

Sex Pheromones in Nereids: Volatile Compounds of the Coelomic Fluid of *Nereis virens*

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Volatile compounds of the pheromone bouquet of *Nereis virens* have been isolated and identified from the coelomic fluid of ripe sub-heteronereids. One of the minor compounds is the sex pheromone of *Platynereis dumerilii*, 5-methyl-3-heptanone.

Nereis virens is widespread in Europe, inhabits different substrata from rocky shores to sandy beaches and could be found also in estuaries. Most of the marine nereids perform a metamorphosis before reproduction as epitokous heteronereid form and have a special reproductive behaviour – swarming and nuptial dance. *Nereis virens* too undergoes a slight metamorphosis and the sub-heteronereids swarm during daytime with a semilunar cycle at spring tides in April [1–3] at an age of 2–3 years.

The swarming behaviour and gamete release is controlled by chemical signals. Addition of coelomic fluid induces gamete release in the partner of the opposite sex. This pheromone communication was described by Boilly-Marer & Lassalle [4] for different *Nereis* species. For *Platynereis dumerilii* one sex pheromone, controlling the nuptial dance behaviour could be identified as the volatile compound 5-methyl-3-heptanone recently in our group [5]. In this note we wish to report the identification of the volatile compounds of the coelomic fluid of *Nereis virens*.

Swarming *Nereis virens* were caught at spring tide in April at Helgoland island, F.R.G. The organic volatile compounds of the coelomic fluid of both sexes (100 heteronereids) were concentrated by using a closed-loop-stripping technique [6] on a charcoal filter, desorbed with acetone (50 µl), analyzed by gaschromatography and identified by

GC-MS (Fig. 1). The majority of the volatile organic compounds present in the coelomic fluid can be classified into two groups. Aldehydes *n*-alkanes and benzols are found also in seawater [5], but less concentrated. The second group of compounds, mainly ketones, branched alkanes and alkenes were found only in the coelomic fluid of the subheteronereids.

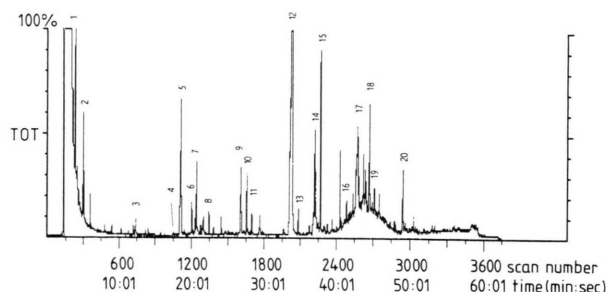


Fig. 1. Gas chromatogram (Ion Trap Detection) of an acetone extract, concentrated by closed-loop-stripping from the coelomic fluid of *Nereis virens* males and females. No.: identified major compounds – see Table I, No. 6; 14; 20: unknown. Glass capillary column coated with DB5 (30 m × 0.53 mm, film thickness 1.0 µm); 310 °C (15 min) – 250 °C at 5 °C/min.

Most of the proposed structures listed in Table I were verified by mass spectrometry and gas chromatographic retention time comparison with authentic synthetic material. The identification of a few compounds was based solely on mass spectral evidences. In those cases the mass spectra left no doubt as to the structure of the compounds, or their mass spectra were in conjunction with the spectra of other homologues present in the coelomic fluid, afforded sufficient evidence to support the proposed structure. In contrast to the coelomic fluid of *Platynereis dumerilii* males [5] a number of alkenes, alca-dienes and alcohols are present in the coelomic fluid of *Nereis virens*. These substances may come from the female coelomic fluid. One of the minor compounds is the sex pheromone of *P. dumerilii*, 5-methyl-3-heptanone, while two other C8-ketones were also present.

The coelomic fluid of *Nereis virens* shows heterospecific activity with gamete release in *Platynereis dumerilii* as supposed by Boilly-Marer and Lassalle [4]. Electrophysiological and behavioural

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Table I. Volatile compounds of coelomic fluid of *Nereis virens*.

Ketones	Alcenes	Aldehydes
2-hexanone	6-methyl-5-hepten-2-one (7)	hexanal*
2,4-dimethyl-3-hexanone	4-methyl-1-decene	heptanal*
2-heptanone	5-nonene-2-one (9)	4-methyl-hexanal
5-methyl-3-heptanone (4)	<i>E,E</i> -3,5-octadien-2-one	octanal*
6-methyl-2-heptanone	<i>E,Z</i> -3,5-octadien-2-one	nonanal*
2-octanone	4,4-dimethyl-2-pentene (1)	decanal*
2-nonanone (10)	3-heptadecene	2,4-undecadienal
2-decanone	geranylacetone (17)	
2-undecanone (15)	5-octadecene	
3-undecanone		
2-dodecanone (16)		
3-tridecanone (18)		
2-tetradecanone		

Alkanes	Others	Benzenes
<i>n</i> -heptane*	2-ethyl-furane	toluene* (2)
<i>n</i> -octane*	2-pentyl-furane	<i>m</i> -xylene*
<i>n</i> -nonane*	2,4-dimethyl-2-pentanol*	<i>o</i> -xylene*
<i>n</i> -decane*	2-nonene-1-ol (11)	ethylbenzene* (3)
<i>n</i> -undecane*	dimethyldisulfane	1,2,3-trimethylbenzene*
<i>n</i> -dodecane* (13)	dimethyltrisulfane (5)	<i>o</i> -ethyl-toluene*
<i>n</i> -tridecane*	dimethyltetrasulfane (12)	<i>m</i> -ethyl-toluene*
<i>n</i> -tetradecane*	1-H-indole	1,3,5-trimethylbenzene*
<i>n</i> -pentadecane* (19)	1,3-benzenediamine	<i>n</i> -propylbenzene*
4,5-dimethylnonane	1-cyclohexene-1-carboxy-	1,2,4-trimethylbenzene*
2,3,6-trimethyloctane (8)	aldehyde, 2,6,6-trimethyl*	<i>p</i> -isopropyltoluene*
cyclodecane	Bicyclo(2.2.1)heptan-2-	1,3-dimethyl-2-ethylbenzene*
2,5-dimethyldodecane	one, 1,7,7-trimethyl	1-butylheptylbenzene
2,3,5-trimethylpentane	4-decene-6-yne	1-butylloctylbenzene
<i>n</i> -hexadecane*	3-undecene-1-yne	1-propyloctylbenzene
<i>n</i> -heptadecane*	5-undecene-3-yne	
<i>n</i> -octadecene*		

* Detectable also in seawater.

() no. of compound in Fig. 1.

bioassays to prove the activity of 5-methyl-3-heptanone on ripe sub-heteronereids of *Nereis virens* and GC-MS analysis to identify the still unknown constituents and to separate and identify the biological active compounds are being carried out.

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