Summary

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Banana was one of the most important fruit in Egypt and cultivated in wide areas. In 1996, banana production exceeded to 512.5 thousand metric tons .and the average crop was 11.27 & 13.71-tons/ feddan as a result of cultivation of new varieties high in production.

Banana was susceptible to viral disease, so, much effort in producing a banana crop was directed at controlling such disease. In the present study we focused on banana bunchy top disease (BBTD) which caused by banana bunchy top virus (BBTV) and banana mosaic disease (BMD) which caused by banana mosaic virus (BMV).

The present work aimed to study the isolation of BBTV and BMV via studying the biological properties. Include the symptoms, mode of transmission; serological detection of the two viruses using DAS-ELISA & Dot- ELISA techniques; histochemical detection using the stain triphenyl tetrazolium chloride; histopathological changes in the infected cells; the usage PCR to detect viruses and mutation in plants resulted from tissue culture was also studied.

The results revealed that the first symptoms of banana infected with BBTV were dark green streaks on the lower portions of the midrib of the banana leaf, the fresh infected leaves were brittle, reduced in the size and gather at the top of plant making a rosetting shape. The symptoms of BMV were characterized by a conspicuous interveinal chlorosis of the leaves. Common observation of infected plants was stunted growth and low yield. In severe cases this was accompanied by rotting of the heart leaf and central cylinder.

It was noticed that BBTV could be mechanically transmitted via syringe to some host plants as *Canna* sp., which exhibited mosaic symptoms after 20 days.

Plants reacted with BMV and exhibited different systemic symptoms, included *Cucumis sativus* (Systemic mosaic and stunting), *Sorghum vulgare* and *Zea mays* (Mosaic after 20 days), *Musa sp.* (typical mosaic after 20 days), *Datura metel* (mosaic after 19 days), *Nicotiana tabacum* var. Samsun (Mild to severe mosaic

and stunting after 20 days) and *Lycopersicon esculentum* (Mosaic and stunting). Other group exhibited local lesions only on the inoculated leaves, included *C. amaranticolor* (necrotic local lesions after 12-16 days), *C. quinoa* (chlorotic local lesions after 12 days), *Vigna sinensis* and *Vigna unguiculata* (Brown lesions in inoculated leaves after 10 days). Other group exhibited local lesion symptoms on the inoculated leaves followed by systemic symptoms included *Cucurbita pepo* (Yellow spots after 6 days followed by systemic mosaic) and *Nicotiana glutinosa* (Yellow spots after 16 days followed by systemic mosaic).

It was found that BBTV and BMV were transmitted from banana to banana by infective aphid vector (*Pentalonia nigronervosa*). Discs of suckers infected with BBTV turned brick red with the stain triphenyl tetrazolium chloride whereas the discs obtained from infected plants with BMV appeared black.

Electron microscopic examination of cells in ultrathin sections prepared from banana naturally infected with mixed infection revealed disorganization, degeneration of phloem cells as well as the appearance of necrotic cells; the ultrastructural study carried out in this investigation showed that chloroplasts and mitochondria were malformed.

This study also aimed to resist the banana viruses by applying two programs as follows

1. Establishment of an aseptic culture of banana

A. ***In vitro*** (tissue culture) of banana as a mean developing virus-free plants from infected stocks. Three methods had been used to produce plants free from BBTV and BMV.

A. a. Meristem tip culture

Meristem tip culture had been frequently used to eliminate BBTV and BMV from infected plant dependence on meristem size. The results showed that, the percentage of the survival plantlets were 10 and 15 as while virus-free plantlets were 70 and 75 % respectively. While the survival of healthy plantlets ranged from 25-30 % due to absence of the virus infection.

b. Chemotherapy

Results demonstrated that virazole and salicylic acid at concentration 10 mg/l enhanced growth differentiation of propagated meristem, while decreasing the percentage virus-free plants. On the other hand, 30 mg/l of two antiviral decrease the development of shoot micropropagated plantlets and had a deleterious effect on the regeneration and growth of the propagated shoots but increased virus-free plantlets to be 90 and 99 % for virazole and salicylic acid respectively. Incorporation of virazole in culture medium at concentrations 10,20,30 and 40 mg/l progressively increased the virus-free plantlets to 90 % for BBTV and 80,85,90,90 % for BMV.

c. Thermotherapy

The micropropagated shoots were exposed to 36,38 and 40 °C for 30 days under photo period cycle of 16/8 hours as light/dark. Then, the plantlets (subculture 3) were transferred to fresh MS medium and incubated at 28 ± 1°C. The best temperature that gave virus-free plantlets was 36°C (100 % for BBTV & 60 % for BMV).

Using RAPD-PCR analysis revealed the presence of mutation of vegetative and fruit on banana plants resulted from TC after their transplantation on the field.

B. ***In vivo*** (establishment of mother banana plants in nursery), the use of virus-free tissue culture-derived planting stock as a disease management decision was more likely to be successful. By treating these plants either by injection chitosan using syringe in the corms before planting them or by spraying the suckers with chitosan periodically (each 15 days for 2 months). After that, we detected these suckers for the presence of the viruses using DAS-ELISA technique. Virus-free plant percentage was recorded.

2. Continuation of banana plants growth and control the vectors and weeds in open field orchards

1. Periodically detection of BBTV and BMV via external symptoms and yearly by random method using DAS-ELISA and dot-ELISA tests.
2. Roguing and destruction of the infected banana plants outside the groves which appeared dark green streaking of leaf veins and midrib, marginal yellowing and bunched leaves and gave positive

DAS-ELISA results. The rogued plants were destroyed by burning at the end of growing season.

3. At the same time control of aphid vectors by spraying with an effective insecticide (malathion 57 % E.C.)) and eradication of weeds and grasses by using glyphosate (57 % E.C.). The results revealed that suckers associated with the healthy mother plants not appeared symptoms like those of the original ones in the field.

4. Dealing with this problem as a community.

5. Quarantine regulation must be implemented.