Assessment of Weed Flora Composition in Arable Fields of Bench Maji, Keffa and Sheka Zones, South West Ethiopia

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Abstract

Assessment of Weed Flora Composition on of weeds in arable fields were conducted in Bench Maji, Kef a and Sheka Zones, South West Ethiopia, during 2017 main and sub cropping seasons. The study was initiated to determine the weed flora, prevalence and distribution of weeds in the major crop fields. The result showed a total of one hundred thirty five weed species that were collected and recorded in 135 genera and 35 families. Poaceae (20), Asteraceae (21), Fabaceae (12) and Polygonaceae (7) were by far the richest taxa and accounted together (44.5 %) of the entire flora of the study area. The most frequent, abundant and dominant weed species were Amaranthus graecizans L. Mimosa invisa, Amaranthus hybridus L. and Cynodon dactylon L. The average values for frequency and dominance of weed species in arable fields ranged between 7-87 % and 0.04 to 2.4 %, respectively. Similarity indices of weed communities in different locations were also determined to be >60 % across all locations sampled.

Keywords: Flora composition; Qualitative; Quantitative; Similarity index; Weed communities

Introduction

Weeds compete with cultivated food crops for limited resources such as water, nutrients and light [1-3]. Weeds infestation also encourage disease problems, serve as alternate host for deleterious insects and diseases, slow down harvesting operation, increase the cost of production, reduce the market value of crops and increase the risk of fire in perennial crops, plantation and forest reserves [4].

The nature of crop, cultural practices and cropping pattern or system, soil type, moisture availability, location and season have been reported to cause variation in the abundance or distribution of weed species that are found in a cropped field [4,5]. Density of single or many weed species can change depending on factors such as seed purity, choice of crops, rotations, sowing time and techniques, soil management, harvest time, fertilizing, chemical and mechanical weed control methods during a long period [3,6-8].

Therefore, survey of weed flora composition, distribution and intensity is essential for a comprehensive understanding of the weed problem that poses negative impacts on crop production in a given area. Such assessment of the nature of weed flora determines, to a large extent, the type of weed management measures to be adopted. To design effective weed control measures, identification, characterization, and quantification of weed species in a certain area are important steps to be followed. Information on weed density, distribution, and species composition may help to predict yield losses and such information helps in deciding whether it is economical to control a specific weed problem [9,10]. There is no detailed information available about the amount of crop yield losses due to weeds in Ethiopia. Furthermore, the relative importance of common weed species in the major crops and cropping systems is not well documented [11], especially in south western Ethiopia. Hence, this study was initiated to determine the weed flora, prevalence and distribution of weeds in the major crops of Bench Maji, Kef a and Sheka zones.

Materials and Methods

Description of the study areas

The study was conducted in selected Districts of Bench Maji (Guraferda, Menit Shasha, Menit Goldya, Semen Bench and Shey Bench) Kef a (Bita, Bonga Zuria, Chena, Ginbo and Decha) and Sheka (Andracha and Yeki) Zones in Southern Nations Nationalities and Peoples Region (SNNPRs) (Figure 1).
Bench Maji is one of the Zones of the Ethiopian Southern Nations, Nationalities, and Peoples’ Region (SNNPR). Bench Maji is bordered on the south by the Ilemi Triangle, on the west by South Sudan, on the northwest by the Gambela Region, on the north by Sheka, on the northeast by Keffa, and on the east by Debub Omo. The administrative center of Bench Maji is Mizan Teferi; other towns include Maji. Bench Magi Zone is in SNNPRS and located at latitude from 5°.33” to 7°.21”N and longitudes from 34°.88” to 36°.14”E with an elevation ranging from 1200 to 1959 meters above sea level. The area receives mean annual rainfall ranging from 1500 to 1800mm (an average 1692mm) per year and has 15 °C to 27 °C range of temperature annually and the soil is loam or silty-loam soil type. The main food crops in this Zone include maize, godere (taro root), and enset, while sorghum, teff, wheat and barley are cultivated to a significant extent. Cash crops include fruits (bananas, pineapples, oranges) and spices (e.g. coriander and ginger). However, coffee is the primary cash crop.

Keffa: Keffa is a Zone in the Ethiopian Southern Nations, Nationalities, and Peoples’ Region (SNNPR). Keffa is bordered on the south by Debub Omo, on the southwest by Bench Maji, on the west by Sheka, on the north by the Oromia Region, and on the east by Konta. The administrative center of Keffa is Bonga.

Sheka: Sheka is a Zone in the Ethiopian Southern Nations, Nationalities and Peoples’ Region (SNNPR). Sheka is bordered on the south by Bench Maji, on the west by the Gambela Region, on the north by the Oromia Region, and on the east by Keffa. The administrative center of Sheka is Masha. Sheka Zone, lies between 7°24” to 7°52” N, 35°13” to 35°35” E and 900 to 2700m asl. The zone covers about 2175.25km2, out of which 47% is covered by forest, and 56, 24 and 20% is a highland, a mid altitude and lowland, respectively. It receives high amounts of rainfall, with an average between 1800 to 2200mm per annum. The major crops grown in the zone are maize, sorghum, millet, beans, coffee, ginger, turmeric, enset, wheat, barley and pea. The zone is divided into three administrative woredas” (districts), namely Yeki, Anderacha and Masha.

Data collection

A survey of the weed flora in major crop fields in South Western Ethiopia was carried out during the rainy season from February to April and July to October 2016. One hundred eighty crop fields were surveyed. Representative districts within each zone were selected, then representative peasant associations within each district, villages within association, and farmers within villages. Third, fields were selected regardless of size, and on the grounds of accessibility (adjacent to road) and whether it carried the required crop or crop combination.

In each field, 4m² quadrats were used following an inverted W pattern [12]. In each field, a pattern of an inverted W [12] was followed continuously for every 2.5 to 3 hectares. The numbers of samples per hectare was determined by the species area curve and site condition [13]. The first quadrate sample was taken following the procedure of [14], where the surveyor walks 50 paces along the edge of the field, turns right angle, walks 50 paces into the field, throws quadrant, and starts taking sample. A preliminary species versus area analysis were suggested the sample size to be appropriate to detect almost all of the weed species in the small fields. Percentage cover (the ground area covered by the vertical projection of above-ground plant parts) was estimated by eye for each of the weed species in each quadrat.

Specimens of all plant species encountered in sampling areas were collected, tagged and pressed in the field using a newspaper and herbarium presser. Field notes were documented the colour of the flower, fruit, fragrance or any special features of the plants collected. When the plant specimens are completely dry, they were mounted on herbarium sheet of 16.5”×11” using glue, and

Figure 1

1 - Sheka Zone
2 - Keffa Zone
3 - Bench-Maji Zone
SNNPR - Southern Nations, Nationalities and Peoples Regional State
labeled. Plant specimens in the field were identified using the available plant identification guides. Identification in the field was based on weed identification guides [11,15]. Those species that were difficult to identify in the field was tagged, pressed, and sent to the National herbarium of Addis Ababa University. Nomenclature followed flora of Ethiopia and Eritrea, volumes 2, 3, 4, 6, and 7 [16-18].

**Data Analysis**

The data on weed species were summarized using the formula described by [19] as depicted below.

**Frequency (constancy):** Is the percentage of sampling plots (vegetation registrations) on which a particular weed species is found. It explains as how often a weed species occurs in the survey area. Frequency is calculated for all weed species as follows:

\[ F = \frac{100 \times X}{N} \]

Where, \( F \) = frequency; \( X \) = number of occurrences of a weed species; \( N \) = sample number

**Abundance**

Population density of weed species expressed as the number of individuals of weed plants per unit area.

\[ A = \frac{\sum W}{N} \]

Where, \( A \) = abundance; \( W \) = number of individual species/sample; \( N \) = sample number

**Dominance**

Abundance of an individual weed species in relation to total weed abundance.

\[ D = \frac{A \times 100}{\sum A} \]

Where, \( D \) = dominance; \( A \) = abundance; \( \sum A \) = total abundance (of all species)

**Similarity index/Community index**

Is the similarity of weed communities between different locations or crop types or grazing areas.

\[ SI = 100 \times \frac{E_{pg}}{(E_{pg} + E_{pa} + E_{pb})} \]

Where, \( SI \) = Similarity index; \( E_{pg} \) = number of species found in both locations; \( E_{pa} \) = number of species found in location I; \( E_{pb} \) = number of species found in locations II

**Result and Discussion**

**Weed flora composition**

One hundred thirty five weed species were collected and identified from the surveyed 180 fields of selected districts of the Bench Maji, Keffa and Sheka Zones. These weed species were distributed in 135 genera within 35 families. The large majority of these, 109 were dicotyledonous species, 22 grasses, and 4 sedges. The seven major families, based on the number of taxa were: *Asteraceae* (15.6%), *Poaceae* (14.8%), *Fabaceae* (8.9%), *Polygonaceae* (5.2%), *Acanthaceae* (4.4%), *Solanaceae* (4.4%) and *Amaranthaceae* (3.0%) accounted for 56.3% of the total weed flora. Moreover, *Asteraceae, Poaceae* and *Fabaceae* were also found to be most important in other studies in the tropics. These families were also reported to be economically important and common in different parts of the country [3,8,19]. Moreover, these families are very rich in species diversity so it is usual that they contain many plant species. *Asteraceae, Poaceae* and *Fabaceae* were also found to be most important in other studies in the tropics [10] (Table 1).

**Table 1:** Number and proportion of weed species within the thirty five diverse families.

| Families       | Number of species | Percent Flora |
|---------------|------------------|--------------|
| *Asteraceae*   | 21               | 15.6         |
| *Graminea*     | 20               | 14.8         |
| *Fabaceae*     | 12               | 8.9          |
| *Polygonaceae* | 7                | 5.2          |
| *Acanthaceae*  | 6                | 4.4          |
| *Solanaceae*   | 6                | 4.4          |
| *Amaranthaceae*| 4                | 3            |
| *Bonginaceae*  | 4                | 3            |
| *Caryophyllaceae* | 4          | 3            |
| *Chenopodiaceae* | 4           | 3            |
| *Cyperaceae*   | 4                | 3            |
| *Euphorbiaceae*| 4                | 3            |
| *Rubiaceae*    | 4                | 3            |
| *Convulvulaceae* | 3             | 2.2          |
| *Lamiaceae*    | 3                | 2.2          |
| *Malvaceae*    | 3                | 2.2          |
| *Capparaceae*  | 2                | 1.5          |
| *Commelinaceae*| 2                | 1.5          |
| *Oxalidaceae*  | 2                | 1.5          |
| *Papaveraceae* | 2                | 1.5          |
| *Primulaceae*  | 2                | 1.5          |
| *Verbenaceae*  | 2                | 1.5          |
| *Aizoaceae*    | 1                | 0.7          |
| *Aipaceae*     | 1                | 0.7          |
| *Cruciferaea*  | 1                | 0.7          |
| *Cucurbitaceae*| 1                | 0.7          |
| *Loranthaceae* | 1                | 0.7          |
| *Nyctaginaceae*| 1                | 0.7          |
| *Orobanchaceae*| 1                | 0.7          |
| *Plantaginaceae* | 1          | 0.7          |
| *Portulaceae*  | 1                | 0.7          |
| *Rosaceae*     | 1                | 0.7          |
| *Scrophulariaceae* | 1        | 0.7          |
| *Tiliaceae*    | 1                | 0.7          |
| *Urticaceae*   | 1                | 0.7          |
| *Zygophyllaceae* | 1           | 0.7          |
Frequency and abundance

The weed flora in arable fields of Bench Maji, Keffa and Sheka Zones were dominated by large number of species. This large number of weeds in arable fields can be attributed to its long duration of rain fall, heavy fertilization and constant moist condition which are required by the crops that create conducive conditions for the growth of weeds. Averaged over locations, the frequency value of the species ranged from 7-87%. The highest frequency value (87%) recorded by Amaranthus graecizans L. followed by Mimosa invisa (78%) and Amaranthus hybridus L. (75%). Whereas, the least frequency value recorded from Galinsoga parviflora (7%) followed by Digitaria abyssinica, and Phalaris paradoxa that recorded (4%). The abundance value of the species varied from 0.04 to 2.4 plants m⁻². The highest abundance value (2.4 plants m⁻²) was recorded by Mimosa invisa followed by Amaranthus hybridus L. (1.26 plants m⁻²), Cynodon dactylon (L.) Pers. (1.72 plants m⁻²) and Amaranthus spinosus L. (1.68 plants m⁻²). Whereas, the least abundance value (0.04 plants m⁻²) was recorded for Tragus racemosus (L.) All. (Table 2). Similar results were found from [3,4,8,10]; reported that if the specific plant species had higher frequency and dominance value, it indicate the economic importance of it. Therefore, this study confirmed that Mimosa invisa is one of the major social, environmental and economic threats in the study area. In general, there were positive and significant correlations among frequency, abundance and dominance, that is the higher the frequency of the weed species, the higher will be its abundance and dominance and vice versa.

Table 2: Weed Species composition in Bench Maji, Keffa and Sheka Zones of 12 districts after main (long) and short rainy season during 2017.

| Species | Family | Life form | Frequency | Abundance | Dominance |
|---------|--------|-----------|-----------|-----------|-----------|
| 1 | Abyssinian grass | Poaceae | Grass | 21 | 0.12 | 0.18 |
| 2 | Acalypha crenata A. Rich. | Euphorbiaceae | A herb | 12 | 0.32 | 0.49 |
| 3 | Acanthospermum hispidum DC. | Asteraceae | A herb | 14 | 0.32 | 0.49 |
| 4 | Ageratum conyzoides | Asteraceae | Herb | 23 | 0.16 | 0.24 |
| 5 | Alkemilla abyssinica Fresen. | Rosaceae | A herb | 20 | 0.12 | 0.18 |
| 6 | Alternanthera pungens Kunth | Amaranthaceae | P herb | 22 | 0.2 | 0.31 |
| 7 | Alysicarpus quartinianus A. Rich | Fabaceae | A herb | 20 | 0.12 | 0.18 |
| 8 | Amaranthus graecizans L. | Amaranthaceae | A herb | 87 | 1.4 | 2.14 |
| 9 | Amaranthus hybridus L. | Amaranthaceae | Herb | 75 | 1.8 | 2.75 |
| 10 | Amaranthus spinosus L. | Amaranthaceae | Herb | 56 | 1.68 | 2.57 |
| 11 | Anagalis arvensis L. | Primulaceae | A herb | 27 | 0.4 | 0.61 |
| 12 | Anthriscus sylvestris (L.) Hoffm. | Apiaceae | A herb | 27 | 0.4 | 0.61 |
| 13 | Antirrhinum crinitum L. | Scrophulariaceae | A herb | 19 | 0.08 | 0.12 |
| 14 | Argemone mexicana L. | Papaveraceae | Herb | 54 | 1.28 | 1.96 |
| 15 | Argemone ochroleuca Sweet | Papaveraceae | A herb | 25 | 0.32 | 0.49 |
| 16 | Asystasia schimperi T. Anderss. | Acanthaceae | A herb | 19 | 0.08 | 0.12 |
| 17 | Avena fatua L. | Poaceae | A grass | 20 | 0.12 | 0.18 |
| 18 | Avena vaviloviana | Poaceae | Grass | 23 | 0.08 | 0.12 |
| 19 | Barkeria eranthenoides R. Brown | Acanthaceae | P shrub | 18 | 0.04 | 0.06 |
| 20 | Bidens pachyloba (Olive & Hiern) Cufl. | Asteraceae | A herb | 20 | 0.12 | 0.18 |
| 21 | Bidens pilosa | Asteraceae | Herb | 20 | 0.28 | 0.43 |
| 22 | Blepharis ciliaris L. | Acanthaceae | A herb | 24 | 0.28 | 0.43 |
| 23 | Boerhavia erecta L. | Nyctaginaceae | P herb | 24 | 0.28 | 0.43 |
| 24 | Cassia mimosoides L. | Fabaceae | A herb | 18 | 0.04 | 0.06 |
| 25 | Chenopodium fasciculatum | Chenopodiaceae | Herb | 65 | 1.16 | 1.77 |
| 26 | Chenopodium opilifolium | Chenopodiaceae | Herb | 45 | 1.4 | 2.14 |
| 27 | Chenopodium opilfolium Schr. | Chenopodiaceae | A herb | 29 | 0.48 | 0.73 |
| 28 | Chenopodium procercum | Chenopodiaceae | Herb | 67 | 1 | 1.53 |
| 29 | Cleome monophylla L. | Caparaceae | A herb | 35 | 0.72 | 1.1 |
| 30 | Commelina benghalensis L. | Commeliniaceae | Herb | 17 | 0.88 | 1.34 |
| 31 | Commelina latifolia A. Rich | Commeliniaceae | P herb | 68 | 0.92 | 1.41 |
| 32 | Convolvulus arvensis L. | Convolvulaceae | 17 | 0.48 | 0.73 |
| No. | Species Name                                      | Family          | Type       | Frequency | Relative Frequency |
|-----|--------------------------------------------------|-----------------|------------|-----------|--------------------|
| 33  | Conyza bonariensis (L.) Cronq.                   | Asteraceae      | A herb     | 24        | 0.28               |
| 34  | Corchorus olitorius                              | Malvaceae       | A herb     | 17        | 0.2                |
| 35  | Corchorus trilocularis L.                        | Tiliaceae       | A herb     | 39        | 0.88               |
| 36  | Coreopsis barianiana                             | Asteraceae      | Herb       | 14        | 0.08               |
| 37  | Corrigiola littorale L.                          | Caryophyllaceae | A herb     | 19        | 0.08               |
| 38  | Crotalaria incana L.                             | Fabaceae        | A herb     | 24        | 0.28               |
| 39  | Crotalaria laburnifolia L.                       | Fabaceae        | A herb     | 18        | 0.04               |
| 40  | Gomphocarpus ciliatus L.                         | Fabaceae        | P herb     | 18        | 0.04               |
| 41  | Cuscuta spp                                      | Convolvulaceae  | Parasite   | 45        | 0.92               |
| 42  | Cythara dactylon (L.) Pers.                      | Poaceae         | P grass    | 60        | 1.72               |
| 43  | Cynodon nlemfuensis                              | Poaceae         | Grass      | 36        | 1.28               |
| 44  | Cynoglossum lanceolatum Forssk                   | Boraginaceae    | Herb       | 32        | 1                  |
| 45  | Cyperus esculentus L.                            | Cyperaceae      | Sedge      | 36        | 0.96               |
| 46  | Cyperus rotundus L.                              | Cyperaceae      | Sedge      | 39        | 1.68               |
| 47  | Datura stramonium L.                             | Solanaceae      | A herb     | 44        | 1.08               |
| 48  | Digitaria abyssinica                             | Poaceae         | Grass      | 4         | 1.36               |
| 49  | Digitaria ternata (A. Rich) Stapf                | Poaceae         | A grass    | 18        | 0.04               |
| 50  | Dolichos formosus A. Rich.                       | Fabaceae        | P herb     | 19        | 0.08               |
| 51  | Drogaetia iners (Forssk.) Schweinf.               | Urticaceae      | P herb     | 18        | 0.04               |
| 52  | Eleusine indica (L.) Gaertn                     | Poaceae         | Grass      | 17        | 0.92               |
| 53  | Eragrostis ciliarisensis (All.) Vign. Ex Janchen | Poaceae         | A grass    | 22        | 0.2                |
| 54  | Erioclae fatensis                                | Poaceae         | Grass      | 12        | 0.2                |
| 55  | Erucastrum arabicum Fisch.                       | Crucifereae     | Herb       | 25        | 0.08               |
| 56  | Euphorbia heterophylla L.                        | Euphorbiaceae   | Herb       | 24        | 0.2               |
| 57  | Euphorbia hirta L.                               | Euphorbiaceae   | A herb     | 37        | 0.8                |
| 58  | Euphorbia schimperiana Scheele                   | Euphorbiaceae   | A herb     | 18        | 0.04               |
| 59  | Fimbristylis hispidula (VA herbl.) Kunth         | Cyperaceae      | A sedge    | 18        | 0.04               |
| 60  | Flaveria trinervia (Spreng.) C. Mohr             | Asteraceae      | A herb     | 20        | 0.12               |
| 61  | Galinsoga parviflora Cav                         | Asteraceae      | Herb       | 7         | 1                  |
| 62  | Galium hamatum L.                                | Rubiaceae       | A herb     | 22        | 0.2                |
| 63  | Galium spurium L.                                | Rubiaceae       | Herb       | 8         | 0.48               |
| 64  | Glycine wightii (Wight & Arn.) Verdc.            | Fabaceae        | P herb     | 20        | 0.12               |
| 65  | Guzota scabra (Vis.) Chiov.                      | Asteraceae      | A herb     | 44        | 1.08               |
| 66  | Gynandropsis gynandra (L.) Briq.                 | Capparaceae     | A herb     | 23        | 0.24               |
| 67  | Heliotropium cinerascens Steud. ex DC.           | Boraginaceae    | Herb       | 9         | 0.2                |
| 68  | Heliotropium zeylanicum (Burm.) Lam.             | Boraginaceae    | A herb     | 48        | 1.24               |
| 69  | Hibiscus trionum L.                              | Malvaceae       | A herb     | 28        | 0.44               |
| 70  | Hygrophila auriculata                            | Acanthaceae     |            | 6         | 0.2                |
| 71  | Indigofera schimperi Jaub. & Spach.              | Fabaceae        | P shrub    | 18        | 0.04               |
| 72  | Ipomoea eriocarpa R. Br.                         | Convolvulaceae  | A herb     | 19        | 0.08               |
| 73  | Justica schimperi (Hochst.) Dandy                | Acanthaceae     | P shrub    | 22        | 0.2                |
| 74  | Kohautia spp.                                    | Rubiaceae       | A herb     | 19        | 0.08               |
| 75  | Lamiaceae L.                                     | Lamiaceae       | A herb     | 18        | 0.04               |
| 76  | Lantana camara L.                                | Verbenaceae     | Shrub      | 45        | 0.32               |
| 77  | Launaea cornuta                                  | Asteraceae      | Herb       | 32        | 0.2                |
| 78  | Launaea cornuta (Oliv. & Hiern) C. Jeffrey       | Asteraceae      | P herb     | 47        | 1.2                |
| 79  | Lycium procerum                                   | Malvaceae       | A herb     | 19        | 0.08               |
| No. | Species Name                          | Family            | Life Form | Frequency | Height (cm) | Width (cm) |
|-----|--------------------------------------|-------------------|-----------|-----------|-------------|------------|
| 80  | Leucas martinica (Jacq.) Ait.f.      | Lamiaceae         | A herb    | 56        | 1.56        | 2.38       |
| 81  | Lolium temulentum L.                 | Poaceae           | Grass     | 21        | 0.36        | 0.55       |
| 82  | Lysimachia ruhmeriana Vatke          | Primulaceae       | A herb    | 22        | 0.2         | 0.31       |
| 83  | Medicago polymorpha L.               | Fabaceae          | A herb    | 34        | 0.68        | 1.04       |
| 84  | Mimosa invisa                        | Fabaceae          | Herb      | 78        | 2.4         | 3.67       |
| 85  | Molugo nudicaulis Lam.               | Aizoaceae         | A herb    | 20        | 0.12        | 0.18       |
| 86  | Nicandra physalodes                  | Solanaceae        | Herb      | 9         | 0.24        | 0.37       |
| 87  | Ocimum basilicum L.                  | Lamiaceae         | A herb    | 23        | 0.24        | 0.37       |
| 88  | Oldenlandia herbacea L.              | Rubiaceae         | Herb      | 10        | 0           | 0          |
| 89  | Oplismenus compositus (L.) P. Beauv. | Poaceae           | P grass   | 19        | 0.08        | 0.12       |
| 90  | Orobanche ramosa L.                  | Orobanchaceae     | Herb      | 32        | 0.28        | 0.43       |
| 91  | Oxalis corniculata L.                | Oxalidaceae       | Herb      | 4         | 0.36        | 0.55       |
| 92  | Oxalis latifolia H. B. K.            | Oxalidaceae       | P herb    | 26        | 0.36        | 0.55       |
| 93  | Oxynoton sinuatum (Meissn.) Dammer   | Polygonaceae      | A herb    | 45        | 1.12        | 1.71       |
| 94  | Parthenium hysterophorus L.          | Asteraceae        | A herb    | 71        | 2.16        | 3.3        |
| 95  | Pennisetum clandestinum              | Poaceae           | Grass     | 4         | 0.36        | 0.55       |
| 96  | Phalaris pandoxa L.                  | Poaceae           | Grass     | 4         | 0.44        | 0.67       |
| 97  | Physalis philadelphica Lam.          | Solanaceae        | A herb    | 19        | 0.08        | 0.12       |
| 98  | Plantago lanceolata L.               | Plantaginaceae    | B herb    | 29        | 0.48        | 0.73       |
| 99  | Polygonum aviculare L.               | Polygonaceae      | A herb    | 18        | 0.04        | 0.06       |
| 100 | Polygonum barbatum L.                | Polygonaceae      | A herb    | 18        | 0.04        | 0.06       |
| 101 | Polygonum nepalense Mein.            | Polygonaceae      | Herb      | 12        | 0.36        | 0.55       |
| 102 | Polygonum nepalensis Spreng.         | Polygonaceae      | A herb    | 22        | 0.2         | 0.31       |
| 103 | Portulaca oleracea L.                | Portulacaceae     | P herb    | 15        | 0.28        | 0.43       |
| 104 | Rhynchosia spp.                      | Fabaceae          | P herb    | 18        | 0.04        | 0.06       |
| 105 | Ruellia patula Jaquin                | Acanthaceae       | A herb    | 18        | 0.04        | 0.06       |
| 106 | Rumex abyssicus Jacq.                | Polygonaceae      | Herb      | 22        | 1.28        | 1.96       |
| 107 | Rumex bequaertii De Wild.            | Polygonaceae      | P herb    | 24        | 0.28        | 0.43       |
| 108 | Schkuhria pinnata (Lam.) Thell.      | Asteraceae        | A herb    | 18        | 0.04        | 0.06       |
| 109 | Scleranthus annuus L.                | Caryophyllaceae   | A herb    | 18        | 0.04        | 0.06       |
| 110 | Senecio abyssicus Oliv. & Hiern      | Asteraceae        | A herb    | 18        | 0.04        | 0.06       |
| 111 | Senna didymobotrya (Fresen.)         | Fabaceae          | Herb      | 23        | 0.6         | 0.92       |
| 112 | Senna occidentalis (L.) Link          | Fabaceae          | A herb    | 23        | 0.24        | 0.37       |
| 113 | Setaria verticillata (L.) Beau.      | Poaceae           | A grass   | 25        | 0.32        | 0.49       |
| 114 | Setaria virgata (L.) Beau.           | Poaceae           | Grass     | 25        | 1.4         | 2.14       |
| 115 | Sida acuta Burm. F.                  | Malvaceae         | P herb    | 38        | 0.84        | 1.28       |
| 116 | Snowdenia polystachya (Fresen.) Plig.| Poaceae           | A grass   | 33        | 0.64        | 0.98       |
| 117 | Solanum dulburum Fresen.             | Solanaceae        | P shrub   | 23        | 0.24        | 0.37       |
| 118 | Solanum inanum L.                   | Solanaceae        | P shrub   | 21        | 0.16        | 0.24       |
| 119 | Solanum nigrum L.                   | Solanaceae        | A herb    | 39        | 0.88        | 1.34       |
| 120 | Sonchus asper (L.) Hill              | Asteraceae        | A herb    | 25        | 0.32        | 0.49       |
| 121 | Spargula arvensis L.                 | Caryophyllaceae   | A herb    | 17        | 0.36        | 0.55       |
| 122 | Sporobolus lacidoides (Trin.) Nees   | Poaceae           | P grass   | 18        | 0.04        | 0.06       |
| 123 | Stellaria media L.                   | Caryophyllaceae   | 4         | 0.36        | 0.55       |
| 124 | Tagetes minuta L.                    | Asteraceae        | Herb      | 25        | 0.2         | 0.31       |
| 125 | Tagetus minuta L.                    | Asteraceae        | A herb    | 57        | 1.6         | 2.44       |
| 126 | Tapinanthus globiferus               | Loranthaceae      | 18        | 0.04        | 0.06       |
| 127 | Tragus racemosus (L.) All.           | Poaceae           | A grass   | 18        | 0.04        | 0.06       |
Similarity index

Similarity index is the similarity of plant species composition among different districts in three Zones. The result showed a similarity index value of 64-93%, 70 - 84% and 50% among the districts of Bench Maji, Keffa and Sheka Zones respectively (Table 3). This suggests that the weed species composition among the different the districts were similar by 64-93%, 70 - 84% and 50%. As described by [19], if the index of similarity is below 60%, it is said that the two locations have different weed communities. Since similarity indices for the different location were greater than 60% it can be concluded that the locations exhibited similar weed community and thus, require similar management options. The difference in altitude, climate, soil types and field management practices applied to the different district could be the cause that affected the distribution, abundance and dominance of the weed species [5,7,20]. Similarly, weed species composition was dissimilar between districts of Sheka Zone [10,21]; noted that weed growth, population density and distribution vary from place to place depending upon soil and climatic factors that affect the weed flora, and farmers’ management practices (Table 4 & 5).

Table 3: Similarity index of weed species in the five district of Bench Maji Zone.

| Locations      | Guraferda | Menit Goldiya | Menit Shasha | Semen Bench | Shey Bench |
|----------------|-----------|---------------|--------------|-------------|------------|
| Guraferda      | 100       | 64            | 71           | 74          | 66         |
| Menit Goldiya  | 100       | 64            | 71           | 74          | 66         |
| Menit Shasha   | 100       | 83            | 73           |             |            |
| Semen Bench    | 100       | 93            |             |             |            |
| Shey Bench     | 100       |               |             |             |            |

Table 4: Similarity index of weed species in the five district of Keffa Zone.

| Locations | Bonga Zarua | Chena | Decha | Ginbo | Bita |
|-----------|-------------|-------|-------|-------|------|
| Bonga Zarua | 100        | 70    | 72    | 71    | 70   |
| Chena      | 100        | 72    | 72    | 71    |      |
| Decha      | 100        | 73    | 72    |       |      |
| Ginbo      | 100        | 84    |       |       |      |
| Bita       | 100        |       |       |       |      |

Table 5: Similarity index of weed species in the two district of Sheka Zone.

| Locations | Andracha | Yeki |
|-----------|----------|------|
| Andracha  | 100      | 50   |
| Yeki      | 100      |      |

Conclusion

Based on the study, the total of one hundred thirty five different weed species were identified. The importance of each species was determined by calculating the frequency, abundance and dominance values. In the experiment identified a large and diversified weed flora. Within the weed spectrum surveyed in both in district, dominant weed species were identified at both three Zones. The most dominant families according to the frequency and number of weed species were Asteraceae, Poaceae, Fabaceae, Polygonaceae, Acanthaceae and Solanaceae. Weed species composition varied between districts within the same district and across districts at both Zones. Thus, when devising a weed control strategy in the future, different weed management options would be required for the districts differing in weed flora composition.

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