

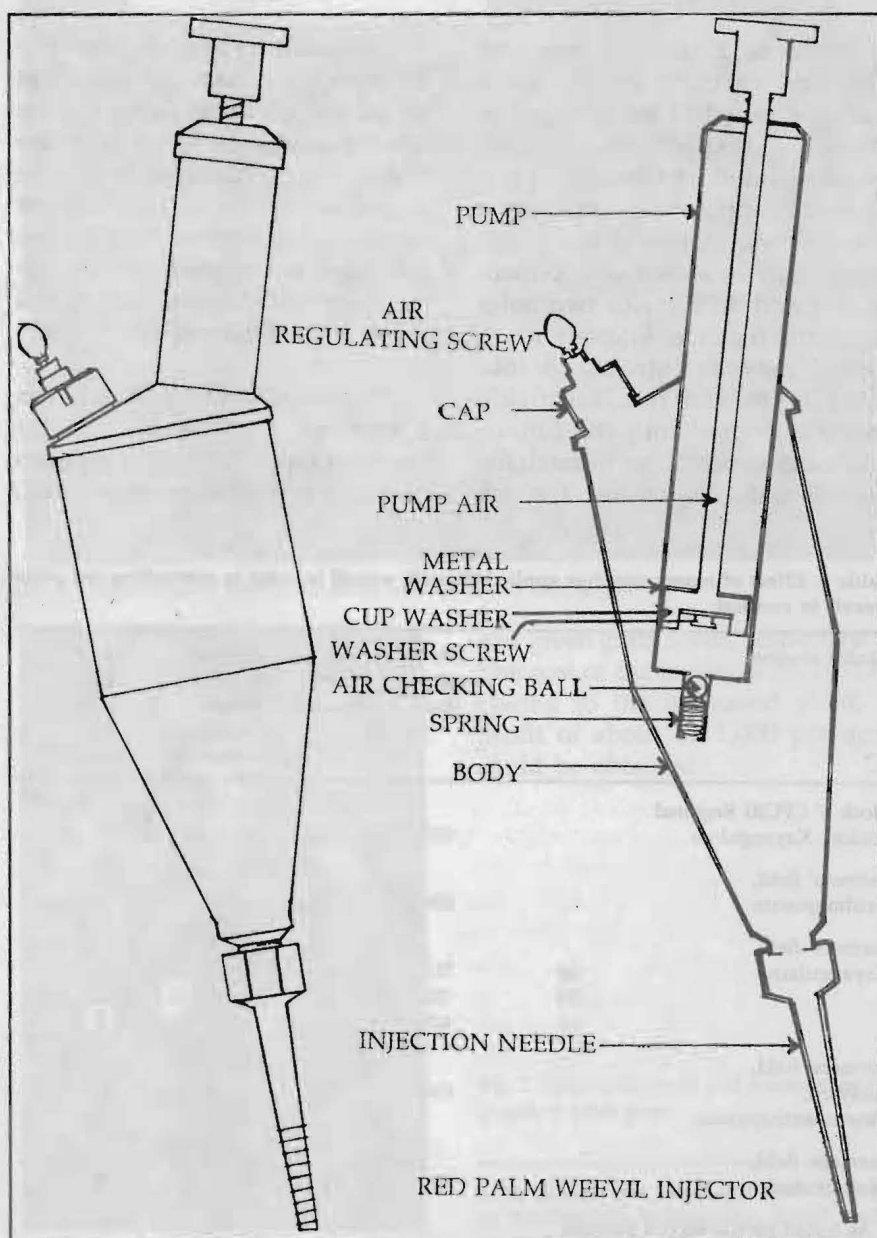
An insecticide injector for palm weevil control

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Insecticide injected into the palm tree keeps the dreaded pest away.

RED palm weevil *Rhynchophorus ferrugineus* is the most dreaded pest of coconut palm in India and other countries. It attacks other palms also. The pest lays eggs in selected sites like soft or injured portions of the stem, and the crown portion affected and decayed due to bud rot and leaf rot disease. In the preferred sites, the female weevil scoops out a hole with its proboscis and inserts the ovipositor in the hole. Eggs are laid singly in these portions. The hole is sealed off with a cement like substance. The eggs hatch in 2 to 3 days and the newly emerged larvae start feeding on the live tissue and tunnel into the stem. The feeding by the grubs results in the damage of the growing tip and the palm succumbs to weevil attack.

The great drawback in planning control operations against this pest is the inability to detect the weevil incidence at an early stage, which is the appropriate stage to tackle the pest attack. By the time the weevil infestation is detected by external symptoms like drooping



of leaves, extrusion of frass and exudation of viscous brown liquid from the holes, most of the palms might have succumbed to weevil attack. With the use of electronic equipment the pest infestation could be detected at an early stage. During early stage of infection the exact location of the pest and extensive tunnels made by the grubs are not easily known.

Pyrocone E one per cent one litre and carbaryl 20-30g (50% wettable powder) in 1000 ml of water respectively, are recommended against the pest. Method of application of insecticide is as follows. At first all exit holes, if any, may be closed with cement or clay and drill one or two holes above the region of infestation. A funnel may be introduced into these holes and the insecticide solution poured into the funnel. The solution percolates through the tunnels and kills the insect which

comes in contact with it. However, in the early stage when the exact location of the pest is not known, administering of insecticides using funnel may not be effective. Monocrotophos, a systemic insecticide is also effective in undiluted form against the pest. To apply systemic insecticides an injector has been designed and tested in the field.

Different types of pressure injectors have been designed and tested on coconut palm. One injector works on screw pressure and is piston operated while the second one works on attached foot pump. The injector described in this paper is designed with a built-in pump and needle to suit red palms weevil control operations.

The weevil injector (sketch) has a conical body with slightly rounded top. At the top a pump (used for kerosene stoves) is fitted.

An outlet is provided for pouring insecticide solution. The outlet is provided with a screw cap with an air vent at the top operated by screw. The lower end of the body tapers to form a tube threaded to accommodate an injection needle. The injection needle is a hollow screw of 5 cm to 8 cm long welded to 3/4 inch size nut. At all joints rubber/fibre washers are provided to make the instrument air-tight.

Working

A hole 5 cm in depth is drilled with an auger of 5 mm diameter on the stem. The injector needle is inserted into the hole and screwed tight and the injector kept in position. Monocrotophos 10 to 15 ml diluted with 500-700 ml of water depending on the size of the palm is poured into the injector and the screwcock tightened. Air is pumped in with the pump to force the liquid through the injection needle into the palm. The pump is capable of creating a built-in pressure of 15 to 20 pounds on the liquid. One or two subsequent pumping at 10 to 15 minutes interval is required to empty the entire fluid into the palm.

A total of 1986 palms in farmers' field and CPCRI were screened with the weevil sensor to locate affected palms and 45 palms were found to be weevil infested. Seven palms showed external symptoms of weevil attack. All the palms were injected with monocrotophos. The treated palms were screened 10 days after treatment with the weevil sensor and none of the palms showed presence of weevil as evidenced by the lack of feeding sound in these trees.

Table 1. Effect of monocrotophos applied through weevil injector in controlling red palm weevil in coconut.

Garden observed		No. of palms obsd.	No. of weevil affected*	No. of trees showing external symptoms	No. of palms treated and cured
Block V CPCRI Regional Station, Kayangulam		410	2	-	2
Farmers' field, Krishnapuram		638	1	-	1
Farmers' field, Kayangulam	(a)	215	8	2	8
	(b)	22	2	-	2
	(c)	60	7	8	7
Farmers' field, Anayara, Tiruvananthapuram		439	17	2	17
Farmers' field, Muthukulam		202	8	-	8

* As tested by the weevil detector.

(Contd. on page 571)

Similar relations may also be derived from other quadruplets:

$$\begin{aligned}
 25 + 57 + 78 + 82 &= \\
 &52 + 75 + 87 + 28 \\
 25^2 + 57^2 + 78^2 + 82^2 &= \\
 &52^2 + 75^2 + 87^2 + 28^2 \\
 34 + 46 + 69 + 93 &= \\
 &43 + 64 + 96 + 39 \\
 34^2 + 46^2 + 69^2 + 93^2 &= \\
 &43^2 + 64^2 + 96^2 + 39^2
 \end{aligned}$$

It is possible to derive similar reversible identities by starting respectively with five, six ..., ten digits and combining them cyclically as before. Various relations with different number of starting digits are possible:

$$\begin{aligned}
 1. \quad &12+24+45+57+71 = \\
 &21+42+54+75+17 \\
 &12^2+24^2+45^2+57^2+71^2 = \\
 &21^2+42^2+54^2+75^2+17^2 \\
 2. \quad &01+14+46+68+89+90 = \\
 &10+41+64+86+98+09 \\
 &01^2+14^2+46^2+68^2+89^2+90^2 = \\
 &10^2+41^2+64^2+86^2+98^2+09^2 \\
 3. \quad &12+24+45+56+67+79+91 = \\
 &21+42+54+65+76+97+19 \\
 &12^2+24^2+45^2+56^2+67^2+79^2+91^2 = \\
 &21^2+42^2+54^2+65^2+76^2+97^2+19^2 \\
 4. \quad &01+12+23+35+57+78+89+90 = \\
 &10+21+32+53+75+87+98+09 \\
 &01^2+12^2+23^2+35^2+57^2+78^2+89^2+90^2 = \\
 &10^2+21^2+32^2+53^2+75^2+87^2+98^2+09^2 \\
 5. \quad &12+23+34+45+56+67+78+89+91 = \\
 &21+32+43+54+65+76+87+98+19 \\
 &12^2+23^2+34^2+45^2+56^2+67^2+78^2+89^2+91^2 = \\
 &21^2+32^2+43^2+54^2+65^2+76^2+87^2+98^2+19^2 \\
 6. \quad &01+12+23+34+45+56+67+78+89+90 = \\
 &10+21+32+43+54+65+76+87+98+09 \\
 &01^2+12^2+23^2+34^2+45^2+56^2+67^2+78^2+89^2+90^2 = \\
 &10^2+21^2+32^2+43^2+54^2+65^2+76^2+87^2+98^2+09^2 \quad \square
 \end{aligned}$$

(Contd. from page 564)

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