

# IPM FOR SMALL SCALE CHILLI FARMERS: NATURE OF LEAF CURL AND ITS CONTROL WITH REDUCED INSECTICIDE APPLICATIONS

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In chilli cultivation irrational use of insecticides against chilli leaf curl results in low profits or economic losses from spraying as well as increasing the likelihood of negative environmental effects. Survey on farmer's insecticide use on chilli in Mahaweli H area reveals that the average farmer uses about 20 sprayings per crop to control leaf curl.

Chilli leaf curl can be caused by the direct feeding of thrips (Johnpulle, 1939) and mites or viruses transmitted by aphids and whitefly (Peiris, 1944; Peiris, 1953). However, under hot weather conditions prevailing in *yala* seasons in the dry zone mite populations do not build up to epidemic levels. There is little evidence to prove that the viruses transmitted by whitefly and aphids are of great economic importance in the context of yield losses. Thus thrips are considered the most important component of this disorder. Leaf curl induced by thrips is not new to chilli farmers. Sri Lankan farmers had

to contend with this problem since chilli cultivation virtually began about 60 - 70 years ago (Park and Fernando, 1938). However, the economic importance of this problem changed radically over the last few years with heavy outbreaks during *yala* seasons leading to total crop failures. Today the insecticide usage has increased the chilli production cost to the point where the crop can no longer be grown and marketed profitably.

The entomological research on thrips induced leaf curl is brief and is confined mainly to chemical control trials. As any pest management system cannot solely depend on chemicals, a more intergrated approach to thrips control is needed. However, I feel that irrespective of any nature of schemes an immediate reduction in the amount of insecticides applied to chilli crop is needed. This paper looks at the taxonomic status of the thrips involved in chilli leaf curl and discusses a program through which an immediate reduction of insecticide inputs on chilli can be achieved.

## SPECIES OF THRIPS INVOLVED IN CHILLI LEAF CURL

In a survey under taken in 1993 in major chilli growing areas of the dry zone, samples of thrips were collected and their identification was established with the help of the taxonomists of the Commonwealth Institute of Entomology, U.K. and the Indian Agric. Research Institute, New Delhi. The species identified are given in Table 1.

Table 1. Species of thrips recorded on chilli (*Capsicum annum*)

Species name	Family
i. <i>Thrips palmi</i> , Karny.	Thripidae
ii. <i>Scirtothrips dorsalis</i> , Hood	Thripidae
iii. <i>Frankliniella schultzei</i> , Trybon	Thripidae
iv. <i>Megalurothrips usitatus</i> , Bagnall	Thripidae

Johnpulle (1939) identified *Scirtothrips dorsalis* as the only species of thrips associated with chilli leaf curl. However, during 1963, another 2 species of thrips, viz, *Haplothrips gowdevsi*, and *Frankliniella sulphurea* have been identified (Anon, 1963).

## HISTORY OF THRIPS CONTROL

Thrips have been present for the last 60-70 years (Johnpulle 1939; Fernando and Peiris 1957).

However, during the past farmers were able to control it with 5-6 applications of insecticides recommended by the DOA

The first severe outbreak of chilli thrips developed in 1987 in the Dry Zone areas where chilli is extensively cultivated. Subsequently the thrips assumed the primary pest status and became uncontrollable; frequent insecticide applications tended to exasperate the problem.

Since late 1970s farmers widely used two pesticides, viz, Pirimiphos methyl 50% EC and Oxydemeton methyl 50% EC at the rate of 800-1500 ml and 700-1250 ml / ha, respectively to control leaf curl problem. Among these Pirimiphos methyl is the most widely used insecticide. The particular advantages of Pirimiphos methyl are that it has relatively low toxicity (2000 mg / kg body weight orally to rats) and it being a phosphorothionate compound is very much safe for natural enemies. These chemicals were in use over a decade. There are indications that over the years, thrips developed resistance to these insecticides. In an experiment conducted in farmer's field in 1992 it was revealed that none of the recommended insecticides achieved good control; Oxydemeton methyl achieved 44% of control whereas Pirimiphos methyl achieved only 12% control (Anon, 1992). Subsequently, farmers turned to highly toxic

chemicals such as Monocrotophos and Methamidophos. Gradually these insecticides were used at a higher rate and frequencies. Today thrips appear practically immune to all the available organophosphorus insecticides.

Indiscriminate use of insecticides can result in the pest outbreak via development of resistance, destruction of natural enemies and the increase of reproductive potential (Plapp, 1991; Dettrich, 1987).

### CONTROL STRATEGIES OF THRIPS

The most basic principle for avoiding all the negative effects resulting from pesticide use is not to use them; use non-chemical control wherever possible (Roush, 1991). However, the harsh reality is that alternatives as cheap and effective as pesticides are very difficult to develop.

In any insect pest control program insecticides have to be used at least in some circumstances. Therefore, the major motivation of any pest management program is to minimize the use of pesticides and thereby minimizing the negative effect caused by them.

Losses due to thrips induced leaf curl will be repeated in future unless the thrip populations are maintained at low level, through rationalized insecticide use. This can only be achieved with a gradual

reduction in the amount of insecticide applied to chilli cultivation. This gradual reduction can be achieved by encouraging farmers to reduce insecticide application rates and frequencies.

### REDUCTION OF THE NUMBER OF INSECTICIDE APPLICATIONS; DEMONSTRATIONS WITH FARMERS.

Insecticide inputs on chilli can be lowered by reducing the frequency of insecticide applications and reduced doses. This is an important way to slow down the development of resistance and minimize the other negative environmental effects of insecticides.

Field demonstrations were conducted with selected farmers in Mahaweli "H" area to demonstrate as to how the frequency of insecticide applications can be minimized on chilli. The main objective of these demonstrations was to test the practicability of controlling thrips by spraying the crop only when the new flush begins to show the characteristic symptoms of leaf curl. Thrips attack tender leaves first and when the population increases they start feeding on older leaves and pods. Therefore, initiation of thrips infestation can be detected easily on the young leaves of the terminal branches. The symptoms may come in different forms. However,

generally the tender leaves attacked by thrips will develop a brownish discoloration which sometimes appears on petiolate end and develops towards the tip of the leaves. In some cases this discoloration may also develop along the edges of the leaves or silvery sheen could be observed on the surface of the leaves with slight upward curling. If the spraying is timed at the initiation of these symptoms thrips can be controlled very easily. However, if the population builds up to high numbers control becomes difficult.

#### METHOD

Each demonstration plot comprised of an area of 1/4 acre. Each farmer was provided with one of the chemicals given in table 2 free of charge and they were advised to apply insecticides only when 10-15 plants show the characteristic symptoms of upward curling. Farmers were also given instructions to apply insecticides in case of disease incidence or occurrence of any other insect damage.

Table 2. The insecticides used in chilli demonstrations in Mahaweli H area (yala/1994)

Insecticide	Dosage
1 Profenophos 500g/L	18ml/0L
2. Prothiofos 500g/L	18ml/10L
3. Imidacloprid 200 L	10ml/10L
4. Carbosulfan 20 EC	30ml/10L

The first three are the recommended insecticides. Carbosulfan has shown some promise in controlling leaf curl in the field experiment conducted earlier. Therefore, the demonstrations with carbosulfan were also conducted with few selected farmers.

#### RESULTS AND DISCUSSION

In these demonstration farmers were expected not to use chemicals on alternate basis. Unfortunately, five farmers used more than one insecticide alternatively (Table 3) without a scientific basis. Use of insecticides on alternate basis can only be successful if there is no cross resistance between the insecticides used (Scott, 1991). Therefore, use of OP compound, eg. Prothiofos, Profenofos, etc., alternately can not be a good strategy as these insecticides have the same mode of action. Eight applications of Prothiofos and two applications of Imidacloprid has given a good yield indicating satisfactory control of leaf curl. Alternate application of each Prothiofos and BPMC and 3 applications of Profenofos has also given good control of thrips leading to good yield (BPMC has been used by the farmer on his own). Although I do not intend to describe the merits or demerits of these alternations, it is clear that in the context of resistance management, Imidacloprid is good for replacing organophosphorus insecticides.

Two farmers did not use the chemicals given to them but used

**Table 3: Reduced insecticide applications to control thrips induced leafcurl**

Name of Farmers	Village	Names of insecticides used	*	Yield kg/ 0.25 acre	Comments
G. Rajakaruna	Ipalogama	Prothiofos	8	164	
		Imidacloprid	2		
T.M. Dharmadasa	Meegalawa	Prothifos	5	58	
		Profenofos	3		
		Imidacloprid	3		
M.B. Jinadasa	Madatugama	Prothifos	5	88	
		Imidacloprid	4		
T.K.M.Seneviratne	Alagamuwa	Carbosulphan	7	51.11	Pod borer damage was severe
B.G.Wijebanda	Nochchiyagama	Monocrotophos	2		Crop failed due to severe infesttion of thrips
K.H.M.Wimalaratne	Galikiriyagama	Carbosulphan	4	186	
S.N. Jayathunghe	Tambuttegama	Prothiofos	2	110	
		Protenofos	3		
		BPMC	2		
J.M.W. Jayanthe	Galkiriyagama	Carbosulfan	6	170	
J.M. Kiribanda	Galkiriyagama	Carbosulfan	6	325	

\* Number of sprayings

Monocrotophos at their own will. Use of Monocrotopos induced thrips resurgence leading to total crop failure. Similar phenomenon has been observed in whitefly populations treated with Monocrotophos in certain areas of Sudan (Dettrich, 1987). Farmers who used Carbosulfan have been able to obtain good yield with 6-8 applications.

These demonstrations clearly show that leaf curl can be controlled with reduced insecticide applications. Two farmers have, however, used more than 10 insecticide applications which is not acceptable. As many of these farmers have used more than one insecticide, the effectiveness of individual insecticides can not be fully evaluated. The main

advantage of reduced application is that it slows the resistance development, (Roush, 1991); in addition it will have less adverse effect on natural enemies and environment.

In developing management strategies for thrips, the choice of insecticides is of utmost importance. Selection of insecticides should invariably take into account the history of insecticide use during the past for controlling thrips. If the development of resistance is suspected to the previously used insecticides, the insecticide with different mode of action has to be applied. In the context of mode of action, Imidacloprid is the most suitable insecticide for thrips control. This product belongs to a new class of chemical named Nitromethylene insecticides and has an entirely different mode of action. Organophosphorus compounds inhibit the enzyme acetylcholinesterase, leading to over stimulations of subsequent nerve fibres. However, Imidacloprid binds to acetylcholine and becomes undegradable by acetylcholinesterase (Leicht, 1993). Thus insects that are resistant to OP can be controlled with Imidacloprid.

Carbamate compounds can be used successfully to control thrips and other pests that have

developed resistance to organophosphorous insecticides. Although they have similar mode of action, cross resistance to compound in these groups does not necessarily occur. In field demonstrations and in experimental trials Carbosulphan was found to be effective in controlling thrips. Another insecticide that may fit into chilli IPM program is BPMC. Farmers who used BPMC have obtained satisfactory control of thrips. This product merits further study to evaluate its effectiveness against thrips.

Insecticide selectivity is another criterion that should be taken for consideration. Selectivity against beneficial insect tends to be lower with phosphorothiolate (P=O) insecticides such as profenofos and Acephate etc. (Plapp, 1991). Use of such insecticides should be discouraged. The insecticides such as Imidacloprid, Carbosulphan, etc. offer a powerful alternative, which can relieve the resistance pressure on other valuable group of insecticide like organophosphates. However, IPM system will be needed to minimise the rise of resistance development for these insecticides. Therefore, immediate reduction in the amount of insecticide applied to chilli crop is the first step towards formulating an integrated

approach to control thrips and other insects associated with chilli. Farmers should be encouraged to use the chemicals only when their use is necessary. The demonstrations described in this study show that the farmers are responsive to withdraw from the insecticide treadmill which is the immediate necessity before formulating a long term management strategy.

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