NOVEL APPROACH TO OLIVE FRUIT FLY (*BACTROCERA OLEAE*, ROSSI) MONITORING AND/OR CONTROL USING VOLATILE COMPOUNDS PRODUCED BY BREWING BY-PRODUCT

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INTRODUCTION

The olive fruit fly (*Bactrocera oleae* Rossi) is the most economically important olive pest, and its presence regularly has a negative impact on the quantity and quality of olive fruit and oil. For years, the control of *B. oleae* was based exclusively on pesticides, which have had a negative impact on the environment and biodiversity in olive groves in recent decades. The EU has therefore set itself the target of reducing the use of pesticides by 50 % by 2030 and 100 % by 2050. Effective non-pesticidal methods to monitor and/or control *B. oleae* are needed to sustainably reduce the damage by reducing the use of conventional insecticides. Current evidence suggests that various waste brewer's yeasts (WBY) attract certain teprhitids, but it has not yet been investigated which of the volatiles they produce attract a particular pest species. The interaction between *B. oleae* and WBY, a by-product of beer production, and their volatiles has not yet been investigated. The aim of the study is therefore to investigate whether two types of modified WBYs are attractive to *B. oleae* and, if so, which volatiles might be responsible for the attraction.

MATERIALS & METHODS

Two types of WBYs (ale - *Saccharomyces cerevisiae* and lager - *S. pastorianus*) were procured from two Croatian beer producers for the production of protein baits to be used for further investigations. Both WBYs were modified in the laboratory by boiling in a water bath with constant stirring (Fig. 1). After boiling, the concentrated yeasts were digested with papain (Fig. 2), preserved with methyl p-hydrozybenzoate (Fig. 3) and refrigerated at 4°C. The volatile compounds were identified by HS-SPME-GC/MS (Fig 4).

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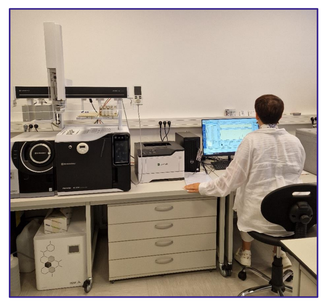

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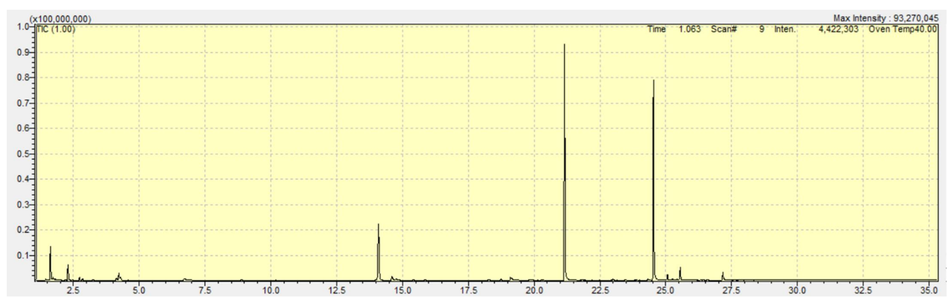
RESULTS

Thirty-nine volatiles were identified in WBY from ale beer production, while 31 volatile compounds were identified in WBY from lager beer production (Table 1). The most common volatiles identified in ale WBY were ethyl octanoate, ethyl decanoate and β-myrcene (Table 1, Fig. 5), while ethyl decanoate, ethyl octanoate and ethanol were found in lager WBY (Table 1, Fig. 6).

Table 1.

Compound	RI	Ale	Lager
Ethanol	< 700	4,41	17,15
Acetone	< 700	0,35	1,24
Dimethyl sulfide	< 700	0,13	nd
Ethanethiol	< 700	nd	1,15
Ethyl acetate	< 700	nd	0,90
2-Methyl-3-buten-2-ol	< 700	2,26	nd
2-Methyl-1-propanol	< 700	0,04	0,19
3-Methyl-butanal	< 700	0,45	0,45
2-Methyl-butanal	< 700	0,22	0,14
3-Methyl-2-butanone	< 700	0,13	nd
3-Methyl-1-butanol	729	0,53	4,20
4-Methyl-2-pentanone	733	1,37	nd
Dimethyl disulfide	736	0,63	1,20
3-Methyl-2-pentanone	748	0,11	nd
3-Methyl-thiophene	764	nd	0,12
3-Methyl-1-butanol acetate	876	0,22	2,31
β-Pinene	972	0,06	nd
6-Methyl-5-hepten-2-one	988	0,19	nd
β-Myrcene	990	12,47	0,21
Ethyl hexanoate	1001	0,97	0,60
Pentyl butanoate	1020	0,19	nd
Limonene	1031	0,21	nd
(*E*)-β-Ocimene	1055	0,07	nd
Perillene	1100	0,29	nd
Phenylethyl Alcohol	1114	1,13	2,64
Benzyl nitrile	1144	0,30	1,95
Ethyl octanoate	1198	37,07	24,10
Octyl acetate	1213	nd	0,32
β-Phenethyl acetate	1262	nd	0,22
Ethyl nonanoate	1297	0,22	0,15
(*E*)-Geranic acid methyl ester	1327	0,18	nd
iso-Butyl n-octanoate	1350	0,05	nd
Citronellol acetate	1356	0,08	0,07
Ethyl (*Z*)-4-decenoate	1382	0,21	0,04
α-Copaene	1386	0,13	nd
Ethyl 9-decenoate	1389	nd	0,32
Ethyl decanoate	1396	29,39	37,84
Decanol acetate	1411	nd	0,15
Caryophyllene	1434	0,76	0,12
Isopentyl octanoate	1449	0,20	0,17
(*E*)-β-Farnesene	1461	0,11	nd
α-Humulene	1470	1,87	0,59
β-Selinene	1503	0,08	nd
α-Selinene	1512	0,08	0,02
δ-Cadinene	1537	0,08	0,03
Ethyl dodecanoate	1596	1,63	1,33
Isopentyl decanoate	1647	nd	0,09
Total chromatogram identified %		**98,89**	**100,00**



5. Ale

6. Lager

The attraction of *B. oleae* to both modified WBYs will be tested in laboratory and field trials, and the most promising volatiles responsible for the attraction of *B. oleae* to both modified WBYs will be determined based on laboratory and field trials. Among these, five volatile blends will be selected for further investigation. A more comprehensive knowledge of the effects of both protein-based baits and their volatile compounds on the behavior of *B. oleae* could improve the use of attractants as baits for insect control.

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