Occurrence of powdery mildew disease of Gerbera in Kerala

N.M. Praveen*1, Reshmy Vijayaraghavan1, S. Beena1 and S. Krishnan2
1Department of Plant Pathology, College of Horticulture, Kerala Agricultural University, Kerala, India-680 656
2Dept of Agricultural Statistics, College of Horticulture, Kerala Agricultural University, Kerala, India-680 656
Email: pn40785@gmail.com, drreshmydhanesh@gmail.com, reshmy.v@kau.in

ABSTRACT
A purposive sampling survey on the occurrence of powdery mildew disease of gerbera crops grown under both protected and open field condition. Among the other fungal diseases of gerbera, powdery mildew disease causes decisive damage to the ornamental cut flower crop, thereby decline in the industrial value of the crop. Symptom of the disease include as white powdery mat on the upper surface of leaf lamina that gradually turned pale yellow to brown. Powdery mildew existed in two locations of Wayanad viz., Ambalavayal and Chulliyode where highest per cent disease severity (PDS) of 50.72 was observed at Chulliyode and 47.2 per cent was observed at Ambalavayal during November-December. In Ambalavayal, the disease was non-significant and no correlation existed between weather parameters and disease progress. But, in Chulliyode, correlation studies revealed that it was significant with positive correlation to relative humidity and a reverse relation existed with temperature and rainfall. The weather data clearly depicts that at a low rainfall of 96 mm and above average relative humidity of 80.27 per cent during November-December was the congenial factor influencing the disease development. But during summer, decline in relative humidity (78.37%) and rainfall (63.13 mm) caused a slight reduction in mean per cent disease severity of 49.12 per cent and 33.6 per cent at Chulliyode and Ambalavayal respectively. Morphological and cultural characters of the pathogen depicts presence of two distinct organism viz., Golovinomyces cichoracearum (Erysiphe cichoracearum) and Podosphaera sp. as the causative organism of the disease. Golovinomyces cichoracearum produced hyaline, septate mycelia with globose conidia with irregular peripheral end formed in a chain and Podosphaera sp. produced superficial, hyaline, coenocytic mycelium with oval or ellipsoidal, catenate conidia with dimension ranging from 22.1-30.18 x 13.36-18.08μm formed in unbranched erect conidiophores.

Keywords: Gerbera, Golovinomyces cichoracearum, Podosphaera sp., per cent disease severity

INTRODUCTION
Gerbera is 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, these plants were grown throughout the world in a wide range of climatic conditions and are in great demand in the floral industry as cut flower as well as potted plant due to its beauty, color, long vase life and ability to rehydrate after long transportation. Fungal, bacterial and viral diseases being the major constraints that bring down the growth of the cut flower industry. Among the fungal disease, powdery mildew affects the yield and economic profitability of the cut flower cultivation. Powdery mildew disease observed mainly in the hilly tracts due to the favorable humid and temperature prevailing in those locations. Hence, the present study is focused on to study the occurrence of powdery mildew disease in Wayanad district of Kerala, its correlation with the weather parameters and also the disease causing pathogen.

A purposive sampling survey on the occurrence of powdery mildew diseases of gerbera in Wayanad district was conducted during the months of July-August, November-December and March-April to get a complete profile on the occurrence of diseases
prevailing during rainy, winter and summer season. The
disease incidence and disease severity were recorded
based on extent of symptoms produced by the pathogen.
The severity of disease was assessed by adopting a
standard score chart of 0-6 scale developed by Kumar
et al (2012).

During sampling survey, the extent of intensity
and severity were recorded for powdery mildew
disease and was correlated with the weather
parameters viz., temperature, relative humidity (RH)
and rainfall prevailing during each seasons.

Pathogenicity of obligate parasites causing
powdery mildew diseases was proved by detaching
an infected leaf containing a single colony and
inoculating onto a fresh healthy leaf. The whole leaf
sample was covered with plastic bag and observations
were taken for symptom development. Uninoculated
plants were maintained under same condition and were
treated as control (Warkentin et al., 1995).

Symptoms of powdery mildew on gerbera was
studied under natural conditions during the survey.

A temporary mount of fungal pathogen was
prepared by using a strip of transparent cellophane
tape (10 cm long) which was held in between the
thumb and the forefinger. The sticky side of the tape
was firmly pressed onto the leaf surface of a
sporulating colony. After gently removing the
cellophane tape, the sticky surface carrying fungal
spores and hyphae was carefully placed over drops of
lactophenol cotton blue kept at the centre of a clean
glass slide. The tape was gently pressed and the
extended ends of the tape is held over the ends of the
slide and observed under the light microscope where
the characteristics of spores and sporulatingstrucutures
were studied (Narayanasamy., 2011).

For further confirmation, the isolates were sent
to National Center for Fungal Taxonomy (NCFT),
New Delhi where the cultures were also deposited
under different accession numbers.

Survey was conducted in mainly two locations
of Wayanad district viz., Ambalavayal and Chulliyode
for assessing the incidents of powdery mildew in the
district. The disease was devastating in nature with a
PDI of 93.6 and 95.2 per cent in Ambalavayal and
Chulliyode during November-December respectively.
Per cent disease severity of the disease with the
maximum of 57.4 per cent at Chulliyode and a
minimum of 32.7 per cent at Ambalavayal was also
found to be very high compared to other diseases
observed during the survey.

Powdery mildew existed in two locations viz.,
Ambalavayal and Chulliyode of Wayanad district with
more severity at Chulliyode. Mean per cent disease
severity was maximum during November-December
with 50.72 per cent in Chulliyode and 47.2 per cent in
Ambalavayal. In Ambalavayal, the disease was non-
significant and no correlation existed between weather
parameters on disease progress. But, in Chulliyode,
correlation studies revealed that it was significant with
positive correlation to relative humidity and a reverse
relation existed with temperature and rainfall. The
weather data clearly depicts that at a low rainfall of
96 mm and above average relative humidity of 80.27
per cent during November-December was the
congenial factor influencing the disease development.
But during summer, decline in relative humidity
(78.37%) and rainfall (63.13 mm) caused a slight
reduction in mean per cent disease severity of 49.12
per cent and 33.6 per cent at Chulliyode and
Ambalavayal, respectively.

The correlation analysis that clearly depicted
the major weather factors that influenced the spread
of powdery mildew were low temperature, high
relative humidity and sparse but less intense rainfall.
This might be the one of the reason why powdery
mildew was not noticed during the monsoon season.
As a testimonial to the above conclusion, Kumar et al.
(2012) detailed weather parameters most congenial
for powdery mildew which included high relative
humidity (80-95%), moderate temperature (20-28°C)
and low light intensity or shade. Similarly, the results
are in accordance with Leah et al. (2012), who showed
that the disease exhibited positive correlation with RH
and negative with temperature.

Infected samples collected during the sampling
survey were used to inoculate the powdery mass onto
fresh healthy leaves whereby the symptoms appeared
three weeks after inoculation. The development of
symptom after inoculation was very slow due to
obligate nature of the pathogen. Dispersed white
powdery growth was observed above the leaf lamina,
thus confirmed the pathogenicity of the isolate.
Similarly, Baiswar et al. (2010) confirmed the
pathogenicity of the powdery mildew pathogen,
*Podosphaera* sp. in gerbera by dusting conidia on
healthy plants.
Symptoms of powdery mildew were found to be as similar as that observed in other crops. Symptoms appeared as distinct white powdery mould on the upper surface of leaf lamina. These spots later enlarged to form white powdery mat which gradually turned pale yellow to brown (Plate 1). It was observed that immature leaves were severely affected compared to mature ones leading to complete death of the plant. The description of powdery mildew symptom was in conformity with the findings put forth by other workers (Ferronato et al., 2008; and Rossman, 2009; Baiswar et al. 2010 and Troisi et al., 2010).

Morphological characterisation of the isolates revealed the existence of two distinct pathogens viz., Erysiphe sp. and Podosphaera sp. Light microscopy revealed the presence of hyaline, septate mycelia, globose oidia 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. Podosphaera sp. produced superficial, hyaline, coenocytic mycelium with oval or ellipsoidal, catenate conidia with dimension ranging from 22.21-30.18 μm x 13.36-18.08 μm formed in unbranched erect conidiophores where these characters are in conformity with those reported by Baiswar et al. (2010) where they detailed the morphological characters Podosphaera sp. in Gerbera jamesonii from India (Plate 2 and Plate 3). Based on the host and morphological characteristics, the powdery mildew pathogens were identified as Golovinomyces cichoracearum (previously known as Erysiphe cichoracearum) and Podosphaera species.
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