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Controlling *Sitophilus zeamais* (Coleoptera: Curculionidae) in Maize Grains by Using Microwave and Radio Frequency Energy

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Abstract

Infestation with insect pests is a serious problem associated with raw and processed stored products. Among the stored product pests, maize weevil, *Sitophilus zeamais* (Coleoptera: Curculionidae), is one of the most economic primary pests of stored cereal grains, particularly maize. Generally, chemical fumigants are used to disinfest product, however, these pesticides have a negative impact on human health and environment. Therefore, the industry has been forced to explore non-chemical alternatives. One possible alternative is the use of dielectric heating, microwave (MW) or radio frequency (RF) energy to rapidly heat product to lethal levels.

To study the potential of MW and RF treatments for controlling insect pests in stored grains, the adults of *S. zeamais* were exposed to the MW (2450 MHz) and RF (27.12 MHz) at different temperatures 45, 50 and 55°C for 3 min in maize grains at 10, 14 and 18% initial moisture contents (IMC). Moreover, the germination capacity of treated maize was also determined to study the effect of these treatments on grain quality. Results show that there is a possibility for controlling *S. zeamais* adults with MW and RF energy. However, in comparing between the effect of MW and RF on the mortality of the adults, the results proved that the mortality rates of the adults were lower in MW treatments than those of RF. The lethal temperature of the adults was estimated as 55°C under MW treatments, while it was 50°C under RF treatments at all studied levels of IMCs. Both MW and RF treatments significantly ($p < 0.05$) reduced the germination rate of maize grains. However, the germination rate of the grains treated with RF is higher than the MW treated grains.

In conclusion, the current study indicated the potential application of MW and RF as alternative methods in controlling stored pest. Moreover, the findings confirm that radio frequency heating was more effective than microwave heating in the eradication of *S. zeamais* as well as maintaining higher germination rates of maize grains than those treated with microwave heating.

Keywords: Germination, maize weevil, microwave, mortality, radio frequency