J.Pest Cont. & Environ. Sci. 10(1): 55-67 (2002)

Field evaluation of some commercial products against spider mites (*Tetranychus* spp) and their common predatory mites on cotton plants

By

Abdel Rahman, S.M.* and Shawir, M.S.**

* Central Pesticides Laboratory, Sabahia Station.
** Pesticide Chemistry Dept., Faculty of Agriculture, El-Shatby, Alexandria University.

Received 27/12/2001, Accepted 19/1/2002

ABSTRACT

The effects of M-pede (saponified fatty acid), Biofly (*Beauveria bassiana)*, Natrilo (natural oil) and Marshal (carbosulfan) on spider mites *Tetranychus* spp. and their predatory mites, *Agistemus exertus* and *Tydues californicus* were examined on cotton fields. Tested treatments were applied at recommended and half recommended rates as follows: 3, 1.5 liter/feddan for M-pede; 400, 200 ml/feddan for biofly, 300, 150 g/feddan for carbosulfan and 1250, 625 ml/feddan for natrilo. Natrilo at the higher rate, showed the highest reduction of *Tetranychus* spp infestation, while at the lower rate had the lowest reduction. In the meantime, other treatments showed moderate reduction of infestation throughout fifteen days of application. Moreover, there were no significant differences between the tested treatments except for the Natrilo treatments (1250 and 625 ml/f). The side effect of the tested compound treatments on the predatory mites revealed that there were no pronounced effects on *A. exertus* when the lower rate was used.

INTRODUCTION

Two-spotted spider mite,*Tetranychus urticae* (koch) and its sibling species, the carmine spider mite, *T. cinnabarinus* (Boisduval), continue to be major pests to field crops, vegetables, fruits and ornamental plants (Edge and James, 1986). The intensive use of the broad-spectrum insecticides incurs economic, health, and environmental costs and may cause pest resurgence and secondary pest outbreaks through decimation of natural enemies (John *et al.,* 1986). Furthermore, documented losses by *Tetranychus* spp. was reported by several authors; e.g., Park *et al.*, (1988), Hoy and Conley (1990), Kim and Lee (1990), Mizukochi (1988), Goodwin *et al.*, (1995) and Marcic (1996).

Therefore, it is necessary to search and develop insecticides with alternative modes of action that do not obviate the activity of natural enemies. The efficiency of mineral oils, detergents, insecticidal soaps, and bio insecticides have been demonstrated efficiency against *Tetranychus* spp. on cotton and several vegetable crops under field conditions (Tamai *et al.,* 1999, El-Duweini and Sedrak 1999).

The aim of this work is to evaluate the residual field toxicity of potential commercial products against mobile stage of spider mites, (*Tetranychus* spp.) and their predatory mites on cotton plants.

MATERIALS AND METHODS

Treatments:-

Biofly 100%: commercial liquid product of entomopathogenic fungus, *Beauveria bassiana* ($3x10^7$ spores / ml).

M-pede 49 %: Blend of potassium salts of natural long chain fatty acids (Saponified fatty acid).

Natrilo (natural oil 94%): Blend of vegetable oils, emulsifiers and antioxidant.

Marshal 25% W.P: (carbosulfan) 2,3 dihydro – 2,3dimethyl benzofurnanyl {(dibutyl amino) thio} methyl carbamate.

The tested chemicals were obtained as fresh formulated products from the Central Agricultural Pesticides Laboratory, Ministry of Agriculture, El-Dokki , Giza, Egypt.

Field trails : The field trails were carried out at the Alexandria University Experimental Station at Abees area throughout two successive cotton seasons, 1998 and 1999. The cotton variety Giza 70, an extra long stable of *Gossypium barbadens*, was obtained from the Agronomy Department, Faculty of Agriculture (Shatby) Alexandria University. An experimental area of about 1/8 feddan was divided into 16 plots, each 21m^2; in a complete randomized block design. Four replicates were used for each treatment in addition to the control group. Cultural practices were applied as recommended for commercial production of cotton. The treatments were applied at two rates (recommended and half recommended) using a hand operated knapsack sprayer. Treatments were evaluated by counting mobile stages of mites on samples, each has 25 leaves. Samples were taken at random from lower, middle and upper leaves of plants of each replicate. Counts were made just before treatment and at zero, 1, 3, 6, 9, 12 and 15 days post treatment. The samples were collected early morning (about 7 a.m.) to ensure the stability of mites and to avoid the adverse climatic conditions.

The reduction percentage in the population of spider mites was estimated using the formula of Henderson and Telton (1955). The statistical analysis was performed after transformation of the data to values of square root for (x+1) according to Snedecor and Cochran (1967), where (x) is the number of mobile stages per 25 leaves.

RESULTS AND DISCUSSION

Effect of treatments on *Tetranychus* spp: The effect of the tested compounds either as the higher or lower dose on spider mites, *Tetranychus* spp. Infesting cotton plant was presented as percent reduction of control in Table (1).

The reduction percentage of *Tetranychus* spp was recorded along 15 days after treatment. The results showed that Natrilo provided reasonable control of *Tetranychus* spp. (76.10 % reduction) followed by M-pede (74.69%), Marshal (67.73%) and biofly (64.91) when the higher rate was used. The corresponding values in different treatments with the lower rate were 54.93, 68.47, 66.65 and 61.42, respectively. The statistical analysis revealed no significant differences between all compounds used either at the higher or the lower rate. The data also showed that the reduction of population increased with increasing the application rates .

The present results are in line with that reported by Tamai *et al.*, (1999) who showed that higher values of accumulated mortality of red spider mite were observed with increasing concentrations of the biofly (*Beauveria bissiana*). Also, Andreeva and Shternshis (1995) mentioned that *B.bassiana* kept population of *T. urticae* and greenhouse whitefly *Trigleurodes vaporariorum* below economic threshold. El-Duweini and Sedrak (1999) recorded that Ortus

(acaricide) was the most toxic compound followed by M-pede to *Tetranychus urticae*. Also, they showed that M-pede + jojoba oil mixture produced a high level of synergrsm against *T.urticae*.Stanyard *et al.*, (1998) indicated that repeated application of horticulture oils and M-pede were required to reduce Tetranychid *Panonychus ulme* and, no more effect in conserving predatory mites than some of the selective acaricides was found.

Effect of treatments on predatory mites: The effect of the tested chemicals against *A. exertus* and *T. californicus* on cotton plants are presented in Tables (2 and 3). The results showed that percent reduction of *A. exertus* was low even at the higher rates of application where it was 20.07, 24.75, 25.26 and 34.23 for biofly, Marshal, M-pede and Natrilo, respectively.

However, the parallel values, at the lower rates of application, were 15.99, 10.99, 14.15 and 19.92 respectively. The results revealed that all of the tested chemicals at the two tested doses were less detrimental to the *A. exertus*. Also, the statistical analysis revealed no significant differences either between all compounds or concentrations used.

Natrilo was the most toxic treatment (67.53%) where the percent reduction in infestation was 53.67, 44.74, 34.62% for Marshal, M-pede and biofly, respectively when the higher rate was used. However, the corresponding values were 51.56, 45.28, 28.24 and 23.55% for Natrilo, Marshal, M-pede and biofly, respectively when the lower rate was used. Again no significant differences were observed between M-pede, biofly and Marshal when the higher rate is used. The results are

Table (1): Reduction percentage of *Tetranychus*. spp. infesting cotton plant as affected by some compounds under field conditions.

Treatment	Application Rate g (ml)/feddan	Reduction percentage in the populations at different intervals (Days)							Mean residual effect (%)±S.E
		Zero	1	3	6	9	12	15	
M-pede	3000	80.55	79.49	92.71	54.24	79.03	59.52	77.26	$74.69^{ab} \pm 5.01$
	1500	91.67	90.03	72.15	62.46	62.17	52.20	45.64	$68.47^{ab} \pm 6.63$
Biofly	400	60.42	91.35	74.35	69.21	48.73	55.52	54.78	$64.91^{ab} \pm 5.51$
	200	60.42	66.90	62.13	57.37	77.94	61.89	43.32	$61.42^{ab} \pm 3.92$
Marshal	300	93.75	83.97	84.72	44.24	63.46	51.43	52.53	$67.73^{ab} \pm 7.38$
	150	58.33	75.21	100.0	47.80	76.79	61.24	47.20	$66.65^{ab} \pm 7.03$
Natrilo	1250	95.83	91.98	87.29	61.01	59.61	78.98	58.03	$76.10^{b} \pm 6.25$
	625	79.17	87.50	55.09	38.66	48.01	38.84	37.21	$54.93^{a} \pm 7.75$

LSD 0.05 = 13.43

Means followed by the same letter (s) are not significantly different at 5 % level.

Table (2): The effectiveness of compounds at two different rates against spider mite predator, *Agistemus exertus*

Treat-ment	Application Rate g (ml)/feddan	Reduction percentage in the populations at different intervals (Days)							Mean residual effect (%)±S.E
		Zero	1	3	6	9	12	15	
M-pede	3000	25.0	0.0	0.0	50.0	0.0	75.0	26.79	25.26 [a] ± 10.9
	1500	25.0	0.0	0.0	25.0	0.0	25.83	23.33	14.15 [a] ± 5.0
Biofly	400	25.0	0.0	50.0	12.5	0.0	45.83	7.14	20.07 [a] ± 7.88
	200	25.0	0.0	25.0	12.5	0.0	45.83	3.57	15.99 [a] ± 6.41
Marshal	300	16.67	0.0	50.0	25.0	25.0	45.83	10.72	24.75 [a] ± 6.81
	150	25.0	0.0	0.0	12.0	0.0	35.83	3.57	10.99 [a] ± 5.41
Natrilo	1250	25.0	0.0	50.0	25.0	50.0	55.67	33.93	34.23 [a] ± 7.39
	625	25.0	0.0	50.0	12.5	0.0	43.17	17.96	19.95 [a] ± 6.87

LSD 0.05 = 18.12

Means followed by the same letter (s) are not significantly different at 5 % level

Table (3): The effectiveness of compounds at two different rates against spider mite predator, *Tydues californicus*.

Treat-ment	Application Rate g (ml)/feddan	Reduction percentage in the populations at different intervals (Days)							Mean residual effect (%)±S.E
		Zero	1	3	6	9	12	15	
M-pede	3000	91.67	25.0	50.0	50.0	22.22	24.29	50.0	$44.74^{abc} \pm 9.24$
	1500	54.17	0.0	30.0	45.0	8.33	20.0	50.15	$28.24^{a} \pm 7.48$
Biofly	400	58.33	.0.0	30.0	45.0	8.33	41.67	58.98	$34.62^{ab} \pm 8.75$
	200	44.99	0.0	87.50	0.0	0.0	3.57	23.81	$23.55^{a} \pm 12.75$
Marshal	300	91.67	25.0	50.0	50.0	19.44	66.67	72.94	$53.67^{bc} \pm 9.75$
	150	91.67	25.0	35.0	40.0	20.0	50.0	55.3	$45.28^{abc} \pm 9.06$
Natrilo	1250	50.0	25.0	100.0	50.0	75.0	75.0	97.73	$67.53^{c} \pm 10.34$
	625	91.67	25.0	87.50	0.0	11.11	66.43	79.22	$51.56^{bc} \pm 14.52$

LSD 0.05 = 16.69

Means followed by the same letter (s) are not significantly different at 5 % level

coincide with that reported by Wright and Knauf (1994) who showed that Naturalis-L (*Beauveria bassiana*) did not deleteriously affect bees, natural predators and parasitoids, it is also being effectively used in insect resistance management programs. Murphy *et al.*, (1998) showed that *Beauveria bassiana* at 0.5 and 1.0 1b/acre had no apparent adverse effects on the parasitoid, *Encarsia formosa* as a biological control agent. Hinz and Wright (1997) also pointed out that *B. bassiana* was active against the major cotton pests including *Bemisia tabaci*. Pavlyushin and Krasavina (1997) found that stable reduction in the numbers of *Aphis gossypii* on cucumber in greenhouse could be obtained through the combined action of the fungus (*Beavueria bassiana*) and the predator, *Chrysopa sinica*.

The results also indicated that the use of half recommended rate of the tested compounds gave moderate control of *Tetranychus spp.* and allow the survival of its predators especially *A. exertus*. These results comply with those obtained by Abdel-Rahman (1995) who reported that the use of one-sixth of the recommended rate of Tedifol gave insufficient control of the spider mite and permitted the survival of its predators.

In general, all of the tested chemicals were close in its activity against *Tetranychus* spp. along 15 days post treatment either when used at half recommended or at recommended feild rate. Moreover, reducing recommended dosages of Mpede, biofly, Natrilo, and Marshal did not reduce the period of residual control. Furthermore, these chemicals were less harmful to the predatory mite, *A. exertus*. The beneficial mite, *T. californicus* was more susceptible to the tested chemicals than *A. exertus*. Finally these chemicals could be useful in controlling mites when implemented in IPM programs because

they are more safe to the environment compared with other traditional pesticides.

ACKNOWLEDGEMENT

We warmly thank Dr.M.Radwan for reviewing the manuscript.

REFERENCES

Abdel – Rahman, S.M. (1995). Biological and toxicological studies on spider mite, *Tetranychus spp*. Ph.D. thesis Fac. of Agric. Alexandria Univ.

Andreeva, I.V. and M.V. Shternshis (1995). Microbiological formulation against web mites in green houses. Zashchita Restenii (Moscow), (11): 41-42.

Edge, V.E. and D.G. James (1986). Organo-tin resistance in *Tetranychus urticae* (Acari : Tetranychidae) in Austratia. J. Econ. Entomol., 79(6): 1477-83.

El-Duweini, F.K. and R.A., Sedrak (1999). Synergism and antagonism of mixing some acaricides with jojoba oil for control of spider mite (Acari: *Tetranychidae)* in Egypt. Rev. of Agric. Entomol., 87 (1): 57 (Abstract).

Goodwin, S.; G. Herron; N. Gough; T. wellham; J. Rophail; and R. Parker (1995). Relationship between insecticide-acaricide resistance and field control in *Tetranychus urticae* (Acari: Tetranychidae) infesting roses. J. Econ. Entomol 88., (5): 1106-12.

Mizukoshi, T. (1988). Acaricide resistance of the two spotted spider mite (*Tetranychus urticae* koch) on apple crops in Hokkaido. Susceptibilities to dicofol and cyhexatin. Bulletin of the Hokkaido Prefectural Agricultural Experiment Stations, No. 58, 101-109.(C.f. Rev. of Agric. Entomol., (1990), *78* (4): 3790).

Murphy, B.C.; T. Morisawa; and M.P. Parrella (1998). Insect killing fungi floriculture's IPM future. Growertalks. 61:10-68.

Park, H. M.; S.Y. Choi; J.K. Yoo; S.Y. Na; and K.H. Lee. (1988). Chemical resistance of apple orchard mites (*Panonychus ulmi* Koch and *Tetranychus urticae* Koch) and their control with several acaricides. Rev. of Appl. Entomol., 76 (8): 588 (Abstract).

Pavlyushin, V.A. and L.P. Krasavina (1997). Reduction of the abundance of the melon aphid under the combined action of aphidophages and entomopathogenic fungi (Russian) Vessoyuznyi Nauchno-issledovatel, skii institut Zashchity Rastenii, Leningrad, USSR: 77-83.

Snedecor, G.and W. Cochran (1967). Statistical methods. Iowa State College Press. Ames. Iowa, USA, pp. 593.

Stanyard, M.J.; R.E. Foster and T.J Gibb (1998). Population dynamic of *Amblyseius fallacis* (Acari : Phytoseii dae) and Eurapean red mite (A cari: Tetranychidae) in apple trees with selected acaricides. J. Econ. Entomol., 91 (1): 217-25.

Tamai, M.A.; S.B. Alves; and P.J. Neves (1999). Pathogenicity of Beauveria bassiana (Bals.) Vuill. Against *Tetranychus urticae* koch . Rev. of Agric. Entomol., *87 (12): 1517 (Abstract).*

Wright, J.E.; and T.A. Knauf (1994). Evaluation of Naluralis-L for control of cotton insects. British Crop Protection Council, BCPC Publication, Bracknell, UK. pp - 45-52.

الملخص العربى

التقويم الحقلى لبعض المركبات على العنكبوت الاحمر والحلم النافع فى حقول القطن

د.صفاء مصطفى عبد الرحمن* ، د. محمد سالم شعوير**

*المعمل المركزى للمبيدات - محطة البحوث الزراعيه بالصبحيه- اسكندرية
**قسم كيمياء المبيدات- كلية الزراعة بالشاطبى – جامعة الاسكندرية

تم تقييم تأثير كل من أم بيد ، ناتريلو ، بيوفلاى، والمارشال على العنكبوت الاحمر والحلم النافع فى حقول القطن، وقد تم تطبيق هذه المركبات بجرعتين جرعة حقلية وجرعة نصف حقلية (تبعا لتوصيات وزارة الزراعة). ولقد اظهرت النتائج ان مركب ناتريلو بتركيز ١٢٥٠ مل للفدان قد اعطى اعلى نسبة خفض فى اعداد العنكبوت الاحمر واعطى نفس المركب بنصف الجرعة نسبة أقل فى خفض أعداد العنكبوت الاحمر وقد اعطت بقية الكيماويات نسبة خفض متوسطة فى اعداد الافة خلال ١٥ يوم من تطبيقها ، ولم تظهر فروق معنوية بين الجرعتين المستخدمتين لكل المعاملات فيما عدا مركب ناتريلو. ولقد اظهرت النتائج ايضا ان التأثيرات الجانبية لهذه المركبات على المفترسات كانت اقل ما يمكن على المفترس اجاستيمس باستخدام الجرعة النصف حقلية.