AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

CARIBBEAN FOOD CROPS SOCIETY

41

Forty First
Annual Meeting 2005

GUADELOUPE

Vol. XXXXI - Number 1

T-STAR - Invasive Species Symposium

Proceedings of the Caribbean Food Crops Society. 41(1):182-188. 2005

POSTER

DISTRIBUTION OF THE CHILLI THRIPS, *SCIRTOTHRIPS DORSALIS* HOOD (THYSANOPTERA: THRIPIDAE), IN PEPPER FIELDS ON ST. VINCENT.

***D. R. Seal*[1]**, *M. Ciomperlik*[2], *M. L. Richards*[3] *and W. Klassen*[1]

[1]*University of Florida-IFAS, Tropical Research and Education Center, Homestead, FL 33033; Phone: 305-246-7001 Ext. 260; E-mail: dseal@ifas.ufl.edu .* [2]*USDA APHIS PPQ CPHST, Pest Detection Diagnostics and Management Laboratory, 22675 N. Moorefield Rd., Bldg. 6414, Edinburg, TX 78541-9398;* [3]*Ministry of Agriculture and Fisheries, St. Vincent, Richmond Hill, Kingstown, St. Vincent and the Grenadines.*

ABSTRACT: Chili thrips, *Scirtothrips dorsalis* Hood, is a newly introduced pest in the western hemisphere. It has the potential to cause significant damage to various vegetable, ornamental and fruit crops. Baseline information about its biology and management is very insufficient. Due to the paucity of knowledge about this pest we initiated a study on its biology and management. We conducted several studies to understand distribution pattern of *S. dorsalis* within the plant and within fields of `Scotch Bonnet' pepper in St. Vincent in 2004 and 2005. *S. dorsalis* adults and larvae were most abundant on terminal leaves of a `Scotch Bonnet' pepper plant followed by middle leaves, lower leaves, and reproductive parts. The distribution of both adults and larvae of *S. dorsalis* on the terminal leaves was aggregated irrespective of plot size (6, 12, 24 and 48 m^2). Detailed information on distribution has been reported in a manuscript submitted to Florida Entomologist.

KEYWORDS: spatial distribution, within plant distribution, pepper, alien invasive species, Caribbean

RÉSUMÉ: Les thrips de piment, *Scirtothrips dorsalis* Hood, est un parasite nouvellement présenté dans l'hémisphère occidental. Il a la potentialité pour endommager significatif de diverses récoltes de légume, ornementales et de fruit. Les informations de ligne de base sur sa biologie et gestion sont très insuffisantes. En raison du manque de la connaissance appropriée que nous avons essayé d'étudier sa biologie et gestion. Dans la présente étude, nous avons entrepris plusieurs études pour comprendre le modèle de distribution des dorsalis dans-usine et dans-champ de S. poivre de ` de capot écossais 'dans la rue Vincent en 2004 et 2005. Les adultes et les larves de dorsalis de S. étaient abondants sur les feuilles terminales usine de poivre de ` de capot écossais 'suivie des feuilles moyennes, des feuilles inférieures, et des pièces reproductrices. Les distributions des adultes et des larves de dorsalis de S. sur les feuilles terminales ont été agrégées indépendamment de la taille de parcelle de terrain (6, 12, 24 et 48 m2). L'information détaillée sur la distribution a été rapportée dans un manuscrit soumis au journal Florida Entomologist.

MOTS-CLÉS: istribution spatiale, dans la distribution d'usine, poivre, espèce invahissante étrangère, des Caraïbes

INTRODUCTION.

The chili thrips, *Scirtothrips dorsalis* Hood, is considered as a pest of various vegetable crops, cotton, citrus and other fruit and ornamental crops in eastern Asia, Africa, and Oceania (Ananthakrishnan 1993, CABI/EPPO 1997, CAB 2003). In India, *S. dorsalis* is a severe pest of chilli pepper and hence it is known as the chilli thrips (Thirumurthi et al. 1972). In Japan, *S. dorsalis* is known as the yellow tea thrips (Toda and Komazaki 2002). The Florida Nurserymen and Growers Association consider *S. dorsalis* as one of the thirteen most dangerous exotic pest threats to the industry (FNGA 2003). Venette and Davis (2004) indicate that the potential geographic distribution of *S. dorsalis* in North America would extend from southern Florida to north of the Canadian boundary, as well as to Puerto Rico and the entire Caribbean region. *S. dorsalis* is a key vector of tomato spotted wilt virus (TSWV). It causes bud necrosis disease (BND), an important disease of peanut in India (Amin et al. 1981, Mound and Palmer 1981, Ananthadrishnan 1993).

Since 1984, USDA-APHIS inspectors at various U.S. ports-of-entry have reported *S. dorsalis* 89 times on imported plant materials belonging to 48 taxa (USDA 2003). Most commonly the pest was associated with cut flowers, fruits and vegetables. On July 16, 2003, T. L. Skarlinsky, a Plant Protection and Quarantine officer intercepted *S. dorsalis* at Miami, Florida on C*apsicum* spp. from St Vincent and the Grenadines, West Indies. This was the first interception at a U.S. port of this thrips on a shipment from a port of origin in the Western Hemisphere. Skarlinsky (2003 made a preliminary assessment of the distribution and abundance of the *S. dorsalis* population on St. Vincent the island, and he found *S. dorsalis* on pepper several sites in St. Vincent.

St.Vincent is a volcanic island located at latitude 13^0 15' N and longitude 61^0 12' W within the Windward Islands chain in the eastern Caribbean. Temperatures fluctuate between 18° and 32°C, the dry season extends from December through June, and the rainy season from July through November. The island's average annual rainfall ranges from about 1,500 mm on the southeast coast to about 3,800 mm in the interior mountains. Vegetable and fruit crops are produced year round for domestic consumption and export.

There are no published reports on within-plant and spatial distribution patterns of *S. dorsalis*. Such information is essential in the development of tactics and strategies for managing this pest.

Beginning in October 2004 we undertook studies on the spatial distribution patterns of *S. dorsalis* adults and larvae on St. Vincent, as part of a larger effort on the pest's host diversity, geographical distribution, natural enemies and methods of detection, monitoring and control. Here we report on the thrips' within plant distribution on pepper and on its spatial distribution within pepper fields.

MATERIALS AND METHODS

Within plant and within field distribution of *S. dorsalis* was conducted in `Scotch Bonnet' pepper fields in William's Farms in October, 2004; and in March, 2005. All fields were located in George Town, St. Vincent, and were about 3,035 $m^2$ each. Each field was planted to `Scotch Bonnet' pepper into a deep soil. The plants were spaced 90 cm within a row and 1.2 m between rows. Plants were maintained by using standard cultural practices recommended for St. Vincent. The pepper plants were not treated with any insecticides, but they received the recommended fungicide and fertilizer applications. Plants were treated with Manzate and Bravo at 7-10 d intervals. Plants were drip-irrigated weekly. In both years, the studies were initiated 2 - 3 mo after planting the crop.

For the purpose of studying distribution patterns of *S. dorsalis*, each field was divided into 60 equal plots, each 4.6 m long and 1.2 m wide and contained 5 plants.

Within plant distribution. Five plants were randomly selected from each of five plots from different locations of each field. From each plant, a set of 3 - 4 leaves was collected from the top, middle and bottom strata. Thus, 15 - 20 leaves were collected from each pepper plant stratum in each plot. In addition, five flowers and five fruits were also collected from each plot. All samples were placed in zip-lock bags and labeled to indicate the plot and plant part. Samples were transported to the laboratory for further processing. Adults and larvae of *S. dorsalis* in each sample were separated by following the methods as described by Seal et al. (2005a, b).

Within field distribution. The within field distribution of *S. dorsalis* was studied in plots of four different sizes- 6, 12, 24, and 48 m^2. Spatial distribution of *S. dorsalis* in 'Scotch Bonnet' pepper fields was studied in two years by collecting terminal leaves contained in a group of 3-4 leaves at the tip of a branch. From each of five randomly selected plants, one such group of terminal leaves was excised and placed in a zip lock bag to prevent escape of *S. dorsalis*. All samples were transported to the laboratory for further processing as discussed in the previous study.

The Spatial distribution patterns of *S. dorsalis* were determined by using Taylor's power law (Taylor 1961) and Iwao's patchiness regression (Iwao 1968). Taylor's power law parameters were obtained by the regression of log10-transformed variances, s^2, on log10-transformed mean numbers of *S. dorsalis* adults and larvae per sample by means of the linear regression model: $\log s^2 = \log a + b \log x$ (Taylor 1961). Similarly, Iwao's patchiness regression ($x^* = □ + □x$) is the regression of mean crowding, x^*, on the mean x (Lloyd 1957, Iwao 1968), □ is a sampling factor depending on the size of the sampling unit and □ is the index of aggregation in the population. In both instances, a population with an aggregated distribution has a b value > 1, while this value is significantly less than 1 for a regular distribution, and not significantly different from 1 for a random distribution. The fit of each data set to the linear regression model was evaluated by calculating the r^2 value.

Statistical Analysis. Data on the within plant distribution were subjected to square root (x + 0.25) transformation to stabilize error variance (Steet & Torrie 1980). Transformed data were analyzed using software provided by Statistical Analysis System (release 6.03, SAS Institute Inc. Cary, NC; SAS Institute, 1989). General linear model procedures were used to perform analysis of variance. Means were separated by using Duncan Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

Within plant distribution of *S. dorsalis*. We found *S. dorsalis* on all above-ground plant parts (Table 1). Mean numbers of *S. dorsalis* adults and larvae were most abundant on the terminal leaves, 2^{nd} most abundant on middle leaves and least abundant on bottom leaves, flowers and fruits (adult: $F = 7.77$; $df = 4,15$; $P < 0.05$; larva: $F = 13.93$; $df = 4,15$; $P < 0.05$; total: $F = 16.88$; $df = 4,15$; $P < 0.05$). The mean numbers of *S. dorsalis* adults and larvae did not differ among those found on the bottom leaves, flowers and fruits. The least number of adults were found on fruits, and the least number of larvae were found in flowers, but these numbers were not significantly smaller than those for any other plant parts.

Within-Field Distribution of S. dorsalis in 2004.

The values of r^2 obtained with both Taylor's power law and Iwao's patchiness distribution were higher for plot sizes of 24 and 48 m^2 than for 6 and 12 m^2 plots. This indicates a good fit of both models to the data on adults using terminal leaf as sampling unit in 24 and 48

m^2 plots. The slope in either model was significantly higher than 1.00 ($P > 0.05$) indicating that the distribution of larval populations in all plots, irrespective of size, was aggregated.

Within-Field Distribution of *S. dorsalis* in 2005.

The results from both Taylor's power law and Iwao's patchiness were in agreement that the distribution of adults in the 6 m^2 plots was random and that it was regular in the 12, 24 and 48 m^2 plots (Table 3). The values of r^2 from Taylor's power law ranged from 0.22 – 0.99 indicating moderate to good fit to the data collected from the various plots, while those from Iwao's patchiness regression were low for 6 and 12 m^2 plots (indicating poor fit to the data), and 0.99 for the 24 and 48 m^2 plots (indicating a very good fit to the data in larger plots (0.99). The distribution pattern of *S. dorsalis* adults in various plot sizes at Russ farms was fairly similar in two seasons in 2004 and 2005.

Southwood (1978) observed that when a population in an area becomes sparse, the chances of an individual occurring in any sample unit are so low that the distribution is effectively random. In the present study the population abundance of *S. dorsalis* was low with frequent occurrence in various samples indicating aggregated pattern of distribution. Southwood (1978) also reported that the dispersion of the initial insect invaders of a crop is often random. In the instance of *S. dorsalis*, adult populations were localized at a certain part of the crop field. In one field under the present study, infestation starts at the edge of a field covering 6 m wide strip and proceeds south to north along that 6 m wide band with the progression of time. Seal et al. (1992) reported that the wireworms, *Conoderus rudis* Brown, *C. scissus* Schaffer and *C. amplicollis* Gyllenhall oviposited in a regular pattern in a field with a previous history of infestation; but the distribution changed because of the movement of the medium and large larvae. In the present study, the distribution of *S. dorsalis* was variable in various plot sizes which might be due to the movement of the adults from one plot to other. *S. dorsalis* pupates in soil, and the prepupae may have moved short distances away from the plant before entering the soil to pupate. Thus only the movement of adults might have shifted the distribution pattern in certain plots.

From our results, we draw the following conclusions: (1) *S. dorsalis* population tends to be most abundant on terminal leave; 2) flowers and fruits have the least numbers of *S. dorsalis*; 3) *S. dorsalis* adults were aggregated in the largest plots.

ACKNOWLEDGMENTS

We are very grateful to the Plant Quarantine Division, Ministry of Agriculture, Industry and Labour, Kingstown, Saint Vincent and the Grenadines for the use of laboratory facilities, local transportation and arrangements with growers. This study could not have been accomplished without the facilitation and encouragement of Mr. Philmore Isaacs, Chief Agricultural Officer. Also we are grateful to Mr. Emil Williams and Mr. Lauron Baptist for allowing us to conduct the studies on their farms. Financial resources and guidance were provided by the Animal and Plant Health Inspection Service, USDA through the leadership of Dr. Daniel A. Fieselmann, National Science Program Leader and Ms. Carolyn T. Cohen, Caribbean Area Director. In addition financial support was provided by the Florida Agricultural Experiment Station and the University of Florida's Center for Tropical Agriculture.

REFERENCES CITED

Amin, P. W., and J. M. Palmer. 1985. Identification of groundnut Thysanoptera. Tropical Pest Management 31: 286-291, 340, 344.

Ananthakrishnan, T. N. 1993. Bionomics of thrips. Annual Review of Entomology 38:71-92.

CABI. 2003. Crop protection compendium: global module. CAB International, Wallingford, UK.

CABI/EPPO. 1997. Quarantine Pests for Europe, 2nd Ed. CAB International, Wallingford, UK.

FNGA. (Florida Nurserymen &Growers Association) 2003. Report of the Florida Nursery, Growers & Landscape Association (FNGLA). Orlando, Florida, USA

Iwao, S. 1968. A new regression model for analyzing the aggregation pattern of animal populations. Res. Popul. Ecol. (Kyoto) 4: 35-46.

Mound, L. A., and J. M. Palmer. 1981. Identification, distribution and host plants of the pest species of *Scirtothrips* (Thysanoptera: Thripidae). Bull. of Entomol. Res. 71: 467-479.

SAS Institute. 1989. SAS User's guide: statistics; SAS Institute. Cary, NC.1988.

Seal, D. R., M. Ciomperlik, M. L. Richard and W. Klassen. 2005a. Comparative effectiveness of chemical insecticides against the chilli thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae), on pepper and their compatibility with natural enemies. Crop Protection (submitted).

Seal, D. R., M. Ciomperlik, M. L. Richard and W. Klassen. 2005b. Distribution of the Chilli Thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae), within pepper plants and within pepper fields on St. Vincent. Florida Entomologist (submitted).

Seal, D. R. R. McSorley, and R. B. Chalfant. 1992. Seasonal abundance and spatial distribution of wireworms (Coleoptera Elateridae) in Georgia sweet potato fields. J. Econ. Entomol. 85: 1802-1808.

Steel, R. G. D. and J. H. Torrie. 1980. Principles and procedures of statistics: a biometrical approach, 2nd ed. McGraw Hill, New York. 633 p.

Southwood, T. R. E. 1978. Ecological methods with particular reference to the study of insect populations, 2nd ed. Wiley, New York.

Taylor, L.R. 1961. Aggregation, variance and the mean. Nature (London) 189: 732-735. 1984. Assessing and interpreting the spatial distributions of insect populations. Annu. Rev. Entomol. 29:321-357.

Thirumurthi, S., K. A. Ali, and T. R. Subramanian. 1972. A note on the varietal incidence of grapevine (*Vitis vinifera*) berry thrips *(Scirtothrips dorsalis* Hood). South Indian Horticulture 20: 92-93.

Toda, S., and S. Komazake. 2002. Identification of thrips species (Thysanoptera: Thripidae) on Japanese fruit trees by polymerase chain reaction and restriction fragment length polymorphism of the ribosomal ITS2 region. Bulletin of Entomological Research 92: 359-363.

USDA.2003**.** Port Information Network (PIN-309): quarantine status database. US Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine, Riverdale, MD, USA. (Restricted access database.)

Venette, R.C., Davis, E.E. 2004. Chilli thrips/yellow thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) Mini Pest Risk Assessment. Univ. of Minnesota, St. Paul, MN, USA. 31 pp.

Table 1. Within plant distribution of *S. dorsalis* adults and larvae on `Scotch Bonnet' pepper plants in three fields in St. Vincent based on samples taken during October 2004 (Field 1), March 2005 (Fields 2 and 3).

	Location on Pepper plant	*S. dorsalis* Adult	Larvae	Total
Field 1	Terminal leaf	4.50a	5.50a	10.00a
	Middle leaf	1.75b	2.00b	3.75b
	Bottom leaf	0.50b	0.75c	1.25c
	Flower	0.75b	0.25c	1.00c
	Fruit	0.25b	1.00bc	1.25c

Means within a column of each field with similar letter do not differ significantly ($P > 0.05$, DMRT).

Table 2. Distribution of *S. dorsalis* adults on terminal leaves in a scotch bonnet pepper fields on St. Vincent during October 2004.

	Taylor's power law			Iwao's patchiness regression		
Plot size (m^2)	r^2	*a*	*b*	r^2	*a*	*b*
6	0.28	0.09	0.63REG	0.17	0.70	0.56REG
12	0.37	0.08	0.38REG	0.34	0.83	0.39REG
24	0.99	0.09	0.04REG	0.99	1.28	-0.03REG
48	0.99	0.01	1.29AGG	0.99	-0.28	1.29AGG

AGG, aggregated distribution, *b* significantly > 1; REG, regular distribution, *b* significantly < 1; RAN, random distribution, *b* not significantly different from 1. These distributions are significant at $P \leq 0.05$ based on Student's *t*-test. Numbers of plots (*n*) are 2, 4, 8, and 16 for the 6, 12, 24 and 48 m^2 sized fields, respectively

Table 3. Distribution of *S. dorsalis* adults on terminal leaves in a scotch bonnet pepper field on Russ Farms, St. Vincent during March, 2005.

	Taylor's power law			Iwao's patchiness regression		
Plot size (m^2)	r^2	*a*	*b*	r^2	*a*	*b*
6	0.38	-0.05	1.02RAN	0.07	-0.13	1.04RAN
12	0.22	-0.17	0.79REG	0.01	0.44	0.43REG
24	0. 99	0.36	0.40REG	0.99	0.32	-0.48REG
48	0.99	0.36	0.40REG	0.99	0.32	-0.48REG

AGG, aggregated distribution, *b* significantly > 1; REG, regular distribution, *b* significantly < 1; RAN, random distribution, *b* not significantly different from 1. These distributions are significant at $P \leq 0.05$ based on Student's t-test. Numbers of plots (*n*) are 2, 4, 8, and 16 for the 6, 12, 24 and 48 m^2 sized fields, respectively.

Table 4. Distribution of *S. dorsalis* adults on terminal leaves in a scotch bonnet pepper field on Baptist Farms, St. Vincent during March 2005.

	Taylor's power law			Iwao's patchiness regression		
Plot size (m^2)	r^2	*a*	*b*	r^2	*a*	*b*
6	0.61	-0.25	0.12REG	0.64	-0.95	1.72AGG
12	0.69	-0.32	2.63AGG	0.58	-1.18	1.89AGG
24	0. 95	0.48	3.30AGG	0.99	-2.83	2.79AGG
48	0.99	0.59	3.93AGG	0.99	-3.47	3.20AGG

AGG, aggregated distribution, *b* significantly > 1; REG, regular distribution, *b* significantly < 1; RAN, random distribution, *b* not significantly different from 1. These distributions are significant at $P \leq 0.05$ based on Student's *t*-test. Numbers of plots (*n*) are 2, 4, 8, and 16 for the 6, 12, 24 and 48 m^2 sized fields, respectively