RABBIT BREEDING SITUATION IN EGYPT- A CASE STUDY

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ABSTRACT

The objective of this communication was to point to the current situation of the development of the rabbit industry in Egypt by using specifically selected lines. A brief of the historical background of the local Egyptian rabbit lines and the establishment process of the distinguished new lines was mentioned in the manuscript. Three specialized rabbit lines were established and improved through genetic programs in Egypt during the last two decades. One paternal line (Alexandria), one maternal line (APRI) and one global objective line (Moshtohor) were developed in the framework of an Egyptian-Spanish project to develop specific rabbit lines in Egypt. The performance of these specialized selected rabbit lines in different traits was characterized in many papers. A spot on the development of theses lines and their current performance is considered to present in this communication

Key words: Rabbit lines, selection, hot climate, litter traits, growth

INTRODUCTION

Local Egyptian rabbit genetic resources are categorized as local breeds, ancient Egyptian lines and modern Egyptian lines. Galal and Khalil (1994) reported that the establishment of rabbit farms has become a popular target among smallholders, which led to easy spread of foreign breeds (New Zealand White, California, Bouscat, Chinchilla and Rex) and lines (V Line and Hy plus) for economic reasons (fast productive and reproductive performance); and in contrast, neglecting native Egyptian rabbits in the large-scale production (Emam *et al.*, 2017).

Gabali rabbit breed is raised in desert areas of Sinai Peninsula and Matrouh (Emam *et al.*, 2016). In 1994, Egyptian Gabali Sinai (EGS) rabbits were successfully domesticated from a feral habitat to cage production by a cooperation project between Ministry of Agriculture and Faculty of Agriculture, Moshtohor, Benha University (Khalil, 1999). Native (Baladi) rabbit breed is an Egyptian domestic rabbit breed found in rural areas of Delta, Middle and Upper Egypt (El-khishen *et al.*, 1951 and Badawy, 1975). Abdel-Kafy *et al.* (2011) reported that animal production research institute (APRI) established a native rabbit nucleus from three governorates in Middle Egypt. The collected rabbits were named Native Middle Egypt Rabbit breed (NMER). On the other hand, Emam *et al.* (2017) mentioned that although native rabbit breeds showed high genetic parameters, it suffers from neglect especially in the large-scale production. The ancient Egyptian lines were established in the middle of last century. Ministry of Agriculture researchers tried to improve native Egyptian rabbits by crossbreeding for several generations with the Flemish Giant (Khalil, 2002). The breeding plan carried out in five stages. Abou Khadiga *et al.* (2012) reported the development of the strains which were Egyptian Red Baladi (ERB), Egyptian Black Baladi (EBB) and Egyptian White Baladi (EWB) with 1/8 Baladi and 7/8 FG. According to Ministry of Agriculture and Land Reclamation in Egypt and FAO report (2003 and 2013) the EWB has become extinct. In addition, previous reports indicated that ERB and EBB are endangered.

The modern Egyptian lines were established in the first decade of the second millennium. Long-term selection program was considered to establish specialized synthetic rabbit lines that were Alexandria line (El-Raffa, 2007), APRI line (Youssef *et al.*, 2008), and Moshtohor line (Iraqi *et al.*, 2010). All the lines originated from crossing the Spanish V line with local breeds in Egypt. The program involved Alexandria University, Animal Production Research Institute (APRI, Cairo) and Benha University and Polytechnic University of Valencia as the Spanish partner. The present article tried to focus on the current situation for modern Egyptian lines after two decades from foundation

Selection methodology

All the lines were selected based on BLUP procedures (Best Linear Unbiased Prediction) in the framework of mixed model methodology (Henderson, 1973). APRI and Moshtohor lines were selected using a repeatability animal model (Quaas, 1984). The selection intensity was about 31% to produce females of the next generation from the best evaluated matings based on the average of their predicted breeding values, while the males were selected within sire families (Abou Khadiga *et al.*, 2010).

Alexandria line

It was developed as a paternal line in Alexandria University selected for daily gain between 28-63 days. The line was founded by crossing V line bucks with Black Baladi does. Then, two backcrossing generations with V line bucks, obtaining progeny of 87.5% from V line and 12.5% from Baladi Black. Finally, two generations of *inter se* mating was performed to get Alexandria line (El-Raffa, 2007).

Since its foundation, the most of the published studies on the development of the line were mainly focused on molecular analysis. From the phylogenetic tree, the genotypes Alexandria and V line appeared to be closely related (El-Sabrout and Aggag, 2014). The results revealed two specific bands which could be used as specific protein markers to characterize Alexandria rabbits. These specific protein markers are expression genes and these genes may be responsible for the superiority of Alexandria line in body weight (El-Sabrout and Aggag, 2015). They found two specific protein banding patterns of Alexandria line compared with V line and Baladi Black rabbits in zones 4 and 12 with MW (KDa) of 245.000 and 70.000, respectively. El-Sabrout *et al.* (2017) measured intestinal insulin-like growth factor-1 (IGF-1) mRNA level and observed that the expression levels of IGF-1Ea, IGF-1Eb and IGF-1R were nearly the same in weaning age 28 and 33 days, while they were the lowest in age 23. Serum IGF-1 concentrations tended to present significant differences (P<0.05) with different weaning ages. These authors found that levels of IGF-1 in rabbits weaned at 28 and 33 d of age were convergent and higher than the IGF-1 levels in rabbits weaned at 23 d of age. This therefore suggests that moderate weaning (28d) will be suitable for the farm economy and will improve rabbit production better than early or late weaning.

APRI line

It was developed in the Animal Production Research Institute stations (Gimmizah and Sakha) as a maternal line selected for litter weaning weight. The APRI line was founded by crossing Baladi Red bucks with V line does to produce F_1 (50% BB and 50% V) animals, followed by two generations of *inter se* mating to achieve performance stability (Youssef *et al.*, 2008 and Abou Khadiga *et al.*, 2010).

After establishment of the line (Youssef *et al.*, 2008), several authors reported details about the selection program and characterization of the line (Khalil *et al.*, 2010; Abou Khadiga *et al.*, 2012). As a maternal line, it was a competitor to many of the known breeds under Egyptian conditions, surpassed V line in some litter and milk traits (Abou Khadiga *et al.*, 2010). The genetic trends were also estimated using mixed model methodology and were significant and comparable (34.2 and 32.5 g per generation) for the selected trait (litter weaning weight) in APRI and V lines, respectively (Abou Khadiga *et al.*, 2010). Abou Khadiga *et al.* (2012) reported extensive numeric details about the litter, milk, reproductive (male and female) traits stressed on the desirable genetic trends in litter traits. These authors reported significant ($P < 0.05$) desirable genetic trends of the selection criteria for litter weaning weight (34.2 g per generation), and for the related traits litter birth weight, number born, number born alive and number weaned of 5.7 g, 0.06, 0.05 and 0.04 rabbits, respectively. Data revealed comparable results with those obtained by previous studies in newly formed lines. Authors concluded that APRI line has the potential to be a superior line in reproductive performance and authors recommended the continuation of the selection program. They also suggested a crossbreeding between APRI and other Egyptian lines to produce crossbred does which could be used in a three-way scheme.

Hassan *et al.* (2015) stated that estimated breeding values (EBV) using animal models and genetic predictions published by genetic evaluation programs are useful for sire and dam selection under Egyptian environmental conditions. They reported heritabilities of the considered doe traits to be relatively low being 0.17, 0.04 and 0.11 for litter weights at birth; 21 days and weaning, respectively. Authors found estimates of common litter effects to be low (0.2, 0.002 and 0.008) for litter weight at the same manner. They suggested family or within family selection to be more effective and valuable than individual selection to improve these traits of APRI rabbits. They found the ranges of APRI sires' transmitting ability for litter weight at birth, 21 days and at

weaning to be 0.11, 0.24 and 0.81 g with the accuracies being 0.51% for all litter weight traits. In addition, they found significant moderate genetic correlation estimates among various ages' BV of the studied traits for the APRI does indicating correlated response to selection that should be considered in selection plans. These authors concluded that selection for litter weight may not be practically and realistically associated with higher performance of does in their later ages. They added that could also increase the the selection costs. Ashour and Shamia (2015) studied the similarity of APRI, Baladi Black and New Zealand White (NZW) rabbits. They found that RAPD patterns generated, in total, 104 bands, out of them 62 were polymorphic. They added that APRI and BB genotypes shared most of the bands which supports their common origin, since they have the same common ancestors. The phylogenetic tree indicated that both genotypes APRI and BB were highly similar than NZW which was highly diverged than other genotypes.

Moshtohor line

It was developed as a multi-purpose line in the Department of Animal Production, Faculty of Agriculture, Moshtohor, Benha University, Egypt. The Moshtohor line was founded by crossing Sinai Gabali (SG) bucks with V line does to produce F_1 (50% SG and 50% V) animals, followed by three generations of *inter se* mating. Selection was practiced in two steps for litter weight at weaning and individual weight at 56 days of age (Iraqi *et al.*, 2010).

A full description of the line performance was reported by Iraqi *et al.* (2010). Several studies on the line performance in different traits compared with other genetic resources were reported. Iraqi *et al.* (2012) investigated semen quality of Gabali, V-line and Moshtohor line. Traits of ejaculate volume (EV), semen pH, mass motility (MM), sperm cell concentration (SC), individual motility (IM), live sperm per ejaculate (LS), and sperm abnormalities per ejaculate (SA) were studied. Significant differences for EV, SC, IM, MM, LS, and SA in Gabali, V line and Moshtohor line were detected being 0.60, 0.66 and 0.72 ml for EV, 405.83, 474.48 and 456.1 x106 for SC, 46.95, 48.63, and 54.82% for IM, 2.26, 2.22 and 2.41 grads for MM, 80.63, 82.38, and 81.99% for LS, 11.79, 12.92, and 12.09% for SA, respectively. Authors concluded that the M-line, followed by V line of buck rabbits could be used as effective indicators for good semen quality. Based on heterosis percentages, it was concluded that Moshtohor line bucks had superiority in EV (14.3%), semen pH (0.13%), SC (3.6%), MM (7.6%), IM (14.7%), LS (0.6%) and SA (-2.14%) over its two ancestors, which might be due to dominance and/or over-dominance gene action at different loci on chromosomes.

Radwan *et al.* (2012) studied doe traits as ovulation rates (OR), number of implantation sites/doe (NIS), number of viable embryos/doe (NVE), implantation rate (IR), number of corpora lutea (NCL), weight of corpora lutea (WCL), weight of lutein tissue (WLT), weight of ovary (WO), early embryonic mortality (EEM) %. They found that results were mostly favoring Moshtohor line and showed significant differences in OR, NIS, NVE, IR, NCL, WCL and WLT between the Gabali, V line and Moshtohor line being 8.67, 8.1 and 9.2 for OR; 7.36, 7.43 and 8.33 for NIS; 5.02, 6.67 and 7.13 for NVE; 84.89%, 91.72% and 90.54% for IR; 12.9, 14.1 and 13.6 mg for WCL; and 111.84, 114.21 and 125.12 mg for WLT, respectively. Average of the early embryonic mortality was 20.69, 9.12 and 10.87% in Gabali, V line and Moshtohor line, respectively.

El-Aksher *et al.* (2017) investigated the genetic diversity and phylogenetic relationship among Moshtohor line rabbits and their parental lines of Spanish V line and Sinai Gabali rabbits using the French Giant Papillon (FGP) as a reference population. Among the four populations, Moshtohor line and V line rabbits had the closest relationship which was confirmed with the estimates of the Neigbour-Joining phylogenetic tree. Moshtohor line rabbits showed high genetic diversity based on both microsatellites and SNP markers. Moshtohor line recorded the highest and significant frequency of GG genotype of G/A2464 SNP located in the promoter region of PGR gene indicating its potentiality for the improvement of litter traits. It also showed closer relationship with its maternal founder (V line) than with its paternal founder (Gabali) based on phylogenetic tree and structure clustering pattern. This study suggested SNPs to be useful for future studies targeting the assessment of the genetic variation in rabbit population.

CONCLUSION

Since the formation of the modern rabbit lines in Egypt, several studies were reported to characterize and to investigate the performance of the lines in different matters. However, more studies are needed to assess the

selection response after several years of selection. A reported recommendation of involving the modern Egyptian rabbit line in a crossbreeding scheme could be also considered.

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