Title The potential of heated controlled atmosphere treatments for the control of south African phytosanitary pests and storage quality of plums

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Abstract

Environmentally-friendly postharvest mitigation treatments against phytosanitary pests are necessary to maintain intenational trade in agricultural products. The controlled atmosphere and temperature treatment system (CATTS) was developed in the United States (US) to control phytosanitary pests on pome and stone fruit. CATTS uses high-temperature forced air combined with a low oxygen and high carbon dioxide atmosphere. Developing CATTS treatments is expensive since it requires infesting and treating large quantities of fruit. In order to determine the most tolerant pest species and life stage, without the expense of working with infested fruit, CATTS treatments were simulated using a water bath system also developed in the US.The controlled atmosphere water bath system (CAWB) was used to test treatments on three phytosanitary pests of South African export fruit: Macchiademus diplopterus (grain chinch bug), Phlyctinus callosus (banded fruit weevil) and Thaumatotibia leucotreta (false codling moth). Adult grain chinch bug and banded fruit weevil, and each developmental stage of the eggs and larvae of false codling moth were subjected to treatments. Water temperature was increased at a linear rate of 12°C/h to 45°C under regular air (RA) and controlled atmosphere (CA) conditions of 1% O_2 and 15% CO_2 in nitrogen. The least tolerant was P. callosus, requiring a CA treatment of 2.0h to achieve 100% mortality. The most tolerant were 4th instar T. leucotreta larvae, with less than 50% mortality after 3.0h, while 5th instar larvae and grain chinch bugs, exhibited 100% mortality after a 3.0h CA treatment. In a preliminary trial, Songold and Laetitia plums were also subjected to a CAWB treatment, to assess the effect on fruit quality. Fruit was heated to a pulp temperature of 40°C under the same conditions used in the insect CA treatments, and evaluated after storage for 42 days ilt a dual temperature regime. Although results were non-significant, internal browning on Songold was lower, while treated fruit were firmer compared to untreated fruit. Phytotoxicity occurred on Laetitia plums, which could be related to surface injuries on overmature plums, or sensitivity to the treatment. Further research will focus on developing CATTS treatments using infested fruit and the most tolerant species and/or life stage identified from CAWB treatments, while the effect of CATTS treatments on fruit quality will also be evaluated on a larger scale in a CATTS unit.