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Demographic performance of local sheep and goat breeds in two agro-ecological zones in Egypt

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Abstract. Small breeders in Egypt raise locally adapted sheep and goats breeds, which have the ability to produce and reproduce under the prevailing harsh conditions. Improving resilience of their production system is a major challenge to support socioeconomic development. However, little is known about the productive abilities of these breeds in small farming systems. The present work is an attempt to assess the performance of local breeds in small farming systems, and their capacity to cope with feed scarcity and harsh climatic conditions. In 2018, a retrospective survey was conducted over 12 month period to assess demographic rates of 25 local Barki sheep and goat flocks in the rain-fed area of Coastal Zone of Western Desert (CZWD) and 28 local Saidi sheep and goat flocks under the hot intensive agriculture system in Upper Egypt (UE). Flocks are larger, reproductive performance and offtake rates are higher (and mortality lower) in the CZWD, a region specialized in small ruminant breeding whereas it remains a secondary activity in Upper Egypt. The marketing season is mainly during Korban Eid festival. Their main challenges are frequent incidence of drought in the CZWD and high prices of feed stuffs in both sites. Our study suggests breeders have different strategies in UE and the CZWD when confronted with feed shortage. Breeders in the CZWD purchase feed to maintain high herd productivity whereas in UE small ruminant breeding is a minor activity with less productive animals that are resilient to feed shortage.

Keywords. Local breed – Barki – Saidi-Egypt – Performance.

Performance démographique des races locales ovines et caprines dans deux zones agro-écologiques de l’Égypte

Résumé. Les races locales de petits ruminants élevées en Égypte sont reconnues pour leur la capacité à demeurer productives malgré des conditions climatiques extrêmes. L’amélioration de la résilience des systèmes d’élevage est un défi majeur pour le développement socioéconomique. Cependant, les performances démographiques de ces races n’ont à ce jour pas été caractérisées en conditions réelles. Ce travail présente les premiers résultats d’une étude sur les performances de ces races dans deux régions d’élevage contrastées en Égypte. En 2018, des enquêtes démographiques rétrospectives sur les 12 derniers mois ont été effectuées sur 25 troupeaux de moutons et chèvres Barki dans la zone pastorale côtières et sur 28 troupeaux de moutons et de chèvres Saidi le long de la vallée du Nil en Haute Égypte, une région historique d’agriculture intensive. La fertilité et les taux d’exploitations sont plus élevés en zone pastorale (et la mortalité moindre) vraisemblablement en raison de la spécialisation de cette région dans l’élevage alors qu’il s’agit d’une activité secondaire en Haute Égypte. Le gros des ventes se déroule pendant les fêtes religieuses de Korban Eid. Les principaux défis sont la récurrence des sécheresses dans la zone pastorale et les coûts élevés des aliments dans les deux sites. Nos résultats suggèrent une stratégie différente des éleveurs confrontés au manque de fourrage. Dans la zone pastorale côtière, les éleveurs maintiennent la productivité du troupeau en achetant de l’aliment tandis qu’en Haute Égypte l’élevage de petits ruminants est une activité mineure avec des animaux moins productifs mais résilient au manque de fourrage.

Mots-clés. Races locales – Barki – Saidi, Égypte – Performance.

I – Introduction

Small breeders in Egypt raise locally adapted sheep and goats breeds under intensive or extensive systems in different agro-ecological zones. The breeds have the ability to produce and reproduce under the prevailing harsh conditions. They play an important socio economic role by constituting a capital that can serve as a source of food or cash in times of need (e.g. dowry in marriages, social events...). Sheep and goats are raised mainly for meat production, with coarse wool and goat milk as secondary products. Breeders face numerous challenges such as human demographic growth, increasing demand on animal products, competition for land, climate stress and market price fluctuations. There is little information about the productive capability and dynamics of these breeds in small holder farming systems.

The identification of animals and the routine collection of animal data are rare in Egypt for small farmers. In the absence of written records, retrospective surveys provide a quick diagnostic tool to determine the demographic characteristics of flocks. The present work is an attempt to assess the annual performance of these local breeds, their capacity to cope with feed scarcity and harsh environmental conditions, in the two agro-ecological zones for the period of 2017-2018.

In Egypt, two of the main small ruminant production systems are the Upper Egypt (UE) intensive agriculture system and extensive Coastal Zone of Western Desert (CZWD) pastoral system. In Upper Egypt, the intensive cultivation of winter and summer crops is concentrated in a narrow strip of irrigated land along the Nile River that produces economic crops as well as feed for animals. The agriculture production system is intensive on small areas of land of around 1 feddan (≈ 1 acre) with 1-2 large ruminants and 1-5 small ruminants for each household. Local breeds adapted to extreme temperatures are Saidi sheep and goats.

In the Coastal Zone of Western Desert, the Bedouins mostly rely on raising sheep, goats and camels; they also cultivate barley and grow olive and figs trees. Extensive livestock breeding depends on rain fed natural pastures. Local breeds are Barki sheep and goats, which have the ability to move over rough terrain to feed on sparse desert vegetation. Sheep flock size ranges from 15 heads to more than a thousand animals and goat herds between 5 and 200 animals. The mixed sheep and goat flocks use the available rangelands during winter and early spring, however the contribution of natural pastures to the feed requirements of the animals has been decreasing over the last decades due to successive years of drought.

II – Materials and methods

1. Study areas

Matrouh belongs to the Coastal Zone of Western Desert which extends from Alexandria to the Libyan border. It is characterized by an arid Mediterranean climate with annual rainfall below 150 mm between mid-October and mid-March. Temperatures range from maximum 36°C in July to minimum 6°C in January.

Assiut is located in Upper Egypt along the Nile River. The weather is hot with maximum temperature over 40°C and minimum 3°C; annual rainfall is negligible.

2. Retrospective demographic survey

The 12MO method (Lesnoff *et al.*, 2010) consists in categorizing all the animals in a herd by age and sex and listing the demographic events (births, natural deaths, slaughtering, loans, purchases, etc.) that occurred over the last twelve months. We conducted 12MO surveys between September 15th and 20th 2018 in Matrouh just after El-Eid festivities and from November 14th to 17th

2018 in Assiut just after berseem clover was sown. Memorable dates were chosen to ensure the breeder accurately recorded events over the last 12 months. Fifty-two breeders were surveyed (25 Matrouh + 27 Assiut) amounting to 1371 heads (753 Barki + 618 Saidi) of sheep. For goats, the total number of breeders was 30 (11 Matrouh + 19 Assiut) amounting to 308 heads (141 Barki + 167 Saidi). The size of studied flocks in Matrouh ranged between 15 to 45 heads of sheep and 5 to 22 goats, whereas in Assiut it ranged between 5 and 15 sheep and 3 to 10 goats.

In the absence of longitudinal surveys, 12MO approach provides demographic rates with only one visit per flock and can be applied to all farming systems. It is a quick and efficient method to estimate herd performance. The main limitations are possible biases in demographic rates when the breeder forgets to mention births, deaths or sales. The survey only considers the past 12 months and cannot account for fluctuations in demographic rates between years. To limit investigative bias, we hypothesized that large flocks had similar demographic performance to medium sized flocks, we sampled flocks with less than 60 reproductive females and always conducted interviews in presence of the animals and the shepherd or breeder in charge of rearing them.

3. Estimation of demographic parameters

Demographic parameters (parturition, abortion, off-take and mortality) are presented as instantaneous hazard rate (h) (Lesnoff *et al* 2010); h can be calculated for each category of animals as:

$$h = \frac{m}{T} \quad (\text{eq. 1})$$

Where m is the number of events (e.g. number of deaths) that have occurred in the last 12 months, and T is the total 'time at risk' (time spent by animals for a given category in the herd over the last 12 months). Hazard rates were calculated separately by site, species, sex and age class (young < 1 year, adult > 1 year). Hazard rates were estimated using the 12MO package (<http://livtools.cirad.fr/12mo>) in R version 3.5.3.

III – Results

Parturition rate of both sheep and goats was higher in Matrouh than in Assiut. For both species, offtake rates were higher and mortality rates lower in Matrouh than Assiut, with the exception of adult males because breeders keep very few reproductive males.

Table 1. Parturition and abortion hazard rates

Species	Site	n. adult females	Parturition		Abortion	
			n. event	h±se	n. event	h±se
Goats	Assiut	89	72	0.82±0.09	6	0.07±0.007
	Matrouh	101	93	0.95±0.09	6	0.06±0.006
Sheep	Assiut	408	308	0.76±0.04	12	0.03±0.001
	Matrouh	572	540	0.98±0.04	22	0.04±0.002

The off take rate for young (< 1 year) Barki males and females (2.82 and 1.78, respectively) in Matrouh was high when compared to the same age class of Saidi sheep in Assiut (1.97 and 0.83, respectively). The same could be found for goats, as the off-take rates for young Barki males (2.75) and females (1.8) were higher than off-take rates of young Saidi males (0.75) and females (0.70). In Assiut, there were high mortality rates for young sheep and goats for both males and females when compared to the mortality rates of young sheep and goats in Matrouh. The mortality rates for adult sheep and goats in both sites were low (Table 2).

Table 2. Offtake and mortality hazard rates

Species	Site	Sex ¹	Age class ²	n. animals	Offtake		Mortality	
					N. event	h±se	N. event	h±se
Goats	Assiut	F	A	89	13	0.14±0.04	1	0.01±0.01
		F	Y	25	17	0.70±0.17	24	0.99±0.20
		M	A	14	8	0.51±0.18	0	–
		M	Y	39	23	0.75±0.16	13	0.42±0.12
	Matrouh	F	A	101	8	0.08±0.03	3	0.03±0.02
		F	Y	21	49	1.8±0.26	3	0.11±0.06
		M	A	4	0	–	0	–
		M	Y	15	79	2.75±0.31	6	0.21±0.09
Sheep	Assiut	F	A	408	34	0.08±0.01	24	0.06±0.01
		F	Y	119	79	0.83±0.09	43	0.45±0.07
		M	A	33	24	0.64±0.13	1	0.03±0.03
		M	Y	58	168	1.97±0.15	40	0.47±0.07
	Matrouh	F	A	572	89	0.15±0.02	33	0.06±0.01
		F	Y	104	262	1.78±0.11	33	0.22±0.04
		M	A	34	5	0.16±0.07	0	–
		M	Y	43	361	2.82±0.15	51	0.39±0.06

¹Sex: F: Female, M: Male, ²Age class: A: Adult (>1 year), Y: Young (<1 year).

III – Discussion

In Matrouh, most Barki ewes give birth twice per year and this is in accordance with previous studies by Galal *et al* (2005). Bedouin breeders inherit their flock from their ancestors and have great experience of rearing animals in harsh desert conditions. They are specialized in small ruminant breeding which is their main source of income. Keeping high parturition rates is paramount to maintain their revenue, leading breeders to supplement females during the years of drought for them to produce offspring more than once per year. Lower parturition rates in Assiut may result from the lower importance of small ruminants in Upper Egypt. Farmers with land mainly rely on cultivating their land throughout the year by using irrigation from the Nile, and landless farmers struggle to provide feed for their flock (Alary *et al.*, 2015). Saidi sheep and goats are less valued than large ruminants and only have access to left over crop residues and smaller amounts of concentrates. As a result, lack of feed may partly explain the differences in parturition rates between Assiut and Matrouh. In addition, Barki breeds may have been selected to be inherently more prolific than Saidi that are kept in smaller herds and for which less attention is given to reproductive performance but resilience to feed shortage is paramount.

Young lambs and kids (<1 year) have the highest mortality rate in both sites and both sexes. This may be due to lack of feed, lack of veterinary care, harsh climatic conditions and transboundary diseases in Matrouh. Galal *et al* (2005) reported mortality rate of Barki lambs from birth till 4 months was 6.3 % to 16.6%. The mortality rate of young animals in Assiut was higher than Matrouh and this also may be due to non-specialized management in a mixed production system.

Selling and slaughtering rates were very high for young lambs for males and females in both sites. Selling young animals is necessary for breeders to purchase feedstuffs to feed their flock and veterinary medicine to maintain a core breeding herd of reproductive females. In Matrouh, there is also high market demand on young lambs, as it is preferable for the consumer because lambs have a lean carcass. There was a high selling rate for young males and females compared to Assiut.

High levels of offtake observed in both sites may reflect a drought coping strategy by reducing flock size without affecting reproductive outputs. Alary *et al* (2014) indicated that the breeders in Matrouh usually sell sheep and goats to face drought to maintain their reproductive animals and to cover their family needs. However, this hypothesis remains to be confirmed by comparing the rates measured in 2018 (a particularly dry year in the CWDZ) with years of higher rainfall and pasture productivity.

IV – Conclusions

The last twelve month method is used to roughly evaluate animal performance in small to medium flocks. However, estimated parameters should be interpreted with caution. The two studied agro-ecological zones showed similar parameters for mortality and selling rates for both sheep and goats. Only the parturition rate was higher in Barki compared to Saidi. Our study suggests breeders have different strategies in Assiut and Matrouh when confronted to feed shortage. In Matrouh, family livelihoods depend on small ruminant breeding (especially sheep) particularly during droughts due to lack of revenue from other agricultural activities (barley, olives and figs). Breeders purchase feed to maintain high productivity and sell the lambs and kids to buy food for people and feed for animals. In Assiut, irrigated agriculture provides the main livelihood, and small ruminants are secondary. They feed on left over crop residues and concentrates, Saidi breeds are less productive but may be more resilient to feed shortage. Further experimental work is needed to compare Saidi and Barki breeds under similar climatic conditions and feed rations to disentangle environmental and genetic contributions to animal performance.

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