MHC diversity affects pup survival in male banded mongooses

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BACKGROUND

In many species, high early life mortality limits individual fitness. Genes of the major histocompatibility complex (MHC) have the potential to affect survival for example by determining the effectiveness of immune responses against pathogens. Since MHC molecules bind peptides matching their peptide binding site, the diversity of MHC genes might affect the set of peptides bound, and thus influence immune responses[1]. Theory and computational binding prediction studies indicate that higher MHC diversity should lead to increased parasite recognition and thus fitness[2,3] (Fig 1). Pup mortality is also an important factor limiting fitness in banded mongooses, but it is unknown whether it is influenced by MHC diversity.

Fig 1 Potential influence of MHC diversity on fitness via regulation of the immune response against parasites.

METHODS

- Determine **allele number** with **high throughput sequencing** (Illumina) of **MHC-I Exon 2 and 3 and MHC-II DRB Exon 2** (Fig 2)
- **Long-term life history, behavioral and physiological data** from wild banded mongooses habituated to human observation in Queen Elizabeth National Park, Uganda (**n=285-385** individuals)
- **GLMM** of survival to 90 days. **Fixed effects**: allele number*sex, rainfall 30 days prior birth (associated with early life survival[4,5]), heterozygosity. **Random effect**: litter nested within pack (consecutive litters per pack possible)

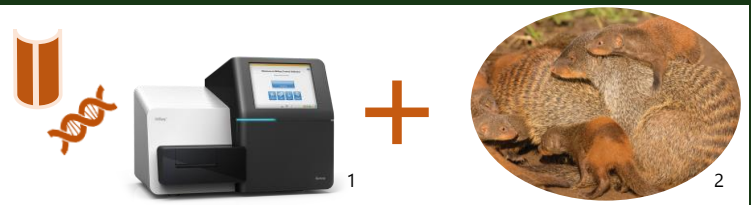

Fig 2 Methods: Combination of high throughput sequencing and long-term observational data.

RESULTS

- No significant effect of MHC-I (Exon 2 and 3) on pup survival.
- Male compared to female pups show a significant positive effect of MHC-II allele number on survival (Fig 3+4).

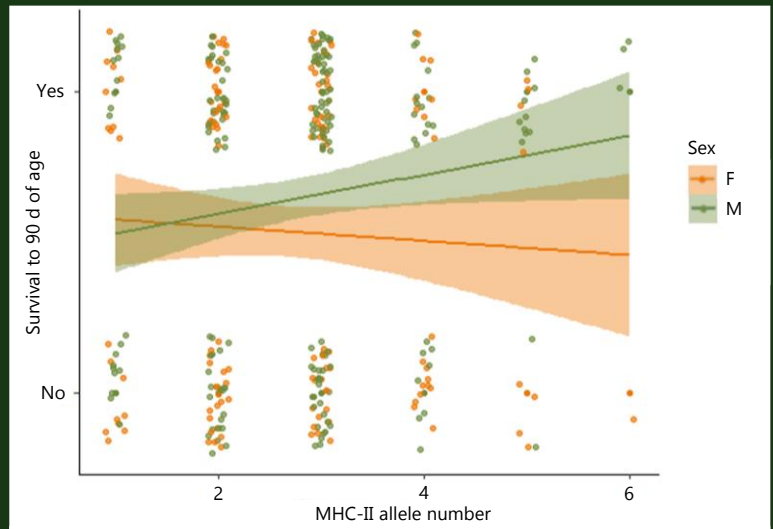

Fig 3 Pup survival in relation to MHC-II allele number split by sex. Jitter applied on both axes to increase visualization of data points.

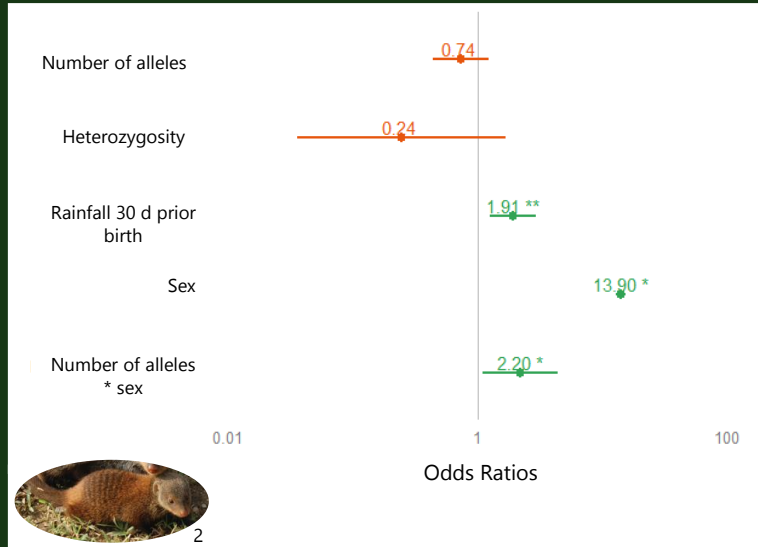

Fig 4 Odds ratios: GLMM of banded mongoose pup survival.

DISCUSSION & OUTLOOK

As MHC-II molecules mostly interact with exogenously derived peptides[1], the efficiency of the immune response against parasites might be driving pup survival. Moreover, sexually antagonistic selection may cause the opposed links between MHC diversity and fitness for the sexes[6]. Although in line with previous findings, further research is needed to identify the mechanisms by which MHC-II diversity affects pup survival in banded mongooses.

REFERENCES (1) Rammensee et al. 2013. Springer S&B Media.; **(2)** Wakeland et al. 1990. *Immunol Res* 9, 115–122.; **(3)** Pierini & Lenz 2018. *Mol Bio Evol* 35:9, 2145–2158.; **(4)** Nichols et al. 2015. *Behav. Ecol.*, *26*(6), 1486-1494.; **(5)** Sanderson et al. 2015. *Mol. Ecol.*, *24*(14), 3738-3751.; **(6)** Roved et al. 2017. *Horm Behav*, *88*, 95-105.; **PHOTOS (1)** Illumina®, **(2)** Vitikainen et al. 2017, *ProcB: BiolSci*, *284*(1854), 20162384).