

Research Article

Tenuipalpus pasificus Mite on Orchid in Malang Raya

Tungau Tenuipalpus pasificus pada Anggrek di Malang Raya

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ABSTRACT

Malang Raya is the center of orchid cultivation (Orchidaceae) in Indonesia. However, the presence of mites might lead to economic losses. This study aimed to determine the population density of mite *Tenuipalpus pasificus* and the intensity of attack on four genera of orchids (Dendrobium, Cattleya, Phalaenopsis, and Coelogyne). Snowball technique was used to collect mite samples on eight locations. During the observation, *T. pasificus* was found dominant in Coelogyne orchid (72 mites/plant). The highest population of *T. pasificus* was commonly found at 10 a.m. on Phalaenopsis and Coelogyne, while on Dendrobium at 12 p.m., and on Cattleya at between 10 a.m. and 4 p.m.. The intensity of attack of *T. pasificus* was not significantly differing among four orchids, which was varied from 20.02 to 30.10%, and was determined as low intensity.

Keywords: Malang Raya, orchid, *Tenuipalpus pasificus*

INTISARI

Malang Raya merupakan sentra budidaya tanaman anggrek (Orchidaceae) di Indonesia. Keberadaan tungau dapat menyebabkan kerugian secara ekonomi. Penelitian ini bertujuan untuk mengetahui kepadatan populasi tungau *Tenuipalpus pasificus* dan intensitas serangannya pada empat jenis anggrek yaitu *Dendrobium*, *Cattleya*, *Phalaenopsis*, dan *Coelogyne*. Metode pengambilan sampel dilakukan dengan teknik snow ball, sehingga didapatkan delapan lokasi pengamatan. Berdasarkan hasil penelitian, *T. pasificus* paling banyak ditemukan pada tanaman anggrek jenis *Coelogyne* (72 ekor per tanaman). Kepadatan populasi *T. pasificus* tertinggi ditemukan pada pukul 10.00 WIB pada *Phalaenopsis* dan *Coelogyne*, sedangkan pada *Dendrobium* pada pukul 12.00 WIB, dan pada *Cattleya* pada pukul 10.00 hingga 16.00 WIB. Intensitas serangan tungau *T. pasificus* pada keempat jenis anggrek tidak berbeda secara signifikan yaitu bernilai 20,02–30,10% dengan kategori intensitas serangan ringan.

Kata kunci: anggrek, Malang Raya, *Tenuipalpus pasificus*

INTRODUCTION

Orchid is one of the main commodity in floral industry. Indonesia is the center of orchid cultivation in the world, especially in Java which has a huge number of orchid species (Puspitaningtyas, 2007). One of the center of orchid cultivation in Java is Malang Raya, East Java Province (Andri & Tumbuan, 2015).

Mites such as *Tetranychus urticae* (Koch, Acari: Tetranychidae), *Tenuipalpus orchidarum* (Parfitt, Acari: Tenuipalpidae), and *Brevipalpus oncidii* (Baker, Acari: Tenuipalpidae) mites are determined as important pests on orchids (Catting *et al.*, 2010).

While, six species of tenuipalpid mites that attack orchids are *B. phoenicis* (Geijskes), *B. californicus* (Banks), *B. oncidii* (Baker), *T. pacificus* (Baker), *T. orchidarum* (Parfitt), and *Tenuipalpus orchidofolio* (Moraes & Freire) (Moraes & Freire, 2001; Labanowski & Soika, 2011; Thithila *et al.*, 2015).

T. pasificus mites are potentially harmful to orchids in tropical and subtropical countries (Mesa *et al.*, 2009; Childers & Rodrigues, 2011; Kanjani, *et al.*, 2013). This pest is one of the major problems in orchid plants in Malang Raya, but it has not been studied. In a survey conducted in January 2016, *T. pasificus* were found in four orchid locations

(Figure 1). Therefore, the aim of this study was to determine the population density of *T. pasificus* and the intensity of attack on four genera of orchids, i.e. Dendrobium, Cattleya, Phalaenopsis, and Coelogyne which was cultivated in Malang Raya. In addition, the possibly impacts of cultivation methods, such as mixing more than one genus of orchids in one cultivation place on the population density of mite was also discussed in this article.

MATERIALS AND METHODS

The research was conducted by observing eight orchid cultivations in Malang Regency (district of Karangploso) and Batu Town (district of Junrejo and

Batu) (Table 1). Samples were obtained by finding, identifying, selecting and taking samples in a network or chain of relationships which is called snowball technique (Nurdiani, 2014). This study was conducted from September 2016 to January 2017.

Counting of Population

Plant samples were randomly assigned as much as 2% from the total of each genus of orchid on each observation site (Table 2). Four genus of orchids used in this study, i.e. Cattleya, Dendrobium, Phalaenopsis, and Coelogyne were widely cultivated by farmers and has high value in the market (Andri & Tumbuan, 2015). The calculation of mites population was done directly at observation sites with magnifying glass,

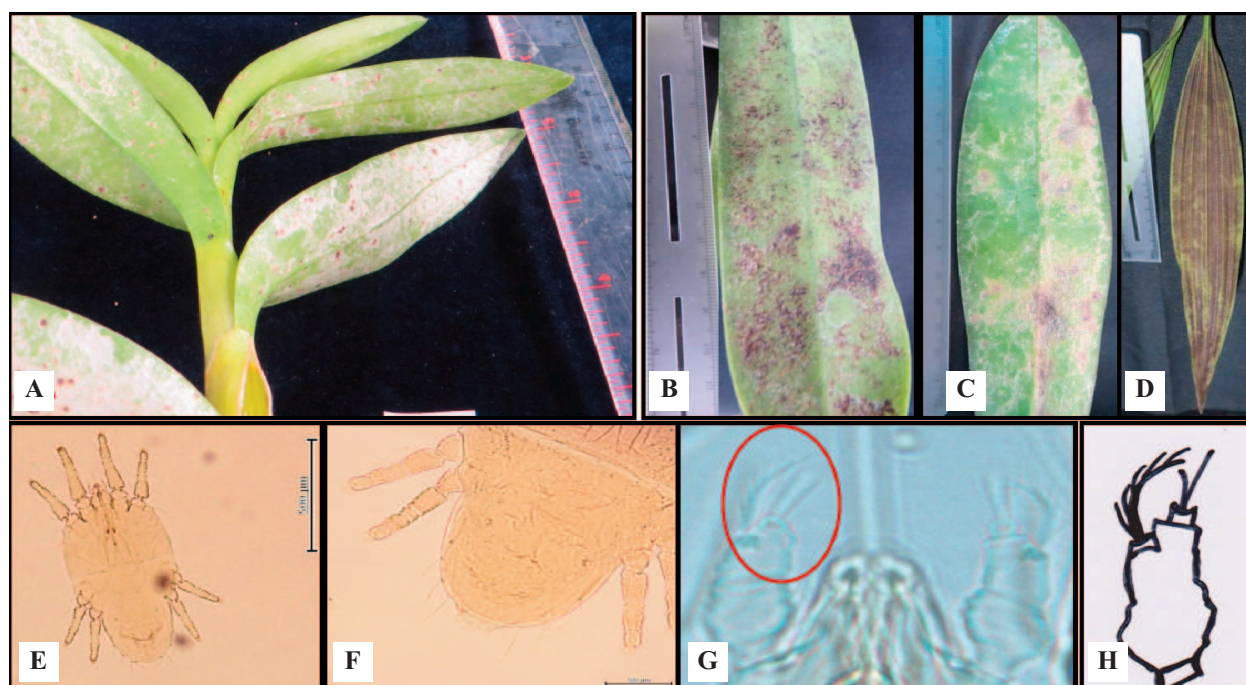


Figure 1. Symptom of *Tenuipalpus pasificus* on orchids: Dendrobium (A), Cattleya (B), Phalaenopsis (C), Coelogyne (D); ventral view of female *T. pasificus* (E), flagella setae h2 on idiosoma (F), palpi (G), types of palpi *T. pasificus* (H)

Table 1. Location where *Tenuipalpus pasificus* was found on orchid in Malang Raya

Regency/ City	Location	Coordinated	Altitude (m)	Farming system
Malang	Ngijo, District of Karangploso	S07°54'49.44" E112°36'49.98"	498	Greenhouses
Batu	Areng-areng, Distric of Junrejo	S07°54'30.95" E112°34'37.32"	622	Greenhouses
	Junrejo, District of Junrejo	S07°54'31.09" E112°33'32.08"	684	Garden
	Junrejo, District of Junrejo	S07°45'33.15" E112°33'17.49"	773	Greenhouses
	Junrejo, District of Junrejo	S07°54'23.29" E112°32'45.96"	814	Garden
	Jeding, District of Junrejo	S07°54'23.94" E112°32'36.98"	821	Greenhouses
	Ngaglik, District of Batu	S07°52'10.30" E112°30'59.32"	880	Garden
	Songgokerto, District of Batu	S07°51'49.40" E112°30'18.74"	957	Greenhouses

Table 2. List of sample used in this study

Location	The amount of orchid samples			
	Dendrobium	Cattleya	Phalaenopsis	Coelogyne
Ngijo, District of Karangploso, Malang	0	220	800	150
Areng-areng, Distric of Junrejo, Batu	1200	50	50	50
Junrejo, District of Junrejo, Batu	150	520	230	0
Junrejo, District of Junrejo, Batu	1260	550	100	0
Junrejo, District of Junrejo, Batu	0	0	520	0
Jeding District of Junrejo, Batu	440	200	50	0
Ngaglik District of Batu, Batu	600	760	80	90
Songgokerto District of Batu, Batu	20	200	22	0

hand counter, and flashlight with interval of observation time as per two hours: at 6 a.m., 8 a.m., 10 a.m., 12 p.m., 2 p.m., 4 p.m., and 6 p.m..

Counting of Attack Intensity

The sampling point was determined by following diagonal pattern. The intensity of attack was evaluated using the Townsen & Heuberger's formula (Sinaga, 2006 *cit* Townsend & Heuberger, 1943) with modification according to field conditions. Infected plant were classified according to scale of attack, i.e. 0 = 0% no attack, 1 = <25% very low intensity, 2 = >25–50% low intensity, 3 = > 50–75% moderate intensity, 4 = >75% heavy intensity.

$$IS = \sum \frac{(n \times v)}{Z \times N} \times 100\%$$

where IS = Attack intensity, n = degree of damage according to scale, v = number of scale per category, Z = highest degree of damage, N = total number of plant screened.

Variable Observed

The variables observed were temperature, humidity, altitude and host conditions. Observation of temperature and humidity was done with interval of observation time as per two hours: at 6 a.m., 8 a.m., 10 a.m., 12 p.m., 2 p.m., 4 p.m., and 6 p.m.. using thermohygrometer. Altitude, longitude and latitude on each location was recorded using Global Positioning System (GPS).

Data Analysis

Data of the mite population and intensity of attack by the mite were analyzed with SAS v.9.3 to find the differences. If the differences were found, a Post-Hoc analysis was performed to identify the level of difference among the genus of orchids.

RESULTS AND DISCUSSION

Effect of Temperature on Population Density of T. pasificus

The study showed that temperature fluctuation affected the change of population density. In general, population density of *T. pasificus* tended to increase as the temperature increased (Figure 2). However, the peak population of mite was reached at different time at different genus of orchids. The mite on Phalaenopsis and Coelogyne reached peak population at 10 a.m., while the peak population of the mite on Dendrobium was reached at 12 p.m. and on Cattleya was reached at between 10 a.m. and 4 p.m..

Population of *T. pasificus* was reached the highest at temperature of between 30 and 32°C on Dendrobium and Cattleya. But, highest population of mite on Phalaenopsis was reached at between 28 and 30°C, and on Coelogyne was at between 34 and 36°C.

There are a huge number of studies have revealed the impact of temperature on biological aspects of mite, such as reproduction, duration of life, and behaviour (Zaher & Yousef, 1972; Yousef et al., 1979; Ghoshal et al., 2011). Meanwhile, Allen et al. (1995) shows that peak population of mite *Phyllocoptruta oleivora* occurs at temperature 29°C. In addition, mite *T. granati* exceeds one life cycle (larva, protonymph, and deutonymph) faster at temperature of between 29.8 and 30.7°C (Yousef et al., 1979), as similarly was shown in the populations of *T. punicae*, *T. granati*, and *T. pernicious* which reaches a very high population at temperature of 29.8–34.5°C (Zaher & Yousef, 1972; Yousef et al., 1979; Ghoshal et al., 2011).

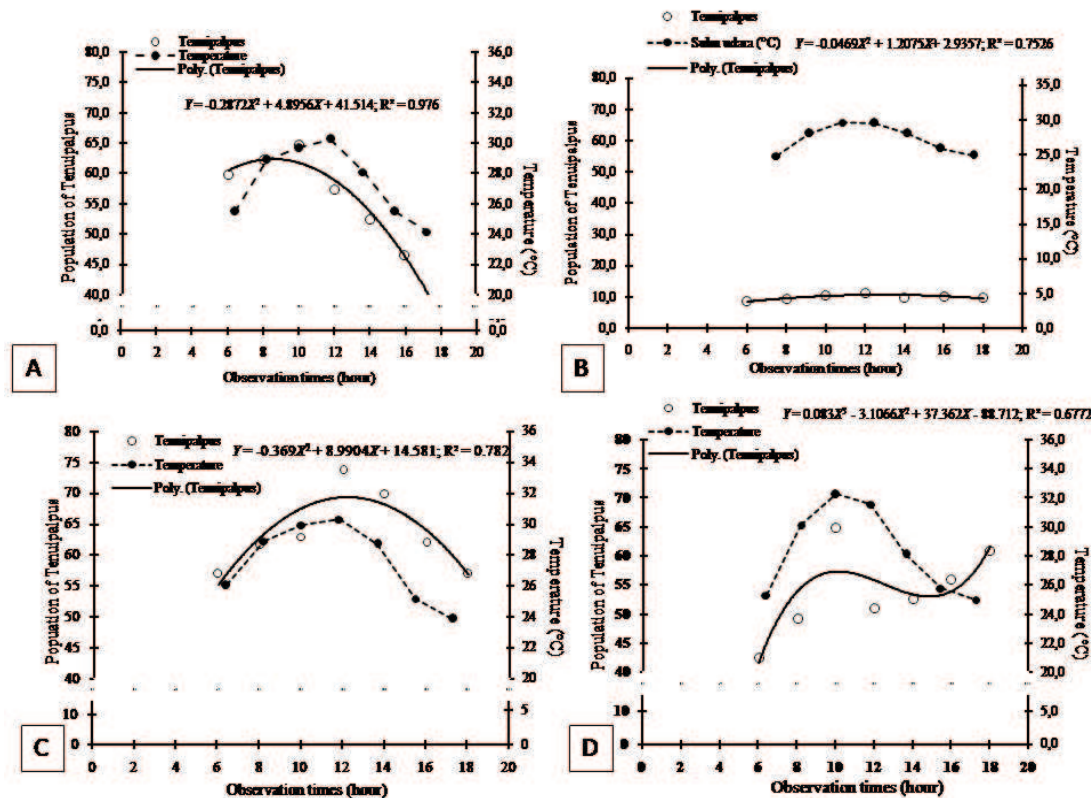


Figure 2. Relationship between population density of *Tenuipalpus pasificus*, active time and temperature: Dendrobium (A), Cattleya (B), Phalaenopsis (C), Coelogyne (D)

Effect of Relative Humidity on Population Density of *T. pasificus*

Furthermore, the effect of relative humidity on mite population was similar with the temperature in contrary results (Figure 3): the population tended to increase at the lower humidity. The lower population of the mite was reached at more than 80% of humidity on genus Cattleya, Dendrobium, and Coelogyne, while it was reached at between 75 and 80% of humidity on Phalaenopsis.

Some studies also show the impact of relative humidity on population density of mite. For example, population of *T. punicae*, *T. granati*, and *T. perniscis* increase significantly at relative humidity of 61.6–72.62%. In addition, *T. granati* completes one life cycle faster at relative humidity of 61.6–67.5% (Yousef *et al.*, 1979).

The study showed the effects of temperature and relative humidity on the population of *T. pasificus*, although it was also determined by the genus of orchids. For example, genus Coelogyne has large, sword-shaped leaf with the tip tapered with multiple

surface (Destri *et al.*, 2015) which may support *T. pasificus* to settle at Coelogyne. Other study by Zaher & Yousef (1972) also mentions that mite *T. punicae* prefers to occupy concave areas, in the midrib, in cracks, and under bark of plant tissue.

From the plant management and protection point of view, the condition of planting site, such as garden and/or greenhouse, might determine the population of mite due to temperature and humidity level. The selection of orchid genus to be cultivated in site, as also it will planted in monoculture or polyculture might determine the preference of mite to invade and occupy the orchids. As each orchid genus has also specific preference to microclimate, the preference of mite on each orchid genus might affected. In general, the temperature and humidity on each sites affected population of mite. Therefore, this correlation should be noticed by farmer in purpose to keep the mite population still under economic injury level. For example, since *T. pasificus* was abundant on Coelogyne, it might be better to cultivate this orchid in isolated place.

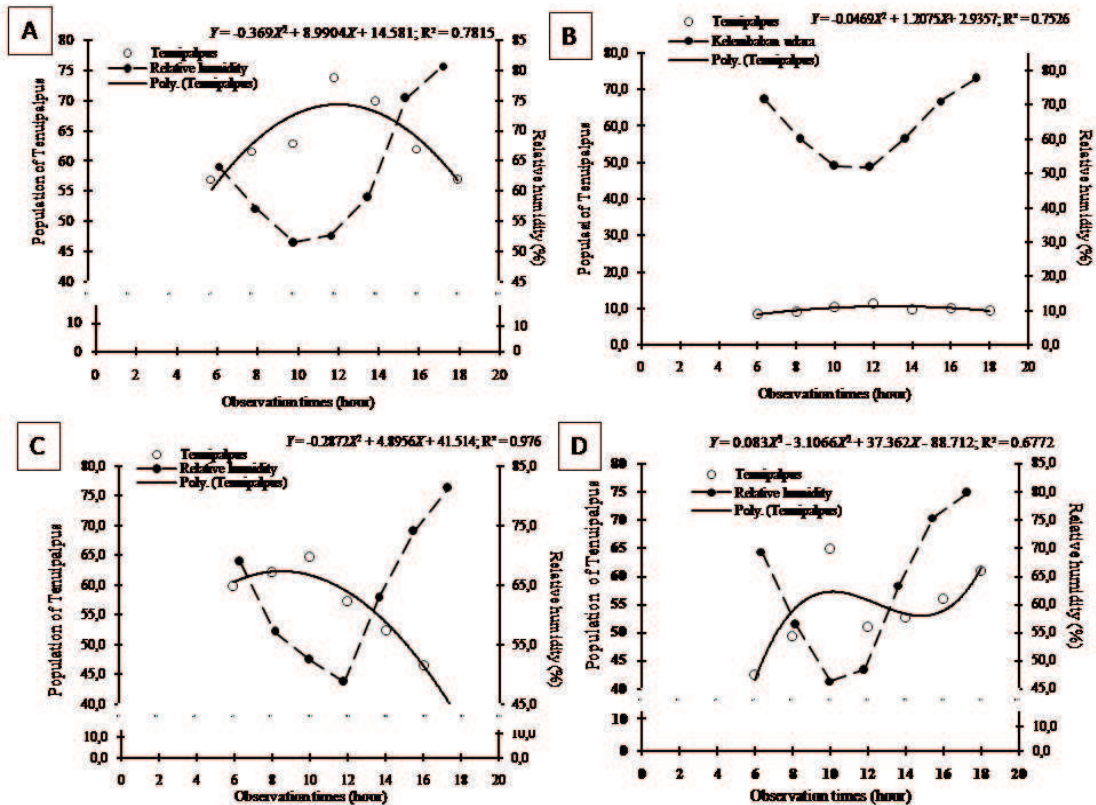


Figure 3. Relationship between population density of *Tenuipalpus pasificus*, active time and relative humidity: Dendrobium (A), Cattleya (B), Phalaenopsis (C), Coelogyne (D)

Population Density and Attack Intensity of *T. pasificus* on Orchids

Although *T. pasificus* was found on all four genus of orchids, the population densities were differed significantly ($P < 0.01$) (Figure 4A). The highest population of the mite was found on Coelogyne and Dendrobium, while the lowest population was found on Cattleya. However, interestingly, the intensity of attack by the mite is relatively high on Coelogyne, and was recognized similar with the intensity on the other three ($P > 0.5$) (Figure 4B).

However, this study was also noted other factor which might also determine the population of mite, i.e. chemical treatments, although it was not specifically considered. In general, orchid farmers apply spraying pesticide twice a week for mite control. According to Puspitarini (2012), scheduled pesticide application might trigger *Panonychus citri* to become resistant to pesticide, beside potentially kills the predatory mites such as *Amblyseius* sp. (Phytoseiidae). Thus, choosing the other technique which is much cheaper and safer, such as spraying forcefully with water at

the lower side of orchid leaves at the time when mites were concentrated at high population (as shown in Figure 2 and 3) is highly recommended.

The study then revealed that management of plant might determine the level of population of mite and also the damage possibly made on orchid. Synchronizing the choose of orchid genus and management of plant cultivation to minimize the explosion of mite population is important. It is also important to reduce the use of synthetic pesticide, or at least the choose of less harmless pesticide, to prevent the possibility of mite to be resistant and the death of natural enemies (Mansour *et al.*, 1993). Furthermore, there are some approaches to manage the population of mite proposed by researchers. Hoy (2011) stated that Integrated Mite Management is an effort to synchronize several management strategies, including cultural control (sanitation, irrigation, pruning, etc.), monitoring phytophagous mite and the natural enemies, and biological control. Meanwhile, Gulati (2014) mentioned that intercropping with host or non-host plant may potentially

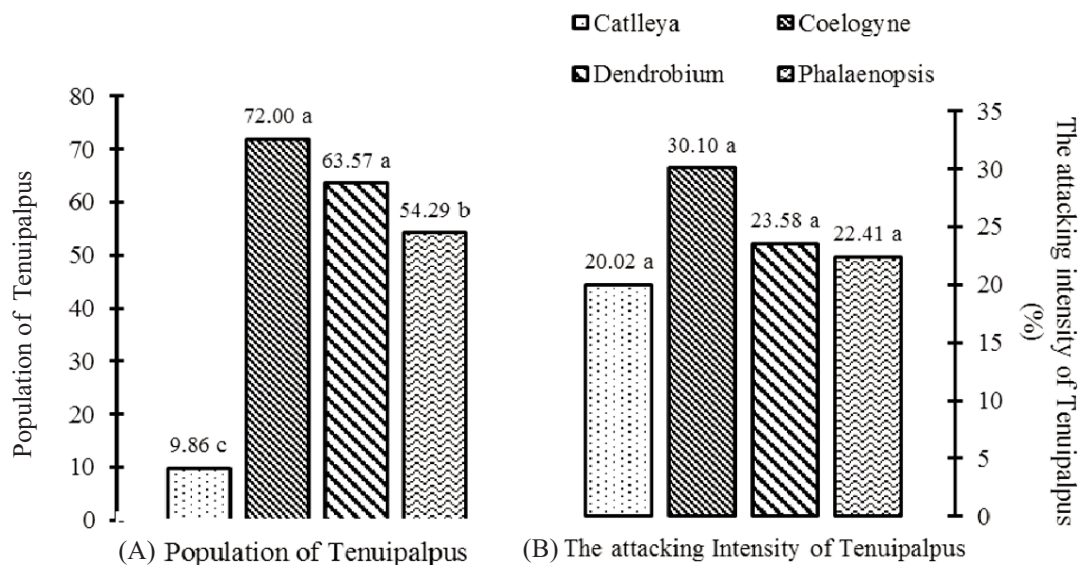


Figure 4. Population density and attack intensity of *Tenuipalpus pasificus* on four genera of orchids

reduce mite population. Therefore, orchid pest management in Malang Raya should be improve to cultivate one orchid genus/species with other non-host crops to repel or at least reduce the preference of mite.

CONCLUSION

Tenuipalpus pasificus was found dominant in Coelogyne orchid (72 mites/plant). The highest population of *T. pasificus* was commonly found at 10.00 a.m on Phalaenopsis and Coelogyne, while on Dendrobium at 12 p.m, and on Cattleya at between 10 a.m. and 4 p.m. The intensity of attack of *T. pasificus* was not significantly differing among four orchids, which was varied from 20.02 to 30.10%, and was determined as low intensity.

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