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Pest management of social insects in urban settings

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ABSTRACT

Pest management of social insects in urban environments is a growing global concern, given the problems that these pests generate and the growth of urban areas worldwide. In this special issue, we present studies on the management and control of ants, wasps and termites from different areas. Also, we report a global overview on the approaches and efficiency of the different methods used to manage and control them. Current advances on the management of urban social insect pests are promising, yet many challenges remain. We expect that this special issue contributes to shed light on these crucial topics, and brings attention to this challenging and growing problem.

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Insects are likely the most important pests to humans worldwide. Herbivorous species can significantly affect agricultural crops and food production, natural and plantation forests, and even may disturb the aesthetic value of parks and gardens. Insects are also of concern to pest managers as many species are vectors of human diseases or affect the health of livestock and pets. Together with the remarkable increase in the urbanization of human populations, insects have become an increasing problem in human dwellings. In some cases, urbanization has led to the degradation and fragmentation of natural habitats and the creation of a new environment that has favoured the spill-over and local adaptation of many organisms. Social insects are one example of organisms that have become increasingly common in urban areas, likely taking advantage of their plastic ability to become easily adapted to new environments (Wilson 1987; Rust & Su 2012).

While only 5% of the species that arrive in a new area establish successfully, causing significant impacts to the receiving community, a quarter of those that cause environmental damage are eusocial (Beggs et al. 2011). Eusocial insects are characterized by a highly organized colonial life. Also, they typically possess high reproductive rates, good dispersal abilities, broad habitat ranges and superior competitive abilities than other solitary insects. These characteristics make them good invaders in human environments (Wilson 1987; Moller 1996) and allow them to achieve high populations once established. In the urban setting, the management of populations of ant, wasp and termite pests remains a standing challenge, not only because of the species themselves, but also due to the complexity towns and cities offer for the implementation of some control practices. The goal of this special issue is to present recent advances on the management of social insects in the urban setting.

Since differences exist in the biology of pests and in human dwellings within urban areas worldwide, there are a diversity of needs and approaches applied to manage social insect pests. To further understand this, Dimarco et al. assemble the standing information on the current practices applied to manage and/or control social insect pests in urban environments worldwide. Their aim is to understand the possible drivers of success in the control or management of social insect in urban environments and to highlight what are likely promising research topics for future work. They also discuss a less common approach to undertake the reduction of populations through the control of the worker caste, by taking advantage of the Allee effects.

Several species of ants are common in metropolitan environments. *Solenopsis invicta, Linephitema humile* and *Acromyrmex lundy* are examples of this, causing ecological, economic and human health negative effects on the receiving ecosystems (Human & Gordon 1996; McGlynn 1999; Christian 2001; Sanders et al. 2001). So far, efforts to eradicate these species have focused mainly on the use of chemical products (e.g. Vega & Rust 2003; Silverman et al. 2006; Klotz et al. 2009; Choe et al. 2010); however, this approach has shown low success rates and may not be always environmentally safe. In this special issue, Greenberg et al. compare the efficacy of two new treatment protocols to control *L. humile* populations. Those protocols try to achieve the control of ant populations by using less toxic ingredients than other in use, and they also measured the runoff of the latter into waterways of

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southern California, with the aim of mitigating their effects. They show that it is possible to reduce the toxic runoff while maintaining efficacy of the ant control treatments. Defagó et al., in turn, show how the manipulation of ant foraging behaviour could be an approach to the management of invasive species. The authors evaluate whether the foraging activity of *A. lundi* displayed in the field, is affected by the extract of a native plant. In a similar fashion, Josens et al. show that baits to control ant populations exhibit a higher efficiency if optimized in terms of the feeding behaviour of worker ants. The authors also list the ant species present in the largest urbanized area of Argentina, from where some of the most widely distributed and destructive invasive ant species are native (e.g. *L. humile, S. invicta, Solenopsis richteri, Wasmannia auropunctata*).

A small proportion of vespid wasps have successfully established in different regions of the world yet may cause significant ecological, economic and social impacts (Beggs et al. 2011). *Vespula germanica, Vespula vulgaris* and *Polistes dominula* are eusocial species commonly established in urban areas, where their powerful and occasionally fatal sting makes them unwanted there (Beggs et al. 2011). To reduce the number of foraging worker wasp in urban areas is the aim of most pest managers in the invaded regions. In this special issue, a study by Rust et al. proposes a non-obtrusive monitoring and baiting programme to reduce the number of yellowjacket foragers in a large urban park of southern California, presenting also a novel strategy to control wasp populations. Complementing such findings, Edwards et al. explore the transition from scientific trials to an available pest control tool for *V. vulgaris* and *V. germanica*, the most common exotic wasps in New Zealand. They demonstrate a considerable success for applications at area-wide scales, suggesting that a successful programme of wasp control could be supported by local communities.

Termites are the most problematic pests of plants and man-made constructions. They are almost always restricted to human-modified environments, such as houses, buildings and cultivated crops (Gay 1969; Verma et al. 2009). There are several studies analysing different strategies to control termites; however, few have shown successful results. Synthetic pesticides remain the primary method used to prevent termite attacks on wooden structures. In laboratory bioassays, Lewis and Forschler recorded the mortality of *Reticulitermes flavipes*, a serious pest in North America and Europe, associated with five chitin synthesis inhibitors containing termiticidal baits. They found that the commercial bait formulation tested in the laboratory could transfer in an effective manner, showing a low dose/mortality relationship.

Pest management of social insects in urban environments is a growing global concern given the growth of urban areas worldwide. Current advances in the management of these pests are very promising, yet many challenges still remain, including the use of environmentally safe procedures. We expect that this special issue contributes to shed light on some of these crucial topics needed of further research, and brings attention to this challenging pest problem.

Disclosure statement

No potential conflict of interest was reported by the authors.

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