CAPS Datasheets provide pest-specific information to support planning and completing early detection surveys.

Orthotospovirus Groundnut bud necrosis virus

Scientific Name

Orthotospovirus arachinecrosis

Synonyms:
Peanut bud necrosis virus (PBNV)
Bud necrosis virus (BNV)

Common Name

Groundnut bud necrosis virus (GBNV)

Disease: Bud necrosis disease (BND), Potato stem necrosis disease (PSND), Peanut bud necrosis disease (PBND), Groundnut bud necrosis disease, Tomato bud blight disease, Mung bean necrosis disease, Necrosis disease of black gram

Figure 1. Two images of wilting of GBNV infected tomato plants (right) compared to healthy tomato plants (left). Courtesy of Naidu Rayapati, Washington State University.

Type of Pest

Virus

Taxonomic Position

Class: Bunyaviricetes, **Order:** Elliovirales, **Family:** *Tospoviridae*

Notes on taxonomy and nomenclature:

Orthotospovirus arachinecrosis is the name currently listed by the International Committee on Taxonomy of Viruses (ICTV). Orthotospovirus Groundnut bud necrosis virus (GBNV) will be used for the CAPS Program to remain consistent with the name used in the diagnostic protocols.

Pest Recognition

This section describes characteristics of the organism and symptoms that will help surveyors recognize possible infestations/infections in the field, select survey sites, and collect symptomatic material. For morphological descriptions, see the Identification/Diagnostic resources on the AMPS pest page on the CAPS Resource and Collaboration website.

Pest Description

Molecular diagnostics are necessary to identify Groundnut bud necrosis virus (GBNV) as there are no visible diagnostic features for this organism in the field. Orthotospoviruses are quasi-spherical (80–120 nm in diameter) enveloped isometric RNA viruses with a tripartite genome containing large (L), medium (M), and small (S) segments of single stranded RNA (Bhat et al., 2002; Radhakrishnan, 2023).

Symptoms

Different isolates of GBNV produce very similar symptoms including chlorosis (yellowing), mottling, lesions, stunted growth, necrotic rings, and bud and stem necrosis, regardless of the host (Mandal et al., 2012; Reddy et al., 1991).

In peanut (Fig. 2): “Initially, mild chlorotic (yellow) spots appear on young quadrifoliate leaves, and subsequently necrosis and chlorotic rings develop. In rainy and post-rainy seasons, necrosis of the terminal bud at the top of the stem is the main characteristic symptom. Secondary symptoms such as stunting, axillary shoot proliferation, and malformation of leaflets are common. Plants infected early are bushy, stunted, and die prematurely. If plants older than one month are infected, the symptoms are restricted to a few branches only” (Mandal et al., 2012).

Figure 2. Symptoms in peanut: **(A)** Rings, **(B)** chlorotic spots, **(C)** stunting, and **(D-F)** necrosis of terminal bud. Photos courtesy of B.V. Bhaskara Reddy, Acharya N G Ranga Agricultural University.

In tomato (Fig. 1 & 3): Symptoms include concentric rings and patchy color on fruit, necrotic rings on leaves**,** and stem necrosis (Mandal et al., 2012; Manjunatha, 2008). Foliar necrosis often causes the stem or entire plant to collapse, resembling blight symptoms. Typically, plants infected at an early stage collapse and die (Akram et al., 2012).

Figure 3. (A) Symptoms of GBNV infection on tomato fruit. Photo courtesy of Naidu Rayapati. **(B)** Symptoms of GBNV infection on tomato leaves. Photo adapted from "Induction of innate immunity and plant growth promotion in tomato unveils the antiviral nature of bacterial endophytes against groundnut bud necrosis virus" by Sharanya et al., 2024. Copyright © 2024 Sharanya et al. CC BY 4.0.

In potato (Fig. 4): Symptoms include stem and petiole necrosis, leaf deformation, yellowing and stunting of the plant (Khurana et al., 1997). Necrosis of foliage often leads to collapse of a stem or the entire plant. Potato plants infected at an early growth stage often collapse and die (Akram et al., 2012; Pundhir et al., 2012). GBNV infection can cause significant reductions in potato tuber yield (Ansar et al., 2015).

Figure 4. Necrotic spots on GBNV infected potato leaves. Photo courtesy of Mohammad Ansar, Bihar Agriculture

Easily Mistaken Species

There are several other orthotospovirus species that infect the same hosts as GBNV, and at least two, Groundnut ringspot virus (GRSV) and Tomato spotted wilt virus (TSWV), are present in the United States. Both GRSV and TSWV cause similar symptoms in tomato and peanuts and are vectored by the thrips *Frankliniella occidentalis* and *F. schultzei* (Cabrera, 2020; Reitz et al., 2011; Webster et al., 2010). Furthermore, GBNV shares approximately 29% sequence identity with the nucleocapsid (N) protein of TSWV (Radhakrishnan, 2023).

Other orthotospovirus species that infect solanaceous hosts and are also vectored by thrips include: Capsicum chlorosis virus (CaCV), Groundnut yellow spot virus (GYSV), Iris yellow spot virus (IYSV), Tomato chlorotic spot virus (TCSV), Tomato yellow ring virus (TYRV), and Watermelon bud necrosis virus (WBNV) (Reitz et al., 2011). Molecular identification is necessary for confirmation of GBNV.

In tomato, GBNV-induced foliar necrosis leading to collapse of the stem or entire plant may visually resemble symptoms of blight caused by *Phytophthora infestans* (Akram et al., 2012).

Commonly Encountered Non-targets

The approved survey method for GBNV is visual survey with collection of symptomatic plant material. Because molecular identification is necessary for confirmation, commonly encountered non-targets includes any of the Easily Mistaken Species mentioned above.

Biology and Ecology

GBNV is transmitted by *Thrips palmi* (Fig. 5), *Frankliniella schultzei*, and *Scirtothrips dorsalis* (Whitfield et al., 2005). A wide variety of plants, including peanut, tomato, and potato, support both thrips development and virus transmission and act as primary inoculum sources (German et al., 1992; Whitfield et al., 2005). Thrips typically acquire orthotospoviruses in the larval stage and transmit them in the adult stage (Jones, 2005). *T. palmi* larvae, for example, can acquire GBNV with a minimum access period of 15 minutes, and can transmit GBNV during an inoculation feeding period of at least 1 hour in their adulthood (Ruth, 2018). *T. palmi* larvae that have acquired the virus cannot transmit it while in the larval stage, and an adult can only transmit the virus if obtained in its larval stage (Ruth, 2018). GBNV is transmitted in a circulative and propagative manner (Mandal et al., 2012), meaning that the virus can replicate in the midgut and other parts of the insect's body (German et al., 1992). Replication occurs in the latent period between acquisition and transmission (Jones, 2005). A single *T. palmi* adult can transmit GBNV virus with an efficiency of 24 to 32%, while 10 adults per seedling can achieve a 100% transmission rate (Ruth, 2018). Thrips thrive under hot and dry weather conditions, with an optimal temperature around 85°F (Park et al., 2010; Somani et al., 2007). GBNV-infected plants are more attractive to insect vectors compared with healthy plants (Daimei et al., 2017b). Under field conditions, peanut genotypes susceptible to the virus exhibited higher densities of *T. palmi* compared to resistant genotypes (Lakshmi et al., 1995).

GBNV-infected plants develop chlorotic spots approximately 4 days post inoculation (dpi), and the chlorotic spots turn necrotic at around 6-8 dpi in cowpea and around 10 dpi in tomato. At approximately 15 dpi, stem necrosis occurs in tomato (Gayathri et al., 2024; Singh et al., 2018).

Although seed transmission has not been confirmed in peanut and other hosts (Madhavi et al., 2021b; Sastry, 2013), GBNV is seed-borne at a low rate (1%) in watermelon (Dhkal et al., 2023).

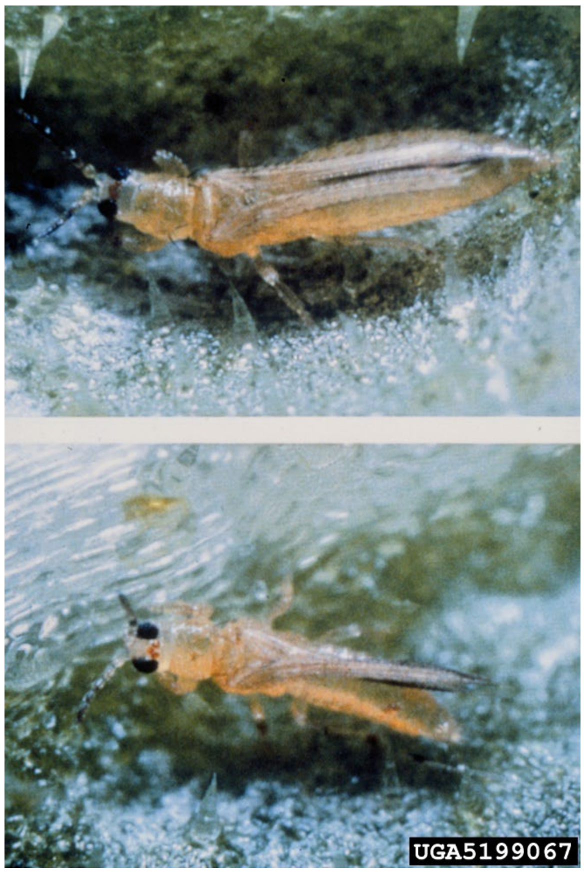

Figure 5. *Thrips palmi*, a known vector of GBNV (Florida Division of Plant Industry, FDACS, Bugwood.org). CC BY 3.0 US

Known Hosts

GBNV has a wide host range. While peanut is the primary host, the virus has been reported to cause symptoms in various horticultural crops, ornamental plants, and weeds. Weeds can act as reservoirs for both the virus and its vector, playing a crucial role in the epidemiology of GBNV (Radhakrishnan, 2023).

The host list below includes cultivated and wild plants that 1) are infected or infested by the pest under natural conditions, 2) are frequently described as major, primary, or *preferred hosts, and 3) have primary evidence for feeding and damage documented in the literature. Plants are highlighted in bold if they are commercially produced and the pest causes economically significant damage.*

Preferred hosts

Table 1. Preferred hosts of Groundnut bud necrosis virus

Scientific Name	Common Name	Type/Use	References/Notes
Arachis hypogaea*	Peanut	cultivated	Reddy et al., 1992
Solanum lycopersicum*	Tomato	cultivated	Akhter et al., 2012; Akram et al., 2012
Solanum tuberosum*	Potato	cultivated	Akram et al., 2012; Pundhir et al., 2012

* Host with known U.S. distribution.

While not preferred targets for survey, Table 2 (below) includes additional confirmed hosts of this species that can be a secondary target for survey based on the needs of the surveyor.

Additional hosts

Table 2. Additional hosts of Groundnut bud necrosis virus

Scientific Name	References/Notes
Acalypha indica (copperleaf)	Gopal et al., 2011
Acanthospermum hispidum (bristly starbur)*	Gopal et al., 2011
Ageratum conyzoides (tropic ageratum)*	Gopal et al., 2011
Allium cepa (onion)*	Sujitha et al., 2012
Alysicarpus rugosus (red moneywort)*	Gopal et al., 2011
Amaranthus spp. (pigweed)*	Gopal et al., 2011
Anthurium andreanum (flamingo-lily)*	Amruta et al., 2020
Capsicum annuum (chili)*	Devi et al., 2019
Catharanthus roseus (Madagascar periwinkle)*	Basavaraj et al., 2017; Daimei et al., 2017a
Chrysanthemum indicum (Florists' chrysanthemum)*	Holkar et al., 2017
Citrullus lanatus (syn. *Citrullus vulgaris*, watermelon)*	Radhakrishnan, 2023; Reddy et al., 1995
Colocasia esculenta (taro)*	Sivaprasad et al., 2011a
Corchorus trilocularis (jew's mallow)	Gopal et al., 2011
Calotropis gigantea (giant milkweed)*	Reddy et al., 2011
Commelina benghalensis (Benghal dayflower)*	Radhakrishnan, 2023
Commelina jacobi (dayflower)	Gopal et al., 2011
Corchorus capsularis (white jute)	Sivaprasad et al., 2011b
Cucumis melo (muskmelon)*	Dhkal et al., 2023
Cucumis sativus (cucumber)*	Reddy et al., 1995
Dahlia coccinea (dahlia)*	Holkar et al., 2017
Dolichos lablab (syn. *Lablab purpureus,* hyacinth bean)*	Jain et al., 2005
Eclipta alba (false daisy)*	Gopal et al., 2011; Radhakrishnan, 2023
Euphorbia heterophylla (syn.*Euphorbia geniculata* (garden spurge)*	Gopal et al., 2011
Gerbera jamesonii (Barberton daisy) *	Bhat et al., 2021

Glycine max (soybean)*	Gopal et al., 2011; Madhavi et al., 2021a
Gossypium hirsutum (cotton)*	Jain et al., 2005
Jasminum sambac (jasmine)*	Sujitha et al., 2013
Lagasca mollis (silkleaf)*	Radhakrishnan, 2023
Lochnera pusilla (tiny periwinkle)	Gopal et al., 2011
Momordica charantia (bitter melon)*	Nagendran et al., 2017
Parthenium hysterophorus (carrot weed)*	Vemana et al., 2015
Pergularia daemia (pergularia)	Aravintharaj et al., 2018
Phalaenopsis sp. (moth orchid)*	Pant et al., 2019
Phaseolus vulgaris (French bean)*	Akram et al., 2010b
Physalis minima (cape gooseberry)*	Gopal et al., 2011
Pisum sativum (pea)*	Akram et al., 2010a
Sesamum indicum (sesame)*	Gopal et al., 2011
Sesbania rostrata (rostrata)	Gopal et al., 2011
Solanum melongena (eggplant)*	Madhavi et al., 2021a
Solanum nigrum (black nightshade)*	Bhat et al., 2020
Vicia faba (faba bean, fava bean)*	Madhavi et al., 2021a
Vigna glabrescens (Creole bean)	Akram et al., 2013
Vigna hainiana	Akram et al., 2013
Vigna mungo (black gram)*	Akram et al., 2010b
Vigna radiata (mungbean)	Akram et al., 2013
Vigna trilobata (African gram)	Gopal et al., 2011
Vigna umbellata (rice-bean)	Akram et al., 2013
*Vigna unguiculata** (cowpea, southern pea)	Akram et al., 2013

[*] Host with known U.S. distribution.

Pest Importance

Total annual losses due to GBNV in Asia are estimated at more than $89 million (Reddy et al., 1995). In peanut, yield losses of 80% have been reported in India (Dasgupta et al., 2003). In tomato, disease incidence of over 90% and yield losses up to 80-100% have been reported in India (Mandal et al., 2012; Manjunatha, 2008; Venkata Ramana et al., 2010). In potato, stem necrosis caused by GBNV is also known to occur, and disease incidence of 50-90% and losses of up to 29% have been reported in India (Mandal et al., 2012; Pundhir et al., 2012).

Peanut, tomato, and potato are important to the United States and vulnerable to GBNV infection. In 2022, peanut was grown on 1.45 million acres, and over 5.57 billion pounds of peanuts were produced (USDA-NASS, 2024a). Tomato was planted in California and Florida on 316,000 acres with a value of over $2.76 billion in 2023 (USDA-NASS, 2024c). Potato was planted on 965,000 acres and over 0.44 billion cwt of potatoes were produced (USDA-NASS, 2024b).

GBNV is listed as a harmful organism in the Republic of North Macedonia (USDA-PCIT, 2024), and the United Kingdom listed GBNV as a quarantine pest in 2022 (EPPO, 2025). There may be trade implications with these countries if this pest becomes established in the United States.

Pathogens or Associated Organisms Vectored

This species is not known to be associated with other pathogens or vectored organisms.

Known Vectors (or associated insects)

Transmission studies have confirmed *Thrips palmi* (melon thrips), *Scirtothrips dorsalis* (chilli thrips), and *Frankliniella schultzei* (common blossom thrips) as vectors for GBNV (Amin et al., 1981; Bhat et al., 2021; Ghanekar et al., 1979; Lakshmi et al., 1995; Rabeena, 2019). *Thrips palmi* has a restricted distribution in the United States, having only been reported from Florida (Seal et al., 2013) and Hawaii (Johnson, 1986). *Scirtothrips dorsalis* is present in the United States, with the South Asia 1 member of the species complex well-established in the south and present in California, and the East Asia 1 member of the species complex endemic to northeastern states (Kumar et al., 2023). *Frankliniella schultzei* is limited primarily to Florida and Hawaii in the United States (Capinera, 2020a). All three thrips species occur in greenhouses in the United States.

Known Distribution

Table 3. Countries where GBNV is known to occur.

Continent	Country	References/Notes
Asia	Bangladesh	Akhter et al., 2012
Asia	China	Chen et al., 2003
Asia	India	Reddy et al., 1995
Asia	Indonesia	Damayanti et al., 2009
Asia	Iran	Golnaraghi et al., 2002
Asia	Nepal	Sharma, 1996
Asia	Pakistan	Delfosse et al., 1995
Asia	Sri Lanka	Reddy et al., 1995
Asia	Thailand	Chiemsombat et al., 2008
Asia	Vietnam	Thuan et al., 1996

Pathway

The most likely pathway of entry for GBNV is by transport of infected plants for planting or by infected thrips vectors (Balol et al., 2014 Bhat et al., 2021; Tsompana et al., 2008). Thrips in general are not strong flying insects, but they can be blown by wind over long distances, or can be carried in trade on fruits, vegetables, flowers, plants for planting, or in packing materials (Jones, 2005; Kumar et al., 2017; Lewis, 1991; Skarlinsky II, 2024; Vierbergen et al., 1991). Once an infected vector population is established, GBNV may spread via thrips or mechanical transmission (Jones, 2005; Tsompana et al., 2008).

Seeds are not considered a common pathway to transmit GBNV (Madhavi et al., 2021b; Sastry, 2013). However, GBNV is seed-borne at a low rate (1%) in watermelon (Dhkal et al., 2023).

Use the manual listed below to determine 1) if host plants or material are allowed to enter the United States from countries where the organism is present and 2) what phytosanitary measures (e.g., inspections, phytosanitary certificates, post entry quarantines, mandatory treatments) are in use. This manual is updated regularly.

Agricultural Commodity Import Requirements(ACIR) manual: ACIR provides a single source to search for and retrieve entry requirements for imported commodities.

Potential Distribution within the United States

Based on host and vector distribution, we expect that GBNV could establish in several regions of the United States, with southern states and Hawaii especially at risk. The pathogen could also occur in greenhouses across the country.

The following vectors of GBNV are present in the United States: *Frankliniella schultzei*, *Scirtothrips dorsalis*, and *Thrips palmi* (Capinera, 2020b; Kakkar et al., 2017; Kumar et al., 2017). If GBNV is introduced into the United States, chances of spread through vector transmission are high. *Thrips palmi* and *Frankliniella schultzei* are both found in Florida and Hawaii, while *Scirtothrips dorsalis* is widespread throughout the South and has been reported from California and several northeastern states (Akhter et al., 2012; Capinera, 2020a; Johnson, 1986; Kumar et al., 2023; Seal et al., 2013). All three thrips species are found in greenhouses.

Georgia is the largest peanut-producing state and accounts for over half of all commercial peanut production in the United States. The other top commercial peanut producing states are Alabama, Florida, North Carolina, Texas, South Carolina, Arkansas, and Virginia (USDA-NASS, 2024a).

Two thirds of all U.S. commercial tomato acreage is found in California and Florida (USDA-NASS, 2024a). Other states with significant commercial tomato cultivation include: Indiana, Michigan, Ohio, Tennessee, New Jersey, Pennsylvania, South Carolina, North Carolina, and Georgia (USDA-NASS, 2024a). Greenhouse tomato production occurs in most states (USDA-NASS, 2024a), and tomato is also popular with home gardeners throughout the United States.

Potato is grown throughout the United States in backyard gardens and is grown commercially in many states.

Survey and Key Diagnostics

Approved Methods for Pest Surveillance*:

For the current approved methods and guidance for survey and identification, see Approved Methods for Pest Surveillance (AMPS) pest page on the CAPS Resource and Collaboration website, at https://approvedmethods.ceris.purdue.edu/.

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Versions

August 2016: Datasheet completed (Version 1)

August 2017: Review completed (Version 2)

April 2025 (Version 3)

- Added “Notes on taxonomy and nomenclature”
- Revised common name and taxonomy
- Removed **Background Information**
- Revised **Pest Description**
- Revised **Biology and Ecology.**
- Updated and created chart for **Known Hosts**
- Revised **Known Vectors**
- Revised **Known Distribution**
- Revised **Pathway**
- Revised **Potential Distribution within the United States**
- Revised **Survey and Key Diagnostics** section

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