Evaluation of different seed treatment for control of bean seed fly (*Delia platura* [Meigen]) on bean in Spain

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Untersuchung von verschiedenen Samen zur Kontrolle der Bohnensaatenfliege (*Delia platura* [Meigen]) bei spanischen Bohnen

1 Introduction

The bean seed fly (*Delia platura* [Meigen]) is a widely distributed polyphagous dipterous insect of the *Anthomyiidae* family (TROTUS and GHIZDAVU, 1996b; TROTUS et al., 1996).

In beans, the most serious attack is caused by first-generation larvae in spring (TROTUS and GHIZDAVU, 1996b), although that can be five generations in one year (HIGLEY and PEDIGO, 1984). The larvae penetrate the germinating seeds or the seedlings and mine the cotyledons, the small shoots and/or young roots before sprouting. Plants are at greatest risk for 3–4 weeks, until tissues are harder and less vulnerable to attack. Infested plants are weakened or die (WESTON and MILLER, 1989), sometimes necessitating resowing if treatment is not available (BOTO and REINOSO, 1996). Weakened plants are also more susceptible to diseases caused by soil fungi (LETOURNEAU and MSUKU, 1992; BOTO and REINOSO, 1996).

The longer the period between seeding and emergence of the cotyledons, the greater is the risk, especially under conditions of high moisture and low temperatures (MONTECNIOS et al., 1986), and by a high content of organic matter in the soil (BOTO and REINOSO, 1996).

Seed treatment with insecticides is often used as a preventive treatment, as it is usually too late for anymeasure by the time the damage is evident (MONTECNIOS et al., 1986). Insecticide seed treatments also control an other dipterous insect, *Ophiomya spencerella* (TRUTMANN et al., 1992).

This study evaluates different insecticides for bean seed fly control in order to assess their influence on bean seed fly control.

2 Material and methods

2.1 Site characteristics

Six experimental plots were established in the province of León (Spain) from 1998 to 2001, using one traditional

Zusammenfassung

Bei der Bohnenssaatenfliege, *Delia platura*, handelt es sich um eine verbreitete Plage, die den Samen oder das Keimblatt des Sämlings bevor sie treiben befällt. Von 1998 bis 2001 führte man eine Insektiziden Behandlung der Samen durch zur Kontrolle der Bohnensaatenfliege um die Wirksamkeit der folgenden vier Insektizidefestzustellen: Fenthion, Imidacloprid, Lindane und Diazinon. Nur wenige der Pflanzen, die mit Insektiziden behandelt worden sind, wurden von der Bohnensaatenfliege befallen, wobei Imidacloprid am wenigsten effektiv war.

Schlagworte: *Phorbia platura*, Fenthion, Imidacloprid, Lindane, Diazinon.

Summary

The bean seed fly, *Delia platura*, is a widespread pest that attacks seeds or cotyledons of bean seedlings before sprouting. Insecticide seed treatment was investigated for bean seed fly control during 1998–2001 to determine the efficacy of four insecticides, fenthion, imidacloprid, lindane and diazinon. Te results show that fewer plants were affected by bean seed fly when insecticides were used. Imidacloprid showed the least effect.

Key words: *Phorbia platura*, Fenthion, Imidacloprid, Lindane, Diazinon.

Table 1: Climatic conditions and site characteristics of the experimental plots during the experimental period
Tabelle 1: Witterungsumstände und Charakteristiken der Lage des Versuchsfeldes wurden für die Dauer der Versuchsperiode festgelegt

	Year – Locality					
	1998		1999			2001
	VLN	BRP	SMP	RBV	VJL	SCV
Average rainfall (mm)						
May	78.1	78.1	105.9	48.9	48.9	20.7
June	52.2	52.2	24.5	22.5	22.5	0.0
Number of days of rain						
May	10	10	8	10	10	6
June	3	3	2	2	2	0
Average temperature (° C)						
May	13.0	13.0	13.4	10.4	10.4	13.8
June	17.2	17.2	17.1	12.8	12.8	19.0
Soil Texture	Loam	Sandy Loam	Loam	Loam	Loam	Loam
Organic matter (%)	2.1	1.8	1.7	2.5	2.0	1.5
Previous crop	Sugar beet	Sugar beet	Wheat	Wheat	Potato	Maize

VLN: Villamañán. BRP: Bercianos del Páramo. SMP: Santa María del Páramo. RBV: Ribas de la Valduerna. VJL: Villamejil. SCV: Santa Colomba de la Vega.

bean landraces (Canela) and different insecticides (in 2000 no field trial was conduced). The province of León is located in the Northwest of Spain. The site characteristics are showed in Table 1.

2.2 Experimental design

Sowing was carried out following a statistical pattern of random blocks with four replicates, using one traditional bean landrace (Canela). This variety has a growth habit Type I (SINHG, 1982) and a long vegetation (115–120 days from sowing to harvesting). The seed of this variety is cinnamon (light brown) and its size is medium (1,000-seed weight, 525 g). Fenthion, imidacloprid, lindane, and diazinon were used at doses recommended by the manufacturers (0.002 m^3/kg for fenthion and diazinon, 0.0025 m^3/kg for imidacloprid and 0.001 kg/kg for lindane). The investigated insecticides are the most used in protection of bean seed (VALENCIANO, 2000) but also other insecticides are in use for seed treatment (ESTER et al., 2003), even there exist new insecticides (ANDERSCH and SCHWARZ, 2003). The insecticides were mixed with Thiram (0.002 kg/kg) to protect against the root rot attack (PARADELA et al., 1995). Pesticide application was carried out on the seeds five days before sowing.

The experimental plot was 100.00 m^2 (36.36 x 2.75 m) with lines 0.55 m apart and a space between the plants of 0.09 m, for a total of 2020 plants per plot. Seeds were sown individually with a pneumatic seed drill (VALENCIANO et al., 2004). In 1998 and 2001, sowing was carried out in the 3rd week of May, and in 1999 in the 4th week of the same month. The plots were kept free from weed by applying Ethalfluralin prior to sowing (doses: 0.0025 m^3/ha).

2.3 Data collected

Bean seed fly damage was assessed over three weeks after sowing. Bean plants emerge between the ninth and fifteenth day after sowing in the conditions prevailing in Northwestern Spain (ESCRIBANO et al., 1994), so the plants were checked for a further week after the average period of emergence. Inspections were made three times a week of four groups at random of fifty plants on each plot to assess the damage. We recorded the percentage of plants that showed larval penetration of the germinating seeds, larval tunnels in the cotyledons, or in the young shoots or roots, for visual assessment of symptoms (BATEMAN et al., 1997). Samples were dug out manually to facilitate the observation of damage.

2.4 Data analyses

Analyses of variance appropriate to a random blocks design were performed for each location. The least significant difference (LSD) method ($P < 0.05$) was used to evaluate the differences between the treatments if a significant difference

Table 2: Mean squares for percentage of plants affected by bean seed fly in six locations
Tabelle 2: Prozentueller Durchschnittswert der von der Bohnensaatenfliege befallenen Pflanzen in sechs verschiedenen Orten

	Df[a]	Locality					
		Villamañán 1998	Bercianos 1998	Santa María 1999	Ribas 1999	Villamejil 1999	Santa Colomba 2001
Blocks	3	6.3	4.8	7.6	23.9	11.0	0.6
Treatment	4	880.3**	2172.3**	56.8*	156.6*	28.8*	4.1*
Error	12	161.9	401.5	12.8	50.9	10.9	1.2
Total	19						

[a] Df: Degrees of freedom
* Significant at $P \leq 0.05$, ** Significant at $P \leq 0.01$

was observed when they were observed to be significant (STEEL and TORRIE, 1986).

3 Results

Significant or highly significant differences for the treatments were detected in all environments (Table 2). Insecticides significantly decreased fly damage in comparison with untreated seeds. Only in 1998 there were significant differences between the insecticides (Table 3).

4 Discussion

A general initial observation confirmed damage existed in all the plots due to bean seed fly being an endemic pest in the traditional bean growing areas of the province of León (BOTO and REINOSO, 1996). The damage level was found to be different on the trials, an explanation could be variations in environmental conditions (MONTECNIOS et al., 1986), with the 1998 trial having the largest attack. The least damage was in 2001 observed, this trial plot had the least content of organic matter in the soil (BOTO and REINOSO, 1996) and the temperature was higher at the time of sowing that provided better conditions for the emergence (MONTECNIOS et al., 1986), diminishing the attack risk. The damage in 1999 was smaller than in 1998, this could be due to a later sowing (practically in June) that supposed to have better conditions during the bean emergence. Also, the rainfall was inferior in 1999in consequence the soil moisture was smaller.

On untreated plots more bean fly damage was recorded (MONTECNIOS et al., 1986; TROTUS and GHIZDAVU, 1996a). Insecticide treatments contribute decisively to reducing or eliminating damage of plants by the bean seed fly (BOTO and REINOSO, 1996; TROTUS and GHIZDAVU, 1996a; ESTER et al., 2003), although its use must be combined with the integrated pest management (BESTE et al., 2001, VALENCIANO et al., 2004).

Imidacloprid gave the least control of this insect, here the infestation was the heaviest, contrary to the results obtained by TROTUS and GHIZDAVU (1996a) in Rumania. Lindane

Table 3: Means for the percentage of plants affected by the bean seed fly in every plot investigated (the pesticides application was carried out on the seeds five days before sowing)
Tabelle 3: Durchschnittswert der von der Bohnensaatenfliege befallenen Pflanzen in jedem Flurstück (Die Anwendung des Bekämpfungsmittels erfolgte fünf Tage vor der Aussaat auf den Sämling)

	Locality					
	Villamañán 1998	Bercianos 1998	Santa María 1999	Ribas 1999	Villamejil 1999	Santa Colomba 2001
Diazinon (doses: 0.002 m^3/kg)	1.13c	1.56c	0.88b	0.75b	0.94b	0.19b
Imidacloprid (doses: 0.0025 m^3/kg)	21.38b	33.25b	3.75b	4.94b	3.13b	0.56b
Lindane (doses: 0.001 kg/kg)	3.94bc	7.81bc	0.81b	3.69b	1.63b	0.25b
Fenthion (doses: 0.002 m^3/kg)	1.06c	2.31c	0.75b	1.19b	0.44b	0.31b
Without insecticide	43.38a	69.31a	11.56a	19.56a	8.88a	3.06a
Least significant difference (0.05)	19.60	30.87	5.50	10.99	5.09	1.66

Numbers within columns followed by the same letter are not significantly different at $P \leq 0.05$.

used to be the most used insecticide in bean seed protection (VALENCIANO, 2000) but it didn't provide better results that the other pesticides. At the moment, Lindane is not authorized in Spain, but the prohibition doesn't suppose any problem because the other investigated substances showed the same or even better effects on been seed fly protection.

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