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Distribution of Major Wheat Diseases on Bread Wheat (*Triticum aestivum L.*) in the Central Highland Part of Ethiopia

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ABSTRACT

Wheat rusts and *Septoria tritici* blotch are among the most important constraints in wheat production in Ethiopia. The aim of this study was to study the geographical distribution of major wheat diseases such as stem rust, yellow rust, leaf rust & STB in central highland parts of Ethiopia and determine the reaction of wheat cultivars to wheat rusts in the country during 2020 cropping season. A total of 48 wheat fields were surveyed in major wheat growing areas of Oromia & Amhara Regions of South West Shewa, West Shewa & North shewa zones. *Septoria tritici* blotch and yellow rust were the most widely distributed disease in the surveyed fields with a prevalence percentage of 100 & 68.5% respectively. The overall mean incidence values for *Septoria tritici* blotch, yellow rust, stem rust and leaf rust were 73.32, 26.9, 15.7 and 0.12%, respectively. Likewise, the overall mean severities were 22.6, 9.8, 8.6 and 0.01%, respectively in the same order. The incidences and severities of wheat rusts varied among wheat varieties in the season. Most varieties showed moderately susceptible to susceptible responses against yellow rust and stem rust populations. The predominance of susceptible varieties can be an important recipe for the development of rust epidemics in Ethiopia. The present findings confirmed the importance of *Septoria tritici* blotch, yellow rust and stem rust in Ethiopia. Hence, continuous supply of resistance varieties is needed to avoid wheat disease epidemics in the country.

Keywords: Wheat; Disease survey; Major wheat diseases; *Septoria tritici* Blotch; Yellow rust; Stem rust; Leaf rust

INTRODUCTION

Wheat (*Triticum* spp.) is considered among the most commonly cultivated cereal crops with over 755 million metric tons harvested each year [1]. It is the fourth most important cereal crop in agriculture. Although the crop is widely cultivated at altitudes ranging from 1500 to 3000 m.a.s.l, in Ethiopia, the most suitable area falls between 1700 and 2800 m.a.s.l. [2]. Bread wheat (*Triticum aestivum* L.) accounts for approximately 20% of the totally consumed human food calories and provides the most stable food for 40% of the human population. Ethiopia is the second largest producer of wheat in Sub-Saharan Africa after South Africa [3]. In spite of the production and yield increases, average grain yield of wheat is still low (<2.7 t/ha) and highly variable and below the world's average (3.09 t/ha) [1].

Crop yields are dependent on interactions of socio-economical, biological, technological and ecological factors. The ideal daily temperature for wheat development varies from 20-25°C for germination, 16-20°C for good tillering and 20-23°C for proper plant development [4]. The crop can be grown in most locations where annual rainfall ranges from 250 to 1750 mm. About 75% of the wheat grown world-wide receives an average rainfall between 375 and 875 mm annually [4,5]. However, too much precipitation can lead to yield loss from diseases and poor root growth and development problems [5].

Despite its importance as food and industrial crop, wheat production and productivity around the globe is hampered by a number of factors including biotic and abiotic stresses as well as low adoption of new agricultural technologies [6]. Of the biotic stresses, diseases caused by fungi are the most important factors constraining wheat production. Yellow rust (*Puccinia striiformis f.sp. tritici*), stem rust (*P. graminis f.sp. tritici*), leaf rust (*P. triticina*) and Septoria diseases especially *Septoria tritici* blotch (STB) are prevalent throughout the country and major disease of wheat in all wheat growing areas of the country causing serious economic losses [7-9].

However, according to Teklay A et al. [10], the prevalence and severity of the diseases is more dependent on weather conditions of the season and varieties grown. The combination of mild temperatures with high humidity in areas, where susceptible wheat

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varieties are grown on large scale, creates the perfect conditions for the foliar wheat diseases to spread rapidly.

Several sources of resistance have been reported but breeding for resistance has not always been successful in protecting wheat from the damaging effects of the diseases; as expression of resistance is often correlated with morphological traits. Moreover, wheat cultivars resistant in one part of the world may display susceptibility elsewhere. Even within a country, a difference observed in pathogen virulence that may be associated with fungal genetic variability [11] is hindering the development of wheat varieties with broad spectrum of resistance. Resistance in wheat could be durable if the type of resistance in the variety is partial, which is polygenic, or non-specific to particular pathogen genotypes. Selection for partial resistance to STB may be restricted if that trait has a significant cost, for example reduced yield, which is the most important target for many wheat breeders.

Overall wheat foliar diseases (STB, wheat rusts) remained an important constraint to wheat production all over the world including in Ethiopia but the status of the disease is variable every year due to environmental condition and race difference. So it is very crucial to assess the status of the disease every year. In Ethiopia, wheat is grown in different agro-ecological zones. The areas vary in-terms of weather conditions, wheat varieties grown and crop management practices. The crop contributed a great deal to the country as source of food and income but it is continuously ravaged by the diseases and other biotic constraints. The diseases occurs almost in all wheat growing places but their intensity varies from place to place due to variability in weather conditions, differential responses of wheat varieties to the disease and as a result of variations in crop management practices. Thus far, only limited surveys were conducted in few areas. Yield loss assessment studies have been carried out in fewer areas and they are largely based on data from field surveys. As a result there is a need to assess the incidence and severity of major wheat diseases such as **STB, YR, SR and LR** in different regions and across agro-ecological zones to have a complete understanding of the importance of the disease in the country. Thus, this study was designed with the following objectives:

General objective

To contribute towards improved wheat production in the central highlands of Ethiopia through effective and sustainable management of economically important diseases of wheat in Ethiopia.

Specific objective

To study the distribution of major diseases of bread wheat in the central highlands of Ethiopia.

MATERIALS AND METHODS

Assessment of major wheat foliar diseases

Disease surveys were carried out in the major wheat producing districts of North, South-west and West Shewa zones of Amhara and Oromia regional states. Survey districts in each zone were selected based on wheat area coverage. The surveys were carried out in 2020 main cropping season (from October to November) along the main roads and accessible routes in each survey district, and stops were made at every 5-10 km intervals based on vehicles odometers as per wheat fields available. A total of 48 wheat fields were surveyed across 25 districts.

Description of the study areas

The wheat disease survey was carried out in North, West and South-west Shewa zones of Amhara and Oromia Regional State in Ethiopia (Table 1).

North shewa is located at 08°37'71"-09°66'94"N, 38°30'57"-39°29'83"E and with elevation ranges between 2283-3043 m.a.s.l. The area is characterized by a unimodal rainfall pattern and receives an average annual rainfall of 929 mm. The annual average maximum and minimum air temperatures are 21.4 and 9.0°C, respectively. West Shewa zone is located at 8°10´03´´-9°21´39´´N latitude and 37° 30´25´´-38 ° 33´01´´E longitudes and within elevation ranges between 2079-2868 m.a.s.l. Annual mean maximum and minimum rain fall is 1900 mm and 600 mm, respectively. The mean minimum and maximum air temperature of the area is 11.7°C and 25.4°C, in that order. South-west Shewa zone is located at 8°16-9° 56´N latitude and 37° 05´-38° 46´E longitude and altitude ranging from 1600 to 3576 m.a.s.l. It receives annual rainfall ranging from 900 -1900 mm. The mean minimum and maximum air temperature of the area is 10°C and 35°C, respectively.

Data collection and analysis

Depending on the size of the field, 5-10 spots in quadrant (2mx2m) were assessed in each field in "W" orientation. Disease prevalence and incidence data were obtained using the following formulae.

$$Prevalence = \frac{No.of\ fields\ infected}{Total\ No.of\ fields\ assessed} * 100\%$$

$$Disease\ Incidence = \frac{No.of\ disease\ plants}{Total\ No.of\ plants\ examined} * 100\%$$

The severity of *Septoria tritici* blotch was recorded using the double-digit scale (00–99) developed as a modification of Saari and Prescott's severity scale to assess wheat foliar diseases [12,13]. The first digit (D1) indicates vertical disease progress on the plant and the second digit (D2) refers to severity measured as diseased leaf area. Percent disease severity is estimated based on the following

Table 1: Description of administrative zones included in the major wheat diseases survey.

Zones	Number of fields assessed	Altitude (m.a.s.l.)	Latitude	Longitude
South-West Shewa	10	2072-2670	8°16-9° 56´N	37° 05´-38° 46´E
West Shewa	13	2079-2868	8°10´-9° 21´N	37°30´- 38° 33´E
North Shewa	25	2283-3043	08°37"-09° 66' N	38°30'-39° 29' E

formula:

$$\%Disease\ severity(PDS) = \left(\frac{D1}{Y1}\right) * \left(\frac{D2}{Y2}\right) * 100\%$$

Where D1 and D2 represent the score recorded (00-99 scale) and Y1 and Y2 represent the maximum score on the scale (9 and 9) [14]. The geographic coordinates (latitude and longitude), and altitude were recorded using Geographic Positioning System (GPS) unit. In Survey data (prevalence, incidence and severity) were analyzed by using the descriptive statistical analysis (means) over districts, varieties and altitude range.

The three rusts such as YR,SR &LR severity were estimated visually as a proportion leaf area affected by stripe rust using the modified Cobb'sscale [15] and the host plant response (infection type) was noted according to Peterson RF, et al. [16]. The CI was calculated by multiplying the level of disease severity and the constant value of infection type. The constant values for infection types were used based on; R = 0.2, MR = 0.4, M= 0.6, MS = 0.8, S = 1 [17].

RESULTS AND DISCUSSION

Disease survey and prevalence

The current survey covered a wide range of areas located in the Central highlands of Ethiopia. From the 48 wheat fields assessed in the three zones, 99% were affected by the diseases (Table 2). *Septoria tritici* blotch prevalence 100% in North Shewa, Southwest and West Shewa zones each. Takele A, et al. [18] also reported 100% STB prevalence in their previous study.

- **Yellow rust** prevalence 68.5% in North Shewa, 8.3% in Southwest and 40% in West Shewa zones each.
- **Stem rust** prevalence 7.1% in North Shewa, 100% in Southwest and 6.7% in West Shewa zones each.
- **Leaf rust** prevalence 1.8% in North Shewa, 0% in Southwest and 0% in West Shewa zones each.

Takele A, et al. [18] also reported 100% STB prevalence in their previous study. Out of the 24 districts surveyed in the present study, STB was recorded in 24 districts with mean prevalence of 100%. Although STB appeared to be prevalent in the survey areas, both incidence and severity of the disease varied markedly across districts (Table 2). The overall distribution/prevalence of the disease in the 24 districts reached 100%. The high prevalence of STB in the survey areas could be attributed to weather conditions that are suitable to the disease development (frequent rains and moderate temperature) [19]. The highest yellow rust prevalence recorded in North shewa zone where as the lowest recorded in South west shewa zone. The highest stem rust prevalence recorded in South west shewa zone where as the lowest recorded in west shewa zone.

Disease incidence

The mean incidence of STB in the surveyed zones (South west, West and North Shewa) was 69.38%, 89.67% and 73.32%, respectively (Table 2). Across the survey districts, STB incidence ranged between 40% and 100%, averaging on 77.45%. The highest mean incidence (100%) was recorded in Gedeo, Ejersalafo, Welimera, Sebetawas,Alelitu, Sendafa, Weqelo, Qinbibit, Sheno & Hamus gebeya districts. This was followed by Tokekutaye with 88% mean STB incidence and Kersamalima district, which had a mean STB incidence of 80%. Takele A, et al. [18] also reported 80-98% STB incidence leading to up to 60% yield loss on susceptible wheat varieties. In addition, Hailu E, et al. [7] reported mean incidences of 90-100% in Toke Kuyara and Wolisso districts.

The mean incidence of Yellow rust in the surveyed zones (South west, West and North Shewa) was 13.3%, 8.3% and 26.9%, respectively (Table 2). Across the survey districts, Yellow rust incidence ranged between 0% and 100%, averaging on 16.2%. The highest mean incidence (100%) was recorded in Chancho district. This was followed by Sululta with 90% mean YR incidence and Ejere district, which had a mean YR incidence of 50%. Takele A, et al. [18] also reported 80-98% STB incidence leading to up to 60% yield loss on susceptible wheat varieties. In addition, Hailu E, et al. [7] reported mean incidences of 90-100% in Toke Kuyara and Wolisso districts.

The mean incidence of Stem rust in the surveyed zones (South west, West and North Shewa) was 41.1%, 1% and 5%, respectively (Table 2). Across the survey districts, Stem rust incidence ranged between 0% and 93.3%, averaging on 15.7%. The highest mean incidence (93.3%) was recorded in Kersamlima district. This was followed by Basonawerena with 50% mean Stem rust incidence and Becho district, which had a mean Stem rust incidence of 40%. Takele A, et al. [18] also reported 80-98% Stem rust incidence leading to up to 60% yield loss on susceptible wheat varieties. In addition, Hailu E, et al. [7] reported mean incidences of 90-100% in Toke Kuyara and Wolisso districts.

The mean incidence of Leaf rust in the surveyed zones (South west, West and North Shewa) was 0%, 0% and 0.36%, respectively (Table 2). Across the survey districts, Leaf rust incidence ranged between 0% and 5%, averaging on 0.12%. The highest mean incidence (5%) was recorded in Siyadeberenawayu district. Takele A, et al. [18] also reported 80-98% Leaf rust incidence leading to up to 60% yield loss on susceptible wheat varieties. In addition, Hailu E, et al. [7] reported mean incidences of 90-100% in Toke Kuyara and Wolisso districts.

The survey areas were categorized into two altitude groups based on their elevation. Group I, areas with altitude ranging between 1500-2000 m.a.s.l., were considered as intermediate altitudes while the Group II areas, with altitude of >2000 m.a.s.l., were considered as highlands. STB incidence was higher in the higher altitude areas than the low laying ones. The incidence of the disease was 66% at high altitude ranges. This could be due to favorable weather conditions for disease onset, development and spread.

Disease severity

The mean severity of **STB** in the surveyed zones (South west, West and North Shewa) was 18.79%, 24.7% and 24.16%, respectively (Table 2). Across the survey districts, STB severity ranged between 6.3% and 89%, averaging on 22.55%. The highest mean severity of 89% was recorded in Sendafa. This was followed by Alelitu with 43.2% mean STB severity and Welimera district, which had a mean STB severity of 42.3%. Takele A, et al. [18] also reported 80-98% STB severity leading to up to 60% yield loss on susceptible wheat varieties. In addition, Hailu E, et al. [7] reported mean severity of 90-100% in Toke Kuyara and Wolisso districts.

Table 2: Prevalence, incidence and severity of stem rust and leaf rust diseases of wheat in South-west, West and North Shewa Zones of Ethiopia in 2020 cropping season.

Region	Zone	Woreda	No. of Fields Assessed	Stem rust					Leaf Rust				
				Prevalence	Incidence Range	Incidence Mean	Severity Range	Severity Mean	Prevalence	Incidence Range	Incidence Mean	Severity Range	Severity Mean
Oromia	West Shewa	Gedeo	2	0.0	0	0.0	0	0.0	0.0	0	0	0	0
		Toke Kutaye	5	40.0	0-20	6.0	0-10MS	2.0	0.0	0	0	0	0
		Ejersalafo	1	0.0	0	0.0	0	0.0	0.0	0	0	0	0
		Iluberga	2	0.0	0	0.0	0	0.0	0.0	0	0	0	0
		Ejere	2	0.0	0	0.0	0	0.0	0.0	0	0	0	0
		Wolemera	1	0.0	0	0.0	0	0.0	0.0	0	0	0	0
Mean			**13**	**6.7**		**1.0**		**0.3**	**0**		**0**		**0**

Region	Zone	Woreda	No. Of Fields Assessed	Stem rust					Leaf Rust				
				Prevalence	Incidence Range	Incidence Mean	Severity Range	Severity Mean	Prevalence	Incidence Range	Incidence Mean	Severity Range	Severity Mean
Oromia	South west	Sebeta Awas	4	100.0	10-40	18.8	5R-20MS	5.3	0.0	0	0	0	0
		KersaMalima	3	100.0	80-100	93.3	60S-90S	70.0	0.0	0	0	0	0
		Becho	1	100.0	40	40.0	20MS	16.0	0.0	0	0	0	0
		Woliso	2	100.0	10—15	12.5	5R-10MR	2.5	0.0	0	0	0	0
Mean			**10**	**100.0**		**41.1**		**23.4**	**0.0**		**0**		**0**

Region	Zone	Woreda	No. of Fields Assessed	Stem rust					Leaf Rust				
				Prevalence	Incidence Range	Incidence Mean	Severity Range	Severity Mean	Prevalence	Incidence Range	Incidence Mean	Severity Range	Severity Mean
Amhara	North shewa	Chancho	1	0.0	0	0.0	0	0.0	0.0	0	0	0	0
		Sululta	2	50.0	0-40	20.0	0-20MS	8.0	0.0	0	0	0	0
		Muketuri	3	0.0	0	0.0	0	0.0	0.0	0	0	0	0
		Alelitu	1	0.0	0	0.0	0	0.0	0.0	0	0	0	0
		Sendafa	1	0.0	0	0.0	0	0.0	0.0	0	0	0	0
		Wuchale	1	0.0	0	0.0	0	0.0	0.0	0	0	0	0
		Weqelo	1	0.0	0	0.0	0	0.0	0.0	0	0	0	0
		Siyadeber	4	0.0	0	0.0	0	0.0	25.0	0-20	5	0-5MR	0.5

Region	Zone	Woreda	No. of Fields Assessed	Stem rust					Leaf Rust				
				Prevalence	Incidence Range	Incidence Mean	Severity Range	Severity Mean	Prevalence	Incidence Range	Incidence Mean	Severity Range	Severity Mean
Amhara	North Shewa	Moretenajiru	2	0.0	0	0.0	0	0.0	0.0	0	0	0	0
		Basonawerena	2	50.0	0-100	50.0	0-80S	40.0	0.0	0	0	0	0
		Angolelanatara	3	0.0	0	0.0	0	0.0	0.0	0	0	0	0
		Kinbebit	1	0.0	0	0.0	0	0.0	0.0	0	0	0	0
		Sheno	2	0.0	0	0.0	0	0.0	0.0	0	0	0	0
		Hamus gebeya	1	0.0	0	0.0	0	0.0	0.0	0	0	0	0
		mean	**25**	**7.1**		**5.0**		**1.9**	**1.8**		**0.36**		**0.04**
		Grandmean/ Total	**48**	**37.9**		**15.7**		**8.6**	**0.6**		**0.12**		**0.01**

The mean severity of **Yellow rust** in the surveyed zones (South west, West and North Shewa) was 6.7%, 8.4% and 14.4%, respectively (Table 2). Across the survey districts, Yellow rust severity ranged between 0% and 80%, averaging on 9.8%. The highest mean severity (80%) was recorded in Chancho district. This was followed by Sululta with 70% mean YR severity and Ejere district, which had a mean YR severity of 40%. Takele A, et al. [18] also reported 80-98% STB severity leading to up to 60% yield loss on susceptible wheat varieties. In addition, Hailu E, et al. [7] reported mean severity of 90-100% in Toke Kuyara and Wolisso districts.

The mean severity of **Stem rust** in the surveyed zones (South west, West and North Shewa) was 23.4%, 0.3% and 1.9%, respectively (Table 2). Across the survey districts, **Stem rust** severity ranged between 0% and 70%, averaging on 8.6%. The highest mean severity (70%) was recorded in Kersamalima district. This was followed by Basonawerena with 40% mean Stem rust severity and Becho district, which had a mean Stem rust severity of 16%. Takele A, et al. [18] also reported 80-98% Stem rust severity leading to up to 60% yield loss on susceptible wheat varieties. In addition, Hailu E, et al. [7] reported mean severity of 90-100% in Toke Kuyara and Wolisso districts.

The mean severity of **Leaf rust** in the surveyed zones (South west, West and North Shewa) was 0%, 0% and 0.04%, respectively (Table 2). Across the survey districts, **Leaf rust** severity ranged between 0% and 0.5%, averaging on 0.01%. The highest mean severity (0.5%) was recorded in Siyadebreanawayu district. Takele A, et al. [18]

Table 3: Prevalence, incidence and severity of yellow rust and septoria tritici blotch diseases of wheat in Southwest, West and North Shewa Zones of Ethiopia in 2020 cropping season.

				Yellow Rust					STB				
Region	Zone	Woreda	No. of fields Assessed	Prevalence	Incidence Range	Incidence Mean	Severity Range	Severity Mean	Prevalence	Incidence Range	Incidence Mean	Severity Range	Severity Mean
Oromia	West Shewa	Gedeo	2	100.0	0-10	10.0	0-5MR	2.0	100		100.00	32-33	9.20
		Toke Kutaye	5	40.0	0-40	10.0	0-25MS	4.4	100	40-100	88.00	33-89	42.72
		Ejersalafo	1	0.0	0	0.0	0	0.0	100	100	100.00	53	18.52
		Iluberga	2	50.0	0-20	10.0	0-10MS	4.0	100	50-100	75.00	33-74	22.84
		Ejere	2	50.0	0-100	50.0	0-80S	40.0	100	50-100	75.00	33-64	20.30
		Wolemera	1	0.0	0	0.0	0	0.0	100	100	100.00	74	34.60
	Mean		**13**	**40.0**		**13.3**		**8.4**	**100**		**89.67**		**24.70**
	South west	Sebeta Awas	4	0.0	0	0.0	0	0.0	100	**100**	**100.00**	**53-73**	**27.16**
		KersaMalima	3	33.3	0-100	33.3	0-80S	26.7	100	60-100	80.00	33-64	20.30
		Becho	1	0.0	0	0.0	0	0.0	100	40	40.00	32	7.40
		Woliso	2	0.0	0	0.0	0	0.0	100	40-75	57.50	33-64	20.30
	Mean		**10**	**8.3**		**8.3**		**6.7**	**100**		**69.38**		**18.79**
	North Shewa	Chancho	1	100.0	100	100.0	80S	80.0	100	60	60.00	42	9.90
		Sululta	2	100.0	80-100	90.0	60S-80S	70.0	100	**60-75**	**74.70**	**33-64**	**16.90**
		Muketuri	3	33.3	0-10	3.3	0-5MR	0.7	100	60-100	74.70	32-75	19.30
		Alelitu	1	100.0	5	5.0	5R	1.0	100	100	**100.00**	75	**43.20**
		Sendafa	1	0.0	0	0.0	0	0.0	100	100	100.00	89	88.90
		Wuchale	1	100.0	0	0.0	0	0.0	100	50	**50.00**	32	**7.40**
		Weqelo	1	100.0	20	20.0	5MR	2.0	100	100	100.00	74	34.60
		Siyadeber	4	75.0	0-40	26.7	0-5S	2.8	100	32-100	**69.30**	22-54	**16.10**
		Moretenajiru	2	100.0	10-20	15.0	5R-5MR	1.5	100	30-50	40.00	22-32	6.20
Amhara		Basonawerena	2	0.0	0	0.0	0	0.0	100	50-75	**62.50**	32-53	**13.00**
		Angolelanatara	3	100.0	10-100	46.7	5R-90S	31.7	100	50-100	70.00	32-64	16.10
		Kinbebit	1	100.0	30	30.0	10MR	4.0	100	100	**100.00**	62	**14.80**
		Sheno	2	50.0	0-80	40.0	0-20MS	8.0	100	100	100.00	62-64	22.20
		Hamus gebeya	1	0.0	0	0.0	0	0.0	100	100	**100.00**	64	**29.60**
	Mean		**25**	**68.5**		**26.9**		**14.4**	**100**		**73.32**		**24.16**
Grand Mean/ Total			**48**	**38.9**		**16.2**		**9.8**	**100**		**77.45**		**22.55**

also reported 80-98% Leaf rust severity leading to up to 60% yield loss on susceptible wheat varieties. In addition, Hailu E, et al. [7] reported mean severity of 90-100% in Toke Kuyara and Wolisso districts (Table 3).

Intensity of major wheat diseases on various wheat varieties commonly grown in the survey areas

Almost all of the bread wheat varieties grown in the study area were susceptible to STB, YR & SR. A total of seven different wheat varieties were found to be commonly cultivated across the survey areas. None of the varieties were resistant to STB, YR &SR but disease incidence and severity varied across the varieties. Overall STB incidence varied between 40 and 100% while disease severity ranged from 6.2% to 89.9% (Tables 4 and 5). Average STB incidence was the lowest (34.17%) on variety Kekeba and the highest (90%) on Kubsa. Mean STB severity was the lowest (18.52%) on the local variety and the highest (60.49%) on Kubsa, a variety which also had the highest incidence of STB. SR incidence varied between 0 and 100% while disease severity ranged from 0% to 90% (Tables 4 and 5). Average SR incidence was the lowest (0%) on variety Et-13, Digalu & Kubsa and the highest (90%) on Hidase. Mean SR severity was the lowest (0%) on the Et-13, Digalu & Kubsa varieties and the highest (80%) on Hidase, a variety which also had the highest incidence of SR. YR incidence varied between 0 and 100% while disease severity ranged from 0% to 90% (Tables 4 and 5). Average YR incidence was the lowest (0%) on variety Kubsa & Hidase and the highest (100%) on Digalu. Mean YR severity was the lowest (0%) on Hidase & Kubsa and the highest (80%) on Digalu, a variety which also had the highest incidence of YR. LR incidence varied between 0 and 20% while disease severity ranged from 0% to 2% (Tables 4 and 5). Average LR incidence was the lowest (0%) on all varieties and the highest (20%) on Hidase. Mean LR severity was the lowest (0%) on all varieties and the highest (2%) on Hidase, a variety which also had the highest incidence of LR. This finding is in line with Takele A, et al. [18], who reported susceptibility of all wheat cultivars grown in surveyed areas. Current results suggest the vulnerability of improved wheat varieties to major wheat diseases although results need to be confirmed with additional studies. Major wheat diseases causing from 50 up to 82% yield loss on released varieties were reported in previous studies [20]. The populations of wheat diseases are highly diverse genetically and the fungus may reproduce sexually several times during the wheat-growing season [21,22]. The planting of diverse

Table 4: Incidence of major wheat diseases in central highland parts of Ethiopia.

Variety	SR Incidence		LR Incidence		YR Incidence		STB Incidence	
	Range	Mean	Range	mean	Range	mean	Range	Mean
Kekeba	0-100	11.2(13)	0	0	0-100	17.7(13)	30-100	81.2(13)
Dendea	0-100	13.4(19)	0	0	0-80	16.05(19)	30-100	70.1(19)
ET-13	0	0(1)	0	0	20	20(1)	50	50(1)
Digalu	0	0(2)	0	0	100	100(2)	50-60	55(2)
Hidase	100	100(1)	20	20(1)	0	0	75	75(1)
Kubsa	0	0(1)	0	0	0	0	100	100(1)
Local	0-40	10(9)	0	0	0-100	32.2(9)	50-100	76(9)
Mean		19.23		2.9		26.6		72.47

Table 5: Severity of major wheat diseases in Central Highland Parts of Ethiopia.

Variety	SR Severity		LR Severity		YR Severity		STB Severity	
	Range	Mean	Range	mean	Range	mean	Range	Mean
Kekeba	0-60	5.3(13)	0	0	0-80	8.5(13)	32-89	59.5(13)
Dendea	0-90	9.3(19)	0	0	0-20	7.12(19)	21-87	53.6(19)
ET-13	0	0(1)	0	0	8	8(1)	33	33(1)
Digalu	0	0(2)	0	0	80	80(2)	33-35	34(2)
Hidase	80	80(1)	2	2(1)	0	0(2)	45	45(1)
Kubsa	0	0(1)	0	0	0	0(1)	89	89(1)
Local	0-16	3.7(9)	0	0	0-90	25.8(9)	32-89	53.6(9)
Mean		14.47		0.29		18.49		52.53

and susceptible wheat varieties in the wheat producing areas of the country may provide a perfect medium for the multiplication of highly aggressive races of the pathogen that may threaten wheat production in the study areas and beyond. According to Sharma RC, et al. [14], a high degree of variability at the lesion sampling level and a low degree of variability at the leaf and location sampling levels suggest that the primary source of inoculum was mostly air-borne aeciospores. As a result due attention should be given to the deployment of varieties that possess broader spectrum of resistance to major wheat diseases. Addition to this, wheat variety grown, planting dates, previous crop/s, and any control measures applied by the farmers were recorded.

CONCLUSION AND RECOMMENDATIONS

Bread wheat (*Triticum aestivum* L.) is one of the most important cereal crops in Ethiopia. It is widely grown in most of the regions in the country, including the Central highlands. However, its production is affected by abiotic and biotic factors. Among the biotic factors, *Septoria tritici* blotch (*Septoria tritici*) (STB) and wheat rust diseases such as yellow rust and stem rust were the most important problems of wheat production in the country where as leaf rust is negligible. Disease surveys were conducted in the major wheat producing districts of North, Southwest and West Shewa zones of Amhara and Oromia regional states. Our results also confirmed susceptibility of almost all bread wheat varieties under production in the study area to STB; YR & SR. Current results also suggest the vulnerability of improved wheat varieties to STB, YR & SR.

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