Screening of microbiome of bark beetle Ips typographus for antibiotic producers

Sofiia Sinelnikova[1,2], Anna A. Baranova[1], Vera A. Alferova[1], Olga A. Belozerova[1], Arseniy A. Sinichich[1,3]

1 Shemyakin-Ovchinnikov Institute of Bioorganic Chemistry, Miklukho-Maklaya 16/10, 117997 Moscow, Russia
2 Department of Biotechnology, A.P. Nelyubin Institute of Pharmacy, I.M. Sechenov First Moscow State Medical University (Sechenov University), Trubetskaya 8, building 2, Moscow, 119991, Russia
3 Department of Chemistry, Lomonosov Moscow State University, Leninskie Gory 1, Moscow 119991, Russia

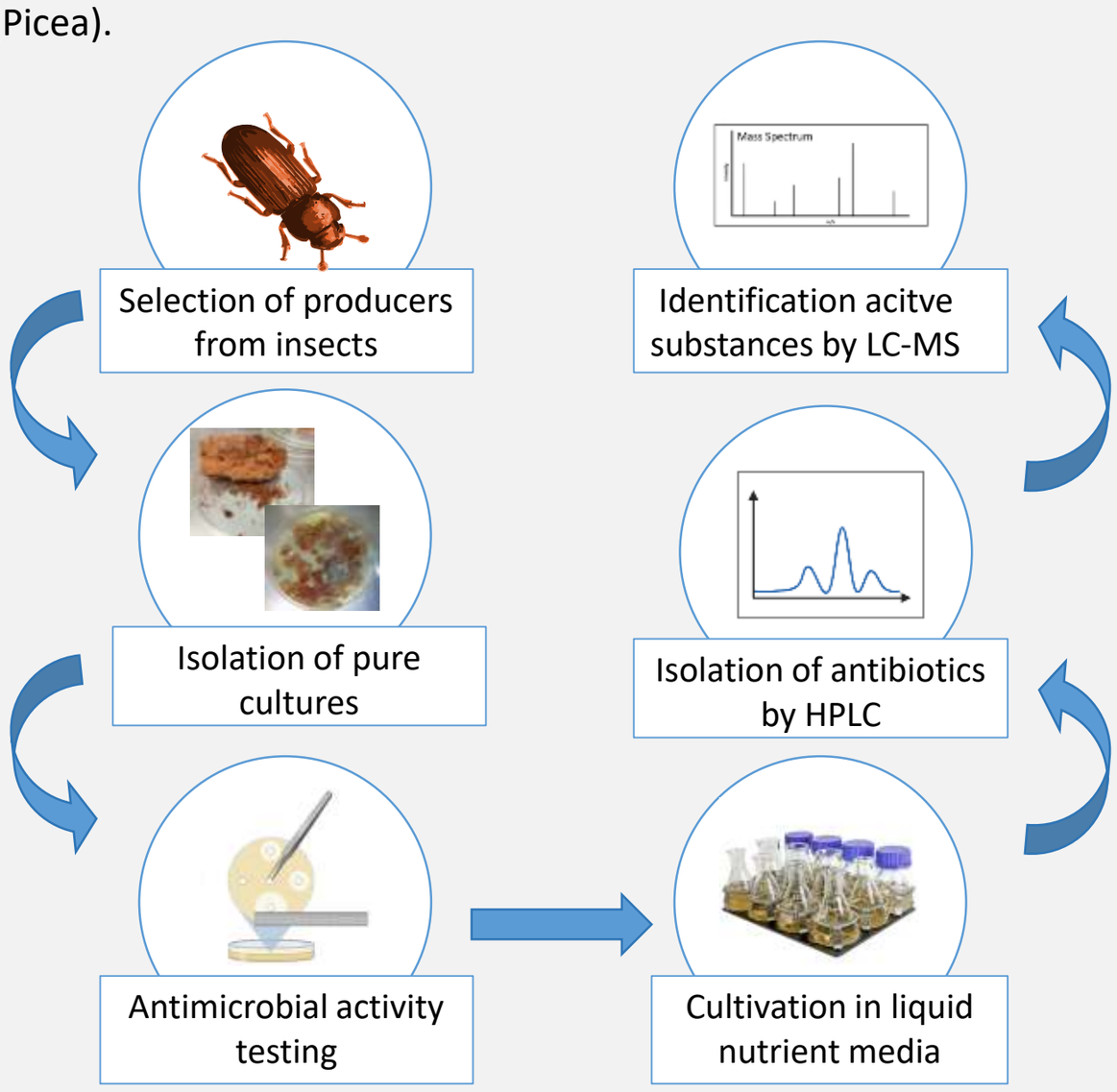
email: sinelnikowa.sofia@yandex.ru

INTRODUCTION

One way to search for antibiotics is the isolation of microbial antibiotic producers from insects and their products. Symbionts and insect-associated microorganisms represent an almost inexhaustible source of bioactive compounds, including antibiotics

OBJECT OF STUDY

In this study, we examined samples of the bark beetle typographus (Ips typographus) found in the bark of fallen spruce (Picea).



Flowchart of the research process

ANTAGONISTIC AKTIVITY

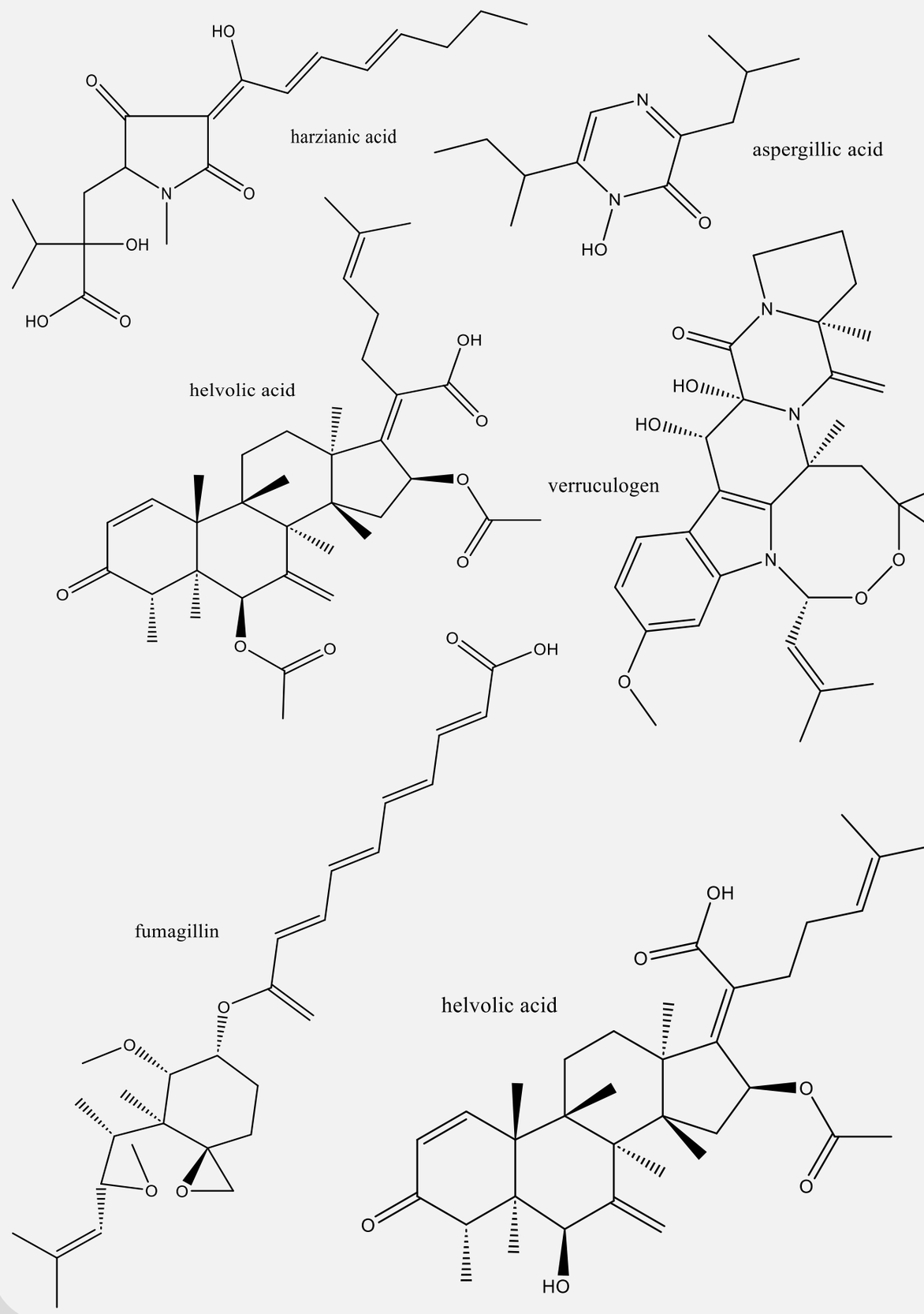
113 microbial isolates were obtained. Antimicrobial activity was investigated using the agar diffusion method against a wide range of tested microorganisms. The table includes 16 isolates with any activity indicators.

Ips typographus		*A. niger* INA 00760	*C. albicans* CBS 8837	*B. subtilis* ATCC 6633	*E. coli* ATCC 25922	*E. faecalis* ATCC 29212	*E.coli* dtolC	*E.coli* lptD
K1-	26	+	-	+++	-	-	++	++
	27	+++	-	+	-	-	-	+
	31	-	-	-	-	-	-	+
K2-	6	-	++	++	-	+	++	++
	7	-	++	++	-	+	++	++
	20	-	++	++	-	-	+	++
K3-	12	-	-	+	-	-	-	++
	13	-	-	+	-	-	-	+
K4-	10	-	+	++	-	++	+	-
	14	-	-	-	-	-	-	+
	15	-	-	-	-	-	-	+
	27	-	-	+	-	-	++	+++
	28	-	-	+	-	-	+++	++++
	30	-	-	+	-	-	-	+
	31	-	-	-	-	-	+	-
	33	-	-	-	-	-	++	++

«+++» - high activity, «++» - moderate activity, «+» - low activity, «-» no activity

ISOLATION OF ANTIBIOTICS

As a result, 3 isolates of micromycetes with pronounced antimicrobial properties were selected for further study and cultivation in liquid nutrient media. The acitve substances were identified by LC-MS. Strain K1-26 produced harzianic acid, which has antifungal activity and is an inhibitor of acetohydroxyacid synthase. Strain K4-28 produced aspergillic acid, which is also known as an antibiotic with antifungal activity. Strain K2-6 produced several antibiotic substances: verruculogen (diketopiperazine alkaloid with broad spectrum of biological activity), fumagillin (mycotoxin), helvolic acid (a broad-spectrum mycotoxin), helvolinic acid (showed potent antimicrobial activities against Staphylococcus aureus).



CONCULUSIONS

- Screening the Ips typographus microbiome revealed three micromycete isolates with significant antimicrobial activity
- LC-MS analysis identified the production of several known antibiotics, suggesting the bark beetle microbiome as a valuable source for novel bioactive compounds.