A MODIFIED LEAF ARENA TECHNIQUE FOR REARING PHYTOSEIID OR TETRANYCHID MITES FOR BIOLOGICAL STUDIES

M. M. ABOU-SETTA
Plant Protection Research Institute
Agriculture Research Center
Dokki, Giza 12618 Egypt

AND

C. C. CHILDERS
University of Florida, IFAS
Citrus Research and Education Center
700 Experiment Station Road
Lake Alfred, FL 33850 USA

ABSTRACT

A new procedure for rearing mites in the families Phytoseiidae or Tetranychidae is described. The rearing unit provides air exchange and a stable level of humidity (75–85% RH) in the microenvironment at 1 cm height. At 26°C or less, mature citrus leaves were maintained in the unit up to 8 weeks. Pollen of the ice plant, Malephora crocea (Jaq.), was usable for 10 to 15 days as food for Euseius nemaeus (Dean) at 18 to 30°C. The method requires low maintenance, is simple, relatively inexpensive, and allows monitoring of mite behavior or development through the clear plastic lid.

RESUMEN

Se describe un nuevo procedimiento para cría de ácaros en las familias Phytoseiidae o Tetranychidae. La unidad de cría provee intercambio de aire y un nivel estable de humedad (75–85% humedad relativa) en el microambiente a 1 cm de altura. A 26°C o menos, se mantuvieron en la unidad hojas maduras hasta 8 semanas. El polen de la planta Malephora crocea (Jaq.) fue usable de 10 a 15 días como alimento para Euseius nemaeus (Dean) de 18 a 30°C. Este método requiere bajo mantenimiento, es sencillo, relativamente barato, y permite chequear el comportamiento o el desarrollo de los ácaros a través de una tapa plástica transparente.

Adequate environmental conditions and food sources are essential for successful mite rearing. Optimum conditions vary according to mite species and important factors include temperature, light duration and intensity, humidity, proper food, and a rearing substrate. McMurtry and Scriven (1965) indicated favorable humidity (ca. 80%) was extremely important for successful rearing of many phytoseiid mite species in the genera Amblyseius, Phytoseiulus, and Typhlodromus.

A suitable food source for tetranychid mites usually is a leaf or fruit surface. However, suitable food source(s) for phytoseiid mites may vary from plant pollen to specific arthropod or nematode species or combinations of these. To determine the intrinsic rate of increase (r_m) of an insect or mite, food(s) must be provided which maximize development and reproduction. Ristich (1956) used infested bean leaves on saturated cotton in Petri dishes for rearing Neoseiulus fallacticus (Garman). Gilstrap (1977) reported a tabletop rearing technique for tetranychid mites and their phytoseiid natural enemies using rooted lima bean leaves.
A technique for rearing *Euseius hibisci* (Chant) on ice plant (*Malephora crocea* (Jacq.)) pollen was developed by McMurtry and Scriven (1964). This pollen was usable for 5 days as a food for the phytoseid mite compared to 2 or 3 days for most other plant pollens tested. Some phytoseid mites can be reared on an artificial surface while being fed tetanychild mites whereas other phytoseid mites require a leaf surface (McMurtry and Scriven 1965). A rough natural substrate such as a leaf surface was found to favor oviposition by *Phytoseius hawaiiensis* Prasad more than a smooth tile surface (Sander son & McMurtry 1984). Ingested plant sap may provide the phytoseid mite with an alternate source of food and/or moisture (Porres et al. 1975).

Rasmby (1970) used citrus leaves for rearing *Typhlodromus gossipi* El-Rady. A lemon leaf arena was used by Moraes and McMurtry (1981) for rearing *E. citrifoliatus* (Denmark and Muma). These methods were similar in using a *leaf surface* on a water-saturated cotton or foam rubber. The high relative humidity hastened mold development in pollen that was used as food. Munger and Gilmore (1983) used a leaf cage for individual studies of the citrus red mite developed by Munger (1942). This structure was modified later by Tashiro (1966i) and Swirski et al. (1966i) as a self-watering acrylic cage. These units provided lower humidity than previously reported and could use citrus leaf or fruit surfaces.

**THE CITRUS LEAF ARENA TECHNIQUE**

The leaf arena method reported here was developed following the study of the biology of the phytoseid mite *E. mesembrinus* (Dean) (Abou-Setta & Childers 1987).

This method was developed to provide a more optimal procedure for successful rearing of mites (i.e., *Phytoseiidae* or *Tetranychidae*) under Florida conditions. The method requires low maintenance, is simple, relatively inexpensive, and allows monitoring of mite behavior or development through the clear plastic lid.

Several of the previously described techniques were tested and better survival was obtained when citrus leaves rather than a plastic arena with water was used (Swirski et al. 1967). The rearing method reported previously (Abou-Setta & Childers 1987) required a daily water adjustment by weight and the following methods were used to improve the procedure.

A 1-cm-diam hole was drilled in the center of the lid of a 9-cm-diam plastic Petri dish (Figs. 1, 2). The lid was sealed using Elmer's* glue over a deep plastic Petri dish which was used to hold water. Two holes each 4 mm diam were drilled in the upper part of the side wall of the deep dish for water refill using a syringe bottle. A wick consisting of a strip of filter paper was fitted through the center hole of the lid. The lid was then fitted with an absorbent cotton dice, lined with a filter paper (Whatman No. 1*), and saturated with deionized water. The wick maintained the saturated bed and water was added weekly. The upper part of the dish was used as the cover and included 12, 4-mm-diam holes to allow air exchange and to prevent relative humidity from reaching saturation. An entire citrus leaf or individual leaf disk was used for mite rearing. When an entire leaf was used, its petiole was placed under the saturated cotton disc to allow access to water. Leaf edges were surrounded with a thin barrier of Canada Balsam and Castor bean oil (ratio: 1:5:1), as needed (Swirski et al. 1967). The oil barrier was effective in containing *E. mesembrinus*. However, it may not be equally effective for other mite species. Ice plant pollen was usable for 10 to 15 days as food for *E. mesembrinus* at 18 to 30°C using this technique compared to 5 days for the same pollen in California (McMurtry & Scriven 1964). The longer availability of an acceptable food source reduced handling time and disruption of individual mites.

These units may be held in an insectary or in an environmental chamber with air circulation. The rearing units provided a stable level of temperature and humidity (75-
85% RH) in the microenvironment at 1 cm height as measured by a Digi-Sense® thermocouple probe. The following mites were reared using mature citrus leaves in the unit: *Tetranychus urticae* Koch, *T. tumidus* (Banks), *Eutetranychus banksi* (McGregor), *Panonychus citri* (McGregor) (Acari:Tetranychidae), *E. mesembrinus*, and *E. hibisci* (Acari:Phytoseiidae). At 26°C or less, mature citrus leaves were maintained in the unit up to 8 weeks unless fed upon by the phytophagous mites. Leaf discs could not be maintained for as long as whole citrus leaves. However, enough time elapsed (i.e., 14 days) for mites to complete a generation without changing the plant material.

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Fig. 2. Rearing units containing leaf discs or a whole leaf as rearing substrates for mites.


