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Host resistance and coevolution in spatially structured populations

Most natural, agricultural and human populations are structured, with a proportion of interactions occurring locally or within social groups rather than at random. This within-population spatial and social structure is important to the evolution of parasites (e.g. [1]) but little attention has been paid to how spatial structure affects the evolution of host resistance, and as a consequence the coevolutionary outcome. We examined the evolution of resistance across a range of mixing patterns using an approximate mathematical model (pair approximation) and stochastic simulations. We found that as reproduction becomes increasingly local, hosts are always selected to increase resistance. More localised transmission also selects for higher resistance, but only if reproduction is also predominantly local. If the hosts disperse, lower resistance evolves as transmission becomes more local. These effects can be understood as a combination of genetic (kin) and ecological structuring on individual fitness. When hosts and parasites coevolve, local interactions select for hosts with high defence and parasites with low transmissibility and virulence. Crucially, this means that more population mixing may lead to the evolution of both fast-transmitting highly virulent parasites and reduced resistance in the host [2].

References

[1] Boots, M. and Sasaki, A., *'Small worlds' and the evolution of virulence: infection occurs locally and at a distance* Proc. Roy. Soc. B, **266**: 1933-1938.

[2] Best, A., Webb, S., White A. and Boots, M., *Host resistance and coevolution in spatially structured populations* Proc. Roy. Soc. B, *In Press* (published online, doi:10.1098/rspb.2010.1978).