Advances in Bioscience and Bioengineering
2023; 11(4): 90-94
http://www.sciencepublishinggroup.com/j/abb
doi: 10.11648/j.abb.20231104.12
ISSN: 2330-4154 (Print); ISSN: 2330-4162 (Online)

Diversity and Distribution of Cereal Weed Species in Highland of Guji, Southern Ethiopia

Seyoum Alemu*, Yared Tesfaye, Kabna Asefa

Bore Agricultural Research Center, Bore, Ethiopia

Email address:
seyoum23@gmail.com (Seyoum Alemu)

*Corresponding author

To cite this article:
Seyoum Alemu, Yared Tesfaye, Kabna Asefa. (2023). Diversity and Distribution of Cereal Weed Species in Highland of Guji, Southern Ethiopia. *Advances in Bioscience and Bioengineering*, *11*(4), 90-94. https://doi.org/10.11648/j.abb.20231104.12

Received: November 20, 2023; **Accepted**: December 9, 2023; **Published**: December 22, 2023

Abstract: A weed survey was carried out during the primary cropping seasons of two consecutive years in the Highland of Guji zone, Southern Oromia, to assess the distribution and relevance of weeds in cereal crops and to investigate the most common weed flora in cereal crops. Three agro-ecologically representative districts provided the data for this survey. In total, 180 fields were evaluated during this study from four kebele chosen from each area. Quantitative and descriptive approaches were used to test the collected data. The result was the identification of 42 different weed species from 18 different plant groups. The survey revealed that the families with the highest number were Rubiaceae, Polygonaceae, Compositae, and Gramineae. Galansoga Palviflora, Guizotia Scabra, Tagetes minuta L, Snowden Polistachia, Avena fatua, Bromus pectinatus Thunb, Phalaris paradoxa L, Setaria pumila, Digitaria abyssinica, Bidens pilosa L, Bidense pachloma, Parthinium hystrophorus L., Polygonum Nepalense, Oxygonum sinuatum, Rumex abyssinica, Andropogon Abyssinicus, Lauracaea Cornuta, Galium Sporium were the most prevalent species were Galansoga Palviflora (Hochst. Ex A. Rich) Stapf (68%) and Snowden Polistachia (51%). Furthermore, Galansoga Palviflora was regarded as the worst weed by the majority of farmers (90%) in high land districts, whereas Snowden Polistachia was listed as an important weed. These two weeds were also discovered to be the most prevalent, frequent, and abundant weed species in the highland agro-ecologies of the Guji Zone, according to the data gathered. However, in both the Mid land and Low land agro-ecologies of the Guji Zone, Setaria Verticillata (L.) and Setaria Pumila were found to be the most common, frequent, and dominant weed species of cereal crops. In conclusion, this study would offer fundamental details about the prevalence of cereal crop weeds in highland agro ecologies in the Guji Zone, which might used as the basis for further weed research and weed management studies.

Keywords: Cereal Crops, Frequency, Abundance, Dominance, Weeds

1. Introduction

Numerous biotic and abiotic variables severely impede cereal crop production in Ethiopia. Weed occupies a significant share of biotic factors. Weeds are a type of plant that interfere with human goals and needs and significantly reduce crop yields by competing for scarce natural resources including plant nutrients, soil moisture, light, and space, especially in locations where continuous monoculture is practiced. Weeds not only harm crops directly, but they can also host pathogens, pest insects, rodents, and wild animals. Weeds are one of the biggest obstacles to effective crop production since they devastate agricultural lands more economically than all other pests combined [1].

In addition to promoting disease issues, weed infestations slow down crop harvesting, raise production costs, lower crop market value, and raise the risk of fire in plantations, forest reserves, and perennial crops. They also act as a substitute host for harmful insects and diseases [2].

Due to the fact that weeds are thought to result in a yield loss of even though the precise amount of production loss is unknown, it has been noted that this insect is likely to cause significant loss in the majority of Ethiopian regions where crops are produced extensively [3]. The issue is also particularly important in the nation's high land agro-ecologies. This can be because it frequently rains heavily during the

growth seasons for crops. Under these circumstances, favorable conditions will be established for the growth and spread of various weed species, which will then compete with the crops that are scheduled to be cultivated [2, 4]. Because it is difficult and time-consuming to properly prepare the land before sowing and manage it after sowing. As a result, each weed population in an agricultural field is typically caused by Weed control techniques change depending on the type of weeds, when they arise, what crops are being grown and etc [5-8]. Therefore, it is essential to identify weeds in particular crops before implementing management measures [9-11]. As a result, several weed species are present throughout the nation's various agro-ecological areas. Therefore, it's crucial to recognize significant weed species that are present in particular areas. Because understanding the makeup of the weed community plays a key role in weed management and is crucial in determining the top objectives for both weed management and research. In light of this, the current survey was carried out to talk about the following. goals: (i) to determine the weed species distribution in cereal crops; and (ii) to assess and identify the dominance, frequency, and abundance of cereal weeds.

2. Materials and Methods

2.1. Description of the Study Area

The survey was conducted over a two-year period during the main cropping season in 2014–2015 in high land agro-ecologies in Guji Zone, Southern Oromia. Guji zone is 385 kilometers to the south of Addis Abeba, at an altitude of 600 to 2700 meters above sea level. Geographically, the Zone is surrounded by the Sidama administrative zone to the north, the Bale administrative zone to the south-east, the Somali Regional state to the south, and the Borena administrative zone to the west. It is located at 05 39'59".99 North latitude and 39 0 00'0".00 East longitude. Guji Zone is divided into thirty rural and two urban districts, with a total area of 35,454 km2 and housing more than 1.6 million people (Zonal statistics). Approximately 68% of the Zone's climate is classified as Kola, followed by 19% Weina Dega and 13% Dega. The Zone experiences 500–1750 mm of rain annually, with maximum and minimum temperatures of 30.5°C and 10.5°C, respectively. A sizable amount of the Zone's economy, when combined with other sectors, is devoted to agriculture.

2.2. Survey Methodology

Low altitude (1600 m.a.s.l), medium altitude (1600–1900 m.a.s.l), and high altitude (>1900 m.a.s.l) districts were chosen for this survey using a stratified sample method based on elevations, a categorization that is frequently employed in relation to the potential of cereal crop produced in the zone. As a result, two districts from highland agro-ecology were chosen. Bore and Anna Sora were consequently chosen from highland districts. Four Kebeles were deliberately chosen from the chosen districts. Then, at each 5-kilometer car speedometer, cereal agricultural areas were chosen based on accessibility (near to road) and size. Three to five 0.5 m × 0.5 m quadrants were employed in each field, arranged in an inverted "W" designs [17]. The species area curve and site characteristics were used to calculate the number of samples per hectare [12-14, 16]. The initial quadrate sample was obtained by means of the protocol of [13], where the surveyor walks 50 paces around the field's border, makes a right turn, enters the field, throws a quadrant, and begins collecting samples. Percentage cover is the amount of ground that is covered by the vertical projection of above-ground plant components.

The main environmental factors and farming practices that are believed to affect the overall weed flora and the cereal crop specifically in each field were observed (soil type, topography, crop type), measured (altitude), conducted farmer interviews (number of ploughings prior to planting, month of planting, fertilizer use, number of weedings prior to the survey date), and secondary sources (rainfall, administrative zone). Environmental and agricultural management variables of nominal type, such as administrative zone, soil type, topography, crop type, and fertilizer use, were converted into binary dummy variables. These variables take on the value 0 if a field does not belong to the category or 1 if it does. The quantitative variables that were measured on this scale were altitude, rainfall, the quantity of weeds to be pulled, the planting month, and the number of ploughings.

2.3. Interviews with Farmers

Fifteen queries concerning weeds in general, weed control in particular, and the cereal crop in particular was posed to the farmers. Only a portion (n = 148) of the farmers whose fields had been surveyed were questioned because the answers tended to be fairly similar within each community. The following five questions led to the responses that are being published here: 'List and rank the major weeds you encounter in your field', 'Are you aware of weed in cereal crop?', 'How and when do you think observed weed was introduced to this area?', 'In which place is most problematic: cultivated land, grazing area, forest, or other (specify)?' and 'List beneficial uses of observed weed (if any) in order of importance' are some of the questions you may be asked. Thus they put weed the second problem next to rust diseases in the highlands of the zone. This is because of high rain fall in the area.

2.4. Data Analysis or Data Analysis Methods

The information on weed species was compiled using:

a. Frequency: As a percentage of all fields examined, the number of fields containing a species is indicated.

b. Abundance: $A = \sum W/N$

Where, A = abundance, W = number of individuals of a weed species, N = Sample number

c. Dominance: $D = A/\sum Ax100$

Where, D = dominance, ∑A = total abundance of all species and

d. Field uniformity: the percentage of total samples that fall into each sampling quadrant where a species was found in a field.

3. Results and Discussion

A total of 10 Pa's and two districts that were grouped under highland agro-ecologies were examined for this study. During the investigation, 100 fields from all Pa's were evaluated (Table 1). From the highland agro-ecologies of the Guji zone, a total of 42 weed species from seven different plant families were identified. Rubiaceae (4.79%) and Polygonaceae (4.62%) were the most prevalent weed families, while Gramineae (43.86%) and Compositae (33.84) were the most dominant weed families (Table 1). These families were also reported by different authors as they are economically important and common in different parts of the country [3, 8, 9]. However, based on the quantity, regularity, and homogeneity of the weed species in the field, various weed species were recognized at each agro-ecology. From high land agro-ecology, about 20 weed species with dominance ranges of 1.8-17.58, frequency 6-80, abundance 3-29.3, and field uniformity of 9-43 were found (Table 1). Accordingly, the most prevalent, frequent, and abundant weed species found at high land agro-ecologies of the Guji zone were Galisonga Palviflora, Snowden Polistachia, Avena fatua, and Phalaris paradoxa L (Table 1). It was also discovered throughout the survey that all of these weeds had a significant impact on the output of grain crops. Farmers who were interviewed further stated that because of the convalescing nature of the weed species toward the management techniques implemented, all of these weeds are considerably reducing yield and are beyond their capacity to control. Farmers said that the region's climate played a significant role in the development of bad management methods. It was difficult for them to complete land preparation on time and carry out its management operations appropriately because the area was known for having continual rain during the growing season. It was discovered that the majority of the fields were not successfully managed, from bug control to ground preparation, based on the farmers' instructions. Two distinct strategies of observing farmers' weed management methods were used. Hand weeding was the main method of weed control in 85% of the fields that we studied. The bulk of the fields showed evidence of 1-2 manual weeding operations. A few cases of fields being unweeded were also recorded. Less than 15% of the evaluated fields, however, were managed with inefficient and advised herbicide packages.

Table 1. *Major identified weed species in field of cereal crop in high lands of Guji Zone, Southern Oromia and their quantitative measures over two years consecutive cropping season.*

Botanical name	Local name	Family	Frequency	Abundance	dominancy	Field uniformity	Life form
Galansoga Palviflora	Darachesa	Compositae	80	29.3	17.58	43	Broad laeved
Snowden Polistachia	Mujjaa	Gramineae	67	28	16.79	42	Annual grass
Avena fatua,	Jigidaa	Gramineae	64	13.8	8.29	39	Annual grass
Phalaris paradoxa L	Asandaaboo	Gramineae	61	10.7	6.42	37	Annual grass
Bromus pectinatus	Gishee	Gramineae	43	9.8	5.88	37	Annual grass
Polygonum Nepalense	Abbaadabboo	Polygonaceae	60	9.7	5.82	28	Broad laeved
Pennisetum polystachion (L.) Schult.	-	Gramineae	19	3.2	1.92	28	Annual grass
Pennisetum clandestinum Hochst.ex chiov.	-	Gramineae	28	4.6	2.76	28	Annual grass
Guizotia Scabra (vis.) chiov	Hadaa	Compositae	39	7.7	4.62	27	Broad laeved
Galium Sporium	Ashkiti (maxxannee)	Rubiaceae	52	8	4.79	23	Broad laeved
Bidens pilosa L	Qaqqabataa	Compositae	50	8.2	4.92	23	Broad laeved
Erucastrum arabicum Fisch & Mey	Zaroo	Cruciferae	49	8.8	5.28	21	Broad laeved
Rumex abyssinica	Shaabee	Polygonaceae	20	4.4	2.64	18	Broad laeved
Bidense pachloma	Abaaboo birraa	Compositae	19	3.1	1.86	17	Broad laeved
Cynodon dactylon (L.) Pers.	Saardoo		19	3.6	2.16	17	Annual grass
Tagetes minuta L.	Ajoo	Compositae	18	7.5	4.5	17	Broad laeved
*Oxygonum sinuatum (*Meisn.) dammer		polygonaceae	12	3.3	1.98	12	Broad laeved
Lolium temulentum L.	Inkirdaada	Gramineae	6	3	1.8	9	Annual grass

Farmers were using a variety of management techniques, but it was found that the weed was not being properly controlled. This might be the result of various things. One of the main challenges to effectively controlling weeds in fields is the systematic behavior of some problematic weed species toward any management measures. The majority of the highland fields that were analyzed had significant snoden polistachia and guizotia scabra weed damage. Additionally, it was noted by farmers that these weed species were significantly impacting their crops and were out of their

control. Some of the fields that were observed had more weeds than intended crops. From this situation, it was determined that an active season for weed emergence and expansion might be caused by lack of timely and frequent proper land preparation, the use of weed-free planting materials (a source of seeds used to control weed movement to unreached fields), the lack of a scheduled cereal crop rotation with other recommended crops (to avoid source of the pest's inoculums), and improper timing of planting. Another element seen in the majority of the fields studied is proper management practices (time spent managing weeds based on appearance and weed species, methods of managing weeds utilized for different types of weed species, etc.). In general, the emergence and spread of various destructive weed species to the area are mostly caused by the absence of appropriate weed control strategies in the highland agro-ecology of the Guji Zone. With a few exceptions, most farmers were physically managing their fields (weeding by hand) for a variety of reasons. Because they believed that the use of herbicides in crop production was expensive, that the herbicides were ineffective, that the herbicides had a negative impact on the environment and animals, and that even the grain generated by the herbicides was bad for feed. So, in order to increase cereal crops' productivity and profitability in the highland agro-ecology of the Guji Zone, the responsible body must pay close attention to weed control methods by changing farmers' attitudes toward using suggested herbicides as well as providing the herbicides.

4. Conclusions

Weed control has a significant role in crop yield. Cereal crops in particular are quite effective against many weed types. The most crucial strategy for any intervention to be developed with relation to weed management is to identify the most troublesome weed species in a particular area in order to provide producers with effective weed management alternatives. As a result, utilizing various quantitative criteria and factors that contribute to their prevalence, this study was also undertaken to identify the most troublesome cereal weeds found at various agro-ecologies of the Guji Zone. The Guji Zone's most prevalent and problematic weed species were ranked through this survey study of small-scale farms in various agro-ecologies. In terms of frequency, abundance, and dominance, changes in weed flora composition were found between soil types, crop kinds, and geographic locations in the highlands agro-ecologies. Accordingly, the most prevalent weed species from high land agro ecology were determined to be Galansoga Palviflora and Snowden Polistachia. inadequate land preparation (frequency and time), the use of subpar seeds, the absence of crop rotation, a lack of knowledge regarding the significance of Managing weeds using suggested pesticides, the type of sowing (broadcasting), the lack of accessibility, and the price and compatibility of herbicides were all noted as major contributors to the occurrence and spread of weed species found in the research region. As a result, this study has produced some first data on the taxonomy of weeds in the Guji Zone, which will serve as the foundation for future research and management strategy implementation.

Acknowledgments

Our special thanks go to Bore Agricultural Research Center (BoARC) for providing fund of the research. We also thank all cereal team members for assisting in the field work and data collection

Conflicts of Interest

The authors declare there are no conflicts of interest.

References

[1] Roy, R. N., Finck, A., Blair, G. J. and Tandon, H. L. S., 2006. Plant nutrition for food security. *A guide for integrated nutrient management. FAO Fertilizer and Plant Nutrition Bulletin*, *16*(368).

[2] Patil Vishwas S. and Jadhav Prakash S., 2013. A Survey of Weed Flora in Crop Fields of Satara Tahsil (M.S.), India. Universal Journal of Environmental Research and Technology. Vol 3(2): 233-241.

[3] Tena E, Hiwet AG, Dejene M. 2012. Quantitative and Qualitative Determination of Weeds in Cotton-Growing Areas of Humera and Metema, Northwestern Ethiopia. Ethiop J Appl Sci Technol 3(1): 57- 69.

[4] STROUD A&PARKER C. 1989. A Weed Identi®cation Guide for Ethiopia. Food and Agriculture Organization of the United Nations, Rome, Italy.

[5] Takim FO, Amodu AA. 2013. Quantitative Estimate of Weeds of Sugarcane (*Saccharum Officinarum L.*) Crop In Ilorin, Southern Guinea Savanna of Nigeria. Ethiopian Journal of Environmental Studies and Management 6 (6): 611-619.

[6] Gidesa A, Tadesse T, Dabi A. 2016. Quantitative Determination of Weed Occurrence on Upland Rice of Bambasi, Ethiopia. Ecology and Evolutionary Biology 1(3): 53-56.

[7] Albrecht H. 1995. Changes in arable weed flora of Germany during the last five decades. 9 EWRS Symp. Budapest 1: 41-48.

[8] Mennan H, Isik D. 2003 Invasive weed species in onion production systems during the last 25 years in Amasya, Turkey. Pak J Bot 35(2): 155-160.

[9] Roger N, Micheal DK Owen, Swanton CJ. 2015. Weed Abundance, Distribution, Diversity, and Community Analyses. Weed Science 63: 64-90.

[10] Himalaya Subedi, 2013. Wheat Weed Identification and Management under Cereal Production System Nepal. *Journal of Sustainable Society* Vol. 2(3), 74-85 DOI: 10.11634/216825851302470.

[11] Kropff MJ, Spitters CJJ. 1991. A simple model of crop loss by weed competition from early observation on relative area of the weed. Weed Res 31: 97-105.

[12] Belachew K, Tessema T. 2015. Assessment of Weed Flora Composition in Parthenium (*Parthenium hysterophorus L*.) Infested Area of East Shewa Zone, Ethiopia. Malaysian Journal of Medical and Biological Research 2: 63-70.

[13] Pohlan J. 1984. Arable farming, 3/4 Weed control. Institute of tropical Agriculture, Plant protection section, Germany.

[14] Kevine V, Mccully M, Sampson G, Watson. 1991. Weed Survey of Nova Scotia Lobush Blueberry (*Vacinum angustifolium*). Weed Science 39(2): 180-185.

[15] Taye T, Yohannes T. 1998. Qualitative and quantitative determination of weeds in tef in west Shewa zone. In: Reda F, Tanner DG (Eds.), Arem. Addis Ababa, Ethiopia, 4: 46-60.

[16] Arpana M (2013). Parthenium hysterophorus: A noxious weed for plant diversity. International Journal of Scientific Research 2(9): 2277-8179.

[17] Thomas AG (1985) Weed survey system used in Saskatchewan for cereals and oilseed crops. Weed Sci 33(1): 34-43.