



ANIMAL SCIENCE

Reproduction in the spider mite *Oligonychus yothersi* (Acari: Tetranychidae)

JÚLIA J. FERLA, JULIANA GRANICH & NOELI J. FERLA

Abstract: In this work we reported injuries caused by the spider mite *Oligonychus yothersi* on *Vitis vinifera* leaves and we also investigate the sex ratio of this species under laboratory conditions. To access the aspects regarding reproduction, females were placed individually in arenas made of *V. vinifera* leaves to oviposit and all progeny were mounted on slides when they reached adulthood to confirm the offspring sex. Our study showed that *O. yothersi* reproduces by thelytokous /arrhenotokous parthenogenesis, generating low number of males. Additionally, we found vine plants with leaf browning, particularly on the adaxial surface, where mites were usually found.

Key words: Grapevine, parthenogenesis, sex rate, sexual behavior, *Vitis vinifera*.

Brazil is one of the largest grapevines producing countries, and Rio Grande do Sul state accounts for up to 90% of the national production of wines and grape juice and approximately 85% of sparkling wine (Mello & Machado 2020). European grapes (*Vitis vinifera* L.) are the most commonly cultivated worldwide. The phytophagous mite families of economic importance in this crop are Tetranychidae, Eriophyidae, Tarsonemidae and Tenuipalpidae (Schruft 1985, Duso & de Lillo 1996).

Tetranychidae, a mite family of high economic importance, is subdivided into two subfamilies: Bryobriinae and Tetranychinae (Baker & Tuttle 1994, Migeon et al. 2020). Many tetranychid species have a parthenogenetic reproduction, where unfertilized females produce eggs capable of development (Mittwoch 1978, Helle & Pijnacker 1985). Male-producing parthenogenesis (arrhenotoky) is most frequently found, but there are also records of female-producing parthenogenesis (thelytoky) (Helle & Pijnacker 1985). The Bryobriinae are

unique in showing similar distribution of arrhenotoky and thelytoky in the species where this has been examined (Helle & Pijnacker 1985). Arrhenotoky has the most frequent occurrence in the subfamily Tetranychinae (Heinrich 1972, Helle & Pijnacker 1985). However, the genus *Oligonychus* is peculiar with most of the species studied being arrhenotokous (Heinrich 1972, Helle & Pijnacker 1985). In particular, *O. ilicis* (McGregor) and *O. mangiferus* Rah. & Punj. exhibit thelytoky/arrhenotoky, while *Oligonychus thelytokus* Gutierrez is the only species of the genus to exhibit thelytoky exclusively (Gutierrez 1977, Heinrich 1972, Helle & Pijnacker 1985).

Oligonychus yothersi (McGregor) (Tetranychidae) has already been registered in Brazil in several crops such as avocado, yerba mate, coffee, mango, grapes and ornamental plants (Flechtmann & Moraes 2017). Only arrhenotokous parthenogenesis has been observed for this species (Alves et al. 2004). Thus, a better understanding of the biology and life cycle of this mite species would

facilitate management practices and favor the establishment of a sustainable pest mite control.

We recorded *O. yother*s*i* in a backyard vineyard, “BRSVitória” variety (*V. vinifera*), planted in 2015 and managed without pesticides and fertilizers, in Arroio do Meio County, Rio Grande do Sul state, Brazil (29.402604066190467°S, 51.94319997583439°W). We found plants with symptoms caused by *O. yother*s*i*: leaf browning, particularly on the adaxial surface, where mites

were usually found, but were also found on the abaxial surface when population densities were high (Figure 1).

*Oligonychus yother*s*i* (Figure 2) is characterized by: female with empodium clawlike (Figure 3a) and two pairs of duplex setae distal and approximate on tarsus I (Figure 3b). Longitudinal pregenital striae and 2 pairs of para-anal and anal setae (Figure 3c). Males are similar to females, with aedeagus bent portion

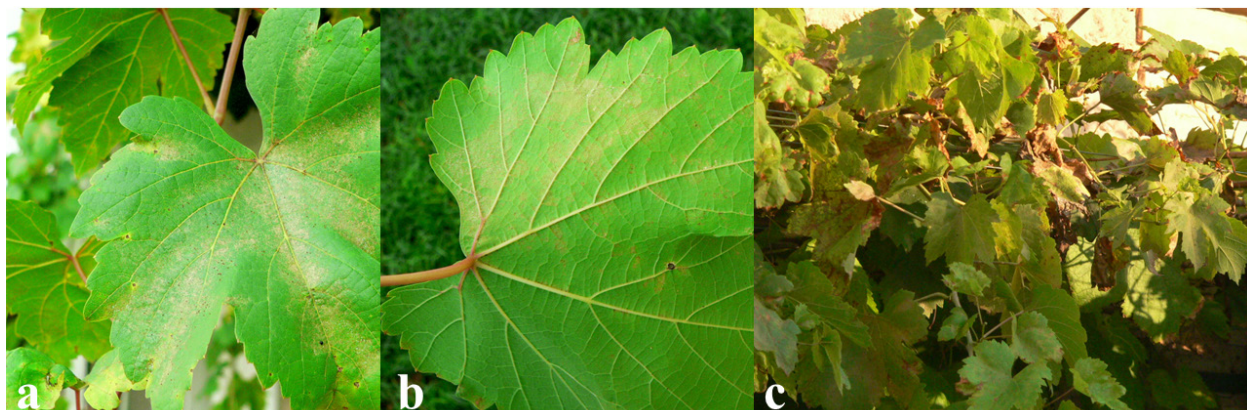


Figure 1. Leaf symptoms caused by *Oligonychus yother*s*i* on *Vitis vinifera*. a - Adaxial surface. b - Abaxial surface. c - On vineyard.

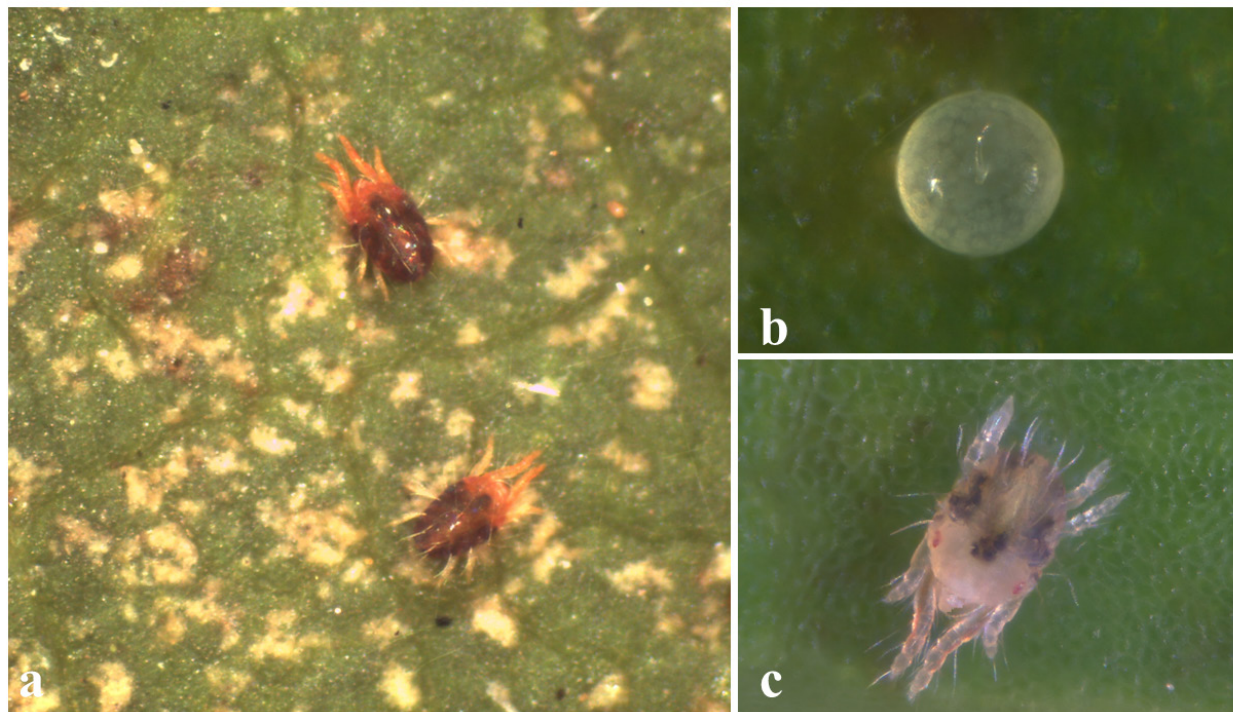


Figure 2. Stereomicroscope. *Oligonychus yother*s*i*. a - Adult females. b - Egg. c - Immature stage.

slightly fattened then abruptly tapered to the tip (Figure 3d) (Baker & Tuttle 1994).

We observed that males were rare on the field, thus we assessed the sex ratio in a laboratory experiment. To do so, 36 females were placed individually in arenas to oviposit. The arenas were made of *V. vinifera* leaves, placed on a moistened sponge with the adaxial surface upwards, and their borders were protected with cotton wool. Distilled water was added on a daily basis to the sponge in order to keep the leaves hydrated and to the cotton wool to prevent mites from escaping. The experiment was conducted at $25\pm 1^\circ\text{C}$, $80\pm 5\%$ relative humidity and 12 hours of photoperiod in the laboratory. After laying one egg each, the females were removed. All of the eggs were observed once a day until adulthood. After reaching the adult stage, all females oviposited throughout adulthood until death. The offspring were counted and placed

in new arenas until they reached adulthood, when all of them were mounted on slides to confirm the sex. All slides were examined using a phase contrast microscope (Axio Scope. A1 – Zeiss) and they were identified with a proper dichotomous key (Baker & Tuttle 1994). Sex ratio was calculated as follows: $\text{Number of females} / (\text{number of females} + \text{number of males})$.

There was a total of 522 offspring, which the sex ratio was 99.4% females ($n= 519$) and 0.6% males ($n= 3$). Our study showed that unfertilized *O. yotheri* female, under laboratory conditions reproduces by thelytokous /arrhenotokous parthenogenesis, generating low number of males. It is important to emphasize the difference in the previous study where arrhenotoky was observed by Alves et al. (2004). Studies involving sex chromosomes should be done to confirm which form of parthenogenesis occurs in *O. yotheri* and if it may be variable. Aspects

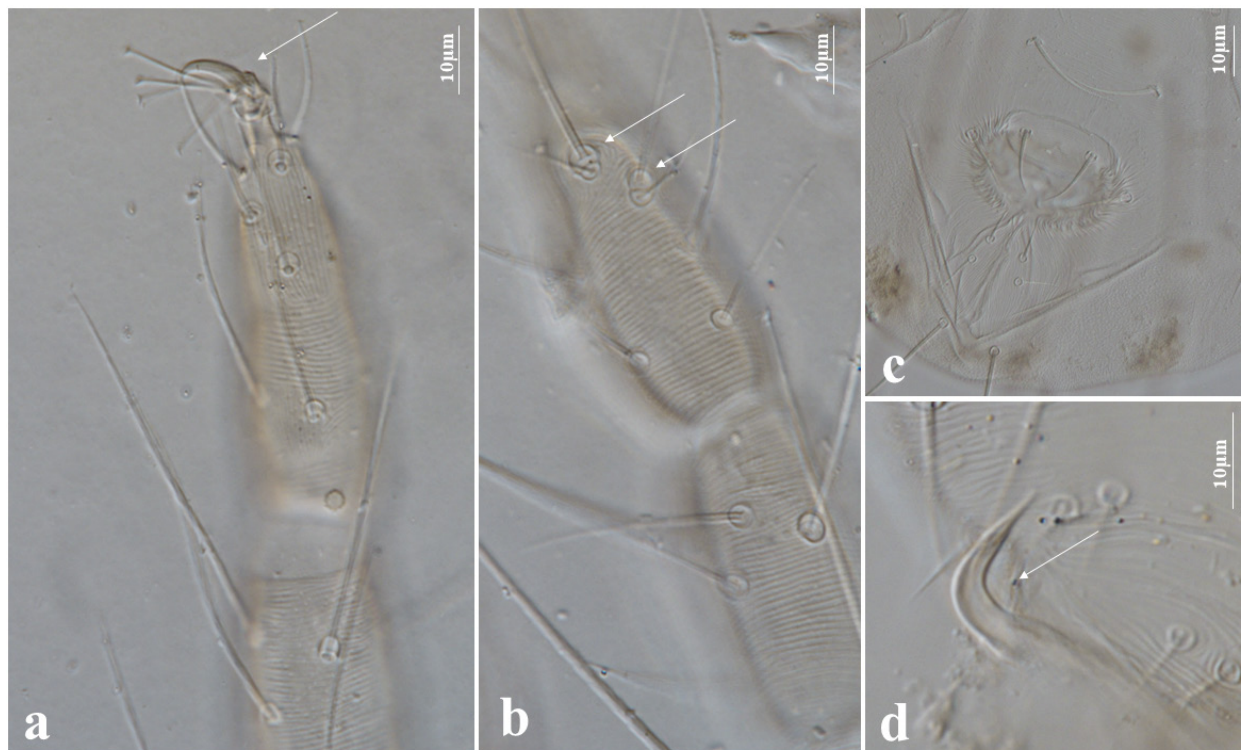


Figure 3. Phase contrast microscope. Female of *O. yotheri*. a - Empodium of leg I. b - Duplex setae on the tarsus of leg I. c - Anogenital region. d - Male aedeagus.

regarding the impact of the environment on reproduction merits attention especially aiming for proper biological control practices.

Acknowledgments

The authors are grateful to Professor Carlos H. W. Flechtmann, for revising the manuscript, providing scientific literature and for taxonomical help. This research was funded by Coordenação de Aperfeiçoamento de Pessoal de Nível Superior—Brasil (CAPES)—Finance Code 001, “Conselho Nacional de Desenvolvimento Científico e Tecnológico” (CNPq, 312784/2021-0), and Universidade do Vale do Taquari – Univates.

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How to cite

FERLA JJ, GRANICH J & FERLA NJ. 2024. Reproduction in the spider mite *Oligonychus yotheri* (Acari: Tetranychidae). An Acad Bras Cienc 96: e20230500. DOI 10.1590/0001-3765202420230500.

Manuscript received on June 27, 2023;
accepted for publication on April 7, 2024

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