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THRIPS ON EGGPLANT, CHILLI AND BELL PEPPER IN CAMERON HIGHLANDS, MALAYSIA

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ABSTRACT

Thrips have always been one of the major pests for eggplant (*Solanum melongena* L.), chili and bell peppers (*Capsicum annuum* L.). Thrips damage these vegetable crops either by direct feeding on the leaves, flowers or fruits or they act as vectors for viruses. However, not all thrips feed on the above-mentioned crops, thus identification of the thrips that feed on these vegetable crops is important in order to provide an effective solution. Therefore, the objective of this study is to identify the species of thrips that attack these plants and cause major damages. Cameron Highlands was selected as the study area because it is one of the major vegetable production areas in Malaysia. Thrips were collected from several farms in Cameron Highlands. The thrips samples were stored in 70% ethanol, macerated by soaking in weak sodium hydroxide (5% NaOH), dehydrated using alcohol and clove oil and finally mounted on

microscopic glass slides using Euparal as mounting medium. The thrips specimens were identified based on the morphology. The thrips that were found abundant on these vegetable crops were *Thrips palmi* Karny and *Thrips parvispinus* Karny. These thrips were usually found feeding in the flowers of susceptible vegetable crops. There were on average 5 thrips per flower. The damage of thrips can only be observed during fruit formation as scars on the external surface of the fruits. The damage became intensified as the fruits grew to cause them to develop irregular shapes and dry-looking. These unpleasant looking fruits, although edible, are not preferred by consumers, thus causing them to be non-marketable.

Keywords: *Thrips palmi*, *Thrips parvispinus*, Cameron Highlands, major pest of chili, eggplant and bell pepper.

ABSTRAK

Thrips merupakan salah satu serangga perosak utama untuk terung (*Solanum melangena* L.), cili dan cili benggala (*Capsicum annuum* L.). Thrips merosakkan tumbuhan sayur disebut dengan menghisap sap dari daun, bunga atau buah atau mereka boleh menjadi vektor untuk virus tumbuhan. Bagaimanapun, bukan semua thrips adalah perosak untuk tumbuhan sayur disebutkan, dengan itu spesies thrips yang merosakkan tumbuhan disebut perlu di mengenal pasti untuk menghasilkan cara penyelesaian yang berkesan. Oleh itu, objektif penyelidikan ini adalah untuk mengenal pasti spesies thrips yang merosakkan tumbuhan sayur yang disebut atas dan perosak utama untuk tumbuhan sayur yang disebut. Cameron Highlands dipilih sebagai lokasi penyelidik kerana ia merupakan

salah satu penghasil utama sayur-sayuran di Malaysia. Thrips ditangkap dari beberapa kebun sayur di Cameron Highlands. Sampel thrips disimpan dalam 70% ethanol, melembutkan dengan 5% natrium hidroksida, dehidrasi dengan alcohol dan minyak bunga cengkih (clove) dan akhirnya, diletak pada mikroskop slides dengan menggunakan euparal sebagai media pelekat. Sampel thrips yang disediakan dikenal pasti dengan morfologi. Thrips yang paling banyak dijumpa dalam sayur-sayuran yang diselidik adalah *Thrips palmi* Karny dan *Thrips parvispinus* Karny. Thrips biasanya dijumpa di dalam bunga cili, terung dan cili benggala dengan purata 5 thrips dalam satu bunga. Kerosakan thrips saja boleh dinampak apabila pembentukan buah sebagai parut di permukaan buah. Kerosakan tersebut menjadi intensif semasa buah membesar dan menyebabkan buah tidak dalam bentuk yang biasa dan kelihatan kering. Buah yang tidak cantik, walaupun masih boleh makan, tidak disukai oleh pengguna, oleh itu, mereka tidak dapat dijualkan.

Kata kunci: *Thrips palmi*, *Thrips parvispinus*, Cameron Highlands, serangga perosak utama cili, terung dan cili benggala.

INTRODUCTION

Thrips are from the order Thysanoptera, and adult thrips are usually less than 2.5mm long (Van Emden 2013). Thripidae, one of the families under Thysanoptera from which most of the species are plant feeders and some are the pest of agricultural crops. Most of these plants feeding thrips have piercing-sucking mouthparts that allow them to feed on plant juices or saps and they are commonly found in flowers and leaves which include

agriculture crops (Robinson 2005). However, not all of these plants feeding thrips damage or feed on chili, eggplant and bell pepper. According to Mound and Teulon (1995), the damage of pest thrips on crops results from several factors, namely direct feeding on leaves, flowers or fruits, transmission of viruses and causing contamination during or after feeding.

Thrips palmi Karny or the melon thrips, was reported as one of the common pests on eggplant (*Solanum melongena* L.) as well as chili and bell pepper (*Capsicum annuum* L.) (Fauziah & Saharan 1991; Muniappan et al. 2012; Srinivasan 2009). According to Srinivasan (2009), it was widely distributed in South Asia, Southeast Asia, and Oceania. Invasive thrips species, *Frankliniella occidentalis* Pergande, also commonly known as western flower thrips were reported to be abundant in highlands areas (Mound & Azidah 2009). According to Funderburk et al. (2011) and Papadaki et al. (2008), *F. occidentalis* was also the key pest thrips of chili, bell pepper, and eggplant, of which eggplant is more attractive to *F. occidentalis* as compared to chili and bell pepper. *Scirtothrips dorsalis* Hood was also reported to be pest thrips in *Capsicum annuum* in Asia (Chang 1991; Muniappan et al. 2012). *Thrips parvispinus* Karny was reported in Indonesia as the major pest of *C. annuum* (Sastrosiswojo 1991; Vos et al. 1991). Azidah (2011) also reported the presence of other thrips on chili, bell pepper and eggplant in Peninsular Malaysia, namely, *Ceratothripoides brunneus, Danothrips alis, Frankliniella schultzei, Megalurothrips mucunae, Megalurothrips usitatus, Microcephalothrips abdominalis, Stenchaetothrips biformis, Thrips hawaiiensis, Thrips levatus* and *Trichromothrips trifasciatus*.

The damage of thrips due to feeding is typically in the form of scars on the leaves, flower petals or fruits (Reitz et al. 2011). The damage symptoms of several species of thrips reported by Srinivasan (2009), Hodges et al. (2009) and Muniappan et al. (2012) were similar, where the leaf crinkled and discolored. Slightly infested leaves exhibit silver feeding scars on the abaxial surface while heavily infested leaves turn brown or yellow and are dry on abaxial surface; infested fruit is scarred and deformed or irregular in shape, and flowers show a flecked or speckled appearance and browning or dying prior to pre-maturation.

MATERIALS AND METHODS

Thrips sampling

Thrips were randomly collected from different eggplant, bell pepper, and chili farms in Cameron Highlands (Table 1). The thrips were stored in 70% ethanol upon collection.

Table 1 Farming Area for Thrips Sampling

Location	**Estimated Coordinate**	
Blue Valley	4°35’06”N	101°25’05”E
Kampung Raja	4°34’03”N	101°24’06”E
Tringkap	4°30’35”N	101°25’30”E
Mensun Valley	4°29’49”N	101°23’45”E
Habu and Boh Road Area	4°27’03”N	101°23’35”E
Ringlet	4°25’16”N	101°23’18”E

**note: the coordinates do not show the exact location of each farm but the location of the farming area, which consists of multiple farms.

Thrips mounting

The mounting method was modified from Bisevac (1997). Thrips were transferred directly from 70% ethanol into 5% weak sodium hydroxide and soaked for no more than 12 hours. The thrips were positioned before being transferred to distilled water for 5 minutes. The thrips were then soaked in AAA solution (20ml glacial acetic acid, 50ml 95% ethanol and 45ml distilled water) for 30 minutes. The thrips were dehydrated by soaking in 95% ethanol for 5 minutes before being immersed in 99.5% absolute ethanol for 1 to 2 minutes. The thrips were further dehydrated by soaking in clove oil for 30 minutes. The thrips were then transferred ventrally up into a drop of euparal (mounting medium) on the coverslip. Another drop of euparal was placed on the glass slide and a drop of euparal essence could be added if the euparal was too thick. The glass slide was inverted and gently placed over the coverslip and it was immediately re-inverted as soon as the two drops of euparal merged. The thrips were readjusted gently by moving the coverslips if they were not properly positioned. The slide was placed into an oven at 38-40°C for several weeks until the euparal hardened.

Identification of thrips

The thrips were identified by using the key morphology characteristics listed in Mound and Ng (2009), Mound and Azidah (2009), Sartiami and Mound (2013) and Kirk (1996). The thrips sample were examined with Motic compound microscope BA310E under 400x to 1000x magnification. The thrips images (Figure 2) were taken by using MotiCam 5 with 40x magnification.

RESULTS AND DISCUSSION

Approximately three hundred thrips were mounted and identified. Based on the identification, the species of thrips found on chili, bell pepper, and eggplant were *Thrips palmi* Karny, *Thrips parvispinus* Karny, *Frankliniella occidentalis* Pergande and *Megalurothrips usitatus* Bagnall.

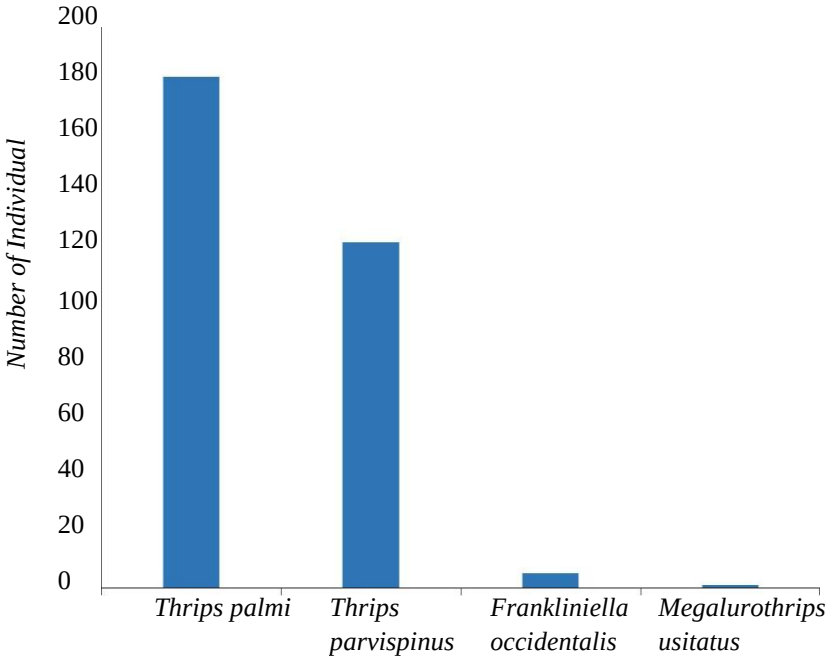

Figure 1 The total number of each thrips species found in the collected sample.

Figure 2 The species of thrips found on chili, bell pepper, and eggplant in Cameron Highlands. (1) *Thrips palmi*, Female, 40x magnification; (2) *Frankliniella occidentalis*, Female, 40x magnification; (3) *Megalurothrips usitatus*, Female, 40x magnification; (4) *Thrips parvispinus*, Female, 40x magnification.

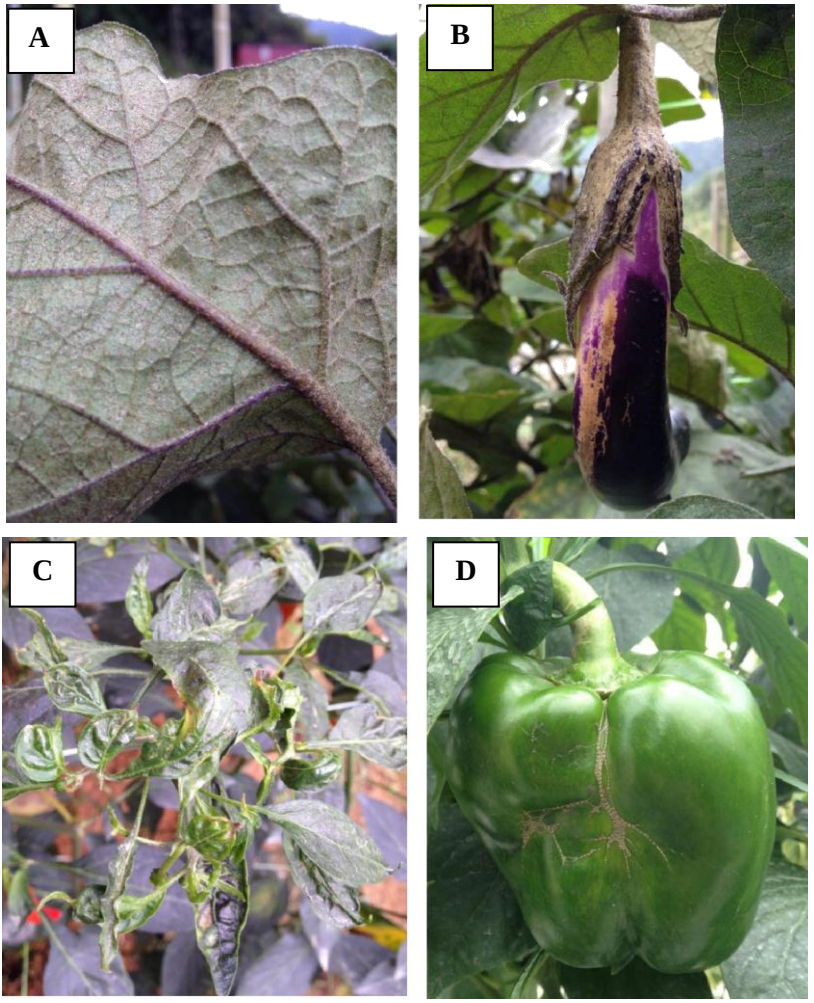

Figure 3 Damages caused by thrips on: (A) eggplant leaf; (B) eggplant fruit; (C) chili plant; and (D) bell pepper fruit

Species of thrips on chili, bell pepper and eggplant

According to Azidah (2011), *Frankliniella occidentalis, Megalurothrips usitatus, Thrips hawaiiensis, Thrips palmi* and *Thrips parvispinus* were previously reported in Cameron Highlands on a variety of plants, namely ornamental flowers and edible fruiting crops such as chili and eggplants. *Scirtothrips dorsalis* was found in Cameron Highlands by Ng et al. (2014). In this study, however, only four species of thrips were found and two of them were abundant among the examined thrips samples. In addition, *Scirtothrips dorsalis* which was previously reported by Chang (1991) and Muniappan et al. (2012) as one of the common thrips pests for *Capsicum annuum* was not found on chili or bell pepper. Even though four out of the six species previously reported in Cameron Highlands were present in the samples, *T. palmi* and *T. parvispinus* were the only two species which were abundant. Only five *F. occidentalis* and one *M. usitatus* were present in the sample. Therefore, there appeared to be a reduction in the diversity of thrips on eggplants, chili, and bell pepper in Cameron Highlands. The reduction in the number of species might be due to the constant usage of insecticides as the sole chemical control for pest problems in farms. According to Carson (1962), pesticide usage does reduce the diversity of birds. In addition, Isenring (2010) also reported on the negative impact of pesticides on species diversity of mammals, such as bats and rodents and insects, such as beetles, bees, and butterflies. Hirose (1991) also reported that the increased incidence of *T. palmi* could be due to the increased in insecticide application which causes the decrease of diversity in farms land and leads to *T. palmi* outbreaks. Therefore, it is possible that constant or over-usage of insecticides in farms may have reduced the diversity of thrips species.

Damages of thrips on chili, bell pepper and eggplant

The damage caused by thrips on chili, bell pepper and eggplant is shown in Figure 3. Thrips were mainly found in the flowers of these plants. Thrips were only found on the leaves when the farm was heavily infested. The damage was similar to those reported previously by Srinivasan (2009), Hodges et al. (2009) and Muniappan et al. (2012). The more commonly observed damage was scarring of the fruits. The scar on fruits might be due to direct feeding of thrips during the flowering stages of the plants, and as the flowers form fruits, the damage becomes intensified. In addition to the scars, the fruits will appear deformed or irregular in shape. According to farmers in Cameron Highlands, these damaged fruits are non-marketable. In heavily infested farms, especially chili and bell pepper, the young leaves will appear crinkled and the plant will be stunted and soon became wilted. According to farmers in Cameron Highlands, their losses range from 20% to 80% depending on the severity of the thrips infestation. Thrips damage is usually higher during the dry season or warmer temperature. According to Capinera (2000), the life cycle of thrips is significantly shorter during warmer temperature, for instance, the larval stage is 14 days at 15°C but only 5 days at 26°C. Besides the non-marketable fruits, the farmers also reported that the duration of the crops planted were shortened because of thrips damage, and this was also one of the reasons that lead to their loss. According to Jansen and Westphal (1993), the life cycle of *Capsicum annuum* was approximately a year (≈12 months) while *Solanum melongena* was approximately one and a half years (≈18 months).

CONCLUSION

Based on this study, *Thrips palmi* and *Thrips parvispinus* were found to be abundant on chili, bell pepper, and eggplants in Cameron Highlands, Malaysia. *Frankliniella occidentalis* and *Megalurothrips usitatus* were also sampled but the numbers were very low, five and one individuals respectively. The thrips were mostly found feeding in the flowers. The most commonly observed thrips damage was scarring of the fruits, causing them to be deformed and irregular in shape.

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