International Journal of Agricultural and Natural Sciences
E-ISSN: 2651-3617 17(3): 242-254, 2024
doi:10.5281/zenodo.14063402
Research Article

DISEASE INCIDENCE, INSECT PEST PREVALENCE, WEED ABUNDANCE, AND DIVERSITY IN SESAME (*Sesamum indicum L.*) FIELDS OF KAMASHI AND ASSOSA ZONES OF BENISHANGUL GUMUZ REGION, ETHIOPIA

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(Received 24th March 2024; accepted 18th June 2024)

ABSTRACT. Sesame, a vital global oilseed crop, confronts persistent challenges from diseases and pests, particularly in high rainfall areas like Northwestern Ethiopia, where yield loss is imminent. Information regarding the primary pests affecting sesame within specific agroecological contexts is essential for devising effective pest management strategies. However, limited information exists on major sesame pests in the Assosa and Kamashi zones of the Benishangul Gumuz region, Ethiopia. Hence, a survey was conducted during the 2017/2018 main cropping season in Assosa and Kamashi zones to identify major diseases, insect pests, and weed species affecting sesame, as well as to determine the incidence and severity of diseases, prevalence of insect pests, and the abundance and diversity of weed species in the area. The survey uncovered bacterial blight, Cercospora leaf spot, and phyllody as the predominant diseases affecting sesame crops in the regions surveyed. Bacterial blight exhibited the highest disease incidence at 98.84%, followed by Cercospora leaf spot at 73.25%, with phyllody recorded at a lower incidence of 11.29%. Disease severity assessment indicated bacterial blight had a mean severity of 49.88%, while Cercospora leaf spot recorded 36.44%. Additionally, aphids, gall midge, and webworms were found as primary insect pests, with aphids and gall midge having mean incidences of 13.76% and mean prevalence of 45.61% and 8.77%, respectively. In contrast, webworm had a low mean incidence (1.00%) and prevalence (1.75%). The survey also highlighted the diversity of weed species, with ten identified as broadleaf. These broadleaf weeds, especially fast-growing ones, compete significantly with sesame, suggesting early hand weeding, particularly in regions like Benishangul Gumuz with high rainfall. Overall, the findings underscore the necessity for customized pest management strategies based on agroecological conditions and pest dynamics.

Keywords: *Bacterial blight, disease severity, weed density, weed diversity, Shannon-Weaver index*

INTRODUCTION

Sesame (*Sesamum indicum L.*) is a highly adaptable oilseed crop with a long history of cultivation. While it can thrive in various agroecological conditions, certain factors significantly influence its growth and yield. These factors encompass temperature, rainfall, soil type, and altitude [1]. Sesame prefers warm temperatures between 25 and 30°C, making it imperative to identify agroecological zones with optimal temperature ranges for successful cultivation. Although it exhibits drought tolerance, adequate and evenly distributed rainfall during growth stages is crucial. In areas with distinct dry seasons, supplementary irrigation might be necessary to support sesame cultivation [2]. While sesame can adapt to different soil types, it performs best in well-drained sandy loam soils [3].

Sesame cultivation spans globally, with major production hubs including India, China, Sudan, Myanmar, and Tanzania [4]. Ethiopia ranks among the top global producers of sesame, with its productivity deeply intertwined with the country's agricultural practices. Sesame holds significant economic importance for Ethiopia, contributing substantially to its agricultural sector and overall economy. It serves as a key commodity in international trade, thereby directly influencing Ethiopia's trade dynamics.

Despite its economic significance, sesame cultivation encounters challenges such as susceptibility to diseases, insect pests, and weeds, which can markedly impact yields. Diseases can hinder crop productivity by impeding photosynthesis, disrupting nutrient-water uptake, stunting growth, inducing premature senescence, increasing susceptibility to other stresses, and diminishing product quality. Bacterial blight [5], cercospora leaf spot [6], fusarium wilt [7], and phyllody [8] are the major diseases of sesame. On the other hand, insect pests pose a threat by directly feeding on crops or transmitting diseases. Gall midge [9], leaf roller/capsule borer [10], whitefly [11], and jassids [12] are major sesame insect pests affecting sesame globally. Weeds further compound the issue by competing with crops for essential resources like water, sunlight, and nutrients, leading to reduced yields if not adequately managed. Weeds can significantly reduce the availability of these resources for crops, leading to stunted growth and lower productivity [13]. Sesame faces competition from various weed species that can significantly reduce yield and quality. Cyprus spp. [14] and Amaranthus spp. [15] are the major weeds occurred in sesame fields.

Diseases and insect pests stand out as primary factors limiting sesame productivity in Ethiopia [16]. In Ethiopia, prevalent diseases such as bacterial blight, cercospora leaf spot, and phyllody, as well as significant insect pests like aphids, gall midge, and webworm, pose substantial challenges to sesame production [16, 17]. The severity and incidence of these pests and diseases vary across different agroecological regions. Suitable agroecologies for sesame exist in various regions of Ethiopia, including Amhara, Tigray, Oromia, and Benishangul Gumuz [16]. However, different agroecological zones may face unique pest and disease challenges. The incidence and severity of diseases, prevalence of insect pests, and abundance and diversity of weed species are influenced by agroecological features such as temperature, humidity, precipitation levels, elevation, soil characteristics, and host plants. Identifying major diseases and pests, along with understanding their economic significance in specific growing ecologies, is crucial for effective management and sustainable production. By comprehending disease incidence, insect pest prevalence, and weed abundance and diversity, farmers can implement integrated pest management practices, like crop rotation and use of disease resistant varieties to mitigate yield losses. Thus, the study aimed to: 1) identify major diseases, insect pests, and weeds in sesame farms in the region and 2) examine disease incidence and severity, insect pest prevalence, as well as weed abundance and diversity.

MATERIALS AND METHODS

Description of the Study Area

The survey was carried out during the 2017/18 cropping season in Assosa and Kamashi zones of the Benishangul Gumuz region in the Northwestern Ethiopia. The region is located between 9° 30′ N and 11° 39′ N latitude and 34° 20′ E and 36° 30′ E longitude. Benishangul Gumuz region experiences a unimodal rainfall distribution pattern, typically spanning 7 months from April to October, albeit with some variations across certain areas. The region receives an average annual rainfall of 1275 mm, with temperatures ranging between 14°C to 20°C and 25°C to 39°C for minimum and maximum values, respectively [18]. The combined land area of the Assosa and Kamashi zones amounts to approximately 35 thousand square kilometers.

Sampling Procedure and Data Collected

In the Benishangul Gumuz region, Kamashi and Assosa are potential zones for sesame production. For this study, the selection of districts within each zone was meticulously carried out to ensure that areas with high production potential were selected. Bambasi and Mao-Komo districts were selected from the Assosa zone based on their potential for sesame production. In contrast, Kamashi, Yaso, and Agalometi districts were included in the survey for the Kamashi zone. Within each selected district, specific Kebeles (the smallest administrative unit in Ethiopia) known for their sesame-growing potential were identified. This involved consultations with local agricultural experts, review of agricultural records, and field observations. Within each Kebele, sesame fields were evaluated at 3–5-kilometer intervals using the Global Positioning System (GPS). A total of 57 sesame fields from the two zones were surveyed. The survey was conducted during the crop growth stages, ranging from flower initiation to the capsule filling period to coincide with the emergence of diseases, insect pests, and weeds. Disease species and infected plants were documented in each quadrant of all fields surveyed. Five plants were randomly selected to assess disease severity using a scale of 1 to 9, where 1 indicates high resistance and 9 indicates high susceptibility [19]. Insect pest species, the number of plants infested by each species, and the total number of plants were evaluated per quadrant across all surveyed fields. Weed species and their respective numbers were assessed within each field using a $0.25m^2$ plot (0.5m x 0.5m quadrant) following a 'W' pattern [20]. During field data collection, unidentified weed specimens were collected for later identification and confirmation, utilizing resources such as the Flora of Ethiopia [21] and other pertinent sources.

Data Analysis

The mean incidence (%) and severity index (%) of disease species, along with the mean incidence (%) and prevalence (%) of insect pests, as well as the Shannon-Weaver diversity index for weed species, were calculated using R software version 4.3.2 [22]. Conversely, weed species frequency (%) and density, along with graphical presentations of the data, were performed using Microsoft Excel 2019 [23].

Disease incidence and severity

Incidence of disease species was computed as follows:

$$Incidence\ (\%) = \frac{Number\ of\ infected\ plants\ in\ a\ sample}{Total\ number\ of\ plants\ in\ a\ sample} \times 100$$

The data initially recorded on a scale from 1 to 9 was converted into the percentage severity index (PSI) following the method outlined by Wheeler [24], as outlined below:

$$\text{PSI (\%)} = \frac{\text{Sum of all disease scores}}{\text{Number of ratings} \times \text{Maximum disease grade}} \times 100$$

Insect pest incidence and prevalence

The magnitude of a specific insect pest species (incidence) and the frequency of its occurrence (prevalence) were calculated using the methodologies outlined by Kefale *et al*. [17], as follows:

$$Incidence\ (\%) = \frac{Number\ of\ infested\ plants\ in\ a\ quadrant}{Total\ number\ of\ plants\ assessed} \times 100$$

$$Prevalence\ (\%) = \frac{Number\ of\ quadrants\ in\ which\ a\ particular\ species\ occured}{Total\ number\ of\ quadrants} \times 100$$

Weed species abundance and diversity

Density and frequency served as metrics for assessing the abundance of weed species. Weed frequency, indicating the frequency of occurrence of a weed species within the survey area, was calculated by the methodology proposed by Nkoa et al. [25].

$$Frequency\ (\%) = \frac{Number\ of\ quadrants\ in\ which\ a\ particular\ species\ occured}{Total\ number\ of\ quadrants} \times 100$$

Weed density was quantified by counting the number of individuals belonging to a specific weed species within a defined area, as outlined by Travlos *et al*. [26], in the following manner:

$$Density = \frac{Number\ of\ individuals\ of\ a\ particular\ weed\ species\ occured\ in\ a\ quadrant}{Surface\ area\ of\ a\ quadrant}$$

The Shannon-Weaver diversity index [27] was determined to measure weed species diversity in the sesame farm. In ecological studies, richness or diversity is considered as the absolute number of species present in the population of interest [28]. The Shannon-Weaver diversity index was computed using *bio.index* function in the R software as follows:

$$H' = -\sum_{i=1}^{S} Pi\ (lnPi)$$

Where Pi represents the proportion of individuals attributed to the i^{th} species, and S denotes the overall number of species.

RESULT AND DISCUSSION

Disease Species, Incidence, and Severity

The survey findings revealed that in the surveyed areas, sesame crops were afflicted primarily by bacterial blight (*Xanthomonas campestris pv. sesami*), cercospora leaf spot (*Cercospora sesami*), and phyllody. Similarly, previous studies indicated that bacterial blight [5], Cercospora leaf spot [6], and phyllody [7] are the major diseases affecting sesame. Bacterial blight exhibited the highest mean disease incidence at 98.84%, followed by Cercospora leaf spot at 73.25%. Conversely, the occurrence of phyllody was relatively limited, recorded at 11.29% (Table 1). Assessment of disease severity on infected plants indicated that bacterial blight had a mean severity of 49.88%, while Cercospora leaf spot was recorded at 36.44%.

***Table 1**. Occurrence and mean severity index (%) of diseases observed in sesame fields of Kamashi and Assosa zones of Benishangul Gumuz region, Ethiopia, during 2017/18 cropping year.*

Disease	Incidence (%)	Percentage of severity index (%)
Bacterial blight	98.54	49.88
Cercospora leaf spot	73.25	36.44
Phyllody	11.29	-

Bacterial blight disease initially manifests as water-soaked spots on the undersurface of the leaf, progressing to the upper surface. These spots enlarge, becoming angular and delimited by veins, eventually turning dark brown (Fig. 1). Subsequently, multiple spots merge, forming irregular brown patches and leading to leaf desiccation. Waterlogging exacerbates bacterial blight spread and increase the crop's susceptibility to the disease. Early sowing, prior to disease epidemics, and the utilization of bacterial blight-resistant varieties such as Gida Ayana, Benishangul-1, and Abasena, adaptable to high rainfall regions, are recommended. Conversely, delayed sowing increases susceptibility, particularly at the seedling stage due to intensified rainfall and waterlogging. Moreover, employing clean seed and implementing crop rotation aids in bacterial blight control [16].

Cercospora leaf spot presents as light brown angular lesions with dark purple margins on sesame leaves (Fig. 1). Initially, lesions develop on leaves, expanding into round to irregular spots on both leaf surfaces. These spots coalesce, forming patches of various sizes, ultimately causing premature leaf shedding. Primary infection can arise from seeds and infected debris. Effective management of cercospora leaf spot includes crop rotation, early sowing, using clean seeds, and applying mancozeb.

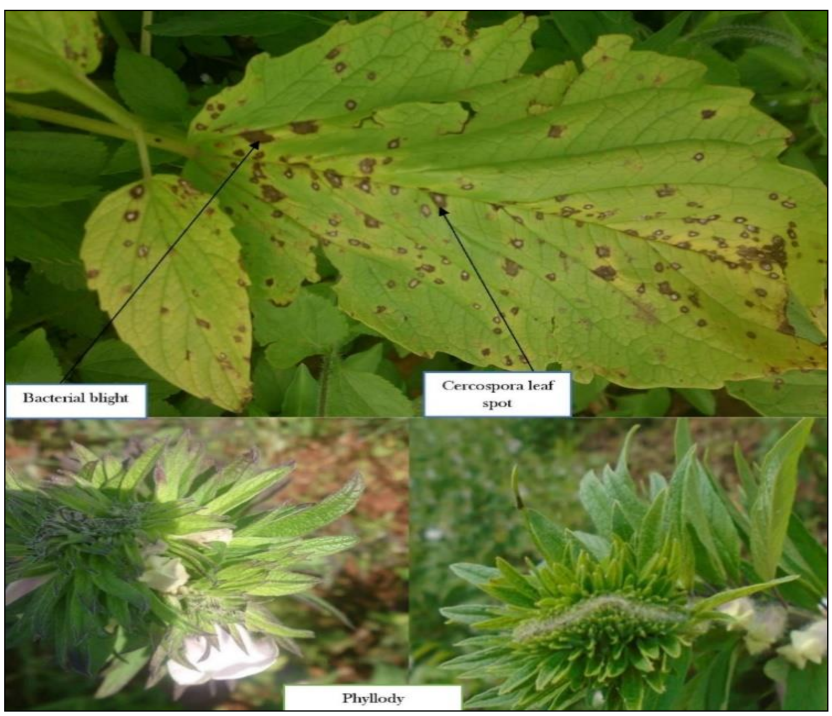

***Fig. 1.** Symptoms associated with bacterial blight, Cercospora leaf spot, and phyllody diseases observed on sesame plants during the survey.*

Conversely, phyllody induces leaf and flower deformation. Affected top portions exhibit shorter internodes, increased branching, and adopt a broom-like or bunchy appearance (Fig. 1). Plants infected with phyllody fail to produce capsules. If they do, these capsules are deformed and prematurely crack, resulting in shriveled seeds [16]. Controlling phyllody entails removing and incinerating infected plants, using seeds from phyllody-free fields, and applying insecticides against its vector, the jassid, to minimize spread.

The occurrence and severity of bacterial blight were notably higher in the Kamashi zone compared to Assosa, whereas the Cercospora leaf spot exhibited its highest incidence and severity in Assosa. Specifically, bacterial blight incidence rates were 99.91% in Kamashi and 95.56% in Assosa (Fig 2), with severity levels of 53.69% and 41.65%, respectively (Fig 3). The mean incidence of Cercospora leaf spot was 667.36% at Kamashi and 86.13% in Assosa (Fig 2), while severity indices were 33.84% and 42.13% in Kamashi and Assosa, respectively (Fig 3). Phyllody disease was confined to the Kamashi zone, with a mean incidence of 11.29%.

Bacterial blight, Cercospora leaf spot, and phyllody are prevalent diseases affecting sesame crops in Ethiopia. These diseases were prominent in West Gondar, Northwestern Ethiopia [17]. Bacterial blight and cercospora leaf spot predominantly afflict sesame in sesame-growing agroecology characterized by high humidity and abundant rainfall. In contrast, phyllody poses a significant threat in semi-arid sesame cultivation areas. The incidence and severity of bacterial blight vary depending on agroecological conditions, reaching up to 100% in Northwestern Ethiopia, where rainfall and humidity levels are high, and ranging from 10% to 50% in semi-arid areas such as Werer and Humera [16, 29].

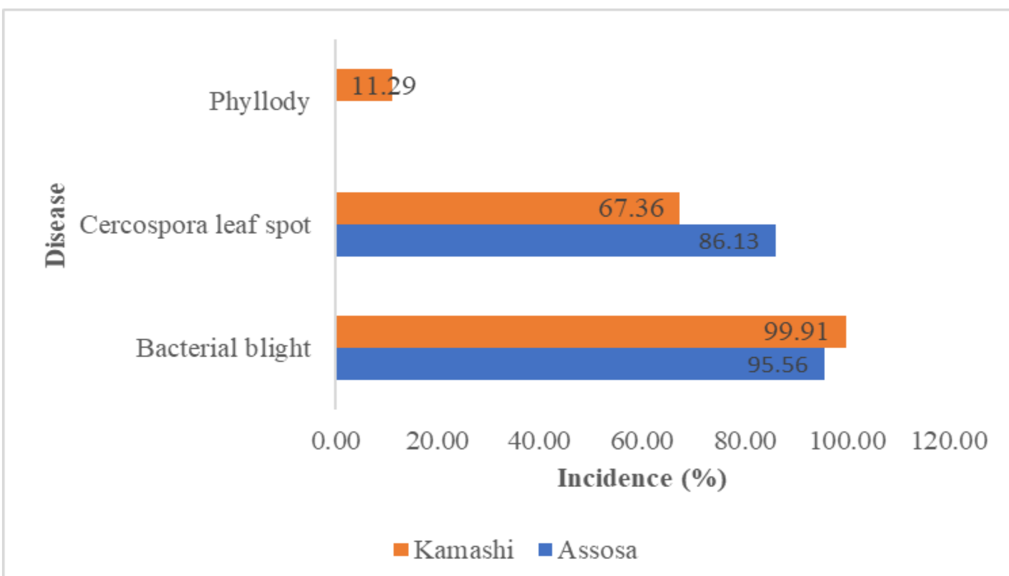

Fig. 2. *Disease incidence in sesame field of Kamashi and Assosa zones of Benishangul Gumuz region, Ethiopia*

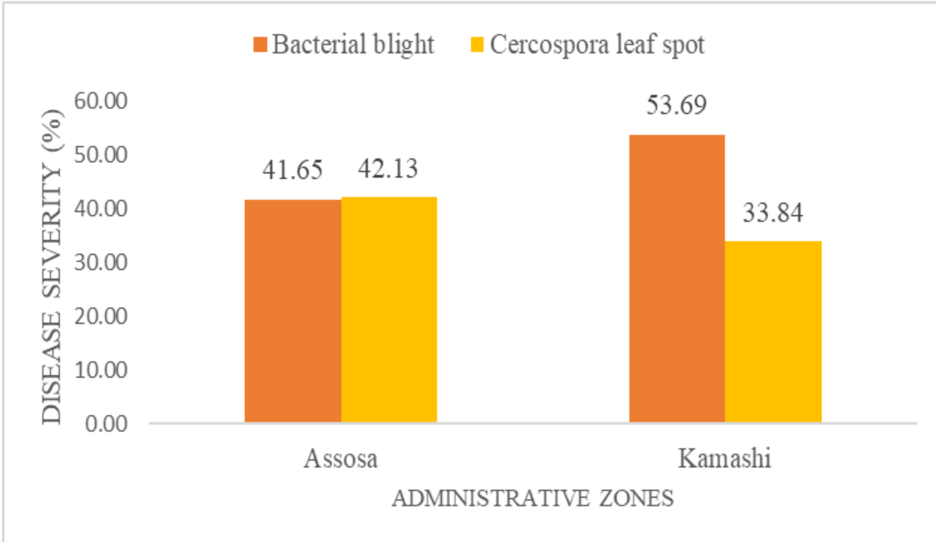

Fig. 3. *Severity of bacterial blight and cercospora leaf spot on sesame in Assosa and Kamashi zones of Benishangul Gumuz region, Ethiopia*

Insect Pest Species, Incidence, and Prevalence

The survey revealed that aphids, gall midge (*Asphondilia sesame*), and webworms (*Antigastra catalaunalis*) emerged as the primary insect pests in sesame fields across the study area. Aphids [16, 17], gall midge, and webworm [5, 6, 18] have been recognized as significant threats to sesame production. Throughout the survey, the mean incidence of aphids and gall midge was recorded at 13.76%, with a mean prevalence of 45.61% and 8.77%, respectively (Table 2). Conversely, the study identified a low mean incidence (1.00%) and prevalence (1.75%) for webworms in the study areas, suggesting that while aphids and gall midge demand priority attention in pest management strategies, webworm poses a lesser threat to sesame production. In some areas of Ethiopia, such as Humera, the prevalence of gall midge is alarming, reaching as high as 94% [31].

Table 2. *Insect pest species, their incidence and prevalence in sesame fields of Assosa and Kamashi zones of Benishangul Gumuz region, Ethiopia, during the 2017/18 cropping year.*

Insect pest	Incidence (%)	Prevalence (%)
Aphids	13.76	45.61
Gall midge	13.76	8.77
Webworm	1.00	1.75

However, our study reveals a different scenario regarding the incidence and prevalence of webworm compared to Kefale *et al*. [17], who documented the highest prevalence of webworm in North Gondar, Northwestern Ethiopia, possibly due to environmental variations. As depicted in Figure 4, aphids pose a significant threat by sucking on young shoots, leading to stunted growth and leaf curling. Moreover, aphids can directly harm sesame plants by transmitting viruses. On the other hand, Webworm larvae inflict damage on sesame plants from their seedling stage throughout subsequent growth phases [16], resulting in yield losses ranging from 25% to 42% [30]. Initially, these larvae feed on the epidermis of leaves (Fig. 4), progressing to capsules and buds [30]. The gall midge larvae hatch on flowers and buds, subsequently consuming the floral buds and developing capsules, ultimately forming galls [31], as depicted in Fig. 4.

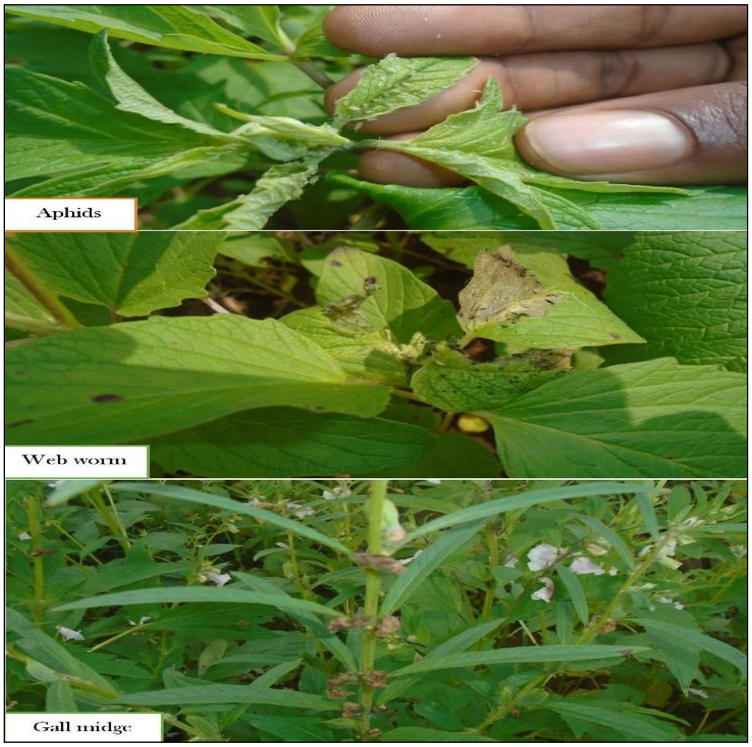

Fig. 4. *Depicting sesame plants infested by aphids, webworms, and gall midges in the Assosa and Kamashi zones of the Benishangul Gumuz region, Ethiopia.*

Gall midge infestations were observed solely in the Assosa zone, with a mean incidence of 42.50% (Fig. 5) and a prevalence of 23.8% (Fig. 6). Assosa zone experiences higher and more frequent rainfall compared to Kamashi, potentially creating conditions favorable for gall midge epidemics. Weather factors such as elevated relative humidity, frequent rainfall, and high temperatures promote the proliferation of gall midge outbreaks [31]. Moreover, our survey noted a higher frequency of gall midge occurrences in sesame fields sown later (after late June) than those sown earlier (late May to mid-June). Farmers in Kamashi tend to sow sesame earlier than those in Assosa, as the offset of rainfall starting from late September in Kamashi is conducive to harvesting. In contrast, rainfall continues until November in Assosa areas like Bambasi and Mao Komo districts. We observed a trend of complete yield loss in fields shown later due to gall midge damage. Aphids exhibited a slightly equivalent mean incidence at Kamashi (14.49%) and Assosa (11.83%), but aphid prevalence was highest in Kamashi (52.77%) compared to Assosa (33.33%). Aphids' infestation tends to escalate during dry seasons and infrequent rainfall patterns. The elevated prevalence of aphids in Kamashi compared to Assosa may be attributed to infrequent rainfall patterns in the Kamashi compared to the Assosa zone. In contrast, webworms were only recorded with low incidence (1.00%) and prevalence (2.77%) in the Kamashi zone.

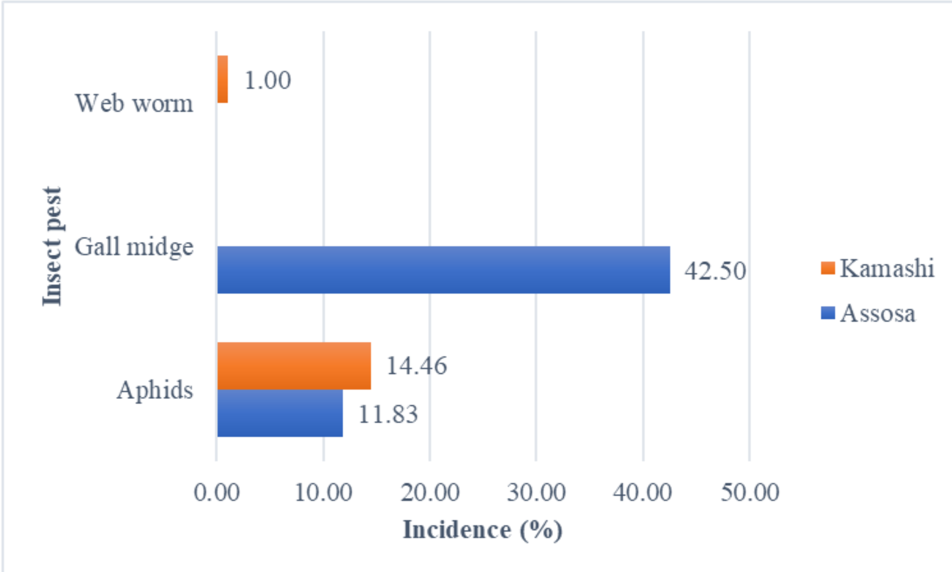

Fig. 5. *Incidence of insect pests in sesame fields at Assosa and Kamashi zones of Benishangul Gumuz, Ethiopia.*

Identifying insect pests and recognizing their economic significance is crucial for devising effective pest management strategies. Based on our survey findings, it has been determined that early sowing serves as an efficient measure to mitigate gall midge damage in the surveyed areas. However, the maturity period of cultivars must align with the appropriate harvest time for sesame. Therefore, we recommend early sowing of late-maturing varieties, such as Gida Ayana, Benishangul-1, and Abasena, with maturity periods ranging from 110 to 120 days. Additionally, to effectively control gall midge, we advocate for practices like crop rotation, intercropping with cereals, and applying systemic insecticides such as dimethoate, as suggested by Terefe *et al*. [16].

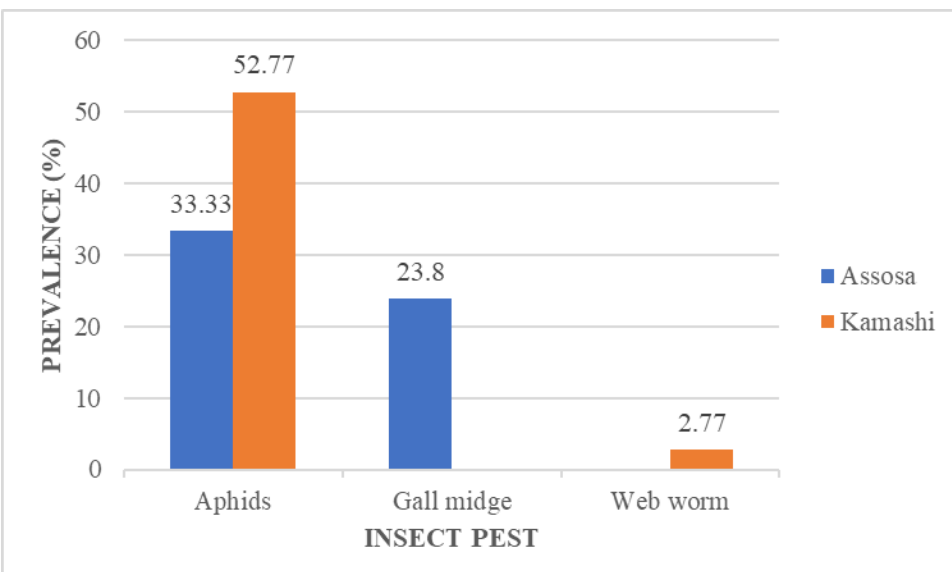

Fig. 6. *Prevalence of aphids, gall midge, and webworm in sesame fields of Assosa and Kamashi zones of Benishangul Gumuz, Ethiopia*

Weed Species, Abundance, and Diversity

The current survey identified eleven weed species belonging to eight different families (Table 3). Terefe *et al*. [16] reported the presence of 98 weed species from 31 families across various sesame growing areas in Ethiopia. It is crucial to identify the predominant weed species and grasp their abundance and distribution within specific agroecological contexts for effective weed management strategies. *Commelina benghalensis* was the most prevalent weed species, accounting for 38.48% of occurrences, followed by *Ageratum conyzoides* at 36.54% and *Leucas martinicensis* at 30.77%. On the other hand, *Ipomoea eriocarpa* and *Sonchus arvensis* were less commonly found, each representing 7.69% of field proportions. Consequently, the survey highlights five weed species, ranging in field frequency from 28.85% to 38.48%, showing substantial distribution in the surveyed area. Regarding taxonomic classification, the Asteraceae family comprised three weed species, while the Amaranthaceae family had two. Except for *Cyperus rotundus*, classified as a sedge, the remaining ten weed species exhibited broadleaf morphology.

Table 3. *Weed species and their abundance in sesame fields at Kamashi and Assosa zones, Benishangul Gumuz region, Ethiopia.*

Scientific name	Common name	Family	Morphology	Frequency (%)	Density/m^2
Commelina benghalensis	Benghal dayflower	Commelinaceae	Broadleaf	38.46	49.23
Ageratum conyzoides	Ageratum	Asteraceae	Broadleaf	36.54	172.31
Leucas martinicensis	Cobbin weed	Lamiaceae	Broadleaf	30.77	91.69
Celosia trigyna	Wool flower	Amaranthaceae	Broadleaf	28.85	129.23
Euphorbia heterophylla	Mexican fireplant	Euphorbiaceae	Broadleaf	28.85	20.62
Guizotia scarba	Me'ch'i (Amharic)	Asteraceae	Broadleaf	28.85	94.46
Corchorus trilocularis	Wild jute	Malvaceae	Broadleaf	19.23	116.92
Cyperus rotundus	Nutsedge	Cyperaceae	Sedges	17.31	58.46
Amaranthus spp.	Pigweed	Amaranthaceae	Broadleaf	15.38	34.15
Ipomoea eriocarpa	Morning glory	Convolvulaceae	Broad leaf	7.69	1.85
Sonchus arvensis	Field milk thistle	Asteraceae	Broad leaf	7.69	12.31

Abundance is a metric for assessing the population size or occurrence frequency of organisms within a specific area [25]. Among the various methods available for measuring abundance, frequency, and density are the most straightforward and widely used. Proper sampling techniques are crucial for obtaining reliable data. Frequency, which denotes the proportion of sampling units containing a particular species, can effectively illustrate the spatial distribution of that species within the surveyed region [25]. Conversely, density quantifies the number of individuals per unit area.

In this study, weed species, such as *Ageratum conyzoides*, *Celosia trigyna*, *Corchorus trilocularis*, *Guizotia scaraba*, *Leucas martinicensis*, *Cyperus rotundus*, and *Commelina benghalensis* were observed in the highest numbers, ranging from 49.23 to 172.31 per square meter. Conversely, species such as Ipomoea eriocarpa, *Sonchus arvensis*, *Euphorbia heterophylla*, and Amaranthus spp. exhibited relatively low densities, ranging from 1.85 to 34.15 per square meter. Effective weed management strategies rely on comprehensively understanding the weed species' characteristics and morphology. Broadleaf weed species, characterized by rapid growth and expansive canopies, pose significant competition and early-stage damage potential to crops such as sesame. Consequently, in regions with high rainfall, like Benishangul Gumuz, early hand weeding post-crop emergence is recommended to mitigate weed-related risks.

Analysis using Shannon-Weaner indices indicates a diverse array of weed species, with *Ageratum conyzoides* showing the highest dominance, followed by *Celosia trigyna* and *Corchorus trilocularis* (Table 4). Species richness, denoting the number of species present, stands in contrast to evenness, which assesses whether a particular weed species dominates the community or if species are more uniformly represented with similar numbers of individuals [25].

The diversity of weed species can intensify competition for vital resources like water, nutrients, and sunlight. Left unmanaged, s competition could negatively affect crop growth and yield. Moreover, a greater diversity of weed species may enhance the risk of pest and disease proliferation, exacerbating challenges in crop management. Weeds can serve as alternative hosts for insect pests and pathogens, providing a continuous source of inoculum or breeding sites for these organisms [32]. This can lead to increased pest and disease pressure on crops. Higher weed species diversity implies that integrated weed management (IWM) practices could yield more effective results. IWM strategies, which combine cultural, mechanical, biological, and chemical control methods, can address the complexity of diverse weed populations more sustainably and effectively [33]. Although weed species diversity in crop fields may pose challenges for crop management, it also presents potential benefits such as providing ecosystem services, aiding resistance management, and contributing to biodiversity conservation. Effective weed management strategies should balance these factors to optimize crop production while concurrently promoting environmental sustainability.

Table 4. *Weed diversity in sesame fields at Kamashi and Assosa zones, Benishangul Gumuz region, Ethiopia*

Scientific name	Common name	Family	Pi	$\ln Pi$	$Pi\ (lnPi)$
Commelina benghalensis	Benghal dayflower	Commelinaceae	0.06	-2.76	-0.17
Ageratum conyzoides	Ageratum	Asteraceae	0.22	-1.51	-0.33
Leucas martinicensis	Cobbin weed	Lamiaceae	0.12	-2.14	-0.25
Celosia trigyna	Wool flower	Amaranthaceae	0.17	-1.80	-0.30
Euphorbia heterophylla	Mexican fireplant	Euphorbiaceae	0.03	-3.63	-0.10
Guizotia scarba	Me'ch'i (Amharic)	Asteraceae	0.12	-2.11	-0.26
Corchorus trilocularis	Wild jute	Malvaceae	0.15	-1.90	-0.28
Cyperus rotundus	Nutsedge	Cyperaceae	0.07	-2.59	-0.19
Amaranthus spp.	Pigweed	Amaranthaceae	0.04	-3.13	-0.14
Ipomoea eriocarpa	Morning glory	Convolvulaceae	0.00	-6.05	-0.01
Sonchus arvensis	Field milk thistle	Asteraceae	0.02	-4.15	-0.07
	$\sum_{i=1}^{S} Pi\ (lnPi)$				-2.10
	H				2.10

H = Shannon-Weaner diversity, Pi = the proportion of individuals belonging to the ith species, and S is the total number of species

CONCLUSION

The survey findings highlight that bacterial blight, Cercospora leaf spot, and phyllody are major diseases of sesame in the surveyed areas, with bacterial blight exhibiting the highest incidence and severity. Appropriate sowing time, use of bacterial blight-resistant varieties, clean seeds, and crop rotation could mitigate yield loss in sesame due to diseases. Regarding insect pests, the survey findings underscore the significant threat posed by aphids and gall midge, which demand priority attention in pest management strategies due to their higher incidence and prevalence. In contrast, webworms pose a lesser threat in the surveyed areas. Early sowing with appropriate varieties can mitigate gall midge damage, with recommendations for crop rotation and intercropping. Furthermore, the current survey identified eleven weed species belonging to eight different families, 10 of them representing broadleaf weeds. Broadleaf weed species, characterized by rapid growth and expansive canopies, pose significant competition and early-stage damage potential to sesame, suggesting implementing management practices at an early stage.

Various pests significantly impact sesame production globally and in Ethiopia. The present survey provides insights into the need for tailored pest management approaches based on agroecological conditions and pest dynamics. Effective management strategies, including integrated pest management practices, are essential to mitigate these threats and ensure sustainable sesame production.

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