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Field survey guidance for *Babuvirus* banana bunchy top virus

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Introduction

Active and regular monitoring and surveillance are critical for countries to establish the presence or absence of plant pests, especially those with severe impacts on food security, the environment, trade, and agricultural productivity. This early warning information is crucial for rapid response, making sound phytosanitary decisions, effectively managing risks, and controlling and protecting borders against pest entry.

This field survey guidance, therefore, provides easy-to-follow guidelines for technical personnel of national plant protection organizations (NPPOs), to survey for *Babuvirus* banana bunchy top virus, a key pest in Africa.

This survey guidance provides a protocol to aid in the monitoring, detection, sample collection, and diagnostics for *Babuvirus* banana bunchy top virus, ensuring effective phytosanitary decision-making to manage the pest risk and protect trade in plants and plant products. To simplify the identification of the pest, this document also provides visuals.

This field survey guidance complements the digital tools available to NPPO plant health inspectors, through the Africa Phytosanitary Programme (APP) mobile application and Geographic Information System (GIS) platforms.

APP is an initiative of the International Plant Protection Convention (IPPC), designed to transform pest management across Africa by enhancing the capabilities of phytosanitary personnel within NPPOs, to leverage advanced science and modern digital technology for effective and timely pest surveillance, detection, diagnostics, control, and prevention. APP aims to strengthen the resilience of Africa's phytosanitary systems against plant pests of regulatory, economic and environmental significance. Some of the countries involved in APP listed *Babuvirus* banana bunchy top virus as a priority pest requiring effective surveillance.

The IPPC implements APP in collaboration with the Food and Agriculture Organization of the United Nations (FAO) and the African Union Department of Agriculture, Rural Development, Blue Economy and Sustainable Development, through the African Union Inter-Africa Phytosanitary Council (AU-IAPSC).

This guide was developed with technical and financial support from the United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS).



Acknowledgements

The IPPC Secretariat and the IPPC community are grateful to all the institutions that contributed to the production of this technical resource. This document presents guidance to national plant protection organizations (NPPOs) to support active surveillance, detection, diagnostics, control and prevention of *Babuvirus* banana bunchy top virus. This document was created with financial support from the United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS). The guidance provided in this document was prepared by subject matter experts from USDA APHIS and reviewed by technical officers at the IPPC Secretariat, in the framework of the Africa Phytosanitary Programme (APP). APP is an IPPC initiative implemented in collaboration with the Food and Agriculture Organization of the United Nations (FAO) and the African Union Commission on Agriculture, through its technical unit, the African Union Inter-Africa Phytosanitary Council (AU-IAPSC).

Abbreviations

APHIS	Animal and Plant Health Inspection Service
APP	Africa Phytosanitary Programme
AU-IAPSC	African Union Inter-Africa Phytosanitary Council
BBTV	Banana bunchy top virus
CABI	Centre for Agriculture and Bioscience International
ELISA	Enzyme-linked immunosorbent assay
GIS	Geographic Information System
IPPC	International Plant Protection Convention
NPPO	National Plant Protection Organization
PCR	Polymerase chain reaction
USDA	United States Department of Agriculture



Field survey guidance for *Babuvirus* banana bunchy top virus

Scientific name

Babuvirus banana bunchy top virus

Common name

Banana bunchy top, BBTV

Type of pest

Virus

Taxonomic position

Class: Arfiviricetes

Order: Mulpavirales

Family: Nanoviridae

Known Hosts

Banana (*Musa* spp.), including *M. acuminata*, *M. textilis* and *M. × paradisiaca* (syn. *M. paradisiaca*).

Associated organism

Banana aphid (*Pentalonia nigronervosa*) is the vector for banana bunchy top virus and is present in Africa.



Figure 1: Young banana plant infected with banana bunchy top virus exhibiting symptoms of erect, bunched, yellow leaves. © College of Tropical Agricultural and Human Resources, University of Hawai'i at Mānoa

Survey protocol

Time of year to survey

A survey can be conducted whenever leaves are present; for visual inspection, young leaves are more likely to express symptoms of the disease.

Survey site selection

Survey where banana plants occur. This may include commercial production sites, landscaped or natural areas with wild banana plants.

Visual survey

Inspect plants for symptomatic foliage. Young leaves are more likely to present symptoms of the disease. The presence of the banana aphid vector, *Pentalonia nigronervosa*, is an indication that the pathogen may be present (Figure 6).

Symptoms

Symptoms include narrow leaves with yellowing towards the edges and irregular dark green streaks or flecks in the shape of dots and dashes on leaf midribs and petioles. The dark green streaks can, but do not always, form a hook shape where the midrib meets the leaf blade (Figure 2). Infected plants often have stunted, discoloured leaves that bunch at the top of the plant (Figure 4(a)). Severely affected plants may have dead leaves still attached to the stem and any fruit produced may be stunted (Figure 4(b)). Fruit is not always symptomatic but may also be stunted in growth or absent (Figure 5).



Figure 2: Infected banana leaves with green streaks and hooks (see arrow).

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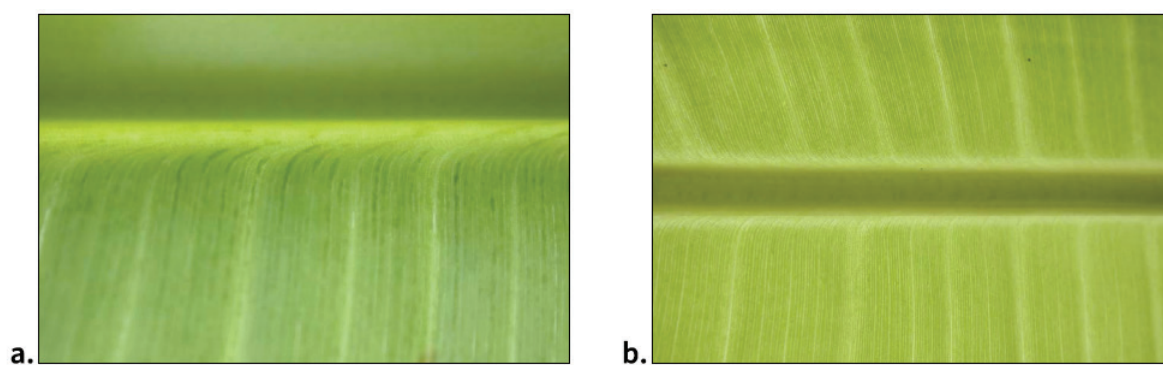


Figure 3: (a) Infected banana leaf versus (b) healthy banana leaf.

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Figure 4: (a) Banana leaves bunched at top of stem and (b) dead leaves still attached to banana plant stem. © College of Tropical Agricultural and Human Resources, University of Hawai'i at Mānoa.



Figure 5: Stunted (small) banana fruit infected with banana bunchy top virus. © College of Tropical Agricultural and Human Resources, University of Hawai'i at Mānoa.



Figure 6: *Pentalonia nigronervosa*, vector of banana bunchy top virus. © CABI.

Transmission

The banana aphid is the vector for banana bunchy top virus (Figure 6).

The virus can also be spread when infected plants and vectors are introduced into a new area.

Sample collection

Collect leaf samples of symptomatic *living* tissue. Use of disposable gloves is recommended.

If sampling multiple plants, sanitize hands or change gloves between plants to avoid cross-contamination. To get high-virus content, try the midrib of the third leaf from the top. Excise with a clean knife. Disinfect knife between plant samples to avoid cross-contamination. Place samples with leaf and midrib section in dry paper towels in a resealable, labelled plastic bag. Place the smaller bag with the sample contents inside another larger resealable bag. Remove air from the bags before sealing. Keep samples cool and dry in an ice chest, but do not freeze.

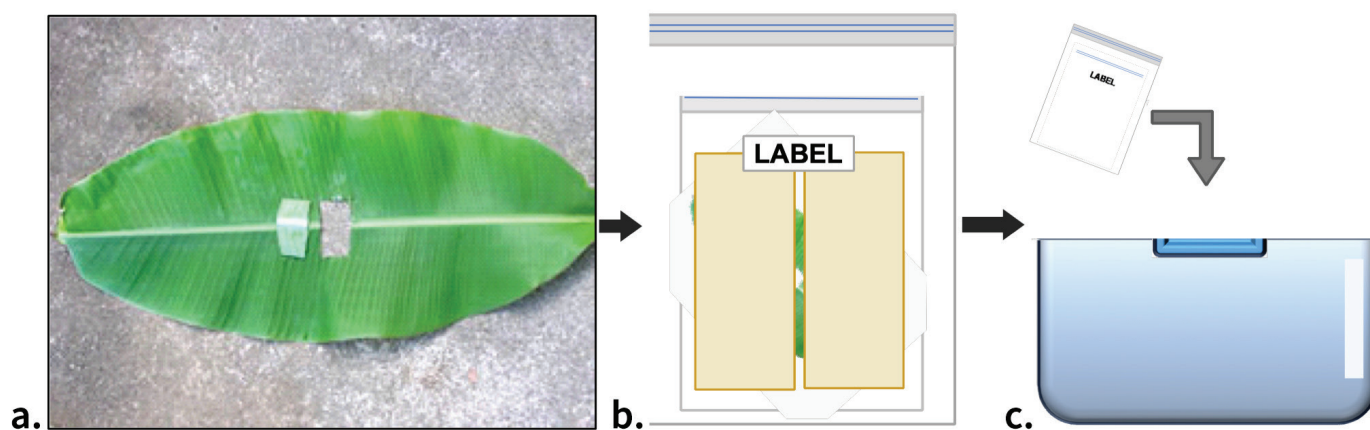


Figure 7: Sample collection protocol: (a) banana leaf (third) collected from plant with a section of midrib cut out; (b) entire leaf and midrib placed in a labelled, resealable bag with paper towels, then the bag placed inside a second, larger resealable bag; (c) sample placed in cool and dry conditions in an ice chest, but not frozen.

Pest identification and diagnostics

Pest description

The organism itself cannot be seen in the field, only the disease symptoms.

A diagnosis is made by molecular techniques, such as polymerase chain reaction (PCR).

Enzyme-linked immunosorbent assay (ELISA) may also be available.

Identification and diagnostic resources

The College of Tropical Agriculture and Human Resources, University of Hawai'i at Mānoa, has a datasheet with additional images of symptomatic banana plants (<https://www.ctahr.hawaii.edu/oc/freepubs/pdf/PD-12.pdf>).

Easily mistaken species

Cucumber mosaic virus (*Cucumovirus*) on banana presents interveinal chlorosis and may be confused with banana bunchy top virus.

IPPC

The International Plant Protection Convention (IPPC) is an international plant-health agreement that aims to protect global plant resources and facilitate safe trade. The IPPC vision is that all countries have the capacity to implement harmonized measures to prevent pest introductions and spread, and minimize the impacts of pests on food security, trade, economic growth, and the environment.

Organization

- » There are over 180 IPPC contracting parties.
- » Each contracting party has a national plant protection organization (NPPO) and an official IPPC contact point.
- » Ten regional plant protection organizations have been established to coordinate NPPOs in various regions of the world.
- » The IPPC Secretariat liaises with relevant international organizations to help build regional and national capacities.
- » The secretariat is provided by the Food and Agriculture Organization of the United Nations (FAO).

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