

## Study of Sex Pheromone of the Siberian Moth *Dendrolimus superans* Butl.

Alexander A. Alekseev

*Institute of Chemical Kinetics and Combustion  
3 Institutskaya Str., Novosibirsk 630090, Russia, e-mail: alekseev@ns.kinetics.nsc.ru*

Andrey K. Dobrotvorsky

*Institute of Systematics and Ecology of Animals  
11 Frunze Str., Novosibirsk 630091, Russia*

Alexander I. Vjalkov, Sergey V. Morozov, Alexey V. Tkachev

*Novosibirsk Institute of Organic Chemistry  
9 Lavrentjev Avenue, Novosibirsk 630090, Russia*

Pheromones represent a promising tool for monitoring and control of forestry pests. Moth of the genus *Dendrolimus* (*Lepidoptera: Lasiocampidae*) are dangerous defoliators of coniferous forests, and sex pheromones of many species have been identified and synthesized. Nevertheless, the Siberian moth (*Dendrolimus superans* Butl.) remained uninvestigated in this respect, in spite of its great economic importance.

The aim of the present study is to analyze composition of extractive compounds from females, that can be constituents of sex attractants. We collected pupae of *D. superans* during the second decade of June, 1998, in the north-eastern part of the Novosibirsk region, Russia. After the eclosion of moths, we dissected out two last abdominal segments of one day old virgin females and extracted them with hexane for 10 min (100  $\mu$ L of the solvent per individual). Three day old males were used for behavioral tests. We placed the filter paper disk treated with 1 mL of the extract into a cage (50 $\times$ 50 $\times$ 50 cm) with 15 males inside and recorded behavioral acts (moving of wings, flight, and attempt to copulate) in one minute interval within 15 min.

From 30 to 70 % of the males responded positively to freshly prepared female crude extract. GC-MS analysis revealed more than 100 compounds in the extract. Among them saturated hydrocarbons, isoprenoids, fatty acids, aldehydes, alcohols, and cholesterol derivatives were identified. Fatty saturated hydrocarbons ( $C_{23}$  –  $C_{29}$ ), hexadecanoic and oleic acids, squalene and unidentified unsaturated aldehyde with one carbon-carbon double bond ( $C_{19}H_{36}O$ ) were the principal constituents of the female crude extract.

In order to determine which group of compounds is responsible for pheromonal activity, we fractionated the crude extract using liquid chromatography on a silica gel column. Fraction of hydrocarbons was inactive completely. Fraction of oxygenated compounds induced positive response of males.

We did not find any dienic aldehyde with 12 carbon atoms and other  $C_{12}$ -derivatives which have been reported as constituents of sex pheromones of other *Dendrolimus* species. Even though the  $C_{12}$  compounds are present in the samples, their amounts are less than 0.05 ng per individual.

Based on the results of our work, attention should be paid to unsaturated aldehyde  $C_{19}H_{36}O$  as a candidate constituent of sex pheromone. Sex attractants of many lepidopteran species contain similar compounds. According to GC-MS data, this aldehyde was present in all samples (*ca.* 3 ng per individual) which induced positive responses of male moths, and was absent in the samples with no pheromonal effect.