

Evolution of parasitoid host preference and performance in response to an invasive host acting as evolutionary trap

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Abstract

The invasion of a novel host species can create a mismatch in host choice and offspring survival (performance) when native parasitoids attempt to exploit the invasive host without being able to circumvent its resistance mechanisms. Invasive hosts can therefore act as evolutionary trap reducing parasitoids' fitness and this may eventually lead to their extinction. Yet, escape from the trap can occur when parasitoids evolve behavioural avoidance or a physiological strategy compatible with the trap host, resulting in either host-range expansion or a complete host-shift. We developed an individual based model to investigate which conditions promote parasitoids to evolve behavioural preference that matches their performance, including host-trap avoidance, and which conditions lead to adaptations to the unsuitable hosts. One important aspect of these conditions was reduced host survival during incompatible interaction, where a failed attempt by a parasitoid resulted in host killing. This non-reproductive host mortality had a strong influence on the likelihood of establishment of novel host-parasitoid relationship. Killing unsuitable hosts can constrain adaptation under conditions which in fact promoted adaptation when parasitoids would leave the trap host unharmed and survive parasitoid attack. Moreover, our model revealed that host-search efficiency and genetic variation in host-preference play a key role in the likelihood that parasitoids will include the suboptimal host in their host range, or will evolve behavioural avoidance resulting in specialization and host-range conservation, respectively. Hence, invasive species might change the evolutionarily trajectory of native parasitoid species, which is important for predicting biocontrol ability of native parasitoids towards novel hosts.

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