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Evaluation of combination product (Indoxacarb 5% + Fipronil 5% SC) against jassid, *Amrasca biguttula biguttula* and whitefly, *Bemisia tabaci* in cotton

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ABSTRACT

Field studies were undertaken at research farm, IPFT, Gurgaon to evaluate the efficacy of indoxacarb 5% + fipronil 5% SC at four doses, viz. 100 (50+50) g a.i./ha ,125 (62.5+62.5) g a.i./ha, 150 (75+75) g a.i./ha and 250 (125+125) g a.i./ha, along with fipronil 5% SC @ 100 g a.i./ha, indoxacarb 14.5% SC @ 75 g a.i./ha and Chlorpyrifos 16% + Alphacypermethrin 1% EC @ 425 (400+25) g a.i./ ha against jassids and whiteflies in cotton during *kharif,* 2013-14 and *kharif,* 2014-15. Indoxacarb 5% + fipronil 5% SC @ 125 g a.i./ha was highly effective in suppressing the population of jassids and whiteflies, resulting in 1.00, 0.67 and 1.07, 0.67 mean population of jassids and whiteflies during first and second season respectively and was on par with the higher doses of Indoxacarb 5% + fipronil 5% SC during both the seasons.

Key words: Cotton, Efficacy, Fipronil, Indoxacarb, Jassids, Whiteflies

Cotton (*Gossypium hirsutum*) unanimously designated as "white gold" of India is cultivated in 119.78 lakh hectare with a production of 365.00 lakh bale of seed cotton (Anon 2013). Major constraint in attaining high production of seed cotton is damage inflicted by insect pests. The pest spectrum of cotton is quite complex and as many as 200 species of insects have been reported to attack cotton at different stages of crop growth in India (Anon., 1981). Apart from boll worm complex, its productivity is abominably reduced due to heavy infestation of sucking pest complex, viz. *Bemisia tabaci* (Gennadius), *Amrasca biguttula biguttula* (Ishida), *Aphis gossypii* (Glover) and *Scirtothrips dorsalis* H. Introduction of transgenic cotton in India by 2002, promisingly reduced the boll worm complex but boosted the sucking pest complex resulting in 21.2 % loss in cotton crop (Dhawan *et al.* 1988). Pesticide application is an important strategy followed by farmers to prevent sucking pest complex however, over time targeted pests have developed resistance to pesticides necessitating increased applications. The right choice of chemical pesticides in pest control is not governed by its toxicity alone, but depends on their safety to natural enemies in the ecosystem and the environment too (Stanley 2007). Registered insecticides which provide adequate control of the pests require repeated application in higher doses and might result in adverse effects on the environment and health. In order to circumvent the problems, replacement of conventional insecticides with new powerful molecules at lower dose is necessary (Shivanna *et al*. 2012). New formulations and new sources of existing molecules are likely to hold superiority in terms of higher toxicity, pest suppression, safety to natural enemies and non-target organisms, reduced spray dosages and rounds of spray and the benefits accrued in terms of savings in labour and time. Fipronil, a phenyl-pyrazole compound, operates by disrupting neural transmission in the central nervous system of invertebrates (Delso *et al*. 2015) and indoxacarb an oxadiazine insecticide acts by inhibiting sodium ion entry into nerve cells, resulting in paralysis and death of target pest, it has also shown outstanding field insecticidal activity, environmental compatibility and safety to natural enemies (Wing *et al.* 2000). Fipronil has been reported to be effective against sucking pests like *Bemisia tabaci* and *Amrasca biguttula biguttula* in cotton (Patil *et al.* 2009), all sucking pests in cotton (Sreekanth and Reddy 2011). Also, indoxacarb has proved its efficacy against *Spodoptera litura* (Fab.), *Helicoverpa armigera* (Hubner) (Justin *et al*. 2015) and *Thrips tabaci* L. in cotton (Rudramuni *et al.* 2011). In the present study, a combination product of indoxacarb 5% and fipronil 5% SC was tested for its efficacy against jassids and whiteflies in cotton at Research Farm, Institute of Pesticide Formulation Technology, Gurgaon, Haryana.

MATERIALS AND METHODS

The present study was carried out in research farm at Institute of pesticide formulation technology, Gurgaon,

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Haryana during two *kharif* seasons, i.e. 2013-14 and 2014-15. The field was laid in randomized block design with eight treatments replicated thrice including the untreated check. Cotton variety RCH 317 was sown during third week of May, 2013 (*Kharif*, I season) and during first week of June, 2014 (*Kharif,* II season) in plots of 6 × 5 m^2 with a spacing of 90 cm × 60 cm. The crop was raised adopting standard agronomic practices and the test insecticide, viz. indoxacarb 5% + fipronil 5% SC supplied by Gharda chemicals Ltd, Thane at four doses, viz. 100 (50+50) g a.i./ha ,125 (62.5+62.5) g a.i./ha, 150 (75+75) g a.i./ha and 250 (125+125) g a.i./ ha, were compared with fipronil 5% SC @ 100 g a.i./ha, indoxacarb 14.5% SC @ 75 g a.i./ha and Chlorpyrifos 16% + Alphacypermethrin 1% EC @ 425 (400+25) g a.i./ ha. Untreated check was maintained and the treatments were imposed when the pests crossed the economic threshold level. Three sprays were given using a high volume sprayer at fifteen days interval with a spray fluid of 500 l/ha. The pre and post-treatment observations were recorded on 1,3,5,7 and 10 days on the incidence of jassids and whiteflies. The observations were made on three leaves/plant one each from top, middle and bottom region and from ten plants/plot selected at random leaving border rows. The mean population of jassids and whiteflies recorded were converted into "n transformed values and subjected to statistical analysis of variance.

RESULTS AND DISCUSSION

The results pertaining to the bioefficacy of indoxacarb 5% + fipronil 5% SC against cotton jassids and whiteflies are presented in Table 1 and Table 2.

Jassids (Amrasca biguttula biguttula): The mean population prior to insecticidal application varied between 10.13 to 13.03 nymphs/ three leaves/ plant during first season and varied from 8.00 to 10.67 during second season. Indoxacarb 5% + fipronil 5% SC @ 250 (125+125) g a.i./ha, 10 DAA (Days after application) recorded lowest mean population of 0.83 and 0.67 nymphs/ three leaves/ plant during first and second season respectively which was

Table 1 Efficacy of Indoxacarb 5% + Fipronil 5% SC against jassids on cotton during *kharif* (2013-14 and 2014-15)

Treatment	Dose (g.a.i./ha)	Mean number of jassid nymphs per three leaves/ plant* during first season (2013-14)						Mean number of jassid nymphs per three leaves/ plant* during second season (2014-15)					
		1 DBA	1 DAA	3 DAA	5 DAA	7 DAA	10 DAA	1 DBA	1 DAA	3 DAA	5 DAA	7 DAA	10 DAA
Indoxacarb 5+ Fipronil 5 SC	100 (50+50)	11.80 (3.49)	2.30 (1.66)	1.63 (1.46)	1.47 (1.40)	1.37 (1.37)	1.23 (1.31)	9.67 (3.18)	3.00 (1.86)	2.33 (1.66)	2.00 (1.48)	1.33 (1.29)	1.00 (1.22)
Indoxacarb 5+ Fipronil 5 SC	125 (62.5+62.5)	12.67 (3.61)	2.17 (1.61)	1.97 (1.55)	1.37 (1.33)	1.03 (1.23)	1.00 (1.21)	10.67 (3.31)	2.67 (1.74)	2.00 (1.56)	1.67 (1.44)	1.00 (1.22)	0.67 (1.05)
Indoxacarb 5+ Fipronil 5 SC	150 (75+75)	10.13 (3.23)	1.90 (1.53)	1.60 (1.45)	1.27 (1.33)	0.93 (1.15)	0.87 (1.13)	10.33 (3.26)	2.67 (1.76)	2.33 (1.64)	2.00 (1.56)	0.67 (1.05)	0.67 (1.05)
Indoxacarb 5+ Fipronil 5 SC	250 (125+125)	11.9 (3.51)	1.77 (1.48)	1.43 (1.31)	1.23 (1.22)	0.90 (1.13)	0.83 (1.10)	8.67 (2.99)	2.33 (1.68)	2.00 (1.56)	1.67 (1.46)	0.33 (0.88)	0.67 (1.05)
Fipronil 5 SC	100	14.17 (3.82)	2.37 (1.66)	2.03 (1.57)	1.70 (1.47)	1.37 (1.36)	1.20 (1.30)	9.33 (3.05)	3.67 (2.03)	3.33 (1.93)	3.00 (1.84)	1.33 (1.34)	1.00 (1.22)
Indoxacarb 14.5 SC	75	11.03 (3.39)	2.40 (1.67)	2.07 (1.59)	1.73 (1.47)	1.40) (1.37)	1.33 (1.35)	8.00 (2.90)	4.00 (2.11)	3.67 (2.03)	3.00 (1.81)	2.33 (1.54)	2.67 (1.72)
Chlorpyrifos 16%+Alpha-cypermethrin 1% EC	425 (400+25)	10.43 (3.31)	2.57 (1.74)	2.17 (1.62)	1.90 (1.51)	1.57 (1.42)	1.47 (1.38)	9.00 (3.07)	4.33 (2.20)	3.67 (2.02)	3.33 (1.94)	2.33 (1.66)	2.67 (1.77)
Untreated Check	—	13.03 (3.66)	13.43 (3.59)	14.00 (3.73)	14.40 (3.73)	14.77 (3.80)	15.4 (3.92)	10.00 (3.23)	10.67 (3.34)	11.00 (3.39)	11.67 (3.48)	12.67 (3.62)	13.67 (3.76)
SEm+		0.28	0.38	0.37	0.39	0.34	0.3	0.36	0.18	0.25	0.32	0.31	0.21
CD (P=0.05)		NS	1.16	1.13	1.2	1.02	0.91	NS	0.56	0.76	0.96	0.95	0.63

Table 2 Efficacy of Indoxacarb 5% + Fipronil 5% SC against whiteflies on cotton during *kharif* (2013-14 and 2014-15)

Treatment	Dose (g.a.i./ha)	Mean number of whitefly adults per three leaves/plant* during first season (2013-14)						Mean number of whitefly adults per three leaves/plant* during second season (2014-15)					
		1 DBA	1 DAA	3 DAA	5 DAA	7 DAA	10 DAA	1 DBA	1 DAA	3 DAA	5 DAA	7 DAA	10 DAA
Indoxacarb 5% + Fipronil 5% SC	100 (50+50))	6.40 (2.60)	2.10 (1.50)	2.00 (1.46)	1.67 (1.37)	1.67 (1.46)	1.17 (1.29)	8.00 (2.91)	2.33 (1.64)	2.00 (1.52)	1.33 (1.27)	1.00 (1.17)	1.00 (1.17)
Indoxacarb 5% + Fipronil 5% SC	125 (62.5+62.5)	7.07 (2.74)	2.00 (1.56)	1.77 (1.49)	1.57 (1.43)	1.40 (1.37)	1.07 (1.24)	7.33 (2.77)	1.67 (1.46)	1.33 (1.29)	1.00 (1.17)	0.67 (1.05)	0.67 (1.05)
Indoxacarb 5% + Fipronil 5% SC	150 (75+75)	7.73 (2.87)	1.93 (1.55)	1.67 (1.45)	1.43 (1.39)	1.37 (1.36)	1.03 (1.23)	6.33 (2.59)	1.33 (1.34)	1.00 (1.17)	0.67 (1.05)	0.33 (0.88)	0.67 (1.05)
Indoxacarb 5% + Fipronil 5% SC	250 (125+125)	6.73 (2.68)	1.90 (1.54)	1.60 (1.44)	1.33 (1.35)	1.23 (1.31)	1.00 (1.21)	6.67 (2.66)	1.00 (1.17)	0.67 (1.05)	0.33 (0.88)	0.67 (1.05)	0.33 (0.88)
Fipronil 5% SC	100	8.07 (2.93)	2.27 (1.65)	2.10 (1.60)	1.97 (1.56)	1.80 (1.52)	1.80 (1.52)	8.33 (2.94)	2.67 (1.72)	2.33 (1.64)	1.67 (1.44)	1.33 (1.34)	1.00 (1.22)
Indoxacarb 14.5% SC	75	6.73 (2.63)	2.77 (1.76)	2.50 (1.70)	2.67 (1.76)	2.33 (1.67)	2.10 (1.60)	11.67 (3.48)	2.00 (1.56)	1.33 (1.34)	1.33 (1.34)	1.00 (1.22)	1.33 (1.34)
Chlorpyrifos 16% + Alphacypermethrin 1% EC	425 (400+25)	6.73 (2.63)	3.43 (1.96)	3.10 (1.87)	2.90 (1.80)	2.57 (1.74)	2.57 (1.73)	7.67 (2.85)	3.00 (1.86)	1.67 (1.46)	1.33 (1.34)	1.00 (1.22)	1.67 (1.44)
Untreated		7.40 (2.80)	8.77 (2.93)	9.13 (3.01)	9.43 (3.07)	9.77 (3.14)	10.10 (3.20)	9.33 (3.12)	10.67 (3.34)	12.00 (3.53)	13.33 (3.72)	14.33 (3.84)	15.33 (3.97)
SEm+		0.31	0.38	0.36	0.34	0.25	0.30	0.26	0.26	0.27	0.24	0.18	0.22
CD (P=0.05)		NS	1.17	1.10	1.02	0.76	0.91	NS	0.79	0.82	0.74	0.53	0.67

DBA- Days before application, DAA-Days after application, Mean of three sprays, NS-Non significant, *Mean of three replications. Figures in parenthesis are mean square transformed values x+0.5

statistically on par with Indoxacarb 5% + fipronil 5% SC @ 150 (75+75) g a.i./ha and Indoxacarb 5% + fipronil 5% SC @ 125 (62.5+62.5) g a.i./ha which resulted in mean population of 0.87, 0.67 and 1.00, 0.67 nymphs/ three leaves/ plant 10 DAA, during season 1 and season II respectively (Table 1). Fipronil 5% SC @ 100 g a.i./ha recorded a mean population of 1.20 and 1.00 nymphs/ three leaves/ plant and Indoxacarab 14.5 SC@ 75 g a.i./ha resulted in a mean population of 1.33 and 2.67 during first season and second season respectively. Earlier reports on the efficacy of fipronil against jassids (Patil *et al.* 2009; Sreekanth and Reddy 2011) fall in line with the present study.

Whiteflies (Bemisia tabaci): As affirmed from Table 2, The lower dose of indoxacarb 5% + fipronil 5% SC @ 125 (62.5+62.5) g a.i./ha resulted in 1.07 and 0.67 mean number of whitefly population 10 DAA during both the *kharif* seasons (2013-14 and 2014-15) which was on par with higher dose of indoxacarb 5% + fipronil 5% SC @ 250 (125+125) g a.i./ha which registered least number of whitefly population (Table. 2). On the other hand, combination product of chlorpyrifos 16% + alphacypermethrin 1 % EC accounted for highest number of whitefly population registering 2.57 and 1.67 which was next only to untreated control which recorded 10.10 and 15.33 mean number of whitefly population/ three leaves/ plant 10 DAA during first and second season respectively. The results are in closer proximity with the studies conducted by Rudramani *et al.,* 2011 which proved efficacy of indoxacarb against sucking pests of cotton.

Indiscriminate and extensive use of synthetic pesticides have led to problems like insecticidal resistance, pest resurgence and destruction of natural enemies. To overcome these problems and to minimize the usage of synthetic insecticides, newer molecule Indoxacarb 5% + Fipronil 5% SC @ 125 (62.5+62.5) g a.i./ha, which effectively controlled population of jassids and whiteflies in cotton, can be used for promising management of jassids and whiteflies in cotton, based on the results acquired from the field trials conducted during *kharif* season, 2013-14 and 2014-15.

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