

Utilizing atmospheric nitrogen in stored product protection

Christos G. Athanassiou, Christos I. Rumbos, Maria Sakka, Paraskevi Agrafioti*

Laboratory of Entomology and Agricultural Zoology, Department of Agriculture, Crop Protection and Rural Environment, University of Thessaly, Phytokou str. 38446, N. Ionia, Magnessia, Greece.

*corresponding author's email: agrafiot@agr.uth.gr

Nitrogen is an eco-friendly method which was applied in commercial facilities against stored product insects. The effect of nitrogen on the entomological and microbial loads was investigated thoroughly in the present study. More than 20 trials were conducted in the nitrogen laboratory and commercial chambers. Different commodities were exposed for 2, 2.5, 3, 5, 6 and 9 days in nitrogen with 1 % O₂ at 28, 31 and 40 °C. Adults of *Oryzaephilus surinamensis*, *Rhyzopertha dominica*, *Tribolium castaneum*, *Sitophilus oryzae*, *Callosobruchus maculatus* and different life stages of *Trogoderma granarium* were used in the experiments. After each trial, insect mortality was noted and each treated commodity were collected, and forward for microbial analysis of their organoleptic characteristics. Moreover, 65 d later the progeny production was measured in the treated substrate. In light of our findings, at the commercial chambers when nitrogen was applied at 28 °C, high insect mortality levels were recorded; however in most cases there were some combinations that there were found surviving insects. Moreover, different susceptibility to nitrogen was observed among different life stages of *T. granarium* with the larvae stage to be more resistant to nitrogen treatment in low temperatures. At 40 °C and 2.5 d complete mortality was observed for all life stages of *T. granarium*. More susceptible to nitrogen were found to be *O. surinamensis*, *S. oryzae* and *C. maculatus* with 100% mortality in all treatments. No progeny production was recorded for almost all the tested species with the exception of *O. surinamensis* at 40 °C and 2.5 days. At 28 °C and 3 d, progeny production was recorded for *S. oryzae* and *T. castaneum* and only in some locations. Moreover, at laboratory chambers when nitrogen was applied against phosphine resistant and susceptible populations of *R. dominica*; significant differences were noted between the two populations. Overall, based on the current results, nitrogen can be used by the industry as an alternative method for the control of adults of the major stored product insects.

Keywords: disinfestation, nitrogen, life stages, mortality, stored product insects

