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INSEKTICIDNA TOKSIČNOST 1,8-CINEOLA, KAMFORA I EUGENOLA NA *TRIBOLIUM CASTANEUM* (HERBST)

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Disertacija (2)

SAŽETAK

Testirana je kontaktna i fumigantna učinkovitost (u laboratorijskim uvjetima), 1,8-cineola, eugenola i kamfora na imago, ličinke i kukuljice kestenjastoga brašnara *Tribolium castaneum* (Herbst), i njihov utjecaj na potomstvo. Kontaktnom aplikacijom ostvareni su pozitivni rezultati za sve tri komponente na sva tri razvojna stadija *T. castaneum*, a najveću je učinkovitost imao 1,8-cineol, slijedi eugenol te kamfor. Fumigantna aktivnost sve tri komponente općenito je bila slabije izražena u odnosu na kontaktnu primjenu, s najboljim učinkom na sve testirane razvojne stadije *T. castaneum* 1,8-cineola, zatim kamfa te eugenola. Fumigacijom u ispunjenome prostoru zrnom pšenice zabilježeno je slabije djelovanje sve tri komponente za sve razvojne stadije u odnosu na prazan prostor, s najboljim učinkom 1,8-cineola, zatim kamfora te eugenola (eugenol nije imao letalan učinak za stadij imaga). Za ličinke, učinkovitost 1,8-cineola je u ispunjenom prostoru smanjena za 3,5x, eugenola za 32x, a učinkovitost kamfora nije se značajno mijenjala. Toksičnost komponenata na stadij kukuljice *T. castaneum* bila je izražena letalno i s direktnim utjecajem na metamorfozu kukuljica u imago. Između spolova kukuljica zabilježene su značajne razlike u učinkovitosti komponenata, s najjače izraženim razlikama kod 1,8-cineola te kamfora, a najslabije kod eugenola. Muški spol općenito je senzibilniji na komponente, a kod ženskoga spola uočeno je više deformiranih jedinki (naročito u tretmanu fumigacije s kamforom). Općenito, najtolerantniji stadij je stadij kukuljice; na kontaktnu i fumigantnu aplikaciju svih komponenata. Utjecaj na smanjenje broja potom-

stva *T. castaneum* imali su 1,8-cineol i eugenol, a kamfor nije utjecao na smanjenje F1 generacije.

Generalno, s visokim potencijalom 1,8-cineola u suzbijanju *T. castaneum* (u svim tretmanima za sve razvojne stadije), kamfora u fumigantnoj aplikaciji za suzbijanje imaga (u praznome prostoru), kao i eugenola u kontaktnoj (za kontrolu svih razvojnih stadija) i fumigantnoj primjeni (za smanjenje potomstva *T. castaneum*), te komponente predstavljaju osnovu za iznalaženje novih aktivnih tvari, kao alternativu dosadašnjim konvencionalnim sredstvima za zaštitu uskladištenih proizvoda.

Ključne riječi: 1,8-cineol, kamfor, eugenol, *Tribolium castaneum*, imago, ličinka, kukuljica, potomstvo

INSECTICIDAL TOXICITY OF 1,8-CINEOLE, CAMPHOR AND EUGENOL ON *TRIBOLIUM CASTANEUM* (HERBST)

Doctoral thesis

SUMMARY

Contact and fumigant activity of 1,8-cineole, camphor and eugenol compounds were tested in laboratory conditions on adult, larvae and pupae of the red flour beetle *Tribolium castaneum* (Herbst), as well as their effect on progeny emergence. Positive results were obtained with contact application for all three tested compounds and on all three stages of development of *T. castaneum*, with the highest activity of 1,8-cineole, followed by eugenol and camphor. In

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general, fumigant activity of all three compounds was lower in comparison to contact application, with the best activity of 1,8-cineole, followed by camphor and eugenol on all three developmental stages of *T. castaneum*. However, lower activity was recorded for fumigation of the space 50% filled with wheat grain for all three tested compounds on all three stages, with the best activity of 1,8-cineole, followed by camphor and eugenol, whereas eugenol showed no toxicity to the adult stage. The activity of 1,8-cineole and eugenol in the space 50% filled with wheat grain decreased by 3.5 and 32 times, respectively, whereas the activity of camphor had no significant difference on the larvae. Toxicity of the tested compounds on pupae *T. castaneum* was either lethal or directly affected to metamorphosis pupae. There were significant differences observed in the efficacy of the tested compounds on the gender of the pupae, with the most markedly differences for 1,8-cineole, followed by camphor and the minimal for eugenol. Males were more sensitive to the applied compounds, whereas females

had more deformed units, especially in the fumigation treatment with camphor. The most tolerant stage on the contact and fumigant application of all compounds was the pupae stage. Eugenol and 1,8-cineole had influence on the reduction of *T. castaneum* progeny emergence, whereas camphor had no such effect. Due to a high potential of 1,8-cineole for the control of the red flour beetle *Tribolium castaneum* (Herbst) (at all treatments, for all the tested stages of development), camphor for the fumigant control of adult (in the empty storages), as well as of eugenol for contact control (all developmental stages) and for fumigant application (for the reduction of progeny), these compounds represent a valuable basis for creating new active substances as an alternative to the conventional pest control products.

Key-words: 1,8-cineole, camphor, eugenol, *Tribolium castaneum*, adult, larvae, pupae, progeny