



RESEARCH ARTICLE

STUDY OF ROSE PLANT DISEASES AND ITS IDENTIFICATION WITH MODERN AUTOMATION TECHNIQUES

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ABSTRACT

Today in the world of agriculture plants are demanding the utmost care to protect from various diseases. These diseases can create several damage to different plants & their growth. This paper characterizes different diseases of rose plants, common stages followed in plant disease identification methods. Few changes are suggested in the preprocessing stage to improve the quality of results. Lot of research is going on in this area with the help of Machine learning & Image processing. As some diseases of rose plant are common with many of the cash crops like cotton, this work can be further extended to the automatic plant disease identification method of many such plants.

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INTRODUCTION

India being the agricultural country, advancement in this field plays important role. For the further development in this field, protection of plants and helping the farmer is the main concern (Jayme Garcia ArnalBarbedo, 2016 and Jayme Garcia ArnalBarbedo, 2013). Producing agriculture products is a difficult task to accomplish due to the number of micro-organism attacks, pests and bacterial agents causing different diseases. There can be natural factors such as weather which cannot be controlled by the farmers so if the plants are affected by pest it is to be immediately rectified (Sanjana, 2015). This review paper discusses on the various steps in early automatic detection of different rose plant disease proposed by different authors (Zulkifli Bin Husin, 2012). Roses are liked by one and all, irrespective of the age group. A bouquet is incomplete until roses are not present in it. The reason why all of us love roses is the pleasant smell that it possesses. They are not only famous for their fragrance but also for the diversity in their colors. Plants that are grown today need utmost care so that they are made free from any sort of diseases. These diseases cause severe damage to the plants and their growth is affected (Sanjana, 2015). The rose plant is also no exception. It also suffers from a numerous disease that can cause it a stunned and

a hampered growth. With the help of technological growth various opinions about automatic detecting the disease of the rose plants are studied in this survey paper (Jayme Garcia ArnalBarbedo, 2016; Jayme Garcia ArnalBarbedo, 2013 and Rabia Masood, 2016)

Literature Survey

The different types of roses vary on the grounds of their ability to resist any disease and the maintenance they require. For the successful growth of roses, we should be able to differentiate among the species that are in need of care that can be provided. The shrub type roses bloom beautifully with the very less amount of chemical control measures. On the other hand, the hybrid type of roses requires an effective spraying before the season begins (Haiguang, 2012). Some of the diseases that the rose plant suffers from are enlisted below.

Black Spot: Black spot is a one of the common diseases that's present in the roses. It is also considered as one of the most serious diseases that are caused by the fungus named *Diplocarpon rosae*. The severity of the disease is at its peak post the warm springs. The symptoms that can be seen in the rose plant include rounded black spots that are covered by a yellow portion. The leaves that are infected by this disease often fall off the plants. This infection is so harsh, that continues throughout the summer season. As a result of this infection, the plants suffer from stunted growth, producing

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fewer and paler leaves. By the midst of the summer, the most severely affected plants, might have shed half of their leaves.

Prevention and Treatment

The spread of black spot in roses can be reduced and in near future the minimization of infections can be done by the following methods

Maintaining good sanitation The practice of good sanitation is must in order to reduce the future infections and disease development. In fall or winters, the old leaves are to be removed on the ground along with the mulch that's polluted with the diseased leaves. The new layer of mulch is to be replaced before there's a growth of new roses

Removal and Destruction of Infected Canes: The canes that are affected by the black spot infection are to be removed and are dark and identified by reddish patches also known as the lesions. The most severely affected plants are to be pruned back in the winter season. During the growing season, the infected leaves should be removed and disposed as soon as they are spotted (Jones, 1999).

Keeping the leaves dry: Syringing of plants with water and the usage of an overhead irrigation methods in the later afternoon or early evening should be avoided. Planting the rose in full sun, speedy drying of leaves done. Distance must be maintained between two plants for good circulation of air.

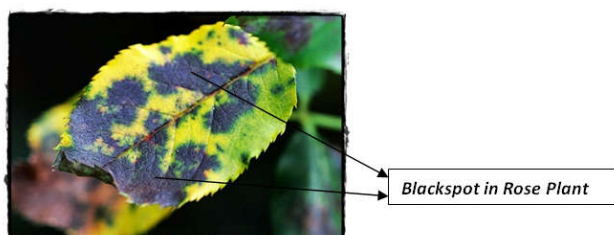


Figure 1. Black spot in Rose Plant

Powdery Mildew: The powdery mildew is caused in roses due to *Peronosporasparsa*, which is also responsible for its growth in other plants also such as raspberry (Jones, 1999 and Clemson). On the surface of fresh leaves powdery mildew creates grayish-white dusty stuff. There are also chances of distortion in some of the leaves and some amount of leaves might also drop. There's also a possibility that the flower buds may fail to blossom and the fortunate ones that open up, might be producing the poorer quality of flowers. This infection has no fixed time for its spread as it can occur at any point of time during the growing season, when the temperature is warm and the humidity is low in the day time and maximum during night (Clemson) The severity of this disease can be seen in the shady areas and when the nights are cooler.

Prevention and Treatment

- There is a diversity in the roses and they differ in their susceptibility to this particular disease. This disease can be measured with the varieties of roses. A thin film of water is responsible for the inhibition of infection and in the years where there is enough of rainfall especially during the spring and summer. The destruction and removal of all the diseased leaves along with the canes

should take place during the growing season of the plant.

- In case the severity of the disease is too high, and can't be controlled by certain chemical controls, an appropriate fungicide should be chosen, that is responsible for stopping both blackspot and powdery mildew (Mark Windham, 2013)

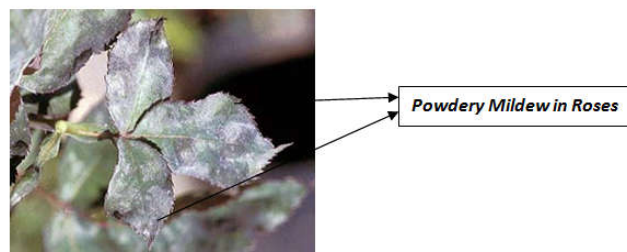


Figure 2. Powdery Mildew in Roses

Stem Canker & Dieback: This looks like no color and dead at the rose canes. It can vary in different colors. This type of disease caused by different fungi including *Botryosphaeria*, *Leptosphaeria*. All these type of fungi enter the canes through the wounds that found in winter due to flower cutting casual pruning. The cankers can expand up to the base of the plant. It may kill the whole plant. Their occurring is common in those roses that are weakened by the blackspot.

Prevention and Treatment

As such there are no fungicides available that can control and eradicate stem cankers in roses. Care can be taken by controlling the spread of other diseases such as the black spot, powdery mildew.

Avoiding injury to the plant: Wounds formed because of various ways such as cultivating, pruning, transplanting of flowers act as a gateway for the fungus to the plant. Thus, injury should be avoided so as to stop the spreading of fungus in the plants.

Pruning properly: Pruning should be done properly and to an outwards facing bud. Due to this too many branches wouldn't grow at the center of plant.

Removal of dead & diseased part of the cane: The removal of all dead as well as diseased portions of the canes should be done immediately, as they might lead to further damage in the plants. Making all pruning cuts below the diseased and infected areas (Gary, 2012).

Rust: Another disease that a rose plant suffers from is the rose rust, which is caused by the fungi *Phragmidium* species. This species of fungi cause an orange colored appearance on the stems as well as the leaves. When the rust is at its peak of severity, an orange substance appears on the plant and ground below the plant. This disease attacks all the parts of the plants other than the roots and petals. The most infected and diseased leaves turn either yellowish or brownish and finally they drop.

Prevention and Treatment

- The utmost care that should be taken is that the plants should be provided with good air circulation. Also, the roses should not be planted in crowded areas and

pruning of plants at regular intervals should be done in order to keep the centers of the plant open

- The plants should be watered before noon and also the wetting of leaves should also be avoided
- Diseased leaves should be removed and destroyed, so that the infection doesn't spread

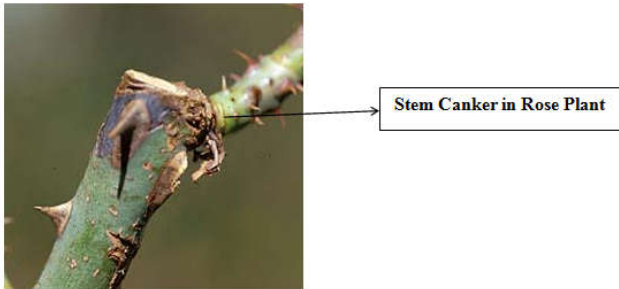


Figure 3. Stem Canker in Rose Plant

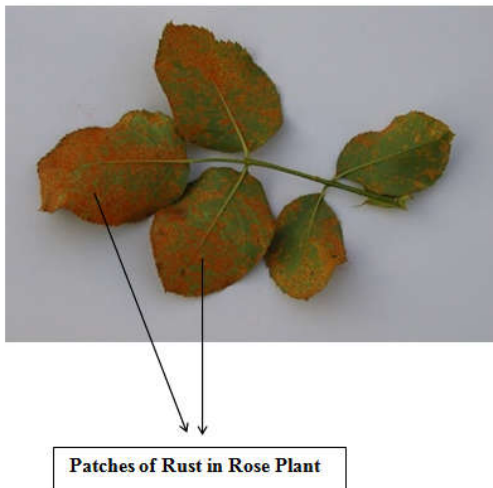


Figure 4. Patches of Rust in Rose Plant

Botrytis Blight: Due to this the rot of the plant becomes gray in color. The buds and flowers colors changes to gray or brownish. 62 to 72 F temperature & moist in weather is most favorable for this fungus. Canes become colorless due to infection of this fungus. The infected flower petals can be identified with small spots which are covered by reddish halos. With the time this will expand with irregular blotches. This disease can cause the bud's inability to fail and often droop.

Prevention and Treatment:

- The most important factor for prevention of the disease is to keep the area clean. All the faded flower blossoms and leaves are collected and discarded. Good air circulation should be provided and wetting of the leaves should be avoided when it's being watered
- This particular disease can easily develop on the canes that have been damaged. It can also damage the canes if kept wet.
- For necessary chemical controls, fungicides that contain thiophanate methyl or neem oil should be used. The neem oil is to be used on a trial basis, especially during the hot weather (Jones, 1999; Clemson and Gary, 2010).

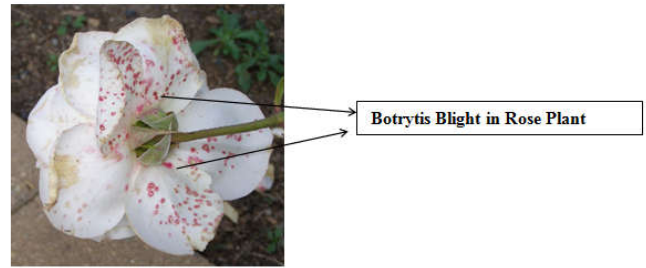


Figure 5. Patches of Rust in Rose Plant

Rose Rosette Disease: This disease is considered to be an untreatable disease and is caused because of the Rose rosette virus (RRV). It gets introduced & later spreads in the rose plant during the feeding (Sachin, 2015). The leaf curl mite affects a very portion but if it carries the RRV virus, the symptoms of infection can be seen within one to three months. Some of the symptoms that can be seen on the roses include the reddened terminal growth taking place on the infected leaves, with the stems becoming thicker. Stems are covered with lot of green or red colored thorns. The leaves on the diseases branches are very small in size compared to all usual leaves. The flowering capability of the plant is also reduced. These symptoms are seen during end of spring and start of summer. RRV damages the whole plant also spreads on neighboring plants. Infected plants dies within one or two years.

Prevention and Treatment

- The wild multiflora roses are very much affected by this disease. So any wild plant near to rose plant must be removed properly.
- The diseased roses must be immediately removed & destroyed. No roots should be left behind so that there are any chances of sprouting of the disease again.
- No part of the uprooted and infected plant should be left behind in the garden.
- Spacing should be done between the rose plants and they should not touch each other

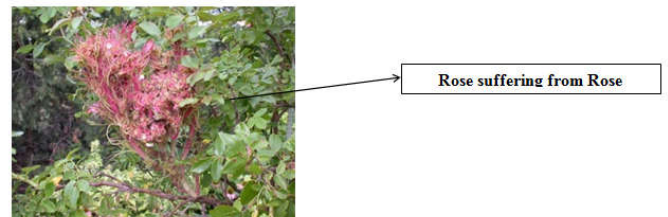


Figure 6. Rose suffering from Rose Rosette

Crown Gall: This disease is introduced due to soil preventing bacteria named, *Agrobacterium tumefaciens*. Due to this swelling occurs on the stems and roots below the soil surface. The swollen galls are light green in color and at a tender age they are nearly white. As size increases, color of galls darkens. It becomes woody. The galls are responsible for disruption of water flow and nutrients that travel upto the roots and plants, thereby making weakening and restricting the growth of the plant top.

Prevention and Treatment: For prevention of galls, disease-free roses should be chosen. Once a plant is infected, there are no countermeasures to stop the infection.

- Injury should be avoided to the roots and top of the plant in the process of plantation and cultivation, as the bacteria can enter the plant through the fresh wounds
- The infected plants should be removed as early as the galls are spotted
- If possible, then infected plants area soil should be removed and discarded immediately.

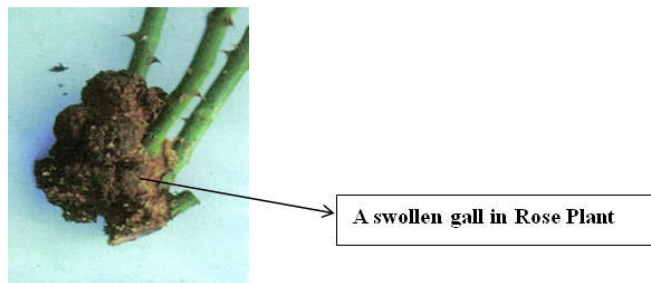


Figure 7. A swollen gall in Rose Plant

The following table is the summary of all the diseases that occur in roses and also it contains the cause along with the fungicides that need to be used for overcoming these diseases and thereby retrieving the health of roses.

Existing Automatic Rose Disease identification Methods:

Existing automatic rose disease identification processing scheme contains image acquisition with a digital camera. As existing technique is based on image processing with different stages, which prominently includes image enhancement & image segmentation followed by feature extraction and classification (Haiguang Wang, 2012; Sachin, 2015; Vijai Singh, 2015; HarshalWaghmare&RadhaKokareDetection, 2016; Kiran, 2014; Kadu, 2015; Suproteem, 2016).

Five major stages used for identifying of plants disease are

Image acquisition: Image of different leaves is captured using a digital camera. Input image is resized to 256*256 pixels.

Table 1. Summary of all the rose plant diseases

S. No:	Name of the Disease	Causing Fungi	Fungicide(s) Used	Image of the Disease
1.	Black Spot	<i>Diplocarponrosae</i>	chlorothalonil, mancozeb	
2.	Powdery Mildew	<i>Sphaerothecapannosa</i>	Propiconazole	
3.	Stem Canker	<i>Botryosphaeria, Leptosphaeria</i>	No particular fungi used for stem cankers, but fungicides used for controlling black spot and mildew need to be deployed	
4.	Rust	<i>Phragmidium</i>	Fungicides that contain the portions of myclobutanil, mancozeb or propiconazole	
5.	Botrytis Blight	<i>Botrytis cinerea</i>	Fungicides containing thiophanate methyl, chlorothalonil	
6.	Rose Rosette Disease	Rose rosette virus and <i>Phyllocoptesfructiplilus</i>	Bifenthrin sprays	
7.	Crown Gall	<i>Agrobacterium tumefaciens</i>	Disinfecting the plants in a solution of 0.5% sodium hypochlorite for several minutes	

This is the first and most important stage in automatic disease identification. In this step hardware like scanner or camera is involved. The quality of hardware should be very good which helps for the smooth future operations.

Image Pre-Processing: In the clustering & classification process the input data should be very clear. If the captured images are not clear then clustering becomes difficult. Image preprocessing is the stage in which input image is improved with enhancement in image features. It contain color space conversion and image quality improvement called as image enhancement. This is achieved with DCT by scaling the transform coefficient

Color space conversion: To decide the infected part of the leaf, specific image portion need to be identified with the help of image processing. This stage gives idea about color transformation which helps in cluster separation. With the help of RGB color space, it determines the luminosity and chromaticity. RGB generates color and HSV (hue saturation value) model helps for color perception.

Image Segmentation: - Many algorithms are present for the purpose of image segmentation. Amongst all K-mean clustering algorithm is most prominently used for image segmentation purpose. It helps to classify the pixels based on the parameters & features set. It simplifies the image representation by forming different clusters. If a leaf contains more than one disease then different clusters will be formed.

Feature Extraction: In this stage feature extraction will took place from the segmentation portions. This extraction can be either fractional, statistical, structural or signal processing. Some basic methods Spatial Gray-level Dependence Matrices (SGDM) , Color co-occurrence, Gabbar filters, Grey Level Co-occurrence Matrices (GLCM), Principal component analysis and Wavelets are used for feature extraction.

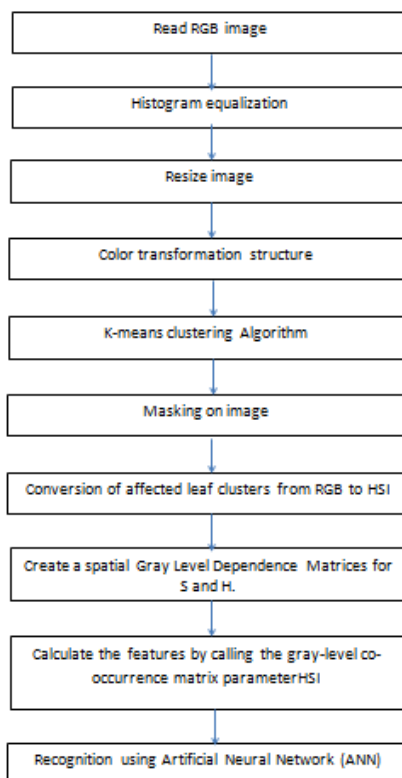


Figure 8. Block diagram shows the steps proposed in preprocessing stages

Classifier: Based on the existing dataset of rose plant diseases, the exact matching of the processed image disease must be compared. It helps for exact identification of the disease. For this different classification methods are used. Most prominently used classification techniques are K-Nearest neighbor (KNN), Radial basis function (RBF), Probabilistic Neural Networks (PNN), Back Propagation Network (BPN), Support Vector Machine (SVM).

Proposed Automatic Rose Disease identification Methods

Study of various research papers (Braik, 2011; SmitaNaikwadi, 2013; Hrishikesh, 2014; Baldomero, 2016; Surender Kumar, 2015; Prakash, 2015) shows that by following the above mentioned stages, plant disease can be identified. But the major problem is accuracy of the results to give the precious solution. In proposed automatic disease identification of rose plant, the several images of rose leaf are taken from the dataset and are observed in order to improve the quality of image prior to clustering process. Flowing block diagram shows the steps proposed in preprocessing stages to improve the results of existing method of automatic rose plant health disease identification method.

Conclusion

Here review of different diseases of rose plants is made. In the critical review different symptoms of a rose plant disease, their prevention & cure techniques are studied. It is concluded that for the better growth of the rose plant early disease identification of plant is important. Visual inspection is less expensive method as compare to automation methods for plant disease identification. But accuracy & reliability is far better in the automated methods using image processing. If someone improves the preprocessing stage the results will be more accurate. Many diseases of rose plants are common in many other cash crops like cotton. In future this automatic disease identification can be developed for such crops which will be agreat revolution in the field of agriculture.

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