Among the most destructive diseases of banana, Banana Bunchy Top Disease (BBTD) is one of them. Once the disease is established, it is very difficult to control or manage. There are no accurate estimates of international economic impact of the disease but the disease is widespread in Asia and the south pacific regions. Two disease outbreaks have been taken place, one in Australia in 1920 and second in Pakistan during 1990-92, which has caused severe losses. Banana bunchy top disease is caused by banana bunchy top virus (BBTV) that belongs to nano virus group. BBTV is a small virus of size 20-22 nm in diameter, consisting of SSDNA with the relative molecular mass of 2.0 x 106 and a coat protein sub-unit with relative molecular mass of 2,000 dalton. The disease is distributed in South-east Asia, Philippines. Transporting planting material obtained from infected plants spreads the virus from place to place and aphid spreads from plant to plant. There is no cure of the disease. They are reservoirs of the virus, they must be destroyed. BBTD is a threat to banana industry and to the productivity of banana plantings.

Field Diagnosis of BBTV Based on Symptoms

Initially there is development of dark green streaks in the veins of lower portion of the leaf midrib, petiole base and on pseudostem. The symptom is some time referred to as 'Morse code streaking' because the streaks are irregular and resemble a series of 'dots' and 'dashes'. Rubbing away the waxy white coating that covers the petiole base of midrib makes it easier to see the streaking, the dark green, hook like extensions of the leaf lamina veins can also be seen in the narrow, light - green zone between the midrib and the lamina. These are known as 'Green J-hooks'. The short hooks point down along the midrib toward the petiole and can be seen by back lighting the leaf against the sky or sun.

On mature plants infected with BBTV, new leaves emerge with difficulty, look narrower than normal with wavy margin and some times have yellow leaf margins. Finally they appear to be 'bunched' at the top of the plant, the peculiar symptom for which this disease is named. Severely infected banana plants usually do not bear fruits, but if fruit is produced, the banana hands and fingers are distorted, stunted, twisted or otherwise deformed and of little use.

The suckers that develop after a 'mother' plant has been infected with BBTV are usually severely stunted, with leaves that do not expand normally and remain bunched at the top of the pseudostem. These leaves are stiff and erect,
shorter and narrower than normal leaves, and havoc chlorite edges. Suckers with these symptoms do not produce fruits. Therefore the disease can result in a 100% yield loss.

Development and Spread of Disease

Banana bunchy top virus spreads by the banana aphid, pentolonia nigronervosa that acquires the virus after at least 4 - 18 hr of feeding on an infected plant. The aphid can retain the virus through its adult life, for a period of 15 - 20 days. During this time, the aphid can transmit the virus to a healthy banana plant by feeding on it, possibly for as little as 15 minutes, but more typically for about two hr. No other aphid is known to transmit the virus. BBTV does not replicate in aphid vector and probably retained when the vector moults, but not transmitted congenitally to the progeny of vector. This transmission of virus by aphid is responsible of short movement of disease.

Environmental conditions and aphid reproduction capacity are very important factors in disease development. Aphid requires hot and humid climate of better transmission. Reproduction is more during the said climate. Adverse conditions affect the aphid activities. Predominantly a vegetatively propagated crop, makes spread of disease by the use of infected planting material including micro-propagated plants is a constant risk. The virus perpetuate through the infected suckers and thus responsible for long distance movement of disease.

Management Practices

The following conventional and non-conventional strategies can be adopted to manage the BBTD.

Quarantine Measures:

With the availability of a range of sensitive and specific methods for BBTV diagnosis and detection and the advantage of in-vitro propagated bananas, now it is possible to provide large quantities of virus tested banana germplasm and planting material. With the adoption of the said material, the risk of introducing BBTV into new areas should greatly be reduced. The international Network for the improvement of Bananas and Plantains (INIBAP) has established a 'transit center' at Leuven in Belgium that maintains an extensive in-vitro collection of Musa germplasm from 7 which virus tested banana and plantain cultivars can be obtained.

Cultural Practices:

For BBTD management, it carries both the responsibilities of virus and aphid management. Cultural practices like regular inspection, rouging and digging play an adequate role in minimizing the disease. Early and efficient detection and eradication are the elements of this strategy and require knowledge and ability to diagnose BBTD from early symptoms. Destruction of weeds and alternate hosts, creation of banana free buffer zone around banana farm and adoption of diversified agriculture are other important BBTV reducing factors. Spread of disease could not occur if infected plants could be located and destroyed in the symptom less stage of within a short time of symptoms being displayed. An isolation distance of 100-200 m between any new bananas planting is very beneficial to control BBTD. Removal of diseased banana plants and replant with virus free banana plants leads to effective management strategy. Cultural practices also play a very important role in aphid management. Destruction of wild or unattended patches of bananas is must to control aphids. A large population of banana aphids can grow on them and the wild patches when infected can serve as a serious and constant source of diseases for farms and residential neighborhoods. Maintenance of good weed control in the banana patches can help in aphid
Some weeds may host the banana aphid or other banana pests. Aphids prefer to feed on young banana suckers so the banana mats should be pruned of all unwanted suckers.

**Eradication:**

Eradication is being done by digging and burning of diseased plants and suckers in the field. The herbicide picloram (Keipin frimation) effectively eradicate diseased banana with no detrimental effects to adjacent plants. This technique, coupled with a routine monitoring programme, promises to be an effectively method for reduction of BBTD. The formulation allows for precise placement of the herbicide with no noticeable effects on adjacent vegetation. It permits selective eradication within a plantation, which can be rapidly followed by plant treatment.

**Biological Control:**

Biological control may be used to suppress aphid population in some situation. Ladybird beetle (Coccinella septumpunctata) has predatory potentialities on banana aphid, Pentalonia nigronervosa. Introduction of aphid parasitoids as bioagents leads to a good aphid control. Introduction of the polyphagous parasitoid (Aphidius colemani) can be used to control banana aphids. Frequent use of insecticide spray can have a negative, detrimental effect upon aphid predators and parasites. Ants should be controlled as they aggressively protect the aphids from their natural enemies and they feed upon the sweet honeydew that aphids produce. Boric acid baits can be used for ant control.

**Resistant Cultivars:**

Resistance cultivars to BBTV would be most effective means of disease management. Unfortunately, there are no known commercial cultivars of banana that are immune to BBTV. Transgenic virus resistance, based on virus-derived transgenic, is a good strategy for controlling viruses.

**Chemical Control:**

Treating the suckers at the time of planting with malathion @ 0.2% and mancozeb @ 0.3% may reduce the pest attack and Spray the crop with power kerosene or malathion in the affected pseudostem and apex of the plant around the central leaf at 60 and 90 days after planting.

Nirakar Ranasingh is a Specialist in Plant Protection, Krishi Vigyan Kendra, Rayagada, Gunupur, Orissa

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Smt. Anita Agnihotri, Commissioner-cum-Secretary, Textile & Handloom Department briefing the press on National Handloom Expo-2007 on 9.1.2007