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Identification of Insect Pests of Maize (*Zea mays* L.) in Girar Jarso and Hidebu Abote Districts, North Shewa Zone, Oromia, Central Ethiopia

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ABSTRACT

Background: Maize is the most important staple food crops in sub-Saharan Africa, including Ethiopia, predominantly produced and consumed directly by the smallholder farmers. Insect pests are the serious pests causing yield loss of maize in field at different growth stages.

Methods: The field survey was carried out during 2019-2020 crop growing season. Purposive sampling technique was used for selecting the districts based on the potential producers of maize and a random sampling technique was used to select the kebeles and the stakeholders.

Result: The major identified insect pests of maize in the two districts were grass hopper (*Hieroglyphus nigrorepletus*), maize leaf hopper (*Cicadulin ambila*), maize pod borers (*Helicoverpa armigera,* Etiella), maize stem borers (*Chilopartellus* Swinhoe), Hairy caterpillar (*Amsacta albistriga* Walker), Black cut worm (*Agrotis ipsilon* Hufnagal), Maize leaf Aphid (*Rhopalosiphum maidis* Fitch), Army worm (*Mythimna separata* Walker), Fall armyworm (*Spodoptera frugiperda*), Pink stem borer (*Sesamiain ferens* Walker), Corn Earworm (*Helicoverpa zea* Boddias), Chafer beetle (*Chiloloba acuta* Wiedmann), Shoot bug (*Peregrinus maidis* Ashamed), White grub (*Holotrichia consanguinea*) and shoot fly (*Atherigona soccata*).

Key words: Identification, Insects pests, Maize.

INTRODUCTION

Maize (*Zea mays* L.) is an important crop and widely grown by commercial and small-scale farmers (Midingoy *et al.*, 2016). Maize ranked the second in area covered having an area of 17.68% (about 2,274,305.93 hectares) and found the first ranks in yield contributed 28.75% (96,357,345.00 quintals) in production in Ethiopia (CSA, 2020). In Sub-Saharan Africa, 77% of maize is using as food and only 12% serves as feed (Inuwa, 2018).

Due to changing global climatic patterns and due to change in host range of pests, many new pests previously not known on maize has been reported to feed on maize and a latitudinal shift in the distribution of insect pests has been observed (David and Ramamurthy, 2017). Stem borers belong to a group of moths whose larval stages are the most destructive, as they initiate their feeding on the plant, thereby inflicting physically and economically important damage on crops. Stem borers caused important lossesof maize ranging from 11% in the highlands to 21% was lost in the dry areas in Ethiopia (Odendo *et al.*, 2003).

In the study area, the socio-economic conditions are very poor and maize production is highly limited due to lack of insect pests' awareness, identification and prevalence of pestsand insufficient of agricultural extension expert in the characteristics and identification of insect pests. Thus, the current investigation was aimed to identify theinsect pests' infestation level of maize, the types of species/orders and infestation status at different maize growth stages.

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MATERIALS AND METHODS

The survey was conducted in the year of 2019 to 2020 cropping season in North Shewa Zone, Oromia, Ethiopia. The Zone is found 112 km away from Addis Ababa on the northern direction.The study was carried out in Girar Jarso and Hidebu Abote District of the Zone. The average annual temperatureand average annual rainfall of Girar Jarso and Hidebu Abote varies from 15°C - 26°C and1200-1400 mm and 20-4°C and 800-1100 mm respectively (Fig 1).

The sample size was determined according to the formula:

$$n = \frac{N}{1 + N (e^2)}$$

Where

n= Sample size; N= Number population; e is confidence level (95%) (Yemane, 1967). The survey was purposively selected

to get ease access of resources to elicit the views of persons who have expertise and knowledge about specific domain (Tongco, 2007). The pest assessment was carried out at all crops growth stages. Ten crops were taken from each diagonalfrom 10 m^2 area and assessed. Pest assessment was done along the two diagonals (in an "X" pattern) of the field from three points quadrants. The major data collected were the species/ orders of insect pests and nature of pests' damage to maize at different growth stages. Morphological identification of pest was done using hand lens and utilizing identification keys (Zim and Cottam, 2000). The pests status were determined based on the degree of damage caused to plant and were named in a scale of 1-3, where 1 = little or not important; 2 = cause little and occasional damage and 3 = common and causes serious damage (Adamu *et al.,* 2000). The data were analyzed using SPSS (Version 20.00) and descriptive statistics was used to get the variation of the surveyed insect pests in percentage.

RESULTS AND DISCUSSION

Major constraints of maize production

The survey indicated that the majority of respondents ranked (50.00%) as yield loss by insect pests, (37.00%) yield loss by lack of improved maize varieties, (33.00%) yield loss by diseases, (18.12%) yield loss by lack of inorganic fertilizer and (11.10%) yield losses by weed infestation in Girar Jarso District (Table 1). Likewise, maize production was affected as the respondents mentioned (48.00%) due to lack of improved maize seed variety, (47.00%) due to attacked by insects, (29.00%) loses due to diseases infestation, (28.20%) due to lack of inorganic fertilizer and (8.88%) by

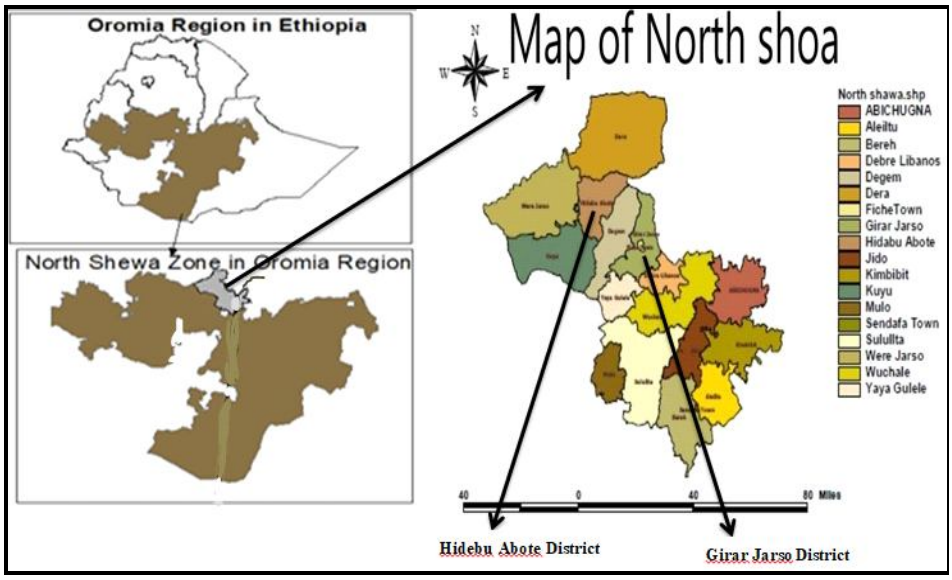

Fig 1: Maps of the surveyed districts.

Table 1: Yield losses of maize by different agents and lack of inputs in surveyed districts.

Districts	Kebeles	Yield losing agents and inputs					
		Yield loss by diseases	Yield loss by weeds	Yield loss by insects	Lack of improved variety	Lack of fertilizer	Yield loss by birds
Girar Jarso	Adisge	35.00%	13.90%	40.00%	20.00%	20.90%	16.50%
	Silmi	30.00%	9.70%	60.00%	30.00%	13.60%	7.90%
	Sherer Genet	20.00%	8.30%	60.00%	40.00%	10.20%	10.34%
	Shebele Fati	30.00%	13.90%	40.00%	35.00%	15.90%	13.90%
	Wedesa	50.00%	9.70%	50.00%	60.00%	30.00%	10.00%
	Average	33.00%	11.10%	50.00%	37.00%	18.12%	11.73%
Hidebu	Debala Bokolo	30.00%	13.90%	50.00%	50.00%	50.00%	33.90%
Abote	Adaya Bonaya	40.00%	8.30%	45.00%	40.00%	25.00%	24.00%
	Kobil Godeti	20.00%	6.90%	30.00%	50.00%	20.00%	32.90%
	Gidabo Jama	30.00%	9.70%	70.00%	60.00%	16.00%	12.00%
	Alkochi Kare	25.00%	5.60%	40.00%	40.00%	20.00%	14.30%
	Average	29.00%	8.88%	47.00%	48.00%	28.20%	23.42%

weeds in the surveyed kebeles of Hidebu Abote District (Fig 2). Early *et al*. (2016) reported that the spread of insect pests, plant diseases and invasive alien plant species to new regions, as the world's climate changes, is a threat to farmers globally, especially in Africa where climate change effects are projected to be the most severe in the world and anticipated that the spread of diseases, insect pests and weeds were potentially cause the loss of more than 40% of the world's food supply. As reported by (Bhandari *et al*, 2015), Survey report revealed that 42% respondents ranked for insects as a main problem followed by 32% for weed and 17% for disease.

Insect pest Infestation at different growth stages

The highest and lowest Average yield loss of maize due to insects stated by respondents (46.68%) and (30.95%) were infested at Shebele Fati and Sherer Genet kebele of GirarJarso Districts whereas the highest and the lowest average that respondents ranked (52.93%) and (20.50%) yield loss of maize were reduced by insect at Gidabo Jama and Dabala Bokolo kebeles of Hidebu Abote district at different growth stages.At district level, the total average yield loss of maize emphasized by respondents were (48.00%) by lack of improved variety and (8.88%) by weed infestation in Hidebu Abote District (Table 2) . The maximum and minimum infested maize by insects were (64.38%) and (63.34%) and 9.20% to 13.00% in Girar Jarso and Hidebu Abote Districts at late seedling and seedling growth stage (Fig 3). The samples of photos of infested maize and sorghum by insects at different crops growth stages at the two districts were taken during field observation (Fig 4).

Major identified insect pests of maize at Hidebu Abote district

The survey result indicated that lepidopterans, orthopterans, coleopterans, hemipterans and thysonepterans were identified in the district. From the fifteen identified insects, grass hopper (*Hieroglyphus nigrorepletus*), maize leaf hopper (*Cicadulinambila*), maize pod borers (*Helicoverpa armigera*, Etiella), maize stem borers (*Chilopartellus* Swinhoe), Hairy caterpillar (*Amsacta albistriga* Walker), black cut worm (*Agrotisipsilon* Hufnagal), Maize leaf Aphid

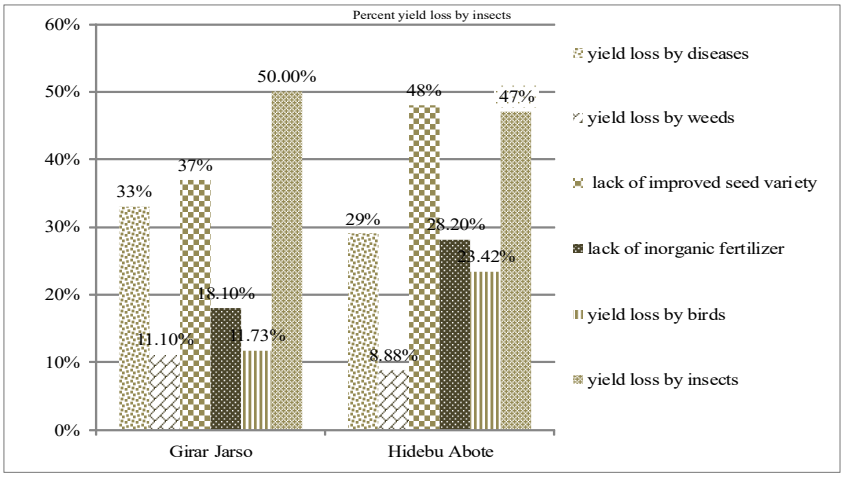

Fig 2: Yield losses of maize due to pests' infestation and lack of inputs.

Table 2: Summary of insect pests infested maize at different growth stages.

Districts	Kebeles	Maize growth stages				
		Seedling stages	Late seedling	Maturity	Storage	Averages of Infestation
GirarJarso	Adisge	8.00%	60.00%	37.50%	28.60%	33.53%
	Silmi	16.00%	66.00%	20.00%	38.18%	16.50%
	Sherer Genet	8.00%	71.40%	44.40%	30.00%	30.95%
	Shebele Fati	20.00%	66.70%	50.00%	50.00%	46.68%
	Wedesa	12.00%	57.10%	50.00%	40.00%	39.78%
	Average	**12.80%**	**64.24%**	**40.38%**	**37.36%**	33.49%
Hidebu	Debala Bokolo	12.00%	15.00%	10.00%	20.00%	14.25%
Abote	Adaya Bonaya	10.00%	44.40%	30.00%	15.00%	24.85%
	Kobil Godeti	4.00%	55.60%	50.00%	16.70%	31.58%
	Gidabo Jama	4.00%	67.80%	50.00%	57.1%	44.73%
	Alkochi Kare	16.00%	56.43%	33.30%	28.60%	33.58%
	Average	9.20%	47.85%	34.66%	27.48%	29.79%

Table 3: Total number of insect pests infested maize at different growth stages on 10 M^2 in Hidebu Abote district.

Common name	Scientific /species name	Order	Family	Mean % Infested maize at different growth Stages				
				Seedling	Late seedling	Maturity	Total pests	Damage status
Grass hopper	*Hieroglyphus nigrorepletus*	Orthoptera	Acrididae	32.00±5.2 SE	127.00±39.3 SE	72.00± 32.2 SE	231	3
Maize leaf hoppers	*Cicadulinambila*	Hemiptera	Cicadellidae	6.00±0.4 SE	9.00±1.3 SE	7.00± 2.01 SE	22	3
Pod borers	*Helicoverpa armigera*, Etiella	Lepidoptera	Noctuidae	0.00±0.0 SE	0.00±0.0 SE	19.00± 3.3 SE	19	3
Thrips	*Megaluro thripsusitatus*	Thysanoptera	Thripidae	2.00±0.2 SE	24.00±3.3 SE	3.00± 0.11 SE	29	3
Maize stem borer	*Chilopartellus* Swinhoe	Lepidoptera	Pyralidae	10.00±1.2 SE	37.00±5.04 SE	3.00± 0.11 SE	50	3
White grub	*Holotrichia consanguinea*	Coleoptera	Scarabaeidae	7.00±0.02SE	00.00±0.00 SE	00.00± 0.00 SE	7	1
Hairy caterpillar	*Amsacta albistriga* Walker	Lepidoptera	Eribidae	0.00±0.00 SE	8.00±1.01 SE	58.00± 16.1 SE	66	3
Black Cut Worm	*Agrotis ipsilon* Hufnagal	Lepidoptera	Noctuidae	32.00±5.2 SE	3.00±0.01 SE	00.00± 0.00 SE	35	3
Maize leaf Aphid	*Rhopalosiphum maidis* Fitch	Hemiptera	Aphididae	87.00±11.3 SE	113.00±33.2 SE	75.00± 9.17 SE	275	3
Army worm	*Mythimna separata* Walker	Lepidoptera	Noctuidae	8.00±0.39 SE	13.00±2.12 SE	00.00± 0.00 SE	21	3
Fall army worm	*Spodoptera frugiperda*	Lepidoptera	Noctuidae	23.00±3.72 SE	7.00±24.81 SE	15.00± 2.41 SE	45	3
Chafer beetle	*Chiloloba acuta* Wiedmann	Coleoptera	Scarabaeidae	3.00±0.02 SE	9.00±0.11 SE	00.00± 0.0 SE	12	2
Pink stem borer	*Sesamia inferens* Walker	Lepidoptera	Noctuidae	00.00±0.00 SE	33.00±5.03 SE	5.00± 0.05 SE	38	3
Shoot bug	*Peregrinus maidis* Ashamed	Hemiptera	Delphacidae	00.00±0.00 SE	5.00±0.02 SE	11.00± 1.51 SE	16	2
Corn Ear worm	*Helicoverpa zea* Boddi	Lepidoptera	Noctuidae	00.00±0.00 SE	2.00±0.00 SE	27.00± 4.21 SE	29	3
			Total pests	210	450	298	895	
Temperature (°C)	Minimum = 13.8	Maximum = 32						
Relative humidity	Minimum = 63	Maximum = 89						
Elevation (masl)	Minimum = 1200	Maximum = 3419						

Note: Degree of pest damage (1= Little or not important; 2 = Cause little and occasional damage and 3 = Common and causes serious damage).

Table 4: Total number of insect pests infested maize at different growth stages in 10 M^2 in Girar Jarso district.

Common name	Scientific /species name	Order	Family	Mean % Infested maize at different growth stages				
				Seedling	Late seedling	Maturity	Total pests	Damage status
Grass hopper	*Hieroglyphus nigrorepletus*	Orthoptera	Acrididae	20.00±2.2 SE	57.00±12.6 SE	17.00±1.78 SE	94	3
Maize leaf hoppers	*Cicadulina sp.*	Hemimptera	Cicadellidae	2.00±0.01 SE	5.00±0.4 SE	00.00±0.00 SE	7	2
Pod borers	*Helicoverpa armigera*, Etiella	Lepidoptera	Noctuidae	0.00±0.01 SE	0.00±0.0 SE	4.00±0.03 SE	4	1
Thrips	*Megaluro thripsusitatus*	Thysanoptera	Thripidae	7.00±0.3 SE	12.00±0.8 SE	0.00±0.00 SE	19	3
Maize stem borer	*Chilopartellus* Swinhoe	Lepidoptera	Pyralidae	23.00±3.9 SE	15.00±2.35 SE	6.00±0.51 SE	44	3
Hairy caterpillar	*Amsacta albistriga* Walker	Lepidoptera	Noctuidae	0.00±0.00 SE	2.00±0.00 SE	6.00±0.42 SE	8	2
Maize cut worm	*Mythimna separata*	Lepidoptera	Noctuidae	5.00±0.3 SE	0.00±0.00 SE	00.00±0.00 SE	5	1
maize leaf Aphid	*Rhopalosiphum maidis* Fitch	Homoptera	Aphididae	27.00±4.02 SE	18.00±4.07 SE	6.00±1.11 SE	51	3
Army worm	*Mythimna separata* Walker	Lepidoptera	Noctuidae	2.00±0.01SE	5.00±1.03 SE	1.00±0.00 SE	8	2
Fall army worm	*Spodoptera frugiperda*	Lepidoptera	Noctuidae	00.00±0.00 SE	3.00±0.01 SE	00.00±0.00 SE	3	1
Chafer beetle	*Chiloloba acuta* Wiedmann	Coleoptera	Scarabaeidae	5.00±0.11 SE	4.00±0.21 SE	1.00±0.00 SE	10	2
Pink stem borer	*Sesamia inferens* Walker	Lepidoptera	Noctuidae	00.00±0.00 SE	3.00±2.01 SE	23.00±4.05 SE	26	3
Shoot bug	*Peregrinus maidis* Ashamed	Hemimptera	Delphacidae	3.00±0.00SE	0.00±0.01 SE	2.00±0.17 SE	5	1
Corn earworm	*Helicoverpa zea* Boddi	Lepidoptera	Noctuidae	00.00±0.00 SE	00.00±0.00 SE	12.00±2.31 SE	12	2
			Total pests	94	124	78	296	
Temperature (°C)	Minimum = 11.5	Maximum = 28						
Relative humidity	Minimum =73	Maximum = 85						
Elevation (masl)	Minimum = 1300	Maximum = 3467						

Note: The degree of pest damage (1= Little or not important; 2 = Cause little and occasional damage and 3 = Common and causes serious damage)

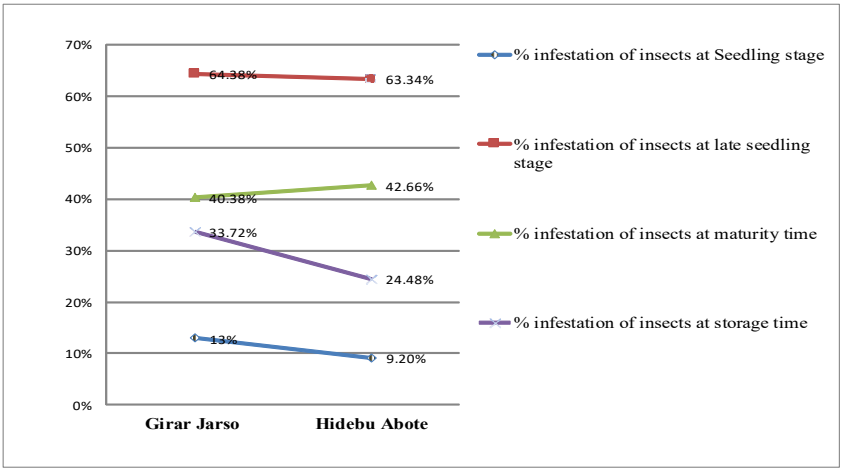

Fig 3: Per cent level of insect pests' infestation at different maize growth stages.

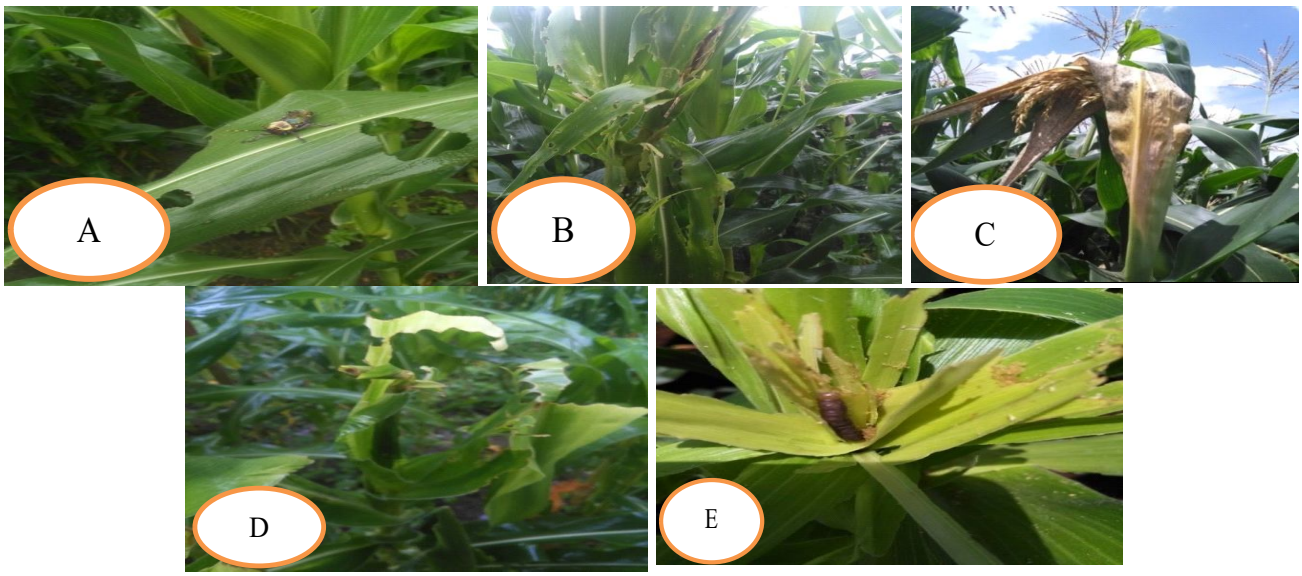

Fig 4: Indicated; A= maize attacked by adults of Grass hopper, B and C = maize affected by stalkborers and shoot fly at blossom time, D and E= attacked maize by stalkborers and shoot fly at seedling and late seedling growth stage.

(*Rhopalosiphum maidis* Fitch), army worm (*Mythimna separata* Walker), fall armyworm (*Spodoptera frugiperda*), pink stem borer (*Sesamia inferens* Walker), Thrips (*Megaluro thripsusitatus*) and corn ear worm (*Helicoverpa zea* Boddias) were identified as a major pests causing serious losses of maize (Table 3).The research reported by (Fentae*t al.,* 2019), More than 40 species of insects has been recorded on maize in the field.

Major identified insects at Girar Jarso district

Grass hopper (*Hieroglyphus nigrorepletus*), thrips (*Megaluro thripsusitatus*), maize stem borer (*Chilopartellus* Swinhoe), corn leaf aphid (*Rhopalosiphum maidis* Fitch) and pink stem borer (*Sesamia inferens* Walker) were the major insect pests infested maize at different growth stages. Whereas, maize leaf hoppers (*Empoasca kraemeri*), hairy caterpillar (*Amsacta albistriga* Walker), army worm (*Mythimna separata* Walker), chafer beetle (*Chiloloba acuta* Wiedmann) and corn ear worm (*Helicoverpa zea* Boddi) were the minor insectsinfested maize medium to lower at different growth stages. In other ways, pod borers (*Helicoverpa armigera* Etiella), black cut worm (*Agrotis ipsilon* Hufnagal), fall army worm (*Spodoptera frugiperda*) and shoot bug (*Peregrinus maidis* Ashamed) were the lowest available insects cause little or not important to loss of maize at kebeles of Girar Jarso district (Table 4). The total average number of insect pests emerged were (124) at late seedling stage, (94) at seedling stage and (78) at maturity stage. Homoptera, Lepidoptera, Thysnoptera, dipthera and Orthoptera were the major insect orders infested maize at seedling, late seedling and maturity stages.

CONCLUSION

The maximum and minimum yield loss of maize recorded by insect pests and weed infestationwere (50.00%) and

(11.10%) in GirarJarso district and (48.00%) due to lack of improved maize seed variety and (8.88%) due to weeds infestation in Hidebu Abote district. Lepidopterans, orthopterans, coleopterans, hemipterans and thysonepterans were the identified orders. Grass hopper (*Hieroglyphus nigrorepletus*), maize leaf aphid (*Rhopalosiphum maidis* Fitch) and maize stem borer *(Chilopartellus* Swinhoe) were the serious identified insects in the two districts.

RECOMMENDATION

Strong pest monitoring, identifying, characterizing and taking measure has to be given especially for major pests, insect pest management, giving training for farmers reduce the infestation of maize by insects.

Conflict of interest: None.

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