Role of Pheromone Trapping in the Management of Red Palm Weevil

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The insect genus *Rhynchophorus* belonging to the order Coleoptera and family Curculionidae constitutes a major threat to palm crops all over the world. R.*Palmarum* (L) besides causing severe damage to oil palm and coconut is also known to transmit the nematode, *Bursaphelenchus cocophilus* Baujard. causing the deadly red ring disease. *R.ferrugineus* Oliv. popularly known as red palm weevil, a key pest of coconut, during the last decade, has become a severe limiting factor in the production of date palm.

In both coconut and date palm the females of red palm weevil lay eggs on young palms, mostly preferring those in the age group of 5 to 20 years. The grubs on hatching feed on the surrounding plant tissue often leading to the formation of tunnels. Feeding by grubs may also result in the death of the palm. In coconut and date palm it has been estimated that 5 to 7 per cent of the palms are infested. Timely detection of the pest can save the crop. However, due to its concealed nature, early detection is difficult. This makes the problem of palm weevil management intricate.

In order to deal with the problem from various angles, an integrated pest management programme (IPM) was first developed on coconut in India (Abraham *et.al.* 1998). This IPM programme has been suitably modified and implemented to manage red palm weevil population on date palm in Saudi Arabia since 1993 (Abraham *et. al.* 1998) The results have been very encouraging and have therefore, been adopted by other Middle East countries.

In both coconut and date palm trapping the weevil constitutes a major tactic of the IPM strategy. Early work on trapping the red weevil in coconut revolved around the use of food attractants (Kurian, *et.al.*, 1979, 1984, and Abraham, 1987). It was seen that coconut logs treated with coconut toddy, yeast and acetic acid attracted weevils in coconut log traps. This technique formed an important component in the IPM strategy. Further, Abraham, 1987 first revealed the presence of pheromones in male *R.ferrugineus*. Later, Hallett, *et.al.* 1993 identified the male aggregation pheromone "ferruginol" (4-methyl-5-nonanol) from *R. ferrugineus*. A synthetic product of the same is now commercially available as ferrolure.

Trapping of palm weevil using pheromone lures in food baited bucket traps containing insecticide forms an important component of the IPM strategy presently adopted to manage palm weevil on date palm and coconut.

Pheromones are secretions of the exocrine glands used for intraspecific communication between individuals of a single species, triggering specific reaction in the receiving individuals, leading to alarm sexual attraction, aggregation, tracking or sexual determination at maturity (Karlson and Butenandt, 1959).

Importance of Pheromone Trapping

Trapping the weevil using pheromone lures has three distinct objectives,

1) to monitor weevil activity and detect its presence if any, in pest free areas.

2) to mass trap the weevil in hot spots and destroy the floating weevil population, and

3) to assess the population levels of the pest.

Wide stretches of coconut / date plantations can be monitored for weevil activity using monitor or survey traps. Based on weevil captures from monitor traps and infestation reports an area can be mass trapped.

As soon as a trap registers weevil captures it is essential to locate the source of infestation from where the insect is released. Detecting such infested palms as soon as possible will help in the quick curative treatment and also minimise the spread of the pest. Usually, examining gardens lying in a radius of 100 metres around a particular trap that captures weevils will help in locating the source of infestation. Mass trapping is also, aimed at bringing down the population, as a sizable amount of the floating population can be captured using pheromone traps, which will ultimately lead

to reduced pest infestation levels. It is significant to point out that the captures are female dominated which is advantageous in suppressing the population. Significant reduction in both levels of *R. palmarum* and the red ring disease of oil palm were obtained in Costa Rica (South America) by trapping the pest using pheromones (Oehlschlager, 1995).

In monitor areas it is often difficult to locate the source of infestation as the trap density is very low and wide stretches of gardens are served by a single trap. Here, in the case of repeated weevil captures by a particular monitor, it is recommended to set three to four additional traps called "indicators", 200 to 300 m around this monitor. This will enable the plant protection worker involved in examining the gardens, to come closer to the source of infestation. If this method fails to detect the source, then the area should be mass trapped.

Further, assessment on the magnitude of the problem can be determined from the weevil capture data. This would enable the plant protection workers to categorise the pest infested location as either high or low population area and thereby plan the future pest management strategy.

Trap design

Various types of traps have been tested in different countries. Maharaj (1973) developed a metal trap in Trinidad which was found to be superior to the coconut log traps. However, in India the coconut log trap was more efficient than the metal trap (Kurian, *et.al.* 1979).

Hagley (1965) used a chemical mixture as attractant for *R.palmarum*. Kurian, *et.al.* (1984) recommended the use of coconut log traps treated with coconut toddy, yeast and acetic acid to trap R. *ferrugineus*. With the advent of the pheromone it was necessary to develop a suitable trap.

Oehlschlager, *et.al.*(1993), tested various traps for *R. palmarum* in Costa Rica and found that the 19 L bucket as most convenient. Subsequently, the Ministry of Agriculture and water Saudi Arabia has successfully modified the bucket trap demonstrated by Oehlschlager and designed a five litre plastic bucket to trap R. ferrugineus in date palm. This trap has four windows (5x1.5 cm) cut equidistantly just below the upper rim of the bucket. On the exterior surface of the bucket is stuck a jute sack cloth, so as to provide better grip for the attracted weevils, enabling them to crawl into the trap. The pheromone lure is hung on the under side of the bucket lid. Besides the pheromone the bucket trap contains one kilogram date palm stem bits and one litre solution of either 0.1 per cent carbaryl or trichlorphon to kill the trapped weevils. For using this trap in coconut gardens, date palm stem bits can be replaced with fresh coconut petiole bits/sugar cane. The food attractants can be improved by using the combination of coconut toddy, yeast and acetic acid.

Servicing of traps

Usually, the traps are serviced once a week, when the food and insecticide solution is replaced. Also, the number of weevils captured can be recorded during this time. It has been seen that under Middle East conditions, during the winter season the food lasts for a longer period to two weeks as compared to the summer season when the food decomposes faster and has to be replaced every week. Date fruit can also be used as a food substitute instead of date palm stem bits. Date stem bits whenever available in surplus, can be packed in thick polyethylene bags and stored in the refrigerator (10 to 15°C) for two months.

Placement of traps

Studies conducted in Costa Rica and Saudi Arabia have shown that better weevil captures were obtained when the traps were set at ground level. However, for practical reasons, traps are hung on palms 1 to 1.5 m above the ground level. It may also be noted that weevil captures are improved when traps are hung on palm trunks instead of an artificial standards. Placement of traps on young palms should be avoided as far as possible. Studies have shown that traps when exposed to direct sun light exhausted the pheromone much faster as compared to traps set under the shade.

Traps are used for monitoring the weevil activity and also for mass trapping the pest in hot spots. When used as monitors, one trap is set to serve an area of one sq km. However, for mass trapping a trap density of one trap per ha is recommended. When large areas need to be mass trapped the programme can be initiated with a lower trap density and gradually increased to one trap per ha on a judicious basis.

Types of lures and trapping mechanism

At present the most widely used pheromone lure in palm weevil management is FERROLURE, manufactured and supplied by Chem Tica Natural, Costa Rica. Two formulations i.e. ferrolure (F) and ferrolure+ (F+) are available. About 700 mg of the chemical is loaded in polyethylene sachets. When set in the traps the chemical from the sachet gets released (volatilised) in to the surroundings, thus attract the weevil to-

wards the trap and the food attractant in the bucket orients the attracted weevil into the trap. Once trapped the insect upon contact with the insecticide solution gets killed. Studies have shown that under Saudi Arabian conditions both, F and F+ capture the same number of weevils and do not differ significantly in their release rates under uniform weather conditions. Recently, Agrisense, U.K and Calliope, France have also synthesized the same aggregation pheromone for red palm weevil.

Lure longevity

In order to maintain the efficiency of the weevil trapping programme it is essential to have a uniform release of the chemical in the field, and replace exhausted lures with fresh ones. Under the Middle East conditions it has been seen that the Chem Tica lure has a longer field life during winter(about 5 months) as compared to the summer when the lures get exhausted in three months. In the coconut growing coastal belts of South Western India, it is expected that ferrolure will have a field life of about five months.

Seasonal weevil captures

The weather conditions of a given area have a direct impact on the number of weevils caught by the pheromone traps. It has been in Saudi Arabia that high weevil captures are obtained when moderate weather conditions prevail, that is when it is neither too hot nor too cold, between March to May and September to November. At the height of the summer and winter seasons, weevil captures drop significantly. In South Western India, uniform weevil captures can be expected throughout the year, where moderate weather conditions with high humidity prevail. However, weevil captures will drop during the heavy monsoon.

Pheromone trapping of red palm weevil is therefore, an ecologically safe and environmentally friendly tool in the IPM strategy currently adopted worldwide for red palm weevil management in coconut, oil palm and date palm. This powerful component of the IPM programme can be implemented on large scale either by the state or by farmers on a collective basis.

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