BVG Trust

J. Sci. Trans. Environ. Technov. 2019, 12(3) : 131-134

Scientific Transactions in Environment and Technovation

Isolation and identification of fungal pathogens from onion crop cultivated in Perambalur District, South India.

https://doi.org/10.56343/STET.116.012.003.004
http://stetjournals.com

G.Vaijayanthi and R.Vijayakumar*

Department of Microbiology, Government Arts and Science College , Kurumbalur-621 107, Perambalur District, India.

Abstract

Onion (*Allium cepa* L.) is the most important oldest commercial crop grown all over the world and consumed in various forms. Tamilnadu is a leading onion producing state of India, Perambalur is one among the major onion producing districts of this state. In the present study the onion plants associated with different diseases *viz.,* damping off, basal rot, black mold, blue mold rot, downy mildew and purple blotch were collected from different localities namely Chettikulam, Kanavaai, Kurumbalur, Palayam, Pommanappadi, Renganathapuram, Sathramanai, Senjery, Thambiranpatti and Vellor in Perambalur district, Tamilnadu were collected. The pathogens present in the diseased portions of the plant were isolated on potato dextrose agar (PDA), morphological characters were studied and identified. All the pathogens belonged to fungi, *viz., Alternaria porri, Fusarium oxysporum, Apergillus niger, Rhizoctonia solani, Penicillium* sp. and *Pythium ultimum*.

Key words: Onion diseases, phytopathogenic fungi, isolation, identification.

Received : February 2018 Revised and Accepted : March 2019

INTRODUCTION

Onion is one of the important cash-crops grown in India during past 5000 years and also throughout the tropical and sub-tropical countries of the world. It is the commercial vegetable crop grown all over the world and consumed in various forms. It is generally used as a vegetable, spice or as a medicine. Onion possesses anti-inflammatory, anti-cholesterol, anticancer and antioxidant properties when it was added with diet of the human (Slimestad and Vagenim, 2007). The fungicidal and insecticidal properties of onion are also well documented (Mishra *et al.,* 2014). India is the second largest producer country of onion after the China (Pawar *et al.,* 2016). In Tamilnadu, onion cultivation occupies an area of 37.7 thousand hectares with the production of 11,450 kg/hectare. Perambalur is one of the major onion producing districts of Tamilnadu, South India, which contributes 35-40% of its onion production.

It is the general practice by farmers in particular districts of India to cultivate onion as a monoculture repeatedly in the same farm fields. Therefore, it provides a conducive environment for the development of several economically significant crop diseases. Onion is cultivated during April – May and October – November months. It requires sufficient soil moisture during its growing period but heavy rains during bulb germination and bulb formation affects the crop growth. The onion also loses its productivity due to bacterial, viral, nematode, mycoplasma and fungal diseases. The onion crop is attacked by many diseases and insect pests at different stages of growth which resulted in considerable loss in the yield. Onion is infected by many fungal pathogens which cause the diseases such as damping off, basal rot, black rot, blue mold rot, downy mildew, white rot, southern blight, purple blotch, white tip, smudge, smut and twister. They not only cause loss in the yield but also affect the quality. The present article deals with the various fungal diseases associated with the onion crop cultivated in Perambalur district, Tamilnadu, India.

MATERIALS AND METHODS

Collection of samples

Infected onion (small) samples were collected from the onion crop fields of seven different locations, namely, Chettikulam, Kanuvaai, Pommanappadi, Renganathapuram, Sathramanai, Thambiranpatti and Vellor in Perambalur district (Latitude: 11.2333^{o} N; Longitude: 78.8833^{o} E; Altitude: 98-160 m) Tamilnadu, India. Infected samples of onion leaves, bulbs and roots were collected in sterile polythene

*Corresponding Author :

email: *rvijayakumar1979@gmail.com*

P - ISSN 0973 - 9157
E - ISSN 2393 - 9249

bags and brought to the laboratory for further investigation.

Isolation of phytopathogens

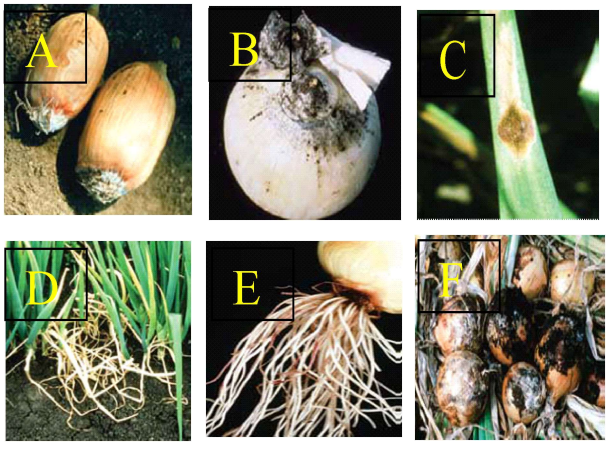
The collected onion samples were washed with sterile distilled water, by surface sterilization with 1% $HgCl_2$ solution, rinsed several times with sterilized water and dried. After surface sterilization, the samples were inoculated on to PDA medium and incubated at 27°C. After 4-5 days of incubation, the developed fungal colonies were purified by hyphal tip and single spore isolation technique. The colony morphology of the isolated fungi were observed and recorded.

Identification of phytopathogens

Identification of the fungal isolates was carried out by using morphological characteristics including colony morphology on PDA medium, mycelia, spore and sporangium appearance under phase contrast microscopy with the help of lactophenol cotton blue technique as described by Gillman (1957) and Kritzman (1983) and microphotographs were taken. On the basis of morphological appearance on microscopy, the fungal isolates were identified.

RESULTS AND DISCUSSION

Red loam to black soil with good drainage facilities is highly preferable for onion cultivation. The onion can grow well at soil pH range of 6-7 and a mild season without extremes of heat and cold. Different varieties of small onion such as CO 1, CO 2, CO 3, CO 4 and MDU 1 and CO (On) 5 (free flowering and seed setting type) are commonly cultivated in Perambalur District. In the present study, a total of 45 colonies (CFU) were isolated from the infected leaves, bulbs and roots of onion (Fig. 1) of different locations in Perambalur district. Among the 45 fungal colonies, 6 morphologically varied from one another. On the basis of colony and microscopic morphological properties,



A-Basal rot, B-Black mold, C-Purple blotch, D-Damping off, E-Root infection, F-Blue and Black mold

Fig.1. Onion samples infected for assessment of various fungal diseases

Table.1. Occurrence of phytopathogenic fungi of infected onion in various sampling stations

Name of the fungi	Source of infected parts	Chettikulam	Kanavaai	Pommanappadi	Renganathapuram	Sathramanai	Thambiranpatti	Vellor
Alternari porri	Leaves and bulbs	+	-	-	-	+	+	-
Fusarium oxysporum		+	-	-	-	+	-	-
Apergillus niger	Bulbs	++	++	++	++	++	++	++
Penicillium sp.		+	-	-	-	-	+	-
Pythium ultimum	Leaves and roots	++	-	++	-	++	++	+
Rhizoctonia solani		++	++	++	++	++	++	++

- = nil; + = rare occurrence; ++ = frequent occurrence

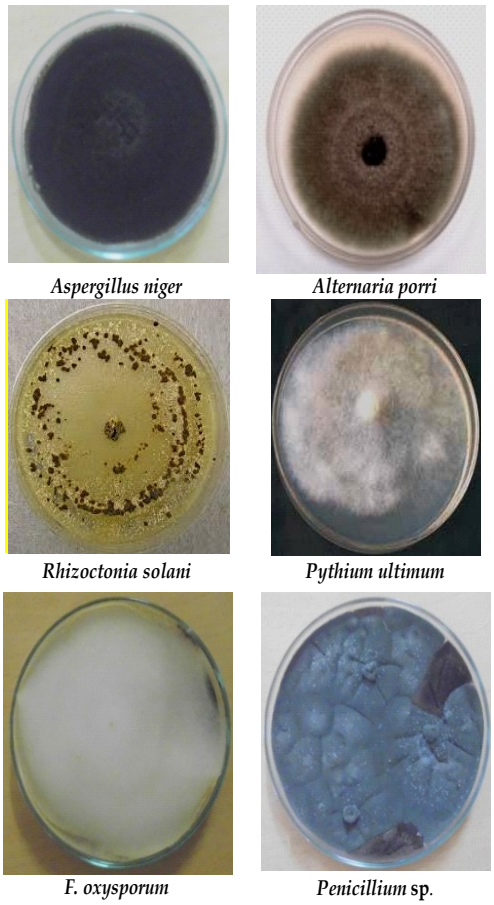


Fig.2. Morphology of fungal isolates from infected onion samples

six morphologically distinct fungal isolates were identified. *Alternari porri* and *Fusarium oxysporum* were isolated from both leaves and bulbs of infected onion. *Apergillus niger* and *Penicillium* sp. were isolated from the bulbs alone, and *Pythium ultimum* and *Rhizoctonia solani* were isolated from both leaves and roots of the onion crop (Table 1; Fig. 2). In a study, Gaikwad *et al.* (2014) reported that the phytopathogenic fungi namely *Alternaria porri, Fusarium oxysporium and Stemphylium vesicarium* were isolated from the soil as well as from the infected onion leaves. Similarly, *F. oxysporum, Botrytis allii* and *Sclerotium rolfsii* were also isolated from infected onion bulb samples affected by basal rot, neck rot and southern blight respectively (Pawar *et al.,* 2016).

Generally, a variety of diseases and disorders affect onions and related crops. Most of the diseases are caused by fungi, whereas disorders are caused by adverse weather, air pollutants, soil conditions, nutritional imbalances and pest control products. Downy mildew, basal rot, black mold, brown blotch and damping off are major diseases of onion in the Perambalur district (Fig. 1). The damping-off of caused by *Fusarium oxysporum* during both pre and post harvest, invaded the roots and eventually the bulbs are turned dark red or black as they decay. Seedlings are unthrifty and stunted, eventually turned yellow, wilted and finally the onion crop died (Conn *et al*., 2012). *Pythium ultimum* also attacked the seeds and caused a watery decay. Older plants that are infected became stunted, yellow and wilting of leaves could occur during severe infections. *Rhizoctonia solani* caused rotting of seeds before germination and the seedlings get decayed before emergence. A brown rot was developed on roots and lower stems at or below the soil line, and infected seedlings quickly wilted and collapsed. *Penicillium* sp. infection of bulbs is usually through tissues damaged by bruising, freezing injury or sunscald. The pathogen grows well at 21-25°C. Black mold generally develops at the neck of the bulbs on injured or necrotic leaf tissue is caused by *Aspergillus niger* (Conn *et al*., 2012). Brown blotch caused by *Alternari porri* in the older leaves tend to be more susceptible than younger leaves. Symptoms begin as water-soaked lesions that usually have a white center. Edges of lesions become brown to purple and the leaf turns yellow above and below the lesions (Vengadaramana and De Costa, 2014).

In the present study, phytopathogens of onion crop namely *Fusarium oxysporum* and *Rhizoctonia solani* were isolated from the infected onion leaves and roots of all the sampling stations. While the pathogen *Pythium ultimum* was recorded from five sampling stations followed by *Alternaria porri* which wasfound in three stations, and other two fungal isolates namely *Apergillus niger* and *Penicillium* sp. were recorded from only two stations (Table 1). Further, Chettikulam sampling station contributed maximum of all the six fungal genera as reported in the present study, followed by Sathramani and Thambaranpatti stations (each 5 genera), Pommanappadi and Vellor stations (each 3 genera) and Kanavai and Renganathapuram stations (each 2 genera) (Table 1). From these sampling stations, Vaijayanthi and Vijayakumar (2016) reported the presence of *Fusarium oxysporum* in the onion plants which caused damping-off and basal rot diseases. Similarly, many workers reported the fungal pathogens from the infected onion leaves, including purple blotch caused by *Alternaria porri* (Alves *et al.,* 1982; Schwartz *et al.,* 2007), onion leaf blight by *Botrytis squemosa* (Lorbeerj, 1983) downey mildew by *Pernospora destructor* (Schultz and French, 2009; Gadge and La-wande, 2012; Bissteine *et al*., 2009), stemphylium leaf blight by *Stemphylium vasicarium* (Gupta and Pandey, 1986; Hassan *et al*., 2007; Misawa and Myasuoka, 2012), *Fusarium oxysporum, Botrytis allii* and *Sclerotium rolfsii* were isolated from infected field onions bulbs (Pawer *et al.,* 2016). *Fusarium* sp., *Rhizopus* sp. and *Aspergillus* sp. were isolated from market onion samples (Ushasri and Anil Kumar, 2018). Thus it is reported that the prevalence of phytopathogenic fungi in onion is not uniform, and varied depending on the variety of onion cultivars used for cultivation, ecological properties of the cultivating soil and its indigenous flora of fungi and application of fungicides.

CONCLUSION

Downy mildew, basal rot, black mold, brown blotch and damping off are the major diseases of onion crop which were found throughout the sampling stations investigated in the present study. The results of the present study suggested that the regular field visits and survey of fungal phytopathogens will reduce the incidence of crop diseases and reduce the economic loses and sudden price trudge of market value. Control of these phytopathogens by using biocontrol agents would be a strategy of ecofriendly approach.

ACKNOWLEDGEMENTS

The authors are thankful to Tamilnadu State Council for Higher Education (TANSCHE), Govt. of Tamilnadu (838/2018 A/ /02.03.2019) for financial assistance.

REFERENCES

Alves, M.L.B., Paiva, W.O. and Asis, L.A.G. 1982. Incidence of purple spot (*Alternaria poori*) on onion. Em Manaus, *A. J. Acta Amazonica*, 12(4): 673-676.
https://doi.org/10.1590/1809-43921982124673

Baker, A., Siddique, M. and Cook, D.C. 2010. Onion leaf blight of *Botrytiss quamosal*. *J. Biosecurity* online. P. 1.

Conn, K.E., Lutton, J.S. and Rosenberger, S.A. 2012. Onion disease guide, A practical guide for seedsmen, growers and agricultural advisors, P. 72.

Gadge S.S. and Lawande K.E. 2012. Crop damage due to climatic change. A major constraint in onion farming, Indian research journal of extension, special issue (Vol.II) P.38-41.

Gaikwad, K.N., Jadhav, S.U. and Kakulte, V.R. 2014. Management of fungal diseases of onion (*Allium cepa* l.) by using plant extract. *Int. J. Life Sci. Pharma. Res.*, 4(2): 28-30.

Gillman, J. 1957. A manual of soil fungi. Revised 2nd ed. Oxford and IBH (Indian reprint).
https://doi.org/10.1097/00010694-195708000-00021

Gupta, R.P. and Pandey, U.B. (1986). Stemphylium blight of onion. A meance in North India. *Indian J. Hortic.*, 31(3): 27-28.

Hasan, M.H.A, Allam, A.D.A, Elyou, A. and Hussein M.A.M. 2007. First report of Stemphylium leaf blight of onion caused by *Stemphylium vesicarium* in Egypt. *Plant Pathol.*, 56: 724.
https://doi.org/10.1111/j.1365-3059.2007.01581.x

Kritzman, G. 1983. Identification of latent *Botrytisallii munn* in onion bulbs. *Crop Prot.*, 2: 243.
https://doi.org/10.1016/0261-2194(83)90051-0

Lorbeerj, W. 1983. Diseases of onion *Botrytis* leaf blight. *J. Agri. Experiment Station* Genewa. 737.10.

Misawa, T. and Myasuoka, S. 2012. *Stemphylium vesicarium* caused by onion leaf blight. *J. Plant Pathol.*, (78):18-29.
https://doi.org/10.1007/s10327-011-0352-8

Mishra, R.K., Jaiswal R.K., Kumar, D., Saabale, P.R. and. Singh, A. 2014. Management of major disease and insect pests of onion and garlic: A comprehensive review. *J. Plant Breeding Crop Sci.*, 6(11): 160-170.
https://doi.org/10.5897/JPBCS2014.0467

Pawar, S.B., Mane, S.B., Bhosale, S.B. and Chavan, A.M. 2016. Isolation and identification of field bulb fungal pathogen from (*Allium cepa* l.) in Maharashtra. *Asian J. Sci. Technol.*, 7(8): 3387-3389.

Schultz, D. and French, R. 2009. Downey mildew of onion, Taxa Agrilife Extension service fort myers florida. PLPA- Oni009-01.

Schwartz, H.F., Gent, D.H. and Bartola, M.E. 2007. Purple blotch high plants IPM Colorado state University and Montana State University.

Slimestad, R. and Vagenim, F.T. 2007. Onions A source of unique dietryflavonoides, *J. Agri. Food Chem.*, 55(25): 10067-10080. PMid:17997520
https://doi.org/10.1021/jf0712503

Ushasri, K. and Anil Kumar, B. 2018. Isolation and identification of fungal pathogen from (*Allium cepa* L.) in Piler vegetable market, Andhra Pradesh, India. *World J. Pharma. Pharmaceut. Sci.*, 7(3): 955-963.

Vaijayanthi, G. and Vijayakumar, R. 2016. Screening of chitinolytic actinobacteria for biological control of *Fusarium oxysporum:* a pathogen causing damping-off and basal rot diseases in onion. *World J. Pharm. Pharmac. Sci.*, 5(1): 940-947.

Vengadaramana, A. and De Costa, D.M. 2014. Molecular and pathogenic diversity of the causal agents of onion leaf twister disease in Batticaloa district of Sri Lanka. *Universal J. of Pl. Sci.*, 2(7): 121-127.
https://doi.org/10.13189/ujps.2014.020702