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Distribution, Intensity, and Morphological Variability of Wheat Blotch (Septoria Tritici) in Central-South-Eastern of Oromia, Ethiopia

Girma Ababa[1*], Girma Adugna[2] and Bekele Hundie[3]

[1]Department of Agricultural, Ethiopian Institute of Agricultural Research, Pawe, Ethiopia

[2]Department of Horticulture and Plant Sciences, College of Agriculture and Veterinary Medicine, Jimma University, Jimma

[3]Department of Agricultural, Ethiopian Institute of Agricultural Research, Assela, Ethiopia

***Corresponding author:** Girma Ababa, Department Agricultural, Ethiopian Institute of Agricultural Research, Pawe, Ethiopia

girmaabebe65@gmail.com

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Abstract

In Ethiopia, studies of the wheat Septoria Tritici Blotch (STB) status at a different location, on agronomic practice, and pathogen variability are greatly lost. Therefore, this study was intended to assess the distribution and intensity of the STB, as well as to study the morphological variability of isolates. Zones and districts were selected purposively whereas kebeles by systematic sampling method in central-southeastern of Oromia. Mean comparison of the fixed effects was analyzed by using LSD tests in GLM. The variability of isolates was identified by their colony texture, forms, and colors. The association between disease intensity and independent variable were analyzed by Pearson correlation and its magnitudes were predicted by multiple regressions. A total of 108 fields were assessed and % prevalence of zones (88.9%-100%) and districts (77.8-100%) was documented. The STB intensity of the districts was not significantly different (p<0.05) however; severity of the zones was highly different (p<0.01). The correlation between weed infestation (r=0.78 and r=0.2) and growth stages (r=0.72 and r=0.36) was positive but the plowing frequency (r=-0.77 and r= -0.43) was negative with incidence and severity respectively. Forty-three isolates are grouped into four colors, three textures, and growth form. The current study areas are more favorable for the STB epidemics in which it should be targeted areas for integrated management. Our findings indicate that proper weed management, soil tillage, and crop rotation are interventions that can reduce the impact of wheat STB.

Keywords: Distribution; Intensity; Variability; STB; Wheat

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Introduction

Wheat Septaria Tritici Blotch (STB) is a distractive disease that causes problems in many parts of the world [1], and Zymo*septoria tritici* is a causal agent of STB [2-5]. It is a hemibiotrophic fungal pathogen [6] and causes a considerable yield loss on the wheat by affecting the photosynthesis part [7,8].

The epidemics of STB in wheat fields largely depend on host susceptibility and prevailing weather conditions [1]. It is also influenced by inoculum density, the pathogenicity of the strains, and cultural practices [9,10]. The infected plant debris, seeds, and alternate hosts serve as sources of the primary inoculums. [11-13]

Wheat yield losses of 30%–54% 1 and even>60% [14] have been attributed to STB infestations. In Ethiopia, STB causes 25% to 82% wheat yield loss in the increasing incidence and severity in the major production areas [15-19]. Yield losses attributed to heavy incidences of STB have been reported to range from 31% to [20] to 53% 8. The *Septoria tritici* blotch occurs throughout the world. [11]

In Ethiopia, the occurrence of STB was reported for the first time by [21] now a day *Septoria tritici* is distributed in Oromoia, Amhara, SNNPR region of Ethiopia. [19,22,23] Its intensity is high in the highlands of the central part of Ethiopia [24] and high in high humidity, altitude, and warmer temperature environments [1, 11, 23,25].

The high intensity is expected from the diverse population of the pathogen. The studies of colony morphology on different media indicate that the *Septoria tritici* has different growth forms, colors, and textures [10,26,27]. This means that the pathogen is very variable due to genetics among the population since location is not affected by their variability [9,28].

Besides, the assessment, one of the few kinds of research done on STB in Ethiopia was fungicide and wheat varieties evaluation under natural infection. But, morphological and pathogenic variability studies of *Septoria tritici* isolates are not thus far done. The disease is dynamic so; continuous disease assessment and studies of disease variability are used for early alarming of the farmers as well as governments, designing of management practice, and further studies. Then, this study aimed to observe the STB distribution and intensity from the area which before not studied and to identified the variability of collected isolates based on their colonies colours, growth forms, and textures.

Materials and Methods

Description of the survey areas

Septoria tritici field surveys were conducted in central-southeastern parts of Oromia in Ethiopia during the 2020 cropping season. The surveyed areas include Arsi, West Arsi, Bale, and West Shoa zones. Geographical locations of the survey zones located in Oromia are shown in **Figure 1**.

Sampling method and strategy

The wheat STB survey was conducted from flowering to maturity growth stages. The four zones and three districts were selected based on a purposive sampling method from the region. Three kebeles within each district and three farms within each kebele were assessed at 5-10 km intervals along the main, available, and accessible roadsides **(Table 1)**. As well, farmer's training centers and research stations were simultaneously surveyed. Infected wheat leaf tissues by STB were collected and ninety-one green leaves that had *pycnidia* and few dried samples were collected from 108 farmer's fields in paper bags for isolation of the pathogen **(Figure 2)**. Collected samples were labelled with the name of the zone, district, kebele, variety, altitude, latitude, longitude, and date of collection. The sample was dried under natural air at about 25oC to prevent secondary infection and kept at room temperature.

Diseases assessment

A 1 m^2 quadrant was thrown at three-five points at random depending on the size of the field, by having 15 meters intervals along the segment. Fourteen plants were randomly picked from each 1 m^2 quadrant and assessed for STB incidence and severity [1]. *Septoria tritici* prevalence was calculated as the number of fields infected divided by a total number of fields assessed and incidence as the infected plant divided by total plant assessed from three quadrants [29]. Its severities were recorded using a double digit-scale [30]. This scale (00-99) measures overall foliar infection on the whole plant where the first digit (0-9), represents the STB upward movement on the plant and the second digit (0-9) points determine its severity [1]. Its severity index was determined by the formula (%)=D1/Y1*D2/Y2*100, where, D1 representing STB upward movement, whereas D2 is the severity. Y1 represents the maximum STB upward movement and Y2 represents the maximum severity [31].

Data of agronomic practice **Table 2**, altitude **Table 1**, and crop growth stage were gathered to do an association with *Septoria tritici* intensity. The longitude and latitude of each field were taken using a global positioning system (GPS) **(Table 1)**.

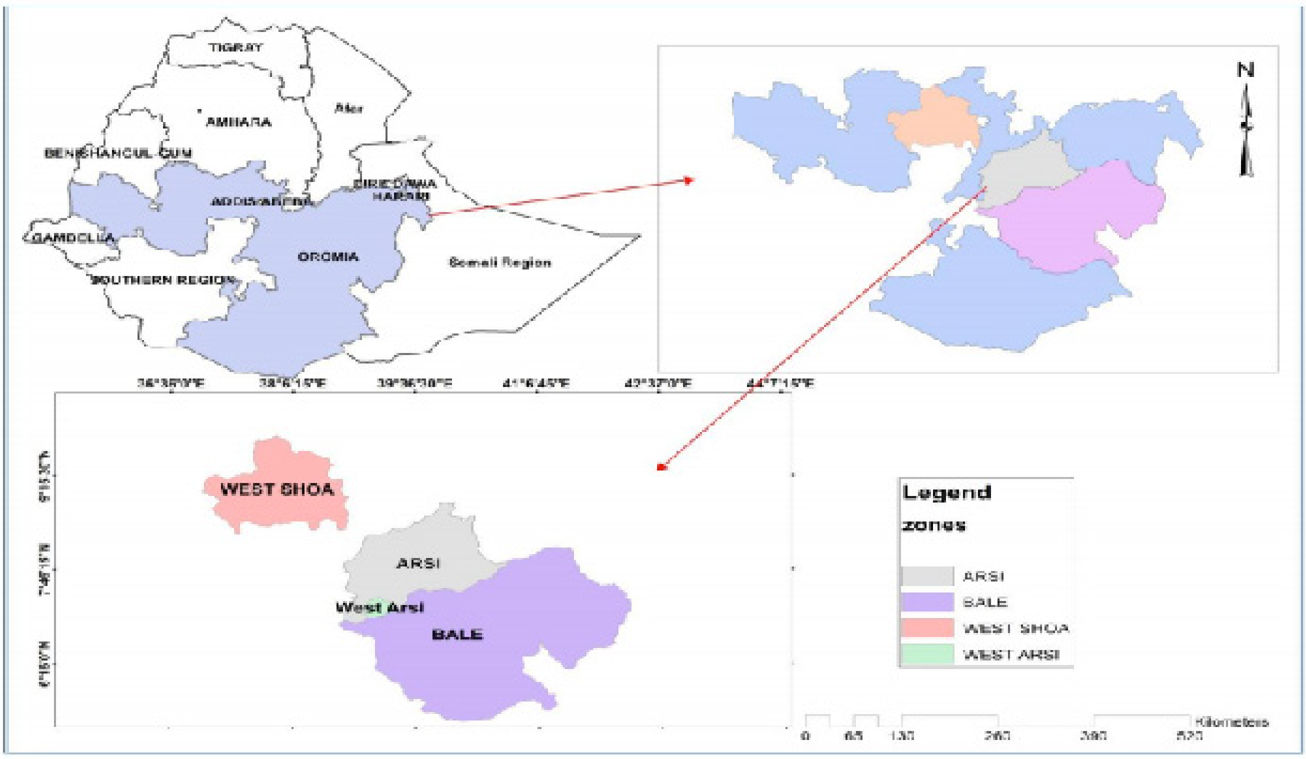

Figure 1: Locations of STB survey area in 2019 in Oromia, Ethiopia.

Zones	Districts	No. of farmers field assessed/ kebele	No. of farmers field assessed /district	Longitude	Latitude	Altitude range (m a.s.l.)
West Shoa	Welmera	3	9	038028'60''	09052'6''	2252-2577
	Tokekutaye	3	9	037043'45''	08051'31''	2245-2792
	Ambo	3	9	037050'49''	08053'26''	2463-2988
West Arsi	Adaba	3	9	039026'59''	07001'33''	2357-2498
	Dodola	3	9	039003'36''	07059'33'	2410-2573
	Assassa	3	9	039009'29''	07002'28''	2386-2573
Arsi	Sire	3	9	039030'69''	08015'53''	2018-2366
	Hetosa	3	9	039014'37''	08010'45''	2123-2244
	Lemunabilbilo	3	9	039016'22''	07018'46''	2602-2938
Bale	Sinana	3	9	0400'17'48'	07064’30’’	2481-2625
	Goba	3	9	039058'23''	07011’40’’	2392-2472
	Agarfa	3	9	039056'53''	07016'36''	2344-2462
Total		36	108			

Table 1: Description of surveyed areas in 2020 in central–southeast parts of Oromia, Ethiopia.

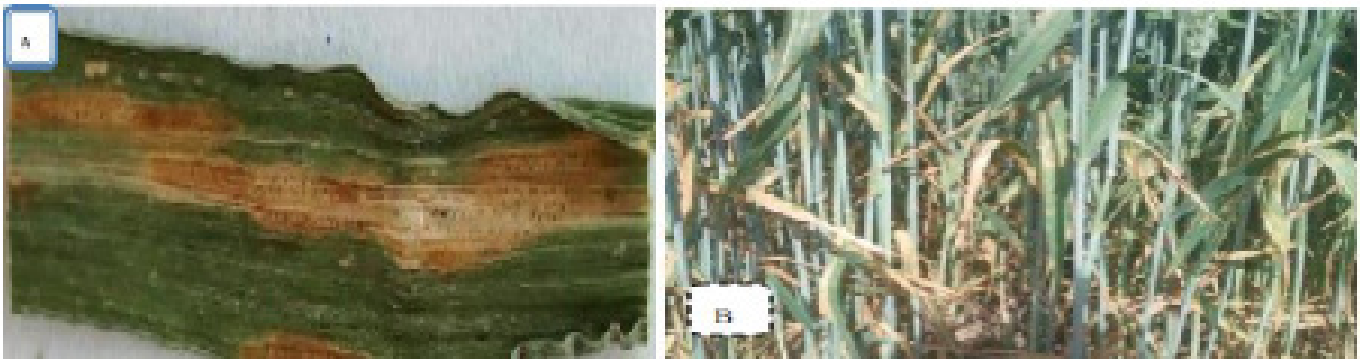

Figure 2: Symptoms of *Septoria tritici* on the leaves, of the wheat plant (a and b).

Plowing frequency		Weed infestation		Crop growth stage	
Qualitative measurement	Quantitative levels	Qualitative measurement	Quantitative levels	Qualitative measurement	
One times	1	Low	1	Flowering	1
Two times	2	Medium	2	Milking	2
Three times	3	Good	3	Dough	3
Four times	4	Very good	4	Maturity	4

Table 2: Descriptions of agronomic practice and crop growth stage with their qualitative measurement and quantitative levels.

Isolation process

The isolation process was carried out in the Microbiology Laboratory at Holeta National Biotechnology Research Center Holeta, Ethiopia. The isolation was done with some modification of [1]. In the first step, the filter paper was placed on the Petri dish and wetted with distilled water. Then, 7 cm segment of wheat leaves were placed on the wetted filter paper.

That petridish was incubated at 24oC for 2-8 hours depending on the stages of leaves for enhancing oozing of pycnidiospores through an opening of the pycnidium (ostiole), cirrhus. With the help of a dissecting microscope or stereoscope, the oozes formed were transferred to Potato Dextrose Agar (PDA) supplemented with chloramphenicol succinate 250 mg for 1 litter distilled water 1. However, *pycnidia* that didn’t form ooze were removed from the leaf epidermis by a sterile needle and transferred to PDA plates.

After seven days the colony was picked by sterile loops and streaked onto PDA plates. The streaked plates were incubated in the incubation chamber adjusted at 24oC for seven days for enhancing fungal growth. The single pinkish-orange, dark hard color colonies that corresponding with [10] were further streaked on PDA plates and then the single colony was picked and was spread on new PDA plates without antibiotics.

Colonial morphological feature

Based on the macroscopic observation the cultural appearances (colony colour, forms, and texture) were distinguished on PDA. A laboratory manual and a pictorial atlas for the identification of fungi by [32] were equally used in the description of colony morphology.

Data analysis

The SAS version 9.3 statistical software [33] packages were used to analyze the data. Kolmogorov-Smirnov analysis confirmed the significant differences (p<0.05) and revealed a nonnormal distribution of survey data, so, the survey data were transformed by using ARCSINE [9]. Except for farmer's fields, fixed factors were arranged in three stages of nested design [34-42], and farmer's fields were treated as a random effect. In the three stages of nested design, kebeles were nested under districts whereas districts under zones. GLM procedure was used to analyze the variance and the mean comparison of fixed effects was separated by LSD mean comparison. The association between STB intensity and agronomic practice, altitude, and crop growth stages was analyzed by Pearson correlation and its intensity magnitudes were predicted by multiple regressions.

Results

Distribution of *Septoria tritici* across a location

Wheat Septoria tritici was prevalent in all the surveyed areas with 100%, 88.8%, and 96.3% prevalence in Bale, Arsi, and both in West Arsi and West Shoa respectively. From the surveyed zones the highest prevalence (95.4%) of *Septoria tritici* was recorded. In eight districts, its prevalence was very high 100% and the lowest prevalence (77.8%) was scored from Lemunabilbilo district **(Figure 3)**.

The intensity of Septoria tritici across a location

Septoria tritici incidence was not significantly different both at zones and districts levels (p<0.05). This showed that it was intensively infected the wheat crops at all of the surveyed areas in a comparable manner. The STB incidence of West Shoa, West Arsi, Arsi, and Bale zones was 95.7%, 94.7.9%, 87.7%, and 99% respectively. The highest incidence (100%) was documented at three districts and the lowest 75% incidence was registered at Lemunabilbilo district **(Figure 3)**.

The STB severity index showed highly significant (p<0.01) differences between the four zones. The severity index of Arsi and Bale zones significantly differed from each other but the other zones were the same **(Table 3)**. However, the severity index of districts not significantly differed (p<0.05). The maximum 42% severity index was scored at Tokekutaye and the lowest 12% severity index was recorded at Lemunabilbilo districts **(Figure 3)**.

Association of STB with agronomic practices, altitude, and wheat growth stages

The severity index of wheat *Septoria tritici* showed a positive correlation (r=0.78) a highly significant (P<0.001) difference with weed infection levels. A negative correlation was observed between plowing frequency and STB severity index (r=-0.77) and incidence (r=-0.43). Strong positive correlations (r=0.72) were observed between *Septoria tritici* severity and wheat crop stages. From our current results, the increment of altitude in meters did not show a significant correlation with disease intensity (P< 0.05) **(Table 4)**.

Multiple regressions

The amount of disease intensity was predicted and a negative relationship was observed between disease incidence and plowing frequency in high significance (P<0.01).

No significance of other factors observed with disease incidence. The disease severity predicted was increased in highly significant (P<0.001) as weed infestation increased, it was decreased in highly significant (P<0.001) as plowing frequency increased, and increased significantly (P<0.05) as crop growth stages increased but, no significant with altitude at (P<0.05) **(Table 5)**.

Microscopic identification

The *Septoria tritici* isolates were produced pycnidiospores of very thin, and more than three septations and few curves in shape **(Figure 4)**. Its pycnidiospore also had four septa.

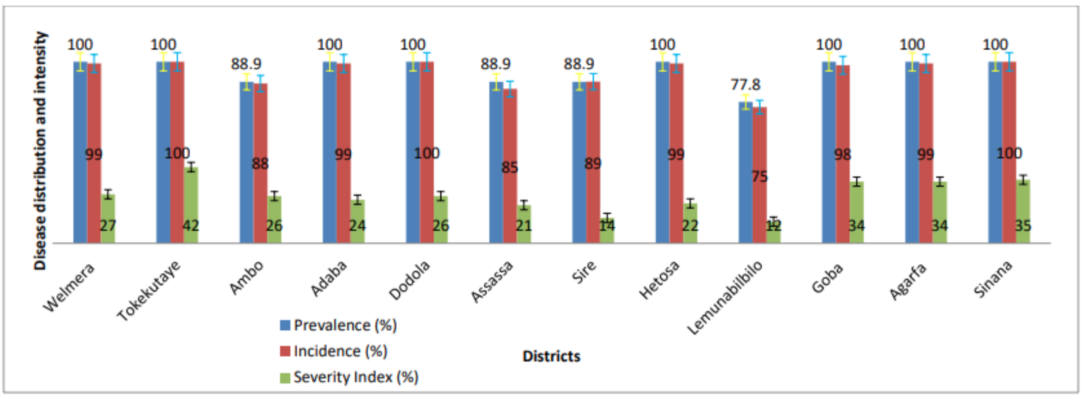

Figure 3: Disease distribution and intensity in 2019 in central-southeast of Oromia, Ethiopia.

Zones	Disease Severity Index (%)
West Shoa	31.69ab
West Arsi	23.5ab
Arsi	15.64b
Bale	34.57a
CV	40.7

Table 3: The effect of four zones on disease severity in 2019 in central-southeast of Oromia, Ethiopia.

Variables	ALT	WIL	PF	GS	DSI	DI
ALT	1	0.01ns	0.012ns	-0.002ns	-0.008ns	-0.14ns
WIL		1	-0.66***	0.69***	0.78***	0.2*
PF			1	-0.68***	-0.77***	-0.43***
GS				1	0.72***	0.36***
DSI					1	0.36***
DI						1

DI - Disease incidence, DSI - Disease severity index, WIL-Weed infestation level, PF-Plowing frequency, ALT - Altitude, and GS - Growth stage.
*Significant level at p<0.05 ** Significant level at 0.01 and ***Significant level at 0.001.

Table 4: Pearson's correlation coefficients between STB Intensity with Agronomic practice, altitude, and crop growth stages, in 2019.

Predictor	Parameter estimate	
	Incidence	Severity
Constant	167	42
GS	4.44ns	3.19*
PF	-11.8**	-10.4***
WIL	-4.54ns	9.73***
ALT	-0.0141ns	-0.00075ns

Disease Incidence = 167 + 4.44 GS - 11.8 PF - 4.54 WIL - 0.0141 ALT
Determination coefficient R2 = 0.22
WIL-Weed infestation level, PF-Plowing frequency, ALT - Altitude, and GS - Growth stage
Disease severity index = 42.0 + 3.19 GS - 10.4 PF + 9.73 WIL - 0.00076 ALT
Determination coefficient R2= 0.74
WIL-Weed infestation level, PF-Plowing frequency, ALT - Altitude, and GS - Growth stage
Ns indicates non-significant

Table 5: Multiple regression of *Septoria tritici* intensity over agronomic practice, altitude, and crop growth stages in 2019 in the Oromia, Ethiopia.

Figure 4: Pycnidiospores of wheat *Septoria tritici*.

Morphological variability

Six isolates of the pinkish colony had a creamy texture and three growth forms: dense, medium, and sparse growth forms. The isolates of whitish color had a creamy texture and the ooze rushes the lines of sowing. The isolates of dark colours are compact, dense, and sparse growth on PDA. The isolates of brown color are the intermediate, solid, and creamy texture whereas the growth forms are sparse and dense **(Table 6)**.

Only two (4.5%) isolates had whitish colony color of the total isolates. Twenty- eight isolates (63%) of the total isolates produced a colony of black color and this becomes the most dominant. The isolates of brown color are 8 (18.2%) and the pinkish color is 6 (14%) out of the total isolates studied.

Nine isolates derived from Bale samples have different colors. Four isolates had pinkish color, and three had brown whereas two isolates had black colors. One isolate has whitish, three had black and two isolates had pinkish color and those were collected from the Arsi zone. The isolates from West Arsi had one brown, and five black colours. Eighteen isolates from West Shoa had colonies of black color whereas one and four isolates resulted in colonies of pinkish and brown colors, respectively **(Figure 5)**. Forty-four *Septoria tritici* isolates were derived from 91 samples collected from different zones of the Oromia region **(Table 7)**.

Zones	No of isolates	Colony color	Colony growth	Texture
West Shoa	23	Bark, pinkish, and brown colors	Dense, intermediate and sparse	compact, cream, and intermediate
West Arsi	6	Brown, dark colors	Dense, intermediate and sparse	intermediate and compact
Arsi	6	Whitish, pinkish, and bark color	Dense, intermediate and sparse	Cream and compact
Bale	9	Pinkish, brown, and bark color	Dense, intermediate and sparse	Cream, intermediate, and compact

Table 6: Morphological variability of *Septoria tritici* isolates in 2019 in central-southeast of Oromia, Ethiopia.

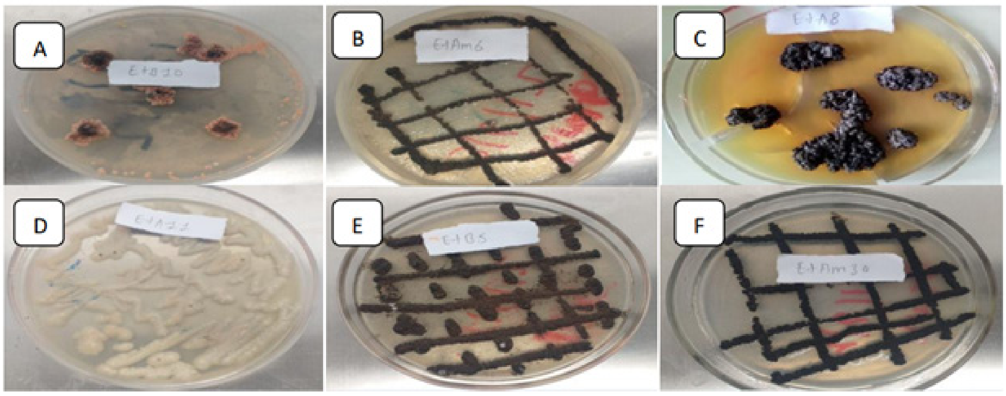

Figure 5: The four colors of wheat *Septoria tritici* isolates on PDA, a. Pinkish color, b and e. Brown color, d. Whitish color, c and f. Black color.

Sr.No	Isolate code	Geographical source			Varieties source
		Zone	District	Kebele	Names
1	EtAm-1	West Shoa	Welmera	Holeta Agricultural Research Center in the station	Alidoro
2	EtAm-2	West Shoa	Tokekutaye	Handersa	Danda'a
3	EtAm-3	West Shoa	Tokekutaye	Maruf	Digalu
4	EtAm-4	West Shoa	Ambo	Bojibilo	Danda'a
5	EtAm-5	West Shoa	Ambo	Yaechebo	Hidasse
6	EtAm-6	West Shoa	Tokekutaye	Malkedera	Danda'a
7	EtAm-9	West Shoa	Ambo	Kuregatira	
8	EtAm-10	West Shoa	Ambo	Bojibilo	Danda'a
9	EtAm-11	West Shoa	Ambo	Bojibilo	Danda'a
10	EtAm-12	West Shoa	Ambo	Bojibilo	Danda'a
11	EtAm-13	West Shoa	Ambo	Bojibilo	Danda'a
12	EtAm-14	West Shoa	Ambo	Bojibilo	Danda'a
13	EtAm-16	West Shoa	Ambo	Kibakube	Kingbird
14	EtAm-19	West Shoa	Ambo	Yaechebo	Danda'a

15	EtAm-20	West Shoa	Tokekutaye	Malkedera	
16	EtAm-21	West Shoa	Tokekutaye	Maruf	Hidasse
17	EtAm-22	West Shoa	Tokekutaye	Maruf	Digalu
18	EtAm-23	West Shoa	Tokekutaye	Maruf	Huluka
19	EtAm-26	West Shoa	Tokekutaye	Gorobiyo	Gololcha
20	EtAm-27	West Shoa	Tokekutaye	Adersabila	Hidasse
21	EtAm-28	West Shoa	Tokekutaye	Adersabila	Danda'a
22	EtAm-29	West Shoa	Tokekutaye	Adersabila	Hidasse
23	EtAm-30	West Shoa	Tokekutaye	Adersabila	Hidasse
24	EtB-1	Bale	Goba	Sinja	Hidasse
25	EtB-2	Bale	Sinana	Shalo	Ogolcho
26	EtB-3	Bale	Agarfa		
27	EtB-4	Bale	Goba	Sinja	Candidate
28	EtB-5	Bale	Agarfa	Ilani	Ogolcho
29	EtB-6	Bale	Sinana	Amalama	Ogolcho
30	EtB-7	Bale	Sinana	Robearea	Ogolcho
31	EtB-8	Bale	Gasera	Wute	
32	EtB-10	Bale	Goba	Misira	Ogolcho
33	EtA-3	Arsi	Hetosa	Hatehandode	Ogolcho
34	EtA-4	Arsi	Hetosa	Hatehandode	Kubsa
35	EtA-7	Arsi	Hetosa	Seruanketo	Ogolcho
36	EtA-8	Arsi	Lemunabilbilo	Kulumsa Agricultural Research Center in sb-station	
37	EtA-11	Arsi	Hetosa	Hatehandode	Kubsa
38	EtA-19	Arsi	Tiyo	Dosha	Danda'a
39	EtSh-1	West Arsi	Assassa	Debara	Ogolcho
40	EtSh-2	West Arsi	Dodola	Bekola	Paven-76
41	EtSh-4	West Arsi	Dodola	Kechamachare	Ogolcho
42	EtSh-5	West Arsi	Assassa	Edobelo	Kubsa
43	EtSh-6	West Arsi	Assassa	Tuse	Kubsa
44	EtSh-7	West Arsi	Assassa	Kulumsa Agricultural Research Center in sb-station	

Table 7: Collection area and varieties source of *Septoria tritici* isolates in 2019 in central-southeast of Oromia, Ethiopia.

Discussion

The high prevalence of STB in the surveyed areas is attributable to weather conditions that are suitable to the STB development (frequent rains and moderate temperature) .

Previously, reported that 38%-100% *Septoria tritici* incidence was observed in the altitude range of 2072-3043 m.a.s.l. Besides, the present results show that *Septoria tritici* is distributed 100% in the surveyed areas confirms that it is a major threat to wheat production in the country. Zymo*septoria tritici* is a fungal pathogen that is a causal agent for wheat *Septoria tritici*. It occurs worldwide in the most wheat-producing countries as diverse as Argentina, Ethiopia, Iran, United States, Netherlands, Russia, New Zealand, and Australia. It is a big problem on durum wheat in Iran, Tunisia, and Morocco .

The reason for the high incidence can be recognized as high inoculum level associated with farming systems mainly in the surveyed areas. Farmers generally, do not practice suitable crop rotation systems with non-host plants to the pathogen and grow the wheat from year to year especially at Arsi and Bale zones. This causes the STB rapid inoculum build-up and higher possibilities of inoculum survivals because it overwinters in the soil and decaying plant residues as *pycnidia* .

The high STB incidence was identified throughout this study is due to high inoculum buildup, susceptible cultivars cultivated by the farming communities, and favorable environmental conditions of all agro-ecologies of the surveyed areas of the country.

Most of the farmers in the surveyed area, across zones were not practicing crop rotation with nonhost crops to the pathogen; as well the poor weed management and low plowing frequency are very adapted. Monocropping is common in Arsi and Bale zones relative to central highland areas of Ethiopia.

The increment of the weed population can increase the severity of STB, this could be due to wheat competitions for nutrients, water, space, and sunlight with the weeds consequently; this is increased wheat succulence and reduces its ability for physical defiance mechanism to the pathogen. The plant's canopy bringing closer the wheat leaves which makes it easier to rain splashes spores dispersal and influencing the pathogen`s life cycle itself .

The microclimate such as the high moisture was always available in the dense plant population which makes it's a good environment for the pathogen. The greater STB development in the high plant density may be due to a more favorable microclimate produced within the leaf canopy .

Many studies have been made on the impact of environmental factors on Zymo*septoria tritici*, suggesting that the most important role is played by temperature fluctuations, because leaves temperature is the temperature of the pathogen`s body that develop onto or into plant leaves, influencing significantly their life cycle. Besides temperature, the moist leaf surface plays an important task in early infections being necessary an amount of rainfall of 10 mm three consecutive wet days with at least 1 mm rain.

Septoria tritici severity was decreased as the plowing frequency increased, in which the same result with [42-50] the impact of soil tillage on Zymo*septoria tritici* has been studied in few dissimilar geographical areas. However, the contradictory results forwarded as the severity of STB was higher in plowed plots under conventional tillage than in other tillage systems.

During crop cultivation, increasing soil tillage is used for different purposes why because, soil tillage can expose the inoculum to the sunlight and remove the inoculums sources from the soil. As a result, it can be hindering the STB lifecycle to reduce the number of inoculums from the soil .

Once more, STB incidence was decreased as the plowing frequency increased. Rotation to nonhosts and sanitation attained by deep plowing of crop debris can decrease the number of inoculums available to initiate a new STB life cycle. This may be less effective on a field basis, due to the long-distance dispersal of ascospores, however, may be helpful if subsequent within a region.

This result was different from some studies that confirmed low *Septoria tritici* incidence in zero tillage or conservation tillage. The tan spot and mildew incidence is reduced as the plowing frequency is increased but, *Septoria tritici* incidence is increased as the plowing frequency is increased in farmer's fields suggested the opposite results, conservation tillage is supporting the over-summering of *septoria tritici*.

Throughout the survey work, from the greater part of the district's the growth stages of wheat were at their dough stage. Although in some districts especially in the midland areas the crop was at its full maturity stage. This difference in growth stage was played an important role in the severity of the *Septoria tritici*. The positive correlation indicates that as the crop stage increased, the severity of the STB also increased why because of the crop senescence. The reason behind this is the crop becomes loss the ability of physical and chemical defense at the mature stage; then the pathogen can easily penetrate and develop on the crop .

The different reports showed that the increment of altitude in meter negatively correlated with wheat stem rust but from our study, the *Septoria tritici* intensity is not correlated with altitude in the surveyed areas.

We observed the disease magnitude and generalized that the disease incidence was reduced by 11.84% amount as plowing frequency increased. The disease severity was increased by 9.73% amount as weed infection levels increased however, the disease severity decreased by 10.42% amount as plowing frequency increased. In other factors, disease severity was increased by 3.19% amount in significant as crop growth stages increased from flowering to maturity.

The pycnidiospore of *Septoria tritici* isolates, differentiated from pycnidiospore of Septoria nodurum that had thick, less than three septations an erect shape. Again the number of septations, shape, and thickness of the germinated spores of those *Septoria tritici* isolates were the same with 1.

The colony morphology of isolates on a solid PDA medium showed a great diversity of textures, growth forms, and colors. The whitish color isolates were identified from the current studies in which were previously not reported by.

EtAm-14 and EtA-4 had the pinkish color similar to Bale Zone and EtA-3, EtA-8, and EtSh-1 also had the black color similar to the West Shoa zone, this indicates, the location may not affect the outcome of colonies of various colors resulting from isolates plated on PDA media, meaning that the isolates collected from different locations and plated on PDA could have the same or various colors, or the isolates from the same location had different colors and from the same location again have the same color . This study revealed that *Septoria tritici* isolates colonies varied morphologically being plated on the PDA growth media.

Conclusion

This shows that the *Septoria tritici* has high diversity in colony morphology which is reported for the first time in our country. From the current observation, the morphologic variability of wheat *Septoria tritici* isolates in Ethiopia was confirmed.

Since wheat *Septoria tritici* is highly prevalent and very severe in all central-southeast parts of Ethiopia, and wheat is the 1st most important crop in that area, giving do attention to developing an effective management strategy of STB is very critical. Over, isolates diversity studies depending on their morphology by using different media and spore length, width, and septation number are mandatory.

Acknowledgment

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Data Availability

The data that support the findings of this study are available on request from the corresponding author.

Conflicts of Interest

The authors state that there is no conflict of interest.

Ethical Statement

This study did not engage in any human or animal testing.

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