World Journal of Agricultural Sciences 17 (4): 278-288, 2021
ISSN 1817-3047

DOI: 10.5829/idosi.wjas.2021.278.288

Distribution and Importance of Faba Bean (*Vicia fabae* L.) Fungal Diseases in Ethiopia

Tajudin Aliyi, Bayoush Birke and Alemayehu Hailu

Ethiopian Institute of Agricultural Research Ambo Agricultural Research Centre,
P.O. Box: 37, Ambo, Ethiopia

Abstract: Among biotic factors, diseases were the most important constraints of faba bean yield in Ethiopia. This investigation was designed: to identify, document, prioritize and be acquainted with distribution of fungal diseases of faba bean in Ethiopia; to map geographical distribution areas for economically important faba bean fungal diseases. Assessments of diseases were accomplished in 2017 and 2018 main growing season of the crop throughout the country. From each representative zone of major growing areas, districts were surveyed based on production of faba bean and at an interval of 5 to 10 km. Each sampling point was checked with the global positioning system (GPS) using GPS receiver for altitude and co-ordinates. Survey results revealed the prevalence, incidence and percent disease index of different fungal diseases across all districts in spite of the different levels recorded. Among 191 fields observed, the overall prevalence of *Aschochyta fabae, Botrytis fabae* and *Physoderma* sp. were 72.2, 70.7 and 45.6%, respectively. *Botrytis fabae* was severe in East Arsi compared to other zones with the maximum mean incidence of 98.89% and percent disease index (PDI) of 33.56% whereas the highest mean faba bean gall (FBG), intensity up to 72.9% incidence and 28.3% PDI were calculated from different districts of North Shewa of Amhara region. The most vulnerable stage for the outbreak of epidemics of most fungal diseases was reproductive stage. Based on these results initiation of alternative management options at hotspot areas, evaluation of new source of genotypes and their screening under artificial inoculation should be given due attention for economically important diseases.

Key words: Diseases · Faba Bean · *Physoderma* · Incidence · Percent Disease Index · Prevalence · Vulnerable

INTRODUCTION

Ethiopia is regarded as a secondary center of diversity and one of the nine major agro-geographical faba bean production regions. As a result, Ethiopia accounts for 24 percent of global faba bean output at the moment [1]. In Ethiopia, faba bean covered for 3.63 percent (roughly 466, 697.68 hectares) of the 12.16 percent (1, 563, 768.72 hectares) of pulse crops [2]. Despite being the world's second-largest producer of faba beans, Ethiopia's productivity of this significant crop is only 2.157 t ha^{-1} [2], far below the crop's potential greater than 3 tonne per hectare. The low productivity of the crop is attributed to susceptibility to biotic and abiotic stresses [3, 4] of which diseases are important factors limiting the production of the crop specifically in Ethiopia. Some diseases on faba bean have significant and/or intermediate importance in terms of yield reduction and aggressiveness. Chocolate spot (*Botrytis fabae* Sard.), rust (*Uromyces vicia fabae*), black root rot (*Fusarium solani*) and foot rot (*Fusarium avenaceum*) are among fungal diseases that contribute to the low productivity of the crop [5].

Earlier study with regard to the distribution of faba bean diseases in Ethiopia stated that numerous pathogens infect the crop in different parts of the country. Diseases caused by *Botrytis fabae*, *Uromyces viciae-fabae*, *Fusarium solani*, *Aschochyta fabae* and faba bean necrotic yellow virus (FBNYV) reported to have economic significance [6].

Corresponding Author: Tajudin Aliyi, Ethiopian Institute of Agricultural Research Ambo Agricultural Research Centre, P.O. Box: 37, Ambo, Ethiopia.

Furthermore, in current years, the crop is prone to a newly occurring disease known as Faba Bean Gall (*Physoderma* sp. You), locally known as "Kormid", triggering up to complete crop failure in some highland faba bean growing areas. It is widespread across the country within a short period of time with terrible economic concerns [7, 8].

Fungal diseases on faba bean differ in terms of prevalence and intensity from season to season even from one vicinity to another largely reliant on genetic makeup of the plants and predominant ecological conditions. At an earlier time key faba bean diseases were restricted to particular zones and cultivars, but some diseases are turning to be highly important and in most faba bean growing agrological spaces even some newly evolving diseases are also being noticed in various growing zones. Although diseases on this crop is the main factor that reduces the yield and distribution nationwide, there is inadequate data and updated information that reveal the level of prevalence, incidence and severity across the country and the geographical dissemination of important faba bean diseases are not systematically mapped. Thus this enquiry planned to identify, document, prioritize and develop updated information on the distribution and importance of faba bean infecting fungal diseases in Ethiopia.

MATERIALS AND METHODS

The assessments of the farmers' fields for diseases occurrence were carried out in the period of 2017 and 2018 in main faba bean growing seasons throughout the country in major growing agro-ecological zones to determine disease prevalence and intensity.

Each area was carefully chosen depending on dissimilarities in farming system, climatic condition, elevation and coverage of the plants. From each representative faba bean agro ecological zone, fields were randomly assessed for diseases at the interval of 5-10 km. Each sampling point was marked with the global positioning system (GPS) by GPS receiver for elevation and co-ordinates. The temperature at the survey time measured using portable thermo hygrometer which measures both humidity and temperature of the air. 'X' fashion sampling techniques (in which five spots were made in each faba bean field) was adopted and data collected from five spots were averaged to represent a site [9].

Disease prevalence was determined by counting the number of fields affected divided by the total number of fields assessed and expressed in percentage.

$$\text{Prevalence (\%)}=\frac{\text{Number of fileds affected}}{\text{Total number of fileds assessed}}$$

Disease incidence was measured as proportion of plants displaying symptoms in the field.

$$\text{Diseasses incidenece (\%)} = \frac{\text{Number of Diseased plants}}{\text{Total number of plants observed}}*100$$

Severity of each disease evaluated by visually observing on the whole plant. Disease severity on whole plant basis was rated using a visual scale suggested for each disease on faba bean crop and its scores were converted to percent disease/severity index PSI (PDI) [10, 11].

$$\text{PSI(\%)}=\frac{\text{Sum of numerical rating}}{\text{Total number of plant observed * maximum rating}}*100$$

Disease data (incidence and percent disease index) were analyzed using summary of descriptive statistics. Moreover, spatial disease distribution maps were shaped using Arc GIS 10.3 software with spatial analyst by interpolating the surface from GPS points and related diseases data using the inverse distance weight (IDW) interpolation method.

Diagnosis of faba bean diseases were made based on disease symptoms in the farmers' field which was carried out based on a practical guide to identification of bean pests [12] and microscopic examination in the laboratory using standard procedures recommended for both biotrophs and necrotrophs fungal plant pathogens using Ambo Agricultural Research Centre manual for identification of plant fungal pathogen of imperfect fungi.

RESULTS AND DISCUSSION

Intensity of Fungal Diseases of Faba Bean: In this investigation eight fungal diseases were identified from faba bean in different districts of major faba bean growing agro ecologies across the country based on the symptomology and laboratory examination (Figures 4-8 and Table 1). Among 191 farmers' fields observed, the overall mean prevalence of Ascochyta *(Ascochyta fabae* f.sp. *fabae),* Chocolate spot (*Botrytis fabae*), Rust (*Uromyces fabae*), Faba bean gall (*Physoderma* sp.) and Alternaria leaf spot (*Alternaria alternata*) were 72.2%, 70.7%, 48%, 45.6% and 34.6%, respectively.

Table 1: Over all mean prevalence, incidences and percent disease indexof fungal diseases across the major faba bean growing zones accessed during the 2017 and 2018 main seasons

Diseases	Number of zone	NIF	Altitude Range (m.a.s.l)	Temperature Range (°C)	Over all mean Prevalence (%)	Over all mean DI (%)	Over all mean PDI (%)
Chocolate spot (*Botrytis fabae* Sardina)	8	135	1701-3310	16.7-32.6	70.68	69.273	15.606
Ascochyta blight (*Ascochyta fabae* f.sp. *fabae*)	8	136	1701-3169	16.7-32.6	72.20	51.176	6.596
Faba bean Gall (*Olpidium viciae* Kusano)	8	87	2274-3310	16-29	45.55	61.069	19.954
Rust (*Uromyces viciae-fabae)*	8	92	2100-2900	21-27.5	48.17	56.119	11.076
Alternaria leaf spot (*Alternaria alternata*)	8	66	2323-2944	23-29.6	34.56	36.09	4.257
Root rot (*Fusarium solani* and *Rhizoctonia solani)*	8	45	2275-2490	25-32.5	23.56	9.956	3.333
Cercospora leaf spot *(Cercospora* sp.*)*	8	8	2188-3169	20-29.9	4.19	30	2.375
Powdery mildew *(Microsphaera* sp.*)*	8	1	1861	24.9	0.52	20	1

PDI, percent disease index; DI, diseases incidence; m.a.s.l, meter above sea level; NIF, number of infected field

Table 2: Mean incidence and percent disease index of important fungal diseases in major faba bean growing zones in the country during the 2017 and 2018 season

Zones	Districts/Woredas	CS	AB	FBG	Rust	Alternaria leaf spot	Root rot	Cercospora Leaf spot
Bale	Agarfa, Dinsho, Gasera, Goba and Sinana	61 (11)	38.13 (5.13)	0	60.5 (11.83)	53.5 (11.7)	17.86	0
East Arsi	Digelu Tijo, Hetosa, Limuna bilbilo, Tiyo	98.89 (33.56)	62.5 (16)	0	63.33 (7.66)	0	27.5	0
West Arsi	Adaba, Asasa and Kofale	86.25 (26.63)	52.5 (5.5)	0	85 (27.83)	0	0	0
South West Shewa	Ameya, Bacho, Dawo, Sedensodo and Waliso	65.67 (10.27)	51.15 (5)	0	57.73 (9.55)	28.11 (2.22)	18.75	0
East Shewa	Ada'a, Gimbichu	62.5 (11.75)	46.67 (4)	15(4)	51.14 (16.57)	19.6(2.6)	26	16.67 (2.67)
West Shewa	Ada'a Berga, Ambo woreda, Bako tibbe, Chelia, Chobi, Dendi, Dire inchini, Ilu Gelan, Jeldu, Jibat, Meta robi, Meda kegn, Nono, Toke kutaye and Welmera	76.98 (13.32)	56.86 (8.24)	52.32 (7.79)	62.75 (3.75)	44.77(3.09)	26.05	0
North Shewa (Oromia)	Abichu, Aleltu, Amertew, Chancho, Debre libanos, Degem, Girar jarso, Kembibit, Kuyu, Sheno, Sululta, W. gida, Wara jarso, Wucale	60 (18.81)	33.27 (3.54)	58.86 (24.18)	39.63 (14.68)	26.18(3.82)	22	0
North Shewa (Amhara)	Ambaber, Angollela tera, Ankober, Baso, Basona, Ensaro, Menjarna, Moretna, Siyadebrina Wayu and Termaber	57.76 (13.21)	59.46 (6.54)	72.93 (28.28)	42.78 (6.33)	25.38 (2.63)	36	38 (2.2)

Note: Figures in parenthesis indicate percent disease index; 0, no diseases symptom; FBG, Faba Bean Gall; AB, Ascochyta blight; CS, Chocolate spot

Table 3: Average incidence and percent disease index of important fungal diseases on different faba bean developmental stages in Ethiopia during the 2017 and 2018/19 main growing season

Stages	Number of fields	CS	AB	FBG	Rust	Alternaria leaf spot	Black Root rot	Cercospora Leaf spot
Vegetative	1	20 (3)	0	40 (15)	0	100 (15)	0	0
Flowering (flower development phase early flowering to 50% flowering)	47	60.21 (12.66)	40 (6.27)	58.48 (22.62)	53.05 (9.86)	43.2 (5.84)	22.67	30 (2)
Pod setting (from early pod setting to physiological maturity)	93	78.14 (16.45)	57.27 (7.35)	61.94 (16.71)	58.58 (12.41)	29.7 (2.6)	27.63	37.5 (2.25)
Early Maturity	13	47.78 (16.778)	42.5 (4.88)	69.38 (30.63)	39.29 (11)	34.33 (5)	25	10(3)
Maturity	23	67.38 (19.52)	52.19 (4.63)	50.71 (14.71)	71.2 (22.47)	26.25 (3.25)	17.5	40(2)

Note: Figures in parenthesis indicate percent disease index; 0, no diseases symptom; FBG, Faba Bean Gall; AB, Ascochyta blight; CS, Chocolate spot

An overall maximum mean disease incidence of 69.3% was recorded for Chocolate spot followed by Faba bean gall (FBG) (61.1%), Rust (56%) and Ascochyta blight (51.2%). The highest percent disease index of 19.9% and 15.6% were, respectively, recorded for FBG and Chocolate spot (Table 1).

Abebe [13] reported that the overall mean incidence for faba bean gall, Chocolate spot, Aschochyta blight, Alternaria leaf spot and black root rot were 66 percent, 45.5 percent, 45.9 percent, 28.9 percent and 5.7 percent, respectively which also indicated that the newly emerged, faba bean gall, is becoming important in the faba bean growing agro ecological districts.

On the other hand, disease incidence and percent disease index, PDI, calculated for each zone pointed out that Chocolate spot was severe in Arsi compared to other zones. Accordingly, the mean maximum incidence (98.89%) and PDI (33.56%) were recorded from various districts of Arsi. The symptoms reflected by *Botrytis fabae* on faba bean vary from minor necrosis to extensive destruction of tissue. As the name indicated the pathogen exhibited small chocolate like spots on the leaves, stems, flowers and pods. Leaves were observed as the main part of the plant affected but under favorable conditions for the disease it might be observed on the other parts of faba bean (Figure 7).

Similarly, observable signs for *Uromyces viciae-fabae* (Figure 8A&B), typical symptoms of *Ascochyta fabae* f.sp. *fabae* (Figure 8C) and *Cercospora* sp. (Figure 8D) on faba bean were noticed at the time of study and photographed.

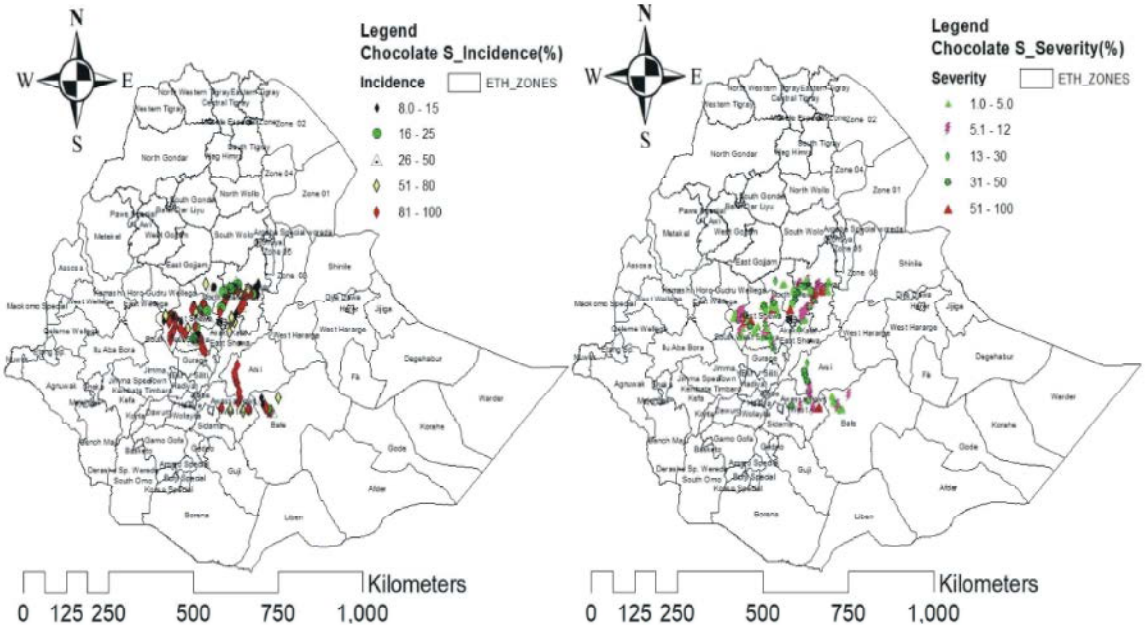

Fig. 1: Map of Ethiopia showing distribution, incidence and percent severity index of chocolate spot in major faba bean growing areas during the 2017 and 2018/19 main seasons

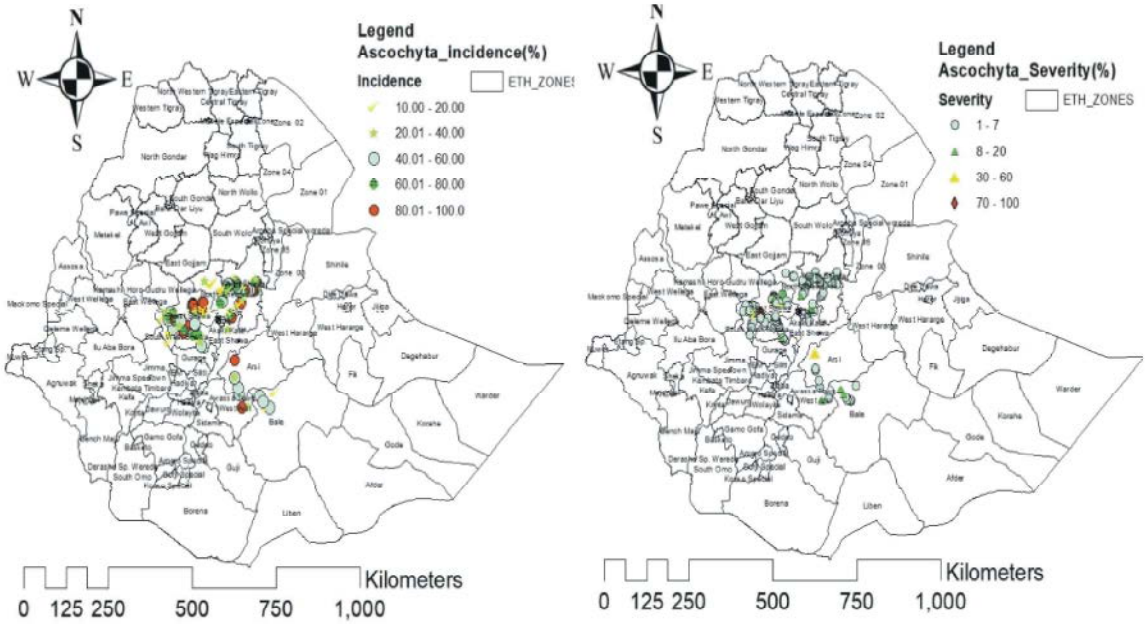

Fig. 2: The distribution, incidence and percent severity index of Ascochyta blight in 2017 and 2018/19 main growing seasons

Faba bean gall (FBG), which was the most recently emerged disease compared to others was observed in most faba bean growing zones (i.e. North Shewa of both Amhara and Oromia regions, East Shewa zone Ada'a and Gimbichu districts, West Shewa zone Medakegn and Ambo districts) in Ethiopia. But it was not yet distributed to zones such as Bale, South West Shewa, Arsi and West Arsi during the study period. The highest mean FBG intensity (i.e.72.9% incidence and 28.3% PDI) were calculated from different districts of North Shewa zone of the Amhara administrative region (Table 2).

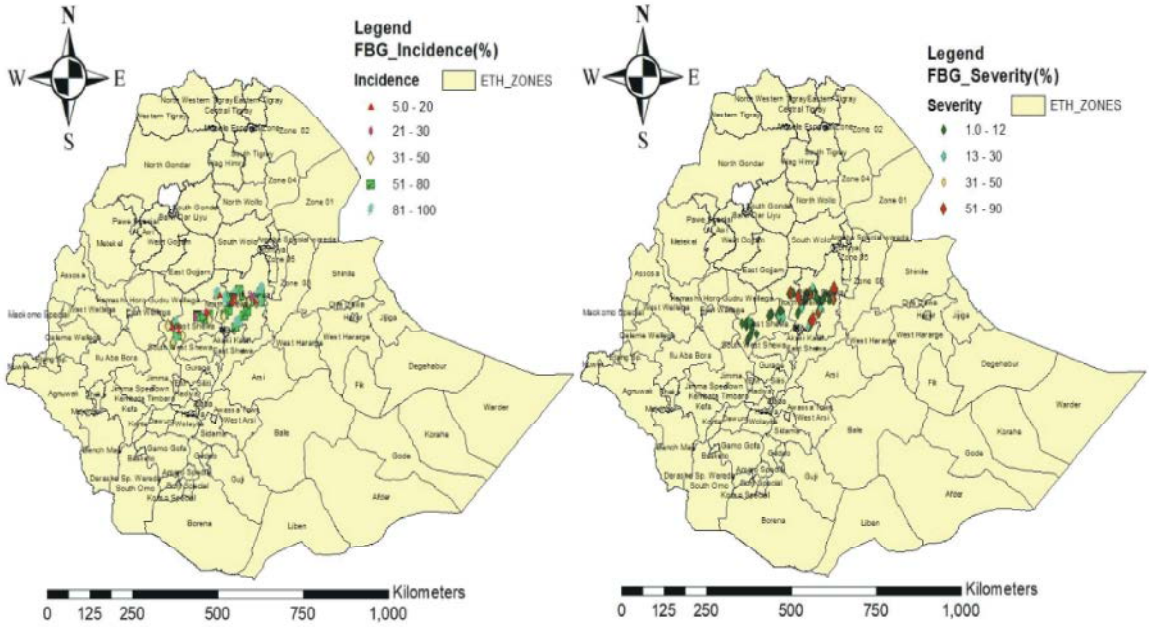

Fig. 3: Map of Ethiopia showing the distribution, incidence and percent severity index of FBG during 2017 and 2018/19 main seasons

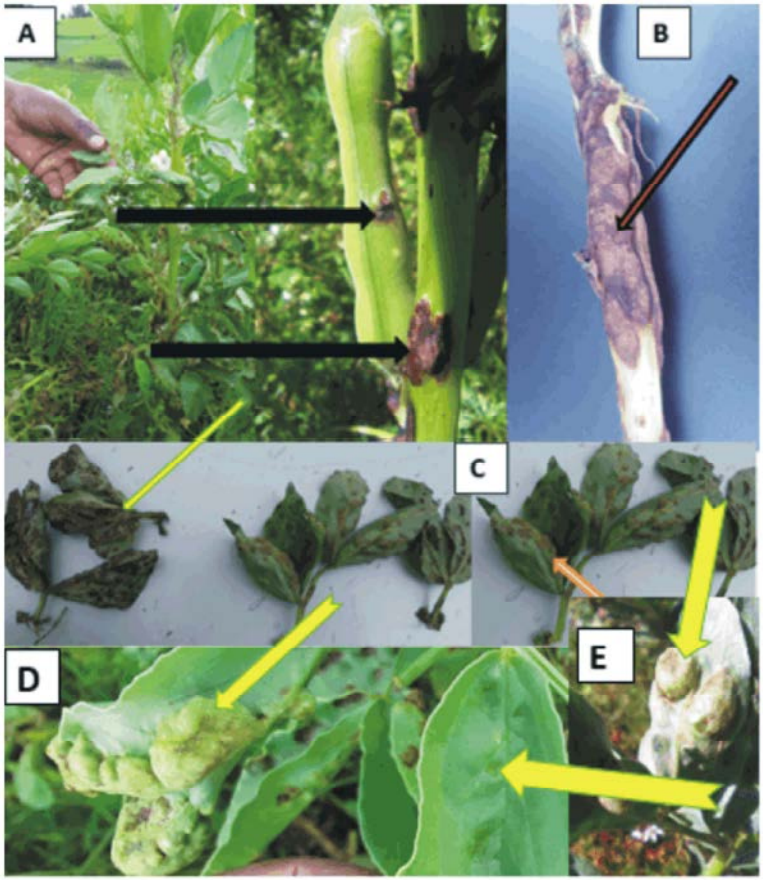

Fig. 4: Symptom of Faba bean gall (*Physoderma* sp. You) on faba bean pod and stem (A & B) and leaves (C, D & E)

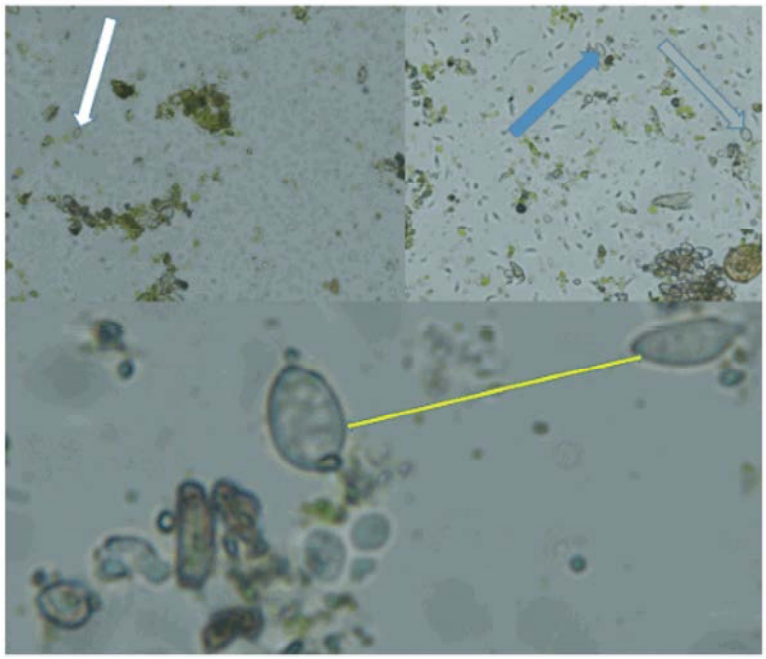

Fig. 5: Morphology of *Physoderma* under compound microscope: Zoospores

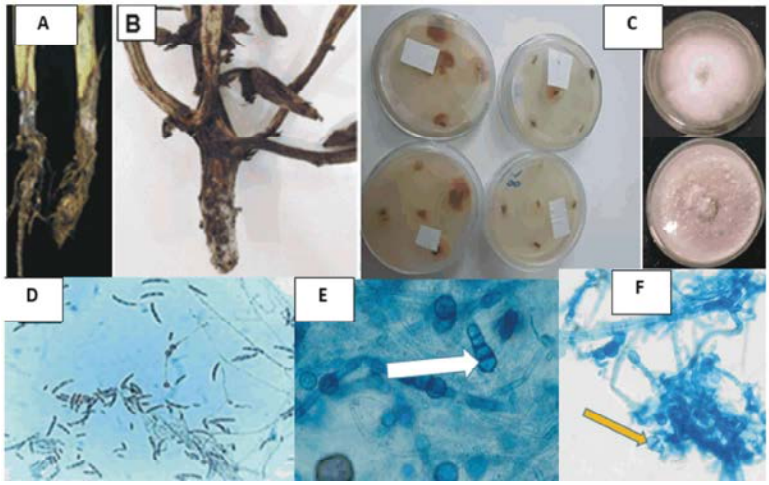

Fig. 6: Symptoms caused by *Fusarium solani* on faba bean, black root rot, (A and B) cultural haracteristic on Potato Dextrose Agar medium (C) and Macroconidia, Chlamydospores and microconidia of *F. solani* under compound microscopy (D, E and F)

Symptoms of faba bean gall was mainly appeared on the leaf, stem and pod (Figure 4A). The early appearance of symptoms was light green nearly round spots, the surfaces of the spots appeared rough with development, proliferated gradually to form intumescent and abnormal enlargement. The abnormal enlargement (strumae) was solitary or colonial, was able to fuse into irregular shape (Figure 4D). The severe infected plants were pygmyism and leaves were dysmorphosis. Strumae and slightly rough surface on both leaves and stem were considered as characterization symptom for the faba bean gall, which are the important basis for the diagnosis. This study identified the characterization symptoms for diagnosis of faba bean gall on leaves, stem and pod of faba bean crop which provided scientific basis to diagnose, prevent and control of this disease perfectly (Figure 4). Getaneh [14] reported that faba bean gall symptoms mainly observed on the leaves, stalk and sometimes also on petiole but not on pod. However, in this study the symptoms caused by *Physoderma* also detected from pods of faba bean.

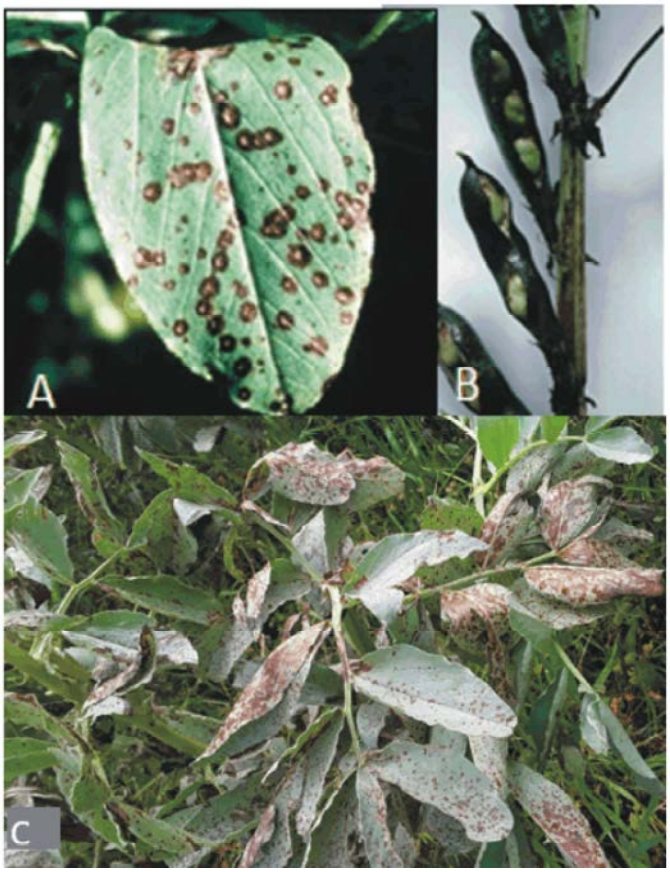

Fig. 7: Chocolate spot caused by *Botrytis fabae* symptom developed on leaves (A & C) and pods (B)

Fig. 8: Signs of Rust on faba bean (A&B) and symptoms of Ascochyta blight (C) and Cercospora leaf spot on faba bean (D)

With regard to the real causal agents of faba bean gall, numerous efforts have been done so far. *Olpidium viciae* [15], belonging to the Olpidiaceae, was accepted as the causal agent of FBG in Ethiopia [16, 17], the same pathogen first reported in Japan in 1912 on *Vicia unijugae* [15] and reported subsequently as the cause of "blister disease" of faba bean in China by Liang [18], Lang [19], Yan [20] and Yan and Ye [21]. In contrast, You [22] recently reported that *Physoderma* is the true causal agent of 'faba bean gall' diseases in Ethiopia. Of course

Ethiopian detection was based on symptoms similarity [23] and observation of resting spores within infected leaves' galls. Similarly in the current study it was also concentrated on quantitative observation of diseases symptoms on the field and identified the causal agents from galls of affected leaves, pods and stem of faba bean based on morphology of sporangia and zoospores using compound microscope, Olympus CX43, in laboratory (Figure 5). As a result the relative dissemination and importance of faba bean gall in different agro-ecological zones were mapped.

Some soil borne diseases including fusarium wilt caused by *Fusarium solani* observed and identified in this exploration. An overall mean wilt incidence of black root rot up to 36% was recorded in North Shewa of Amhara region followed by West Shewa Zone which was 26.05% (Table 2). The symptoms on the field caused black discoloration of the roots followed by death of the plant. Other symptoms include elongated reddish lesions on primary roots, longitudinal cracks on the outer root (Figure 6A) and destruction of the tap root black discoloration of the main root and lateral roots, beginning at or near the soil level. The disease developed slowly, infected plants showed chlorosis and dark black roots, which finally disintegrated. Faba bean plant infected with black root rot was easily pulled out and the black discoloration of the whole root was observed (Figure 6A and B). *F. solani* produced abundant, white cream mycelium on potato dextrose agar (PDA) medium (Figure 6C). Macroconidia had three to four septa on average, slightly curved, rather wide and thick walled and had slightly blunted apical end. Microconidia were abundant, oval to kidney shaped, formed in false heads on very long monophialides and Chlamydospores were also abundant (Figure 6D, E &F).

Nigussie [5] reported that several diseases have been affecting faba bean (*Vicia faba* L.), but only a few of them have either major or intermediate economic significance. These include chocolate spot, rust, black root rot and foot rot.

On the contrary, the present study revealed that numerous fungal diseases were becoming economically important or shifted from minor to major across faba bean growing areas in Ethiopia. For instance, the status of Ascochyta blight shifted to major disease of faba bean across surveyed locations in the country. Faba bean gall (*Physoderma* sp.) is being considered as an economic disease and caused total failure of faba bean in North Shewa zones of Amhara and Oromia regions (Figure 2 and Table 2).

Geographical Distribution of Faba Bean Fungal Diseases: Diseases incidence and severity map of major fungal diseases on faba bean throughout the seasons showed that the importance and variation of diseases intensity from location to location was based on environmental conditions for each disease and altitude range (Figures 1-3). In addition, the disease maps illustrate severity (percent severity index or percent disease index) and incidence levels over major faba bean growing zones and districts and were used to depict the status of recorded diseases during the study period. Hence, Chocolate spot percent incidence ranged from 8-100% while percent severity which is converted to percent severity index or PDI ranged from 5-100%. The Chocolate spot incidences of 81% and above were recorded in most districts surveyed. Thus, relatively a maximum disease incidence (81-100%) was recorded from most districts of Arsi, West Arsi, most distiricts in West and South West Shewa, most districts of North Shewa zones of Amhara and Oromia regions. In contrast, low incidences (8-15%) noticed in some areas studied across the country, such as in some districts of Bale and West shewa zones and North shewa zone of the Amhara region. Similarly, Chocolate spot percent severity index of 51-100% were recorded in Arsi (Digelu Tijo, Hetosa, Limuna bilbilo, Tiyo districts), West Arsi and some districts of North shewa zones in Oromia and Amhara regions followed by severity ranging from 31-50% (Figure 1) in most districts of Arsi and few districts in West arsi zones as well as some districts of West shewa and North Shewa zones in Amhara. The relatively low (1-5%) Chocolate spot incidences were recorded in most districts of Bale, West Shewa, most districts of North Shewa zones in Amhara and Oromia regional states (Figure 1).

Diseases incidence for Ascochyta blight (AB) varied from 10% to 100% whereas the severity fluctuated between 1 and 100%. Hence, areas such as Arsi and West Arsi (few districts), West Shewa (most districts) and most districts of North Shewa zones (Amhara and Oromia) scored high disease incidence ranging from 80.01 to 100% compared to others. On the other hand percent disease index ranged from 70-100% for few districts of West Shewa, 30-60% for few districts of Arsi and some districts of West Shewa zones. While, in the majority of studied areas, low PDI (1-12%) were recorded (Figure 2).

The results also showed that the minimum and maximum Faba Bean Gall (FBG) incidences recorded were 5% and 100% in faba bean gall infected areas such as most districts of North Shewa zones of Amhara and Oromia regions, East Shewa zone Ada'a and Gimbichu

districts, West Shewa zone Meda kegn and Ambo districts. Similarly percent disease index also ranged from 1% to 90% (Figure 2). Faba bean gall was not noticed in Bale during this study period. In line with the current study, different earlier investigation stated that faba bean production in Ethiopia was threatened by the most destructive disease, FBG, caused by *Physoderma* sp. You pathogen [22]; particularly in Amhara, Oromia and Tigray regions [7, 24, 25]. This pathogen was attributed to cause complete crop failure in Ethiopia [7, 25]. It was also considered as the most challenging disease of faba bean crop in Ethiopia [26].

The minimum altitude at which FBG noticed was 2274 meters above sea level whereas the extreme altitude was at 3310 m.a.s.l. The temperature at the survey time measured using portable thermo hygrometer ranged from 16 to 29°C (Table 1 and 2). It was also observed that the severity increased with the altitude in the faba bean agro ecological zones although restricted to specific locations. This might be due to the conducive environmental condition and inoculum source at those spots for infection and symptoms development of the faba bean gall. Thus altitude from 2274 to 3310 m.a.s.l and temperature from 16°C to 29°C estimated as favorable for faba bean gall infection and symptoms occurrence.

Diseases Incidence and Percent Diseases Index at Different Faba Bean Growth Stages: Disease incidence and PDI showed noticeable variation across different faba bean growth stages. The most vulnerable stage for epidemics of most fungal diseases was observed from flowering to early maturity. The observations from this study showed that the most fungal diseases on faba bean were sever starting from flowering stage with the exception of FBG, which can attack the crop at early vegetative stages as well depending on the favorable environmental condition and host susceptibility (Table 3). Accordingly, overall mean incidence for Chocolate spot, Rust and Ascochyta blight were high at flowering to maturity stage with incidences of up to 78.1%, 58.6% and 57.3% were recorded, respectively compared to other growth stages. More or less the same is true for other fungal diseases regarding disease developmental vis-à-vis crop growth stages. In addition, Ascochyta blight, Rust and Cercospora leaf spot were not observed at vegetative growth stage. On the other hand, disease onset and overall minimum mean incidence of 40% were recorded for FBG at the vegetative growth stage, although the highest incidence (69.4%) was recorded at the early maturity stage. Similarly, the maximum PDI (30.6%) was noted at early maturity growth stage for FBG (Table 3). Soil borne diseases such as *Rhizoctonia solani* on vegetative stage and Black root rot caused by *Fusarium solani* detected as important pathogen recorded in most developmental stages of faba bean.

CONCLUSION

The results stated geographical distribution, intensity, importance of fungal diseases of faba bean during the study period. The most prevalent diseases were Ascochyta blight, Chocolate spot, Rust, Faba bean gall and Alternaria leaf spot which scored 70.7%, 72.2%, 48%, 45.6% and 34.6, respectively. Chocolate spot incidence ranged from 8-100% while Percent disease index was also from 5-100%. Incidence for Ascochyta blight varied from 10 to 100% whereas the severity fluctuated between 1 and 100%. The minimum and maximum Faba bean gall incidences noted were, respectively, 5% and 100% in faba bean gall infected areas. Likewise, percent disease index of faba bean gall ranged from 1 to 90%.However, based on these results, at hot spot areas identified for major diseases in this study, screening of faba bean genotypes and initiation of alternative management options at hot spot areas and/or using artificial inoculation should be conducted at major faba bean growing agro ecological areas. Losses should be quantified for different infection regimes for economic diseases. A search for resistance genes should continue for at least economically important diseases.

Conflict of Interests: The authors have not declared any conflict of interests.

ACKNOWLEDGMENTS

The authors would like to thank Ethiopian Institute of Agricultural Research (EIAR) for the financial and logistical supports provided. Special thanks also goes to Dr. Berhanu Bekele for his critically reviewed the manuscript.

REFERENCES

1. FAO (Food and Agriculture Organization), 2019. FAOSTAT Statistical Database of the United Nation Food and Agriculture Organization (FAO) statistical division. Rome.

2. CSA (Central Statistical Agency) – Federal Democratic Republic of Ethiopia, 2020. Agricultural Sample Survey 2019/2020 (2012 E.C.): Report on Area and Production of Major Crops (private peasant holdings, Meher season).
3. Sahile, S., C. Fininsa, P.K. Sakhuja and A. Seid, 2008. Effect of mixed cropping and fungicides on Chocolate spot (Botrytis fabae) of Faba Bean (Vicia faba) in Ethiopia; Crop Protection, 27: 275-282. https://doi.org/10.1016/j.cropro.2007.06.003.
4. Musa, J., G. Dereje and K. Gemechu, 2008. Procedures of Faba bean improvement through Hybridization. Technical Manual. No. 21, Ethiopian Institute of Agricultural Research, pp: 48.
5. Nigussie, T., A. Seid, G. Dereje, B. Tesfaye, F. Chemeda, A. Adane, A. Melkamu, Abiy, A. Fekede and M. Kiros, 2008. Review of Research on Diseases Food Legumes. In: Abraham Tadesse (Eds). Increasing Crop production through improved plant protection, Plant Protection Society of Ethiopia (PPSE), 19-22 December 2006. Addis Ababa, Ethiopia, 1: 85-124.
6. Gorfu, D. and T. Beshir, 1994. Faba bean disease in Ethiopia. In: Asfaw Tesfaye, Geletu Bejiga, Mohan C. Saxena & Mahmoud B.solh (Eds.), Cool season food legumes of Ethiopia, pp: 328- 327. Proceeding of first National cool season food legumes Review conference. 16-20 December, 1993. Addis Ababa, Ethiopia.
7. Dereje, G.M. Wondafrash and K. Gemechu, 2012. Faba Bean Galls: a new disease of faba bean in Ethiopia. Available at Google. Doc. Com., pp: 1-6.
8. Wulita, W., 2015. Management of the newly emerged disease "qormid" on faba bean (*Vicia faba* L.) using varieties and fungicides in North Shoa, central Ethiopia. MSc. thesis, Haramaya University, Haramaya, Ethiopia.
9. Tamiru, G., 2017. The Study on Prevalence and Importance of Faba Bean Diseases in Sidama and Gedeo Highland Districts, South Eastern Ethiopia. Journal of Natural Sciences Research, 7(9): 27-30, DOI: 10.20448/813.11.24.29.
10. Wheeler, B.E.J., 1969. An Introduction to Plant Diseases. Wiley and Sons, London, pp: 347.
11. Kumar, G.S., B.C. Kamanna, V.I. Benagi and E.E. Unit, 2011. Management of Chrysanthemum Leaf Blight Caused by *Alternaria alternata* (Fr.) Keissler under Field Condition, 11(1): 553-555.
12. Schwartz, H.F., 1979. Bean production problems: disease insect, soiland climatic constraints of phoseolus vulgaris (No. C004. 031). Centro International de Agricultura Tropical (CIAT).
13.. Abebe, T., T. Birhane, Y. Nega and A. Workineh, 2014. Study on occurrence and importance of faba bean diseases with special consideration to the newly emerging "Faba Bean Gall" in Tigray, Ethiopia. African Journal of Agricultural Research, 9(50): 3627-3631.
14. Getaneh, G., E. Hailu, K. Sadessa, T. Alemu and G. Megersa, 2018. The Causal Pathogen, Inoculum Sources and Alternative Hosts Studies of the Newly Emerged Gall Forming Faba Bean (*Vicia fabae*) Disease in Ethiopia. Advances in Crop Science and Technology, 6: 368. doi: 10.4172/2329-8863.1000368.
15. Kusano, S., 1912. On the life history and cytology of a new species of Olpidium with special reference to the copulation of motile isogametes. Journal of the College of Agriculture, Imperial University, Tokyo, 4: 141-199.
16. Dereje, G., M. Wondafrash and K. Gemechu, 2012. Faba Bean Galls: a new disease of faba bean in Ethiopia. Available at Google. Doc. Com., pp: 1-6.
17. International Food Policy Research Institute (IFPRI), 2010. Pulses value chain potential in Ethiopia. Constraints and opportunities for enhancing exports. Washington, USA: IFPRI.
18. Liang, X.Y., 1986. Faba bean diseases in China (*Vicia faba*) FABIS Newsletter, Faba Bean Information Service, ICARDA No. 15, 49-51.
19. Lang, L.J., Z.H. Yu, M.S. Xu and H.Q. Ying, 1993. Faba Bean in China: State-of-the-art review. Aleppo, Syria. International Centre for Agricultural Research in the Dry Areas (ICARDA).
20. Yan, J., 2012. Study on Blister Disease of Broad Bean caused by Olpidium viciae Kusano. (Doctoral dissertation, PhD dissertation. Sichuan Agricultural University).
21. Yan, J. and H. Ye, 2012. Histopathology of broad bean blister caused by *Olpidium viciae*. Acta Phytopathologia Sinica, 42: 365-373.
22. You, M.P., B.B. Eshete, S.A. Kemal, J. Van Leur and M.J. Barbetti, 2021. Physoderma, not Olpidium, is the true cause of faba bean gall disease of *Vicia faba* in Ethiopia. Plant Pathology, 00: 1-15. https://doi.org/10.1111/ppa.13359.

23. Earecho, M.K., 2019. Extent and management strategies of faba bean gall disease (*Olpidium viciae* Kusano) in Ethiopia. A Review. EC Agriculture, 5: 13-24.
24. Teklay, A., B. Tsehaye, N. Yemane and W. Assefa, 2014. The prevalence and importance of faba bean diseases with special consideration to the newly emerging "Faba Bean Gall" in Tigray, Ethiopia. Discourse Journal of Agriculture and Food Sciences, 2: 33-38.
25. Hailu, E., G. Getaneh, T. Sefera, N. Tadesse, B. Bitew, A. Boydom, D. Kassa and T. Temesgen, 2014. Faba bean gall; a new threat for faba bean (*Vicia faba*) production in Ethiopia. Advances in Crop Science and Technology. http://dx.doi.org/10.4172/2329-8863.1000144.
26. Ampadu-Boakye, T., M. Stadler and F. Kanampiu, 2017. N2 Africa Annual Report 2016 (No. 97). N2Africa.