

Biological activity of essential oils of *Alpinia conchigera* rhizome against *Sitophilus zeamais* and *Tribolium castaneum*

Suthisut, D. ^{*2}, Fields, P.G. ^{#1}, Chandrapatya, A. ²

¹ Cereal Research Centre, Agriculture & Agri-Food Canada, 195 Dafoe Road, Winnipeg, Manitoba, R3T 2M9, Canada, paul.fields@agr.gc.ca

² Department of Entomology, Faculty of Agriculture, Kasetsart University, Bangkok, Thailand, 10900, dsuthisut@yahoo.com, chandrapatya@yahoo.com

* Corresponding author

Presenting author

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Abstract

Research dealing with plant products is a new direction as an alternative to conventional insecticides for stored-product insect control (Shaaya et al., 1991, 1997). *Alpinia conchigera* Griffin (Zingiberaceae) is a native plant in southern Thailand, and it has a wide variety of the essential oils (Ibrahim et al., 2009). The toxicity and repellency of the water distilled essential oils from rhizome of *A. conchigera* was evaluated against the major stored-product insect pests, maize weevil, *Sitophilus zeamais* Motschulsky and red flour beetle, *Tribolium castaneum* (Herbst) 1-14 day-old adults at 29±2 °C and 65±5% r.h. In fumigation trials (Liu and Ho, 1999), the mortality was assessed at concentrations ranging from 74 to 667 µL/L in air with exposure times ranging from 3 to 24 h. There was complete mortality of *S. zeamais* at 222 µL/L after 24 h, whereas 593 µL/L for 24 h was required for complete mortality of *T. castaneum*. *Sitophilus zeamais* adults (LC₅₀, fiducial limits: 121, 114-129 µL/L) were more susceptible to essential oils of *A. conchigera* than *T. castaneum* (295, 203-369 µL/L) (Table 1). Contact toxicity was assayed by topical application to insect thoraxes (Liu and Ho, 1999) at different concentrations (10 to 40%). *Sitophilus zeamais* adults (LC₅₀, 27, 18-40 µg/mg) had the same mortality as *T. castaneum* (LC₅₀, 34, 28-47 µg/mg) (Table 2). A filter paper choice bioassay (Ko et al., 2009) of essential oils of *A. conchigera* in 100% ethanol showed that *T. castaneum* has repelled more than *S. zeamais* (Table 3).

Keywords: *Alpinia conchigera*, *Sitophilus zeamais*, *Tribolium castaneum*, Essential oils, Toxicity

Table 1 Fumigation toxicity of essential oils from *Alpinia conchigera* rhizome against *Sitophilus zeamais* and *Tribolium castaneum* at 29 °C after 24 h.

Insect	LC ₅₀ (µL/L)	95% confidence Intervals (µL/L)	LC ₉₅ (µL/L)	95% confidence Intervals (µL/L)	Degrees of freedom	Chi-square
<i>S. zeamais</i>	121	113-128	180	168-196	8	0.395
<i>T. castaneum</i>	294	203-368	417	350-658	8	170.09

Table 2 Contact toxicity of *Alpinia conchigera* rhizome essential oils against *Sitophilus zeamais* and *Tribolium castaneum* at 29 °C after 24 h.

Insect	LC ₅₀ (µg/mg)	95% confidence Intervals (µg/mg)	LC ₉₅ (µg/mg)	95% confidence Intervals (µg/mg)	Degrees of freedom	Chi-square
<i>S. zeamais</i>	26	18-39	51	38-103	3	18.04
<i>T. castaneum</i>	34	28-46	60	47-101	3	9.33

Table 3 Percent repellency (PR) of *Alpinia conchigera* rhizome essential oils against *Sitophilus zeamais* and *Tribolium castaneum* using treated filter paper test*

Insect	Oil ($\mu\text{g}/\text{cm}^2$)	PR (Mean% \pm SD)					PR (Mean%)
		Time after insect release (h)					
		1	2	3	4	5	
<i>S. zeamais</i>	0.16	32 \pm 59 b	36 \pm 59 b	56 \pm 38 b	68 \pm 41 a	60 \pm 47 a	50
	0.31	88 \pm 11 a	68 \pm 61 ab	76 \pm 26 ab	80 \pm 14 a	60 \pm 20 a	74
	0.47	96 \pm 9 a	96 \pm 9 a	88 \pm 18 a	72 \pm 30 a	72 \pm 33 a	85
	0.63	100 \pm 0 a	100 \pm 0 a	96 \pm 9 a	72 \pm 30 a	48 \pm 39 a	83
	0.79	100 \pm 0 a	96 \pm 9 a	96 \pm 9 a	80 \pm 45 a	60 \pm 14 a	86
<i>T. castaneum</i>	0.16	80 \pm 20 a	100 \pm 0 a	92 \pm 11 a	76 \pm 26 b	52 \pm 30 b	80
	0.31	72 \pm 18 a	80 \pm 25 b	92 \pm 11 a	80 \pm 14 ab	84 \pm 22 a	82
	0.47	84 \pm 17 a	96 \pm 9 ab	92 \pm 11 a	92 \pm 11 ab	100 \pm 0 a	93
	0.63	92 \pm 18 a	100 \pm 0 a	96 \pm 9 a	96 \pm 9 ab	80 \pm 28 ab	93
	0.79	96 \pm 9 a	96 \pm 9 ab	96 \pm 9 a	100 \pm 0 a	88 \pm 18 a	95

*Five replicates of 10 insects in each replication, for each insect, means in same column followed by the different letters are significantly ($P>0.05$) Duncan's multiple range test (DMRT).

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