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Pheromone Trials Against *Orthotomicus erosus* (Woll.) in Istanbul Princes' Islands, Turkey

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Abstract: This study was carried out in Red pine forests of Buyukada region which is subject to Kanlica Forestry Administration, Islands Forest Management Chieftaincy, at the year 2010. The aim of the study is to investigate biological activity of a pheromone which has a trade name SMC DAKOL and which is used against the harmful insect *Orthotomicus erosus* (Woll.) (Mediterranean pine engraver beetle) in field conditions with funnel and Scandinavian type traps. In the experiment, a pheromone called VIT ORTERO which was certificated before is used for comparison pheromone.

Key words: *Orthotomicus erosus* (Woll.), pheromone, red pine, Princes islands, DAKOL

INTRODUCTION

There exists many biotic and abiotic originated factors among parameters detrimental to forest health. One of the most important of these is the bark beetles. Controlling is generally realized by cultural, mechanical, biological, chemical and biotechnical methods. According to studies conducted insecticides used in chemical control are found to bring damage to nature in the long term period. For this reason, nowadays, environment friendly control methods such as biological and biotechnical practices come into prominence. Pheromones secreted from adult bark beetles are generally used in biotechnical control.

Pheromone is an odor that is used for communication between the members of an insect species. In other words, pheromone is a chemical speaking language between insects. A male insect that senses the odor secreted by a female insect ready for mating, reaches to female insect by tracking the trails of the odor. Scientists, by collecting a great number of insects of several species, learned chemical properties of odors secreted by insects in laboratory conditions for being able solve chemical properties of pheromones. After finding out the chemical properties of pheromones, scientists observed that these odors vary depending upon the species.

That is to say, pheromones are chemical substances that are secreted by an individual and that are influence the behavior of individuals of the same species.

Influenced behaviors can be classified as sexual, ovulating, alarm and defense, swarming and leaving trace (Coluson and Witter, 1984; Witzgall *et al*., 2010). Pheromones, as can be understood from their definitions, are species-specific. In order to control the insects, this property called forth the idea of flocking the insects together and later exterminating them. Produced through artificial ways, pheromones enable entrapping of the adults with the use of special traps in which pheromones are embedded.

Pheromones do not have harmful effects to beneficial organisms such as parasites and predators, honey bees, pollinator insects, vertebrates and human beings. For this reason, their areas of usage increase every year. Primary reason why pheromone traps emerges is that they can subdue pests easily without damaging natural balance (Kucukosmanoglu and Arslangundogdu, 2002).

Bark beetles (Scolytidae) are the main harmful insects in Turkish forests. They had been studied by several native and foreign researchers (Sekendiz, 1974; Serez, 1987; Selmi, 1985; Inac and Laz, 2001; Kirkendall and Faccoli, 2010; Regnier and Law, 1968; Sarikaya and Yildirim, 2011; Sarikaya and Avci, 2011; Varli and Sever, 2013; Akbulut *et al*., 2008) and information about the status of the bark beetles in Turkish forests were given. These insects can cause big economic loss due to their mass reproduction at favorable conditions at certain years.

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Orthotomicus erosus (Woll.) is one of the most important damagers of the country's forests. This harmful beetle's effects increase at favorable climatic conditions and especially at the years in which harmful effects of *Thaumetopoea pityocampa* Schiff. (Pine processionary moth) are dense and it can cause the trees to dry up considerably.

In this study, the biological effectiveness of a pheromone slide that has a trade name SMC DAKOL using against *Orthotomicus erosus* (Woll.) was investigated by testing it. For testing area, Istanbul-Kanlica Forestry Administration, Islands Forest Management Chieftaincy, Buyukada series *Pinus brutia* (Red pine) forests at where the related insect is densely populated is chosen.

MATERIALS AND METHODS

For against *Orthotomicus erosus* (Woll.), pheromone slide trade named SMC DAKOL is experimented by means of using 3 components (A, B and C) of the pheromone. The formulations of these components are:

Component A:
- Common name: SMC DAKOL
- Chemical name: Ipsdienol
- Explicit formula: 2-methyl-6 methylene -2,7-octadien -4-ol
- Formula: ($C_{10}H_{16}O$)
- Active substance amout: Ipsdienol (23 mg)
- Component amount: Ipsdienol 1.34 g (±10%)

Component B:
- Common name: SMC DAKOL
- Chemical name: Cis-verbenol
- Explicit formula: Icis-4,6,6-trimethylbicyclo [3.1.1] hept -3-en-2-ol
- Formula: ($C_{10}H_{16}O$)
- Active substance amout: Cis-verbenol (75 mg)
- Component amount: Cis-verbenol 0.78 g (±10%)

Component C:
- Common name: SMC DAKOL
- Chemical name: 2-methyl-3 butene -2-ol
- Explicit formula: 2-methyl-3 butene-2-ol
- Formula: ($C_5H_{10}C$)
- Active substance amout: 2-methyl 3 butene -2-ol (1450 mg)
- Component amount: 2-methyl -3 butene -2-ol 9, 89 g (±10%)

At the experiment, VIT ORTERO pheromone, certificate is obtained before, containing 1500 mg methyl butanol+100 mg cis-verbenol+30 mg Ipsdienol was used as a comparison pheromone.

Table 1: Average temperature, precipitation and humidity in the area

Months	Average temp. (°C)	Average humidity (%)	Average precipitation (mm)
April 2010	12.7	75.1	41.5
May 2010	17.6	72.4	17.0
June 2010	22.6	69.0	22.6
July 2010	25.9	72.0	13.6
August 2010	25.4	75.4	16.1

General properties of the application (testing) area:
- Average tree diameter: 50 cm
- Average tree height: 10 m
- Average tree quantity per ha: 1000
- Altitude: 100 m
- Soil type: sandy loam
- pH: 5.5
- Soil depth: 30-100 m

Temperature, precipitation and humidity averages in April, May, June, July and August are given in Table 1. These records were taken from Kartal Meteorological Station which is the closest one to the application area.

Flying time of the insect (*Orthotomicus erosus* (Woll.) in the area was taken as implementation time. Field survey started at March 30, 2010 and finished at August 30, 2010. As pheromone traps, scandinavian type traps were used in addition to funnel type traps.

Traps are hung to sections in the forest at which insect harms were observed before and they are at least 50 m apart from each other. Consisting of a testing pheromone and a comparison pheromone, the traps are placed at the application area. Once in 15 days on average insects collected from the traps were carried away to laboratory for counting.

RESULTS AND DISCUSSION

In this study, biological efficiency of SMC DAKOL is investigated via using funnel and scandinavian type traps. Insects which are collected once in 15 days during testing period (30/03/2010-30/08/2010) from funnel and Scandinavian type traps in which testing and comparison pheromones reside separately were counted by doing species identification. These counts are given separately in the tables by taking both testing and comparison pheromones as well as funnel and Scandinavian type traps into account (Table 2 and 3).

When the counting results in the tables are evaluated, it is observed that in funnel type traps, testing pheromones are 93% more efficient than comparison pheromones. This ratio is found 98% more effective in scandinavian type traps (Table 4).

Comparison of the 2 trap types according to the results obtained shows that for testing pheromone,

Table 2: Insect counts in funnel and Scandinavian type traps containing SMC DAKOL

		The number of captured insects															
Dates	Trap type	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
08.04.2010	F	317	318	297	312	207	119	17	0	7	0	23	15	42	11	9	1694
	S	97	110	90	78	3	0	25	0	0	10	18	9	12	7	16	475
27.04.2010	F	327	620	230	270	140	0	93	430	130	363	211	32	17	93	0	2956
	S	521	265	460	0	71	37	320	330	590	983	20	35	110	0	0	3742
13.05.2010	F	43	71	118	191	55	0	88	209	63	181	72	59	82	191	29	1452
	S	17	59	293	268	51	119	218	205	265	47	0	43	18	0	0	1603
28.05.2010	F	0	16	30	6	5	0	8	0	11	165	41	16	13	25	14	350
	S	26	6	6	40	5	36	470	50	121	7	0	0	25	0	0	792
10.06.2010	F	10	108	18	7	0	0	20	0	5	53	9	0	8	7	10	255
	S	22	5	36	51	5	45	132	51	0	15	73	1	3	5	8	452
25.06.2010	F	0	610	81	162	55	65	0	110	97	0	205	10	45	125	0	1565
	S	15	360	13	1070	320	960	40	480	0	210	360	20	20	30	430	4328
13.07.2010	F	55	20	0	230	70	140	94	0	60	560	145	15	40	90	0	1519
	S	40	105	0	1115	470	440	380	520	335	70	730	10	60	37	190	4502
28.07.2010	F	40	165	110	265	90	265	20	640	173	370	293	10	57	116	0	2614
	S	20	95	65	15	60	445	30	1280	645	16	25	60	100	58	97	3011
12.08.2010	F	146	450	1023	0	350	753	315	900	175	0	218	117	232	110	30	4819
	S	34	318	900	131	30	1200	38	1500	1200	32	263	95	110	32	188	6071
27.08.2010	F	140	228	27	230	228	260	160	204	145	46	41	80	232	0	0	2021
	S	241	252	251	760	86	740	105	1050	380	6	140	162	16	332	163	4684

Table 3: Insect counts in funnel and Scandinavian type traps containing VIT ORTERO

		The number of captured insects															
Dates	Trap type	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
08.04.2010	F	151	30	78	39	0	107	12	0	0	0	12	12	16	2	18	477
	S	135	40	248	16	0	4	7	0	2	0	9	56	53	8	5	583
27.04.2010	F	358	125	20	200	130	120	20	147	450	45	40	143	92	0	0	1890
	S	436	120	283	60	0	192	40	210	95	820	15	5	11	41	0	2328
13.05.2010	F	13	45	17	32	13	88	22	34	76	27	77	33	38	61	89	665
	S	88	39	65	78	17	101	62	81	95	154	9	98	38	23	115	1063
28.05.2010	F	0	6	1	4	8	8	3	0	39	5	22	12	7	15	0	130
	S	35	10	0	30	0	45	0	5	10	72	0	23	8	10	18	266
10.06.2010	F	0	0	0	0	0	50	0	2	4	0	5	3	12	5	7	88
	S	21	2	0	42	5	7	0	5	2	6	0	23	36	0	20	169
25.06.2010	F	95	35	35	45	10	75	60	35	210	72	39	34	140	65	0	950
	S	60	5	7	38	6	120	0	10	6	20	0	70	280	40	7	669
13.07.2010	F	120	192	0	135	2	115	60	10	160	70	120	15	130	38	30	1197
	S	20	60	0	106	10	270	320	65	151	145	45	760	210	52	0	2214
28.07.2010	F	145	65	86	120	0	0	33	25	315	115	130	20	139	33	10	1236
	S	9	0	190	185	0	0	70	10	30	35	45	0	580	13	0	1167
12.08.2010	F	211	222	53	1121	0	71	65	45	166	35	280	120	204	28	1	2622
	S	5	38	40	63	0	132	115	7	163	4	1	1800	2550	3	90	5011
27.08.2010	F	60	51	21	152	4	28	52	7	93	22	46	9	131	10	11	697
	S	15	34	33	138	40	110	145	14	52	125	36	9	600	16	80	1447

Table 4: Evaluation of the counting results

Trap type	Total number of insects in 15 traps containing SMC DAKOL	Total number of insects in 15 traps containing VIT ORTERO	Proportion	Percentage of efficiency (%)
F	19.245	9.952	1.93	93
S	29.660	14.917	1.98	98

F: Funnel trap; S: Scandinavian trap

Scandinavian type trap is 1.5 times more efficient than funnel type traps. This ratio is approximately the same in the comparison pheromone (Fig. 1 and 2).

Within the collected insects, a trace number of insects belonging to species *Ips sexdentatus* (Borner) and *Blastophagus piniperda* (L.) were encountered other than target pest (*Orthotomicus erosus* (Woll.)).

At the field observations during the testing time, a phytotoxic effect of the studied pheromone was not observed at the trees on the testing area.

To summarize, it is understood that the tested SMC DAKOL pheromone is more successful (93 and 98%) than comparison pheromone for both of the two types of trap types used. Also, Scandinavian type traps are found more successful than funnel type traps.

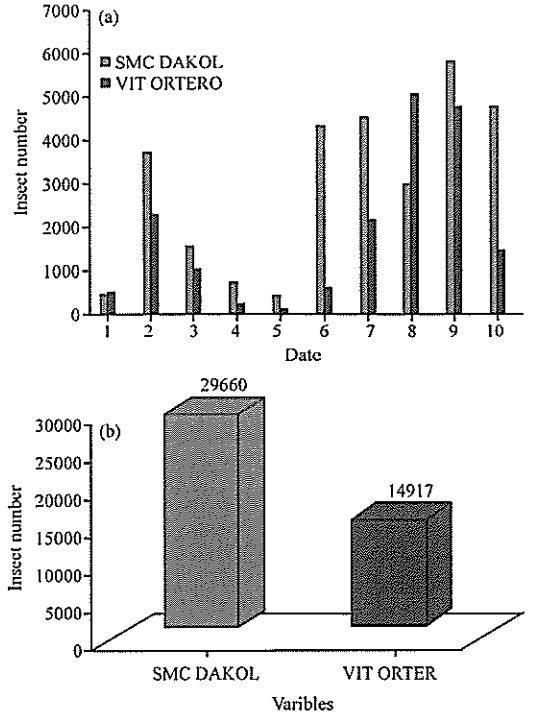


Fig. 1: The number of captured insects in Scandinavian trap

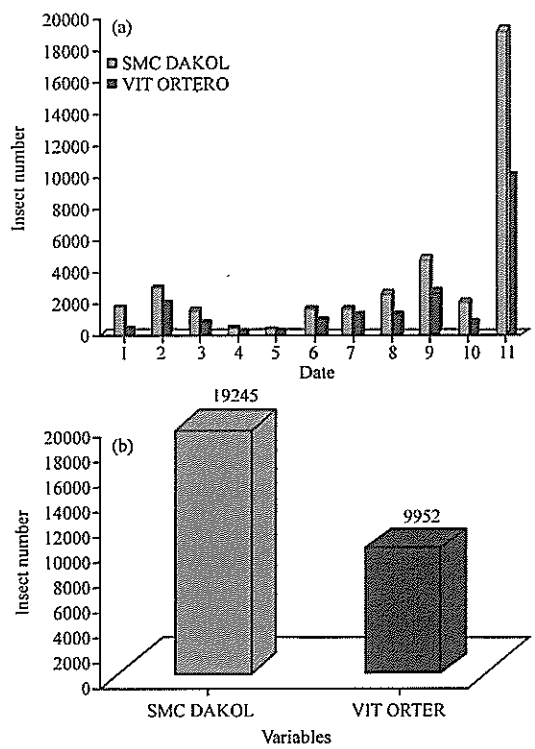


Fig. 2: The number of captured insects in funnel trap

Pheromones are found to be advantageous in comparison to war against insecticides because in the situations where they are effective against pests, they do not have a harmful effect on environment, human beings, other animals and beneficial insects. Hence, besides protective measurements against *Orthotomicus erosus* (Woll.) at the forests use of pheromones that are found successful in the tests against the related pest will lead to a success at controlling it before the possible outbreaks.

CONCLUSION

According to the results obtained, against *Orthotomicus erosus* (Woll.) pheromone trade named SMC DAKOL is found to be 93-96% more successful than comparison pheromone (VIT ORTERO) with regards to trap type used. Also, Scandinavian type traps are found to be 1.5 times more effective than funnel type traps for SMC DAKOL pheromone.

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