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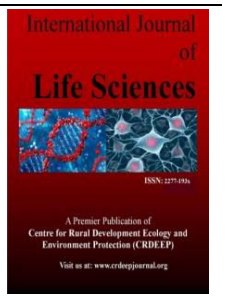

Full Length Research Paper

Allelopathic Effect of Sweet Basil (*Ocimum basilicum* L.) as phytotoxic extract on V egetative growth of commercial crop plants and its associated weed

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ABSTRACT

The present invention is depending on evaluate the phytotoxic potential of natural products of aromatic plant for weed control. Allelopathy phenomena are kinds of weed / crop, weed / weed or crop / crop interference where some chemical constituents are released by some plant species which can cause inhibitory effect on the growth of the other species. Three experiments carried out at the wire house of Weed Research Laboratory at Giza, field crops and horticulture farm experiments at Sids Research Station, Beni Suef Governorate, Agriculture Research Center, conducted during the period of 2014 to 2017 to study the exploration portion of the phytotoxic (allelopathic) potential of aqueous extracts from dry leaves, stem and seeds of ocimum basilicum on commercially important agricultural crops and its associated weeds. Results show that tomatoes crop as well as Portulaca oleraceus L, Amaranthus spp, Euphorbia helioscopia L, Ammi majus, L., Anagallis arvensis were sensitive to aqeous O. basilicum extracts when applied at the concentration 3, 4 and 5% post emergence at 2-4 leaf stage of weeds, but, aqueous O. basilicum extracts did not any effect on maize, kidney bean, as summer crops and wheat, Chickpea, clover and onion winter crops, or Beta vulgaris, L, Capsella bursa-pastoris, L, Malva parviflora, L., Sonchus oleraceus, Rumex dentatus, L., Medicago polymorpha, L, Melilotus indica L., Trifolium respinatum L., at different concentration. However, Chenopodium album, Amaranthus hybridus and Portulaca oleraceus were susceptible to low concentrations of Ocimum extract 1, 2, 3, 4 and 5% when applied post- emergence at stage 2-4 leaves of weeds. O. basilicum extracts at the concentration 3, 4 & 5% caused reduced percentage of P. oleraceus; T. portulacastrum and C. rotundus by 60, 80 & 86%; 75, 80 & 90% and 75, 90 & 91%, respectively, in average in all experiments under study. This method for weed control is characterized by preserving the environment from contamination by the herbicide that are used for reducing weed density incidence, obtaining a healthy, clean and safe agricultural product for public health, with ease of manufacturing and saving hard currency for importing herbicides.

Introduction

Sweet basil (*Ocimum basilicum*) belonging to the lamiaceae family is a well- known medicinal plant that has bean utilized for a number of purposes. Some of the *Ocimum sp.* is used in the traditional medicine for different ailments especially in many Asian and Africa countries for its essential oil composition of sweet basil, oil and oleoresin of basil using in food and many authors have mentioned the antimicrobial, antifungal and Several components, such as camphor and 1,8-cineole have been suggested as agents in allelopathy reactions, (Yusuf *et al*, 1994; Dube *et al*, 1989; Duke *et al,* 2000; Viňa A. and E. Murillo 2003; Wesołowska *et al*, 2012 and Mekky *et al*, 2019).

Sweet basil oil distilled in France, Italy, Bulgaria, Egypt, Hungary, South Africa and occasionally in the USA, contains almost identical amounts of methyl chavicol (20–43%) and linalool (37–55%), (De Masi, *et al*, 2006). Allelochemical need to reduce chemical inputs into agricultural systems has renewed the interest to use of allelochemical produced by plants in the genus *Ocimum* (Weston and Duke, 2003 and Seject *et al*, 2012). Many researchers studied the allelopathy is a phenomenon effect of crops on weeds have appeared recently such as *Ocemum* basilicum, (Rosado *et al*, 2009, Dhima *et al*, 2009 and Fanaei *et al*, 2013) reported that aqueous extract of basil presented a significant reduction effect on the germination velocity index of tomato, dry weight of *C. album* and abutilon (*Abutilon theopharasti*), green manur of *O. basilicum* reduced common purslane (*Portulaca oleracea* L.), common lambsquarters (*C. album),* by 25 – 79, 58 - 83%, respectively, but, maize emergence was not affected by any green manure with increase grain yield than that in the corresponding green manure free plots. The observation prompted us to explore the phenomenon through (i) different concentration of *O. basilicum* extracts (ii)

involvement of organic molecules through (iv) different assay crops and some dominant weed species associated in these crops. The objectives of this investigation to study the Phytotoxic effect of aqueous *O.basilicum* extracts by methanol 80% on commercially important agricultural crops (summer and winter crops) like, maize, kidney bean, tomatoes as summer crops and wheat, Chickpea, clover and onion winter crops and some weed species like *Portulaca oleraceus* L, *Trianthema portulacastrum* L *Chenopodium album*, L *Amaranthus* spp, *Cyperus rotundus,* L, *Convolvulus arvensis, Anagallis arvensis* L, *Euphorbia helioscopia* L,*Ammi majus*, L., *Beta vulgaris,* L, *Capsella bursa- pastoris,* L, *Malva parviflora*, L., *Sonchus oleraceus*, *Rumex dentatus*, L., *Medicago polymorpha,* L, *Melilotus indica* L., Trifolium *respinatum* L., *Brachiria reptans,* L and *Echinochloa colonum* L. Link, as allelopathic receptors.

Materials and methods

Three experiments in wire house pots at Giza Station, ARC, field crops and horticulture farm experiments at Sids Agricultural Research Station, Beni Suef Governorate, Agriculture Research Center conducted during 2014 – 2017 period to study the allelopathic effect of sweet basil extract on germination and seedling development of some weed species, commercially important agricultural crops (summer and winter crops) like, maize (*Zea mays* L.), kidney bean (*Phaseolus vulgaris*), tomatoes *Lycopersicum esculentum* Mill. as summer crops and Wheat (*Triticum aestivum* L.), Chickpea (*Cicer arietinum,* L), clover (*Trofolium alexandrium,* L) and onion (*Allium cepa* L.) winter crops.

Extraction procedure:

Collected mature entire plants of sweet basil were grounded by tissue grinder to pass through 1 – 2 mm screen. The dried samples (0.5 kg) were extracted with aqueous methanol 80% for 72 hours, at room temperature, then filtrated through Whatman's filter paper No. 1 and the solvents were evaporated by rotary evaporator at 40ºC under reduced pressure. Extract yield (100 g) formulae in solution with 40 ml clove oil and the volume complete to 500 ml distilled water and then kept under room condition until use. The extractions were diluted to obtain gradual concentrations extracts by diluting the extracted with water to the required concentrations as mentioned in the following experiments.

Wire house experiments: -

Effect of sweet basil extracts on maize and associated weed species.

Pot experiments were conducted to determine the effect of aqueous methanol 80% from sweet basil on the growth weed species and maize in pots. Pot diameter 50 cm and 75 cm deep in three replicates, Pots were filled by clay soil which was naturally highly infested by (*Trianthema portulacastrum* L.), (*Portulaca oleraceae* L.) as broad leaved weeds and *Brachiria reptans* and *Echinochloa colonum* as grassy weeds.

These treatments were arranged complete randomize design on pots in three replicates as the following:-

1 - Sweet basil extract at 2% [2 ml formulae (0.4 g of extractable material)/100 ml water] applied at 2 – 5 leaves of weeds.
2 - Sweet basil extract at 3% applied at 2 – 5 leaves of weeds.
3 - Sweet basil extract at 4% applied at 2 – 5 leaves of weeds.
4 - Sweet basil extract at 5% applied at 2 – 5 leaves of weeds.
5 - Untreated check (control).

Maize

Maize variety was Giza 2 sowing in 28th April, 28th June and 28th August in the first, second and third exp., summer season 2014 at the rate of 3 plants /pot. Pots were watered regularly as needed. All used concentrations were sprayed by hand sprayer one liter volume with 50 ml of bio-herbicide solution/pot. The efficiency of *Ocimum* extractions on weeds and its phytoxicity on maize were recorded after 45 days from sowing.

The following data were recorded:-

1 -.Fresh weight of maize plant g/plant.
2 – Dry weight of maize plant g/plant.
3 - Fresh weight of grassy weeds g/pot.
4 - Fresh weight of broad – leaved weeds g/pot.
5 - Fresh weight of total weeds g/pot.
6 – Inhibitory % in weight of total weeds compared to check.

Clover

Pot experiment was conducted to study the phytoxicity effect of aqueous methanol 80% from sweet basil on the growth clover and associated weed species. Pots were filled by clay soil which was naturally highly infested by *Chanopodium murale* L., *Rumex dentatus* L. and *Ammi majus* L. as broad leaved weeds and *Setaria viridis* L, *Avena fatua*, *Phalaris paradoxa*, *Diplachena fusca* L., as grassy weeds. The efficiency of *ocimun* extract on weed species and phytoxicity on clover were recorded weed coverage and clover phytotoxic was visual from sowing until end growing season, as well as, fresh weight of weed species, fresh and dry weight of clover at end cut (sixth cut of clover).

These treatments were arranged randomize design on pots in three replicates as the following:-

1. Untreated check (control).
2. Spray sweet basil extract at 2% concentration [2ml formulae (0.4 g of extractable material)/100 ml water] applied after fourth cut of clover with the appearance of weed species infestation and at 2-4 true leaves of weeds.
3. Sweet basil extract at 3% applied after fourth cut of clover with the appearance of weed species infestation and at 2-4 true leaves of weeds.

4. Sweet basil extract at 4 applied after fourth cut of clover with the appearance of weed species infestation and at 2-4 true leaves of weeds.
5. Sweet basil extract at 5% applied after fourth cut of clover with the appearance of weed species infestation and at 2-4 true leaves of weeds.

Clover variety was Giza 2 sowing in 18th November 2014/15 winter season. The preceding summer crop was maize (*Zea mays* L.) which treated by *ocimum* extract at the rate 1, 2, 3, 4 and 5% with unweeded check for control associated weed of maize. Sowing clover seed at the rate, 1.5 g/pot after removal the west preceding summer crop without any tillage of soil.
Pots were watered regularly as needed in extract treatments or in chick. All used concentrations were sprayed by hand sprayer one liter volume with 50 ml of bio- herbicide solution/pots.

Statistical analysis: -
The experimental design was RCB in three replications in wire house experiments, all data were statistically analyzed according to the procedures outlined by Steel and Torrie, 1980 and the treatments means were compared by least significant differences (L.S.D) as all experimental under studied.

Field crops and vegetables experiment: -
Effect aqueous methanol 80% from sweet basil on commercially important agricultural and associated weed species:-
Field studies were carried out at Sids Agricultural Research Station, Agriculture Research Center, Ministry of Agriculture, during summer 2016 and winter season 2016/2017 consist two experiments as follows: -

1. **Vegetable crops (tomatoes and kidney bean): -**
   Two field experiments at horticulture farm experiments at Sids Research Station, Beni Suef Governorate, Agriculture Research Center, conducted during 2016 summer season to study the phytotoxic (allelopathic) potential of aqueous extracts from whole plant of *ocimum basilicum* on Vegetable crops like, kidney bean (*Phaseolus vulgaris*), tomatoes (*Lycopersicum esculentum* Mill.) and associated weed species**.**
2. **Field crops experiments (wheat, chickpea and onion):**
   Field experiments were conducted from Field crop farm at Sids Research Station, Agriculture during 2016 and 2017 winter seasons to study the phytotoxic (allelopathic) potential of aqueous extracts from whole plant of *ocimum basilicum* on. commercially important agricultural winter crops like, wheat (*Triticum aestivum* L.), chickpea (*Cicer arietinum,* L) and onion (*Allium cepa* L.) and associated weed species.

These treatments were arranged complete randomize block design in three replicates as the following:-

1- Sweet basil extract at 1% concentration [10 ml formulae (0.2 g of extractable material)/one liter water] applied at 2 – 5 leaves of weeds.
2- Sweet basil extract at 2% applied at 2 – 5 leaves of weeds.
3- Sweet basil extract at 3% applied at 2 – 5 leaves of weeds.
4- Sweet basil extract at 4% applied at 2 – 5 leaves of weeds.
5- Sweet basil extract at 5% applied at 2 – 5 leaves of weeds
6- Untreated check (control).

All used concentrations were sprayed with knapsack sprayer CP3 with 200 liter water/fed. The efficiency of *Ocimum* extractions on weeds and its phytoxicity on commercially important agricultural crops was recorded after 60 days from sowing. The following data were recorded:-

Weeds: -Estimation of the weed coverage visual on aria in control plots after 45 days from sowing. Weeds were classified into species and determining the reduction percentage of each species compared with the control plots.

Commercially important agricultural winter crops: -
The phytoxicity effect on commercially important agricultural winter crops was estimated visual according to WSSA scale of phytoxicity where a level is no phytoxicity appeared on crop plants and 9 scale to complete damage to the crop plants, Pesticides Section of the Australian Department of Primary Industry, 1979. A visual rating of the discoloration effect of herbicide is done according to the European Weeds Research Council (EWRC) scoring for efficacy and crop tolerance. This system is given in Table 1.

Table 1. Guidelines for field evaluation of herbicides (1979)*

Score	Efficacy (weed kill)	Crop Tolerance
1	Complete kill	No effect
2	Excellent	Very slight effects, some stunting & yellowing just visible
3	Very good	Slight effects, stunting & yellowing obvious, effects reversible
4	Good- acceptable	Substantial chlorosis and (or) stunting, probably no effect on yield, most effects
5	Moderate but not	probably reversible
6	generally acceptable	Strong chlorosis/stunting, thinning of the stand, some yield loss expected
7	Fair	
8	Poor	Increasing severity of damage
9	Very poor	

** Source: Australian Government Publishing Service, Canberra 1979.*

Results and Discussion

Wire house experiments: -

First experiment: Effect of aqueous methanol 80% from sweet basil on maize and associated weed species:

The most predominant weed flora in three pot experiments were *Amaranthus sp., portulaca oleracea* and *Trianthema portulacastrum* L as annual broad leaf weeds and *Brachiria reptans* and *Echinochloa colonum* as annual grassy weeds.

Table (2) reported that fresh weight of grassy, broad leaved and their total weeds were significantly reduced by different concentration of aqueous sweet basil extracted, but, the reduction of grassy weeds in the second experiments was not statistically significant with different concentration of aqueous extract of sweet basil and water check. The best reduction in fresh weight of broad leaved weeds and total weeds were resulted from the application sweet basil extract at concentration 5%. The reduction percentage of broad leaved weeds by different concentrations of sweet basil extracted at the concentration 2, 3, 4 and 5% was 78.4, 75.0, 90.9 and 96.0 & 51.5, 68.7, 75.8 and 72.4% & 74.9, 75.4, 83.7 and 87.8% in the first & second & third experiments. These resulted due to broad leaved weed species in pot infestation was more sensitive of *Ocimum* extract, efficacy of (weed kill) was excellent effect than grassy weed was moderate but not generally acceptable based on, Guidelines for field evaluation of herbicides (1979) as well as grassy weed was low infestation in first and third experiments than broad leaved weeds. The data are in agreement with the results previously obtained by (Shlevin 2000; Rosado et al, 2009, Fanaei et al, 2013 and Dhima et al, 2009) reported that aqueous extract of basil presented a significant reduction effect on the germination velocity index of tomato, plantlet dry weight of Chenopodium album and abutilon (*Abutilon theopharasti*), green manur of *Ocimum basilicum* reduced common purslane (*Portulaca oleracea L.*), common lambsquarters (*Chenopodium album*), by 25 – 79, 58 - 83%, respectively, but, maize emergence was not affected by any green manure with increase grain yield than that in the corresponding green manure free plots or cultivated members of the genus *Ocimum* to suppress weeds.

Table 2. The effect of aqueous methanol 80% from sweet basil on number and fresh weight weed classes (g) and fresh and dry weight of maize and clover.

Treatments	Grassy weed (g/pot)	Broad leaved W, (g/pot)	Total weed (g/pot)	% of reduction	Fresh W. of maize (g/plant)	Dry W. of maize (g/plant)
			First experiment			
Sweet basil extract at 2%	2.67	30.68	33.35	77.88	96.51	34.05
Sweet basil extract at 3%	2.00	35.5	37.50	75.13	61.79	30.49
Sweet basil extract at 4%	0.67	12.87	13.37	91.13	67.95	26.72
Sweet basil extract at 5%	0.00	5.63	5.63	96.27	46.96	23.78
Untreated check (control).	8,87	141.90	150.77	0.00	68.80	30.42
LSD	4.43	21.31	19.66		NS	NS
			Second experiment			
Sweet basil extract at 2%	25.87	50.57	76.44	48.09	45.12	16.26
Sweet basil extract at 3%	16.53	32.64	49.18	66.60	47.36	24.40
Sweet basil extract at 4%	17.77	28.59	46.30	68.56	44.80	17.31
Sweet basil extract at 5%	22.77	28.80	51.43	65.07	48.67	15.59
Untreated check (control).	42,87	104.38	147.25	0.00	38.77	9.84
LSD	NS	18.83	18.08		2.74	3,41
			Third experiment			
Sweet basil extract at 2%	10.46	37.68	48.15	73.03	49.75	12.62
Sweet basil extract at 3%	16.13	37.00	53.13	70.24	42.83	11.33
Sweet basil extract at 4%	12.60	24.43	37.03	79.26	46.37	12.90
Sweet basil extract at 5%	5.17	18.27	23.43	86.88	46.80	11.74
Untreated check (control).	28.20	150.33	178.53	0.00	43.12	10.37
LSD	11.40	25.11	26.44		NS	NS
			Clover experiments			
Sweet basil extract at 2%	17.87	29.91	47.77	19.67	26.25	3.65
Sweet basil extract at 3%	9.07	28.36	37.42	37.08	61.43	11.64
Sweet basil extract at 4%	9.99	21.77	31.76	46.59	58.26	12.23
Sweet basil extract at 5%	26.32	26.60	52.92	11.01	33.34	4.83
Untreated check (control).	20.47	39.00	59.47	0.00	13.54	0.72
LSD	NS	10.11	NS		11.89	2.64

Clover crop: -

From the experiments reported that sowing clover after 15 days from treatments by *Ocimum* extract at all concentration did not effect on emergence percentage of clover seeds and the appearance of weeds in pot was after fourth month from sowing before fifth cut of clover, so application of *ocimum* extract was after fourth cut and data recorded of fresh and dry weight of clover of sixth cut and weed fresh weight after one month from the end spray of *ocimum* extract.

The most predominant weeds in pots experiment was *Chanopodium murale* L., *Rumex dentatus* L. and *Ammi majus* L. as

broad leaved weeds and *Setaria viridis* L, *Avena fatua*, *Phalaris paradoxa*, *Diplachena fusca* L., as grassy weeds.

Table (3) reported that *Chanopodium murale* L. and *Ammi majus* L. was more effective by *ocimum* extract at all concentration, but, *Rumex dentatus* L. was effected by *ocimum* extract at the concentration 3, 4 and 5% without any phytotixic of clover crop or grassy weeds such as *Setaria viridis* L, *Avena fatua*, *Phalaris paradoxa*, *Diplachena fusca* L.. The reduction percentage of broad leaved weeds were 23.3, 27.3, 44.2 and 31.8% at the concentration 2, 3, 4 and 5% of *Ocimum* extract, respectively. These results due to *Rumex dentatus* L was dominant in some pots at the concentration 3 and 5% concentration of *Ocimum* extract and *Rumex dentatus* L, was low sensitive of *Ocimum* extract than *Chanopodium murale* L. and *Ammi majus* L which more sensitive at all concentration of *Ocimum* extract.

Field crops and vegetables experiment: -

Effect of aqueous methanol 80% from sweet basil on wheat, tomatoes, kidney bean, chickpea, onion and their associated weed species:-

Vegetables experiment (tomatoes and kidney bean): The most predominant weeds flora in the two field trials tomatoes (*Lycopersicum esculentum* Mill.) and kidney bean (*Phaseolus vulgaris*) during 2017 summer season was *Portulaca oleraceus* L., *Chenopodium album*, L., *Amaranthus* spp, *Cyperus rotundus,* L., *Convolvulus arvensis, Anagallis arvensis* L., *Euphorbia helioscopia* L.

Table (3), photos (1, 2) and Fig. (1 and 2) reported that the extract of whole *Ocimum* plant (leaves, stem and seeds) at the rate of 2% decreased fresh weight of *Portulaca oleraceae* L. and *Chenopodium album,* L about 50 -75%, without any phytotoxicity on all crops under study as well as other weed species. *Ocimum* extracts at the rate 3, 4 and 5% was more effective on some dominant weed species associated in these crops as *Portulaca oleraceus* L., *Chenopodium album*, L., *Amaranthus* spp, *Cyperus rotundus,* L., *Convolvulus arvensis*, *Euphorbia helioscopia* L., about 60 to 96% as well as tomatoes crop by 30-40% reduction on growth, flower and fruit, but, *Phaseolus vulgaris*, was low effect in plant without any reduction on development growth of plants or seed yield.

Photo (1 and 2) Effect of *Ocimum* extract at concentration 4% after sprayed by 15 days in tomatoes and 10 days in kidney bean.

Field crops (wheat, lentil, chickpea, faba bean and onion)

The most predominant weeds flora in the five field experiments wheat (*Triticum aestivum* L.), chickpea (*Cicer arietinum,* L) and onion (*Allium cepa* L.) during 2016/2017 winter season was *Beta vulgaris,* L, *Capsella bursa-pastoris,* L, *Malva parviflora*, L., *Sonchus oleraceus*, *Rumex dentatus*, L., *Medicago polymorpha,* L, *Melilotus indica* L., Trifolium *respinatum* L., *Avena fatua*, *Phalaris paradoxa*.

Table (3) and Fig. (1 and 2) reported that *Ocimum* extract at the rate of 2% decreased fresh weight of *Chenopodium album,* L about 30 -50%, without any phytotoxicity on all crops under study as well as other weed species. *Ocimum* extracts at the rate 3, 4 and 5% was low effect on dominant weed species associated in these crops like as *Beta vulgaris,* L, *Capsella bursa-pastoris,* L, *Malva parviflora*, L., *Sonchus oleraceus*, *Rumex dentatus*, L., *Medicago polymorpha,* L, *Melilotus indica* L., Trifolium *respinatum* L., *Avena fatua*, *Phalaris paradoxa*, *Diplachena fusca* L., *Setaria viridis,* L, *Brachiria reptans,* L and *Echinochloa colonum* L. Link. A visual rating of the discoloration effect of bio-herbicide is done according to the European Weeds Research Council (EWRC) scoring for efficacy and crop tolerance. This system is given in Table 1.

Table 3. Allelopathic effect of Ocimum extract at different concentration on weed species and some commercial crops.

Family name	Weed species	% of control at different concentration of *Ocimum* extract				
		1%	2%	3%	4%	5%
Amaranthaceae	*Amaranthus* spp,	8	25	45	60	96
	Beta vulgaris, L	-	-	-	10	25
Chenopodiaceae	*Chenopodium album*, L	-	-	10	15	25
	Chenopodium murale, L	16	35	80	89	92
Portulaceae	*Trianthema portulacastrum* L	20	35	70	85	95
	Portulaca oleraceus L	10	30	60	80	86

Primulaceae	*Anagallis arvensis* L	-	-	20	40	45
Euphorbiaceae	*Euphorbia geniculate,* L	-	-	5	15	35
	Euphorbia helioscopia L	-	-	70	75	88
Umbeliferae	*Ammi majus*, L.	5	25	25	30	35
Convolvulaceae	*Convolvulus arvensis*	-	10	75	80	90
Cyperaceae	*Cyperus rotundus,* L	-	-	75	90	91
Cruciferae	*Capsella bursa-pastoris,* L	-	-	-	-	-
Malvaceae	*Malva parviflora*, L	-	-	-	-	-
Compositae	*Sonchus oleraceus*	-	-	-	-	10
	Xanthum pungens Wallr	-	-	3	3	5
Polygonaceae	*Rumex dentatus*, L	-	-	-	-	-
Leguminosae	*Medicago polymorpha,* L	-	-	-	-	-
	Melilotus indica L	-	-	-	-	-
	Trifolium *respinatum* L	-	-	-	-	-
Gramineae	*Avena fatua*	-	-	-	-	-
	Phalaris paradoxa	-	-	-	-	-
	Diplachena fusca L	-	-	-	-	-
	Setaria viridis, L	-	-	-	-	-
	Brachiria reptans	-	-	-	-	-
	Echinochloa colonum L. Link	-	-	-	-	-
Commercial crop plants						
Leguminosae	*Cicer arietinum,* L	-	-	-	-	- - - -
	Trofolium alexandrium, L	-	-	-	-	
	Phaseolus vulgaris	-	-	-	-	
Gramineae	*Triticum aestivum* L.	-	-	-	-	
	Zea mays L.	-	-	-	-	
Liliaceae	*Allium cepa* L.	-	-	-	-	
Solanaceae	*Lycopersicum esculentum* Mill.	-	-	10	25	

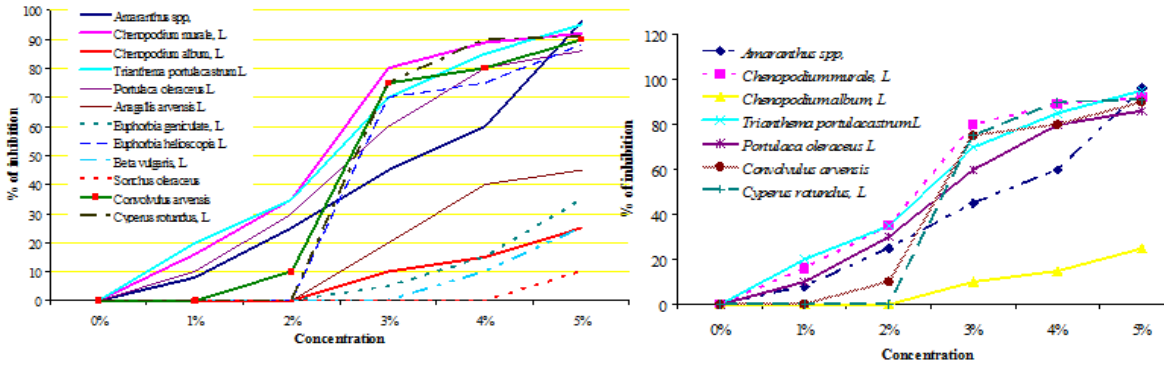

Fig 1. Effect of *Ocimum* extract at different concentration on weed spp.

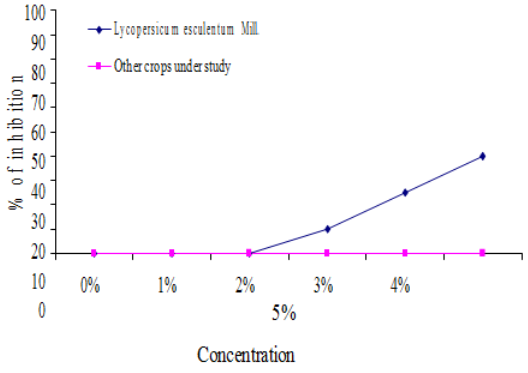

Fig 2. Effect of *Ocimum* extract at different concentration on commercial crops.

Conclusion

From this study suggest that annual sweet basil (*Ocimum basilicum*) extract is safe and can be used as selective natural herbicide to control broad leaved weeds in maize, wheat, clover, kidney bean, chickpea and onion fields. *Ocimum* more effect on annual summer broad leaved weeds, *Portulaca oleraceae* L., *Amaranthus* spp, *Trianthema portulacastrum* L, *Chanopodium murale* L and *Ammi majus* L and *Cyperus rotundus, Convolvulus arvensis* as perennial weeds, but, did not

effect on annual grassy weeds and legume weeds and *Beta vulgaris*, *Capsella bursa-pastoris*, *Malva parviflora*.

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