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The survey on field insect pests of sesame (*Sesamum Indicum* L.) in east wollega and horo guduru wollega zones, west Oromia, Ethiopia

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Abstract
Despite the potential for increasing the production and productivity of sesame in Ethiopia, there are a number of biotic and abiotic challenges inhibiting its production and productivity. Among the biotic constraints, the insect pests are responsible for the yield reduction in terms of quantity and quality, disease transmission and post-harvest crop management. The study was conducted in three woredas of western Oromia during 2016 crop season with the objective of determining the insect pests associated with the sesame crop at the field stage. The study result showed that there are group of insects from Hemiptera, Lepidoptera, Orthoptera and Isopteran orders found attacking the crop. Among the recorded insects, the sesame web worm (*Antigastra catalaunalis* Dup.) found the most serious pest feeding on the crop from the seedling up to the maturity stages. Among the piercing sucking insects which are responsible for disease transmission in addition to the physical damage to the crop, the incidence of the cotton whitefly and green peach aphid have also been noted. Finally, the author recommends that it is important to give more emphasis on improving production technologies and more studies are needed to identify severity, insect disease complexes and integrated pest management (IPM) packages with better collaboration of the stakeholders for improved exploitation of high potentiality of the study areas.

Keywords: Ethiopia, insect pests, antigastra catalaunalis, insect disease complex, IPM

1. Introduction
Sesame is the important oil crop in Ethiopia and occurs both as cultivated and wild (Zerihun, 2012) [26]. It is the major oil seed in terms of exports, accounting for over 90% of the values of oil seeds exports of Ethiopia. The oil seeds is one of Ethiopia's important and fastest growing sector both in terms of its foreign exchange earnings and as a main source of income for many millions of nations. It is the second largest source of foreign exchange earnings after coffee (CSA, 2011) [5]. A sizable proportion of the population generates income from oilseed farming, trade and processing. Owing to this and other reasons, sesame production is gaining attention and the Ethiopian government is enhancing the small and large scale farm investors to rely on such industrial crops.

The major constraints in sesame production worldwide are lack of wider adapting cultivars, shattering of capsules at maturity, nonsynchronous maturity, poor stand establishment, lack of fertilizer responses, profuse branching, and low harvest index (Ashri 1994) [4]. Beside the potential for increasing the production and productivity of sesame in Ethiopia, there are also a number of challenges inhibiting sesame production and productivity. Among them, the most important include a lack of improved cultivars, a poor seed supply system and a lack of adequate knowledge of farming and post-harvest crop management. There are also severe biotic stresses such as diseases and insect pest problems.

According to ENUPI (2002) [8], damage from insect pests ranged from 5% to 50% of the total sesame production. Weiss (2000) [24] also reported that insects reduce about 25% of the potential yield of sesame in the world. There are a number of pests known attacking sesame. Among various insect pests responsible for the low productivity of sesame, the insect pests associated with flowering phase usually inflicts very severe damage to the crop. Piercing sucking insects have great economic importance to sesame plants. They cause serious damage directly by sucking plant sap or indirectly by transmission of virus and mycoplasma diseases (El Gindy, 2002).

Despite the potential, economic importance, attention gained and current problems of the crop, its increased production in the country is mainly dependent on extensive than intensive farming (Zerihun, 2012) [26]. It is suggested that the use of improved technologies would ultimately result to achieve maximum yield from this large area size. Efficient research strategy may be required to reduce the effect of various yield reducing factors in sesame production in the country. The research attention that has been given to improve this crop is not comparable with the contribution of this crop in Ethiopian economy. Hence, it is important to identify the insect pests associated with sesame crop to fill its protection research gap specifically in the study area and in the country as the whole. Therefore, the current study was undertaken with the objective of identifying the field insect pests associated with sesame crop in the study area.

2. Materials and Methods
2.1 Description of the study area
The study was carried out in East Wollega and Horro Guduru Wollega zones (Nekemte and Shambu capital cities, respectively) of western Oromia (Fig. 1) in 2016. East Wollega is located at 36°31' East and 9° 06' North and H/G/W is located at 36º39' - 37º40' East longitude range and 9º 09' North latitude. The study areas are characterized by dry season (winter) and wet season (summer) with annual temperature ranges between10 and 30 ºC and 16.8 and 29.1°C and the annual rain fall between 900 and 2000mm and 1200 and

2400mm, respectively. The altitude ranges of HGWZ lies between 1350 and 3170 m.a.s.l.[23](Temesgen, 2014 and HGWZ, n.d.). Both zones are characterized by subsistence mixed farming system of crop cultivation and raising livestock. Cereal crops, pulses, oil crops, vegetables and fruit crops are the major crops grown. Moreover, stimulant crops such as coffee and chat are major cash crops in some parts of the zones. Sesame is one of the major source of income for small-scale producers and the zones are playing major role in providing input for the country's sesame export.

2.2 Sampling technique and data collection

Three representative woredas (districts) viz, Leka Dulecha and Sibu Sire from East Wollega zone and Abe Dongoro from HGWZ were used for the study. Two kebeles from each district and two farmers' field in each kebele were observed at seedling, vegetative, flowering and pod setting, maturity and harvesting stages of the sesame. Four plots with four meter square area were marked in zigzag way in the selected field to collect insects at each day of data collection. The field were visited once approximately at neither hot nor cold time of the day and for immobile insects only five plants were observed to count the existing number of each insects in the plot. But, the mobile insects were collected as much as they found in the plot and they were dropped in to wider plastic bag by dragging them or shaking the plant until they drop into the bag or fly out of the plot to insure avoid of recounting the same individual insect. After being collected the insects counted and the insect identification was done according to Rosan (2013) [16]. Information about the past history and experience of sesame production, constraints and insect pest problems and their management were collected from the farmers as supplementary data.

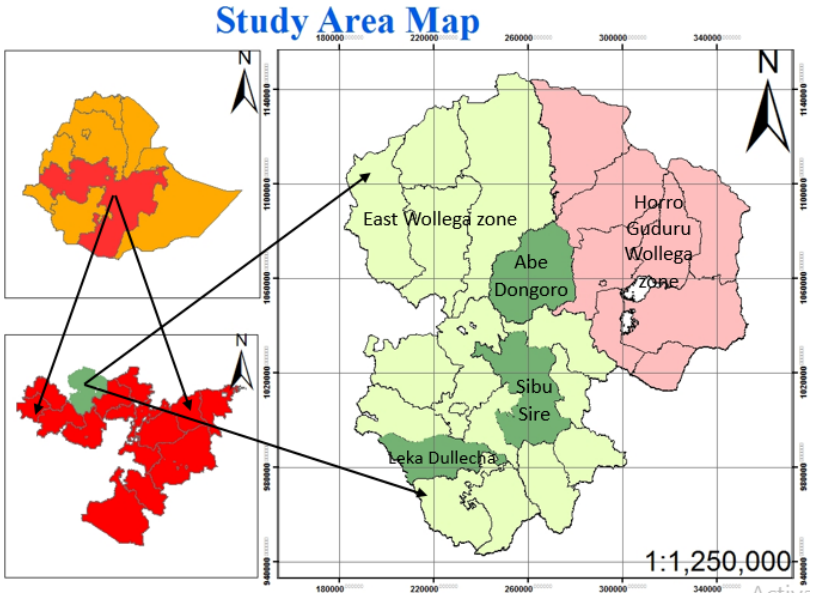

Fig 1: The study area map

3. Result and Discussion

3.1 Sesame farm practices

Small scale farming of sesame was found in the study area and the contacted farmers described that they have short history of sesame farming (less than 25 years). Even though they have better willing to produce the crop, lack of recognized agronomic activities and extension works, inputs, price fluctuation and market relation, infrastructure and crop failure due to weeds, field and post-harvest insects and diseases were raised as the main bottlenecks among the farming community. Similar to this finding, Selamun (2011), Zerihun (2012), Julian *et. al.* (2012), Mahmoud (2013) [12] and Egonyu *et. al.* (2005) [6] reported that the low yields of the crop have been attributed to several factors, including low yielding varieties, poor agronomic practices, soil acidity, poor drainage, poor planting methods (broadcasting), weeds, diseases and insect pests. The researcher concluded that the lack of infrastructure and government and the stakeholders' collaboration for awareness, support and enhancement of the farming activities remains as the first tricky to improve the local farmers attitude and invite the large scale investors in the areas for the sesame being driven by high market value and suitability of environmental conditions as well as other potential agricultural investments.

3.2 Sesame insect pests

The decline in productivity of the sesame crop is stated to be owed to the pest problems, lack of good management practices and knowledge of production and harvesting in the study area and the insect pests are the major bottlenecks for effective production worldwide. The current study revealed that many insect species visit the sesame field at different growth stages and some of them are the pests of the crop. The study result shows that the following insect pests were found feeding on the crop with the leading pest status and damage by sesame web worm from seedling stage to pod setting stage and higher number of green peach aphid due to adult and nymph found infested (Table 1.). On the other hand, three species of piercing sucking insects which play an important role in reducing the production of sesame yield were recorded. According to Mahmood, 2013 there is the report showing highest pest damage in less fertilizer use area of sesame production like the current study area and the populations of piercing sucking insect pests of sesame were maximum at zero potassium fertilization.

Table 1: Insects counted in 4m^2 area plot of sesame field in the study woreda in all growth stages (from seedling up to maturity)

S. No.	Insect name	Order	Frequency in number			Total	Frequency in percentage (No. of individual/total insect collected)		
			Leka Dulecha	Sibu Sire	Abe Dongoro		Leka Dulecha	Sibu Sire	Abe Dongoro
1.	Grasshopper	Orthoptera	25	41	37	103	2.24	3.47	3.72
2.	Cotton whitefly (*Bemisia tabaci*)	Hemiptera	54	32	41	127	4.83	2.71	4.12
3.	Sesame seed bug (*Elasmolomus sordidus*)	Hemiptera	63	97	112	272	5.64	8.21	11.25
4.	Sesame web worm (*Antigastra catalaunalis*)	Lepidoptera	347	414	214	975	31.04	35.03	21.49
5.	Termites	Isoptera	214	187	201	602	19.14	15.82	20.18
6.	Green peach aphid	Hemiptera	415	411	391	1217	37.12	34.77	39.26
	Total		1118	1182	996	3296	100.01	100.01	100.02

i) Sesame web worm (*Antigastra catalaunalis,* Dup.)

It is lepidopteran insect which was reported to attack the sesame crop in every growth stage being severe during dry seasons and after flower initiation (Suliman, *et. al.,* 2004). The larva feeds on tender foliage by webbing the top leaves and later bores into the pods and shoots (Narayanan and Nadarajan, 2005) [14]. In line with Tadele, 2005 and Zenawi *et. al.,* 2016 [25] who reported the sesame webworm as an important insect that damages sesame in Ethiopia, every observed field were shown the occurrence of the web worm, but the symptom was more occurred in fields with poor plant stand at vegetative stage. This may be due to the webbing process as it greatly influenced by the area of the leaf irrespective of the larval size according to the report of Suleiman *et. al.,* 2013. Their study revealed that the larger area of the leaves, the greater number of stitches made and the longer time taken for completing the webbing and the smaller leaves were webbed quickly, so the infestation will be rapidly in the poor plant stand.

ii) Grasshoppers

Grasshoppers are individuals of orthopteran order and their injury usually consists of defoliation or destruction of the plant. This may involve feeding on leaves or biting through the stems, severing the heads, feeding on ripening kernels and thereby causing extensive shattering. Because grasshoppers are highly mobile and it is difficult to observe while they are feeding, in the current study it was tried to correlate the symptom and occurrence of the grasshoppers in the field. Three grasshopper species viz. common field grasshopper (*Chorthippus brunneus*), Devil's grasshoppers (*Diabolocatantopx axillaris*) and Green grasshoppers were found damaged the crop during the study. Similarly, Selamun, 2011 was reported devil's grasshopper was one of the important pest found affecting the sesame crop in Humera area. Similarly, Bhadaurla *et. al.,* 2000 reported *Chrotogonous trachypterous* and *Oxya* spp. among the orthopteran insects were the serious pests of sesame through sporadic occurrence.

iii) Cotton whitefly, *Bemisia tabaci* (Gennadius)

They are Hemipteran insects of Aleyrodidae family. The cotton whitefly are found feeding at every stage in all surveyed field although the frequency is higher at the vegetative stage. Among the various economically important insect pests of sesame crop, the nymphs and adults of whitefly reportedly suck the cell sap from leaves, flower and pods due to which curl downward leaf margins, stunted growth, sickly appearance of the crop and abnormal growth of the leaf tissue is observed (Shaukat, 2004). The irregular yellow spots are found on upper surface of leaves affected by whitefly (Ahirwar *et. al.,* 2010) [1]. Although the occurrence was noted, the damage the whitefly incurred was not reasonable in the study area. This may be similar to the report of Bhadaurla *et. al.,* 2000 and Navarajan, 2007 [15] that the insects are serious pests in case of sporadic occurrence only.

iv) Sesame seed bug (*Elasmolomus sordidus,* Fab.)

Sesame seed bug is a Hemipteran insect which belongs to the order hetroptera and family lygaeidea (Schmeutterer, 1969) and it is a serious pest causing extensive damage to sesame. Although it was reported as a postharvest pest of sesame occurring in large numbers on the harvested plants which were heaped for threshing on the floor, it was observed that the nymph and adults were found from flowering stage and found feeding on the green pods in the field as also reported by Kalaiyarasan and Palanisamy, 2002 and Selamun, 2011. High yield loss was reported due to the insect from pod opening up to storage in the warehouses. The nymphs and adults suck the oil from the seeds, which becomes shrivel, bitter and worthless and incurs both physical damage (weight loss, color change, and shape) and quality loss (oil yield, odor, and change of protein content) (Mandefro *et. al.,* 2009) [13].

v) Green peach aphid (*Myzus persicae* Sluzer)

Although numerous plant families are known to be host for green peach aphids and they differ in their susceptibility, actively growing plants and the youngest plant tissues most often harbors large aphid populations. Both nymphs and adults are known to suck the cell sap from leaves and tender apical shoots. The under surface of the leaves get crinkled and slightly curled backwards. The vitality of the plant is diminished and the plants turn yellow, get deformed and dry away (Mahmood, 2013). The major damage caused by green peach aphid is through transmission of plant viruses. Nymphs and adults are equally capable of virus transmission, but adults, by virtue of being so mobile, probably have greater opportunity for transmission (Anonymous, n.d.).

vi) Termites

The termite problem was observed mostly after the crop cut and during the drying period before threshing and the farmers reported that the infestation at this time was very difficult once occurred since it can go up to the storage. Similarly, Mandefro *et. al.,* 2009 mentioned the report of termites as an important pest in Wollega, Hararghe, Gamo Goffa and the Middle Awash areas in Ethiopia. The insects were found feeding on the dried woods and plant leftovers at seedling stage also and the

infestation was reduced after the vegetative stage owing to the field clearing and weeding activities. Farmers reported that the termite infestation will be less if the field cleared and burnt before seeding and the stalks after threshing can be fully vanished by the termites if not burnt soon and can be used for insect build up in the next season.

4. Conclusion and Recommendation

A number of insect pests found damaging the sesame crop in Ethiopia complimenting the previous works. Sesame insect pests are not only direct pests, but they can cause disease complexes in the field and storage. In contrary to the country's export potential and agriculture led industry strategical plan, limited due are given to improvement and extension works for such important crops. Collaborative works of concerned stake holders and experts are needed for the development of agricultural productivity, IPM (Integrated pest management) packages, other technological packages and extension works.

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