SEASONAL VARIATION IN THE FATTY ACID COMPOSITION OF THE WOODLOUSE, *TRACHEONISCUS RATHKEI* BRANDT

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ABSTRACT. — The fatty acid composition of *Tracheoniscus rathkei* was determined monthly from March through January. The predominant saturated acid was palmitic acid (16:0), and the predominant unsaturated acids were palmitoleic acid (16:1), oleic acid (18:1), and linoleic acid (18:2). Lipid unsaturation increased during midwinter due to increases in the proportions of arachidonic acid (20:4) and docosahexaenoic acid (22:6).

Among the various groups of arthropods, the analysis of body lipids has received the most attention in the insects (Fast, 1964; Young, 1967). Even within this class, however, little is known of seasonal variations within natural populations. Preliminary reports on changes in fatty acid composition during hibernation have appeared for a mosquito (Buffington and Zar, 1968) and a beetle (Zar, 1968). This paper has extended these studies to include seasonal changes in the woodlouse *Tracheoniscus rathkei* Brandt (Isopoda: Oniscidae).

MATERIALS AND METHODS

Specimens of *Tracheoniscus rathkei* were collected (about 120 per month) in Trelease Woods, a deciduous forest about 10 miles northeast of Urbana, Illinois. The animals generally were found under leaf litter and logs, and under the bark of logs. During the winter, however, from November through January, they were found only within log crevices, on the undersurface of logs, or in the soil. The methods utilized in the preparation of the woodlice for analysis were as described by Buffington and Zar (1968), as were the fatty acid determinations by gas-liquid chromatography. Chromatograms were run as long as the known retention time for methyl docosahexaenoate.

RESULTS AND DISCUSSION

The mean ($\pm$ SE) water content and caloric value of the animals were 66.1 $\pm$ 4.7 percent and 3521 $\pm$ 2 g-cal/gm, respectively. Table 1 presents the results of the fatty acid analysis. The iodine values were calculated for each fatty acid mixture from the fatty acid composition. The results obtained indicate that the fatty acid composition of *T. rathkei* is unlike that of insects or arachnids that have been studied (Fast, 1964; Young, 1967).

In some insects (Fraenkel and Hopf, 1940; Munson, 1953; Harwood and Takata, 1965) and aquatic crustaceans (Lewis, 1962; Farkas

TABLE 1. — Monthly fatty acid analysis of *Tracheoniscus rathkei* from 14 March 1966 through 22 January, 1967. Table values are percents (by weight).

	14 March	15 April	15 May	15 June	15 July	16 August	15 Sept.	15 Oct.+15 Nov.	14 Dec.	22 Jan.
Fatty acids*										
12:0	2.2	1.3	1.8	1.1	2.1	1.6	2.4	0.8	2.5	1.1
14:0	0.5	0.6	0.4	0.6	1.2	1.0	0.7	1.0	0.8	0.8
16:0	12.6	15.3	12.8	15.7	15.6	17.8	16.6	14.0	12.4	12.1
16:1	14.5	14.7	9.6	9.8	8.6	10.4	10.4	11.0	9.0	7.2
18:0	1.5	2.2	2.8	3.0	3.8	3.3	2.6	2.0	2.4	2.3
18:1	28.7	36.8	30.0	31.6	22.5	26.5	26.4	29.4	33.4	29.1
18:2	15.4	19.6	17.2	18.4	18.9	16.8	19.9	22.0	21.7	19.2
18:3	2.1	1.1	3.9	3.7	3.7	4.1	2.9	3.9	4.9	3.1
20:4	7.2	1.5	4.0	3.0	14.0	6.9	8.1	2.9	4.4	10.2
22:6	7.2	0.1	0.4	1.4	4.4	0.0	0.0	2.5	<0.1	6.9
other†	8.0	5.7	16.9	11.7	6.3	11.4	10.0	10.4	8.4	8.1
Iodine value of fatty acids	143	100	106	113	148	111	115	120	116	152
Body lipids (% of dry wt.)	9.3	11.2	9.8	11.4	8.6	9.3	9.4	10.8	8.4	22.7
Body wt., mg (Mean, dry)	9.2	8.5	8.4	15.1	9.8	11.5	9.4	10.2	10.4	8.0

* Carbon chain length: number of double bonds.
† Includes 10 minor components, tentatively identified as 12:1, 14:1, 14:2, 16:2, 20:1, 20:2, 20:3, 22:0, 15:0, and 17:0.

and Herodek, 1964), a positive correlation between lipid saturation and ambient temperature has been shown. Likewise, *T. rathkei* exhibited its greatest degree of fat unsaturation in January, the month with the coldest environmental temperature. This increase in total unsaturation (as indicated by the iodine value of the fatty acid mixture) was due mainly to the relatively increased amounts of arachidonic acid (20:4) and docosahexaenoic acid (22:6). The increase in 20:4 is not as striking, however, as that found in the same January in a ladybird beetle (Zar, 1968); instead, the woodlouse exhibits a large increase in 22:6, a fatty acid not even detected in the beetle. If the 20:4 and 22:6 are membrane rather than triglyceride fatty acids, their increase may be related to increased cold tolerance in a manner similar to that in plants, in which higher mitochondrial membrane lipid unsaturation is more chill-resistant (Lyons *et al.*, 1964; Lyons and Asmundson, 1965).

According to Hatchett (1947) and Judd (1963), *T. rathkei* mates in April and May and the young emerge 35-42 (mean of 39) days later, there generally being but one brood per year. The 15 June collection in the present study consisted largely of gravid females. This accounts for the high June weight of the animals, but it is of interest that July, after the young had emerged, was a period of high lipid unsaturation.

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