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Harnessing Population Genetics for Pest Management: Theory and Application for Urban Rats

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ABSTRACT: Effective management of rodent pests requires an ecological understanding of how they move through their environment, and how those movements influence the invasion, persistence, or reinvasion of problematic colonies. Traditional methodologies used to describe rodent movement patterns, such as mark-recapture, are hindered by their time-consuming nature and limited geographic scope. As such, our understanding of how rodents interact with urban environments remains limited. Population genetic principles and tools have the capacity to greatly increase our understanding of rodent population dynamics, ecological relationships, and movements across space but this field is often unapproachable to non-scientist pest management professionals. In this paper we aim to promote collaborative and integrative rodent pest management by introducing relevant population genetic principles, providing examples of their applications in studies of urban brown rats, and proposing future initiatives that link scientific, private, and government entities. Using a densely-sampled brown rat population in the city of Vancouver, BC we show how genetic relationships among individual brown rats can be leveraged to understand the geographic distribution of genetic clusters (i.e., colonies), natural barriers to migration, and the spatial scale of dispersal. We describe how these results can be exploited by PMPs to directly inform the creation of management units and decrease the likelihood of rapid post-treatment reinvasion. Further, we discuss the difficulties inherent in population genetic studies and the potential for high-quality model sites to develop generalizable strategies. Overall, we hope to expand the toolbox of pest management professionals, foster collaboration, and move towards more informed and sustainable management strategies.

KEY WORDS: dispersal, Integrated Pest Management, Norway rats, population genetics, rats, *Rattus norvegicus*, rodents, urban commensals

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