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BIOCHEMICAL GENETICS, PRODUCTIVE AND REPRODUCTIVE PERFORMANCE FOR FLANDER AND REX RABBIT BREEDS UNDER EGYPTIAN CONDITIONS

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ABSTRACT

Data on 403 kindling produced by 88 does (45 Flander and 43 Rex rabbit) were collected during two successive years of production (2007/2008 and 2008/2009). The present study was carried out to study the effect of genetic and non-genetic factors on doe productive and reproductive traits, as well as to evaluate the biochemical genetic markers associated with productive and reproductive traits using electrophoretic pattern of proteins and some isozymes such as esterase in blood serum. The important results could be summarized as follows: 1. Flander rabbits breed were non-significantly higher than Rex onse for most litter size and weight traits studied. 2. Years of kindling significantly ($P \leq 0.05$, 0.01 or 0.001) affected all litter size and weight traits at the different ages studied in two breeds. 3. Season for kindling showed a significant ($P \leq 0.01$ or 0.001) effects on litter traits in the two rabbit breeds studied. 4. In general, all litter traits studied increased as parity advanced till the third parity then decreased. 5. Pre-weaning mortality from birth to 21 days and birth to 35 days (weaning) were significantly ($P \leq 0.05$) affected by year and season of kindling. 6. Most doe reproductive traits were significantly ($P \leq 0.05$, 0.01 or 0.001) affected by breed-type, year of kindling, season of kindling and parity order. 7. Protein banding pattern exhibited the presence of one band with MW (68.092 – 44.242 KD) could be used as biochemical marker. 8. In addition, esterase isozyme can not be used as biochemical marker in the present material.

Keywords: Rabbits, litter traits, doe reproductive traits, genetic, non-genetic factors.

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INTRODUCTION

The rabbit industry in Egypt does not widely spread as that for broiler or egg production industries as the consumers still prefer red meat and broilers. This causes of very low consumption of rabbit meat. Local demand of rabbit meat is dependent on small flock in holders and farmers. They usually experience high mortality rate and low level performance of the local rabbits (Abd El-Halim, 2003).

Litter size (the number of kits born) is the most important economic character in rabbit production (Abo- Khadiga, 2004 and Nofal *et al.*, 2005).

Rabbit body weight as an economic important character in the commercial meat rabbit industry was found to be improved by crossing of local breeds with exotic standard breeds (Nofa *et al.,* 1995; Afifi *et al.,* 2001 and Piles *et al.,* 2004).

The study of genetically controlled biochemical polymorphisms of blood proteins is at present a useful tool to characterize livestock breeds and populations; hence it contributes to knowledge of genetic similarities and distances amongst breed (Zaragoza *et al.,* 1987 and Arana *et al.,* 1987).

Now a day, biochemical genetic markers as well as molecular markers for the essential productive traits are quite tool for phylogenetic studies among different genetic resources (White and Cooke, 1992 and Radovic and Vapa 1996).

Molecular genetic markers and determination of genetic differences among rabbit breeds will be helpful in breeding program for improving productive and reproductive traits.

The objectives of the present study were: 1) To study the effects of breed-type, year of kindling, season of kindling and parity order on productive and reproductive traits. 2) To develop biochemical genetic markers associated with productive and reproductive traits as detected by the electrophoretic pattern of proteins and some isozymes such as esterase in blood serum.

MATERIALS AND METHODS

Rabbits and Management

The present study was carried out in Rabbitry farm, Department of Poultry, Faculty of Agriculture, Zagazig University, Zagazig, Egypt, during the period from September 2007 to August 2009, to study the effects of Breed type, year of kindling, season of kindling and parity order on doe productive and reproductive traits for Flander and Rex Rabbit breeds.

Rabbits of the current study were raised in an opened rabbitry. Breeding doe and bucks were housed separately in individual wired-cages. Cage of each doe was provided with a metel nest box for kindling. Each buck mated 1-5 does of the same breed and each doe palpated ten days thereafter to determined pregnancy. Does failed to conceire were returned to the same mating buck. At weaning age (35 days), the young rabbits were separated from their mothers cages, sexed, weighted, ear tagged and lodged in collectives cages in groups haring automatic drinkers. All animals were fed ad libitum a pelleted ration. Cages of all animals were cleaned and disinfected before each kindling regularly. Manure was collected daily and removed outside the rabbitry.

Data and Models of Analysis

Data on 403 Kindling produced by 88 does (45 Flander and 43 Rex) were collected to study the effects of breed-type (2 levels), year of kindling (2 levels), season of kindling (4 levels) and parity order (7 levels) on doe productive and reproductive traits.

The traits studied were Litter size at birth (LSB), Number born a live (NBA), Litter size at 21 days (LS_{21}), Litter size at weaning (LSW), Litter weight at birth (LWB), Litter weight at 21 day (LW_{21}), Litter weight at weaning (LWW), Litter weight gain from birth to weaning (LWG), Pre-weaning mortality (PWM), Number of services per conception (NSC), Days open (DO), Kinding interval (KI) and Gestation length (GL).

Statistical Model

The least-square analysis of variance for data for all traits studied was accomplished using the SAS General Liner Models Procedure (SAS Institute, 1996). The statistical model used was:

$$Y_{ijklm} = \mu + B_i + K_J + S_K + P_I + e_{ijklm}$$

Where:

Y_{ijklm}=An observation, μ = Overall mean, B_i = The effect of the breed-type (2 levels), K_J=The effect year of kindling (2 levels), S_K = The effect of season (4 levels), P_I = The effect of parity order (7 levels) and e_{ijklm} = The random error.

Duncan's new multiple range test was used to test the differences among the least-square means (Steel and Torrie, 1980). All percentages were converted to the corresponding arcsine prior to statistical analysis.

Biochemical Genetic Markers

Protein electrophoresis

SDS polyacrylamide gel electrophoresis (SDS-PAGE) was performed according to the method of Laemmli (1970) which was modified by Studier (1973).

Isozyme electrophersis

Extraction of isozymes

Electrophoretic pattern of isozymes were studied in the serum for the two breeds. Blood samples were collected in eppendorf tubes and left for about 30 minutes until blood clotted, then centrifuged for 10 minutes at 12000 rpm at 4°C. Supernatants were transferred to new tubes and stored at 4°C. All studied serum enzymes were investigated during one week from extraction.

Polyacrylamid gel electrophoresis (PAGE) of serum isozymes

Vertical Bio-Rad gel electrophoretic apparatus was used in all isozymes run with slab diameter of 180 x 200 mm and 1.5 mm combs. Two slot formers (combs) for 20 slots (well) were used. Prior to run, glass plates were washed with detergent and tap water, then with distilled water.

Electrode and gel buffer were prepared according to Markert and Faulhaber (1965) while the polyacrylamid stock was prepared according to Bollag and Edelstein (1994).

Staining condition for the studied enzyme

Na- phosphate buffer, pH 6.2 (0.1 M)	100 ml
α-naphthyl acetate	25 mg
β-naphthyl acetate	25 mg
Fast blue RR salt	25 mg

RESULTS AND DISCUSSION

Litter Traits

Effect of breed-type

Most litter size and weight traits studied for Flander rabbits breed were non-significantly higher than Rex rabbits (Tables 1 and 2). These results were in agreement with those reported by Chineke (2006) and Ghosh (2003) who observed nonsignificant effects for breed-type on litter traits.

The PWM percentages at all ages studied were differed non-significantly among the two breads studied (Table 3). These results are comparable to those reported by Anon (2003 and 2004) and Ghosh (2003) who found that PWM did not differ between the NZW and Chinchilla.

Table 1. Least-square means and standard errors (S.E.) of factors affecting litter size traits in Flander and Rex rabbit breeds

Item	LSB		NBA		LS_{21}		LSW	
	N	$\overline{X}\pm SE$	N	$\overline{X}\pm SE$	N	$\overline{X}\pm SE$	N	$\overline{X}\pm SE$
Breed		NS		NS		NS		NS
Falander	194	0.16±6.90	194	6.34±0.17	188	5.69±0.15	183	5.49±0.15
Rex	209	6.78±6.14	209	6.22±0.17	198	5.81±0.14	196	5.49±0.14
Year		*		**		**		***
2007-2008	196	7.06±0.16^{a}	196	6.58±0.18^{a}	189	6.10±0.16^{a}	182	6.01±0.16^{a}
2008-2009	207	6.64±0.14^{b}	207	5.99±0.16^{b}	197	5.43±0.12^{b}	197	5.01±0.12^{b}
Season		***		***		***		**
Autumn	108	6.74±0.22^{b}	108	6.27±0.25^{a}	105	5.82±0.21^{b}	105	5.61±0.21^{a}
Winter	124	7.48±0.18^{a}	124	6.90±0.22^{a}	119	6.34±0.18^{a}	119	5.90±0.18^{a}
Spring	99	6.84±0.20^{b}	99	6.25±0.21^{a}	95	5.60±0.20^{b}	90	5.44±0.19^{a}
Summer	72	5.90±0.22^{c}	72	5.26±0.26^{b}	67	4.84±0.22^{c}	65	4.62±0.21^{b}
Parity		*		NS		*		*
1st	88	6.34±0.24^{ab}	88	5.92±0.25	86	5.64±0.23^{ab}	86	5.41±0.23^{ab}
2nd	87	7.22±0.24^{ab}	87	6.54±0.28	84	5.85±0.22^{ab}	84	5.56±0.22^{ab}
3rd	76	7.29±0.22^{a}	76	6.71±0.28	72	6.28±0.22^{a}	71	5.92±0.23^{a}
4th	67	6.96±0.25^{ab}	67	6.43±0.28	64	5.92±0.27^{ab}	62	5.71±0.27^{ab}
5th	51	6.63±0.28^{ab}	51	6.10±0.31	48	5.23±0.30^{ab}	44	5.16±0.28^{ab}
6th	29	6.31±0.32^{ab}	29	5.48±0.42	27	5.07±0.28^{b}	27	4.59±0.29^{b}
7th	5	6.00±0.10^{b}	5	6.00±1.00	5	5.20±0.80^{ab}	5	4.80±0.92^{ab}

LSB= Litter size at birth, NBA = Number born a live, LS_{21}= Litter size at 21 days, LSW= Litter size at weaning.
NS = Non-significant ($P > 0.05$).
* = Significant at level ($P \leq 0.05$).
** = Highly significant at level ($P \leq 0.01$).
***= Very highly significant at level ($P \leq 0.001$).

Table 2. Least-square means and standard errors (S.E.) of factors affecting litter weight traits in Flander and Rex rabbit breeds

Item	LWB		LW_{21}		LWW		LWG	
	N	$\bar{X} \pm SE$	N	$\bar{X} \pm SE$	N	$\bar{X} \pm SE$	N	$\bar{X} \pm SE$
Breed		NS		NS		***		***
Falander	194	399.81±7.83	188	1820.82±45.65	183	3907.40±97.90[a]	184	95.54±3481.89[a]
Rex	209	393.99±7.31	198	1774.15±39.35	196	3494.42±80.48[b]	196	76.06±3094.28[b]
Year		*		***		***		***
2007-2008	196	407.37 ± 8.25[a]	189	1920.96±48.18[a]	182	4042.13±98.51[a]	183	95.41±3606.29[a]
2008-2009	207	386.78 ± 6.81[b]	197	1677.84±34.41[b]	197	3372.06±75.62[b]	197	72.40±2980.69[b]
Season		***		***		***		***
Autumn	108	386.32±10.42[b]	105	1822.58±54.90[b]	105	3744.97±121.28[a]	105	15.49±3355.63[a]
Winter	124	430.65±9.51[a]	119	1980.63±49.38[a]	119	3969.45±114.97[a]	119	111.01±3531.80[a]
Spring	99	400.18±9.63[b]	95	1778.89±65.09[b]	90	3711.33±130.11[a]	90	124.18±3307.89[a]
Summer	72	349.52±12.26[c]	67	1455.75±61.95[c]	65	3082.38±127.35[b]	66	126.30±2678.95[b]
Parity		**		***		**		**
1st	88	362.98±11.50[ab]	86	1707.41±60.29[abc]	86	3634.62±130.36[ab]	86	122.95±3266.41[abc]
2nd	87	415.73±12.00[a]	84	1867.01±60.50[ab]	84	3708.98±140.87[ab]	84	135.07±3289.05[abc]
3rd	76	423.93±12.03[a]	72	2000.69±64.99[a]	71	4051.83±145.71[a]	71	141.96±3618.22[a]
4th	67	412.98±12.06[a]	64	1888.67±81.76[ab]	62	3853.87±167.83[a]	63	167.71±3376.04[ab]
5th	51	380.92±14.24[ab]	48	1592.60±90.69[bc]	44	3434.43±164.40[ab]	44	155.59±3046.75[abc]
6th	29	370.28±16.72[ab]	27	1525.74±72.78[c]	27	3065.00±173.36[b]	27	165.10±2693.22[c]
7th	5	348.72±58.16[b]	5	1473.00±301.84[c]	5	3068.00±687.84[b]	5	634.67±2719.28[bc]

LWB = Litter weight at birth, LW_{21}= Litter weight at 21 day, LWW= Litter weight at weaning, LWG = Litter weight gain from birth to weaning

NS = Non-significant ($P > 0.05$).

* = Significant at level ($P \leq 0.05$).

** = Highly significant at level ($P \leq 0.01$).

***= Very highly significant at level ($P \leq 0.001$).

Effect of year of kindling

The least-square means of LSB, NBA, LS21, LSW, LWB, LW21, LWW and LWG varied, significantly (P≤0.05, 0.01 or 0.001) and did not show a similar trend throughout the two years of kindling (Tables 1 and 2). In this respect Gad (1998); Abou-Khadiga (2004) and Gharib (2008) reported significant (P≤0.05, 0.01 or 0.001) effect for year of kindling on LSB, NBA, LWB, LWW and LWG in different breeds of rabbits. Accordingly, (Khalil *et al.*, 1995) stated that the influence of year effect as a major part of the environment must be considered in the analysis of genetic studied for doe performance.

The results presented in Table 3 showed that PWM percentages from Birth to 21 days and birth to 35 days (weaning) were significantly (P≤0.05) affected by year of kindling. Differences in Pre-weaning mortality due to year of kindling are usually associated with differences in climatic conditions, stock man's skill, management of the rabbitry, Feeding and incidence of diseases. Abd El-Aziz (1998) noted that Pre-weaning period showed in consistent trend from year to another with non- significant differences when compared among different years. On the other hand, Abo-Khadiga (2004) reported that year of kindling effect on Pre-weaning litter mortality.

Effect of season of kindling

Season of kindling showed a significant (P ≤ 0.01 or 0.001) effects on litter size and weight studied wherease, the highest values for aforementioned traits were recorded in winter season and the lowest values in the summer season (Tables 1 and 2). In this respect Ghosh (2003) found that, rabbits born during winter and rainry seasons attained a significantly (P≤0.01) higher for LWW than the other born during the summer season. The seasonal effect upon the early growth performance of rabbits was also reported by Kumar *et al.* (2001). The difference associated with the kindling season can be attributed to the preralent environmental conditions and to stress factors affecting feed in take (Eberhart, 1980).

The least- squar means of PWM during the periods of 21- 35 day and birth- 35 days were affected significantly (P ≤ 0.05 or 0.01) by season of kindling (Table 3). The best values for all different periods studied were observed in the autumn season when compared with the highest values in the summer season

Table 3. Least-square means and standard errors (S.E.) of factors affecting pre-weaning mortality in Flander and Rex rabbit breeds

Item	Birth to 21 days		21 to 35 days		Birth to 35 days	
	N	$\bar{X} \pm SE$	N	$\bar{X} \pm SE$	N	$\bar{X} \pm SE$
Breed		NS		NS		NS
Falander	194	20.33±1.76	188	8.23±1.40	188	24.82±1.99
Rex	209	19.07±1.74	198	7.42±1.06	198	24.17±1.88
Year		*		NS		*
2007-2008	196	17.18±1.81^{b}	189	7.72±1.49	196	21.13±2.06^{b}
2008-2009	207	22.04±1.69^{a}	197	7.90±0.95	207	27.65±1.79^{a}
Season		NS		*		**
Autumn	108	15.97±2.19	105	4.01±1.03^{b}	108	18.88±2.36^{b}
Winter	124	18.83±2.13	119	7.11±1.13^{ab}	124	23.87±2.30^{ab}
Spring	99	21.52±2.57	95	11.80±2.48^{a}	99	27.71±3.02^{a}
Summer	72	24.15±3.33	67	9.39±2.40^{a}	72	29.49±3.52^{a}
Parity		NS		*		NS
1st	88	14.18±2.31	86	4.21±1.03^{b}	88	17.63±2.44
2nd	87	20.73±2.54	84	5.14±1.26^{ab}	87	24.07±2.75
3rd	76	19.24±2.90	72	8.37±1.99^{ab}	76	24.39±3.26
4th	67	20.10±3.10	64	8.86±2.45^{ab}	67	25.62±3.40
5th	51	25.77±4.14	48	15.37±4.16^{a}	51	32.55±4.71
6th	29	24.07±4.86	27	10.20±2.64^{ab}	29	31.24±5.07
7th	5	11.27±5.39	5	8.00±7.99^{ab}	5	16.98±10.53

NS = Non-significant ($P > 0.05$).
* = Significant at level ($P \leq 0.05$).
** = Highly significant at level ($P \leq 0.01$).
***= Very highly significant at level ($P \leq 0.001$).

during the interval of birth to 21 days and birth to 35 days (Table 3).

Abd El- Azeem *et al.* (2007) indicated that Pre-weaning mortality was higher in summer than winter season, i.e. less litter servival is observed. They attributed that lee the direct effect of heat stress on the sensitive young kits, in addition to reduction of dam's milk production Ayyat *et al.* (1995) as a results of the general depression of metabolic activity in such conditions (Shafie *et al.*, 1984).

Effect of parity order

The differences in LSB, LS21, LSW, LWB21, LWW and LWG among parities were significant ($P \leq 0.05$, 0.01 or 0.001) (Table 1 and 2). In general, all litter traits studied increased as parity advanced till the thired parity then decreased (Tables 1 and 2).

Afifi (1997) reported that the lowest performance was generally recorded for litter traits in the first parity when compared to those of other parities. However, the differences in litter size and weight at birth and weaning may be attributed to change in the physiological efficiency of the doe especially these related to evulation, uterine capacity milk production and the ability of the doe to suckle its young (Afifi *et al.*, 1992) and differences in conception rate and may also due to the maternal effects determined by the number of mature, fertilized and established ova (Gad-Alla *et al.*, 2005; Nofal *et al.*, 2005 and Pannu *et al.*, 2005).

The parity-order effects on PWM were significant ($P \leq 0.05$) at the period of 21- 35 days (Table 3). In general, PWM percentages were increased as parity advanced till the fifth parity then decreased (Table 3).

From literature, parity effect on mortality rate or survival had no consistent trend through a lot of experiments allover the world. Also, a lot of investigators revealed a non-significant effect parity order on the PWM (Khalil and Afifi, 1991; Sorensen *et al.*, 2001; Abo-Khadiga, 2004 and Akpo *et al.*, 2008).

Doe Reproductive Traits

Effect of breed-type

Breed-type means differed significantly ($P<0.05$ or 0.01) for NSC, Do and KI (Table 4). Rex doe rabbits had the lowest values for all doe reproductive traits studied when compared with Flander rabbit breed (Table 4).

Table 4. Least-square means and standard errors (S.E.) of factors affecting do reproductive traits in Flander and Rex Rabbit Breeds

Item	NSC		DO		KI		GL	
	N	$\bar{X}$ ± SE	N	$\bar{X}$ ± SE	N	$\bar{X}$ ± SE	N	$\bar{X}$ ± SE
Breed		*		**		**		NS
Falander		1.99±0.09^{a}	148	30.15±1.93^{a}	148	61.03±1.92^{a}		30.92±0.08
Rex		1.79±0.07^{b}	166	24.84±1.13^{b}	166	55.71±1.12^{b}		30.80±0.07
Year		**		**		**		NS
2007-2008		1.73 ±0.07^{b}	153	24.46±1.54^{b}	153	55.31±1.53^{b}		30.82±0.08
2008-2009		2.04±0.08^{a}	161	30.08±1.53^{a}	161	60.98±1.52^{a}		30.89±0.08
Season		***		***		***		**
Autumn		1.46±0.06^{b}	46	16.74±0.90^{c}	46	47.83±0.91^{c}		30.88 ±0.11^{ab}
Winter		1.60±0.08^{b}	113	22.28 ± 1.54^{b}	113	53.44±1.53^{b}		31.15 ±0.11^{a}
Spring		2.30±0.13^{a}	91	33.21±2.43^{a}	91	63.81±2.42^{a}		30.67 ±0.10^{b}
Summer		2.46 ± 0.15^{a}	64	35.56±2.35^{a}	64	66.14±2.39^{a}		30.60 ±0.12^{b}
Parity		***		***		***		NS
1st		1.44±0.07^{c}		——		——		30.81 ±0.11^{ab}
2nd		1.63±0.09^{c}	87	21.17±1.45^{c}	87	52.18±1.44^{cd}		31.01 ±0.12^{a}
3rd		1.83±0.14^{bc}	75	25.97±2.81^{bc}	75	57.05±2.80^{bcd}		31.09 ±0.14^{a}
4th		2.18±0.15^{ab}	67	29.61±2.23^{ab}	67	60.31 ± 2.19^{abc}		30.70 ±0.13^{ab}
5th		2.59±0.20^{a}	51	35.49±2.88^{a}	51	66.24± 2.86^{a}		30.75 ±0.14^{ab}
6th		2.31±0.21^{a}	29	31.00±3.07^{ab}	29	61.62 ±3.16^{ab}		30.62 ±0.22^{ab}
7th		1.61±0.25^{c}	5	20.600±2.50^{c}	5	50.80 ±2.60^{d}		30.20 ±0.20^{b}

NSC= Number of services per conception, Do = Days open, KI= Kinding interval, GL = Gestation length.
NS = Non-significant ($P > 0.05$).
* = Significant at level ($P \leq 0.05$).
** = Highly significant at level ($P \leq 0.01$).
***= Very highly significant at level ($P \leq 0.001$).

There results are in agreement with those reported by Khalil *et al.* (1998); Bujarbaruah *et al.* (1989); Ghosh (2003) and Chineke (2006).

Effect of year of kindling

Doe reproductive traits (NSC, Do and KI) were significantly ($P \leq 0.01$) affected by year of kindling while, GL was insignificantly affected by year of kindling. Year of kindling effect on NSC and Do were found to be significant ($P \leq 0.05$, 0.01 or 0.001) as reported by Gad (1998) and Gharib (2004) Abd El-Raouf (1993), Youssef (1992) on the other hand Hassan (1993), Afif *et al*, (2000) and Farid (2004) observed that, the effect of year of kindling on GL was non-significant.

Effect of season of kindling

Results presented in Table 4 showed that, NSC, Do and KI were significantly ($P<0.001$) increased with advance of season of kindling from autumn to summer.

The same trend was observed by Kalamah *et al.* (2001) and Gharib (2004) found that does which received the first service during autumn or winter received the first service during autumn or winter required less NSC than those started to be served during spring and summer Also, GL was significantly ($P \leq 0.01$) affected by season of Kindling.

The differences in GL was not proved by season effect only, but may be depend on the physiological status of the pregnant does with the increase in litter size at birth, which may due to big uterine size of pregnant female rabbits which accelerate parturition because of high stress on uterus (Jainudeen and Hafez, 1980).

Effect of parity order

The least-square means in Table 4 showed that, in general NSC, Do and KI were significantly ($P \leq 0.001$) increased with advance in parity order.

Whereas NSC, Do and KI recorded the highest values with the fifth parity and the highest value for GL were recorded with the third parity.

Similarly, El-Sayiad *et al.* (1993) and Kalamah *et al.* (2001) showed that parity was a significant ($P \leq 0.05$ or 0.01) saurse of variation in NSC and Abdel-Raouf (1993) and Hassan (1993) in NSC, Do and KI.

Biochemical Genetic Studies

Based on the established fact that proteins and enzymes are the other face of genetics the biochemical assays of genetic variation at the pratein and enzyme molecular level can provide rich insights into the genetic structure of biological organisms. Studies of several locus protein or allozyme variations of biochemical genetic variation in animals. The polymorphism of blood protein genetic markers supplies useful information in several fields of animal science.

SDS. PAGE protein patterns

Electro phonetic assays have been rudely used as rapid and accurate tests to identify and characterize different animal genetic resources By these techniques it is now possible to actually fingerprint animal breed to asses its identity and its genetic potentialities. In this part of the present study, sodium deducible sulfate polydactyl amidogen electrophoresis (SDS – PAGE) technique was used for identification character-rabbit breed studied.

Animal-specific markers confine the rate of segregation in the populations. In other words the frequency of polymorphic bands with in breeds reflects the inbreeding value. In practice, it allows selection of given animal genotype for superior characteristics to be used in mating programs.

The electrophoretic banding patterns of SDS–PAGE, molecular weight (MW) in kilo claltion (KD) and one/zero data for Gel mage for the three parents and their offsprings of the two rabbit breeds studied are shown in Fig. 1 and Table 5. 73 bands were appeared with MW ranging from 181.334 to 24.024 KD. Most of these bands were common to all lanes. The first 8 bands (MW from 181.33a to 73.745) were mono morphic bands appared in all material studied.

However, rest 5 bands (MW from 68.092 to 24.024 KD) were polymorphic bands. These bands appear in son individuals and absence the others. There fore these bands could be used as biochemical marks tin addition, it is noticed that the 68.092 KD band was detected in two lanes for Rex rabbits and did not appear in all individuals of Flander rabbits. The refore, it could be concluded that this band is accurate biochemical marker for Rex rabbits and can be used to distinguble between the two rabbits breeds.

The obtained results were in agreement with those reported by Ryan *et al.* (2005); Branski *et al.* (2004) and Verdolini *et al.* (2003).

Esterase isozyme

Fig. 2 represent actual banding patterns of estrase isozgme for serum blood rabbits for the three parents and their offspring for the two breeds studied. Very high

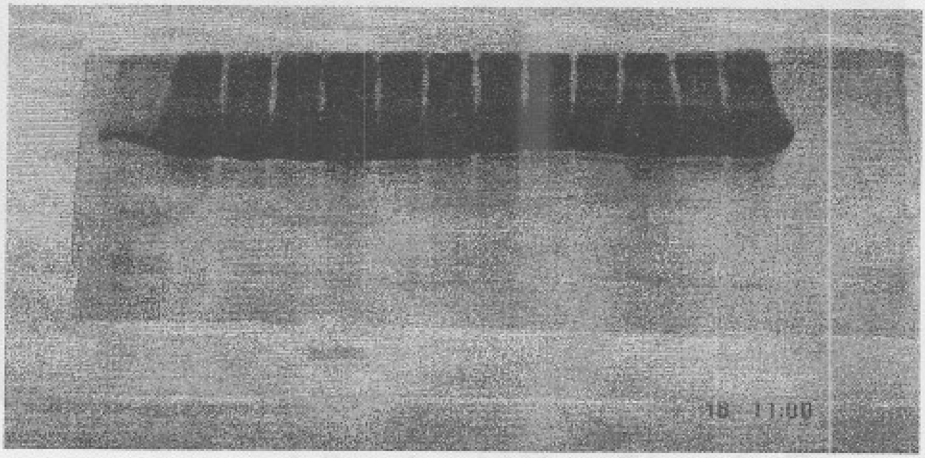

Fig. 1. SDS-PAGE Protein Patterns for serum in Flander and Rex rabbit breeds studied

Table 5. Protein banding patterns for the three parents and their offspring for Flander and Rex rabbit breeds studied

MW(KD)	Flander						Rex					
	P_1	Of	P_2	Of	P_3	Of	P_1	Of	P_2	Of	P_3	Of
181.334	1	1	1	1	1	1	1	1	1	1	1	1
165.773	1	1	1	1	1	1	1	1	1	1	1	1
153.447	1	1	1	1	1	1	1	1	1	1	1	1
146.35	1	1	1	1	1	1	1	1	1	1	1	1
132.794	1	1	1	1	1	1	1	1	1	1	1	1
116.362	1	1	1	1	1	1	1	1	1	1	1	1
88.902	1	1	1	1	1	1	1	1	1	1	1	1
73.745	1	1	1	1	1	1	1	1	1	1	1	1
68.092	0	0	0	0	0	0	0	0	0	1	0	1
62.404	0	0	1	1	0	0	0	0	1	1	0	0
48.396	0	0	0	1	1	1	1	1	1	1	1	1
44.242	0	0	0	0	1	1	1	1	1	1	0	0
24.024	1	0	1	1	1	1	1	1	1	1	1	1

MW (KD) = molecular weight in kilo dalton
P = Parent sample
Of = Offspring sample
1 = Band present
0 = Band absent

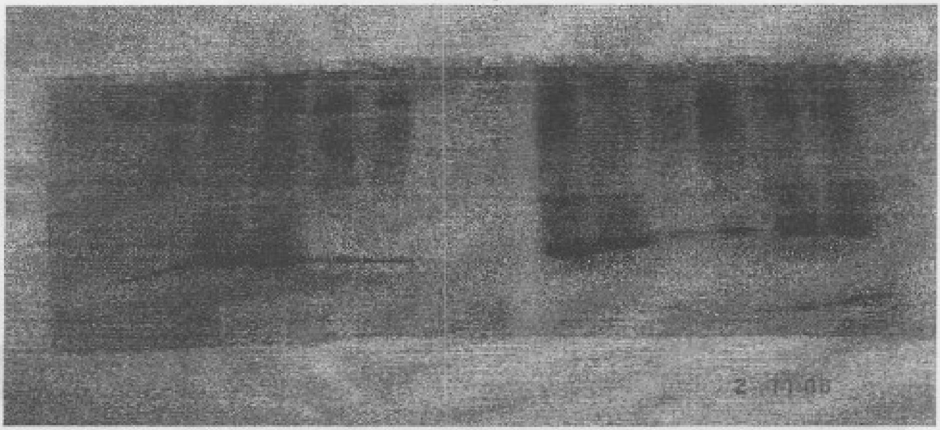

Fig. 2. The occurrence of serum esterase isozyme bands by PAGE in Flander and Rex rabbit breeds studied

similarity between all individuals studied was shown. AU banels clensity. Therefore, the data obtained from the analysis of mative-PAGE of isozyme electrophoresis was not used to studied material. In fact, these results must be supported by advanced molecular studies on the DNA level.

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الوراثة البيوكيميائية والأداء الإنتاجي والتناسلي لسلالتي أرانب الفلاندر والركس تحت الظروف المصرية

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تم تجميع البيانات من ٤٠٣ خلفة ناتجة من ٨٨ أنثى (٤٥ أرنب فلندر و ٤٣ أرنب ركس) خلال عامين متتاليين من الإنتاج (٢٠٠٧/٢٠٠٨ و ٢٠٠٨/٢٠٠٩). حيث أجريت هذه الدراسة: (١) لدراسة تأثير العوامل الوراثية والغير وراثية على الصفات الإنتاجية والتناسلية لإناث الأرانب. (٢) تقييم الواسمات الوراثية الحيوية المرتبطة مع الصفات الإنتاجية والتناسلية والمقاسة بواسطة التفريد الكهربائى للبروتينات وبعض الأيسوزويم (متشابهات الإنزيم) مثل الاستيريز فى سيرم الدم. كانت النتائج كما يلى: ١– سجلت سلالة أرانب الفلاندر نتيجة غير معنوية مقارنةً بالركس لمعظم صفات حجم وزن الخلفة المدروسة. ٢– أثرت سنة الولادة معنويا (مستوى ٠,٠٥، ٠,٠١ أو ٠,٠٠١) على صفات حجم وزن الخلفة عند المراحل العمرية المختلفة المدروسة فى السلالتين. ٣- أثر موسم الولادة معنويا (مستوى ٠,٠١ أو ٠,٠٠١) على صفات الخلفة فى سلالتين الأرانب المدروستين. ٤– بصفة عامة ذادت كل صفات الخلفة بزيادة ترتيب البطون حيث كانت أعلى زيادة فى البطن الثالثة ثم انخفضت بعد ذلك. ٥– تأثر معدل النفوق قبل الفطام فى الفترة من الولادة حتى ٢١ يوم ومن الولادة حتى ٣٥ يوم (الفطام) معنويا لسنة وموسم الولادة. ٦– تأثرت معظم الصفات التناسلية للإناث معنويا (مستوى ٠,٠٥ ، ٠,٠١ أو ٠,٠٠١) للسلالة وسنة الولادة وموسم الولادة وترتيب البطون. ٧– أظهر التفرير الكهربى للبروتين: أ– وجود الخدمة البروتينية ذات الوزن الجزئى ٦٨,٠٩٢ فى فردين فقط من سلالة Rex وغيابها تماما فى جميع أفراد السلالة Flander يمكن الاعتماد عليها كخدمة بيوكيماوية مميزه للتفريق بين السلالتين. ب– ظهور الخدمة ذات الوزن ٤٤,٢٤٢ فى معظم أفراد Flander وغيابها فى معظم أفراد Rex يمكن اعتبارها إلى حد ما كخدمة مميزة. ٨– التماثل شبه التام فى حزم إنزيم الاستيريز فى جميع العينات المستخدمة يدل على عدم إمكانية الاعتماد على التفرير الكهربى لهذا الإنزيم فى التمييز بين السلالات.