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Research Article

Nutrient Alteration Study on Coriander Infected with *Alternaria poonensis* Raghunath

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Abstract

In India, the green leaves and dried fruit powder of coriander (*Coriandrum sativum* L.) are used to flavour and garnish salads, curry dishes, and many food items. The pathogens attack green coriander, including *Alternaria poonensis* Raghunath (*Pleosporales: Pleosporaceae*). In both pre- and post-harvest conditions, this pathogen grows luxuriously. Pathogen grow more efficiently in humid condition. The pathogen caused qualitative and quantitative losses in host plant nutrients.

Key words: *Alternaria poonensis,* coriander, nutrients

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Coriandrum sativum L. belongs to the family *Apiaceae* or *Umbelliferae*. In Sanskrit, coriander is called *Kustumbari* or *Dhania*. Coriander was used in Greek medicine by Hippocrates (460-377 BC) (Alev Onder2018). Leaves are crucial in daily food and salad preparation in India and other countries. The coriander is native to the Eastern Mediterranean, from where it spread throughout the world. This plant is an erect annual herb, 20-70 cm tall. The leaves are green, glabrous, and lanceolate.It is commercially grown in Rajasthan, Andhra Pradesh, Madhya Pradesh, Karnataka, Tamil Nadu, and Uttar Pradesh during the rabbi season. Maharashtra is one of the states where farmers grow coriander leaves as vegetables throughout the year.

Materials and Methods

Material and methods have four stages: collection, pathogen isolation, pathogenicity test and nutrient analysis (Dongre Mayur A; Borse KN 2015, 2017, 2019, 2020 and 2021).

Collection sites. Maharashtra state has five geographical regions. They are Khandesh, Konkan, Marathwada, Vidarbha, and West Maharashtra (Omvir 2017). During the study, samples of diseased and healthy vegetables were collected on the spot and stored in sterile plastic bags (Onuorah Samuel et al 2016). The samples were preserved in Waeco CDF-11 Coolfreeze CDF-11 11 L car refrigerator freezer. This device can work at -50 C. Samples were studied for pathogen identification and biochemical assays in the laboratory (Table 1).

Disease symptoms, isolation and pathogenicity. Coriander leaves show dirty brown-black irregular spots, and conidiophores emerge from the stomata or burst. Sometimes they are found in a bunch of 2-4 or a single piece. Conidiophore rarely branched, erect, dark coloured, and septet, may be 2 to 4. In Maharashtra, diseased coriander leaves with distinctive oval, necrotic spots were collected. They were placed in a zipped plastic bag to prevent decomposition and kept at low temperatures. (Fig 1D). The infected leaves part was cultured on a PDA agar medium, with ampicillin (antibiotic), to check bacterial growth. The Petri dishes were incubated at 25±3 C for 3 to 5 days. Repeat sub-culturing helps to maintain a pure culture of pathogenic fungi. (Onuorah S et al 2015, Onuorah, Samuel et al 2016, Chukwuka KS et al 2010).The colony begins to grow within three days of inoculation at 25±3 C temperature. Direct sunlight

Table 1. Collection site, culture, and morphological characters of *Alternaria poonensis*

S. No.	Place of Collection	Geographical Data	Culture appearance on PDA plate		
			Colour of colony	Appearance	Conidia length length × diameter (µm)
1.	Khandesh -Nashik	20°06'19.1"N 73°56'29.6"E	Greyish	Cottony	131.0 × 16.2
2.	Khandesh -Jalgaon	21° 00'9" N, 75° 56'0" E	Greyish	Cottony	94.6 × 14.3
3.	Konkan- Vasai-Thane	19°23'29.1"N 72°49'34.6"E	Greyish	Cottony	196.4 × 19.0
4.	Konkan -Lonere	18°10'18.1"N 73°20'15.5"E	Greyish	Cottony	154.0 × 15.6
5.	Vidharbha – Amravati	20°55'13.5"N 77°45'19.6"E	Greyish	Cottony	65.4 × 11.2
6.	Vidharbha –Akola	20°42'32.9"N 77°00'10.3"E	Greyish	Cottony	125.0 × 14.2
7.	Western Maharashtra Pune	18°34'25.0"N 73°46'36.6"E	Greyish	Cottony	86.4 × 10.0
8.	Western Maharashtra Solapur	17°40'23.5"N 75°55'02.0"E	Greyish	Cottony	110.1 × 13.6
9.	Marathwada Parbhani	19°16'00.6"N 76°46'20.8"E	Greyish	Cottony	174.7 × 17.8
10.	Marathwada Aurangabad	19°52'17.4"N 75°22'33.8"E	Greyish	Cottony	123.4 × 14.1

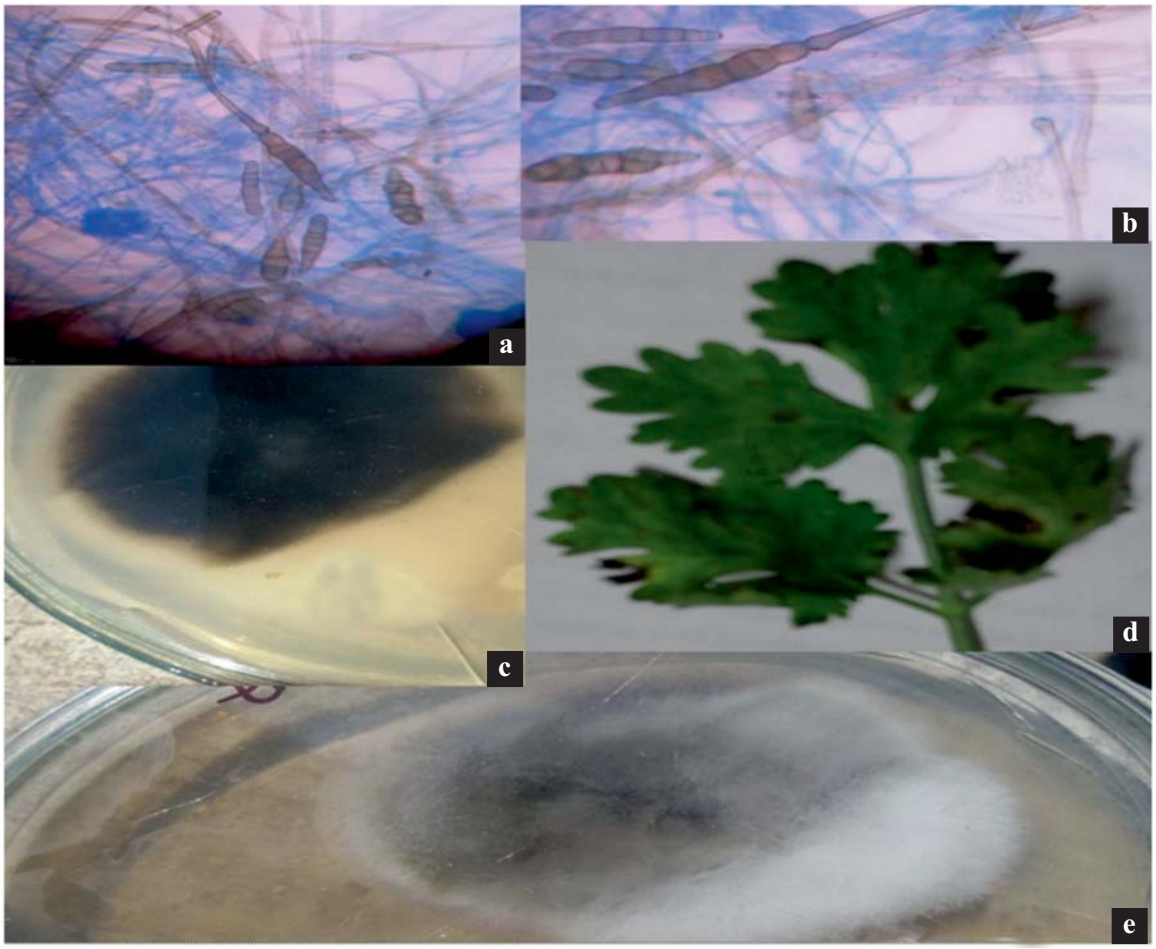


Figure 1. Hyphae, Conidiophores, and conidia (A & B), pure culture of *Alternaria poonensis* on PDA media (Reverse side view (C) and Dorsal view of culture (E) and infected leaves (D)

enhances sporulation in culture (Raghunath 1963&1968). The colony began as a cottony white growth, then turned dark-coloured. Throughout the colony, the margins were irregular. (Figs 1C&E). There is a dark colour to the conidia. They are solitary, monomorphic, and have a long, septet beak. It has 5 to 9 transverse septa, longitudes between 0 and 4, and a circular base with scarring. It ranges from 65.4 to 196.4 µm in length and 10 to 19 µm in diameter. Support for finding *Alternaria poonensis*, described by Raghunath in 1963 (Figs 1A&B). *Alternaria poonensis* L. suspension of mycelium spores prepared in distilled water was sprayed on a month-old coriander plant. For comparison, a healthy plant was grown under the same condition. A pathogen was reisolated from the infected leaves and examined under a microscope and confirmed as *Alternaria poonensis*.

Nutrient analysis. Standard protocols which eminent scientists in the past proposed were applied to analyse how much amount of nutrients are present in the given vegetable coriander. Based on Nelson Somogyi's (1944) method, reducing sugar was estimated with arsenomolybdate reagent. Absorbance was taken at 520 nm using a Systronics 2202 double-beam UV-Visible spectrophotometer. A Lawry method was used to estimate the protein content of diseased and healthy leaves with a Systronics 2202 double-beam UV-Visible spectrophotometer. Oil contents were extracted through the Soxhlet apparatus with petroleum ether as a solvent, following the protocol by Sadasivam S (1996) and Sadasivam S and Manickam (2005). The Ninhydrin method use for the estimation of free amino acids. Measurement of absorbance at 570 nm using a Systronics 2202 double-beam UV-Visible spectrophotometer. Dry matter content and

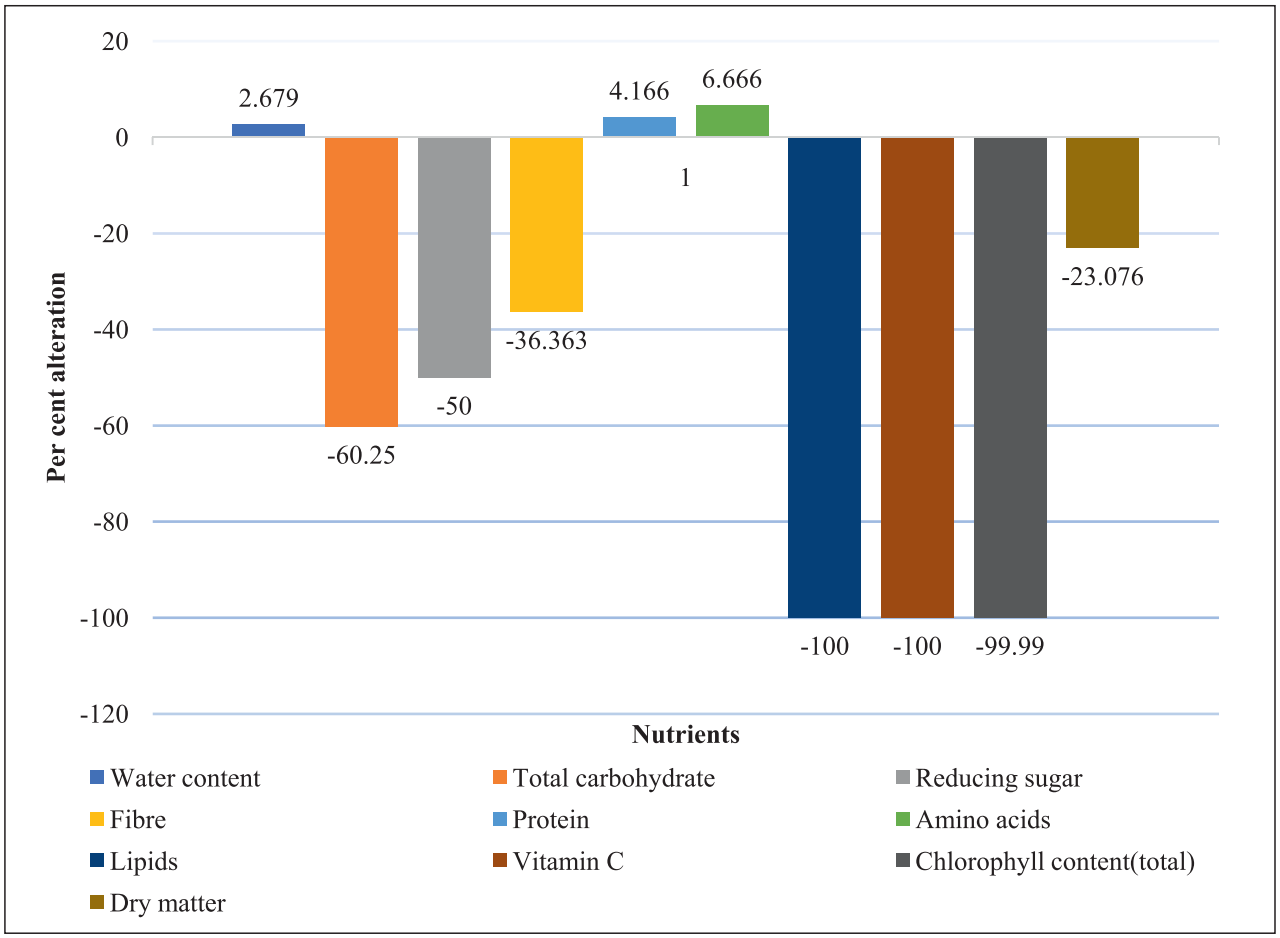


Figure 2. Percentage alteration of nutrients by *Alternaria poonensis* on host coriander leaves

Table 2. Nutrient content and percentage alteration in coriander leaves due to *Alternaria poonensis* infection

S. No.	Nutrients	Content in 100 gram fresh leaves	Content in 100 gram diseased leaves	Percentage alteration due to *A. poonensis* infection
1.	Water content	89.60 Grams	92.00 Grams	2.679
2.	Total carbohydrate	4.00 Grams	2.41 Grams	-60.250
3.	Reducing sugar	1.10 Grams	0.40 Grams	-50.000
4.	Fiber	3.00 Grams	2.10 Grams	-36.363
5.	Protein	2.40 Grams	2.50 Grams	4.166
6.	Amino acids	2.10 Grams	2.24 Grams	6.666
7.	Lipids	0.50 Grams	0.00 Grams	-100.000
8.	Vitamin C	30.00 mg	0.00 mg	-100.000
9.	Chlorophyll content(total)	260.00 mg	0.01 mg	-99.990
10.	Dry matter	10.40 Grams	8.00 Grams	-23.076

water content were analysed using the procedure given by Ruck (1969). Randall Murray et al (1977) proposed dietary fibre estimation. Vitamin C content was estimated using a 2,6-dichlorophenol-indophenol dye solution, a procedure given by Sadasivam S. and Manickam (2005). To estimate chlorophyll pigment Arnon's (1949) method was used. Finally, control and diseased nutrient contents were compared to determine how they changed after the disease.

Result and Discussion

A change in nutrient content was found when *Alternaria poonensis* infected healthy leaves. This alteration was tabulated in a comparative format (Table 2). In this, selected nutrients from the control were compared with diseased leaves. This pathogen is more predominant in post-harvest conditions than in the field. Coriander leaves infected with *Alternaria poonensis* showed reduction in total carbohydrate (60.25%), reducing sugar (50%), fibre (36.363%), lipid (100%) and vitamin C. At the same time, the percentage increase of protein (4.166%) and free amino acids (6.666%) were observed. When a pathogen grows successively, carbohydrates, lipids, vitamins, chlorophyll, dietary fibre, and water content reduced. The presence of fungal colonies at an infection site leads to an increase in protein content. The level of amino acids indicates the proteolytic nature of the pathogen.

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Compliance with ethical standards

Conflict of interest. The authors declare that thereis no conflict of interest.

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