

## EFFICACY OF SOME MEDICINAL PLANT EXTRACTS AGAINST “COLLECTROTRICHUM CAPSICI” CAUSING ANTHRACNOSE DISEASE OF CHILLI

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### ABSTRACT

In this study the efficacy of three selected medicinal plants extracts were studied against a fungal and plant pathogen scientifically known as “*Colletotrichum capsici*” causing Anthracnose disease on Chilli. The three selected medicinal plants were: *Withania coagulans*, *Achillea wilhelmsii*, *Zataria multiflora*. *Colletotrichum capsici* is a species of fungus and plant pathogen which causes leaf blight on *Chlorophytum borivillianum*, basil, chickpea and pepper as well as dieback in pigeonpea and anthracnose in poinsettia. The research investigations were carried out under in-vitro conditions in department of plant pathology, at Lasbella University of Agriculture, Water and Marine Science, Uthal Balochistan. Aims of the present study were to find out the efficacy of two most effective medicinal formulations of *Achillea wilhelmsii* & *Withania coagulans* for the management of Chilli anthracnose, a predominant postharvest disease of Chilli caused by *colletotrichum capsici*. Among these medicinal plant extracts, were most effective in the in-vitro studies. *Withania coagulans* was much affected against anthracnose of Chilli and had potential to control the mycelial growth of *colletotrichum capsici* about 58.18% and *Achillea wilhelmsii* also had efficacy to control this disease about 53.89%. Therefore, it is stated that commercial medicinal plant formulations have rich ability to control the postharvest diseases in Chilli and also recommended above medicinal plant extracts as safest agents for management of diseases.

**Key words:** Efficacy, medicinal plants, *Colletotrichum capsici*, Chilli, Lasbella.

### INTRODUCTION

Since the day of creation, humans are busy in finding ways and sources of calm and disease-free life. Best cure for any disease is topic of interest from very beginning. For this, plants become the first choice of mankind because of

their low coast, with least side effects and easy accessibility. However, the exact number of plants in the universe is still a big question for scientists but roughly it is believed that there are approximately 250,000 to 500,000 plant species (Aziz, Adnan, Khan, Shahat, et al., 2018; Christenhusz & Byng, 2016; Jamshidi-Kia et al., 2018), among which 80, 000 are medicinal plants, of which 15, 000-20, 000 are with high quality medicinal value while 50, 000 are being reported to be used by pharmaceutical and cosmetic industry for various products.

While, only 7000-7500 species are used for folklore medicine by traditional communities mostly without having any knowledge related to biochemical effects of plant extracts since prehistoric times. Even though medicinal flora is unevenly distributed throughout the globe, mostly collected from natural world (Jamshidi-Kia et al., 2018; Qazi Majaz & Molvi Khurshid, 2016; Singhal et al., 2014). Researchers proved the dependency of herbal medicines for cure of common diseases by local communities of Asian countries. Even the communities from Pakistan, India, China, Greeks and Egyptians, all developed their respective material medica that then leads to the development of notable number of modern drugs (Jamshidi-Kia et al., 2018; Qazi Majaz & Molvi Khurshid, 2016). The human knowledge about plants developed gradually with time and he started classifying plants in to two groups i.e. dietary plants & medicinal plants. Later, these plants were put into distant pharmacopeia. The second group comprises the plants that exhibit ant-inflammatory, analgesic, anticoagulant purgative, stimulant, antidepressant properties and synergistic actions (Ismail et al., 2017).

Chilli (*Capsicum annuum* L.) is an important vegetable as well as spice crop, cultivated world wide. It is not only used in many cuisines but also found to have many medicinal properties. The genus *Capsicum* comprises about 20-25 species, out of which *C. annuum*, *C. baccatum*, *C. chinense*, *C. frutescens* and *C. pubescens* are cultivated. *Capsicum annuum* is widely cultivated variety, second being *C. frutescens*. Commonly used term is Chilli, which refers to hot types of *Capsicum*. Though it was originated in the American tropics, it is widely propagated (Sahitya et al., 2014). Chilli (*Capsicum annuum* L.) also called red pepper is an important cash crop in India. It is grown for its pungent fruits. Both green and ripe fruits are used to impart pungency to the food. Chilli anthracnose was first reported in India on from the Coimbatore of Madras Presidency (Sydow, 1913). The disease has been identified in all the chilli producing regions of the world and has become a serious constraint to chilli production. Different species of colletotrichum, namely *C. capsici*, *C. colletotrichum*, *C. acutatum* are known to cause anthracnose in chilli in India. Anthracnose disease appears as small circular spots that coalesce to form large elliptical spots on fruits and leaves. Under severe conditions, defoliation of affected plants occurs. Kim et al. (2004) reported that different species cause diseases of different parts of the chilli plant. The disease has been observed to occur in three phases; seedling blight or dumping off, leaf spot, die- back and anthracnose or fruit rot. Management of these diseases through agro chemicals alone is neither cost effective nor environmentally safe. Therefore, an integrated disease management (IDM) approaches, using chemical, cultural and eco-friendly bio-agents are needed for sustainable chilli production (Pandey and Satpathy, 2009; Lydia and Zacharia, 2012).

### *Description of the Study area*

The study was conducted in the laboratory under control environmental conditions at department of plant pathology in Lasbela University of Agriculture, Water and Marine Sciences (LUAWMS).

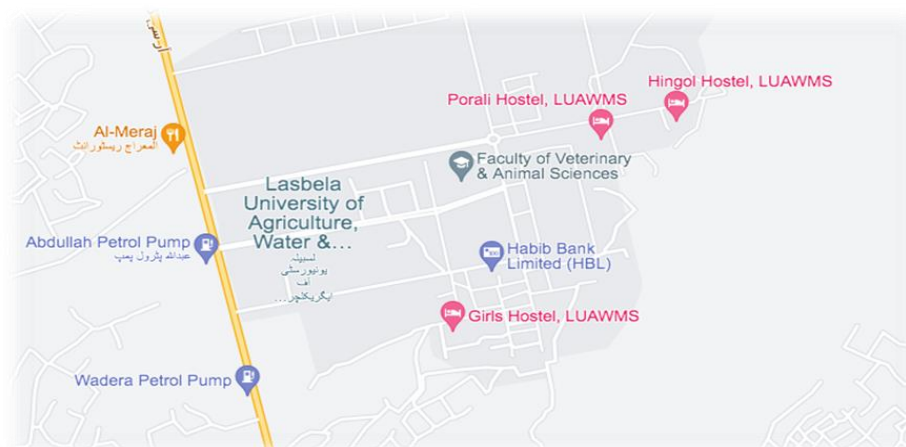


Figure 1. Map of Study Area, District Lasbela in Balochistan province of Pakistan.

It is located at N25 (RCD) Highway in Uthal in the historic and magnificent district Lasbela in Balochistan province of Pakistan. The GPS Coordinates of University are 25°50'30"N and 66°37'46"E. This institute is truly a comprehensive institution of higher education with enduring commitment to achieve excellence in higher education, innovative technology, cutting-edge research, and superior public service. LUAWMS is dedicated to prepare its graduates for successful careers and enable them to play a constructive role in progressing social inclusion, economic prosperity, and environmental quality.

## METHODS AND MATERIAL

### Data Collection

The data collection and analysis were based upon the following steps:

- Collection of diseased samples on the basis of symptoms
- Isolation of pathogen
- Preparation of Pure Culture under Controlled Conditions
- Collection of Medicinal Plants
- Preparation of Extract and Doses
- Efficacy Assessment
- Statistical Analysis

## RESULTS

Effect of *Withania coagulans* extract on the colony growth of *Colletotrichum capsici*:

The result in (Table-1) shows the response of the in-vitro efficacy of seven different doses of *Withania coagulans* extract which were prepared and evaluated for their efficacy to control *Colletotrichum gloeosporioides* by food poisoning technique. All doses were checked against linear colony growth of *Colletotrichum capsica* compared by control. *Withania coagulans* extract proved to be effective in controlling the test pathogen because mycelial growth of the test fungus was inhibited at all the doses

Table 1. Effect of *Withania coagulans* extract on the colony growth of *colletotrichum capsici*

Treatments <i>Withania coagulans</i>	Doses	Linear colony growth (cm)								Reduction in colony growth (R CG) C-TCG	Reduction (%) RCG (100)/ C
		1 <sup>st</sup> Day	2 <sup>nd</sup> day	3 <sup>rd</sup> Day	4 <sup>th</sup> day	5 <sup>th</sup> day	6 <sup>th</sup> day	7 <sup>th</sup> day	Total		
T1	3%	0.5	1.65	2.55	2.65	3.15	3.95	4.75	4.75	3.6	43.11%
T2	5%	0.5	1.45	2.65	3.15	3.45	3.85	4.6	4.6	3.75	44.91%
T3	10%	0.5	1.5	2.35	2.85	3.35	3.65	4.55	4.55	3.8	45.50%
T4	15%	0.5	1.45	2.3	2.9	3.55	3.9	4.45	4.45	3.9	46.70%
T5	20%	0.5	1.5	2.15	2.95	3.65	4	4.35	4.35	4	47.90%
T6	25%	0.5	1.35	2.25	2.65	3.35	3.85	4	4	4.35	52.09%
T7	30%	0.5	1.25	1.75	2.45	2.85	3.25	3.85	3.85	4.5	53.89%
Control(C)	0%	0.65	1.9	2.95	3.85	5.85	7.95	8.35	8.35	0	0%
CV%									5.66	5.37	
LSD									0.48	0.32	

In-vitro efficacy of *Achillea wilhelmsii* against linear colony growth of *colletotrichum capsici* causing Anthracnose of Chilli:

The result in (Table-2) shows the response of the in-vitro efficacy of seven different doses of *Achillea wilhelmsii* extract which were prepared and evaluated for their efficacy to control *Colletotrichum capsici* by food poisoning technique.

All doses were checked against linear colony growth of *Colletotrichum capsici* compared by control. *Achillea wilhelmsii* extract indicated to be effective in controlling the test pathogen because mycelial growth of the test fungus was inhibited at all the doses.

Table 2. In-vitro efficacy of *Achillea wilhelmsii* against linear colony growth of *colletotrichum capsici* causing Anthracnose of Chilli.

Treatments <i>Achillea wilhelmsii</i>	Doses	Linear colony growth (cm)								Reduction in colony growth (R CG) C-TCG	Reduction (%) RCG (100)/C
		1 <sup>st</sup> Day	2 <sup>nd</sup> day	3 <sup>rd</sup> day	4 <sup>th</sup> day	5 <sup>th</sup> day	6 <sup>th</sup> day	7 <sup>th</sup> day	Total		
T1	3%	0.5	1.75	2.35	2.85	3.35	3.9	4.25	4.25	4	48.48%
T2	5%	0.5	1.9	2.5	3.2	3.65	3.85	4.15	4.15	4.1	49.69%
T3	10%	0.5	1.45	2.15	2.65	2.85	3.5	3.95	3.95	4.3	52.12%
T4	15%	0.5	1.55	2.0	2.45	2.65	3.45	3.85	3.85	4.4	53.33%
T5	20%	0.5	1.45	1.85	2.25	2.7	3.45	3.7	3.7	4.55	55.15%
T6	25%	0.5	1.25	1.5	2.0	2.95	3.35	3.6	3.6	4.65	56.36%
T7	30%	0.5	1.15	1.3	1.95	2.35	2.9	3.45	3.45	4.8	58.18%
Control(C)	0%	0.5	1.85	2.95	3.95	5.85	7.75	8.25	8.25	0	0%
CV%									2.25	7.57	
LSD									0.17	0.51	

In-vitro efficacy of *Zatoria multiflora* against linear colony growth of *Colletotrichum capsici* causing Anthracnose of Chilli.

The result in (Table-3) shows the response of the in-vitro efficacy of seven different doses of *Zatoria multiflora* extract which were prepared and evaluated for their efficacy to control *Colletotrichum gloeosporioides* by food poisoning technique.

All doses were checked against linear colony growth of *Colletotrichum capsici* compared by control. *Zatoria multiflora* extract proved to be effective in controlling the test pathogen because mycelial growth of the test fungus was inhibited at all the doses.

Table 3. Effect of *Zatoria multiflora* extract on the colony growth of *colletotrichum capsici*

Treatments <i>Zatoria multiflora</i>	Doses	Linear colony growth (cm)								Reduction in colony growth (RCG) C-TCG	Reduction (%) RCG (100)/C
		1 <sup>st</sup> Day	2 <sup>nd</sup> day	3 <sup>rd</sup> Day	4 <sup>th</sup> day	5 <sup>th</sup> Day	6 <sup>th</sup> day	7 <sup>th</sup> day	Total		
T1	3%	0.5	1.45	2.45	2.65	3.5	3.75	4.85	4.85	3.5	41.91%
T2	5%	0.5	1.55	2.35	3.25	3.55	3.85	4.7	4.7	3.65	43.71%
T3	10%	0.5	1.25	2.25	2.65	3.35	3.95	4.64	4.64	3.71	44.43%
T4	15%	0.5	1.65	2.35	2.85	3.45	3.9	4.51	4.51	3.84	45.98%
T5	20%	0.5	1.5	2.15	2.95	3.65	4.15	4.37	4.37	3.98	47.66%
T6	25%	0.5	1.35	2.25	2.65	3.35	3.85	4.15	4.15	4.2	50.29%
T7	30%	0.5	1.25	1.75	2.45	2.85	3.25	3.95	3.95	4.4	52.69%
Control(C)	0%	0.65	1.9	2.95	3.85	5.85	7.95	8.35	8.35	0	0%
CV%									1.50	1.84	
LSD									0.12	0.11	

Table 4. Anova for Achellia Reduction in Colony Growth

Treatment	R1	R2	R3	Total	Mean	Sum Sq	STD
T1	3.39	3.65	3.76	10.8	3.6	10.8	0.19
T2	3.5	3.9	3.85	11.25	3.75	11.25	0.22
T3	3.66	3.77	3.97	11.4	3.8	11.4	0.16
T4	3.35	4.1	4.25	11.7	3.9	11.7	0.48
T5	3.75	3.8	3.45	11	3.67	11	0.19
T6	4.15	4.4	4.5	13.05	4.35	13.05	0.18
T7	4.25	4.6	4.65	13.5	4.5	13.5	0.22
T8	0	0	0	0	0	0	0
T Ave	26.05	28.22	28.43	82.7	27.57	82.7	1.32
G mean	3.45						
				F	Prob Level		
SOV	d.f	SS	MS	value		T value	
Rep	2	0.43	0.22	6.34			
D	7	42.9	6.13	179.04	0	2.14	
Er	14	0.48	0.03				
Total	23	43.81					
	CV%	5.37					
	LSD	0.32399375		0.15			

Table 5. Anova for Achellia Total Colony Growth

Treatment	R1	R2	R3	Total	Mean	Sum Sq	STD
T1	4.66	4.75	4.84	14.25	4.75	14.25	0.09
T2	4.36	4.58	4.86	13.8	4.6	13.8	0.25
T3	4.34	4.44	4.87	13.65	4.55	13.65	0.28
T4	4.29	4.5	4.56	13.35	4.45	13.35	0.14
T5	4.32	4.33	4.4	13.05	4.35	13.05	0.04
T6	3.25	3.8	4.95	12	4	12	0.87
T7	3.76	3.87	3.92	11.55	3.85	11.55	0.08
T8	8.24	8.39	8.42	25.05	8.35	25.05	0.1
T Ave	37.22	38.66	40.82	116.7	38.9	116.7	1.81
G mean	4.86						
				F	Prob Level		
SOV	d.f	SS	MS	value		T value	
Rep	2	0.82	0.41	5.42			
D	7	43.63	6.23	82.28	0	2.14	
Er	14	1.06	0.08				
Total	23	45.51					
	CV%	5.66					
	LSD	0.482004		0.22			

Table 6. Anova for Withania Reduction in Colony Growth

Treatment	R1	R2	R3	Total	Mean	Sum Sq	STD
T1	3.2	3.8	5	12	4	12	0.92
T2	3.95	4	4.35	12.3	4.1	12.3	0.22
T3	4.25	4.31	4.34	12.9	4.3	12.9	0.05
T4	3.95	4.4	4.85	13.2	4.4	13.2	0.45
T5	4.25	4.65	4.75	13.65	4.55	13.65	0.26
T6	4.37	4.68	4.9	13.95	4.65	13.95	0.27
T7	4.54	4.76	5.1	14.4	4.8	14.4	0.28
T8	0	0	0	0	0	0	0
T Ave	28.51	30.6	33.29	92.4	30.8	92.4	2.4
G mean	3.85						
				F	Prob Level		
SOV	d.f	SS	MS	value		T value	
Rep	2	1.44	0.72	8.45			
D	7	52.33	7.48	87.98	0	2.14	
Er	14	1.19	0.08				
Total	23	54.96					
	CV%	7.57					
	LSD	0.51049163		0.24			

Table 7. Anova for Withania Total Colony Growth

Treatment	R1	R2	R3	Total	Mean	Sum Sq	STD
T1	4.15	4.24	4.36	12.75	4.25	12.75	0.11
T2	3.92	4.18	4.35	12.45	4.15	12.45	0.22
T3	3.77	3.98	4.1	11.85	3.95	11.85	0.17
T4	3.56	3.75	4.24	11.55	3.85	11.55	0.35
T5	3.47	3.67	3.96	11.1	3.7	11.1	0.25
T6	3.54	3.55	3.71	10.8	3.6	10.8	0.1
T7	3.35	3.47	3.53	10.35	3.45	10.35	0.09
T8	8.15	8.23	8.37	24.75	8.25	24.75	0.11
T Ave	33.91	35.07	36.62	105.6	35.2	105.6	1.36
G mean	4.4						
				F	Prob		
SOV	d.f	SS	MS	value	Level	T value	
Rep	2	0.46	0.23	23.61			
D	7	52.33	7.48	763.88	0	2.14	
Er	14	0.14	0.01				
Total	23	52.93					
	CV%	2.25					
	LSD	0.17325045		0.08			



Figure 2. Author during research analysis at the Laboratory.



Figure 3. Pure culture of *C.capsici*.

### **Discussion**

A variety of diseases have infected several vegetables, including chillies. The pathogens that are most noticeable are *Colletotrichum capsici*. On the efficient chemical treatment of the condition, several studies had been done in the past. The use of chemicals to treat post-harvest illnesses causes environmental contamination, toxicity residues in agricultural products, and health risks for people. The new strategy of creating effective and environmentally safe methods of disease management through the use of plant products is therefore currently gaining steam (Renganathan and Saravanan, 2018). Studies using extracts from 42 plant species, including garlic and neem, against the pathogen responsible for mango and banana anthracnose discovered that the extracts were effective (Sangeeta et al., 2013).

In our investigation, the medicinal plant extract of "*Withania coagulans*" was very successful in reducing the target pathogen's mycelial colony growth by 30%. These results support Padderet al's (2010) claim that Neemgold is effective against *Colletotrichum lindemuthianum* (Sacc. & Magnus) Briosi and Cavara. Similar to this, Tiwari et al. (2008) showed that neemazal, tricure, and Neem gold suppressed *Colletotrichum capsici* development and sporulation. The outcomes of the current study are equivalent to those attained by the scientists previously mentioned.

### **CONCLUSION**

The results of this study showed that two plant extracts have fungicidal capabilities against *Colletotrichum capsici*, however the extract of *Withania coagulans* is the plant with the potential to be most effective at reducing post-harvest losses. Concentration demonstrates the successful management of the fungal infection that severely damages perishable fleshy vegetables after harvest and results in significant losses. In light of its eco-friendliness, lack of health risks, and potential for being an affordable method for the management of plant diseases, particularly for the control of post-harvest disease losses, the extract of *Withania coagulans* is thus enthusiastically recommended to farmers and store room owners for use.

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