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# Morphological and genetic variation of *Thrips parvispinus* (Thysanoptera: Thripidae) in chili plantation (*Capsicum annuum* L.) in the lowland and highland of Jambi Province, Indonesia

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**Abstract:** *Thrips parvispinus* Karny (Thysanoptera: Thripidae) are dangerous pests for chili (*Capsicum annuum* L.). Thrips can be found in lowland to highland. The damage caused by thrips can reach 60% and this damage will be greater if the thrips also be vectors of plant virus diseases. The research aims to analyze morphological and genetic variation of *T. parvispinus* located in the lowlands and in the highlands of Jambi province, Indonesia. *T. parvispinus* were collected in 2012 from chili plantation in 19 villages spread over 5 districts in the lowlands and 26 villages spread over 2 districts in the highlands. The results showed that *T. parvispinus* were found at each research site. The size and color of the body *T. parvispinus* have variations with long, medium and short criteria. Variation in body size of *T. parvispinus* in lowland: length of 1.42 ± 0.065 mm, medium 1.32 ± 1.15 mm and short 0.122± 0.051 mm. Variation in body size of *T. parvispinus* in the highlands: length of 1.46 ± 0.035, medium of 1.35 ± 0.051 and short of 1.22 ± 0.089. *T. parvispinus* with long body size and dark brown color predominantly are found in all survey sites, is 80.53% in the lowlands and 75.91% in the highlands. The results also showed that the insects having different body sizes belong to the same *T. parvispinus* species.

**Keywords:** *T. parvispinus*, Morphology, Color, DNA

## 1. Introduction

*T. parvispinus* is a dangerous insect pests that attack and damage chili plants. These pests damage plants by sucking and whittling (Kalshoven 1981). The damage, which was caused by thrips in Bandung and Bogor Regency of Indonesia ranged 10-46%. Yield losses due to attack *T. parvispinus* on chili plantation could reach 22.8% (Sastrosiswojo 1991). Plant damage, which was caused by thrips will be greater if the thrips was to be vectors of plant virus diseases (Ullman & German, 1995; Marullo and Mound, 2002).

*T. parvispinus* is originating from Southeast Asia with regional distribution starting from Thailand, Malaysia to New Guinea and northern Australia. Currently these thrips are also found in Greece. According to Mound (2006) the inclusion of *T. parvispinus* in Greece it's because taken along accidentally by the *Gardenia* sp. flower from Indonesia.

*T. parvispinus* are thrips that become major pests for vegetable plants in Indonesia (Sastrosiswojo 1991). According to Vos (1994) *T. parvispinus* is a major pest for cultivating chili in Java. Mound (2006) reported that one of the thrips that are so damaging species in Southeast Asia is *T. parvispinus*. Talekar (1991) reported that the species of T. *parvispinus* predominantly are found in Indonesia and most destructive chili plants. Prabaningrum (2007) reported that only *T. parvispinus* are found in paprika plant in Bandung

regency, West Java. The result of preliminary survey found that morphological *T. parvispinus* are varied. However, research of morphology of *T. parvispinus* is still very limited. Therefore, aims of this study were to identify and analyze morphological variations and some other characteristics of *T. parvispinus* that attack chili plants in the lowlands and in the highlands province of Jambi, Indonesia. This research can increase knowledge about of *T. parvispinus*.

## 2. Methods

The survey was conducted between February and August 2012 at the height of 1-200 meters above sea level in the lowlands and 800-1750 meters above sea level in the highlands. Research sites had temperatures in the range 23-32$^{o}$C in the lowlands and 17-29$^{o}$C in the highlands, the air relative humidity in the lowlands ranged between 60-98% and highlands ranged 58% -95%.

Exploration thrips was done by collecting thrips imago of 150 plants at each location by tracing a line transect (Khan 2006). The thrips imago collected were put into a plastic vial which contains 70% alcohol volume of 50 ml to prevent damage before it's made slides for identification. The microscopic slides were made for identification of collected thrips species. Identification was conducted in the department of plant protection Biosystematics Laboratory IPB Bogor, Indonesia.

Identification was done by observing, recording and documenting morphological characteristics such as, antenna, ocelli, tassel and wings color, metanotum, abdomen and other vital parts binocular compound microscope 40x magnifications. Identification of species using identification keys which made by; Mound and Kibby (1998); Moritz *et al*. (2001); Mound (2006).

DNA extraction from thrips was performed by method of Goodwin *et al.* (1994).

## 3. Results and Discussion

The results of identification of *T. parvispinus* specimen are showed in Table 1 and Fig. 1. The morphological features of *T. parvispinus* are as follows: (1) body color was brown to dark brown; color of head and thorax was brighter than the abdomen, (2) head had strong reticulation patterns and big eyes that have pigment, (3) compound eyes had not elongated shape, (4) antenna consisted of seven segments, while the second and third segments had a fork-shaped sensory organs, (5) sample does not have ocellar setae 1, ocellar setae 2 is shorter than ocellar setae 3, (6) pronotum had 2 pairs of long setae posteroangular and 3 pairs of setae posteromarginal were shorter, (7) at the metanotum there was no sensila campaniform, (8) at Tergit VIII there was a comb (comb microtichia), (9) at the V-VIII there was a ctenidia at part of lateral and at Tergit VIII ctenidia which was located behind the spiracles, (10) lengt of wing was more than half the length of the abdomen, (11) dark wings or shaded, with a pale base, (12) at the first and second wings vein front there was a complete line of seta (Fig. 1). Sequences analysis of DNA fragments from three specimens (A, B and C) were found approximately 655 nucleotides with 99.38% consider identical with T. *Parvispinus*.

***Table 1.*** *Plateau place found T. parvispinus in chilli plantation at lowland and highland in Jambi Province*

| Family | Species | Altitude (mdpl) |
|---|---|---|
| ***Lowland*** | | |
| Thripidae | *Thrips parvispinus* | 8, 10, 17, 20, 21, 22, 24, 25, 26, 27, 29, 31, 34, 54, 56, 60, 65, 126 |
| ***Highland*** | | |
| Thripidae | *Thrips parvispinus* | 837, 847, 984, 1.054, 1.071, 1.079, 1.104, 1.391, 1.416, 1.416, 1.445, 1.471, 1.473,1.480, 1.498,1.507, 1.508, 1.510, 1.517, 1.558, 1.560, 1.607, 1.623, 1.639, 1.710, 1.713 |

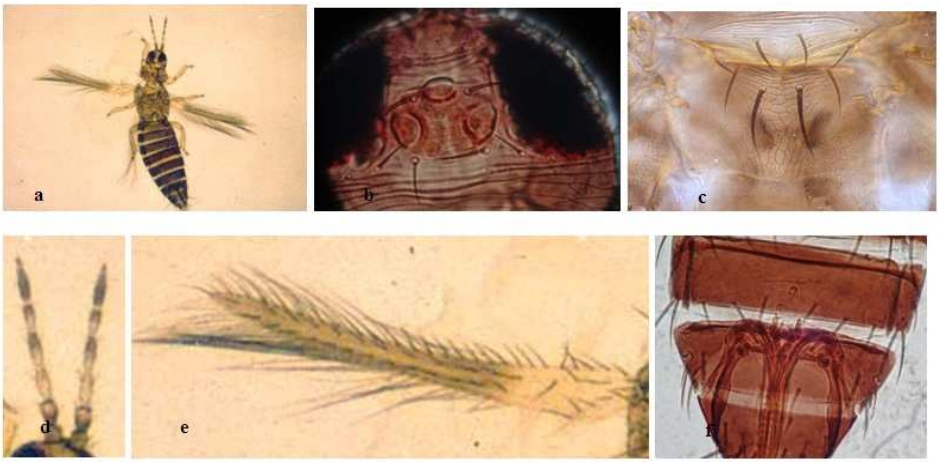


***Figure 1.*** *Morphology of T. parvispinus a. female imago, b. Ocellar, c. metanotum, d. antena, e.wings, f. tergit VIII*

*T. parvispinus* which were found in its own body size varies. They were long, medium and short (Figure 2). The average body length of *T. parvispinus* found in the lowlands was the size of the body length of 1.42 ± 0.065 mm, medium of 1.32 ± 1.15 mm and short of 1.22± 0.051 mm. In the highlands of *T. parvispinus* body size length of 1.46 ± 0.035 mm, medium was 1.35 ± 0.051 mm and short of 1.22 ± 0.089 mm (Table 2). Differences in body length of *T. parvispinus* long category, medium and short were statistically significantly different.

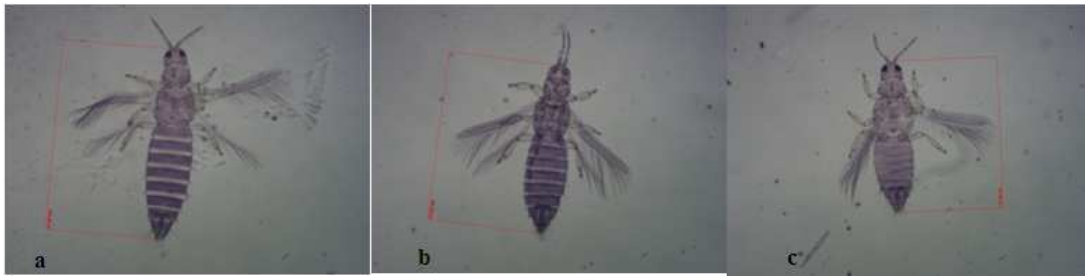


***Figure 2.*** *Body size variation of long T. parvispinus (1.42 mm) (a), medium (1.32 mm) (b) and short (1.17 mm) (c) at mulberry 4x*

***Table 2.*** *Body size of imago of T. parvispinus*

| Parameters | Body size, mm | | |
|---|---|---|---|
| | Long, dark brown | Medium, dark brown | Short, dark brown |
| Lowland | | | |
| Long of body | 1,42 ± 0,065 | 1,32 ± 0,051 | 1,15 ± 0,122 |
| Long of abdomen | 0,85 ± 0,041 | 0,79 ± 0,049 | 0,68 ± 0,088 |
| Long of wings | 0,72 ± 0,031 | 0,69 ± 0,042 | 0,65 ± 0,046 |
| Long of antena | 0,28 ± 0,010 | 0,27 ± 0,008 | 0,26 ± 0,015 |
| Width of head | 0,16 ± 0,015 | 0,16 ± 0,012 | 0,15 ± 0,015 |
| Width of thorax | 0,30 ± 0,024 | 0,30 ± 0,027 | 0,29 ± 0,029 |
| Highland | | | |
| Long of body | 1,46 ± 0,035 | 1,35 ± 0,051 | 1,22 ± 0,089 |
| Longof abdomen | 0,89 ± 0,043 | 0,83 ± 0,064 | 0,73 ± 0,077 |
| Long of wings | 0,75 ± 0,014 | 0,73 ± 0,031 | 0,70 ± 0,046 |
| Long of antena | 0,29 ± 0,013 | 0,28 ± 0,010 | 0,27 ± 0,011 |
| Width of head | 0,16 ± 0,014 | 0,15 ± 0,010 | 0,15 ± 0,007 |
| Width of thorax | 0,30 ± 0,017 | 0,28 ± 0,021 | 0,29 ± 0,027 |

Explanation: Mean of the result measurement from 165 trips imago (adult thrips )

Body color of *T. parvispinus* was found vary (Table 3). Body color begins to brown to dark brown. *T. parvispinus* size and body length dark brown are dominant species found than *T. parvispinus* medium-sized body and a short. The results of Prabaningrum research (2007) found that the color and body length of *T. parvispinus* varied. Mound and Collins (2000) found a morphological variation in *T. parvispinus*. To the variations in body length of *T. parvispinus* were performed electrophoresis testing. The Testing used 1% gel of agarose gel PCR thrips with primer pairs ITS 2 thrips. The test results showed that *T. parvispinus* with varying body length was still classified into the same species.

***Table 3.*** *The amount and percentage of T. parvispinus at lowland and highland in Jambi Province*

| *T. parvispinus* | Amount | Percentage (%) |
|---|---|---|
| lowland | | |
| long, dark brown | 4,691 | 80.53 |
| long, brown | 325 | 5.58 |
| Medium, dark brown | 336 | 5.77 |
| Medium, brown | 31 | 0.53 |
| Short, dark brown | 426 | 7.31 |
| Short, brown | 16 | 0.27 |
| Highland | | |
| long, dark brown | 9,161 | 75.91 |
| long, brown | 455 | 3.77 |
| Medium, dark brown | 1,013 | 8.39 |
| Medium, brown | 202 | 1.67 |
| Short, dark brown | 994 | 8.24 |
| Short, brown | 244 | 2.02 |

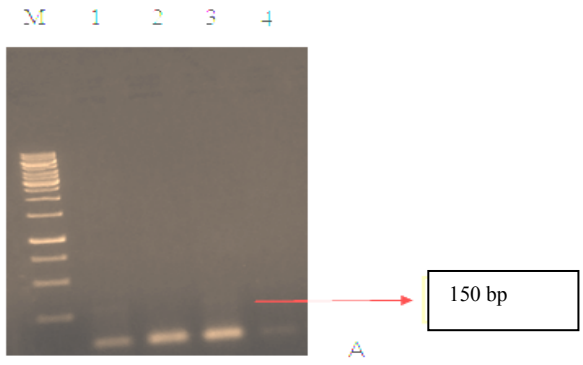


***Figure 3.*** *The result of electrophoresis with 1% gel agarose gel PCR Thrips in pairs primer ITS 2, row 1 ( long T. parvispinus , 2 ( medium T. parvispinus , 3 (short T. parvispinus ): amplified, and 4 (male individu) : not amplified, row M: marker 100 bp (Sigma).*

*T. parvispinus* which were found with different morphological variations, as identified by the key identification made Mound & Kibby (1998); Moritz *et al.* (2001); Mound (2006) have the same specific characteristics. Specific characteristics that are owned by *T. parvispinus* are long, medium and short, that are, the antenna consists of 7 segments, the second and third segments have fork-shaped sensory organ, there have no ocellar setae 1 and ocellar setae 2 is shorter than ocellar setae 3, at the pronotum there are 2 pairs of long posteroangular setae and 3 pairs of posteromarginal setae, on metanotum there is no sensila campaniform, on Tergit VIII contained no comb, on Tergit V-VIII are lateral ctenidia and at Tergit VIII ctenidia located behind the spiracles, dark wing color or shaded with pale base and the first vein and second front wing there are complete row of seta.

Electrophoresis used 1% gel agarose gel PCR thrips with primer pairs ITS 2 thrips showed (Fig. 3) the primer pair ITS 2 (Hillis and Dixon 1991) 28 Z 5 'AGACTCCTTGGTCCGTGTTTC 3' and P1 5 'ATCACTCGGCTCGTGGATCG 3' was able to identify the species of *T. parvispinus* long good-sized, medium, or short with 150 bp DNA fragment size. This ITS 2 primer determines the site of DNA replication is begun. Each of any genetic material can be replicated in large quantities by determining a pair of primers flanked the sequences DNA desired. The way of PCR working is started from binding primer which has known its sequences. Then the enzyme of polymerase DNA will extend the oligonucleotide (primer). Each of reaction in the PCR is repeated after denaturation step so there was amplification (multiplication) happened exponentially (Stansfield *et al*. 2003).

On these PCR thrips there were three temperature or stages of incubation which repeated 35 times. A replay of these stages is called a cycle. The first stage is called denaturation, where the two strands of the target DNA molecules are separated (denatured) by its heat. DNA at temperature of 95°C can break the hydrogen bonds between the bases and produce two separated DNA strands. The second stage is called annealing (annealing), where the two primers will hybridize to become complementary sequences on single DNA strands. The primers mean here are a single-stranded synthetic of DNA sequences and short (length 20-30 bases). Primers were chosen of that sort in order to one primer is complementary to one end of the desired gene on one strand. Meanwhile, the second primer is complementary to the other end on the other DNA strand. Primer will form a hydrogen bond (stick) with complementary sequences so with the result that form a stable double-stranded molecule. Annealing temperature used in PCR thrips is 60°C. At the third stage, extension or elongation, primer is extended by DNA polymerase at 72°C.

# 4. Conclusions

*T. parvispinus* found in highlands and lowlands of Jambi province, Indonesia, were investigated. The same species of *T. parvispinus* can have different morphology and other characteristics. The size and color of the body *T. parvispinus* had variations with long, medium and short criteria. The results also showed that the insects having different body sizes belong to the same *T. parvispinus* species.

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