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Tospovirus (family Bunyaviridae).

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The definition of the genus Tospovirus (family Bunyaviridae) has a wide worldwide distribution, being able to infect more than 1050 plant species in 92 botanical families. Head turner is a globally important disease in potato crops, which can spread rapidly in the crop with incidence rates between 30-40% and lead to the death of plants. This disease is caused by viruses known as tospovirus. In Brazil, three species of tospovirus capable of infecting potatoes are present: Tomato spotted wilt virus, Groundnut ringspot virus, and Tomato chlorotic spot virus (Figure 1) [1-5]

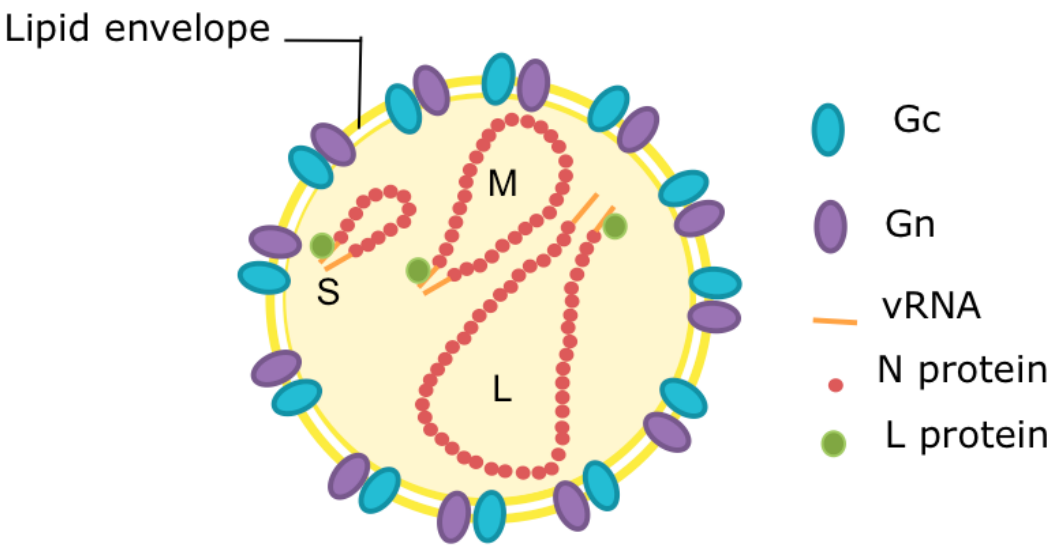

Figure 1. Schematic diagram of a bunyavirus virion. Source: Credit Veronica Rezelj and http://cvr.academicblogs.co.uk/bunyaviruses-we-are-one-big-family/.

Tospoviruses infect more than 550 plant species in 70 families, mainly Solanaceae (e.g.: tomato, potato, pepper, pepper) and Asteraceae (lettuce). They also infect ornamental plants (begonia, chrysanthemum, dahlia, and gladiolus) and weeds that serve as sources of the virus and/or vector. It is interesting to note that the family is mainly made up of viruses that infect animals and humans, and the majority are transmitted by arthropods. The Tospovirus genus includes only viruses that infect plants and at the same time thrips, which are considered vectors in the agricultural world for spreading tospoviruses (Figure 2) [5-7].

Figure 2. Pepper Disease - Tospovirus Virus. Crops: Pepper, Pepper. Pathogen type: Viruses Causal agent: Tospovirus "Tomato spotted wilt virus". Type of symptom: Spot. Symptoms on plants appear between 15-21 days after infection. There is chlorosis in the upper part of the plant and marked necrosis in the leaves stems, and fruits (generally concentric rings). Plant growth is paralyzed, and necrotic lesions are visible on the fruits. Tarsis de Aguiar. Source: https://sistemasdeproducao.cnptia.embrapa.br and Photos: www.bugwood.org [7-15].

In Brazil, six species of tospovirus have already been reported: Tomato spotted wilt virus; tomato chlorotic spot virus; and Groundnut ringspot virus, widespread in tomatoes, peppers, lettuce, peanuts, and ornamentals. *Chrysanthemum* stem necrosis virus, found mainly in tomatoes and chrysanthemums; Iris yellow spot virus, a virus found in onions in Northeast Brazil; and Zucchini lethal chlorosis virus, a virus of importance in cucurbits in some regions of Brazil. The initial symptoms of Tospovirus in tomatoes appear at the top of the plant, with an increase in pigments in the tissues like melanin, presenting a purplish color, progressing to tanning and apical necrosis, which can lead to the death of the plant. The apex of the plant also tends to present an asymmetrical development pointer turning to one side, hence the name tomato plant head turner. The leaves and fruits may present symptoms in the form of circular rings, characteristic of the disease [7-15].

Tospoviruses are responsible for the disease known as tomato virus, which causes annual losses in the table and processing of tomato crops. These viruses are transmitted by thrips in a circulative/propagative manner. Species of this genus have a worldwide distribution and present a great diversity of viral species infecting a wide range of hosts. Groundnut ringspot virus is the tospovirus species prevalent in tomato plantations in Brazil. Susceptible plants generally present symptoms of tanning and/or spots in chlorotic rings on the leaves, necrosis of petioles, necrotic rings on fruits, and generalized necrosis (Figure 3) [7-15].

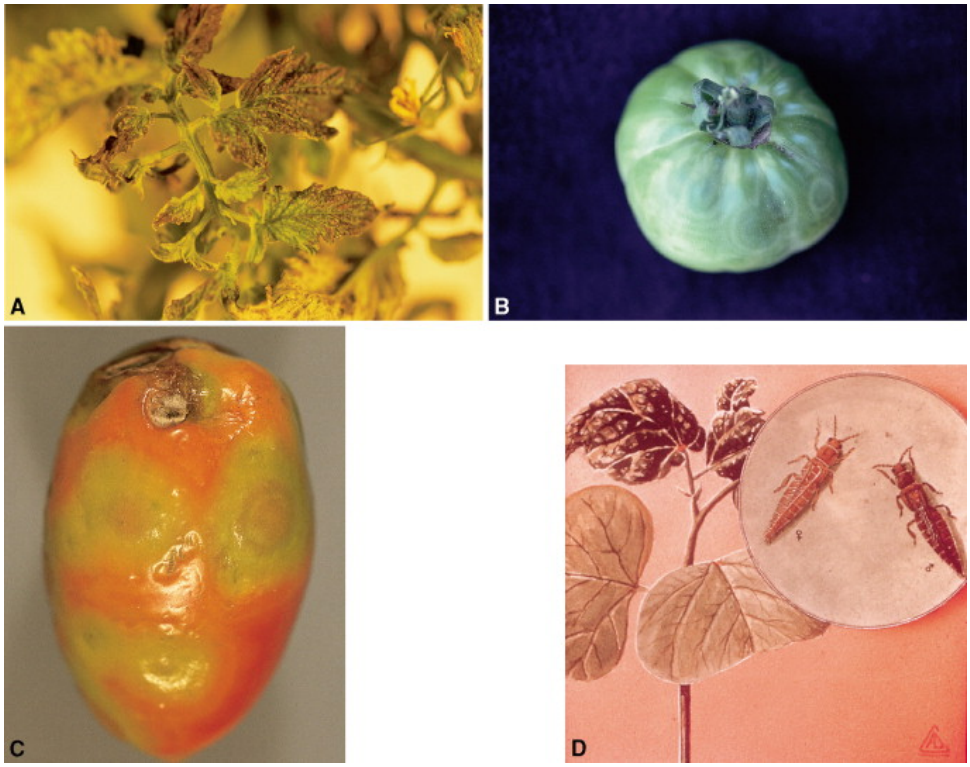

Figure 3. Tomato spotted wilt symptoms caused by the tomato spotted wilt virus (TSWV). (A) Tomato plant showing bronzing and necrosis. (B and C) Young and ripe tomato fruit showing rings of spotted wilt. (D) Thrips, the insect vector of TSWV. Sources: Photographs courtesy of (A, C, and D) Plant Pathology Department, University of Florida, and (B) R. J. McGovern and ttps://www.sciencedirect.com/topics /biochemistry-genetics-and-molecular-biology/tospovirus.

The development of tomato cultivars with resistance to the virus is the best method for controlling the disease. Tospoviruses are responsible for the disease known as “tomato virus”, which causes annual losses in the table and processing of tomato crops. These viruses are transmitted by thrips in a circulative/propagative manner. Species of this genus have a worldwide distribution and present a great diversity of viral species infecting a wide range of hosts. The tospovirus species is prevalent in tomato plantations in Brazil [7-15].

Susceptible plants generally present symptoms of tanning and/or spots in chlorotic rings on the leaves, necrosis of petioles, necrotic rings on fruits, and generalized necrosis. The development of tomato cultivars with resistance to the virus is the best method for controlling the disease. Control of the disease can be carried out through the selection of resistant plants and transfer of resistance alleles or through molecular markers, which lead to faster results, in addition to not depending on environmental conditions and the stage of development of the plant to carry out the disease. Selection [7-15].

The new virus in bean plantation Bean necrotic mosaic virus is from the tospovirus genus, which generally attacks vegetables and causes necrosis in plants. Although some species cause real damage to crops, such as tomatoes, for example, the new virus has not yet demonstrated this power. However, the possibility of a drop in productivity because of virus infection worries researchers. Brazil is the world's largest producer of beans, although it is not the leader in exporting

the product. In general, this group does not infect beans systemically, which is why it is very distinct. The virus is transmitted by the thrips insect, responsible for the transmission of all viruses of this genus. The most used methods for detecting tospovirus species have been mechanical inoculation on indicator plants, serological tests, PCR, hybridization with radioactive probes, ELISA, and hybridization with a radioactive cDNA probe [7-15].

References

[1] Resende RO, et al. New tospoviruses found in Brazil. Proceedings of the International Symposium on Tospovirus and Thrips of Floral and Vegetable Crops. Acta Horticulturae. 1996; 431(1): 78-89.

[2] Bezerra IC, et al. Increase of tospoviral diversity in Brazil with the identification of two new tospovirus species, one from *Chrysanthemum* and one from zucchini. Phytopathology. 1999; 89(11): 823-830.

[3] Wang M, Gonsalves D. ELISA detection of various tomato spotted wilt virus isolates using specific antisera to structural proteins of the virus. Plant Disease. 2019; 74(2): 154-158.

[4] Eiras M, Resende RO, Avila AC. Strategy for detecting tospovirus. archives of the biological institute. 2001; 68(1): 69-73.

[5] Peters D. An updated list of plant species susceptible to tospoviruses. In: Peters D, Goldbach RW, eds. Recent progress in tospovirus and thrips research; 1998. p.107-110.

[6] Avila AC, et al. Distinct levels of relationship between tospovirus isolates. Archives of Virology. 1993; 128(2): 211-227.

[7] Virus vectors [Internet]. Pelotas; Cultivar Magazine; @2024 [cited 2024 Mar 12]. Available from https://revistacultivar.com.br/index.php/artigos/vetores-de-virus and DOI: 10.11.2015.

[8] Oliveira RM. Analysis of genetic resistance to Tospovirus and Potyvirus in*Solanum* accesses (*Lycopersicon* Section) [Internet]. Goiânia: Master's Dissertation, Federal University of Goiás; @2015 [cited 2024 Mar 12]. Available from https://files.cercomp.ufg.br/weby/up/70/o/Disserta%C3%A7%C3%A3o_RENATA_MARIA_DE_OLIVEIRA.pdf.

[9] Nogueira DW. Molecular marker associated with the Ty-1 allele in tomato and its selection efficiency. Brazilian Agricultural Research. 2012; 47(7): 955-963.

[10] Wijkamp I, Lent JV, Kormelink R, Peter D. Multiplication of tomato spotted wild virus in its insect vector*Frankliniella occidentalis.* Journal of General Virology. 1993; 74: 341-349.

[11] Nogueira DW, et al. Molecular marker associated with the Ty-1 allele in tomato and its selection efficiency. Pesquisa Agropecuária Brasileira. 2012; 47(7): 955-963.

[12] Nogueira DW, et al. Microsatelite marker associated with the Ty-1 allele for resistance to Begomovirus in tomato. Pesquisa Agropecuária Brasileira. 2011; 46(4): 412-419.

[13] Lopes CA, Ávila AC. Tomato diseases. 1st ed. Brasília: Embrapa Vegetables. 2005.

[14] Colariccio AM. Detection of *Chrysanthemum* stem necrosis virus in tomato plants in the state of São Paulo. Summa Phytopathologica. 2000; 26: 252-254.

[15] Researcher discovers new virus in bean plantation [Internet]. Brasília: UnB Science- Biological Sciences-University of Brasília; @2011 [cited 2024 Mar 12]. Available https://www.unbciencia.unb.br/biologicas/104-ciencias-biologicas/258-pesquisador-descobre-novo-virus-em-plantacao-de-feijao.