International Journal of Biological, Life and Agricultural Sciences
ISSN: 2415-6612
Vol:11, No:11, 2017

Solomon 300 OD (Betacyfluthrin+Imidacloprid): A Combi-Product for the Management of Insect-Pests of Chilli (*Capsicum annum* L.)

R. S. Giraddi, B. Thirupam Reddy, D. N. Kambrekar

***Abstract*—**Chilli (*Capsicum annum* L.) an important commercial vegetable crop is ravaged by a number of insect-pests during both vegetative and reproductive phase resulting into significant crop loss.Thrips, *Scirtothripsdorsalis*, mite, *Polyphagotarsonemuslatus* and whitefly, *Bemisiatabaci* are the key sap feeding insects, their infestation leads to leaf curl, stunted growth and yield loss.During flowering and fruit formation stage, gall midge fly, *Asphondyliacapparis* (Rubsaaman) infesting flower buds and young fruits and*Helicoverpaarmigera* (Hubner) feeding on matured green fruits are the important insect pests causing significant crop loss.The pest is known to infest both flower buds and young fruits resulting into malformation of flower buds and twisting of fruits.In order to manage these insect-pests a combi product consisting of imidacloprid and betacyfluthrin (Soloman 300 OD) was evaluated for its bio-efficacy, phytotoxicity and effect on predator activity.Imidacloprid, a systemic insecticide belonging to neo-nicotinoid group, is effective against insect pests such as aphids, whiteflies (sap feeders) and other insects*viz*., termites and soil insects.Beta-Cyfluthrin is an insecticide of synthetic pyrethroid group which acts by contact action and ingestion. It acts on the insects' nervous system as sodium channel blocker consequently a disorder of the nervous system occurs leading finally to the death. The field experiments were taken up during 2015 and 2016 at the Main Agricultural Research Station of University of Agricultural Sciences, Dharwad, Karnataka, India.The trials were laid out in a Randomized Block Design (RBD) with three replications using popular land race of Byadagi crop variety.Results indicated that the product at 21.6 + 50.4% gai/ha (240 ml/ha) and 27.9 + 65% gai/ha (310 ml/ha) was found quite effective in controlling thrips (0.00 to 0.66 thrips per six leaves) as against the standard check insecticide recommended for thrips by the University of Agricultural Sciences, Dharwad wherein the density of thrips recorded was significantly higher (1.00 to 2.00 Nos./6 leaves). Similarly, the test insecticide was quite effective against other target insects, whiteflies, fruit borer and gall midge fly as indicated by lower insect population observed in the treatments as compared to standard insecticidal control. The predatory beetle activity was found to be normal in all experimental plots. Highest green fruit yield of 5100-5500 kg/ha was recorded in Soloman 300 OD applied crop at 310 ml/ha rate as compared to 4750 to 5050 kg/ha recorded in check. At present 6-8 sprays of insecticides are recommended for management of these insect-pests on the crop. If combi-products are used in pest management programmes, it is possible to reduce insecticide usages in crop ecosystem.

***Keywords*—**Imidacloprid, Betacyfluthrin, gallmidge fly, thrips, chilli.

R. S. Giraddi and D.N. Kambrekar are professors of Agricultural Entomology with the University of Agricultural Sciences, Dharwad-580 005, Karnataka-India (e-mail: deanacd@uasd.in)

B. Thirupam Reddy is a Ph.D. scholar in the department of Agricultural Entomology with the University of Agricultural Sciences, Dharwad-580 005, Karnataka-India

I. Introduction

CHILLI(*Capsicum annum* L.) an important commercial vegetable crop in south India is ravaged by number of insect-pests during vegetative and reproductive phase resulting into significant crop loss [1]. Among these thrips, *Scirtothripsdorsalis* (Hood) whiteflies, *Bemisiatabaci* (Gennadius), mite, *polyphagotarsonemuslatus* (Banks) and fruit feeding insects are very important [2]-[4].In the past decade, the recommended insecticides for the management of chilli insect-pests were mostly organo-phosphate insecticides which were broad spectrum, highly toxic and unsafe to human and other non-target biota. Indiscriminate use of such pesticides has often resulted into unwanted effects on the environment.

Imidacloprid, a neonicotenoid insecticide known for its efficacy against sucking insect-pests and Betacyfluthrin, a synthetic pyrethroid insecticide effective versus lepidpteron caterpillars are the two ingredients in the combi product, Solomon 300 OD that is evaluated for its bio-efficacy against two groups of insect-pests of chilli i.e. sucking pests and fruit feeding species. *S. dorsalis, B. tabaci* and *P. latus* feed on tender leaves leading to leaf curling. Chilli gall midge, *Asphondyliacapparis* Rubsaamen (Diptera: Cecidomyiidae) is the emerging pest of chilli in south India, which infests during reproductive phase of the crop leading to distortion and drying of young flower buds. Young fruits will be twisted due to its infestation. As much as 30 to 40% yield loss has been reported due to gall midge infestation [5], [6]. *Helicoverpaarmigera* (Hubner) is the major species infesting developed fruits of chilli, which feeds on fruit contents.

Owing to development of pest resistance to insecticides, use of combi products having different modes of action is recently encouraged in Indian Agriculture and an array of such products are registered with the Central Insecticide Board, Government of India each year.

II. Materials and Methods

Field experiments were conducted at the Main Agricultural Research Station, University of Agricultural Sciences, Dharwad (Karnataka-India) during 2015 and 2016 to evaluate the bio-efficacy of combi-product of insecticide, betacyfluthrin 90-imidacloprid 210 OD against insect pests of chilli infesting during vegetative and reproductive phase of the crop. The crop experiments were laid out in RBDwith nine treatments and three replications.The seedlings of chilli

(var.,byadagi) were raised in the nursery with the University recommended nursery raising practices. Later 35 days old seedlings were transplanted in the experimental main field. The crop in the main field was raised by following the university package of practices with respect to nourishment (application of farm yard manure, NPK fertilizers) but without application of pesticides.Treatments with insecticide application were made as per the treatment plan given below. A total of three spray applications, two for sucking pests (in vegetative phase) and one spray for flower and fruit feeding insects (reproductive phase) were made for the management of insect pests.

TABLE I
TREATMENT DETAILS

Treatments	Details	Dosage rate
T1	Betacyfluthrin 90 +Imidacloprid 210 OD	15.3+35.7 a.i.g (170ml)/ha
T2	Betacyfluthrin 90 +Imidacloprid 210 OD	21.6+50.4 a.i.g (240ml)/ha
T3	Betacyfluthrin 90 +Imidacloprid 210 OD	27.9+65.1 a.i.g (310ml)/ha
T4	Betacyfluthrin 25 SC	28 a.i.g (1120ml)/ha.
T5	Imidacloprid 200 SL	65.2 a.i.g (326ml)/ha
T6	Imidacloprid 200 SL	50 a.i.g (250ml)/ha
T7	Pyriproxyfen 5% +Fenpropathrin 15% EC	37.5+112.5 a.i.g (750ml)/ha
T8	Standard Check (UAS recommendation)	Individual chemical at recommended rates*
T9	Untreated Control	

*Dimethoate 30 EC (1.7ml/l) and Phosphamidon 40 SL (0.5ml/l) sprays at vegetative phase at 21 days interval; Spinosad 45 SC(0.12ml/l) and Novuluron 10 EC (0.75ml/l) at reproductive phase at 21 days interval.

Insecticide applications in the treatments were made when any one of the insect pest reached economic threshold level (ETL). The density of thrips and whiteflies were observed on top six leaves from five tagged plants. *A. capparis*and *H. armigera*were observed for the damage on reproductive parts. The activity of predators in various plots was also recorded. The data obtained on these parameters were subjected to suitable statistical transformational and data were analyzed using analysis of variance (ANOVA) technique and interpretations were made as per the pooled results obtained

III. RESULTS AND DISCUSSION

Results pertaining to the bio-efficacy of Betacyfluthrin 90 - Imidacloprid 210 OD v/s insect-pests of chilli crop were significant during both years and the results are interpreted using pooled means. The combi product at 310ml/ha dosage (27.9+65.1 a.i. g/ha.) was quite effective in reducing the density of thrips (0.62 numbers/six leaves) and whiteflies (0.26/six leaves) as compared to the standard check(1.35 and 1.74/six leaves), respectively, which comprised of spray applications of dimethoate 30EC (850ml/ha.), Phosphamidon 40SL (250ml/ha.) applied at 3 and 6 weeks after transplanting of the crop (Fig. 1). The leaf curl index was significantly lower (0.90) v/s the index value (2.05) in the check treatment in 0 to 4 scale. Bio-efficacy of the combi product at 240ml/ha. (21.6+50.4 a.i. g/ha) was next in the order followed by pyriproxyfen 5%+fenpropathrin 15% EC (750ml/ha.). Other treatments registered significantly higher insect population and leaf curl index (Fig. 2). Also, significantly lowest gall midge fly and *H. armigera* infestation was observed in treatment No. 3 followed by T2 and T7 as seen in Fig. 3. Untreated control receiving no insecticide spray registered significantly highest density of sucking pests and flower and fruit feeding insect pests.

The order of efficacy of chemicals used in the present study v/s pests of chilli was Solomon at 310ml/ha. > Solomon at 240ml/ha. >Imidacloprid 200 SL at 326ml/ha. >Imidacloprid 200 SL at 250ml/ha. > Standard check >Pyriproxifen 5% + fenpropathrin 15% EC > Solomon at 170ml/ha. >betacyfluthrin 25 SC >Untreated control. For gall midge fly, efficiency was of the order Solomon at 310ml/ha. >betacyfluthrin 25 SC >Pyriproxifen 5% + fenpropathrin 15% EC > Solomon at 240ml/ha. >Imidacloprid 200 SL at 250ml/ha. >Imidacloprid 200 SL at 326ml/ha. > Standard check > Solomon at 170ml/ha. > Untreated control and Betacyfluthrin 25 SC > Solomon at 310ml/ha. >Pyriproxyfen 5% + fenpropathrin 15% EC > Standard check > Solomon at 240ml/ha. > Solomon at 170ml/ha. >Imidacloprid 200 SL at 250ml/ha. >Imidacloprid 200 SL at 326ml/ha. > Untreated control (for fruit borer, *H. armigera*).

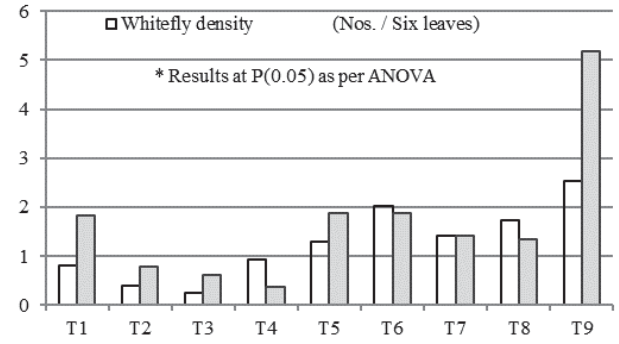

Fig. 1 Bio-efficacy of Betacyfluthrin 90+Imidacloprid 210 OD against whitefly and thrips

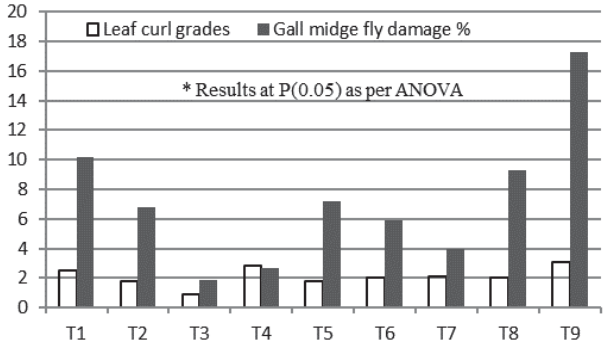

Fig. 2 Leaf curl grade and gall midge fly damage as influenced by the insecticidal spray

TABLE II
BIOEFFICACY OF BETACYFLUTHRIN90+ IMIDACLOPRID210 OD (SOLOMON 300 OD) AGAINST CHILLI INSECT-PESTS

Sl No	Treatment Details	Dosage	Coccinellids(Nos/plant)			Green chilli yield(kg/ha.)		
			2015	2016	Pooled	2015	2016	Pooled
1.	Betacyfluthrin 90+Imidacloprid 210 OD	15.3+35.7a.i.g (170ml)/ha.	1.80(1.52) *	4.00(2.12)	2.90(1.84)	3500	4030	3765.0
2.	Betacyfluthrin 90+Imidacloprid 210 OD	21.6+50.4 a.i.g (240ml)/ha.	2.10(1.61)	3.70(2.05)	2.90(1.81)	4990	5100	5045.0
3.	Betacyfluthrin 90+Imidacloprid 210 OD	27.9+65.1 a.i.g (310ml)/ha.	1.90(1.55)	3.60(2.02)	2.75(1.81)	5500	5050	5275.0
4.	Betacyfluthrin 25 SC	28 a.i.g (1120ml)/ha.	2.40(1.70)	2.80(1.82)	2.60(1.75)	4250	3950	4100.0
5.	Imidacloprid 200 SL	65.2 a.i.g (326ml)/ha.	2.00(1.58)	2.40(1.70)	2.20(1.57)	3100	3250	3175.0
6.	Imidacloprid 200 SL	50 a.i.g (250ml)/ha.	3.00(1.87)	3.20(1.92)	3.10(1.90)	3175	3100	3138.5
7.	Pyriproxyfen 5%+Fenpropathrin 15% EC	37.5+112.5 a.i.g (750ml)/ha.	2.15(1.63)	2.90(1.84)	2.53(1.74)	4500	4750	4625.0
8.	Standard Check (UAS recommendation)	As in treatment plan	1.60(1.45)	3.80(2.07)	2.70(1.79)	5050	4750	4900.0
9.	Untreated Control	-	2.90(1.84)	3.00(2.10)	2.95(1.86)	3000	2725	2862.5
	Std. Err. Mean±		0.150	0.194	0.165	250.7	214.5	227.6
	P (0.05)		NS	NS	NS	750.0	642.0	680.0

* √X+05 Transformations
**Chilli yields from three harvests only

A good control of the insect pests on the crop cycle in various treatments was reflected on green fruit yield of chilli (as shown in Table II). Significantly highest yield of 5.275 tons/ha was obtained in the treatment that comprised Soloman spray at 310ml/ha dosage followed by same product at 240ml/ha dosage. Pyriproxyfen 5%+Fenpropathrin 15% EC spray was next in the order in bio-efficacy. The activity of predatory lady bird beetles (Coleoptera: Coccinellidae) in various treatments was normal and was comparable to the density of these beetles seen on unsprayed crop.

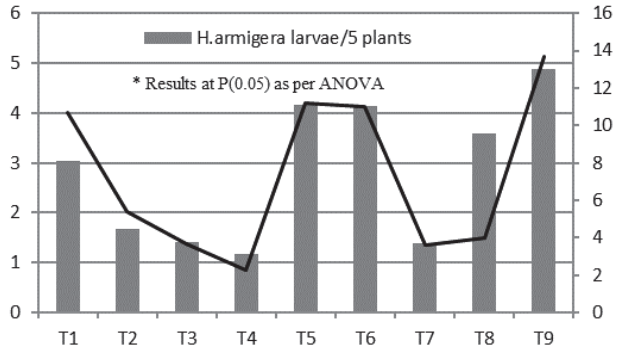

Fig. 3 *H. armigera* larval density in chilli crop and extent of fruit damage

Bio-efficacy of Imidacloprid against sucking pests and efficacy of synthetic pyrethroids against lepidoteran caterpillars in different crops including chilli has been proved experimentally [7]-[9]. In the recent years, use of combi insecticides is on the rise and the products with neonicotenoid and pyrethroid combinations have become very popular in pest management. These products successfully target different groups of insects, resulting in optimum control of insect populations due to their varied mode of action. Superior bio-efficacy of neonicotenoid + pyrethroidcombi products against crop pests has been reported [10]-[12]. Effective control of bollworms of cotton using combi-insecticides has also been on record [13], [14].

The advantage of combi insecticides is that they result in reduced number of insecticide application since they target more than one type of insect-pests at a given point of time. Also, they are quite handy to manage pesticide resistant insect populations. Besides, use of spray tank mixtures of two chemicals without the knowledge of their compatibility can be avoided by using combi-products.

REFERENCES

[1] Anonymous, Annual report of 1996-97. Project Directorate of biological control, Bangalore, p.40, 1997.
[2] K. Ahmed, M. G. Mohamed, and N. S. R. Murthy., "Yield loses due to various pests in hot pepper *Capsicum"* Newsletter, vol. 6, pp. 83-84, 1987.
[3] C. Kandasamy, M. Mohanasundaram, and P. Karuppachamy. "Evaluation of insecticide for the control of thrips, *Scirtothripsdorsalis*Hood in chillies (*Capsicum annum* L.)", *Madras Agric.Jr*, Vol. 77, pp. 167-172, 1990.
[4] K. P. Gundannavar, and R. S. Giraddi, "Effect organic soil amendments on the activities of sucking pests of chilli". *Global Journal of Science Frontier Research*,vol. 13(2), pp.300-304, 2013.
[5] D. K. Nagaraju, "Biology, Ecology and management of the Capsicum gall midge, *AsphondyliaCapparis*Rubsaaman (Diptera:Cecidomyiidae) and other insects associated with gall on bell pepper". *Ph.D. Thesis*. Univ. of Agril.Sci., Bangalore, India, 2000.
[6] Basavaraj "Studies on seasonal incidence of chilli gall formers, biology and crop loss estimation due to chilli gall midge, *Asphondyliacapparis* (rubsaaman)" *M.Sc(Agri)thesis*, Univ. of Agril. Sci., Dharwad, India, 2010
[7] K. Shivaramu, "Investigations on fruit borers *Helicoverpaarmigera* (Hubner) in chilli", *Ph.D. thesis*, *Univ. of Agril. Sci.,Dharwad, India*, 1999.
[8] T. S. Verghese, "Management of thrips, *Scirtothripsdorsalis* Hood and mite, *Polyphagotarsonemuslatus* (Banks) on chilli using biorationals and Imidacloprid", *M.Sc (Agri) thesis, Univ. of Agril. Sci., Dharwad, India*, 2003.
[9] B. V.Patil, A. G. Shrinivas, and A. Hosamani. "Management of chilli insect-pests in irrigated ecosystems. Winter school on integrated pest and disease management in irrigated crops", 21st Nov – 11th Dec. 2007, College of Agriculture, Raichur, India, 2007.
[10] S. Jeyarani, and M. Chandrashekaran, "Bioefficacy of certain acaricides against chilli mite, *Polyphagotarsonemuslatus*(Banks)", *Agric. Sci. Digest*, vol. 26,pp.132-134, 2006.
[11] S. D. Wale and A. G. Chandele, "Evaluation of Solomon ((Beta-cyfluthrin 9%+imidacloprid 21%) 300 OD against aphids and fruit borer of brinjal",https://www.researchgate.net/.../292926448, 2013.
[12] Paramasivam, M. Deepa, C. Selvi, S. Chandrasekaran, "Dissipation kinetics of beta- cyfluthrin and imidacloprid in tea and their transfer from processed tea to infusion". *Ecotoxicol.Environ.* vol. 144, pp. 531-536, 2017.
[13] A.N.Supram, P.S. Neharkar, P. Subhangi, Bhasme, S. R. Kamdi, and B. S. Kadam, «Bioefficacy of new combi product against cotton boll worms, Indian *Jr. of Plant Sci*, *vol.* 4(2), pp. 10-15, 2014.

[14] P.K.Borad, H. M. Patel, D. B. Sisodiya, N. M. Vaghela, and J. R. Patel, « Bioefficacy of endosulfan35% EC and Cypermethrin 5 % EC mixture against insect pests of cotton H-6, Indian Jr. of Entomol., vol. 65 (3), pp. 416-421.

R. S. Giraddiwas born in Haveri district of Karnataka-India. He passed his B. Sc. (Agri), M. Sc. (Agri) in first class from University of Agricultural Sciences (UAS), Bengaluru and Ph. D. from UAS, Dharwad-India. Later he completed one-year Post-Doctoral study in England (1997-98) under Commonwealth Programme. His research areas are integrated and Organic Pest Management in which he has published more than 150 research papers in peer reviewed journals of repute. Indian Citation Index (2016) of Confederation of Indian Inustry indicating research productivity of Indian Universities has put him in 46th rank (article) and 18th rank (citation) out of top 100 Scientists.

He has visited England, Wales, Nepal, Taiwan, Hongkong for presentation of research papers in International Conferences. He has got National Award in plant protection. Presently he is the Dean (Academics), College of Agriculture, UAS, Dharwad. He is the member of many reputed Scientific bodies and Research Foundations, besides working as Member of University Academic and Research Council.