Development of an automated multidirectional pest sampling detection system using motorized sticky traps

ABSTRACT

Insect detection and counting constitute a considerable challenge in the field of agriculture. However, among various biotic issues of agricultural production, pest infestation is a major challenge, with the humid environment surrounding the crops encouraging the survival and proliferation of pests. In addition, electronic traps need protection, especially from rain. This study describes the design and development of a prototype for an automatic pest sampling and detection system for agricultural crops. To the best of our knowledge, the proposed system is the first motorized automatic trap developed to handle monitoring operations in two directions of precise movement (i.e., clockwise and counterclockwise) and cover four directions of insect sampling that provides additional details of insect infestation direction. A square-shaped sticky box was designed, and an optical sensor was attached to a scalable arm. The movements of the sticky box and the camera arm were generated by motors. Preprocessing was conducted by using morphological operations, whereas insect detection and counting were implemented by an algorithm of connected components labeling that applied by using MATLAB image processing toolbox. Different kernel functions, such as disk, diamond, square, and sphere, were used as matching functions for the insect detection and counting algorithm. The average accuracy of the highest sphere kernel was 85.2%. Test results of the hardware show the reliability, flexibility, and system protection of the automatic system to provide accurate movements in two degrees of freedom.

Keyword: Automatic trap; Insect sampling; Insect counting; Motorized trap; Morphological image processing; Pest detection; Yellow sticky box trap