



Full Length Research Paper

Distribution and occurrence of wheat rusts and septoria leaf blotch in Bale and Arsi Zones, 2014 Belg season

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Stem rust, yellow rust and septoria leaf blotch are the most damaging diseases of wheat in Ethiopia that causing significant losses on yield and quality in years with favorable environmental conditions and inoculums potential. Currently, regular monitoring and assessment during Belg and Meher main season is crucial to manage rusts before causing huge loss. Surveys of wheat disease was accomplished with the objective of identifying the distribution and intensity of wheat disease and understand the rusts inoculums risk level from Belg to Meher (main) season. The survey was made following the main roads and accessible routes in each districts stops were made every 5-10 km interval on vehicle odometer as per Belg wheat field available. Five stop were made in each wheat field by moving X fashion at each stop interval using quadrants and data were collected from each. The results of the present studies indicated that a total of 94 wheat fields were examined for the presence of wheat diseases in Arsi and Bale zone in Belg season 2014. Twenty-nine wheat fields were inspected in Arsi zone, of which 41.4% and 6.9% were infected with yellow rust and septoria leaf blotch respectively, similarly, from 65 field assessed in Bale zone septoria leaf blotch, leaf rust, stem rust and yellow rust diseases was distributed over 36 (55.4%), 28 (43.1%), 20 (30.8%) and 3 (4.6%) farmers' fields respectively. Septoria leaf blotch and leaf rust could be the two important potential diseases constrain to major rain fed belg wheat production in South-eastern parts of Ethiopia.

Key word, Wheat, rusts, surveys, inoculums, distribution

INTRODUCTION

Wheat is one of the most important cereal crops covering an area of more than 1.6 million ha with total production of more than 34 million quintal in main season in Ethiopia (CSA, 2013). Ethiopia is one of the major wheat producing countries in the Sub-Saharan Africa. However, the productivity of wheat is low due to many factors among which diseases caused by fungal pathogens are the major constraints in tetraploid wheat production. From

fungal wheat diseases rusts and septorial leaf blotch are a major disease of wheat in Ethiopia and it is widespread in the wheat growing regions, particularly in Central, South-East and North-West, Ethiopia, (Admass et., al 2005). Monitoring wheat diseases is great importance for sustainable wheat production. A survey of practical importance began in Ethiopia in the late sixties. According to Dagnatchew (1967) reported that the

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rusts, as a group, were the most important diseases of wheat, with stem rust (*Puccinia graminis*) being the most destructive, causing heavy damage to crops at altitudes below 2300 m. Leaf rust (*Puccinia recondita*) appeared endemic occurring in most regions, while yellow rust (*Puccinia striiformis*) was important only at altitudes above 2100 m. So far, 30 fungal, 3 bacterial, 1 viral and 4 nematodes diseases have been identified on wheat in Ethiopia (Hailu *et al.*, 1991).

In view of the importance of disease studies for wheat improvement, much work remains to be done to minimize the damage due to disease epidemics in Ethiopia. Disease survey is basic to all effective control of the diseases (Stubbs *et al.*, 1986). Therefore, surveying wheat diseases during the belg crop growing season is very crucial in identifying early potential infections caused by rusts and septoria leaf blotch diseases and helps in making fungicide interventions in case of epidemics. In addition, there is always pathogenic variability of wheat rusts from year to year, from season to season and from location to location. In order to catch this variability it is important to make belg seasons wheat diseases survey on annual basis in the major Belg wheat producing region of our country. Therefore, the main objective of the Belg season wheat disease survey was to assess diseases distribution and intensity (incidence and severity) in the Belg season and understand the rusts inoculum risk level from Belg season to *Meher* season and provide advice to farmers, extension and policy makers.

MATERIALS AND METHODS

Survey and Surveillance of Wheat diseases

Wheat disease survey was carried out in 15 districts, seven districts in Arsi and eight districts in Bale zones, in South eastern Ethiopia in 2014 Belg cropping season with the objective of distribution and quantifying diseases intensity on wheat in the Belg season. These districts were identified as major Belg wheat growing areas of the Arsi and Bale zone. Purposive sampling was utilized both in selection of the PAs in the Districts and wheat fields from the PAs. PAs with high belg wheat coverage were selected from the Districts. On the other hand, wheat fields were assessed at every 5th to 10th km along the main and accessible roadsides. The plant samples with in a selected field were taken in X-fashion throwing 5-10 quadrants depending on the size of the field assessing rusts and other diseases of the plants. The assessments were made when the crop growth stage was on average between the medium milk and early maturity stages (Zadoks, J.C *et al.*, 1975). Rusts incidence and severity were recorded from five to ten quadrants along the two diagonals of the X axis in the field and used to calculate average values. The incidence of rusts' was calculated by using the number of infected plants and expressed as a percentage of the total number of plants assessed.

Similarly, Disease severity for rust was assessed with the modified Cobb scale (Peterson, *et al.*, 1948) based upon percentage of the plant infected and type of disease reaction. In addition, (00-99) digit scale was used septoria disease. Disease distribution is measured by number of fields infested out of the total fields assessed in each zone.

R ESULTS AND DISCUSSIONS

Distribution of wheat rusts and septoria diseases in Bale Zone

Septoria leaf blotch, leaf rust, stem rust and yellow rust diseases distributed over 36, 28, 20 and 3 farmers' fields in 8, 7, 5 and 3 districts of Bale zone (Tables 1-2, Figures 1-4), respectively. This result implicated that septoria and leaf rust are the first and second most distributed diseases followed by stem rust and yellow rust in the April-August crop season. Among rusts, leaf rust had a wider distribution followed by stem rust. Yellow rust remained the least distributed as it was discovered only in three districts, namely Sinana, Ginner and Goba on local emmer wheat and two bread wheat varieties, Kubsa and Tusie in this order. Stem rust was found in Sinana, Agarfa, and Gassera and Ginner districts in fields cropped either to bread wheat varieties Digalu, Tusie, Danda'a, Kubsa, or to emmer wheat local variety, depending on the district. The rusts were detected in 28 fields distributed in Sinana, Agarfa, Gassera, Ginner Gololch and Goro districts. No rusts were encountered in Dinsho and Goba districts. Ginner district was the most infested district by leaf rust. Of 28 fields infested with leaf rust in all districts in this zone, 14 fields were encountered in Ginner district. Bread wheat varieties Tusie, Madawalabu, Kubsa, Danda'a, Kakaba, Digalu, Pavon-76, Shina, Kubsa, Dashen or the local emmer wheat hosted the leaf rust in Bale zone (Table 2).

Incidence and severity of wheat diseases in Bale Zone

Septoria: Both disease incidence and severity varied from field to field. Of 36 fields infested with septoria in eight districts of Bale zone (Tables 1-2 & Figure 1), 26 and 5 fields sustained 100% and 40-50% disease incidence, respectively. Of five fields with 40-50% disease incidence, four and one fields had 11 and 81 disease severity in double digit scale (00-99). Of the 26 fields that sustained 100% incidence, 5 and 21 fields had 11-31 and 51-83 in aforementioned scale, respectively. The rest remaining five infested fields had low disease incidence, trace (<5%) and disease severity of 11-21

Yellow rust: Although yellow rust had least distribution in Bale zone, both the disease incidence and severity were also significantly halted and thus, did not develop even to the level of 5% except in one field encountered in Ginner district where the incidence was 50 % (Table 1-2 & Figure 2).

Table 1: Wheat rusts and sptoria disease incidence and severity status in Arsi and Bale zones, Belg seasons, 2014.

Zone	District	Yellow rust (%)			Stem rust (%)			Leaf rust (%)			septoria			
		TF	IF	Inci	Sev	IF	Inci	Sev	IF	Inci	Sev	IF	Inci (%)	Sev(00-99)
Arsi	Arsi-Robe	5	0	0	0	0	0	0	0	0	0	1	100	22
	Chole	1	1	tr	tr	0	0	0	0	0	0	1	tr	11
	Dikesis	1	0	0	0	0	0	0	0	0	0	0	0	0
	Guna	7	3	tr	tr	0	0	0	0	0	0	0	0	0
	Jaju	9	6	tr-40	Tr-10	0	0	0	0	0	0	0	0	0
	Lode-Hitosa	2	0	0	0	0	0	0	0	0	0	0	0	0
	Sire	4	2	tr	tr	0	0	0	0	0	0	0	0	0
	Total		29	12			0			0		2		
Bale	Agarfa	3	0	0	0	1	tr	Tr	1	tr	tr	1	100	53
	Densho	2	0	0	0	0	0	0	0	0	0	1	100	22
	Gassera	9	0	0	0	4	tr	Tr	1	tr	tr	8	40-100	31-83
	Ginir	18	1	50	tr	11	tr-80	Tr	14	tr-100	tr-30	3	tr-100	21-81
	Goba	7	1	tr	tr	0	0	0	0	0	0	4	tr-100	11-82
	Gololcha	6	0	0	0	0	0	0	5	tr-100	tr-40	1	100	82
	Goro	10	0	0	0	1	tr	tr-10	4	tr-100	tr-5	8	50-100	52-83
	Sinana	10	1	tr	tr	3	tr	Tr	3	80-100	tr-15	10	tr-100	11-83
	Total		65	3			20			28		36		

Tf=total field inspected, If=infested fields,Inci=incidence,Sev=severity,tr=Trace(<5%)

Figure 1: Septoria leaf blotch distribution, incidence and severity status in Arsi and Bale zones, Belg season, 2014, South eastern, Ethiopia

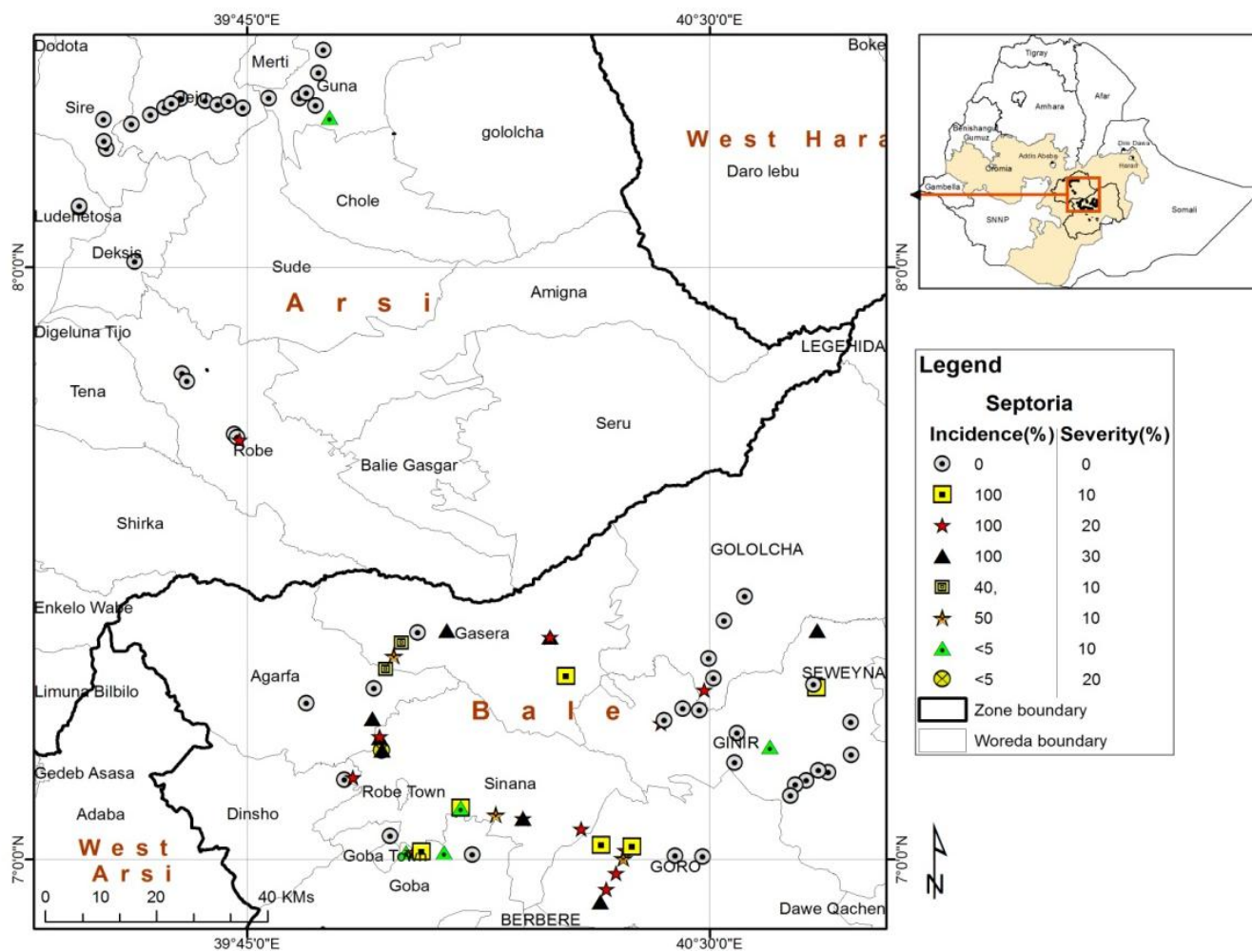


Table 2: Disease Distribution by District, Altitudes and Varieties infected in Arsi and Bale Zones, Belg season, 2014

Zone	District	Altitude (m.a.s.l)	Total field by Variety		Disease types by the variety types in number			
			variety	Total field	Yellow rust	stem rust	leaf rust	septoria
Arsi	Arsi-Robe	2378-2408	Digalu	5	0	0	0	1
	Chole	2867	K-6295 4A	1	1	0	0	1
	Dikesis	2624	Israel	1	0	0	0	0
	Guna	2722-2888	K-6295 4A	5	3	0	0	0
			Digalu	1	0	0	0	0
			Kubsa	1	0	0	0	0
	Jaju	2568-2756	K-6295 4A	9	6	0	0	0
	Lode-Hitosa	2687-2692	Madawallabu	1	0	0	0	0
			Digalu	1	0	0	0	0
	Sire	2454-2898	Batu	2	1	0	0	0
			Kubsa	1	1	0	0	0
		Israel	1	0	0	0	0	
			29	12	0	0	2	
Bale	Agarfa	2384-2505	Tusie	3	0	1	1	1
	Densho	2528-2599	Emmer Local	1	0	0	0	0
			Madawallabu	1	0	0	0	1
	Gassera	2341-2428	Tusie	2	0	1	0	2
			Kakaba	2	0	0	0	2
			Digalu	3	0	2	0	2
			Madawallabu	1	0	0	1	1
			Danda'a	1	0	1	0	1
	Ginir	1889-2289	Kubsa	6	1	3	5	2
			Tusie	1	0	0	1	0
			Danda'a	3	0	3	2	1
			Digalu	1	0	1	1	0
			Unknown	2	0	1	2	0
			Pavon-76	1	0	0	1	0
			Kakaba	3	0	3	1	0
			Shina	1	0	0	1	0
	Goba	2445-2600	Danda'a	1	0	0	0	1
			Madawallabu	4	0	0	0	3
			Tusie	2	1	0	0	0
	Gololcha	1993-2102	Unknown	2	0	0	2	1
			Kakaba	1	0	0	0	0
			Kubsa	2	0	0	2	0
			Dashen	1	0	0	1	0
	Goro	1805-2237	Madawalabu	5	0	0	3	5
			Kubsa	1	0	0	1	1
			Ttusie	2	0	1	0	2
			Kakaba	2	0	0	0	0
Sinana	2374-2456	Digalu	2	0	1	0	2	
		Emmer Local	3	1	1	3	3	
		Kakaba	2	0	0	0	2	
		Danda'a	2	0	1	0	2	
		Madawallabu	1	0	0	0	1	
		Total	65	3	20	28	36	

Table 3: Status wheat rusts and sptoria disease in Arsi and Bale Belg seasons, 2013

Zone	District	Tf	Yellow rust (%)			Stem rust (%)			Leaf rust (%)			septoria		
			If	Inci	Sev	If	If	Inci	Sev	If	If	Inci	Sev	If
Arsi	Chole	1	0	0	0	0	0	0	0	0	0	1	0	0
	Diksis	5	0	0	0	0	0	0	0	0	3	100	31-82	
	Guna	11	2	Tr-50	Tr-15	0	0	0	0	0	8	100	31-83	
	Hetososa	3	0	0	0	0	0	0	0	2	100	32-51		
	Jeju	6	3	Tr-10	5-10	0	0	0	3	Tr	5	100	51-83	
	Ars-Robe	3	0	0	0	0	0	0	0	0	3	100	21-81	
	Sire	3	0	0	0	0	0	0	1	Tr	3	100	11-81	
	Total		32	5		0			4		25			
Bale	Agarfa	3	0	0	0	2	5-40	1-5	1	Tr	Tr	0	0	0
	Dinsho	2	0	0	0	0	0	0	1	100	5	Tr	51	
	Gasera	3	0	0	0	1	Tr	5	1	Tr	2	100	22-81	
	Ginner	14	0	0	0	11	1-50	Tr	7	1-100	1-40	9	100	81-83
	Goba	4	0	0	0	0	0	0	2	1-100	Tr	3	100	81-83
	Gololcha	5	0	0	0	2	100	Tr	4	100	10-30	1	100	82
	Goro	11	0	0	0	1	Tr	Tr	6	Tr-100	Tr-30	10	100	51-84
	Sinana	20	0	0	0	4	Tr	Tr	4	Tr-100	Tr-30	20	100	81-84
	Total		62	0		21			26		47			

Tf=total field inspected, If=infested fields,Inci=incidence,Sev=severity,tr=Trace(<5%)

Figure 2: Yellow rust, distribution, incidence and severity status in Arsi and Bale zones, Belg season, 2014, South-eastern, Ethiopia

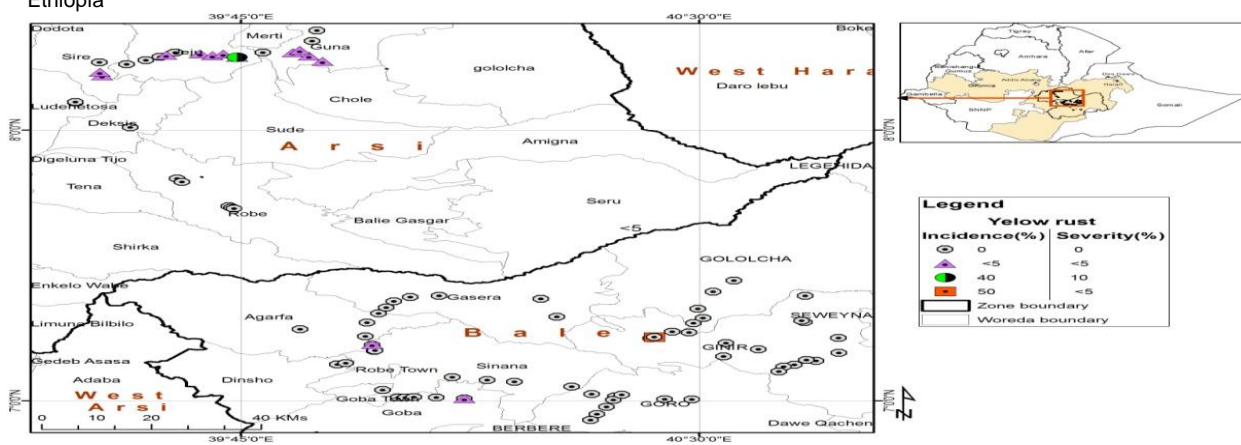


Figure 3: Stem rust, distribution, incidence and severity status in Arsi and Bale zones, Belg season, 2014, South-eastern, Ethiopia

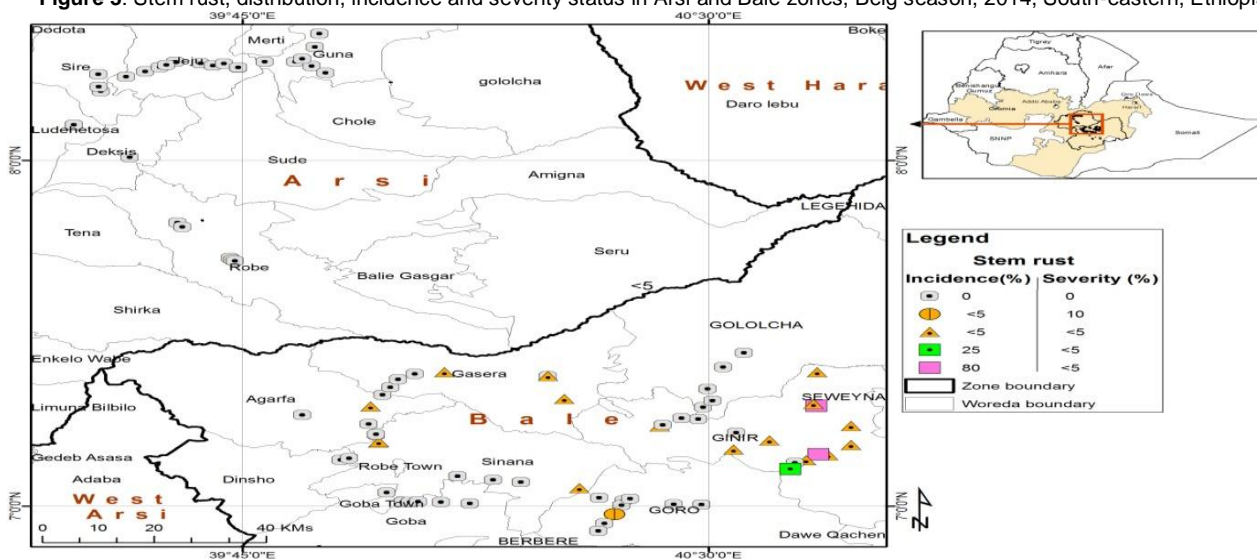
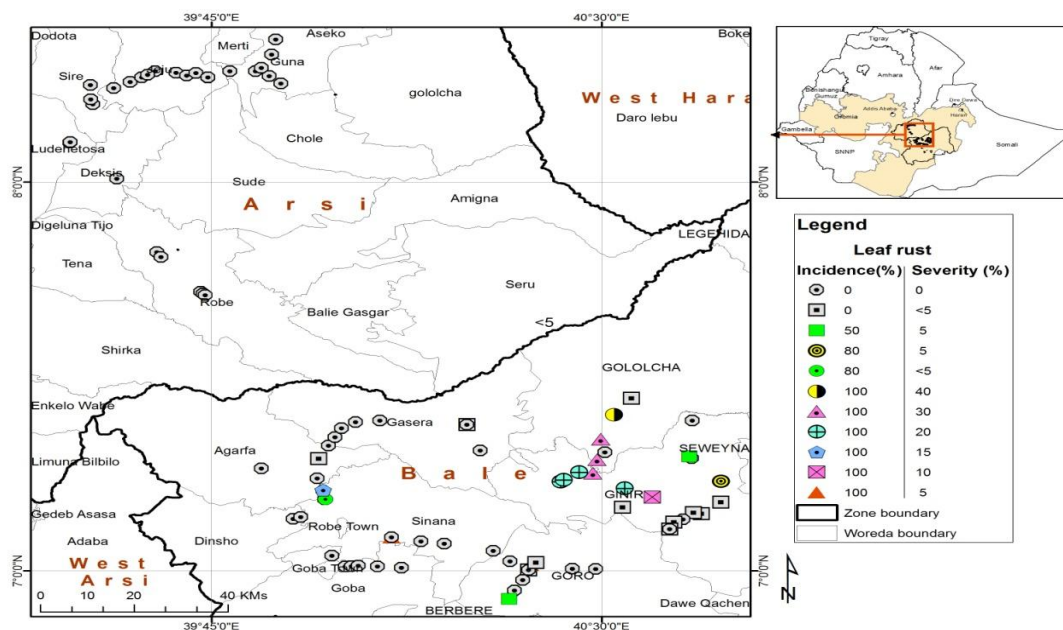


Figure 4: Leaf rust distribution, incidence and severity status in Arsi and Bale zones, Belg season, 2014, South-eastern, Ethiopia



Stem rust: The incidence and severity were at below 5%. Nevertheless, an incidence of 80% was detected in two fields cropped with Danda'a in Ginner district (Tables 1-2 & Figure 3)

Leaf rust: Leaf rust was more important than stem rust and yellow rust in Bale zone both in terms of disease distribution, incidence and severity (Table 1-2 & Figure 4). Seventeen of 28 fields infested sustained a disease incidence ranging from 50 to 100%. Disease severity in seventeen infested fields ranged from 5 to 40%. Leaf rust was more important in Ginner district followed by Gololcha considering the criteria of disease distribution, incidence and severity. Peak severity of 20-40% was observed in eight fields of these districts. Of the remaining fields, two fields had severity levels of 10% and 15% in Ginner and Sinana districts. Leaf rust severity did not exceed 5% in the rest of the fields.

Wheat disease distribution in Arsi zone

Twenty nine fields were assessed for wheat diseases in Arsi zone. Of these fields inspected for diseases, 14 fields harboured wheat diseases, yellow rust and septoria leaf blotch (Tables 1-2 & Figures 1-4). Yellow rust was encountered in Arsi in 12 farmers' fields. In terms of both fields and districts infested, yellow rust was still the most distributed disease in Arsi zone. Sire, Jaju, chole and Guna districts were the only districts harboured yellow rust. This rust was detected on wheat crops raised from bread wheat varieties K6295-4A, Batu and Kubsa. Septoria was found in two fields out of 29 farmers' fields covered by this survey work. Stem rust and leaf rust were not detected in all farmers fields surveyed in Arsi in this season.

Incidence and severity of wheat diseases in Arsi Zone:

The incidence and severity of yellow rust was very low. In all 12 infested farmers' fields, both parameters were at trace (<5%) level except in one field, in Jaju district, where the disease incidence of 40% and severity of 10% were recorded (Tables 1-2 & Figure 2). In addition, Septoria was detected in two fields, one field each in Arsi Robe and another field in Chole districts. Incidence was 100% in one field and trace (< 5%) in another field. The disease severity was low both in terms of disease progress -up of the plant and affected plant parts, 11-22 in double digit scale (Table 1-2 and Figure 1).

Comparison of disease occurrence in 2013 and 2014 Belg seasons within Bale and Arsi zones

Bale zone the Belg season, 2013, disease survey (Table 3) and Belg season, 2014 disease survey (Table 2) summary data confirm that septoria leaf blotch distribution, and leaf rust distribution, incidence and severity were more less consistent with two years within the zone although the incidence and severity of septoria leaf blotch showed variation by year, were higher in 2013 Belg season than they were in 2014 Belg season (Table 1 & 3). Arsi zone Septoria leaf blotch was much variable within the zone by year (Table 1 & 3). This disease has got wider distribution, higher incidence and severity in Belg season, 2013 as compared with Belg season of 2014. Belg seasons surveys data revealed that septoria leaf blotch, leaf rust and stem are most consistently associated with Bale zone rather than with Arsi zone

(Tables 1 & 3). The reverse is true for yellow rust, in dependent of the disease survey years; it was most consistently and widely distributed in Arsi zone Belg season. This result also in line with Dagnatchew (1967) studies indicated that wheat rust was the major constraint in the wheat producing areas of Ethiopia.

CONCLUSIONS

Data generated by Belg season disease survey revealed that septoria leaf blotch and leaf rust could be the two important potential diseases constraining rainfed Belg wheat production in Arsi and Bale zones. Stem rust and yellow rust were unimportant diseases for Belg season wheat producing areas of Arsi and Bale zones. Most interestingly, this finding is in line with findings of year 2013 Belg season disease survey results as well as previous long terms Belg season wheat diseases surveys conducted in Bale zone (unpublished data). However, it does not mean that low level of yellow rust and stem rust infection in Belg season wheat crops cannot be an inoculum sources for main/*meher* seasons in which number of stem and yellow rusts epidemics outbreaks were experienced in Ethiopia. In addition to Belg season wheat fields harboured rusts, it is also assumed that rusts infection also present on some other distant fields and volunteer wheat crops that are more nearer to vast areas planted to this current *meher* season in South-eastern and other parts of Ethiopia. Rust spores be it from stem rust and yellow rust not risk or leaf rust epidemic potential areas, Belg season could be transported to the *meher* season wheat crops which are currently predominantly at complete tillering to stem elongation stages in Arsi and west Arsi zones. Rust spores moving from Belg season to *meher* season wheat crops could be one of the important elements for early *meher* season rusts infection onset and damaging rusts epidemics, especially epidemics of yellow rust and stem rust, the most common characteristics of *meher* season. Recently, by 12 August and 14, 2014 trace level of yellow rust and stem rust infection at few scattered foci was observed on *meher* season planted bread wheat variety Digalu and on the *meher* season planted bread wheat varieties such as Digalu, Danda'a and PBW343 and Lakech at Kulumsa

Agricultural Research center at main-research station, respectively.

In generally, in 2013 crop season early *meher* season wheat diseases survey has contributed to the timely management of yellow rust occurred on susceptible wheat variety Kubsa in Arsi zone, South-eastern Ethiopia. In order to keep on with such benefits, we are conduct routine annual early *meher* season disease survey at national level in which Federal and Regional Research centers are participating in Ethiopia.

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