# Review of various grape diseases

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***Abstract***

Grapevine is a foremost vegetative disseminated berry with high global socioeconomic prominence. It is vulnerable to numerous graft-transmitted agents that cause several diseases and extensive crop fatalities, decreasing fruit quality, plant strength, and also reduce the durability of vines. The vegetative transmission and frequent exchanges of propagative material within countries contribute to unfold these pathogens, esteeming the development of multifaceted diseases. Its lasting life cycle further accelerates the blending and introduction of numerous epidemiologic agents into a single plant. At present, almost 65 viruses belonging to different families have been reported infecting grapevines, however, all do not cause economically significant diseases. Regrettably, there are several breeds of vine diseases that prosper in all circumstances. Bacteria and fungi are a source of most common grapevine diseases. Insects can also propagate viruses and harm roots. Ecological circumstances can cause mold development that inflicts disorder on grapevines in vineyards. Here, we review the recent knowledge of these viruses, report advances in their diagnosis and prospection of new species, and give indications about the management of the associated grapevine diseases.

***IndexTerms*** **- Grapevine, Crop fatalities,grapevine diseases.**

- **Introduction**

India is an agricultural country. More than seventy per cent of the population depends on agriculture. Our economy in major depends on agriculture. Thus, development in this field will highly contribute to the economic welfare. Irrigation/Water stress, Fertilizers, pesticides and quality of yield, disease monitoring and detection are the major factors of concern in agriculture. Major expertise is required to analyze the problems. Such problems are being time consuming and also costlier issues in the developing countries.

We are inflating in a new epoch of computing technology, i.e. Internet of Things (IoT). IOT is a kind of "wide-ranging universal neural structure" in the cloud which interfaces diverse things. The IoT is a cleverly associated gadgets and frameworks which encompassed savvy machines collaborating and communicating with further machines, surroundings, matters and groundworks.

In the Agricultural sector, endeavors are being made to improve the efficiency and lessen fatalities by utilizing the cutting edge innovation and gear. One such technology, such as, Internet of Things can come about into economical yet operative strategies for agribusiness, which subsequently will without a doubt, offer rise to greater quality production.

Grape farming has social and monetary significance in India. Maharashtra positions first in grape production[1]. In the due course, the quality of grapes has debased in light of many reasons. One of the essential causes is ailments on grapes. To avoid maladies, agriculturists sprig tremendous measure of pesticides, as the consequence of which the creation cost expands. Agriculturists are likewise incapable of distinguishing the infections physically. The illnesses are recognized simply after the disease, nevertheless it takes up a great deal of time and unfavorably affect the vineyard.

Grapes are a harvest that is vulnerable to numerous infections. The imperative grape maladies are anthracnose, downy mildew, powdery mildew and bacterial leaf spot, mealy bug, black rot and some more. It is prescribed that vineyards be efficiently examined all through the developing season to screen the appearance and improvement of infections. Also, at harvest and toward the finish of the season, it is recommended, to evaluate the occurrence of ailments like downy and powdery mildew or anthracnose on the leaves to assess the level of inoculum. Quick, precise distinguishing proof of ailments in the vineyard is vital to avert genuine flare-ups and misfortunes in yield and quality.

The trending and future technologies like IOT, digital image processing alongside sensor networks has demonstrated their evitable accomplishment in different applications individually, but the combination of these is so far non-existent.

An expert system based on the Internet of Things (IoT) can be used to collect and monitor the real time data. To further detect the grape leaf diseases, an image processing based approach can be applied. This will help to take proactive and preventive actions.

The trending and future advancements like IOT, digital image processing close by sensor systems have exhibited their evitable achievement in various applications separately, however the blend of these is so far non-existent.

We propose a specialist framework in light of the Internet of Things (IoT) to gather and monitor real continuous information. To additionally recognize the grape leaf maladies, an image processing based approach will be utilized. This will take proactive and preventive actions.

The objective is to detect, identify, accurately quantify and prevent disease occurring in order to minimize the losses and increase the economical profit.

This review endeavors to present a gritty record of grapevine diseases and their protection followed by a concise discourse on technological measures to determine them.

- **LITERATURE REVIEW**

Grape diseases arise due to many reasons , to name a few as Fungi, Bacteria, Virus, Pests.

**Fungal Diseases :**

Powdery Mildew, Downy Mildew, Rust, Phosmopsis cane, Leaf Spot, Bortrysis Bunch Rot

**Bacterial Diseases :**

Crown Gall of Grape

**Viral :**

Grapevine fan leaf, Arabic mosaic ,Rupestris stem pitting ,

**Pests**

Grape cane borer, Mealy bug, Spider Mites, Vine Girdler

**Fungal Diseases**

The vital grape diseases are anthracnose, downy mildew, powdery mildew and bacterial leaf spot. In current years, Alternaria is additionally turning into a genuine pathogen[2].

**Powdery Mildew:**

This is a fundamental disease caused by the parasite Uncinulanecator, that can taint each and every tissue of the grapevine [3]. This has a fine white appearance and produces a whitish dim, dusty growth on grape leaves or shoots and fruits as presented in Fig.1.


Figure 1 a) Powdery Mildew on leaf b) Grapes with powdery mildew c) Powdery Mildew on shoots d) Disease on buds

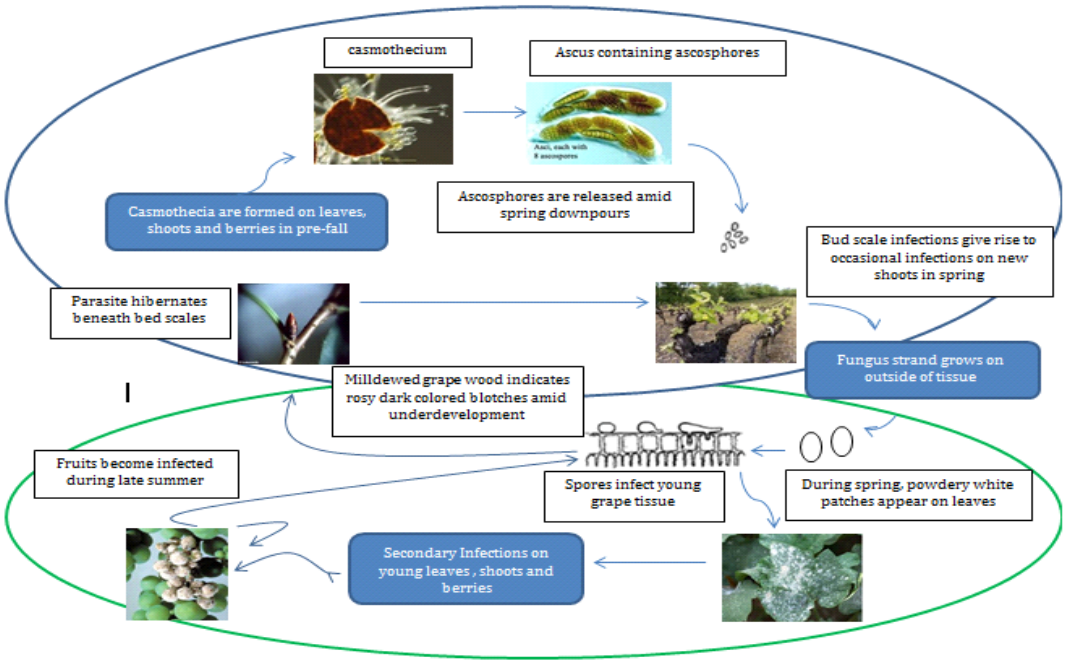



Figure.2 Powdery Mildew disease life cycle[4]

Due to this, the bunch stems and green shoots often seem to be twisted or hindered. Berries too can be contaminated, resulting in the reduction of the wine quality, even if the infection is insignificant. Berries are vulnerable to disease from early sprout through three in a month after blossom. The leaves infected due to powdery mildew may turn dim and tumble off.

As shown in Fig.2, the temperatures of $21^0$C to $31^0$C are ideal for contamination and disorder, in spite of the fact that the disease can ensue from $15^0$C to $32^0$C. Temperatures over $35^0$C restrain germination of conidia and exceeding $40^0$C they are thrashed. High relative humidity is helpful for creation of conidia. Climatic moisture in the 40 to 100 percent relative moistness extend is adequate for germination of conidia and contamination.

Free moisture, particularly rainfall, is adverse to existence of of conidia. Low, diffuse light appears to support powdery mildew expansion. Under ideal conditions, the time from contamination to generation of conidia is around seven days. It is critical to recall that powdery mildew can be a major issue in drier emerging seasons when it is excessively dry for different diseases, for example, dark decay or downy mildew to raise.

**Downy Mildew:**

The grapes become highest prone to the Downy Mildew disease. It is responsible for the severe damages of the crops. The risk of infection is most common during the 'Adra lunar mansion' of rainy season i.e. the wet moist weather. Sticks and bunches of grapes also damage due to inefficiency cause of this disease.

Downy mildew [5] is caused by the parasite Plasmoparaviticola. The disease cycle of Downy Mildew is displayed in Fig 3. The parasite hibernates in contaminated leaves on the ground and conceivably in contaminated shoots. The overwintering spore (oospore) grows in the spring and develops an alternate sort of spore (sporangium). These sporangia are spread by wind and sprinkling precipitation. At the point when plant parts are secured with a flick of humidity, the sporangia discharge little swaying spores, called zoospores. Zoospores, which likewise are spread by splashing rain, sprout by developing a germ tube that enters the leaf through stomates (minor pores) on the lower leaf surface. The Fig.4 depicts the damages caused due to downy mildew.The ideal temperature for malady advancement is $18^0$C to $25^0$C.

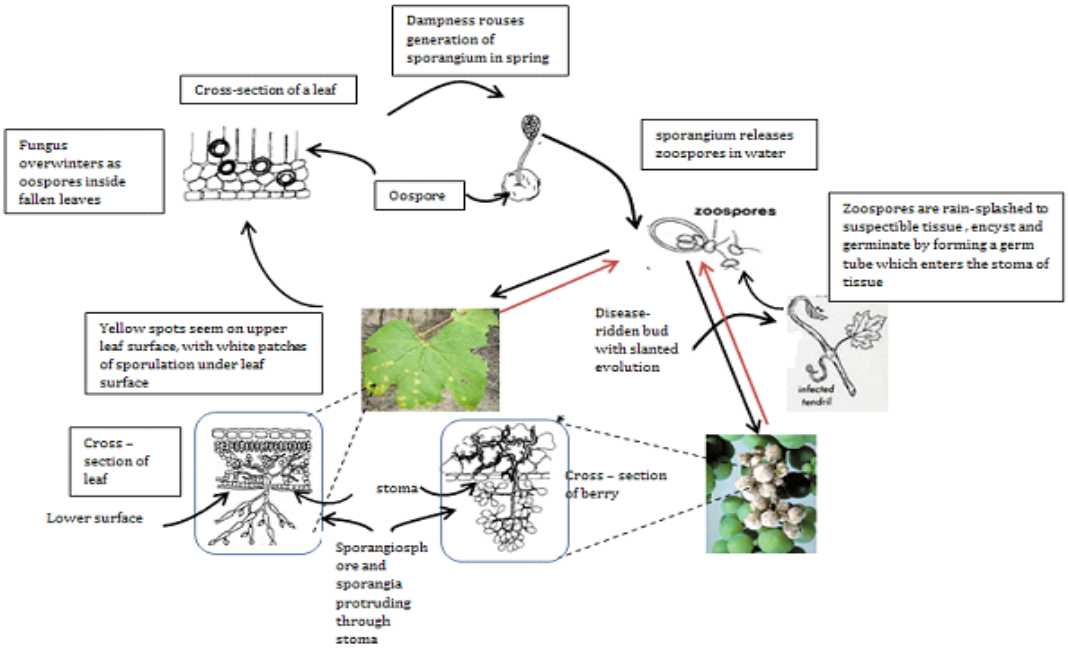
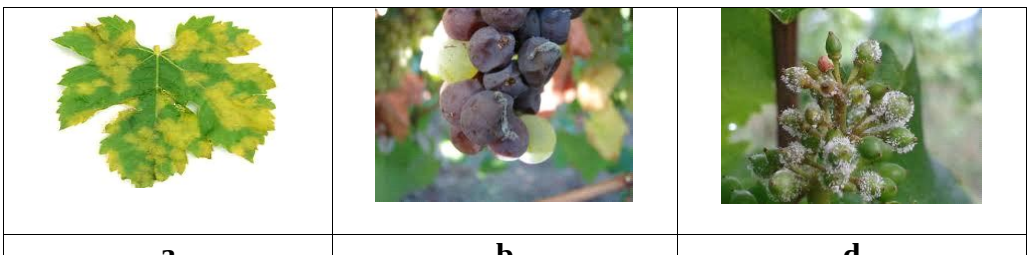



Figure.3: Downy Mildew disease life cycle [6]



| a | b | d |
|---|---|---|

Figure.4 a) Downy Mildew on leaf b) Grapes with downy mildew c) Downy Mildew on buds

The infection can withstand a base temperature of $12^0$C to $13^0$C and a greatest temperature of around $30^0$C. Once inside the plant, the organism develops and spreads through tissues. Contaminations are generally noticeable as injuries in around 7– 12 days. During the evening amid times of high moistness and temperatures over $13^0$C, the organism becomes out through the stomates of contaminated tissue and creates infinitesimal, stretched, tree-like structures (sporangiophores) on the lower leaf surface. More spores (sporangia) are created on the tips of these tree-like structures. The little sporangiophores and sporangia make up the cottony, downy mildew development.

**Anthracnose:**

This is also known as bird's-eye rot. Anthracnose of grape is caused by the organism Elsinoeampelina[7]. The fungus overwinters in the vineyards as sclerotia (parasitic survival structures) on contaminated shoots. In the spring, sclerotia on contaminated shoots develop to yield ample spores (conidia) when they are wet for 24 hours or more, as well as the temperature is over $2^0$C. Conidia are spread by sprinkling precipitation to new developing tissues and are not carried by airstream. Another sort of spore, called an ascospore, is developed inside sexual fruiting bodies and may likewise shape on tainted sticks and berries left on the ground or in the trellis from the preceding year.

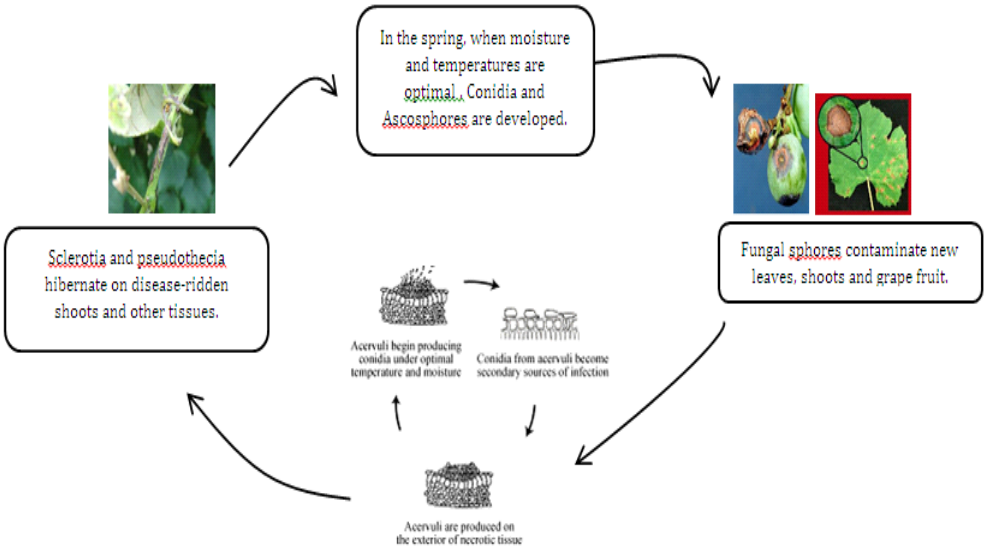



Figure.5 Anthrachnose Disease Cycle[8]

Once the disease is built up, abiogenetic fruiting bodies called acervuli frame on the diseased ranges. These acervuli create conidia in the course of wet climate. These conidia are the optional cause of inoculum and are in charge of continuous spread of the organism and the disease all through the developing season.Damage due to Anthracnose is as shown in Fig.6.

| a | b | c | d |
|---|---|---|---|

Fig.6 a) Anthracnose on leaf b) Grapes with anthracnose c) Anthracnose on shoots d) Disease on buds

**Bacterial Disease:**

**Crown Gall:**

Crown gall is a plant ailment caused by the soil-inhabiting bacterium, Agrobacterium tumefaciens. The bacterium causes strange developments or lesions on roots, shoots, and branches. The bacterium encourages the speedy development of plant cells that outcomes in the lesions(galls). Notwithstanding being unattractive, the lesions weaken and stop the development of the plant. In spite of the fact that lesions can disturb the stream of water and supplements up the roots and branches, they do

not affect in complete plant loss. The malady can spread to other helpless plants through polluted soil and apparatuses. Most concoction medications are not successful.

Galls are usually found close to the ground level on the roots and lower branches of the plants. As the galls grow, they turn out to be timbered and rigid. Fig.8 shows the same.The external layer turns darker. The plant might be hampered and caught up with some branch or tip dieback. Indications may not grow instantly after contamination. Galls develop quickly amid the warm atmosphere.

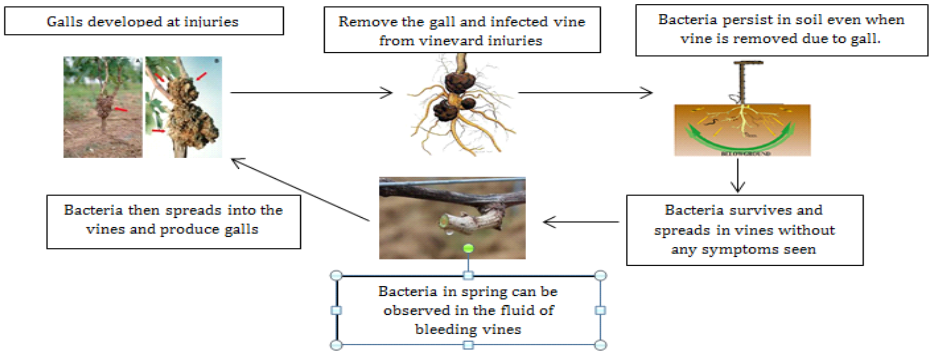



Fig7. a. Crown Gall Disease Cycle[9] , b. Crown Gall Disease Damage

**Viral Disease:**

**Grapevine fan leaf:**

Grapevine fanleaf [10] degeneration is a typical grape infection transmitted by knife nematodes. With interpretations backtracking to 1841, it is the most established disease found and also extreme viral ailments of grapes. Any types of grape can be contaminated, yet Vitisvinifera, Vitisrupestris and their mixtures are the most suspectible. Contaminated plants frequently show a moderate decay and trouble setting fruit, however almost dependably bear a particular leaf deformation. Affected leaves display a fanlike shape due to the irregularities in vein development, and yellow tinge either in a mosaic pattern or in groups along significant veins. This yellow hue for the most part shows up in summer.

**Pests Diseases:**

The important pests of grapes in India are mealy bugs.

**Mealy Bugs:**

Mealybugs[11] are delicate bodied, wingless creepy crawlies that frequently show up as white cottony masses on the leaves, stems and fruit of plants. They sustain by embedding long sucking mouthparts, called stylets, into plants and drawing sap out of the tissue. Mealybugs create a foul, unattractive mess that can render your grapes unfit for sale. These pests excrete honeydew, a sweet, sticky substance that drops on leaves and fruit. Honeydew not only attracts ants, but also serves as a growth medium for damaging, unsightly sooty mold.

Mealybugs make a foul, ugly wreckage that can render your grapes unfit available to be purchased. These vermin discharge honeydew, a sweet, sticky substance that drops on leaves and natural product. Honeydew draws in ants, as well as fills in as a development medium for harming, unattractive dirty shape.

## III FINDINGS

Table 1. Summarization of all Diseases

| Disease | Development Reason | Development Time | Symptoms | Damages | Suggestion |
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| **Powdery** | • Dense diverse, | • After April | • Fine white | • Shoots, | • Keep capsules |

 

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| **Mildew[12]** | cloudy atmosphere, and windy air<br>• Grows at optimal temperatures22$^0$ C– C | and October Pruning<br>• Can be a serious problem in drier growing seasons | appearance<br>• Small, white or grayish-white patches on leaves<br>• Dark-brown to black patches on shoots | leaves, flowers and fruit are all vulnerable<br>• When the fruit is retained, there is a possibility of bloated white tissue on new cloves and possibility of fruit loss.<br>• The size of the growing fruit, irregularly, leads to dark hay feathers on the neck. | free from starting<br>• Do not let the leaves to be crowded<br>• Start early-within 4-6 inches of shoot growth with an eradicant. |
| **Downy Mildew [5]** | • Hot and Humid Climate<br>• Minimum temperature of 11$^0$C<br>• Grows at optimal temperatures18$^0$ C–C<br>• Heavy Rainfall is the principal factor | • After October Pruning<br>• From first leaf unfolded particularly during periods of rain, heavy dew and persistent fog at temperature above 11°C. | • At young stage, very small, greenish-yellow, translucent spots that are difficult to see<br>• Cuts on leaves are angular, yellowish, sometimes oily, and found between the veins<br>• shoot tips [13], bend in a shepherds hook and become white with sporulation | • Extremely contaminate leaves will drop<br>• Infected shoot tips turn out to be thick, curl, and eventually turn brown and die.<br>• Disease-ridden white varieties will turn a dull gray-green whereas red varieties will turn pinkish red | • Cutting of the grapevines after the second week of October serves to limit the harm by this disease. Every influenced bit of the vine ought to be expelled at the season of cutting and devastated instantly.<br>• Downy mildew tainted leaves ought to be specifically gathered and thrown in the dung pit. |
| **Anthracnose** | • Temperature and dampness are the key fragments in affecting ailment advancement | • In the spring when there is a wet period of 24 hours and temperatures above 2ºC<br>• Anthracnose can be very damaging during heavy rainfall and hail. | • Numerous small, circular, and reddish spots appear on shoots.<br>• Wounds with gray centers and curved or angular edges are produced further. | • Disease-ridden parts may crack, affecting shoots to be weak.<br>• Lesions may outspread into the tissue and may crack the fruit. | |

 

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| | | | • Dark reddish-brown to violet-black boundaries sooner or later frame the wounds | • When veins are affected, especially on young leaves, the lesions prevent normal development, resulting in malformation or complete drying or burning of the leaf. | |
| **Crown Gall[14]** | • Chilly winter temperatures<br>• Through Freezing, cutting, joining, hail damages, preparing vines, and from other mechanical gadgets utilized in keeping up the vineyard<br>• Vitis dwelling in the dirt on root trash can specifically cause sores on creating roots and contaminate the plant through those wounds | • First noticed in June-July<br>• Galls can also sometimes be detected on ripening sticks and even on roots.<br>• In the Spring when it is cold. | • Abnormal development change in shape of the plants cells at the spot or close to the spot of disease<br>• Close to the base of the trunk as small, smooth cankers<br>• White plump tissue<br>• Later, they become dry and cork-like subject to the stage of development. | • Show reduced strength and produce of grape vines.<br>• As the gall develops, the tissues that typically lead water from the roots to the shoots lose their capacity to work<br>• Photosynthetic matters from the leaves to the roots turn out to be very disordered. | • Crown gall is probably more prune in limed soil than in corrosive soils so sterilize the soil.<br>• Use disease-free stock when establishing a new vineyard<br>• Disease-ridden vines ought to be detached from the place former to cultivation<br>• Evading machine-driven damage through traditional applies will decrease the occurrence of the disease. |
| **Grapevine fan leaf[15]** | • Due to the congenital "*nepovirus GFLV ( Grapevine Fan Leaf Virus"* of the infected cuttings or rootings of the vines. | • Preeminent in spring, around blossoming and berry set, while pruning | • Leaves turn out to be slanted and uneven with hard saw-like margins, nearer primary veins, and an open petiolar sinus[16].<br>• Red varities: Green veins and reddening | • Causes extensive yield losses, lessens fruit value and diminishes the durability of grapevines in the vineyard<br>• Berries become uneven in | • Planting certified disease-free grapevines that have nematode resistant rootstocks in new soil far away from the location of your infected grapes. |

 

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| | | | between veins<br>• White varieties: mild yellowing<br>• Downward rolling of leaves | size<br>• Yield loss can go up to 80% | • Keep weeds tightly controlled around any grape plantings to eliminate vector plants and replant grape areas thickly with nematicidal plants |
| **Mealy Bug** | • Warmer growing climates | • During the winter months<br>• From Spring to Summer | • The male nymph forms a cottony cocoon in which the pupal stage is found mainly in the winter season<br>• the pink mealybug results on leaves<br>• Developmen t of sooty mold fungi | • Weakens the grownup vines<br>• In case of severe mealybug infestation young vines often die.<br>• Raisins cannot be prepared from such infested bunches | • Do not over water or overfertilize — mealybugs are attracted to plants with high nitrogen levels and soft growth. |

## IV. CONCLUSION

Grape is one in every of the foremost vital fruit crops of the globe and it comprises several valuable parts necessary forever. The crop incorporates a wide ability, and grapes might cultivate at lower temperate, sub-tropical and tropical weather conditions and varied agro-ecological settings. The food, nutrition, healthy and pecuniary values of the crop can be of substantial importance for the population of the Region.

Similar to the alternative plant species, grapevine is vulnerable to ecological impacts, diseases and pests. There area many grape diseases and pests all over the world. These diseases include fungal,bacterial,viral and pest diseases.

Fungi are responsible for major plant diseases such as powdery mildew, grey moulds, downey mildew. Former studies exhibited that as a result of both low inoculum levels in the vineyards and low pruning-wound exposure, trimming grapes in late winter can considerably lessen the threat of infection by the canker-causing pathogen.

This paper intended to share an original methodology to address the association of the grapedisease,pest occurrences and climate. The information herwith will certainly benefit agronomists to take several preventive measures inorder to produce top-quality grapes through effective disease management.

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