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Effect of Altenaria blight (*A. brassicae*) on the composition and quality of mustard (*Brassica juncea* L.*)* seeds

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Abstract

Disease stress might have profound effect on crop extending to food ready to eat. Keeping this in view the healthy and diseased seeds were analysed for oil content, fatty acid profile and iodine value of oil. The nutritional quality index (NQI) was expressed as the ratio of oleic/erucic acid. The fat free meal was analysed for total protein (TP) crude protein (CP) and non-protein nitrogen (NPN) in 12 genotypes of B. juncea both the healthy and Alternaria brassicae affected seeds grown and analysed under similar conditions for comparative performance. The results indicated that oil content varied due to both genotypes and fungal infection. The oil content varied from 38.4% to 44.0% with the average of 41.3% in healthy seeds. In case of disease affected seeds, the oil content ranged from 32.9% to 40.5% with an average of 36.2% indicating a decrease of 12.34% in diseased seeds as compared to healthy seeds. The fatty acid composition varied only due to genotypes but the disease had little effect. The seed protein content (TP = true protein) which varied from 39.5% to 46.0% in healthy and 38.6% to 44.5% in diseased seeds. NPN content tended to increase due disease incidence.

Key words - Biochemical parameters, *Brassica juncea*, Alternaria blight

Introduction

It is well known that infection of a pathogen on host plant causes the derangement in the normal metabolic process both in vegetative parts and seeds. In the present study, an attempt has been made to see the variation in biochemical composition and quality of mustard seeds as affected by A. brassicae. Several workers have reported changes in the composition of plant parts due to Alternaria infection (Agrawal *et al*., 1980; Agrawal and Khare 1983; Awasthi 1986; Awasthi and Kolte, 1989). However, the effect of disease on composition and nutritional quality components remains less studied hence such studies have a bearing on the quality of food ready to eat. The present study has therefore, been conducted to obtain a systematic information regarding the quality composition of mustard seed as affected by A. *brassicae*.

Materials and Methods

Ten seeds of twelve varieties /genotypes were grown in each pot having 20 kg soil and 4 sets were sown for each variety marking 48 pots in CRD (completely randomized design). The two sets were artificially inoculated with A. brassicae in 20 days old seedlings. These pots were fertilized uniformly and the yield of seeds was recorded and expressed in g/pot. At maturity, the seeds of both healthy and diseased plants were analyses for various parameters. The oil content of seed was analyses by wide line NMR spectrometer model Oxford 4000 adopting the programme mode calibrated with relaxed water. The programme mode was kept at 5, A.F. gain 500, R.F. gain 40, gate width 1.5 calibration time 1 minute per

sample under single point calibration. The value was standardised with Soxhlet value of the oil. Fatty acid composition of the oil was determined by Gas chromatography using 15% DEGS column and Flame Ionization Detector and the values were recorded on the integrator. Methyl esters of fatty acids were prepared by transmethylation of the oil using sodium methoxide method as described by Luddy *et al*., (1968). The defatted meal was subjected to micro Kjeldahl analysis for nitrogen and the protein values were expressed as N multiplied by 6.25 to obtain total protein. A portion of sample was refluxed with 70% ethanol to remove non protein nitrogen and again subjected to protein estimation by above method to obtain the value of true protein. The above parameters were defined as – Crude protein (CP) –True protein (TP) = NPN

Results and Discussion

In the present study, the change in seed oil, meal protein and fatty acid composition as influenced by Alternaria blight due to infection of *Alternaria brassicae* had been studied for 12 genotypes of B. *juncea* and the results are presented in Tables 1, 2, 3 & 4.

Table .1 Effect of disease on oil content of *B. juncea* due to *Alternaria brassicae* infection

Genotypes	Oil contents (%)		Per cent decrease in oil
	Healthy	Diseased	
DIR-621	41.7	35.9	13.90
JGM-9508	40.3	33.4	17.12
PCR-9306	39.8	36.0	9.54
PRO-AGRO-1101	42.7	35.5	16.86
RK-9504	44.0	40.5	7.95
DIM-52	38.4	34.7	9.63
TKG-5	41.2	34.6	16.01
RK-9501	43.5	39.8	8.50
JGM-95	40.9	35.4	13.44
PSR-22	39.	32.9	17.12
VSL-5	41.2	37.4	9.22
Varuna	42.0	38.5	8.33
Mean	41.3	36.2	12.34

Oil content

The seed oil content varied from 38.4% to 44.0% in healthy seeds with a mean value of 41.31% (Table 1). In case of diseased seeds, it ranged from 32.9% to 40.5% with a mean of 36.2%. The oil content declined due to occurrence of disease in all the genotypes in varying magnitude. The reduction in oil content due to disease varied from 7.95% to 17.12%. The genotypes JGM-9508 and PSR-22 were affected with 17.1% decrease in oil content closely followed by PRO-AGRO-1101 (16.86%) and then by TKG-5 (16.01%), DIR-621 (13.90%) and JGM-22 (13.44%). The genotypes Varuna and RK-9504 gave least decrease of 7.95% and 8.33% respectively in oil. However, RK-9501 (8.50%), VSL-5 (9.22%), PCR-9306 (9.54%) and DIM-52 (9.63%) might also be regarded as less susceptible to Alternaria blight (A. brassicae) with magnitude of decrease from 7.95% to 9.63% in relation to the corresponding healthy seeds. It is clearly demonstrated from the results of Table 1 that the seed oil content was significantly affected by disease incidence.

Table 3. Ranges of variation and mean values of different fatty acids as affected by *A.*

brassicae

Fatty acids	Healthy		Diseased	
	Range	Mean	Range	Mean
Palmitic	2.0-2.8	2.36	2.0-3.0	2.53
Stearic	0.1-0.7	0.44	0.1-0.7	0.43
Oleic	14.6-18.2	16.55	15.2-19.3	16.38
Linoleic	17.2-22.0	19.58	17.9-21.7	19.23
Linolenic	10-13.4	11.50	10.2-13.8	11.92
Eicosenoic	5.1-8.1	6.69	5.0-8.3	6.54
Erucic	40.3-46.2	44.88	39.4-45.0	41.69

Table 4. Effect of *A. brassicae* infection on protein fractions of B. juncea seed meal health

Genotypes	Seed meal health			Diseased		
	CP%	TP%	NPN%	CP%	TP%	NPN%
DIR-621	41.65	41.20	0.45	41.20	41.20	1.00
JGM-9508	43.49	43.05	0.44	43.39	41.95	1.44
PCR-9306	45.23	44.80	0.43	45.18	43.51	1.67
PRO-AGRO-1101	43.28	42.92	0.36	42.55	40.80	1.75
RK-9504	46.46	46.00	0.46	46.27	44.50	1.77
DIM-52	43.97	43.50	0.47	43.83	42.56	1.27
TKG-5	40.59	40.20	0.39	40.39	39.50	0.89
RK-9501	41.98	41.50	0.48	41.78	40.50	1.28
JGM-95	42.45	42.00	0.45	41.50	40.00	1.50
PSR-22	40.90	40.52	0.38	40.68	38.91	1.77
VSL-5	40.60	40.20	0.40	40.39	39.44	0.95
Varuna	39.88	39.51	0.37	39.69	38.62	1.07
Mean	42.54	42.11	0.42	42.23	40.87	1.36

This might be due to impaired seed morphology resulting in shrivelled and poor seeds as compared to healthy ones. The study also revealed that certain genotypes having certain degree of resistance to disease as indicated by less decrease in oil content. The variation in oil content was significant statistically due to both genotypes and disease incidence, interaction between genotypes and disease. Several workers have reported the impaired seed morphology and decrease in oil content of Brassica seeds under disease stress (Awasthi, 1986; Khan and Ansari, 1990; Gupta *et al.,* 1995).

Fatty acid composition

The fatty acid profile of healthy and diseased seed oils of B. juncea genotypes as affected by Alternaria brassicae infection is given in Table 2. The profile revealed that oleic, linoleic, linolenic, eicosenoic and erucic acids were the major fatty acids and palmitic and stearic acids were present in minor amounts. The average composition in healthy seeds were palmitic (2.36%), stearic (0.44%), oleic (16.6%), linoleic (18.82%), lenolenic (11.5%), eicosenoic (6.6%) and erucic (42.89%). The corresponding values in case of diseased seed oil were palmitic (2.59%), stearic (0.42%), oleic (17.69%), linoleic (11.92%), eicosenoic (6.55%) and erucic (41.69%). Except in case of erucic acid which was slightly decreased due to disease over its healthy counterparts, no other fatty acid appeared to be affected by disease incidence and only genotypes effects were evident. The ranges of variation in different fatty acids along with their mean values as shown in Table 3, indicated that the genotypic differences were conspicuous and there existed

little variation due to disease. It is reported that the composition of oil in terms of constituent fatty acids is not affected to any significant extent due to environmental factors and the genotypes differences were significant (Awasthi and Kolte, 1994).

Protein

The data relating to different protein fractions of healthy and Alternaria affected seed meal are presented in Table 4. The crude protein content of healthy seeds varied from 39.88% to 46.46% and the lowest value was exhibited by genotype Varuna and highest by RK-9504. Similarly, true protein content offered a range of variation from 39.51% to 46.00% and NPN content was reported as the difference between CP and TP, the average NPN content being as 0.42%. In case of diseased seeds, CP varied from 39.69% in Varuna to 46.27%, in RK-9504, TP varied from 38.62% to 44.50% and the values were given by Varuna and RK-9504, respectively. The average NPN content was 1.36% which, was about 3.23% times higher than that of healthy seeds.

Table 2 Fatty acids profile of healthy and diseased seeds of *Brassica juncea* genotypes due to *Alternaria brassicae* infection

S. No.	Healthy								Diseased							
	Pal.	Stea.	Oleic	Lino.	Linolen.	Eicos.	Eru.	O/E.	Pal.	Stea.	Oleic	Lino.	Linolen.	Eicos.	Eru.	O/E
1	2.5	0.4	15.5	19.8	11.5	6.5	43.8	0.35	2.1	0.2	17.1	19.9	11.2	6.3	43.2	0.40
2	2.1	0.6	18.2	19.2	12.2	6.7	41.2	0.44	2.7	0.5	18.7	19.3	12.5	6.5	39.8	0.47
3	2.7	0.3	15.9	21.1	12.1	7.2	40.7	0.39	2.5	0.3	19.3	18.1	12.2	7.05	40.5	0.47
4	2.3	0.4	16.4	18.8	11.0	7.1	44.2	0.37	2.8	0.4	18.2	17.5	13.7	6.3	41.1	0.44
5	2.0	0.2	14.6	12.1	12.1	7.0	42.9	0.34	2.1	0.3	15.2	10.0	13.1	7.2	42.1	0.36
6	2.2	0.6	15.4	18.2	12.0	8.1	43.5	0.35	2.0	0.5	17.5	17.9	12.4	8.3	41.3	0.42
7	2.1	0.2	19.8	17.2	11.5	7.7	42.3	0.45	2.1	0.2	19.1	18.0	11.2	7.6	41.8	0.47
8	2.4	0.7	17.4	22.0	10.0	7.2	40.3	0.43	3.8	0.7	17.6	21.7	10.6	7.0	39.4	0.45
9	2.8	0.1	16.8	18.1	13.4	6.3	42.5	0.40	2.7	0.1	17.2	18.5	13.8	6.1	41.5	0.41
10	2.7	0.5	17.8	19.3	11.8	5.0	42.0	0.42	2.8	0.6	19.3	20.2	11.4	5.7	40.4	0.47
11	2.5	0.6	16.1	20.4	10.2	5.1	45.1	0.36	2.9	0.5	16.3	20.4	10.7	5.0	44.2	0.37
12	2.0	0.7	15.7	19.6	10.3	5.5	46.2	0.24	2.6	0.7	16.8	19.0	10.2	5.5	45.0	0.37
Mean	2.36	0.44	16.63	18.82	11.51	6.62	42.89	0.39	2.59	0.42	17.69	18.38	11.92	6.55	41.69	0.43

Conclusion

The results indicated that there was significant reduction in both CP and TP with a consequent increase in NPN. Increase in NPN indicates the deterioration in protein quality. The accumulation of free nitrogen to any considerable extent might be due to deranged protein synthesis under the disease stress. It is reflected from the results that the total protein was reduced due to disease. Similar results have been reported by Awasthi (1986).

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