

## False spider mites (Acari: Tenuipalpidae) as pests on orchids (*Phalaenopsis* hybrids) in Poland

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**Abstract:** So far, no false spider mites have been reported from orchids in Poland. This paper provides information about *Tenuipalpus pacificus* Baker, which was recorded for the first time in Poland, on *Phalaenopsis* hybrids imported from China. Diagnostic characters are also given for *Brevipalpus phoenicis* (Geijskes), which was up to this time not found on orchids in Poland. It was earlier found on orchids only in Hawaii. The types of injuries caused by false spider mites and results of chemical control of *T. pacificus* with various acaricides are given. The best results were observed after repeated treatment with Ortus 05 SC (fenpyroximate).

**Keywords:** *Tenuipalpus pacificus*, *Brevipalpus phoenicis*, *Phalaenopsis* hybrids, chemical control

### INTRODUCTION

The family Tenuipalpidae is worldwide in distribution and consists of 891 species belonging to 34 genera (MESA et al. 2009). However, in Poland until recently only 5 species of this family were found:

1. *Cenopalpus lineola* (Canestrini & Fanzago) – on *Pinus sylvestris* (BOCZEK & KROPCZYŃSKA 1964);
2. *Cenopalpus pulcher* (Canestrini & Fanzago) – on *Malus* sp. (BOCZEK & KROPCZYŃSKA 1964);
3. *Brevipalpus phoenicis* (Geijskes) – on *Phoenix dactylifera*, *Marantha leuconeura*, and *Cyclamen persicum* (ŁABANOWSKI 1995);
4. *Brevipalpus obovatus* Donnadieu – on *Rhododendron simsii*, *Citrus*, and *Cissus* spp. (ŁABANOWSKI 1995); and
5. *Pentamerismus taxi* (Haller) – on *Taxus baccata* (ŁABANOWSKI & SOIKA 2006).

Worldwide, only 6 tenuipalpid species have been reported on orchids so far. Half of the species belong to the genus *Brevipalpus* Donnadieu: *B. phoenicis* (Geijskes), *B. californicus* (Banks), and *B. oncidii* Baker. The other 3 species represent the genus *Tenuipalpus* Donnadieu: *T. pacificus* (Baker), *T. orchidarum* Parfitt, and *T. orchidofilo* Moraes & Freire. In the present study we focus on *B. phoenicis* and *T. pacificus*, because they have been recently found for first time on orchids (*Phalaenopsis* hybrids) in Poland, but first we will briefly describe the other species.

Mites belonging to the genus *Brevipalpus* feeding on orchids include the oncidium mite *Brevipalpus oncidii* Baker (favourite hosts: *Odontoglossum* and *Oncidium*) and the omnivorous mite *B. californicus* (Banks) – also known as *B. australis* (Truckner) – with a wide host range: citrus, rubber plants, tea, and other tropical plants. Among orchids, the latter species feeds on *Odontoglossum*, *Dendrobium*, *Lycaste*, *Stanhopen*, *Trichophila*, *Peristeria*, *Epidendrum*, *Gongora*, *Brassia*, *Catasetum*, *Houlletia*, *Acineta*, *Anguloa*, and *Bletia* spp. (PRITCHARD 1951; DENMARK 2009). Species such as *B. californicus* (Banks), *B. obovatus* Donn. and *B. phoenicis* (Geijskes) have been incriminated as vectors of at least one unassigned rhabdovirus (CHILDERS & DERRICK 2003).

*Brevipalpus phoenicis*, named the red and black flat mite, was earlier recorded in Poland on various plants. For the first time, in 1961, it was collected from *Phoenix dactylifera* (BOCZEK & KROPCZYŃSKA 1964), and in 1986–1991 severe damages were observed on leaves of this plant, as silvery and brown spots near the main veins. This mite species also caused damages on *Marantha leuconeura* and *Cyclamen persicum*, as ridges around leaf blades (ŁABANOWSKI 1995). This species was described from specimens collected from *Phoenix* sp. in a greenhouse in the Netherlands, but it is widely distributed all over the world (HATZINIKOLIS 1986). Host plants of *B. phoenicis* belong to 64 families, 118 genera, and 486 species, but it is known mostly as a pest of citrus and tea (CHILDERS et al. 2003). *B. phoenicis* has been reported on orchids only from Hawaii so far (KESSING & MAU 1992). Currently there are 4 viruses known to be associated with the *Brevipalpus-phoenicis* complex, and they include the orchid-fleck-virus (OFV), which appeared on *Phalaenopsis* as chlorotic flecks (ANONYMOUS 2009).

Mites belonging to the genus *Tenuipalpus* feeding on orchids are: *T. pacificus* (Baker, 1935), *T. orchidarum* (Parfitt, 1859), and *T. orchidofilo* Moraes & Freire, 2001. The first species will be described in detail below. *T. orchidarum* was initially described by Parfitt in 1859 as *Acarus orchidarum* and in 1875 by Donnadieu as *Brevipalpus perger*. It also feeds on orchids: *Phalaenopsis* and *Cypripedium* (DOSSE 1954). By contrast, *T. orchidofilo* Moraes & Freire, 2001 was described only 10 years ago, from Brazil, on the basis of the mobile juveniles and adult stages collected on the orchid *Arundina graminifolia*.

*Tenuipalpus pacificus* was described by Baker in the USA from *Phalaenopsis stuartiana* in 1943, but it has been introduced on orchids from the tropic areas also to other regions and is known in Australia, England, Germany, the Netherlands, Java, Panama, Philippines, Siam, and the United States (DENMARK 1968). Host plants for this mite are orchids: *Aerides*, *Cattleya*, *Cypripedium*, *Dendrobium*, *Grammatophyl-*

*lum*, *Oncidium*, *Phalaenopsis*, *Saccolabium* spp., but also ferns from the family Polypodiaceae: *Davallia fejeensis* and *Platynerium* spp. (DENMARK 1968).

In commercial greenhouses the damage of *Phalaenopsis* plants caused by *T. pacificus* was clearly visible on the upper and lower leaf surfaces, and the number of mites was relatively high already, so treatment with acaricides was necessary. Thus in this study we present results of treatment of the infested orchids with several acaricides. Additionally we describe the morphology of *B. phoenicis* and *T. pacificus* on *Phalaenopsis* hybrids, as these are the first observations of false spider mites on orchids in Poland.

#### MATERIAL AND METHODS

Observations on the occurrence of alien invasive mites and insects on ornamental plants, including orchids, were carried out in 1995–2009. Samples of the damaged plants were collected in commercial glasshouses, and in the laboratory the samples were examined for the presence of tenuipalpid mites. Individuals were mounted on glass slides in Heinze medium and were dried for 2 weeks at 60 °C. Their morphology was studied under a phase-contrast microscope, and species of tenuipalpids were identified according to DENMARK (1968) and ZHANG's (2003) descriptions.

In 2008, in a glasshouse with *Phalaenopsis* 'Taisuco Beauty' (formerly known as × *Doritaenopsis* 'Taisuco Beauty') plants heavily infested by *T. pacificus*, an experiment was conducted with several new acaricides, namely: Borneo 110 SC (etoxazole), Envidor 240 SC (spirodiclofen), Floramite 240 SC (bifenazat), and Ortus 05 SC (fenpyroximate). The results were compared with the reference product Talstar 100 EC (bifenthrin). The trial was conducted in a randomized design with 3 replicates, each consisting of 5 plants. The treatments were applied onto plants with a handle sprayer 'Venus', using 1000 L of the solution per ha. Motile forms and eggs of *T. pacificus* collected on 2" leaves from 5 plants, using a mite-brushing machine (HENDERSON & McBURNIE 1943) were counted at the following observation periods: before treatment (PRE-T), 7 days after the first treatment (T1+7), 7 days after the second treatment (T2+7), as well as 14 days (T2+14) and 21 days (T2+21) after the second treatment. The results were subjected to analysis of variance (ANOVA) after transformation of the data according to the function  $y = \log(x+1)$ . The significance of differences between means was evaluated using the Duncan *t*-test at  $P = 0.05$ . Data are also presented as efficacy (%), calculated according to the Henderson-Tilton formula.

#### RESULTS AND DISCUSSION

During the observation period in the collected samples of orchids, 2 species of Tenuipalpidae were found: *Brevipalpus phoenicis* on a *Phalaenopsis* hybrid (in Konstantynów Łódzki on 30 Aug 2002) and *Tenuipalpus pacificus* on various *Phalaenopsis* hybrids, namely Sogo cultivars 'Yokidian', 'Taisuco Beauty', 'Alice Girl' and 'Baldan's Kaleidoskop' imported from China (in Skierniewice on 26 and 31 Oct 2007; 8 Feb 2008; 28 Mar 2008, 26 Sep 2009; 16 Dec 2009, all stages).

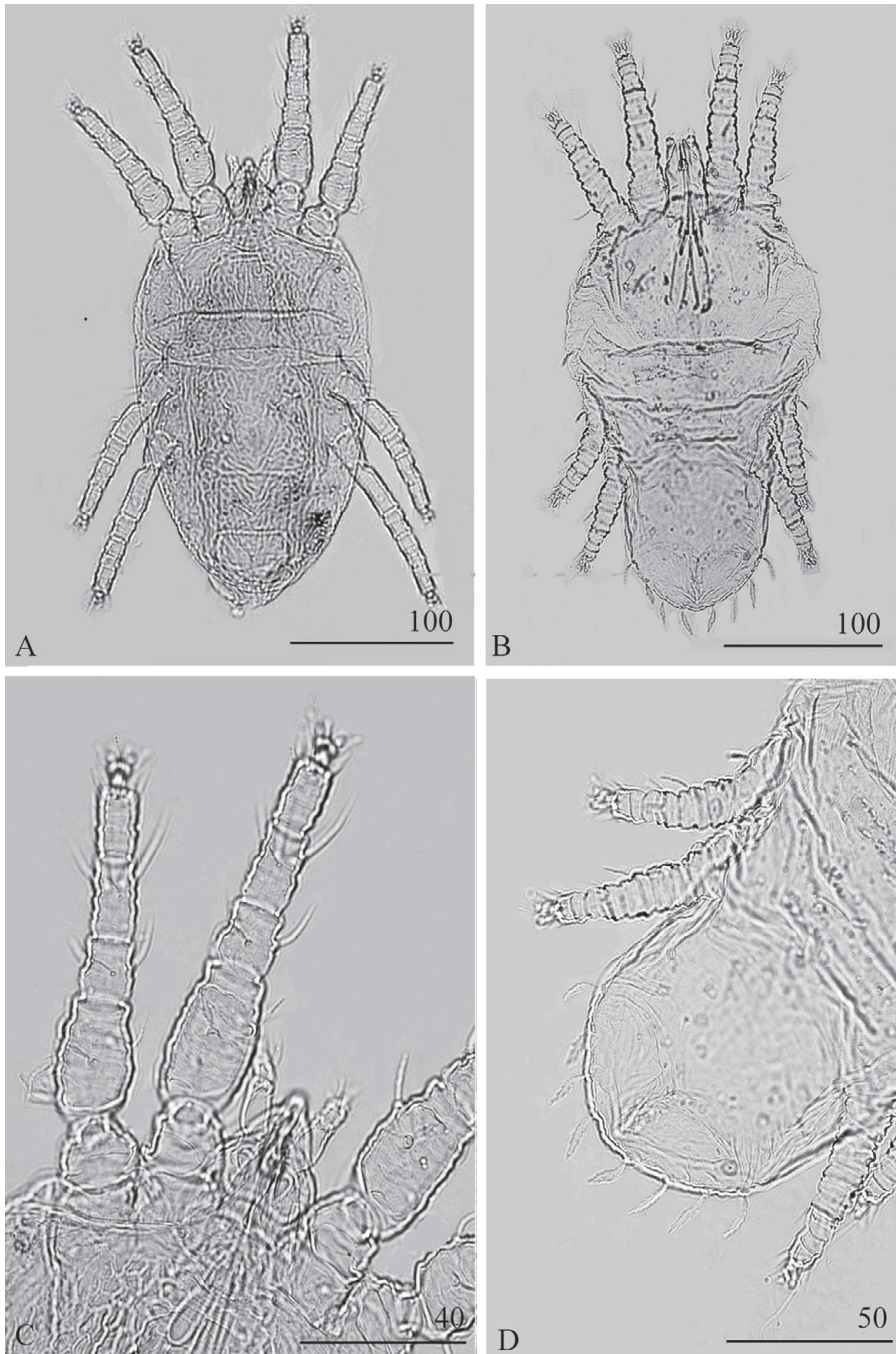


Fig. 1. *Brevipalpus phoenicis*: A – dorsal view of female, B – ventral view of male, C – legs, D – hysterosoma. Scale bar (µm)

On the observed plants, *B. phoenicis* mites feeding on the upper leaf surface and feeding injury is firstly noted as stippling (silvering), which eventually becomes rusty and brown. Females are elliptical, flat, reddish orange, with a black H-shaped mark. Males are reddish and more wedge-shaped than females, without black markings. Larvae are 6-legged and bright orange-red when newly emerged, and opaque orange when fully grown, with a pair of distinct lateral darkish areas on the idiosomal dorsum. The protonymph is similar to the larva, but it differs by marginal seta IV of the hysterosoma, which is lanceolate and serrate. The deutonymph is similar in appearance to the protonymphs except for having an extra pair of legs and 2 additional setae. The eggs are elliptical in shape, with a stipe, reddish orange soon after laid, but later they become darker. More detailed descriptions are given by HARAMOTO (1969), LAL (1978), and ZHANG (2003). Some diagnostic characters of collected females and males in microscopic slides are presented in Fig. 1 and they are in agreement with the description given by RAHMANI et al. (2008).

Observations of damages caused by *T. pacificus* indicate that this mite is one of the most destructive pests, which can be found on orchids under greenhouse conditions. The mite feeds on both sides of the leaf, but prefers the lower surface. It pierces the epidermis and removes the chlorophyll, causing the plant tissue to become silvery in appearance. Damaged plants have dark spots on the upper leaf surface. Females collected from *Phalaenopsis* are dark reddish, with a dorsal ornamentation consisting of a few longitudinal striae. In microscopic slides the main characters of collected females and males are presented in Fig. 2. The body is abruptly narrowed behind legs IV and bearing a pair of long whip-like setae near the posterior end. The palp is 3-segmented, and its third, terminal segment is small, with a short straight seta and a longer, slightly curved seta. The hysterosoma has 4 pairs of nonflagellate setae and a pair of flagellate setae caudally. The male has the same general appearance as the female, except the smaller and narrower body. All this is in agreement with the description given by DENMARK (1968).

The best results for the control of *T. pacificus* motile forms (their number reduced by over 85% at 14 and 21 days after the second application) were obtained with Ortus 05 SC (fenpyroximate) at a concentration of 0.1%. A lower efficacy (less than 75%) was recorded for Floramite 240 SC (bifenazat) at 0.05% and Borneo (etoxazole) at 0.05%. The long-term effect (21 days after the second treatment) against motile forms was also provided by Envidor 240 SC (spirodiclofen) at a concentration of 0.05%. All new products showed better results for the control than the reference product – Talstar 100 EC (Table 1). According to REIS et al. (2005), this product at a dose of 300 ml/ha gave the best results in the control of *B. phoenicis* on coffee plants, as on 15 days after treatment its efficacy against motile forms was equal to 100% and against eggs, to 98.4%. A relatively low efficacy of all tested products was found for eggs (Table 2). In Germany, abamectin, spirodiclofen, and tebufenpyrad are recommended for the control of this mite species on orchids, in intervals of 2–3 weeks, with changing agents, until the new leaves are visibly free from infestation (ANONYMOUS 2008).

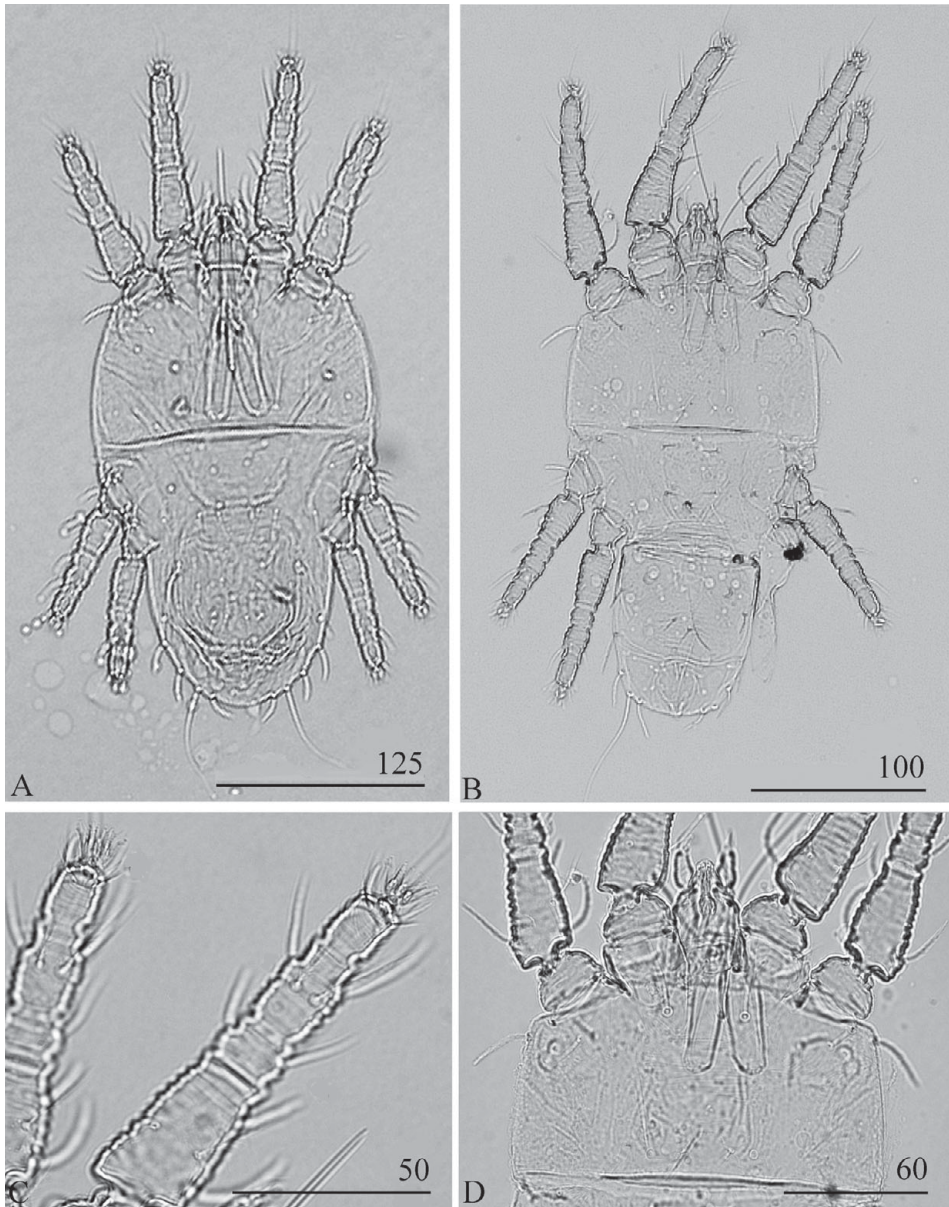


Fig. 2. *Tenuipalpus pacificus*: A – ventral view of female, B – ventral view of male, C – legs. D – propodosoma, Scale bar ( $\mu\text{m}$ )

Table 1. Efficacy of acaricides against motile forms of *Tenuipalpus pacificus* on *Phalaenopsis* 'Taisuco Beauty'

Acaricide type and concentration (%)	Period of observation in days after treatments (T1 and T2)				
	PRE-T	T1+7	T2+7	T2+14	T2+21
Mean no. of motile forms per 2.5 leaves					
Floramite 240 SC – 0.05	1097.8 a	267.8 ab	227.4 a	236.5 b	206.5 b
Talstar 100 EC – 0.05	941.1 a	589.0 bc	372.5 ab	393.3 bc	285.4 bc
Borneo 110 SC – 0.05	1204.4 a	617.2 bc	215.7 a	270.6 b	220.3 b
Ortus 05 SC – 0.1	701.8 a	250.4 a	247.0 a	82.9 a	43.5 a
Envidor 240 SC – 0.05	656.0 a	559.5 bc	380.2 ab	232.4 b	87.7 a
Control (no treatment)	818.1 a	799.0 c	661.6 b	659.9 c	527.1 c
Efficacy (%) according to Henderson-Tilton formula					
Floramite 240 SC – 0.05	-	75.0	74.4	73.3	70.8
Talstar 100 EC – 0.05	-	35.9	51.1	48.2	52.9
Borneo 110 SC – 0.05	-	47.5	77.9	72.1	71.6
Ortus 05 SC – 0.1	-	63.5	56.9	85.4	90.4
Envidor 240 SC – 0.05	-	12.7	28.3	56.1	79.3

Location – greenhouse in Skierniewice, date of spray treatments: 23 and 30 April 2008.

Means followed by the same letter within columns do not differ significantly (Duncan multiple range test,  $P = 0.05$ ).

Table 2. Efficacy of acaricides against eggs of *Tenuipalpus pacificus* on *Phalaenopsis* 'Taisuco Beauty'

Acaricide type and concentration (%)	Period of observation in days after treatments (T1 and T2)				
	PRE-T	T1+7	T2+7	T2+14	T2+21
Mean no. of eggs per 2.5 leaves					
Floramite 240 SC – 0.05	1620.2 a	941.9 a	1018.1 a	1091.7 a	853.4 bc
Talstar 100 EC – 0.05	1305.3 a	1041.7 a	1612.2 ab	1750.1 a	1580.9 cd
Borneo 110 SC – 0.05	1286.5 a	1213.7 a	1395.9 ab	1628.9 a	1773.1 cd
Ortus 05 SC – 0.1	1087.1 a	694.8 a	899.6 a	863.3 a	433.6 a
Envidor 240 SC – 0.05	1147.3 a	1156.2 a	1146.8 ab	1122.6 a	585.8 ab
Control (no treatment)	1100.2 a	1310.7 a	2143.8 b	1785.3 a	1844.5 d
Efficacy (%) according to Henderson-Tilton formula					
Floramite 240 SC – 0.05	-	51.2	67.8	58.5	68.6
Talstar 100 EC – 0.05	-	33.0	36.6	17.4	27.8
Borneo 110 SC – 0.05	-	20.8	44.3	22.0	17.8
Ortus 05 SC – 0.1	-	46.4	57.5	51.1	76.2
Envidor 240 SC – 0.05	-	15.4	48.7	39.7	69.5

Explanations: see Table 1.

## CONCLUSIONS

1. *Phalaenopsis* hybrid is the first reported orchid host for *Brevipalpus phoenicis* (Geijskes) in Poland. It was earlier recorded on orchids only in Hawaii (KESSING & MAU 1992).
2. *Tenuipalpus pacificus* (Baker) was recorded for the first time in Poland. It was found on *Phalaenopsis* hybrids 'Yokidian', 'Taisuco Beauty', 'Alice Girl', 'Baldan's Kaleidoskop' imported from China, but it was eradicated from the commercial glasshouses in Skierniewice, where it was found.
3. The most effective control against motile forms of *T. pacificus* was obtained with Ortus 05 SC (fenpyroximate) at a concentration of 0.1%, applied as 2 spray-treatments with a 7-day interval. A relatively low efficacy of all the tested products was observed for eggs.

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