

Artificial Diets and Rearing Techniques in Thrips

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SUMMARY

The description of improved laboratory methods and the available artificial diet used for mass rearing of various thrips species, such as *Frankliniella occidentalis*, *Frankliniella intonsa*, *Thrips palmi*, *Thrips tabaci* (Thysanoptera: Thripidae) are discussed in detail. In the first method, flower pollen and honey solution are provided as food sources whereas in the second method, germinated broad bean seeds are being provided as host. Larvae can be mass reared on pollen or germinated broad bean seeds until emergence of adult without additional water and food. A composition of artificial diet that can be successfully used to mass rear thrips is also discussed.

INTRODUCTION

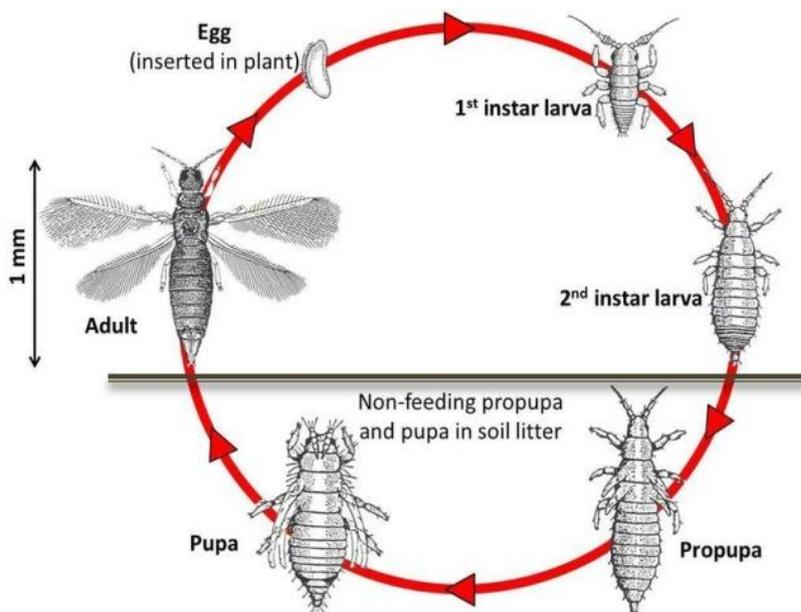
Thrips belong to the Thysanoptera order and are small, slender insects with fringed wings. Stippling, discoloured flecking and silvering of the leaf surface are caused by their puncturing the epidermal layer of the host tissue and sucking out the contents of the cells. Thrips feeding usually results in black varnish flakes that look like frass. Pest species are plant feeders that discolour and scar the leaves, flowers and fruit surfaces, deform plant components or spread plant diseases. They also feed on fungal spores and pollen. They feed on pollen from orchids and African violets which could result in unwanted pollen deposits and shorten the lifespan of the flowers. They also predate on the larvae of other insects and mites (IPM-UC, 2017).



Reyes *et al.*, 2021

Life cycle

Thrips develop from an egg into two active larval stages and two non-feeding stages, prepupal and pupal before reaching turning into an adult. Despite the fact that thrips do not have a true pupal stage, late-instar larvae are referred to as prepupae and pupae because they alter considerably in appearance and behaviour. The females of most plant-feeders lay elongate, cylindrical to kidney-shaped eggs on or into leaves, buds or other feeding sites. The pale prepupae and pupae fall to the ground or leaf litter, or lodge in plant fissures or galls. Pupa (and eggs) of gall-producing species like Cuban laurel thrips and myoporum thrips are present on lower leaf surfaces but are enveloped within twisted plant tissue. Every year, thrips produce a large number of generations even up to eight. When the temperature is warm, the life cycle from egg to adult can be completed in as little as two weeks (IPM-UC, 2017).



Schrader *et al.*, 2019

Evaluation of an improved method for mass-rearing of thrips (Murai & Loomans, 2001)

Mass rearing of thrips larvae

Rearing on pollen

- Place the newly hatched larvae in a rearing cage with 100 to 200 mg (pine) pollen (supplied only once).
- Add a thin layer of paper disc with cavities to the pollen, providing pupation sites.
- Provide 10% honey solution enclosed between two layers of stretched film so that larvae could feed on pollen directly and on honey solution through the thin membrane.
- The larvae pupated in the cavities of the paper disc, developed to adults without additional food.

Rearing on broad bean seeds

- Provide several germinated broad bean seeds with seed coat removed as food for thrips larvae in a box cage.
- Place a sheet of kitchen paper with small cavities at the bottom of a box for providing pupation sites.
- Rear the larvae at densities of 20 to 40 larvae per bean and replace the dried beans out at the time of pupation in order to maintain the humidity above 90% RH in the box cage.

Table 1. Composition of the artificial diet for larval thrips based on the generalist insect formula by Singh (1983) (Romero-Gonzalez *et al.*, 2011)

| Ingredient | Concentration (%) |
|----------------------|-------------------|
| Casein | 3.50 |
| Cholesterol | 0.05 |
| Linoleic acid | 0.25 |
| Sucrose | 3.00 |
| Vanderzant vitamins | 2.00 |
| α-Tocopherol | 2.26 |
| Ascorbic Acid | 76.43 |
| Biotin | 0.01 |
| Calcium Pantothenate | 0.28 |
| Choline Chloride | 14.15 |
| Folic Acid | 0.07 |
| Inositol | 5.66 |
| Vitamin B3 amide | 0.28 |
| Vitamin B6 HCl | 0.07 |
| Vitamin B2 | 0.14 |
| Vitamin B1 HCl | 0.07 |
| Vitamin B12 | 0.57 |
| Wesson's salt | 1.00 |

Deionized water was used as solvent. Mixture was vortexed, sonicated and centrifuged

Methods of rearing (Reiter *et al.*, 2014)

Bean jar method

The most classic way in order to maintain a stockthrips colony alive is jar method. It is an inexpensive method and consumes only a little space. The glass jars of sizes varying from 250 to 1000 mL can be used. A hole can be cut and screened on the lid and moisture absorbent material can be inserted on the bottom. The temperature range is 15–25 °C is maintained throughout the growth period, which is commonly cultured in climate chambers.



Bean jar method
(Egger and Koschier, 2014)



Potted plant with screening
(Halbritter *et al.*, 2021)

Potted plant with screening

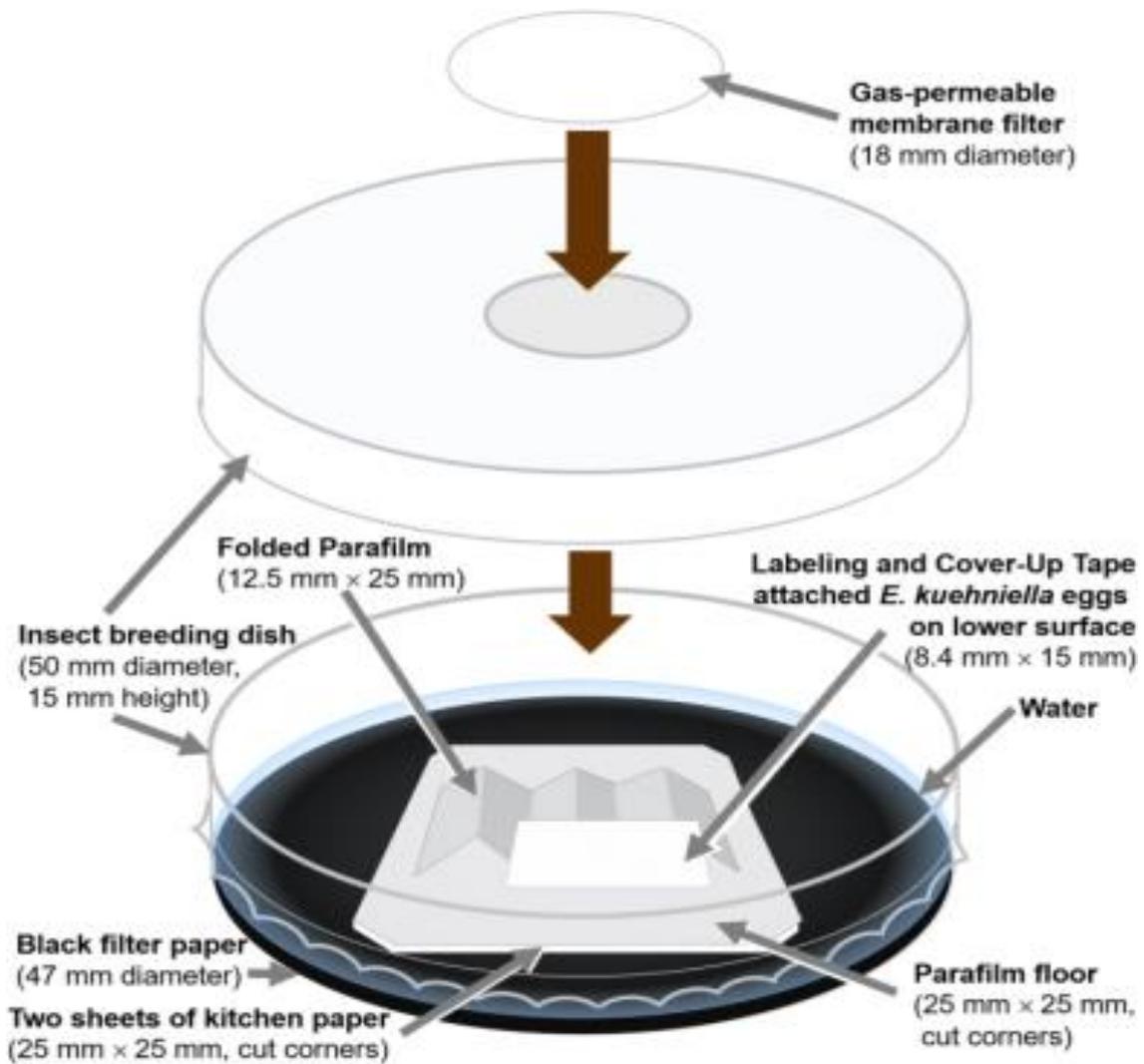
A cage and a potted living host plant are required for this method. Plexi glass cages with screened holes, screened cages, cylindrical plastic or glass tubes and containers are used. The cages were normally placed in greenhouses in a temperature range of 20–25 °C. This method needs a large amount of space and a well-isolated region in which to establish thrips-free fresh host plants.

Potted plants without nets

In greenhouses and climatic chambers, thrips-infested potted host plants were used. It needs a large amount of space and a well-isolated area where thrips-free fresh host plants can be grown.

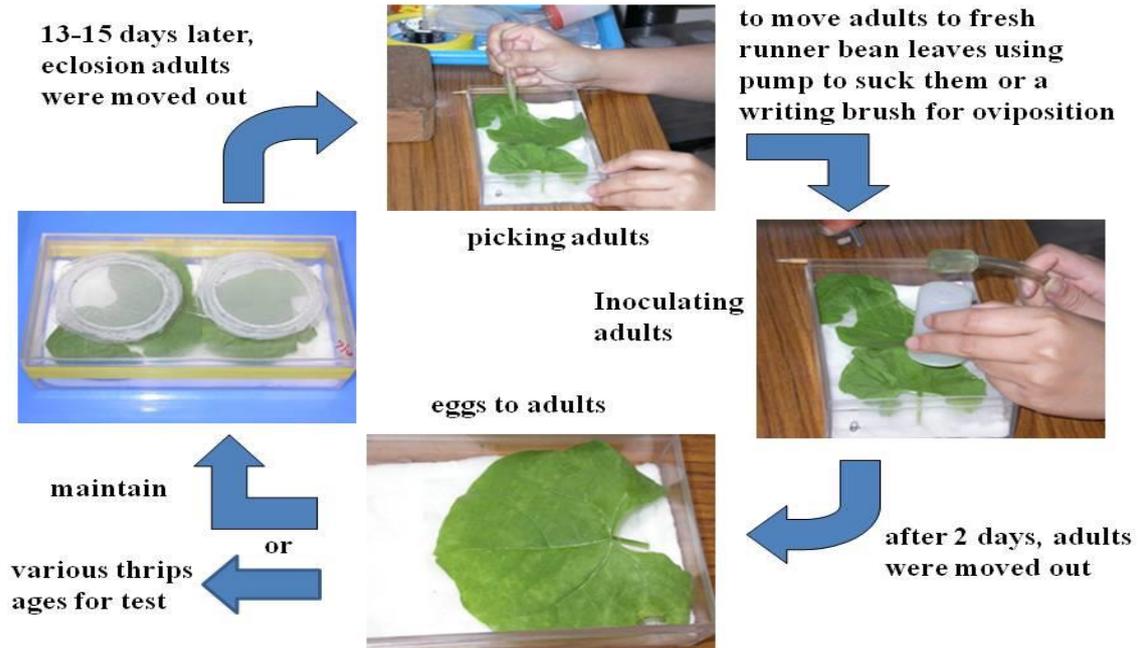
Membrane method

10% honey solution is placed between two layers of parafilm and by piercing through the parafilm layers, the thrips feed on it. Females lay eggs through the parafilm layer which can be gathered. Though, it is a time-consuming process, it ensures maximum security. Most of the plant and insect diseases can be eliminated by using artificial feeding.



Membrane method (Oida, 2019)

Rearing processes of *Thrips palmi*



(Huang, 2013)

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