



Plant protection measures to control insect-pests and diseases of betelvine

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Betelvine (*Piper betle* L.) is a perennial evergreen shade loving creeper to the family piperaceae. In India, it is commercially cultivated as an important and potential cash crop. The betel leaf occupies a significant place in everyday life of Indian people as it is used in rituals and in Indian system of medicine as cure of many diseases and disorders. Betelvine crop cultivation is a profitable enterprise. Betelvine cultivation is the best example of direct income (in cash) in agriculture. Due to this character, this plant is very loving to farmers. A borj of 500-600 sq. m. area is sufficient enough to nurture a family of 4-5 members whole round the year. But, all is not well in this enterprise. There are lot of problems in its' cultivation. The crop is also infested by several insect-pests and diseases which is a major reason for reduced profit margin. Therefore, introduction of several suitable plant protection measures will be able to control the insect-pests and diseases and make betelvine farming economically perfect. Betelvine yard is always threatened by insect-pests and diseases infestation. The major insect-pests and diseases and their control measures are the following:-

Insect-pests : More than 15 insect-pests attack betelvine yard, the major ones are described below in detail.

Betelvine bug (*Disphinctus politus*) : The nymphs and adults damage the leaves by puncturing and sucking the juice which develop black spots near the punctures causing the leaves to shrivel, fade and dry up. The bug is slender, reddish brown with dark head and antennae and measuring about 12 mm in length. Control measures: Spraying Malathion 50EC @ 1.5 ml /litre of water.

Linear scale pest (*Lepidosaphes cornutus*) : It infects the leaves, petiole and main vines and results in 30 to 35 per cent yield loss. The scale insects are either light brown or dark brown in colour. Both the nymphs and adults suck the sap and the infested leaves loose colour, exhibit waxy, watery appearance, crinkle and dry up ultimately in case of severe damage. The severity of damage found more in old gardens. Control measures: (1) Scale free setts should be selected for planting (2) Remove and destroy severely affected vines (3) Spray 5 per cent neem seed kernel extract (4) Spray 2 per cent neem oil emulsion

(5) Spray Chloropyriphos 20 per cent EC @ 2ml per litre of water and repeat after 21 days interval if necessary (6) Malathion 50 per cent EC @ 1ml/litre of water (4) Nuvan (Dichlorovos 76% EC) @ 1ml/litre of water.

Mealy bug (*Ferrisia virgata*): The leaves are covered with white masses and the insects, both nymph and adult suck the sap from leaves and tender shoots and reduce the vitality of vines. Affected leaves become deformed and vigour of the vine is reduced.



Control Measures : (1) Brushing of mealy bugs with the help of used tooth brush (2) Conserve or mass release of predators like *Cryptolaemus montrouzieri* and *Leptomastrix dactylopii* (3) It can be effectively controlled by spraying Malathion 50 per cent EC @ 1ml/litre of water (5) Nuvan (Dichlorovos 76% EC) @ 1ml/litre of water.

Red spider mite (*Tetranychus neocaledonicas*) : Mites colonise under protective cover of fine silken web on ventral surface of leaves and suck the sap of the leaves. Severely affected leaves show blotching symptom with pale yellow colour, which finally dry off. Damaged leaf fetches reduced market price. The leaves become pale yellow with numerous small spots which reduces the quality of the leaves.



Control measures : (1) Spraying with water-soluble Sulphur @ 3g/litre (2) Spray the crop with soap water to wash away the colonies (3) Spray NSKE 5% or neem oil 2 per cent mixed with 0.1 per cent adjuvant (4) Spray *Palcilomyces fumosorosus* @ 4-5g per litre of water (5) Spray Dicofol @ 1 ml per litre of water.

Aphids (*Aphis gossypii*) : Nymphs and adults suck the sap from succulent apical shoot and young leaves causing loss of plant vigour. Curling, crinkling and distortion of leaves occur. Black shooty mould develops on the leaves during the end of January to March. Control measures :

(1) It can be effectively controlled by spraying 0.03% Metastox (2) Malathion 50%EC @ 1ml/litre of water (3) Nuvan (Dichlorovos 76% EC) @ 1ml/l of water (4) This can be effectively controlled by applying Confidor 200 SL or Neurocombin @ 1-2 ml/l of water (0.2%).



Black fly (*Aleurocanthus rugosa*) : Symptoms : Adults of the insect species are crowded near the growing apex preferring ventral surface of apical leaves and suck sap. Elliptical nymphs also suck sap voraciously remaining on ventral aspect leaf. Curling, discolouration and reduced size of leaves, brown scars at the point of injury, stunted plant growth and development of sooty mould on dorsal leaf are some of the resultant effect of the insect damage. Injury results in reduced



taste and texture of leaves and market value of the crop. Control measures : (1) Avoid dense foliage growth (2) This can be effectively controlled by applying Confidor 200 SL or Neurocombin @ 1-2 ml/litre of water (0.2%) (3) Malathion 50%EC @ 1ml/litre of water (4) Nuvan (Dichlorovos 76% EC) @ 1ml/litre of water (5) Flubendiamide 20% WDG @ 0.25 g/litre of water (6) Clothianidin 50%WDG @ 0.1 g/litre of water (7) Thiomethoxam 25%WG @ 0.33 g/litre of water (8) Acephate 75% SP @ 0.75 g/litre of water.

White fly (*Dialeurodes pallid*) : It sucks the sap of leaves resulting the development of discolouration of patches and yellowish marking appear on infected leaves considerably. Control measures: (1) Avoid dense foliage growth (2) Use yellow sticky trap (3) Use *Neem* cake (4) Spray NSKAE 5% @ 50g/l (5) Neem oil 2% mixed with 0.1% adjuvant (6) This can be effectively controlled by applying Confidor 200 SL or Neurocombin @ 1-2 ml/l of water (0.2%).



Leaf eating caterpillar (*Spodoptera litura*) : The caterpillars feed voraciously on the leaves at night. The pest is also classed as cutworms. The moth is grayish brown with white markings on the forewings and hind wings with irradiantly white with a brown border. The thorax and abdomen are light brown and display a tuft of hairs in the end. Control measures : (1) This pest can easily be controlled by spraying Malathion 0.5%. (2) To save the boroj from infestation, before planting seedlings apply Heptachlor @ 37 kg/ha as basal dose, should be applied to the soil. (3) Nuvan (Dichlorovos 76% EC) @ 1ml/litre of water (4) Acephate 75% SP @ 0.75g/litre of water (5) Indoxacarb 14.5 SC @ 0.5ml/litre of water (6) Spray 5% neem seed kernel extract (7) Spray 2% neem oil emulsion.



Root knot nematode (*Meloidegyne incongnita*) : The

Table 1 : Commonly infested insect-pests and diseases of betelvine

Sr. No.	Name of the Insect-pests	Scientific name of causal organism	Name of the diseases	Scientific name of causal organism
1.	Betelvine Bug	<i>Disphinctus politus</i>	Foot rot	<i>Phytophthora parasitica</i> var <i>piperina</i>
2.	Linear scale pest	<i>Lepidosaphes cornutus</i>	Root rot	<i>Rhizoctonia solani</i>
3.	Mealy bug	<i>Ferrisia virgata</i>	Collar rot/foot rot/ Sclerotial wilt (Gendi)	<i>Sclerotium rolfsii</i>
4.	Red Spider Mite	<i>Tetranychus neocaledonicas</i>	Leaf rot (Phoska para)	<i>Phytophthora</i> sp.
5.	Aphids	<i>Aphis gossypii</i>	Leaf spot and Anthracnose (Angari/chitla)	<i>Colletotrichum capsici</i>
6.	Black fly	<i>Aleurocanthus rugosa</i>	Bacterial Leaf spot/Leaf blight/Stem canker (Kathiya)	<i>Xanthomonas campestris</i> var. <i>Betlicola</i>
7.	White fly	<i>Dialeurodes pallida</i>	Powdery mildew	<i>Oidium piperis</i>
8.	Leaf eating caterpillar	<i>Spodoptera litura</i>	Betel vine wilt	<i>Phytophthora capsice leomian</i>
9.	Root knot nematode	<i>Meloidegyne incongnita</i>	Dew or fog injury	-----

root knot nematodes affected plants become stunted in appearance bearing yellowish coloured small sized leaves and swollen aerial roots in cluster. When they are uprooted, deformed roots with prominent galls and swelling are observed. They are also found frequently associated in different stages of rotting caused by bacterial and fungal infection. Eventually the affected plants wilt and die. Control measures : For effective control of nematodes following practices can be applied. (1) Chopped green leaves of Calotropis and neem at the time of planting. (2) Oil cake of neem or mustard @ 500kg/ha to 1 t/ha (3) Carbofuran 1.5 kg a.i. per hectare in fresh planting in endemic areas two weeks prior to planting to manage nematodes in soil.



Diseases :

Foot rot (*Phytophthora parasitica var piperina*): It is also known as chitla disease. The important symptom is a wet rot condition associated with wilt. Hence, this foot rot condition is often described as wilt. The first visible symptom of the disease is the disappearance of luster of the leaves. Soon after, the vines show signs of wilting and the leaves drop and become pale. Finally the vine completely wilts and dries up. The underground parts rot completely. The disease is caused by the fungus, *Phytophthora parasitica* which survives in the soil in the form of dormant oospores. The disease becomes most severe during or just after rainy season. Control measures: (1) At the time of planting, the cuttings should be dipped at least for 20 minutes in 1 per cent Bordeaux mixture or 0.1 per cent Ceresan (2) Bordeaux mixture (0.5%) or 0.2 % Zineb (Dithane Z 78) should be spread on the ground near vines and also on diseased leaves at an interval of 15 days from last week of June to October (3) Once the plant is diseased, it should be removed and the soil partially sterilized by drenching with chestnut compound or adding lime and mix thoroughly (4) Spray Blitox 50 WP @ 4g/ litre of water.

Root rot (*Rhizoctonia solani*) : Initial attack is similar to that caused by *Phytophthora* or *Pythium* showing foot rot. In advance stage of attack the girdling lesion on stem base at or below the soil level becomes discoloured and the rotten portion is distinctly dry unlike that of foot rot. The disease is most prevalent during post monsoon months. Control measures : (1) Destruction of dead vines (2) Crop rotation (3) Deep summer ploughing (4) Use of organic manures reduce the severity of the disease.

Collar rot/foot rot/ Sclerotial wilt (Gendi) (*Sclerotium*

***rolfsii*) :** The fungus attacks the plants at the collar region and below the soil. Dark lesions start developing from just below the soil to about 10 cm above ground level. The leaves soon turn yellow and fall off resulting in wilting of the entire vines. While rosy mycelial strands creep over the stem portion. Large number of small, light to deep brown sclerotia develops on the mycelial mat. The fungus is a soil borne pathogen having wide range of host plants. Control measures : (1) Apply judicious doses of nitrogenous fertilizer (2) Soil sterilization with diluted formalin (1:50) (3) Use *Trichoderma harzianum* @ 2kg/50kg FYM (4) Drenching with *Trichoderma viride* @ 3g/litre of water.

Leaf rots (*Phytophthora sp. and Pythium sp.*) : The first symptom of the leaf rot is the appearance of water soaked lesions. The infected spots enlarge rapidly to cover the blade, which starts rotting. Diseased leaves turn brown to dark brown and later dirty black. The disease is caused by *Phytophthora parasitica var. piperina*, occurs in severe form in rainy season. This is a soil borne pathogen. Control measures : (1) At the time of planting, the setts should be dipped at least for 20 minutes in 1 per cent Bordeaux mixture or 0.1 percent Ceresan (2) Bordeaux mixture (0.5%) or 0.2 % Zineb (Dithane Z 78) should be spread on the ground near vines and also on diseased leaves at an interval of 15 days from last week of June to October (3) Soil sterilization with formalin (1:50) (4) Use *Trichoderma harzianum* @ 2kg in 50kg FYM

Leaf spot and anthracnose : The disease is caused by *Colletotrichum capsici*, a set borne pathogen which is very serious disease. Small black circular lesions appear on leaves expanding rapidly in humid conditions. Leaf spot appears as brownish black centre with yellowish hallow around and in severe cases the leaves drop owing to shrinkage of tissues. Control measures : (1) Use healthy planting materials (2) Improved drainage system is the prime requirement to reduce the severity of the disease (3) Before planting the setts should be dipped in 0.1% Ceresan or other organo mercurial solutions (4) Cutting to be used for planting purpose should also be treated with 1% Bordo micture (5) Spraying once or twice 0.2% solution of Zineb (Dithane Z-78) or 0.1% Bavistin (6) Spray Phytolan 50 WP @ 4g/litre of water (7) In severe case drench the soil with Metalaxyl 8% W.P. +Mancozeb 64% @ 2g/ litre of water.

Bacterial leaf spot : It is a bacterial disease caused by *Xanthomonas campestris var. Betlicola*. This is the most serious disease affecting the betelvine yard in Sundarbans. Locally it is known as “Angari”. Minute water soaked spots developed on the under surface of leaves. Later

these appear on upper surface also as dark round angular ones surrounded by yellowish zone. The centre of spots are mottled down and later turn black and in severe conditions leaves turn yellow and fall. This occurs mainly in high humid season and rapidly covers the whole vine yard. Control measures : (1) High precautions are very much necessary to reduce the incidence of this disease in vineyard (2) Two or three sprays of 0.25 per cent Zineb or Zirum should be made after every six months as a protective measure (3) The disease intensity can also be reduced regulating the shade in the vineyard (4) Drenching with wettable Ceresan 0.1 per cent or Agallol 0.1 per cent (5) This disease can effectively be controlled during primary stage by spraying either of 1 per cent Bordeaux mixture and Streptomycin sulphate 250-500 ppm or 0.25 - 0.3 per cent Zineb and Streptomycin sulphate 250-500 ppm at monthly interval starting from August to January (6) Uproot the diseased plants and burn or bury them to protect other vines (6) Never use a infected sett for planting in new vineyard (6) Spray of Plantomycin 500ppm is also useful in control of leaf spot (7) Spray Phytolan 50 WP @ 4g/litre of water

Powdery mildew (*Oidium piperis*) : The disease affects the foliage, causing several damages. Small white patches appear on both the surfaces of young leaves. These patches enlarge running together to cover large portion of the blade, covering the leaf surface with characteristic whitish powdery coating. It is a fungal disease. The fungus survives on the old vines. It is an air borne disease usually appears in the month of January and February. Warm humid weather and cool nights favours the spread of disease. Control measures : (1) Spraying with wettable Sulphur @ 2g/ litre of water (2) Spray Bavistin @ 1g/ litre of water.

Betelvine wilt : In severe condition plant started wilting and shown water stress condition caused by *Phytophthora capsice leomian*. Control measures : It can effectively be controlled by applying neem leaf extract (2%) or neem cake extract (0.5%).

Dew or fog injury : Betelvine leaves are also damaged due to dew or fog injury. In winter season the leaves are injured due to drops of dew which turns into white spots and blotch. This injury can reduce the market price of infected betel leaves. Control measures : (1) The disease can effectively be controlled by spraying 0.3 per cent Zineb (Dithane-Z-78) or 0.25 to 0.3 per cent Zirum spray 2-3 times on a fortnightly interval (2) The disease incidence can also be lowered through extra layering of upper surface

of boroj by paddy straw.

Conclusion : Betelvine plant is an important and well-familiar plant in Indian agricultural diaspora. After lunch or dinner, chewing a pan quid is a culture of many parts of our country. Hence, the plant is a culture influencing or culture forming plant. Advantages in day to day life and medicinal values have made the plant an essential plant in Indian agriculture. Other dimension of this crop is that it is an important cash crop. It is considered that amongst all cultivated crops, betelvine is the most profitable crop (per unit land production basis). The betelvine cultivation offers perennial employment and income because of its capital and labour intensive characteristics. Above all, unique character of betelvine cultivation is that it is highly suited to small holding may be 5-10 decimal land. Therefore, it is the need of the hour to sustain cultivation of such type of highly potential crop. There are several limitations of betelvine cultivation, out of these the most important ones are mainly (1) Insect-pests infestation and diseases infestation (2) Lack of proper price of product (3) No insurance in betelvine cultivation (4) Lack of irrigation water (5) Lack of soil testing facility (6) Price of input is high (7) Lack of fund and (8) Lack of proper export etc. Out of these problems, insect-pests and diseases infestation is major one. If this problem is managed properly automatically farmers will have better profit margin. Only in few states, Assam Meghalaya, West Bengal, Orissa, Andhra Pradesh, Tamil Nadu and Kerala, betelvine cultivation covers vast areas but in other states especially in Northern India, it is cultivated in few pockets. Therefore, sufficient information is unavailable for proper controlling of insect-pests and diseases. To solve these problems we need the following prime considerations-(1) More research will be conducted on plant protection aspects of betelvine cultivation at university levels as well as govt. levels considering a potential crop in Indian agriculture. (2) Govt. should consider betelvine cultivation as important crop cultivation (3) Govt. should take various promotional measures to expand the betelvine cultivation area horizon in our country. (4) Govt. should take proper and confirm measures to export the betelvine products to other countries. (5) On aspect of value addition of betelvine products, more researches are to be conducted. Therefore, the extension agencies who are working at base level should take proper measures to promote the betelvine cultivation especially, there is needed more awareness programmes on plant protection aspects.

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