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A *Corcyra* egg card making machine for the mass production of *Trichogramma* spp.

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ABSTRACT: **A machine for making *Corcyra* egg cards was designed, fabricated and evaluated for labour efficient mass production of *Trichogramma* egg cards. The machine could paste on an average 9.97 ml of eggs per minute compared to 0.7 ml in the manual method. The number of eggs pasted per 0.25 sq cm of the card varied from 32 to 145 eggs with an average of 73 eggs for machine made cards whereas the corresponding values for manually made cards were 45, 118 and 76.65, respectively. The average number of egg cards produced per hour in the machine operated system was 14.3 times higher when compared to the manual system. The machine is provided with an in-built UV chamber for the sterilization and inactivation of the host eggs. The cost of the machine works out to be about Rs.20, 000 per unit and this is the first report of a machine developed for host egg card preparation from India.**

KEY WORDS: *Corcyra cephalonica*, egg card making machine, mass production, *Trichogramma*

The insect egg parasitoids, *Trichogramma* spp. (Hymenoptera: Trichogrammatidae) are used widely for the population suppression of a number of major insect pests of crops (Anon., 1994). In the laboratory, the parasitoids are multiplied on *Corcyra* egg cards and the cards containing parasitized eggs (*Trichogramma* cards) are conveniently placed in the crop fields for large-scale releases of the parasitoids. Anonymous (1975) described an automatic egg-sticking machine with a capacity of 100g eggs per hour from the erstwhile USSR. Antropov and Pipinkevich (1980) also reported the mechanization of the biofactories in their country. Ying (1982) reported a machine for the preparation of the egg cards using silkworm eggs from China. The uses of insecticide fogger (Morrison, 1985) and varnish sprayer (Chen *et al.*, 1993) to partially mechanize the egg card production units have also been reported. Storage of the host eggs at low temperature or exposure to ultraviolet or gamma radiation is usually used for the sterilization and killing of the egg embryos without affecting their nutritive value prior to providing for parasitization by *Trichogramma* (Singh, 1969). Presently, in India, egg cards are prepared manually by pasting the cards with gum and then sprinkling the host eggs over it. The procedure is too cumbersome with a very low output. Moreover, uniform distribution of eggs on the cards is also affected by the method.

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This paper reports the design and development of a machine for the production of *Trichogramma* spp. with an in-built UV chamber to increase the efficiency of egg sterilization process.

MATERIALS AND METHODS

The machine was designed and developed at the Indian Agricultural Research Institute, New Delhi during 1993-96. The manually operated *Corcyra* egg card making machine (Fig. 1a and 1b) basically consisted of (i) a hopper or dispenser to hold the eggs with regulated egg discharge, (ii) a stand for holding paper strip roll, (iii) a mechanism to unroll the paper roll for application of gum and (iv) a set of pulleys with cam arrangement attached to sieve the eggs for uniform distribution on the paper. The whole assembly is mounted on a frame which has a cutter attached to it for cutting the paper into strips (egg cards). The sterilization chamber is provided below the panel board of the machine (Fig.1b) to facilitate continuation of eggs in the production process. A 60cm long 30W germicidal lamp fitted onto a grooved iron stand served as the UV source. The stand facilitated the adjustment of the distance between the light source and the egg card tray. Metallic trays of 12x12cm size were used for feeding the egg cards, which move on a rail inside the chamber.

Operation of the machine

When the hand driven pulley is rotated, the paper is carried forward and is pasted with gum oozing through the sponge tongue attached to the bottom slit of the gum vessel. Uniform spreading of gum is achieved as the paper moves below the sealing roller. The shuttling sieve and the hopper formed the egg releasing and spreading units. The hopper is V-shaped with a fine slit, which opens and closes precisely with the help of a plate controlled by a spring-loaded screw. The hopper is mounted on a stand. Below the hopper a reciprocating sieve is provided. When the slit of the hopper opens, the eggs fall through the reciprocating sieve and spread on the moving paper coated with a thin layer of gum. The paper is carried forward and cut into five cm long pieces with the help of the cutter attached at the end.

The output of egg cards per unit time by the machine and the distribution pattern of eggs on the cards were studied and compared with those of the manual method. The number of egg cards (@ 1ml eggs/ card) that can be made per hour was estimated. To study the egg distribution patterns, 20 random samples of 0.25 sq cm were taken from the egg cards and the numbers of eggs were counted under a binocular microscope.

The effect of the UV chamber on egg sterilization was studied by keeping the eggs at 5, 7.5, 10, 12.5 and 15cm away from the light source and exposing them to various time intervals of 1 to 6 minutes. Ten *Corcyra* eggs (0-24 h old) pasted on a 1.5x1.5cm card constituted one replication, and five replications were maintained for each treatment and unexposed eggs were taken as control. After exposure, the eggs were kept at a constant temperature of 25°C and 70 per cent relative humidity and hatching was recorded. The data were analyzed using Analysis of Variance.

RESULTS AND DISCUSSION

In the mechanical method, the quantity of eggs pasted ranged from 8.6 to 11.5ml per minute with an average of 9.97ml, whereas in manual method it was as low as 0.7ml (Table 1). Number of eggs pasted per 0.25sq.cm area varied from 32 to 145 eggs with an average of 73eggs for machine-made cards and the corresponding values for hand-made cards were 118, 45 and 76.6, respectively. Variation in the number of eggs pasted per unit area was slightly higher in the machine -made egg cards compared to hand made cards. Results of the studies on egg sterilization (Table 2) showed that even one minute exposure to the UV light was sufficient to significantly reduce the egg hatching irrespective of the distances from the UV source. The increase in exposure period steadily increased the per cent egg sterilization and complete sterilization was observed when the eggs were exposed for more than five minutes irrespective of the distances from the UV source. Exposing the

Table 1. Comparative performance of mechanized and manual methods of *Corcyra* egg card production

Observation	Egg card making machine			Manual method		
	Max.	Min.	Av.	Max.	Min.	Av.
Quantity of eggs pasted per min (ml)*	11.5	8.6	9.97	0.9	0.5	0.7
No. of egg cards /hour (1ml/card)	690	516	603	54	30	42
No. of eggs**	145	32	73	118	45	76.65

* Average of 10 observations

** Per 0.25 sq cm of the egg card, average of 20 samples

Table 2. Effect of in-built UV chamber on hatching of *Corcyra* eggs

Distance between UV source and eggs (cm)	Exposure period (min)						Mean of distances (cm)	Control
	1	2	3	4	5	6		
	Mean number of hatched eggs							
5.0	0.6	0.0	0.0	0.0	0.0	0.0	9.6	9.6
7.5	2.2	2.0	0.0	0.0	0.0	0.0	8.4	8.4
10.0	2.8	0.0	0.0	0.0	0.0	0.0	9.8	9.8
12.5	4.0	1.2	1.8	0.2	0.0	0.0	9.2	9.2
15.0	3.2	1.4	0.6	0.4	0.0	0.0	9.2	9.2
Mean of exposure period	2.56	0.92	0.48	0.12	0.0	0.0	9.24	

CD ($P<0.05$) for Exposure period = 0.613

CD for Distance = 0.518

eggs for 4 to 5 minutes at 5cm distance from the UV source is recommended. There was no desiccation of eggs and were well accepted by *Trichogramma* females. Further refinements in the egg dispensing mechanism of the egg card making machine is required to improve the uniformity of distribution of eggs. However, the higher turn out of egg cards (603cards/h) and the low exposure time for complete sterilization of the eggs on the in-built chamber make the machine ideal for bio-factories to maximise the production of the bioagents at cheaper rate. The total cost of fabrication of the machine works out to be about Rs. 20,000.

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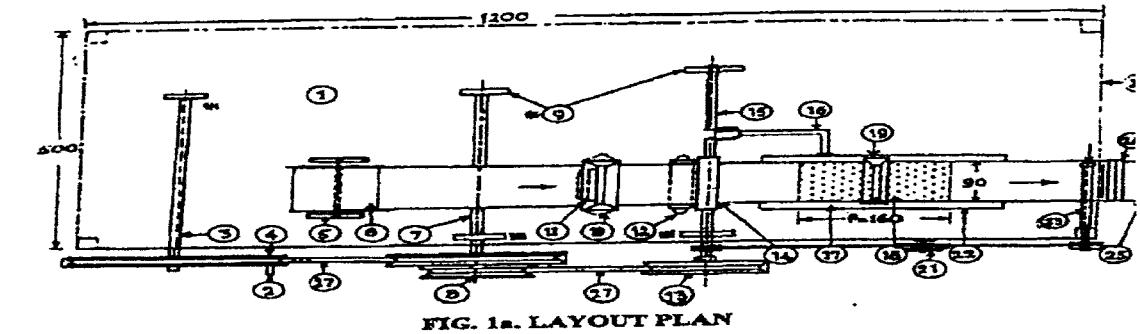

FIG. 1a. LAYOUT PLAN

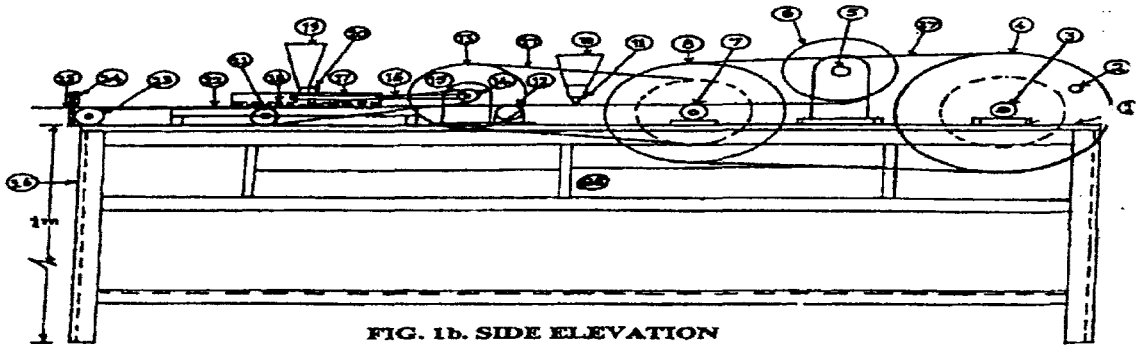

FIG. 1b. SIDE ELEVATION

1. Panel board
2. Pulley Handle
3. Pulley shaft
4. V-pulley
5. Paper roll stand
6. Paper roll
7. Step pulley shaft
8. Step Pulley
9. Ball bearings
10. Gum vessel
11. Sponge
12. Sealing roller
13. Propelling pulley
14. Propelling roller
15. Crank shaft
16. Shaking lever
17. Sieve fixing frame
18. Sieve (BSS 34)
19. Hoppwer
20. Egg flow regulator
21. Reduction puller
22. Sizing limiter
23. Forwarding roller
24. Cutter
25. Outgoing strip
26. Iron stand
27. V-belt
28. UV chamber

FIG.1 : CORCYRA EGG CARD MAKING MACHINE

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