A Novel Rearing Technique for the Chilli Thrips *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae)

Latha, K.R[#], Krishna Kumar, N. K*, Mahadeva Swamy^, H. M, Ranganath, H. R[#], Asokan, R^, Riaz Mahmood[†]

[#] *Division of Entomology & Nematology, Indian Institute of Horticultural Research, Bangalore, Karnataka, INDIA*
[*] *Division of Horticulture, Indian Council of Agricultural Research (ICAR), New Delhi, INDIA*
[^] *Division of Biotechnology, Indian Institute of Horticultural Research (IIHR), Bangalore, Karnataka, INDIA*
[†] *Post-Graduate Department of Studies and Research in Biotechnology and Bioinformatics, Kuvempu University, Shimoga, Karnataka, INDIA*

Abstract: **Successful multiplication of *Scirtothrips dorsalis* in the laboratory has never been established so far. *S. dorsalis* has been noted as major pest in field as well as under protected cultivation, recently this pest developed resistance to well know chemical insecticides. In order to develop a suitable management practices it is very much necessary to have pure culture of same life stages. Keeping its economic importance both as a direct pest and possible vector of viral diseases in crops a simple rearing technique was developed for chilli thrips. Adults can be reared on a tender capsicum (10-12 days old) in a screw cap plastic container (10 cm diameter ×8 cm long) with the lid cut open and stuck with tissue paper for aeration. This procedure was found useful up to 400 larvae with relatively low mortality rates. Evaluation of this technique showed that a small scale culture initiated with 100 adults released in each container with 4 replications at an average temperature ranged from 25-26.71°C, relative humidity ranged from 38.19-69.06% and L16:D8 during 7 to 12 days yielded mean larval populations of 915 (SEM 54.83) and produced adults with mean populations 472 (SEM 49.14). Approximately 5 min per day is required to achieve this productivity. These procedures enable standardization of the cultural methods and synchronization of the life stages of thrips species for further work.**

Keywords: rearing; capsicum; S. dorsalis; aspirator; vector of viral diseases.

I. INTRODUCTION

Out of as many as 5500 species of thrips described so far in literature, a mere 1% species is considered serious pests [6]. Thrips are polyphagous insects that inhabit tropical, subtropical and temperate regions of the world [1]. It can reduce crop yield or value indirectly by vectoring plant diseases and also by feeding directly on the crop. They negatively affect global trade due to the quarantine risks [6]. The genus *Scirtothrips* comprises more than 100 species and *S. dorsalis* is one of the most studied pests due to its economic importance and global distribution. Both larval and adult stages of thrips serve as vectors of tospovirus, which can actively feed on infected host plants. However, only early larval instars can acquire the virus and later instar larvae and adults can transmit the virus after a latent period [17], [15], [16], [11]. To take up vector potential studies it is very much necessary to maintain a pure culture of the same life stages and to develop a suitable management practices in future. In light of background information present work was initiated to develop a simple rearing technique for the Chilli thrips *S. dorsalis* with a suitable host at a minimal cost.

II. MATERIALS AND METHODS

Small tender capsicum fruits (10-12 days old) were selected as an oviposition and rearing source. These were treated with contact fungicide (copper hydroxide 77% WP) for 5 minutes to avoid fungal contamination and later washed in running water to get rid off the treated fungicide prior to use. Screw cap plastic container measuring 10cm diameter ×8cm long, with the lid cut open in the centre and stuck with tissue paper for aeration were used for rearing. Thrips were collected from infested rose plants in the floriculture field at the Indian Institute of Horticultural Research farm. Thrips were made to dislodge from the infested tender leaves and flower buds of rose plants by gentle tapping. A white paper sheet was held below to collect dislodged thrips. Fallen thrips were immediately collected by an aspirator and subsequently used for rearing work in the laboratory. Thrips thus collected were confined to a refrigerator for a minute to slow down the movement, to aid in identification and segregation of species. *S. dorsalis* were identified using morphological keys described by Chandra et al 2010. A tender capsicum fruit was placed in a container for oviposition with the help of a fine synthetic brush (No.2). Confined adults were allowed for 24 hrs to oviposit. After 24 hrs adults from the oviposited capsicum host were scooped out gently using a camel hair brush (No.12) on to a separate container with fresh capsicum for oviposition to get a series of larvae of same age (Fig. 1.).

Oviposited capsicum was shifted to a fresh container and maintained at ambient laboratory temperature 28˚C $\pm$ 5˚C) and RH ranging from 40-60%, about 4 replications were maintained. After completion of second instar several waded pieces of tissue paper were provided to facilitate pupation. Culture containers were replenished once in 4-5 days with fresh capsicum in all experimental containers.

Larvae on the old and drying up capsicum move on to the fresh ones. Once all the larvae were moved, the dried capsicum should be removed. Observations were recorded at 24 hours intervals.

In the rearing room apart from the natural light additional lighting was provided from the incandescent light set 50 cm above the culture containers. The humidity was upheld accordingly by placing the wet sand in a tray. One way ANOVA test was performed to test for significant differences among *S. dorsalis* population throughout the year.

III. RESULTS AND DISCUSSION

The objective of the present investigation was to develop a novel rearing technique for the chilli thrips using tender capsicum as source. The rearing of this insect in *in vitro* condition is one of the basic keystones in the understanding of its behaviour, potential, and its weaknesses. Due to its small size, and the presence of various "types" of *S. dorsalis*, it is quite difficult to make a secure yet cost and time effective way to conduct research with this insect pest, but focusing on what can be used to rear and conduct treatments with *S. dorsalis*. Knowledge about morphology and developmental processes as well as the resulting behaviour and adaptations help to clarify, why some species are highly adapted to their host plant and while others show a broad host plant spectrum, why only a few thrips species act as tospovirus-transmitters, and which are the basics of the development of different social life styles within the order Thysanoptera. Development of effective management practices for *S. dorsalis* is still in its infancy; in this direction the present investigation was useful to develop a rearing technique for *S. dorsalis* using a suitable host at a minimal cost.

In the present study, method for rearing of *S. dorsalis* for the first time is described and evaluated in *in vitro* conditions. The larval emergences varied between months with the maximum population observed in February 2013 (1156 larvae/400 adults) followed by November (1099), May (1067), April (1048) and January (1031). Least larval emergence (618) was observed in June 2013 (Fig.1). Developmental time from hatching to adult emergence was about 8-10 days and, except for the 400 larval density treatment, mortalities were below 50%. Further there was no significant relationship between rearing density and mortality rate. Handling time for carrying out the rearing processes, such as larvae collection, and providing foods take less than 5 minutes per cage per day.

So far, very few thrips species have been reared on a purely synthetic diet [5]. Reference [12]were the first to use a thin membrane ('fish skin') for rearing second instar larvae and adults of *Thrips tabaci.* Reference [4] showed that individuals of some thrips species belonging to the Terebrantia (Thysanoptera) could lay eggs in water through an artificial film. Because it is difficult to collect eggs of terebrantian species from their host plants, Reference [7] developed a method for artificial egg procurement and development using plant pollen and a honey solution dispensed between two layers of stretched laboratory film. With this method, Reference [7] and [10] cultured several thrips species, throughout their whole life cycle on just this food. Later, other researchers modified this method when rearing the New Zealand flower thrips, *Thrips obscuratus* (Crawford) [13], the western flower thrips, *F. occidentalis* [14] and its parasitoid *Ceranisus menes* (Walker) [8] [2] . Reference [9] developed an improved method for mass-rearing of thrips and a thrips parasitoid such as *Frankliniella occidentalis*, *Frankliniella intonsa*, *Thrips palmi*, *Thrips tabaci* (Thysanoptera: Thripidae) and a thrips parasitoid, *Ceranisus menes* (Hymenoptera: Eulophidae), using various foods. Reference [3] reported the method for rearing western flower thrips *Frankliniella occidentalis*.

All the described methods often require a constant supply of fresh plant material. Risks of contamination with other thrips species, with natural enemies and diseases, of overlapping developmental stages of thrips, these all increase with an increasing rearing scale. In addition, most previously described methods are not suitable for rearing large numbers of thrips in synchronized cohorts when using small containers[9].

Condensation and subsequent drowning of larvae occasionally occurred in culture boxes. The main cause was a temperature difference between the outside and inside of the box and usually could be avoided with a well-controlled climate room. Condensation usually occurred only in those boxes with excessive numbers of larvae and/or too much capsicum in the box.

IV. CONCLUSION

In conclusion for the first time *S. dorsalis* was reared on capsicum. The successful rearing of *S. dorsalis* requires suitable food *i.e.* capsicum and skilled labour. Results obtained from this study identified that: **(i)** Capsicum served as a best source for *in vitro* rearing of *S. dorsalis* **(ii)** the methodology used in rearing *S. dorsalis* in this project caused relatively less levels of mortality (**iii**) Up to 4 generation of *S. dorsalis* were successfully reared on capsicum, is considered to be economically viable. This project was an attempt to lay the initial groundwork so that a future sophisticated production system can be designed for other Thrips species.

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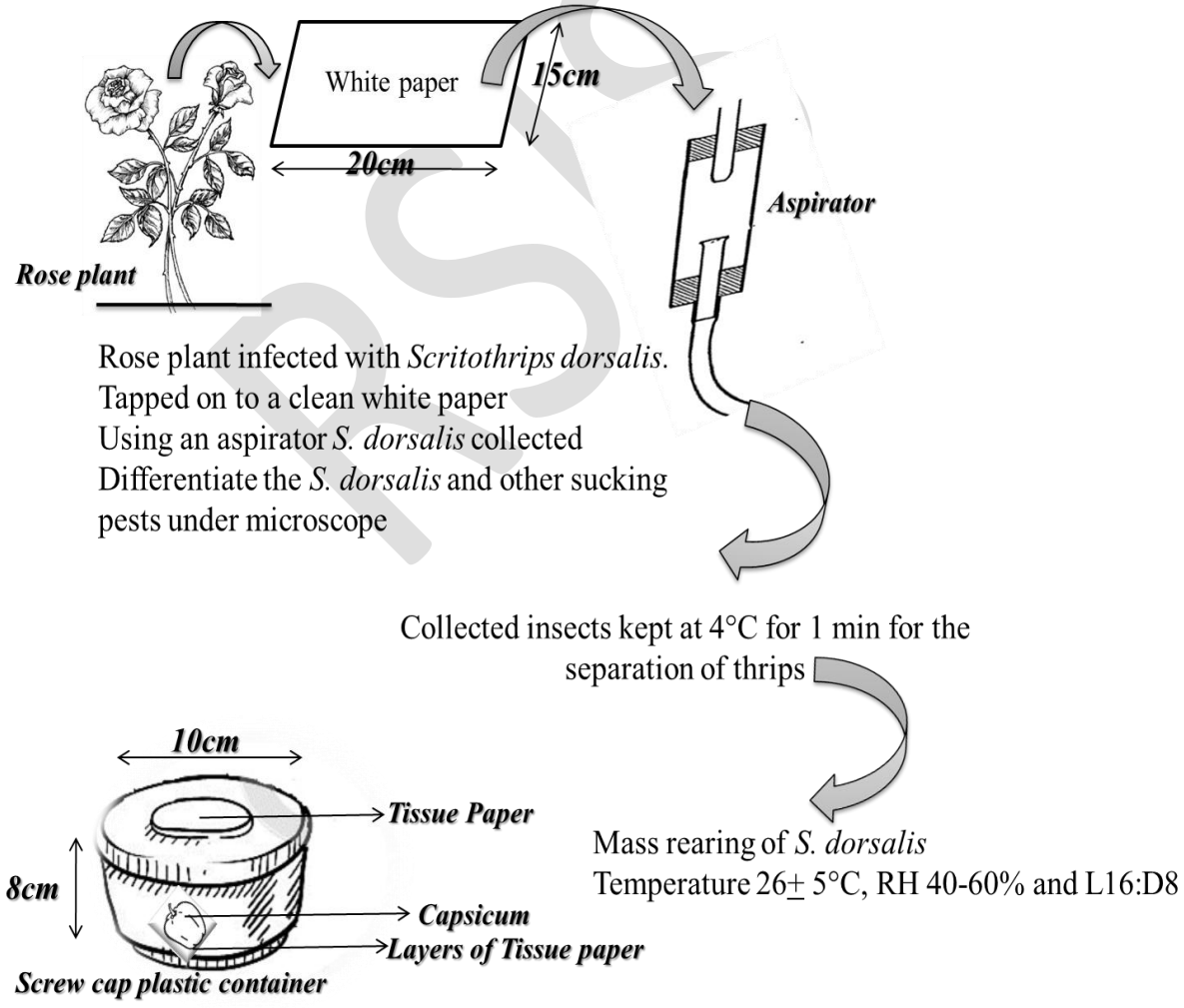

Fig 1. Schematic representation for rearing of *Scirtothrips dorsalis* using capsicum. I-Collection of insects for mass rearing; II-Separation of insects and transferring; III-Mass rearing of insects

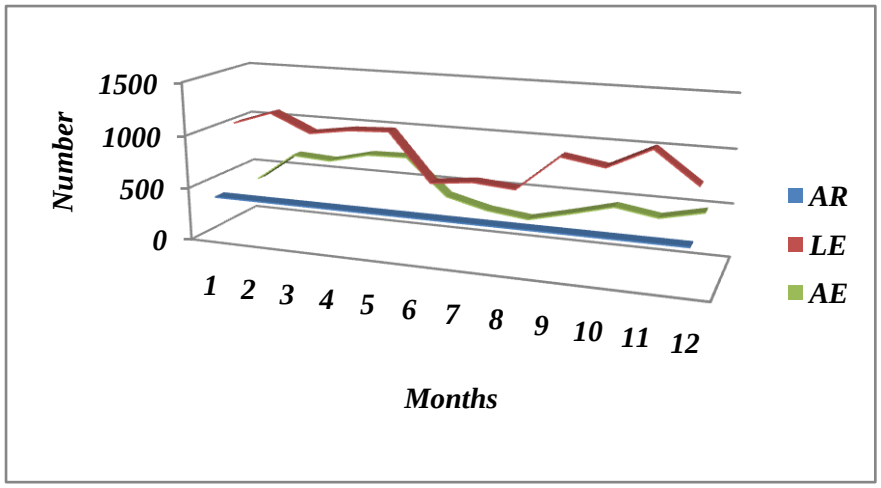

Fig 2. Depiction of *S.dorsalis* adults released, larval emergence and adult emergence of the year 2013

Table I. Details of *S.dorsalis* Adults Released, Larval Emergence and Adult Emergence of the Year 2013

Month	**AR**	**LE**	**AE**
January	400	1031	381
February	400	1156	653
March	400	990	631
April	400	1048	723
May	400	1067	733
June	400	618	386
July	400	663	289
August	400	633	242
September	400	966	338
October	400	903	441
November	400	1099	379
December	400	810	469
Std. Deviation		189.9	170.2
Std. Error of Mean		54.83	49.14
P value		< .0001	
R square		0.7231	
P value summary		****	
Significantly different standard deviations? (P < 0.05)		Yes	