;nt. At 7 DAA the per cent reduction of O, PO and MO was 6.46, 3.67 and 1.07 nereas it was 21.78 and 27.29 in monocrotophos d imidacloprid treated plots and 32.44 in iem cake applied plot. At 15 DAA the damage vel was 16.00 to 34.66 in treated plots and e per cent reduction ranged between 6.52 . 50.17.

The low efficacy of the second round spray may be attributed to the following asons: The botanicals could only ward off e pest from nibbling the bark before egg ying and once the pest got entry into the ant the treatments might not be effective. the time the second round of spray was en, almost all the hatched out grubs might ve entered inside the plant making the botanicals effective. It is also surprising that the chemical secticide monocrotophos also could not give ch control. In this period more plants were und wilted due to invasion of root rot fungus r which the botanicals might not be effective. owever the soil application of neem cake minimizes the stem weevil damage (Anon, 1988). The results are in conformity with the earlier findings (Jayaraj *et al.* 2001).

References

Anonymous (1988). In: Advances in management and conservation of soil fauna, Eds. G.K.Veeresh, D. Rajagopal and C.A. Viraktamath.

Gomez, K.A. and Gomez, A.A. (1984). Stantistical procedures for agricultural research. John Wiley and Sons, New York, p.680.

Henderson, C.F. and Tilton, E.V. (1955). Tests with acaricides against the brown wheat mite. *J. Econ. Entomol.* 48: 157-161.

Jayaraj, S., Abdul Razzak, T. and Saminathan, V.R. (2001). Studies on the effect of fortified non-edible oils and seed kernel extracts against cotton stem weevil. Proceedings of the national symposium on pest management strategies: Current trends and future prospects, Entomological research institute, Loyola College, Chennai-600 003.

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esearch Notes

Reproductive strategy of the native oophagus parasitoid, *Trichogramma japonicum* Ashmead (Hymenoptera : Trichogrammatidae) of Andaman Islands

HEEBA, P.K. SINGH AND G. SHYAM PRASAD
Department of Entomology, Central Agricultural Research Institute, Port Blair, A & N Islands.

Trichogramma spp. are proficient egg arasitoids being used globally for the biological ontrol of insect pests, primarily Lepidoterous Stinner *et al.* 1974). The reproductive strategy dopted by the indigenous *Trichogramma japonicum* shmead (Hymenoptera : Trichogrammatidae) as investigated for their exploitation in biological ontrol programs. Potential benefits of the eproductive pattern followed by this parasitoid nd its practical implications are discussed.

T. japonicum was collected from paddy yellow stem borer (*Scirpophaga incertulas*, Pyralidae, Lepidoptera) egg masses in South Andamans. It was mass multiplied in laboratory on factitious host, Rice meal moth, *Corcyra cephalonica* Stainton. Freshly emerged adults of *T. japonicum* $\leq$ 6 hours of age were separated into shell vials (4.4 x 0.5 mm). The walls of the vials were streaked with a 1:1 Honey:

Fig 1. Adult survival percentage based on modes of reproduction

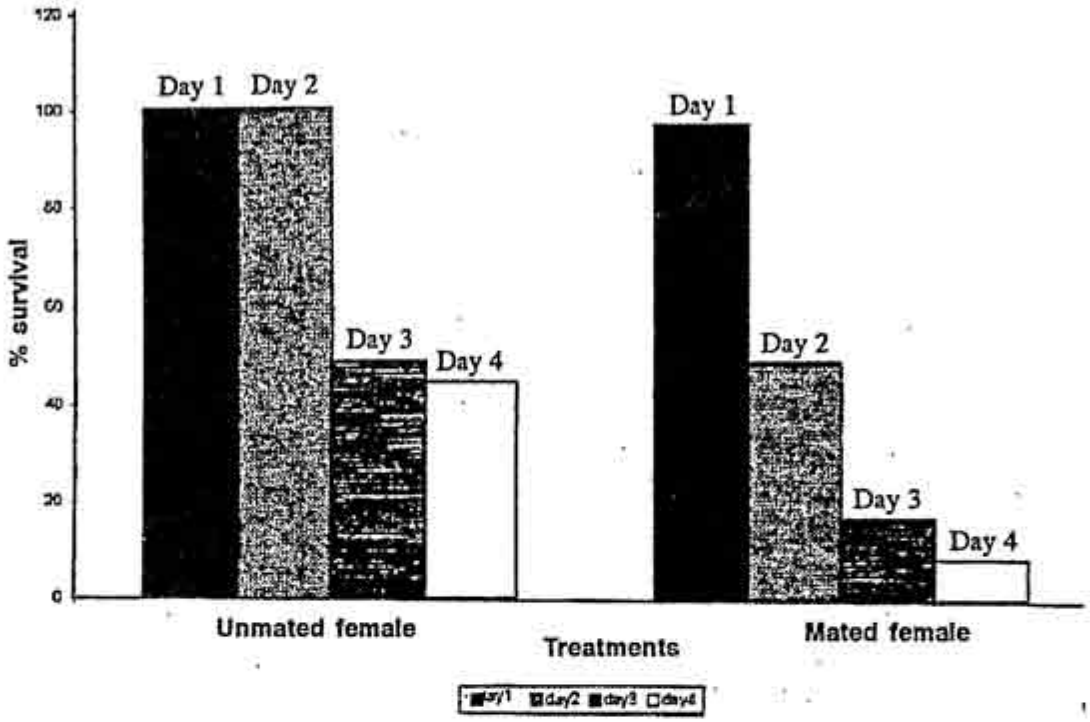
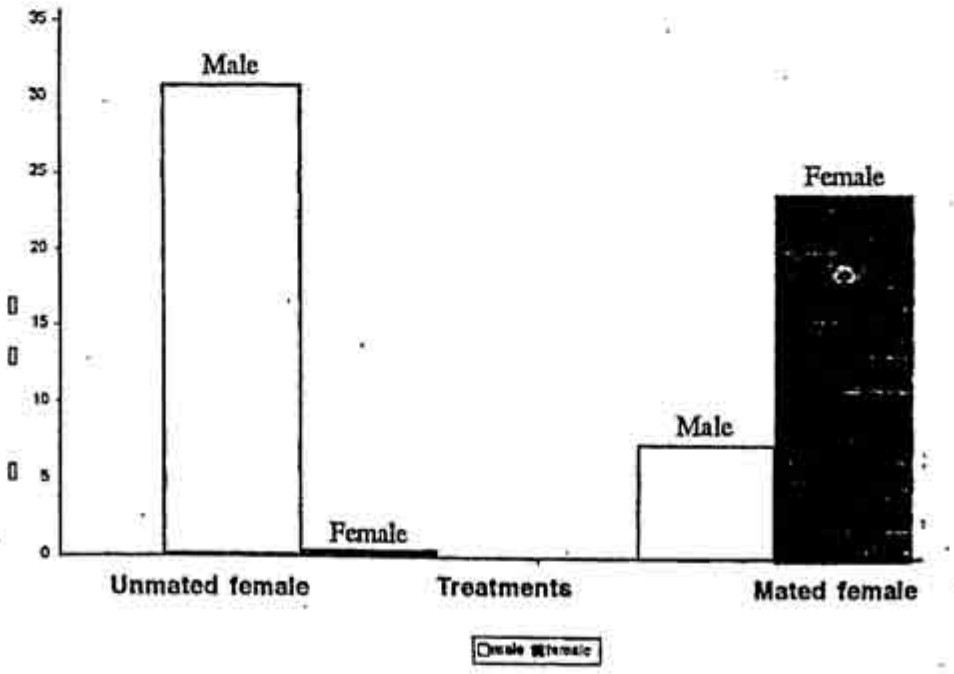


Fig 2. Progeny sex ratio based on modes of reproduction



ater solution. Two sets each were replicated times. First set, paired adults were exposed ultra violet treated (45 min) *C. cephalonica* gs. Second set, unmated (virgin females were gregated and given same number of host gs. Daily observation were made on adult ngevity, survival percentage along with mean cundity and progeny sex ratio. Data was analysed ing CRD and the means compared using LSD.

Studies revealed that *T. japonicum* exhibited rhenotokous mode of reproduction. Asexual rms were also found in predominantly sexual pulations of the field collected *T. japonicum*. was in accordance with the reports given Aeschlimann (1986) and Stouthamer *et al.* 990). It was seen that the asexual females irgin) of *T. japonicum* produced male offsprings clusively. Clausen (1940) also reported that jority of haplodiploid species readily reproduced the laboratory, producing only male progeny. xually multiplying adults showed higher rasitisation rate (34.6 eggs/female) than asexual rms (31.04 eggs/female), but the longevity asexually producing adult Trichogrammatids ere significantly higher than sexually producing nes. For virgin females the average longevity as 2.48 days whereas for mated females only .68 days (Table 1). The survival percentage as highest on the first day, declining later respective of treatments. There was no difference etween treatments but significant difference xisted between days. Virgin females showed 00% survival on first two days, reduced to 4% on 3rd day, 12% on 4th day and nil from 5th day onwards. The data clearly indicates hat mating reduced the survival ability of females Fig. 1). Probably excessive loss of energy during nate searching and copulation could be the eason for such differences. Sexually multiplying emales of *T. japonicum* showed biased progeny ex ratio, 1: 3.3 (Fig.2) i.e. it exhibited higher ate of increase, in response to male progeny y virgin females. Stouthamer (1993) also stated hat arrhenotokous forms exhibited much higher 'killing power' (*i.e.* number of hosts parasitized and a higher rate of increase (i.e. number of daughters produced per mother). Sex ratio adjustment as followed in *T. japonicum* could be used to substantially reduce the cost of parasitoid rearing. Female biased sex ratio will increase the intrinsic rate of increase of the population in culture and thereby the efficiency of production of parasitoids per unit host.

Results indicated that both forms of *T.japonicum* are required for the successful maintenance of their population. Increased number of female broods through sexual reproduction is counter balanced by excessive male broods through asexual reproduction to reduce the allee effect stated by Stouthamer (1993). Individuals with better male searching capacity perpetuates sexually and the virgin females parthenogenetically. Depending on the population, the female *T.japonicum* can alter the brood sex ratio for further perpetuation, has female-biased sex ratios and relatively high intrinsic rate of increase which makes it an efficient parasitoid. These parasitoids can be mass multiplied and used further in biological control programmes.

Table 1. Average fecundity and longevity of *Trichogramma japonicum*

Modes of reproduction	Mean fecundity	Mean longevity
Asexual females	31.04b	2.48a
Sexual females	34.6a	1.68b

Means followed by the same letter are not significantly different from each other by LSD (0.05%)

References

Aeschlimann, J.P. (1986). Distribution and effectiveness of *Anaphes diana*, a parasitoid of *Sitona* spp. Eggs in the Mediterranean region. *Entomophaga*, **31**: 163-172.

Clausen, C.P. (1940). Entomophagous insects, McGraw-Hill, New York, 688 pp.

Stinner, R.E., Ridway, R.L., Coppedge, J.R., Morrison, R.K. and Dicerson, W.A. (1974). *Parasitism of Heliothis* eggs after field releases of *Trichogramma pretiosum* in cotton. *Environ. Entomol.* **3**: 497-500.

Stouthamer, R. (1993). The use of sexual versus asexual wasps in biological control. *Entomophaga*, 38: 3-6.

Stouthamer, R., Pinto, J.D., Platner, G.R. and Luck, R.F. (1990). Taxonomic status of thelytokous forms of *Trichogramma*. *Ann. Entomol. Soc Amer.* 83: 475-581.

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Research Notes

Root activity pattern of *Gliricidia sepium* (Jacq.) using tracer techniques

A. RAJARAJAN AND J. BALAMURUGAN
Radioisotpe (Tracer) Laboratory, Tamil Nadu Agricultural University, Coimbatore-641 003, Tamil Nadu.

Roots anchor the tree and absorb and transport water and nutrients to the above ground parts. They influence soil profile development and, upon drying, roots contribute to soil organic matter.

Though the extent and gross morphology of root system of a few tree species have been described (Friend *et al.* 1991) information on roots of tree crops is generally scanty because of the great difficulties encountered in extracting these large underground organs without destroying or modifying them (Vose, 1980). However, with radioactive tracers, it has been possible to precisely determine the extent of root activity pattern of tree crops without actually having to excavate the roots (IAEA, 1975).

Gliricidia sepium is a small, elegant and quick growing tree with arching branches and feathery foliage. It is strikingly beautiful in bloom when its branches for the greater part of their length are covered with masses of pinkish purple or pale pink flowers. The flowers grow in clusters. The rapid growth of the tree and its long leafy branches recommend it as a useful shade tree for crops and for green manuring. The whole tree is rich in nitrogen. Using the radiotracer ^{32}P, the root activity of *Gliricidia* was studied.

The experiment was conducted during June, 1999 at Forest College and Research Institute, Mettupalayam, Coimbatore district, Tamil Nadu. The trees in the plantation had been raised at an espacement of 2m x 2m. The soil in the experimental site was red sandy loam type. The important characteristics of soil are furnished in Table 1.

Single trees were used as experimental units. The trees selected were 3 years old and had uniform vegetative characteristics (girth and foliage). Four untreated guard trees surrounded each experimental tree. Calculated quantity of ^{32}P orthophosphoric acid was mixed with requied quantity of the filler activated clay, dried, ground to a fine powder and filled in gelatin capsules at the rate of 250 mg per capsule. Each capsule carried on activity 18.5 MBq. These capsules were then placed in soil using an auger to bore holes at three radial distances (25, 50 and 75 cm) from the base of the tree and at four vertical depths (30, 60, 90 and 120 cm) from soil surface. Twenty four trees were thus tagged, representing 12 treatment combinations of lateral distances and vertical depths, each replicated twice. For each factorial combination of lateral distance and vertical distance, the capsules were placed at 8 equidistant holes around the tree, such that the total radioactivity applied for tree was 148 MBq.