Effect of Thiometon on the Germination of Sarson

(*Brassica campestris* Linn. Var. Brown Sarson)

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Thiometon (*O,O*-dimethyl-*S*-ethylmercapto ethyldithiophosphate) inhibits the germination of sarson seeds (*Brassica campestris* Linn. Var. Brown Sarson) by limiting the activity of lipase enzyme which causes the degradation of fat; ultimately it depresses the biosynthesis of carbohydrates.

Thiometon (*O,O*-dimethyl-*S*-ethylmercapto ethyldithiophosphate) is a selective organophosphatic systemic insecticide which is extensively employed to control insects. This agricultural chemical possesses low mammalian toxicity and high insect toxicity. Since it is absorbed into plants, there is a possibility that the residues of this insecticide may either accelerate or retard some of the biochemical processes taking place in plants and thus, adversely or otherwise, affect germination of seeds.

Organophosphates inhibit the activity of cholinesterase enzyme, the function of which is to accelerate the hydrolysis of acetylcholine. This paper describes the effect of Thiometon on the activity of lipase and levels of carbohydrates, fat, and crude protein of sarson seeds during germination.

MATERIAL AND METHODS

A variety of Brown Sarson was procured from the Plant Breeding Department of this university and was processed as follows.

Seed Treatment and Sowing. For the seed treatment of sarson, seven different emulsions, *viz.*, 0.00, 0.15, 0.20, 0.25, 0.30, 0.35, and 0.40% of Thiometon were prepared from 25% of its formulation. About 100 grams of seeds were soaked in each solution for 4 hours. The seeds were then washed with tap water. Ten grams of seeds from each treatment were extracted with water to determine the activity of lipase enzyme. Fifteen grams of the treated seeds from each batch were dried in the oven at 100° C. The rest of the seeds, from different treatments, were arranged on filter paper, which was spread on sand in iron trays. The experiment was conducted on the randomized block design, with four replications in each case.

Sampling. Samples of germinating seeds were taken at intervals of 4, 40, 80, 120, and 160 hours after sowing. They were washed and 10 grams of the seeds from each treatment were processed for the enzyme lipase. The remaining sample, representing about 10 grams, was dried in an oven at 100° C., ground to pass through a 40-mesh sieve, and stored in tightly capped glass bottles.

Table I. Effect of Thiometon on Sarson Seeds during Germination

Dose of Thiometon, %	Time after Sowing (Hours) 4	40	80	120	160
	Activity of Lipase, % Fat Split[a]				
0.00	9.95	36.15	75.78	60.15	40.85
0.15	9.72	30.75	60.05	46.14	36.15
0.20	8.70	25.33	48.55	38.75	35.27
0.25	8.44	22.45	32.33	23.28	20.95
0.30	7.18	19.49	26.35	23.33	18.75
0.35	6.05	12.10	20.95	15.55	12.25
0.40	3.02	6.05	9.15	9.15	6.25
			Fat, %		
0.00	40.05	33.18	25.03	18.30	12.33
0.15	39.98	35.05	26.18	20.35	14.03
0.20	40.91	36.67	26.93	21.03	16.77
0.25	41.35	37.50	27.62	22.33	17.04
0.30	41.50	38.33	28.03	26.97	18.33
0.35	42.90	39.75	30.35	—	19.50
0.40	43.30	—	31.72	27.35	21.03

[a] Results significant at 5% level; average of four determinations.

Crude Fat, Crude Protein, and Carbohydrates. Analyses were performed as described in A.O.A.C. (1965). The carbohydrates were also determined by the procedure described by Hulme and Narain (1931).

Lipase Enzyme. The enzyme was extracted with water from the germinating seeds of sarson and its activity was determined by the method of Willstater (1923).

RESULTS AND DISCUSSION

Effect of Thiometon on the Activity of Lipase Enzyme. The activity of lipase has been calculated in percentage fat split per 5 grams of sample. The results are given in Table I.

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Table II. Effect of Thiometon on Sarson Seeds during Germination
Levels of Carbohydrates, % (Average of Four Determinations)[a]

Dose of Thiometon, %	Time after Sowing (Hours)									
	4		40		80		120		160	
	Red.[b]	Non-Red.[c]	Red.[b]	Non-Red.[c]	Red.[b]	Non-Red.[c]	Red.[b]	Non-Red.[c]	Red.[b]	Non-Red.[c]
0.00	0.19	6.35	0.23	8.23	1.28	9.83	2.03	11.11	2.58	15.75
0.15	0.18	6.30	0.16	7.25	1.15	9.25	1.78	10.15	2.03	13.25
0.20	0.19	6.32	0.12	7.10	1.08	8.75	1.62	9.90	1.97	11.39
0.25	0.17	6.25	0.11	6.85	0.90	8.105	1.45	9.23	1.62	11.05
0.30	0.15	6.18	0.09	6.45	—	7.40	—	8.95	1.43	10.75
0.35	0.18	6.15	0.10	—	0.72	7.45	1.15	8.20	1.37	10.03
0.40	0.16	6.20	0.08	6.25	0.65	7.03	1.03	8.12	1.25	9.57

[a] Results significant at 5% level.
[b] Reducing sugar.
[c] Nonreducing sugar.

Enzymic activity increased with increasing time up to 80 hours in the case of both treated and untreated seeds, after which it decreased gradually. With all doses of Thiometon, the enzymic activity was lower in the treated seeds than in the control. The activity of lipase decreased gradually in a similar manner in inverse proportion to the concentration of Thiometon, irrespective of the time of germination.

Effect of Thiometon on the Crude Fat Content. The results given in Table I show that as the dose of Thiometon increases there appears to be a decrease in the breakdown of crude fat in the germinating seeds. With application of Thiometon ranging from 0.15 to 0.40%, the fat content increased gradually in the samples taken during germination. This trend was noticed in all the treated and untreated seeds, regardless of the time of sowing. The fat content decreased with the lapse of time, irrespective of the concentration of Thiometon used. A higher dose of Thiometon produces lesser breakdown of fat.

Effect of Thiometon on Carbohydrates (Reducing and Nonreducing Sugars). The results for reducing and nonreducing sugars have been calculated on an oven-dry basis and are given in Table II. The amounts of both reducing and nonreducing sugars increased with time during germination. With the application of higher concentration of Thiometon, ranging from 0.00 to 0.40%, the amount of reducing and nonreducing sugars decreased in all samples except the sample taken after 4 hours, in which no significant change was observed.

Fat content of sarson seeds decreased irrespective of the application of Thiometon during germination. This decrease evidently occurs because the oil is converted to carbohydrates (glyoxalate cycle) and thus carbohydrates accumulate in subsequent stages of germination. This is in accordance with the observation made by others that carbohydrates are synthesized at the expense of fat during germination (Rabari *et al.*, 1961). The results of the present investigation, therefore, show that the application of Thiometon retarded the biosynthesis of carbohydrates by inhibition of the activity of lipase and lesser breakdown of lipids in germinating seeds.

Effect of Thiometon on Crude Protein. The crude protein content of the seeds remained the same during germination, regardless of the concentration of Thiometon.

CONCLUSIONS

During germination, Thiometon inhibits the activity of lipase enzyme, and thus causes a depression in the breakdown of fat and its conversion to carbohydrates; it slows the breakdown of carbohydrates into reducing and nonreducing sugars.

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