Disentangling factors limiting diamondback moth, *Plutella xylostella* (L.), spatio-temporal population abundance: A tool for pest forecasting

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Abstract

Data-mining techniques play an important role in hyperparameter optimization of heterogeneous environmental factors and their relative contribution as determinants of incidences in insect pest ecological studies. A multidimensional field-based surveillance was conducted in two seasons (24 months), July–June of each season (2015/2016 - season 1 and 2016/2017 - season 2) using sex-pheromone-baited traps and Thermocron i-Buttons to identify key determinants of population abundance of diamondback moth, *Plutella xylostella* L., across spatial horticultural hotspots of Botswana. The moth is a notorious global brassica pest. Pearson's product moment correlation matrix showed month of the year (*M*), mean temperature (T_{mean}) and maximum temperature (T_{max}) as positively correlated ($p < 0.001$) to number of moths (*N*), while minimum temperature (T_{min}), minimum relative humidity (RH_{min}), mean relative humidity (RH_{mean}), maximum relative humidity (RH_{max}) and host plant (*h*) were negatively correlated ($p < 0.001$) to *N*. Using Waikato Environment for Knowledge Analysis (WEKA) data-mining techniques, two models were developed: (a) M5P decision-tree algorithm associated with nine linear models (LMs) and (b) principal component analysis (PCA) based on four principal components. Both approaches identified *M* as the major predictor of moth abundance, followed by *h* and farming region (*R*). However, *R* was a function of T_{max} (positive auto-correlation) and RH_{max} (negative auto-correlation). These results provide simplified relative contribution of heterogeneous factors in influencing *P. xylostella* spatio-temporal abundance, essential for early warning systems in pest management. This is an important component of sustainable pest management aimed at managing insect pests and minimizing pesticides abuse in brassica production systems.