International Journal of Science, Environment and Technology, Vol. 4, No 5, 2015, 1296 – 1300

ISSN 2278-3687 (O)
2277-663X (P)

# IMPACT OF SPRAY OF DICHLOROVOS AND DIMETHOATE ON POPULATION BUILD-UP OF PAPAYA MEALYBUG, *PARACOCCUS MARGINATUS* AND ITS PARASITOID, *ACEROPHAGUS PAPAYAE* IN MULBERRY ECOSYSTEM

***N. Sakthivel[1], Y. Humayun Sharief[2], T. Sivasubramonian[3] and V.Sivaprasad[4]**
[1]Research Extension Centre, Central Silk Board (CSB), Srivilliputtur – 626 125, Tamil Nadu, India
[2]Research Extension Centre, CSB, Samayanallur – 625 402, India
[3] Research Extension Centre (Sub-Unit), CSB, Berigai – 635 105, India
[4]Central Sericultural Research and Training Institute, Mysore – 570 008, India
Emails: [1]sakthivelcsb@hotmail.com (**Corresponding Author*), [2]sheriefcsb@gmail.com, [3]sivasubramonian@gmail.com, [4]siva.nsso@gmail.com

**Abstract:** The effect of application of dichlorovos and dimethoate, the commonly used insecticides in mulberry garden, on the parasitoid (*Acerophagus papayae*) of papaya mealybug, *Paracoccus marginatus* was studied. There was a constant reduction in the population of papaya mealy bug in untreated plots corresponding to increase in percent parasitism by *A. papayae*. But, all the treatments exhibited significant adverse effect on the parasitization and the mean values indicated that the adverse impact on parasitoid was highly pronounced with 80.8% reduction in parasitism in the plots treated twice with dimethoate at 10 days interval followed by dichlorovos and dimethoate (73.7%), dimethoate and dichlorovos (68.0%), twice with dichlorovos (62.1%), single spray of dimethoate (59.6%) and single spray of dichlorovos (43.5%) which resulted to remarkable increase in the population of papaya mealybug in the treated plots (27.8 – 42.5%) over control.
**Keywords:** Dichlorovos, dimethoate, mulberry, *Paracoccus marginatus*, *Acerophagus papaya.*

## INTRODUCTION

The papaya mealybug, *Paracoccus marginatus* Williams and Granara de Willink (Hemiptera: Pseudococcidae), native to Mexico and / or Central America was described first in 1992 (Williams and Granara de Willink, 1992). Spread of this invasive pest was reported in series of countries *viz*. Virgin Islands Dominican Republic, French Guyana, Cuba, Puerto Rico, Guam, Palau, Hawaii *etc.* in last two decades. However, it's entry in Indonesia, India, Sri Lanka, Thailand, Bangladesh and Maldives was recorded during 2008-2009. In India, outbreak of papaya mealybug was recorded over 84 plant species including agricultural and horticultural crops, trees, ornamental plants and weed species during 2009-2010 (Selvaraju

*Received Aug 13, 2015 * Published Oct 2, 2015 * www.ijset.net*

and Sakthivel, 2011). Intensive damage of this pest on mulberry, the food plant of silkworm posed serious threat to sericulture industry (Sakthivel *et al*., 2012).

Since the pest was a stranger to India, the farmers in turn applied the chemical control measures with different insecticides at initial stage of its spread to protect their crops, in the absence of appropriate IPM packages. But this practice did not yield any success due to presence of thick protective waxy coating over the body, wider host range of the pest and resistance to the chemical insecticides. The pest was successfully managed only by classical biological control with vital role of the effective exotic encyrtid parasitic wasp, *Acerophagus papayae*. However, the farmers are invariably in practice to spray chemicals in mulberry field to control other major pests. An investigation was thus undertaken to find out the impact of these chemical pest management practices on the field proliferation of the parasitoid and population build-up of papaya mealybug.

## MATERIALS AND METHODS

The experiments were conducted in the five potential sericulture clusters in Srivilliputtur, Virudunagar district of Tamil Nadu, India during March- August 2013 in three consequent crops on V1 mulberry variety cultivated under irrigated conditions. The crop was maintained by following standard agronomic practices. The insecticides, dichlorovos and dimethoate recommended commonly against mulberry pests and invariably used by the farmers were selected for the study. Randomized block design was followed with seven treatments and was replicated thrice. Each plot measured 7.3 X 3.6 m with 42 mulberry bushes in a paired row *i.e.* (5'+3') X 2' spacing system. One row in between each plot was kept as a barrier of drift. The treatments comprised of $T_1$ Single spray of dichlorovos, $T_2$ Single spray of dimethoate, $T_3$ two sprays of dichlorovos, $T_4$ dichlorovos followed by dimethoate, $T_5$ two sprays of dimethoate and $T_6$ dimethoate followed by dichlorovos and $T_7$ =water spray as control. The first spray was undertaken 15$^{th}$ day after pruning (DAP) of the plant and second at an interval of 10 days using a knapsack sprayer.

The stock culture of *A. papayae* received from National Bureau of Agriculturally Important Insects, Bangalore, India were mass multiplied at Research Extension Center, Central Silk Board, Srivilliputtur and released in each experimental site at the rate of 200 pairs per site, a week (8DAP) before commencement of first spray. Pre-treatment count on the population of PMB as well as the parasitization was done a day prior to spray (14 DAP) as well as post treatment counts at 20, 30, 45 & 60 DAP by fixed plot method. Random samples were taken from 30 plants per location and the population of the pest was recorded from 10 cm twig portions using hand lens**.** Simultaneously mummies with and without exit holes were also counted and the percent parasitism as well as percent reduction or increase of PMB population were worked out. The experimental results obtained were evaluated by analysis of variance (ANOVA) at 5% level of significance.

**RESULTS AND DISCUSSION**

The results revealed that there was a constant reduction in the population of papaya mealy bug from 20-60 DAP corresponding to increase in percent parasitism by *A. papayae* in untreated control plots and the population was markedly reduced (1.17) at 60 DAP wherein highest parasitism (66.63%) recorded. But, all the treatments exhibited significant adverse effect on the parasitization and the mean values indicated that the adverse impact on parasitoid was highly pronounced with 80.8% reduction in parasitism in the plots treated twice with dimethoate ($T_5$) followed by T4, dichlorovos and dimethoate (73.7%), $T_{6,}$ dimethoate and dichlorovos (68.0%), $T_{3,}$ twice with dichlorovos (62.1%), $T_2$, single spray of dimethoate (59.6%) and $T_{1,}$ single spray of dichlorovos (43.5%) which resulted to remarkable increase in the population of papaya mealybug (27.8–42.5%) over control. Similarly, Sakthivel *et al.* (2011) reported drastic reduction in the population of predatory coccinellids and spiders in the mulberry garden treated with dichlorovos and dimethoate.

The chemical insecticides were reported to be partially effective against papaya mealybug due to presence of thick protective waxy coating over the body and development of resistance. At the same time the natural enemy complex is affected in a greater extent due to their high sensitivity (Muniappan *et al*., 2006 and Sakthivel *et al*., 2012). Though dichlorovos exhibits low persistency in the field, its fumigant and penetrant action might have caused knockdown effect to the adult parasitoids in the field and resulted to drastic reduction in their population immediately after spray (Sakthivel and Qadri, 2010). Dimethoate is a broad spectrum insecticide having contact cum systemic action could cause mortality in adults directly and the lethal and sub-lethal doses of the chemicals in the nymphs of papaya mealybug could have prevented their multiplication. In the present study the adverse impact was more spelled in dimethoate treated plats compared to dichlorovos.

Thus, it could be concluded that all the chemical treatments in the mulberry garden indirectly induce the population built-up of papaya mealybug with deleterious effect on it’s active parasitoid. Therefore, applications of chemical insecticides need to be avoided in mulberry ecosystem for field proliferation of *A. papayae* in order to keep the population of papaya mealybug subsided. Use of eco-friendly pest management practices *viz.* biological control, use of botanical pesticides, water jetting (Sakthivel *et al*., 2011), traps *etc,* against other major pest could help to prevent outbreak of papaya mealybug in mulberry garden.

**REFERENCES**

[1] Muniappan R., Meyerdirk, D.E., Sengebau, F.M., Berringer, D.D., Reddy, G.V.P. (2006) Classical biological control of the papaya mealybug, *Paracoccus marginatus* (Hemiptera: Pseudococcidae) in the Republic of Palau. *Florida Entomologist*, **89**(2), 212 -217.

[2] Sakthivel, N., Balakrishna, R., Qadri, S.M.H. (2011) Comparative efficacy of water jetting and chemical measures against major sucking pests of mulberry and their safety to natural enemies. *Journal of Biopesticides*, **4** (2), 219-230.

[3] Sakthivel, N., Qadri, S.M.H. (2010) Impact of insecticides and botanicals on population build-up of predatory coccinellids in mulberry, *Journal of Biopesticides*, **3**(1), 85-87.

[4] Sakthivel, N., Qadri, S.M.H., Balakrishna, R., Kirsur, M.V., Helen, S.M. (2012) Management Strategies of Papaya Mealybug Infesting Mulberry, Technical Bulletin, January 2012, Regional Sericultural Research Station, Central Silk Board, Government of India, Salem – 636 003, Tamil Nadu, India, pp. 2-4**.**

[5] Selvaraju, N.G., Sakthivel, N. (2011) Host plants of papaya mealybug (*Paracoccus marginatus* Williams and Granara de Willink.) in Tamil Nadu. *Karnataka Journal of Agricultural Sciences*, 24(4), 567-569.

[6] Williams, D. J., Granara de Willink, M.C. (1992) Mealybugs of Central and South America. CAB International, Wallingford, England.635 pp.

**Table: 1 Effect of insecticides on the population built-up papaya mealybug and parasitization in mulberry garden**

| Treatment | PTC (14DAP) | | 20DAP | | 30DAP | | 45DAP | | 60DAP | | Mean | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | POP | PAR | POP | PAR | POP | PAR | POP | PAR | POP | PAR | POP | PAR |
| $T_1$ Dichlorovos –I | 30.18 | 22.13 | 21.33 (7.9) | 6.76 (-79.0) | 15.00 (42.6) | 18.55 (-61.0) | 8.49 (38.5) | 33.33 (-47.2) | 3.12 (166.6) | 59.83 (10.2) | **12.0** (27.8) | **29.61** (-43.5) |
| $T_2$ Dimethoate -I | 29.77 | 21.65 | 16.90 (-14.5) | 0.68 (-97.9) | 17.23 (63.8) | 9.17 (-80.7) | 10.15 (65.6) | 29.12 (-53.8) | 5.97 (522.8) | 45.65 (31.4) | **12.56** (33.7) | **21.15** (-59.6) |
| $T_3$ Dichlorovos -I Dichlorovos -II | 27.90 | 22.70 | 20.95 (6.0) | 5.42 (-83.2) | 13.28 (26.2) | 7.18 (-84.9) | 10.90 (77.8) | 28.65 (-54.6) | 6.00 (412.8) | 38.12 (42.78) | **12.78** (36.1) | **19.84** (-62.1) |
| $T_4$ Dichlorovos -I Dimethoate -II | 30.56 | 21.67 | 21.16 (7.1) | 5.87 (-81.8) | 9.23 (-12.3) | 1.23 (-97.4) | 12.38 (102.0) | 18.66 (-70.4) | 9.63 (723.0) | 29.31 (56.0) | **13.10** (42.5) | **13.76** (-73.7) |
| $T_5$ Dimethoate -I Dimethoate -II | 29.00 | 24.09 | 15.92 (-19.4) | 1.33 (-95.8) | 8.35 (-20.6) | 0.86 (-98.2) | 17.50 (185.5) | 12.00 (-81.0) | 11.66 (891.4) | 26.07 (60.8) | **13.35** (42.1) | **10.06** (-80.8) |
| $T_6$ Dimethoate -I Dichlorovos -II | 28.88 | 23.86 | 16.15 (-18.2) | 0.94 (-97.0) | 12.74 (21.1) | 5.30 (-88.8) | 12.35 (101.5) | 27.06 (-57.1) | 7.43 (535.0) | 33.78 (49.3) | **12.16** (29.5) | **16.77** (-68.00) |
| $T_7$ Control (Water spray) | 28.35 | 23.30 | 19.76 | 32.28 | 10.52 | 47.60 | 6.13 | 63.15 | 1.17 | 66.63 | **9.39** | **52.41** |
| CD @ 5% level | 1.08 | 0.96 | 0.23 | 0.17 | 0.22 | 0.10 | 0.12 | 0.80 | 0.09 | 1.19 | 0.13 | 0.11 |

DAP: Days after pruning, POP: population of PMB, PAR: Parasitization
Figures in the parenthesis are percent reduction (-) or increase (+) over control