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Assessment and Distribution of Major Hot Pepper (*Capsicum Annuum L.*) Pests in West Hararghe Zone, Eastern Ethiopia

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Abstract

The hot pepper (*Capsicum annuum L.*) is a vital agricultural product that increases export earnings and is a major cash crop for Ethiopians, especially smallholder farmers in the West Hararghe zone. However, the crop's yield was less than the country's overall yield. This low production is due to the major pest, which has limited the hot peppers' ability to grow and yield in the area. The main objective of the study was to assess the major pests of hot peppers and the associated factors that affect hot pepper production in the study area. The study was conducted in Daro Labu and Boke districts, 2019–2020). All pertinent quantitative and qualitative data was collected to count and categorize the different weed species. The study results revealed that 40 different weed species from 16 families were discovered in the farm fields. Asteraceae and Poaceae, the two most common groups and counted at 27.5 and 25%, respectively. The two weed species, Verbesina encelioides and Parthenium hystrophorus, were the most common predominated weeds in the fields. In both districts, the most significant diseases were observed, including Fusarium wilt, Cercospora leaf spot, powdery mildew, and anthracnose. Of these, Fusarium wilt had the highest prevalence, incidence, and severity, which was the most common disease there. For insect invasion, fruit borer was observed on all farms in the study area. In light of the low adoption rate of improved cultural practices by farmers, the study signifies the necessity of increased training and awareness, further advocating for a comprehensive, integrated approach to pest management in the region.

Keywords: Disease; Incidence; Infestation; Pest; Severity; Weed infestation

Introduction

Hot pepper *(Capsicum annuum L.)* is the most significant vegetable crop in the Solanaceae family. It was first cultivated in the American tropics and is now grown all over the world for fresh, dried, and processed products.

Pepper is becoming increasingly significant right now. In Ethiopia, research on vegetables has been prioritized due to their great importance as spices and industrial raw materials for the production of oleoresin products [1]. Moreover, Red peppers currently hold the majority, or around 69.12%, of the acreage used for vegetable crops, with a total production of roughly 2,959,805.08 quintals, the area of hot pepper production for green pods was approximately 168,345.57 hectares [2].

According to estimates, the state farm's dry pod output is about 3 q/ha, compared to roughly 4 q/ha in small-holder farmer fields. According to FAO's 2019 report, the average global production of dried pepper is 3.8 t/ha and 32.3 t/ha, respectively. Ethiopia produces far less hot peppers than the rest of the globe on average (1.58 t/ha for dry peppers and 5.34 t/ha for green peppers, respectively).

Pepper's history in Ethiopia is arguably the oldest of any vegetable commodity, according to the EEPA [3]. Dark red pepper, which is prize in Ethiopia primarily for its great pungency, has a significant cultural connection. An essential flavoring is a finely powdered, pungent substance. The green pod is consumed as a vegetable when combined with other foods, while the finely powdered, pungent result is an essential flavoring and coloring element in the popular traditional sauce "stew or wot." Ethiopians have a widespread notion that someone who consumes hot pepper frequently is resistant to a number of ailments. The majority of Ethiopians eat it every day. Adults in Ethiopia consume an estimated 15g of red pepper daily, more than they do of tomatoes and the majority of other vegetables [4].

Most small-holder farmers in the West Hararghe zone grow vegetables for food and as a spice called hot pepper. In the zone, Oda Bultum, Boke, Daro Lebu, and Hawi Gudina districts are currently the most promising hot pepper producers and market hubs in the West Hararghe Zone. In addition, the productivity of the area is low (1.29 t/ha) as compared to the global average production of 32.3 t/ha green pepper and 3.8 t/ha dried pepper. According to this study, this difference in yield is caused by a lack of crop management methods, such as a water application system that could promote the spread of disease, a lack of improved varieties, crop rotation, and a harvesting system [5,6,7]. This may lead to farmers sometimes being forced to abandon their production due to excessive infection pressure in the field. Pest-related crop production losses are typically estimated to be around 35% in key crops and may even surpass 50% in some areas with few pest control alternatives [8]. However, the growing areas have great potential in terms of the physical environment and market opportunities, the production and productivity of pepper is becoming decreasing.

However, due to the importance of hot peppers in Ethiopia, total crop failure due to diseases has been common, and sometimes farmers are forced to abandon their production due to high pest infestations in the field. Among the fungal diseases, Fusarium wilt, damping off, anthracnose or fruit rot, powdery mildew, and leaf spots are the most

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prevalent ones. Fusarium wilt is caused by Fusarium spp. Anthracnose disease caused by Colletotrichum species, bacterial wilt caused by Pseudomonas solanacearum, and mosaic disease caused by chilli veinal mottle virus (CVMV) or cucumber mosaic virus (CMV) are the foremost genuine dangerous destructive diseases of chilli [9]. Among the diseases, Fusarium is the most challenging disease in the hot pepper production area as a whole in Ethiopia [10,11]. Fusarium wilt and root rot (Fusarium solani) had the highest overall mean percent severity index (69.5%), followed by damping off (56.7%) and Fusarium wilt (55.4%). It is essential to have knowledge of the pests (diseases, insect pests, and weeds) that affect the health of these crops as output rises to satisfy these demands. Among the main ailments found in hot pepper pests are anthracnose, Fusarium wilt, and root rot (Fusarium solani). It is one of the diseases that affect Ethiopia's potential to produce hot peppers is the hot pepper leaf spot. The findings from several studies carried out in various parts of Ethiopia, six diseases of hot peppers, including Cercospra leaf spot, were evaluated in the West Shoa and East Wollega zones. Moreover, it has been identified to induce bacterial leaf spots on hot peppers in southern Ethiopia. The leaf spot (Cercospora capsici), which affects the production of hot peppers, was discovered in Horo Guduru, Wollega, Oromia, Ethiopia [12,13].

The geographic distribution and spread of hot pepper wilt complex illness in Ethiopia can also be influenced by agro-ecological factors such as temperature, rainfall, and soil type. The study found agro-ecological elements that affect the disease's geographic distribution and spread of epidemics.

Although the majority of farmers show little concern for the harm that weeds do to their crops, survey findings show that weeds account for up to 45% of all annual losses of agricultural products. Weeds are currently playing a big part in this area's pest problems, which are becoming increasingly complicated. Weeds can be helpful by sheltering pollinators and natural enemies of insects, but the negative effects of weeds hosting crop pests far outweigh any potential advantages. According to [14], to, several diseases and insect pests can use weed species prevalent in and around vegetable crops as host plants, which can then infest surrounding crops.

Knowing the main production bottlenecks for peppers on a national scale and being familiar with them allows pepper growers to look for alternate, successful management strategies, at least for the economically significant pest across different regions. For smallholder farmers who lack enough knowledge and information about the principal diseases that cause devastation to their hot pepper crop and the management strategies to lower the amount of yield loss, the economic damages caused by insect, weed, and fungal diseases are significant and are getting worse. On the other hand, there is little data available that shows the amount and geographic distribution of each significant exotic weed and soil-borne fungal disease of pepper across the nation. Additionally, an understanding of the pest's significance and yield loss across major pepper-growing areas is required in order to create workable management strategies for quick action to keep up production. To build a sound management strategy, the relative relevance of pests across areas has not been evaluated and well profiled for the area. Thus, the objectives of the study were to assess the occurrence and distribution of diseases and weed species on farms growing hot pepper crops in the West Hararghe Zone.

Materials and Methods

Description of the study area

During the 2019-2020 growing season, the study was carried out in the West Hararghe Zone, in two main hot pepper producing districts, Daro Lebu and Boke. The two districts had midland agro-ecology. It lies at an altitude of 1610-1770 m.a.s.l. There are some differences between the research regions in terms of yearly mean temperature, rainfall, soil properties, cropping patterns, weed management techniques, etc. Despite the aforementioned criteria, various hot pepper pests, diseases, insects, and weed species regularly appeared on all farms growing the chosen crops in the studied area. About 90% of the workforce in the study area is employed in the agricultural sector. These regions are the most exposed to and environmentally affected by erratic rainfall. The Zone of Agricultural Department states that farmers mostly use rainfed agriculture for the production of cash crops such as chat and cereal crops, maize, sorghum, and finger millet, as well as hot pepper, mangoes, and potatoes for horticulture crops (Figure 1).

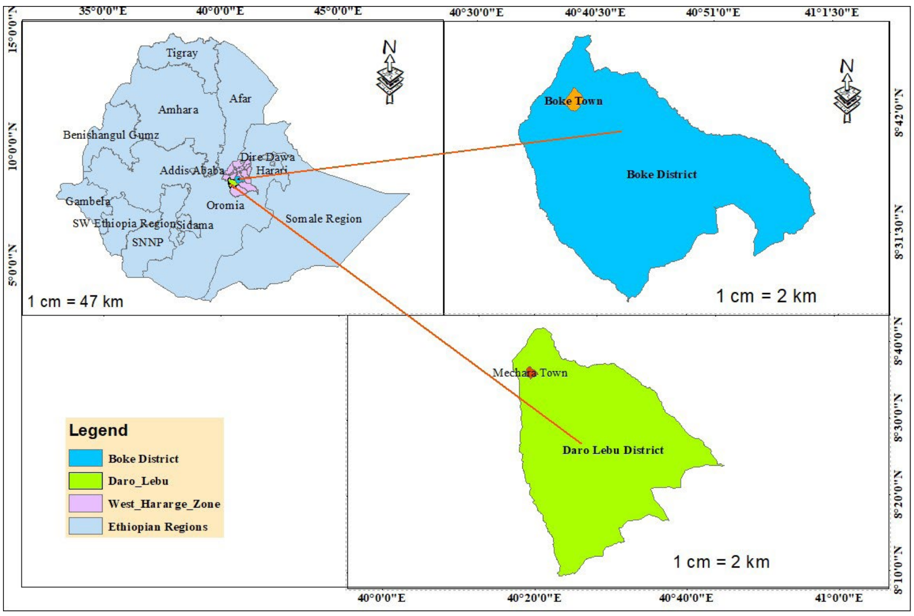

Figure 1: Map of the study area.

Sampling techniques and data collection: Two districts that produce hot pepper crops, Daro Lebu, and Boke, were specifically chosen for the zone. Based on a purposive sample, four representative kebeles were selected from each district. Then, a total of 64 farmer's fields were selected from the two districts, scrutinized and surveyed. First, both primary and secondary sources of data were employed to gather qualitative and quantitative information. The sample was timed to occur while most weed species, diseases, and insects were in their active seasons at the seedling to fruit-setting stages of the crop.

During the assessments, multidisciplinary professionals participated, and small-scale farmers were interviewed for major hot pepper production constraints, cropping history, cropping system, the methods that they used to control different diseases, climate conditions, temperature (^{o}C), major vegetation cover, seed sources, and agronomic practices.

Sampling procedures and analysis for the weed survey

Weed sampling was done randomly within the trisected diagonal in the form of an "X" pattern. Thereby, we systematically walked in each sample field, and data was counted within 1m2 quadrants. A total of five acres were taken per field. A total of 64 weed samples were taken from the surveyed districts.

Field notes were documented by the morphological character of the weed, and unknown weed specimens were identified with the help of the flora of Ethiopia [15]. Field questionnaires were taken from farmers. Farm owners (farmers) were interviewed with semi-structured questionnaires.

The data on weed species were summarized using descriptive statistics. The determinations were illustrated using the following formulae (1-8) that were described by [16].

Frequency: F = X/N x 100

Where F = frequency of a particular weed species, X = number of samples in which a particular weed species occurs, and N = total number of samples.

Abundance: A = ΣW/N

Wherea = A = abundance, Σw = sum of individuals of a particular weed species across all samples, N = total number of samples.

Dominance: D A/ ΣAx100

Where, D = dominance of a particular species, A = abundance of the same species, Σw = total abundance of all weed species.

Density = D=X/A

Where D is the density of a particular weed species, X is the number of individual target weed species, A=surface area of the sampling unit.

Relative density =X/N*100

Data collection procedures and analysis for disease

The timing of the survey was chosen to coincide with the time when the disease has reached the maximum growth stage of the plant (early growth, flowering/fruiting stage). Disease incidence, percentage and severity were scored (1-5) for each disease symptom. In the case of disease assessment, 2m2 quadrant were selected randomly and diagnosed visually for incidence and severity. The diseased samples were collected by visual observation was done with the use of a field books. The assessment was done at one

Disease prevalence: it was calculated using the number of fields that occupied by a particular disease divided by the total number of fields assessed and expressed in percentage

$$\text{Disease prevalence (DP \%)} = \frac{\text{Number of fields occupied particulant disease}}{\text{Total number of fields assesed}} x100$$

Disease incidence (DI) was calculated as the proportion of infected plants per plot and expressed as a percentage.

$$\text{Disease Incidence (DI \%)} = \frac{\text{Number of infected plants per row}}{\text{Total number of plants per variety}} x100$$

The incidence was calculated and grading was done on the basis of wilt incidence (%) as follows: highly resistant (HR) = 0% wilting; resistant (R) = 1-10% wilting; moderately resistant (MR) = 11-20% wilting; moderately susceptible (MS) = 21-30% wilting; susceptible (S) = 31-50% wilting; highly susceptible > 50 % wilting.

The disease severity was rated based on a 1-5 point scale as per the AVRDC pepper disease compendium (Black et al., 1991). Such as 0 = no visible infection, vigorous and healthy = R; 1 = slight leaf yellowing = MR; 2 = old lower leaf yellowing and plant wilting = MS; 3 = lower leaf shading and stunted plants = S; 4 = all leaves shedding and stem collapsed and few plants dying = HS; 5 = total plant death.

$$\text{Disease severity (DS \%)} = \frac{\text{Sum of all disease rating}}{\text{Total no. of rating x maximum disease grade}}$$

Results and Discussion

Response of farmers to cultural practice for hot pepper crop production

According to the survey's assessed data, 50-54% of the farmers in the study districts utilized their own seed. However, 3 to 6% of the farmers bought enhanced seed from governmental and non-governmental groups, and 40 to 47% of the farmers bought their seeds from local marketplaces (Table 1).

Majority of seed sources (54% and 50%) came from their own sources in Daro Lebu and Boke districts, respectively, while 40% and 47% of the seed sources, respectively, came from local markets in both districts of Daro Lebu and Boke, the majority of the seed sources, 54% and 50%, came from their own sources. These two seed sources, the nearby market and conventionally harvested seeds, are erratic, more vulnerable to seed-borne pathogen attacks, and contribute to the spread of disease throughout the field. Farmers in some Ethiopian

Table 1: Response of farmers on cultural practices for hot pepper production in the studied area.

Districts	Source of Seed %			Cultivars %		Farming system%		Rotation %		Plant density%		
	Govt and NGO	Local Mrkt	Own Source	Improved variety	Local variety	Sole cropping	Inter Cropping	Yes	No	high	Rec	low
D/Lebu	6	40	54	16	84	91	9	91	9	82	13	5
Boke	3	47	50	13	87	95	5	95	5	81	11	8

DL=Daro Lebu; BK=Boke; Rs=research; Imp=improved seed; Own=Own seed; Local Mrk=local market; Sole=sole cropping; InCr=inter cropping; Rec = recommended rate regions that grow hot peppers have used their traditional knowledge to choose plants that meet their particular requirements and save the seeds for the following growing season. Furthermore, according to said that while cultural control methods in the field are important parts of disease control, the seed is where it all begins. Whereas the districts of Daro Lebu and Boke had the lowest reported percentages of seed sources, at 6% and 3%, respectively. This could have to do with the various players involved in this district's seed sector development programs. This is consistent with the research by, who found that the majority of farmers also recycle seeds of particular types by storing them and trading them with other farmers on a seasonal basis.

Similarly, farmers local seed was used in the majority of farming systems in the region, accounting for 84 and 87% of hot pepper fields in the districts of Daro Lebu, and Boke, respectively. On the other hand, enhanced seed covered 16% and 13% of hot pepper crops in the districts of Daro Lebu and Boke, respectively. However, in certain regions of the nation, particularly those well-known for producing peppers, the long-standing knowledge of farmers in choosing and preserving pepper seeds from plants that naturally cross-pollinated segregants appears to contribute significantly to an increase in pepper yield. In both districts, solitary cropping was the cropping system that was used. However, Boke district had the greatest sole cropping percentage at 95%, followed by Daro Lebu district with 91%. Following the production of hot peppers in both districts, all farmers who were questioned used rotation. But from farmer to farmer, the number of years and the kind of crop rotated differed. Farm produce was used by 91 to 95 percent of the farmers in the hot pepper field. Using the suggested cultural methods, such as optimum fertilizer rates, row planting, proper spacing, crop rotation, and the use of clean seeds from improved varieties, will help manage the majority of the disease seen on. Moreover, recommendations for cultural methods such as crop rotation, row planting, proper spacing, optimum fertilizer rates, and the use of clean seed from improved varieties can effectively prevent the majority of illnesses seen on hot pepper farms.

By employing advised cultural methods such as crop rotation, row planting, proper spacing, optimum fertilizer rates, and the use of clean seed from improved varieties, the majority of diseases found on hot pepper farms can be prevented. For crop establishment in both districts, the highest seed rate was applied in the same way. According to (Table 1), the districts of Daro Lebu and Boke had high plant densities of 82% and 81%, respectively. Peak disease may thrive in an environment that is more favorable due to high plant density. A significant population density was present in the farmers' uneven broad casting approach, despite the recommended inter- and intra-raw spacing for pepper being 30 cm and 70 cm, respectively, in addition to the spacing between hot pepper plants. It seems that local farmers are still unaware of the benefits of spacing crops to reduce the spread of disease.

The hot pepper weeds species' frequency, abundance, dominance, and density

Weed species composition and taxonomy characteristics in assessed areas

During the 2019-2020 cropping seasons, a total of 40 weed species from 16 families were identified throughout the cropped area in two districts (Daro labu and Boke). In the field under study, the various cropping systems have diverse weed populations and types, where the Poaceae family had the largest number of weed species (11) and composition (27.5%), with the Asteraceae family following closely after with ten weed species and a weed percentage of 25%. However, the families Primulaceae, Oxalidaceae, Rubiaceae, and Cyperaceae had the fewest documented weed species (1) and composition (2.5%). This author's outcome was comparable to this one (Figure 2).

Thirty different weed species were found in the assessed hot pepper field. The majority of the weed species that were evaluated belonged to the groups Asteraceae, Poaceae, Amaranthaceae, and Solonaceae. According to, these families Asteraceae, Poaceae, Amaranthaceae, and Solonaceae were also the most significant in Eastern Ethiopian small-scale farming.

In the Daro Lebu district, there was variation in the frequency of each type of weed (14.67% to 93.33%) and the degree of infestation (dominance) (1.39% to 5.36%). Similarly, the highest weed species frequency value (93.33%) belonged to Verbesina encelioides, followed by Parthenium hystrophorus (88.33%), and the lowest weed frequency (11.67%) to Argrmone Mexicana. This result was verified by, reporting.

The Boke district has a range of 1.67 to 81.67% for each specific species of weed and a range of 0.09 to 4.43% for the amount of prevalent infestation. Parthenium hystrophorus, which was identified in Boke and Daro Lebu, respectively, had the greatest weed density (2.08 and 1.87) of all the species that were found. In the area under study, Parthenium hystrophorus was likewise considered a field weed. According to the survey results, this particular weed is currently more common in the research region. Moreover, the farmers who were interviewed mentioned that there were benefits to this weed (Table 2).

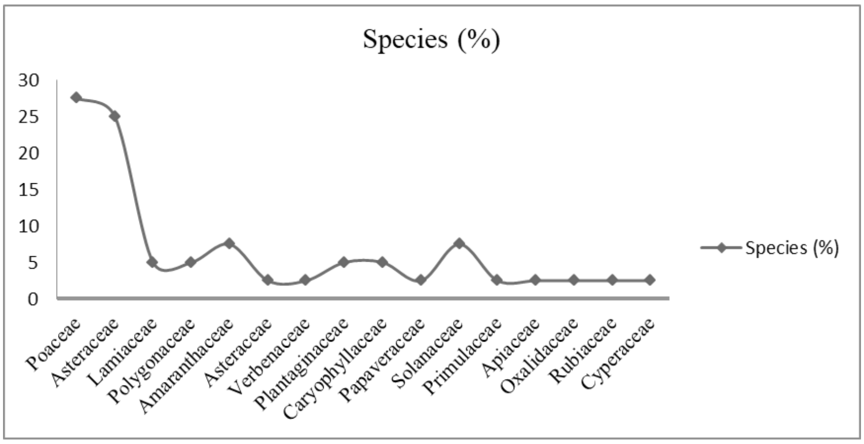

Figure 2: Weed species composition and taxonomy characteristics in assessed areas.

Table 2: Weed dominance, frequency, abundance, density, and relative density in hot pepper fields of major growing areas in the West Hararghe Zone in the 2019-2020 cropping season.

Weed spp	Family	Daro Lebu district					Boke district				
		F %	A	DS	D	RD	F %	A	DS	D	RD
Cynodon dactylon	*Poaceae*	70	1.67	1.17	3.25	4.32	36.67	3.05	1.12	2.7	4.94
Bidens plosa	*Asteraceae*	35	2.33	0.82	4.54	3.03	65	2.05	1.33	1.82	5.9
Elymusrepens	*Poaceae*	33.33	1.95	0.65	3.8	2.41	6.67	3.5	0.23	3.1	1.03
Galinsoga parviflora	*Asteraceae*	41.67	2.36	0.98	4.6	3.64	8.33	3.8	0.32	3.37	1.4
Leucas martinicensis Jacq. S. Moore	*Lamiaceae*	33.33	2.45	0.82	4.77	3.03	16.67	2.2	0.37	1.95	1.62
Rumex abyssinicus	*Polygonaceae*	48.33	1.69	0.82	3.29	3.03	23.33	1.5	0.35	1.33	1.55
Amaranthus spinus	*Amaranthaceae*	66.67	1.75	1.17	3.41	4.32	78.33	1.68	1.32	1.49	5.82
Verbesina encelioides	*Asteraceae*	93.33	2.96	1.83	3.83	6.79	81.67	2.14	1.75	1.9	7.74
Lantana trifolia	*Verbenaceae*	16.67	2.1	0.35	4.09	1.3	6.67	3.5	0.23	3.1	1.03
Plantago lanceolata	*Plantaginaceae*	66.67	2.03	1.35	3.94	5	51.67	2.23	1.15	1.97	5.08
Chinopodium ambrosioides	*Amaranthaceae*	65	1.77	1.15	3.45	4.26	18.33	2.64	0.48	2.34	2.14
Setaria viridis	*Poaceae*	55	1.82	1	3.54	3.71	20	4.17	0.83	3.69	3.68
Stellaria media	*Caryophyllacea*	65	1.97	1.28	3.85	4.76	23.33	4.29	1	3.8	4.42
Argemone mexicana	*Papaveraceae*	11.67	1.29	0.15	2.5	0.56	3.33	1.5	0.05	1.33	0.22
Datura stramonum	*Solanaceae*	6.67	2.75	0.18	5.36	0.68	65	1.49	0.97	1.32	4.27
Xanthium strumarium	*Asteraceae*	78.33	1.68	1.32	3.27	4.88	48.33	3.07	1.48	2.72	6.56
Cynodon dactylon	*Poaceae*	70	1.67	1.17	3.25	4.32	36.67	3.05	1.12	2.7	4.94
Bidens plosa	*Asteraceae*	35	2.33	0.82	4.54	3.03	65	2.05	1.33	1.82	5.9
Elymus repens	*Poaceae*	33.33	1.95	0.65	3.8	2.41	6.67	3.5	0.23	3.1	1.03
Galinsoga parviflora	*Asteraceae*	41.67	2.36	0.98	4.6	3.64	8.33	3.8	0.32	3.37	1.4
Guizotia scabra(vis)	*Asteraceae*	71.67	1.86	1.33	3.62	4.94	46.67	0.36	0.17	0.32	0.74
Biden pachyloma	*Asteraceae*	80.00	1.83	1.47	3.57	5.44	78.33	1.49	1.17	1.32	5.16
Pennisetum clasdentinum Hochst	*Poaceae*	15.00	1.67	0.25	3.25	0.93	5.00	0.50	0.25	4.43	1.11
Rottboellia chochinchinensis	*Poaceae*	55.00	2.03	1.12	3.95	4.14	35.00	4.67	1.63	4.14	7.22
Solanum nigrum L.	*Solanaceae*	13.33	1.88	0.25	3.65	0.93	6.67	1.75	0.12	1.55	0.52
Eleusin eindica (L) Gaertn	*Poaceae*	33.33	2.00	0.67	3.90	2.47	65.00	2.28	1.48	2.02	6.56
Lolium temulentum	*Poaceae*	0.00	0.00	0.00	0.00	0.00	1.67	3.00	0.05	2.66	0.22
Phalaris paradoxa	*Poaceae*	41.67	1.96	0.82	3.82	3.03	51.67	0.10	0.05	0.09	0.22
Daucus carota	*Apiaceae*	11.67	0.71	0.08	1.39	0.31	1.67	0.00	0.00	0.00	0.00
Lapsana communis	*Asteraceae*	81.67	1.84	1.50	3.58	5.56	65.00	2.44	1.58	2.16	7.00

F= frequency, Ab = abundance, DS= density, Dm = dominance, RD= relative density

Table 3: Incidence and severity of major hot pepper diseases across both locations.

Name disease	Daro Lebu district			Boke district		
	% Disease prevalence	% Disease incidence	Disease Severity(%5)	% Disease prevalence	%Disease incidence (%)	Disease Severity(%)
Anthracnose	80.61	21.67	8.99	78.53	25.00	10.34
Powdery mildew	56.21	11.67	1.67	66.51	15.00	11.1
Fusarium Wilt	89.13	45.00	33.43	89.86	51.00	38.80
C.Leaf spot	23.14	8.33	2.11	33.21	13.33	1.12
Rhizoctonia solani	16.78	13.33	1.67	16.35	9	6.6

Distribution, incidence, and severity of hot pepper diseases in the surveyed areas

In all studied areas, five diseases of hot pepper, Fusarium wilt (Fusarium oxysporum), Cercospra leaf spot (Cercospora capsici), powdery mildew, and Anthracnose (Colletotrichum gloeosporioides) were observed in the farm field. A root disease caused by Fusarium oxysporum was found to have a high level of distribution and infection rate.

According to the mean score values for both districts, the highest disease prevalence (89%) was found in Fusarium spp. in Daro Lebu district and the highest disease prevalence (80.61%) in Boke district. In Daro Lebu and Boke districts, Rhizoctonia solani was found to have a minimum mean disease prevalence of 16.78% and 16.35%, respectively. Out of 60 sampled red pepper fields in 2019 and 2020, fusarium wilt (Fusarium oxysporum) was the most frequent disease discovered in 54 farmer farms. In Daro Lebu and Boke, respectively, Fusarium wilt was found to have the highest disease incidence rates at the same period (45 and 51%). It can be the most significant illness in the region. Although Rhizoctonia solani and C. leaf spot had the lowest mean disease incidence values across all districts (Table 3), there may be a correlation between the two diseases' similar incidence rates due to the pathogens' propensity to proliferate when monocropping from the same seed source and poor field management techniques. A comparable finding was made by, who discovered that the West Gojjam zone in the Amhara Region is the primary location for a certain disease.

Similarly, Fusarium wilt had the greatest disease severity score values in the districts of Daro Lebu and Boke, with 33.43 and 38.80%, respectively. Although the Boke district showed the lowest mean (1.12%) severity of C. leaf spots, continuous cropping growing crops in the same field for multiple years could be a contributing factor. In this sense, when hot pepper production rises at a particular location, so will the collection of inoculum sources. According to, Fusarium oxysporum can infect hot peppers during the seedling, vegetative, blooming, and harvest growth stages, which is consistent with the findings of the current studies. Additionally, another researcher observed that isolates of F. oxsporium were found in nearly all plants exhibiting characteristic signs of fusarium wilt.

Fusarium wilt disease, which is caused by Fusarium species, is another highly economically significant disease that can reduce marketable yields from 10% to 80% of Ethiopia's crop production [17]. The most significant disease identified were also the vascular wilt of pepper, which was brought on by numerous Fusarium species, particularly Fusarium solani and Fusarium oxysporum. Additionally, this study's findings were consistent with those of which showed that the districts in the West Shoa and East Wellega Zones had the highest rates of fusarium wilt, with Bako Tibe having the highest rate at 54.8 percent and Ilu Gelan having the second-highest rate at 47%.

Conclusion and Recommendation

The relative economic importance of major disease and weed species varied among their surveyed districts. The purpose of this field survey was to assess the status of the most important crops, including hot pepper disease and weed species.

The most aggressive and difficult-to-control weeds in the survey have been identified in different areas. As a result, Verbesina encelioides, Parthenium hystrophorus, and Bidens plosa were the most dominant and frequently occurring weeds of hot pepper. At the same time, Guizotia scabra (vis), Biden pachyloma, and Parthenium hystrophorus were important in the surveyed area.

In relation to disease assessment, five diseases were identified for each crop. Among all diseases, two major fungal diseases, Fusarium wilt (oxysporum) and anthracnose, were the most frequently encountered in hot pepper producing areas. In addition, pod borer was an important insect pest for hot peppers in the study area. Management strategies that include the use of clean seeds, crop rotation, and pacing are suggested for controlling these hot pepper diseases. Furthermore, a critical highlight of the investigation was the low adoption rate of such recommended practices by local farmers, emphasizing the urgent need for comprehensive initiatives to increase their application for improved productivity. Furthermore, the paper identified the need for an integrative approach in developing solutions for managing these hot pepper diseases, necessitating the simultaneous implementation of multiple Preventive measures. These measures could include the development of resistant hot pepper varieties, better agronomic procedures, and increased education for both farmers and agricultural experts on effective integrated weed management strategies. In general, the research underscores the necessity for comprehensive and integrated strategies to bolster hot pepper production in the West Hararghe Zone of Eastern Ethiopia, address pest prevalence, and promote the use of improved cultural practices for disease management.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon reasonable request.

Conflict of Interest

The authors declare that they have no conlicts of interest.

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