Feeding Preference of Melon Thrips on Orchids in Hawaii

Trent Y. Hata¹, Arnold H. Hara², and James D. Hansen³

Department of Entomology, University of Hawaii at Manoa, 461 West Lanikaula Street, Hilo, HI 96720

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Abstract. Feeding preference of melon thrips, *Thrips palmi* Karny (Thysanoptera: Thripidae) was evaluated on 21 *Dendrobium* cultivars and the bamboo orchid *Arundina graminifolia* (D. Don) Hochr. Pigmented flowers resembling the morphotype *phalaenopsis* from *Phalaenanthus* sections were preferred over nonpigmented *phalaenopsis*, *Phalaenanthus* × *Ceratobium* hybrids, and bamboo orchids. This study suggests the separation of susceptible cultivars from preferred cultivars as a pest management strategy for melon thrips control.

A serious quarantine pest of dendrobium is the melon thrips, *Thrips palmi*, which is widely distributed throughout southeast Asia and several islands in the Pacific, including Hawaii (Johnson, 1986). Melon thrips has a wide host range, affecting many crops of economic importance (Johnson, 1986). Adults and nymphs are reported to feed on various plant parts such as leaves, stems, flowers, and fruits, causing scars and deformities. In severe infestations, plant death has been reported (Sakimura et al., 1986).

On dendrobium, adult melon thrips and nymphs are found in open blooms deep within the flower and petal folds. Flower injury is observed with severe infestations. Light infestations produce no visible injury and, therefore, are difficult to detect. Melon thrips is a difficult pest to control with insecticides due to physical protection of the thrips by flower petals. Additionally, melon thrips tolerate many organophosphate insecticides (Suzuki et al., 1982).

Melon thrips is a federal quarantine action pest with a zero tolerance level (P.Y. Lai, unpublished). Orchid flower shipments to the continental United States and other uninfested areas of the world are rejected as a result of melon thrips infestations (Nakahara, 1985). Development of management strategies that decrease the likelihood of *T. palmi* infestations would aid the orchid industry in the export of dendrobiums. The objectives of this study were to determine

the feeding preference of *T. palmi* on various dendrobium cultivars and determine if the bamboo orchid found in the wild is a source of thrips.

Infestation preference in shadehouse. (Study 1). Fourteen dendrobium cultivars were grown in a volcanic cinder medium under 30% shade using standard cultural practices in Kapoho, Hawaii. Thirty plants of each cultivar were divided into two equal groups and placed on separate benches in a thrips-infested shadehouse. Thrips population was allowed to build for 3 weeks before the survey. The thrips population for each group was surveyed weekly for 5 weeks from 15 flowers of each cultivar. Two groups, each containing 15 flowers, were also taken weekly from bamboo orchids growing in the wild outside the shadehouse. Thrips were extracted with a Berlese funnel, and nymphs counted under a dissecting microscope. Nymphs for identification were reared on eggplant, *Solanum melongena* L. var. Esculentum. To evaluate feeding in less susceptible cultivars, which otherwise may not be observed, a nymph population of N = 150 per group was the minimum total population level for determining feeding preference among the cultivars. Thrips population data

among the cultivars were analyzed by Kruskal-Wallis nonparametric test. A dendrogram was produced using Ward's minimum variance method of cluster analysis (SAS Institute, 1987). In addition, flower color and morphotype were subjected to single degree-of-freedom comparisons.

Field survey of infestation (Study 2). Seven cultivars from three commercial dendrobium farms located in Hilo, Puna, and Kaihuala-Kona, Hawaii, were surveyed for *T. palmi*. Plants at all three farms were grown in crushed basaltic rock under 30% shade. Four samples, each containing 15 flowers, were randomly selected from each cultivar. Thrips were extracted with a Berlese funnel and counted under a dissecting microscope. At Hilo and Kaihuala-Kona farms, thrips populations among cultivars were subjected to Hartley's F_{max} test for homogeneity. Data were subjected to analysis of variance and means separated by Duncan-Waller K-ratio *t* test.

All nymphs isolated in Study 1 were identified as *T. palmi*. Four of the weekly surveys had the minimum population levels to determine feeding preference. The number of nymphs differed significantly among the cultivars ($P < 0.001$). Thrips were not found on bamboo orchid, and the *Ceratobium*-type orchids had the fewest among the cultivars

Fig. 1. Cluster analysis of number of *Thrips palmi* nymphs by Ward's minimum variance method. Cultivars 1004, 2025, 2065, 2051, and 2081 were preferred over others.

Table 1. Average number of *Thrips palmi* nymphs per cultivar from four weekly surveys.

Cultivar	Type ^a	Color ^b	Nymphs ^c
2081 Chieko Matsui x Kelli Nicole	P	DP	65.8
2051 Dorian Sato x Kristen Ann	P	DP	36.3
2065 Phalaenopsis x June Carson	P	P	23.5
2025 Dorian Sato x G. Kur-L. Ham	P	DP	22.5
1004 Phalaenopsis Alba x Self	P	LW	20.3
H3010	C	DP	10.0
2078 Joan Kushima	SP	PB	8.3
1002 Phalaenopsis Alba x Sibling	P	W	7.3
3002 Barry Fujimoto x Jaquelyn Thomas	C	DP	5.0
3005 Madam Julie Sulianti	C	LW	4.5
3013 Singapore White	C	W	3.8
2041 Joan Kushima	SP	DL	3.0
3008 Jaquelyn Thomas x 44 x 503	C	LW	0.5
4008 Robson Waimea x May Neal SRPN	C	YC	0.3
Wild bamboo orchid ^d	---	WL	0.0

^aMorphotype: P = Phalaenanthus type, C = Ceratobium type, SP = Semiphaenopsis.

^bDP = Deep purple; P = purple; LW = lavender white; W = white; PB = pink blush; DL = deep lavender; YC = yellow with chocolate center; WL = white and lavender.

^cSignificant by Kruskal-Wallis nonparametric test, $P < 0.001$; mean of 15 flowers.

^dWild bamboo orchid, *Arundina graminifolia*.

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¹Research Associate.

²Associate Entomologist.

³Assistant Researcher.

Table 2. Flower color and morphotype preference of *Thrips palmi*.^z

Color	<i>P</i> > <i>F</i>
Purple and lavender/pink vs. white and yellow	0.0204*
Purple vs. lavender/pink	0.0001**
White vs. yellow	0.6163
Morphotype	
<i>Phalaenanthe</i> vs. semiphalaenopsis, <i>Ceratobium</i> and Wild	0.0001**
Wild vs. semiphalaenopsis and <i>Ceratobium</i>	0.5737
Semiphalaenopsis vs. <i>Ceratobium</i>	0.8013

*Single degree-of-freedom comparison, and the corresponding probability of significance.

(Table 1). The *Phalaenanthe* types had the most thrips. Cluster analysis clearly separated preferred cultivars from less preferred (Fig. 1). Single degree-of-freedom comparisons indicated purple, lavender/pink orchids, and *Phalaenanthe* morphotype were more attractive than other colors and morphotypes (Table 2). Based on this study, purple, lavender, and pink flowers resembling the morphotype phalaenopsis from *Phalaenanthe* sections were preferred over nonpigmented phalaenopsis and *Ceratobium* × *Phalaenanthe* hybrids. In addition, pigmented *Ceratobium* morphotype orchids were more attractive than nonpigmented.

Surveys of dendrobium farms in Study 2 were consistent with results of Study 1. At the Hilo farm, dark purple semiphalaenopsis morphotype had the most thrips (*P* = 0.01). Pigmented *Ceratobium* morphotype orchids were more attractive than nonpigmented. At the Puna farm, dark purple *Phalaenanthe* morphotype had the most thrips. *Ceratobium* morphotype orchids were not attractive to *T. palmi*. At the Kailua-Kona farm, pigmented semiphalaenopsis morphotype attracted the most thrips (*P* < 0.01). Pigmented *Ceratobium* morphotypes were more attractive than nonpigmented (Table 3).

For pest management of melon thrips, purple, lavender, and pink orchids of the *Phalaenanthe* morphotype should be isolated from the nonpreferred cultivars to reduce thrips population near the latter. This cultural practice will also reduce the number of pesticide applications and minimize the risk of melon thrips developing insecticide resistance. In addition, by surveying susceptible cultivars, dendrobium growers would be able to control thrips by early detection and immediately implement a spray program reducing rejection in shipment. This study also suggests bamboo orchids growing in the wild outside of shadehouses are not hosts of *T. palmi*.

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Table 3. Average number of *T. palmi* per 15 flowers from dendrobium farms in Hilo, Puna, and Kona, Hawaii.^z

Cultivar	Type ^y	Color ^x	Hilo ^w	Puna ^v	Kona ^u
Tay Swcecking	P	DP	---	3.5	---
Dendrobium cross ^t	P	LW	---	---	16.8 a
Nancy Reagan	SP	DP	3.5 a	---	---
Uniwai Blush	C	PB	0.8 b	---	4.8 b
Uniwai Supreme	C	TTL	0.5 b	0.0	6.3 b
Uniwai Princess	C	LL	0.0 b	---	---
Uniwai Pearl	C	W	0.0 b	0.3	2.5 b

^zData subjected to Hartley's *F*_{max} test for homogeneity. Mean separation in columns by Waller-Duncan K-ratio *t* test.

^yMorphotype: P = *Phalaenanthe* type, C = *Ceratobium* type, SP = *Semiphalaenopsis*.

^xDP = Dark purple; PB = pink blush; TTL = two-tone lavender; LL = light lavender; LW = lavender white; W = white.

^wData transformed to *x* + 1 and subjected to ANOVA, *P* = 0.01.

^vNo analysis was conducted for survey in Puna.

^uUniwai Pearl variance was not homogeneous by Hartley's *F*_{max} test.

^tDendrobium neo Hawaii 4N × *Phalaenopsis alba* 'C'.

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