

1 **Polyandry promotes successful colonisation in novel thermal envi-**
2 **ronments**

3 Rebecca Lewis*, Michael Pointer*, Lucy Friend, Ramakrishnan Vasudeva, James Bemrose, Mathew J.G.
4 Gage and Lewis G. Spurgin**

5 School of Biological Sciences, University of East Anglia, Norwich Research Park, United Kingdom

6 * These authors contributed equally to this work

7 ** **Correspondence:** L.Spurgin@uea.ac.uk

Abstract

Global climates are getting warmer, with dramatic consequences for population dynamics and species distributions. We have limited understanding of the colonisation dynamics when species shift to novel thermal environments, and of the evolutionary processes that promote colonisation and extinction. Previous theory and experimental research has showed that polyandry can promote successful colonisation through reducing levels of inbreeding in newly colonised populations. Here we show that polyandry provides substantial benefits in the colonisation of novel, and harsh, thermal environments. Using colonisation experiments with the model beetle *Tribolium castaneum*, we founded populations at increased temperature using either singly or doubly mated females, and followed population dynamics for ten generations. We found that extinction rates were XX in polyandrous compared to XX in monandrous-founded populations.

Key words: colonisation, extinction, population dynamics, sexual selection, *Tribolium*

19 Introduction

20 Materials and Methods

21 Experimental protocols

22 All beetles were of our Karakow Superstrain (KSS) and were maintained for X both before and throughout
23 the experiment on a fodder medium consisting of 90% organic white flour, 10% brewer's yeast topped with a
24 thin layer of oats for traction.

25 Founding females and their mates were reared and mated under standard conditions of 30°C and 60% humidity.
26 Matings were carried out in 5 cm Petri dishes containing Xml fodder. Populations were maintained in 100 ml
27 PVC screw-cap containers, with the caps pierced for ventilation, and containing 70 ml fodder.

28 All females received two matings lasting 24 hours each. In the first round of matings, random pairs of virgin
29 females and virgin males (aged ~7 days post-eclosion) were combined. In the second round of matings, females
30 from the monandrous treatment were re-mated to the same male, who was removed from the dish before
31 being replaced. Females from the polyandrous treatment were mated to a second male, with males being
32 cycled within groups of five females.

33 After the second mating round, females were transferred to a population container and left to oviposit for
34 7 days at 38°C after which she was removed and the offspring left to develop. All containers post-mating
35 were marked only with an ID number so that a population's treatment was unknown by researchers during
36 subsequent handling.

37 35 days after founding females were removed, generation 1 adults were separated from the fodder by sieving,
38 the fodder was discarded and the container and sieve cleaned with ethanol. The number of live adults was
39 counted and placed into fresh fodder to seed the next generation. If >100 individuals were present, 100 were
40 retained and the remainder discarded after counting.

41 Another 7 days later, adults were removed by sieving and the offspring again left to develop. This process
42 was repeated for 10 generations.

43 Statistical analyses

44 **Results**

45 **Discussion**