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Neem oil (Azadirachta indica) fabricated silver nano-particles as an eco-friendly tool for the control of Helicoverpa armigera – A case study

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Abstract: Helicoverpa armigera is a polypghagous insect pest that infests many crop plants. Indian neem (Azadirachta indica) tree is a versatile plant which possesses enormous insect control properties. Nanoencapsulations and nanoemulsions are the potential nanotechnology tools that can be used in managing biological systems, including insect pest control. In this study, neem oil nanoencapsulate silver nanoparticles (AgNPs) and neem nanoemulsions were tested against larval and pupal populations of the cotton bollworm, Helicoverpa armigera, and lethal concentrations (LC50 and LC90) were established. The silver encapsulated insecticidal nanomaterials performed as reducing and stabilizing agents. Results obtained from UV, XRD, FTIR, DLS, ZETA, SEM, TEM and EDX analyses showed quantitative and morphological characters of the synthesized nanoencapsulated silver nanoparticles. Neem essential oil, nanoemulsions and encapsulated silver nanoparticles showed significant larvicidal and pupicidal toxicity against the Helicoverpa armigera. Sub-lethal doses of nanoencapsulated silver nanoparticles and neem oil nanoemulsion treatment significantly affected the longevity and fecundity and also reduced egg hatchability. Treated insects displayed reduced food consumption as well as lower growth and nutritional indices such as efficiency of ingested and digested food materials (ECI and ECD) and concomitant reduction in the digestive enzyme activity (a-amylase, lipase and proteases, serine, cystein and aspartic proteinases). In addition, the insects egested lesser number of faecal pellets and time taken to pass out first faecal pellets were also diminished in the experimental insects. The results revealed that encapsulated AgNPs of nanoemulsified droplet concentrations (ppm level) might have affected the digestive physiology of insects. Overall, encapsulated AgNPs and nano-emulsions from plant essential oil have shown demonstrated potential for the development of safer alternative insecticidal formulations for the control of H. armigera.

Will an exotic, competitive egg parasitoid displace a native larval parasitoid?

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Abstract: Fopius arisanus Soman (Hymenoptera: Braconidae) is a generalist tephritid egg parasitoid from the Indo-Pacific region introduced to Brazil in 2012 to control the exotic fruit fly pest Bactrocera carambolae Drew & Hancock (Diptera: Tephritidae) in the northern region. Doryctobracon areolatus Szépligeti (Hymenoptera: Braconidae) is a native generalist parasitoid of second instar larval fruit flies from Central and South America. Because both species of fruit fly parasitoids share some genera of fruit fly hosts, we evaluated if the commercial release of F. arisanus could cause adverse effects (e.g., competitive displacement) on the native parasitoid. Host preference and competitive ability were compared using as hosts the native Anastrepha fraterculus Wiedemann (Diptera: Tephritidae) and the exotic Ceratitis capitata Wiedemann (Diptera: Tephritidae) fruit fly species. To evaluate host preference, choice and no-choice experiments were conducted with lines of F. arisanus reared from each of the hosts. Laboratory studies showed that F. arisanus accepted only 2-3% of the native hosts compared to 34-41% of the exotic hosts under no choice conditions, with similar results when given a choice of native and exotic hosts. The field cage choice study showed similar results when F. arisanus was reared on the exotic host, but when reared on the native host, F. arisanus parasitized more of the native host than when reared on the exotic host. However, both lines of the parasitoid preferred the exotic host. To evaluate competitive ability, experiments with both species together and separate were conducted in the laboratory and in field cages. Both experiments showed that F. arisanus had no measurable detrimental effect on the native parasitoid in either the native or exotic host. Indeed, the native parasitoid was consistently the superior competitor in native host even though it parasitized larvae while F. arisanus is an egg parasitoid. These results indicated that F. arisanus interacted minimally with the native parasitoid on the native host, and while it interacted with the native parasitoid on the exotic host, it did not detrimentally affect it. Thus, F. arisanus is unlikely to cause adverse effects on the native parasitoid, D. areolatus in Brazil.