Phenotypic diversity and local adaptation of Sahelian goat populations in Niger

Regina Roessler[1], Andreas Buerkert[2]

[1] Animal Husbandry in the Tropics and Subtropics (AHTS), University of Kassel, Germany
[2] Organic Plant Production and Agroecosystems Research in the Tropics and Subtropics (OPATS), University of Kassel, Germany

Introduction

- Goats are essential for ensuring food security and resilient transformation of food systems in oasis systems in northern Niger
- Rising pressure on goat populations due to land use change calls for conservation efforts for well-adapted populations
- No phenotypic information of the Sahelian goat available to design conservation programs

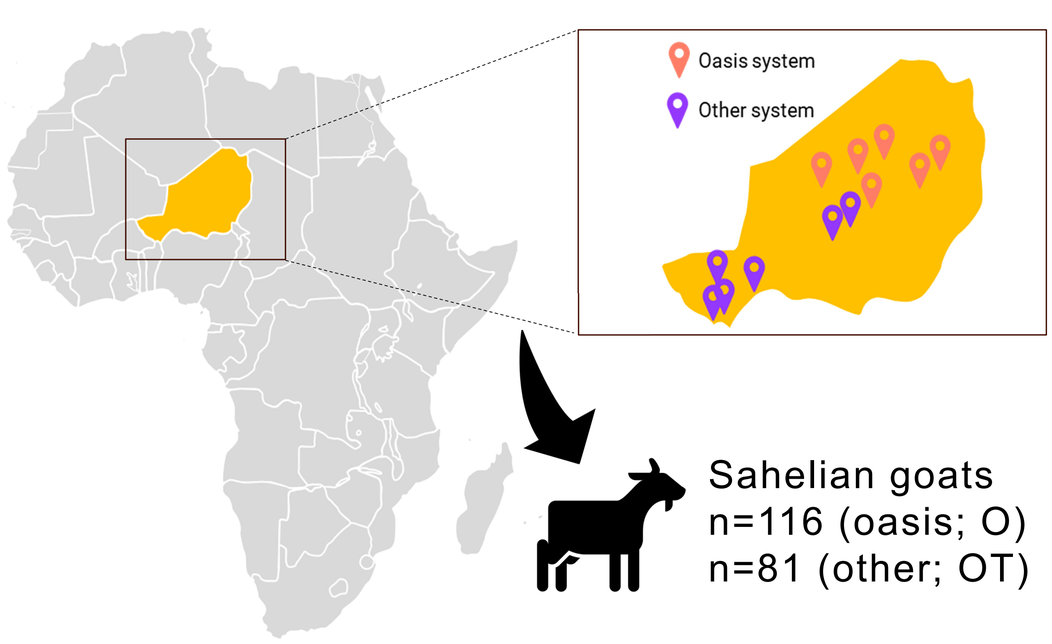
Objective and working hypotheses

Objective: Assess the phenotypic diversity of Sahelian goats in different production systems in Niger

Working hypotheses

- Communities in oasis systems in northern Niger intentionally selected goats for high capability to survive under extreme environmental conditions
- Goats in oases are phenotypically distinct from goats in other systems

Methodology



Seven morphological characteristics (FAO, 2012)
(1) Body coat color pattern, (2) Body hair color, (3) Hair type, (4) Presence of horns, (5) Presence of wattles, (6) Presence of beard, (7) Ear orientation

$$Occurrence\ (\%) = \frac{Individuals\ (n) with\ the\ phenotype}{Total\ individuals\ (n)}\ x\ 100$$

Phenotypes (Aranda et al., 2021)
Typical phenotype: Occurrence ≥ 50%
Intermediate phenotype: Occurrence of 11-49%
Unusual phenotype: Occurrence ≤ 10%

Allelic frequencies (Hardy-Weinberg equilibrium)
Wattles: Wattled (W) / wild (+), Horns: Polled (P) / wild (+), Bearded: Bearded (b) / wild (+) (Lauvergne et al., 1987)

$$q = \sqrt{\frac{m}{t}}\quad p = 1 - q$$

Highlights

Goats in oases in northern Niger are phenotypically distinct from goats in other systems, with a higher proportion of goats having long hair and a lower proportion having a white coat.

The low segregation of dominant alleles especially in oases shows that there is need to preserve these trait from risk of extinction.

Results

Figure 1. (a) Typical and (b) unusual phenotypes of Sahelian goats in Niger

- Typical phenotypes of Sahelian goats: Horns (99%), short body hair (97%), long pendulous ears (60%), absence of beard (60%) and wattles (59%) (Fig. 1a)
- Varied coat patterns and colors, with grey (7%) and brown (4%) hair as unusual phenotypes (Fig. 1b)
- Phenotypic distribution influenced by the production system (Fig. 2)

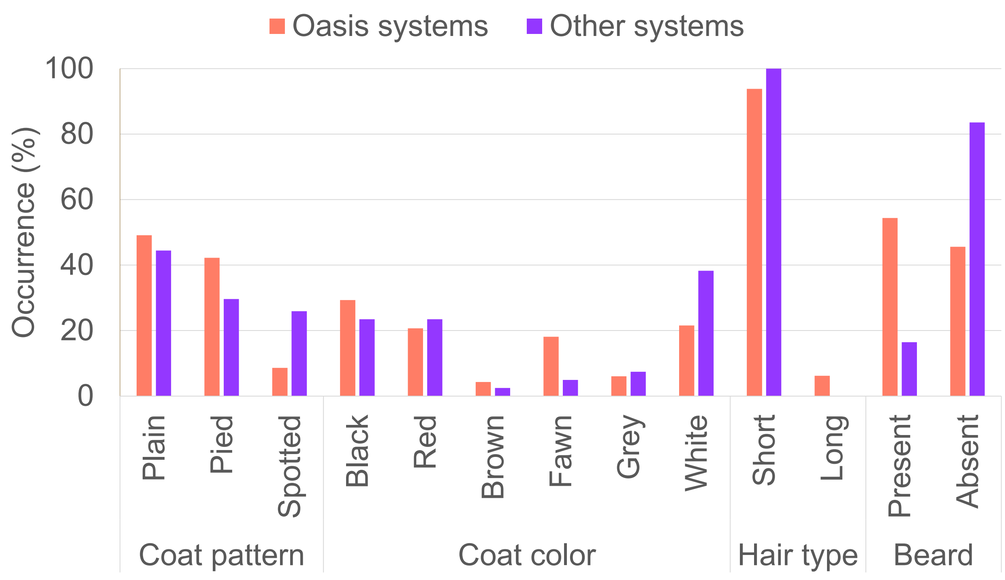


Figure 2 Distribution of phenotypes in oases and other systems in Niger

- Observed allele frequencies < Expected allele frequencies (Tab. 1; dominant allele in bold)

Table 1. Observed allele frequencies of does

Trait	Phenotype	Genotype	Overall	Oasis	Other
Horns	Horned	Ho^{+}	0.98	0.97	1.00
	Polled	Ho^{P}	0.02	0.03	0.00
Wattles	**Wattled**	Wa^{W}	0.43	0.38	0.49
	Unwattled	Wa^{+}	0.57	0.62	0.51
Beard	Bearded	Br^{b}	0.38	0.52	0.17
	Unbearded	Br^{+}	0.62	0.48	0.83

regina.roessler@uni-kassel.de