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COMMUNICATION

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CURRENT DATA ON THE REPRODUCTION OF FOUR-HORNED ANTELOPE *TETRACERUS QUADRICORNIS* IN ZOOLOGICAL PARKS

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Abstract: The Four-horned Antelope *Tetracerus quadricornis* is currently facing numerous dangers throughout its natural range. The major threats include human overpopulation, deforestation, and degradation of its habitat. It is classified as Vulnerable on the IUCN Red List. Now, this species is rare or even absent in most zoos. Given the threats encountered by this species in the wild, its reproduction was analyzed from animal data obtained in European and Indian zoological parks during 39 consecutive years from 1977 to 2016. There was an average of 1.42 new-borns per litter. Twins were more numerous than singletons. Sexual maturity in females did not occur before 18–36 months of age. Most females, however, reproduced for the first time much later, on average at 6–7 years of age and more than half of females produced only one litter. In females that raised their young, new fertilization generally took place 101 days after the preceding birthing. In Indian zoos, where temperatures vary little between seasons, births were numerous in September–February, especially in September–November when rainfall decreases, contrary to deaths that occurred predominantly in June–August during peak rainfall. In European zoos, most litters occurred in December–February. Thus, Four-horned Antelopes maintain part of the birth season of their native countries, despite unfavourable local climate conditions. Deaths of individuals also occurred mainly in December–February in European parks, i.e., during the coldest season. Globally, more males than females died during the first month of life as in other species, but not so after that age. On the whole, there is a low reproductive success in populations of the Four-horned Antelope under managed care compared to other ruminant species. This could partly be due to husbandry and management procedures of individuals in these parks. This raises the question of the possibility of reintroducing individuals into the wild from ex situ livestock.

Keywords: Bovidae, captive population, Chousingha, ex situ conservation, reproductive success.

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Author Contribution: All authors participated in data collection in the French parks.

For **French abstract** see end of this article.

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INTRODUCTION

The Four-horned Antelope *Tetracerus quadricornis* de Blainville, 1816, or Chousingha, is a small antelope in the family Bovidae (15–25 kg) of the tribe Boselaphini that inhabits wooded undulating or hilly areas never far from water in India and Nepal (Haltenorth 1963; Nowak 1999; Leslie & Sharma 2009). The species has a wide but scattered geographic distribution because its natural habitat is affected by deforestation and degradation (Rahmani 2001). Its status is difficult to assess with confidence (Mallon & Kingswood 2001). Numbers are estimated at about 10,000 wild individuals and the species is classified as Vulnerable on the IUCN Red List (IUCN SSC Antelope Specialist Group 2017). Apart from its presence in Indian national parks or protected areas (Mallon & Kingswood 2001), the species has been kept in some European and Indian zoos.

The Four-horned Antelope is exceptional because it is endemic to a restricted area of the Old World and is the only non-domestic mammal species where the male has two pairs of horns. It, however, is poorly known except for the general features of its biology — most authors characterize it as leading a solitary life in dry deciduous forests (Haltenorth 1963; Walther 1988; Nowak 1999; Krishna et al. 2009; Leslie & Sharma 2009). This lack of knowledge is also evident concerning its reproduction, although some specific data were reported by several authors (Shull 1958, 1962; Acharjyo & Misra 1975; Mauget et al. 2000; Leslie & Sharma 2009; Baskaran et al. 2011). Indeed, the species has been very little studied in the wild and is rarely kept under managed care in zoos. It was present in zoological parks in France between 1977 and 2004, in the United Kingdom between 1983 and 1999, and in India only from 2000. In 2018, it was reported as absent from all zoological parks in the world, except for 118 individuals in 12 institutions of India and three individuals in one institution of Nepal (ZIMS 2018). Consequently, in the absence of reliable information from natural populations, it is useful to consider the known characteristics of its reproduction and the fate of individuals that have been held in zoological parks. This will allow us to address the problem of the success of the species in zoological institutions, especially since the future of this species could depend in part on its ex situ conservation.

MATERIAL AND METHODS

Data used in the study exclusively came from two Parisian parks (Parc Zoologique de Paris and Ménagerie du Jardin des Plantes), one English park (Howletts Wild Animal Park), three Indian parks (Sakkarbaugh Zoo, Rajiv Gandhi Zoological Park, and Sri Chamarajendra Zoo), from a report of the Zoological Information Management System (ZIMS 2018). Some other data on the Parisian parks were added from personal observations. Together, this covered the period between 1977 and 2016 and concerned particularly captive-born individuals: 31 males and 34 females in the Parisian parks, 40 males and 61 females in the English park, and 18 males and 32 females in the Indian parks.

Dates of birth and death and age at death of all individuals were recorded for zoos within each country. Some new-borns were stillborn or died before one month of age (28 out of 30 new-borns died before 14 days), probably due to insufficient reproductive capacities of the mothers. They were grouped into the same category of young less than one month of age. Young older than one month were a priori considered as viable individuals.

All available information on the reproduction of females was taken into consideration: age at first litter, date, composition and sex ratio of each litter, and the interval between two successive litters. Finally, to determine whether the reproduction of this species was seasonal, these different parameters were compared to those of local temperature and rainfall according to four periods of three months each, i.e., December–February, March–May, June–August, and September–November.

Data were processed by categories of sex, age, rearing condition, and season, globally and in each country, using the χ^2 -test. Means were compared with the t-test. Data concerning small samples were processed with the Mann-Whitney U-test, and the corresponding correlations calculated with the Spearman's rank-correlation coefficient r_s . In all statistical comparisons, $p > 0.05$ was considered non-significant (ns).

RESULTS

Litter composition

As shown in Table 1, the Four-horned Antelope produces one or two young per litter (87 litters vs. 69 litters, respectively) with an average of 1.42 new-born per litter (1.38–1.45, according to the country). There is no difference in the litter composition between

Table 1. Composition of Four-horned Antelope litters, according to country. Parks in France: Parc Zoologique de Paris and Ménagerie du Jardin des Plantes. Park in the United Kingdom: Howletts Wild Animal Park. Parks in India : Sakkarbaugh Zoo, Rajiv Gandhi Zoological Park, and Sri Chamarajendra Zoo.

		France (two parks)	United Kingdom (one park)	India (three parks)	All parks (six parks)
Number of litters		46	71	39	156
Number of new-borns		65	103	54	222
Number of new-borns/litter		1.41	1.45	1.38	1.42
% of singleton new-borns	1 male	22.58	14.56	17.95	17.73
	1 female	22.58	23.30	15.38	21.16
	Subtotal	45.16	37.86	33.33	38.90
% of twin new-borns	2 males	6.45	11.65	10.26	9.79
	2 females	9.68	23.30	25.64	19.88
	1 male + 1 female	38.71	27.18	30.77	31.43
	Subtotal	54.84	62.14	66.67	61.10
Sex ratio male/female		1:1.07	1:1.51	1:1.29	1:1.31

Table 2. Males and females of Four-horned Antelopes born and surviving for less than one month in European zoological parks.

	France (two parks) % (number)	United Kingdom (one park) % (number)	All parks (three parks) % (number)
Males	45.16 (14)	56.10 (23)	51.39 (37)
Females	26.47 (9)	25.81 (16)	26.04 (25)
Both sexes	37.10 (23)	37.86 (39)	37.58 (62)

countries ($X^2=1.291-8.085$, $df=4$, $p>0.05$, ns). Twins are 1.55 times more numerous than singletons and as often of the same sex as of different sexes (64 vs. 60). The sex ratio at birth is in favour of females, although not significantly ($X^2=0.114-1.367$, $df=4$, $p>0.8$, ns).

Percentage of young living less than one month

New-borns dead before one month of age were taken into account in European parks, but not in Indian parks where age at death was reported for few young and only from the end of 2009. Males die more often than females during the first month of life, on average at 52.1% vs. 26.6%, respectively ($X^2=11.228$, $df=1$, $p<0.001$; Table 2). Consequently, the sex ratio at one month becomes unbalanced in favour of females: on average 0.56 male per female vs. 0.76 at birth ($X^2=6.665$, $df=1$, $p<0.01$). At one month, it remains only 0.90–0.91 living young per litter.

Interval between two successive litters

Twenty-four intervals between two successive litters were available concerning 14 out of 33 breeding

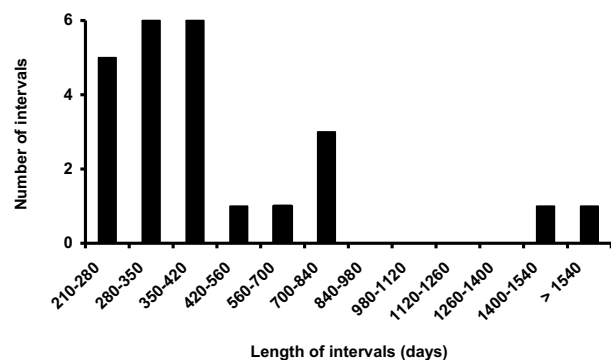


Figure 1. Distribution of intervals between successive litters in Four-horned Antelope females.

females since the other females produced only one litter. The average inter-birth interval in all females was variable (Fig. 1). A new litter, however, was produced in the majority of cases (17/24) 318.8 ± 13.3 days after the preceding one. Considering the gestation periods reported in this species (Table 3), new fertilization thus occurred on average 88.6 ± 8.6 days after birthing.

The interval between two successive litters did not depend on the fate of new-borns. In females whose new-borns lived less than one month, the mean interval was not significantly shorter than that of females whose young lived 1–4 months or more (492.2 ± 124.7 days vs. 496.7 ± 94.3 , respectively; $U_{9,15}=68$, $p>0.05$, ns). In nine females that reared their young until weaning, the interval indicated that they were again receptive an average of 100.6 ± 51.3 days after birth (32–185 days), which is comparable to the above value.

Finally, the net production of 21 females followed

Table 3. Characteristics of reproduction of females and survival of individuals in Four-horned Antelopes.

	Shull 1958, 1962	Haltenorth 1963; Walther 1988; Nowak 1999	Achariyo & Misra 1975	Mauget et al. 2000	Leslie & Sharma 2009	Baskaran et al. 2011	This study
Gestation period	233, 246 days	7.5–8 months				~8 months	
Number of new-borns/litter		1–3	1.83	1.59	1.6	1.6	1.38–1.45
Sex ratio M:F at birth				~1:1.04			1:1.07–1.51
% of young dead before one month							37.1%–37.9%
Interval between successive litters			285, 347 days				318 days (210–413)
Age at first fertilization			13 months				18–36 months
Age at first litter			21 months				26–44 months
Maximum longevity		10–12 years			17.4 years		12.7–17.5 years
Sex ratio M:F in individuals >1 month					1:1.41–2.70		1:1.08–2.70
Birth season (maximum)	Nov, Mar	(Jan–Feb)	Jan–Apr	Aug–May	Whole year (Oct–Nov)	(Feb–May)	Whole year (Sep–Feb)
Fertilization season (maximum)	Mar, Jul	(Jun–Sep)			(Jun–Jul)	(May–Jul)	Whole year (Jan–Jun)
Mortality season (maximum)							Sep–Feb or Jun–Aug

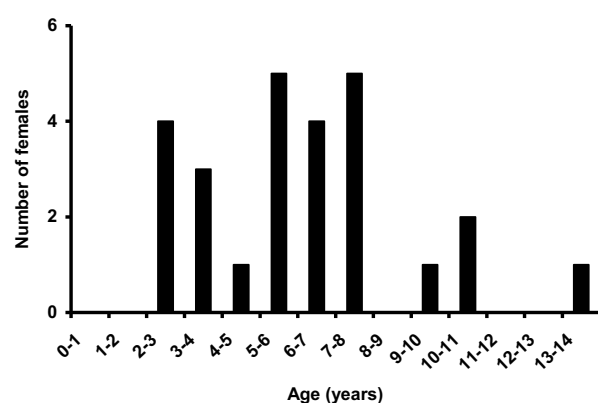


Figure 2. Age of Four-horned Antelope females at first litter.

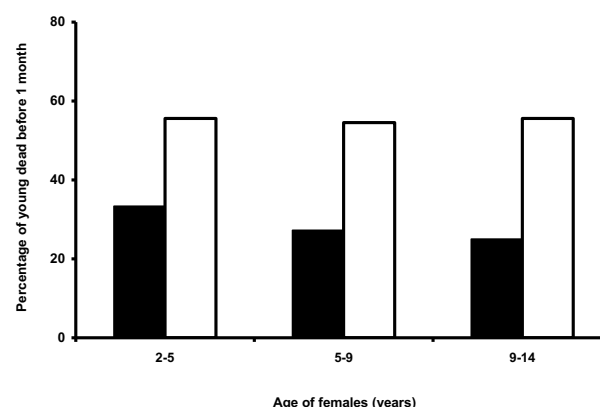


Figure 3. Overall percentage of young that died before one month of age, according to the age of Four-horned Antelope females. Black bars - first litters, white bars - following litters.

over eight consecutive years was an average of only 0.13 juvenile (older than one year) per female per year.

Variations according to age

(a) First litter in females

First litters do not occur in females before 26–44 months of age (Fig. 2). Considering again the gestation period, this corresponds to the first fertilization between 18 and 36 months of age. Many females (18/33), however, produce only one litter at an older age (after five years), and thus there is no significant difference in the mean age of all captive females between first litters and the following ones: 6.06 ± 2.70 vs. 7.08 ± 2.39 years

($t=1.349$, $df=46$, $p>0.1$, ns). There are as many new-borns per litter in first litters as in subsequent ones: 1.41 ± 0.50 vs. 1.48 ± 0.51 ($t=0.519$, $df=55$, $p>0.5$, ns).

(b) Percentage of young living less than one month (Europe only)

The percentage of young living less than one month is lower in females of 5–8 years of age than in younger and older females (30.0% vs. 55.8%; $X^2=4.702$, $df=1$, $p<0.05$). Curiously, this percentage in first litters is half of that of the subsequent litters, regardless of age

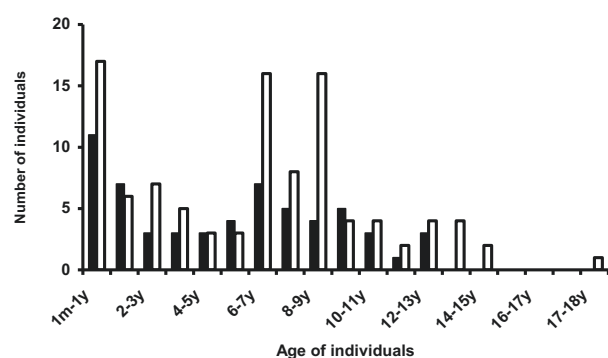


Figure 4. Age at death of viable individuals (>1 month of age) of Four-horned Antelopes. Black bars - males, white bars - females, m - month, y - year.

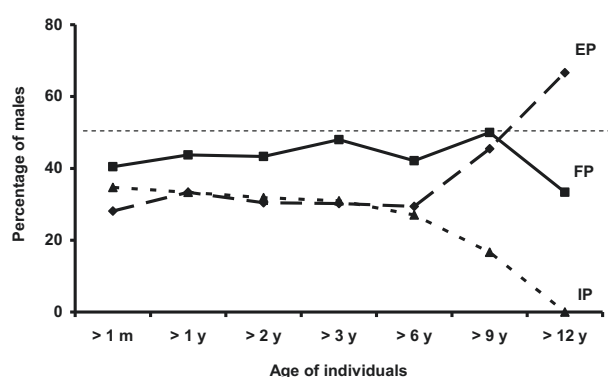


Figure 5. Percentage of males of Four-horned Antelopes, according to the age of individuals. The dashed horizontal line indicates 50% males. French parks - FP, continuous line; English park - EP, dashed line; Indian parks - IP, dotted line. m - month, y - year.

category (on average: 28.9% vs. 55.2%; $\chi^2=4.702$, $df=1$, $p<0.05$; Fig. 3).

(c) Death of viable individuals

The average percentage of individuals living in European parks decreases from 67.3% after one month of age to 52.4% after one year. Thereafter, individuals die especially between six and nine years in all parks (Fig. 4). The average lifespan varies from 4.8 years to 6.2 years, with no difference between sexes or countries ($\chi^2=0.906-5.022$, $df=5$, and $\chi^2=0.656-3.363$, $df=6$, respectively, $p>0.2$, ns). The maximum longevity for a female is 17.5 years in the Parc Zoologique de Paris and 12.8 years for a male in the Howletts Wild Animal Park.

From one month to nine years of age, the percentage of males in the population remains almost stable (between 27.0 and 48.0%; Fig. 5), with no difference between countries ($\chi^2=0.719-1.866$, $df=5$, $p>0.8$, ns).

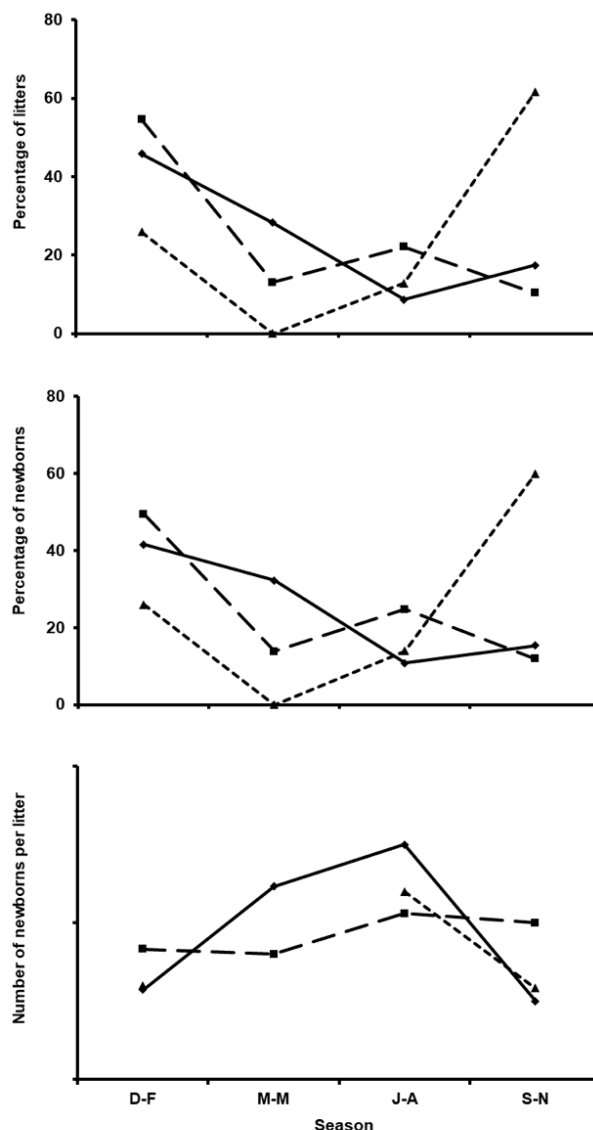


Figure 6. Seasonal distribution of Four-horned Antelope. a - litters (%); b - new-borns (%); c - number of new-borns per litter. December–February (D-F), March–May (M-M), June–August (J-A), September–November (S-N). French parks - continuous line, English park - dashed line, Indian parks - dotted line.

Seasonal variations

(a) Litters

In all parks, births occur throughout the year, except between March and May in India (Fig. 6a). The percentage of litters born in each season, however, varies in each country ($\chi^2=7.126-17.299$, $df=3$, $p\sim 0.05$ – $p<0.001$). A high percentage occurs between December and February in the European parks (45.9% and 54.6% of all births in France and England, respectively), and between September and November in the Indian parks (61.5%). Differences between countries are significant ($\chi^2=8.143-35.611$, $df=3$, $p<0.05$ – 0.001).

(b) New-borns

Because the percentage of individuals born in each season is directly correlated to that of litters in the three countries ($r_{s4}=1.00$, $p<0.05$), the same seasonal distribution occurs concerning the new-borns (Fig. 6b), with comparable variations in each country ($X^2=8.446$ – 21.931 , $df=3$, $p<0.05$ – 0.001) as differences between countries ($X^2=11.301$ – 41.024 , $df=3$, $p\sim 0.01$ – $p<0.001$).

The number of new-borns per litter varies in the opposite direction to the percentage of litters, with a small increase between June and August (Fig. 6c). There, however, is no direct relationship between these two data (r_{s4} varying from -0.4 to 0.2 , ns). Furthermore, the seasonal variations are not significant in each country ($X^2=0.053$ – 0.433 , $df=3$, $p>0.9$, ns) as are the differences between countries ($X^2=0.049$ – 0.862 , $df=3$, $p>0.8$, ns).

(c) Young dead before one month of age (Europe only)

Seasonal variations of young that died before one month of age are comparable to those of births, with a maximum between December and February (44.4% and 45.1% of all deaths in France and England, respectively), although deaths are also numerous in September–November in England, and with a minimum in June–August (Figs. 7A-2,B-2). These seasonal variations are obvious in England ($X^2=9.313$, $df=3$, $p\sim 0.02$), but not in France ($X^2=5.077$, $df=3$, $p>0.10$).

(d) Death of viable individuals

As above, the maximum number of deaths of viable individuals occurs in December–February in European parks (47.4% and 31.5% of all deaths in France and

England, respectively), with a minimum in June–August (Figs. 7A-2,B-2). On the contrary, there is a clear maximum of deaths in June–August in the Indian parks (Fig. 7C-2), principally in July where 83.3% of annual deaths are recorded in the Sakkarbaugh Zoo and 85.7% in the other parks. There is a great difference on this point between these two types of countries ($X^2=55.877$ – 77.187 , $df=3$, $p<0.001$), since the seasonal variations are obvious in India ($X^2=47.051$, $df=3$, $p<0.001$), but not in Europe ($X^2=5.334$ – 5.671 , $df=3$, $p>0.1$, ns).

(e) Correlations with local climate conditions

As reported above, the percentage of births in Europe is highest between December and February, when the temperature is the lowest (Figs. 7A-1,A-2 in France; Figs. 7B-1,B-2 in the United Kingdom). Consequently, an inverse relationship appears between these two events in France ($r_{s4}=-1.00$, $p<0.05$). The same could be true concerning the death of young before one month of age and that of viable individuals ($r_{s4}=-0.80$). On the contrary, there is no apparent link with rainfall ($r_{s4}=0.20$ – 0.40 , ns).

In India, where the average daily temperature varies little (24.7 – 28.7 °C, according to the season), births are numerous in September–February, especially in September–November when rainfall decreases, contrary to deaths of viable individuals that occur predominantly in June–August during peak rainfall ($r_{s4}=0.80$; Figs. 7C-1,C-2). Notable differences, however, exist between parks. At Sakkarbaugh Zoo (22°N), births are most numerous after heavy rainfall (74.3% of the total in September–November), contrary to deaths that are the

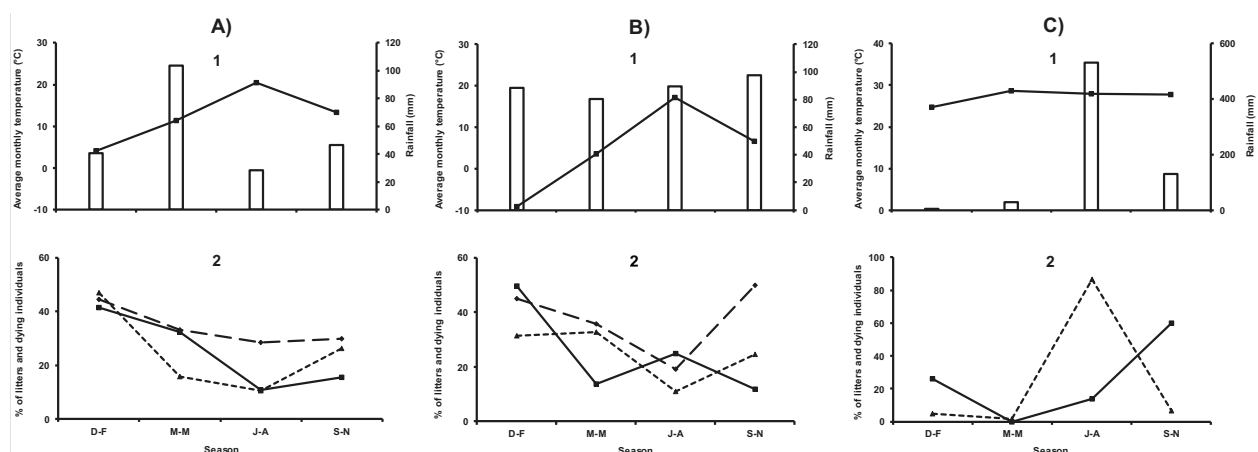


Figure 7. Climate conditions and percentage of litters and dead individuals of Four-horned Antelopes according to seasons in the parks. A - France; B - the United Kingdom; C - India. 1 - average monthly temperature (continuous line) and rainfall (white bars); 2 - percentage of litters (continuous line), young that died before one month of age (dashed line) and dead viable individuals (dotted line) in December–February (D-F), March–May (M-M), June–August (J-A), and September–November (S-N). Young dying before one month of age were not recorded in the Indian parks (see text).

most numerous (83.3%) precisely in July, the rainiest month of the year (840mm). In the other Indian parks (12–21 °N), heavy rains last longer, from June to October. At Rajiv Gandhi Zoological Park, the maximum number of births occurs later than above, in December–February. The maximum number of deaths (79.2%), however, still takes place in July, the month with the highest rainfall (235mm).

DISCUSSION

On the basis of values reported to date (Shull 1958, 1962; Haltenorth 1963; Walther 1988; Nowak 1999; cf. Table 3), the gestation period lasts between 228 and 246 days. It could even be shorter since an interval of only 210 days between two successive litters was reported in the Howletts Wild Animal Park. It, however, is greater than that of most ruminants of comparable body mass, such as *Sylvicapra grimmia* and *Capreolus capreolus*, where it often represents only 160–220 days (Dubost et al. 2011).

The average interval of 319 days between two successive litters in females is consistent with the data previously reported by Acharjyo & Misra (1975). Analysis of intervals occurring in females that raise their young indicates that they are receptive an average of 101 days after birth, which corresponds to a normal suckling period for a ruminant species of similar size (Dubost 1978; Dubost et al. 2011; Riesch et al. 2013). Nevertheless, two values deserve special attention. In the Howletts Wild Animal Park, one female gave birth 247 days after its preceding litter of which one of the two new-borns was suckled for 43 days. In the same park, another female gave birth 264 days after a preceding litter whose unique new-born had to be hand-reared. These two cases suggest that post-partum oestrus could occur 1–19 days or 18–36 days after birth, respectively, in this species. The average interval between two successive litters and the fact that the females that do not suckle their young do not become receptive again significantly before those that do rear their young, however, could signify that the Four-horned Antelope usually reproduce only once annually.

The number of new-borns per litter is one or two, an average of 1.42. Three young were never encountered, contrary to the indication of Walther (1988), and the high values reported in the literature are based on small samples (11 and 14 new-borns in Acharjyo & Misra 1975 and Baskaran et al. 2011, respectively) unlike in this study (216 new-borns). Twins are more numerous than

singletons and as often of the same sex as of different sexes, as in other species (Williams & Rudge 1969; Riesch et al. 2013).

The sex ratio is not different from unity at birth, which is consistent with other ruminant species (Williams & Rudge 1969; Dubost 1978; Riesch et al. 2013). It becomes unbalanced in favour of females at one month of age, because males die more often than females during the first month of life for unknown reasons, as occurs also in numerous other ruminant species (Williams & Rudge 1969; Dubost 1978). It, however, does not significantly vary between one month and nine years of age.

The minimum age of females at first fertilization in these parks (1.5–3 years) is greater than that previously reported by Acharjyo & Misra (1975) and than those known in comparable-sized ruminant species (Williams & Rudge 1969; Dubost 1978; Dubost et al. 2011; Riesch et al. 2013). In addition, many females reproduce for the first time later in life and give birth to only one litter. Consequently, there is no difference in the mean age of all captive females between their first and following litters.

Contrary to what one might expect, first litters appear to be more successful than the following ones — they produce as many new-borns per litter as the latter, but their percentage of young that die before one month is half that of the subsequent litters, regardless of the age of the mother.

In Indian parks, most young are born during a period of six months (September–February), always after the heavy rains, as occurs in nature (Krishna et al. 2009). In Europe, births are at a maximum between December and February as in India, but this corresponds locally to the coldest season of the year. Thus, even after living for many years in Europe, this species has maintained part of the birth season of its native countries, despite unfavourable local climatic conditions. The length reduction of the maximum period of births from six to three months corresponds to the increase in latitude between the Indian and European parks (12–22 °N vs. 49–51 °N, respectively).

Maximum number of deaths also occurs in Europe in the same months as births, i.e., in December–February, the coldest season, although shelters were available in most parks. There is no apparent link with local rainfall, unlike in India where deaths almost exclusively occur in the rainiest month (July) while the temperature varies little. Thus, in each country, deaths seem correlated with the most locally unfavourable climatic factor.

In Europe, the number of young per litter decreases from 1.41–1.45 at birth to only 0.69–0.76 at one year

of age, when the young are supposed to disperse (Sharma et al. 2009; Baskaran et al. 2011) and breed for the first time. This corresponds to a survival rate of 48–54 %, which is comparable to that of other ruminant species where it is usually between 40% and 70%, as is comparable to the high mortality of adults between six and nine years of age (Williams & Rudge 1969; Dubost 1978; Garrat et al. 2015). The absence of sexual difference in the average longevity of individuals, however, is rather unusual and could be due to the living conditions in captivity, since males generally have a shorter lifespan than females under natural conditions (Dubost 1978; Garrat et al. 2015). The maximum lifespan of the Four-horned Antelope is consistent with data known from other ruminants of similar size under managed care (Dubost et al. 2011).

CONCLUSIONS

There is a relatively low success of sustainable populations of the Four-horned Antelope under managed care, since no more young survive to reproductive age in this species than in the others, despite a relatively larger litter size. For example, the Water Deer *Hydropotes inermis*, a small cervid of comparable body mass living semi-freely in a large park, multiplied its population by 1.4 in three years in France and showed a mean annual net increase in population of 26% during the first seven years in United Kingdom (Dubost et al. 2011). Considering that the average litter size of the Four-horned Antelope is 56% that of the Water Deer (2.53 new-borns per litter in *H. inermis*), the annual net increase of Four-horned Antelope populations must be between 7.5 and 14.6%. Thus, the Four-horned Antelope apparently shows a low success rate and this could explain why it is rarely kept in zoological parks.

It is not possible to know whether these results are characteristic of this species since there are no reliable data on its reproduction under natural conditions. The fact that the percentage of young that died before one month of age in first litters is half that of those in subsequent ones, however, could signify that the reproductive capacities of captive individuals decrease with time. Limited space, management requirements or difficulties, and delays in obtaining or exchanging individuals between parks could also be reasons why most females do not reproduce for the first time before 5–8 years of age and give birth to only one litter. Furthermore, the management process of captive individuals, such as the isolation of males, may cause a

delay in the age of females at first reproduction and a lengthening of the interval between successive litters. Conversely, life in special conditions, as is the case in zoological parks, could explain why the percentage of males does not decrease significantly between one month and nine years of age, contrary to the wild. Finally, the fact that most births in Europe occur when the climatic factors are locally unfavourable could also be a cause of the low success of captive populations of this species. Unfortunately, we do not currently have the means to verify these points. If, as supposed, the survival of this species in the wild should depend partly in the future of populations kept in zoological parks, it is necessary that detailed scientific studies of this species be carried out as soon as possible.

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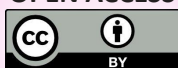
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French Abstract: Résumé: Le Tétracère *Tetracerus quadricornis* fait face actuellement à de nombreux dangers dans la nature, principalement à cause de la surpopulation humaine, de la déforestation et de la dégradation de son habitat. Il est classé comme Vulnérable dans la liste rouge de l'U.I.C.N. Actuellement, cette espèce est rare ou même absente dans la plupart des zoos. Compte-tenu des risques qu'il encourt à l'état sauvage, sa reproduction a été étudiée à partir de données obtenues dans des parcs zoologiques d'Europe et d'Inde pendant 39 années consécutives de 1977 à 2016. Il y a eu une moyenne de 1,42 nouveau-nés par portée. Les jumeaux étaient plus nombreux que les jeunes uniques. La maturité sexuelle des femelles n'avait pas lieu avant l'âge de 18-36 mois. Cependant, la plupart des femelles se sont reproduites pour la première fois beaucoup plus tard, en moyenne à 6–7 ans, et plus de la moitié n'ont eu qu'une seule portée. Chez les femelles ayant élevé leur jeune, une nouvelle fécondation avait lieu généralement 101 jours après la naissance précédente. Dans les zoos indiens, où la température varie peu selon les saisons, les mise-bas étaient nombreuses entre septembre et février, et surtout en septembre-novembre quand la pluviosité diminue, contrairement aux décès qui se produisaient surtout en juin-août, au maximum des pluies. Dans les zoos européens, la plupart des naissances avaient lieu en décembre-février. Le Tétracère avait donc gardé partiellement en Europe la saison de reproduction de son pays d'origine, en dépit de conditions climatiques localement défavorables. Les décès avaient également lieu surtout en décembre-février en Europe, donc pendant la saison la plus froide. Globalement, les mâles mouraient davantage que les femelles au cours de leur premier mois de vie, comme cela se rencontre chez d'autres espèces, mais il n'y avait plus de différence entre les sexes après cet âge. Dans l'ensemble, il y a un faible succès de reproduction du Tétracère maintenu en captivité, comparé aux autres ruminants. Cela pourrait être dû en partie aux conditions de maintien et de gestion des individus dans ces parcs. Cela pose la question de la possibilité de réintroduire des individus dans la nature à partir d'élevages ex-situ.





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