

Original Article

The prenatal mortality rate of the wild boar (*Sus scrofa*) in Gunma Prefecture

ANEZAKI Tomoko

Gunma Museum of Natural History: 1674-1, Kamikuroiwa, Tomioka, Gunma 370-2345, Japan
(anezaki@gmnh.pref.gunma.jp)

Abstract: The reproductive status of wild boar (*Sus scrofa*) is evaluated based on the examination of ovaries, a number of corpus luteum, retrograded corpus luterum, and embryos or fetuses. These data are used to estimate number of ovulation, number of implantation and the rate of pregnancy. However, it is known from the studies of domesticated pigs that number of piglets per swine is highly influenced by not only the number of ovulation and implantation, but also the fetal mortality rate. Therefore, in this study, the reproductive performance of female wild boar is investigated based on their fetal mortality rate.

A total of 401 female wild boars collected from April 2007 to June 2011 were used in this study. Out of 401 samples, corpus luteum and embryo/fetus were found in 78 individuals. The average number of corpus luteum was 5.7, average number of embryo or fetus was 4.2, and overall prenatal mortality rate was 27.2%. The percentage of degenerated embryo or fetus was high at 60 and 100 days at pregnancy at 22.6% and 27.3%. The high survival rate of embryo or fetus indicates the successful reproduction of boars in Gunma Prefecture, which implies further increase in the number of boars in the region.

Key Words : *Sus scrofa*, prenatal mortality, corpus luteum, embryo, fetus, degeneration

Introduction

It is important to evaluate the reproductive status of boars throughout the year based on a long term survey in order to understand the population dynamic of boars and assess the impact of different management strategies. The wild boar (*Sus scrofa*) has adapted well to the natural environment of Gunma Prefecture. Their distribution has expanded to lowlands, and the frequent appearance of boars in the human habitat had increased the conflicts, such as damage to agricultural crops, in the past 10 years.

The reproductive status of wild boar (*Sus scrofa*) in Japan is mainly investigated during the hunting-season and the reproductive performance of boars differed among prefectures (Kanzaki, 1993; Nature Conservation Division of Chiba Prefecture and Boso Deer Research Group, 2001, 2002; Wildlife Management Office Inc., 2001; Japan Wildlife Research Center, 2002). The number of ovulation, number of implantation and the rate of pregnancy are evaluated based on the examination of ovaries, a number of corpus luteum, retrograded corpus luterum, and embryos or fetuses. However, it is known from the studies of domesticated pig that the number of piglets per swine is highly influenced by not only the number of ovulation and implantation, but also the fetal mortality rate (e.g. Tsutsumi, 1970a). The reproductive success of wild boar is known to be high compared to other ungulates (Kaminski *et al.*, 2005; Keuling, 2009), but there are no studies investigating the prenatal mortality rate of the Japanese wild boar as there are for *Sus scrofa* in other countries (e.g. Baber and Coblenz, 1986, Nahlik and Sandor, 2003), and it needs to be examined for understanding their reproductive

status. Therefore, the aim of this paper is to evaluate both the number of ovulation and the prenatal mortality rate of the wild boar in Gunma Prefecture.

Materials and methods

The ovaries and uteri of 401 female wild boars were collected from April, 2007 to June, 2011 in Gunma Prefecture (Fig.1). The ovaries were examined visually from the outside and then dissected to determine the presence of corpus luteum, follicles and corpus albicantia. The number of corpus luteum on left and right ovaries was counted. The presence of corpus luteum indicated the number of ovulation that had occurred for the individual implying the number of potential fetuses present. The uteri were cut off along with ovaries from the individual for close examination to check for pregnancy. The length of horns and tubes of the uterus were measured. The uterus was cut open along the antimesenterial line, the position of the embryos and fetuses was recorded to estimate the number of litters produced by females based on Andersen (1927), Warwick (1928), Patten (1948), Tsutsumi (1970a, 1970b), Matsumoto (1985), Rural Culture Association Japan (1986) and Bruzewicz (2000). The embryo or fetus located closest to the tube was numbered as L1 or R1; L and R corresponding to the left and right uterus horns, respectively. The number increases as the embryo or fetus is located closer to the ovaries. Embryos or fetuses were weighed and gender was determined in a fetus whenever sexual characteristics could be distinguished. In general, the gender could be determined in a fetus measuring more than 5cm (Patten, 1959). The crown-rump



Fig.1. Sampling locations of the wild boar in Gunma Prefecture. The line indicates the municipal boundaries. Sample numbers are shown in parentheses. Darker shaded areas indicate higher elevation. The darkest for altitude over 2,000m, dark for 1,000 to 2,000m, light dark for 500 to 1,000m, slight dark for 200 to 500, light gray for 100 to 200, white for 0 to 100m.

length was measured to estimate embryo or fetus age (Patten, 1959 ; Marrable and Ashdaown, 1967 ; Matsumoto *et al.*, 1985 ; Gethoffer *et al.*, 2007) . A gestation period of 114 days was used for estimating the age of embryo or fetus (Rural Culture Association Japan 1986; Niwa *et al.*, 1994) .

The rate of prenatal mortality and rate of degenerated embryo or fetus were calculated according to Hammond(1921) , Corner (1923) , Warwick(1928) , Pomeroy(1960) , Tsutsumi(1970a, 1970b) , Matsumoto(1985) , and Rural Culture Association Japan (1986) .

Result

Of the 401 individuals collected, 78 individuals had embryos or fetuses. All of these pregnant females were captured between the months of December to August (Fig.2) . We found 448 corpus luteum and 326 live embryos and fetuses. We estimated an over-all prenatal mortality as 27.2% (122/448, Table.1) . The mean number of corpus luteum was 5.7, mean number of the live embryo or fetus per female was 4.2 (Table.1) , and the sex of fetus was 130 male and 134 female (Table.2) . The initial ten days of the pregnancy had the highest prenatal mortality rate (75%) (Table.1) . At 60 days and 100 days of pregnancy, the percentages of degenerated embryo or fetus were 22.6% and 27.3% respectively, whereas the average of degenerated embryo or fetus was 10.2%.

(number of individuals)

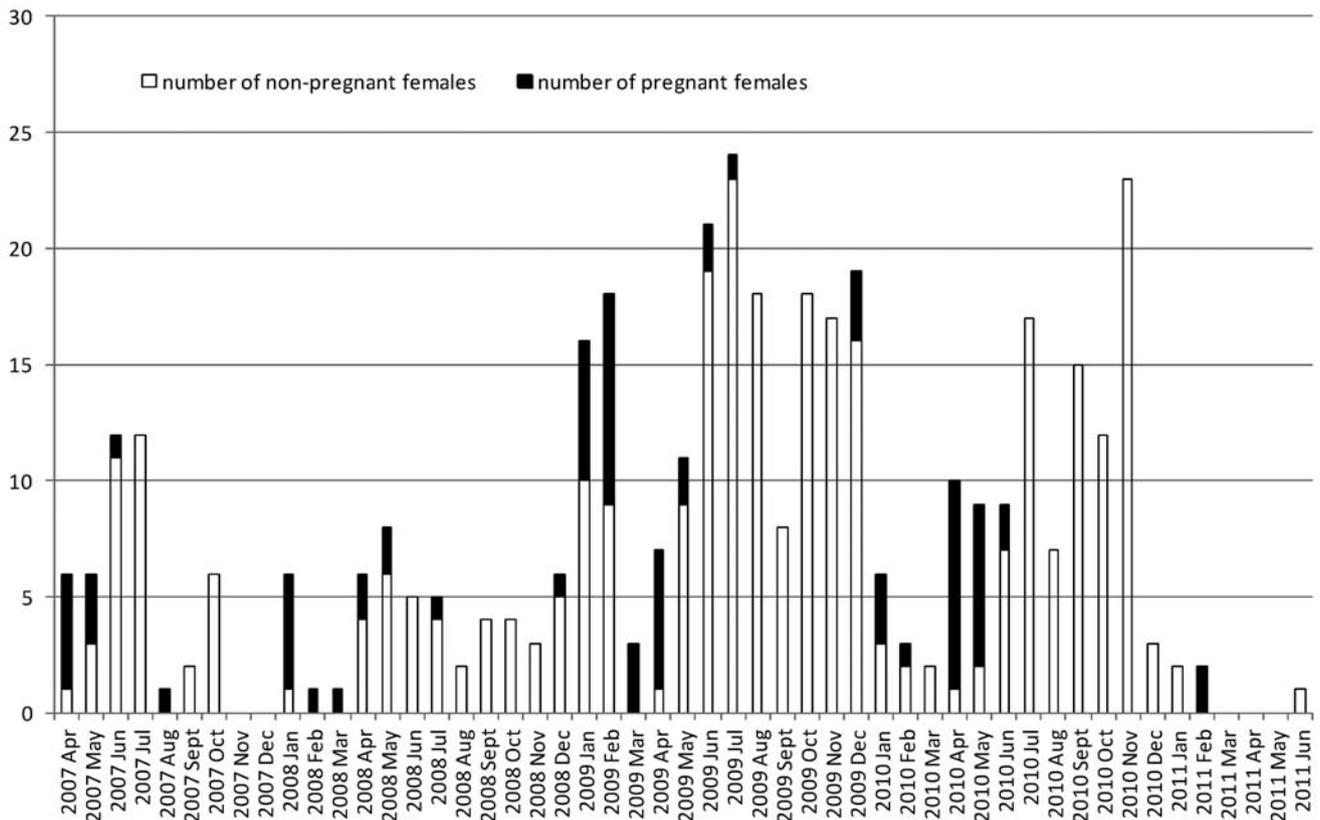


Fig.2. Seasonal changes in pregnancy rate of female wild boars collected from April, 2007 to June, 2011 in Gunma Prefecture.

be high. The analyses of stomach contents of wild boars from the east region of Gunma Prefecture suggest that wild boars had access to both natural and agricultural resources throughout the year (Anezaki *et al.*, 2011). The investigated population was mostly wild, and low in the degree of hybridization between wild boars and domestic breeds (Takahashi *et al.* 2009, 2010). The combination of good habitat quality and favorable climate may further increase the population density of wild boar in Gunma Prefecture in near future.

To conclude, this study evaluated the reproductive performance of wild boar in Gunma Prefecture. The season of birth was monophasic ranging from March to September. Their reproduction was successful with prenatal mortality of 27.2%, with sex ratio of 1 to 1 for male and female. The occurrence of degenerated embryo or fetus indicates that not only the rate of pregnancy, but also the prenatal mortality rate is an important factor in understanding the reproductive status of the wild boar.

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群馬県におけるニホンイノシシ (*Sus scrofa*) の出生前死亡率

姉崎智子

〒370-2345 群馬県富岡市上黒岩1674-1 群馬県立自然史博物館

要旨: 捕殺個体を利用したイノシシの繁殖状況の評価方法として、卵巣の観察による黄体と黄体退縮物の検出、子宮内の観察による胎児の検出、卵巣の組織観察がある。これらのデータは、排卵数、着床数、妊娠率の推定に用いられることが多い。しかしながら、イノシシにおける1腹あたりの出産頭数は、排卵数、着床数に加え、胎児の発育が進み娩出されるまでの間において死亡し退化する卵子、あるいは、胎児数によって大きく左右される。本研究では、イノシシの排卵数、胚胎の子宮内分布とその死亡状況をモニタリングすることで、出生前死亡率について検討することを目的とした。

2007年4月から2011年6月までに自然史博物館に搬入された401体のイノシシメスの内、胚胎が確認された78体について、胚胎の子宮内分布と退化状況を観察した。1腹あたりの平均黄体数は5.7個、平均胚胎数は4.2個であり、出生前死亡率は27.2%と推定された。子宮内退化胚胎児の死亡率は、推定胎齢日60日と100日で22.6%、27.3%と高い値が示された。胎児の高い生存率は、群馬県においてイノシシは良好に繁殖していることを示し、今後、さらなる生息数の増加が予測される。

キーワード: *Sus scrofa*, 出生前死亡率, 黄体, 胚, 胎児, 退化胚胎児