

# Fumigantna učinkovitost 1,8-cineola i eugenola na stadij kukuljice kestenjastog brašnara *Tribolium castaneum* (Herbst) (Insecta: Coleoptera: Tenebrionidae)

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## Sažetak

Fumigantna učinkovitost komponenata 1,8-cineola i eugenola testirana je na stadij kukuljice kestenjastog brašnara *Tribolium castaneum* (Herbst). Određen je mortalitet i aktivnost rasta kukuljica oba spola, kao i razlike u osjetljivosti između spolova kukuljica *T. castaneum* na ispitivane komponente. Komponente su testirane u 3 koncentracije 120, 300 i 600  $\mu\text{l}$  350  $\text{ml}^{-1}\text{vol.}$  u kontroliranim uvjetima na  $30\pm 1^\circ\text{C}$ ; 70-80 % rvz, u tami tijekom 48 sati. Kukuljice *T. castaneum* su pokazale različitu osjetljivost ovisno o apliciranoj komponenti i koncentraciji. Toksičnost 1,8-cineola i eugenola očitovala se dvojako. Kao prvo mortalitetom tretiranih kukuljica, dok je kod preživjelih kukuljica uočena pojava „adultoid“ jedinki i deformiranih imaga. Povećanjem koncentracije 1,8-cineola (sa 120 na 300 i 600  $\mu\text{l}$  350  $\text{ml}^{-1}\text{vol.}$ ) značajno je smanjen postotak normalno razvijenih živih imaga koji su se razvili iz preživjelih tretiranih kukuljica muškog spola (56,25 %; 31,25 % i 18,75 %;  $F=25,0$ ;  $df=3$ ;  $P<0,05$ ). Utvrđeno je da su kukuljice muškog spola općenito senzibiljnije na obje testirane komponente. U tretmanu s 1,8-cineolom (300  $\mu\text{l}$  350  $\text{ml}^{-1}\text{vol.}$ ), kod muškog spola je uočeno značajno više deformiranih živih jedinki u odnosu na ženski spol (22,50 %, odnosno 10,00 %  $F=6,82$ ;  $df=1$ ;  $P=0,040$ ), kao i značajno manji postotak živih jedinki imaga koji su se razvili iz tretiranih preživjelih kukuljica (31,25 %; odnosno 55,00 %;  $F=9,42$ ;  $df=1$ ;  $P=0,0220$ ), što ukazuje na općenito bolje preživljavanje kukuljica ženskog spola. Razlika učinkovitosti po spolu bila je slabije izražena u tretmanu s eugenolom. Sve ukupno, bolje djelovanje je ostvareno s 1,8-cineolom, dok s eugenolom nije postignut zadovoljavajući učinak na testirane kukuljice.

Ključne riječi: fumigacija, 1,8-cineol, eugenol, *Tribolium castaneum*, kukuljica

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# Fumigant efficacy of 1,8-cineole and eugenol on the pupal stage of *Tribolium castaneum* (Herbst) (Insecta: Coleoptera: Tenebrionidae)

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## Abstract

The fumigant efficacy of 1,8-cineole and eugenol compounds was tested on the pupal stage of the red flour beetle *Tribolium castaneum* (Herbst). Mortality and growth activity of both sexes were determined, as well as differences in sensitivity to the tested compounds between the sexes of *T. castaneum* pupae. Compounds were tested at 3 doses rate 120, 300 and 600  $\mu\text{l}$  350  $\text{ml}^{-1}\text{vol.}$  at  $30 \pm 1^\circ\text{C}$  and  $70 \pm 10\%$  r.h. in darkness during 48 h. *T. castaneum* pupae showed different sensitivity depending on the applied compound and dose. Manifestation of 1,8-cineole and eugenol toxicity was twofold. First, as mortality of the treated pupae, whereas among survived pupae the appearance of adultoids and deformed adults was detected. With increasing dose of 1,8-cineole (from 120 to 300 and 600  $\mu\text{l}$  350  $\text{ml}^{-1}\text{vol.}$ ), percentage of live adults, which normally developed from survived treated male pupae, significantly decreased (56.25 %; 31.25 % and 18.75 %;  $F=25.0$ ;  $df=3$ ;  $P<0.05$ ). Male pupae were generally more sensitive to both tested compounds. In the treatment with 1,8-cineole (300  $\mu\text{l}$  350  $\text{ml}^{-1}\text{vol.}$ ) significantly more deformed live male individuals were observed with regard to females (22.50 %, respectively 10.00 %  $F=6.82$ ;  $df=1$ ;  $P=0.040$ ), as well as significantly lower percentage of live adults which developed from treated survived pupae (31.25 %; respectively 55.00 %;  $F=9.42$ ;  $df=1$ ;  $P=0.0220$ ) indicating that female pupae generally stand a better chance of survival. Efficiency differences between sexes were less expressed in the treatment with eugenol. Overall, better efficiency was performed with 1,8-cineole, while eugenol had not accomplished satisfactory impact on the tested pupae.

Key words: fumigation, 1,8-cineole, eugenol, *Tribolium castaneum*, pupae

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