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Imidacloprid, thiamethoxam and cyromazine seed treatments for the control of cabbage insect pests in Erzurum, in Turkey

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ABSTRACT: Experiments were assessed between 2003 and 2004 in Erzurum for protection of white cabbage against cabbage aphid (*Brevicoryne brassicae*), flea beetles (*Phyllotreta atra, P. nigripes*), diamondback moth (*Plutella xylostella),* and large white butterfly (*Pieris brassicae*) by film coating the seed with insecticides at five doses in addition to a fungicide, thiram. Each treatment was replicated three times with a randomized complete block design. A total of 30 plants per treatment were examined at once a week. Seed treatment with imidacloprid, thiamethoxam and cyromazine reduced the number of plants infested with aphids for at least nine weeks after transplanting in 2003 and six weeks in 2004. The cabbage plants were also less damaged by flea beetles, with the proportion of damaged plants reduced by at least a 90 % six weeks after transplanting in 2004.

Key words: Cabbage insect pests, imidacloprid, thiamethoxam, cyromazine, chemical control, filmcoated seed.

Erzurum'da Lahana Zararlısı Böceklerin Mücadelesinde Imidacloprid, Thiamethoxam ve Cyromazine ile Yapılan Tohum İlaçlama Uygulamaları

ÖZET: Bu çalışma, 2003-2004 yıllarında Erzurum'da yürütülmüştür. Çalışmada, imidacloprid, thiamethoxam ve cyromazine etkili maddelerinin beş farklı dozu ve her doza fungusid (thiram) ilave edilerek lahana tohumları bu ilaçlar ile ilaçlanmıştır (kaplanmıştır). Her muamelenin ekimi üç tekerrürlü olarak şansa bağlı bloklar metodu uygulanarak yapılmıştır. Bu ilaçlanmış tohumlardan yetişen bitkilerin lahana afidi (*Brevicoryne brassicae*), lahana yaprak pireleri (*Phyllotreta atra, P. nigripes*), lahana güvesi (*Plutella xylostella)* ve büyük lahana kelebeği (*Pieris brassicae*)'ne karşı etkileri değerlendirilmiştir. Haftada bir kez olmak üzere her muameleden 30 bitki incelenmiştir. Üç etkili maddenin de afit bulaşıklılık oranını azalttığı ve 2003'de dokuz, 2004'de ise altı hafta süresince etkili oldukları saptanmıştır. Bunun yanısıra, lahana bitkilerinde yaprak pirelerinin zararının oldukça azaldığı ve 2004 yılında bitkilerin dikiminden altı hafta sonra zararın % 90 oranında düştüğü tespit edilmiştir.

Anahtar Kelimeler: Lahana Zararlıları, Imidacloprid, Thiamethoxam, Cyromazine, Kimyasal Mücadele, Tohum Ilaçlaması

INTRODUCTION

Cabbage (*Brassica oleracea* L. var. *capitata*) is a major vegetable crop in Erzurum, Turkey, where the important insect pests include *Brevycoryne brassicae* (L.) (Homoptera, Aphididae), *Phyllotreta atra* (F.), *P. nigripes* (F.) (Coleoptera, Chrysomelidae), *Plutella xylostella* (L.) (Lepidoptera, Plutellidae), *Pieris brassicae* (L.), *P. rapae* (L.) (Lepidoptera, Pieridae), *Mamestra brassicae* L. (Lepidoptera, Noctuidae) and *Delia radicum* (L.) (Diptera, Anthomyiidae) (Avcı and Özbek, 1989, 1990; Tozlu et al., 2002). Damage to the crop can be extremely high when no control measures are used (Yildirim, 2008), so farmers spray several different insecticides. Seed coating dramatically reduces the usage of pesticides and has been advocated as an alternative to spraying. Filmcoated dry onion seed treatments were compared with in-furrow drench applications for onion maggot control, and the seed treatments were estimated to permit an 85 % reduction in pesticide application per unit land area based on commercial practices and planting density (Taylor et al., 2001). European investigators have evaluated the effect of film-coated seeds of vegetable crops with several insecticides (Ester and de Moel, 1992; Ester and de Vogel, 1994; Finch and Edmonds, 1999; Ester et al., 1994, 1997, 2002, 2003) with similar efficacy of control.

The seed treatment technology proposed by Taylor (1997) includes spraying a solution or suspension of a film-forming polymer onto seeds to encapsulate an active ingredient, such as an insecticide. The result is a relatively exact and efficient placement of active ingredient around the germinating seed.

Imidacloprid, thiamethoxam and cyromazine can be expected to provide effective tools for management of cabbage insect pests and they are potentially useful for film-coating the seed of cabbage crops. Moreover, these insecticides pose relatively little risk to beneficial insects, mammals, birds, and aquatic organisms (Yildirim, 2008).

Cyromazine, an insect growth regulator with a different mode of action to the other pesticides used has been effective as a seed treatment in controlling onion maggots in both field and laboratory (Grafius and Hayden, 1988; Hayden and Grafius, 1990; Ebert 1999; Yildirim and Hoy, 2003). Imidacloprid and thiamethoxam also have systemic activity and a

potential use for filmcoating the seed of cabbage crops (Aydinoğlu et al., 2002).

The aim of this study is to determine the efficacy of cabbage seeds film-coated with imidacloprid, thiamethoxam and cyromazine at different rates in the field for the control of important cabbage insect pests.

MATERIALS AND METHODS

The trials were carried out with white cabbage in 2003 and 2004 at Erzurum in Turkey. The soil was a sandy loam. Each treatment was replicated three times with a randomized complete block design. Plots were 10 rows, 7 m wide (0.7 m between rows) and 5 m long (0.5 m between plants) 7x5 m (35 m^2) and each plot contained 100 plants. The seed was sown in the end of March and seedlings were planted out at June 24, 2003 and May 25, 2004. Lengths of these plants were varied between 10 and 17 cm when transplanted. The film-coated seeds were planted 6.25 x 6.25 cm^2 peat fibber pots in greenhouse. The cells were filled loosely with peat-based potting compost.

All the seeds were uniformly film-coated with an insecticide and a fungicide (Yildirim and Hoy, 2003). Treatments included imidacloprid (Gaucho 70 WS) 1.8, 3.5, 7, 14, 21 g (AI)/kg seed, thiamethoxam (Cruiser 350 FS) 0.5, 0.9, 1.9, 3.8, 7.5 g (AI)/kg seed, and cyromazine (Trigard 75 WP) 3.1, 6.25, 12.5, 25, 50 g (AI)/kg seed, plus an untreated control. Separately, all the seeds were film-coated with thiram fungicide at the standard commercial rate (1.6 g (AI)/kg seed). The thousand-kernel weights (tkw) of white cabbage seed for 2003 and 2004, were 2.86 and 3.14g respectively.

Treatments were evaluated weekly on a total of 30 plants [10 per replicate] from July 1, 2003 and June 26, 2004 and continued over twelve weeks in 2003 and seven weeks in 2004. Observation on cabbage were focussed on the cabbage aphid and the number of aphids (*B. brassicae*) was counted on a single leaf of each plant that is the highest dense infested with aphids. Cabbage plants were scored for damage caused by flea beetles (*P. atra, P. nigripes*) on July 1, 2003 and June 17, 2004. Flea beetles were counted on 30 plants per treatment, with holes in the leaves from July 1, 2003 and on June 17, 2004 for over twelve weeks in 2003 and four weeks in 2004. Caterpillars of the diamondback moth (*P. xylostella)* and of the large white butterfly (*P. brassicae*) were counted on 30 plants per treatment. Treatment evaluations began on July 1, 2003 and on June 26, 2004 and continued over seven weeks, extremly only twelve weeks in 2003 in *P. xylostella*.

The differences among the insecticides tested were determined according to an analysis of variance (ANOVA) test by using SPSS 11.0 software package. Duncan's Multiple Range Test was used for comparison of means.

RESULTS AND DISCUSSION

The results of this work support the claim that imidacloprid, thiamethoxam and cyromazine are effective insecticides against insect pests on cabbage (*Brevycoryne brassicae* (L.) (Homoptera, Aphididae), *Phyllotreta atra* (F.), *P. nigripes* (F.) (Coleoptera, Chrysomelidae), *Plutella xylostella* (L.) (Lepidoptera, Plutellidae) and *Pieris brassicae* (L.) (Lepidoptera, Pieridae)). The results are summarized in Table 1 and 2.

Seed treatment with imidacloprid, thiamethoxam and cyromazine reduced the number of plants infested with aphids compared with the untreated control. Seed treatments with these insecticides ensured good protection against cabbage aphids for at least nine weeks in 2003 and six weeks in 2004 after transplanting. But after this time these insecticides are less effective (Figs. 1-6). Especially, imidacloprid was efficient insecticide against cabbage aphids in both years (Table 1, 2).

Cabbage plants film-coated with imidacloprid, thiamethoxam and cyromazine were less damaged by flea beetles (Figs. 1-6). There was at least a 90 % reduction in the percentage of damaged plants. Similarity, Kuhar et al., (2002) showed that seed treatment of sweet corn with imidacloprid and thiamethoxam reduced flea beetle feeding injury to leaves in all varieties and reduced disease incidence by 37-83 % in the susceptible variety Sprint. Ester et al. (2002) recorded that seed treatment of flax seeds with imidacloprid or thiamethoxam resulted in a 75 % reduction in the number of plants damaged by flea beetles.

In this study, film-coating of cabbage seed was effective against flea beetles with all investigated doses of imidacloprid, thiamethoxam and cyromazine in the both years. Therefore, flea beetle damage was controlled by these insecticides.

The diamondback moth is the main butterfly infesting cabbage plants a few weeks after transplanting. But, the large white butterfly is sometimes also a problem. Seed treatments with imidacloprid, thiamethoxam and cyromazine reduced the number of plants infested with caterpillars compared with the untreated control. Therefore, these insecticides are effective against caterpillars. But, in 2004, six weeks after transplanting, plants from seeds treated with imidacloprid at 7 and 14 g (AI)/kg seeds and with cyromazine at 25 g (AI)/kg seeds had a higher number of caterpillars per plant compared with plants from untreated seeds (Figs. 1-6).

Imidacloprid, thiamethoxam and cyromazine were showed similar effective between their doses against diamondback moth, flea beetles and butterfly (Table 1, 2).

Ester et al. (2003) recorded that treatment of cabbage and cauliflower seed with imidacloprid was ineffective at controlling cabbage root fly larvae and caterpillars whereas it gave a good control of flea beetle and cabbage aphis at a rate of 70 g a.i. per 100.000 seeds. Cabbage root fly is the most serious pest of cabbage crops in Western Europe. But, this species is not a serious pest of cabbage crops in our region and was only found on 19 September 2003 in two plants of our research plots.

Insect Pest Management (IPM) has to face up to the economic and ecological consequences of the use of pest control measures. Sixty years of sustained struggle against harmful insects using synthetic and oil-derivative molecules has produced perverse secondary effects. The diversification of the approaches inherent in IPM is necessary for better environmental protection. Among the alternative strategies the use of different insecticidal allelochemicals of plants, appears to be promising. The main concern is to determine the potential insecticides for the control of the cabbage insect pests. Our results indicate that imidacloprid, thiamethoxam and cyromazine seed treatments reduced damage of cabbage insect pests in Erzurum. Film-coating of cabbage seeds was successful in controlling cabbage insect pests. The result warrants further research to establish the effect of lower doses. The results of this work support the claim that imidacloprid, thiamethoxam and cyromazine are an effective protection against cabbage insect pests.

Table 2. Results of multiple comparisons with means of number of pests after the use of three different insecticides on cabbage insect pests in 2004 (N= 15).

Brevicoryne brassicae								
Insecticides=	17.June	26. June	03.July	09. July	16. July	24. July	31. July	09.Agus
Std. Error=	S.E=0,06	S.E=0,21	S.E=0,24	S.E=0,32	S.E=0,55	S.E=0,79	S.E=0,77	S.E=6,43
Imidacloprid	-	0,20b**	1,34b**	1,56b**	5,84b**	2,74b**	6,80d**	23,53c**
Thiamethoxam	-	0,00b	0,56b	2,41b	7,91b	6,94b	13,46c	55,77b
Cyromazine	-	0,00b	0,36b	1,52b	6,10b	8,20b	17,08b	54,96bc
Control		2,43a	5,70a	6,90a	18,46a	23,70a	40,13a	107,10a
Plutella xylostella								
Imidacloprid	-	0,05b**	0,40b**	2,58b**	0,86b**	2,30b**	1,28b**	3,64b**
Thiamethoxam	-	0,00b	0,12b	2,56b	0,68b	2,38b	2,04b	1,70b
Cyromazine	-	0,11b	0,20b	2,90b	0,80b	2,23b	2,14b	1,84b
Control		3,33a	1,30a	10,73a	8,00a	13,66a	10,60a	57,93a
Phyllotreta spp.								
Imidacloprid	0,22c**	0,84b**	0,69b**	0,36b**	-	-	-	-
Thiamethoxam	0,30bc	1,34b	1,08b	0,02b	-	-	-	-
Cyromazine	0,40b	1,16b	1,24b	0,11b	-	-	-	-
Control	1,20a	6,33a	7,50a	12,00a	-	-	-	-
Pieris brassicae								
Imidacloprid	-	0,21b**	0,61b**	0,63b**	0,78b**	2,17b**	0,44b**	3,16b**
Thiamethoxam	-	0,24b	0,92b	1,00b	0,49b	2,01b	1,03b	1,10b
Cyromazine	-	0,42b	0,72b	1,09b	0,39b	1,50b	1,10b	1,42b
Control	-	2,46a	3,33a	6,43a	7,56a	11,10a	6,16a	11,53a

Values followed by different letters in the same column under different species differ significantly at P≤ 0.01 or P≤ 0.05

** P≤ 0.01

*P≤ 0.05

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REFERENCES

Avcı, U., Özbek, H. 1989. Biological and morphological studies on cabbage fly, *Delia radicum* (L.) (Diptera: Antomyiidae) in Erzurum. Turk. J. Entomol., 13: 153-162.

Avcı, U., Özbek, H. 1990. Cabbage lepidopterous pests and their parasitoids in Erzurum. Proceedings of the Second Turkish National Congress of Biological Control, September 26-29, 1990, Ankara, 319-330.

Aydinoğlu, H., Dursun, H. Y., Bayraktar, L. 2002. Plant Protection Products. Tarim ve Köyişleri Bak. Kor. ve Kont. Gen. Müd., Ankara, 336 pp.

Ebert, S. M. 1999. Insect growth regulator, Cyromazine (trigard), control of onion maggot (*Delia antiqua* (Meigen) and effects on possible biological controls. M. S. Thesis. Michigan State University, East Lansing.

Ester, A., de Vogel, R. 1994. Film-coating of leek seeds with insecticides: Effects on germination and on the control of onion fly (*Delia antiqua* (Meigen)). *In Seed treatment: Progress and Prospects* (T. J. Martin ed.). Brit. Crop Protection Council Monogr., pp. 195-199.

Ester, A., de Moel, C. P. 1992. Controlling cabbage root fly in Brussels sprouts by film-coating seeds with insecticides. Proc. Ext. Appl. Entomol., 3: 181-190.

Ester, A., Hofstede, S. B. Kosters, P. S. R., de Moel, C. P. 1994. Film-coating of cauliflower seed, *Brassica oleracea* L. var *botrytis* L., with insecticides to control the cabbage root fly, *Delia radicum.* Crop Protect., 14: 1 4-19.

Ester, A., van de Steene, F., Drieghe, S. 1997. Effects of film coating Brussels sprout seeds with various insecticides on the transport into seedlings and on the control of cabbage root fly, *Delia radicum*. J. Plant Dise. and Protect., 104: 47-53.

Ester, A., Huiting, H. F., Nijenstein, J. H. 2002. Effects of film-coating flax seeds with various insecticides on germination and on the control of flea beetles. IOBC/WPRS Bulletin Integrated Control in Field Vegetable Crops.

Ester, A., de Putter, H., van Bilsen, J. G. P. M. 2003. Filmcoating the seed of cabbage (*Brassica oleracea* L. convar. *Capitata* L.) and cauliflower (*Brassica oleracea* L. var. *Botrytis* L.) with imidacloprid and spinosad to control insect pests. Crop Protect., 22: 761-768.

Finch, S., Edmonds, G. 1999. Evulation of imidacloprid against flea beetles, *Phylotreta* spp. and cabbage root fly, *Delia radicum*, in glasshouse trials. Test of Agrochemicals and Cultivars 20. Ann. Appl. Biol., 134: 2-3.

Grafius, E., Hayden, J. 1988. Control of onion maggot 1986. Insect. Acaricide Tests, 13: 126-127.

Hayden, J., Grafius, E. 1990. Activity of cyromazine (trigard) on onion maggot larvae (Diptera: Antomyiidae) in the soil. J. Econ. Entomol., 83: 2398-2400.

Kuhar, T. P., Stivers-Young, L. J. Hoffmann, M. P., Taylor, A. G. 2002. Control of corn flea beetle and Stewart's with in sweet corn with imidacloprid and thiametoxam seed treatment. Crop Protect., 21: 25-31.

Taylor, A. G. 1997. Seed storage, germination and quality. pp. 1-36. *In The Physiology of Vegetable Crops* (H. C. Wien ed.),. CAB International, New York, NY.

Taylor, G.A., Eckenrode, C. J., Straub, R. W. 2001. Seed coating technologies and treatments for onion: challenges and progress. Hortoscience, 36: 199-205.

Tozlu, G., Gultekin, L. Hayat, R., Güclü, Ş. 2002. Studies on the natural enemies of cabbage pests in Erzurum. Procedings of the Fifth Turkish National Congress of Biological Control, September 4-7, Erzurum, 227-235.

Yildirim, E. 2008. The Management Methods of Agricultural Pests and Pesticides. Second Edition. Atatürk University, Agriculture Faculty Press, No: 219, Erzurum, 350 pp.

Yildirim, E., Hoy, C. W. 2003. Cyromazine seed treatments to control onion maggot, *Delia antiqua*, on green onions. J. Econ. Entomol., 95: 1494-1499.