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Odium piperis Fungus Identification for Piper Betel Plants Using Digital Image Processing

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Abstract: The betelvine cultivation is very much affected by diseases and outcome of the farmer is big loss for betelvine cultivation. The aim of this study is to detection of Powdery mildew disease in the betelvine plants using digital image processing techniques. The digital images of the uninfected or normal betelvine leaves and the digital images of the infected in Powdery mildew diseased betelvine leaves at different stages are collected from different betelvine plants using a high resolution digital camera and collected betelvine images are stored with JPEG format. The digital image analyses of the leaves are done using the image processing toolbox in MATLAB. The mean values for all sample leaves are computed and calculated mean values are stored in the system. The mean values of test leaves are computed and compared with the stored values. As the result of this comparison, it is identified whether test leaves are affected by Powdery mildew disease or not. Finally, this analysis helps to recognize the Powdery mildew disease can be identified before it spreads to entire crop.

Key words: Piperaceae, piper betel, Powdery mildew disease, oidium piperis, digital image

INTRODUCTION

The green heart shaped leaves of betelvine are popularly known as paan in Hindi. The fresh leaves of betelvine are commonly known as vettilai in Tamil. The biological name of betelvine is Piper betel. It belongs to the family Piperaceae. The betelvine plants (usually the male plants) are cultivated throughout India except the dry northwestern parts. Further, the female plants also rarely produce any flower or fruit in the Indian climate. Betelvine is widely cultivated in the states of Tamil Nadu, Uttar Pradesh, Bihar, Madhya Pradesh, Northeastern India, Maharashtra, Karnataka, West Bengal, Orissa, Andhra Pradesh and Kerala.

There are about 70 varieties of betelvine in the world of which about 40 are found in India and 30 in West Bengal. In Tamilnadu, based on the color, size and taste there are many varieties of betelvine leaf and some of the most popular varieties are Vellaikodi, Karpoori, Pachaikodi and Sirugamani are mostly available. The leaves are very nutritive and contain substantial amount of vitamins and minerals are shown in Table 1. Six betelvine leaves with a little bit of slaked lime is said to be comparable to about 300 mL of cow milk particularly for the vitamin and mineral nutrition. In this study, only consider vellaikodi variety of betelvine leaves. The group of research is going on in the field of betelvine plant disease analysis for various centers within the country under the name all India coordinated research project on betelvine. During cultivation betelvine is very much affected by diseases and outcome of the farmer is big loss for betelvine cultivation. The most important diseases of betelvine plants are Powdery mildew disease, leaf rot disease, foot rot disease and leaf spot disease. It occurs in a very powerful form and if not controlled causes unlimited damage and even total demolition of the entire of betelvine plantations (Vijayakumar and Arumugam, 2012b). The farmer is not able to identify the disease at an early stage to initiate preventive action due to the non-availability of modern technology. So, for each farmer, to have access to the modern technology there is a need to construct modern commercial farm. This has been the base to develop a new tool to identify the disease well in advance to enhance the cultivation. Digital Image processing is used as a tool for early identification of the Powdery mildew disease.

Table 1: Nutritional composition of fresh betel leaf

Components	Approximate composition
Water	85-90%
Protein	3-3.5%
Fat	0.4-1.0%
Minerals	2.3-3.3%
Carbohydrate	0.5-6.10%
Vitamin C	0.005-0.01%
Vitamin A	1.9-2.9 mg/100 g
Potassium	1.1-4.6%
Calcium	0.2-0.5%
Iron	0.005-0.007%
Iodine	3.4 g/100 g
Essential oil	0.08-0.2%
Energy	44 kcal/100 g

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MATERIALS AND METHODS

Powdery mildew is sourced by *Oidium piperis*. The recent year's Powdery mildew disease has been doing much damage to betelvine plants but it has been reported from other parts of the province where this crop is also extensively cultivated. It makes its appearance in the cold season and almost disappears as the hot weather approaches. The disease shows on the undersurface of the leaves as white to brown Powdery patches. The photograph is shown in Fig. 1 for front and back view of Powdery mildew infected betelvine leaves. These infected areas gradually increase in size and repeatedly combine with each other (Vijayakumar and Arumugam, 2012c). They vary in size from a few to 40 mm in diameter and are covered by dusty growth which is fairly thick in cases of sever attack. Areas on the upper surface corresponding to patches on the under surface appear yellowish, raised and irregular in outline. Young leaves when attacked fail to grow and become deformed, the surface being cracked and the margin turned inwards. Such leaves present a pale appearance and drop with slight disturbance. The disease is more prevalent in old plantations. The disease has been reported to be in the leaves only and it has been found to disappear during the hot season.

The betelvine leaves are correctly washed to eliminate the dust components. Digital imaging technique is divided into three phases. Normal or uninfected betelvine leaves phase, Powdery mildew disease infected betelvine leaves phase and test betelvine leaves phase (Vijayakumar and Arumugam, 2012d). Normal or uninfected betelvine leaves phase consists of without any disease infected in the betelvine leaves. The normal or uninfected betelvine plant and the front and back view of normal or uninfected betelvine leaves are shown in Fig. 2-4. Infected betelvine leaves phase consisted of visually unidentifiable infected betelvine leaves to visually identifiable infected betelvine leaves. The samples are collected various stages of Powdery mildew disease and the front and back view of Powdery mildew disease infected betelvine leaves are shown in Fig. 5 and 6. Test leaves phase consists of visually

Fig.1: Front and back view of betelvine leaves

Fig. 2: Normal or uninfected betelvine plant

Fig. 3: The front view of normal leaf

Fig. 4: The back view of normal leaf

Fig. 5: The front view of infected leaf

Fig. 7: The front view of test leaf

Fig. 6: The back view of infected leaf

Fig. 8: The front view of test leaf

unidentifiable infected betelvine leaf, samples are collected at uninfected or normal betelvine leaves and various stages of the Powdery mildew disease infected betelvine leaves. The front and back view of Powdery mildew disease infected betelvine leaves are shown in Fig. 7 and 8. Ten samples from each phase were taken for this research. The size of all the digital images are 256×256 (Vijayakumar and Arumugam, 2012a, 2013). To eliminate the background using Photo Shop 7.0 and background was chosen to be white color and these digital images are stored in the system. This stored digital images are given as input to the MATLAB file and the RGB colour components are separated and find the mean values for all healthy and Powdery mildew disease infected leaves and calculated values are stored in the system. For the test leaf, the mean values for all sample leaves are computed and calculated mean values are stored in the system. The mean values of test leaves are computed and compared with the stored values. As the result of this comparison, it is identified whether test leaves are affected by Powdery mildew disease or not.

Finally, this analysis helps to recognize the Powdery mildew disease can be identified before it spreads to entire crop. The result of the study is all the normal and infected leaves are given as input to the MAT LAB and RGB color components are separated. The mean value are calculated for front and back view of each component and calculated mean value are stored in the system and test leaves are given as input to the MAT LAB and RGB color components are separated and the mean value are calculated for front and back view of each component and calculated mean value are stored in the system (Vijayakumar and Arumugam, 2012e). To compare all the stored results and identify either Powdery mildew disease

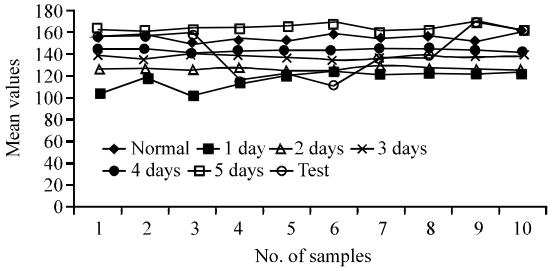

Fig. 9: Front view for red component mean value

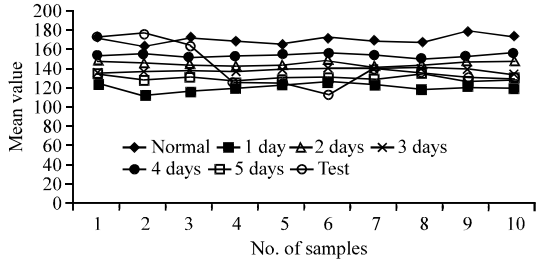

Fig. 10: Back view for red component mean value

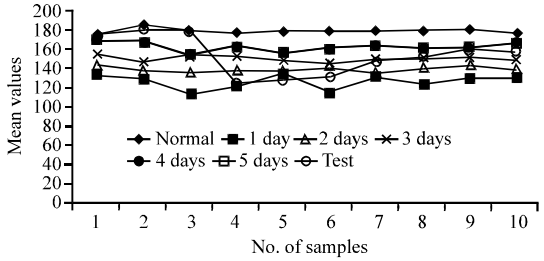

Fig. 11: Front view for green component mean value

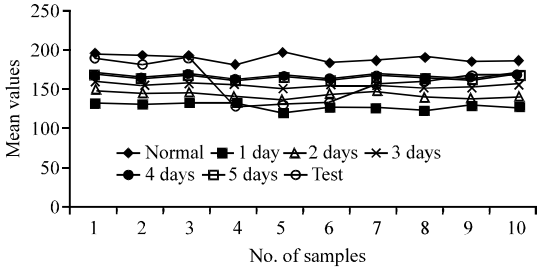

Fig. 12: Back view for green component mean value

infected or not in the test betelvine leaf, the mean value of Red component for normal leaves and infected leaves front and back views are shown in Fig. 9 and 10. The mean value of green component for normal leaves and infected leaves front and back views are shown in Fig. 11 and 12. The mean value of blue component for normal leaves and infected leaves front and back views are shown in Fig. 13 and 14. In normal leaves, mean value for front view of red

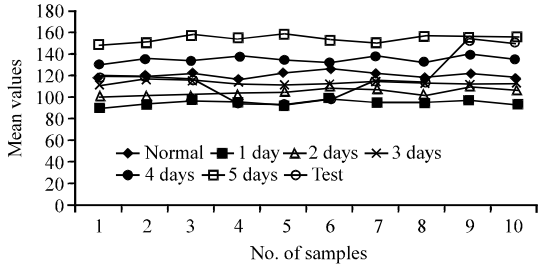

Fig. 13: Front view for blue component mean value

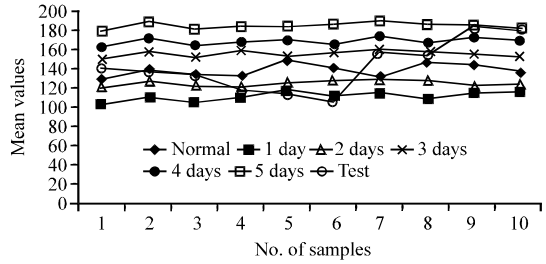

Fig. 14: Back view for blue component mean value

component value ranges from 150.36-160.73 and mean value for back view of red component value ranges from 164.67-179.01. In first three samples of test leaves, mean value for front view red component value ranges from 150.36-160.73 and mean value for back view of red component value ranges from 164.67-179.01. In 4th, 5th and 6th samples of test leaves, mean value for front view red component value ranges from 102.73-123.95 and mean value for back view of red component value ranges from 112.18-125.86. In 7th and 8th samples of test leaves, mean value for front view red component value ranges from 134.07-136.67 and mean value for back view of red component value ranges from 135.30-140.80. In last two samples of test leaves, mean value for front view red component value ranges from 161.16-169.50 and mean value for back view of red componnt value ranges from126.19-134.79.

In normal leaves, mean value for front view of green component value ranges from 174.04-182.64 and mean value for back view of green component value ranges from 180.60-195.37. In infected in Powdery mildew disease at 1st day leaves, mean value for front view of green component value ranges from 112.58-133.29 and mean value for back view of green component value ranges from 120.19-134.97. In infected in Powdery mildew disease at second day leaves, mean value for front view of green component value ranges from 134.19-142.28 and mean value for back view of green component value ranges from 137.18-149.16. In infected in Powdery mildew disease

at 3rd day leaves, mean value for front view of green component value ranges from 143.92-152.95 and mean value for back view of green component value ranges from 150.43-158.92. In infected in Powdery mildew disease at 4th day leaves, mean value for front view of green component value ranges from 153.06-169.26 and mean value for back view of green component value ranges from 160.12-169.92.

In infected in Powdery mildew disease at 5th day leaves, mean value for front view of green component value ranges from 153.06-169.26 and mean value for back view of green component value ranges from 160.12-169.92. In first three samples of test leaves, mean value for front view green component value ranges from 174.04-182.64 and mean value for back view of green component value ranges from 180.60-195.37. In 4th, 5th and 6th samples of test leaves, mean value for front view green component value ranges from 112.58-133.29 and mean value for back view of green component value ranges from 120.19-134.97. In 7th and 8th samples of test leaves, mean value for front view green component value ranges from 143.92 -152.95 and mean value for back view of green component value ranges from 150.43-158.92. In last two samples of test leaves, mean value for front view green component value ranges from 153.06-169.26 and mean value for back view of green component value ranges from 160.12-169.92.

In normal leaves, mean value for front view of blue component value ranges from 116.01-127.15 and mean value for back view of blue component value ranges from 130.03-148.81. In infected in Powdery mildew disease at 1st day leaves, mean value for front view of blue component value ranges from 91.26-99.48 and mean value for back view of blue component value ranges from 104.14-118.85. In infected in Powdery mildew disease at 2nd day leaves, mean value for front view of blue component value ranges from 101.02-109.97 and mean value for back view of blue component value ranges from 120.40-129.49. In infected in Powdery mildew disease at 3rd day leaves, mean value for front view of blue component value ranges from 111.65-115.78 and mean value for back view of blue component value ranges from 151.09-160.41. In infected in Powdery mildew disease at 4th day leaves, mean value for front view of blue component value ranges from 130.33-139.99 and mean value for back view of blue component value ranges from 163.21-174.75. In infected in foot rot disease at 5th day leaves, mean value for front view of Blue component value ranges from 149.13-158.58 and mean value for back view of blue component value ranges from 180.11-189.98. In first three samples of test leaves, mean value for front view blue component value ranges from 116.01-127.15 and mean value for back view of blue component value ranges from 130.03-148.81. In 4th, 5th and 6th samples of test leaves, mean value for front view blue component value ranges from 91.26-99.48 and mean value for back view of blue component value ranges from 104.14-118.85. In 7th and 8th samples of test leaves, mean value for front view blue component value ranges from 111.65-115.78 and mean value for back view of blue component value ranges from 151.09-160.41. In last two samples of test leaves, mean value for front view blue component value ranges from 149.13-158.58 and mean value for back view of blue component value ranges from 180.11-189.98.

RESULTS AND DISCUSSION

To compare all the ten test sample leaves of mean values from stored mean values of normal and infected leaves. The result is first three test sample leaves are uninfected or normal leaves. In 4th, 5th and 6th test sample leaves are infected in 1st day for Powdery mildew disease. In 7th and 8th test sample leaves are infected in 3rd day for Powdery mildew disease. In last two test sample, leaves are infected in 5th day for Powdery mildew disease.

CONCLUSION

The above proposed methods convey that the betelvine plants disease can be identified disease infected or not in the betelvine leaf and thus preventive action can be taken well in advance such that the entire plantation can be saved before the disease starts to spread. The method of detecting the disease is cost effective. The efficiency of the system can be increased by taking the camera parameters as the camera parameters are considered constant in this project. Periodic inspection of the farm is required to prevent the disease. This method can also be extended to detect diseases of all kind to initiate early preventive action.

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