



## Studies on Antifungal Activities of Some Plant Extracts Against the Leaf Rust of Jowar Under Field Conditions

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### Abstract

The effect of plant extracts on leaf rust, *Puccinia purpurea* of jowar were studied under field condition in Kharif season 2017. Field application of plant extracts gave effective control on jowar leaf rust disease. *Azadirachta indica* Juss and *Calotropis gigantea* L were the most effective treatments gave least percent disease index of 12.18 was recorded in T2 followed by T3 recorded 14.09 percent respectively. Least percent disease control of 75.29 percent was recorded in T2 followed by T3 and recorded 71.35 percent. Foliar spray with all plant extracts significantly reduced the percent disease index (PDI). Application of higher concentrations of the extracts showed better disease control. All the treatments were significantly superior to untreated control. Hexaconazole (0.05%) showed complete protection against rust disease incidence in field trials.

**Keywords:** Hexaconazole; Jowar; *Puccinia purpurea*; Leaf Rust; Plant Extracts

### Introduction

The rust of sorghum is a severe disease wherever the crop grown. The disease is found all over the India and causing huge loss to irrigated and dry areas crop. The lower leaves of the plants have infected commonly by the pathogen and rust pustules appear on both the surfaces with severely infected upper half than lower half. The fungal pathogen responsible for sorghum rust is *Puccinia purpurea* Cooke. Spraying with protectant chemicals or seed treatments has been tried with success in India [1]. While protectant fungicides are potentially valuable in controlling rust, they are not widely used in the world [2,3]. Microbial diseases of plants reduce the yield or the survival capability resulting in death. The use of chemical to the fungal pathogen is effective and popular but due to chemical cause environmental pollution. Severe rust infection also contributes to lodging by reducing leaf area and increasing plant stress [4]. Patil [5] reported that Hexaconazole

(Contaf) at 0.05% (1 ml per liter of water) was the most effective fungicide against the disease. Many plants have been reported to contain antibacterial and antifungal substances [6]. Usman., *et al.* [7] found that neem seed kernel extract (2%) was most effective in controlling rust and late leaf spot of groundnut. Ramesh., *et al.* [8] reported that maximum inhibition of spore germination of *Colletotrichum gloeosporioides* Penz. was observed in garlic bulb extract.

The chemical control shows many disadvantages. The plant originated fungicides are a better way to the jowar rust. Now a day some farmers are agree with use of plant extracts of various plants, but they didn't have correct knowledge of it. So survey of plant which shows the fungitoxicity property is a challenge in front of farmers and agricultural experts. Many plants are easily available and they have the possible source of fungicides. In the present

study some plants available in and around the fields were tested *in vivo* condition to inhibit the germination of jowar rust under field conditions.

**Materials and Methods**

A field experiment was conducted during Kharif season, where jowar was grown regularly in a randomized block design. A rust susceptible local variety of jowar was used. The experiment was laid out in a randomized block design (RBD) with twelve treatments and three replications with size 1x1m plot. Fresh, healthy leaves of selected plants like *Capsicum annum* L, *Allium sativum* L, *Azadirachta indica* Juss, *Oxalis corniculata* L, *Parthenium hysterophorus* L, *Datura stramonium* L, *Ipomoea fistulosa* Mart. Ex Choisy, , (*Ipomoea carnea*) Jacq, *Clerodendron inerme* Gaertn, *Calotropis gigantea* (L.) R.Br, *Argemone mexicana* L, *Pongamia (glabra) pinnata* (L) Pierre, (*Pongamia glabra*) Vent, *Nerium oleander* L etc. were collected from agricultural fields of Karad region. About five grams of leaves were weighted and washed with running water for several times and then weep with blotting paper. They were crushed in a mortar and pestle with 5ml distilled water. The extract was filtered through four layered muslin cloth and filtrate was then passed through whatman’s filter paper no. 3. this filtrate was considered as stock solution and then made up 1 %, 2 % and 3 % concentrations by adding distilled water. The fungicide Hexaconazole (0.05%) were used at recommended doses to know their efficacy on spore germination (standard check). For control distilled water was used. The plant extracts that produced high percentage of inhibition at 3% concentration viz, *Capsicum annum* L, *Allium sativum* L, *Azadirachta indica* Juss, *Oxalis corniculata* L, *Parthenium hysterophorus* L, *Datura stramonium* L, *Ipomoea fistulosa* Mart. Ex Choisy,, (*Ipomoea carnea*) Jacq, *Clerodendron inerme* Gaertn, *Calotropis gigantea* (L.) R.Br, *Argemone mexicana* L, *Pongamia (glabra) pinnata* (L) Pierre, (*Pongamia glabra*) Vent, *Nerium oleander* L etc. The *Allium* bulb contains alkaloids, flavonoids, saponnins, steroids etc, The neem based products/ pesticides are used in plant protection and there is a bright future for its medical, veterinary and pharmaceutical application, The chemical compounds like, alkaloids, flavonoid, saponnins and tannins were present in leaf of *Oxalis*, The *Parthenium* root exhibited the presence of flavonoides. Leaf extract contains alkaloides, saponnins, steroids and tannins and the *Datura* exhibited the presence of alkaloids, flavonoids, saponnins, steroids and tannins

in flower and seed. Tannins were present in leaf etc. Extracts of plant parts such as leaf, bulb, tuber, seed, etc. were tested further to see their effect under *in vivo* conditions.

The uredospore inoculum prepared in tap water was uniformly sprayed in the evening hours to all the treatments plats at 35 days after sowing. Recommended package of practices were followed to raise the crop. Plant extracts of test plants were prepared a fresh on the day of foliar application and used for spray immediately after preparation. Hexaconazole (0.05%) and effective plant extracts was applied using handpump backpack sprayer at low pressure to minimize drift. The spray treatments were started after 5 days of planting followed by two subsequent checks with Hexaconazole (0.05%) and untreated control (water spray) was also maintained. Minimum and maximum temperature for the growing season of 2017. Temperature declined gradually over the duration of the season despite day-to-day fluctuations. Data were analyzed for variance and means separated using Fischers Least Significant Difference (P = 0.05).

**Percent disease index (PDI)**

The five plants were selected from each plot and labeled randomly. The top, middle and bottom leaf of each wheat and jowar was taken, labeled and the index of the disease was recorded by scoring all the individual five plants in each cultivar using 0-9 scale [9,10]. Further the PDI was calculated with the above scales using the formula of Wheeler (1969).

$$\text{Sum of numerical values grades} \qquad 100$$

$$\text{PDI} = \frac{\text{Sum of numerical values grades}}{\text{Number of plants observed} \times \text{Maximum disease rating}}$$

Where,

PDI= Percent Disease Index.

Spray schedule-

First spray: 45 days after onset of disease

Second spray: 60 days after first spray

Third spray: 75 days after second spray

Observations on intensity of disease was recorded using five randomly selected plants from each treatment plot and graded as per 0 to 9 scale given by Mayee and Datar [9]. This has been described here under:

Scale

Score Description

0 = No pustules

1 = 1-10% leaf areas covered with rust pustules

3 = 11-25% leaf areas covered with rust pustules

5 = 26-50% leaf areas covered with rust pustules

7 = 51-75% leaf areas covered with rust pustules

9 = > 75% leaf area covered with rust pustules

**Percent disease control (PDC)**

The percent disease control was calculated by using the formula of Wheeler (1969).

PDI in control - PDI in treatment

$$PDC = \frac{\text{PDI in control} - \text{PDI in treatment}}{\text{PDI in control}} \times 100$$

PDI in control

Where,

PDC= Percent Disease Control, PDI= Percent Disease Index.

**Result and Discussion**

The field experiments were carried out during Kharif season. The selected plants, which were found effective *in vitro* were supplied to farmers for field trials for their efficacy against jowar rust. Chemical fungicides Hexaconazole 0.05% was used as standard check and distilled water as a control.

**Percent disease index (PDI)**

The data of disease index recorded at periodic interval are presented in (Table 1). The treatment differences in respect of index of rust as influenced by plant extracts and fungicide were statistically significant at fifteen days interval of observations except at initial observation (Natural condition). The results indicated that there was a significant difference between the various treatments with respect to percent disease index. Least percent disease index of 11.88 percent was recorded in T2 followed by T3 which were recorded 13.73 percent respectively. However, these two treatments were superior over rest of the treatments and control. The T10 (Control) recorded maximum percent disease index of 43.40 percent followed by T1, T4, T6 and T7. Where, T1, T4, T6 and T7 treatments were on par with each other and were recorded 19.84, 19.23, 24.50 and 25.73 percent respectively. The fungicide Hexaconazole 0.05% was least effective (0%) which was followed by control that had 43.40 percent disease index.

Tr. no	Name of the plant	Plant part used	*Average mean percent disease index (PDI) at days after sowing			Pooled Mean
			45	60	75	
T1	<i>Capsicum annum</i>	Fruit	5.41	15.10	38.54	19.68
T2	<i>Azadirachta indica</i>	Leaf	2.45	9.00	24.19	11.88
T3	<i>Calotropis gigantea</i>	Leaf	2.84	12.17	26.20	13.73
T4	<i>Argemone mexicana</i>	Seed	4.46	15.10	37.62	19.06
T5	<i>Datura stramonium</i>	Seed	3.63	12.99	29.70	15.44
T6	<i>Parthenium hysterophorus</i>	Leaf	6.73	20.23	45.98	24.31
T7	<i>Pongamia pinnata</i>	Leaf	8.21	22.21	46.21	25.54
T8	<i>Nerium oleander</i>	Leaf	5.66	18.51	42.65	22.27

T9	Hexconazole (0.05%)	Chemical fungicide	00	00	00	00
T10	Control	Distilled water	15.18	39.92	74.76	43.28
SE ±				3.65	0.18	0.24
C.D at 5%				10.95	0.54	0.71

**Table 1:** Disease index in *Puccinia purpurea* causing leaf rust of jowar as influenced by different plant extracts spray under field condition at various days after sowing by farmers.

\* - Average mean value of the occurrence of disease by farmers.

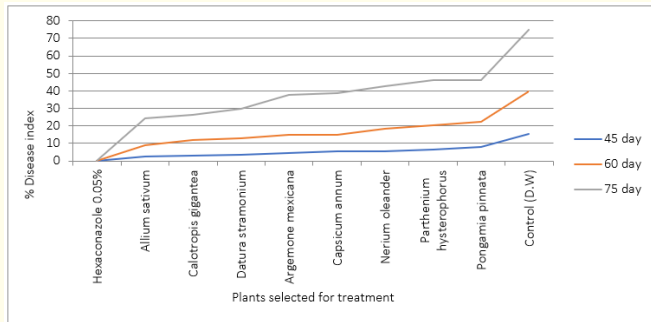
**Percent disease control (PDC)**

The field data of disease control recorded at periodic interval are presented in (Table 2). The treatment differences in respect of disease control of rust as influenced by plant extracts and fungicide were statistically significant at fifteen days interval of observations except at initial observation (Natural condition). The results indicated that there was a significant difference between the various treatments with respect to percent disease control. Least percent disease control of 71.91 percent was recorded in T2

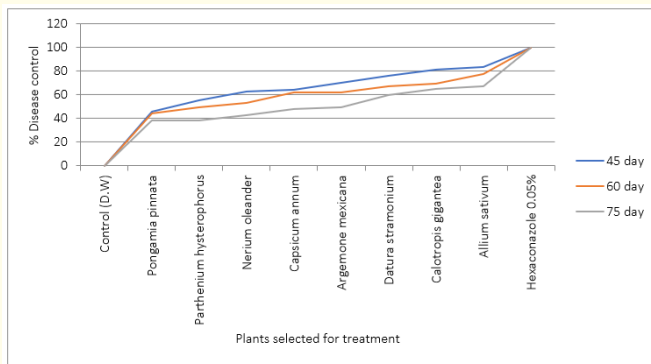
followed by T3 which were recorded 76.31 percent respectively. However, these two treatments were superior over rest of the treatments and control. The T10 (Control) recorded less percent disease control of (0%) followed by T1, T4, T6 and T7. Where, T1, T4, T6 and T7 treatments were on par with each other and were recorded 58.08, 60.06, 47.39 and 42.96 percent respectively. The fungicide Hexaconazole 0.05% was maximum effective (100%) which was followed by control that had (0) percent disease control.

Tr. no	Name of the plant	Plant part used	Mean percent disease control (PDC) at days after sowing			Pooled Mean
			45	60	75	
T1	<i>Capsicum annum</i>	Fruit	64.36	62.17	48.44	58.32
T2	<i>Azadirachta indica</i>	Leaf	83.86	77.45	67.64	76.31
T3	<i>Calotropis gigantea</i>	Leaf	81.29	69.51	64.95	71.91
T4	<i>Argemone mexicana</i>	Seed	70.61	62.17	49.67	60.81
T5	<i>Datura stramonium</i>	Seed	76.08	67.45	60.27	65.93
T6	<i>Parthenium hysterophorus</i>	Leaf	55.66	49.32	38.49	47.82
T7	<i>Pongamia pinnata</i>	Leaf	45.91	44.36	38.18	42.81
T8	<i>Nerium oleander</i>	Leaf	62.71	53.63	42.95	53.09
T9	Hexconazole (0.05%)	Chemical fungicide	100	100	100	100
T10	Control	Distilled water	00	00	00	00
SE ±						1.43
C.D at 5%						4.30

**Table 2:** Disease control in *Puccinia purpurea* causing leaf rust of jowar as influenced by different plant extracts spray under field condition at various days after sowing.



**Figure 1:** Effect of plant extracts on Percent disease index in *Puccinia purpurea*. Data points represent the means values after 3% concentration at 45, 60 and 75 days incubation period.



**Figure 2:** Effect of plant extracts on Percent disease control in *Puccinia purpurea*. Data points represent the means values after 3% concentration at 45, 60 and 75 days incubation period.

**Conclusion**

Present investigation suggests that locally available plant resources such as *Azadirachta indica* and *Calotropis gigantea* may be of use for possible control of *Puccinia purpurea*. However, further work is needed to explore potential of selected plants at the field level.

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