

Plasma-activated water as potential green adjuvant to enhance the insecticidal activity of pesticides against cotton aphids

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BACKGROUND: The cotton aphid, *Aphis gossypii* Glover, is a major pest of cotton [1], causing damage through both direct feeding, and indirectly via virus transmission and contamination of aphid honeydew [2]. Chemical pesticides, such as imidacloprid and flonicamid, are commonly used to control cotton aphids [3]. However, their excessive use has resulted in increased resistance and environmental pollution [4].

RESULTS: In this study, we propose a novel method of using plasma-activated water (PAW) as an adjuvant to enhance the effectiveness of pesticides and investigate its synergistic effects against cotton aphids. The results showed that combining PAW with imidacloprid increased the susceptibility of field populations to imidacloprid across all developmental stages, and the mortality rate of adult aphids rising from 36.75% to 75.25%. Additionally, the combination of PAW and imidacloprid also increased the mortality rate of adult aphids in imidacloprid-resistant populations, rising from 38.71% to 72.72%. In contrast, for the flonicamid groups, the synergistic effect of PAW was not significant for adult aphids in either the field populations or flonicamid-resistant populations ($P > 0.05$). After 3 days of PAW treatment, the reproduction of cotton aphids in field populations decreased significantly ($P < 0.05$). Moreover, the combination of PAW with pesticides showed no adverse effects on chlorophyll contents and photosynthetic parameters of cotton leaves.

CONCLUSION: PAW serves as an eco-friendly adjuvant that enhances the insecticidal efficacy of pesticides without harming cotton leaves, presenting a promising alternative for sustainable pest management.

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