainfed | CP 818 | 24.30 | 22.60 |
| | | Lakshakoppa | | Red | Vegetative | Rainfed | DKC 8101 | 32.50 | 18.98 |
| | | | | | | | Mean | 33.75 | 24.01 |
| | Hungund | Illakal | Zone 3 | Black | Grain filling | Rainfed | Laxmi 999 | 20.86 | 18.16 |
| | | Kesarwadi | | Black | Grain filling | Irrigated | Virat | 24.34 | 20.90 |
| | | Amingad | | Black | Grain filling | Rainfed | CP 818 | 30.90 | 26.30 |
| | | Karadi | | Black | Grain filling | Irrigated | Alrounder | 34.20 | 16.56 |
| | | | | | | | Mean | 27.57 | 20.48 |
| Belagavi | Hukkeri | Hukkeri | Zone 8 | Black | Grain filling | Irrigated | CP 818 | 45.14 | 32.64 |
| | | Khanapura | | Black | Grain filling | Rainfed | 900 M | 50.56 | 22.72 |
| | | Hebbal | | Black | Grain filling | Irrigated | Laxmi 999 | 48.62 | 30.00 |
| | | Daddi | | Black | Grain filling | Irrigated | Kargil | 42.70 | 18.45 |
| | | Goturu | | Black | Grain filling | Rainfed | Kargil | 40.08 | 20.62 |
| | | | | | | | Mean | 45.42 | 24.88 |
| | | | | | | | | | |
| Belagavi | Bailhongal | Bailhongal | Zone 8 | Black | Grain filling | Rainfed | 900 M | 30.66 | 20.42 |
| | | Inchal | | Black | Tasseling | Irrigated | NK 6240 | 15.60 | 16.20 |
| | | Belavadi | | Black | Tasseling | Irrigated | Virat | 44.00 | 12.84 |
| | | Sangolli | | Black | Grain filling | Irrigated | Arjun | 42.80 | 18.98 |
| | | Bailawada | | Black | Tasseling | Rainfed | - | 20.36 | 24.82 |
| | | | | | | | Mean | 30.68 | 18.65 |
| | Savadatti | Kurabetta | Zone 3 | Black | Grain filling | Rainfed | Maharaj | 32.62 | 26.08 |
| | | Munavalli | | Black | Grain filling | Rainfed | 25K25 | 40.52 | 18.21 |
| | | Yaragatti | | Black | Tasseling | Rainfed | 900 M | 44.98 | 20.50 |
| | | | | | | | Mean | 39.37 | 21.60 |
| | Gokak | Arabhavi | Zone 3 | Black | Grain filling | Irrigated | CP 818 | 50.80 | 31.68 |
| | | Bedigiwad | | Black | Grain filling | Irrigated | CP 818 | 28.62 | 27.58 |
| | | Ganeshwad | | Sandy loam | Grain filling | Irrigated | Alrounder | 34.89 | 20.86 |
| | Gokak | Gataprabha | Zone 3 | Black | Grain filling | Irrigated | NK 6240 | 42.92 | 28.64 |
| | | Gokak | | Black | Grain filling | Irrigated | PH 3441 | 50.47 | 29.11 |
| | | Kalloli | | Black | Grain filling | Irrigated | NK 6240 | 44.10 | 26.96 |
| | | | | | | | Mean | 41.96 | 27.47 |
| Dharwad | Dharwad | Dharwad | Zone 8 | Black | Tasseling | Irrigated | Arjun | 30.36 | 26.2 |
| | | Garaga | | Black | Grain filling | Rainfed | Maharaja | 20.50 | 24.34 |
| | | Thadakoda | | Black | Grain filling | Rainfed | Alrounder | 22.98 | 22.16 |
| | | Lokur | | Black | Seedling | Irrigated | GK 3059 | 18.26 | 0.00 |
| | | Narendra | | Black | Grain filling | Rainfed | PH 3441 | 24.12 | 22.98 |
| | | | | | | | Mean | 23.24 | 19.13 |
| | Khalagatgi | Kalaghatagi | Zone 9 | Black | Grain filling | Rainfed | DKC 8101 | 20.68 | 12.54 |
| | | Jodalli | | Black | Grain filling | Rainfed | CP 818 | 6.00 | 10.34 |
| | | Devikoppa | | Black | Grain filling | Rainfed | Laxmi 999 | 26.84 | 30.08 |
| | | | | | | | Mean | 17.84 | 17.65 |
| | Hubballi | Hubballi | Zone 8 | Black | Grain filling | Rainfed | Laxmi 999 | 24.36 | 12.26 |
| | | Sattur | | Black | Grain filling | Rainfed | DKC 8101 | 20.14 | 10.36 |
| | | Unkal | | Black | Grain filling | Rainfed | CP 818 | 12.94 | 7.56 |
| | | Chabbi | | Black | Tasseling | Rainfed | NK 6240 | 16.28 | 18.36 |
| | | | | | | | Mean | 18.43 | 12.13 |
| Gadag | Gadag | Beldadi | Zone 3 | Black | Grain filling | Rainfed | VMH 126 | 20.22 | 10.62 |
| | | Harti | | Black | Grain filling | Rainfed | VMH 126 | 16.26 | 7.56 |
| | | Hirehondigol | | Black | Grain filling | Rainfed | Maharaja | 15.00 | 14.24 |
| | | Hombal | | Black | Grain filling | Rainfed | CP 818 | 13.48 | 16.28 |
| | | Hulkoti | | Black | Grain filling | Rainfed | NK 6240 | 10.32 | 19.48 |
| | | | | | | | Mean | 15.05 | 13.63 |

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| District | Taluk | Villages | Agroclimatic zone | Soil type | Stage of the crop | Type of cultivation | Hybrid | Per cent disease index | |
|-----------|--------------------|----------------|-------------------|------------|-------------------|---------------------|--------------|-----------------------------|-------------|
| | | | | | | | | <i>Turcicum</i> leaf blight | Common rust |
| Naragund | Kalakeri | | Zone 3 | Black | Grain filling | Irrigated | Kargil | 11.48 | 15.00 |
| | | Nargund | | Black | Grain filling | Irrigated | 25K25 | 14.94 | 18.26 |
| | | Tadala | | Black | Grain filling | Irrigated | VMH 126 | 20.34 | 6.38 |
| | | Kurlageri | | Black | Grain filling | Irrigated | 900 M | 10.68 | 9.20 |
| | | Konnur | | Black | Grain filling | Irrigated | Laxmi 999 | 8.02 | 10.36 |
| | | | | | | | Mean | 13.09 | 11.84 |
| | Ron | Nidgundi | Zone 3 | Black | Grain filling | Rainfed | VMH 126 | 14.32 | 15.26 |
| | | Ron | | Black | Grain filling | Rainfed | 900 M | 10.86 | 12.38 |
| | | Abbigeri | | Black | Grain filling | Rainfed | Laxmi 999 | 20.40 | 10.34 |
| | | Chikkamanur | | Black | Grain filling | Rainfed | NK 6240 | 16.76 | 11.82 |
| | | Mallapur | | Black | Grain filling | Rainfed | - | 15.98 | 12.72 |
| | | | | | | | Mean | 15.66 | 12.50 |
| | Haveri | Nelogal | Zone 8 | Red | Grain filling | Rainfed | Alrounder | 5.00 | 4.68 |
| | | Haveri | | Red | Grain filling | Rainfed | PH 3441 | 10.38 | 2.64 |
| | | Motebennur | | Red | Grain filling | Rainfed | Virat | 14.20 | 0.00 |
| | | Kerimattihalli | | Black | Tasseling | Rainfed | - | 6.20 | 0.00 |
| | | Vardi cross | | Red | Tasseling | Rainfed | PH 3441 | 8.20 | 3.46 |
| | | | | | | | Mean | 8.70 | 2.15 |
| | Hanagal | Adur | Zone 9 | Black | Grain filling | Rainfed | NK 6240 | 12.68 | 10.36 |
| | | Balambeed | | Sandy loam | Grain filling | Rainfed | Alrounder | 16.32 | 5.80 |
| | | Kanavi | | Black | Grain filling | Irrigated | CP 818 | 10.36 | 4.68 |
| | | | | | | | Mean | 13.12 | 6.94 |
| | Hirekerur | Gundagatti | Zone 8 | Black | Vegetative | Rainfed | - | 8.40 | 9.48 |
| | | Hullatti | | Red | Tasseling | Rainfed | NK 6240 | 0.00 | 0.00 |
| | | Masur | | Black | Grain filling | Rainfed | Alrounder | 14.32 | 10.56 |
| | | Rattihalli | | Black | Grain filling | Irrigated | 900 M | 11.28 | 8.46 |
| Vijayapur | Shiggaon | | Zone 8 | | | | Mean | 8.50 | 7.12 |
| | | Bankapur | | Black | Tasseling | Rainfed | CP 818 | 0.00 | 0.00 |
| | | Bisalahalli | | Black | Grain filling | Rainfed | PH 3441 | 8.64 | 12.34 |
| | | Niralagi | | Black | Grain filling | Rainfed | Laxmi 999 | 15.34 | 8.00 |
| | | Shiggaon | | Black | Grain filling | Rainfed | 900 M | 5.00 | 6.48 |
| | | | | | | | Mean | 7.24 | 6.70 |
| | Basavana -bagewadi | Agasabal | Zone 3 | Black | Grain filling | Rainfed | Laxmi 999 | 13.68 | 8.32 |
| | | Managuli | | Black | Grain filling | Rainfed | Kanchana | 4.34 | 5.54 |
| | | Ronehal | | Black | Grain filling | Rainfed | - | 11.50 | 6.38 |
| | | | | | | | Mean | 9.84 | 6.74 |
| | Vijayapur | Devar Gennur | | Black | Vegetative | Rainfed | CP 818 | 2.04 | 0.00 |
| | | Vijayapur | | Black | Grain filling | Rainfed | Arjun | 10.30 | 6.38 |
| | | Mamadapur | | Black | Tasseling | Rainfed | 900 M | 5.06 | 3.92 |
| | | | | | | | Mean | 5.8 | 3.43 |
| | Indi | Gundawan | Zone 3 | Black | Grain filling | Irrigated | Laxmi 999 | 5.00 | 10.94 |
| | | Horti | | Black | Grain filling | Rainfed | Kanchana | 4.00 | 0.00 |
| | | Agasanal | | Black | Grain filling | Rainfed | Ganga kaveri | 3.46 | 5.68 |
| | | | | | | | Mean | 4.15 | 5.54 |

Similar observations were also made by several workers (Laxminarayana and Shankarlingam, 1983; Gowda *et al.*, 1989 and Babu *et al.*, 2004). Earlier survey reports (Harlapur *et al.*, 2000) indicated that, cultivar susceptibility, weather parameters play an important role for the high severity of TLB disease and such variations of CR severity was also observed by Schall *et al.* (1983), Emanu, (2015) and Tolessa *et al.* (2015).

The present investigation suggested that high per cent disease index was at Belagavi district due to favorable environmental conditions during cropping season. This was due to intensive cultivation of maize crop season after season, every year, narrow genetic makeup of the commercial hybrids and non-adoption of disease management practices by the farmers. The minimum per cent disease index was observed at Vijayapur district due to less relative humidity.

Table 2. District and block wise severity of *turcicum* leaf blight and common rust in northern parts of Karnataka during *kharif* 2016

| District | Block | Mean per cent disease index | |
|-----------|------------------|-----------------------------|-------|
| | | TLB | CR |
| Bagalakot | Bagalakot | 33.75 | 24.01 |
| | Hunagund | 27.57 | 20.48 |
| | Mean | 30.66 | 22.24 |
| Belagavi | Bailhongal | 30.68 | 18.65 |
| | Gokak | 41.96 | 27.47 |
| | Hukkeri | 45.42 | 24.88 |
| | Savadatti | 39.37 | 21.60 |
| | Mean | 39.35 | 23.15 |
| Dharwad | Hubballi | 18.43 | 12.13 |
| | Dharwad | 23.24 | 19.13 |
| | Kalghatgi | 17.84 | 17.65 |
| | Mean | 19.83 | 16.30 |
| Gadag | Gadag | 15.05 | 13.63 |
| | Ron | 15.66 | 12.50 |
| | Nargund | 13.09 | 11.84 |
| | Mean | 14.60 | 12.65 |
| Haveri | Hanagal | 13.12 | 6.94 |
| | Haveri | 8.70 | 2.15 |
| | Hirekerur | 8.50 | 7.12 |
| | Shiggaon | 7.24 | 6.70 |
| | Mean | 9.39 | 5.72 |
| Vijayapur | Basavanabagewadi | 9.84 | 6.74 |
| | Vijayapur | 5.8 | 3.43 |
| | Indi | 4.15 | 5.54 |
| | Mean | 6.59 | 5.22 |

Table 3. Severity of *turcicum* leaf blight and common rust under different situations

| Particulars | PDI | |
|---------------------|-------|-------|
| | TLB | CR |
| Soil types | | |
| Black soil | 27.37 | 18.01 |
| Red soil | 7.56 | 2.16 |
| Sandyloam | 25.61 | 13.33 |
| Rainfed / Irrigated | | |
| Rainfed | 20.56 | 14.93 |
| Irrigated | 26.46 | 15.88 |
| Stage of the crop | | |
| Vegetative stage | 14.31 | 9.49 |
| Tasseling stage | 17.37 | 11.48 |
| Grain filling stage | 22.06 | 15.50 |

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