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Displacement of pregnancy in roe deer *Capreolus capreolus*

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In autumn 1993, a Danish hunter informed the Department of Wildlife Ecology of the National Environmental Research Institute that he had shot a doe with a full-grown foetus in the uterus on 7 October 1993. The fawn was a female with fully-developed hooves and coat complete with white spots. The fawn weighed nearly 1,400 g, which corresponds to normal delivery weight. If the mother had not been killed, the fawn would have been born within at most two weeks. The mother was estimated to be two years old (based on tooth-wear), although it was not possible to obtain the reproductive organs.

The roe deer *Capreolus capreolus* is the only ruminant exhibiting delayed implantation, i.e. an embryonic diapause. The eggs are fertilised shortly after breeding, but remain in the uterus for 4.5 - 5 months before actual foetal development commences. Thus, roe deer have a total pregnancy period of 9.5 months. Based on body size comparisons with other ruminants, roe deer should have a gestation period of only 4 - 5 months (R. Hofmann, pers. comm.).

Despite the great variation in timing of birth, the record of a full grown foetus in October represents a considerable deviation from the norm. Very few records of pregnancy outside the usual period of gestation exist, and a full grown foetus in October has never before been reported. On a theoretical basis there may be at least two possible explanations for this displacement of pregnancy. Firstly, the doe might have copulated in January, followed by a normal gestation period of 9.5 months, or, alternatively, the doe might have conceived in May and developed the foetus without diapause. The first explanation seems highly unlikely. Not only would the female need to have been on heat almost six months outside the normal season, but a sexually active male able to procreate would also be required at the same time. Normally, roe deer bucks are physically unable to produce sperm in January, but the possibility that a female on heat could induce rutting behaviour among males cannot be completely ruled out. Conception in May is the more probable explanation, since examples of embryonic development without delayed implantation exist. Raesfeld (1977) quotes an example from Germany, where a 10-month old female kept in a paddock with a male of the same age mated several times from 1 April and gave birth to a fawn on 28 August.

Three cases of fully developed foetuses have been reported from November and December: Short reports one from 28 December 1976 in Scotland (in Hofmann 1981), and Rank reports one from 13 December 1975 in Germany (in Hofmann 1981). In both cases, the mother was shot and the foetus was found while cleaning the carcass. Both does were carrying one fawn and both fawns were considered to be close to birth by experienced veterinarians. The third example comes from Switzerland, where a female killed in a car accident on 12 November 1976 contained two foetuses. According to a local hunter, they

would have been fully developed within a few weeks. Their stages of development correspond to weights of 1,050 and 1,120 grams, respectively (Hofmann 1981). All three does could have become pregnant during the normal rut season in July - August and could have developed foetuses without diapause.

The stimulus initiating foetal development remains unknown. The commencement of foetal development late in the year has led to the assumption that changes in day-length after the winter solstice could be the determining factor. However, this does not explain the variation in timing of birth. Rieck (1955) states (after Hübner 1938) that the duration of embryonic development could be prolonged under harsh climatic conditions. This is not in accordance with results obtained in Danish investigations which show that foetus development is similar in East and West Jutland populations. However, embryos from deer in West Jutland (Borris) reach a given weight 13 days later than those from Kalø in East Jutland (Strandgaard 1972a). Furthermore, differences in the timing of rutting between the two Danish areas may indicate that other factors than day-length are involved, e.g. timing of insemination. At Kalø, the earliest recorded date of copulation is 1 August and copulation has not been observed after the end of August (Strandgaard 1972b). At Borris, copulation has been observed in early September.

Why some individuals on rare occasions depart from the normal timing of the breeding season is not clear, but it may represent the extreme range of variation. Birth of roe deer fawns usually occurs in early summer, with some geographical variation throughout the range of the species (Danilkin 1996, table 8.2). For example, in East Jutland (Kalø) the median date of birth (i.e. the date when 50% of the fawns of the year have been born) is 2 June compared with 14 June in West Jutland (Borris). This difference corresponds well with a 13-day delay in foetus development in females from Borris compared to females from Kalø (Strandgaard 1972a). Within the study areas, there is considerable variation in the timing of birth. At Borris, the earliest record of a newborn fawn is 10 May and the latest 19 July (Fig. 1). The corresponding dates for Kalø are 25 April and 8 July, respectively. Rieck (1955) stated that the median date for birth of fawns was 1 June in western Germany and 9 June in eastern Germany, and that the fawning period in southwest Germany extends from the end of April to the end of June, compared to early May till early July in the northeastern part of the country.

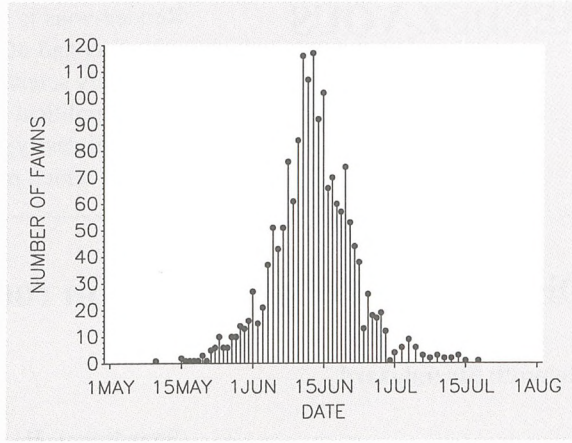

Figure 1. Extend of the fawning period in the Borris area, based on 1,692 newborn fawns, ear-tagged during 1956-1980. Eighty per cent of the births were given within 19 days.

Gaillard et al. (1993) give 15 May as the median date for a French population, and Linnell (1994) gives 21 May for a population on the west coast of Norway (Danilkin 1996).

The process of delayed implantation in roe deer is still not fully understood. It seems to be an evolutionary strategy enabling rutting and fawning to occur under the most favourable conditions, i.e. at different times at different geographical locations. Selection might constantly act by adjusting time of birth as fawns born under the most favourable conditions have the highest probability of survival and hence reproductive success. In this way the species maintains a relatively fixed breeding season. However, since there are spatial and temporal variations in environmental conditions there may be an adaptive advantage in maintaining a degree of variation in the time of breeding. This would provide the mechanism for adapting to different conditions, such as those reported from the Borris, and Kalø areas. West Jutland roe deer are immigrants from East Jutland where the mean monthly temperature for May, June and July is 0.5°C higher than at Borris, and in the Borris area night-frost frequently occurs even in June. It is obvious that spring arrives later in Borris than in East Jutland. Plants start to grow later in Borris, and furthermore different plant species are available as food resources (Petersen & Strandgaard 1992). So time of birth may have been adapted to fit available feeding resources as well as climatic conditions. Unfortunately, so far no investigations on the relationship between food quality and reproductive timing have been carried out.

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