Spatial distribution of predators and prey affect biological control of twospotted spider mites, *Tetranychus urticae* Koch (Acari: Tetranychidae), using *Phytoseiulus persimilis* Athias-Henriot (Acari: Phytoseidae) on impatiens greenhouses

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ABSTRACT

The twospotted spider mite, *Tetranychus urticae* Koch (Acari: Tetranychidae), initially occurs as localized populations or "hot spots" in commercial greenhouses. Growers concerned about mite damage are often advised to focus on "hot spots", either with chemicals or natural enemies. However, many growers spread natural enemies evenly around the greenhouse. I investigated the impact of spider mite distribution among plants on population growth and plant damage and on the effectiveness of biological control by the predatory mite, *Phytoseiulus persimilis* Athias-Henriot (Acari: Phytoseiidae) under two predator release strategies: broadcast or point (localized) application. The experimental unit consisted of 16 impatiens plants arranged in a square. Each unit was started with the same numbers of spider mites, but spider mites were distributed either evenly (the total number of spider mites was divided equally among the 16 plants in the unit) or clumped (the total number of spider mites was divided equally among the 4 central plants). The clumped distribution simulated a "hot spot." Predators were released at an overall 1:4 predator:prey ratio based on the total number of spider mites in a unit, but were released in either an even or clumped pattern. Within nine days after predator release, spider mite populations were reduced in all treatments, but only in the clumped spider mite-clumped predator treatment were spider mite populations reduced to undetectable levels. In the other spider mite-predator treatments, predators reduced spider mites more quickly in the even-even and even-clumped treatments than in the clumped-even treatment. By 18 days after predator release, spider mites were eliminated in all treatments, but a reduction in average plant damage occurred only in treatments in which the predator release pattern matched the spider mite distribution (i.e., even-even or clumped-clumped) with the greatest reduction in the even-even treatment. my results suggest that there is an advantage to releasing predators in "hot spots" at a recommended predator:prey ratio. If more uniform predator releases are made, overall predator numbers need to be kept sufficiently high so that the recommended predator:prey ratio of 1:4 shown to prevent damage on impatiens is achieved in higher-density spider mite patches.

KEY WORDS spider mites, bedding plants, spatial distribution, biological control