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# New records of Eriophyidae and Tenuipalpidae mites (Acari: Prostigmata) on bougainvillea plants in South Africa

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## Original research

### ABSTRACT

Bougainvillea plants, native of Brazil, are cultivated in home gardens in South Africa. *Vittacus bougainvilleae* (Keifer) (Eriophyidae), *Brevipalpus californicus* s.l. (Banks) and *Brevipalpus yothersi* Baker (Tenuipalpidae) are recorded for the first time in this country infesting bougainvillea plants. The bougainvillea rust mite, *V. bougainvilleae*, was detected in the Western Cape Province during the summer season. Infested plants showed symptoms of leaf rolling, as well as leaf and flower drop. *Brevipalpus californicus* and *B. yothersi* were detected in Mpumalanga Province during winter and late autumn causing no obvious damage.

**Keywords** *Brevipalpus*; rust mite; flat mites; ornamental plants; *Vittacus*

## Introduction

Bougainvillea are ornamental plants native to Brazil and belong to the family Nyctaginaceae. The family consist of approximately 30 genera worldwide. In South Africa, the genus *Bougainvillea* is represented by three important species, namely, *B. spectabilis* Willds, *B. glabra* Choisy and *B. peruviana* Bonpl. (Douglas and Spellenberg 2010; Struwig and Siebert 2010; Ghogar and Jiraungkoorskul 2017; Saika and Lama 2011).

Fruits and ornamental plants, the most common exported commodities, often host eriophyoid mites. Mite fauna on ornamental plants receive very little attention compared to other agricultural commodities of economic importance (Jeppson *et al.* 1975; Navia *et al.* 2010). In 1996, Smith Meyer reviewed nine genera with 24 eriophyoid species associated with ornamental flowering plants worldwide. During the same year, Castagnoli reported 15 genera of Phytoptidae and Eriophyidae as vagrants on ornamental coniferous trees. In addition, a project in Europe inventorying alien species reported 13 eriophyoid species, including the bougainvillea rust mite, *Vittacus bougainvilleae* (Keifer) (Navia *et al.* 2010).

*Vittacus bougainvilleae* was first described, as *Phyllocoptes bougainvilleae* Keifer, from leaves of *Bougainvillea spectabilis* Willd. (Nyctaginaceae) collected in Campinas, São Paulo, Brazil (Keifer 1959; Flechtmann and Berti-filho 1994). The bougainvillea rust mite causes upward leaf edge rolling to total leaf rolling from the underside of bougainvillea plants (Keifer


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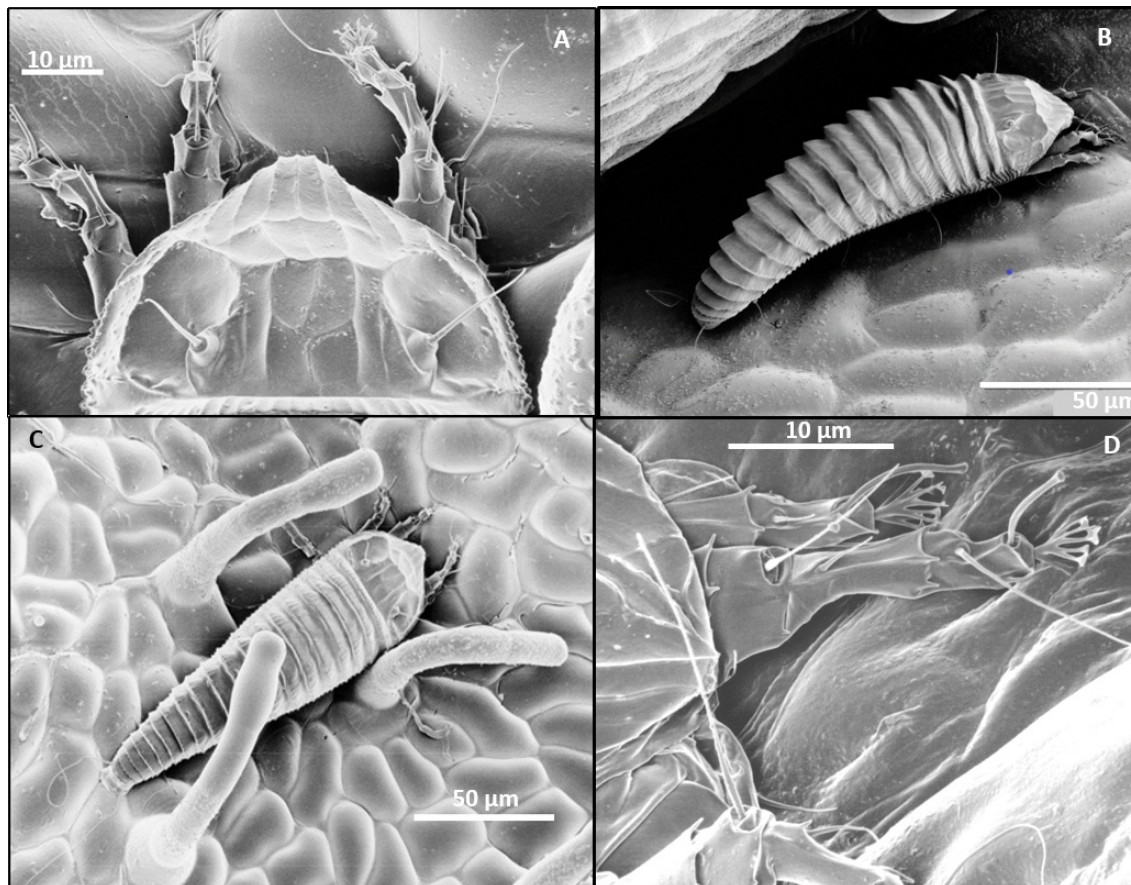
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**Figure 1** *Vittacus bougainvilleae*. A – Prodorsal shield ornamentation; B – Opisthosomal dorsal pattern; C – whole mite between plant trichomes; D – Legs I and II.

1959; Costa and Carvalho 1960). The mite was reported and redescribed in Kenya on *B. glabra* var. *sandeina* (Abou-awad and Elbanhawey 1991). In 1995 and 1998 it was intercepted in Florida and California (USA) from Egypt and Brazil respectively (Welbourn 1995, Navia *et al.* 2010, Ochoa personal communication). Ochoa and Amrine studied the 1995 and 1998 specimens using low-temperature scanning microscope (LTSEM) (Figure 1). *Vittacus bougainvilleae* was subsequently reported in Egypt infesting *B. spectabilis* Willd. *B. glabra* Choisy and *B. luteoalba* H. . K. (Nyctaginaceae) (Elhalawany 2018).

The family Tenuipalpidae has a worldwide distribution and all are phytophagous with several species of economic importance. (Welbourn *et al.* 2003; Mesa *et al.* 2009; Childers and Rodrigues 2011). *Brevipalpus*, the second largest genus in the family, has five species recorded in South Africa: *B. yothersi* Baker (1949), *B. lewisi* McGregor 1949, *B. obovatus* Donnadieu (1875), *B. californicus* (Banks, 1904) and *B. ericae* Meyer (1979) (Smith-Meyer 1979; Smith-Meyer and Craemer 1999; Saccaggi *et al.* 2017). Worldwide, three species of tenuipalps have been reported from *Bougainvillea*; *Brevipalpus phoenicis* s.l. (Geijskes 1939) from a *Bougainvillea* sp. in Brazil and *B. glabra* in India; and *B. californicus* (Banks, 1904) and *Tenuipalpus shanxiensis* Qian *et al.*, 1981 from *B. glabra* in India and China, respectively (Castro *et al.* 2021).

This study reports for the first time the presence of *V. bougainvilleae* in South Africa. It also presents for the first time bougainvillea as a host plant for *B. yothersi* in the world and for *B. californicus* in South Africa.

## Material and methods

The Department of Agriculture, Land Reform and Rural Development (DALRRD) received a sample of bougainvillea plants from a nursery farm in Hopefield (33°02'45"S 18°20'51"E), Western Cape Province, South Africa, during summer, January 2020. The samples showed symptoms of stunted growth, rolled-up leaves as well as leaf and flower dropping. The plants were found to be infested with eriophyoid mites. To investigate the spread of infestation, samples were also collected from a household in Stellenbosch (33°56'05.7"S 18°50'10.1"E) in January 2020 and again in winter, June 2020. More samples were collected at two other households in Badplass (25°57'24.9"S 30°33'53.9"E) and Elukwatini (26°03'15.9"S 30°47'16.9"E) in Mpumalanga Province in winter, June 2020 and late spring, November 2020.

All mites were collected under a stereomicroscope at a minimum of 30X magnification. Eriophyoid mites were collected from the underside of the leaves into a drop of sorbitol-isopropyl solution, cleared in Keifer's booster and mounted in Keifer's F-medium for identification (Jeppson *et al.* 1975; Amrine and Manson 1996). Identification to genus level was done with "The key to world eriophyoid genera" by Amrine *et al.* (2003) and identification to species using Keifer (1959), Abou-Awad and Elbanhawy (1991), and Elhalawany (2018). Flat mites were collected from shoots and leaves into 70% alcohol. Mites were cleared in lactic acid and mounted on glass slides in polyvinyl alcohol (PVA) medium (Upton 1991; Evans 1992; Upton 1993). Slide-mounted specimens were identified to family using Krantz and Walter (2009) and further to species using Beard *et al.* (2012), Beard *et al.* (2015), Mesa *et al.* (2009) and Smith-Meyer (1979). Mounted specimens of Eriophyidae and Tenuipalpidae were studied and identified with a Leica DM4B compound microscope with phase contrast and DIC using 10X eyepieces and 100X oil immersion objectives. The microscope was fitted with a camera (Leica MC170 HD) used together with LAS V4.12 software for imaging and processing.

The voucher specimens were deposited in the National Collection of Arachnida – Mites (NCA–Mites) housed by Agricultural Research Council – Plant Health and Protection (ARC-PHP), Pretoria, and Department of Agriculture, Land Reform and Rural Development at Plant Quarantine Station in Stellenbosch, South Africa.

## Results

Eriophyoid mites detected on bougainvillea plants from a nursery in Hopefield, were identified as *V. bougainvilleae*, the symptoms associated with the infestation were stunted growth, rolled-up leaves, as well as leaf and flower dropping (Figure 2). During the same season, specimens of *V. bougainvilleae* were detected from a Stellenbosch household from asymptomatic plants. However, no mites were detected on the same site during winter. In Mpumalanga, *V. bougainvilleae* was not found, but flat mites were detected at one site with no visible symptoms. Fifty specimens of *V. bougainvilleae* were collected in the Western Cape Province (Figures 3-4). Ten specimens of *Brevipalpus* species comprising *B. yothersi* and *B. californicus* were collected in Mpumalanga (Figures 5-6).

## Discussion and Conclusion

*Vittacus bougainvilleae* induced symptoms on bougainvillea plants under controlled growth environment. These plants showed clear signs of curled up leaves, flower, and leaf drop, while no obvious symptoms were observed on infested plants under natural environment. Ngubane (2018) observed that high mite populations were encouraged by high temperatures of between 26°C and 33°C. In this case, high mite populations, which resulted in symptoms in the nursery, might be due to higher temperatures linking to what Ngubane (2018) observed. It is not clear why mites were detected in Western Cape and not in Mpumalanga Province but a possible explanation could be that the current distribution of these mites may be limited to Western Cape.



**Figure 2** Curled up leaves (A, B) and dying flowers (B) of bougainvillea plants infested with *Vittacus bougainvilleae* at the nursery farm.

Another reason could be that the mites were sampled out of season in Mpumalanga or other environmental factors. *Vittacus bougainvilleae* could not be detected in winter in Stellenbosch which is an indication that mites cannot withstand cold temperatures.

The population of *Brevipalpus* mites on bougainvillea was low, even though the presence of *B. californicus* and *B. yothersi* has been observed on different crops for a long time in South Africa (Smith-Meyer 1979). *Brevipalpus californicus* has been known to affect important crops such as citrus and cotton. For many years *B. yothersi* has been confused with *B. phoenicis* (Beard *et al.* 2015), and more recently it was collected and identified as *B. yothersi* on grapevine



**Figure 3** *Vittacus bougainvilleae* collected from South Africa. Dorsal view of prodorsal shield ornamentation and opisthosoma.

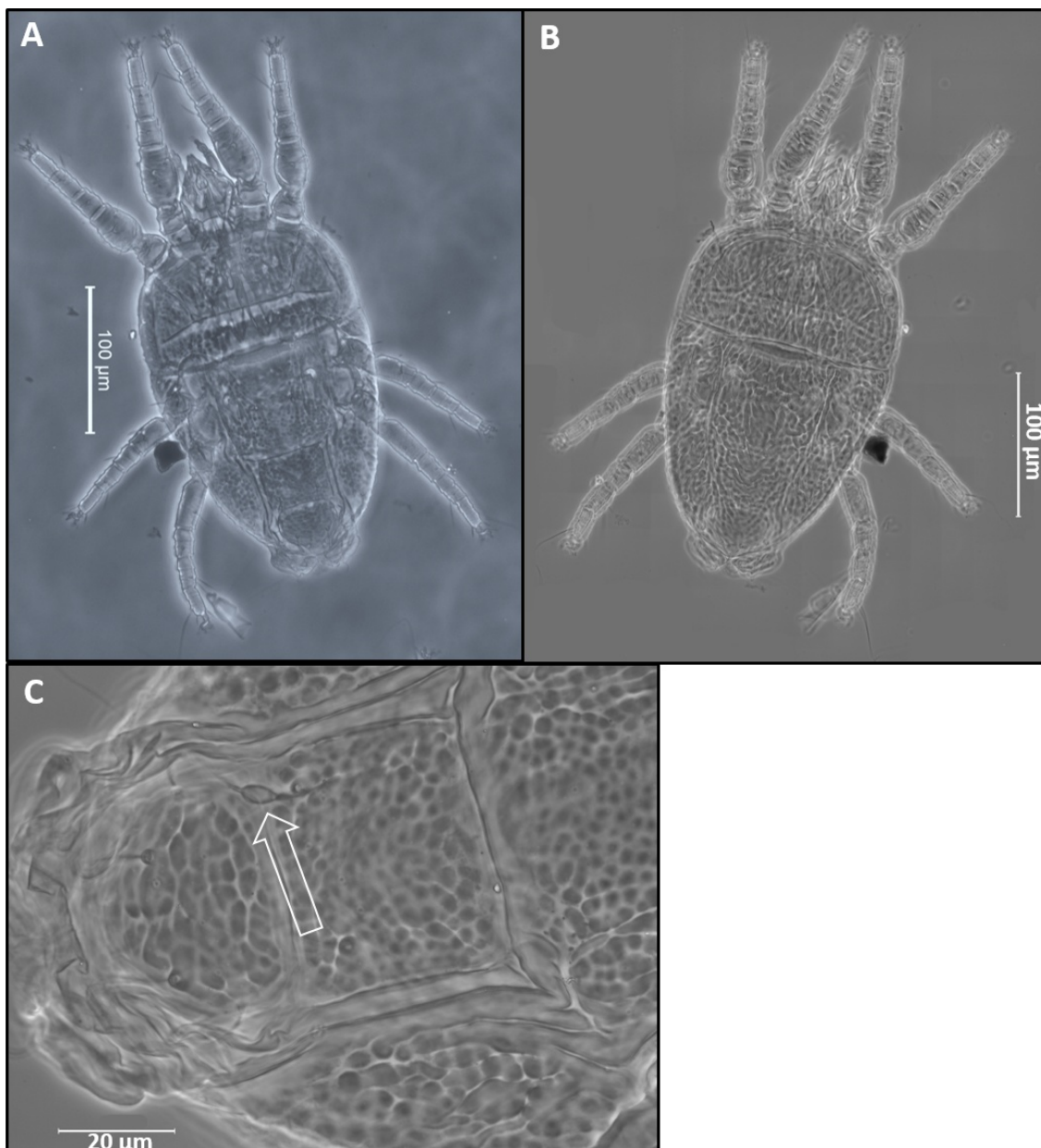


**Figure 4** *Vittacus bougainvilleae* collected from South Africa. A – Dorsal view; B – lateral view of the opisthosoma; C – female coverflap; D – coxigenital region showing male genitalia.

in South Africa (Saccaggi *et al.* 2017). According to Ulian and Oliveira (2002), *B. spectabilis* is not favourable to the development of *B. phoenicis* complex. Therefore, bougainvillea was recommended for use as hedges and/or windbreaks around citrus orchards in Brazil (Maia and Oliveira 2004). This is contrary to our findings where *Brevipalpus* species were collected on bougainvillea plants. Although the *Brevipalpus* species did not induce visible symptoms on bougainvillea, the risk associated with the presence of these species cannot be taken lightly, since *B. californicus* and *B. yothersi* may vector viruses which may lead to serious crop injuries (Childers and Rodrigues 2011; Rodrigues and Childers 2013).

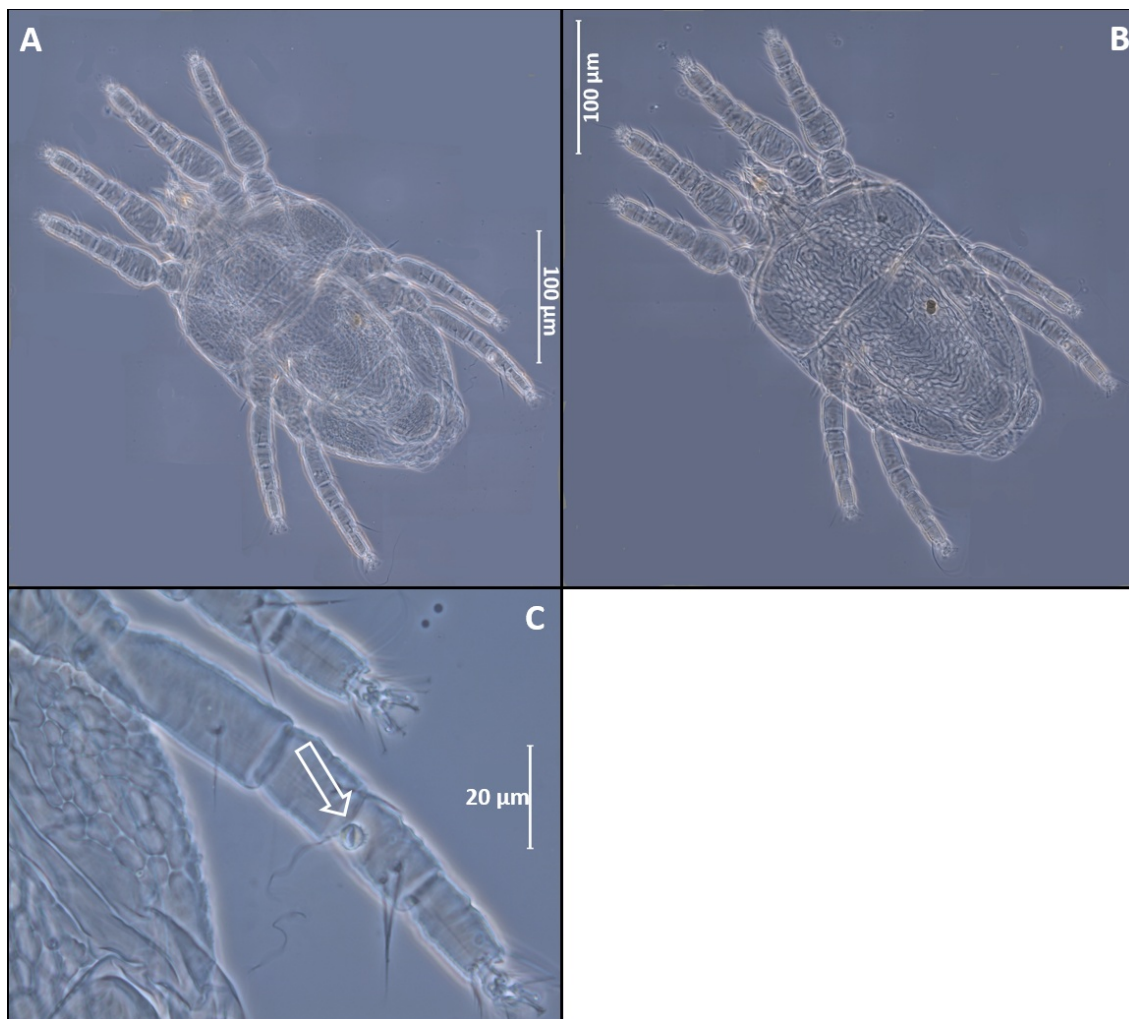
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**Figure 5** *Brevipalpus yothersi* from bougainvillea in South Africa. A – ventral view; B – dorsal view of opisthosoma; C – spermatheca vesicle.

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**Figure 6** *Brevipalpus californicus* from bougainvillea in South Africa. A – ventral view; B –dorsal view; C – spermatheca vesicle.

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