CHARACTERIZATION OF REPRODUCTIVE PERFORMANCE OF THE APRI LINE OF RABBITS

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ABSTRACT

An attempt to characterize the reproductive performance of a new synthetic maternal line of rabbits (APRI) recently formed in Egypt has been carried out. The formation of the line, a general description, main features of its reproductive performance are presented here. Selection program, genetic improvement and primary results are included, as well. Data of six generations after the line formation were considered for litter, reproductive and milk traits. Most of the results are in the range of those that have been reviewed for the specialized lines in the Mediterranean area. The reproductive performance of the APRI line could be an indicator to an acceptable line that performs well under Egyptian conditions. Continuation of the current selection program and using this line in three-way crossbreeding schemes in Egypt to produce the higher performing does is recommended.

Key words: Rabbits, maternal line, litter traits, reproductive performance.

INTRODUCTION

The recent development of new maternal lines is important in the rabbit industry. Foundation of new lines could be of interest in order to increase rabbit productivity. Many of the recent developing specialized lines over the world are synthetics, which result from a planned cross of purebreds and/or crossbreds that have been conducted in a manner such that a composite population is produced. Synthetic populations have been generally formed to combine desirable traits (Brun and Baselga, 2004).

Maintaining specialized rabbit lines is generally not be feasible in the less developed countries. Instead, development of multi-purpose lines that that are selected for both of growth and prolificacy traits is considered (Moura et al., 2001). Many of the specialized rabbit lines are found in the Mediterranean and in warm climate areas (Gómez *et al.*, 1996; Gómez *et al.*, 2000; Baselga, 2002a, 2002b, 2002c; Bolet and Saleil, 2002a, 2002b; Khalil *et al.*, 2005). Still, the number of specialized lines that currently undergo selection in Egypt are quite limited (El-Raffa, 2007; Youssef *et al.*, 2008a; Abou Khadiga *et al.*, 2010a; Iraqi *et al.*, 2010). In all of the specialized maternal lines, litter and milk production traits are considered as the most important traits for efficient production, and some of these traits are objectives of selection to develop maternal lines of rabbits (Estany *et al*., 1989; Gómez *et al*., 1996; Brun and Baselga, 2004; Khalil *et al.*, 2005; Youssef *et al.*, 2008a; Abou Khadiga *et al.*, 2010a; Iraqi *et al.*, 2010). Nevertheless, few experiments have considered litter weaning weight as a main selection criterion in rabbit lines (Gómez *et al.*, 2000; Moura *et al.*, 2001; Khalil *et al.*, 2005 and Youssef *et al.*, 2008a; Abou Khadiga *et al.*, 2010a).

The objective of this study was to characterize the potential of reproductive performance of the APRI line after its formation in the primary stage of the selection program.

MATERIALS AND METHODS

Foundation of the line

A project to synthesize a new maternal line (APRI) established from Egyptian Baladi Red (BR) and a Spanish line (V) rabbits was started in 2002 at the Sakha experimental rabbitry, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt. The APRI line was founded by crossing Baladi Red bucks with V line does to produce F_1 (½B½V) stock, followed by two generations of *inter se* matings to achieve performance stability (Youssef *et al.*, 2008a and Abou Khadiga *et al.*, 2010a, 2010b). Selection for litter weaning weight was carried out based on BLUP procedures (Best Linear Unbiased Prediction) under a repeatability animal model (Quaas, 1984) in the framework of mixed model methodology (Henderson, 1973). The females of the next generation were selected from the progeny of 31% of the best evaluated matings based on the average of their predicted breeding values, while the males were being selected within sire. One male, at least, from the progeny of each sire was selected in attempt to reduce the inbreeding depression throughout the generations. After the F_1 generation, no further crossbreeding was performed.

Selection of animals was done regardless of the animal's color, which falls in different categories (black, white, grey and brown).

Animals and studied traits

The data used in this study were taken from the collected records of APRI line rabbits during the first six generations of selection after the initial line formation. A total of 1400 litters from six generations were evaluated for reproductive traits (gestation length (days), GL; kindling interval (days), KI; insemination period (days), IP; days open (days), DO, conception rate, CON%; ejaculation volume (ml), Vol, pH: semen pH, motility (%), MOT%, abnormal sperm (%), ABN%, Live sperm, ALV%); litter traits (litter birth weight, LBW; litter weaning weight, LWW; total number born, NB; number born alive, BA and number weaned at 28 days, NW); and milk traits (milk yield, milk components of fat, protein, lactose, ash and total solids).

Statistical analysis

The following repeatability animal model shown in matrix notation was used to estimate genetic parameters for the litter traits, as well as means of all traits, using WOMBAT software (Meyer, 2006):

$$\mathbf{y} = \mathbf{Xb} + \mathbf{Za} + \mathbf{Zp} + \mathbf{e},$$

where, **y** is the vector of observations; **b** is the vector of fixed effects of year-season (20 levels) and physiological state of doe at mating (3 levels), taking into account if the doe at mating was nulliparous, was lactating the previous litter or was not lactating; **a** is the vector of additive genetic effects of animal; **p** is the vector of the non-additive genetic plus permanent environmental effects of the doe that affect all its parity records; and **e** is a vector of residual random effects. The matrix **X** is the incidence matrix for the fixed effects and **Z** is the incidence matrix relating observations to animals.

The averages of the predicted additive values in each generation were regressed on generation number to estimate the genetic trend.

RESULTS AND DISCUSSIONS

Actual means of reproductive, litter and milk traits are presented in Tables 1, 2 and 3, respectively. Means and ranges of the reproductive traits were estimated from the data analysis. In general, the trait results of the APRI line were in the range of reviewed estimates for the specialized lines in the warm and hot climates (Baselga, 2004; Costa *et al.*, 2004; Al-Saef *et al.*, 2008; Khalil and El-Saef, 2008; Youssef *et al.*, 2008b).

Table 1: Reproductive trait performance of APRI male rabbits[1].

Item	Female traits					Semen traits				
	GL	KI	IP	DO	CON%	Vol	pH	MOT%	ABN%	ALV%
Mean	31.1	48	7.0	17.1	80	1.36	6.3	68.3	12.2	80.1
Range	30-34	31-62	1-32	1-31	61-93	0.1-2	5.5-7.5	20-95	0-22	28-98

[1]GL: Gestation length (days), KI: Kindling interval (days), IP: Insemination period (days), DO: Days open (days), CON%: Conception rate, Vol: Ejaculation volume (ml), pH: Semen pH, MOT%: Motility (%), ABN%: Abnormal sperms (%), ALV%: Alive sperms (%).

Table 2: Litter trait performance of APRI female rabbits.

Item	Traits				
	Litter birth weight (g)	Litter weaning weight (g)	Number born	Born alive	Number weaned
Mean	451	3174	8.63	8.37	6.53
Range	115-695	535-4890	2-14	2-13	1-12

Source: Abou Khadiga et al. (2010a, 2010b).

Table 3: Milk trait performance of APRI female rabbits.

Item	Traits					
	Total yield at 28 d (g)	Fat (%)	Protein (%)	Lactose (%)	Ash (%)	Total solids (%)
Mean	4154	15.01	12.81	2.41	2.35	32.58
Range	650-6399	3.90-30.32	7.3-19.0	0.74-3.35	1.50-3.19	22-36

Source: Ayat Ragab (2008).

Genetic improvement

Estimates of genetic parameters for litter traits in APRI line were previously reported (Abou Khadiga *et al.*, 2010a, 2010b). Estimates of heritabilites, repeatabilities and genetic trends for litter traits are summarized in Table 4. In general, estimates of heritability (0.08 to 0.11) and repeatability (0.16 to 0.34) agree with values from the literature for specialized maternal lines in the Mediterranean area (Baselga *et al.*, 2002a, 2002b, 2002c; Bolet and Saleil, 2002a, 2002b; Iraqi *et al.*, 2006; Iraqi *et al.*, 2010).

With a generation interval of 10 months, direct genetic trend of 34.2 grams per generation for litter weaning weight, the selection criterion, has been estimated by mixed model methodology. All of the estimated trends were significant ($P < 0.05$). In comparison with different specialized maternal lines, the present results are comparable to those obtained by Moura *et al.,* (2001); Bolet and Saleil (2002a) and lower than those obtained by Bolet and Saleil (2002b); Khalil *et al.* (2005).

Table 4: Genetic parameters for litter traits.

Genetic parameters	Traits				
	Litter birth weight (g)	Litter weaning weight (g)	Number born	Born alive	Number weaned
h^2	0.11±0.01	0.10±0.01	0.09±0.1	0.12±0.01	0.10±0.01
r	0.31±0.03	0.16±0.03	0.34±0.03	0.30±0.03	0.27±0.04
Trend	5.7±0.68	34.2±3.28	0.06±0.02	0.05±0.01	0.04±0.02

h^2: heritability, r: repeatability; All trends are significant at $P < 0.05$
Source: Abou Khadiga *et al.* (2010a, 2010b).

CONCLUSIONS

Characterization of the reproductive performance of APRI line after the primary stage of the selection program has been done. Positive genetic trends could be an indicator to the potentiality of the newly formed maternal line for reproductive performance. However, to complete the line characterization,

different studies should be conducted to evaluate its genetic stability for reproductive performance, and to evaluate the line for growth pattern, nutritional needs, heat tolerance and its performance in advanced reproductive techniques, as well. Moreover, combining the APRI line with the other Egyptian maternal lines in a crossbreeding scheme should be considered to introduce the improved crossbred does to the Egyptian rabbit industry.

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