

## **Weeds of Major Black Pepper (*Piper Nigrum L.*) and Cardamom (*Elitiera Cardamom*) Growing Area of South West Ethiopia**

**Habetewold Kifelew, Hailemariam Abera, Haimanot Miteku, Girma Hailemichel**

Department of plant protection  
Tepi National Spices Research Center Tepi, Ethiopia  
*habtekifelew@gmail.com*

---

**Abstract:** *In Ethiopia black pepper (*Piper nigrum L.*) and cardamom (*Elettaria cardamomum M*) are economically important spices in the family Piperaceae and Zingiberaceae, respectively. These spices are highly suffering due to weed infestation especially competing for water and nutrient. However, before estimating yield losses due to weeds and devising weed control strategies, identification and quantification of weeds are very important. The weed survey was conducted in Sheka, Benchmaji and Majang zones during 2008 to 2009 in both spring 'Belg' and summer (Meher') seasons. Weed species characteristics, average frequency and dominance over locations and seasons were calculated. The result shows that a total of 25 and 22 weed species were identified in black pepper and cardamom fields, respectively. The most important families according to the number of represented species were Poaceae, Malvaceae, Asterace, Amaranthaceae and Cyperaceae in black pepper, and Poaceae and Asterace in cardamom fields. The frequency of individual weed species in black pepper and cardamom field ranged from 1% up to 67% and 3% up to 55% while the dominance value ranged from 0.09 up to 24% and 0.01 up to 85%, respectively. The most frequent and dominant weed was *Commelina benghalensis* in black pepper field whereas, the most frequent weed was *Galinsoga parviflora* and the most dominant weed was *Cerastium arvense* in cardamom field. There were a positive and significant relationship among weed species frequency, abundance and dominance ( $P < 0.01$ ). This survey has ranked the most abundant and troublesome weed species in Black pepper and cardamom growing area of south west Ethiopia. This information is vital for setting research and developmental work priorities concerning Black pepper and cardamom weeds of the study area.*

**Keywords:** *Black pepper, Cardamom, Survey, Weeds.*

---

### **1. INTRODUCTION**

Black pepper (*Piper nigrum L.*), It is an economically important species of the family *Piperaceae*, It is a perennial glabrous woody climber that yields the 'black pepper' of commerce, which is profusely used as a culinary spice and condiment all over the world. Whereas, Cardamom (*Elettaria cardamomum Maton*) belonging to the, family *Zingiberaceae*, is known as 'Yeshay kemem' Amharic in Ethiopia. It is also called the "Queen of Spices".

These two spices are highly suffer for weed infestation especially for water and nutrient competition in area where there is high weed diversity and fast weed growing. However, before estimating yield losses due to weeds and devising weed control strategies, the identification and quantification of weeds in major Black pepper and cardamom growing area is very important, because the degree of yield losses due to a weed depends on the species' competitive ability, relative growth rate, height, time of emergence (i.e. relative to the crop), leaf area, vegetative mass and density.

Weed growth, population density and distribution vary from place to place depending upon soil and climatic factors, and farmer's management practice. Many research suggested that soil and climatic conditions affect weed flora. Therefore, to design effective weed control measures, the identification, characterization and quantification of the weed species in a certain area are important steps.

### **2. MATERIALS AND METHODS**

The weed survey was conducted in Sheka, Benchmaji and Mejenjer zones (figure, 1) during 2010/11 to 2012/13 in both seasons (Belg) and (Meher). A quadrant with a 0.5 x 0.5m (0.25m<sup>2</sup>) sampling area was used to sample weed species. Observation, Identification and counting individual weed species was thoroughly undertaken. Five samples from each field were taken by using 'W' path. Specimens

of weed species that were not identified during the assessment were collected, dried, mounted and maintained for identification. From the species composition and quantitative data the following statistics were calculated

- Frequency (Constancy):  $F = 100 * X/n$ , where F= frequency, X=number of occurrences of a weed species, n= sample number.
- Abundance:  $A = \sum w/n$ , where A= abundance,  $\sum w$ =number of individual weed species, and n= sample number
- Dominance:  $D = A * 100 / \sum A$ , where D= dominance,  $\sum A$ =abundance of all species
- Similarity index (community index):  $SI = 100 * \sum [(Epg) / (Epg + Epa + Epb)]$

Where SI= similarity index, Epg= number of species found in both location, Epa=number of species found only in location I, Epb=number of species found only in location II

Weed species characteristics, average frequency and dominance over locations and seasons were analyzed black pepper (table 1) and cardamom (table 2) for belg and meher seasons (table 3 & 4)

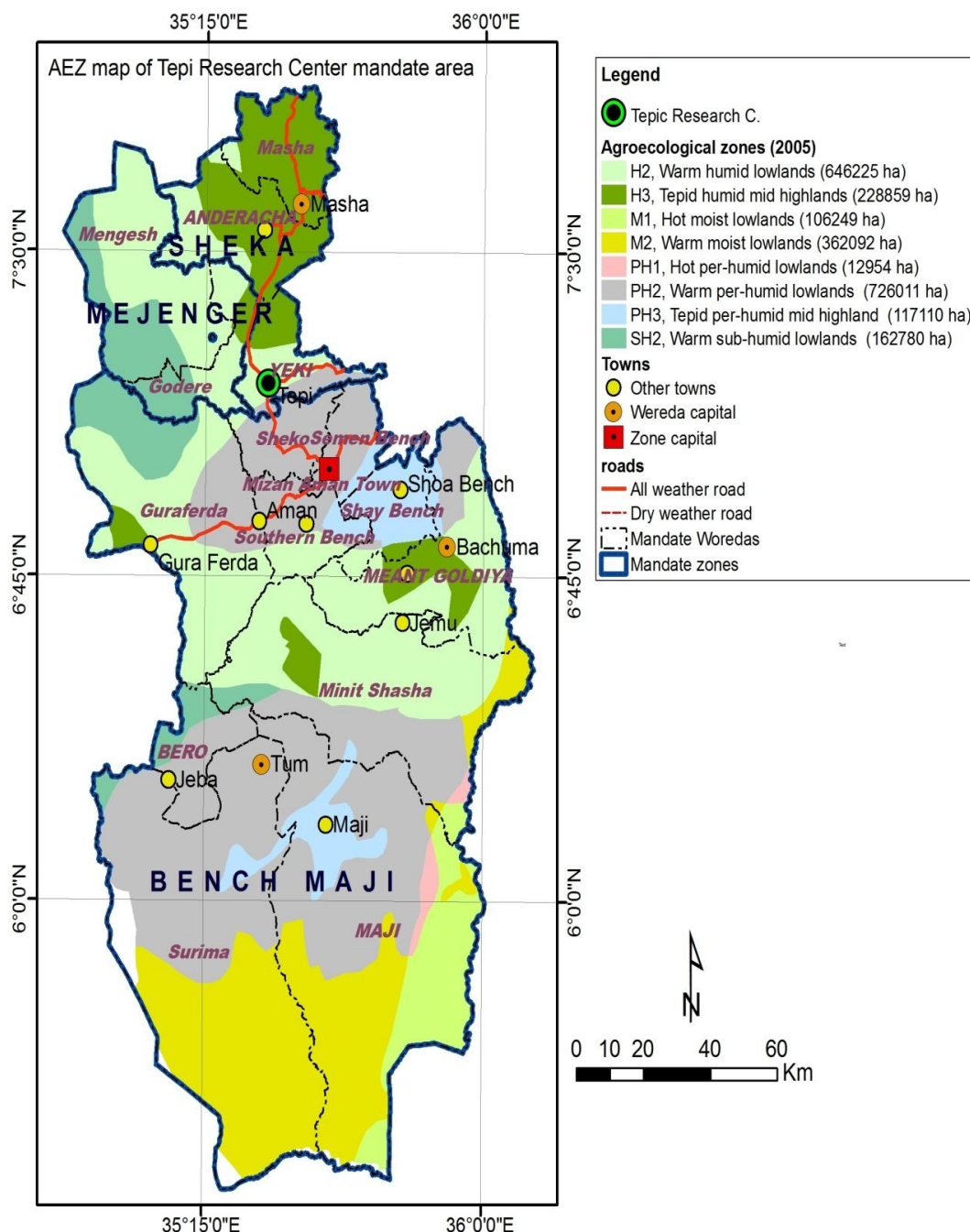


Fig1. Agroecological zone of the survey area

## Weeds of Major Black Pepper (*Piper Nigrum L.*) and Cardamom (*Eliteria Cardamom*) Growing Area of South West Ethiopia

### 3. RESULT AND DISCUSSION

#### 3.1. Black Pepper

A total of 25 weed species were identified from black pepper field. The most important families according to the number of represented species were Poaceae, Malvaceae, Asteraceae, Amaranthaceae and Cyperaceae. The frequency of occurrence of individual weed species ranged from 1% up to 67.5% while the infestation level (dominance) ranged from 0.09% up to 23.73%. The most frequent and dominant weed were *Commelina benghalensis*.

There were a positive and significant relationship among weed species frequency, abundance and dominance ( $P < 0.01$ )

**Table1.** Weed composition, frequency, and dominance in black pepper field of south west Ethiopia in spring 'Belg' and summer 'Meher' seasons of 2010/11 and 2011/12

SN.	Botanical Name	Family	Characteristics	Frequency	Abundance	Dominance
1	<i>Commelina benghalensis</i>	commelinaceae	A/P	67.5	6.825	23.74
2	<i>Euphorbia heterophylla L</i>	Euphorbiaceae	A	30	3.55	12.35
3	<i>Galinsoga parviflora</i>	Asteraceae	A	30	2.975	10.35
4	<i>Rottboellia cochinchinensis</i> (Lour.) W.D.Clayton	Poaceae	A	27.5	1.75	6.09
5	<i>Achyranthus aspera.</i>	Amaranthaceae	A/P	25	2.15	7.48
6	<i>Cynodon dactylon</i>	Chlorideae	P	20	1.575	5.48
7	<i>Galium spurium L. Var. africanum Verdc</i>	Rubiaceae	A	17.5	1	3.48
8	<i>Cyperus rotundus</i>	Cyperaceae	P	17.5	1.125	3.91
9	<i>Snowdenia polystachya (Fresen) pilg</i>	Poaceae	A	17.5	1.7	5.91
10	<i>oxalis corniculata L</i>	Oxalidaceae	A	12.5	0.325	1.13
11	<i>Oplismenus hirtellus</i>	Poaceae	P	12.5	1.525	5.30
12	<i>Chenopodium procerum</i> (Hochst ex.) Moq.	Chenopodiaceae	A	12.5	1.225	4.26
13	<i>Portulaca oleracea L.</i>	Portulacaceae	A	7.5	0.3	1.04
14	<i>Bidens pilosa</i>	Asteraceae	A	7.5	0.175	0.62
15	<i>Convolvulus arvensis L</i>	Convolvulaceae	P	7.5	0.3	1.04
16	<i>Eriocloa fatmensis</i> (Hochst. & Steud.) W.D. clayton	Poaceae	A	5	0.1	0.35
17	<i>Eleusine Indica (L) Goertn</i>	Poaceae	A	5	0.925	3.23
18	<i>Sida alba</i>	Malvaceae	A/P	5	0.2	0.69
19	<i>Digitaria abyssinca</i>	Poaceae	P	2.5	0.1	0.35
20	<i>cyperus esculentus</i>	Cyperaceae	P	2.5	0.125	0.43
21	<i>Bidens bipinnata</i>	Asteraceae	A	2.5	0.1	0.34
22	<i>Sida cordifolia</i>	Malvaceae	A/P	2.5	0.125	0.43
23	<i>Sida rhombifolia</i>	Malvaceae	A/P	2.5	0.125	0.43
24	<i>Mimosa pudica</i>	mImosaceae	P	2.5	0.075	0.26
25	<i>Amaranthus spinosus L</i>	Amaranthaceae	A	1	0.025	0.09

P=perennial

A= annual

#### 3.2. Cardamom

From surveyed cardamom field a total of 22 weed species were identified. The most important families according to the number of represented species were Poaceae and Asteraceae. The frequency of occurrence of individual weed species ranged from 3.45% up to 55.17% while the infestation level (dominance) ranged from 0.01% up to 85.39%. The most frequent weed was *Galinsoga parviflora* were as the most dominant weed was *Cerastium arvense*.

There were a positive and significant relationship among weed species frequency, abundance and dominance ( $P < 0.01$ )

**Table2.** Weed composition, frequency, and dominance in Cardamom field of south west Ethiopia in spring 'Belg' and summer 'Meher' seasons of 2010/11 and 2011/12

SN.	Botanical Name	Family	Characteristics	Frequency	Abundance	Dominance
1	<i>Galinsoga parviflora</i>	Asteraceae	A	55.17	27.34	7.48
2	<i>Euphorbia heterophylla</i> L	Euphorbiaceae	A	51.72	7.59	2.08
3	<i>Commelina benghalensis</i>	commelinaceae	A/P	41.38	1.17	0.32
4	<i>Cynodon dactylon</i>	Chlorideae	P	31.03	1.59	0.43
5	<i>Bidens pilosa</i>	Asteraceae	A	27.59	2	0.55
6	<i>Oplismenus hirtellus</i>	Poaceae	P	27.59	2.24	0.61
7	<i>cerastium arvense</i>	Caryophyllaceae	A/P	27.59	312	85.39
8	<i>Achyranthus aspera.</i>	Amaranthaceae	A/P	24.14	1.31	0.36
9	<i>Xanthium strumarium</i>	Asteraceae	A/P	24.14	1.14	0.31
10	<i>oxalis corniculata</i> L	Oxalidaceae	A	20.69	0.93	0.25
11	<i>Snowdenia polystachya</i> (Fresen) pilg	Poaceae	A	20.69	2	0.55
12	<i>Chenopodium procerum</i> (Hochst ex.) Moq.	Chenopodiaceae	A	20.69	1	0.27
13	<i>Rottboellia cochinchinensis</i> (Lour.) W.D.Clayton	Poaceae	A	17.24	0.41	0.11
14	<i>Galium spurium</i> L. Var. <i>africanum</i> Verdc	Rubiaceae	A	13.79	1.52	0.42
15	<i>Sida alba</i>	Malvaceae	A/P	13.79	0.41	0.11
16	<i>cyperus esculentus</i>	Cyperaceae	P	13.79	0.41	0.11
17	<i>medicago polymorpha</i> L	Leguminosae	A	10.34	1.03	0.28
18	<i>Hydrocotyle umbellate</i>	Hydrocotylaceae	P	6.99	0.45	0.12
19	<i>Eleusine Indica</i> (L) Goertn	Poaceae	A	3.45	0.10	0.03
20	<i>Mimosa pudica</i>	mimosaceae	P	3.45	0.034	0.01
21	<i>Boerhaavia erecta</i> L	Nyctaginaceae	A	3.45	0.17	0.05
22	<i>Convolvulus arvensis</i> L	Convolvulaceae	P	3.45	0.03	0.01

P=perennial

A= annual

**Table3.** Weed composition, frequency, and dominance in Cardamom field of south west Ethiopia in spring 'Belg' seasons of 2010/11 and 2011/12

SN.	Botanical Name	Family	Characteristics	Frequency	Abundance	Dominance
1	<i>Galinsoga parviflora</i>	Asteraceae	A	55.17	27.34	7.48
2	<i>Euphorbia heterophylla</i> L	Euphorbiaceae	A	51.72	7.59	2.08
3	<i>Commelina benghalensis</i>	commelinaceae	A/P	41.38	1.17	0.32
4	<i>Cynodon dactylon</i>	Chlorideae	P	31.03	1.59	0.43
5	<i>Bidens pilosa</i>	Asteraceae	A	27.59	2	0.55
6	<i>Oplismenus hirtellus</i>	Poaceae	P	27.59	2.24	0.61
7	<i>cerastium arvense</i>	Caryophyllaceae		27.59	312	85.39
8	<i>Achyranthus aspera.</i>	Amaranthaceae	A/P	24.14	1.31	0.36
9	<i>oxalis corniculata</i> L	Oxalidaceae	A	20.69	0.93	0.25
10	<i>Snowdenia polystachya</i> (Fresen) pilg	Poaceae	A	20.69	2	0.55
11	<i>Galium spurium</i> L. Var. <i>africanum</i> Verdc	Rubiaceae	A	13.79	1.52	0.42
12	<i>Sida alba</i>	Malvaceae	A/P	13.79	0.41	0.11
13	<i>cyperus esculentus</i>	Cyperaceae	P	13.79	0.41	0.11
14	<i>medicago polymorpha</i> L	Leguminosae	A	10.34	1.03	0.28
15	<i>Eleusine Indica</i> (L) Goertn	Poaceae	A	3.45	0.10	0.03
16	<i>Mimosa pudica</i>	mimosaceae	P	3.45	0.034	0.01

**Table4.** Weed composition, frequency, and dominance in Cardamom field of south west Ethiopia in summer 'Meher' seasons of 2010/11 and 2011/12

SN.	Botanical Name	Family	Characteristics	Frequency	Abundance	Dominance
1	<i>Galinsoga parviflora</i>	Asteraceae	A	55.17	27.34	7.48
2	<i>Euphorbia heterophylla</i> L	Euphorbiaceae	A	51.72	7.59	2.08
3	<i>Commelina benghalensis</i>	commelinaceae	A/P	41.38	1.17	0.32

## Weeds of Major Black Pepper (*Piper Nigrum L.*) and Cardamom (*Eliteria Cardamom*) Growing Area of South West Ethiopia

4	<i>Cynodon dactylon</i>	<i>Chlorideae</i>	P	31.03	1.59	0.43
5	<i>Bidens pilosa</i>	<i>Asteraceae</i>	A	27.59	2	0.55
6	<i>Oplismenus hirtellus</i>	Poaceae	P	27.59	2.24	0.61
7	<i>cerastium arvense</i>	<i>Caryophyllaceae</i>	A/P	27.59	312	85.39
8	<i>Achyranthus aspera.</i>	<i>Amaranthaceae</i>	A/P	24.14	1.31	0.36
9	<i>Xanthium strumarium</i>	<i>Asteraceae</i>	A/P	24.14	1.14	0.31
10	<i>oxalis corniculata L</i>	<i>Oxalidaceae</i>	A	20.69	0.93	0.25
11	<i>Snowdenia polystachya (Fresen) pilg</i>	Poaceae	A	20.69	2	0.55
12	<i>Chenopodium procerum (Hochst ex.) Moq.</i>	Chenopodiaceae	A	20.69	1	0.27
13	<i>Rottboellia cochinchinensis (Lour.) W.D.Clayton</i>	Poaceae	A	17.24	0.41	0.11
14	<i>Galium spurium L. Var. africanum Verdc</i>	<i>Rubiaceae</i>	A	13.79	1.52	0.42
15	<i>Sida alba</i>	<i>Malvaceae</i>	A/P	13.79	0.41	0.11
16	<i>cyperus esculentus</i>	<i>Cyperaceae</i>	P	13.79	0.41	0.11
17	<i>Hydrocotyle umbellate</i>	<i>Hydrocotylaceae</i>	P	6.99	0.45	0.12
20	<i>Boerhaavia erecta L</i>	<i>Nyctaginaceae</i>	A	3.45	0.17	0.05
21	<i>Convolvulus arvensis L</i>	<i>Convolvulaceae</i>	P	3.45	0.03	0.01

### 3.3. Sheka Zone

The frequency of individual weed species ranged from 5% up to 40% whereas dominancy ranges from 0.68 up to 26.98% in Sheka zone Black pepper field. The most frequent and dominant weed was *Euphorbia heterophylla L.* This weed species contributed up to 26.98% the infestation of weed in Black pepper field at Sheka zone. Whereas, The frequency of individual weed species ranged from 5% up to 50% whereas dominancy ranges from 0.009 up to 87% in Sheka zone cardamom field. The most frequent weed was *Galinsoga parviflora* whereas the most dominant weed was *cerastium arvense*. This two weed species contributed up to 95.3% the infestation of weed in cardamom field at Sheka zone

### 3.4. Mejenjer Zone

The frequency of individual weed species ranged from 10% up to 60% whereas dominancy ranges from 0.39% up to 26.69% in Mejenjer zone Black pepper field. The most frequent weed was *Cerastium arvense* and dominant weed was *Galinsoga parviflora*. This two species contributed up to 39.44% the infestation of weed in Black pepper field at Mejenjer zone. Whereas, The frequency of individual weed species ranged from 20% up to 80% whereas dominancy ranges from 0.5% up to 45.5% in Mejenjer zone cardamom field. The most frequent and dominant weed were *Euphorbia heterophylla L.* This single species contributed up to 45.5% the infestation of weed in cardamom field at Mejenjer zone

#### 3.1.1. Bench Maji Zone

The frequency of individual weed species ranged from 10% up to 60% whereas dominancy ranges from 0.82% up to 30.6% in Benchmaji zone Black pepper field. The most frequent weed was *Snowdenia polystachya (Fresen) pilg* and dominant weed was *Commelina benghalensis*. This two species contributed up to 57.95% the infestation of weed in cardamom field at Benchmaji zone. Whereas, The frequency of individual weed species ranged from 20% up to 80% whereas dominancy ranges from 0.69% up to 26.6% in Benchmaji zone cardamom field. The most frequent and dominant weed were *Oplismenus hirtellus*. This single species contributed up to 26.6% the infestation of weed in cardamom field at Benchmaji zone

#### 3.1.2. Farmers Practice to Control Weed

Since Black pepper and cardamom are perennial spices it is exposed to weed competition throughout the year both by annual and perennial weeds. The area where hot humid and get more than 1500mm rainfall per year, the agro ecology were suitable to emerge diverse and fast growing weed species. This situation makes weed control difficult. But farmers in the survey area practice hand weeding and slashing to control a weed.

#### 4. CONCLUSION AND RECOMMENDATION

This survey has ranked the most abundant and troublesome weed species in Black pepper and cardamom growing area of South west Ethiopia. Information that is vital for setting research and development priorities concerning weed management.

#### REFERENCES

- [1] Girma H, Digafie T, Edossa E, Belay YB, Weyessa G (2008). Spices research achievements, revised edition. Ethiopian Institute of Agricultural Research, Addis Ababa Ethiopia: 24-27.
- [2] HEDBERG I & EDWARDS S (1989) Flora of Ethiopia (Pittosporaceae to Araliaceae), Vol. 3. The National Herbarium (Addis Ababa, Ethiopia) and Department of Systematic Botany (Uppsala, Sweden).
- [3] HEDBERG I & EDWARDS S (1995) Flora of Ethiopia and Eritrea 7 (Poaceae), Vol. 7. The National Herbarium (Addis Ababa, Ethiopia) and Department of Systematic Botany (Uppsala, Sweden).

#### AUTHORS' BIOGRAPHY



**Habetewold Kifelew Abebe**, was born August 2, 1985 Ethiopia, he is graduated from Jimma university MSc. in plant pathology. He has been working in Ethiopian Institute of Agricultural Research as associate plant pathology researcher since May, 2007.



**Hailemariam Abera** was born March 30/1984, Ethiopia, he is graduated from Jimma university BSc. in Horticulture. He has been working in Ethiopian Institute of Agricultural Research as Assistance plant pathology researcher since May, 2010.



**Girma Hailemichael Gebre** was born in October 25, 1973 in Ethiopia. He is graduated from Valladolid University (Spain) PhD in plant agronomy/physiology. He has been working in Ethiopian Institute of Agricultural Research as Researcher II in Breeding/Agronomy physiology since February 1997.