P-ISSN: 2305-6622; E-ISSN: 2306-3599
International Journal of Agriculture and Biosciences
www.ijagbio.com; editor@ijagbio.com

Research Article

# Assessment and Identification of Weed Flora Associated to Medicinal and Aromatic Plants at Wondo Genet District, Ethiopia

[1]Negasu Guteta Bayisa* and [2]Nigusie Hundesa

[12]Ethiopia Institute of Agricultural Research, Wondo Genet Center, P.O Box 198, Shashemene, Ethiopia
***Corresponding author:** negasuguteta@gmail.com

**Article History:** Received: February 22, 2017 Revised: June 28, 2017 Accepted: July 10, 2017

**ABSTRACT**

Assessment of weed flora associated with aromatic and medicinal plants was carried out in Wondo Genet district of Sidama Zone, South nation, Nationality and People National Regional State, Ethiopia in the years of 2014 to 2016 during cropping seasons. The assessment was made to identify, quantify and prioritize the major weeds. Aromatic and medicinal plants field were purposively selected and after accepting the sample point sampling was done by following an inverted W-pattern within the field. The number of individuals of each species was determined in a 1mx1m ($1m^2$) quadrant at each of the 9-12 locations using metal quadrants were taken from each fields of aromatic and medicinal plants. A total of 43 weed species belonging to 19 families and 36 genera were identified and recorded. Of these, 36 species were annuals and 7 species were perennials. The most important families based on the number of taxa were ten species for Asteraceae, six species for Poaceae and four species for Leguminosae constituting 47.62% of the total weed flora. *Galinsoga parviflora, Bidens pilosa, Oxalis anthelmintica* and *Ageratum conycoides* were found to be the most frequent (35.31-75.42), abundant (6.34-23.79) and dominant (5.5-20.63) broadleaved weed species whereas *Eriochloa villosa, Commelina benghalensis* and *Rottboalliaco chinchinesis* were most frequent (27.81-29.17), abundant (1.8-2.94) and dominant (1.56-2.55) grass weed species and *Cyperus rotundus,* was only sedges and it was the most frequent, abundant and dominant 68.5,20.99 and 18.20 respectively in the survey areas. The data from the current survey can be used in the future as a reference of weed species database of the area and then to determine the impact of crop management and other factors on weed species composition, and to facilitate the designing and establishment of site -specific weed management.

**Key words:** Assessment, Identification, Weed flora, Aromatic, Medicinal frequency, Abundance and dominance

## INTRODUCTION

Ethiopia has long been known as a center of origin and diversity for several plant species due to the existence of wide range of rainfall, temperature, geological, topological, ecological and climatic conditions (Nigist and Sebsibe, 2009). It is remarkably rich in its biological, ecological and landscape diversity and is home to outstanding natural bio-resources such as a number of herbs, medicinal and aromatic plants. Being a land of diverse climatic and edaphic potentials, several of such indigenous and exotic species of medicinal and aromatic plants could sumptuously grow in Ethiopia and provide remarkable benefits to the national economy. Medicinal and aromatic plants (MAPs) can be defined as botanicals that provide people with medicines – to prevent disease, maintain health or cure ailments (Elaine, 2011).

Medicinal and aromatic plants play a valuable and important role in economic, social, cultural and ecological aspects of local communities the world over. MAPs can help small-scale farmers to strengthen their livelihoods directly through income generation from their trade as well as health care provision. In one form or another, they benefit virtually everyone on Earth through nutrition, toiletry, bodily care, incense and ritual healing (Medicinal and Aromatic Plant Working Group, 2010). Medicinal and aromatic plants with strengthened livelihoods comes greater access to a wider range of assets, and a capacity to build these into successful and sustainable activities, thereby reducing vulnerability to poverty in the longer term (Elaine, 2011).

Like agricultural crops various constraints pose serious problem for cultivation of medicinal and aromatic plants viz. nutrient management, water management,

**Cite This Article as:** Bayisa NG and N Hundesa, 2017. Assessment and identification of weed flora associated to medicinal and aromatic plants at Wondo Genet District, Ethiopia. Inter J Agri Biosci, 6(3): 136-140. www.ijagbio.com

suitable genotype, agro-climatic condition, insect pests, diseases and weed management. The losses caused by weeds exceed the losses from any other category of agricultural pests, such as insects, nematodes and rodents. Among the total annual losses of agricultural product from various pests, weeds account for 45%, insects for 30 %, diseases 20 % and another pest 5 % (Rao, 2000).

Weed compete with the aromatic and medicinal plants for nutrient, light, space, moisture and temperature, which ultimately reduces the yield, yield contributing character and quality of medicinal and aromatic plants, and it also reduces the efficiency of farm resources. It has been estimated that weeds cause a yield loss of about 10% in less developed countries and 25% in the least developed countries (Akobundu, 1987; Tomado& Milberg, 2000). Weeds, in addition to their effects on yield, play a significant role in harboring insects, serving as alternate hosts to some diseases, and increasing cost of production (Hanson *et al.*, 1982).

Therefore, to design effective weed control measures, the identification, characterization and quantification of the weed species in a certain area and crop are important steps in describing a crop production system as well as providing the baseline information for future comparisons. The data can be used now to pinpoint major weed problems that require concreted research or extension activity.

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 (Kropff and Spitters, 1991). By way of weed survey one can determine frequency, abundance and dominance of the weed species in a given cropland or locality. Such information gives exact substantial criteria of an exact assay of weed infestation on cropland; serve as basis for planning and decision making for weed control. Options for weed control should consider such information, targeting the control of the most frequent, abundant and dominant species existing in a given cropland or locality. So far, there is no documentation on the relative importance and quantitative information of weed species on aromatic and medicinal production in the Wondo Genet districts. Hence, keeping all the aspects in view, the study was conducted in Wondo Genet districts, Sidama Zone, Southern Nation, Nationality and People Regional National State (SNNPRNS), Ethiopia with the following objective:

**Objective**

To identify, quantify and prioritize the major weed species in medicinal and aromatic plants

## MATERIALS AND METHODS

**Description of the survey area**

The survey was carried out at Wondo Genet district during 2014, 2015 and 2016 cropping season at vegetative and maturity growth stages of aromatic and medicinal plants. Wondo Genet is located at $7^0$ 192' N and $38^0$ 382' E. It is 265km from Addis Ababa to the South. The annual mean rainfall in the area is 1880mm. The annual mean minimum and maximum temperatures are $12.02^0$c and 26.72°C, respectively. The survey sites are located at an altitude of 1652 to 1876m a.s.l. The soil of survey area is Sandy loam (Nitosol). In these locations, the survey area purposively selected where the aromatic and medicinal plants were grown for the purpose of research, demonstration and private for commercial as well as for conservations. All these locations were rain fed as well as free from herbicides use. Prioritized aromatic plants for weed species survey werenardus grass (*Cymbopogon sp.*),palmarosa (*Cymbopogon martini* L.), lemon grass (*Cymbopogon citratus* L.), mint (*Mentha* sp.), rosemary (*Rosemarinus officinalis* L.), lavender (*Lavandula angustifolia* L.), sage (*Salvia officinalis* L.), rose scented geranium (*Pelargonium graveolens* L.), lemon verbena (*Aloysia tripylla* L.),basil (*Ocimum basilicum* L.), damask rose (*Rosa damascene* Mill), organum *(Origanum vulgare* L.*)*,vernonia (*Vernonia galamensis* L.) and fennel (*Foeniculum vulgare).* Whereas Artemisia (*Artemisia anua*L.), senna (*Senna alexanderiana*), stevia (*Stevia rebaudiana* Bertoni L.), hibiscus (*Hibiscus subdariffa*), aloe (*Aloe vera*)), tavernaria (*Tavernaria abysinica* A. Rich), kebericho (*Echnopis kebericho*), ariti (*Artemisia rehan*) and chamomile (*Matricaria chamomile* L.) are the major medicinal plants that focused for weed survey at Wondo Genet district in Ethiopia.

**Sampling and Identification of Weed Flora in Medicinal and Aromatic Plants Fields**

A survey of the weed flora was conducted in major aromatic and medicinal plants growing area of Wondo genet districts in 2014, 2015 and 2016 cropping seasons. Aromatic and medicinal plants field were purposively selected. After accepting the sample point, sampling was done by following an inverted W-pattern within field. The number of individuals of each species was determined in a 1mx1m ($1m^2$) quadrant at each of the 9-12 locations using metal quadrants were taken from each field, resulting in a total sample area of $1m^2$. In 12 locations, 60 samples were collected. The identified and quantified weed species were determined and recorded in each of the sampled quadrants. Weeds within the quadrant were uprooted and separated in the different species and counted. For perennial grasses or herbaceous species the number of shoots rather than the number of plants were counted. Any plant found in the field that could not identify was tagged, pressed and submitted to taxonomists in the National Herbarium for positive identification.

**Data analysis**

To determine the weed communities, quantitative measures were calculated for each weed on each crop based on the procedures followed by Thomas (1985) and Taye and Yohannes (1998). The data obtained from the field were analyzed using MS-excel.

1. **Frequency:** is the percentage of sampling plots (vegetation registration) in which a particular weed species is found. It explains how often a weed species occurs in the survey area. This measure ignored both the number of individuals in field and the size of the plants. Frequency is calculated for all weed species as follows:

F = frequency of particular weed species,
X = number of samples in which a particular weed species occurs
N = total number of samples

2. **Abundance**: is the population density of a weed species expressed as the number of individuals of that species per unit area.

Where
A = abundance;∑w = sum of individuals of a particular weed species across all samples
N = total number of samples

3. **Dominance:** Abundance of an individual weed species in relation to total weed abundance

Where,
D = dominance of a particular species; A = Abundance of the same species
∑w = total abundance of all weed species

## RESULTS AND DISCUSSION

### Weed composition and diversity

A total of 43 weed species belonging to 19 families were identified and recorded from the surveyed areas (Table 1). Among them, 36 species were annuals, while 7 were represented by perennials. These weed species were distributed in 36 genera within 19 families comprising of 33 dicotyledonous species, 9 grasses, and 1 sedges (Fig. 1). The broadleaved species appeared to dominate over grass and sedges and this might be due to high soil moisture that triggered rapid seedling vigoursity and canopy development. The 9 major families, based on the number of taxa were: ten species for Asteraceae, six species for Poaceae, four species for Leguminosae and two species for each of Amaranthaceae, Cyperaceae, Oxalidaceae, Plantaginaceae, Portulacaceae and Solanaceae and contains 76.19% of the total weed flora (Table 2). It has similarity in in weed composition among the surveyed of aromatic and medicinal plants. However, parasitic weed (*Orobanche minor*) was identified and quantified from artemisia and rose scented geranium plant. Therefore, it is important to study on its importance on yield losses and control methods.

The greater number of species in Asteraceae, Poaceae and Leguminosae might be due to their adaptability under a wider range of environment and soil types, growth behavior, fabulous seed production, long lasting dormancy and spectacular competitive ability of weed species present in these families. However, the number and the identity of the weed varied in different cropped areas.

### Frequency, abundance and dominance weed species

The most frequent, abundant and dominant broadleaved weed species irrespective of crop types were *G. parviflora, B. pilosa, O. anthelmintica, A. conycoides*, *T. dubium, C. bonariensis*, *P.lanceolata* and *A. hybridus* and grass weed species were *E. villosa*, *C. benghalensis*. and *R. Cochinchinesis* where as *Cyperus rotundus* L. was sedges. *G. parviflora* was found to be the most frequent (75.42%) weed species whereas *T. repens* and *G. scabra*

**Table 1:** Weed species, their families, life cycle and morphology of weed flora of aromatic and medicinal plants during 2014 to 2016 at Wondo genet districts of Sidama Zone of SNNPRNS, Ethiopia

| Weed species/families | Characters | | |
|---|---|---|---|
| **Acathaceae** | | | |
| *Achyrantes aspera* L. | A | d | Rs |
| **Amaranthaceae** | | | |
| *Amaranthus hybridus* L. | A | d | Rs |
| *Amaranthus spinosus,* Khmer | A | d | Rs |
| **Asteraceae** | | | |
| *Ageratum conycoides* L. | A | d | Rs |
| *Bidens pilosa* L. | A | d | Rs |
| *Galinsoga parviflora* Cav. | A | d | Rs |
| *Guizotia scabra* (Vis.) Chiov. | A | d | Rs |
| *Lactuca scariola* L. | A | d | Rs |
| *Spilathes mauritana* Rich.ex Pers.) D.C | A | d | Rs |
| *Taraxacum officinale* L. | P | d | Rs |
| *Tagetes minuta* L. | A | d | Rs |
| *Conyzasteudelii Sch. -Bip.ExArich.* | A | d | Rs |
| *Conyza bonariensis (L.)* | A | d | Rs |
| **Commelinaceae** | | | |
| *Commelina benghalensis* L. | a/p | m | rs/rv |
| **Cyperaceae** | | | |
| *Cyperus esculentus* L. | A | m | rs/rv |
| *Cyperus rotundus* L. | P | sedges | |
| **Fabaceae** | | | |
| *Lathyrus latifolia* L. | P | d | Rs |
| **Lamiaceae.** | | | |
| *Glechoma hederacea* L. | A | d | rs/rv |
| **Leguminosae** | | | |
| *Tribulus terresteris* L. | A | d | rs/rv |
| *Trifolium dubium* L | A | d | rs/rv |
| *Trifolium pratense* L. | A | d | rs/rv |
| *Trifolium repens* L. | A | d | rs/rv |
| **Orobanchaceae** | | | |
| *Orobanche minor* Smith | A | d | Rs |
| **Oxalidaceae** | | | |
| *Oxalis anthelmintica A. Rich* | A | d | rs/rv |
| *Oxalis corniculata* var. | A | d | rs/rv |
| **Plantaginaceae** | | | |
| *Plantago lanceolate* L. | A | d | rs/rv |
| *Veronica hederifolia* L. | A | d | Rs |
| **Poaceae** | | | |
| *Cynodon dactylon* L. | A | m | Rs |
| Digitariasanguinalis (L.) Scop. | A | m | rs/rv |
| *Digitaria abyssinica* (A. Rich.) stapf | A | m | rs/rv |
| *Eleusine indica (*L.) Gaertn. | A | m | Rs |
| *Eriochloa villosa* (Thunb.) Kunth | A | m | rs/rv |
| *Pennisetum polystachion* (L. Schult.) | A | m | rs/rv |
| *Rottboallia cochinchinesis* (Lour.) Clayton | A | m | rs/rv |
| **Portulacaceae** | | | |
| *Monita fontana* syn. | a/p | d | rs/rv |
| *Portulaca oleracea* –Gourmet Sleuth | A | d | rs/rv |
| **Primulaceae** | | | |
| *Anagallis arvensis* var. caerulea (L.) Gouan | A | d | Rs |
| **Ranunculaceae** | | | |
| *Ranunculus ficaria* L. | P | | Rs |
| **Resedaceae** | | | |
| *Caylusea abyssinica* (Fresn.) Fish & May | A | d | Rs |
| **Solanaceae** | | | |
| *Datura stramonium* L. | A | d | Rs |
| *Nicandra physaloides* L.Gaerth. | A | d | Rs |
| **Violaceae** | | | |
| *Viola riviniana* L. | P | d | Rs |
| **Caryophyllaceae** | | | |
| *Cerastium fontanum* L. | A | d | Rs |

**Note:** rs= reproduce by seed; rv= reproduce by Vegetative; a=annual; d=dicotyledons; m=monocotyledons and p=perennial.

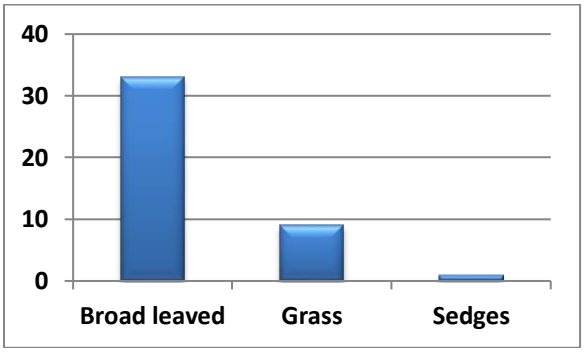


**Fig. 1:** Number of weed species based on morphological character in weed communities in aromatic and medicinal plants in 2014 to 2016.

**Table 2:** Number and proportion of plant species within the nine top diverse families in aromatic and medicinal plants in 2014 to 2016 cropping time

| Family | No of species | Percent of flora |
|---|---|---|
| Asteraceae | 10 | 23.81 |
| Poaceae | 6 | 14.29 |
| Leguminosae | 4 | 9.52 |
| Amaranthaceae | 2 | 4.76 |
| Cyperaceae | 2 | 4.76 |
| Oxalidaceae | 2 | 4.76 |
| Plantaginaceae | 2 | 4.76 |
| Portulacaceae | 2 | 4.76 |
| Solanaceae | 2 | 4.76 |
| Total | 32 | 76.19 |

were recorded with least frequency (0.31%) in aromatic and medicinal fields. Similarly, the dominance level of individual weed species ranged from 0.01 to 20.63. The most frequent weed species in the fields might be due to high seed production capacity, environmental adaptation, competitive ability and similar microclimate needs of the weeds. Tamado and Milberg (2000) also reported that *Cynodon dactylon, Cyperus rotundus, Commelina benghalensis* and *Digitaria abyssinica* were the frequent weed species infesting crops fields in eastern Ethiopia. High reproductive potential and similar requirement of microclimate with those crops might be the possible reason for high abundance of these weeds. In general, there were positive and significant correlation among frequency, abundance and dominance, i.e. the higher the frequency of weed species, the higher will be its abundance and dominance and vice versa. Weed abundance is the main factor that determines the spatial changes in weed flora in agricultural fields. Abundance of weeds can provide a clue that is why the abundances of certain weed species are increased while their frequencies decreased. Variations in frequency of the weed species alone may not be adequate to explain the reasons for changes in weed flora (Bukun and Guler, 2005).

## Conclusion and recommendation

The most frequent, abundant and dominant broadleaved weed species were *Galinsoga parviflora, Bidens pilosa, Oxalis anthelmintica* and *Ageratum conycoides* whereas *Eriochlo avillosa, Commelina benghalensis* and *Rottboallia cochinchinesis* were the most frequent, abundant and dominant grass weed species and *Cyperus rotundus,* wasonly sedges and it was the most frequent, abundant and dominant in the survey areas. The study has documented the species and their relative importance in aromatic and medicinal plants which can be used by extension, research and regulatory personnel. The data from the current survey can be used in the future to determine the impact of crop management and other factors on the weed species composition and community structure. It is suggested that the problem of weeds must be addressed by all the concerned quarters by adapting appropriate measures including cultural, physical, integrated weed management and herbicidal control methods that would lead to substantial improvement in aromatic and medicinal plant yields. Survey and assessment of weed flora should continue at least in every five years interval. Most of the major weed species were broadleaf species. Any weed control strategy should focus on these major weeds. It is also important to identify the economic threshold for major weed species.

**Table 3:** Weed species and their Frequency (F). abundance (A), dominance (D) of weed flora of aromatic and medicinal plants during 2014 to 2016 at Wondo genet districts

| | Common/Scientific name | F | A | D |
|---|---|---|---|---|
| 1 | *Galinsoga parviflora* | 75.42 | 23.79 | 20.63 |
| 2 | *Cyperus rotundus* | 68.54 | 20.99 | 18.20 |
| 3 | *Bidens pilosa* | 52.71 | 10.24 | 8.88 |
| 4 | *Oxalis anthelmintica* | 46.04 | 6.34 | 5.50 |
| 5 | *Ageratum conycoides* | 35.31 | 14.68 | 12.73 |
| 6 | *Trifolium dubium* | 33.44 | 2.60 | 2.26 |
| 7 | *Conyza bonariensis* | 30.21 | 5.11 | 4.43 |
| 8 | *Eriochlo avillosa* | 29.17 | 2.94 | 2.55 |
| 9 | *Commelina benghalensis* | 28.65 | 1.80 | 1.56 |
| 10 | *Rottboallia cochinchinesis* | 27.81 | 2.23 | 1.94 |
| 11 | *Plantago lanceolata* | 25.42 | 3.89 | 3.37 |
| 12 | *Amaranthus hybridus* | 21.98 | 1.69 | 1.46 |
| 13 | *Amaranthus spinosus* | 19.69 | 1.17 | 1.01 |
| 14 | *Nicandra physaloides* | 19.27 | 1.18 | 1.03 |
| 15 | *Caylusea abyssinica* | 17.19 | 0.91 | 0.79 |
| 16 | *Pennisetum polystachion* | 16.67 | 2.21 | 1.91 |
| 17 | *Portulaca oleracea* | 13.85 | 1.05 | 0.91 |
| 18 | *Digitaria abyssinica* | 11.56 | 0.85 | 0.74 |
| 19 | *Digitaria sanguinalis* | 10.21 | 2.34 | 2.03 |
| 20 | *Ranunculus ficaria* | 9.90 | 0.61 | 0.53 |
| 21 | *Veronica hederifolia* | 8.33 | 0.65 | 0.56 |
| 22 | *Cerastium fontanum* | 7.81 | 0.29 | 0.25 |
| 23 | *Datura stramonium* | 6.98 | 0.29 | 0.25 |
| 24 | *Monita fontana* | 5.83 | 0.95 | 0.83 |
| 25 | *Trifolium pratense* | 5.73 | 0.28 | 0.24 |
| 26 | *Tribulus terresteris* | 5.31 | 0.30 | 0.26 |
| 27 | *Anagallis arvensis* | 5.10 | 0.14 | 0.12 |
| 28 | *Oxalis corniculata* | 4.90 | 0.31 | 0.27 |
| 29 | *Orobanche minor* | 4.69 | 0.73 | 0.64 |
| 30 | *Eleusine indica* | 4.38 | 0.21 | 0.19 |
| 31 | *Taraxacum officinale* | 3.85 | 0.14 | 0.12 |
| 32 | *Lathyrus latifolia* | 3.02 | 0.21 | 0.18 |
| 33 | *Cyperus esculentus* | 2.92 | 0.17 | 0.15 |
| 34 | *Glechoma hederacea* | 2.60 | 0.11 | 0.09 |
| 35 | *Cynodon dactylon* | 1.67 | 0.18 | 0.15 |
| 36 | *Conyza steudelii* | 1.56 | 0.16 | 0.14 |
| 37 | *Lactuca scariola* | 1.46 | 0.04 | 0.03 |
| 38 | *Tagetes minuta* | 0.94 | 0.05 | 0.04 |
| 39 | *Achyrantes aspera* | 0.73 | 0.01 | 0.01 |
| 40 | *Spilathes mauritana* | 0.63 | 0.08 | 0.07 |
| 41 | *Viola riviniana* | 0.52 | 0.01 | 0.01 |
| 42 | *Guizotia scabra* | 0.31 | 0.01 | 0.01 |
| 43 | *Trifolium repens* | 0.31 | 0.01 | 0.01 |

**Note:** F = species frequency (%); A = abundance and D = dominance (%)

**Acknowledgements**

The authors are grateful to the Wondo Genet Agriculture Research Center for providing all the necessary facilities and support during the entire experiment. My special thanks also go to Mokonnen Dejene, Teriku Redengi, Genet Dejene and Abera Waritu for their helps in data collection.

## REFERENCES

Akobundu I, 1987. Weed science in the tropics. Principles and practices. Wiley Chicester, p: 522.

Bukun B and BH Guler, 2005. Density and importance value of weeds in lentil production. Inter J Botany, 1: 15-18.

Elaine M, 2011. Health and wealth from Medicinal Aromatic Plants. Rome: Food and Agriculture Organization of the United Nations.

Hanson HN, Borlaug and RG Anderson, 1982. Wheat in the Third World.Westview press, Inc., Boulder, Colorado. p: 174.

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

Nigist Asfaw and S Demisie, 2009. Aromatic Plants of Ethiopia. Shama Books, Addis Ababa, Ethiopia.

Rao VS, 2000. Principles of weed Science. Oxford and IBH Publishing Co. Pvt.Ltd. New Delhi. pp: 427-436.

Taye Tesema and Yohannes Lema, 1998. Quantitative and qualitative determination of weeds in teff in west shoa Zone. Arem, 4:46-60

Thomas AG, 1985. Weed survey system used in Saskatchewan for cereal and oilseed crops. Weed Sci, 33: 3443.

Tomado Tana and P Milberg, 2000. Weed flora in arable fields of eastern Ethiopia with emphasis on the occurrence of *Parthennium hysterophorus* L Weed Res, 40: 507-521.