

CHEMICAL CONTROL OF BEAN WEEVIL, *ACANTHOSCELIDES OBTECTUS* SAY IN STORAGE CONDITION

COMBATAREA CHIMICĂ A GĂRGĂRIȚEI FASOLEI, *ACANTHOSCELIDES OBTECTUS* SAY, IN CONDIȚII DE DEPOZIT

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ABSTRACT

The paper presents the positive results obtained by some pesticides applied against the bean weevil - *Acanthoscelides obtectus* Say, after a synthetic review of the potential chemical methods which may be used in the chemical control of the insects harmful to the stored bean seeds. The chemical control is realised treatments with synthetic pyrethroid (permethrin, deltamethrin) and organophosphoric insecticides (malathion, pirimiphos methyl, fenitrothion and chlorpyrifos-methyl).

KEYWORDS: bean weevil, chemical control, pesticides, stored bean seeds

REZUMAT

Lucrarea prezintă rezultatele pozitive în urma aplicării câtorva pesticide împotriva gărgăriței fasolei - *Acanthoscelides obtectus* Say, după o sintetică apreciere a potențialului metodelor chimice care sunt utilizate în combaterea chimică a insectelor dăunătoare asupra semințelor de fasole dăunate.

CUVINTE CHEIE: gărgărița fasolei, combatere chimică, pesticide, semințe de fasole depozitate

DETAILED ABSTRACT.

The chemical control is effective, quick, secure and economical but it has some major drawbacks: negative impact on products and environment; constant danger of intoxication for humans and animals; presence of residues in different parts of the plants; appearance, at the pest species, of resistance to pesticide (RÖMBKE and MOLTSMANN, 2000). These drawbacks can be eliminated by using some less polluting insecticides, from the IIIrd and IVth group of toxicity, and by using efficient doses, as small as possible.

The chemical control is realised treatments with synthetic pyrethroid (permethrin, deltamethrin) and organophosphoric insecticides (malathion, pirimiphos methyl, fenitrothion and chlorpyrifos-methyl).

The biological material used (adults) has been obtained in growing rooms (thermostat) at a temperature of 28°C (±1°C) and a relative air humidity of 70% (±5%).

The experiment has been organized in 12 varieties with 3 repetitions. The reaction of the organism to a mechanical stimulus has been analysed. If the adult did not respond to the mechanical stimulus, it was considered that the pest had been entirely affected by the active matter of the insecticide (appearance of mortality).

INTRODUCTION

Protection of stored seeds can be differentiated on usage categories: the ones which have seeding destination can be chemically processed while the supplies which have consumption destination can only be protected by non-polluting methods (Ghizdavu and Porca, 2000, Porca and contributors, 2002).

The chemical control is effective, quick, secure and economical but it has some major drawbacks: negative impact on products and environment; constant danger of intoxication for humans and animals; presence of residues in different parts of the plants; appearance, at the pest species, of resistance to pesticide (Jorg and Moltmann, 2000). These drawbacks can be eliminated by using some less polluting insecticides, from the IIIrd and IVth group of toxicity, and by using efficient doses, as small as possible.

Our researches were aimed to determine the efficiency of the products used in the control of bean weevil *Acanthoscelides obtectus* Say, in storage condition, the influence of the dose on the organism (mortality), the use of an efficient dose, with a very reduced impact on human or environment (Porca, 2002).

MATERIAL AND METHOD

The biological material used (adults) has been obtained in growing rooms (thermostat) at a temperature of 28°C (±1°C) and a relative air humidity of 70% (±5%).

The experiment have been organized in 12 varieties with 3 repetitions. Filter paper bands (disks) which have been well moistured with the solution processed at the recommended concentration have been placed in the experimental recipients made of „sarpagan” boxes provided with metallic screen cover. Each repetition was made of 20 adults. They were kept in a thermostat adjusted at a temperature of 28°C (±1°C) and a relative air humidity of 70% (±5%).

Findings regarding mortality, paralysis (reversible or irreversible) respectively, were made by means of stereomicroscope, IOR model, Bucharest. The reaction of the organism to a mechanical stimulus has been analysed. If the adult did not respond to the mechanical stimulus, it was considered that the pest had been entirely affected by the active matter of the insecticide (appearance of mortality).

RESULTS AND DISCUSSIONS

Insecticides which are recommended and tested in this experiment are accepted by the „CODEX” of phytosanitary products homologated to be used in Romania and they are recommended from the point of view of the maximum limit of residues (table 1). We used synthetic pyrethroids (with permethrin and deltamethrin) and organophosphates (with malation, pirimifos metil, fenitrotrion, clorpirifos-metil), from the IIIrd and IVth group of toxicity. In 2000, varieties were used with 1% density and in 2001 varieties were used with 2% density (tables 2,3) (except the following varieties: K’othrine 2.5 EC, Coopex 25 WP, Prostore 210 EC, Prostore 157 UL which were used with 0.5% density in 2000, respectively 1% density in 2001).

Table 2 presents the efficiency of insecticides under the interaction of responding-time insecticides factors in 2000 year.

With regard to the influence of **3 hours responding-time factor**, by comparing the differences of varieties which have been studied with Mt₁ (Carbetox 37 EC), varieties treated with Sumithion 50 EC (450.0%, +70.00), K’obiol DP2 (155.0%, +11.00), K’obiol 25 EC (240.0%, +28.00), K’othrine 2.5 EC (325.0%, +45.00), Coopex 25 WP (298.35%, +39.67), Prostore 210 EC (300.00%, +40.00) and Prostore 157 UL (200.00%, +20.00) recorded higher mortality and the differences statistically assured being very significant positive.

Varieties treated with Reldan 40 EC (25.00%, -15.00), Reldan 50 EC (26.65%, -14.67), Actellic (26.65%, -14.67) and Digrain Stock (10.00%, -18.00) recorded much lower mortality than Mt₁ and the differences are statistically assured being very significant negative.

By comparing the differences of varieties which have been studied with Mt₂ (average of varieties), the varieties treated with Sumithion 50 EC (250.4%, +54.06), K’othrine 2.5 EC (180.80%, +29.06), K’obiol 25 EC (133.50%, +12.06), Coopex 25 WP (166.0% +23.73), Prostore 210 EC (166.90%, +24.06) recorded better mortality, and the differences are statistically assured at the very significant positive significance degree.

The variety treated with K’obiol DP2 recorded lower mortality (86.20%) than Mt₂ and the difference (-4.94) is statistically assured at significant negative significance degree.

Varieties treated with Carbetox 37 EC (55.60%, -15.94), Reldan 40 EC (13.90%, -30.94), Reldan 50

EC (14.80%, -30.61), Actellic (14.80%, -30.61) and Digrain Stock (5.50%, -33.94) recorded much lower mortality than Mt_2 and the differences are substantial

and statistically assured at the very significant negative significance degree.

Table 1: The insecticides use in chemical control of *Acanthoscelides obtectus* Say, in the seeds storage condition (Cluj-Napoca, 2000-2001)

Tabelul 1: Insecticide folosite în combaterea gărgăriței fasolei *Acanthoscelides obtectus* Say, la stocurile de semințe (Cluj-Napoca, 2000-2001)

Variants	Activ substances	year/density %		Toxicity group
		2000	2001	
Carbetox 37 EC	malation 37%	1	2	III
Reldan 40 EC	clorpirifos-metil 40%	1	2	III
Reldan 50 EC	clorpirifos-metil 50%	1	2	III
Actellic 50 EC	pirimifos - metil 50%	1	2	IV
Digrain Stock	malation 200g/l	1	2	III
Sumithion 50 EC	fentrotion 50%	1	2	IV
K'obiol DP 2	deltametrin 0.2%	1	2	III
K'obiol 25 EC	deltametrin 25g/l + piperonil butoxide 250g/l	1	2	III
K'othrine 2.5 EC	deltametrin 2.5%	0.5	1.0	III
Coopex 25 WP	permetrin 25%	0.5	1.0	IV
Prostore 210 EC	bifentrin 10g/l + malation 200g/l	0.5	1.0	III
Prostore 157 UL	bifentrin 7.5g/l + malation 150g/l	0.5	1.0	III

With regard to the influence of **6 hours responding-time factor**, by comparing the differences of varieties with Mt_1 (Carbetox 37 EC), varieties treated with Sumithion 50 EC (273.50%, +55.00), K'obiol 25 EC (125.00%, +10.00), K'othrine 2.5 EC (200.00%, +40.00), Coopex 25 WP (183.30%, +35.55), Prostore 210 EC (190.00%, +36.00) and Prostore 157 UL (150.00%, +20.00) recorded higher mortality and the differences are statistically assured at the very significant positive significance degree. The variety treated with K'obiol DP2 is not statistically assured.

Varieties treated with Reldan 40 EC (20.00%, -32.00), Reldan 50 EC (25.82%, -29.67), Actellic (32.50%, -27.00) and Digrain Stock (10.00%, -36.00) recorded lower mortality than Mt_1 and the differences are statistically assured being very significant negative.

By comparing the differences of varieties which have been studied with Mt_2 (average of varieties), the varieties treated with Sumithion 50 EC (205.50%, +48.78), K'othrine 2.5 EC (173.60%, +33.78), Coopex 25 WP (162.90%, +29.11), Prostore 210 EC (164.40%, +29.78), Prostore 157 UL (129.80%,

+13.78) recorded higher mortality and the differences are statistically assured at the very significant positive significance degree.

Varieties treated with K'obiol 25 EC and K'obiol DP2 have statistically non-assured differences.

The variety treated with Carbetox 37 EC recorded lower mortality (86.50%) than Mt_2 and the difference (-6.22) is statistically assured being distinctly significant negative.

Varieties treated with Reldan 40 EC (17.30%, -38.22), Reldan 50 EC (22.34%, -35.69), Actellic (28.10%, -33.22) and Digrain Stock (8.60%, -42.22) recorded lower mortality than Mt_2 and the differences are statistically assured being very significant negative.

With regard to the influence of **24 hours responding-time factor**, by comparing the differences of varieties which have been studied with Mt_1 (Carbetox 37 EC), varieties treated with Reldan 40 EC (94.38, -4.67), K'obiol DP2 (94.70, -5.00) and K'obiol 25 EC (95.10%, -4.76) have statistically assured differences at the significant negative significance degree.

Table 2: The efficiency of some insecticides used in chemical control for bean weevil, (*Acanthoscelides obtectus* Say) (Cluj-Napoca, 2000) (the interaction of responding-time insecticides factors)
 Tabelul 2: Eficacitatea unor insecticide folosite în combaterea gărgăriței fasolei (*Acanthoscelides obtectus* Say), (Cluj-Napoca, 2000) (interacțiunea factorilor insecticid și timp de acțiune)

No. var.	Variants	mortality (%) in control		± d	Signif. of difference in control Mt ₁	mortality (%) in control		± d	Signif. of difference in control Mt ₂
		Absolute values	Relative values			Absolute values	Relative values		
Factor: action time 3 h									
1.	Carbetox 37 EC (Mt ₁)	20.00	100.00	+0.00	-	20.00	55.60	-15.94	000
2.	Reldan 40 EC	5.00	25.00	-15.00	000	5.00	13.90	-30.94	000
3.	Reldan 50 EC	5.33	26.65	-14.67	000	5.33	14.80	-30.61	000
4.	Actellic 50 EC	5.33	26.65	-14.67	000	5.33	14.80	-30.61	000
5.	Digrain Stock	2.00	10.00	-18.00	000	2.00	5.50	-33.94	000
6.	Sumithion 50 EC	90.00	450.00	+70.00	***	90.00	250.40	+54.06	***
7.	K'obiol DP 2	31.00	155.00	+11.00	***	31.00	86.20	-4.94	0
8.	K'obiol 25 EC	48.00	240.00	+28.00	***	48.00	133.50	+12.06	***
9.	K'othrine 2.5 EC	65.00	325.00	+45.00	***	65.00	180.80	+29.06	***
10.	Coopex 25 WP	59.67	298.35	+39.67	***	59.67	166.00	+23.73	***
11.	Prostore 210 EC	60.00	300.00	+40.00	***	60.00	166.90	+24.06	***
12.	Prostore 157 UL	40.00	200.00	+20.00	***	40.00	111.30	+4.06	-
13.	Variants means (Mt ₂)					35.94	100.00	+0.00	-
Factor: action time 6 h									
1.	Carbetox 37 EC (Mt ₁)	40.00	100.00	+0.00	-	40.00	86.50	-6.22	00
2.	Reldan 40 EC	8.00	20.00	-32.00	000	8.00	17.30	-38.22	000
3.	Reldan 50 EC	10.33	25.82	-29.67	000	10.33	22.34	-35.69	000
4.	Actellic 50 EC	13.00	32.50	-27.00	000	13.00	28.10	-33.22	000
5.	Digrain Stock	4.00	10.00	-36.00	000	4.00	8.60	-42.22	000
6.	Sumithion 50 EC	95.00	237.50	+55.00	***	95.00	205.50	+48.78	***
7.	K'obiol DP 2	43.00	107.50	+3.00	-	43.00	93.00	-3.22	-
8.	K'obiol 25 EC	50.00	125.00	+10.00	***	50.00	108.10	+3.78	-
9.	K'othrine 2.5 EC	80.00	200.00	+40.00	***	80.00	173.60	+33.78	***
10.	Coopex 25 WP	75.33	188.30	+35.55	***	75.33	162.90	+29.11	***
11.	Prostore 210 EC	76.00	190.00	+36.00	***	76.00	164.40	+29.78	***
12.	Prostore 157 UL	60.00	150.00	+20.00	***	60.00	129.80	+13.78	***
13.	Variants means (Mt ₂)					46.22	100.00	+0.00	-
Factor: action time 24 h									
1.	Carbetox 37 EC (Mt ₁)	95.00	100.00	+0.00	-	95.00	101.40	+1.33	-
2.	Reldan 40 EC	89.67	94.38	-4.67	0	89.67	95.70	-3.99	-
3.	Reldan 50 EC	94.33	99.30	-0.67	-	94.33	100.70	+0.66	-
4.	Actellic 50 EC	96.00	101.00	+1.00	-	96.00	102.50	+2.33	-
5.	Digrain Stock	91.00	95.80	-4.00	-	91.00	97.20	-2.66	-
6.	Sumithion 50 EC	98.67	103.90	+3.67	-	98.67	105.30	+5.00	*
7.	K'obiol DP 2	90.00	94.70	-5.00	0	90.00	96.10	-3.66	-
8.	K'obiol 25 EC	90.33	95.10	-4.67	0	90.33	96.40	-3.33	-
9.	K'othrine 2.5 EC	95.00	100.00	+0.00	-	95.00	101.40	+1.33	-
10.	Coopex 25 WP	93.00	97.90	-2.00	-	93.00	99.20	-0.66	-
11.	Prostore 210 EC	96.00	101.00	+1.00	-	96.00	102.50	+2.33	-
12.	Prostore 157 UL	95.00	100.00	+0.00	-	95.00	101.40	+1.33	-
13.	Variants means (Mt ₂)					93.66	100.00	+0.00	-
					DL _{5%} = 4.24			4.24	
					DL _{1%} = 5.88			5.88	
					DL _{0.1%} = 7.76			7.76	

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Table 3: The efficiency of some insecticides used in chemical control for bean weevil, (*Acanthoscelides obtectus* Say) (Cluj-Napoca, 2000) (the interaction of responding-time insecticides factors)

Tabelul 3: Eficacitatea unor insecticide folosite în combaterea gărgăriței fasolei (*Acanthoscelides obtectus* Say) (Cluj-Napoca, 2001) (interacțiunea factorului insecticid și timp de acțiune)

No. var.	Variants	mortality (%) in control Mt ₁		± d	Signif. of difference in control Mt ₁	mortality (%) in control Mt ₂		± d	Signif. of difference in control Mt ₂
		Absolute values	Relative values			Absolute values	Relative values		
Factor: action time 3 h									
1.	Carbetox 37 EC (Mt ₁)	65.00	100.00	+0.00	-	65.00	113.00	+7.48	***
2.	Reldan 40 EC	7.00	10.76	-58.00	000	7.00	12.30	-50.48	000
3.	Reldan 50 EC	7.33	11.27	-58.63	000	7.33	12.70	-50.17	000
4.	Actellic 50 EC	43.67	67.18	-21.33	000	43.67	75.90	-13.85	000
5.	Digrain Stock	8.00	12.30	-57.00	000	8.00	13.90	-49.52	000
6.	Sumithion 50 EC	92.00	141.50	+27.00	***	92.00	159.90	+34.48	***
7.	K ^o biol DP 2	50.00	76.92	-15.00	000	50.00	89.20	-7.52	000
8.	K ^o biol 25 EC	91.33	140.50	+26.33	***	91.33	158.70	+33.81	***
9.	K ^o thrine 2.5 EC	80.00	123.00	+15.00	***	80.00	139.00	+22.48	***
10.	Coope* 25 WP	81.00	124.60	+16.00	***	81.00	140.00	+23.48	***
11.	Prostore 210 EC	80.00	123.00	+15.00	***	80.00	139.00	+22.48	***
12.	Prostore 157 UL	85.00	130.80	+20.00	***	85.00	147.70	+27.48	-
13.	Variants means (Mt ₂)					57.52	100.00	+0.00	-
Factor: action time 6 h									
1.	Carbetox 37 EC (Mt ₁)	87.00	100.00	+0.00	-	87.00	122.90	+16.25	***
2.	Reldan 40 EC	19.33	22.21	-67.67	000	19.33	27.30	-51.42	000
3.	Reldan 50 EC	21.33	24.51	-65.67	000	21.33	30.10	-49.42	000
4.	Actellic 50 EC	81.67	93.87	-5.33	000	81.67	115.40	+10.92	***
5.	Digrain Stock	16.00	18.39	-71.00	000	16.00	22.60	-54.75	000
6.	Sumithion 50 EC	94.33	108.40	+7.33	***	94.33	133.30	+23.58	***
7.	K ^o biol DP 2	77.00	88.50	-10.00	000	77.00	108.80	+6.25	***
8.	K ^o biol 25 EC	93.00	106.90	+6.00	***	93.00	131.50	+22.25	***
9.	K ^o thrine 2.5 EC	90.00	103.40	+3.00	*	90.00	127.20	+19.25	***
10.	Coope* 25 WP	89.33	102.70	+2.33	-	89.33	126.30	+18.58	***
11.	Prostore 210 EC	90.00	103.70	+3.00	*	90.00	127.20	+19.25	***
12.	Prostore 157 UL	90.00	103.40	+3.00	*	90.00	127.20	+19.25	***
13.	Variants means (Mt ₂)					70.75	100.00	+0.00	-
Factor: action time 24 h									
1.	Carbetox 37 EC (Mt ₁)	97.33	100.00	+0.00	-	97.33	100.60	+0.64	-
2.	Reldan 40 EC	92.00	94.52	-5.33	000	92.00	95.10	-4.64	00
3.	Reldan 50 EC	98.00	100.70	+0.67	-	98.00	101.30	+1.31	-
4.	Actellic 50 EC	97.67	100.30	+0.34	-	97.67	101.00	+0.93	-
5.	Digrain Stock	95.00	97.60	-2.33	-	95.00	98.20	-1.69	-
6.	Sumithion 50 EC	98.00	100.70	+0.67	-	98.00	101.30	+1.31	-
7.	K ^o biol DP 2	93.00	95.50	-4.33	00	93.00	96.10	-3.69	0
8.	K ^o biol 25 EC	97.00	99.70	-0.33	-	97.00	100.30	+0.31	-
9.	K ^o thrine 2.5 EC	98.67	101.40	+1.34	-	98.67	102.30	+1.98	-
10.	Coopex 25 WP	97.67	100.30	+0.34	-	97.67	101.00	+0.98	-
11.	Prostore 210 EC	98.00	100.70	+0.67	-	98.00	101.30	+1.31	-
12.	Prostore 157 UL	98.00	100.70	+0.67	-	98.00	101.30	+1.31	-
13.	Variants means (Mt ₂)					96.69	100.00	+0.00	-
DL _{5%} =				2.79					2.79
DL _{1%} =				3.80					3.80
DL _{0.1%} =				5.11					5.11

The rest of varieties recorded mortality close to Mt_1 the differences being statistically non-assured.

By comparing the differences between several varieties with Mt_2 (average of varieties), the variety treated with Sumithion 50 EC (98.67%, +5.00) recorded mortality which is above this average and the difference is statistically assured at the significant positive significance degree.

The rest of varieties recorded high mortality which is situated between 89.67% at Reldan 40 EC, 96.00% at Actellic 50 EC and Prostore 210 EC, but close to Mt_2 and statistically non-assured.

Table 3 presents the efficiency of insecticides under the interaction of responding-time insecticides factors in 2001 year.

With regard to the influence of **3 hours responding-time factor**, by comparing the differences of varieties which have been studied with Mt_1 (Carbetox 37 EC), varieties treated with Sumithion 50 EC (141.50%, +27.00), K'obiol 25 EC (140.50%, +26.33), K'othrine 2.5 EC (123.00 %, +15.00), Coopex 25 WP (124.60%, +16.00), Prostore 210 EC (123.00%, +15.00) and Prostore 157 UL (130.80%, +20.00) recorded higher mortality and the differences statistically assured being very significant positive.

Varities treated with Reldan 40 EC (10.76%, -58.00), Reldan 50 EC (11.27%, -58.63), Actellic (67.18%, -21.33), Digrain Stock (12.30%, -57.00) and K'obiol DP2 (76.90%, -15.00) recorded much lower mortality then Mt_1 and the differences are statistically assured being very significant negative.

By comparing the differences of varieties which have been studied with Mt_2 (average of varieties), the varieties treated with Carbetox 37 EC (113.0%, +7.48), Sumithion 50 EC (159.90%, +34.48), K'othrine 2.5 EC (139.00%, +22.48), K'obiol 25 EC (158.70%, +33.81), Coopex 25 WP (140.00%, +23.48), Prostore 210. EC (139.00%, +22.48) recorded better mortality, and the differences are statistically assured at the very significant positive significance degree.

The variety treated with Prostore 157 UL is not statistically assured.

Varities treated with Reldan 40 EC (12.30%, -50.48), Reldan 50 EC (12.70%, -50.17), Actellic (75.90, -13.85), Digrain Stock (13.90%, -49.52) și K'obiol DP2 (89.20, -7.52) recorded much lower mortality then Mt_2 and the differences are substantial and statistically assured at the very significant negative significance degree.

With regard to the influence of **6 hours responding-time factor**, by comparing the differences of varieties with Mt_1 (Carbetox 37 EC), varieties treated with Sumithion 50 EC (108.4%, +7.33) and K'obiol 25 EC (106.9%, +6.00) recorded higher mortality and the differences are statistically assured at the very significant positive significance degree.

The varieties treated with K'othrine 2.5 EC (103.40%, +3.00), Prostore 210 EC and Prostore 157 UL (103.40%, +3.00) recorded higher mortality and the differences are statistically assured at the significant positive significance degree.

The variety treated with Coopex 25 WP is not statistically assured.

Varities treated with Reldan 40 EC (22.21%, -67.67), Reldan 50 EC (24.51%, -65.67), Actellic (93.87%, -5.33) Digrain Stock (18.39%, -71.00) and K'obiol DP2 (88.50%, -10.00) recorded lower mortality then Mt_1 and the differences are statistically assured being very significant negative.

By comparing the differences of varieties which have been studied with Mt_2 (average of varieties), the varieties treated with Carbetox 37 EC (122.90%, +16.25), Actellic 50 EC (115.40%, +10.92), Sumithion 50 EC (133.30%, +23.58), K'obiol DP2 (108.80%, +6.25), K'obiol 25 EC (131.50%, +22.25), K'othrine 2.5 EC (127.20%, +19.25), Coopex 25 WP (126.3%, +18.58), Prostore 210 EC (127.20%, +19.25) and Prostore 157 UL (127.20%, +19.25) recorded higher mortality and the differences are statistically assured at the very significant positive significance degree.

Varities treated with Reldan 40 EC (27.30%, -51.42), Reldan 50 EC (30.10%, -49.42) and Digrain Stock (22.60%, -54.75) recorded lower mortality then Mt_2 and the differences are statistically assured being very significant negative.

With regard to the influence of **24 hours responding-time factor**, by comparing the differences of varieties which have been studied with Mt_1 (Carbetox 37 EC), varieties treated with Reldan 40 EC (94.52, -5.33) have statistically assured at very significant negative and K'obiol DP 2 (95.50%, -4.33) is statistically assured at distinctly negative significance degree.

The rest of varieties recorded mortality close to Mt_1 the differences being statistically non-assured.

By comparing the differences between several varieties with Mt_2 (average of varieties), the variety treated with Reldan 40 EC (95.10%, -4.64) have the difference statistically assured at distinctly negative

significance degree and the variety treated with K'obiol DP2 (86.10%, -3.69) have the difference statistically assured at the significant negative significance degree.

The rest of varieties recorded high mortality which is situated between 95.00% at Digrain Stock and 98.67% at K'othrine 2.5EC, but close to Mt₂ and statistically non-assured.

CONCLUSIONS

1. A highest efficiency of 90% has been obtained after 24 hours responding-time, all 12 varieties

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recorded high mortality, from 89.67%, at the variety treated with Reldan 40 EC, to 98.67% at the variety treated with Sumithion 50 EC in 2000 and in 2001 from 92.00 at the variety treated with Reldan 40 EC, to 98.67% at the variety treated with K'othrine 2.5 EC.

2. The most efficient varieties, which obtained the best results, were recorded at varieties treated with Sumithion 50 EC, K'obiol 25 EC, K'othrine 2.5 EC, Coopex 25 WP, Prostore 210 EC, Prostore 157 UL and Carbetox 37 EC.

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