PAPER 2:
INFESTATION PATTERN OF *SCIRTOTHRIPS DORSALIS* HOOD (THYSANOPTERA: THRIPIDAE) IN DEVELOPING SHOOT AND FLOWER OF MANGO ARUMANIS 143

Affandi[1], Celia dela Rosa Medina[2], Luis Rey Ibañez Velasco[2], Pio Arestado Javier[2] Dinah Pura Tonelete Depositario[3], Hardiyanto[4], & Muhammad Syakir[5]

[1]Indonesian Tropical Fruits Research Institute, Jl. Raya Solok-Aripan Km. 8 P.O. Box 5 Solok 27301 West Sumatra Indonesia

[2]Department of Entomology, Crop Protection Cluster, College of Agriculture, University of the Philippines, Los Baños, College, Laguna, Philippines, 4031

[3]Department of Agribusiness Management and Entrepreneurship, College of Economic and Management, University of The Philippines, Los Baños, College, Laguna, Philippines, 4031

[4]Indonesian Center for Horticultural Research and Development, Jl. Tentara Pelajar, No. 3C, Cimanggu, Bogor, Indonesia

[5]Indonesian Agency for Agricultural Research and Development, Jl. Ragunan No. 29, Pasar Minggu, Jakarta Selatan, 12540, Indonesia

ABSTRACT

A research to determine the directional preferences and occupation time of the chilli thrips, *Scirtothrips dorsalis* Hood, associated with flush and flower growth stages of mango was conducted in PT. Trigatra Rajasa, a private mango plantation in Situbondo district, East Java Province, Indonesia from October to November 2015. Yellow sticky traps were utilized to verify the presence of *S. dorsalis* that migrate to the mango canopy. The traps were installed facing all eight cardinal directions during bud break and flower stages for 10 consecutive days. Analysis of variance (ANOVA) with 5 replications was used and significant differences among eight cardinal directions were tested using the Least Significant Different (LSD) test (p=0.05). The results show that *S. dorsalis* preferred the North-East cardinal direction and started to move into the mango canopy during the early shoot emergence, beginning to lean in a certain direction on the second day of observation. During shoot emergence, the highest number of thrips existed on day eight, with a total of 21.00 adults trapped per tree. No preference in direction was observed during the flower growth stage. The highest numbers existed at day three (9.40 adults/per tree) during the flower growth stage. This findings of this research suggest that control tactics should be started during early shoot emergence to prevent initial build-up of population.

Keywords: *Scirtothrips dorsalis*, infestation, pattern, mango

INTRODUCTION

Arumanis 143 is the most prefered mango variety by Indonesian consumers because of its very sweet taste and fiberless texture. However, the production of this variety is still relatively low (25-30 kg/tree) compared to its potential productivity (54.7 kg/tree) (Dinas pertanian kabupaten situbondo, 2004). Pest and disease incursion is one of the major constrains for achieving high yield of Arumanis 143.

One of the most damaging pests for mango is the chilli thrips, *Scirtothrips dorsalis* Hood (Affandi & Medina, 2013). Till recently, there has been little information available about production losses due to *S. dorsalis* incidences for mango. *S. dorsalis* incidences have been reported to reduce fruit production of cashew by 15-25% in India (Gowda et al., 1979). A report by Hoodle et al., (2003) states that in 1998, thrips feeding damage on avocados (which possess a similar fruit morphology with mangos), reduced industry revenues to 12%. *S. dorsalis* alters the leaf

color during flush growth from silver to dark brown, which then turns curly and undeveloped, finally falling off. It also decreases fruit set as the young fruit drops. Scarring of the immature and mature fruits are the effects of attack by *S. dorsalis* on flower and fruits.

Basic information on movement of *S. dorsalis* in mango plantation and factors that affect the movement is needed to develop management strategies against *S. dorsalis*. *S. dorsalis* has been reported to prefer buds, tender leaves as well as flowers (Kumar et al., 2013; Mannion et al., 2013). Propensity to a certain direction and time when *S. dorsalis* begins occupying during flush growth and floral induction can be used to determine the type of control strategy for S.dorsalis, whether pre-emptive or reactive management.

The objective of the research is to determine directional preference and time of infestation of *S. dorsalis* associated with mango in flush and flower growth stages.

MATERIALS AND METHODS

The research was conducted in PT. Trigatra Rajasa, a private mango plantation in Situbondo district, East Java Province, Indonesia from October to November 2015. The site is located 30 m above sea level with an average rainfall of 780 mm per year. During the research, the orchard experienced 5.5 wet months and 6.5 dry months.

Arumanis 143 is the only mango variety planted in the orchard. The trees are planted via monoculture with a distance of 8 X 10 m. The mango trees are already 22 years old, reaching 4-5 m in height, with a parabolic-shaped canopy. Good agricultural practices are applied and these include regular prunning, weeding, fertilization, irrigation and pest and disease control. Yellow sticky traps measuring 29.5 x 21 cm were utilized to verify the presence of *S. dorsalis* that migrate from different hosts to the mango trees. The yellow sticky traps were installed facing all eight cardinal directions and were placed 30 cm from the outermost and upper halves of each canopy. The traps was installed during bud break and flower stages of mango. A day after installing the traps, the number of adults caught were recorded daily for 10 consecutive days. Observations were also done during the flowering stage. The counting of thrips trapped in the yellow sticky traps was done in a laboratory using a binocular microscope. The wind direction and speed were also recorded.

The infestation of *S. dorsalis* from different host plants to mango trees was determined by counting the number of *S. dorsalis* adults that adhered to the yellow sticky trap. Analysis of variance (ANOVA) with 5 replications was performed. Hereafter, significant differences among the eight cardinal directions were tested using the Least Significant Different (LSD) test ($p=0.05$).

RESULTS AND DISCUSSION

A total of 379 adults S.dorsalis thrips were trapped during ten consecutive days of observation in the flush growth stage. The thrips started to move in at the start of early shoot emergence and began preferring a certain cardinal direction on the second day of observation. Based on eight cardinal directions, North-East presented as the most preferred direction which was evidenced by the highest average number of trapped *S. dorsalis* (1.74 thrips/trap). Among the 10 consecutive days, the highest number of thrips existed at day eight (21 adults/tree). Analysis of variance and further Least Significant Difference (LSD) based on average trapped population number is presented in Table 1.

The infestation of *S. dorsalis* into the mango trees began soon after the shoot emergence. Mango is one of the trees included as host range of *S. dorsalis* (Aliakbarpour, 2010; Global

Pest and Disease Database, 2011) especially during the flush growth stage, the most preferred food for the S.dorsalis. Various studies have indicated that *S. dorsalis* preferred to feed on the meristem, the terminal and other tender plant parts of the host such as buds and terminal leaves (Seal et al. 2010; Kumar et al. 2013; Mannion et al., 2013; Mannion et al., 2014). It has never been reported to feed on mature host tissues since during the mature stages, leaves contain high lignin content that impair insect feeding and oviposition (Dowd, 2013).

Table 1. *S. dorsalis* daily trap catch in eight cardinal directions during the flush stage of mango.

Direction	Day of Observations (Flush)										
	1	2	3	4	5	6	7	8	9	10	AVR
W	0.80 a	0.20 c	0.00 c	0.20 b	0.80 a	0.20 a	1.40 ab	2.80 ab	0.60 a	0.20 a	0.72 b
SW	0.80 a	0.20 c	0.40 bc	1.20 a	2.20 a	0.60 a	2.40 a	3.20 ab	0.00 a	0.00 a	1.10 ab
S	0.20 a	0.00 c	1.00 abc	0.40 ab	1.80 a	0.80 a	0.60 ab	0.20 b	0.20 a	1.00 a	0.62 b
SE	0.00 a	0.20 c	1.20 abc	0.00 b	0.80 a	0.60 a	0.20 b	0.60 b	0.40 a	0.20 a	0.42 b
E	0.80 a	2.80 ab	1.80 ab	0.20 b	2.20 a	0.40 a	0.80 ab	3.00 ab	1.00 a	0.20 a	1.32 ab
NE	0.60 a	4.00 a	2.60 a	0.20 b	1.60 a	0.20 a	1.20 ab	5.00 a	0.80 a	1.20 a	1.74 a
N	0.40 a	1.00 bc	1.40 abc	0.20 b	0.60 a	0.80 a	0.80 ab	3.20 ab	0.20 a	0.80 a	1.04 ab
NW	1.20 a	0.00 c	0.20 bc	0.00 b	1.00 a	0.40 a	0.20 b	3.00 ab	1.00 a	0.20 a	0.72 b
Total	**4.80 bc**	**9.40 bc**	**8.60 bc**	**2.40 c**	**11.00 b**	**4.00 bc**	**7.60 bc**	**21.00 a**	**4,20 bc**	**3.80 bc**	**7.68**

Note: Means value in each column with the same letter is not significantly different (p = 0.05) based on Least Significant Difference (LSD) test.
W = West SW = South West S = South SE = South East E = East
NE = North East N = North NW = North West

Observations during the flower growth stage showed that a total of 281 adults of *S. dorsalis* thrips were trapped during the 10 consecutive days. It started to colonize the mango trees at the onset of flower emergence. Mango flower is considered as one of the sources of food included in the host range of *S. dorsalis* (Aliakbarpour and Rawi, 2012). Apparently, flowers are preferred due to the non-existence of a meristemal plant parts of mango, especially during the flush stage. *S. dorsalis* has been known to be an opportunistic generalist species that is able to feed on a variety of host plants, depending upon availability of host (Kumar et al., 2013).

Low average population numbers were counted on yellow sticky traps installed in eight cardinal directions. However, *S. dorsalis* did not prefer certain directions based on the average population numbers. In addition, based on Least Significant Different (LSD) test, there was no significant difference among the days of observation (Table 2).

Thrips generally respond to environmental heterogeneity through movement (Dingle and Drake, 2007). Relatively high temperatures during flush growth observation (29.69°C) and low

relative humidity (52.85%) can cause the rapid movement of *S. dorsalis*. Derksen et al. (2016) stated that the peak flight of dispersal for *S. dorsalis* occurred when temperatures reach 30°C under low relative humidity.

Table 2. *S. dorsalis* daily trap catch in eight cardinal directions during the flowering stage of mango.

Direction	Day of Observations (Flower)										
	1	2	3	4	5	6	7	8	9	10	AVR
W	0.00 a	0.00 a	0.40 a	0.60 a	0.60 ab	1.00 a	2.40 a	0.20 b	0.60 a	1.00 a	0.68 a
SW	0.20 a	0.20 a	0.60 a	0.20 a	0.20 ab	1.60 a	1.00 ab	0.20 b	0.80 a	0.60 ab	0.56 a
S	0.80 a	1.20 a	2.00 a	2.00 a	2.20 a	1.00 a	0.60 ab	0.00 b	0.40 a	0.00 b	1.02 a
SE	0.20 a	1.00 a	1.40 a	0.40 a	0.80 ab	1.60 a	0.20 b	1.40 a	0.40 a	0.40 ab	0.78 a
E	0.20 a	0.80 a	1.20 a	0.60 a	0.40 ab	0.60 a	0.60 ab	0.60 ab	1.00 a	0.00 b	0.60 a
NE	0.60 a	0.20 a	0.60 a	1.80 a	1.60 ab	0.40 a	0.20 b	0.20 b	0.80 a	0.60 ab	0.70 a
N	0.40 a	0.40 a	1.80 a	1.80 a	0.00 b	0.60 a	0.60 ab	0.20 b	0.80 a	0.20 ab	0.68 a
NW	0.20 a	1.40 a	1.40 a	0.20 a	0.40 ab	0.40 a	1.00 ab	0.40 b	0.40 a	0.20 ab	0.60 a
Total	**2.60 d**	**5.20 abcd**	**9.40 a**	**7.60 ab**	**6.20 abcd**	**7.20 abc**	**6.60 abcd**	**3.20 bcd**	**5.20 abcd**	**3.00 cd**	**5.62**

Note: Means value in each column with the same letter is not significantly different (p = 0.05) based on Least Significant Difference (LSD) test.
W = West SW = South West S = South SE = South East E = East
NE = North East N = North NW = North West

The incidence of *S. dorsalis* trapped on yellow sticky traps was relatively low during the flower growth stage compared to the flush stage. Relatively high temperatures and high humidity during the flower growth stage (29.72°C; 62.85%, respectively) may have reduced the dispersal activity of *S. dorsalis*. Derksen et al. (2016) found that high humidity was negatively correlated with the number of *S. dorsalis* caught in ornamental plants. A study by Affandi et al. (2017) showed the preferential order of adult S.dorsalis to be the flush stage, followed by the flower stage. The dormant stage was the least preferred by the *S. dorsalis*. Similar research on rose informed that *S. dorsalis* densities was found significantly higher on the rose buds than on flowers or on mature leaves (Mannion et al., 2014). A past study by Hansen et al. (2003) found that thrips appeared to prefer the the upper part of the plant canopy and the outer extremities of their hosts. Lewis (1997) suggested that this could be attributed to the nutrient flow in plants towards new growth areas.

Yellow sticky trap observations during flush growth stages exhibited that average wind direction and speed were 203.06° and 1.05 km/hours respectively, indicating the direction of the the wind from between South and South-West to between North and East. The population numbers of *S. dorsalis* tend to clump at North-East. Statistical analysis showed that there was no significant difference in preference among the cardinal directions of North-East, North, East and South-West based on LSD test (Table 1). Similar research on abundance and distribution of *S. dorsalis* in mangosteen confirm that thrips *S. dorsalis* were more abundant in the North and East sides than in the South and West (Pankeaw et al., 2011). Derksen et al. (2016) added that dispersal direction of *S. dorsalis* was correlated with the direction of prevailing winds.

Observations during flower growth stages indicated that average wind direction and speed were 190.50° and 0.75 km/hours respectively, meaning that the wind blew from between South and South-West to between North and East. However, the population of *S. dorsalis* did not tend to clump in a particulardirection. Possibly the low speeds of wind restrained weak fliers to move toward their desired direction. Similar research showed that *S. dorsalis* was

distributed homogeneously in roses planted in the green house which was absent at low wind speed (Derksen, 2009). Irwin and Yeargan (1980) added that thrips dispersal or flight depends on wind currents which affect the control of their landing abilities.

The result suggested that the availability of wind direction in high speed strongly influences the movement of *S. dorsalis* to find suitable areas for best reproduction and refuge in mango trees. This information should be considered as basic information in the formulation of effective management strategies.

CONCLUSION

The North-East cardinal direction was the most preferred by *S. dorsalis*. *S. dorsalis* started to move into mango canopy during the early shoot emergence. It began to lean in certain direction on the second day of observation and peak numbers presented at day eight totalled 21.00 adults trapped per tree. *S. dorsalis* did not prefer certain directions during the flower growth stage, with peak numbers at day three totaling 9.40 adults/per tree.

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