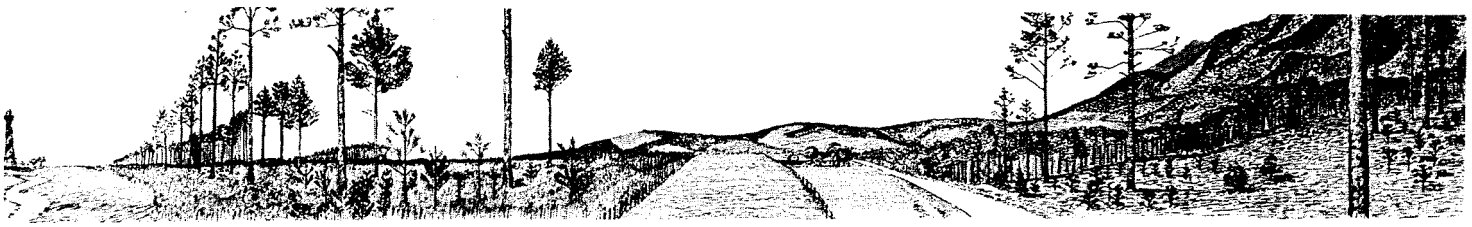

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DEVELOPMENT OF PALES WEEVIL LARVAE ON AN EMULSIFIED SYNTHETIC DIET

Abstract. --The effect of adding an emulsifier to an artificial diet for pales weevil larvae was studied. The hypothesis was that fat-soluble ingredients would be better dispersed in the aqueous media, possibly leading to improved larval growth. The results suggest some Improvement occurred when the emulsifier was incorporated.

Many of today's artificial diets for insects are aqueous preparations with an agar base[1,2] which also contain lipid-soluble substances such as vitamins and oils. In preparing such diets, the lipids are often first blended with a dry ingredient and the dry mixture is then added to the diet with continuous mixing. Usually, the water-lipid phases are simply assumed to be homogeneously mixed.

During the development of an artificial diet for the larva of the pales weevil, Hylobius pales (Herbst),[3] I occasionally observed large variations in size among larvae of the same age. There were also problems with microbial contamination, although the antimicrobial agent, methylparaben, was present at a level comparable to that of similar diets. For these reasons, and because this was an aqueous diet with lipid ingredients, homogeneity of the mixture was in question, and a possible need for some type of emulsifier was indicated. Differences in larval size could be due to poor dispersal of vitamins, and unequal distribution of the methylparaben could inhibit development in some of the larvae or permit microorganisms to invade.

I decided to add a proprietary food emulsifier to the diet in an attempt to reduce variation in size of the larvae and to see if any adverse effect resulted from the additive. Detrimental effects from additives are not uncommon.[4]

[1]House, H. L. Artificial diets for insects: a compilation of references with abstracts. Can. Dep. Agr. Res. Inst. (Belleville) Inform. Bull. 5, 163 pp. 1967.

[2]Vanderzandt, E. S. Defined diets for phytophagous Insects, pp. 273-303. In C. N. Smith (ed.), Insect colonization and mass production. New York: Academic Press, Inc. 1966.

[3]Thomas, H. A. A meridic diet and rearing technique for the pales weevil larva. J. Econ. Entomol. 62: 1491-1494. 1969.

[4]Singh, P., and House, H. L. Anti-microbial agents: their detrimental effects on size of an insect, Agria affinis. Can. Entomol. 102: 1340-1344. 19'70.

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The object of this study was to measure growth of the pales weevil larva on a synthetic diet containing an industrial emulsifier.

METHODS AND MATERIALS

Weight gains of larvae reared on three diet formulations were compared. The operational wheat germ diet (diet A) served as the control (see footnote 3). Diet B consisted of the control plus 2-percent (dry weight) Drewmulse 80,[5] and diet C consisted of diet B with methylparaben reduced from 0.24 percent to 0.16 percent of dry weight. Preliminary experiments with the control diet to which 0.7-percent Drewmulse 300[6] was added prior to autoclaving were discontinued when Drewmulse 80 was found to be better suited.

Newly hatched larvae from laboratory cultures were reared individually in petri dishes of diet formulation as previously reported (see footnote 3). These were held at 25° C. in total darkness, and 15 to 25 larvae from each diet were weighed to the nearest 0.1 mg. every 4th day up to 32 days, except for the first 4-day sample when 5 to 10 were weighed. Preparation of the three diets and weighing of larvae was performed twice, and the weights were pooled for each treatment at each time interval. The data for each time interval were analyzed with Bartlett's test for homogeneity, and treatment effects were compared in an analysis of variance. Duration of the larval period in days and weights of emerging adults were also recorded.

RESULTS AND DISCUSSION

There was no significant difference in the mean duration of the larval stage as a result of treatment or in the weight of the adults. There appeared to be considerably more contamination (primarily bacterial) associated with diet C, though this was a subjective assessment. No records of survival were maintained, but observation indicated no differences as a result of treatment.

The results show that a significant difference ($p = 0.05$) in mean weights as a result of treatment was obtained only in larvae 16 and 28 days old (table 1). A difference significant at $p = 0.10$ was present in the weights of 12-day-old larvae, but this level of significance was not considered appropriate for these experiments. At most of the age intervals, large variances were calculated within treatments, pointing to the need for much larger samples and the likelihood that size variability is inherent and not an indication of lack of homogeneity in the diets. In general, rate of growth of larvae reared on the three diets appeared to be significantly different between the 8th and 16th day, the period which includes the logarithmic growth phase for this larva on synthetic diet. Possibly, the emulsifier made nutrients slightly more available during this critical period.

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[5] A liquid polysorbate emulsifier, Drew Foods, Boonton, N. J. (Mention of trade *names* throughout this paper does not constitute endorsement by the U. S. Department of Agriculture.)

[6] A monodiglyceride emulsifier, Drew Foods, Boonton, N. J.

Table 1. --Number and mean weights of pales weevil larvae reared on three diet formulations

Age (days)	Number and weight of larvae reared on diet--					
	A		B		C	
	No.	Mg.	No.	Mg.	No.	Mg.
4	9	0.82	11	1.28	10	1.31
8	24	[1]6.11	25	[1]6.47	23	[1]7.76
12	20	16.84	25	10.71	24	16.39
16	21	[1]41.99	35	[2]41.75	31	[2]61.93
20	22	70.52	18	61.76	19	82.18
24	16	101.51	17	124.03	16	116.27
28	30	[2]117.19	22	[2]122.92	28	[1]127.30
32	22	117.78	22	126.94	18	119.15

[1]Data nonhomogeneous, Bartlett's test = 10.02.
[2]Means significantly different, p = 0.05.

Further work is needed to demonstrate whether emulsion of the diet improves growth, but the results suggest that the emulsifier may be used without harmful effect.

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