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Habitat Fragmentation and Speciation in enclosed Midwestern Short-Grass Prairie

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Abstract:

This paper examines the genotypic impact of geographic fragmentation on a fluctuating community of meso-organisms in a mixed prairie/dune environment in lakeside Illinois. We observed genotypic drift and variation in a community of approx n_1 = 113 +/- 17 S. Nerdensis, n_2=90 +/- 30 R Norvegicus, and n_3=140+/-20 M Musclus over a common t_{sample}. Compiling results allows us to arrive at a better picture of selective pressures in differing species over narrow areas of habitat.

Introduction

Geographic Fragmentation of habitat remains the primary cause of speciation: large populations dampen the effect of genetic drift and tend to compensate for evolutionary pressures within the preexisting genotype. Population fragmentation exaggerates genetic drift via the founder effect and tends to produce a set of different but commonly descended species via a process of adaptive radiation.

Beginning in January 2008, intraspecies competition resulted in the sealing off of horizontal connectivity through the area of our sample population, dividing the previously united region into five discontinuous sub-habitats. This afforded us a natural in vivo opportunity to examine the resulting speciation and selective pressures. We took genotypic samples of the population at t=p20, p40, and p60 and compared with the base genotype at t=p0 in each section and the whole, while comparing environmental divergences…

Materials and Methods

For the selected habitats, see the results section. Experiments were preformed with wild type/smash$^-$ S. Nerdensis with a lacZ-mediated YFP reporter construct. R Norvegicus and M Musclus were wild types native to the region, albeit with a higher mutation rate than the norm. Thanks due to the Fermi and Groves lab for the last. Specimens were tagged and isolated leading up to p=0, and retrieved at intervals for genotyping following standard university procedures.

Results

3.1 Pressures

We note that sectionation removed access a substantial fraction of the food supply traditionally relied upon for all three species, and so expected to see substantial population reduction and selective pressure for food-acquisition skills. Increases in altitude correlate to increases in latitude in selective effect, so we expected to see increased cold-weather survival skills as we cut off access to lowland refugia during winter conditions. We chose to examine the

first by electromyographic analysis of frequency and strength of signaling in nociceptive regions of cortex under similar conditions, and the second by external keratin concentrations.

3.2: Nerdensis

The net S Nerdensis populations decreased rapidly following habitat divisions. We found that population did not decrease evenly thoughout the divided habitat: population was maintained in greatest frequency in outlying areas, and crashed most heavily in areas lacking in prior long term inhabitants. We hypothesize that this may be related to the inability of short-term populations to subsist on the primary remaining nutrient source of natural stimulant $C_8H_{10}N_4O_2$. Surviving population tended to have weakened nociceptive responses to predecessors and t=0 state, Keratin concentration among survivors was greater than among the overall population but Keratin density did not increase among survivors relative to p=0.
Dietary exceptional zones could be found in sectors to the far of the west of median population, where hydroxylated grain compounds took up a larger share of the diet; we hypothesize that this may have a causal relation with increased closeness to Lake Michigan and/or the college dining hall.
Despite diligent observation, we were unable to locate new members of the p1 generation within the enclosed space, we are unsure of the reasons for the lack of survey results, this is addressed at more depth in the discussion section. We did observe a tendency (compared with broader regional population) for a more distinct genome within the far west and far east sector populations versus the interior sub-species, which seemed more open to genetic inflow from other biomes.
Sensitivity to nociceptive stimulation was largely evenly distributed throughout the population. This was tested in selected decerebrate specimens, although response to nociceptive stimulation was particularly weak at higher altitudes in central regions, we believe this is due to conditioning from the overpopulation of neonates in lower altitudes of the population distributions

Figure 1: Observed *Nerdensis Speciation/ Population Fragmentation*

Dorsal	**<----------->**	**<----->**	**<----->**	**Ventral**	
Population 1	Population 3	Pop. 3	Pop. 3	Population 2	**Anterior**
Population 1	Population 4	Pop. 4	Pop. 4	Population 2	**Posterior**

3.3 R Norvegicus and M. Musculus

Simmilar although not identical results were observed in both *R Norvegicus* and *M Musculus* populations. Although populations of Nerdensis decreased throughout owing to emigration following sector sealing, a corresponding decrease was not observed in the other two populations, which remained largely constant. Genotypic analysis compared across sample times indicated that the two seemed to continue migration throughout the region even after horizontal migration was believed to be blocked. Likewise, the abnormally large (vs non habitat population) physical bulk of these two populations was not noticeably effected, subsequent analysis of stomach contents indicated that *Norvegicus* and *Musclus* continued to receive full nutritive supplements despite all attempts to reduce available food supplies. Stomach contents did however

reveal a surprisingly volume of Hum papers and problem sets within the *Norvegicus* population, which may account for their increased size and lack of response to nociceptive stimuli. *Musculus* seemed to have a reverse preference for the consumption of physics problem sets and alcoholic compounds, which may account for their unusual size and ferocity. *Musculus* populations were responsive to nociceptive stimuli, but in non-decerebrate specimens responded with increased ferocity. Speciation was not observed within these populations, save in sector one where the *Norvegicus* population seems to have become non-interfertile with other populations owing to its caffeine-heavy diet; also *Musculus* in sector five displayed a decrease preference outside of the region.

Discussion

Population fragmentation had limited but measurable effects on variation and speciation throughout the regions studied. We observe that populations tended to diverge along altitudal lines in the central regions, while in the far east and west genotypic vartiation was not observed across altitude. The far east and west did have different populations from eachother and from the central regions: we hypothesize the existence of barriers to migration being of differential strength depending on region.
Dietary requirements converged on available nutrient resources, and seem to have contributed to population divergence.
We suggest future work in examining the population across greater time periods, as results seemed to indicate the potential for migration and hyperactivity periods in the spring stemming from increased competition.
We suspect increased speciation would be observed over a longer test period, as phenotype would change to fit nutrient supplies.
Also, we want a five million dollar research grant.