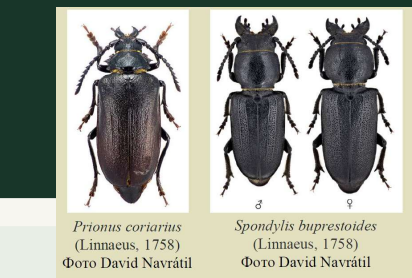


From the soil to the forest canopy: Cerambycid beetle diversity in pheromone traps at Zvenigorod Biological Station

N.D. Knorre¹, A.R. Kobrina¹, A.V. Meteleva¹, B.N. Mikhailov¹, A.V. Radnaeva¹, E.S. Rakitskaya¹, D.E. Rodikov¹, M.P. Savchenko¹, T.V. Semenova¹, A.K. Semibratchenko¹, A.V. Spector¹, A. A. Loshchilova^{1,2}, J.D. Wickham^{1,2}

¹ A.N. Severtsov Institute of Ecology and Evolution, Lab of Soil Zoology and General Entomology
² Moscow State University, Department of Entomology, Biology Faculty, Moscow Russia



WHY PHEROMONES?

Longhorn beetles use volatile chemical signals to find mates and hosts from the soil to the canopy. We combined pheromone-baited traps, aerations of live beetles, and GC-MS analysis to connect field responses with pheromone production. Pheromones, such as monochoamol (Wickham et al. 2024) can be used for surveying and monitoring forest health, detection of invasive species, and biodiversity assessment. Soil megafauna *Prionius coriarius* attacks roots, so a pitfall trap was added to better understand its distribution in nature.

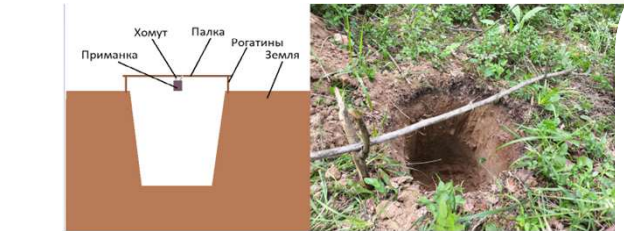
FIELD DESIGN

Flight intercept cross-vane traps (n = 20) were at 1 and 5 m plus 50 cm deep pitfall traps (n = 4); compared 2 biotopes (spruce vs. pine “Sima” forest; lures included monochoamol, prionic acid, fuscumol acetate, and unbaited control traps

MAIN TAKE-HOME MESSAGE

Prionic acid produced exceptional catches of male *P. coriarius*, while female *S. buprestoides* emitted a compound matching fuscumol acetate, which based on trap catches, is evidence of the first female-produced aggregation-sex pheromone identified in the sub-family Spondylidinae (Family Cerambycidae) (typically these are male-produced)

1 FROM FOREST CANOPY TO PITFALL TRAP

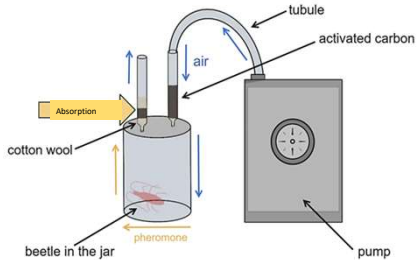


Pitfall trap: field setup and schematic



Cross-vane flight-intercept pheromone trap

FIELD → COLLECTION → AERATION → GC-MS



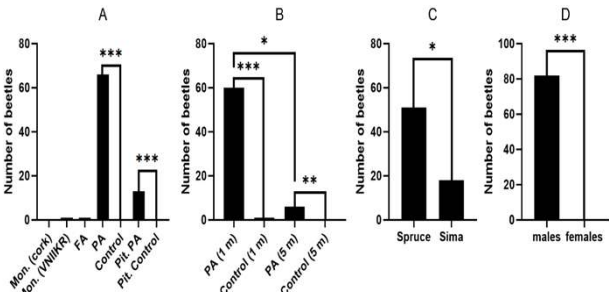
Volatiles were collected on activated carbon and eluted for chromatographic analysis.

2 A SIGNIFICANT PRIONUS RESPONSE

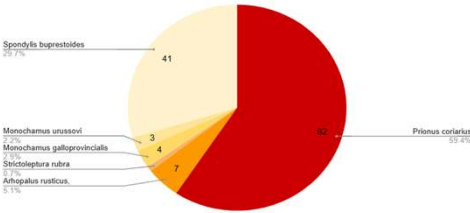
82

males captured

All captured *Prionus coriarius* were males. Record catches reached 11 males in a single trap. Pitfall traps retain fewer beetles but still captured significantly more *P. coriarius* than controls.



Prionic acid was the only strongly attractive lure (* p < 0.05, *** p < 0.001, Kruskal-Wallis ANOVA); catches were higher at 1 m vs. 5 m and differed between spruce vs. pine “Sima” forest biotopes (* p < 0.05, Chi-square test), and males dominated (*** p < 0.001, Chi-square test)

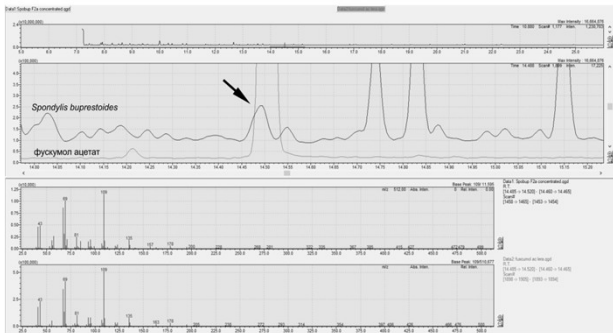


The field experiment was dominated by *P. coriarius* (82 males), followed by *S. buprestoides* (41 beetles) with both sexes attracted

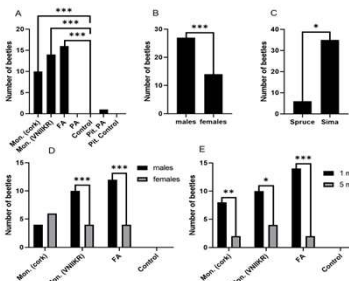
Prionic acid → strong male attraction (female sex pheromone)

3 PHEROMONE IDENTIFICATION

Female *Spondylis buprestoides* produced a compound shown by a peak matching the same retention time and mass spectra as fuscumol acetate



Beetle-produced compound + GC-MS match → fuscumol acetate



(A) *Spondylis buprestoides* was significantly attracted to monochoamol and fuscumol acetate lures (*** p < 0.001, Kruskal-Wallis ANOVA), (B, D) significant overall male-biased sex ratio, particularly with the monochoamol VNIIR lures and fuscumol acetate (FA) *** p < 0.001, Chi-square test), (E) with more beetles in lower 1 m vs. 5 m traps. (C) More beetles were caught in pine forest (“Sima”) vs. spruce (p < 0.001, Chi-square)

Conclusion: Prionic acid can be used in conservation for monitoring the red-book species *Prionus coriarius*; monochoamol and fuscumol acetate were respectively identified as a kairomone and an aggregation-sex pheromone for *Spondylis buprestoides*