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STUDY OF PROLIFICACY AND ITS BIOLOGICAL COMPONENTS IN A LOCAL KABYLIAN RABBITS POPULATION IN ALGERIA.

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Study of prolificacy and its biological components in a local Kabylian rabbits population in Algeria.

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Abstract

A total of 47 females and 9 males an Algerian local population (Kabylia) bred in rational conditions (raised in wire cages, receiving pelleted food) were studied during one year in the rabbitry of the University of Tizi-Ouzou. Females were presented to the male from the 10th – 11th day following every parturition until effective mating, then possibly 12 days later in case of negative palpation. At the end of the experiment, a laparotomy was realised the 12th day following the positive mating on a sample of 16 multiparous females to determine the biological components of their prolificity. During the period of study, prolificity at birth and weaning were modest (7.0 total born with 5.9 born alive per parturition and 5.7 weaned kits per weaned litter). The litter and individual average weight at birth and weaning were respectively 297 g, 49.9 g, 2639 g and 49.4g. The study of the biological constituents of the prolificity allowed observing a high rate of ovulation: 14,4 corpora lutea on the whole for both ovaries. On the other hand, the rates of implantation and embryonic survival rates were relatively low : 54.7 % and 34.7 % of ovulated ova respectively. Season of reproduction exert only small quantitative effects even if significant.

Keywords: *rabbit, prolificacy, ovulation rate, embryonic survival, litter size, birth, weaning*

INTRODUCTION

The numeric productivity of a herd is an important economical criterion in rabbit production. Of works on productivity of rabbits in Algeria (raised in rational or farmer's conditions) appeared a weak prolificity at birth or at weaning of local population (Berchiche *et al.*, 2000; Zerrouki *et al.*, 2001). The main objective of the present work was to control these observations, to study the biological components of the prolificity and by this way to try to explain in part the weak prolificity recorded on these females. In addition some environmental factors (season) would be also studied because they can also influence the different parameters of reproduction.

MATERIAL AND METHODS

The experience has been managed in rabbitry facilities of the University of Tizi-Ouzou during the period October 2000-October 2001.

Animals:

The study involved 47 different females and 9 reproductive male rabbits of a local Kabylian population. The animals of the experience come of females born in the unit (animals maintained in closed population) having achieved the best performances of reproduction since 3 generations. Animals have been distributed in families. Every family was composed of a male to which were affected 5 to 6 females in order to minimise the inbreeding effects.

Housing and general management:

The experience took place in the 3 breeding rooms of a building with 44 wire mesh cages disposed in flat-deck and provided an automatic drinking device. Inside each of the 3 experimental rooms, 3 males were placed in superposed cages. The building was naturally ventilated, but the length of lighting was fixed at 16h per day with artificial lighting. Animals

received *ad libitum* a complete pelleted diet formulated in the laboratory, whose composition was as follows : 90.4% of dry matter, 8.5% ash, 13,5% crude fibre and 20.2% crude proteins.

Reproduction management

Females were presented to males of 5 months minimum, at an age variable between 3.5 and 4.5 months. The theoretical reproduction rhythm was the so-called semi-intensive rhythm. After a first presentation of does to a male 10 days after kindling until effective mating, a pregnancy diagnosis was done by abdominal palpation 10 days after the positive mating. If the female was empty, she was represented to a male 2 days later; in case of refusal, she was presented to a male again 7 days later. A female was systematically eliminated after 4 to 5 negative matings.

Nest boxes were placed in the cages 5 days before the presumed date of parturition. Immediately after birth, number of young (dead-born and alive kits) and litter weight was determined. Kits were weaned when 28-29 days old. The number of weaned kits as well as litter weights at weaning were noted. At the end of experience, 17 multiparous does underwent a laparotomy after sacrifice at 12 days of gestation in order to count the corpora lutea on the two ovaries as well as the living and dead embryos in the two uterine horns.

Statistical treatment

The various controls performed on does of this population permitted the analysis of the prolificity at birth and at weaning expressed as total born, born alive or dead, and number of weaned kits per weaning, as well as rate of ovulation expressed by the number of corpora lutea of the two ovaries and the rate of implantation defined by the total number of implants (with or without embryos) in the two uterine horns divided by the total number of corpora lutea. The alive embryos in proportion of total corpora lutea expressed the embryonic survival. The different observations were subjected to an analysis of variance to study the season effects. Levels considered in the analysis of the effect of positive mating season included 3 levels: fall, winter, and spring+summer. For the biological components, according to the small number of data, only means and standard deviations were calculated.

RESULTS AND DISCUSSION:

Average characteristics of the local Kabylian population: (table 1)

Results of the prolificacy at birth and at weaning recorded on rabbits does of this local population are modest. Effectively, litter size at the birth and at weaning were 7.0 total born with 5.9 born alive and 5.7 weaned by weaned litter. Berchiche *et al.* (2000) already signalled the low prolificacy of female rabbits of this local population in rational conditions (in fact grandmothers of does involved in this study). These results were fare lower than those mentioned by Mirabito *et al.* (1994) in an experience with commercial hybrids (10.1 born alive by litter), and than those calculated by Guerder (2002) as the mean productivity of 447 000 does commercially bred in France (9.96 total born and 7.91 kits weaned per kindling). Contrarily to the low prolificacy recorded at birth, females of this population are characterised by a high ovulation rate (a mean of 14.4 corpora lutea counted on the two ovaries). This ovulation rate is similar or higher than that observed on selected breeds. For example, Hulot and Matheron (1981) recorded a mean of 13 and 11 corpora lutea for Californian and the New Zealand White selected lines, and later, Garcia *et al.* (2000) mentioned an ovulation rate of 13.2 and 14.9 for selected lines A and V respectively. On the other hand, implantation rate and embryonic survival proportion are weak; they represented only 54.7% and 34.7% of corpora lutea respectively The age of females and their

physiological state (females multiparous and at the end of career) could be to the origin of these results. Hulot and Matheron (1981) and Bolet *et al.* (1990), underlined the effect of parity on the biological components of prolificacy; they bring back that ovulation rate increases with age but on the other hand the uterine capacity decreases with age. According to Prud'hon (1975), this situation can be explained by difficulties of implantation in an "old" uterus.

Table 1 : Reproductive and average litter traits of the local Kabylian rabbit population

Traits	Number of observations	Mean	Standard deviation
- Females weight at mating (g)	320	2940	406
- Males weight at mating (g)	320	3217	301
Pregnancy traits			
- number of corpora lutea / doe	16	14.4	5.1
- embryos alive at 12 d. of gestation	16	8.4	4.9
- implantation rate (% c. lutea)	16	54.7	27.7
- embryonic survival (% c. lutea)	16	34.7	28.9
At parturition			
- parturitions / matings (%)	195	60.5	-
- average parity number	118	2.44	1.41
- total born / litter	118	7.03	2.44
- born alive / litter	118	5.86	3.08
- dead born / litter	118	1.17	1.85
- litter weight (g)	111	299	128
- average individual weight (g)	111	49.4	10.1
At weaning			
- weanings / kindlings (%)	113	89.4	-
- weaning age (days)	101	28.7	0.8
- kits alive / weaning	96	5.64	2.37
- litter weight (g)	95	2697	896
- average individual weight (g)	95	500.0	117
- birth to weaning mortality (%)	96	8.0	2.2

The low prolificacy expressed in total born was accentuated by the high proportion of dead-born kits (16.6%). Berchiche and Lebas (1994) recorded on females of the original population raised in farmer's conditions a more elevated mortality at birth (29%). Guerder's calculation (2002) with quite half a million of French commercial does mentioned 5.8% of true dead-born + 4.8% of kits culled for low viability at the occasion of 1st *post partum* control, *i.e.* an average of 10.6% of total born kits which were lost during or immediately after parturition. On the other hand, birth-to-weaning mortality was less important in the Kabylian rabbit population : 8.0% to be compared to the 11.4% mentioned by Guerder (2002). Matheron (1973) underlined the mother's influence on the development of young after the birth for all mammals. As a matter of fact, high maternal qualities of female rabbits (high milk production and/or suckling capacity) during this phase, as well as high birth weight of young rabbits may explain a relatively low mortality. But milk production of females of this population was clearly lower than that observed with selected lines: 2250 g *vs* 3570 g produced in 21 days for litters of 6 young (Zerrouki *et al*, 2002). Moreover, the observed individual birth-weight (49.9

g) was also lower than that observed for selected lines : *e.g.* 56.9 g in litters of 6 kits for the Pannon White line (Poigner *et al*, 2000). Then the explanation of the low birth-to-weaning mortality should be a consequence of a high vitality of kits combined with high capacity of does to suckle their kits. An other explanation may be that only the stronger kits survived the first hours after parturition; effectively in the present case the low birth-to-weaning mortality is clearly associated to a high dead-born proportion.

The average litter weights recorded at birth and weaning were 297 ± 12 g and 2639 ± 96 g respectively, with corresponding individual weights of 50.0 ± 1.1 g and 491 ± 13 g . These results were higher than those recorded with the previous generations of the same population by Zerrouki *et al.* (2001) *i.e.* 298 g and 2202g in test 1 and 256g, 2097 g in test 2. These data were also largely higher than that signalled by Khalil (1998) for the Baladi Black (258g and 1320g).

Effect of season (table2).

The influence of the mating season on prolificacy was significant at birth (P <0.10) but no more at weaning. Litter sizes were the highest after winter matings (7.6 total born and 6.7 born alive) and the lowest after spring+summer matings (6.3 total born and 5.3 born alive).

Table 2 : Productivity of Kabylian does in the different seasons (number of observations and mean ± std error)

Traits	SEASONS (of fertile mating)			Signif. season effect
	Fall Before 21 Dec.	**Winter** 21 Dec-21 March	**Spring+Summer** After 21 March	
- females weight at mating (g)	75 **2879**±36	129 **2981**±40	116 **2934**±37	ns
- kindlings / matings	59 **0.68**±0.06	80 **0.50**±0.06	58 **0.66**±0.06	P=0.062
- average parity number	40 **1.28**±0.07	40 **2.38**±0.17	39 **3.72**±0.21	P<0.001
At parturition				
- total born / litter	40 **7.05**±0.33	40 **7.65**±0.38	38 **6.34**±0.43	P=0.060
- born alive /litter	40 **5.58**±0.48	40 **6.70**±0.47	38 **5.26**±0.51	P=0.093
- dead born / litter	40 **1.48**±0.36	40 **0.95**±0.27	38 **1.08**±0.24	ns
- litter weight (g)	36 **286**±17	39 **329**±20	36 **278**±24	ns
- kits individual average weight (g)	36 **47.5**±1.6	39 **49.0**±1.5	36 **51.6**±1.9	ns
At weaning				
- weaning age (days)	34 **26.68**±0.14	38 **28.63**±0.10	29 (2) **28.79**±0.16	ns
- litters weaned / parturitions	40 **0.85**±0.06	40 **0.95**±0.03	33 (2) **0.88**±0.07	ns
- kits weaned / weaning	33 **5.52**±0.43	36 **5.92**±0.40	27 (2) **5.41**±0.44	ns
- average litter weight (g)	32 **2486**±142	36 **2920** ±153	27 (2) **2649**±181	ns
- kits average individual weight (g)	32 **459**±20	36 **529**±21	27 (2) **509** ±18	P=0.044

(1) ns = non significant P>0.10 ; (2) 5 litters were not weaned when the experiment stops

Otherwise, the season effect was non-significant on birth or weaning litter weights as well as on individual birth weights (table 2). Nevertheless, the average individual weaning weights were significantly higher after the winter matings than after fall matings (+15%; $P<0.05$), despite a numerically greater (non significant) litter size at weaning. The better reproductive performance in winter may be related with the relatively large delay between successive litters during this season at underlined by the significantly ($P<0.10$) lower proportion of fertile matings during this season (0.50 *vs* 0.66-0.68 during the 2 other seasons). Effectively when the delay between successive litters increases, the reproduction-lactation competition decreases and this favours both litter size and milk production (Theau-Clément, 2001)

The relatively low prolificity observed in spring-and-summer time may be related with the higher temperature observed during this period (daily maximum reaching 30°C or more), since its well known that high temperatures have a negative effect on prolificacy as observed by Depres *et al.* (1994). Otherwise, it may be pointed out that average parturition number also varies: 2.4 for litters obtained after winter matings and 3.7 for those following spring-and-summer matings. But normally this range of variation of parity is not associated with wide variations of prolificity (Baselga *et al.*, 1992). This reinforces the hypothesis of a true climatic effect. From an other point of view, it must be underlined that a quite normal reproduction was obtained during the hot months in Algeria : about one half of the "spring+summer" parturitions were observed in June, July or August.

CONCLUSION

This experiment confirms the low prolificacy previously mentioned for this Kalylian local population of rabbits. The situation is a combination of a normal-to-high ovulation rate and of a very low embryonic survival rate, the whole associated with a high proportion of dead born rabbits. But, during lactation the birth-to-weaning mortality remains lower than that commonly observed with selected lines. The final consequences are litters weaned at 90% with a litter size of 5.6 young.
If some significant effects of season were observed, these effects were of small quantitative importance and it may be conclude that does of this rabbit population can efficiently reproduce, whatever the season.

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