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COMPARATIVE STUDY ON EGG PRODUCTION TRAITS AND BIODIVERSITY GENETIC IN EGYPTIAN NATIVE BREEDS OF CHICKEN

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ABSTRACT:The objective of this research, improving egg production and egg quality traits for Egyptian local breeds by detected loci genes using microsatellites (SSR) technique. Three Egyptian native breeds (Fayoumi, Dandarawi and Sinai) were reared under the same environmental, managerial and hygienic conditions from begin to hatching until end experimental (60 weeks of age). Egg weight, egg percentage, and broken percentage were recorded daily from the onset of lay within 3 months intervals. While, egg quality was evaluated at 36 weeks of age. The results appear that Fayoumi and Sinai hens were produced significantly highest egg production than Dandarawi ones. On the other hand, egg quality slightly differ among breeds on these study. The total number of alleles for seven primers and the diversity percentage within each breed. This data pointed that Dandarawi have the highest diversity while the Fayoumi breed have the highest similarity for the studied primers. On the other hand, when comparison among Fayoumi, Sinai and Dandarawi was carried out and indicated that, Dandarawi line was superior in difference of microsatellite markers compared Fayoumi and Sinai breeds. On the other hand, applied egg number (E.N) and egg production (E.P) traits for breeding programs reflected promising success in case of applying these traits on Fayoumi and Sinai breeds.

The recommended that utilizing molecular markers for selection and therefore, be useful in breeding programs.

Keyword: SSR- genetics - Egyptian native breeds - production parameters

INTRODUCTION

Poultry production is an essential domesticated animals part to supply people protein. It is particularly ideal to the smallholder frameworks in creating nations because of low capital speculation and staggering expense productivity. Egyptian native chicken breed are vital, yet the data on their hereditary qualities regarding execution, versatility, opposition, hereditary inconstancy and hereditary connections are close to nothing. Chicken is a standout amongst the most generally circulated animals on the planet. Poultry creation is an essential domesticated animals division for providing human with creature protein. It is particularly great to the smallholder frameworks in creating nations because of low capital speculation and staggering expense effectiveness. It plays a significant role as a source of high-quality protein for human and good income. Native chicken breeds appear to possess enormous genetic diversity, especially in adaptive traits, and the ability to survive harsh conditions and under feeding regimens (Radwan and Mahrous 2018). Chickens are rich in genetic diversity and have high recombination rate (Siegel et al. 2006). Genetic selection programs need to screen a scope of attributes to guarantee that change of one trademark isn't to the detriment of other similarly essential characteristics; this procedure is being helped by expanded learning of the genetic basis of egg quality. Late advances in the accessibility of genomic data have made the dismemberment of the inherited variety behind these characteristics conceivable. The primary genome outputs to recognize loci influencing egg quality attributes have been founded on medium-thickness microsatellite maps (Tuiskula-Haavisto et al. 2012). Microsatellite markers, by ethicalness of their co strength and numerous alleles turned out to be effective in hereditary assorted variety examines, family assessment and hereditary mapping when contrasted with other sub-atomic markers like RAPD, RFLP and ISSRs (Nagaraju et al. 2001, Ahlawat et al. 2004, and Soltan et al., 2018). Sheng et al. (2013) utilized PCR-SSCP (polymerase chain response single strand compliance polymorphism) and sequencing to break down connections between's CTSD (enter compound in yolk development, and it essentially influences egg yolk weight and egg weight) polymorphisms and egg quality characteristics were in neighborhood Shandong chicken breeds. Two variations were observed to be related with egg quality attributes. Several researches have reported associations between genetic markers and quantitative traits (Bacon et al., 2000 and Soltan el al., 2016). Chatterjee et al. (2008) found that the egg weight and production traits showing significant correlations of the markers MCW0041, ADL0210, and MCW0110 with the egg production traits ($P<0.05$), while no significant correlations of MCW0014, MCW0049, ADL0158, and MCW0243 markers were found with any of the egg production traits. In an Egyptian recent study, the total map length was 1901 cM for growth traits and 1949 cM for egg traits (Khalil et al, 2016 and Abdel Alal, 2016). Radwan et al (2014) studied genetic diversity and identified population priorities for egg traits on two lines of Alexandria chicken (selected L1 and control L2) by Eight microsatellite markers linked to QTLs

associated with the studied egg traits were used.

The objective of this research, improving egg production and egg quality traits for Egyptian local breeds by detected loci genes using microsatellites (SSR) technique.

MATERIALS AND METHODS

A total of 450 days-old chicks (Fayoumi , Dandarawi and Sinai breeds) were reared in the poultry farm, Faculty of Agriculture, Ain Shams University under the same environmental, managerial and hygienic conditions from begin to hatching until end experimental (60 weeks of age). They were housed in individual cages placed in an open-sided house. The lighting schedule was maintained at 16 hours of light and 8 hours of darkness throughout the experiment. The genetic experimental was conducted in the genetic department lab at Faculty of Agriculture, Tanta University.

Production performance:

Egg weight, egg percentage, and broken percentage were recorded daily from the onset of lay within 3 months intervals (experimental period).To evaluate egg quality parameters, a total of 180 eggs were randomly collected from each breed at 37 weeks of age. Yolk, albumin and eggshell percentage were calculated. Yolk index (yolk height/yolk diameter) was also calculated. Haugh units were calculated according to Stadelman (1977).

Genomic DNA isolation:

Nine blood samples were randomly collected from each breeds (Fayoumi, Dandarawi and Sinai) into vacuum tubes containing EDTA and stored at -20°C.

Molecular marker analysis (SSR):

Genomic DNA of Nine individuals from each breed were used as a template for PCR which were carried out against ten SSR and primers. The codes, sequences and melting temperatures of these primers are shown in Table (1). PCR was performed in 25 µl volumes containing 12 µl of PCR Master mix 2x (CinnaGen/ Iran), 2 µl of each primer (10 pmol/ µl), 1 µl genomic DNA.

PCR analysis:

PCR reactions were achieved in thermal cycles that were differently programmed for each of the primers. The initial denaturation temperature of the first cycle was 94 C° for 4 min for all primers. The next 30 cycles varied in temperature settings (for 1 min) according to each primer. Final extension was 72 C° for 5 min for all primers.

PCR products (15 µl of each reaction) and 100 bp DNA ladder (Larova GmbH-Germany) as DNA size marker were resolved by electrophoresis on 2 % agarose gel containing Ethidium bromide for 90 min. at 70 volt, visualized via UV trans illuminator and then photographed.

Statistical analysis:

Data were subjected to a one-way analysis of variance with breed effect using the General Linear Model (GLM) procedure of SAS Users Guide, 2001. The fixed model used as following:

$Yeij = \mu + Be + Bi + eij$

Where;µ =overall means, Be =Breed effect (1=1.3),Bi = replication, eij =experimental error.

RESULTS AND DISCUSSION

Egg production characteristics for native Egyptian breeds are shows in Table (2). Fayoumi and Sinai hens were produced significantly highest egg production than Dandarawi ones. While, Sinai eggs egg broken percentage was highest significant compared to other two native breed of this study.

Table (3) shows the means ±SE of egg quality characteristics for native Egyptian breed. Dandarawi eggs were stronger strength compared to Fayoumi and Sinai ones (4.97vs. 4.60and 4.01 Kg/cm^2) respectively. Sinai eggs recorded a insignificant increase in Haugh units compared to Fayoumi and Dandarawi eggs. Yolk index showed a slightly differ among Fayoumi (40.76), Sinai (40.89) and Dandarawi (39.99). Moreover, albumen percentage showed a significant increase for Sinai (56.98%) and Fayoumi eggs (55.89%) when compared with Dandarawi (50.65%). Yolk percentage for Dandarawi eggs (34.03) showed an insignificant increase than Fayoumi (32.65) and Sinai (33.65) ones. Hussein et al. (2010) observed that Sinai hens produce eggs with higher Haugh unit. Radwan (2007) found that there was no significant difference between Dandarawi and Fayoumi eggs for albumen percentage. This result agreed with the result of Farahat et al. (2009) could be seen that Sinai had significantly highest albumen% as compared to other breeds, whereas Fayoumi had the lowest albumen% and a highest yolk% as compared to other breeds. It can be seen that the larger eggs have a greater proportion of albumen, but a lower proportion of yolk. Hussein et al. (2010) could be seen that Sinai had significantly highest albumen.

Table (4) indicates the total number of alleles for seven primers and the diversity percentage within each breed. This data pointed that Dandarawi have the highest diversity while the Fayoumi breed have the highest similarity for the studied primers. On the other hand, when comparison among Fayoumi, Sinai and Dandarawi was carried out and indicated that, Dandarawi line was superior in difference of microsatellite markers compared Fayoumi and Sinai breeds. Farrag et al. (2013) appear high genetic diversity in quail compared to chicken (Sinai breed). The Egyptian native breeds were benefit great genetic diversity subsequently, they enable they have high improvement when inserted breeding program (Radwan et al., 2015a, and Soltan et., 2018).

Table (5) In the light of clear relation between ADL-273, MCW-246 markers and egg number (E.N) trait MCW-41 , MCW-49 markers and egg production (E.P) trait clearing successful diversity for Fayoumi line for this marker, it could be concluded that, fayoumi breed was superior for egg number (E.N) and egg production (E.P) traits comparing with Dandarawi and Sinai breeds. On the other hand, applied egg number (E.N) and egg production (E.P) traits for breeding programs reflected promising success in case of applying these traits on Fayoumi and Sinai breeds. Radwan et al. (2015b) reached that the Fayoumi breed was own possessed specific allele given to distinguish eggshell strength and egg production traits so useful used Fayoumi breed in breeding program intended to improve these traits. Marker genotype linked were very important used in program breeding to improvement the quantitative traits (Bulut et al., 2012).

Genetic distance for three hen breeds Fayoumi, Dandarawi and Sinai based on microsatellite fingerprinting data was shown in figure (1). Seven microsatellites marker according to genetic similitude rates which concluded from Microsatellite fingerprinting seven primers for three breeds showed that all samples divided into two main clusters at 27 % of genetic similitude. First cluster appear by Fayoumi breed. As a result of highly genetic similarity between Dandarawi and Sinai breeds, they located in the same second cluster at 40 % of genetic similarity.

CONCLUSION

This study illustrate that highly importance for Sinai breed was recorded as a result of highly genetic similarity between Fayoumi breed and Dandarawi breed and favorable traits of Sinai breed for egg percentage which grant to improvement these traits for Dandarawi breed. Fayoumi breed showed more susceptibility for egg number and egg percentage traits improvement in breeding programs than Sinai and Dandarawi. The recommended that utilizing molecular markers for selection and therefore, be useful in breeding programs.

Table (1): Codes, sequences and annealing temperatures of the used primers:-

Locus	**Loc.**	**Treat**	**F/R**	**Sequence(5'-3')**	**Annealing temp.**
ADL-273	Z	E.SS/E.N	F	GCCATACATGACAATAGAGG	52
			R	TGGTAGATGCTGAGAGGTGT	
MCW-154	Z	E.S/	F	GATCTGTTTTATCACACACAC	52
		B.W	R	CCATTTCCTTTGTTATCAGGC	
MCW-246	Z	E.SS	F	TCATAAGGCAGAGAATTCATC	52
		E.N	R	TTTCCATTCAGACAACAAGGC	
MCW0170	4	ESS	F	TTGTGAAACTCACAGCAGCTG	55
			R	TTATAGCAGGCTGGCCTGAAG	
MCW-41	2	E.P	F	CCCATGTGCTTGAATAACTTGGG	55
			R	CCAGATTCTCAATAACAATGGCAG	
MCW-49	1	E.P	F	AGCGGCGTTGAGTGAGAGGAGCGA	62
			R	TCCCCAACCCGCGGAGCGCTAT	
ADL-188	1	H.U	F	CACTTCCAGTATTAAGGTGA	51
			R	GTGGACACAATGAGTTCCTC	

B.W : Body weight , ESS: Egg shell strength , E.N : Egg number , E.S : Egg size and E.P : Egg production .

Table (2): Means ±SE of egg production characteristics for native Egyptian breeds.

		Breed		
Traits	**Fayoumi**	**Dandarawi**	**Sinai**	**p-value**
Percentage of egg production	69.57±1.52[a]	61.77±2.06[b]	67.08±1.82[a]	0.01
Egg weight, g	45.06±1.36	44.96±0.92	46.49±1.09	NS
Egg broken percentage	1.38±0.58[b]	0.74±0.54[c]	2.60±10.86[a]	0.03

Table (3): Means ±SE of egg quality characteristics for Egyptian native eggs.

Traits	**Breed**			**P-value**
	Fayoumi	**Dandarawi**	**Sinai**	
Egg weight, g	48.69±0.79[a]	46.27±0.59[c]	52.42±0.78[b]	0.001
Yolk %	32.65±0.43	34.03±0.31	33.65±0.54	NS
Albumin %	55.89±0.98[a]	50.65±0.81[c]	56.98±0.63[a]	0.01
Eggshell %	11.46±0.28	15.32±0.15	9.37±0.27	0.001
Yolk index	40.76±0.28	39.99±0.54	40.89±0.19	NS
Haugh unit	77.98±0.45	76.87±0.37	78.65±0.67	NS
Eggshell strength, kg/cm	4.60±0.21[b]	4.97±0.19[a]	4.01±0.32[c]	0.05
Eggshell thickness, µm	0.38±0.02[b]	0.41±0.03[a]	0.37±0.01[c]	0.001
Egg Size	49.29±0.65	45.98±0.99	53.64±0.64	0.01

[a and b] Means within the same row with different letters are significantly differed.

Table (4): the total number of alleles for siven primers and the diversity percentage within each breeds**.**

		Total alleles Number	**Diversity within breeds**
breeds	**Fayoumi**	41	9
	Dandrawi	59	21
	Sinai	101	16

Table (5): Genetic polymorphism for for Egyptian native breeds.

primers	Fayoumi			Dandarawi			Sinai		
	Total amplified bands	Polymorphic bands	Polymorphism %	Total amplified bands	Polymorphic bands	Polymorphism %	Total amplified bands	Polymorphic bands	Polymorphism %
ADL-273	4	1	55	5	2	50	9	2	11
MCW154	6	0	0	3	0	0	9	0	0
MCW246	28	8	29	6	0	0	9	0	0
MCW0170	6	2	34	10	0	0	7	0	0
MCW-41	20	5	9	7	1	2	12	1	2
MCW-49	7	0	5	6	0	1	12	0	0
ADL-188	6	1	1	5	0	0	5	0	0

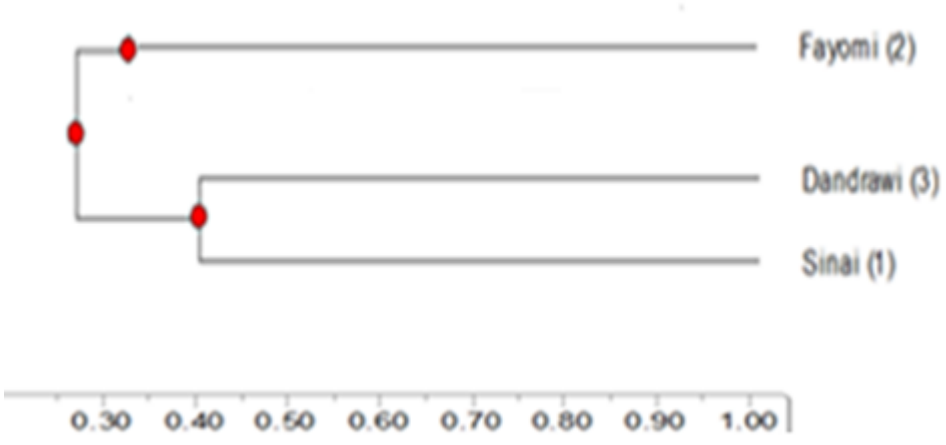

Figure (1): genetic similarity among three hen lines according to microsatellite fingerprinting data.

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الملخص العربى

دراسه مقارنة الصفات الانتاجيه للبيض والتنوع الوراثى فى سلالات الدجاج المصري

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الهدف من هذا البحث هو تحسين صفات إنتاج البيض و جودة البيض للسلالة المحلية المصرية من خلال الجينات المكانية المكتشفة باستخدام تقنية الصغائر .(SSR) تم تربية ثلاثة سلالات مصرية (الفيومى ، الدنداروى ، وسيناء) فى ظل نفس الظروف البيئية والإدارية والصحية من البداية حتى التفريخ حتى نهاية التجربة (60 أسبوعا من العمر). تم تسجيل وزن البيض ، نسبة البيض ، ونسبة مئوية مكسورة يوميا من بداية وضع في غضون 3 أشهر. في حين تم تقييم جودة البيض عند 36 أسبوعًا من العمر. تظهر النتائج أن دجاج الفيومي وسيناء كانا ينتجان أعلى إنتاج للبيض مقارنة بأصناف الدندروي. من ناحية أخرى ، تختلف نوعية البيض قليلاً بين السلالات في هذه الدراسة. العدد الكلي للأليلات لسبع مواد التمهيدي ونسبة التنوع داخل كل سلالة. وأشارت هذه البيانات إلى أن الدندراوي يتمتع بأعلى تنوع في حين أن سلالة الفيومي لها أعلى التشابه بين البكرات المدروسة. من ناحية أخرى ، عند المقارنة بين الفيومى وسيناء والدندراوى نفذت ، وأشار إلى أن خط الدندراوى كان متفوقا فى اختلاف محددات السواتل الميكروية مقارنة بسلالات الفيومى وسيناء. ومن ناحية أخرى ، فإن سمات عدد البيض المستخدم (E.N) وإنتاج البيض (EP) لبرامج التربية تعكس نجاحًا واعدًا في حالة تطبيق هذه الصفات على سلالات الفيومي وسيناء .وأوصت باستخدام علامات جزيئية للاختيار وبالتالي ، تكون مفيدة في برامج التربية.