Efficacy of certain plant extracts in controlling of sunflower leaf spot disease caused by *Alternaria helianthi.*

T. Uma Kiran*, Prof. M. Mamatha

*Governemnt Degree College, Armoor, Telangana state.

Department of Botany, Telangana University, Dichpally, Telangana state

Abstract: Efficacy of twenty two plant extracts like *Azadirachta indica, Allium cepa, Allium sativum, Zingiber officinale, Lawsonia inermis, Lantana camara, Parthenium hysterophorus, Citrus limon, Eucalyptus globulus, Psidium guajava, Mangifera indica, Annona squamosa, Aegle marmelos, Nerium oleander, Ricinus communis, Calotropis procera, Vitex negundo, Catharanthus roseus, Phyllanthus emblica, Moringa oleifera, Cymbopogon citratus, Tagetus erecta* was tested against the growth of a sunflower leaf blight causing pathogen, *Alternaria helianthi* by poisoned food technique under invitro conditions. Among all these plant extracts at 20% concentration *Phyllanthus emblica*, *Lawsonia inermis, Allium sativum, Psidium guajava, Eucalyptus globulus, Zingiber officinale* and *Parthenium hysterophorus* were efficient in controlling the growth of the Pathogen to 64.10%, 56.41%, 55%, 48.72%, 43.59%, 43.59%, 42.31% respectively. At 50% concentrations of the plant extracts *Allium sativum, Eucalyptus globulus, Lawsonia inermis, Phyllanthus emblica, Citrus limon, Zingiber officinale and Allium cepa* showed efficacy in inhibiting the Mycelial growth of the pathogen to 100%, 75.64%, 65.89%, 65.89%, 62.82%, 58.97% and 51.28% respectively. Followed by *Psidium guajava and Parthenium hysterophorus*. Garlic bulb extract was very effective against *Alternaria helianthi* and can be used to manage this fungus under field conditions.

Key words: Sunflower, Leaf blight, *Alternaria helianthi*, plant extracts.

Introduction:

Oilseed crops are vital to the Indian Economy. After the United States, China and Brazil, India's vegetable oil economy is the fourth largest in the world. Oilseed agriculture is practiced on roughly 260 lakh hectares across the country, primarily on marginal areas that are dependent on monsoon rainfall. Oilseeds account for 13% of gross cultivated area, 3% of GNP and 10% of the value of all agricultural commodities. Almost all oilseed crops are grown in India. Soybean, Groundnut, Rapeseed- Mustard, Sesame, Sunflower, Castor, Safflower, Linseed and Niger are the most important. Soybean has the largest average contribution to total oilseed output among India's nine oil seed crops, followed by Rapeseed-Mustard, Groundnut and Sunflower (average from 2016-17 to 2020-21).

Sunflower (*Helianthus annuus L.*) is one of the important oilseed crops in the world and in India it ranks next only to Soybean, Mustard and Groundnut. Cultivated sunflower is a member of Asteraceae family. The large-scale cultivation of sunflower in India started only in 1970's due to its superiority over the oilseed crops owing to its adaptability to different climatic conditions, ability to withstand drought conditions and high potential yield. But, in recent years the productivity is going down and this is due to several factors one among the factor is the crop susceptibility to various diseases. Gulya and Masirevic (1991) listed 80 pathogens occurring on sunflower. Among these leaf blight caused by *Alternaria helianthi* has been considered as a destructive disease causing much yield losses in many parts of the sunflower growing countries. (Allen et.al., 1983a,b,c; Morris et al., 1983; Lipps and Herr,1986). It has been reported from

different parts of the world including India and is known to cause reduction in flower size, number of seeds per head, seed yield per plant, seed weight and also oil content (Balasubrahmanyam and Kolte, 1980 a &b). Most of the work done so far on this pathogen was related to spore germination, histopathological, histochemical studies, use of fungicides and biocontrol agents in controlling the Sunflower leaf blight disease. It has been reported from the studies that fungicides like SAAF; Mancozeb and Propiconazole have recorded least percent disease intensity and high seed yield (K.Venkatramanamma, P.Madhusudhan, S.Neelima and Y.Narasimhudu, 2014). Other fungicides and biocontrol agents like Carbendazim 75 WP, Propiconazole 25 EC, Metalaxyl 35 SD and Azoxystrobin 23 SC, *Trichoderma viride*, *Pseudomonas fluorescens*, *Streptomyces griseus* were effective in inhibiting the Mycelial growth of *Alternaria helianthi* in vitro conditions (Pathare, Akash I, Ingle, S T, Choudhari, R J, 2019).

But very little work has been done on testing the efficiency on plant botanicals in controlling the growth of the pathogen. Plant extracts of few plants were tested against the growth of *Alternaria helianthi* (P. Ahila Devi, S.Mohan and G.Thiribhuvanamala, 2013 and Waghe, K P Wagh, S S, Kuldhar, D P, Pawar, D V, 2015).

Due to usage of chemical fungicides many health hazards are being reported. So, the present investigations were initiated to screen the bio efficacy of plant extracts for their antifungal activity. So that they may be included in the integrated management of the diseases. Thereby minimize the use of Chemical fungicides.

Materials and methods:

Isolation and culture of *Alternaria helianthi* from diseased leaf of Sunflower:

The pathogen causing Leaf blight disease in Sunflower is isolated from infected sunflower leaves collected from the commercial sunflower fields in Nizamabad District of Telangana state and Plants grown in college campus during winter season under moist conditions.

For obtaining the pure culture of the pathogen, diseased leaves parts were cut into one cm sections, which were surface sterilized using 5% Sodium hypochlorite solution for one minute and were rinsed thrice with sterile distilled water. After surface sterilization the leaf discs were placed in Petri plates containing sterilized potato dextrose agar medium. These petri plates were incubated at 25 ± 2°C for seven days. After seven days the inoculum of fungus isolated was again sub cultured and the plates were incubated for one week at 25 ± 2°C until full growth of the pathogen. This was used for further studies.

Preparation of Plant extracts:

Aqueous plant extracts were prepared using fresh leaves. 22 different plants were chosen for this in vitro study. The freshly collected plant materials were washed twice with tap water and once with distilled water, air dried and separately ground in distilled water. 100 gm of fresh plant material was mixed with equal amount of distilled water (1:1 w/v) and grinded using mixer grinder. The extracts obtained were filtered using two layers of cheese cloth. Thus, the filtrate obtained is considered to be 100% concentrated standard plant extract which is stored in refrigerator and used for further studies.

Table-1: List of plant extracts used to control leaf spot on Sunflower- Common name of the plant, Botanical name, Plant part used for experiment.

S.No	Name of Plant	Botanical name	Part used
1	Neem	*Azardirachta indica*	Leaves
2	Onion	*Allium cepa*	Bulb
3	Garlic	*Allium sativum*	Bulb
4	Ginger	*Zingiber officinale*	Rhizome
5	Mehendi	*Lawsonia inermis*	Leaves
6	Lantana	*Lantana camara*	Leaves
7	Parthenium	*Parthenium hysterophorus*	Leaves
8	Lemon	*Citrus limon*	Leaves
9	Eucalyptus	*Eucalyptus globulus*	Leaves
10	Guava	*Psidium guajava*	Leaves
11	Mango	*Mangifera indica*	Leaves
12	Custard apple	*Annona squamosa*	Leaves
13	Golden apple (Indian Bael)	*Aegle marmelos*	Leaves
14	Oleander	*Nerium oleander*	Leaves
15	Castor oil plant	*Ricinus communis*	Leaves
16	Apple of sodon	*Calotropis procera*	Leaves
17	Chinese chaste tree	*Vitex negundo*	Leaves
18	Pink Periwinkle	*Catharanthus roseus*	Leaves
19	Indian Gooseberry	*Phyllanthus emblica*	Leaves
20	Drumstick tree	*Moringa oleifera*	Leaves
21	Lemon grass	*Cymbopogon citratus*	Leaves
22	Marigold plant	*Tagetes erecta*	Leaves

Amendment of Plant extracts in PDA medium:

From the 100% stock plant extract 20% and 50% Concentrations were made. Double strength potato dextrose agar was prepared and this was amended with individual extract of 20% and 50%(v/v) after thorough mixing these were autoclaved at 121℃ for 15 minutes. After sterilization, the medium was poured into 90mm sterilized petri plates and kept for solidification. 5mm disc of 7-day old culture of the Pathogen was cut using sterile corkborer and was inoculated on to the solidified surface PDA medium. Three replications were maintained. The plates were incubated at 25 ± 2℃. The medium without any plant extract served as control.

The mycelial growth of fungus in different petri plates were taken at 3rd, 5th and 7th day. The percent inhibition of radial growth of fungus was calculated by using the formula given by Vincent (1947).

I = C- T/C * 100

Where I = Percent inhibition of growth

C= Growth of Pathogen in control Petri plate (cm)

T = Growth of pathogen in plant extract treated petri plate (cm)

Results and Discussions:

Twenty-two different plant extracts were evaluated for their efficacy in inhibiting the growth of the pathogen by poisoned food technique against test pathogen. Mycelial growth inhibition was significantly different with different plant extracts at different concentrations. At 20% concentration of plant extracts maximum growth inhibition of the pathogen was observed in Amla (64.10%) followed by Mehendi(56.41%), Garlic (55%), Guava (48.72%), Eucalyptus(43.59%), *Zingiber officinale* (43.59%) and *Parthenium hysterophus* (42.31%) as compared to control.

At 50% concentration of the plant extracts maximum growth inhibition of the pathogen was recorded in Garlic (100%), followed by Eucalyptus (75.64%), Mehendi (65.89), Amla (65.89%), Lemon (62.82%), Ginger (58.97%) and Onion (51.28%) as compared to control.

Table-2 Effect of different plant extracts at 20% concentration on mycelial growth of *Alternaria helianthi*

S.No	Plant Extract	T1	I on Day -7
1	Control	7.8	0
2	*Azardirachta indica*	6.2	20.51%
3	*Allium cepa*	6.5	16.66%
4	*Allium sativum*	3.5	55%
5	*Zingiber officinale*	4.4	43.59%
6	*Lawsonia inermis*	3.40	56.41%
7	*Lantana camara*	4.7	39.74%
8	*Parthenium hysterophorus*	4.46	42.31%
9	*Citrus limon*	5.5	29.49%
10	*Eucalyptus globulus*	4.4	43.59%
11	*Psidium guajava*	4	48.72%
12	*Mangifera indica*	5.66	26.92%
13	*Annona squamosa*	5.73	26.92%
14	*Aegle marmelos*	6.83	12.82%
15	*Nerium oleander*	5.6	28%
16	*Ricinus communis*	5.85	24.36%
17	*Calotropis gigantea*	6.1	21.79%
18	*Vitex negundo*	5.36	30.76%
19	*Catharanthus roseus*	6.7	14.10%
20	*Phyllanthus emblica*	2.83	64.10%
21	*Moringa oleifera*	6.2	20.51%

22	*Cymbopogon citratus*	4.83	38%
23	*Tagetus erectus*	5.56	28.20%

(T1 = (20%) Mean ; I= % of growth inhibition)

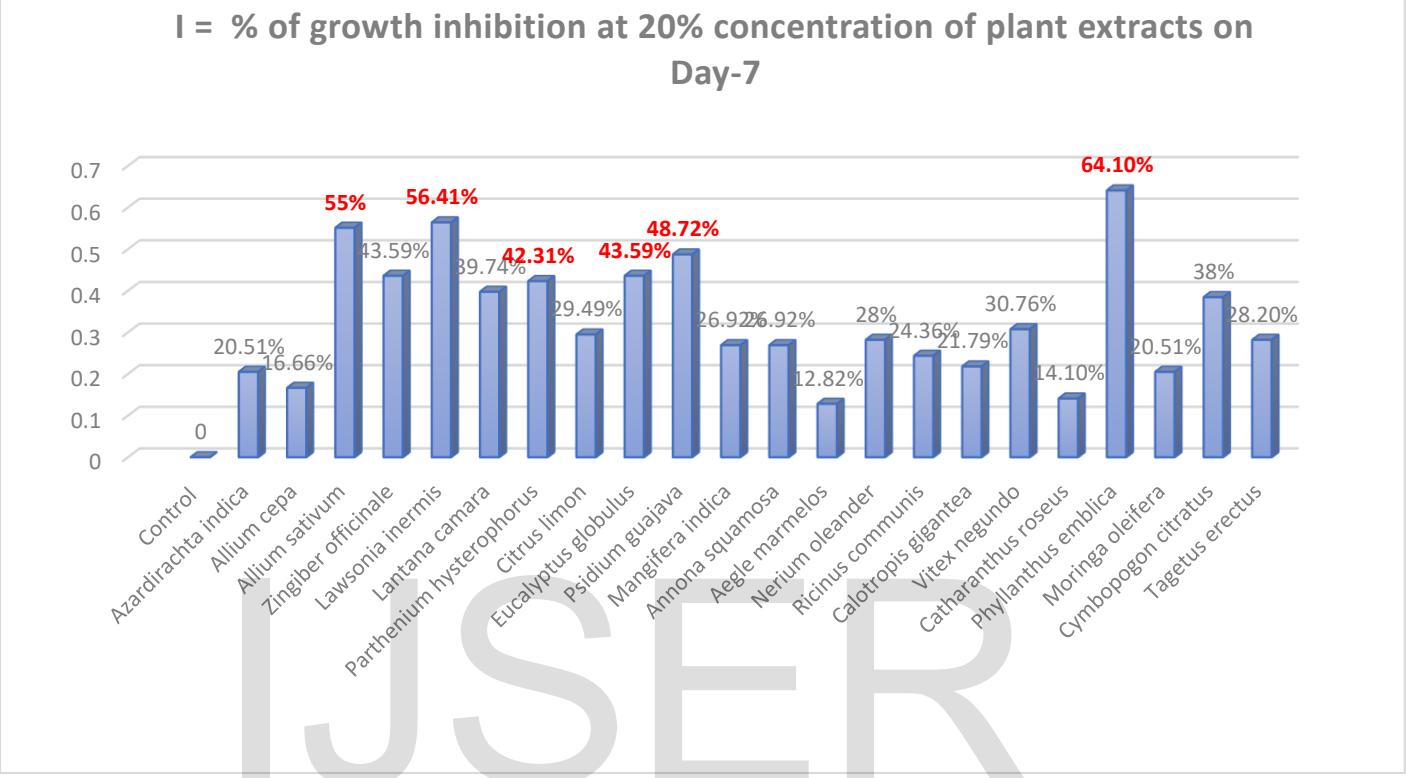


Fig1: Effect of plant extracts on the growth of test fungus at 20% concentration

Table-3 Effect of different plant extracts at 50% concentration on mycelial growth of *Alternaria helianthi*

S.No	Plant Extract	T2	I on Day - 7
1	Control	7.8	0
2	*Allium cepa*	3.8	51.28%
3	*Allium sativum*	0	100%
4	*Zingiber officinale*	3.2	58.97%
5	*Lawsonia inermis*	2.4	65.89
6	*Lantana camara*	4.3	44.87%
7	*Parthenium hysterophorus*	3.95	49.35%
8	*Citrus limon*	2.9	62.82%
9	*Eucalyptus globulus*	1.9	75.64%
10	*Psidium guajava*	4.5	42.31%
11	*Mangifera indica*	4.4	43.59%
12	*Annona squamosa*	5.1	27.14%
13	*Aegle marmelos*	6	23.07%
14	*Nerium oleander*	5.3	32.05%

15	*Calotropis gigantea*	5.3	32.05%
16	*Vitex negundo*	5.4	30.76%
17	*Phyllanthus emblica*	2.4	65.89%
18	*Moringa oleifera*	5.9	24.36%

(T2 = (50%) Mean; I= % of growth inhibition)

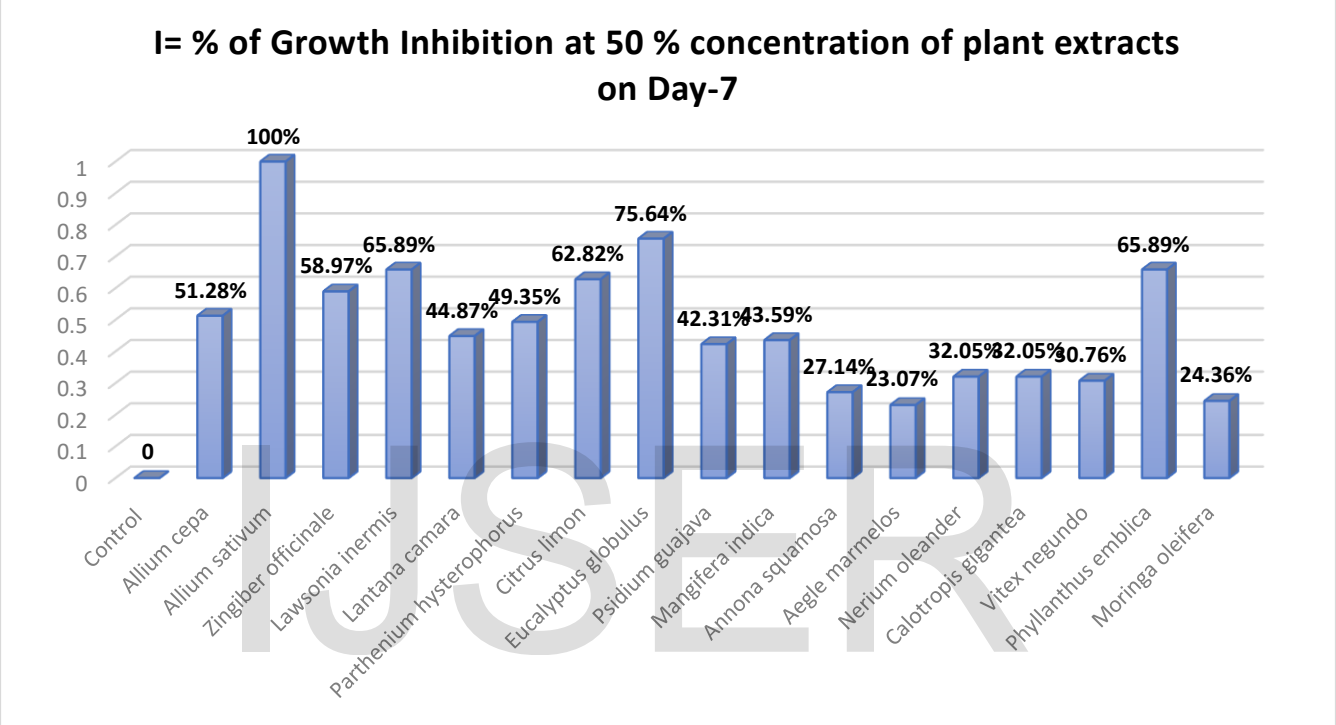
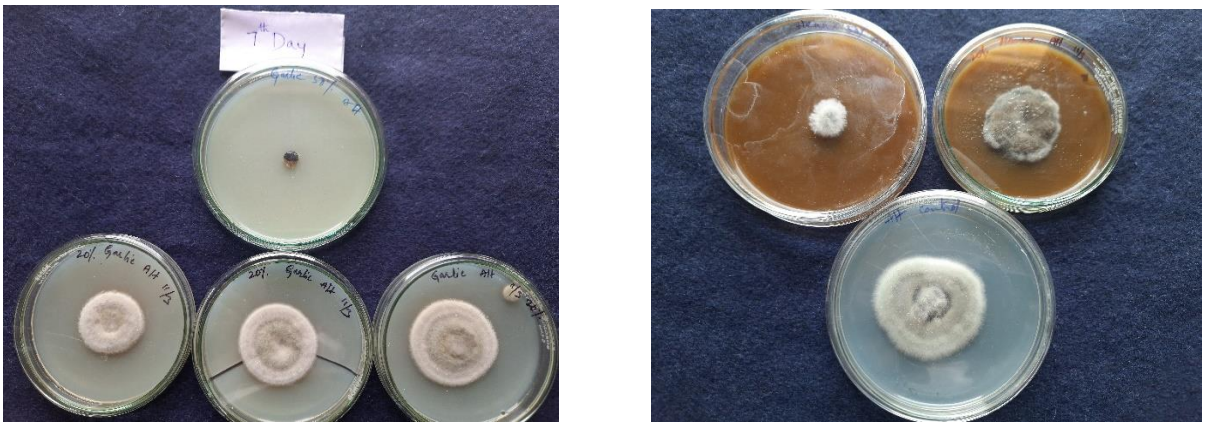


Fig2: Effect of plant extracts on the growth of test fungus at 50% concentration

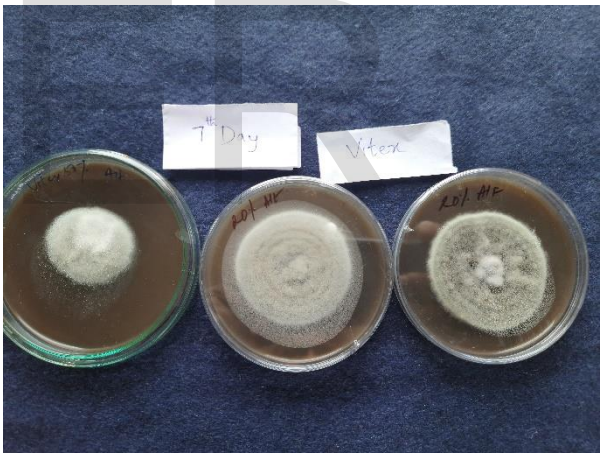


(A) *(B)*

Figure 3 & 4 . In vitro efficacy of Allium sativum, Lawsonia inermis at 20%, 50% on growth inhibition of Alternaria helianthi

(C) *(D)*

Figure 5 & 6 In vitro efficacy of Phyllanthus emblica (C) and Moringa (D) at 20% and 50% on growth inhibition of Alternaria helianthi on Day-5



(E) *(F)*

Figure 7 & 8 In vitro efficacy of Ginger (E) and Vitex (F) at 20% and 50% on growth inhibition of Alternaria helianthi on Day -7

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