Cotton Plant Leaf Diseases: A Brief Survey

Anjali Chaliha[1], Saransh Goyal[2*], Kritagya Gupta[3], Prashant Udawant[4]

[1,2,3]Student, Department of Information Technology, SVKM's NMIMS MPSTME, Shirpur, India
[4]Assisitant Professor, Department of Information Technology, SVKM's NMIMS MPSTME, Shirpur, India

Abstract: **Cotton is India's most significant cash crop. Among all cash crops in the country, it is also known as "White Gold" or "The King of Fibers." Leaf spot, aphid attack, jassid attack, and whiteflies account for 80-90 percent of illnesses that affect cotton leaves. A review on the location and order of cotton leaf illnesses is introduced in this review. Human eyes have difficulty identifying the specific sort of leaf disease that affects a plant's leaf. Consequently, picture preparing, and AI approaches can be gainful in appropriately distinguishing cotton leaf sicknesses. The photographs for this undertaking were taken utilizing an advanced camera in a cotton field.**

Keywords: **Aphid Attack, classification, image processing, jassid attack, leaf spot, plant disease detection, whiteflies.**

1. Introduction

Today, India's agricultural output ranks second in the world. Developed agriculture must find new ways to increase efficiency. Farmers in rural areas may have difficulty distinguishing diseases that may occur during harvest. Our main purpose is to observe the morphology through photo processing and machine learning to distinguish diseases introduced into cotton plants. Diseases and insect pests damage some crops and plants, reduce grain output, and cause food instability. Various modern technologies have emerged to minimize post-harvest processing and maximize productivity. Recently, server-based, and mobile-based disease identification methods have been used for disease identification. Some of the factors in these technologies are high-resolution cameras, powerful processing capabilities, and a wide range of built-in accessories, which are additional benefits of automatic disease detection. Use modern methods such as machine learning and deep learning algorithms to improve the recognition rate and accuracy of the results. To obtain excellent results in plant disease detection, the Deep Learning method requires more data. This is a disadvantage because the currently available data sets are usually small and do not contain enough images. This is necessary for high-quality crystals. The comprehensive data set should contain as many photos taken under as many different conditions as possible.

2. Types of Cotton Leaf Diseases and their Characteristics

There are three main types of diseases affecting the entire plant, namely virus disease, bacterial disease, and fungal disease. In viral diseases, the virus enters the plant through the disease spots that affect the natural growth of the plant. One is the mechanical damage to the plant or leaves or the plant infection by. Cotton leaf frizzy virus is an example of a viral disease. Bacterial diseases are caused by bacteria that can attack stems, leaves, roots, etc. Bacterial decay is one of bacterial diseases. Fungal disease a fungus that causes the entire plant is controlled using fungicides. Gray powdery mildew is one of fungal diseases. Few of them are –

1) Leaf Spot

During the growth season, one or more of the cotton leaf spots can be found in almost every cotton field. Some have to do with the plant's maturity and have little bearing on its growth. Others form on seedlings or young plants and wreak havoc on normal growth and fruiting. Leaf spot organisms generally cause the infected leaves to shed, but some can also harm the branches and bolls. Alternaria tenuis is most likely the most common cause of leaf spot. Although leaf spot is predominantly a leaf disease, it may also affect cotyledons and cotton bolls. The illness manifests itself as tiny, circular brown, grey-brown, or tan patches that range in size from 1 to 10 mm in diameter. Mature spots have a dry, lifeless, grey center that cracks and falls out of the plant. Farmers may have trouble distinguishing between leaf spot and Bacterial blight.

Fig. 1. Leaf Spot

2) Whiteflies

Whitefly is a serious cotton pest that feeds on the underside of leaves and spreads diseases such as cotton leaf roll virus, thereby reducing yield. The white fly feeds on the sap of the leaves and releases the liquid on the leaves, where a black fungus grows. This affects photosynthesis, the nutrient process

*Corresponding author: saransh.goyal018@nmims.edu.in

of the plant, thereby reducing the plant's strength. Cotton whiteflies stay lively for the duration of the yr transferring from one plant to another. They are very lively from June to September however are maximum lively at some point of the new and humid months of August and September. Whiteflies are interested in nitrogen wealthy plant life. Whiteflies stay on different host plant life at some point of the year, like weeds, okra, brinjal, cucurbits and cowpeas.

Fig. 2. Whiteflies

3) Jassid Attack

Cotton jassid is a serious sucking pest on cotton. Grown-ups are little, level like the tip of a focal point. Grown-ups are normally yellow-green or white with dark spots on their forewings. They will bounce and take off with the smallest, unsettling influence. Cotton jassid sucks juice from under the leaves and leaf buds. When jassids are abundant, cotton growth is inhibited, leaves are turned down, and plants may experience severe fruit drop before flowering. The leaves turn white, and the edges appear rusty red. Jassid attacks cotton all year round and lays eggs in the soft tissues of plants. Cotton jassids is more dynamic in the hotter times of summer and can likewise benefit from different plants like potatoes, stew peppers, eggplant, and okra.

Fig. 3. Jassid Attack

4) Aphid Attack

Adults and larvae (oil) are light yellow or dark green, and black oil can also be seen. Toward the start of the period, they look hazier and assault the youthful pieces of the plant. Due to infestation, the affected leaves turn down and then fall off. At the end of the season, the oil stops eating and hides under the leaves. Most adults have no wings. These oils release a sticky substance called "honeydew." A kind of fungus called "soot mold" begins to grow on honeydew, and as the amount of oil increases, the leaves turn black and become sticky. The affected leaves began to fall. Oilseeds continue to grow rapidly

throughout the year. They can without much of a stretch be seen on cotton plants in the long periods of August and September. In addition to cotton, the oil attacks more than 60 species of plants, including watermelons, cucumbers, and pumpkins. It also attacks other vegetables such as peppers, eggplants, okra, etc.

Fig. 4. Aphid Attack

3. Approach for Detection and Classification of Leaf

The general method for identifying leaf illness involves two steps: image processing and disease categorization using machine learning techniques.
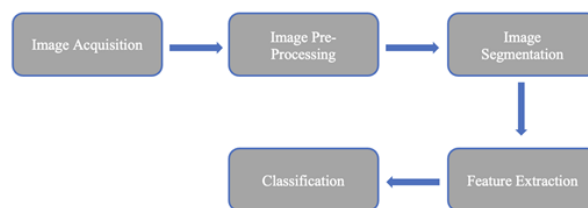

Fig. 5. Flow Diagram

1) Image Processing

Picture Handling (IP) is a sort of PC innovation that permits us to measure, examine, and extricate data from pictures. The recognizable proof of plant infections is the way to staying away from the deficiency of yield and amount of agrarian items. Studying plant diseases means studying the visual patterns visible on plants. Plant health monitoring and disease detection are essential for sustainable agriculture. It is very difficult to manually monitor plant diseases. It requires a lot of work, knowledge of plant diseases, and too much processing time. Therefore, image processing is used to detect plant diseases. Patterns are learned by algorithms based on training data with certain parameters. However, based on the performance indicators, we may always fine-tune the trained model. Finally, we may apply the trained model to new data to generate new predictions.

2) Machine Learning

AI involves the innovative work of calculations that gain from and make expectations dependent on gave information. For distinguishing or classifying ailments, AI for the most part utilizes arrangement calculations. There are several categorization techniques available. Administered learning, unaided learning, and support learning are three fundamental classes for AI undertakings.

4. Related Work

Plant leaf disease detection has been the subject of a few surveys. Computer-based detection of leaf disease is an important study issue because it has the potential to provide numerous benefits in terms of automatically identifying illness from symptoms that arise on the leaf disease in its early stages. The work in [1] recognized and proposed the rapid need to develop reliable and cost-effective health monitoring systems for the agricultural sector. The paper [2] proposed a model for the detection of plant diseases using texture characteristics such as inertia, homogeneity and correlation obtained by calculating the generation matrix in gray scale. Paper [3] classified the objects on the sheets in the a * and b * color spaces into three groups by color-based grouping, which are the background, the foreground, and the diseased part. In paper [4] it was observed that CNN is very suitable for automatic identification of plant diseases. They also used CNN's previously trained AlexNet and Squeeze models for disease detection on tomato leaves. Paper [5] presents a scheme that uses mobile phones for real-time on-field imaging of diseased plants followed by disease diagnosis via analysis of visual phenotypes. In [6] review it saw that Convolutional Neural Organization gives high exactness and identifies a more prominent number of infections of various yields.

5. On Cotton Leaf Disease Recognition and Identification

In this section, our survey of six papers for detection and classification of cotton leaf diseases is carried out. Through the survey of detection of cotton leaf diseases, we did not find any available database for cotton leaf disease. Therefore, we prepared our own database by acquiring cotton leaf images from the field. The table below represents the short conclusion of the survey.

Table 1.
Survey on Cotton Leaf Disease Recognition and Identification

Name	Image Dataset	No. of Disease	Image Processing Steps	Disease Segmentation Technique	Extracted Features	Classifier: Accuracy	Region
P. Warne et al. [7]	400 images	1) Alternaria 2) Cercospora 3) Red spot	Histogram equalization, Feature extraction	k-means clustering	Color, Shape	NN: 89.56%	Akola
P. R. Rothe et al. [8]	Images are taken using Cannon A460 digital camera	1)Bacterialblight 2) Alternaria 3) Myrothecium	Segmentation, Feature extraction	Otsu's thresholding algorithm	Color, Shape	SVM: 90%	Nagpur
B. Adsule et al [9]	200 images	1)Downey mildew 2)Anthracnose	Image preprocessing, segmentation	Otsu global thresholding	Color, Shape, Texture	SVM 70% NN 96.27%	Nagpur
S. Patil et al. [10]	Images are captured using Mobile camera	Leaf Spot	Image restoration, Filtering Segmentation	k-means clustering	Color, Shape, Texture	SVM 89%	Not specified
M.Sartin et al. [11]	Not specified	1) Fusarium wilt 2) Verticillium Wilt 3)Leaf blight	Image pre-processing, Edge detection, Feature extraction, Segmentation	Otsu thresholding	Color, Shape	NN 98%	Nagpur
D. Abhang et al. [12]	Images are taken using Digital Camera	1) Bacterial blight 2)Myrothecium 3)Alternaria	Enhancement Segmentation, Feature Extraction	k-means clustering	Color, Shape	Not Specified	Nagpur and cotton fields in Buldhana and Wardha

6. Conclusion

The accurate detection and classification of plant diseases is very important for the successful cultivation of crops, and it can be completed by image processing. In this article, we have discussed some of the various cotton plant diseases. This article also discusses the characteristics of these diseases. The paper likewise did an overview on characteristic extraction and arrangement strategies to extricate the attributes of tainted leaves and the order of plant illnesses. Using machine learning and deep learning methods, we can use image processing technology to accurately identify and classify various plant diseases.

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