J. Mycopathol, Res, ***50(1)*** *: 81-84 (2012)*

Airspora and epidemiology of Early blight of tomato caused by *Alternaria solani* (Ell and Mart) Jones and Grant in Manipur

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Received : 21. 06 2011 Accepted : 15. 12. 2011 Published : 30.04.2012

Early blight of tomato (*Lycopercicum esculentum* Mill) caused by *Alternaria solani* (Ell and Mart)Jones and Grant is an airborne disease causing significant yield loss of tomato. A total of 28 fungal species belonging to 5 different sub-divisions of fungi constituted the aerospora over the hybrid tomato cultivars (NS-53 & NS-4032). Monthly variations of total fungal spores over the hybrid tomato fields were also observed.Percentage of aerospora contributed by *A.solani* showing monthly variation and its impact on early blight disease (PDI) in relation to weather parameters were observed. Percentage inhibition of *A.solani* varied in different months. However, occurrence of Early blight disease depends on the conducive weather parameters. Correlation between disease incidence and weather parameters and between percentage contribution of *A. solani* with weather factors were significant(P<5%).

Key words: Early blight, *Alternaria solani*, airospora , hybrid tomato, *Lycopercicum esculentum*, epidemiology

INTRODUCTION

Tomato is an important vegetable crop produce in large quantity during a short season (November-April) in Manipur agro-climatic conditions. Significant loss of yield of this crop due to Early blight of foliages caused by *Alternaria solani* is a major constraint for the large cultivation of this crop. Early leaf infection by conidia seemed to have greater impact on yield than secondary infection by *A.solani*. Contribution of fungal airospora to the occurrence and development diseases on different crops such as maize,rice and other vegetable crops have been reported (Berger,1970; Chandwani *et al*,1963). Dispersion pattern of *A.solani* conidia over tomato field and their possible infection to the standing crop is well documented (Datar and Mayee,1982).

In this study, assessment of overall fungal airspora and percentage contribution by pathogenic conidia for the incidence of Early blight disease (PDI) of tomato caused by *Alternaria solani* influnced by weather parameters have been aimed to understand the epidemiology of the diseases. To achieve the objective, an experiment related to aerobiology and epidemiology has been carried out for two years (2007 and 2008) in Lamshang experimental site. Attempts have also been made to correlate the weather parameters with the PDI of tomato in order to understand the influence of environmental factors on epedemiology of Early blight of tomato.

MATERIALS AND METHODS

Tilak Rotorod Air Sampler was employed to sample the airspora over the hybrid tomato (*Lycopersicon esculentum* Mill) cultivar(NS-53 and NS-4032) field located about 7 km away from Imphal. Air sampling was carried out for two cropping seasons (November 2007 to April 2008 and November 2008 to April 2009). Tomatoes were planted on 10th November and harvested on 20th April in each crop season. Transparent cellotape was applied to the rods of the sampler, trimmed back to the width of the rods with a sharp razor blade and then coated with vaseline. Then the air was sampled for 30 minutes by operating the sampler kept at 1 metre above ground level (a.g.l.) clinging at the rate of 100 litres per minute. Air sampling was started 10 days prior to plantation of tomato and continued for 10 days after harvesting of the same crop. After operating, the cellotape was removed, mounted beneath a cover glass using glycerine jelly and thus prepared the slides. Scanning of the prepared slides was done regularly throughout the investigating period. The trapped fungal spores were iden-

tified based on morphological characters, visual identification by comparison with reference slides, published literatures (Ellis, 1971; Barnett and Hunter, 1972; Gregory, 1973; Tilak, 1989). Meteorological data during the study period was obtained from meteorological section of ICAR Research Complex, Lamphelpat, Imphal at a distance of 10 km from the experimental site. Per cent diseases incidence (PDI) was calculated following the standard formula : PDI= No.of plants infected / Total number of plants × 100.

RESULTS AND DISCUSSION

A total of 127280 spores/m^3 and 127135 spores/m^3 of air were trapped in the first crop season (Nov. 2007 – Apr. 2008 and second crop season i.e. S_2) (Nov. 2008 – Apr. 2009 i.e. S_1) respectively (Table 3) and put under two main groups – fungal spores and other types. The fungal spores were assigned to 28 fungal species and contributed 87.08% and 88.61% of the total airspora in S_1 and S_2 cropping season respectively. Hyphal fragments, insect parts, pollen grains, algal fragments, epidermal hair, unidentified types etc. were grouped as "other types" which together contributed 12% and 11.39% in two respective seasons. The fungal spores identified were classified into five fungal sub-division following standard literatures(Ainsworth, 1966; Hawksworth *et al.*, 1985)

Deuteromycotina (67.55%) of the total airspora respectively (Table1). Qualitative and quantitative variations of different fungal spores were more or less similar over the two hybrid tomato fields. Fluctuation in meteorological parameter i.e., relative humidity in particular affect the concentration of spores in the air. Results obtained as regard the influence of relative humidity were in agreement with other workers (Singh and Devi, 1997; Garcia-Mozo *et.al,*.2008; Esfahani, 2008). Dominant fungal types were *Cladosporium* (20.55% and 21.52%), followed by smut spore (7.20 and 7.21) *Nigrospora* (6.52 and 6.53), *Aspergilli-Penicilli* (6.32 and 6.50), *Periconia* (4.91 and 3.89), *Curvularia* (4.71 and 4.81) etc. in S_1 and S_2 respectively.Monthly variation of total fugal spores and their percentage contribution in each month showed that environmental factors might have influenced the variation of airospora (Table 3).

Although overall contribution of *A.solani* varied from 10.92% to 12.75%, yet monthly contribution varies from 10.12% to 18.99% in S_1 and S_2 respective seasons over two hybrid tomato fields. This variations may be due to the differences of relative humidity that has greater role in determining the monthly variation in spore concentration in the air. Per cent disease incidence caused by the pathogen ranged from 5.21% to 18.92% in NS-53 whereas variation was from 5.02% to 19.52% in NS-4032 indicating

Table 3: Monthwise population of fungal spores and their percentage contribution in two different cropping seasons((S$_1$) and (S$_2$).

Month	First crop season (Nov.2007-Apr. 2008) (S1)		Second crop season (Nov.2008-Apr. 2009) (S2)	
	No. of fungal spores	(%) contribution	No. of fungal spores	(%)contribution
Nov	20410	16.07	19640	15.45
Dec	24515	19.30	24600	19.35
Jan	23215	18.28	23395	18.40
Feb	21720	17.10	21750	17.11
Mar	19875	15.65	19330	15.20
Apr	17545	13.81	18420	14.49
Total	127280	100	127135	100

In S_1 Mastigomycotina contributed 2.76%, Zygomycotina (2.30%), Ascomycotina (3.67%), Basidiomycotina (12.29%) and Deuteromycotina (66.06%) whereas in S_2 Mastigomycotina contributed 2.77%, Zygomycotina (2.31%), Ascomycotina (3.68%), Basidiomycotina (12.30%),

more susceptible nature of NS -4032 than NS-53 in first cropping season S_1. Similar trend was observed in S_2 also. However, weather parameters influenced the epidemiology of disease as the correlation co-efficient(r=0.85) between disease incidence and weather parameters was found signifi-

Table 1: Percentage contribution of different spore types to the total fungal airspora over the hybrid tomato fields during the first cropping season (S_1) and second crop season (S_2).

Spore types	Percentage contribution			
	S_1 (Nov.'07-Apr.'08)		S_2 (Nov.'08-Apr.'09)	
	NS-53	NS-4032	NS-53	NS-4032
MASTIGOMYCOTINA				
Albugo	1.36	1.31	1.27	1.33
Phytopthora	1.46	1.45	1.50	1.44
ZYGOMYCOTINA				
Round Spores (Rhizopus Mucor type)	2.37	2.30	2.25	2.31
ASCOMYCOTINA				
Fusiform ascospores	2.30	2.22	2.01	2.21
Chaetomium	0.60	0.62	0.80	0.64
Erysiphe	0.85	0.83	0.83	0.83
BASIDIOMYCOTINA				
Basidiospores	2.55	2.10	2.17	2.12
Rustspore	3.50	2.99	2.85	2.97
Smutspore	7.24	7.20	7.34	7.21
Uromyces	1.00	1.02	1.15	1.03
DEUTEROMYCOTINA				
Alternaria	10.90	10.42	12.55	12.75
Aspergilli Penicilli	6.24	6.32	6.55	6.50
Beltrania	0.72	0.60	0.70	0.55
Bispora	0.61	0.43	0.35	0.33
Cladosporium	20.33	20.55	21.50	21.52
Curvularia	4.94	4.71	4.82	4.81
Drechslera	1.30	1.40	1.14	1.11
Epicoccum	1.02	0.92	0.38	0.42
Helminthosporium	0.97	0.45	0.52	0.44
Nigrospora	6.00	6.52	6.45	6.53
Periconia	4.51	4.91	3.85	3.89
Pithomyces	2.92	2.52	2.59	2.55
Pestatotia	1.24	1.70	1.53	1.65
Pseudotorula	0.75	0.94	0.84	0.88
Tetraploa	0.90	0.73	0.76	0.74
Torula	0.84	0.81	1.35	0.83
Trichoconis	1.16	1.11	1.51	1.02

Table 2 : Percentage of airospora contributed by A. solani (Ell and Mart)Jones and Grant causing Early blight in hybrid tomato in relation to weather parameters.

Months	First cropping season (Nov'2007-Apr 2008)								Second cropping season (Nov.2008-Apr 2009)							
	% contribution of *A.solani*		PDI%		Weather parameters				% contribution of *A.solani*		PDI		Weather parameters			
	NS-53	NS-4032	NS-53	NS-4032	Max °C	Min °C	RH%	Rf mm	NS-53	NS-4032	NS-53	NS-4032	Max °C	Min °C	RH%	Rf (mm)
Nov	12.12	13.14	-	-	25.53	12.15	83.08	1.93	10.12	12.14	-	-	25.25	9.62	83.76	0.05
Dec	17.75	16.32	-	-	23.41	7.44	79.75	0.0006	14.74	16.15	-	-	22.77	7.57	82.20	0.28
Jan	18.15	17.99	5.2	7.5	20.08	6.10	74.33	1.10	16.64	16.99	5.21	5.62	22.80	5.88	75.75	Nil
Feb	18.90	19.05	10.5	12.4	21.16	7.13	70.92	0.72	18.40	18.12	9.31	10.41	26.10	6.43	71.56	0.74
Mar	17.45	18.94	15.4	15.5	24.93	12.54	70.12	2.24	16.01	14.20	16.12	17.53	26.63	13.06	53.70	1.64
Apr	16.16	14.41	25.5	28.5	28.77	15.57	58.88	0.59	18.92	17.92	18.92	19.52	28.16	15.03	82.04	3.09

cant (P<5%) and development of disease occurs only during conducive weather irrespective of conidial concentration of *A.solani* in air as the percentage contribution of *A. solani* was positively correlated (r=0.90, p<5%) with the weather parameters (Table 2).

ACKNOWLEDGEMENTS

The first author thanks to the UGC for financial assisstance through UGC- Minor Research Project and to the Principal, Standard College, Imphal for providing laboratory facilities.

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