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Early Detection of Disease in Bitter gourd Leafs at Flowering Stage

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ABSTRACT

Bitter gourd plant is affected by various diseases at different stages of growth. The aim of this paper is to detect the disease early by analyzing the color Image of leaves. The images of bitter gourd leaves are taken using high resolution digital camera.RGB, HSI and HSV values are separated from healthy and disease leaves and stored in database. These stored values are compared with the values of test leaves .The analysis of these values will help to detect the disease early at that stage.

Keywords: Bittergourd, RGB, HSI,HSV.

1. INTRODUCTION

Bittergourd often known as Morodica Charantia is a vegetable fruit used as food and medicine.It is considered as the most bitter among all fruits and vegetables.The plant thrives in tropical and subtropical regions.Bitter gourd has different varieties.Out of all we are using the priyanka variety for our study as it is widely grown in Southern India.These crops can be grown in areas of low temperature as well as areas with high rainfall.The diseases commonly affecting bittergourd are Alternaria Blight ,Anthracnose, collor rot, powdery mildew, fusarium wilt, Dowmey mildew and mosaic[1,3]. Alternaria Blight is widely seen in South India, this study includes its early detection in flowering stage. In this disease,the leaves developed brown spot over its surface[4]. Figures 1and 2 shows the image of healthy and diseased leafs. As the disease progress the size, shape and color of the leaf changes continuously, causing decreased production of bitter gourd in flowering stage. Basic diagnosis of the disease still depends on human expertise, but for accurate and consistent measurement of disease image processing is needed.This study focuses on early detection of disease in flowering stage using the images in various stages, thus helping to increase the production of bitter gourd.

Fig1. Healthy leaf

Fig2. Diseased leaf

2. MATERIALS AND METHODS

2.1 Data Acquisition

The images of leaves were taken from Agricultural farm which cultivate Bitter gourd (government and private firms) in Kerala, during the month of Nov & Dec. These images were taken using 20 mega pixel digital camera at 640x480 resolution. To avoid back ground images, each leaf is placed on the white board. Images of front and backside are taken for each leaves. Disease may appear in front,back or bothsides as shown in fig3. Constant background and uniform lighting are ensured while taking photographs. Separate images are taken for healthy, diseased and test leaves at flowering stage. The leaf images are analyzed using image processing tool box in MATLAB.

Fig.3.shows images of Disease on both side

2.2 Extraction of RGB (Red, Green, Blue)

The disease of the leaf is detected by the variation of the color intensity.Different stages of diseased and Healthy leaf is taken for analysis.The color characteristic of bittergourd leaf is analyzed using RGB [2].
A color is specified by its trichromatic coefficients

$$X=x/x+y+z \quad (1)$$

$$Y= y/X+y+Z \quad (2)$$

$$Z=z/X+Y+Z \quad (3)$$

From these equation x+y+z =1 The color composition as a function of x(red),y(green)and z(blue).

$$Z=1-(x+y) \quad (4)$$

$$Y=1-(x+z) \quad (5)$$

$$X=1-(y+z) \quad (6)$$

2.3 Extraction of HSI (Hue,Saturation,Intensity)

Hue is a color attribute that describes a pure color (pure yellow, orange or red),where as saturation gives a measure of the degree to which a pure color is diluted by white light. Intensity is one of the key factors in describing color sensation.HSI model is an ideal tool for the developing image processing algorithms based on color descriptions that are natural and intuitive to humans. The RGB to HSI can be carried out through the following formula [2].
The RGB to HSI can be carried out through the following formula.

$$H=\left\{\begin{matrix}\theta \ if\ B<G \\ 360-\theta \ if\ B>G\end{matrix}\right\} \quad (1)$$

$$\theta=\cos^{-1}\left\{\frac{\frac{1}{2}[R-G]+[R-B]}{[(R-G)^2+(R-B)(G-B)]^{1/2}}\right\} \quad (2)$$

Saturation Component in given by

$$S= 1 - \frac{3}{(R+G+B)}[\min(R,G,B)] \quad (3)$$

Intensity Component given by

$$I=\frac{1}{3}(R+G+B) \quad (4)$$

2.4 Extraction of HSV (Hue, Saturation,Value)

To convert from RGB to HSV first find the maximum and minimum value from the RGB triplet.
Saturation s then $S=\frac{(\max-\min)}{\max}$ (1)
and value 'V' is

$$V = \max \quad (2)$$

Hue,H is then calculated as follows first calculate R' G' B'

$$R^1 = \frac{\max - R}{\max - \min} \quad (3)$$

$$G^1 = \frac{\max - G}{\max - \min} \quad (4)$$

$$B^1 = \frac{\max - B}{\max - \min} \quad (5)$$

If saturation, S,is O (zero) then has is undefined (ie the color has no has therefore it is monochrome) other wise then, If R = max and G =min

$$H = 5+B' \quad (6)$$

else if R = max and G ≠min

$$H = 1-G' \quad (7)$$

else if G = max and B = min

$$H=R'+1 \quad (8)$$

else if G=max and B≠min

$$H=3-B' \quad (9)$$

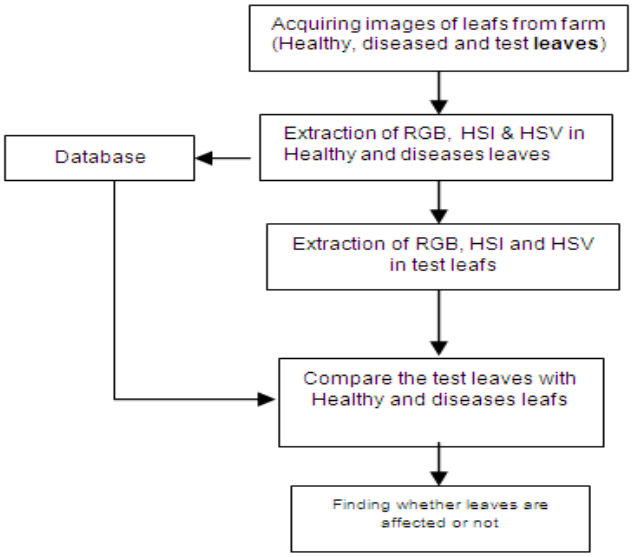
else if R=max

$$H=3+G' \quad (10)$$

otherwise $H=5-R' \quad (11)$

Hue, H, is then converted to degrees by multiplying by 60 giving HSV with S and V between 0 and 1 and H between 0 and 360.

3. METHODOLOGY TO IDENTIFY THE FLOWERING STAGE DISEASE IN BITTERGOURD LEAVES



3.1.1 Collection & taking of image of leafs

Fruiting stages leaves are categorized into healthy, diseased and test leaves. In each category 50 images are taken. Diseased leaves are further divided into five groups (10%, 20%, 40%, 80%, and 100%). 15 images of leaves are taken randomly for testing.

3.1.2 Extraction of RGB, HSI & HSV

RGB, HSI and HSV values are extracted from healthy and diseased leaves. These range of values are stored in Database.

3.1.3 Extraction of RGB, HSI & HSV in test leaves

The values of RGB, HSI and HSV are extracted from test leaves.

3.1.4 Comparing and finding affected leaves

The values of test leaves are compared with healthy and diseased leaves which are stored in database. These helps to find the leaf is affected by disease or not.

4. RESULT

In Normal Leaf's RGB color model, the minimum value for R component obtained is 47pixel and the maximum value is 255 pixel. The minimum value for G component obtained is 51 pixel and the maximum value is 255 pixel. The minimum value for B component obtained is 16 pixel and the maximum value is 255 pixel.The minimum value for V component obtained is 0.26 pixel and the maximum value is 1 pixel.The minimum value for I component obtained is 0.15 pixel and the maximum value is 1 pixel.In Diseased Leave RGB color model, the minimum value for R component obtained is 26pixel and the maximum value is 255 pixel. The minimum value for G component obtained is 30 pixel and the maximum value is 255 pixel. The minimum value for B component obtained is 11 pixel and the maximum value is 255 pixel. The minimum value for V component obtained is 0.20 pixel and the maximum value is 1 pixel. The minimum value for I component obtained is 0.11 pixel and the maximum value is 1 pixel. The values are as shown in Table 1.

Flowering stage leaves are identified and 15 leaves are randomly selected.The images are extracted using MATLAB as shown in fig 4 and fig 5. The values of image are extracted as shown in the table2.The values were compared and it was found that 2 leaves were not affected and remaining all other leaves were affected. The percentage of disease affected is shown in the diagram 1.

Table 1. The minimum and maximum value of Healthy and Diseased leafs

	Red	Green	Blue	Hue	Saturation	Value	Hue	Saturation	Intensity
Healthy	47-255	51-255	16-255	0-1	0-1	0.26-1	0-1	0-1	0.15-1
Diseased	26-255	30-255	11-255	0-1	0-1	0.20-1	0-1	0-1	0.11-1

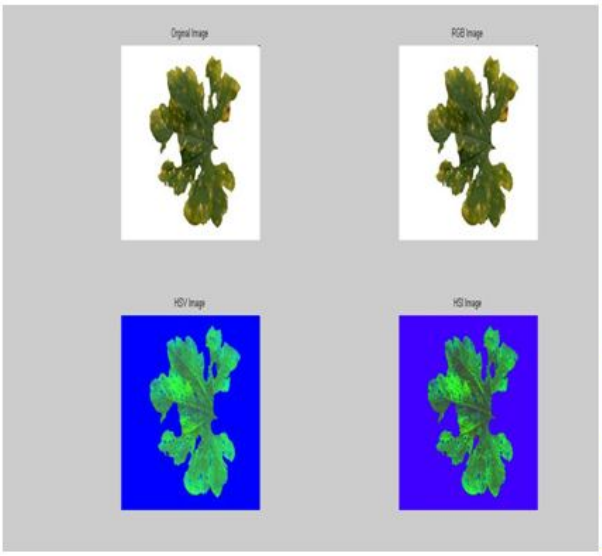


Fig 4. Extracted image in MATLB

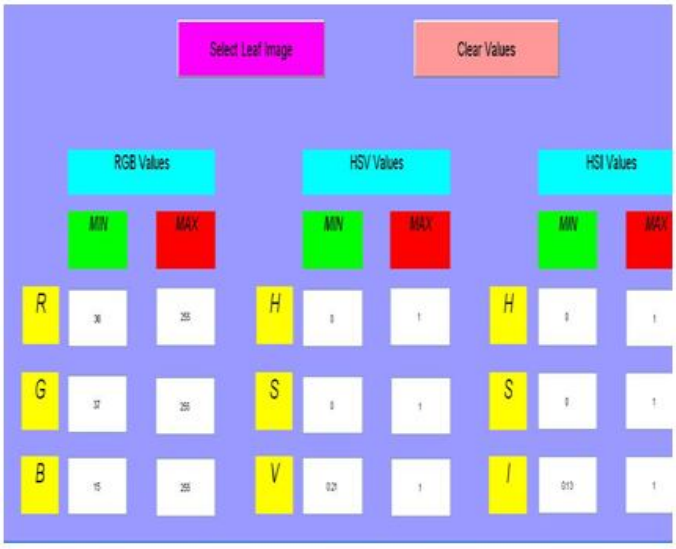


Fig 5. Extracted values of RGB, HSV and HSI in MATLAB

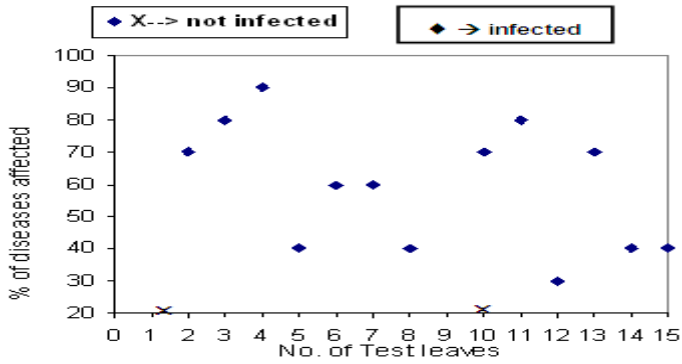


Diagram 1. Percentage of disease affected in flowering stage leafs.

Table 2. Extracted value of flowering stage leafs

No. of leaves		R	G	B	V	I	
1	Front	47	57	18	0.29	0.20	Not Infected
	Back	48	59	19	0.30	0.18	
2	Front	45	47	11	0.18	0.16	Infected
	Back	52	49	13	0.22	0.15	
3	Front	35	53	11	0.21	0.13	Infected
	Back	46	49	12	0.21	0.16	
4	Front	45	40	15	0.25	0.15	Infected
	Back	35	41	15	0.23	0.11	
5	Front	53	61	11	0.29	0.15	Infected
	Back	52	47	12	0.21	0.16	
6	Front	52	61	11	0.28	0.15	Infected
	Back	46	47	12	0.22	0.14	
7	Front	51	62	11	0.29	0.19	Infected
	Back	46	47	13	0.21	0.14	
8	Front	46	51	14	0.25	0.16	Infected
	Back	55	55	11	0.21	0.17	
9	Front	41	47	11	0.28	0.15	Infected
	Back	46	49	11	0.21	0.16	
10	Front	48	58	19	0.29	0.18	Not Infected
	Back	47	70	19	0.29	0.27	
11	Front	46	36	13	0.26	0.13	Infected
	Back	45	46	11	0.20	0.50	
12	Front	45	56	10	0.28	0.15	Infected
	Back	47	61	11	0.21	0.15	
13	Front	47	30	16	0.20	0.15	Infected
	Back	26	46	14	0.25	0.12	
14	Front	61	60	14	0.21	0.15	Infected
	Back	41	51	18	0.25	0.85	
15	Front	60	65	19	0.15	0.15	Infected
	Back	41	50	20	0.20	0.12	

5. LIMITATIONS

The presence of raindrops over leaves can hamper the quality of images also if the atmosphere is cloudy the image quality differs.A constant image background is needed for quality image.Leaves may acquire different shapes like wrinkling causing difficulty in straightening and this affects the quality of image.

6. CONCLUSION

This result shows that the leaves are gradually affected by disease. The percentage of disease affected is different in each leaf. Five leaves are affected below 50 percentage diseases and nine leaves are above50 percentage.So remedial measure can be taken at the appropriate time. This system helps the farmer to detect the disease early.

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