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## Foot Rot Disease Identification for Karpoori variety of Betelvine Plants Using Digital Imaging Technique

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### ABSTRACT

The cultivation of betelvine plants is very much affected by foot rot disease produced by the fungus of *Phytophthora parasitica* and outcome of the cultivator is big loss for betelvine plants cultivation. The aim of this research paper is to detect the foot rot disease infected in the betelvine plants using digital imaging techniques. The digital images of the uninfected betelvine leaves and the digital images of the foot rot disease infected 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 betelvine leaves are done using the digital image processing toolbox in MATLAB. The mean values for all betelvine leaves are computed and stored as a database. The mean values of test betelvine leaves are computed and compared with the stored data. As the consequence of this evaluation, it is identified whether test betelvine leaves are affected by foot rot disease or not. Finally this research work helps to recognize the foot rot disease before it spreads to complete crop.

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## 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 betelvine plants) are cultivated throughout India except the dry northwestern parts. Further, the female betelvine plants also rarely produce any flower or fruit in the Indian climate. There are about 70 varieties of betelvine in the world, amongst 30 in West Bengal and 40 are found in India. In Tamilnadu, based on the color, size and taste there are many varieties of betelvine leaves are mostly available and some of the most popular varieties are vellaikodi, karpoori, pachaikodi and sirugamani. In this research paper, only karpoori variety of betelvine leaves is taken for the investigations. The group of research is going on in the field of betelvine plants disease analysis for various research centers within the country under the name "ALL INDIA COORDINATED RESEARCH PROJECT ON BETELVINE" [6]. 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. The cultivator is not able to recognize the disease at an early stage to initiate preventive action due to the non-availability of modern technology. So for each cultivator, to have access to the modern technology there is a need to construct modern commercial farm used to identify the disease well in advance to enhance the cultivation. Digital Image processing is used as a tool for early identification of the foot rot disease. Basically when a farmer visualizes the foot rot disease for betelvine plant is in the fully developed stage after which identification cannot save the betelvine plant. The foot rot disease spreads to the complete crop and the total plantation gets destructed within few days. Foot Rot disease appears on the disease starts from the roots or rootlets. Human eye cannot predict the disease at an early stage. So we are using computerized image analyzing system in which minute change in the form of color in leaves can be detected at an early stage.

## MATERIALS AND METHODS

Foot Rot is produced by the fungus *Phytophthora parasitica* that lives in the soil and attacks betelvine roots, stem and betelvine leaves. The foot rot affected betelvine plants are shown in Figure 1. The above ground level parts, betelvine leaves or stem do not show any other sign of infection such as lesions or rotting for the starting stage. Such betelvine plants when pulled out easily break at the collar region and underground parts such as

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roots and rootlets are found to be in the state of decay and they are black or brown in color and in decaying condition. The raining conditions the progress of the foot rot disease is developed quickly, whereas under dry conditions the progress of the foot rot disease is slow. The betelvine leaves are correctly washed to eliminate the dust components.



**Fig. 1:** Foot Rot Disease Affected Betelvine Plants.

Digital imaging technique is divided into three phases. Normal or uninfected betelvine leaves phase, foot rot disease infected betelvine leaves phase and test betelvine leaves phase. Normal or uninfected betelvine leaves phase consists of without any disease infected in the betelvine leaves. The infected betelvine leaves phase consists of visually unidentifiable infected betelvine leaves to visually identifiable infected betelvine leaves. The samples are collected various stages of foot rot disease. Test leaves phase consists of visually unidentifiable infected betelvine leaves, samples are collected at uninfected or normal betelvine leaves and various stages of the foot rot disease infected betelvine leaves. Ten samples from each phase were taken for this paper. The size of all the betelvine images is 256x256. To eliminate the background using digital imaging software and background was chosen to be white color and these digital images are stored in the system. These stored normal and foot rot disease infected betelvine leaves are given as input to the MAT LAB and RGB color components are separated. mean values are calculated for front and back view of each component and calculated mean values are stored in the system and test betelvine leaves are given as input to the MAT LAB and RGB color components are separated and the mean values are calculated for front and back view of each component and calculated mean values are stored in the system. To compare all the stored normal, infected and test betelvine leave mean value results and identify either foot rot disease infected or not in the test betelvine leaves. The front and back view red component mean values are shown in the figure 2 and figure 3. The front and back view green component mean values are shown in figure 4 and figure 5. The front and back view blue component mean values are shown in figure 6 and figure 7. In normal betelvine leaves, the mean value for front view red component ranges from 156.99 to 191.17 and the mean value for back view red component ranges from 192.68 to 216.98. The foot rot disease infected in first day betelvine leaves, the mean value for front view red component ranges from 138.34 to 147.23 and the mean value for back view red component ranges from 183.12 to 189.95. The foot rot disease infected in second day betelvine leaves, the mean value for front view red component ranges from 129.05 to 137.96 and the mean value for back view red component ranges from 174.04 to 182.64. The foot rot disease infected in third day betelvine leaves, the mean value for front view red component ranges from 122.11 to 128.95 and the mean value for back view red component ranges from 167.20 to 173.06. The foot rot disease infected in fourth day betelvine leaves, the mean value for front view red component ranges from 114.15 to 121.99 and the mean value for back view red component ranges from 155.19 to 163.86. The foot rot disease infected in fifth day betelvine leaves, the mean value for front view red component ranges from 103.10 to 113.92 and the mean value for back view red component ranges from 148.08 to 154.97. In first two test betelvine leaves, the mean value for front view red component ranges from 156.90 to 191.17 and the mean value for back view red component ranges from 192.68 to 216.98. In third and fourth test betelvine leaves, the mean value for front view red component ranges from 138.34 to 147.23 and the mean value for back view red component ranges from 183.12 to 189.95. In fifth and sixth test betelvine leaves, the mean value for front view red component ranges from 129.05 to 137.96 and the mean value for back view red component ranges from 174.04 to 182.64. In seventh and eighth test betelvine leaves, the mean value for front view red component ranges from 122.11 to 128.95 and the mean value for back view red component ranges from 167.20 to 173.06. In last two test betelvine leaves, the mean value for front view red component ranges from 103.10 to 113.92 and the mean value for back view red component ranges from 148.08 to 154.97. In normal betelvine leaves, the mean value for front view green component ranges from 189.70 to 216.76 and the mean value for back view green component ranges from 209.78 to 230.20.

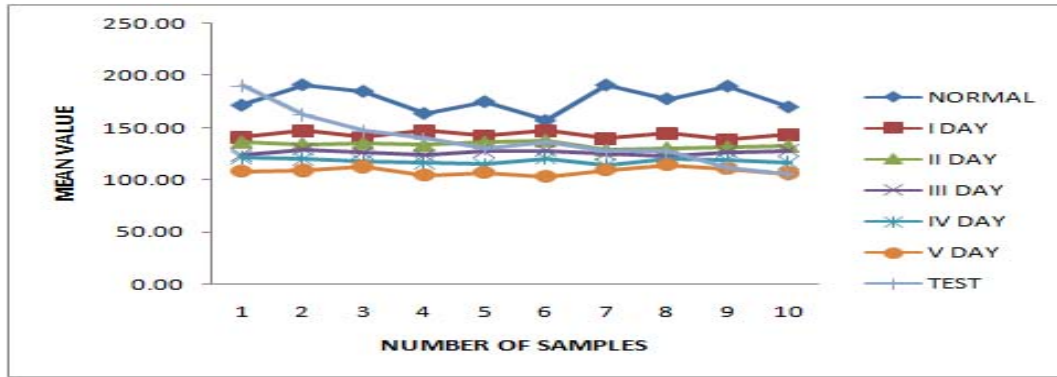


Fig. 2: Front View Red Component Mean Value.

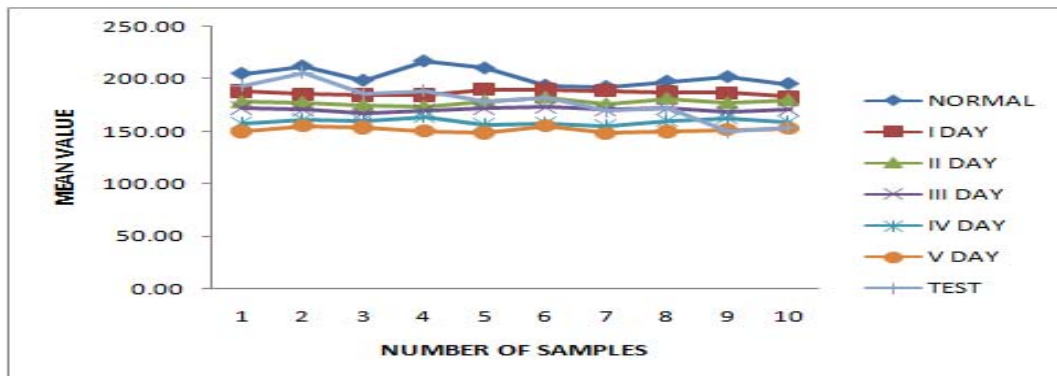


Fig. 3: Back View Red Component Mean Value.

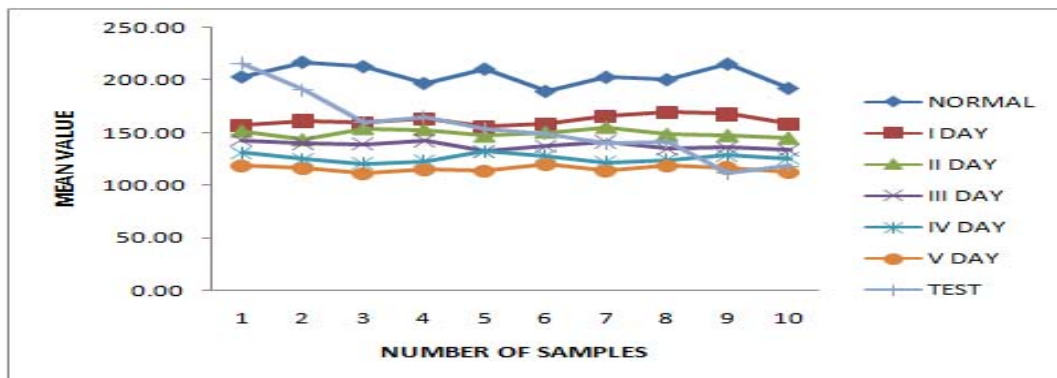


Fig. 4: Front View Green Component Mean Value.

The foot rot disease infected in first day betelvine leaves, the mean value for front view green component ranges from 155.52 to 216.76 and the mean value for back view green component ranges from 188.03 to 198.94. The foot rot disease infected in second day betelvine leaves, the mean value for front view green component ranges from 143.14 to 154.90 and the mean value for back view green component ranges from 175.04 to 187.96. In first two test betelvine leaves, the mean value for front view green component ranges from 189.70 to 216.76 and the mean value for back view green component ranges from 209.78 to 230.20. In third and fourth test betelvine leaves, the mean value for front view green component ranges from 155.52 to 216.76 and the mean value for back view green component ranges from 188.03 to 198.94.

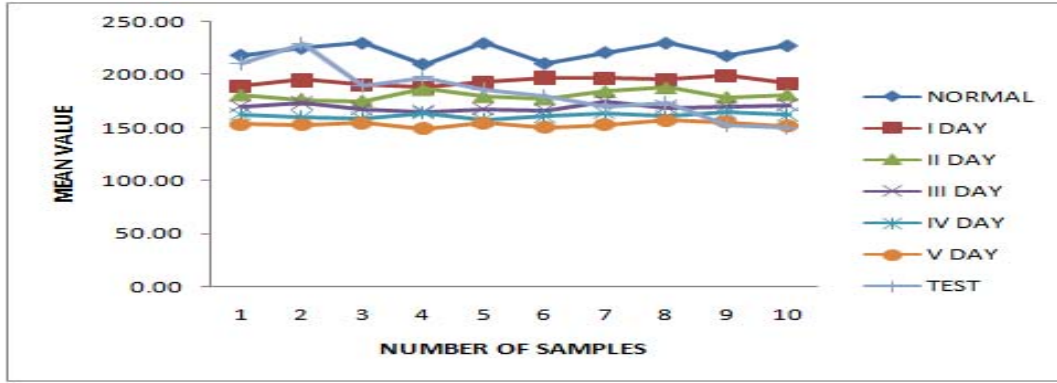


Fig. 5: Back View Green Component Mean Value.

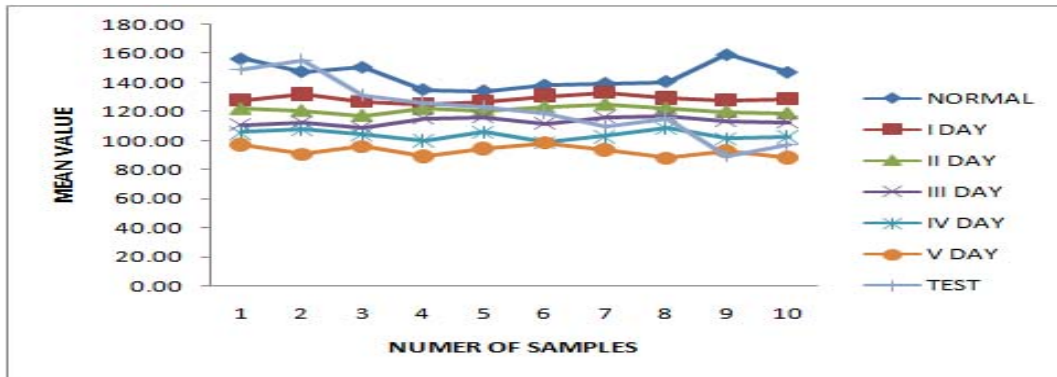


Fig. 6: Front View Blue Component Mean Value.

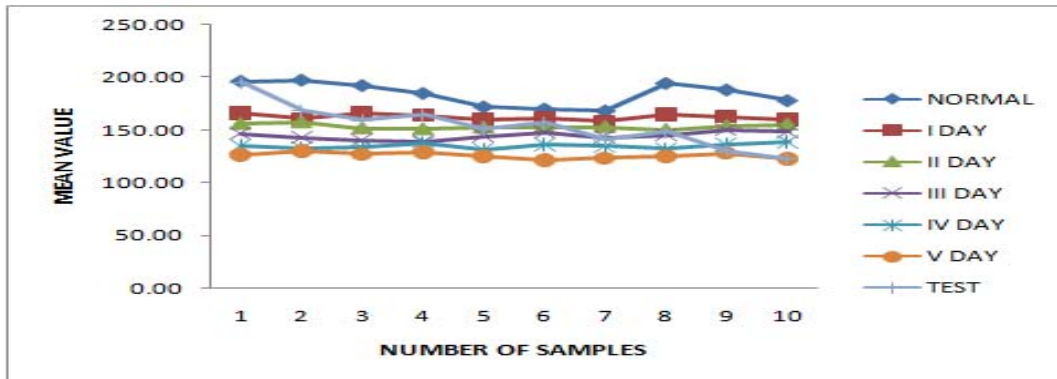


Fig. 7: Back View Blue Component Mean Value.

In fifth and sixth test betelvine leaves, the mean value for front view green component ranges from 143.14 to 154.90 and the mean value for back view green component ranges from 175.04 to 187.96. In seventh and eighth test betelvine leaves, the mean value for front view green component ranges from 132.07 to 142.79 and the mean value for back view green component ranges from 165.32 to 174.92. In last two test betelvine leaves, the mean value for front view green component ranges from 110.94 to 119.65 and the mean value for back view green component ranges from 149.02 to 156.92. In normal betelvine leaves, the mean value for front view blue component ranges from 134.20 to 159.49 and the mean value for back view blue component ranges from 167.94 to 196.92. The foot rot disease infected in first day betelvine leaves, the mean value for front view blue component ranges from 125.10 to 132.84 and the mean value for back view blue component ranges from 158.01 to 165.99. The foot rot disease infected in second day betelvine leaves, the mean value for front view blue component ranges from 117.10 to 124.95 and the mean value for back view blue component ranges from 150.43 to 157.90. The foot rot disease infected in third day betelvine leaves, the mean value for front view blue

component ranges from 109.01 to 116.87 and the mean value for back view blue component ranges from 139.18 to 149.88. The foot rot disease infected in fourth day betelvine leaves, the mean value for front view blue component ranges from 99.06 to 108.61 and the mean value for back view blue component ranges from 1431.33 to 138.97. The foot rot disease infected in fifth day betelvine leaves, the mean value for front view blue component ranges from 87.99 to 98.22 and the mean value for back view blue component ranges from 121.31 to 130.39. In first two test betelvine leaves, the mean value for front view blue component ranges from 134.20 to 159.49 and the mean value for back view blue component ranges from 167.94 to 196.92. In third and fourth test betelvine leaves, the mean value for front view blue component ranges from 125.10 to 132.84 and the mean value for back view blue component ranges from 158.01 to 165.99. In fifth and sixth test betelvine leaves, the mean value for front view blue component ranges from 117.10 to 124.95 and the mean value for back view blue component ranges from 150.43 to 157.90. In seventh and eighth test betelvine leaves, the mean value for front view blue component ranges from 109.01 to 116.87 and the mean value for back view blue component ranges from 139.18 to 149.88. In last two test betelvine leaves, the mean value for front view blue component ranges from 87.99 to 98.22 and the mean value for back view blue component ranges from 121.31 to 130.39.

Comparing all the ten test sample betelvine leaves of mean values from stored mean values of normal and infected leaves, the result is first two test samples of betelvine leaves are uninfected or normal leaves. In third and fourth test samples of betelvine leaves are foot rot disease infected in first day. In fifth and sixth test samples of betelvine leaves are foot rot disease infected in second day. In seven and eighth test samples of betelvine leaves are foot rot disease infected in third day. In last two test samples of betelvine leaves are foot rot disease infected in fifth day.

#### **Conclusion:**

The above proposed techniques convey that the betelvine plants foot rot disease can be identified in early stage and thus preventive action can be taken well in advance such that the entire plantation can be saved before the foot rot disease starts to spread. The method of detecting the foot rot disease cost is effective. This method can also be extended to detect diseases of all kind to initiate early preventive action.

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