Lipid Storage by Honey Ant[1] Repletes[2]

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ABSTRACT

A previously undescribed system of differential food storage in replete forms of the honey ant, *Myrmecocystus mexicanus* Wesmael, is reported. Certain repletes store lipid as glycerol and cholesterol esters associated with sugar solutions containing glucose, fructose, and maltose.

Ants of the genus *Myrmecocystus* are renowned for their ability to store relatively large amounts of liquid food in the greatly distended crops of replete ants. As a consequence of the crop distension, the abdomen is also expanded. The large, immobile repletes are found hanging from the ceilings of the underground nest galleries. The replete ants represent a communal stomach upon which the colony can rely during periods of reduced foraging. We have recently found substantial amounts of lipid stored in some repletes.

The material stored by repletes has been loosely termed honey. Very little is known of its actual composition. Wetherill (1852), in an analysis of honey from a Mexican honey ant, species not given, reported the material to be nearly a pure solution of fructose. Badger and Korytnyk (1956) examined honey from an Australian honey ant of the genus *Melophorus* and found fructose and glucose comprised 59% of the total honey solids.

The source of the honey is generally considered to be honeydew. Honeydew is a nebulous term used to describe the saccharine secretions of many phytophagous insects. *Myrmecocystus* foragers have been reported to collect gall secretions (Wheeler 1908, Hutchins 1966), aphid and coccid secretions (Creighton 1950, Cazier and Statham 1962), and flower nectar (Cazier and Mortenson 1965).

Honey ants are also insectivorous. Cazier and Statham (1962) catalogued members from 6 insect orders which served as booty returned to the nest by foragers of *M. mimicus* Wheeler.

MATERIALS

Repletes from the 2 deserticolous species, *M. mexicanus* and *M. mimicus*, were collected by the senior author at the Southwestern Research Station, Portal, Ariz., in August 1972. The excavation of the nests followed the procedure outlined by Cazier and Mortenson (1965). Repletes were found in galleries 1–1.5m below the soil surface either in or below the caliche layer. Caliche is hypothesized by Wheeler (1908) to serve as a natural waterproofing layer.

The majority of repletes of both species contained liquid material which formed a single homogenous phase in the crop of the ants. However, the crops of a small percentage (ca. 5%) of the repletes of *M. mexicanus* were observed *in vivo* to contain two distinct liquid phases (Fig. 1).

RESULTS AND DISCUSSION

The single phase aqueous layers from both species proved to be typical dilute honey solutions. Silyl ethers of the sugars were determined by gas chromatography on OV-17 at 110°–275°. The proportions of the sugars were as follows: fructose 47–49%, glucose 42–44%, and maltose 7–8%. Small amounts of phosphorus (0.04–0.08%, inorganic only) were present in the honey from each species.

No observable protein was precipitated from the honeys by trichloracetic acid, although some color was developed by treatment with Folin Cicocalteau reagent (Chaykin 1966).

The bi-layer material stored by *M. mexicanus* and the single phase honey of *M. mimicus* were extracted with hexane. There was no residue from the hexane layer of the crop contents of *M. mimicus*. Hexane extraction of the *M. mexicanus* yielded a light yellow, odorless oil.

Thin layer chromatography on silica gel indicated a major proportion of triglyceride and small amounts of cholesterol and its esters. The saponification number of the oil was 171. No free acid was present nor was phosphorus detected. Gas chromatographic analysis (Hadorn and Zurcher 1970) of methyl esters prepared from the oil gave the results shown in Table 1.

The finding of palmitic acid as the only major saturated component and the 18-carbon unsaturates in large proportion supports the idea that *M. mexi-*

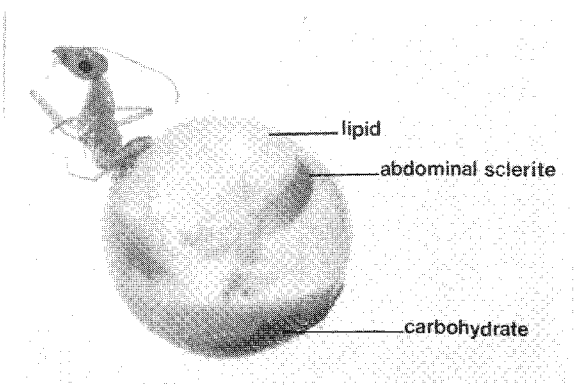

FIG. 1.—Replete form of *Myrmecocystus mexicanus* Wesmael (5x). Top aqueous phase is lipid; bottom phase is carbohydrate; darkened areas are abdominal sclerites.

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Table 1.—Fatty acids of crop contents of *Myrmecocystus mexicanus*.[a]

Fatty acid	Percent
C_{14} and below	5.2
C_{16}	20.4
C_{16} : 1	5.2
C_{16} : 2	0.5
C_{17}	0.7
C_{18}	8.3
C_{18} : 1	54.6
C_{18} : 2	5.0

[a] Methyl esters were prepared by interesterification with sodium methylate and analysed by gas chromatography.

canus lipid stores are of insect origin. The fatty acid spectrum found in the stored lipids of *M. mexicanus* is similar to the findings by Young (1967) of the same pattern in whole body lipids of many insect species.

The confirmation of lipid storage by certain repletes suggests a system of differential storage of fats and carbohydrates by *M. mexicanus*. A similar system of food storage is seen in the separation of liquid carbohydrates (honey) and protein (pollen) by bees of the genus *Apis* (Dietz and Caron 1971).

To date only *M. mexicanus* has been found to possess lipid-containing repletes. How widespread this phenomenon is among honey ants is an interesting question. The question of what selective metabolic capability may be peculiar to the workers or repletes of *M. mexicanus* is also unanswered.

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