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WAX OF SOME FULGOROIDEA

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ABSTRACT

The plume-like tails (waxy secretions) of the following Fulgoroidea-females were analysed: Cixiidae: Reptalus panzeri, Pentastiridius leporinus, Gen. spec.?. Fulgoridae: Phenax variegata. Gas chromatography of these waxes, which were soluble in hot (60 °C) chloroform, detected 15 compounds. Two peaks (C_{16} and C_{18}) were only found in the wax of P. leporinus (11 and 38 area %) and in the wax of R. panzeri (3 and 11 area %). Mass spectra of these peaks indicated 9-oxo-hexadecanol and 9-oxo-octadecanol. Thin layer chromatography and hydrolysis suggest that the other groups of peaks with possible chain-lengths of C_{36-46} and C_{52-64} may be esters. C_{36-56} were found in different amounts in the waxes of R. panzeri, P. leporinus and P. variegata. In the wax of Gen. spec. C_{58-64} only were detected, which were present in low amounts in the other waxes.

KEY WORDS

Wax composition, ketoalcohols, esters, Cixiidae, Fulgoridae

INTRODUCTION

The waxy secretions of some Homoptera have already been analysed chemically: in the wax of the Chinese insect (Coccus cerifera) esters of C_{48-60} were detected (Tulloch 1973). Saponified wax of the cochineal insect Dactylopius confusus contained 15-oxo-tetratriacontanol and 15-oxo-triacontanoic acid in good yields (Meinwald et al. 1975). The major components in the wax of the woolly apple aphid (Eriosoma lanigerum) were identified as diketoesters, with the main component formed through 15-oxo-tetratriacontanol and 13-oxo-dotriacontanoic acid (Cameron and Drake 1976). The wax of the scale insect Drosicha corpulenta, too, comprised mainly esters, the principal being formed through 1-hexacosanol and hexacosanoic acid (Hashimoto and Kitaoka

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1982). The present paper reports some analytical data on the waxy secretions of 4 species belonging to the Fulgoroidea (Hom. Auch.).

MATERIALS AND METHODS

The plume-like tails of the following Fulgoroidea-femals were collected and sent to me by Hannelore Hoch:
- Reptalus panzeri (Löw), Cixiidae, Bad Neustadt/Saale (FRG), June 1977 (Asche leg.): 0.4 mg.
- Petastiridius leporinus (L.), Cixiidae, Jajce (Yugoslavia), June 1979 (Asche leg.): 1.4 mg.
- Gen. spec.?, Cixiidae, Rio de Janeiro (Brazil), November 1926 (Coll. Schöder, Senkenberg, FRG): 1.2 mg.
- Phenax variegata, Fulgoridae, Hansa Humbolt SC (Brazil), 1932 (Coll. Schröder): 2.5 mg.

Waxes were analysed using thin layer chromatography (TLC) in chloroform, capillary gas liquid chromatography (GLC) programmed at 70 - 330 °C (12°/min) or at 200 - 340 °C (8°/min), and mass spectrography (MS) (details: Günthardt 1986). Saponification (transmethylation) was carried out using the methanolic base reagent of Supelco INC., Bellefonte, PA, USA.

RESULTS

Wax fibers looked like glass fibers or calcium sulfate and in two samples (R. panzeri, P. leporinus) they were accompanied by yellowish wax like ear-wax. Two fractions of each sample were taken: fraction 1 with chloroform at room temperature (GLC programmed at 70 - 330 °C), and fraction 2 with hot chloroform of 60 °C (GLC programmed at 200 - 340 °C). Some remaining insoluble traces might have been adhering chitin. GLC detected 15 peaks with different occurrence and quantity (Table 1).

TLC of the wax of P. leporinus showed a prominent band with a polarity between prim. alcohols and diols, and three weak bands, which probably represent different esters. The prominent band was isolated and proved identical with the C_{16} and C_{18} compound detected in the GLC-chromatogramms (Table 1) of the two Cixiidae species with the additional "ear-wax". These compounds led to the characteristic tailing, which is usually formed by substances with more than one oxygen atom (under the GLC-conditions used). Figure 1 shows the MS of the isolated compounds. The first peak contains ions possibly originating from an almost symmetrical ketoalcohol, 9-oxo-hexadecanol: and the second from another ketoalcohol, 9-oxo-octodecanol. The major fragment of the latter, viz. $[HOCH_2(CH_2)_7\text{-}COH{=}CH_2]^+$ (m/e 173) could be the result of a Mc Lafferty rearrangement as reported by Meinwald et al. (1975).

Table 1: Compounds in the waxy secretions of 4 Fulgoroidea species (females) as detected through GLC.

RT	~C	*R. panzeri* area %	*P. leporinus* area %	*P. variegata* area %	*Gen. spec.* area %
Fraction 1:					
6.9	16	3.3	11.1		
8.2	18	10.7	38.1		
17.5	36	44.1			
18.2	38	12.8	5.4	39.4	
18.9	40	5.2	13.7	trace	
19.7	42		1.0	9.5	
20.4	44		1.1	13.6	
21.0	46		1.1	7.3	
22.5	52	3.0	2.0		
23.5	54	3.8	4.9		
24.5	56	4.1	7.8		
Fraction 2:					
17.2	58	trace	3.3	trace	6.6
18.4	60	3.4	4.4	5.6	11.0
19.9	62	7.1	6.2 (?)	16.7	42.3
21.8	64	2.5	?	7.9	49.1

RT = retention time. The sum of the peak areas of both fractions was taken as 100 %.

The wax of *P. variegata* (fractions 1 and 2) and the combined fractions 2 of *Gen. spec.* and *R. panzeri* (esters C_{58-64}) were saponified. But saponification products (Table 2) did not lead to an explanation for the ester composition, the more so, as 73.8 % area (*P. variegata*) or 57.5 % area (*Gen. spec.* + *R. panzeri*) belonged to unknown compounds which could not be investigated further. Fatty acids longer than C_{18} and primary alcohols, however, were not found among the saponification products of the long-chain esters C_{58-64}, whereas C_{14}-diol occurred as a main component. Since less than 1 mg of wax was available analysis was limited.

DISCUSSION

The waxes of *R. panzeri* and *P. leporinus* (Cixiidae) contained two compounds with shorter chain-lengths, probably free ketoalcohols, in addition to the different long-chain esters found in all 4 species. According to its wax analysis the *Gen. spec.* (determined as Cixiidae by H. Hoch) is more closely related to the Fulgorid species *P. variegata*, because in both waxes only different esters were found.

Figure 1: Mass spectra of the first (C_{16}) and the second (C_{18}) peak detected through GLC in the waxes of *R. panzeri* and *P. leporinus*.

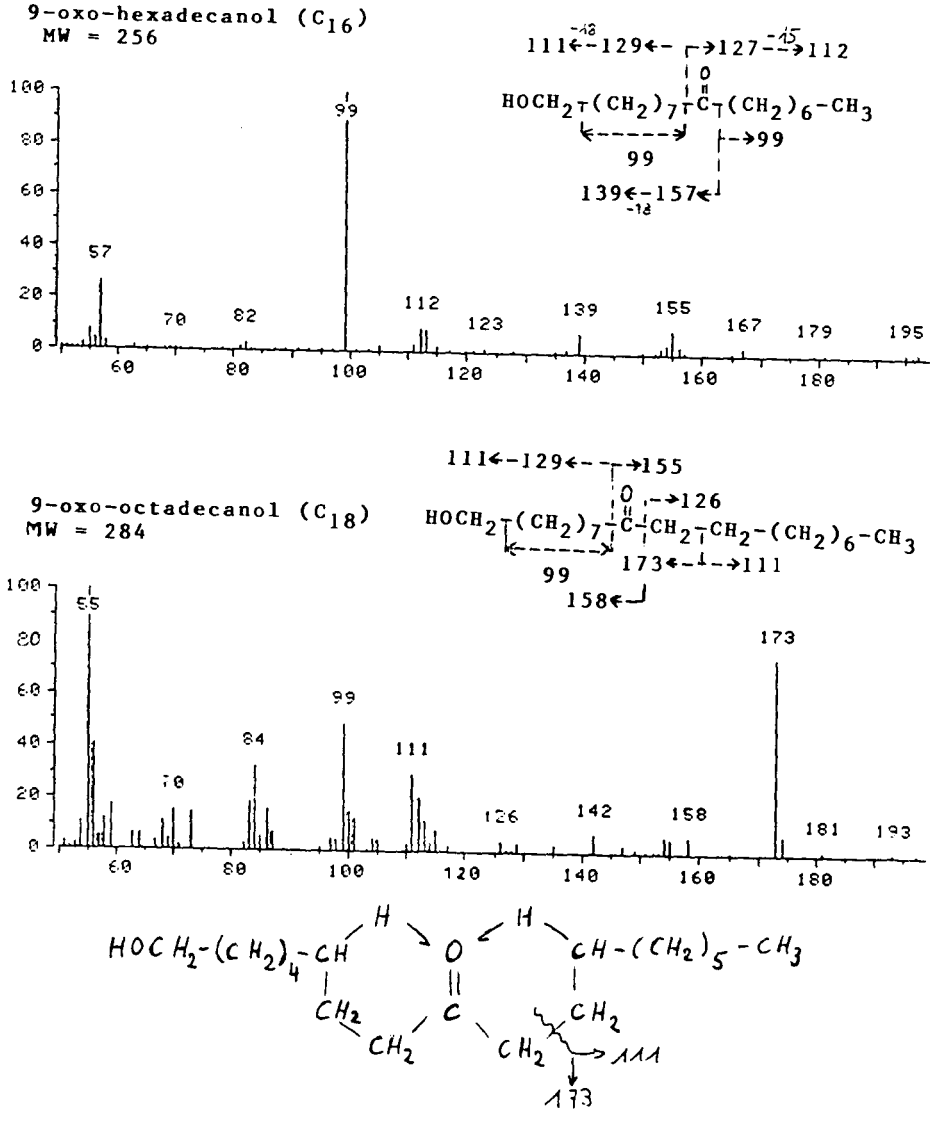

Table 2: Saponification products of the wax of *P. variegata* (fraction 1 + 2) and of *Gen. spec.* + *R. panzeri* (combined fractions 2).

	No. of C	*P. variegata* area %	*Gen. spec.* + *R. panzeri* area %
Fatty acids	14	0.6	1.4
	16	7.3	10.8
	18	2.9	6.7
	20	0.5	
	22	0.6	
	24	0.3	
	30	0.7	
Prim. alcohols	16	0.4	
	18	0.4	
	24	3.3	
ω-diol	14	9.1	23.6
Unknowns	20		15.2
	22	8.7	24.7
	32	62.1	9.7
	34	3.0	7.9
		sum = 100 %	sum = 100 %

Ketoalcohols in esterified form had been previously determined in the waxes of *Dactylopius confusus* (Meinwald et al. 1975) and three aphids: *Prociphilus tessalatus* (Meinwald et al. 1975), *Eriosoma lanigerum*, *Pemphigus spirothecae* (Cameron and Drake 1976). The free short-chain compounds, probably C_{16}- and C_{18}-ketoalcohols, found in the two Cixiidae waxes, are therefore unexpected.

REFERENCES

Cameron, D. W.; Drake, C. B. (1976) Colouring matters of the Aphidoidea. XL The external wax of the woolly apple aphid *Eriosoma lanigerum* (Hemiptera: Insecta). Aust. J. Chem. 26, 2713-2721.

Günthardt-Goerg, M. S. (1986) Epicuticular wax of needles of *Pinus cembra*, *Pinus sylvestris* and *Picea abies*. Eur. J. For. Path. 16, 400-408.

Hashimoto, A.; Kitaoka S. (1982) Composition of the wax secreted by a scale insect, *Drosicha corpulenta* Kuwana (Homoptera: Margarodidae). Appl. Ent. Zool. 17, 453-459.

Meinwald, J.; Smolanoff, J.; Chibnall, A. C.; Eisner T. (1975) Charakterization and synthesis of waxes from homopterous insects. J. Chem. Ecol. 1, 269-274.

Tulloch, A. P. (1973) Comparison of some commercial waxes by gas liquid chromatography. J. Am. Oil Chemist s Soc. 50, 367-371.