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MANAGEMENT OF LATE BLIGHT OF TOMATO THROUGH APPLICATION OF DIFFERENT PLANT EXREACTS

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A B S T R A C T

Late blight disease is potential threat to the successful production tomato. For management of this disease five plant extracts i.e *Azadirachta indica, Moringa oleifera, Zingiber officinales, Citrulus calosynthis, and Calotropis gigentea,* were evaluated for their antifungal potential at three concentrations (S/50, S/25, S/15) against late blight disease of tomato. Three sprays of these plant extracts were done with one week interval under Randomized Complete block design (RCBD) in the experimental area of Department of Plant Pathology University of Agriculture Faisalabad. Among these plant extracts, maximum reduction in disease was exhibited by *Azadirachta indica* (32.15%) followed by *Moringa oleifera* (41.09%), *Zingiber officinales* (48.88%), *Citrulus calosynthis* (49.88%) *and Calotropis gigentea* (53.41%) as compared to control.

Keywords: *Azadirachta indica*, *Moringa oleifera*, *Zingiber officinales*, *Citrulus calosynthis*, *Calotropis gigentea*.

INTRODUCTON

Tomato (*Lycopersicon esculentum* L.) is grown throughout the world. It is the 2nd most important vegetable crop after potato due to their high nutritional value. (Rice *et al*., 1987). In Pakistan, tomato is cultivated in all the provinces but its production is mainly concentrated in Sind and Punjab. It occupies 53.1 thousand hectares with production of 536.2 thousand tones thus an average yield of 10.1 thousand tones /hectare (Anonymous, 2009).

A number of diseases attack on tomato crop but late blight disease is the most destructive one and cause huge loss in terms of production. Different chemicals are being used for management of late blight disease of tomato. (Olanya *et al*., 2001; Kuhl *et a*l., 2007). Although these chemicals expressed pronounced results against late blight disease but posses serious threats to environment in different ways such as in the form of air, soil and water due to presence of copper and other hazardous compounds and their long term effects on environment cannot be avoided. Scientists are searching and exploring the substitute strategies to conventional fungicides for late blight. In these circumstances plant extracts (Krebs *et al*., 2006), and biological antagonists (Ghorbani *et al*., 2005) can be used as an alternate in the replacement of fungicides. Different plant extracts have been reported as a significant application against late blight pathogen (*Phytophthora Infestans*) under laboratory experiments (Goufo *et al*., 2008; Shutong *et al.*, 2007; Rashid *et al.,* 2004) as well as in field experiments (Bassin and Forrer, 2001; Abd-El-Khair and Haggag, 2007). Wang *et al*. (2004) attained up to 90% reticence (inhibition) of fungal diseases such as late blight by application of aqueous leaf extracts of Inula viscose. Similarly, Abd-El-Khair & Haggag (2007) examined aqueous extracts of different parts (leaves, fruits and seeds) of nine different plants in laboratory and outdoor conditions to control *Phytophthora infestans*. They found that out of all the tested plant extracts, 10% leaf extract of grass lemon (*Cymbopogon*

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citratus) was the most effective in reducing spore germination and disease incidence of *Phytophthora infestans*. The ethanol extracts of *A. conyzoides* and *C. citrinus* totally inhibited the pathogen at 5000 ppm, and that of O. gratissimum at 10000 ppm. The fungitoxic potential of some extracts was comparable to synthetic fungicides used as positive controls. Preliminary phytochemical analysis of water and ethanol extracts revealed that stronger inhibiting effects were recorded with extracts rich in phenolic compounds, sterols, flavonoids, condensed tannins, coumarins and alkaloids. These findings suggest that six extracts obtained from *C. citratus, O. gratissimum, C. citrinus* and *A. conyzoides* possess bio-fungicidal potential, which can suitably be exploited to control late blight of *Solanaceae* crops. (Hubert *et al.,* 2013).

Keeping in view the importance of plant extracts, there is a dire need to search out alternate of chemicals which should be cheap and environment friendly. That is why present study was designed to evaluate different plant extracts against late blight disease of tomato.

MATERIALS AND METHODS

Five plant extracts (Moringa olifera, Citrulus calosynthis, Calotropis gigentea, Zingiber officinales, Azadirachta indica) were evaluated under field conditions at three concentrations (S/15, S/25 and S/5). Three sprays of all plant extracts were done with three replications. The first spray of plant extracts will be applied as soon as the first symptom of the disease will be seen in the field and the other sequential spray at an interval of 15 days. For preparation of plant extracts, 75 gram of fresh leaves were macerated in 25 mL of sterilized water using sterilized pestle and mortar. The resultant solution was passed through four layers of sterilized muslin cloth and Whatman filter paper No.14, thus receiving standard (S) plant extract arbitrarily (Ilyas et al., 1997). Similaly S/50 and S/25 were prepared by mixing 100 mL standard concentration with 100 mL of sterilized water 25 mL standard concentration with 100 mL of sterilized water, respectively.Similarly S/15 solution was prepared.

T1 = *Moringa oleifera*
T2 = Citrulus calosynthis
T3 = Calotropis gigentea
T4 = Zingiber officinales
T5 = Azadirachta indica
T6 = Control

Statistical analysis: All statistical tests were performed using SAS/ STAT statistical software (SAS institute, 1990). Means were separated using Fisher's protected least significant difference (LSD) procedure. Significant treatments were identified for control of late blight of tomato.

RESULTS

Among all the plant extracts *Azadirachta indica* expressed minimum disease incidence (32.15), followed by *Moringa olifera* (41.09), *Zingiber officinales* (48.88), *Citrulus calosynthis* (49.80), *Calotropis gigentea* (53.41) as compared to control as shown in (Table 1). And (Figure 1).

Table 1. Impact of different plant extracts against late blight disease of tomato under field conditions.

Sr.	Treatments	Disease incidence (%)
1	*Azadirachta indica*	32.15f
2	*Moringa oleifera*	41.09e
3	*Zingiber officinales*	48.88d
4	*Citrulus calosynthis*	49.80c
5	*Calotropis gigentea*	53.41b
6	Control	65.09a
	LSD	0.18

Mean values sharing similar letters don't differ significantly as determined by the LSD test at 5% level of probability.

Azadirachta indica expressed maximum reduction in disease after 1st (34.44), 2nd (31.85) and 3rd spray (30.15)% followed by *Moringa olifera* (42.11), (41.68), (39.47) %, *Zingiber officinales* (50.42), (48.88), (39.47)% and *Citrulus calosynthis* (50.48), (49.76), (49.17)%, *Calotropis gigentea* (54.88), (53.27), (52.08)% as compared to control (Table 2). And Interaction between Treatment x Concentration shows that maximum reduction in disease by *Azadirachta indica* in all concentration i.e. (37.83), (33.30), (25.31) % followed by *Moringa olifera* (42.12), (41.68), (39.47) % *Zingiber officinales* (52.47), (49.61), (44.55) % and *Citrulus calosynthis* (52.10), (49.75), (47.57) % *Calotropis gigentea* (57.78), (54.20), (48.25) % as compared to control shown in (Table 3).

Interaction between (T x C x S) exhibited that *Azadirachta indica* during all sprays and at all concentrations expressed pronounced results. *Azadirachta indica* at three concentrations (S/50, S/25, and S/15) reduced disease during first spray (39.28), (35.14), (28.20) % during second spray (37.82), (33.55), (24.20) and while during third spray reduced disease (36.40), (31.223), (22.850) % respectively as compared to control.

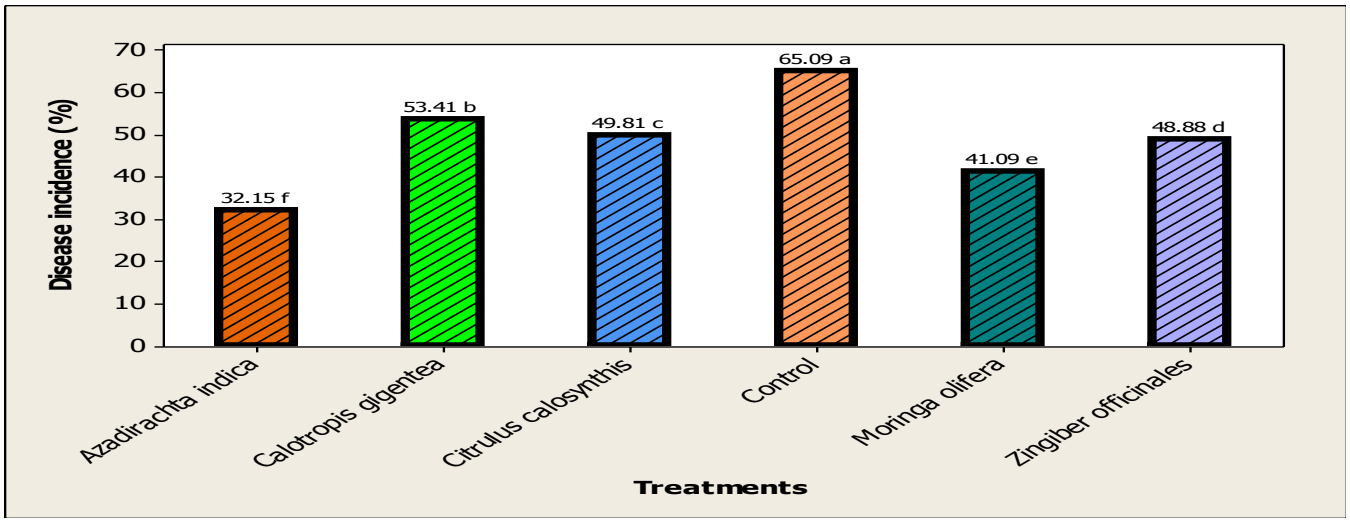

Figure 1. Evaluation of plant extracts against late blight disease of tomato under field conditions.

Moringa oleifera followed *Azadirachta indica* express disease reduction after 1st spray (47.42, 41.11, and 37.80) % during 2nd spray (44.48, 40.61, 39.95) % while during 3rd spray (41.86, 38.97, 37.62) % respectively as compared to control. *Zingiber officinales* followed *Moringa oleifera* expressed disease reduction after 1st spray (53.32, 50.87, and 47.08) %, after 2nd spray (52.56, 49.42, and 44.54) % after 3rd spray (51.52, 48.55, and 42.04) % respectively as compared to control. *Citrulus calosynthis* expressed disease reduction after 1st spray (52.42, 50.06, 50.02) %, during 2nd spray (52.05, 49.600, 47.64) % after 3rd spray (51.83, 48.84, 46.86) % respectively as compared to control. *Calotropis gigentea* expressed disease reduction after 1st spray (59.13, 55.50, 50.02) % during 2nd (57.71, 54.25, 47.86) % and after 3rd spray (56.52, 52.86, 46.87) % (Table 4) and (Figure 2).

Table 2. Evaluation of sprays of plant extracts against late blight disease of tomato under field conditions.

Treatments	Disease incidence (%)		
	After 1 spray	After 2nd spray	After 3rd spray
Azadirachta indica	34.44o	31.85p	30.15q
Moringa oelifera	42.11l	41.68m	39.47n
Zingiber officinales	50.42g	48.84j	47.37k
Citrulus calosynthis	50.48g	49.76h	49.17i
Calotropis gigentea	54.88d	53.27e	52.08f
Control	60.11c	65.12d	70.05a
LSD	0.31		

Mean values sharing similar letters don't differ significantly as determined by the LSD test at 5% level of probability,

Table 3. Evaluation of concentrations of plant extracts against late blight disease tomato under field conditions.

Disease incidence (%)			
Treatment	Concentrations		
	S/50	S/25	S/15
Azadirachta indica	37.83l	33.30m	25.31n
Moringa oleifera	44.59i	40.01j	38.67k
Zingiber officinales	52.47d	49.61f	44.55i
Citrulus calosynthis	52.10e	49.75f	47.57h
Calotropis gigentea	57.78b	54.20c	48.25g
Control	65.05a	65.05a	65.05a
LSD	0.31		

Mean values sharing similar letters don't differ significantly as determined by the LSD test at 5% level of probability.

Table 4. Evaluation of interaction of treatments, spray and concentrations (TxSxC) against late blight disease of tomato under field conditions.

Sr.	Treatments	Disease incidence (%)								
		First spray			Second Spray			Third Spray		
		Concentrations								
		S/50	S/25	S/15	S/50	S/25	S/15	S/50	S/25	S/15
1	*Azadirachta indica*	39.28	35.14	28.20	37.82	33.55	24.20	36.40	31.22	22.85
2	*Moringa oleifera*	47.42	41.11	37.80	44.48	40.61	39.95	41.86	38.97	37.62
3	*Zingiber officinales*	53.32	50.87	47.08	52.56	49.42	44.54	51.52	48.55	42.04
4	*Citrulus calosynthis*	52.42	50.06	50.02	52.05	49.60	47.64	51.83	48.84	46.86
5	*Calotropis gigentea*	59.13	55.50	50.02	57.71	54.25	47.86	56.52	52.86	46.87
6	Control	60.11	60.11	60.11	65.12	65.12	65.12	70.05	70.05	70.05
	LSD	0.54								

Mean valuses sharing similar letters don't differ significantly as determined by the LSD test at 5% level of probability.

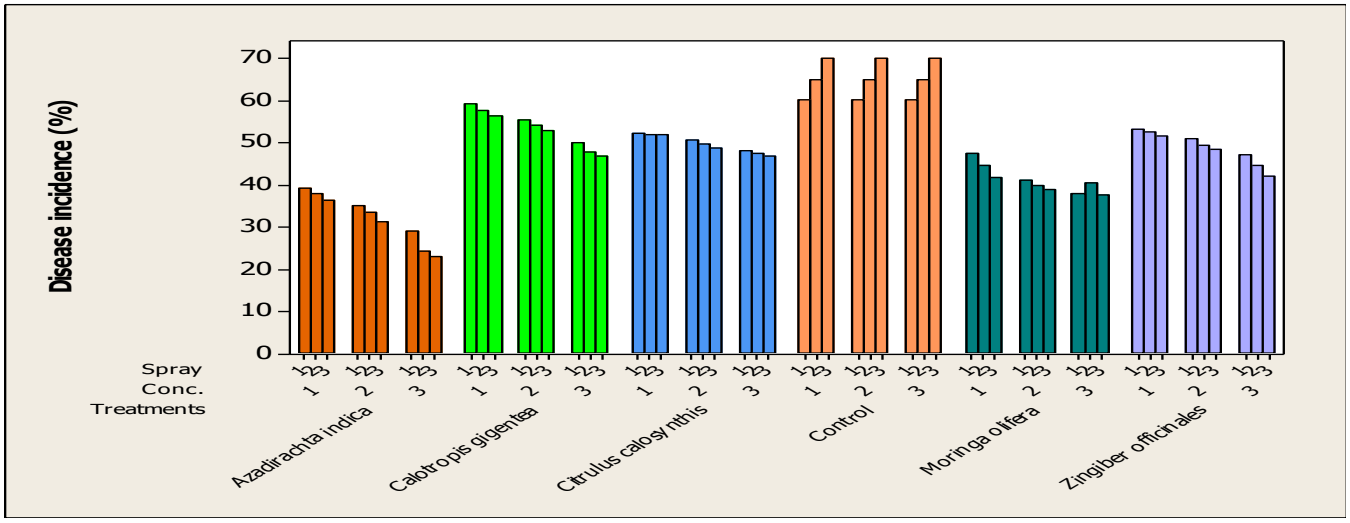

Figure 2. Evaluation of interaction of treatments, spray and concentrations (T x S x C) against late blight disease of tomato under field conditions.

DISCUSSION

Excessive application of chemicals is not eco-friendly and economical while on other the hand use of plant extracts and biologically active products occur in plants are more beneficial for, protection against plant pathogens (Culter and Hill, 1994). Such compounds could be valuable as bio-pesticides for controlling plant diseases because they are biodegradable and selective in their activities. Medicinal plants showed more aggressiveness in controlling plant diseases (Cao *et al*., 2001). So in present study five plant extracts (*Azadirachta indica, Moringa olifera, Zingiber officinales, Citrulus calosynthis, Calotropis gigentea*) were evaluated against late blight disease of potato. Among these plant extracts *Azadirachta indica* expressed minimum disease incidence (32.15), followed by *Moringa olifera* (41.09), *Zingiber officinales* (48.88), *Citrulus calosynthis* (49.81), *Calotropis gigentea* (53.42) as compared to control.

The results of present studies are in line with those of Alabi and Olorunju, 2004 who observed that *Azadirachta indica* expressed inhibitory effects against *Phytophthora infestans*. Extract of *Azadirachta indica* contain a chemical, azadirachtin which is very effective against fungal pathogens particularly late blight disease of potato(Sadri *et al*., 1983). Mirza *et al.,* (2000) used leaf extract of neem against late blight disease and reported its effectiveness as it inhibit the mycelia growth of *Phytophthora infestans* (Hameed, 1997). Wang, (2001) evaluated 88 plant extracts for management of late blight disease but only nineteen exhibited significant results. Among these nineteen plant extracts *Azadirachta indica* expressed maximum reduction in disease.

The fungitoxic potential of some extracts like *A. indica* was comparable to synthetic fungicides used as positive controls. Preliminary phytochemical analysis of water and ethanol extracts revealed that stronger inhibiting effects were recorded with extracts rich in phenolic compounds, sterols, flavonoids, condensed tannins, coumarins and alkaloids. These findings suggest that six extracts obtained from *A. indica*, *C. citratus, O. gratissimum, C. citrinus* and *A. conyzoides* possess bio-fungicidal potential, which can suitably be exploited to control late blight of Solanaceae crops. (Hubert *et al.,* 2013). Because different plants contain different antimicrobial agents. That is why it is need of the hour to search out different biochemical substances present in different plants which are environment friendly and economical (Wang *et al*., 2001; Cuthberston and Murchie, 2005). and can be used against different plant pathogens like *Phytophthora infestans* (Mohan *et al.,* 1995).Out of 88 plant extracts against *p. infestans* 31 extracts inhibited completely the germination of sporangia and 19 extracts showed inhibited the growth of mycelia and sporangial growth (Wang *et al*., 2001).

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