COMPARISONS OF INSECTICIDES AGAINST THE STEM WEEVIL (COLEOPTERA : CURCULIONIDAE) ON WINTER RAPE : METHODS, RESULTS.

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INTRODUCTION

The adaptation of a method, previously used to compare insecticides available against the Pollen beetle, Meligethes aeneus FABRICIUS (PIERRE et al., 1981) and the Pod weevil, Ceuthorrhynchus assimilis PAYKULL (POUZET et MARABY, 1987), did not give satisfaction, neither with the Cabbage Stem flea beetle, Psylliodes chrysocephala LINNEE, nor with the Rape Stem weevil, Ceuthorrhynchus napi GYLLENHAL.
It consisted in mortality evaluations for insects introduced in cages placed on field plants (BALLANGER et CHAMPOLIVIER, 1989 ; BALLANGER et CHAMPOLIVIER, 1990).

In 1990, with the Rape Stem weevil, we tried to determine the level of protection insured to caged treated plants.

MATERIALS AND METHODS

Three field trials (N8, N9 and N10), conducted on winter oil seed rape (Variety : SAMOURAI), in the area of TOULOUSE, South-West of France, are presented. Insecticides tested (Table 1) are pyréthroïds (Labelled : B, D3, F, K, M, S, TA, TR, and X), an organo-phosphorous (Q), and an association (G), at recommanded field application rate for authorized products (Un : untreated). Each insecticide is applied with a backpack sprayer (Pressure : 2 bars, 300 l. of water per hectare) on a single 3 x 10 square meters plot surface.

Table 1. Insecticides tested in trials N8, N9 and N10.

Insecticide		Compound	g/l	g/ha	l/ha	
D3	DECIS CE	deltamethrin	25	7.5	0.30	PROCIDA
F	FASTAC	alphamethrin	50	7.5	0.15	AGRISHELL
G	GALION	deltamethrin	5	6.0	1.20	DOW-ELANCO
		+ endosulfan	200	240.0	1.20	
K	KARATE	l-cyhalothrin	50	7.5	0.15	SOPRA
M	MAVRIK	fluvalinate	240	48.0	0.20	SANDOZ
Q	QUINOPHOS HUIL.	methyl-parathion	200	350	1.75	LA QUINOLEINE
TA	TALSTAR EC	bifenthrin	100	7.5	0.075	PEPRO
TR	TRACKER 108 EC	tralomethrin	108	9.7	0.09	DUPONT
S	SUMI ALPHA	esfenvalerate	25	12.5	0.50	AGRISHELL
X	IS 8903 SC	b-cyfluthrin	125	75.0	0.60	BAYER

F : trials N9 and N10 - Q : trial N8 - (And : Un, untreated).

For each application of the products, 2 efficacy tests (Test 1, test 2) are realised. At each time, we operate with 6 couples of Stem weevil, put on 6 plants per cage, and 4 replicates.

A cage is made of an organdi cylinder, tied on an ovoid metallic frame digged in the soil, for the basal end, closed up between two wooden sticks, for the upper end. Plastic stakes, set inside the cage, get it its volume. Insects have access to soil.

After being introduced, the weevils are allowed to act for at least 2 weeks before plants are gathered and intensity of attacks estimated.

Insects feed by gnawing almost all the parts of the plants, but this kind of injury - little damaging - is not easy to quantify. They also realise "punctures", by digging more or less deeply their rostrums in the stems. These punctures can be related to simple food consumption or to single egg deposits. Only the punctures associated with egg-laying are involved in the nuisibility of this pest (When females are able to lay their eggs, but when stem elongation is not soon engaged, a first appearance of egg-laying can occurs in petiolars). At each plant analysis, an inventory of the different sorts of punctures is performed.

Meteorological datas, temperatures and rainfall, are registered with devices set up in the trial field.

RESULTS

The realisation of the 3 trials is quickly carried out (Table 2) ! As a matter of fact, the first flowers opened are seen as soon as March 5 (Trial N9).

Table 2. Realisation of trials N8, N9 and N10.

		Trial N8				Trial N9				Trial N10			
		DD	MM	d	St.	DD	MM	d	St.	DD	MM	d	St.
Treatments		30	I	0	C1	8	II	0	C2	21	II	0	(5)
Test 1	I1	2	II	3	C1	14	II	6	(5)	2	III	9	(12)
	A1	20	II	21	(5)	5	III	25	(26)	19	III	26	(45)
Test 2	I2	9	II	10	C2	21	II	13	(8)	9	III	16	(20)
	A2	27	II	28	(10)	12	III	32	(37)	23	III	30	(57)

After insecticide treatment, 2 efficacy tests (Test n ; n = 1 or 2) are realised (In : insect introductions on caged plants ; An : plant analysis). DD : day, MM : month, d : number of days after treatment, St.: phenological stage, C1 : re-growth, C2 : first internodes, (n) : stem length, cm.

1 - **Trial N8** - The products are sprayed on plants without elongated stems (Stage : "C1"). Insects are encaged 3 or 10 days after the treatments (Table 2). During in-cage periods, insects and plants profit by a mild and wet weather. Significant rainfalls are noticed from 11 to 13 days after the insecticides applications (71 mm).

N8 I1 - Test 1 - Some punctures are observed, but still with not many eggs, on the short stems and the petiolars (Table 3). Only 3 of the 10 compared modalities are attacked : the organo-phosphorous (Q) soon reveals its limits, a pyrethroïd (M) appears not different from the control (Un).

N8 I2 - Test 2 - For stems more distinctly elongated, few punctures are detected on petiolars (Table 3). We find the former results, with no damage (5 cases), or slight attack for one of the four cages (D3, S), or missing protection of the plants (M, Q).

Table 3. Essai N8 - Insects introduced "d" days after treatments : Mean punctures per cage, after "D" days (See Table 2).

Treatments*		Punctures % (Un) X	K	TA	G	TR	D3	S	M	Q	Punctures Un
Test 1	(1)	0	0	0	0	0	0	0	125-	25-	20
(d=3,N=18)	(2)	0	0	0	0	0	0	0	92-	16-	134
Test 2	(1)	0	0	0	0	0	10	10	115-	113-	40
(d=10,N=18)	(2)	0	0	0	0	0	10	6	104-	109-	107

(1): egg-laying punctures, (2): all punctures - Statistic analysis: DUNNET test (5%), below (-) the reference (K) - *: see Table 1.

2 - Essai N9 - The insecticides are applied to 5 to 8 centimeters stem length plants. Insectes are encaged 6 and 13 days after (Table 2). Rainfalls are abundants from 11 to 14 days after the treatments (73 mm).

The results obtaining is crossed by a tractor passing over, causing the destruction (3 cages : plants are immediatly picked up and examined - D3, X, Un) or the taking off of some cages. This misadventure occurs : 6 days before the first analysis (A1), before a fall in temperature ; 8 days after the second introduction (I2), egg-laying is only starting !

N9 I1 - Test 1 - Egg deposit level is nil or almost nil in 6 cases (Table 4). A pyrethroid appears in a limit position (F). Beside the same inefficient product (M), a second product does not insure the preservation of the treated plants (S).

N9 I2 - Test 2 - With one exception (X), we draw a tendency to a general disconnecting (K, TA, G, TR and especially D3) - (Table 4). For some cages (F, S, M), we find again attack levels at least equals or superior to those of the controls (Un). Great disparities exist beetween cages relatives to the same product (F).

Table 4. Essai N9 - Insects introduced "d" days after treatments : Mean punctures per cage, after "D" days (See Table 2).

Treatments*		Punctures % (Un) X	K	TA	G	TR	D3	F	S	M	Punctures Un
Test 1	(3)(1)	0	0	3	1	3	6	12	73-	101-	143
(d=6,N=19)	(3)(2)	0	0	4	0	3	4	10	59-	79-	252
Test 2	(1)	0	12	10	31	21	62	87-	98-	56	158 (4)
(d=13,N=19)	(2)	0	13	9	37	20	62	83-	98-	62	210 (4)

(1): egg-laying punctures, (2): all punctures, (3): considering without damage a missing cage for X and D3, (4): mean for 3 cages - Statistic analysis : DUNNET test (5%), below (-) the reference (K) - * : see Table 1.

3 - Essai N10 - The products are applied on plants with stem length of 3 or 4 centimeters (Table 2). Later on, insects are introduced on fast elongating plants, 9 or 16 days after the treatments. During the tests, the weather remains mild, weakly rainy, except for a short period of larger thermic amplitudes, characterized by night frosts within the first days or the first test (From 10 to 14 days after the treatments).

N10 - **Test 1** - Complete protection is only observed in a single case (Table 5). Among a group of 6 effective pyréthroïds (K, TA, TR, G, D3, F), tendancies are not favorables to 2 products (D3 and, more, F). Among 4 cages, an insecticide (S) shows 2 résults at the level of the control (Un) and 2 résults indicating a weak attack ! An other product (M) does not insure any protection to plants.

N10 - **Test 2** - In one case (X), no mark of insect activity is yet detectable (Table 5). Behind 4 first products (K, TA, G and indeed TR), one insecticide is not well positioned (D3). A seventh product (F) breaks out more. Two pyrethroïds (S, M) are placed at the control (Un) level.

Table 5. Essai N10 - Insects introduced "d" days after treatments : Mean punctures per cage, after "D" days (See Table 2).

Treatments*		Punctures % (Un) X	K	TA	G	TR	D3	F	S	M	Punctures Un
Test 1	(1)	0	7	8	16	15	26	31	49-	95-	211
(d=9,N=17)	(2)	0	7	8	15	19	25	30	53-	92-	348
Test 2	(1)	0	13	9	11	27	43-	59-	71-	102-	158 (3)
(d=16,N=14)	(2)	0	15	10	13	33	52-	60-	84-	101-	210 (3)

(1): egg-laying punctures, (2): all punctures - (3): mean for 3 cages - Statistic analysis : DUNNET test (5%), below (-) the reference (K) - * : see Table 1.

DISCUSSION, CONCLUSIONS

Field insecticide experimentation poses numerous problems of interpretation, even when the awaited insects are sufficiently numerous and well distributed. So, it seems interesting to under control infestation levels and to turn to cage experiments, while seeking not to move away from the conditions of agricultural practice.

Weevils used are trapped in yellow bowls, at resumption of insect activity and taking flight towards rape crops, and stored until utilization in a refridgerator. After introduction in cages, we waited at least 2 weeks before gathering plants for analysis. As we wanted to compare egg-laying levels, it is necessary to let females time to feed on plants, mature ovocytes and lay eggs.

But, in practice, global puncture countings - including punctures unrelated to egg-laying - do not seem to be without signification. This approach is even inescapable to give a conclusion about insecticide treatments applied at the commencement of spring growth, when egg deposits are not importants (Trial N8). Later, with elongated stem plants, when egg-laying is abundant, as if the respective proportions of the 2 kinds of punctures - with or without egg deposit - are fluctuating, they allow identical conclusions. Considering total punctures avoid egg search and constitute a really appreciable element of simplification for analysis.

Insecticides treatments are still efficacious after 13 and 16 days (Trial N9, Test 2 ; Trial N10, Test 2). But, for these last dates, datas unfavourables to some products are availables. So, we notice the good protections obtained with insect< introductions realised 10 days after plant treatments (Trial N8, Test 1). These protections are better than those obtained after 9 (Trial N10, Test 2) and 13 (Trial N9, Test 2) days, for exemple.

To explain these first results and before confirmation, we have to think about the differences of phenological stages of the plants among the 6 considered tests. Perhaps, do we find there again some effects observed by assessing insect mortalities (1989 trials), when significant rainfalls happened during trial realisation and when the weevils, trying to take shelter (?), do not remain on the inner sides of the cages and die quickly. For the future, we would have to check that, in some cases, cages do not allow insects to access to untreated vegetation parts.

With the organo-phosphorous, QUINOPHOS HUILEUX, we can report a real efficacy of the treatment only for a 3 days delayed insect supply. With the pyrethroïds, we characterize generally more satisfaying plant protections. KARATE and TALSTAR are always placed firsts. DECIS never appears really well positioned, behind TRAKER. The less favourable position is hold by FASTAC, which let become its limits apparent before DECIS. SUMI-ALPHA stands out defavourably by only exhibiting a good efficacy in a context propitious for all the tested products (Trial N8). MAVRIK does not insure any protection to treated plants ("IS 8903" seems remarkable, but, for 75 b-cyfluthrine g/ha !). GALION, as DECIS with the same compound, can be logically related to the efficacious pyrethroïd group. As TRAKER, it always shows datas more flattering than DECIS.

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