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Assessment of economic insect pests of major crops at Borana and West Guji zones, Southern Ethiopia

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Abstract

The crop insect pest assessment was conducted at two zones of southern Oromia, West Guji and Borana Zone from 2020 to 2022 cropping seasons. The assessment was done in two districts of each zone and totally four districts were assessed. The districts were selected purposively based on potential of crop they cultivate. The major crops cultivated at the area were maize, teff and common bean. During, this assessment was done each crop was infested by insects and the pests causes high damage on some field. Insects identified from common bean fields, which leads to high yield loss were *Striacosta albicosta* (cutworm), *Epilachna varivestis* (ladybird beetle) and *Maruca vitrata* (pod borer). Cutworm was recorded only from Teltelle, while pod borer was mostly found in all surveyed districts. The Maximum damages percentage of pod borer was observed at Yabello (40%) followed by Teltelle (36%) whereas minimum damage percentage (27.78%) was detected at Bule Hora. On maize 3 major insect species, *Spodoptera frugiperda* (fall army worm), *Aphis fabae* (black aphids) and *Busseola fusca* (stem borer) were detected. Fall army worm was the dominant pest and accounts 50%, 73.7%, and 18.5% damage percentage at Teltelle, Yabello and Abaya districts respectively followed by stem borer. *Atherigona hyalinipennis* (Shoot fly) was the major pest on tef with infestation levels 23.39%, 19.7%, 30% and 33.64% in Teltelle, Yabello, Bule Hora and Abaya districts respectively.

Keywords: Damage, abundance, infestation percentage, common bean, maize, teff

1. Introduction

In raising and balancing the demand and supply of food quality and quantity for the community needs, protecting the agricultural crops plays a great role^[1]. One practical means of achieving greater yields is to minimize the insect associated losses^[2]. Crop production is one of the major sources of income diversification available to pastoralists and ironically one of the most important competitors to the pastoralist way of life. According to Mengistu *et al.* 2020^[3] the major crops grown around Borana and West Guji are tef, maize, common bean and wheat (exceptional for west Guji zone). In Ethiopia, during 2020/21 production year major crops such as tef, wheat, maize and red common bean and white common bean were cultivated over the area 2.93 mil ha, 1.9 mil ha, 2.53 mil ha, 0.21 mil ha, and 0.1 mil ha respectively. The produce from those areas were 1.882 t/ha, 3.05 t/ha, 4.18 t/ha, 1.796 t/ha, and 1.76 t/ha respectively. In Borana, maize was cultivated on 6,716.82 ha and yields about 891.2089 t which is 1.33 t/ha. Red common bean is cultivated on 5,447.35 ha and yielded about 577.16 t with average yield 1.10 t/ha. Similarly, in West Guji maize was cultivated on over 9,180.49 ha of land and yields about 37880.01 t, with 4.13 t/ha yields, Red common bean 932.52 t from 5,222.94 ha with 0.18 t/ha^[4]. Despite its importance, the productivity of those major crops was very low compared to the national average yield. The yield losses caused by biotic pests are altogether responsible for losses ranging between 20 and 40% of global agricultural productivity^[2]. Among biotic factors, insect pests are one of the major limiting factors to crop production and storage. In Ethiopia, pre harvest yield loss due to insect pests in cereal and legume crops are estimated around 21-44% and 16-29 respectively^[5]. The potential areas of Borana and West Guji zones for crop productions include Yabello, Teltelle, Elweye, Dire, Abaya and Bule Hora districts. The above listed districts have alike climatic conditions except Bule Hora district. Nowadays, demands for crop production had already been raised to fill demand for food security. The study by Tache and Sjaastad (2008)^[11] also confirmed that crop cultivation is firmly expanding in the rangelands and tenure. Though crop production is relatively at initial level in pastoral areas, nowadays the urge for crop production knocks the integrity of every household regardless of the production skill and knowledge^[6]. According to Mengistu *et al.* 2020^[3] about 85%, 65% and 30% of the respondents confirmed that they were producing maize, common bean and teff, respectively.

Some internal constraints are lack of agricultural inputs and land competition. According to respondents, the major factors constraining crop production include lack of rainfall (The rainfall pattern is highly erratic and rains often do not occur at the expected time), presence of different harmful agricultural pests. Among, the constraints insect pests are the major challenging factors of crop production around Borana and West Guji. Therefore, the objective this assessment was to identify the most economic insect pests of major crops and their distribution at Borana and West Guji Zones.

2. Materials and Methods

2.1 Description of the study area

The study was conducted at two zones (West Guji and Borana) of Oromia regional state, southern Ethiopia. West Guji and Borana zones are located at 463 km and 570 km from Addis Ababa to southern part of Ethiopia respectively. The climatic conditions of the study area were characterized with hot and short rainy season. Unlike the other districts Bule Hora district, which found in West Guji zone had different agro-climatic conditions; its topography tends to be mid highland and had a long rainy season than the other districts. There are two rainy seasons with in a year and the main rainy season is ranges from March to May while short rainy season is from early September to end of October.

2.2 Insect Pest Assessment Methods

The assessment was conducted in two districts from each zone and totally at four districts in 2020-2022 production seasons. The assessed districts were Yabello, Teltelle, Abaya and Bule Hora. The study area of each district was located under an elevation range of 1490-1800 masl, 1356-1460 masl, 1422-1460 masl and 1860 to 2328 masl Yabello, Teltelle, Abaya and Bule Hora respectively. The districts were selected purposively based on potential of crop they produce. Fields were assessed with the distance of about 3-5 km apart accordingly i.e., based on the presence of the crop. During assessment GPS map was used, for the purpose of geographical data such as elevation, latitude and longitude, distance and area of the assessed field. The sampling was done at five points (quadrats) in each field and 1 m * 1 m quadrat was used during the survey to take a sample from the fields and sampling was done in diagonal pattern (X-fashion) in each field. The identified insect in each point was recorded and separated according to their families (groups). The abundance level and damage caused by the identified insect pest was recorded from each quadrat. When the assessment was done maize and teff crops were at the stage of flowering, while common bean was at the stage of pod setting. Questionary was developed to collect additional data from the farmers. The infestation percentage of the insects on the crop was recorded specifically for each crop as well as infesting insects. The insect species and their infestation level were recorded from all the surveyed districts for each crop. The major crops produced at the study areas include maize, common bean and teff. Percentage infestation level and damage were calculated using the formula.

2.3 Data Analysis

All collected data were feed into computer and managed by using Excel and lastly the data was analyzed using IBM SPSS Statistics 20.

3. Results and Discussion

3.1 The major insect pests

The survey indicates that there were different insect pests on each assessed crop's i.e., common bean, maize and teff. Also, their prevalence was varied from location to location based on the crop type and cropping history. On majority of assessed areas producers use local varieties which may increase the risk of insect pest damage. Based on the commodity the species of insects observed on each crop were different and even within a crop based on infestation level, they vary from location to location (Table 1).

3.2 Types and Infestation of Insects on the Crops

Among, the identified insect pests on common bean, cutworm (*Striacosta albicosta*), ladybird beetle (*Epilachna varivestis*) and pod borer (*Maruca vitrata*) were insects those have significant role in common bean yield reduction (Table 1). These insect pests have their own abundance and damage levels on common bean crop on farmers field, as analyzed data collected during assessment indicated (figure 1). The population/abundance and damage percentage caused by those insects on common bean was differ from district to district and from field to field (Table 1). The result shows that, Cutworm (*Striacosta albicosta*) was recorded only from Teltelle, while pod borer (*Maruca vitrata*) was found in all assessed districts. As the analyzed data of the assessed field shown, Pod borer (*Maruca vitrata*) damages common bean with about 36%, 40% and 27.78% infestation level at Teltelle, Bule Hora and Yabello districts respectively. Sharma *et al.*,^[7] also reported the pod borer as a major pest of cowpea and pigeon pea, but also damages other food legumes. The other major crop cultivated at the study area was maize and for this activity about 94 maize fields were assessed across the four districts (Yabello, Teltelle, Bule Hora and Abaya). On this, crop three major insect pests fall armyworm (FAW), stem borer and aphids (black) were determined. The damage level caused by these insect species and their infestation percentage were vary from field to field and district to district.

Among, the insects infest maize crop fall armyworm (FAW) (*Spodoptera frugiperda*) was the dominant and existed all over the surveyed fields of both Borana and West Guji zones. Among, the 94 filed of maize assessed about 65 fields were infested by fall armyworm (*Spodoptera frugiperda*) pest. Thus, the Fall armyworm damages on maize from the fields, accounts for about 50%, 73.7% and 18.5% of maize damage percentage in Teltelle, Yabello and Abaya districts respectively (Table 1). The analyzed data shows, the highest infestation level on maize was occurred by fall armyworm (*Spodoptera frugiperda*) over the other insect pests. The maximum infestation percentage of fall armyworm (*Spodoptera frugiperda*) on maize was observed at Yabello district (73.7%) followed by Teltelle (50%), while low infestation was recorded at Bule Hora district (18.3%). The infestation level of stem borer (*Busseola fusca*) in maize fields ranged from 10.5% to 53.7% in surveyed districts. Rajin *et al.* 2000^[8] also reported the infestation of maize stem borer could extend up to 60%, which is in range with this survey results. Aphids' infestation in maize field was less compared to another insect pest at all assessed district.

Among, the major crops cultivated at Borana and West Guji zones teff is one of the most widely cultivated crops and it takes a significant position in using by the communities.

During, the assessment for determination of the most economic insects that attack teff at field, about 89 teff fields were assessed from both Borana and West Guji zones. Then, the assessment result expresses the major insect pest that attacks teff at the study was shootfly (*Atherigona hyalinipennis*) and it was recorded in 76 fields among the 89 fields assessed. The infestation level of shootfly (*Atherigona*

hyalinipennis) was 23.39%, 25.01%, 30% and 33.64% at Teltelle, Yabello, Bule Hora and Abaya districts respectively. The infestation of shootfly (*Atherigona hyalinipennis*) on the teff crop with up to 42.0% infestation level at the age of panicle initiation and infestation could extend up to 100% in severe cases [9, 10].

Table 1: Identified insect pests for three major crops maize, common bean and teff with their abundance percentage across four districts

Districts	Crop	Identified insect name	Damage Average (%)	Abundance %	
Teltelle	Common bean	Cutworm	51.67	25	
		Pod borers	36	41.67	
		Ladybird beetle	37.14	29.17	
	Maize	Fall armyworm (FAW)	50	38.33	
		Stem borers	27.7	28.89	
		Aphids	15.4	33.33	
Teff	Shootfly	23.39	21.45		
	Yabello	Common bean	Pod borers	40	79.41
			Ladybird beetle	13.33	17.65
Maize			Fall armyworm (FAW)	73.7	30.49
		Stem borers	53.8	30.36	
		Aphids	50	40	
		Teff	Shootfly	25.01	22.93
Bule Hora	Common bean	pod borers	27.78	46.3	
	Teff	Shootfly	30	27.51	
Abaya	Maize	Fall armyworm (FAW)	18.5	27.5	
		Stem borers	10.5	25	
		Teff	Shootfly	33.64	30.84

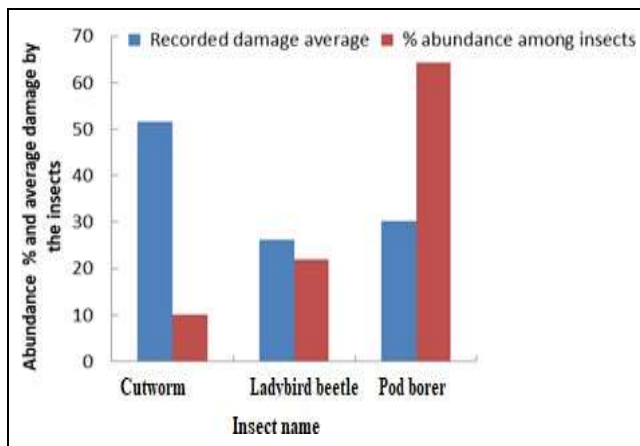


Fig 1: Insects recorded from common bean and their damage level with infestation percentage in districts

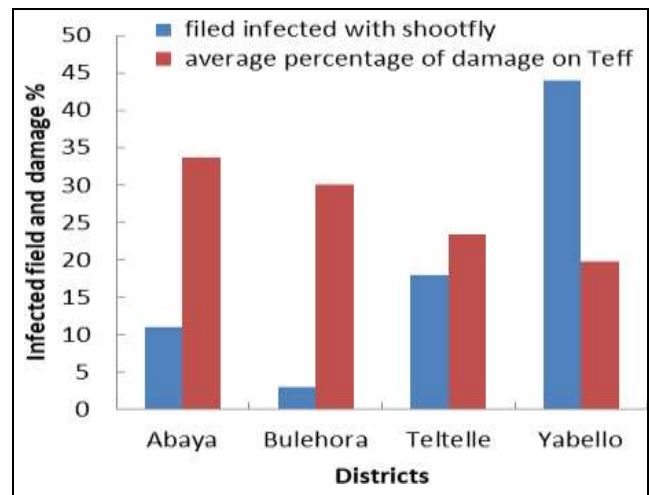


Fig 3: Number of infected Teff fields with Shootfly and damage percentage at four districts of the study area

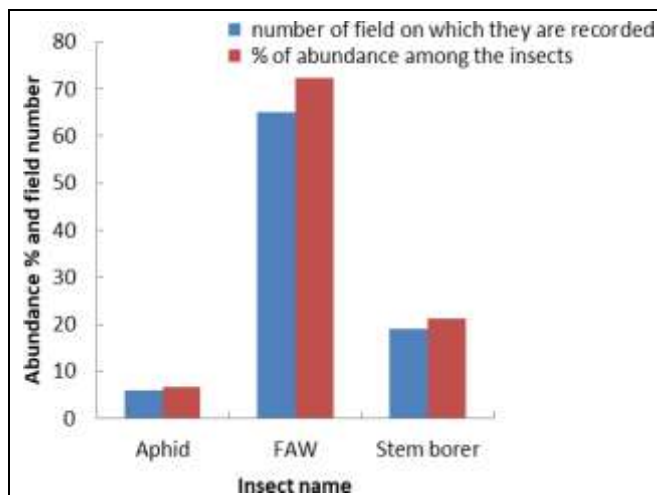


Fig 2: Major insects identified on maize with their abundance percentage

4. Conclusion and Recommendations

The crop cultivation at the study area shows increasing in high level from time to time and the crop mostly cultivated at the area were maize, common bean, and teff. Though, agricultural pests are the major constraining factors for crop production at Borana and West Guji zones. The insect pests are the key in limiting the crop production and productivity and it needs high attention to overcome the destructions occur with insects on the cultivated crop at field. Among, the insect pests affecting each cultivated at field condition Pod borer and cut worm on common bean, fall armyworm on maize and shoot fly on teff were the major insect pests causes high damage on each crop. Therefore, the producers should use different management methods such as crop rotations, field sanitation, and as a last option applying insecticides developed/formulated for respective insect

species at a right time. In the future, efforts should be made towards the integration of multiple control options like development of resistant varieties, development of improved agronomic practices, awareness creation among farmers and experts' right from site selection till post-harvest handling of various insect and their management.

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