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DETERMINATION OF RESISTANCE IN CHICKPEA GERMPLASM AGAINST *ASCOCHYTA RABIEI* (PASS L.) AND ITS CHEMICAL MANAGEMENT

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A B S T R A C T

Chickpea (*Cicer arietinum* L.) is an important edible legume of Pakistan. Chickpea blight is a major yield reducing factor in Pakistan. Screening of chickpea advance lines was conducted under control conditions. Out of hundred advance lines, two advance lines were highly resistant, 2 resistant, 6 moderately resistant, 16 susceptible and 74 were found highly susceptible. Four fungicides Dew, Shelter, State and Nativo and three bio-pesticides Vampire, Biosal and Azadirechtin were tested against Ascochyta at different concentrations (500, 250 and 150 ppm) in lab. To evaluate the fungicides and bio-pesticides food poison technique was utilized. Results of the study revealed that Dew at all concentrations (150, 250 and 500 ppm) showed significant reduction in fungal colony diameter. Nativo presented significant reduction of colony at (500 ppm) concentrations while other fungicides Shelter and State did not affect at any concentration. The results of the field condition suggested, that Dew (150ml/acre), Nativo (65gm/acre) and Bio-pesticides product Azadirechtin (500ml/acre) found effective against disease while fungicide Shelter (600gm/acre), State (500gm/acre) and Bio-pesticide product Vampire (1000ml/acre) and Biosal (1000ml/acre) did not control the disease. This study could be helpful to control chickpea blight.

Keywords: Chickpea, *Acochyta rabiei*, screening, fungicides, bio-pesticides.

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is an important legume cultivated in Pakistan. It is one of the major edible legumes in the world after common bean and field pea *(Pisum sativam* L.). In Pakistan gram quantitatively accounts as a small portion of country's total food supply but its qualitative importance is significant as food supplement for the vegetarian diet necessities. Area under cultivation in Pakistan is 1073 thousand hectares and annual production is 842 tons/ha. The average yield of gram is 784 kg/ha (Anonymous, 2011). The yield is very low as compared to its potential which could be managed through crop production and integrated pest management. The most widespread diseases of gram in Pakistan are Ascochyta blight, Fusarium wilt and stunt virus disease (Ansari, 1982). Many outbreak of fungus in Pakistan has been reported which cause complete crop failure. Disease causes 20-25% annual crop loss while the conditions conducive for the disease development lead to complete crop failure (Ali *et al*., 2009). Different managing strategies were used to avoid the fungal infection that is responsible to reduce the yield. One of those strategies, innate synthetic plant compounds has a bunch of contribution in combat of fungus and plants (Vyvyan, 2002; Neerman, 2003). The purpose of management is reduction of inoculum from field by using vigorous seeds, crop rotation with non-host crop, and destruction of infected plant debris and deep sowing of seeds (Pande *et al.,* 2005). Healthy seeds reduce the possibility of seed borne disease infection in new emerging plantings. Application of seed dressing fungicides and foliar fungicides are also effective against disease and repeat application may be cost effective in areas where productivity is low. When resistant or disease free seed is not available then seed treatment is

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effective way to manage the disease. In India, seed treatment is being in use since 1930s (Sattar, 1933).

Keeping in view the importance of determination of disease and its management present study was planned to investigate the effect of *Ascochyta rabiei* on chickpea crop under controlled conditions by creating artificial environment in plastic tunnel favorable for disease and its chemical management. Study was carried out by keeping in view the following objectives:

- Determination of resistant source in chickpea cultivar against *Ascochyta rabiei* under controlled conditions.
- Management of chickpea blight through the use of available fungicides and bio-pesticides.

MATERIALS AND METHODS

Collection of germ plasm: Advanced breeding lines were collected from Pulses Research Institute Faisalabad, Arid Zone Research Institute Bhakkar (AZRI) and Nuclear Institute for Agriculture and Biology (NIAB).

Isolation and purification of pathogen: Potato dextrose agar medium **(**potato starch 20g, glucose 20g, agar 20g and distilled water 1000ml) and chickpea meal agar medium **(c**hickpea meal 20g, glucose 20g, agar 20g and distilled water 1000ml) were prepared and sterilized in autoclave at 121^{0}C at 15 psi for 20 minutes. The medium were poured in sterilized petri plates and allowed to solidify.

Isolation of the fungus was carried out by taking infected portion of diseased plant debris of previous year crop. Infected portion of previous year crop were cut into small pieces, surface sterilized with chlorax 1% and then gave three washing in sterilized water. The pieces were transferred on the chickpea meal agar in petri plates with the help of forceps in laminar flow cabinet chamber. Afterwards plates were incubated for two days at 25 $\pm$ 2^{o}C in the growth chamber. The growing pathogen were identified by making slide under the microscope through illustrated genera of imperfect fungi (Barnett and Hunter, 1972). Purification of the pathogen was done by taking the portion of fungus mycelium from the actively growing margin after 2 days and then transferred to the PDA containing slants. The slants were incubated at 25+2°C for seven days.

Mass multiplication of the pathogen and preparation of inoculum: Autoclaved CMA was used for mass culturing. It was multiplied for 15 days in conical flask having variety Punjab-1.The inoculum for spray were prepared by macerating the fungus in sterilised water. Spores were counted by using Heamocytometer. Only freshly prepared inoculum were used for spray.

Screening of chickpea germ plasm for their resistance against Ascochyta blight under controlled conditions: Hundred different advanced lines of chickpea grown under plastic tunnels consisting of an area of 100 sq foot were screened against *A. rabiei*. The most susceptible variety K-850 was sown after every two test entries served as spreader. Each row has nine plants and plant to plant distance was six inches and row to row distance was nine inches. The experiment was conducted in three repeats. When plants reached near the maturity, inoculum was sprayed on the plants approximately at the rate of 20, 00, 00 spores per ml of water and 80-90% humidity was maintained by spraying water in the morning and evening. When the check line (K-850) completely blighted the data on disease severity was recorded by using the 1-9 disease rating scale (Shahbaz *et al*., 2013).

Management of Ascochyta blight by the integration of fungicides and bio-pesticides: In lab different fungicides and bio-pesticides were evaluated against *A. rabiei* by using food poison technique. In field conditions different fungicides were sprayed at their recommended doses for the control of chickpea blight at different intervals. The fungicides were Nativo, Dew, Shelter and State and bio-pesticides were Vampire, Biosal and Azadirechtin. Untreated plot served as control and data were recorded after each spray of fungicides by using 1-9 disease rating scale (Shahbaz *et al*., 2013).

***In vitro* evaluation of fungicides and bio-pesticides by food poison technique:** Three concentrations were prepared on the basis of crude material of fungicides which was mixed in sterilized distilled water. Three concentrations (500ppm, 250ppm and 150ppm) were prepared. Doses of fungicides were prepared in ppm (parts per million) by using formula (C1V1×C2V2). Two ml of each concentration was mixed in the chickpea meal agar medium (CMA) in 9mm petri dishes with the help of sterilized stirrer in laminar flow chamber and allow to solidify. Each treatment was repeated ten times. After solidification of media in petri dishes fungus was inoculated in treated petri plates with the help of sterilized cork borer and allows the fungus to grow in incubator at temperature 20±2°C for fifteen days. For comparison control was treated with simple water. Data was recorded after fifteen days on the basis of colony diameter with the help of colony counter.

RESULTS

Screening of chickpea advance lines for their resistance against Ascochyta blight under controlled conditions: Hundred advanced lines collected from Pulses Research Institute AARI Faisalabad, Arid Zone agriculture Research Institute Bhakkar (AZRI), Nuclear Institute for Agriculture and Biology (NIAB) were evaluated for identification of resistant source. The results of the study showed that, out of hundred lines none of them found immune while 74 were highly susceptible. One advance line (k01208) was highly resistant, three (K-01209, K-01212, K-01213) were found resistant, six (K-01207, K-01211, K-01214, K-01215, K-01104, K-01106) showed moderately resistant and sixteen showed susceptible reaction.

Table 1. Reaction of different advance lines/varieties against Ascochyta blight. Tukey's HSD all pair-wise comparison test of D for T. Control variety: K-850.

Sr. No	Lines	Rating	Mean	Standard Error	Reaction
01	D-12001 AB	7	8.0000	0.4434	S
02	D-12002 ABC	7	7.3917	0.3840	S
03	D-12003 ABC	7	7.7166	0.5430	S
04	D-12004 ABCD	7	7.0000	0.4434	S
05	D-12005 A	7	8.3333	0.4434	S
06	D-12006 AB	7	8.0000	0.4434	S
07	D-12007 AB	7	8.0000	0.4434	S
08	D-12008 ABCD	7	6.3333	0.4434	S
09	D-12009 ABCD	7	7.3333	0.4434	S
10	D-12010 ABCD	9	7.3333	0.4434	HS
11	D-12011 A	7	9.0000	0.4434	S
12	D-12012 ABCD	7	7.3333	0.4434	S
13	D-12013 ABCD	7	7.3333	0.4434	S
14	D-12014 AB	9	8.0000	0.4434	HS
15	D-12015 A	9	8.6667	0.4434	HS
16	D-12016 AB	9	8.0000	0.4434	HS
17	D-12017 A	9	8.6667	0.4434	HS
18	D-12018 A	9	9.0000	0.4434	HS
19	D-12019 A	9	8.6667	0.4434	HS
20	D-12020 A	9	8.3333	0.4434	HS
21	D-12021 A	9	8.6667	0.4434	HS
22	D-12022 A	9	7.6667	0.4434	HS
23	D-12023 ABC	9	8.3333	0.4434	HS
24	D-12024 A	9	9.0000	0.4434	HS
25	D-12025 A	7	7.6667	0.4434	S
26	D-12026 ABC	9	8.3333	0.4434	HS
27	D-12027 A	9	8.3333	0.4434	HS
28	D-12028 A	9	7.3333	0.4434	HS
29	D-12029 ABCD	9	9.0000	0.4434	HS
30	D-12030 A	9	8.0000	0.4434	HS
31	D-12031 AB	9	8.0000	0.4434	HS
32	D-12032 AB	9	7.6667	0.4434	HS
33	D-12033 ABC	9	8.3333	0.4434	HS
34	D-12034 A	9	8.0000	0.4434	HS
35	D-12035 AB	9	8.3333	0.4434	HS

Continue…

36	D-12036 A	9	9.0000	0.4434	HS
37	D-12037 A	9	8.0000	0.4434	HS
38	D-12038 AB	9	8.6667	0.4434	HS
39	D-12039 A	9	8.3333	0.4434	HS
40	D-12040 A	9	8.3333	0.4434	HS
41	D-12041 A	9	8.0000	0.4434	HS
42	D-12042 AB	9	8.0000	0.4434	HS
43	D-12043 AB	9	8.6667	0.4434	HS
44	D-12044 A	9	8.3333	0.4434	HS
45	D-12045 A	9	8.0000	0.4434	HS
46	D-12046 AB	9	8.3333	0.4434	HS
47	D-12047 A	9	7.6667	0.4434	HS
48	D-12048 ABC	9	8.0000	0.4434	HS
49	D-12049 AB	9	9.0000	0.4434	HS
50	D-12050 A	9	8.6667	0.4434	HS
51	K-01201 A	9	8.0000	0.4434	HS
52	K-01202 AB	9	8.3333	0.4434	HS
53	K-01203 A	9	7.6667	0.4434	HS
54	K-01204 ABC	9	8.3333	0.4434	HS
55	K-01205 A	9	7.6667	0.4434	HS
56	K-01206 ABC	9	8.0000	0.4434	HS
57	K-01207 AB	5	8.6667	0.4434	MR
58	K-01208 A	1	8.6667	0.4434	HR
59	K-01209 A	3	7.6667	0.4434	R
60	K-01210 ABC	7	8.3333	0.4434	S
61	K-01211 A	5	8.0000	0.4434	MR
62	K-01212 AB	3	8.0000	0.4434	R
63	K-01213 AB	1	8.0000	0.4434	HR
64	K-01214 AB	5	7.6667	0.4434	MR
65	K-01215 ABC	5	8.3333	0.4434	MR
66	K-01216 A	7	8.0000	0.4434	S
67	K-01101 AB	9	9.0000	0.4434	HS
68	K-01103 A	9	5.0000	0.4434	HS
69	K-01104 CDE	5	1.3333	0.4434	MR
70	K-01105 F	7	2.6667	0.4434	S
71	K-01106 EF	5	7.0000	0.4434	MR
72	K-01107 ABCD	9	5.3333	0.4434	HS
73	K-01108 BCDE	9	2.6667	0.4434	HS
74	K-01109 EF	9	1.6667	0.4434	HS
75	K-01110 F	9	5.3333	0.4434	HS
76	K-01111 BCDE	9	4.6667	0.4434	HS
77	K-01112 DE	9	6.6667	0.4434	HS
78	K-01113 ABCD	9	8.3333	0.4434	HS
79	K-01114 A	9	8.6667	0.4434	HS
80	K-01115 A	9	7.6667	0.4434	HS
81	K-01116 ABC	9	5.3333	0.4434	HS
82	K-01117 BCDE	9	7.6667	0.4434	HS

Continue…

83	K-01118 ABC	9	4.6667	0.4434	HS
84	K-01119 DE	9	8.3333	0.4434	HS
85	K-01005 A	9	8.3333	0.4434	HS
86	K-01006 A	9	8.3333	0.4434	HS
87	K-01007 A	9	8.3333	0.4434	HS
88	K-01008 A	9	8.3333	0.4434	HS
89	K-01009 A	9	7.6667	0.4434	HS
90	K-01010 A	9	8.3333	0.4434	HS
91	K-01011 ABC	9	9.0000	0.4434	HS
92	K-01012 A	9	8.6667	0.4434	HS
93	K-01013 A	9	8.3333	0.4434	HS
94	K-01014 A	9	8.3333	0.4434	HS
95	K-01015 A	9	8.3333	0.4434	HS
96	K-01016 A	9	8.6667	0.4434	HS
97	K-01017 A	9	7.6667	0.4434	HS
98	K-01018 A	9	8.3333	0.4434	HS
99	K-01019 ABC	9	8.6667	0.4434	HS
100	K-01020 A	9	8.6667	0.4434	HS
101	K-850 A	9	9.0000	0.4434	HS

Means sharing similar letters are statistically non-significant.

Table 2. Disease rating scale.

Rating Scale	Symptoms on plants	% age Disease Index	Resistant
0	No lesions and stem girdling on plants	0	Immune
1	Small pinhead lesions up to 5% of plants without stem girdling	0.1-5	Resistant
3	Lesions visible on more than 5% plants with stem girdling	5.1-10	Moderately Resistant
5	Lesions visible on more than 5% plants, stem girdling on 10% plants with little damage	10.1-20	Moderately Susceptible
7	Lesions present on almost all plants, 50% plants with stem girdling, death of 10% plants and damage conspicuous	20.1-50	Susceptible
9	Lesions very common on all plants, stem girdling on more than 50% plants and also more than 50% damage	50.1-100	Highly Susceptible

(Shahbaz *et al*., 2013).

Results of the study showed variation for disease reaction among genotypes according to 1-9 disease rating scale (Table 2). The genotypes were categorised according to their disease responses displayed that three genotypes were resistant with disease score of 1 to 3 and sixteen genotypes were moderately resistant with disease score at 4 to 5 and all others were susceptible with disease score of 6-9 rating. Screening of genotypes at vegetative stage, 74 were found to be susceptible.

***In vitro* evaluation of fungicide and bio-pesticides by using food poison technique:** In this experiment four fungicides and three bio-pesticides were evaluated at three different concentrations by using food poison technique.

Management of *A. rabiei* through fungicides and bio-pesticides: This experiment was conducted under plastic tunnel, in which 21 rows of susceptible cultivar K-850 were grown for evaluation of different chemicals and bio-chemicals. Four fungicides and three bio-pesticides were used to manage the chickpea blight. Recommended doses of each fungicide and bio-pesticide on treatment replicated thrice. Fungicide Dew showed significant results against *A. rabiei*. After spray it shows 80% reduction in disease severity while Nativo also control the disease and reduce 60% disease incidence. The fungicides Shelter and State did not inhibit the disease. Bio-pesticide Azadirachtin indicates 60% disease reduction while Vampire and Biosal exhibited no significant results.

Table 1. *In vitro* results of mycelia/colony diameter of fungus at different doses.

Treatments	500 PPM	250 PPM	150 PPM
Dew	1.7067 J	2.0500 I	2.4533 G
Nativo	1.8067 J	2.2600 H	2.6500 F
Shelter	3.3733 D	4.0500 C	4.3333 A
State	3.3600 D	4.0100 C	4.2633 AB
Azadirachtin	0.9200 K	1.7567 J	1.7700 J
Vampire	3.3433 DE	4.2433 AB	4.3000 AB
Biosal	3.2500 E	4.0233 C	4.2000 B
Control	4.2000 B	4.2633 AB	4.2400 AB

Means sharing similar letters are statistically non-significant.

Table 2. Results of different treatments on disease severity.

Treatments	Response
Dew	3.3333 D
Nativo	4.6667 C
Shelter	7.3333 B
State	7.3333 B
Azadirachtin	4.6667 C
Vampire	7.3333 B
Biosal	7.3333 B
Control	9.000 A

DISCUSSION

Most of the previous reports showed that resistant cultivars lose their resistance due to the appearance of new physiological races of *A. rabiei* and leads towards new sources of resistance. Similarly Iqbal (2010) screened 398 genotypes of chickpea under field conditions during crop season of 2003-04. Planting row of each germ-plasm was 4 m in length with two replications. Check (C 727) was planted and replicated after every two test entries of the germplasm as disease spreader. At early flowering stage inoculum was sprayed with spore suspension of *A. rabiei* @ 5 x 10^5spores/ml. Inoculum was applied daily in the evening till the disease appeared. Water spray was applied daily to maintain relative humidity more than 90% for disease development. The date was recoded according to Singh (1981).

This study showed that environmental condition at any stage of plant cause disease to susceptible germ-plasm, so screening of chickpea depends on environmental conditions because some varieties represented resistant response at seedling stage but susceptible at vegetative stage and also chances of disease escape. Germplasm was found to be susceptible that proved the usefulness of artificial inoculation for the development of disease. Some of the advance lines used in the present work exhibited resistance; it confirmed the previous findings on the subject of resistance in chickpea against blight by different renowned workers (Reddy and Singh, 1984).

Resistance level in a few genotypes at two stages may be due to activation of resistant genes at plant growth stages or due to infection type at different stages (Reddy and Singh, 1984; Ilyas *et al*., 1991). Pathogenicity variation in fungus utilized for screening could be a new reasonable explanation for alteration in their behaviour to disease reaction.

The results of resistance to *A. rabiei* suggested clear evidence that there was adequate genetic variation in chickpea for this trait that can be oppressed for disease control. The genotypes those possess a significant level of resistance are recommended to be screened at reproductive stage to verify resistance at this period. This would help to save the resources required to generate high humidity (90%) throughout the months of January and February in the pasture. It has been reported that screening experiments under field situation two weeks of continuous 90% RH are compulsory for consistent spread of the disease, which is not easy under drought conditions. Research institutions in various countries for their further assessment against

different races screened the germplasm. That's why, the majority of the chickpea lines of the nurseries of ICRISAT India and NARC Islamabad were found to be resistant against Ascochyta blight in Pakistan. These sources of resistance documented from chickpea blight nursery was screened in breeding programs for the development of disease resistant cultivars if these were found to hold other enviable agronomic characters and approved through the proper way and obtaining the class of an approved variety. The results presented by Nasir *et al*. (2000) was alike as present work when they screened 14 chickpea cultivars, 29 indigenous chickpea lines and 38 local breeding lines with four Australian isolates of *A. rabiei* and establish that all of the Australian chickpea cultivars were susceptible to *A. rabiei*, however seven indigenous lines and three local advance lines were resistant to *A. rabiei*.

There were three types of induced systemic acquired resistance (SAR) developed through localized necrosis due to hypersensitive reaction (HSR), wound induced resistance typically caused by insect feeding and infection by means of virulent pathogen or by treatment with certain chemically induced systemic resistance (ISR). In systemic resistance there is no need of invading pathogen. Various defense pathways stimulated in the induced plant which produce different defense products including lignin and pathogenesis related proteins some of which was chitinase or β-1, 3-glucanase activity (Pieterse, 2009).

Chemical control has been proved efficient and economical in controlling blight disease. On the other hand increasing public concern on environmental issues needs that alternative management systems should be evolved either to reduce pesticide dependent or naturally occurring compounds should be explored to limit the pathogen attack (Singh, 1984).

In this investigation, both chemicals and bio-control agents were used to identify the source which is effective and economical for farmers when they lack resistant source in field. In this work natural product neem extract have brand name Biosal, Azadirechtin were used and a homeopathic product Vampire was evaluated against *A. rabiei.* Chemicals which were available locally have brand name Dew (Difenconazole), Shelter (Mancozeb), Nativo (Teboconazole+ Trifloxistrobin), State (Tricyclazole) were evaluated. Results suggested that fungicides Dew and Nativo have significant difference when compare to the results of control.

Fungicide Dew reduced the colony diameter of *A. rabiei* (50-80%) while Nativo reduced the colony diameter of fungus 40-60%. Shelter and State show almost same results as control. Bio-pesticides, Azadirechtin have significant results and inhibit the fungus colony development 60-90% when compared with the results of control while vampire and biosal indicated same results as control. Natural plants derived compounds play a significant role in fight against pathogens. A number of plant families like Acanthaceae, Amranthceae, Apiaceae and Magnoliaceae have antifungal and phytotoxic properties (Mansilla and Palenzuela, 1999). Various studies conducted in Pakistan exposed a wide range prediction of using extracts of plants for biological control of pathogenic fungi (Bajwa, 2003). Thus for the sake of identification of safe and effective products to safe the farmers money and health which are commercially present in the market was evaluated.

Shafique *et al*. (2011) evaluated the toxic potential of *Tagetes eserectus* L. against *A. rabiei* the cause of gram blight disease. At different concentrations pathogen exposed aqueous and methanol extracts of shoot and flower of *T. erectus* using food poisoning technique. Concentrations of both shoot and flower extracts significantly censored the growth of target pathogen. Reduction of colony diameter was 4-35% and 55-73% of *A. rabiei* due to different concentrations of flower and shoot extracts of *T. erectus* and 12-50% and 4-42% due to different composition of methanolic shoot and flower extracts of *T. erectus* respectively (Shafique *et al*., 2011). But in this work commercial products were evaluated except plant extract obtained from vegetative parts of plants.

A defensive approach to manage the disease was usually suggested. If no disease has been detected seven to ten days earlier than bloom start (if there have been regular rain fall and/or heavy dew) or at bloom opening (if it is dry), a curative application of fungicides was advised. Seven to ten days after applications of fungicides (Dew, Nativo) showed reduction in disease severity.

There were considerable differences in disease decline in *A. rabiei* was seen due to application of different doses. The highest effectiveness after inoculation of the pathogen was revealed by aqueous solution of Dew (Difenconazole) (70.5%) while the lowest reduction was exhibited by Shelter (Mencozeb) and State (Tricyclazole)

(20%). The application of aqueous solution of Nativo (Teboconazole w/w 50%+ Trifloxistrobin w/w 25%) revealed (55.5%) reduction in the disease. Effectiveness persisted for seven days after the stimulation and inoculation with the fungus culture. The mode of action of Difencolazole is systemic it absorbed in the vegetative parts of plants and move towards the tip and new emerging twigs and reduce the fungus and secondary infection while Nativo has systemic acropetal penetration and also protect secondary infection. Mancozeb has protective mode of action when disease appear in plants it could not help to control the disease. Tycyclazole did not affect the fungus although it is acropetal protectant but in case of *A. rabiei* the brand results are not satisfactory.

Bio-pesticide Azadirechtin have systemic mode of action it control the fungus and vampire has protective mode of action but not affect *A. rabiei.* While at all the dose of chemical that were applied the considerable protection was happening after 11th day and it remains to limit after two weeks. Three plant extracts were evaluated at (5, 10, 15%) doses and leaf extract of neem proved to be effective in inhibition of disease (43.5%) while datura (31.4%) and garlic (26.7%) extracts also confirmed protection but less when compared to neem. Moreover this shield was persisted for two weeks and the maximum concentration was competent in dropping the disease severity.

Commercial product Azadirectin that was used @ of (10, 15%) at the cultivar K-850 reduce the diseases development significantly while Biosal having same active ingredients (Azadirechtin) did not react the disease and plants killed by the fungus. All the extracts were equivalent in reduction of *A. rabiei* under field circumstances with (20.0%) by neem and datura (19.5%) but garlic showed (13.8%) less effectiveness against disease after 14 days of inoculation. The percentage disease reduction in the cultivar Bittle-98 through the application of fungicides and different extracts were considerable. For induction of resistance, the application of chemicals proved more effective as compared to the extracts. The Bion (44.1%) represented maximum disease reduction after fourteen days and KOH with (16.6%) gave the negligible amount of reduction in disease and salicylic acid reduces the blight (29.1%). The effect of these plant extracts and KOH was same while Bion and salicylic acid was better in protection to chickpea against *A. rabiei* (Ghazanfar *et al.*, 2008; Rehman *et al.,* 2013, Bukhari *et al.,* 2011). Resistance induced by chemicals and bio-chemicals attracted many researchers all over the world as a potential approach incorporated in plant disease management (Sundar *et al*., 2001). The curative possessions of salicylic acid and its derivatives have been proved at the time when Hippocrates described the occurrence of salicylates which was helpful during the child birth (Weissman, 1991). Considerable advancement was reported in the last two decades to identify the metabolism and signaling mechanism in plant defense activation through application of salicylic acid (Durner *et al*., 1997).

REFERENCES

Ali, S.R., S.M. Iqbal, U. Iqbal, A. Ghafoor and A. Akram. 2009. Pathogenic diversity in *Aacochyta rabiei* (Pass.) Lib. of chickpea. Pak. J. Bot. 41: 413-419.

Anonymous, 2011. Agriculture statistics of Pakistan. Indian Phytopathology. Islamabad, Ministry of food and Agriculture.

Ansari, M.A. 1982. Pulses, the poor man meat. Pak. J. Agric. Sci. 4:30-31.

Bajwa, R.S. 2003. Antifungal activity of allelopathic plant extracts III: growth response of some pathogenic fungi to aqueous extract of *Parthenium hystrophorus*. Plant pathol. 2: 145-156.

Barnett, H.L. and B.B. Hunter 1998. Illustrated genera of imperfect fungi.(4th ed). The American Phytopathological Society.

Bukhari, A.A., M. Ashraf, A. Rehman, A. Ahmad and M. Iqbal. 2011. Screening of Chickpea germplasm against Ascochyta blight. Pak. J. Phytopathol. 23(1): 5-8.

Durner, J., J. Shah and D.F. Kessig. 1997. Salicylic acid and disease resistance in plants. Trend Plant Sci. 2: 7.

Ghazanfar, M.U., W. Wakil and S.T. Sahi. 2008. Induction of resistance in chickpea (*Cicer arietinum* L.) against *Ascochyta rabiei* by applying chemicals and plant extracts. Chilean J. of Agric. Res. 71: 52-62.

Ilyas, M.B., A. Rehman and K. Iftikhar. 1991. Sources of resistance in chickpea. Pak. J. Phytopathol. 3: 83-86.

Iqbal, S.M. 2010. Identification of resistant sources for multiple disease resistance in chickpea. Pak. J. Phytopathol. 22: 89-94.

Mansilla, H. and J.A. Palenzuela 1999. Minor eudesmanolides from *Artemisia canariensis*. Phytochemistry 51: 995-997.

Nasir M., T.W. Bretag, W.J. Kaiser, K.A. Meredith and J.B Brouwer. 2000. Screening chickpea germplasm for ascochyta blight resistance. Aust. Pl. Pathol. 29: 102–107.

Neerman, M.F. 2003. Sequiterpenes lactones a diverse class of compounds found in essential oils possessing antibacterial and antifungal properties. Int. J. Aromatherapy 13: 114-120.

Pande, K.H.M., G.K. Kishore, P.M. Gaur, C.L. Gowda, T.W. Bretag and J.H. Crouch. 2005. Ascochyta blight of chickpea (*Cicer arientinum* L.): A review of biology, pathology, and disease management. Aust. J. Agri. Res. 56:317–332.

Pieterse, C.M. 2009. Networking by small-molecule hormones in plant immunity. Nature Chemical Biol. 5: 308-316.

Reddy, M. and K. Singh 1984. Evaluation of a world collection of chickpea germ plasm accessions for resistance to Ascochyta blight. Pl. Dis. 68: 900-901.

Rehman, A., S. Mehboob, I. Waqar and N.A. Khan. 2013. Reaction of gram (*Cicer arietinum* L.) verieties against gram blight disease and its management through foliar fungicides in rainfed areas of Pakistan. Pak. J. Phytopathol. 25(1): 7-14.

Sattar, A. 1933. On the occurance, perpetuation and control of gram blight caused by *Ascochyta rabiei* with special reference to indian conditions. Ann. Appl. Boil. 20: 612-632.

Shafique, S., R. Bajwa, N. Akhtar and S. Hanif. 2011. Fungitoxic activity of aqueous and organic solvent extracts of *Tagetes erectus* on phytopathogenic fungus *Ascochyta Rabiei.* Pak. J. Bot. 43: 59-64.

Shahbaz, M.U., M.A. Iqbal, A. Mustafa, M.I. Hassan and F.A. Faiz. 2013. Host plant resistance of different chickpea genotypes against *Ascochyta rabiei* (Pass) Lab. under tunnel conditions. Archive Phytopathol. Pl. Protect. http://dx.doi.org/10.1080/03235408.2013.813146.

Singh, K.B. 1981. Sources of resistance to Ascochyta blight of chickpea. Chickpea Newsletter 4: 16-17.

Singh, K.B. 1984. International testing of chickpeas for resistance to Ascochyta blight. Pl. Dis. 68: 782-784.

Sundar, A.R., R. Velazhahan, R. Viswanathan, P. Padmanaban and P. Vidhyasekaran. 2001. Induction of systemic resistance to *Colletotrichum falcatum* in sugarcane by a synthetic signal molecule, Acibenzolar-S-Methyl (CGA-245704). Phytoparasit. 29: 231-242.

Vyvyan, J.R. 2002. Allelochemicals as leads for new herbicides and agrochemicals. Tetrahedron 58: 1631-1646.

Weissman, G. 1991. Aspirin. Scient. Amer., 264: 84-90.