Dimethyl Sulfide as a Volatile Constituent of a Corn Protein Hydrolysate Attractive to Fruit Flies

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Protein hydrolysates have been used [e.g., Steiner (1)] as attractive components of toxic bait sprays for attempted control of various fruit flies (Tephritidae). A liquid controlled corn protein hydrolysate (Staley's Protein Insecticide Bait No. 7) was considered superior to others tested (2) as attractants to the adult walnut husk fly Rhagoletis completa Cresson. The only volatile component of this product isolatable in analytical amounts was dimethyl sulfide which, in purified form, was without any attraction whatsoever to this husk fly (3). The techniques used to isolate this highly volatile compound and to prove its structure may be of interest to other workers in this area, however, for dimethyl sulfide is a common protein decomposition product.

Methods and Results

The atmosphere over the undiluted liquid attractant was gas

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chromatographed on firebrick. In separate tests with three different stationary phases--tri-m-tolyl phosphate, glycerol, and mineral oil--only a single component other than air was separated. To concentrate this volatile constituent, helium was bubbled slowly through a reservoir of the liquid attractant into a trap cooled with Dry Ice-isopropyl alcohol to remove water, and then through a trap cooled with liquid nitrogen. Identifying characteristics of this concentrated component were determined by infrared and ultraviolet spectrophotometry (Figs. 1 and 2) and by mass spectrometry. The molecular weight characteristics from the last-named measurement are presented in Table I. These molecular weight data and comparative ultraviolet and infrared data demonstrated that the isolated volatile constituent of the attractant bait is dimethyl sulfide.

In order to determine what portion, if any, of the attractant properties of the protein bait was due to dimethyl sulfide, some of it was aerated until there was no longer any ultraviolet spectrophotometric evidence of dimethyl sulfide in the atmosphere over the liquid. The strong absorbance of dimethyl sulfide at 202.6 mμ permits the analytical measurement of as little as 6 p.p.m. in air. In Table II the effects of time and temperature on the dimethyl sulfide concentration in the atmosphere over this depleted bait are recorded, showing the rapid regeneration of dimethyl sulfide, especially at elevated temperatures. This regeneration of dimethyl sulfide by the attractant mixture therefore prevented attractancy comparisons of the depleted material.

Field studies with purified dimethyl sulfide as an attractant to walnut husk flies were without promise (3), as previously noted.

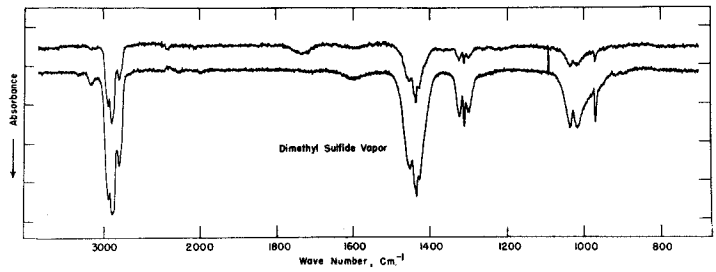

Fig. 1. Comparison of vapor-phase infrared characteristics of volatile constituent from the attractant (upper spectrum) and dimethyl sulfide. Perkin-Elmer Model 21 infrared spectrophotometer with 10-cm. rock salt gas cell; settings: resolution 927, response 1 to 1, gain 5.5, speed 1 min./μ, and suppression 2.

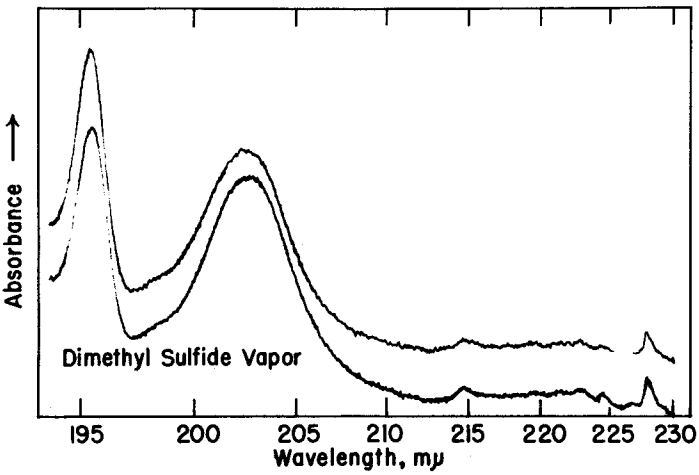

Fig. 2. Comparison of vapor-phase ultraviolet characteristics of volatile constituent from the attractant (upper spectrum) and dimethyl sulfide. Beckman Model DK-2 ratio-recording spectrophotometer with 10-cm. gas cells equipped with quartz windows.

TABLE I

Mass spectrometric characteristics of the volatile constituent and of dimethyl sulfide

Mass no.	Peak height	% Maximum	
		Volatile constituent	Dimethyl sulfide[a/]
45	36	80	62
46	21	47	42
47	45	100	100
61	12	27	30
62	33	74	80

a/ A.P.I. Research Project 44, Mass Spectrometry, Table No. 909, April 30, 1953.

TABLE II

The effects of time and temperature on the dimethyl sulfide concentration in the atmosphere over depleted bait

Elapsed Hours	P.P.M.	
	25°C.	47°C.
0	0	0
6	--	257
24	5	740
48	10	1050
100	--	2340
200	101	--

References

1. L. F. STEINER, "Fruit fly control with poisoned-bait sprays in Hawaii," ARS-33-3, U. S. Dept. Agr., Agri. Research Service (1954).

2. M. M. BARNES and J. C. ORTEGA, J. Econ. Entomol. 52, 279 (1959).

3. M. M. BARNES, unpublished data.

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