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Evaluation of Homeopathic drugs for the management of *Alternaria solani* causing leaf spot disease in tomato under controlled conditions

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Abstract

Man is dependent on plants for almost every need and requirement. Hence, destruction of crop plants due to infection by fungal pathogens has always been an area of prime concern. The use of synthetic fungicides for disease management is harmful for human and animal health as well as soil. They enter the food chain and cause several deleterious effects on biosphere, contributing to significant declines in populations of beneficial soil organisms, soil acidification and compaction, thatch accumulation, and diminished resistance to diseases. Natural plant products are important sources of new agrochemicals for the control of plant diseases. Therefore, the *In vitro* evaluation of Homeopathic drugs against *Alternaria solani* was carried out at M.P.K.V, Rahuri. Total 20 different Homeopathic drugs were evaluated at 10%, 15% and 20% concentration by Poison food technique against these pathogens. Among the 20 different homeopathic drugs, Sulphur, *Pulsatilla nigricans*, *Podophyllum peltatum*, Cina, *Lycopodium clavatum*, *Nux vomica*, Dulcamara, Colocynthis, *Aconitum napellum*, *Natrum muriatum*, *Rhus toxicodendron*, *Arnica montana*, Hepar sulphur, *Arsenicum album* were showed 100% inhibition over the growth of *Alternaria solani* were effective at 20% concentration. The drugs like *Apis mellifera*, *Cinchona officinalis*, *Sepia* and *Calcaria carbonica* showed 87.78, 80.00, 64.44 and 57.78% inhibition over *Alternaria solani* respectively.

Keywords: Homeopathic drugs, *Alternaria solani*, *in vitro* evaluation, tomato

Introduction

Chemical control is the most common and prevalent method of disease control. Chemical fungicides have harmful compositions and result in an accumulation of side metabolites and other active substances in products and adverse effects for the environment and consumers (European Food Safety Authority (EFSA) 2019) [3]. They enter the food chain and cause several deleterious effects on biosphere, contributing to significant declines in populations of beneficial soil organisms, soil acidification and compaction, thatch accumulation, and diminished resistance to diseases. Thus, current thinking about plant and environment protection suggests alternatives to pesticides and use of other strategies in addition to well-known disease management methods such as crop rotation, use of resistant cultivars, planting disease free seeds, biological control etc. for control of fungal diseases. Many studies have proven the antimicrobial activity of various plant species against bacterial diseases (Balestra *et. al*, 2009) [2].

Homeopathic medicines were discovered to be useful among different plant pathogenic fungi in a number of cost-effective crops. *Botryodiplodia* in guava fruit, control of *Aspergillus niger* in coriander and cumin, betel vine disease caused by *Phytophthora parasitica* var. *piperina* and *Aspergillus niger* in sisal plants (Gama *et al.* 2017) [4]. *Alternaria brassicicola* in dark leaf spot of cauliflower (Trebbi *et al.* 2008) [9], blight of cotton caused by *Xanthomonas campestris* pv. *malvacearum* (Javed *et al.* 2013) [5] and *Arabidopsis thaliana* infected with *Pseudomonas syringae* (Shah-Rossi *et al.* 2009) [7]. Homoeopathy is a therapeutic system in which diseases are treated with substances, usually in extreme dilutions, which, when given to healthy individuals, produce the same symptoms as the disease being treated. Homoeopathy is a holistic method of treatment in that the whole organism is treated in an attempt to raise its level of resistance and stimulate its ability to throw off disease. In this respect it is well suited to the holistic concepts of biological agriculture.

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Because of the extreme dilution of the remedies they are relatively cheap, have little or no ecological side-effects and, on the whole, are harmless.

Tomato is an important vegetable crop is grown in India as well as in Maharashtra. Tomato is known to suffer from a number of diseases which affect crop production. This crop is highly susceptible to disease early blight caused by *Alternaria solani* (Elyousr and Hendawy, 2008) [1]. These are common diseases affecting pathogens of tomato in most of the tomato producing areas. To overcome this pesticide residue problem

from vegetables the present work, therefore, aimed *In vitro* evaluation of Homeopathic drugs against *Alternaria solani* causing leaf spot disease in tomato.

Materials and Methods

Isolation of pathogens

The pathogens associated with leaf spot in tomato were isolated on potato dextrose agar and nutrient agar medium by employing tissue isolation method.

Table 1: Homeopathic drugs used in plant protection studies

Sr. No.	Drugs	Use in human medicine
1.	<i>Apis melifera</i>	Treatment of endometriosis and scarlet fever
2.	Sulphur	Treatment of conjunctivitis
3.	<i>Pulsatilla nigricans</i>	Treatment of food poison, backache
4.	<i>Calcaria carbonica</i>	Remedy for problems due to faulty nutrition
5.	<i>Podophyllum peltatum</i>	Useful against intestinal worms, snakebite
6.	Cina	Treatment of stomach pain, parasites
7.	<i>Lycopodium clavatum</i>	Top remedy for liver ailments
8.	<i>Nux vomica</i>	Helps in nausea, sour burping
9.	Dulcamara	Effective in bone pain
10.	Belladonna	First aid for fever and inflammation
11.	Colocynthis	Treatment of neuralgic pain
12.	<i>Aconitum napellum</i>	Remedy for burning sensation
13.	<i>Natrum muriatum</i>	Commonly used for headache
14.	<i>Cinchona officinalis</i>	Treatment of diarrhea and gas, bloating
15.	Sepia	Well known for calming the nerve
16.	Phosphorus	Helps in general fatigue, weakness
17.	<i>Rhux toxicodendron</i>	Used to treat sour throat, arthritis
18.	<i>Arnica Montana</i>	Treatment of acne, rashes, sprain
19.	Hepar sulphur	It is an antibiotic
20.	<i>Arsenicum album</i>	Anti-inflammatory

Evaluation of Homeopathic drugs of different concentrations against *Alternaria solani* of Tomato

Three flasks of capacity 100 ml containing 20 ml of PDA media each separately were sterilized and poured in sterilized Petri plates. 18 ml, 17ml and 16ml of homeopathic drugs were added in those plates separately before they solidify for 10, 15 and 20% concentration respectively. A 4 mm disc of pure culture of *Alternaria solani* was taken and then inoculated to the plates. A control was prepared by inoculating the fungal disc in PDA plate without any homeopathic drug. The plates were kept at 25-27°C and the fungus was allowed to grow. The observations were recorded after seven days when the fungus in control plate was grown completely.

Results and Discussion

A) Effect of Homeopathic drugs on *Alternaria solani* at 10%, 15% and 20% concentration

The efficacy of 20 Homeopathic drugs was evaluated *in vitro* for the control of *Alternaria solani* at three different concentrations viz., 10%, 15% and 20%. Under present investigations the results thus obtained are presented in Table-2.

In the study of effect of Homeopathic drugs on *Alternaria*

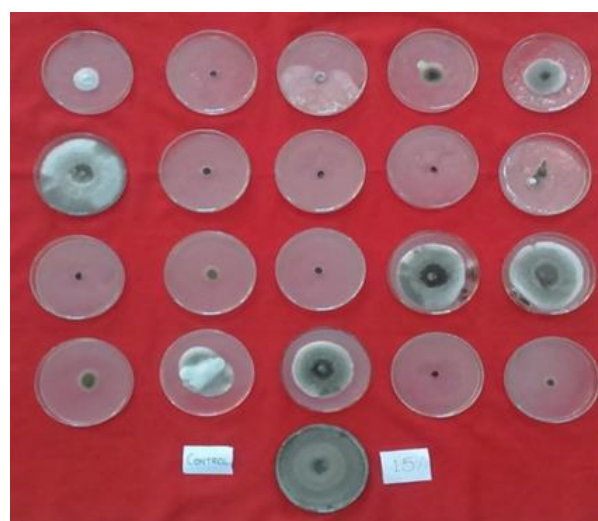
solani at 10% concentration, it was observed that among 20 Homeopathic drugs, not a single was effective against the growth of *Alternaria solani* after 7 days of inoculation.

At 15% concentration, it was observed that among 20 Homeopathic drugs, Sulphur, Dulcamara, Colocynthis, *Aconitumnapellum*, Hepar sulphur were showed 100% inhibition followed by *Pulsatilla nigricans* (85.56%) and *Arsenicum album* (50%). The drugs like *Apis melifera*, *Calcaria carbonica*, *Nux vomica*, *Rhux toxicodendron*, *Arnica mantana* were failed to inhibit the growth of *Alternaria solani*.

Whereas, at 20% concentration, it was observed that among 20 Homeopathic drugs, Sulphur, *Pulsatilla nigricans*, *Podophyllum peltatum*, Cina, *Lycopodium clavatum*, *Nux vomica*, Dulcamara, Colocynthis, *Aconitum napellum*, *Natrum muriatum*, *Rhux toxicodendron*, *Arnica montana*, Hepar sulphur, *Arsenicum album* were showed 100% inhibition over the growth of *Alternaria solani* were effective at 20% concentration. The drugs like *Apis melifera*, *Cinchona officinalis*, Sepia and *Calcaria carbonica* showed 87.78, 80.00, 64.44 and 57.78% inhibition over *Alternaria solani* respectively.

Table 2: Effect of Homeopathic drugs on growth of *Alternaria solani* at 10%, 15% and 20% Concentration (7 days after inoculation)

Sr. No.	Treatment details	Concentrations					
		10%		15%		20%	
		Mean	Per cent inhibition	Mean	Per cent inhibition	Mean	Per cent inhibition
1.	Control	90	-	90.00	-	90.00	-
2.	<i>Apis melifera</i>	90	-	90.00	-	11.00	87.78
3.	Sulphur	90	-	0.00	100.00	0.00	100.00
4.	<i>Pulsatila nigricans</i>	90	-	13.00	85.56	0.00	100.00
5.	<i>Calcarea carbonica</i>	90	-	90.00	-	38.00	57.78
6.	<i>Podophyllum peltatum</i>	90	-	62.00	31.11	0.00	100.00
7.	Cina	90	-	72.00	20.00	0.00	100.00
8.	<i>Lycopodium clavatum</i>	90	-	90.00	-	0.00	100.00
9.	<i>Nux vomica</i>	90	-	90.00	-	0.00	100.00
10.	Dulcamara	90	-	0.00	100.00	0.00	100.00
11.	Belladonna	90	-	90.00	-	40.00	55.56
12.	Colocynthis	90	-	0.00	100.00	0.00	100.00
13.	<i>Aconitum napellum</i>	90	-	0.00	100.00	0.00	100.00
14.	<i>Natrum muriatum</i>	90	-	90.00	-	0.00	100.00
15.	<i>Cinchona officinalis</i>	90	-	90.00	-	18.00	80.00
16.	Sepia	90	-	90.00	-	32.00	64.44
17.	Phosphorus	90	-	58.00	35.56	44.00	51.11
18.	<i>Rhux toxicodendron</i>	90	-	90.00	-	0.00	100.00
19.	<i>Arnica Montana</i>	90	-	90.00	-	0.00	100.00
20.	Hepar sulphur	90	-	0.00	100.00	0.00	100.00
21.	<i>Arsenicum album</i>	90	-	45.00	50.00	0.00	100.00

**Fig 1:** 10% concentration**Fig 2:** 20% concentration**Fig 2:** 15% concentration

Conclusion

Among the 20 different homeopathic drugs, Sulphur, *Pulsatila nigricans*, *Podophyllum peltatum*, Cina, *Lycopodium clavatum*, *Nux vomica*, Dulcamara, Colocynthis, *Aconitum napellum*, *Natrum muriatum*, *Rhux toxicodendron*, *Arnica montana*, Hepar sulphur, *Arsenicum album* were showed 100% inhibition over the growth of *Alternaria solani* were effective at 20% concentration. At the same concentration the drugs like *Apis melifera*, *Cinchona officinalis*, Sepia and *Calcarea carbonica* showed 87.78, 80.00, 64.44 and 57.78% inhibition over *Alternaria solani* respectively. From this study it is concluded that instead of using hazardous chemicals, pesticides we can use Homeopathic drugs for plant disease management.

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