Alteration of Nutrients of vegetable Bell pepper (*Capsicum annum* L.) after infected with *Alternaria alternata*.

Dongre Mayur A. and Borse K.N.
Post Graduate Department of Botany, S.S.V.P. Sanstha's L. K. Dr. P.R. Ghogrey Science College, Dhule, Maharashtra, INDIA

Abstract

Capsicum annum L. (Sweet pepper or bell pepper) belongs to family. This vegetable plant was known to be cultivated from at least 10,000 years (Kew Science). Commonly consumed either raw or cooked, it also used for food decoration purpose all over world. It is a best source of Vitamin C and other nutrients. Provides aroma and hotness due to presence of capsaicin the fruit. Brown spot disease caused by *Alternaria alternata* is most common disease found throughout the field and vegetable markets of Maharashtra. It was reported both preharvest and post-harvest pathogen, and humid climate make severity of disease worst. It causes quality and quantity loss to vegetable.

In vitro inoculation and pathogenicity were tested and later nutrient content were analysed. Here we find that Water content, Total Carbohydrate, Reducing sugar, Dietary fibres, Lipids, vitamin C, Chlorophyll content was decline while protein, free amino acids and dry matter was found to be slightly elevated when compared with control.

Keywords: Capsicum, Alternaria, Vegetables.

1. Introduction

Capsicum annum L. (Sweet pepper or bell pepper) belongs to family *Solanaceae* native of Central and South America. This vegetable plant was known to be cultivated from at least 10,000 years (Kew Science).Plants are perennial but for cultivation, mostly grown as annual crop. Fruit is of berry typeflowers develop after 3 monthss after planting. Fruit may be green , yellow or red in colour. Green bell pepper was consumed as raw or cooked. It easily available all over Maharashtrian markets, and consumed by peoples as salad or vegetable. It is a best source of Vitamin C and other nutrients. Provides aroma and hotness due to presence of capsaicin the fruit.

Brown spot disease caused by *Alternaria alternata* is most common disease found throughout the field and vegetable markets of Maharashtra. It was reported both preharvest and post-harvest pathogen, and humid climate make severity of disease worst. It causes quality and quantity loss to vegetable. Pathogen identification was carried by using various literature present online as well as offline, it includes Wall, *et al.* 1993, Mycota website , Frankin 2001, Jones and Grout 1897, Rao 1969, Stoessl 1982, Ellis 1971 etc.

2. Material and Methods

For pathological study and nutritive study on bell pepper fruit, samples were collected from field as well as from market from where they are subjected to distributed as food (vegetable).

3. Symptoms of disease: -

Symptoms brown spot disease on fruit caused by *A. alternata* develops cracks at location before harvesting or after harvesting of pepper. The first lesion is small and slightly sunken but later lesion get enlarge and fully sunken. The disease severity is directly related to undernourishment of plant, handling practices and environmental conditions. Alternaria is a disease of severe loss to Solanaceous plant species, causes quality and quantity loss to farmer. There are 299 species of Alternaria (Kirk et al. 2008, Nowicki-Marcin et al. 2012).

Table I: Collection site, culture and morphological characters of *Alternaria alternata* on Belly pepper

Sr. no.	Place of Collection	Geographical Data	Culture appearance on PDA plate		Conidia length X diameter µm	Beak length µm
			Color of colony	Appearance		
1.	Khandesh –Chalisgaon	20°27'50.5"N 74°59'55.2"E	Brown	Fluffy, entire margin	48.8 X 12.8	17.8
2.	Khandesh -Nashik	20°06'19.1"N 73°56'29.6"E	Brown	Fluffy, entire margin	65.1X 11.5	21.3
3.	Konkan Ratnagiri	16°59'16.3"N 73°18'43.4"E	Brown	Fluffy, entire margin	24.2X 8.6	13.1
4.	Konkan Mumbai	19°04'18.0"N 73°00'31.7"E	Olivaceous green	Fluffy, entire margin	38.9X 9.5	18.4
5.	Vidharbha – Deori	21°04'25.3"N 80°22'01.7"E	Brown	Fluffy, entire margin	78.5 X 18.1	24.1
6.	Vidharbha -Badnera	20°51'48.7"N 77°44'20.5"E	Brown	Fluffy, entire margin	56.8X 14.8	19.1
7.	Western Maharashtra Satara	17°41'17.4"N 74°01'53.0"E	Brown	Fluffy, entire margin	77.1X 16.1	23.7
8.	Western Maharashtra Sangli	16°51'41.0"N 74°33'46.9"E	Olivaceous green	Fluffy, entire margin	64.2X 12.6	20.8
9.	Marathwada Aurangabad	19°51'43.1"N 75°18'40.7"E	Olivaceous green	Fluffy, entire margin	38.4X 10.7	15.4
10.	Marathwada Parbhani	19°15'10.6"N 76°47'38.6"E	Brown	Fluffy, entire margin	55.7X 10.2	20.1

4. Morphology of pathogen: -

The mycelium was multicellular, septate, and irregularly branched. Initially the mycelium was thin but later it becomes broad up to 4.42 µm in diameter.

The conidiophores produced in cluster or singly, they are brown in colour, slightly swollen at the apex. The conidiophore measure 27.30 to 112 µm in length and 3.12 to 8.43 µm in diameter.

Conidia arise in chains of 10 or even more on conidiophore. The colour of conidia was olive to brown. Shape of conidia differ from obclave to ellipsoidal, muriform. Apex were tapered at the end. Longitudinal septate ranges up to 3 or 4, but transvers septet number ranges from 2 to 10. The length of conidia was ranges from 24-79 µm diameter ranges from 6-18 µm. The length of beak of conidia varies from 13 to 24 µm. (R. Ramjegathesh and E.G. Ebenezar, 2012).

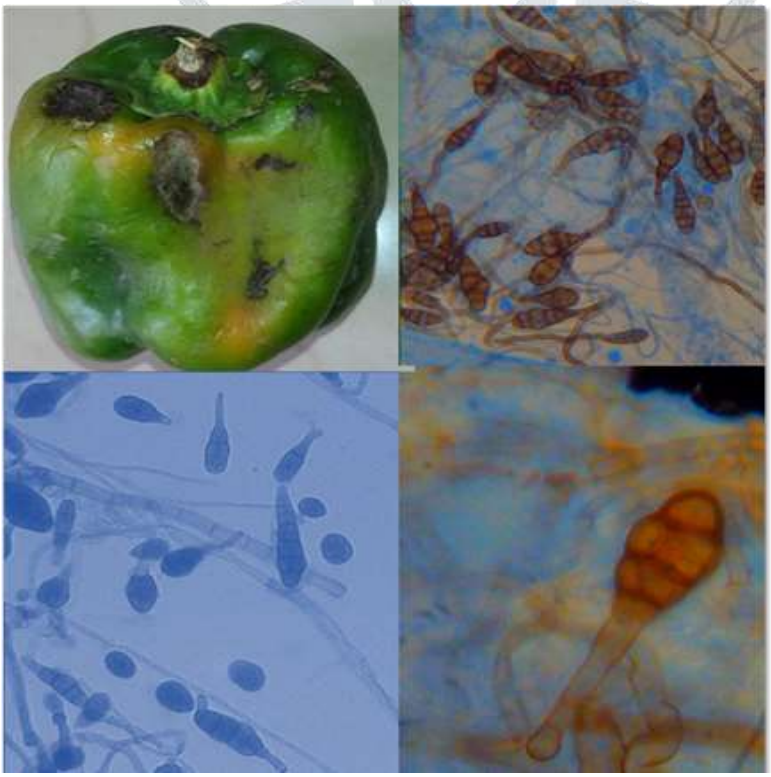


Image:- *Alternaria alternata* infection on *Capscicum* ,Pure culture mycelium and conidia

5. Pathogenicity test: -

Fresh sweet pepper is surface sterilised with 70% ethanol, and each were inoculated with culture of Alternaria alternata (Fr.) Keissler by artificial rupturing the surface using sterilised needle.

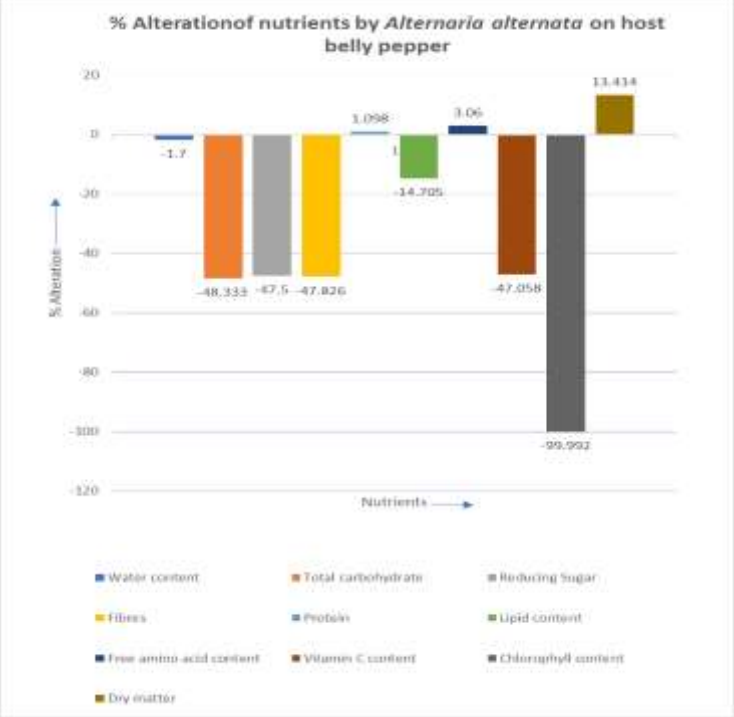
Table II: Nutrient content in Healthy and Diseased vegetables and % alteration of content by *Alternaria alternata*

Sr. No.	Nutrient	Healthy Grams or mg / 100 Grams	Diseased Grams or mg / 100 Grams	% alteration in nutrient
1.	Water content	82	80.6	-1.70
2.	Total carbohydrate	6.0	3.1	-48.333
3.	Reducing Sugar	4.0	2.1	-47.5
4.	Fibres	2.3	1.2	-47.826
5.	Protein	0.91	0.92	1.098
6.	Lipid content	0.34	0.29	-14.705
7.	Free amino acid content	0.98	1.01	3.06
8.	Vitamin C content	81.60mg/100Grams	43.20 mg/100Grams	-47.058
9.	Chlorophyll content	12.56 mg/100Grams	0.001 mg/100Grams	-99.992
10.	Dry matter	16.4	18.6	13.414

6. Nutrient alteration study: -

Total Carbohydrate was estimated by Hedge, J E and Hofreiter, B T (1962) Antrone method.absorbance with 630nm using systronics 2202 double beam UV- Visible spectrophotometer. Crude fibre is mainly consisting of cellulose and lignin and some minerals. Acid and alkali treatment the cellulose and lignin were degraded. The initial and final weight after ignition at 600 ^{O}C give the crude fibre content in the sample. Reducing sugar were estimated using arsinomolybdate reagent by following the method of Nelson-Somogyi. Lawry method was followed for estimating protein. Oil from were extracted through Soxhlet appertatus using Petrolium ether as solvent, following the protocol given by Bligh,E.G., and Dyer,W.J., (1959) and Sadasivam S. and Manickam, (2005). Ninhydrin method was applied for estimation of free amino acids. Dry matter content and water content were analysed by using procedure given by Ruck (1969). Vitamin C content estimated by using 2,6- dichlorophenol-endophenol dye solution, procedure given by Sadasiwam and manickem.

Graph 8: Nutrient content in Healthy and Diseased vegetables and % alteration of content by *Alternaria alternate* on belly pepper



7. Conclusion

In this study various parameters like symptoms on plant, microscopic and macroscopic examination and culture characters prove the pathogen and pathogenicity of *Alternaria alternata* . Alternaria is most abundant among the field and market of Maharashtra.

Nutrients like Protein, free Amino acids and dry matter are seems to be elevated while other content are reduced which includes Vitamin C, Carbohydrate (Reducing and Non reducing), lipid, water etc.

8. Acknowledgements

Author is thanking to farmers and shopkeepers who permit for visiting and collecting samples and also thankful to principal of S.S.V.P. S's L.K. Dr. P.R. Ghogrey Science College, Dhule for providing laboratory.

References: -

1. Alternaria, Mycota-http://mycota-crcc.mnhn.fr/site/genreDetail.php? Lang=eng&num=2&n=Alternaria
2. Ellis M.B., Dematiaceous Hyphomycetes. CMI, Kew, Boco, Surrey, England (1971)
3. Frankin Laemmlen, 2001. Alternaria diseases, University of California, Agriculture and natural resources. Publication 8040. https://anrcatalog.ucanr.edu/pdf/8040.pdf
4. Hedge, J.E. and Hofreiter, B.T. (1962). Determination of reducing sugar and carbohydrates: Anthrone colorimetric method, Methods in Carbohydrate chemistry, 17 (Eds. Whistler R.L. and B.Miller, J.N., Academic press,New York. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1265672/pdf/ biochemj00980-0166.pdf
5. Jones, L.R. and Grout, 1897. Notes on two species of Alternaria. Bulletin of the Torrey Botanical Club, 24: 254-258.
6. Keissler, K. 1912. Zur Kenntis der Pilzflora Krains.Beihefte zum Botanischen centralblatt.29: 395-440.
7. Leslie J.Harris and Mamie Olliver, (1942). the reliability of the Method for Estimating Vitamin C by Titration against 2:6-dichlorophenolindophenol. Biochemical journal, vol. 36, pp. 155-182
8. Lowry, O.H., Rosebrough, N.J., Farr, A.L. and Randall, R.J. (1951). Protein Measurement with the Folin Phenol reagent, Journel of biological chemistry, 193, pp.265on sugar determination, Journrl of Biological Chemistry, Vol. 195, pp. 19-23. https://scholar.google.com/cholar_lookup?title=Notes+on+sugar+determination&author=M.+Somogyi&publication_year=1952
9. Nowicki, M., Nowakowska, M., Niezgoda, A. and Kozik, E. 2012. Alternaria black spot of crucifers: Symptoms, importance of disease and perspectives of resistance breeding. Vegetable Crops Res. Bulletin 76(1):5-19.
10. Rao, V.G. 1969. The genus Alternaria from India. Nova Hedwigia 17: 219-258.
11. Ruck, J.A. (1969). Chemical Method for Analysis of Fruit and Vegetable products Canada Department of Agriculture, pp. 68
12. Sadasivam, S. and Maickam, A. (2005). Biochemical Methods, 2nd edition, New age International (P) Ltd., Publishers, New Delhi
13. Stoessl, A. 1982. Stress compound formation in the interaction of potato tubers with Alternaria solani and Alternaria alternata metabolites. Physiological Plant Pathology 20: 263-273.
14. Wall, M. M. and Biles, C. L. 1993. Alternaria fruit rot of Ripening Chile Peppers. Phytopathology, American Phytopathological Society, 83, 324-328.