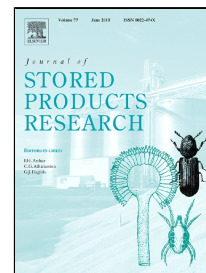


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Prediction of insect mortality in cooled stored grain

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Abstract

Grain aeration with ambient air is the primary method used in France to prevent and control insect infestations. French grain storage operators consider that complete total mortality of insects can be achieved by maintaining grain temperature at 5°C for 3 months. A predictive model on insect survival at low temperature was developed, using data from literature to test this hypothesis on *Sitophilus oryzae*, *Sitophilus granarius*, *Rhyzopertha dominica*, *Cryptolestes ferrugineus*, *Oryzaephilus surinamensis*, *Tribolium castaneum* and *Tribolium confusum*. A Cox proportional hazard regression, belonging to survival analysis, was associated to a Receiver Operator Analysis to evaluate the model and to predict durations of cold exposure required to obtain a total mortality for each species at different developmental stages and temperatures. The model described well the data since occurrence or not of a total mortality was correctly described in 77.2% of all cases. Computed predictions highlighted the facts that species cold-tolerance ranking varied depending on the temperature levels and that difference of cold tolerance between adult and immature stages depended greatly on species. A temperature of 0°C is sufficient to kill all insect populations within 3 months, except *Cryptolestes ferrugineus* ones. However, a temperature of 5°C is highly insufficient to achieve a total mortality. Practical implementations of this work are discussed.

Keywords: low temperatures, insect survival, cox proportional hazard regression

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