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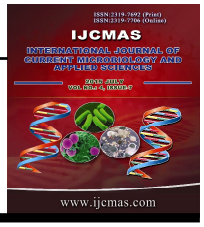

Original Research Article

Green pea pods spoilage due to *Fusarium oxysporum* Schltdl. at Panchgaon, Gurgaon, Haryana, India

Narendra Kumar*

Amity Institute of Biotechnology, Amity University Haryana,
Manaser-122413, Gurgaon, Haryana, India
**Corresponding author*

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Pisum sativum, *Fusarium oxysporum* and Green pea pods

A B S T R A C T

The green pea (*Pisum sativum* L-family –fabaceae) pod spoiled samples were collected from 10 vegetable shops of Panchgaon, Gurgaon. The green pea pods showed blooming of white colour of fungal colonies on pods. They were identified as *Fusarium oxysporum* Schltdl. On inoculation on fresh green pea pods it showed the presence of similar symptoms. On biochemical analysis green pea pods seeds showed decreased amount of carbohydrate, protein and fiber contents per 100g seeds in comparison to healthy pea pods. The neem leaf oil at 1ml dose in 1kg capacity gunny bags containing green pea pods showed complete protection up to 7 days.

Introduction

Sweet, delicious green peas (*Pisum sativum* L-family –fabaceae), also popular as garden peas, are one of the ancient cultivated vegetables grown for their valuable healthful green seeds. Peas probably were originated in the sub-Himalayan plains of north-west India. Today because of various uses this legume is one of the major commercial crops grown all over the temperate and semi-tropical regions.

Green peas are winter crops. Fresh peas can be readily sold from December until April in the various markets. However dry and mature seeds could be made ready for use in the markets around the year. While shopping for green peas look for fresh pods having seeds. The green pea is rich source of protein (25%), amino acids, sugars (12%), carbohydrate, vitamins A and C, calcium and phosphorus and having a small quantity of iron. Peas being very rich in proteins are valuable for vegetable uses. Peas are starchy, but high in fiber, protein, vitamin A, vitamin B6, vitamin C, vitamin K, phosphorus, magnesium, copper, iron, zinc and lutein (vegonline.org). Dry weight is about one-quarter protein and one-quarter sugar (Shereen, 2007). Pea seed peptide fractions have less ability to scavenge free radicals than glutathione, but greater ability to chelate metals and inhibit linoleic acid oxidation (Pownall *et al.*, 2011). Pea plants are infected by powdery mildew disease

mostly occurs sporadically when warm humid conditions favour its growth late in the season. The symptoms of this infection are white powdery formation throughout the plant and severely infected foliage is blue-white in colour, tissue below these infected areas may turn purple. Powdery mildew reduces plant biomass, number of pods, number of seeds, plant height and number of nodes (Hagedorn, 1976).

So far spoiled samples of green pea pods were collected from Panchgaon region in order to study the causal organism responsible for biodeterioration and endemic low cost Botanical control of this spoilage.

Materials and Methods

Sample collection and identification of pathogen

Green spoiled pea pods were collected from different vegetable shops of Panchgaon. The fungal pathogens was scraped with the help of scalpel wiped with alcohol and placed on Potato Dextrose Agar (PDA) medium and kept for incubation in an incubator at 25+2ºC for 2–7 days. During the incubation period, the emerging fungal colonies were purified on PDA slants and used for further work. The identification of white blooming fungal pathogen (*Fusarium*) was done with the help of standard monograph (Toussoun and Nelson, 1976; Booth, 1971). The mycelia growth was examined for its radial growth, morphology, pigmentation pattern and microscopic features. A drop of lactophenol cotton blue stain was kept on the center of clean slide. With incinerated needles, a small tuft of the fungal mycelium was picked from the edge of the growing colony. The mycelium was spread well. A clean cover slip was placed on the drop. Slide was labeled and viewed under the microscope and observations were recorded. Microscopic examination included shape, size, septation and arrangement of conidia, conidiophores and chlamydospores were recorded under a compound research microscope.

Pathogenicity test

For this purpose 500g green pea pods were taken in plastic bags and inoculated with one fungal disc of *Fusarium oxysporum* and kept for incubation up to 7 days.

Biochemical analysis

The Carbohydrate estimation of green pea pod seeds was done following Anthrone method of Thimmaiah (Thimmaiah, 1999).This is the basis of rapid and convenient method for the determination of hexoses, aldopentose and hexuronic acids either free or present in polysaccharides, carbohydrates are dehydrated by Conc. H_2SO_4 to form furfural. Furfural condenses with anthrone (10-Keto-9, 10-dihydro anthracene) to form a blue-green coloured complex, which is measured calorimetrically at 630 nm.

The protein content analysis of green pea pod seeds was carried out by the method described by Lowry (Lowry *et al.,* 1951) using bovine serum albumin as standard. The optical density of each specimen was measured at 650 nm using the colorimetrically. Standard curve of casein protein was (range 0-100µm/ml) plotted and amount of protein content present in green pea pod and spoiled pod samples was determined using standard curve.

The Crude fibers of the green pea pod and spoiled samples were determined according to the standard method Association of Official Agricultural Chemists (1951).

Results and Discussion

Among all vegetable shops green pea pod spoilage was observed having white colour of blooming on pea pods (Figure 1). The fungal hyphae showed septation and were hyaline. Conidiophores were slender, bearing several microconidia (0-1 septate) and macrconidia (2-5 septate) and chlamydospores (both terminal and intercalary). Measurements were taken for all the structures using micrometry (Table1). Microconidia borned on simple phialides arising laterally and abundant oval-ellipsoid, straight to curved, 4-11 x 2.1-3.4 μm, and nonseptate. Macroconidia, were sparse to abundant and borne on branched conidiophores or on the surface of sporodochia and thin walled 3 to 5 septate, fusoid-subulate and pointed at both ends and having pedicellate base. Three-septate conidia showed diamension 27-45 x 3-4 μm while five-septate conidia showed diamension 34-60 x 3-4 μm (Figure 2, 3, 4). Three-septate spores were found to be more common. Chlamydospores were both smooth and rough walled and abundant and form terminally or on an intercalary basis. They were generally solitary, but occasionally form in pairs or chains. (Table 1).

Table.1 Morphological characteristics of the fungal pathogen (*Fusarium oxysporum* Schltdl.) isolated from spoiled green pea pods

S.N.	Characteristics	Observation
1.	Colony morphology	Dense and cottony
2.	Radial growth in 7 days	4.8 cm
3.	Color of the colony	white aerial mycelium
4.	Pigmentation in the medium	reddish purple color
	Measurement	
5.	Microconidia	4-11 x 2.1-3.4 μm
6.	Macroconidia	3 septate 45 x 3-4 μm : 5 septate-34-60 x 3-4 μm.
7.	Chlamydospore	9.2-10.4 x 9.4 μm

Table.2 Nutritional value of healthy pea pods and spoiled pea pods at Panchgaon per 100g

S.N.	**Characteristics**	**Contents in green pea pods**	**Contents in spoiled pea pods**
1.	Carbohydrates	14.45 g	7.79g
2.	Protein	5.42 g	2.32g
3.	Fiber content	5.1 g	1.24g

Figure.1 Spoilage of green pea pods at Panchgaon,Gurgaon

Figure.2 *Fusarium oxysporum* on PDAplates

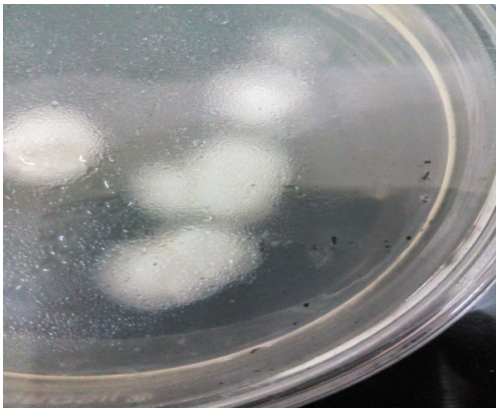
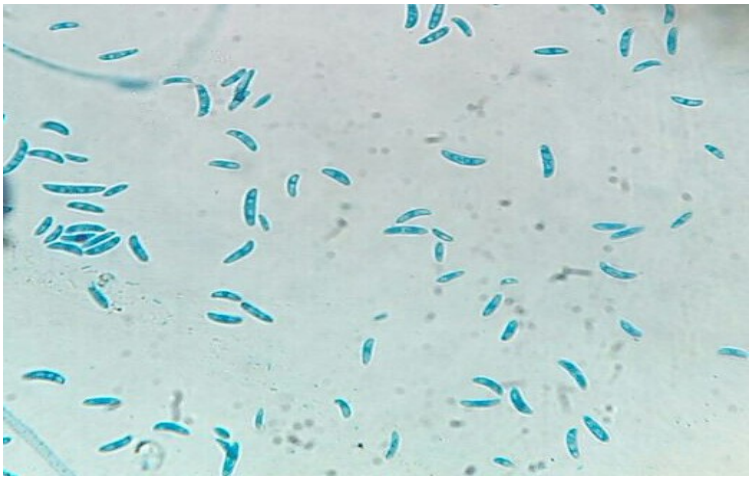


Figure.3 *Fusarium oxysporum* colony with pigmentation

Figure.4 *Fusarium oxysporum* with their conidia



It is evident from Table 2, the nutritional content due to *Fusarium oxysporum* spoilage was decreased. In healthy green pods carbohydrate, protein and fiber was 14.45, 5.42, 5.1 respectively while in spoiled pea pods showed 7.79, 2.32, 1.24 g per 100g respectively.

The pathogenicity test revealed the presence of again white blooming on green pea pod surface and again identified as *Fusarium oxysporum*.

In India powdery mildew disease appears in epidemic form almost every year when plants are in podding stage (Maurya *et al.*, 2001). During transitional period between the end of winter and the onset of spring season, the weather becomes favourable for the epidemic emergence of powdery mildew disease on pea crops. Different sulphur based synthetic fungicides are used to reduce the yield losses caused by powdery mildew disease (Khunt and Desai, 1996). But in present investigation only *Fusarium oxysporum* spoilage was observed.This may be due to different storage conditions or climate of different regions.

Spraying the green pea pods with neem oil gave a better control of the green pod spoilage with *Fusarium oxysporum* kept in gunny bags of 5kg capacity. This oil increased shelf life of green pea pods up to 7 days.

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