Denis Olgen Kiobia

Design and Development of a Low-cost Acoustic Device to Detect Pest Infestation

Abstract

Insect damage to stored maize is one of the major post-harvest losses occurring in developing countries, especially in sub-Saharan Africa. To reduce economic losses, separation of infested grains from clean ones is critical and requires detection of infestation in stored grains. This study aimed at developing a rapid non-destructive detection system with three goals. The first was to investigate the acoustic behavior of internally feeding *S. zeamais (Coleoptera: Curculionidae*) in maize. The pests were monitored for peak activity and signal amplitudes. The study was performed in the morning, afternoon and night times for three consecutive days with an ultrasonic probe attached to acoustic emission detector. The average number of peaks above threshold in the morning, afternoon and night was significantly different. They were 60, 2 and 31 counts/s, respectively ($P < 0.01$). The average maximum amplitude also varies with scores of 2.5, 1 and 1.8V for morning, afternoon and night sessions respectively. The signal frequencies ranged between 1 and 15 kHz with a peak around 7 kHz. The second goal was to design and develop an inexpensive acoustic device for the detection of *S. zeamais* in the stored maize. The device developed included a microphone, signal conditioning circuit and a microcontroller. The third goal was to test the prototype in both clean and infested maize. This was also accomplished. The device can be manufactured for $55 or less. The device has a noise level below 0.2V in clean maize, infestation amplitude up to 1V and about 93.3% correct detection performance in infected maize.