Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2019; 7(2): 338-341

Received: 18-01-2019
Accepted: 21-02-2019

Rajeev Ranjan
Department of Entomology
Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar, India

U Mukherjee
Department of Entomology
Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar, India

Vijay Kumar
Department of Entomology
Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar, India

Correspondence
Rajeev Ranjan
Department of Entomology
Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar, India

Bio-rational approaches to manage major pests of litchi (*Litchi chinensis* Sonn.)

Rajeev Ranjan, U Mukherjee and Vijay Kumar

Abstract
The comparative field efficacy of pest management approaches consisting of bio – pesticides, organic manures and other components of bio-rational approaches were evaluated against major pests (Litchi fruit borer, Litchi mite and Litchi leaf roller) of litchi. Spraying of natural pesticide, spinosad 45 SC (0.045%) twice at flush stage and fruit colour break stage along with the application of plant nutrients through complete organic sources (100%) afforded maximum protection to the litchi trees from the pests recording lowest leaf infestation (5.10 per cent) due to litchi mite (*A. litchii*), fruit damage (6.30 per cent) due to litchi fruit borer, *C. cramerella*, leaf infestation (8.60 per cent) due to litchi leaf roller, *D. aprobola* and the maximum marketable fruit yield (126.80 kg / tree). The NSKE (4%) also provided protection to the litchi trees from the pest menace recording 8.00 per cent leaf infestation due to litchi mite, 9.50 per cent fruit damage due to litchi fruit borer, 12.80 per cent leaf infestation due to litchi leaf roller and fruit yield 121.20 kg per tree during the years 2012 and 2013. These pest management modules were cost effective also particularly, organic protection modules with NSKE (C / B = 1: 9.9) and spinosad (C / B = 1: 10.2).

Keywords: Litchi (*Litchi chinensis* Sonnerat), Litchi shoot and fruit borer (*Conpomorpha cramerella* Snellen)), Litchi mite (*Aceria litchii* Keifer), Litchi leaf roller (*Dudua aprobola* Meyrick), Bio-rational management

1. Introduction
Litchi (*Litchi chinensis* Sonnerat) has been acknowledged as one of the most precious fruits of the world. India is the second largest producer of litchi after China. Litchi fruit crop is attacked by several insect pests and mite during its life but litchi fruit borer (*Conopomorpha cramerella* Snellen), litchi mite (*Aceria litchii* Keifer) and litchi leaf roller (*Dudua aprobola* Meyrick) have been identified as the major threat to litchi production [1-3].
The litchi erineum mite is one of the most destructive pests of litchi in all litchi producing countries of the world. As a result of its feeding, under surface of the infested leaves show abnormal growth of epidermal cells in the form of hair – like velvety growth of chocolate brown colour [4]. The litchi fruit borer (*Conopomorpha cramerella* Snellen) causes severe damage to litchi fruits and leaves [3, 5]. The pest has now established itself as one of the major pests of litchi in India particularly in Bihar and Uttar Pradesh. The newly hatched larvae of litchi fruit borer mine into the newly emerged litchi leaves as leaf miner and then make a tunnel inside the tender shoots and when fruits appear during April – May, the larvae bore into the fruits and feed on their pulp. Infested fruits become unfit for domestic consumption as well as export, resulting in severe losses [2, 5]. Litchi leaf roller, *Platypeplus aprobola* (Meyerick) causing severe damage to litchi foliage [6]. The leaf injured by the leaf roller varies between 16.70 to 71.60 per cent while tree infestation varies from 12.88 to 53.54 per cent during August to February [6]. The litchi fruits are mostly consumed in raw conditions, they are more vulnerable to contamination with plant protection chemicals. The present study was mainly undertaken to explore the possibilities of bio-rational approaches to manage the major pests of litchi under organic fruit production umbrella to promote the activities of natural enemies of these pests and the pollinators associated with this crop, mainly the honey bees [1, 2, 7, 8] as they are very sensitive to chemical pesticides.

2. Materials and Methods
In order to evaluate the pest management strategies, field trial was conducted at the Dr. RPCAU Research Farm of Birauli (Samastipur), Bihar during 2012 to 2013.

The experiment was laid out in randomized block design with litchi cultivar cv. Shahi. The planting distance between two trees was kept at 10 x 10 meters. The pruning and destruction of the infested leaves and shoots by burning were done during the months of June and November. The cakes (Castor and Neem) were applied to the root zones at their respective doses, just after the first shower of rains in the first fortnight of the July in both the years. The nutrients were applied to the trees at their respective doses in the first fortnight of July. The sources of NPK supplied through in organic fertilizers were Urea, Single super phosphate and Muriate of potash. The organic sources of nutrients were farm yard manure ((FYM), poultry manures, vermi-compost and neem cake. All the fertilizers and manures were applied in rings prepared at a distance of 1 to 2 meters from the main trunk of the tree depending on the spread of the tree canopy. The rings were of 30 cm width and 15 cm depth and after application of fertilizers and manures, these rings were closed with soil.

The neem seed kernel extract (NSKE 4%) were prepared freshly by dissolving 400 gm of ground powder of well dried (up to 8 – 10% moisture) neem seeds in 10 litres of water. The seed powder was tied in a cloth immersed in water overnight and stirred well to make a ready to spray suspension.. All the bio-pesticides were sprayed twice at the time of emergence of new flushes (September – October) and at the time of fruit colour break stage at their respective doses. The NSKE preparation was sprayed fresh while commercial formulations were used for Neem oil, *Verticillium lecanii*, an entomopathogenic fungal formulation and spinosad, a fermented product of soil bacterium, *Saccharopolyspora spinosa*. After the application of treatments, observations on orchard to suppress the pest population. After the application of treatments 10 twigs were randomly collected from all the directions of the tree to work out the mean percent leaf infestation to evaluate the impacts of the treatments / pesticides on the pest incidence and 50 fruits were collected randomly from the tree to record the mean per cent fruit infestation for both the years and finally these data were analyzed statistically under RBD design. At the time of fruit harvest, fruit yield (kg / tree) was worked out for both the years.

3. Results and Discussion

Organic farming has become popular with growing global demand for organic products. Litchi fruits are tender and juicy and are more vulnerable to contamination with chemicals due to their residual toxicity. There was a need to test the effectiveness organic components with bio pesticides against the pest activities and also its impact on fruit yield to achieve sustainable productivity with minimum deleterious effects of chemical fertilizers on soil health and the environment. Therefore present investigation was undertaken. When these components along with certain bio-pesticides were tested against the major pests of litchi, significant results were obtained.

The data pertaining to the field efficacy of different organic protection modules against major pests of litchi reveal that spraying of natural pesticide, spinosad 45 SC (0.045%) twice at flush stage and fruit colour break stage along with the application of plant nutrients through complete organic sources (100%) afforded maximum protection to the litchi trees recording lowest leaf infestation (5.10 per cent) due to litchi mite (*A. litchii*), 6.30 per cent fruit damage due to litchi fruit borer, *C. cramerella*, 8.60 per cent leaf infestation due to litchi leaf roller, *D. aprobola* and the maximum fruit yield (126.80 kg / tree). The spraying of NSKE (4%) recorded 8.00 per cent leaf infestation due to litchi mite, 9.50 per cent fruit damage due to litchi fruit borer, 12.80 per cent leaf infestation due to litchi leaf roller and fruit yield 121.20 kg per tree. The other treatments, spraying of neem oil (0.2%) recorded 10.80 per cent leaf infestation due to mite, 12.50 per cent fruit damage due to fruit borer, 13.80 per cent leaf infestation due to leaf roller and 114.80 kg fruit yield per tree while spraying of *Verticillium lecanii* formulation (2 g / lt. of water) recorded leaf infestation 11.90 per cent, fruit damage 14.80 per cent, leaf damage 15.20 per cent and the fruit yield 107.70 kg per tree (Table 1 and Fig. 1). The application of organic manures alone (without pesticides) was also found superior over the RDF (Control) recording 26.40 per cent leaf infestation due to mite, 22.30 per cent fruit damage due to fruit borer, 23.30 per cent leaf damage due to leaf roller and the fruit yield 98.50 kg per tree. Even the combination of RDF with pruning of infested twigs proved superior (34.80 per cent leaf damage, 32.20 per cent fruit damage and 27.90 per cent leaf damage) over control (56.00 per cent leaf damage, 46.50 per cent fruit damage and 44.30 per cent leaf infestation) but the fruit yield of these modules did not differed significantly (Table 1). Though, all the test modules were varied significantly but the interaction of year and treatments were statistically non significant (Table 1). These modules were also found cost effective particularly, organic protection modules with NSKE (C / B = 1: 9.9) and spinosad (C / B = 1:10.2) (Table 1). The significant reduction in the pest incidence and fruit yield under the protection umbrella of organic farming might be due to significant effects of soil fauna on the nutrient dynamics of ecosystem (Kumar, 2007; Moore *et al*., 1988 and Tripathi *et al*., 2003) [9-11]. The organic farming also enhance the activity of AM (Aubuscular mychorrhyza) fungi associated with litchi plants which is reported to increase the nutrient level of the plants and provide protection to the plants by releasing certain allelochemicals particularly phenolics and terpenoids (Maier *et al*.,1995; Ray and Ranjan. 1999) [12, 13]. Lavie (1967) [14] found that the insecticidal components of the neem cake (Maliantriol and azadirachtin) have the systemic action thereby protect the complete tree. Several attempts were made earlier using cakes and neem products against the incidence of litchi mite, fruit borer and leaf roller (Mallik and Vaidya, 1979; Mukherjee *et al.*, 2007; Ranjan *et al.*, 2003 and Ranjan *et al*., 2011) [15-18] but no attempts were seems to be made under the umbrella of complete (100%) organic production system against the pests. Thus the present study would definitely enhance the effectiveness of natural enemies and keep the pest population below injury levels maintaining quality environments for other organisms.

Table 1: Effect of organic protection approaches against major pests of litchi and fruit yield during 2012 and 2013 (Pooled)

Treatments		Mean % leaf infestation due to *A. litchii*	Mean % fruit infestation due to *C. cramerella*	Mean % leaf infestation due to *D. aprobola*	Yield (kg / tree)	Cost : Benefit
T_1	RDF + Pruning & destruction of all the affected twigs / leaves by burning during June and November	34.80 (35.90)	32.20 (29.50)	27.90 (31.30)	81.70	1:5.9
T_2	Organic manuring using 100% plant nutrients through different organic sources + Pruning & destruction of all the affected twigs / leaves by burning during June and November	26.40 (30.60)	22.30 (28.00)	23.30 (28.60)	98.50	1:9.9
T_3	T_2 + spraying of NSKE (4%) at flush stage (Sept - Oct) and at fruit colour break stage	8.00 (15.90)	9.50 (17.90)	12.80 (20.60)	121.20	1:10.2
T_4	T_2 + spraying of neem oil (0.2%) at flush stage (Sept - Oct) and at fruit colour break stage	10.80 (18.70)	12.50 (20.50)	13.80 (21.40)	114.80	1:8
T_5	T_2 + spraying of *Verticillium lecanii* formulation (2 x 10^8 c.f.u /g) @ 2 g / I of water at flush and at fruit colour break stage	11.90 (19.60)	14.80 (22.50)	15.20 (22.50)	107.70	1:5.8
T_6	T_2 + spraying of spinosad 45 SC (0.045%) at flush stage (Sept - Oct) and at fruit colour beak stage	5.10 (13.40)	6.30 (14.40)	8.60 (16.50)	126.80	1:8.9
T_7	RDF (Control)	56.00 (48.40)	46.50 (43.00)	44.30 (41.60)	70.90	-
CD (P = 0.05)		(6.98)	(7.24)	(7.07)	21.32	-
CV		(13.21)	(14.16)	(13.41)	10.12	-
Year x Treatment		NS	NS	NS	NS	-

Values in parenthesis ( ) are angular values, RDF (1000 g N, 500 g P_2O_5 and 500 g K_2 O)

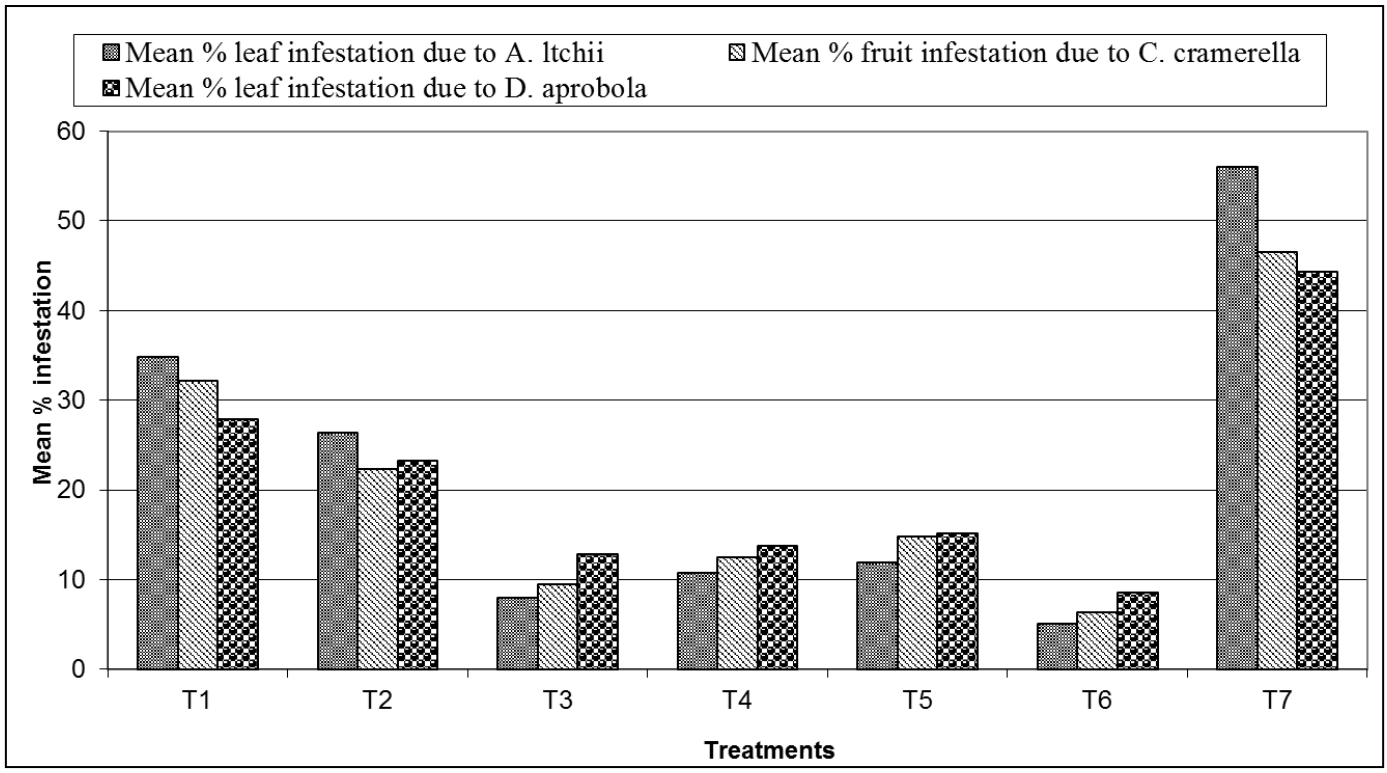

Fig 1: Effect of organic protection approaches against major pests of litchi during 2012 -13.

4. Conclusion

These pest management approaches could be more cost effective as the one or two year time is not enough for the organic treatments to produce better results. The pest management strategy through the organic production system would not only afford protection from the pest attack but also produce quality fruits maintaining quality environment. It is obvious that the findings of this study would provide opportunities to growers to produce quality fruits under the umbrella of organic fruit production technology. It provides opportunities to exporters to fetch more money by sending their quality products to international markets.

5. Acknowledgement

The research findings are the part of the research work of Ph.D Programme of the first author submitted to the Department of Entomology, Dr. Rajendra Prasad Central Agricultural University (Erstwhile. RAU, Pusa), Pusa, Samastipur, Bihar, India.

6. References

1. Hameed SF, Sharma DD, Agrawal ML. Integrated pest management in litchi. Proceedings of National Seminar on Recent Development in Litchi production held at RA.U, Pusa, 1992, 38.
2. Hameed SF, Sharma DD, Agarwal ML. Studies on the

management of litchi pests in Bihar. R.AU Journal of Research. 1999; 9(1):41-44.
3. Singh HS, Rai Mathura, Nath Vishal. Status and Management of Insect Pests and Mites In: litchi, Genetic Resources, Production, Protection and Post harvest management (eds.) Mathura Rai, Vishal Nath and Pradip Dey. 2001, 73-80
4. Lall BS, Rahman MF. Studies on the bionomics and control of Erionose mite, *Eriophyes litchii* Keifer, Acarina: Eriophyidae, Pesticides. 1975; 9(11):49-54.
5. Lall BS, Sharma DD. Studies on the bionomics and control of the cacoa moth, *Acrocercops cramerella* Snellen Lepidoptera: Gracillariidae. Pesticides. 1978; 12(12):40-42.
6. Lall BS, Mallik SN. Bionomics and control of litchi leaf roller (*Platypepla aprobola* Meyrick) Lepidoptera: Tortricidae. Proceedings of the National Academy of Sciences. India, 1976, 22-23.
7. Badiyala SD, Garg R. Studies on the pollination and fruit production by *Apis mellifera* L. In seven cultivars of litchi (*Litchi chinensis* Sonn.). Indian Bee Journal. 1990; 52:28-30.
8. Lew AF. Organic Lychee and Rambutan production. Acta Horticulture. 2005; 665:241-248.
9. Kumar Manoj. Yield and fruit quality of litchi (*Litchi chinensis* Sonn.) under organic and in organic farming systems, M.Sc. Thesis (Horticulture: Pomology). RAU, Pusa, Bihar, 2007.
10. Moore JC, Walter DE, Hunt HW. Arthropods regulation of micro and meso-biota in below ground detrital food webs. Annual Review of Entomology. 1988; 33:419-439
11. Tripathi G, Sharma BM. Impact of land use practices on faunal abundance, nutrient dynamics and biochemical properties of desert pedoeco-system Environmental Technology. 2005; 26:1205-1215.
12. Maier W, Peipp H, Schmidt J, Wray V, Strack D. Levels of a terpenoid glycoside and cell wall bound phenolics in some mycorrhizas. Pl. Physiol. 1995; 109:465-470.
13. Ray PK, Ranjan Rajeev. Litchi ke liye gunkari mikoraija. Fal ful, 1999, 4-5.
14. Lavie D, Jain MK. Antifeedant property of Neem Kernel (*Melia azadirachta* L). Journal of Chem. Comm. 1967, 910:278
15. Mallik SN, Vaidya SN. Effect of Certain insecticides and manures against incidence of *Argyroploce leucaspts* Meyer (Eucosmidae: Lepidoptera). Pesticides. 1979; 13(6):32 - 34.
16. Mukherjee U, Ranjan Rajeev, Ray PK, Kumar Rakesh. Ecofriendly approaches to manage litchi mtie, *Aceria litchii* Keifer in Bihar. Indian Journal of Horticulture. 2007; 64(2):319-221.
17. Ranjan R, Singh PP. Field efficacy of insecticides and plant products against litchi fruit borer. Proceedings of National Symposium on Frontier Areas of Entomological Research held at IARI, Pusa, New Delhi from 5 – 7 Nov. 2003; 63:105.
18. Ranjan Rajeev, Kumar Rakesh, Mukherjee U, Kumar Arun. Efficacy of some phytoproducts and eco-friendly acaricides against litchi mite, *Aceria litchii* Keifer, in Bihar. Proceedings of International Conference on Managing Sustainable Development of Rural Economy and Agri. Business, held at BHU, Varanasi on, 2011, 59.