Validation of Integrated Pest Management (IPM) modules against rice leaf folder complex in the coastal region of Puducherry

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Abstract

Evaluation of IPM modules to control rice leaf folder complex during *Kharif* 2010 *and Rabi* 2011 in the coastal region of Karaikal revealed that per cent leaf damage was less in IPM module namely ecofriendly module in both the seasons with components *viz.*, application of NSKE 5%, *Bacillus thuringiensis, Beauveria bassiana*, Spinosad, release of *Trichogramma chilonis* and erection of bird perches.

Rice leaf folder *Cnaphalocrocis medinalis* (Guenee) was considered to be a minor pest earlier and after 1980's it has become a major pest and reported to have more than one species of leaf folder in rice ecosystem. Use of more nitrogenous fertilizers and misuse of insecticides have been attributed as the causes of this minor pest gaining major pest status (Dhaliwal *et al.,* 1979). Several components of control methods are blended in a compatible manner in IPM so that the pest populations are maintained below economic injury levels.

Materials and Methods

Efficacy of different IPM modules was studied to identify the effective IPM module for the management of the rice leaf folder. Two field experiments were conducted during *kharif 2010 and rabi 2011* seasons. The varieties for the study were ADT43 and White Ponni during these seasons, respectively. The seedlings were transplanted 30 days after sowing for both the crops with 15 x 10 cm spacing for the first crop and 20 x 10 cm for the second crop. The size of each plot was 5 m x 4 m. Both trials were carried out in the Eastern farm of Pandit Jawaharlal Nehru College of Agriculture
and Research Institute, Karaikal, Union Territory of Puducherry. The experiment was laid out in a Randomized Block Design (RBD) with four replications and five treatments. Four different IPM modules tested werer T_1- Insecticide module with only insecticide application; T_2- Ecofriendly module involved release of egg parasitoid, *T. chilonis*, spraying of Neem seed kernel extract (5%), *B. thuringiensis (B.t), B. bassiana*, Spinosad and provision of bird perches; T_3- need based management module integrated module consists of insecticides, botanicals and natural enemies. T_4- Neem based module with application of only neem products like incorporation of neem cake, spraying of neem oil (3%) and Neem seed kernel extract (5%) and T_5- untreated control.

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Results and Discussion

Kharif 2010: The data on the efficacy of IPM modules on rice leaf folder complex during *kharif* season is presented in Table 1. The per cent leaf folder damage at 30 DAT to 79 DAT revealed that except at 30 DAT, significant differences were noticed in various modules tested. The leaf damage was found to be minimum in T_2 module throughout the observation period. Generally T_1 and T_2 modules were on par with each other at different periods of observation. Considering the over all mean, the module T1 and T_2 were equally effective in controlling the leaf damage by the rice leaf folder complex followed by T_3 and T_4 modules. Untreated check uniformly showed highest infestation (21.1%) than all other modules. *Rabi* 2011: The data on efficacy of IPM modules on rice leaf folder management during r*abi* season is presented in Supplementary Table 2. The per cent leaf folder damage at 30 DAT to 100 DAT revealed that except at 30 DAT, significant differences were noticed among various modules at different periods. The leaf damage was found to be less in the T_2 module throughout the study. Generally T_1 and T_2 modules were on par with each other. Considering the over all mean, the modules T_1 and T_2 were equally effective in controlling the rice leaf folder complex followed by T_3 and T_4 modules. The over all mean ranged from 1.44 to 3.90 per cent during *samba* season and the different modules were of the order $T_2 \geq T_1 > T_4 \geq T_3 > T_5$. The leaf damage in modules T_2 (1.44%) and T_1 (1.53%) was significantly low as compared to all other modules and the untreated control recorded highest leaf damage (3.90%). The per cent leaf damage was less in r*abi* when compared to *kharif* seasons.

Table 1: Efficacy of IPM modules in leaf folder management, *kharif* 2010

Treatments	Leaf damage (%)								
	30 DAT	37 DAT	44 DAT	51 DAT	58 DAT	65 DAT	72 DAT	79 DAT	Over all mean
T_1	0.86	1.39 (6.76)^a	1.70 (7.46)^a	2.20 (8.52)^b	5.73 (13.75)^b	2.92 (9.83)^a	4.49 (12.17)^a	4.11 (11.69)^a	2.92 (9.46)^a
T_2	0.68	1.95 (7.96)^a	2.28 (8.60)^{ab}	1.01 (5.71)^a	2.83 (9.58)^a	2.52 (9.12)^a	4.21 (11.82)^a	3.21 (10.29)^a	2.33 (8.52)^a
T_3	0.87	1.75 (7.57)^a	2.57 (9.18)^b	3.27 (10.41)^c	7.64 (16.03)^b	19.62 (26.27)^b	28.83 (32.43)^b	28.59 (32.29)^b	11.64 (17.46)^b
T_4	0.97	1.72 (7.51)^a	2.71 (9.47)^b	2.25 (8.55)^b	6.48 (14.73)^b	19.01 (25.83)^b	27.29 (31.37)^b	27.96 (31.91)^b	11.04 (16.91)^b
T_5	1.06	3.23 (10.35)^b	4.79 (12.63)^c	5.86 (13.98)^d	18.46 (25.35)^c	37.46 (37.73)^c	48.82 (44.32)^c	48.96 (44.39)^c	21.08 (24.35)^c
C.D.	NS	0.45**	0.82**	0.80**	2.72**	5.62**	6.89**	15.12**	8.67**

T_1**:** Insecticide module; T_2**:** Eco-friendly module; T_3**:** Need based management module; T_4**:** Neem based management module; T_5**:** Untreated check, Values in parentheses are arc sine transformed values, In a column, mean followed by a common letters are not significantly different by DMRT. DAT- Days After Transplanting; **-Significant at 1% level; NS- Not Significant

Our results are in conformity with the findings of Katti *et al.* (2001) who revealed that innundative release of *Trichogramma chilonis* significantly reduced the leaf folder damage. Evidently the release of *T. chilonis* substantially suppressed the infestation level of leaf folder. Sivasundaram *et al.* (2008) reported that biological control approach is now gaining importance due to its greater reliability, safety and ecological as well as economic sustainability. Balagurunathan and Rabindra (2001) reported 8.0 to 40.0 per cent reduction of rice leaf folder damage through the releases of *T. chilonis.* Nathan *et al.* (2004) recorded that combination of neem seed kernel extract and *Bacillus thuringiensis* were effective in controlling the leaf folder *C. medinalis*. In the present study the neem seed kernel extract fitted well with other biocontrol agents, used in the T_2 module. Spinosad 45 SC is a biological product from actinomycetes *Saccharopolyspora spinosa* was also effective in controlling rice leaf folder. Nalini *et al.* (2008), Karthikeyan *et al.* (2008) and Suresh *et al.* (2011) reported that application of spinosad 2.5 SC was effective against rice leaf folder. Aswal *et al.* (2010) reported that *B. thuringiensis* was found to be effective against yellow stem borer and leaf folder in rice ecosystem. Installing bird perches may have helped the common black drongo *Dicrurus macrocercus* Bechstein, abundant in the rice fields of Karaika,

The next effective module was T_1 in reducing leaf damage. This was also found to be effective during both the seasons. This may be due to the effectiveness of the insecticides carbofuran, profenofos and flubendiamide. Application of carbofuran 3G in rice nursery reduced the leaf folder incidence (DRR, 2004). In the present study, flubendiamide belonging to diamide group was effective against rice leaf folders. Similarly, profenofos belonging to thiophosphate group is also effective against rice leaf folder. Similar findings were observed when the product was tested through the DRR under multi location trials (DRR, 2009). Profenofos 50 EC effectively

checked the rice leaf folder (Sunita Teresa and Nachiappan, 1997; Kathikeyan and Purushothaman , 2003). According to Tohnishi e*t al.* (2005) flubendiamide showed strong insecticidal activity against lepidopterous pest. Sekh *et al.* (2007) reported that flubendiamide 48 SC provided effective control against rice leaf folder with significant increase in yield

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Supplementary Table 2: Efficacy of IPM modules on leaf damage management during r*abi* 2011

Treatments	Leaf damage (%)											
	30 DAT	**37 DAT**	**44 DAT**	**51 DAT**	**58 DAT**	**65 DAT**	**72 DAT**	**79 DAT**	**86 DAT**	**93 DAT**	**100 DAT**	**Over all mean**
T_1	0.40	0.55 (3.98)^{a}	1.28 (6.42)^{a}	1.47 (6.96)^{a}	1.95 (7.91)^{a}	1.56 (7.14)^{a}	0.73 (4.89)^{a}	1.68 (7.43)^{a}	2.02 (8.16)^{a}	2.43 (8.954)^{a}	2.82 (9.67)^{b}	1.53 (6.88)^{a}
T_2	0.44	0.64 (4.60)^{a}	1.39 (6.72)^{a}	1.81 (7.71)^{a}	1.72 (7.40)^{a}	1.65 (7.33)^{ab}	0.53 (4.12)^{a}	1.39 (6.76)^{a}	1.69 (7.44)^{a}	2.13 (8.34)^{a}	2.46 (9.03)^{a}	1.44 (6.69)^{a}
T_3	0.56	0.72 (4.81)^{a}	2.10 (8.33)^{b}	2.75 (9.51)^{b}	2.27 (8.63)^{a}	3.35 (10.53)^{c}	1.35 (6.65)^{b}	2.50 (9.09)^{b}	3.08 (10.10)^{b}	3.40 (10.62)^{b}	3.54 (10.84)^{c}	2.32 (8.50)^{b}
T_4	0.60	0.77 (5.03)^{a}	1.41 (6.76)^{a}	1.76 (7.51)^{a}	1.86 (7.70)^{a}	2.44 (8.92)^{b}	2.18 (8.49)^{c}	2.76 (9.56)^{b}	2.79 (9.61)^{b}	3.51 (10.79)^{b}	3.40 (10.61)^{c}	2.13 (8.16)^{b}
T_5	1.13	1.53 (7.03)^{b}	2.96 (9.89)^{c}	3.65 (11.01)^{c}	4.12 (11.70)^{b}	5.12 (13.06)^{d}	2.91 (9.79)^{d}	3.23 (10.35)^{c}	4.79 (12.63)^{c}	5.85 (13.98)^{c}	7.64 (16.03)^{d}	3.90 (11.07)^{c}
C.D.	NS	0.54**	0.46**	0.55**	1.00**	0.85**	0.50**	0.33**	0.48**	0.58**	0.39**	0.51**

T_1: Insecticide module; T_2: Eco friendly module; T_3: Need based management module

T_4: Neem based management module; T_5: Untreated check

Values in parentheses are arc sine transformed values

In a column, mean followed by a common letters are not significantly different by DMRT.

DAT- Days After Transplanting; **- Significant at 1% level; NS- Not Significant