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A simple petriplate bracket cage and host plants to culture cotton mealybug, *Phenacoccus solenopsis* (Tinsley) and its predator, *Harmonia octomaculata* (Fab.)

With the recent outbreak of cotton mealybug, *Phenacoccus solenopsis* (Tinsley) (Homoptera: Pseudococcidae) on a wide range of crops and plants (Arif et al., 2009), there is a need to identify potential natural enemies of the pest and to develop simple methods to mass multiply both of them for biological suppression of the pest. We have identified an aphidophagous coccinellid *Harmonia octomaculata* (Fabricius) to feed on P. solenopsis on sunflower and tried to culture them in screenhouse conditions by screening different host plants to maintain *P. solenopsis* and by confining *H. octomaculata* on mealybug-infested plants in simple cages.

Different host plants of *P. solenopsis* were screened and among them *Portulaca oleracea* L. (Portulacaceae), a succulent ornamental plant with sub-circular leaves was found suitable for easy propagation and rapid establishment of mealy bug before designing a simple cage to mass culture *P. solenopsis* and its predator *H. octomaculata* by using plastic tea cups (3 cm long, 7 cm dia.). Petri plates (10 cm dia.), A4 size transparent OHP sheets (30 x 21 cm) and triangular clips (26 mm) were used for preparing simple ptriplate bracket cage.

Bits of fresh *P. oleracea* (10 cm long) clipped off from the plants raised in pots or small plots were planted in plastic tea cups filled with pot mixture. A few punches made at the bottom of the cups allowed the roots to extend out of the cup when kept in plastic trays (30 x 25 cm) with a thin film of water to prevent the ants from reaching the plants into the tea cups. A circle of 4-5 holes and one hole in the centre (each 1.0 cm dia.) were made in a pair of plastic petriplates. One of them was placed over a pot mixture filled tea cup and bits of *P. oleracea* were planted through the holes. An OHP sheet rolled as a cylinder (21 cm long, 8-9 cm dia.) and secured with a pair of triangular clips was placed above the petriplate with the plants inside (Fig. 1). The other petriplate was placed over the OHP cylinder with a fine cloth sandwiched between the cylinder and petriplate to prevent the insects from escaping through the holes. Another outer circle of elongate slits (10 mm long, 1 mm wide) made on the petriplate allowed aeration into the cage from below through the bottom petriplate bracket and out of the cage from above through the top petriplate bracket. The plants were watered by adding water to the lower bracket petriplate or to the plastic tray in which up to five such tea cup plants in petriplate bracket cages can also be kept. Mealy bugs were allowed to infest by placing one or two *P. solenopsis* adults inside the cage or they could build up themselves, if the tea-cup-plants without the OHP cylinder and the upper petriplate bracket were kept in the open during the mealybug season of abundance. The plants grow faster with proper fertilizer application. Pruning them allowed profuse branching. Once mealybug infested, adults or grubs of *H. octomaculata* were released inside the cage. The eggs or the pupae attached to the *P. oleracea* leaves were removed along with a bit of stem and transplanted into another such cage to avoid cannibalism and desiccation.

Fig 1. A typical petriplate bracket cage with Phenacoccus solenopsis-infested *Portulaca oleracea* inside.

The results revealed that *P. oleracea* was highly suitable for *P. solenopsis* culturing under screen house conditions. It was easy to propagate with stem cuttings which rooted quickly. Planting of fresh unrooted cuttings through the petriplate holes in the lower bracket allowed the mealybugs to feed without the plants losing turgidity. Mere placing of mealybug-infested cuttings into the cage without planting were also able to sustain mealybug feeding. Between the two colours of *P. oleracea* (pink and white), those with pink flowers supported more mealybugs than those with white flowers. Those plants with spindle-shaped elongate leaves bearing variably coloured flowers were also supported mealybugs.

H. octomaculata was found to develop inside the Petri plate bracketed cage by feeding on *P. solenopsis* infesting *P. oleracea* in tea cups. Adult beetles laid clusters of eggs usually on the under surface of leaves, on the sides of OHP cylinder, or on the inner surface of the top Petri plate bracket. They needed to be transferred to other fresh cages to avoid cannibalism, a common feature of coccinellids (Omkar and Pervez, 2003). Eggs that were laid on *P. oleracea* leaves survived when such leaves were clipped off along with a stem bit and transplanted in fresh cages with grown up *P. oleracea*. Those eggs laid on OHP sheets or top Petri plate brackets survived when they were kept moist. Upon hatching the first instar grubs were allowed to feed on the egg chorion for a day before carefully transferred to fresh mealybug-infested cages with the help of a feather brush for further development. Early instar (second) P. solenopsis-infested *P. oleracea* cuttings were placed inside such cages to facilitate the early instar *H. octomaculata* grubs to develop.

Sprouted potatoes infested by *P. solenopsis* when placed inside the cages also facilitated *H. octomaculata* to lay eggs. Bhendi fruits attracted more P. solenopsis crawlers when placed on the soil in P. solenopsis infested fields. When such fruits were planted in the central hole of the bottom petriplate bracket with the fruit stalk inserted into the tea cup, they were also found to support the early instar *H. octomaculata.* Late instar *H. octomaculata* grubs survived better only when they were kept in separate mealybug-infested cages devoid of cannibalism.

Upon emergence a few drops of honey placed on *P. oleracea* or potato sprouts encouraged adult *H. octomaculata* to live longer. Confining three to five beetles in such cages ensured mating. Once fertilized, the gravid females with enlarged hind abdominal segments could be confined in a separate cage with proper feeding so that eggs could be harvested for several weeks intermittently. Petri plate bracket cages can be used to raise seedlings of other plants as well by sowing a seed through a much larger central hole in the bottom Petri plate bracket. Stacking the OHP cylinders one over the above is possible to keep taller plants such as rice. In such cases the rice plants can be planted right into the tea cup and the OHP cylinder can be placed around the tea cup without using the lower Petri plate bracket and such cages can be placed in plastic trays filled with water submerging the tea cups. A plastic tray may be placed above a cluster of petriplate bracket cages (3-5) to prevent them from dislodging due to wind or from rain or to arrest excess sunlight, if need be. This type of simple cage is suitable for mass culturing of sucking pests such as mealybugs, aphids and hoppers, and caterpillar pests on their host plants and their natural enemies. Usually *Harmonia spp.* are aphidophagous (Chakrabarti *et al*., 1995). *H. octomaculata* has been reported to feed on non-aphid preys such as brown planthopper, *Nilaparvata* lugens Stal., whitebacked planthopper, Sogatella furcifera (Horvath), green leafhoppers *Nephotettix virescens* (Distant), *N. nigropictus* and zigzag leafhopper, *Recilia dorsalis* (Motschulsky) (Salim and Heinrichs, 1986 and Omkar and Pervez, 2003).

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