Int.J.Curr.Microbiol.App.Sci (2017) *6*(6): 2038-2043

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 6 Number 6 (2017) pp. 2038-2043**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2017.606.240

An Investigation on the Etiology and Characterization of Fungal Diseases of Gerbera

N.M. Praveen[1], Reshmy Vijayaraghavan[1*], K. Ajith Kumar[2] and Deepa James[1]

[1]Department of Plant Pathology, College of Horticulture, Kerala Agricultural University, Kerala, India
[2]Department of Pomology and Floriculture, College of Horticulture, Kerala Agricultural University, Kerala, India
**Corresponding author*

Keywords

Gerbera, Fungal diseases, Kerala.

Article Info

Accepted:
23 May 2017
Available Online:
10 June 2017

A B S T R A C T

A purposive sampling survey was conducted in three districts *viz.*, Thrissur, Malappuram and Wayanad during July-August, November-December March-April seasons for monitoring disease occurrence and sample collection. Three leaf blights (LB-1, LB-2 and LB-3), two leaf spots (LS-1 and LS-2) and powdery mildew (PM) were the foliage diseases observed during the survey. Petal blight was the only flower disease noticed apart from root rot and wilt disease. Eight pathogens were isolated from diseased samples and pathogenicity test for each disease was carried out which aided in relating symptoms of the disease under artificial conditions with that of natural symptoms. Cultural and morphological characterisation of each pathogen was carried out for the identification of pathogens and the identity was confirmed by National Center for Fungal Taxonomy (NCFT), New Delhi. The pathogens causing LB-1, LB-2 and LB-3 were identified as *Alternaria alternata*, *Alternaria tenuissima* and *Myrothecium roridum* respectively. The pathogens responsible for leaf spots (LS-1 and LS-2) were identified as *Ulocladium chartarum* and *Curvularia pallescens* and for powdery mildew as *Golovinomyces cichoracearum* and *Podosphaera* sp. *Curvularia lunata* was identified as the causal organism of petal blight. Moreover, root rot and wilt disease observed during the survey were caused due to *Phytophthora cryptogea* and *Fusarium solani* respectively.

Introduction

Gerbera, a perennial herb, native to tropical regions of South America, Africa and Asia belongs to Asteraceae family. It is the most popular cut flower with increasing commercial significance. It fetches an excellent price in the international market and contributes greatly to the export earnings of the country because of its graceful appearance, hardiness and long shelf life (Aswath and Rao, 2006). One of the important constraints that limit the production of quality flowers in gerbera is the severe incidence of diseases. The crop is affected by various fungal, bacterial and viral diseases which reduce the plant vigour, flower quality and market value, thus causing significant losses to the commercial cut. Hence, considering the emerging trend towards the industry favouring gerbera as a major ornamental crop, the present investigation

was undertaken to identify the fungal diseases of gerbera occurring in the state of Kerala during different seasons and also to catalogue and document the same.

Materials and Methods

Survey and collection of diseased samples

A purposive sampling survey has been scheduled in three districts *viz.*, Thrissur, Malappuram and Wayanad district of Kerala during rainy (July-August), winter (November-December) and summer (March-April) seasons to observe the occurrence of fungal diseases in gerbera.

Isolation and pathogenicity and symptomatology studies

Diseased samples collected during the survey was brought into laboratory and subjected to isolation of pathogens on autoclaved PDA media under *in vitro*. The isolates were stored then under 4^{o}C for further studies. Mycelial Bit Inoculation Method (MBIM) (Rocha *et al.,* 1998) and/or Mycelial Droplet Inoculation Technique (MDIT) (Munaut *et al.,* 1997) were employed for testing pathogenicity of each isolates. Symptoms of the fungal diseases were studied under natural condition during the survey and under artificial condition using MBIM and MDIT method and soil inoculation for soil borne pathogens.

Characterisation and identification of pathogens

Cultural characters of the isolated pathogens were studied while it was grown in PDA media. Morphological characters *viz.*, type of mycelium, branching pattern, type of spores, their shape, size, presence of sexual structures were also studied. The cultures were identified upto genus level with the cultural and morphological characters where it was confirmed from NCFT, New Delhi.

Results and Discussion

Survey, collection and assessment of PDI and PDS

A purposive sampling survey in three districts revealed that in Thrissur, diseases *viz.*, leaf blight 1 (LB-1), leaf blight 3 (LB-3), leaf spot 1 (LS-1), root rot and wilt were observed where LS-1 disease recorded a PDI and PDS of 78.2 and 19.4 per cent followed by LB-1 with PDI and PDS of 74.7 and 16.0 per cent respectively. For root diseases, PDI of 69.4 and 15.5 per cent were recorded for root rot and wilt diseases. LB-1 and leaf spot 2 (LS-2) were observed in Malappuram district which recorded highest PDI and PDS of 82.8 and 10.2 per cent whereas petal blight was the only flower disease observed during the survey. In hilly tracts of Wayanad, LB-1, leaf blight 2 (LB-2), petal blight and powdery mildew were observed where powdery mildew recorded a PDI and PDS of 95.2 and 57.4 per cent.

Isolation of pathogen and pathogenicity tests

Diseased samples collected during the survey were used to isolation of pathogens. The pathogen causing leaf blights (LB-1 and LB-2) were tentatively identified as *Alternaria* spp., LB-3 as *Myrothecium* sp., leaf spots (LS-1 and LS-2) as *Ulocladium* sp. and *Curvularia* sp., root rot as *Phytophthora* sp., wilt as *Fusarium* sp. and petal blight as *Curvularia* sp. Pathogenicity of each isolates were carried out as described in 2.2. Garibaldi and Minuto (2007) and Farhood and Hadian (2012) experimentally proved pathogenicity of *Fusarium oxysporum* and *Alternaria* leaf blight isolates by inoculating spore suspension into healthy gerbera plants respectively. Likewise, the pathogenicity test for fungal pathogen, *Phytophthora cryptogea* pathogenic on petunia (Ampeuro *et al.,* 2008),

Curvularia gladioli on gladioli (Pawar *et al.*, 2012) were described. Moreover, Baiswar *et al.,* (2010) confirmed the pathogenicity of the powdery mildew pathogen, *Podosphaera* sp. in gerbera by dusting conidia on healthy plants.

Symptomatology of fungal diseases

Leaf blight 1 (LB-1) being the *Alternaria* disease, under natural conditions, exhibited scattered yellow chlorotic spots on the leaf lamina which converted into dark brown concentric rings whereas the other showed marginal blightening symptom without the formation of concentric rings respectively. Many authors have reported the occurrence of *Alternaria alternata* (Farhood and Hadian, 2012) and *Alternaria tenuissima* leaf spot in broad bean (Honda *et al.,* 2001). *Myrothecium* sp. caused LB-3 disease produced black water soaked lesions which later enlarged causing blightening of leaves. The organisms associated with leaf spot 1 (LS-1) was *Ulocladium* sp. and that of LS-2 and petal blight were *Curvularia* spp. The former pathogen caused extensive damage on leaves like circular, pale to dark brown necrotic spots and the latter showed typical symptoms as small, yellow-brown flecks, often with a light green halo on the upper surface of leaves which later turned into circular to oval chlorotic irregular patches. Symptoms of powdery mildew showed white powdery growth on adaxial surface of leaf lamina which later turned into necrotic lesions. The description of powdery mildew symptom was in conformity with the findings put forth by other workers (Troisi *et al.,* 2010). Petal blight was noticed as blightening of petals with shot holes which was the only flower disease observed during the survey. Symptoms of *Phytophthora* rot initiated as dark, black coloured lesion on leaves and stem through collar region which later extended to root hairs, apart from foliar yellowing and defoliation. Hyeong *et al.,* (1996) detailed the symptomatology of *Phytophthora* root rot in gerbera which was found similar to the present study. *Fusarium* wilt in gerbera appeared as dark brown discolouration on lateral roots which gradually spread to main tap roots, along with foliar yellowing and defoliation. The above description of symptoms of *Fusarium* wilt was comparable with the report of Garibaldi *et al.,* (2008).

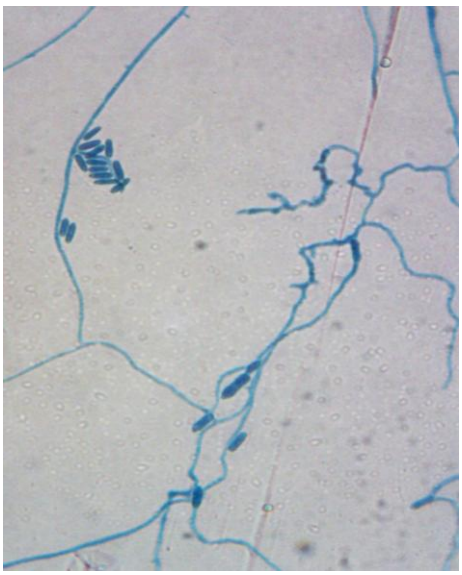
Cultural and morphological characters of pathogen

Cultural and morphological characterisation of pathogens were carried out which was confirmed to the species level with the reports of National Centre for Fungal Taxonomy (NCFT), New Delhi (Plate 1). Isolate of *Alternaria sp.* causing leaf blight 1 (LB-1) produced olivaceous to dark brown spores with varied shape from obclavate to mostly ellipsoidal, muriform having tapered apex with 1-3 longitudinal and 2-10 transverse septa formed in cylindrical, scattered or gregarious, pale grey yellow, straight or curved, geniculate, simple or branched conidiophores. Likewise, LB-2 produced olivaceous to dark brown coloured conidia. All these characters were in accordance with those reported by Nagrale *et al.,* (2012). Another leaf blight (LB-3) causing pathogen, *Myrothecium* sp., produced white, floccose, concentric-ringed colonies on PDA which under microscope appeared hyphae as hyaline, conidiophores formed as 2-4 branches at each node while phialides hyaline, cylindrical. The present study was consistent with the description of *Myrothecium roridum* causing leaf spot in begonia (Fujinawa *et al.,* 2016). The disease leaf spot 1 (LS-1) caused by *Ulocladium* sp. was observed in a polyhouse of Thrissur district. The isolate produced obovoid, non-beaked, olivaceous to dark brown coloured conidia.

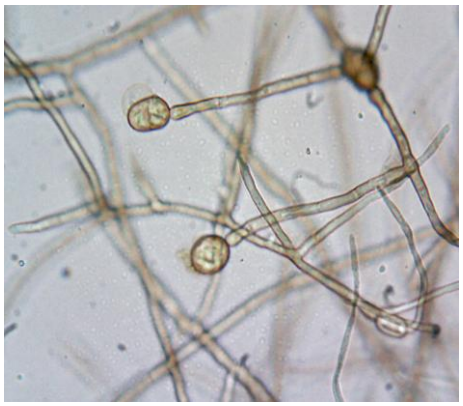
Plate.1 Fungal pathogens isolated from gerbera

***Alternaria tenuissima* (400X)**

***Alternaria alternata* (400X)**



***Myrothecium roridum* (400X)**

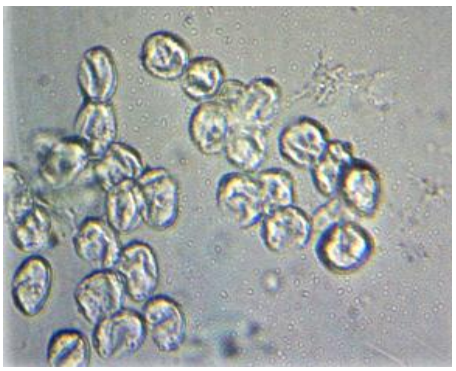


Ulocladium chartarum

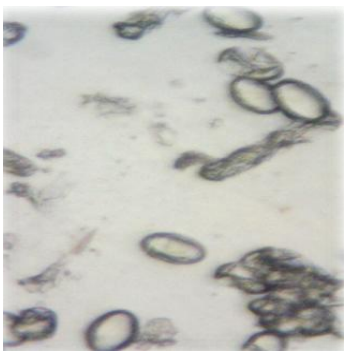
Curvularia lunata

***Phytophthora cryptogea* (400X)**

***Fusarium solani* (400X)**



***Golovinomyces* sp. (400X)**



***Podosphaera* sp. (400X)**

The pathogen on PDA appeared as greyish white with yellowish pigmentation. Leaf spot disease (LS-2) caused due to *Curvularia pallescens* which appeared on PDA as effuse colony producing grey mycelium which later turned black. Conidia three septated, slightly curved. Olufolaji (1983) studied growth and sporulation of *C. pallescens* had detailed the cultural and morphological characters which was found comparable with the present study.

Morphological characterisation of powdery mildew pathogen revealed that presence of hyaline, septate mycelia, globose conidia with irregular peripheral end formed in chains where the characters were similar to that of *Erysiphe* sp. Troisi *et al.,* (2010) from Italy while studying etiology of powdery mildew in gerbera reported *Erysiphe cichoracearum* as the causative agent. The other pathogen, *Podosphaera* sp. produced superficial, hyaline, coenocytic mycelium with oval or ellipsoidal, catenate conidia formed in unbranched erect conidiophores where these characters are in conformity with those reported by Baiswar *et al.,* (2010).

Root rot pathogen, *Phytophthora* sp. produced uniformly dense white cottony growth on PDA. The hypha was branched, hyaline, coenocytic with oval to obpyriform sporangia, non papillate borne either terminally or laterally on the sporangiophores in a simple sympodial fashion. These characters are in agreement with that reported by Erwin and Ribeiro (1996) in gerbera. The descriptions of *Fusarium solani* was comparable with the characteristics of isolate obtained from *Fusarium* wilt of carnation (Kumar *et al.,* 2014). Petal blight of gerbera caused due to *Curvularia lunata* appeared as dark, velvety, rapid growing colony showing thin and suppressed growth in PDA. Basal and apical cells of the conidia was pale brown leaving the other cells brown or dark brown coloured with smooth, curved at third cell from base. Description of Pawar *et al.,* (2012) on the characteristics of *Curvularia lunata* causing leaf spot disease in gladiolus.

Recalling back the results obtained with respect to survey conducted in three districts *viz.,* Wayanad, Malappuram and Thrissur on fungal diseases of gerbera, three leaf blights caused by *Alternaria alternata, Alternaria tenuissima, Myrothecium roridum,* two leaf spots by *Ulocladium chartarum*, *Curvularia pallescens*, two powdery mildew pathogens, *Golovinomyces cichoracearum* and *Podosphaera* sp., petal blight by *Curvularia lunata* and root rot and wilt by *Phytophthora cryptogea* and *Fusarium solani* are documented in gerbera from Kerala. Among the various diseases reported, the most destructive diseases observed in gerbera during the survey were *Alternaria* leaf blight, powdery mildew, root rot and wilt. Search on literature revealed very few studies regarding the pathogen, *Ulocladium* sp. and *Myrothecium* sp. infecting other crop plants. It is worthwhile to mention that this may be the first report of leaf blight and leaf spot caused by *Myrothecium roridum* and *Ulocladium chartarum* on gerbera. Moreover, the observations made through the studies have strongly warranted that *in vitro* and *in vivo* results with fungicides and biocontrol agents against pathogens do not always reflect what happens in the field. Hence, the study should be complemented by varietal screening and multilocational field trials to prove the effectiveness of the aforesaid fungicides and biocontrol agents in the management of fungal diseases of gerbera.

It may be concluded that the present study has enlightened our knowledge on the various fungal diseases of gerbera prevailing in Kerala and thrown light on the management of the major dreadful disease infecting the crop.

References

Ampuero J, Latorre B A, Torres R, and Chavez E R (2008). Identification of *Phytophthora cryptogea* as the Cause of Rapid Decline of Petunia (*Petunia* × *hybrida*) in Chile. *Plant Dis.* 92: 1529-1536.

Aswath C and Rao T M (2006). Breeding of gerbera (*Gerbera jamesonii* Bolus ex Hooke f.) lines suitable for open field cultivation. *J. Orna. Hortic.* 9: 243–247

Baiswar P, Chandra S, Kumar R and Ngachan S V (2010). First report of anamorphic *Podosphaera* on *Gerbera jamesonii* in India. *Plant Pathol.* 59: 802.

Erwin D C and Ribeiro O K (1996). *Phytophthora Diseases Worldwide. The Am Phytopathol. Soc.* 562pp.

Farhood S and Hadian S (2012). First Report of *Alternaria* leaf Spot on gerbera (*Gerbera jamesonii* L.) in North of Iran. *Adv. Environ. Biol.* 6(2): 621-624.

Fujinawa M F, Pontes N C, Vale H M M, Santos N F, and Halfeld-Vieira B A (2016). First report of *Myrothecium roridum* causing *Myrothecium* leaf spot on Begonia in Brazil. *Plant Dis.* 100(3):655.

Garibaldi A and Minuto A (2007). *Fusarium* Wilt of gerbera in Spain in soilless crops. *Plant Dis.* 91(5): 638.

Garibaldi A, Minuto A, Uchimura M S, Gullino M L (2008). *Fusarium* wilt of gerbera caused by a *Fusarium* sp. in Brazil. *Plant Dis.* 92(4): 655.

Honda Y, Rahman M Z, Islam S Z, and Muroguchi N (2001). Leaf spot diseases of broad bean caused by *Alternaria tenuissima* in Japan. *Plant Dis.* 85(1): 95.

Hyeong J J, WanGyu K, SangYub L, and WeonDae C (1996). *Phytophthora cryptogea* causing the foot rot of *Gerbera jamesonii* in Korea. *Kor. J. Plant Pathol.* 12(3): 374-376.

Kumar P R, Adhipathi P, and Nakkeeran S (2014). Antimicrobial peptide genes of PGPR for the management of *Fusarium*wilt of carnation under protected cultivation. *J. Mycol. Plant Pathol.* 44(1): 54.

Munaut F, Hamide N and Marate H (1997). A standardized microdroplet inoculation technique for analysis of the interaction between *Colletotrichum gloeospoiroides*and *Stylosanthes guianensis*. *Parasitica* 53(4): 117-125.

Nagrale D T, Gaikwad A P, Goswami S, and Sharma L (2012). Fungicidal management of *Alternaria alternata* (Fr.) Keissler causing blight of gerbera (*Gerbera jamesonii* H. Bolus ex J.D. Hook). *J. Appl. Nat. Sci.* 4(2): 220-227.

Olufolaji D B (1983). Sporulation and growth of *Curvularia pallescens* as affected by media, temperature and nitrogen sources. *Phytopathol.* 74:260-263.

Pawar M, Arekar J S, Borkar P G (2012). *In vitro* evaluation of bioagents and botanicals against *Curvularia* blight of gladiolus. *J. Plant Dis. Sci.* 7(1): 70-72.

Rocha J R S, Oliveira N T and Menezes M (1998). Comparison of inoculation methods efficiency for evaluation of *Colletotrichum gloeospoiroides*isolates pathogenicity on passion fruits (*Passiflora edulis*). *Braz. Arch. Biol. Technol.* 41: 145-153.

Troisi M, Bertetti D, Garibaldi A, and Gullino M L (2010). First report of powdery mildew caused by *Golovinomyces cichoracearum*on gerbera (*Gerbera jamesonii*) in Italy. *Plant Dis.* 94(1): 130.

How to cite this article:

Praveen, N.M., Reshmy Vijayaraghavan, K. Ajith Kumar and Deepa James. 2017. An Investigation on the Etiology and Characterisation of Fungal Diseases of Gerbera. *Int.J.Curr.Microbiol.App.Sci.* 6(6): 2038-2043. doi: https://doi.org/10.20546/ijcmas.2017.606.240