Madras Agric. J., 97 (1-3): 86-87, March 2010
https://doi.org/10.29321/MAJ.10.100352

Short Note

Toxicity of Spirotetramat 150 OD to Honeybees

B. Vinothkumar*, N. Kumaran, N. Boomathi, P.A. Saravanan and S. Kuttalam
Department of Agricultural Entomology
Tamil Nadu Agricultural University, Coimbatore - 641 003

Laboratory studies were conducted to evaluate the contact toxicity of spirotetramat 150 OD against honeybees in Tamil Nadu Agricultural University, Coimbatore during 2007 - 2008. Spirotetramat 150 OD at 45, 60 and 75 g a.i.ha^{-1} caused 3.33, 10.00 and 20.00 per cent mortality, respectively to Indian bees after 6 HAT, and it increased to 10.00, 16.67 and 30.00 per cent, respectively after 24 HAT. But chloronicotinyl compounds, imidacloprid and acetamiprid and conventional insecticides, monocrotophos and methyl demeton caused increased mortality of 46.67, 43.33, 56.67 and 63.33 per cent, respectively. Similar trend was observed in Italian bees, little bees and stingless bees. Hence, spirotetramat was considered to be relatively safer to honeybees than imidacloprid, acetamiprid, monocrotophos and methyl demeton.

Key words: Honeybees, spirotetramat, safety, chloronicotinyl, tetranic acid

Extensive use of broad spectrum synthetic insecticides results in the destruction of non target organisms.Since they have a long life period, resulting in bioaccumulation and biomagnification in the environment and in the living organisms (Sahai, 1992). In the recent past, synthetic pyrethroids have been extensively used for the control of insect pests, but with number of problems such as pests developing resistance, pest resurgence, and residues in consumable produce at harvest along with destruction of natural enemies and non target insects like honey bees. However, the use of synthetic pesticides in Indian agriculture cannot be dispensed with in view of the targets of food requirements projected for 2020 AD. The Golden Age of insecticide research has met with selective, neuro active and easily degradable compounds. These newer molecules always have a higher stability and superiority over the conventional pesticides to control the pest population in classical manner at field level. In this array, spirotetramat 150 OD (tetranic acid) is one of a novel and superior chemical with an aim to replace the highly effective broad spectrum insecticides. Hence present study was undertaken to know the effect of spirotetramat 150 OD against honey bees.

Material and Methods

A laboratory experiment was conducted to assess the safety of spirotetramat 150 OD to the workers of Indian bee, *Apis cerana indica* Fab., Italian bee, *Apis mellifera* Linn., little bee, *Apis florea* F. and Dammer bee or Stingless bee, *Trigona iridipennis* The experiment was conducted in completely randomized design (CRD) with nine treatments and each treatment was replicated three times. The treatments were Spirotetramat 150 OD @ 45 g a.i. ha^{-1}, Spirotetramat 150 OD @ 60 g a.i. ha^{-1}, Spirotetramat 150 OD @ 75 g a.i. ha^{-1}, Monocrotophos 36 SL @ 450 g a.i. ha^{-1}, Imidacloprid 200 SL @ 25 g a.i. ha^{-1}, Acetamiprid 20 SP @ 20 g a.i. ha^{-1}, Methyl demeton 25 EC @ 125 g a.i. ha^{-1}, Dimethoate 30 EC @ 150 g a.i. ha^{-1} and Untreated check. The effect of spirotetramat 150 OD was assessed by contact toxicity method. Different concentrations of spirotetramat 150 OD and standard checks were prepared using distilled water. Plastic containers with perforations were used for the experiment to allow adequate aeration for the bees. Filter papers were placed inside the container and then treated with 1ml of insecticide solution and then allowed to dry for 15 min. Honey bees were kept in refrigerator for 5 minutes prior to test to calm them and transferred @ 10 per container. After exposure for 1 h, the insecticide treated filter paper was removed and 40 per cent sucrose solution soaked in cotton wool was provided as feed for the honey bees. The bee mortality was observed 6, 12 and 24 h after treatment and per cent mortality worked out.

*Corresponding author email: drbvinothkumar@yahoo.com

Results and Discussion

Contact toxicity of spirotetramat to dammer bees, *Trigona iridipennis* Smith showed that spirotetramat 150 OD at 45, 60 and 75 g a.i. ha-1 caused 6.67, 6.67 and 10.00 per cent mortality at 24 HAT, respectively, whereas standard checks imidacloprid, acetamiprid, dimethoate, methyl demeton and monocrotophos recorded 33.33, 36.67, 40.00, 43.33 and 43.33 per cent mortality, respectively after 24 HAT. In case of little bees, maximum mortality was observed in methyl demeton (56.67 %) and monocrotophos (53.33 %) at 24 HAT. Mortality increased as the time of observation increased from 6 to 24 HAT. spirotetramat at higher dose of 75 g a.i. ha^{-1} recorded 10.00, 16.67 and

23.33 per cent mortality after 6, 12 and 24 HAT, respectively. Contact toxicity of spirotetramat to Indian bees, *Apis cerana indica* Fab. showed that spirotetramat 150 OD at 40, 60 and 75 g a.i. ha^{-1} caused 10.00, 16.67 and 30.00 per cent mortality, respectively, whereas methyl demeton 25 EC at 125 g a.i. ha^{-1} and monocrotophos 36 SL at 450 g a.i. ha^{-1} caused as high as 63.33 and 56.67 per cent mortality after 24 HAT. Maximum mortality of *Apis mellifera* Linn. was observed in monocrotophos (66.67%) followed by methyl demeton (63.33 %). The mortality increased as the time of exposure increased from 6 to 24 hours. Spirotetramat at the high dose of 75 g a.i. ha^{-1} recorded 13.33, 16.67 and 26.67 per cent mortality of Italian bees after 6, 12 and 24 HAT, respectively.

The present findings corroborated with the findings of Mayer *et al.* (1994) who reported that application of imidacloprid in the late evening had minimal effect on leaf cutting bees, honey bees and bumble bees. EPA (1994) stated that imidacloprid is highly toxic to honey bees. Matsuda and Takahashi (1996) stated that Mospilan (acetamiprid) had low toxicity to beneficial insects such as honey bees and bumble bees. Similar results were also

Table 1. Effect of spirotetramat 150 OD on four species of honeybees

Treatment	Mortality (%) (HAT)											
	Sting less bee			Little bee			Indian bee			Italian bee		
	6	12	24	6	12	24	6	12	24	6	12	24
Spirotetramat 150 OD @ 45 g a.i.ha^{-1}	0.00 (0.19)^{a}	3.33 (6.15)^{a}	6.67 (12.29)^{a}	0.00 (0.19)^{a}	3.33 (6.15)^{a}	6.67 (12.29)^{b}	0.00 (0.19)^{a}	3.33 (6.15)^{ab}	10.00 (15.00)^{a}	0.00 (0.19)^{a}	6.67 (12.29)^{ab}	10.00 (15.00)^{ab}
Spirotetramat 150 OD @ 60 g a.i.ha^{-1}	0.00 (0.19)^{a}	0.00 (0.19)^{a}	6.67 (8.86)^{a}	0.00 (0.19)^{a}	3.33 (6.15)^{a}	13.33 (21.14)^{bc}	0.00 (0.19)^{a}	10.00 (15.00)^{bc}	16.67 (23.86)^{ab}	6.67 (12.29)^{b}	10.00 (15.00)^{b}	20.00 (26.07)^{bc}
Spirotetramat 150 OD @ 75 g a.i.ha^{-1}	0.00 (0.19)^{a}	6.67 (12.29)^{a}	10.00 (15.00)^{a}	10.00 (15.00)^{b}	16.67 (23.86)^{b}	23.33 (28.78)^{c}	10.00 (15.00)^{b}	20.00 (26.07)^{cd}	30.00 (33.00)^{bc}	13.33 (21.14)^{bc}	16.67 (23.86)^{bc}	26.67 (31.00)^{cd}
Monocrotophos 36 SL @ 450 g a.i.ha^{-1}	20.00 (26.07)^{bc}	36.67 (37.22)^{b}	43.33 (41.15)^{b}	23.33 (28.78)^{c}	36.67 (37.14)^{cd}	53.33 (46.92)^{d}	26.67 (31.00)^{c}	43.33 (41.15)^{e}	56.67 (48.93)^{d}	30.00 (33.00)^{d}	53.33 (46.92)^{f}	66.67 (54.78)^{e}
Imidacloprid 200 SL @ 25 g a.i.ha^{-1}	13.33 (21.14)^{b}	26.67 (30.79)^{b}	33.33 (35.22)^{b}	13.33 (21.14)^{bc}	23.33 (28.78)^{bc}	40.00 (39.15)^{d}	16.67 (23.86)^{bc}	30.00 (33.00)^{de}	46.67 (43.08)^{cd}	23.33 (28.78)^{cd}	30.00 (33.00)^{cde}	50.00 (45.00)^{e}
Acetamiprid 20 SP @ 20 g a.i.ha^{-1}	13.33 (21.14)^{b}	30.00 (33.00)^{b}	36.67 (37.22)^{b}	20.00 (26.07)^{bc}	30.00 (33.00)^{bcd}	43.33 (41.15)^{d}	23.33 (28.78)^{c}	26.67 (31.00)^{de}	43.33 (41.15)^{cd}	20.00 (26.07)^{cd}	26.67 (31.00)^{cd}	46.67 (43.08)^{de}
Methyl demeton 25 EC @ 125 g a.i.ha^{-1}	23.33 (28.78)^{c}	33.33 (35.22)^{b}	43.33 (41.15)^{b}	26.67 (31.00)^{c}	43.33 (41.15)^{d}	56.67 (48.85)^{d}	23.33 (28.29)^{c}	46.67 (43.08)^{e}	63.33 (52.78)^{d}	26.67 (31.00)^{cd}	50.00 (45.00)^{ef}	63.33 (52.78)^{e}
Dimethoate 30 EC @ 150 g a.i.ha^{-1}	16.67 (23.86)^{bc}	30.00 (33.00)^{b}	40.00 (39.15)^{b}	23.33 (28.78)^{c}	33.33 (35.22)^{bcd}	46.67 (43.08)^{d}	20.00 (26.07)^{bc}	36.67 (37.14)^{de}	53.33 (47.01)^{cd}	23.33 (28.78)^{cd}	43.33 (41.07)^{def}	56.67 (48.93)^{e}
Untreated check (water spray)	0.00 (0.19)^{a}	3.33 (6.15)^{a}	3.33 (6.15)^{a}	0.00 (0.19)^{a}	0.00 (0.19)^{a}	0.00 (0.19)^{a}	0.00 (0.19)^{a}	0.00 (0.19)^{a}	10.00 (15.00)^{a}	0.00 (0.19)^{a}	0.00 (0.19)^{a}	6.67 (12.29)^{a}

HAT – Hours After Treatment ; In a column, means followed by a common letter are not significantly different by DMRT (P = 0.05)
Values in the parentheses are arc sine $\sqrt{\text{per cent}}$ transformed values

obtained by Lacombe (1999), who reported that acetamiprid had low toxicity to mammals, aquatic organisms and wildlife and did not show adverse effects on honey bees or bumble bees. Khan *et al.* (2005) found that imidacloprid was toxic to Apis cerana indica F. Imidacloprid 17.8 SL was toxic to bees and Indian bees were more susceptible than little bees (Preetha 2007). Among insecticides tested spirotetramat was considered to be safer insecticide to honeybees than imidacloprid, acetamiprid, monocrotophos, methyl demeton and dimethoate.

References

EPA. 1994. Office of Pesticide Programs. Pesticide fact sheet: Imidacloprid. Washington D.C., March 18

Khan, R.B., Dethe, M.D., Sharma, D. and Abrol, D.P. 2005. Relative toxicity of some insecticides to *Apis cerana indica*. *Indian Bee J*., **67:** 52-56.

Lacombe, J.P. 1999. Acetamiprid - new possibilities for the control of foliage pests. In: Proc. of the Fifth International Conf. on Pests in Agriculture, Part I, Montpellier, France, 7-9 December, pp. 219-226.

Matsuda, M. and Takahashi, H. 1996. Mospilan (acetamiprid, N1-25) - A new systemic insecticide. *Agrochemicals Japan,* **68:** 20-21.

Mayer, D.F., Patten, K.D., Macfarlane, R.P. and Shants, C.H. 1994. Differences between susceptibility of four pollinator species (*Hymenoptera: Apoidea*) to field weathered insecticide residues. *Melanderia,* **50:** 24-27.

Preetha. G. 2007. Impact assessment of chloronicotinyls on the management of sucking pests in cotton and bhendi ecosystem. Unpub. Ph.D. Thesis. Tamil Nadu Agric. Univ., Coimbatore, India.

Sahai, S.1992. Accumulation and induced histopathological effect of pesticides in the testis of Puntius ticto (Teleosti). *J. Ecobiol.,* **4:** 303-308.

Received: November 11, 2009; Accepted: March 20, 2010