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Relationship between genetic similarity and some productive traits in local chicken strains

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Random amplified polymorphic DNA (RAPD) technique was applied to detect genetic similarity between five local chicken strains that have been selected for eggs and meat production in Egypt. Based on six oligonucleotide primers, the genetic similarity between the egg-producing strains (Anshas, Silver Montazah and Mandarah) ranged from 72.4 to 85.4%. While the genetic similarity between the two chicken strains selected for meat production (Baheij and El-Salam) is 86.9%.

Key words: Chicken, local strains, RAPD-PCR, genetic similarity.

INTRODUCTION

RAPD markers can be applied to generate genotype-specific banding patterns. The use of DNA marker technology in poultry as a strains identification has progressed rapidly during the last decade. The effectiveness of RAPD in detecting polymorphism between chicken populations and their applicability in population studies and establishing genetic relationships among chicken populations have been reported by Sharma et al. (2001). This technology is currently being adopted for the discrimination of genetic resources of economically important Egyptian animals such as poultry, and other farm animals. This technique is playing a significant role in the strains protection law.

RAPD assay is simple, fast, and comparatively low-cost. It has quickly become the method of choice for genotype identification, population and pedigree analysis, phylogenic studies and genetic mapping. We have earlier demonstrated the genetic variability in 17th generation of Japanese quail selected for high eggs and meat production (Ali et al., 2002). In poultry, RAPDs has been used to detect specific markers (Zhang et al., 1995), to estimate genetic relatedness among various poultry species (Sharma et al., 1998; Smith et al., 1996), as well as for genome mapping (Levin et al., 1993). We have also presented some preliminary data showing molecular differences between Egyptian chicken strains (Ali and Ahmed, 2001), and indicating the potential use of RAPD markers for a wide range of applications in poultry breeding. According to Howard and Moore (1984), there are various well-developed strains of poultry that are used commercially. However, information about the genetic characterization of these strains and the amount of genetic diversity among them is minimal. Hence more studies are needed to characterize these strains genetically and to estimate the genetic variability between them in order to enhance selection and breeding.

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Table 1. The sequence of the primers used and their annealing temperatures.

Primer	Sequence 5`- 3`	Annealing Tm/Sec
1	AGG CCC CTG T	34 / 30
2	ATG CCC CTG T	
3	AAA GCT GCG G	30 / 30
4	ACC GCC GAA G	
5	GAA ACG GGT GGT GAT CGC AG	50 / 30
6	GGT GAC GCA GGG GTA ACG CC	55 / 30

MATERIALS AND METHODS

The following chicken strains, Anshas, Silver Montazah, Mandarah, Baheij and El-Salam, were collected from El-Sabhiah Poultry Research Station, Alexandria, Animal Production Research Institute, Dokki, Egypt. DNA extraction was carried out by method of Sharma et al. (2000). The concentration of DNA and its relative purity were determined using a spectro-photometer based on absorbance at 260 and 280 nm respectively. The polymerase chain reaction (PCR) mixture (25 μL) consisted of 0.64 U of Taq DNA polymerase, 25 pmol dNTPs, and 25 pmol of random primer, and

Table 2. Genetic similarity estimated for each primer between strains.

Comparisons	Primer Number						
	1	2	3	4	5	6	Average
Anshas / Silver Montazah	0.933	0.933	0.769	0.769	0.833	0.889	0.854
Anshas / Mandarah	0.727	0.727	0.667	0.750	0.923	1.000	0.799
Silver Montazah / Mandarah	0.667	0.667	0.727	0.667	0.727	0.889	0.724
Baheij / El-Salam	1.000	0.909	0.769	0.615	0.923	1.000	0.869

40 ng of genomic DNA. The reaction mixture was placed on a DNA thermal cycler (Perkin Elmer 9700). The PCR programme included an initial denaturation step at 94°C for 2 mins followed by 45 cycles with 94°C for 30 seconds for DNA denaturation, annealing as mentioned with each primer, extension at 72°C for 30 seconds and final extension at 72 °C for 10 minutes were carried out. The amplified DNA fragments were separated on 2.5% agarose gel and stained with ethidium bromide. The amplified pattern was visualized on a UV transilluminator and photographed.

The RAPD bands were scored for their presence (1) or absence (0). The index of similarity between each two strains was calculated using the formula: Bab=2Nab/(Na+Nb), where Nab is the number of common fragments observed in individuals a and b, and Na and Nb are the total number of fragments scored in a and b, respectively (Lynch, 1990). The similarity index was calculated for each primer separately, and the average for all primers was carried out with each comparison.

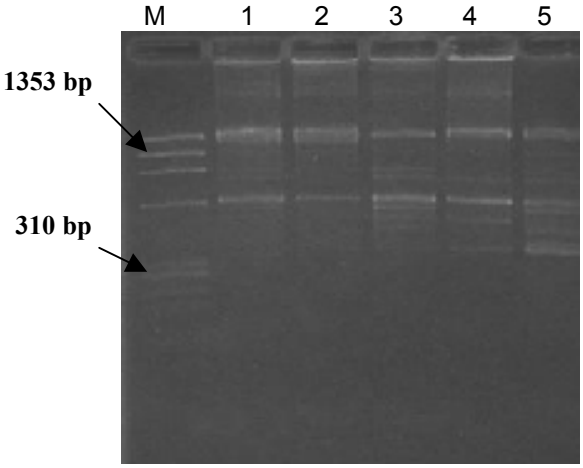

Figure 1. RAPD amplification products generated by Primer 4. Lane M: DNA marker; Lane 1: Anshas; Lane 2: Baheij; Lane 3: El-Salam; Lane 4: Silver Montazah; and Lane 5: Mandarah.

RESULTS AND DISCUSSION

Among ten primers screened, six successfully amplified genomic DNA from samples of chicken strains (Table 1, Figure 1). The estimated genetic similarity between the chicken strains is presented in Table 2. The genetic similarity between the egg-producing strains (Anshas, Silver Montazah abd Mandarah) is between 72.4 to 85.4%. While the two chicken strains selected for meat production (Baheij and El-Salam) is 86.9% similar based on the RAPD data.

It can be concluded from our study that RAPD markers are effective in detecting similarity between chicken strains and they provide a potential tool for studying the inter-strain genetic similarity and the establishment of genetic relationships.

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