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First report on foliar blight caused by *Rhizoctonia solani* on cabbage (*Brassica oleracea* var capitata) and cauliflower (*Brassica oleracea* var botrytis) from India

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Abstract
The pathogen, *Rhizoctonia solani* was observed to be causing foliar blight in cool season vegetable crops in the experimental fields and adjoining areas at College of Agriculture, Padannakkad, Kerala, India, during the post rainy seasons of 2013 and 2014. The disease appeared during October to February in cabbage (*Brassica oleracea* var *capitata*) and cauliflower (*Brassica oleracea* var *botrytis*). The blighted portions initially appeared irregular in shape, light green to bluish green in colour, later turning to straw coloured. In severely affected leaves, the blighted regions became papery and got withered off leaving shot hole symptoms. Microscopic examination revealed the presence of the teleomorph (*Thanatephorus cucumeris*) on the diseased tissues.

Keywords: Leaf blight, *Rhizoctonia solani*, cabbage, cauliflower

Introduction

Cabbage (*Brassica oleracea* var *capitata*) and cauliflower (*Brassica oleracea* var *botrytis*) are some of the important cool season vegetable crops cultivated in India. Recently, a few varieties suitable for cultivation under tropical conditions have been introduced to Kerala and presently the area under these crops is on an increase in the state. During the post rainy season, October of 2013 and 2014, severe leaf blight was observed on 30- to 60 -day-old cabbage and cauliflower plants in the experimental fields and adjoining areas at College of Agriculture, Padannakkad, Kasargode. The per cent disease incidence on the foliage ranged from 5-20%.

The symptoms on cauliflower appeared as small, irregular bluish green lesions that coalesced to form leaf blight (Fig 1 and 2). Generally, the older leaves were the first to get affectd. The spots increased in size later, covering more areas of the leaf lamina, leading to severe blighting. The blighted portions initially appeared light green to bluish green in colour, later turning to straw coloured and irregular in shape. In severely affected leaves, the blighted regions became papery and got withered off leaving shot hole symptoms. At this stage, yellowing symptoms could also be observed around the withered regions. Under less humid situations, the leaves got scorched and dried up completely leading to defoliation whereas under high humid conditions, the whole leaves became black in colour due to severe rotting and got putrefied completely. Creamy white to light brown mycelia of the pathogen was also observed occasionally on the affected foliage. Often, such mycelia aggregated to form hard globular to irregular sclerotial bodies which were initially white in colour later turning to brown, and measured 1-4 mm in diameter. During early morning hours very fine white powdery masses, assumed to be the spores of the pathogen, could be visible on the lower side of the blighted regions. Symptoms of the disease on cabbage appeared similar to those produced on cauliflower. Root rot and stem rot symptoms were absent in both crops.

The affected leaf samples of cabbage and cauliflower collected from the field were brought to lab and were applied with DPX mountant diluted with xylene evenly on the blighted areas. After drying, it was peeled off gently and was stained using Lactophenol Cotton Blue for microscopic observation.

Microscopic examination revealed the presence of both the anamorph (*R. solani*) and the teleomorph (*Thanatephorus cucumeris*) on the affected tissues of cabbage and cauliflower. In both the cases, hyphal anastomosis was found to be prominent between the hyphae of the fungus, and the hyphal thickness ranged from 2.2 to 6.8 µm. Basidia bearing basidiospores could also be observed. The size of basidia was in the range of 7.3 to 11.1 X 4.4 to 6.8 µm (Fig 3). The basidiospores measured 4.1 – 7.9 X 3.5 – 5.9 µm.

The pathogen was isolated from the diseased tissues of cabbage and cauliflower on PDA medium. Small bits of 6 mm size were cut from the diseased tissues and were surface sterilized using 1% sodium hypochlorite and were washed serially in sterile water and placed on PDA plates for isolation. Later, the fungus was brought in to pure culture and was inoculated to PDA plates for studying the colony characters. The colony of the pathogens from both cabbage and cauliflower initially appeared creamy white in colour later turning to light brown. The underside of the plate appeared dark brown in the centre and light brown in the periphery. The hyphae of the fungus were initially hyaline to light brown in colour which later turned to dark brown. The mycelia showed right angled branching and a characteristic septum at the point of origin of the right angle. The hyphae showed a characteristic constriction at the branching point. On continued incubation, small light brown to coffee brown sclerotial bodies of 1- 3 mm diameter were produced individually or in clumps mostly at the edges of the culture plates in both cabbage and cauliflower isolates. On the basis of the morphological and cultural characters, the fungus was identified as *Rhizoctonia solani* Kuhn. The characters showed by the pathogen were in accordance with the reports by Parmeter *et al*. (1970) [6]. Repeated isolations from the

diseased tissues consistently yielded the same pathogen, *R. solani*.

Pathogenicity test was performed on detached leaves by placing the mycelial discs cut from 4 days old culture of *R solani* from cauliflower on the surface of ten healthy leaves of cauliflower at selected areas. Standard procedures for inoculation were followed. The leaves were incubated for 10 days for symptom development within sterile Petri plates of 20 cm diameter with sterile moistened blotting paper placed on top and bottom. Control leaves were maintained under similar conditions without inoculation. The same procedure was repeated in case of cabbage.

After 3 days of incubation, small, water soaked light brown lesions were formed at the inoculated areas of cauliflower which later developed in to straw coloured irregular blight covering more areas of the leaf lamina. Mycelia and sclerotial bodies also could be observed on the blighted regions under continued incubation and the leaves turned black in colour and got completely rotten at that stage. The pathogen was re-isolated from the artificially inoculated leaves showing the blight symptoms and the characters of the isolate obtained were similar to the original isolate. Similar isolates of *R. solani* were recovered from inoculated cabbage leaves also.

Rhizoctonia solani is an important soil borne pathogen causing root rot and blight diseases in many agricultural crops (Lakshmanan *et al*., 1979; Gokulapalan *et al*., 2000) [5, 2, 3]. It is a deuteromycetous pathogen, the perfect stage being *Thanatephorus cucumeris*, coming under the subdivision basidiomycotina. The pathogen has very wide host range and is known to cause diseases in many important crop plants belonging to the families, graminae, leguminosae, zingiberaceae, amaranthaceae etc.

The pathogen is found to be serious under Kerala conditions because of the frequent rainfalls prevailing in the state contributing to high relative humidity, which is conducive for survival and spread of the pathogen.

The pathogen *R. solani* is reported to cause similar foliar blight disease in cabbage in New York State (Abawi and Martin, 1985) [1]. It is reported to cause severe leaf blight in the green leafy vegetable, amaranthus in Kerala (Kamala nayar *et al.*, 1996; Gokulapalan *et al*., 2000) [2, 3, 4]. In cowpea the pathogen causes collar rot and web blight (Lakshmanan *et al*., 1979) [5]. And in rice, it causes banded blight and sheath blight disease (Santha Kumari and Rehumath Niza, 2005) [7]. The pathogen causes foliar blight in ginger crop (*Zingiber officinale* Rose) also (Gokulapalan and Girija, 2000) [2, 3]. According to Abawi and Martin (1985) [1], sclerotia and mycelial fragments of *R solani* free in the soil or associated with the organic debris acts as the source of inoculum for leaf blight of cabbage.

Climatic situation of the state, nature of the preceding crop taken in the area, time of planting and nature of irrigation given to the crop seem to be the key factors to be considered while adopting management practices for *Rhizoctonia* foliar blight of cabbage and cauliflower. Future line of research could be focused on the epidemiology of the disease and the management measures to be taken.

To our best knowledge, this is the first report on foliar blight caused by *Rhizoctonia solani* on cabbage (*Brassica oleracea* var *capitata*) and cauliflower (*Brassica oleracea* var *botrytis*) in India.

Fig 1: Symptoms on cabbage

Fig 2: Symptoms on Cauliflower

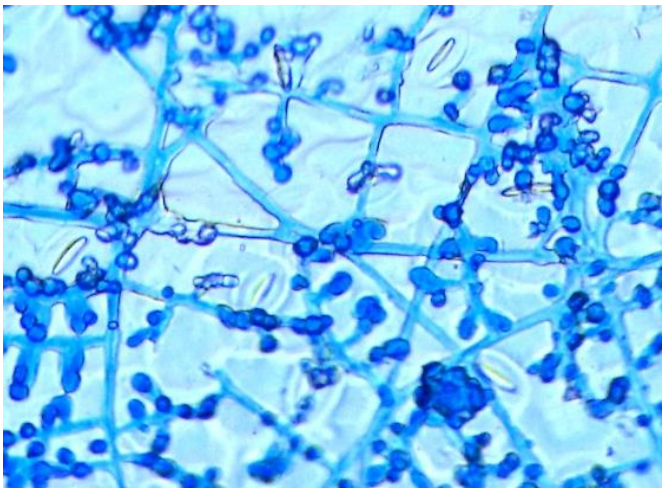

Fig 3: Basidia of R. solani

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