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Evaluation of various botanicals against *Alternaria alternata* (Fr.) Keissler *In vitro* condition

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Abstract
Investigation on leaf spot disease (*Alternaria alternata* (Fr.) Keissler. of brinjal (*Solanum melongena* L.) under South Gujarat condition was carried out to find suitable management strategies. The hazardous effects of chemicals used in plant disease management have diverted plant pathologists to find out an effective alternative method with little or no adverse effect on environment. The aqueous extracts of commonly available eleven plant species belonging to ten different families were evaluated *in vitro* for their inhibitory effect on the mycelial growth and spore formation by *A. alternate*. The results revealed that all the phytoextracts tested were significantly superior over the control in checking the growth of the pathogen. The rhizome extract of turmeric (54.42%) was found significantly superior in inhibiting mycelial growth over the rest. The next best in order of merit was Garlic (50.67%). The sporulation was inhibited by all the phytoextracts as compared to control. Thus, extract of Turmeric, Garlic and Neem proved most effective phytoextracts in inhibiting mycelial growth as well as in preventing spore formation.

Keywords: phytoextracts, brinjal, *A. alternate.*

Introduction
Brinjal or eggplant (*Solanum melongena* L.) belongs to the kingdom: Plantae, division: Magnoliophyta, class: Magnoliopsida, order: Solanales, family: Solanaceae (USDA, 2008) [15] which is also known as aubergine, The name eggplant derived from the shape of the fruit of some varieties, which are white and shaped very similarly to chicken eggs (Chen and Li, 1998) [4]. Total production of brinjal is about 32 million tonnes in the world wherein India is world's second largest producer after China. (Choudhary and Gaur. 2009) [6]. In India, the crop is grown in about 5, 66,000 hectares and produces 95, 96,000 metric tones of fruits (Anon, 2008) [1]. West Bengal, Orissa, Bihar, Karnataka Maharashtra and Gujarat are the major brinjal growing states of the country. In Gujarat, the total area under brinjal cultivation is 55,800 hectares with annual production of 9, 87,700 metric tonnes with productivity of 17.7 metric tonnes /ha. (Anon, 2008) [1]. South Gujarat is an important brinjal growing tract of the state covering 1,3005 hectares area under cultivation with total production of 2,26,123 metric tonnes.(Anon, 2009) [2].

In India, brinjal is consumed as cooked vegetable in various ways. It has nutritive value in human diet, because it contains about 1.4 g proteins, 4.0 g carbohydrates, 0.3 g fat, 18 mg calcium, 2.0 mg potassium, and 0.9 mg iron per 100 g of edible portion. It also provides vitamins like A, B and C. (Choudhary and Gaur, 2009) [6]. Besides having nutritive values, it also possesses medicinal properties. The white brinjal is said to be good food for diabetic patients (Choudhary, 1976) [5]. It can be used as excellent remedy of liver suffering patients (Chauhan, 1981) [3]. The fruit is used as a cure for toothache. The green leaves of brinjal are the main source of Vitamin-C. The seeds of brinjal are used as a stimulant. (Nadkarni, 1972) [9].

Among all the fungal diseases, Alternaria leaf spot, Alternaria leaf blight and fruit rot diseases are of regular occurrence in moderate to severe proportion in India and causes extensive damage to the quality of fruits (Pandey and Vishwakarma (1999) [11]. The important pathogenic fungi *Viz*; *Alternaria solani*, *Phomopsis vexan*, *Alternaria alternata* and *Fusarium oxysporum* which causes leaf spot, fruit rot, blight, wilt and discolouration of seeds in brinjal crop, respectively. Infected seeds caused reduction in seed germination and yield loss up to 30-50 Per cent in the year 2001-2002. (Thippeswamy *et al.* 2005) [14]. Cool and humid weather, coupled with cloudiness which favors the occurrence and spread of the disease. When humid conditions prevailing at ground level, lower leaves are first attacked and infections spread to

the upper leaves and fruits. The disease causes characteristics leaf spots with concentric rings. The spots are mostly irregular and coalesce to cover a large leaf area. Considering the seriousness of the problem, the present study on evaluation of various botanicals against *Alternaria alternata* (Fr.) Keissler *In vitro* condition was carried out.

Materials and Methods

The effect of phytoextracts of various plant species as listed in Table- 1 were tested *in vitro* by poisoned food technique to know their inhibitory effect on the growth of *A. alternata.*

Healthy fresh plant parts i.e., leaves, bulbs or rhizomes were taken, washed thoroughly with fresh water and finally rinsed with sterilized distilled water. Fifty gram of plant parts were cut into small pieces and minced with the help of a grinder by adding 50ml sterilized distilled water. Extracts thus obtained were filtered through double layered muslin cloth in corning brand 150 ml conical flasks and plugged with non-absorbent cotton. The filtered extracts were autoclaved at 1.2 kgcm-2 pressure for 20 minutes. Autoclaved extract was individually added into previously sterilized PDA @ 5 per cent (i.e. 2 ml extract + 18 ml PDA plate) and mixed thoroughly at the time of pouring in the previously sterilized Petriplates. The Petriplates were inoculated aseptically after solidification by placing 5mm diameter mycelial disc at the centre, cut aseptically with cork borer from 10 days old pure culture of *A. alternata*. Three repetitions were kept for each treatment. The plate without phytoextract served as control. The Petriplates were incubated at 27±2 ^{0}C temperature for 10 days.

The observations on colony diameter and sporulation were recorded on the 10th day after inoculation. Per cent growth inhibition over control was calculated by using formula as given below:

$$PGI = \frac{100\ (DC-DT)}{DC}$$

Where,

PGI = Per cent growth inhibition

DC = Average diameter of mycelial colony of control set (mm)

DT = Average diameter of mycelial colony of treated set (mm)

Table 1: List of plant spp. used for preparing phytoextract for testing efficacy against *A. alternata in vitro*

S. No.	Common or local name	Botanical Name	Family	Plant Part Used for Preparing Extract
1	Onion	*Allium cepa* L.	Liliaceae	Bulbs
2	Neem	*Azadirachta indica* Juss.	Meliaceae	Leaves
3	Barmasi	*Catharanthus roseus* L.	Apocynaceae	Leaves
4	Garlic	*Allium sativum* L.	Liliaceae	Bulbs
5	Nilgiri	*Eucalyptus citridora* Hook.	Myrtaceae	Leaves
6	Kadvi mehandi	*Lowsonia enermis* L.	Lythraceae	Leaves
7	Turmeric	*Curcuma longa* L.	Zingiberaceae	Finger
8	Dhatura	*Datura stramoneum* L.	Solanaceae	Leaves
9	Jatropha	*Jatropha curcas* L.	Euphorbiaceae	Leaves
10	Lantana	*Lantana camera* L.	Verbenaceae	Leaves
11	Vilayati baval	*Prosopis juliflora* L.	Mimosaceae.	Leaves

Results and Discussion

The aqueous extracts of commonly available eleven plant species belonging to ten different families were evaluated *in vitro* for their inhibitory effect on the mycelial growth and spore formation by *A. alternata*.

The results presented in Table-2 and depicted in graph and Plate revealed that all the phytoextracts tested were significantly superior over the control in checking the growth of the pathogen. The rhizome extract of turmeric (54.42%) was found significantly superior in inhibiting mycelial growth over the rest. The next best in order of merit was Garlic (50.67%) and Neem (41.27%), followed by, Dhatura (37.08%), Onion (35.40%). Nilgiri (33.52%), Kadvi mehandi (29.52), Barmasi (23.65), Lantana (20.71) Jetropha (17.68%) and Vilayati baval (13.66%). were comparatively less effective.

The sporulation was inhibited by all the phytoextracts as compared to control. Among these, rhizome extract of turmeric, cloves extract of Garlic, leaf extract of Neem and Dhatura produced minimum spores. The extract of Lantana, Jetropha, and bulb extract of Onion were proved moderate in inhibition of sporulation. The extract of Nilgiri, Kadvi mehandi, Barmasi and Vilayati baval were comparatively less effective as there was good spore formation. Thus, extract of Turmeric, Garlic and Neem proved most effective phytoextracts in inhibiting mycelial growth as well as in preventing spore formation. Dhatura and Onion extracts were moderately effective against *A. alternata*. The rests of the phytoextracts were comparatively less effective in inhibiting the mycelial growth and sporulation.

The significant inhibitory effect of turmeric rhizome reported by Gosh *et al.* (2002) [7] and Patel, 2008) [12] and of Garlic (Shekhawat and Prasada, 1971 Lalesh Kumari *et al*. 2006) [13, 8] and Panchal (2009) [10] against *A. alternata* were in confirmity with our present findings.

The effective phytoextracts *viz*., Turmeric and Garlic reported here suggests the possible alternative to over-come the hazardous effect of chemicals. This requires detail investigations for their active principle involved for inhibitory effect and can be confirmed more by taking field experiments.

Table 2: Effect of various botanicals on growth and sporulation of *A. alternata*

S. No.	Local name of Plant spp.	Botanical name of Plant spp.	Av. Colony diameter (mm)	Per cent growth inhibition over control	Sporulation
1	Turmeric	*Curcuma longa* L.	38.80	54.42	+
2	Garlic	*Allium sativum* L.	42.00	50.67	+
3	Neem	*Azadirachta indica* Juss.	50.00	41.27	+
4	Dhatura (black)	*Datura stramonium* L.	53.56	37.08	+
5	Onion	*Allium cepa* L.	55.00	35.40	++
6	Nilgiri	*Eucalyptus citridora* Hook.	56.60	33.52	+++
7	Kadvi mehandi	*Lowsonia enermis* L.	60.00	29.52	+++

8	Barmasi	*Catharanthus roseus* L.	65.00	23.65	+++
9	Lantana	*Lantana camera* L.	67.50	20.71	++
10	Jetropha	*Jatropha curcas* L.	70.33	17.68	++
11	Vilayati baval	*Prosopis juliflora* L.	73.50	13.66	+++
12	Control (PDA only)	-	85.13	-	++++
		S.Em ±	0.84		
		C.D. at 5%	2.45		
		C.V. %	2.44		

Sporulation (No. of conidia/microscopic field) = [+ =Poor (below 5), ++ = Moderate (6-15), +++ = Good (16-20), ++++ = Excellent (above 30)]

Plate 13: Effect of Various phytol extract on growth of *A. alternata*

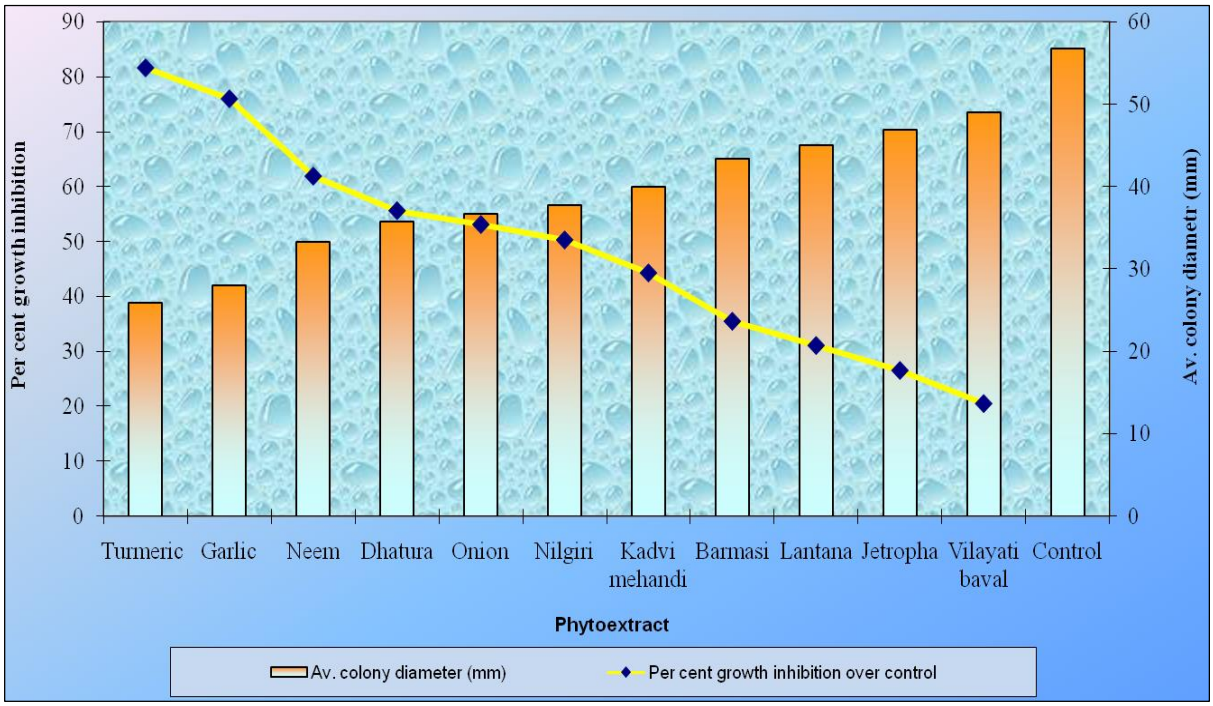

Fig 1: Effect of various botanicals on growth and sporution of *A. alternata*

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