

The Basenji Annual Estrus: The impact of the rainforest ecology on its development

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Introduction

In Africa the majority of Basenjjs have an annual cycle occurring in the fall (Johannes, 2002). To successfully propagate a species or breed should time their reproduction and birth to ensure the highest survival rate for their offspring. Two major factors impacting mammals' reproduction timing are climate and food supplies (Holmes, 1968). Climate includes precipitation, temperature, and wind. One or more of these factors likely caused the Basenji's ancestor to develop an annual estrus when they migrated with man into the rainforest.

The estrus cycle for the Dog and Goat before and after entering the rainforest

When the Bantu agriculturist moved southeast from the Grassfields of southern Cameroon into the central African rainforest they brought two domestic animals with them, the dog and the goat (Vansina, 1990). Both animals were domesticated outside of Africa, in the Far East for the dog and the Near East for the goat.

The dog was domesticated about 15,000 years ago in East Asia from wolves that were seasonal breeders (Savolainen et al., 2002). Unlike the Basenji, most dogs have a non-seasonal, bi-annual estrus. In the savanna of northern Kenya, the Sambura pastoralist has a Basenji like dog. The dog's estrous cycle occurs two times a year (Straight, 2002). Dogs that have a seasonal, annual estrus mostly live in the tropics (Johannes, 2003). The move into the rainforest appears to have changed the estrus cycle of the Basenji's ancestor.

The goat was first domesticated about 9000 years ago in southwestern Asia from wild ancestors that were undoubtedly seasonal breeders (Walkden-Brown, 2001). Like the Basenji, goats are seasonal breeders generally controlled by short-day photoperiod. The extent to which goats respond to photoperiodic signals varies widely and is largely determined by latitude. Generally at high latitudes ($>40^\circ$) goats have a defined annual season in the autumn to late winter. At intermediate latitudes ($25-40^\circ$) there are variations in breeding from seasonal to year round. In the tropical latitudes ($<25^\circ$) most indigenous breeds of goat are able to exhibit estrous cycles anytime during the year (Walkden-Brown, 2001). When the goat was moved from the savanna to the rainforest the estrous cycle did not change, but continued to occur anytime in the year.

Temperature

Hall (2003) thought that the Basenji's annual estrus in the fall was an adaptional response to spare puppies the unbearable heat and humidity of equatorial summer. Temperature can affect fertility in mammals and high temperatures can adversely affect maturation of spermatozoa (Holmes, 1968).

In tropical Africa (savannah and rainforest) mean annual temperature is greater than 20°C and the difference between the average temperature of the coolest and warmest month is from 2°C to 8°C , making for a small seasonal variation in temperature (Grove, 1979). The highest mean monthly maximum daytime temperatures in the Ituri Forest occur in the dry season, December through February, while lowest maximum daytime temperatures occur in June and July (Bailey & Peacock, 1988). The daily temperature throughout the west and central African rainforest, north or south of the equator, decreases during May through July and is highest February through April (Columbus, 2001).

In the rainforest north of the equator Basenji puppies are born in the hottest part of the year. Mating occurs at the time of year when daily temperatures start rising. Goats breed all year round but two seasonal peaks do occur. It has been observed in Ghana that a peak in kidding occurs in April and a smaller one in September, which implies there is a peak in conception in November and April (ILCA, 1979). The first conception peak (April) occurs when daily temperatures are higher and the corresponding kidding (September) occurs when daily temperatures are lower. During the second conception (November) peak daily temperatures are higher and during the corresponding kidding (April) daily temperatures are higher.

It would seem, therefore, that higher daily temperatures have no impact on either Basenji or goat reproduction.

Precipitation

The precipitation in the African forest is relatively seasonal. In Ghana there is a rainy season from April to June and a little rainy season also occurs from September to November (ILCA, 1979). Peaks in goat conception occur just prior to both rainy seasons. Kid mortality is higher in June and July, due mainly to pneumonia (ICLA, 1979). In the Democratic Republic of the Congo the dry season in the north is from December to March and in the south May to October (Columbus, 2001). North or south of the equator, the winter dry season coincides with the arrival of Basenji puppies. It is possible that precipitation would have an impact on survival of young puppies but it is probably not the reason for the timing of the annual estrus. The goat, instead of avoiding the rainy season, produces more kids to make up for increased mortality.

Food Supply

Canids are distributed throughout Africa but are generally absent from the rainforest (Kingdon, 1997). Although they are highly adaptable, their tendency to prey mainly on abundant ungulates, rodents, hares, and rabbits ties them to grassland, savanna, and woodland habitats (Estes, 1991). The Basenji is the only canid living in the African rainforest. Although the dog is considered a carnivore, it has actually evolved as an omnivore and can be fed a vegetarian diet exclusively (Provet, 2000). In Liberia Standifer (1965) observed that the Basenji's diet is food scavenged from around the village. Primarily it is scraps of rice and palm oil and the palm nuts which they chew for hours. On hunting trips they may get entrails, but for the most part they survive on a low-protein diet. Margaret Miller remembers during her time in Liberia that the people raised pigs and chickens, and hunted in the forest for food. The dogs ate anything left over, which Margaret remembers included a lot of rice (Trois-Hoerr, 2001). Jenike (2002) stated that Basenjies in the Ituri forest were sometimes given scraps of food – mostly manioc and plantain, and allowed to lick blood and eat the occasional entrails from kills and butchering sites, but were generally hungry and on the lookout for food. At night he could also hear them foraging in the village looking for scraps. The Basenji will hunt for its food. In a certain area of the Congo the dogs are not fed and their main source of food is a rat like animal which lives underground (Rundle, 1970). It is much less dangerous and easier to scavenge scraps from around human settlements than hunting in the forest. Tropical forest animal fauna generally have high diversity and low densities and biomass (Owen, 1983). Injury while hunting can occur from the chase or prey. Some leopards develop a taste for dog and prefer prey no heavier than themselves (Estes, 1991 & Kingdon, 2001). It is unlikely the Basenji bitch will want to go far from her puppies before the puppies are weaned. Unlike the wolf, she is not assisted in caring for the puppies by the sire or Basenjies closely related to her (Boitani and Ciucci, 1995). Jenike (2002) observed that nursing mothers were especially hungry, because of additional demand for nutrients as result of lactation. When the mother scavenges for food within a human settlement, it is available close at hand and in a relatively safe environment.

Goats in the humid tropics are fed almost entirely on natural grazing and browse, sometimes supplemented with small quantities of household refuse. Tropical grasses are relatively low in energy in protein and high in fiber content compared with species in the temperate zone, largely as result of their more rapid physiological growth and early maturation (ILCA, 1979). Tropical legumes' loss of nutrients is less rapid and they have higher levels of energy and protein at maturity as compared to grasses. Shrubs and trees retain high levels of nutrients during the dry season, which increase with the new growth before the rains. During the dry season, when grass and legume protein content drop to their lowest levels, goats are able to make use of shrubs and trees (ILCA, 1979). Small ruminants are not herded or grazed systematically, but are allowed to roam freely over the compounds, roads and uncultivated areas to browse and scavenge. During the growing season, they are generally tethered during the day to protect the crops, and they usually return to the household compounds in the evenings where they spend the night. They are fed household refuse when available, such as cassava, plantain and yam peels, but no other form of improved feeding is practiced (ILCA, 1979).

Throughout the year the goat can browse on vegetation with the highest nutrition level. The ability to shift to different types of vegetation allows the goat to avoid nutritional deficits. This is not the case for the Basenji. For the most part, the Basenji is dependent on human leftovers from cultivated food. Seasonal changes in weight for agriculturists in the west and central African rainforest have been observed, with loss of weight occurring from April to June (see figure 1 for Beninese women) and weight gain from July through September. In the Ituri Forest, located in northeastern DR Congo, Lese farmers exhibit seasonality in birth (Bailey, et al., 1992) as well as body weight (Jenike, 1995). Figure 2 shows rates of conception for Lese during the year with most conceptions occurring in the fall. In southwestern Nigeria more conceptions occur in August and September (Ayeni, 1986). This variation in weight and conception rate is determined directly by the availability of food (Bailey, et. al, 1992 and Jenike, 1995). The seasonal rainfall causes an agriculture cycle with April through July a time of shortage and the August through March a time of plenty. This time of plenty coincides with the Basenji's estrus and whelping.

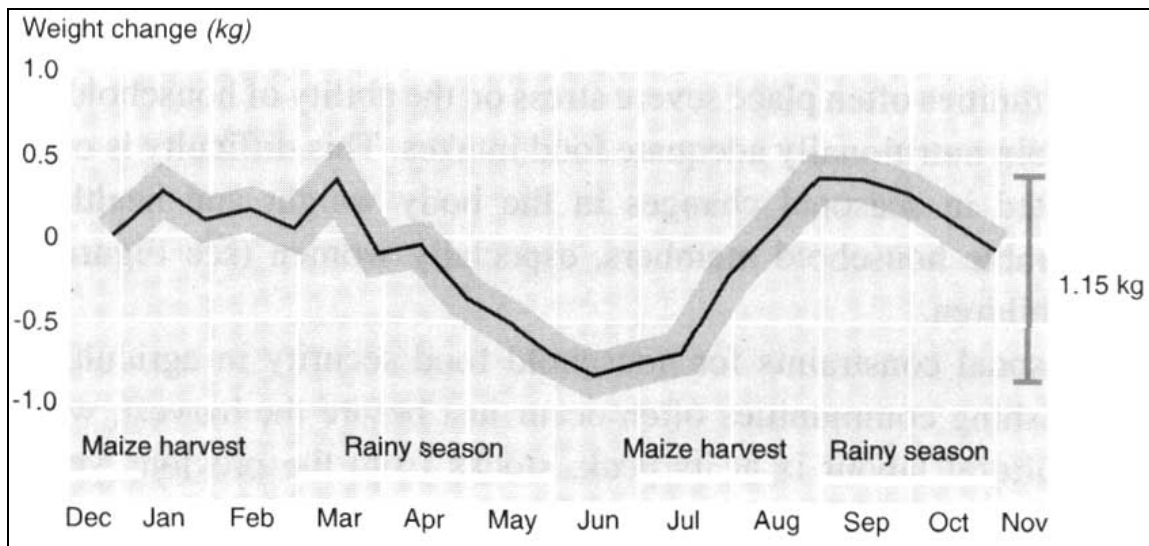


Figure from: Schultink, W. J., et al., 1990.

FIGURE 1 – Seasonal body weight changes of rural Beninese women, Dec. 1985 to Nov. 1986.

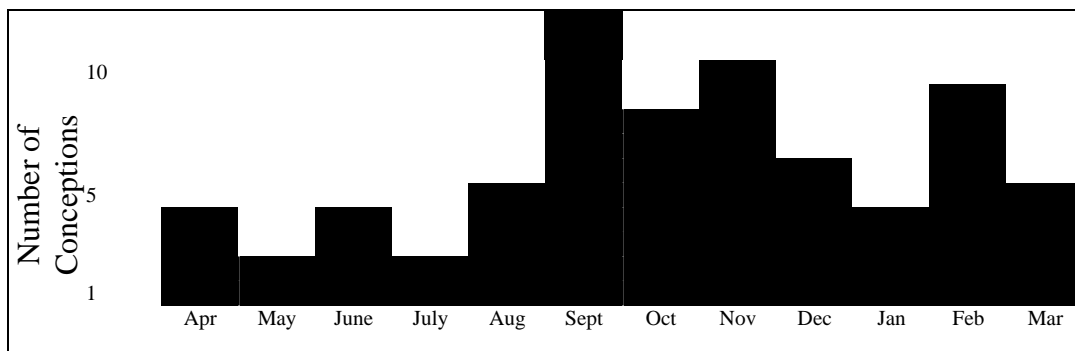


Figure from: Bailey, R. C., et al., 1992.

FIGURE 2 – Frequency of standardised Lese births per conception month in the Ituri Forest.

Conclusions

The main influence on the development of the Basenji annual estrus in the Rainforest is its dependence on the human food supply. Precipitation is also an indirect factor. Seasonality of rainfall causes seasonal availability of food.

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