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A report survey and surveillance of maize diseases in Manipur

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Abstract

In Manipur, maize is the second most important crop next to rice and used both for direct consumption and as well as feed ingredients for piggery and poultry farming. Survey was conducted to determine the level of infection by various pathogens in maize and to determine the prevalence, incidence and severity of maize diseases in Manipur. A total of 50 farmer field were randomly selected from five districts viz. Thoubal, Imphal East, Imphal West, Churachandpur and Senapati district of Manipur during cropping season of 2018 and 2019 for kharif season. Five quadrants were examined per farmers' field for estimation of maize diseases incidence and severity infestation. The diseases were divided into Traces (<10%), Low (10-20%), Moderate (20-40%), High (40-60%) and Severe (60% <) according to the percentage of infection. Both years of kharif surveyed data were analyzed and expressed using simple percentage. Results revealed that the dominant maize diseases were caused by *Exserohilum turcicum*, *Thanatephorus cucumeris*, *Puccinia sorghi* pathogen. Maize disease incidence of *E. turcicum* were ranged from 51.0 to 70.0%, *Thanatephorus cucumeris* 30-63%, *Puccinia sorghi* 12.5-50.0%, *Dickeya zae* 20-30%, *Physoderma maydis* 20-30%, *Ustilago maydis* 16-25% and *Puccinia polysora* 8-11%. Incidence of *Cochliobolus heterostrophus* *Peronosclerospora sorghi*, *Ustilagoideae virens*, *Macrophomina phaseolina* and *Curvularia lunata* were reported in traces. Among twelve identified diseases Turcicum leaf blight (TLB), Banded leaf and sheath Blight (BLSB), Common Rust (CR) were recorded as major disease. Incidence of Bacterial stalk rot, Brown spot, Flag smut and Polysora rust were found moderate while incidence of Maydis leaf blight, Downy mildew, False head smut, Charcoal stalk rot, Curvularia leaf spot were found as minor important.

Keywords: Survey, maize diseases, incidence, prevalence, severity

Introduction

Maize (*Zea mays* L) is the second most important crop next to rice in Manipur, grown in area of 19.81 thousand hectare with a production of 45.84 thousand million tonnes. The average production is 2.31 Mt/ha^[1]. It is mostly grown under rainfed hilly uplands conditions and Jhum fields. In the region Maize production plays a significant role in ensuring food security and is used both for direct consumption and as well as feed ingredients for piggery and poultry farming. Maize is the most potential and predominant rainy season crop in the hills of North Eastern Region (NER) of India^[2]. The area under crop is increasing but the average grain yield on farmer's field is very low. Low productivity of maize in the region may be attributed to various biotic and abiotic stresses such as drought, nutrient deficiencies, Cultivation of local cultivars, prevalence of diseases, insect-pests and poor crop management. Among the biotic stresses Diseases are one of the major constraints in realizing the potential yield of this crop and fungal and bacterial pathogens being the most important one. Diseases such as Turcicum leaf blight (*Exserohilum turcicum*), Banded leaf and sheath Blight (*Thanatephorus cucumeris*), Common Rust (*Puccinia sorghi*) will continue to represent problems in certain conditions. Diseases like Curvularia leaf spot, Brown spot and Polysora rust not previously known as limiting factor, but now identified as new challenges for maize production in Manipur. Change in hybrid deployment may result in changed disease scenario. Hence extensive survey needs to be undertaken to assess the prevalence and severity of new emerging maize diseases and their management for sustainable maize production.

Maize is attacked by as many as 112 diseases in the world posing major constraints in realizing the potential yield of maize. In India, about 35 diseases reported from different locations are predominantly of fungal and bacterial origin. Under favourable environmental conditions, these diseases play havoc and cause immense losses both in quantity and quality as well^[3]. The incidence of maize diseases may vary considerably with geographical location.

The influence of agro-ecological zones on the severity of foliar diseases has also been suggested in Manipur. To minimize crop losses due to diseases, it is important to correctly identify the diseases present. So that appropriate management steps can be taken up. Various diseases attack maize crop in different stages of crop growth and reported to cause significant yield reduction. These diseases not only affect quantity of the produce but also affect the quality of the produce. These studies will determine the prevalence, incidence, severity, and identification of major and minor diseases in maize growing districts of Manipur.

Materials and Methods

Description of the field survey areas

Survey and surveillance of maize diseases were conducted in five different district of Manipur viz. Thoubal, Imphal East, Imphal West, Churachandpur and Senapati district of Manipur. Surveys were carried out during 2018 and 2019 in kharif seasons on farmer maize fields. A total of 50 farmer field were randomly selected from five different districts of Manipur.

Survey and sample collection

Prevalence, Incidence and severity of different diseases of maize were recorded from five different district of Manipur. Maize plants are affected by wide range of pathogens with fungal and bacterial diseases being the most important one. There is no report of incidence of viral diseases of maize in India. The incidence and severity of maize diseases were categorized into traces, low, moderate, high and severe according to percentage of diseases incidence and severity as

Traces (<10%), low (10-20%), moderate (20-40%), high (40-60% <) and severe (60% <).

Results

Survey and surveillance of maize diseases

Maize disease survey and surveillance was undertaken in maize growing areas of Manipur, covering 50 locations during Kharif 2018 and 2019 to obtain the recent information on maize diseases in Manipur. Disease reported during survey were Turcicum leaf blight, Banded leaf and Sheath blight, Maydis leaf blight, Brown spot disease of maize, Curvularia leaf spot, Common rust, Polysora rust, Corn smut and head smut, downy mildew, Bacterial stalk rot, Post flowering stalk rot, Ear rot and charcoal rot. Among the diseases reported Northern corn leaf blight (NCLB) or Turcicum leaf blight (TLB) was the most common and economically important disease affecting maize in Manipur with disease incidence ranging from high to severe followed by Banded leaf and sheath blight (BLSB) and common rust. Incidence of BLSB was more severe in early sown crop and recorded from moderate to severe. Incidence of common rust (CR) was recorded from moderate to high. Incidence of Bacterial stalk rot (BSR) recorded from low to moderate. Low to moderate incidence of Brown spot and flag smut were recorded. Rust and Curvularia leaf spot (CLS) is one of the most gaining importance diseases of maize in Manipur though the incidence was recorded from low to moderates and the disease is found to prevalence in all the maize growing area of Manipur. Incidence of Maydis leaf blight was found in traces. Incidence of Corn smut and head smut were recorded in the form of low and traces respectively.

Table 1: Overall results of the disease surveillance in the maize fields, 2018 and 2019

S/No.	Maize Diseases	Imphal West	Churachandpur	Thoubal	Imphal East	Senapati
1	Turcicum leaf blight (<i>Exserohilum turcicum</i>)	High	Severe	Severe	Severe	Severe
2	Banded leaf and sheath blight (<i>Thanatephora cucumeris</i>)	Moderate	High	Severe	High	Moderate
3	Common rust (<i>Puccinia sorghi</i>)	Moderate	High	High	Moderate	Moderate
4	Bacterial stalk rot (<i>Dickeya zae</i>)	Moderate	Moderate	Moderate	Moderate	Low
5	Brown spot (<i>Physoderma maydis</i>)	Moderate	Moderate	Low	Moderate	Low
6	Flag smut (<i>Ustilago maydis</i>)	Low	Moderate	Low	Low	Low
7	Polysora rust (<i>Puccinia polysora</i>)	Low	Traces	Traces	Traces	Low
8	Maydis leaf blight (<i>Cochliobolus heterostrophus</i>)	Traces	Traces	Traces	Traces	Traces
9	Downy mildew (<i>Peronosclerospora sorghi</i>)	Traces	-	-	Traces	-
10	False head smut (<i>Ustilagoideia virens</i>)	Traces	-	-	-	-
11	Charcoal stalk rot (<i>Macrophomina phaseolina</i>)	-	-	-	Traces	-
12	Curvularia leaf spot (<i>Curvularia Lunata</i>)	Traces	Traces	-	-	-

Among the different diseases surveyed, the Percent disease index (PDI) varied from 1.0 to 62.6% in five different district surveyed. The highest percent disease index was observed in Turcicum leaf blight with PDI of 62.5% followed by Banded leaf and sheath blight with a PDI of 47.2% and common rust with 37%. Besides, the incidence of other foliar diseases the percent disease index of Bacterial stalk rot was recorded with

PDI of 28% followed by Brown spot and flag smut with PDI of 26% and 20.2% respectively. Incidence of Polysora rust was recorded with PDI of 14% only. Maydis leaf blight and Downy mildew incidence were recorded with PDI of 4.5% and 2.0% respectively. Incidence of False head smut, Charcoal stalk rot and Curvularia leaf spot was noticed with PDI of 1% only.

Table 2: Mean prevalence of maize diseases identified in Manipur during survey

S/No.	Diseases	Disease intensity	Disease Severity (PDI)
1.	Turcicum leaf blight (<i>Exserohilum turcicum</i>)	Severe	62.6
2.	Banded leaf and sheath blight (<i>Thanatephora cucumeris</i>)	High	47.2
3	Common rust (<i>Puccinia sorghi</i>)	Moderate	37.1
4	Bacterial stalk rot (<i>Dickeya zae</i>)	Moderate	28.0
5	Brown spot (<i>Physoderma maydis</i>)	Moderate	23.6
6	Flag smut (<i>Ustilago maydis</i>)	Moderate	20.2
7	Polysora rust (<i>Puccinia polysora</i>)	Low	14.32
8	Maydis leaf blight (<i>Cochliobolus heterostrophus</i>)	Traces	14.0
10	False head smut (<i>Ustilaginoidea virens</i>)	Traces	2.0
11	Curvularia leaf spot (<i>Curvularia lunata</i>)	Traces	4.0
12	Charcoal stalk rot (<i>Macrophomina phaseolina</i>)	Traces	2.0

Incidence and severity: Traces (<10%), Low (10-20%), Moderate (20-40%), High (40-60%), Severe (60%<)

Observation on varietal reaction to various diseases was recorded during the survey. It is evident that local cultivars, Local (Chakhou), local yellow, local white grown by farmers of Manipur were highly susceptible to Turcicum leaf blight, Banded leaf and sheath blight of maize, Common rust, Polysora rust and smut diseases of maize. Maize hybrid like HQPM1, HQPM5, Vijay composite, Hero22, VNR4226, Dekalb 9081, Dekalb 9135, PAC740, All Rounder were found to possess high level of field resistance to foliar and stalk rot diseases. Among the hybrid All Rounder and VNR4226 was found to be resistant to TLB and other diseases. Dekalb 9081, Dekalb 9135, PAC740 are found to be moderately susceptible

to diseases. HQPM1, HQPM5, Vijay composite and Hero22 are found to be highly susceptible to TLB, stalk rot and other diseases. Local (Chakhou), local yellow, local white are highly susceptible to most of the diseases found on maize. The percent disease index (PDI) of TLB for local landraces ranges from 60 to 80%, Polysora rust from 40 to 60%, common rust from 50 to 60%. Seed rot, and seedling blight is also noticed with range from 5 to 10%. In Manipur, maize is also grown throughout the year. Because of the availability of maize crop throughout the season, the chance of survival of diseases is also increasing. The incidence of diseases is found to be severe in late sown crop as compared to early sown crop.

Table 3: Mean Prevalence of maize diseases for five districts during a survey of two cropping main seasons

S/N	Maize Diseases	Imphal West (%)	Churachandpur (%)	Thoubal (%)	Imphal East (%)	Senapati (%)
1	Turcicum leaf blight (<i>Exserohilum turcicum</i>)	51	62	70	67.5	62.5
2	Banded leaf and sheath blight (<i>Thanatephora cucumeris</i>)	30	48	63	55	40
3	Common rust (<i>Puccinia sorghi</i>)	40	43	50	12.5	40
4	Bacterial stalk rot (<i>Dickeya zae</i>)	30	30	30	30	20
5	Brown spot (<i>Physoderma maydis</i>)	23	25	20	30	20
6	Flag smut (<i>Ustilago maydis</i>)	20	25	16	20	20
7	Polysora rust (<i>Puccinia polysora</i>)	20	10	10	20	11.6
8	Maydis leaf blight (<i>Cochliobolus heterostrophus</i>)	10	10	20	20	10
9	False head smut (<i>Ustilaginoidea virens</i>)	-	-	-	-	10
10	Curvularia leaf spot (<i>Curvularia lunata</i>)	10	10	-	-	-
11	Charcoal stalk rot (<i>Macrophomina phaseolina</i>)	-	-	-	10	-

Discussion

The results indicated that Turcicum leaf blight, Banded leaf and Sheath blight, Maydis leaf blight, Brown spot disease of maize, Common rust, Polysora rust, Bacterial stalk rot and Ear rot were recorded in all five surveyed districts. Diseases such as false head smut, Curvularia leaf spot and Charcoal stalk rot were recorded from Senapati, Imphal East, Imphal West and Churachandpur district of Manipur.

The data indicated that the fields planted with local cultivar developed higher levels of TLB disease, while for improved cultivar was mainly affected with CLR disease. However, false head smut, curvularia leaf spot diseases with lower incidence and severity infestation were observed in surveyed fields. Differences in disease severity in different fields planted with the same cultivar may have been caused by variations in levels of inoculums, plant maturity, nutritional status, local environmental conditions, and production methods.

The results of surveys conducted for two years showed that TLB was widely distributed and cause high to severe damage

in Imphal West, Churachandpur, Imphal East, Thoubal and Senapati districts of Manipur. The highest incidence and percentage severity index of Turcicum leaf blight disease was recorded in Thoubal district and it might be attributed by favourable climatic conditions, high altitude, susceptible maize varieties grown and possibly disease pressure from the available patho-types of the pathogen. TLB disease has been reported throughout the world wherever maize is cultivated [4]. Epidemics of this disease have appeared repeatedly in various parts of the world causing huge losses.

The findings of the present study are in agreement with earlier workers [5, 6] who stated that prevailing environmental conditions during cropping season could be a reason for higher incidence of disease in these areas [7]. Reported that TLB incidence vary in prevalence and severity from year to year and from one locality to another, depending largely on environmental conditions. Humid weather along with heavy dew favoured the spread and development of the disease in an epidemic form. Earlier survey reports [8] indicated that, cultivar susceptibility, weather parameters play an important

role for the high severity of the disease. Similar observations were also made by several workers ^[9, 10, 11]. Studies on Turcicum leaf blight of maize in Uganda by ^[12] found that the disease occurred in all areas sampled and was more severe in wet areas with relative humidity of more than 80 percent in comparison to dry areas.

Conclusion

From the study, it may be concluded that, through survey and surveillance of maize diseases, all the diseases identified were destructive to maize production in Manipur, due to fact that they occurred widespread in maize producing areas. It is identified that foliar diseases are among the major production constraint that contributed yield losses in maize producing districts. During the survey maize growth period was also affected by drought and water logged are highly observed as abiotic stresses that caused yield losses. Three most important foliar maize diseases were identified with the extent and prevalence of damage of damage caused by maize diseases i.e Turcicum Leaf Blight, Banded leaf and sheath blight and rust diseases (Common rust and Polysora rust) and based on this study further the maize disease management should be investigated.

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