

Inferring on innate locust behavior with individual based models and an information criteria

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Abstract: Locusts are grasshopper species that change behaviour, physiology, morphology and life history in response to crowding. This extreme form of phenotypic plasticity is called phase polyphenism. Two extremes are characteristics of phase polyphenism: a solitary cryptic phase and an aggregating colourful gregarious phase that confers to locusts the capacity to create large destructive hopper bands and adult swarms. Desert locust, *Schistocerca gregaria*, is one of the most infamous locust species, transmitting epigenetically phase characteristics to its progenies. However, recent laboratory works argued on an identical aggregating behaviour at hatching time among progenies of solitary and gregarious mothers.

We conducted 17 laboratory experiments to test the effect of different mother histories on innate locust behaviour. Eggs from grouped or isolated mothers were placed in an arena with climbing sticks for the new born. We measured aggregation and activity on these sticks from photo recording. These laboratory experiments were coupled with an individual-based modelling approach. The model was built to mimic the experiments and the data collection through individual history and behaviour. The objective was to compare three competing model versions of locust behaviour. Multiple criteria of laboratory data (aggregation and activity) were used to adjust and sample parameters related to locusts' behaviour with Metropolis sampling for each model version and each experiment. The POMIC approach (Piou et al. 2009) was used to compare the different model versions. Both origins of eggs were showing aggregating behaviour in some experiments, but in some other, random movement was enough to explain aggregation and activity measures. The modelling approach is promising but further laboratory data are necessary to be more conclusive.

References

Piou, C., Berger, U. and Grimm, V. (2009) Proposing an information criterion for individual-based models developed in a pattern-oriented modelling framework. *Ecological Modelling*, 220:1957-1967.