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Preface to "Beneficial insects and mites: their ecology and potential in pest control"

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Biological control is again at the centre of sustainable pest management. In many agricultural and horticultural systems, dependence on chemical pesticides is increasingly constrained by development of pesticide resistance, regulatory and market expectations, and the ecological costs of disrupting beneficial arthropod communities. At the same time, global movement of plant material and climate-driven shifts in pest ranges continue to generate new invasions and alter outbreak patterns. In this context, beneficial insects and mites—predators, parasitoids and entomopathogen-associated species—remain indispensable components of integrated pest management (IPM). The *Journal of Insect Biodiversity* (JIB) is an international venue whose scope explicitly includes beneficial insects, invasive insects and insect ecology. Its special volumes provide focused collections built around a shared theme. This special volume—*Beneficial insects and mites: their ecology and potential in pest control*—assembles six papers that emphasise a practical principle: biological control succeeds when natural enemies are matched to the pest's life stage, microhabitat and behaviour, and when production and deployment constraints are addressed early.

Li *et al.* (2026) evaluated a dual-agent strategy against the wood-boring beetle *Aromia bungii* using the entomopathogenic fungus *Beauveria bassiana* and the ectoparasitic mite *Pyemotes zhonghuajia.* Fungal efficacy was dose- and stage-dependent, and conidia-carrying mites could deliver lethal infection within 7–8 days, comparable to high-dose fungal immersion, whereas mites alone caused only ~44% mortality in young larvae and ≤7% in older larvae. The combined treatment further accelerated mortality, supporting synergy between mite venom and fungal infection and pointing to arthropod-microbe combinations as a route to reach protected hosts. Li & Zhang (2026a) tested whether the indigenous minute pirate bug *Buchananiella whitei* could exploit the invasive tomato red spider mite *Tetranychus evansi.* Under laboratory conditions, *B. whitei* completed development with high survival on *T. evansi*, and females laid significantly more eggs over seven days on the mite diet than on a control diet (frozen *Ephestia kuehniella* eggs); predation capacity increased with predator instar. The study also documented a variable number of immature instars. Gong *et al.* (2026) addressed the mass-rearing bottleneck of *B. whitei* across three diets (frozen *E. kuehniella* eggs, frozen mixed stages of the dried fruit mite *Carpoglyphus lactis*, and live *C. lactis*), development was completed on all, but adult size was reduced on frozen *C. lactis*. Oviposition occurred only when females were provided with live *C. lactis*. Together, these results identify a cost-effective factitious prey and key environmental conditions that shape reproductive output.

Three papers focus on thrips, illustrating why effective control often requires combining agents across habitats. Li & Zhang (2026b) assessed two commercially available predators—first-instar larvae of the green lacewing *Mallada basalis* and adults of *B. whitei*—against western flower thrips *Frankliniella occidentalis* on strawberries. In both no-choice and choice tests, both predators consumed and preferred immature thrips and showed the lowest preference for adults, supporting stage-timed releases that focus on early thrips instars. Chi *et al*. (2026) shifted the lens to the soil refuge, where thrips pupae were protected from foliar insecticides and canopy predators. They quantified predation and functional responses of the soil-dwelling mite *Stratiolaelaps scimitus* on *F. occidentalis* pupae. All tested predator stages exhibited a Type II functional response, and adult females showed the highest asymptotic consumption, confirming the value of soil predators for targeting the pupal "bottleneck" and supporting mass rearing on factitious prey for deployment. Finally, Cao *et al.* (2026) extended the thrips theme to greenhouse thrips *Heliothrips haemorrhoidalis* on avocado and quantified stage-specific predation by first- and second-instar *M. basalis* larvae. Predation by lacewing larvae was strongest on immature thrips, whereas thrips pupae and adults experienced consistently low predation across

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densities, refining expectations for lacewing-based control and reinforcing the operational value of stage-targeted releases.

Together, the six studies provide an evidence base for biological control that is both ecological and practical (Cao *et al.* 2026; Chi *et al.* 2026; Gong *et al.* 2026; Li *et al.* 2026; Li & Zhang 2026a,b). They show how multi-agent approaches can improve access to concealed pests, how predator utility depends on rearing ecology and environmental sensitivity, and how stage- and habitat-targeted tactics are essential for thrips control. We hope this special volume will help researchers design stronger efficacy tests and help biocontrol producers and practitioners optimise rearing, release timing and habitat targeting.

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