Comunicata Scientiae
Horticultural Journal

SCIENTIFIC NOTE
published: 22 May 2021
https://doi.org/10.14295/CS.v12.3494

Occurrence of the Cowpea aphid-borne mosaic virus in Jataí, Brazil

Francielly Rodrigues Gomes[1], Marcelo Marques Costa[1], Luciana Celeste Carneiro[1], David Marques de Almeida Spadotti[2], Hildeu Ferreira da Assunção[1], Danielle Fabíola Pereira da Silva[1]*

[1]Federal University of Jataí, Jataí, Brazil
[2]University of São Paulo, Piracicaba, Brazil
*Corresponding author, e-mail: daniellefpsilva@gmail.com

Abstract

The passion fruit woodiness disease is one of the main viruses that occur on passion fruit crops. Depending on the stage that the virus infects the orchard, great losses in productivity and fruit quality can be observed. This work aimed to report the occurrence of the passion fruit woodiness disease (*Cowpea aphid-borne mosaic virus*) in plants and fruits of passion fruit in Jataí – GO, Brazil. Plants of passion fruit (*Passiflora edulis*) presented the virus symptoms at the begginning of the second productive cycle, after the flowering. The infection was confirmed by serological analysis using the PTA ELISA indirect test. When the symptoms are observed after the flowering there is no need to immediately destroy the orchard, however, the disease compromises the appearance of the fruits, making it unfeasible they *in natura* commercialization. Since the juice yield has not been affected, these fruits can be used by the juice processing industry.

Keywords: *Passiflora edulis*, plant health, phytopathology, *Potyvirus*

Brazil is the center of origin of several species that belong to the genus *Passiflora* and is the largest producer and exporter of passion fruit (Botelho et al., 2019). The main cultivated species is *Passiflora edulis*, which were produced 602,651 tons in 2018 in the whole country and the state of Goiás was responsible for the production of 7,499 tons of fruits (IBGE, 2019).

One of the main problems faced by passion fruit producers is the losses due to the occurrence of diseases, especially from viral etiology (Anjos et al., 2001). The passion fruit woodiness disease in Brazil is caused by *Cowpea aphid-borne mosaic virus* (CABMV), of the genus *Potyvirus* (Freitas et al., 2015), in Australia, it is caused by PWV (*Passion fruit woodiness virus*) and in Asia, it is caused by EAPV (*East Asia Passiflora Virus*) (Melo et al., 2015).

Since it was first reported in the state of Bahia in 1978, CABMV has spread to all fruit-producing regions and is supposed to occur endemically throughout the country. CABMV has been making fruit production unviable and making this crop itinerant, with many regions failing to produce fruit due to high productivity losses (Narita et al., 2012).

The introduction of the virus occurs through aphids, however, chemical control is not efficient, since the passion fruit culture is not a host of aphids and transmission occurs during probing (Freitas et al., 2015). Transmission through seeds is unknown and there are no reports of introduction other than by aphids (Narita et al., 2011).

The main symptoms observed in plants infected with CABMV consist of mosaic on the leaves, fruits with hard pericarp, and great pulp reduction, which causes losses of approximately 60% (Viana et al., 2014). The fruits of infected plants may not meet market demands regarding internal and external characteristics, since these fruits will have a deformed shape and the consumer evaluates the

Received: 30 June 2020
Accepted: 22 January 2021

quality of the fruits through their appearance (Cavichioli et al., 2011).

Anjos et al. (2001), reported the occurrence and distribution of the passion fruit woodiness disease (*Passion fruit woodiness virus* - PWV) in the Cerrado of Brazil Central. The assessment was carried out from 1998 to 2000, with 37 commercial passion fruit plantations being evaluated in the Federal District and seven municipalities in the Planalto Central Brasileiro region. The PWV was detected in 54.05% of the evaluated plantations, with high severity. Among the municipalities, Jataí-GO was not inspected at the time. This research aimed to report the occurrence of CABMV in plants and fruits of a passion fruit crop in Jataí-GO.

The Orchard was established in the experimental area of the Agronomic Research Center at the Federal University of Jataí (GO), located at latitude 17°53' South, longitude 52°43' West and 670 m above mean sea level (Figure 1). The region's climate is of the Aw type, mesothermal tropical, which has two well-defined climatic seasons, with a higher rainfall index between October and April and a dry period between May and September, according to the Koppen classification. The average temperature is 23.3 °C and the average annual rainfall is 1541 mm (Melo & Dias, 2019).

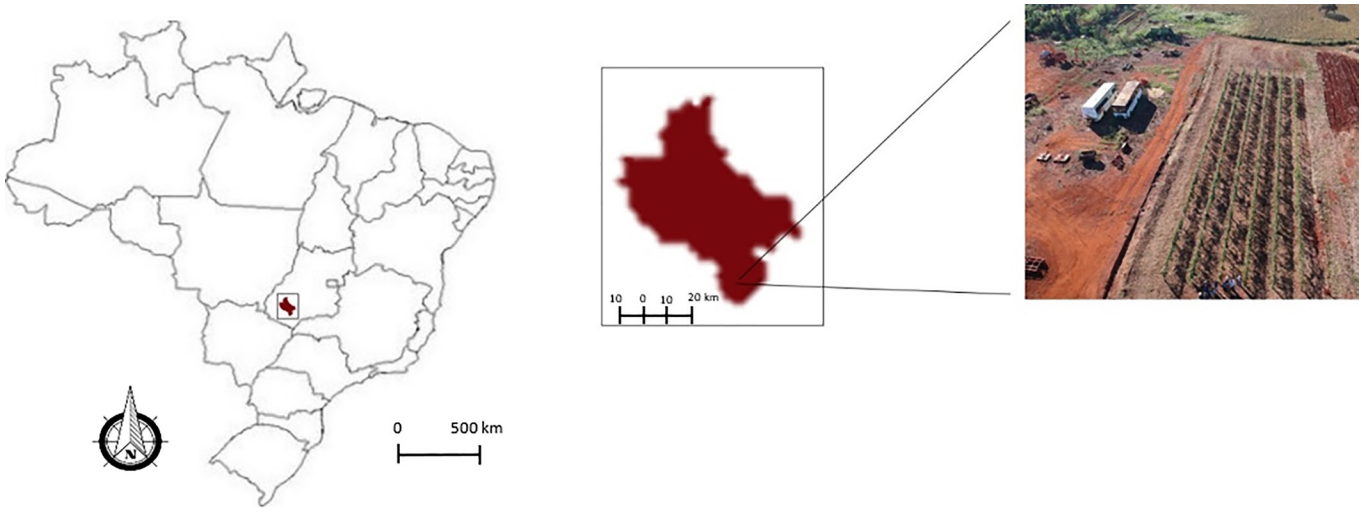

Figure 1. Location of the experimental orchard in the city of Jataí, Brazil. Source: GOMES, 2019.

The orchard soil was classified with a dystrophic Red Latosol. To prepare the soil, 5 tons of limestone per hectare was applied and incorporated with a moldboard plow. Subsequently, *Crotálaria ocroleuca* was sown and after 30 days it was incorporated with a plow, when pits 80 cm deep were opened and fertilized with 500 g of Super Simple phosphate.

Where evaluated 60 plants of a genotype from *P. edulis* and 60 plants from a commercial cultivar (FB 200 from Flora Brasil nursery – Araguari – MG), also belonging to the species *P. edulis*, which were arranged in a completely randomized blocks design. On January 19, 2018, the seedlings that had been produced in a screened nursery on August 12, 2017, were planted in a vertical shoot position with two-wire strands at 3 x 5 m spacing. At this time, the seedlings were approximately 1.0-meter-high, according to the recommendations of Damatto-Junior et al. (2014).

In the first production cycle, which finished in July 2018, the plants have not presented the disease symptoms, and they were identified at the second production cycle in September 2018, after the flowering. It is possible that the infection has occurred through aphids during the probe since the orchard was located next to legumes and vegetable gardens with Cucurbitaceae that can act as hosts for virus vectors, and the pruning tools always were sanitized with a copper sulfate solution after the pruning practices of each plant to avoid diseases dissemination.

The first symptoms observed after the flowering from the second production cycle consisted of chlorotic lesions, blisters, and wrinkling, especially in the youngest leaves (Figure 2G and H). After observing the symptoms, branches from all plants in the orchard with the standard size of 20 cm length were collected, individually wrapped into plastic bags, and sent to the plant virology laboratory of the University of São Paulo - Escola Superior de Agricultura "Luiz de Queiroz". To confirm the infection, the PTA (Plate Trapped Antigen) ELISA (Enzyme-Linked Immunosorbent Assay) indirect serological test was performed, in which positive and negative controls were used, and the samples were considered positive when they had an average absorbance reading equal to or

greater than 3x the reading of the value corresponding to the negative sample at 405 nm, where the infection of all the 120 plants with the *Cowpea aphid-borne mosaic virus* was confirmed.

The symptoms increased with the crop development, in which could be observed visual effects on the fruits that consisted in hardened lesions and cracks (Figure 2 A, B, and C), wrinkles and blisters (Figure 2 D), besides rotting and sharp drop of the fruits (Figure 2 E and F).

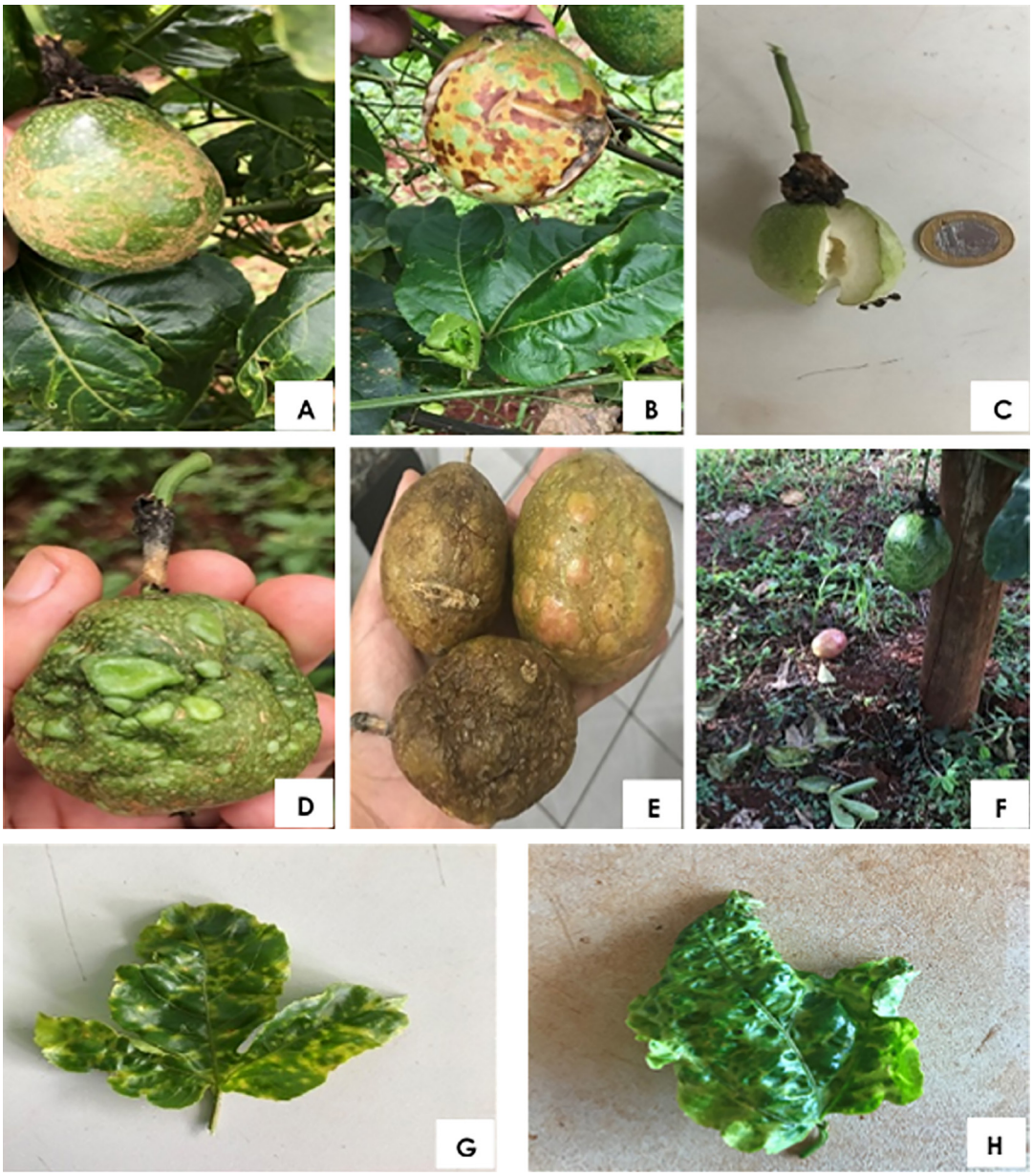

Figure 2. A, B and C: Fruits with symptoms of CABMV; D: Fruits with blisters on the epidermis and wrinkling due to CABMV; E and F: rotting and sharp drop of fruits caused by CABMV symptoms; G and H: Leaves with chlorotic spots and blisters, characteristic symptoms of CABMV.

Despite the effect on fruits epidermis, the pulp and fruit yield were not affected, probably due to the period that the first symptoms were observed, once the flower buds already been formed, and according to Sampaio et al. (2008), in those conditions there is no need to eliminate the diseased plants (*roguing*).

After harvesting the fruits in December 2018, a drastic pruning of the plants was carried out to observe their behavior concerning regrowth, however, due to the progress of the disease, the death of all the plants was observed. The period between the onset of symptoms and the death of the plants was approximately 90 days.

Similar symptoms were identified in passion fruit plants in the Federal District and seven municipalities in the Central Plateau (Anjos et al., 2001), however, the virus detected by the Elisa method was caused by strains of

PWV (Passion fruit woodiness virus) and not by strains of CABMV, as reported in the present study.

After the destruction of the orchard, the area remained at rest for a period before the installation of a new orchard, this practice is suggested by Peruch et al. (2011), to reduce the inoculum potential in the field, also, is recommended the narrow spacing that allows obtaining greater yield per area, avoiding higher losses._

When the symptoms are observed after the flowering in a well-established crop, there is no need to immediately destroy the orchard, since the symptoms become stronger when the fruit were all formed. The passion fruit woodiness disease compromised the appearance of the fruits and reduced their commercial value, making it impossible to be commercialized for fresh consumption, however, as the fruit and juice yield was not affected, these fruits could be destined for juice processing.

Acknowledgments

The authors are grateful to the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) and the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) for financial support.

References

Anjos, J.R.N., Junqueira, N.T.V., Charchar, M.J.A. 2001. *Incidência e distribuição do vírus do endurecimento dos frutos do maracujazeiro no Cerrado do Brasil Central.* Embrapa Cerrados, Planaltina, Brazil. 16 p.

Botelho, S.C.C., Hauth, M.R., Botelho, F.M., Roncatto, G., Wobeto, C., Oliveira, S.S. 2019. Qualidade pós-colheita de frutos de maracujazeiro-amarelo colhidos em diferentes estádios de maturação. *Revista de Ciências Agrárias* 62: 1-8.

Cavichioli, J.C., Corrêa, L.S., Narita, N., Kasai, F.S. 2011. Incidência e severidade do vírus do endurecimento dos frutos em maracujazeiros enxertados em pé-franco. *Revista Brasileira de Fruticultura* 33: 411-414.

Damatto-Junior, E.R., Fuzitani, E.J., Nomura, E.S. 2014. Produção de maracujá com uso de mudas avançadas no Vale do Ribeira. *Pesquisa & Tecnologia* 11: 1-6.

Freitas, J.C.O., Viana, A.P., Santos, E.A., Silva, F.H.L., Paiva, C.L., Rodrigues, R., Souza, M.M., Eiras, M. 2015. Genetic basis of the resistance of a passion fruit segregant population to *Cowpea aphid-borne mosaic virus* (CABMV). *Tropical Plant Pathology* 40: 291–297.

IBGE. Sistema IBGE de Recuperação Automática - SIDRA: Produção Agrícola Municipal: tabelas. 2019. Dados em nível de município. https://sidra.ibge.gov.br/pesquisa/pam/tabelas < Access on 21 set. 2020>.

Melo, J.R.F., Figueira, A.R., Moreira, C.N., Oliveira, A.C. 2015. Recent characterization of *cowpea aphid-borne mosaic virus* (CABMV) in Bahia State, Brazil, suggests potential regional isolation. *African Journal of Biotechnology* 14: 735-744.

Melo, B.M., Dias, D.P. 2019. Microclima e conforto térmico de remanescentes florestais urbanos no município de Jataí – GO. *Revista da Sociedade Brasileira de Arborização Urbana* 14: 01-15.

Narita, N., Yuki, V.A., Narita, H.H., Hirata, A.C.S. 2012. Maracujá amarelo: tecnologia visando a convivência com o vírus do endurecimento dos frutos. *Pesquisa & Tecnologia* 9: 1-7.

Narita, N., Yuki, V.A., Pavan, M.A. 2011. Não transmissibilidade do CABMV do maracujazeiro por sementes. *Summa Phytopathologica* 37: 221-221.

Peruch, L.A. M., Colariccio, A., Schroeder, A. 2011. Sintomas e controle das principais doenças do maracujazeiro (*Passiflora edulis* f. flavicarpa) em Santa Catarina. *Agropecuária Catarinense* 24: 42-45.

Sampaio, A.C., Scudeller, N., Fumis, T.F., Almeida, A.M., Pinotti, R.N., Garcia, M.J.M., Pallamin, M.L. 2008. Manejo cultural do maracujazeiro-amarelo em ciclo anual visando à convivência com o vírus do endurecimento dos frutos: um estudo de caso. *Revista Brasileira de Fruticultura* 30: 343-347.

Viana, C.A.D.S., Pires, M.D.C., Peixoto, J.R., Junqueira, N.T.V., Blum, L.E.B. 2014. Resistência parcial de genótipos de maracujá-azedo à virose do endurecimento do fruto (*Cowpea aphid-borne mosaic virus* CABMV). *Bioscience Jornal* 30: 338-345.

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.