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Full Length Research Paper

# ***Typhlodromalus spinosus* as a potentially new biological control agent for Western Flower Thrips**

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Integrated pest management is increasingly being adopted in the horticultural sector in Kenya. As part of IPM there is need to have a range of predators for the control of pests like Western Flower Thrips (*Frankliniella occidentalis*) (Pergande) (Thysanoptera: Thripidae). Due to the concern about import and release of exotic natural enemies and the increased evaluation and registration demands, there is a trend nowadays to first look for indigenous natural enemies and Kenya is no different. *Typhlodromalus spinosus* (Meyer and Rodrigues) was collected from the wild in Kenya and screened as a potential biological control against *Tetranychus urticae* (Koch) and Western Flower Thrips (*F. occidentalis*). Laboratory feeding trials showed that *T. spinosus* neither fed, multiplied nor reduced the numbers of *T. urticae*. However under laboratory trials and in field grown French beans, *T. spinosus* showed evidence of both feeding, multiplication and reduction of WFT numbers. This is the first report of *T. spinosus* as a potential biological control agent for WFT.

**Keywords:** Western flower thrips, biological control, *Typhlodromalus spinosus*

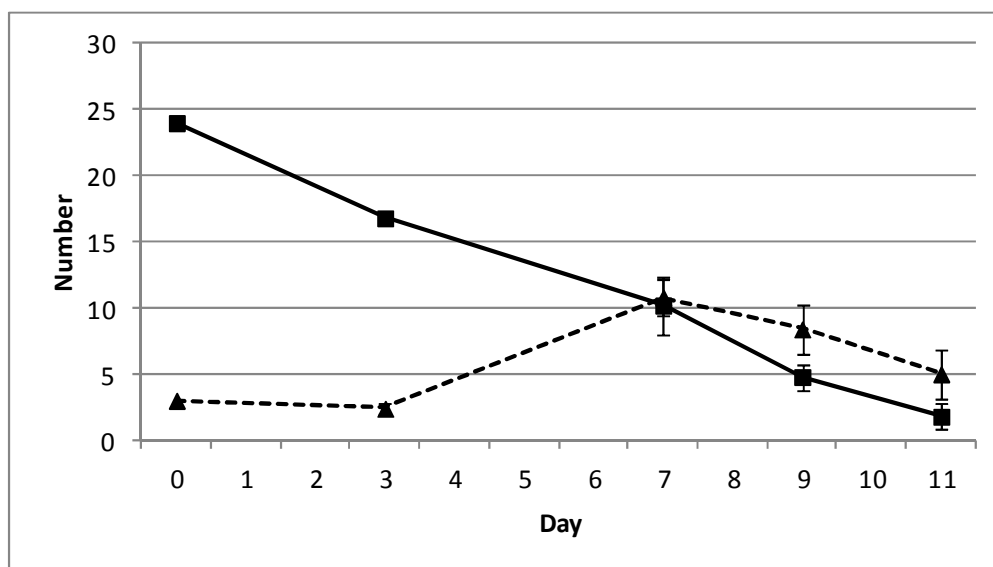
## **INTRODUCTION**

Integrated pest management is increasingly being adopted in the horticultural sector in Kenya. There are numerous reasons including pest resistance to an increasing number of pesticides, the customers concerns about pesticide residues and the increased availability of biological control agents (Wainwright and Labuschagne, 2009). Predators such as Phytoseidii in Kenya need to be approved and registered for use by the Pest Control Products Board of Kenya and they are evaluated for safety and efficiency. Currently there are 5 predatory mite species approved for use in Kenya (PCPB 2014). Two spotted mite (*Tetranychus urticae*) has been successfully control by the use of predators (*Phytoseiulus persimilis* (Athios-Henriot)

and *Neoseiulus californicus* (McGregor), biopesticides such as *Metarhizium anisopliae* icipe 78 (Wekesa et al, 2005) (now a commercial biopesticide in Kenya called Achieve) and selective use of compatible pesticides. However there remains a challenge to control Western Flower Thrips (*Frankliniella occidentalis*) (Pergande) (Thysanoptera: Thripidae) in Kenya as well as many parts of the world.

WFT as with other species of thrips remains a significant challenge to control. A large range of predators including *Neoseiulus cucumeris* (Oudemans), *Typhlodromalus limonicus* (Garman & McGregor), *Typhlodromips swirskii* (Athias-Henriot) have been evaluated but these have been mainly under temperate greenhouse conditions (Messelink et al, 2006). Despite a significant predator range their commercial adoption has been relatively low and only in selected crops (van Lenteren, 2012). Due to the concern

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**Figure 1.** The change in the numbers of adult and larvae WFT (square) compared to the number of adult and juvenile *T. spinosus* on French bean leaf discs in petri dishes. Bars represent the standard error of the mean.

about import and release of exotic natural enemies and the increased evaluation and registration demands, there is a trend nowadays to first look for indigenous natural enemies when a new exotic pest establishes itself. Of the natural enemy species commercially allowed for use in Africa, more than 90% results from material collected in and—initially mass reared on—other continents (van Lenteren, 2012).

An indigenous Phytoseidii species, *Typhlodromalus spinosus* (Meyer and Rodrigues) was collected from the wild having previously been identified in Kenya (El Banhawy and Knapp, 2009) and in Mozambique (Meyer and Rodrigues, 1966). Initially the *T. spinosus* was evaluated for the potential for rapid multiplication which was confirmed. This paper reports on the evaluation of *T. spinosus* as potential predator for two common pests of horticultural crops, two spotted mite and WFT.

## MATERIALS AND METHODS

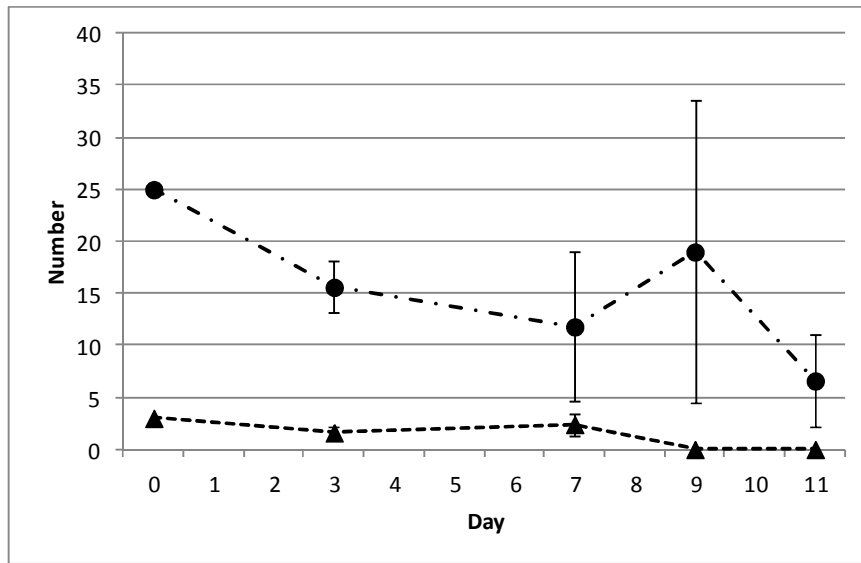
*Typhlodromalus spinosus* (Meyer and Rodrigues) was collected from a tree of *Croton megalocarpus* Hutch. in the Thika region of Central Kenya at about 1,500 m altitude. Identification was confirmed in the laboratories of Dr Francisco Ferragut, Instituto Agroforestal Mediterraneo, Spain (private communication). The *T. spinosus* was reared using the prey mite *Thyreophagus entomophagus*. Two experiments were undertaken, the first was the laboratory screening of *T. spinosus* for the control *F. occidentalis* (WFT) and then *Tetranychus urticae* (Koch) on leaf discs in petri dishes. The second involved the use of *T. spinosus* under field conditions for WFT control. For

both experiments *T. spinosus* was used having previously been reared on *T. entomophagus*.

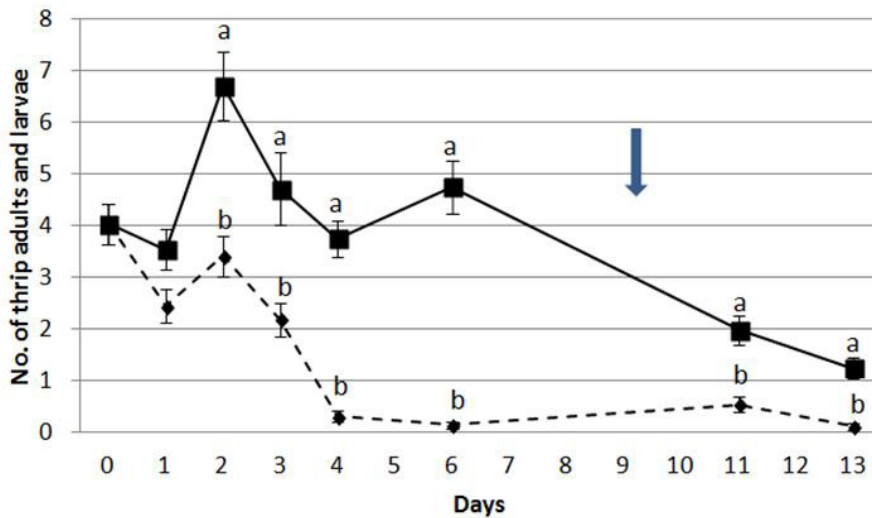
**Laboratory based experiment:** Leaf disc of 3 cm in diameter of bean leaf (*Phaseolus vulgaris*) were placed on agar with the underside facing upwards in petri dishes. The leaves were then infested with 25 WFT larvae (all stages) and three *T. spinosus*, one male and two female in a similar method described by van Lenteren et al (2003). The number of thrips, larvae and adults were assessed after 3, 7, 9 and 11 days. A similar procedure was used but the leaves were infested with motile stages of *T. urticae*. All motile stages of *T. urticae* were assessed as well as those of *T. spinosus*. Each treatment consisted of ten replicates and the experiment was repeated a second time to confirm the results.

**Field experiment:** A field of French beans (*Phaseolus vulgaris*) eight weeks old which had natural levels of WFT infection was used. The level of thrips larvae and adults were initially assessed per tri-leaflet. The application of 25 *T. spinosus* were applied per plant for the treated area whilst no *T. spinosus* or any other control was applied to the untreated area. At every assessment 10 tri-leaflets were sampled for WFT (Larvae and adults) and *T. spinosus* motiles randomly and these were replicated on three trial areas.

**Statistical Analyses:** Standard error of the means were calculated using excel spread sheet software. In the field trial, data obtained was subjected to analysis of variance (ANOVA) and significant differences determined between the means by Fishers protected LSD at  $p < 0.05$  using GenStat Discovery Edit 4 software.



**Figure 2.** The change in the numbers of adult and juvenile *T. urticae* (circle) compared to the number of adult and juvenile *T. spinosus* (diamond) on French bean leaf discs in petri dishes. Bars represent the standard error of the mean.



**Figure 3.** The effect of the application of *T. spinosus* at day 0 (diamond) in comparison to untreated (square) on the combined number of WFT adults and larvae on field grown French bean plants. Rain occurred on day 9 (arrow). Bars represent the standard error of the mean. Data points on the same day were significantly different ( $P < 0.05$ ) if labelled by a different letter

**RESULTS**

Under laboratory conditions *T. spinosus* reduced the level of WFT rapidly from 25 WFT to less than 3 by day 11. The *T. spinosus* were seen to multiply with eggs present and an average of over 10 motiles after seven days though the population of *T. spinosus* then declined with the reduction in WFT (Figure 1). In contrast when placed on leaf discs with *T. urticae*, the *T. spinosus* had died out by day 7 with

no evidence of feeding or multiplication (Figure 2). The multiplication of *T. urticae* was erratic and had considerable variation between leaves.

In the field trials those beans treated with *T. spinosus* showed a decline in WFT so that by day four there were less than 0.5 WFT per tri-leaflet and this was significantly lower than those in the untreated control (Figure 3). Rain fell (21 mm) in day 9 of the field trial which brought the level of WFT down in the untreated control after this rain.

## DISCUSSION

*T. spinosus* has not been previously reported as a predatory mite, however we have found clear evidence that *T. spinosus* predate on WFT under laboratory and field conditions but not on *T. urticae*. There are a wide range of Phytoseidii that predate on thrips including ten species screened by Messelink et al (2006). Two species of *Typhlodromalus* have also been reported as thrips predators *T. aripo* (Cuellar et al, 2002) and *T. limonicus* (Messelink et al, 2006). The potential advantage of *T. spinosus* is that the species is indigenous to East and Southern Africa and that it may be more adapted to local conditions and will certainly be favoured by the regulators. However there is increasing complexity of issues relating to the selection of predators for commercialisation including ease of mass production, adaptability to the host plant, survival rates when the pest is not present or in very low numbers and the ability to control a range of thrip species. *T. spinosus* needs further assessment before commercialisation; however data reported here confirms that *T. spinosus* has the ability to control WFT under laboratory and in the field on a French bean crop when the pest is presence.

## REFERENCES

- Cuellar ME, Belotti AC, Melo EL (2002). Aspects of the biology and rate of consumption of *Neoseiulus cucumeris* and *Typhlodromalus aripo* (Acari: Phytoseiidae) on the host *Thrips palmi* Karny (Thysanoptera: Thripidae). *Rev. Colomb. Entomol.* 28: 1-7.
- El Banhawy EM, Knapp M (2009). Distribution of the predacious phytoseiid mites (Acari: Phytoseiidae) in the different geographical zones of Kenya: species diversity and abundance of mites. *Systematic and Applied Acarology.* 14: 182–190.
- Messelink GJ, van Steenpaal SEF, Ramakers PMJ (2006). Evaluation of phytoseiid predators for control of western flower thrips on greenhouse cucumber. *Bio Control* , 51: 753-768
- Meyer MKP, Rodrigues MC (1966). Acari associated with cotton in South Africa (With reference to other plants). *Garcia de Orta*, 13: 1-33.
- PCPB (2014). Pest control products registered for use in Kenya. 8th edition. Pest Control Products Board, Nairobi. Kenya.
- van Lenteren JC, Hale A, Klapwijk JN, van Schelt J, Steinberg S (2003). Guidelines for quality control of commercially produced natural enemies. pp 265-303. *In* J. C. van Lenteren (ed.) *Quality control and production of biological control agents—Theory and testing procedures.* CABI Publishing, Wallingford.
- Wainwright H, Labuschagne L (2009). Crop protection and the Kenyan flower industry. *Outlooks Pest Manage.*, 20, 153-157.
- Wekesa VW, Maniania NM, Knapp M, Boga HI (2005). Pathogenicity of *Beauveria bassiana* and *Metarhizium anisopliae* to the tobacco spider mite *Tetranychus evansi*. *Exp. Appl. Acarol.* 36: 41–50