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Lipid Composition of the Pecan Weevil, *Curculio caryae* (Horn)

ABSTRACT

The lipids of larvae, male adults, and female adults of the pecan weevil, *Curculio caryae* (Horn), were studied, and special attention was given the fatty acid composition. The larvae contained an unusually high amount of lipid material (40.6%), most of it concentrated in the neutral lipid fraction. Male and female adults contained more conventional quantities, 5.8 and 8.2%, respectively. Oleic acid was the major fatty acid in the total and neutral lipids of all stages; linoleic acid was the most abundant in the phospholipid fractions.

INTRODUCTION

The adult pecan weevil, *Curculio caryae* (Horn), attacks green maturing nuts in late summer and damages them by making feeding and oviposition punctures. The insect then undergoes an extended life cycle which takes 2-3 years to complete. The extended life cycle of the pecan weevil indicates that the role of lipids in this insect is a central one. The importance of lipids in the biochemistry of insects has been stressed in recent reviews (1,2). Also, extensive studies in the order Coleoptera have been conducted (3-6). Our investigation was designed to add to the body of general knowledge of insect lipids and specifically to further the understanding of the lipids of Coleoptera.

The adult pecan weevils were newly-emerged and unfed. The larvae were last instar and about to enter diapause. Extraction, isolation, and identification were as previously reported (5).

DISCUSSION

Table I shows the percentage distribution of the lipids in the stages studied. The total lipid percentage reported for the larvae is among the highest ever reported for any stage of any insect. It results, of course, from the larvae feeding on lipid-rich meats of the pecan, its

habitat and sole source of food since hatching. However, the buildup of this lipid reserve also prepares the larva for the long diapause underground during which no feeding occurs. It is noteworthy that 97.6% of the lipid is neutral lipid, most likely in the form of triglyceride, a readily available source of energy. The token amount of phospholipid (2.4%) probably is contained in the membranous structures of the larvae.

The total lipid percentages of the adult male (5.8%) and female (8.2%) fall within the normal range for most newly-emerged, unfed insects with their lipid stores depleted by the long dormant period in the soil. Females contain a slightly larger amount of lipid, which is a common occurrence in other Coleoptera and also other orders of insects. Presumably, this extra load of fat is used for reproductive purposes. In both males and females, over 90% of the total lipid is in the form of neutral lipids.

The fatty acid composition of the lipids of the pecan weevil is shown in Table II. The fatty acid profile of the total lipids is remarkably consistent for the three states of the insect. Oleic acid is the most abundant fatty acid, and the percentage of oleic acid in these weevils exceeds that of most other insects (2), probably a reflection of dietary influences (7). The predominance of oleic acid also is carried over into the neutral lipid fraction, which is not surprising since over 90% of the total lipid is neutral lipid. The predominant fatty acid in the phospholipid fraction is linoleic acid (50%). Similar large quantities of linoleic acid and other highly unsaturated acids in the phospho-

TABLE I

Weight Relationships of Pecan Weevil Lipids

Developmental stage	Total lipid (%)	Neutral lipid (% of total)	Phospholipid (% of total)
Larvae	40.6	97.6	2.4
Adult male	5.8	91.2	8.8
Adult female	8.2	95.0	5.0

TABLE II
Fatty Acid Composition of Total Lipid,
Neutral Lipid, and Phospholipid of the Pecan Weevil

Developmental stage and lipid class	Fatty acids as mole % of total fatty acids					
	16:0	16:1	18:0	18:1	18:2	18:3
Larvae						
Total lipid	2.0	Trace	Trace	68.1	29.7	Trace
Neutral lipid	2.9	Trace	1.4	61.3	34.2	Trace
Phospholipid	8.0	Trace	4.0	35.5	49.0	3.2
Male adults						
Total lipid	3.7	Trace	Trace	66.9	29.2	Trace
Neutral lipid	3.6	Trace	Trace	68.6	27.6	Trace
Phospholipid	4.7	0.8	1.9	24.2	50.0	18.1
Female adults						
Total lipid	3.3	Trace	Trace	66.1	30.5	Trace
Neutral lipid	4.0	Trace	Trace	60.8	35.1	Trace
Phospholipid	3.4	Trace	3.2	17.2	49.3	26.7

lipids has been observed in *Anthonomus grandis* (6) and a variety of other insects (2). Linolenic acid was present in measurable amounts only in the phospholipid fractions; the concentration was highest in female adults. Insects are known to be unable to synthesize polyunsaturated fatty acids (8), and linoleic and linolenic acids are essential to most insects for normal growth or reproduction. The predominance of these acids in the phospholipids of the pecan weevil and other insects, therefore, is important and worthy of further study.

The phospholipids tentatively identified in the pecan weevil were phosphatidyl ethanolamine, phosphatidyl choline, sphingomyelin, lysophosphatidyl choline, and cardiolipin. Phosphatidyl ethanolamine was the most abundant phospholipid present in the larvae, and phosphatidyl choline was the most abundant in the adults.

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On the Site of the Microbiological Reduction of Cholesterol to Coprostanol in the Rat¹

ABSTRACT

The microbiological reduction of the 5-ene bond of cholesterol (cholest-5-en-3 β -ol) to form coprostanol (5 β -cholestan-3 β -ol) occurs in the gastrointestinal tract of many species. Data are presented

which show that this activity occurs predominantly in the ceca in cholesterol fed rats. This explains the report by others that the removal of the ceca causes coprostanol to disappear from the feces.

INTRODUCTION

The microbiological modification of intestinal sterols by indigenous microflora has been

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