POPULATION STRUCTURE AND PRODUCTION PERFORMANCE OF ASEEL PARENT POPULATION IN TIRUPPUR DISTRICT OF TAMIL NADU

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ABSTRACT

A survey was conducted to assess the breeder production performance in Aseel breeding farms. Aseel birds had multicolored plumage with solid feather patterns distributed all over the body. Pea combs, strawberry and single comb were observed in the population. Birds were housed in layer shed with the ratio of one male for eight females. Age at first egg was recorded as 139±1.94 days. Average cumulative egg production up to 120 weeks per bird was 160.59±0.59 with the 77% hatchability. Percentage hen day egg production for Aseel was 29.72±1.60 and the effective population size (N_e) ranged from 352.94 to 4781.16 and the overall mean Ne in the Aseel population was 2086.59±148.35 with the rate of inbreeding 0.0003.

Key Words: Aseel, Effective population size, Inbreeding, Production, Reproduction performance

INTRODUCTION

Poultry industry is very important in terms of animal protein in Indian rural economy. Recently native chicken are becoming progressively more popular as pure lines for their benefits in production traits and resistance to disease (Arora *et al.,* 2011; Haunshi *et al*., 2011). Aseel is one of the important Indian chicken breed and is well known for unique qualities, pugnacity, majestic gait and fighting qualities (Panda and Mahapatra, 1989). Eight varieties of the Aseel breed were described in the literature (Panda and Mahapatra, 1989). More research and surveys are required to establish baseline values for production parameters of the Aseel breed in field level (Mohan *et al.,* 2008). The knowledge of performance of a Aseel breed and its various economic traits is important for the formulation of breeding plans for further improvement in production traits. Hence, the present study was conducted to evaluate various traits related to the production and reproduction performance in Assel parent population in farmers field in Tiruppur district of Tamil Nadu.

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MATERIALS AND METHODS

Population studied

A survey was conducted in 52 Aseel breeding farms in 23 villages of Tiruppur district, Tamil Nadu. This survey was conducted to assess the breeder production performance in Aseel breeding farms and the survey was conducted during November and December, 2018.

Effective Population Size and Rate of Inbreeding

Three parameters i.e. effective population size (N_e) and rate of inbreeding (ΔF) were estimated using different mathematical formulas. N_e is defined as the size of an idealized population that would give rise to the same variance of gene frequency, or rate of inbreeding as in the actual population under consideration (Falconer, 1996). To estimate the effective population size of Aseel chicken in Tamil Nadu Aseel breeder farm, the following equation was used

$$N_e = \frac{4N_m N_f}{N_m + N_f}$$

Where N_f and N_m are the number of hen and cock respectively. Stepwise multiple regressions were performed to identify differences in N_e/N. The rate of inbreeding (ΔF) in the Aseel population was estimated using the following formula

$$\Delta F = 1/2N_e$$

The rate of inbreeding predicts the probability of homozygous genes that a new progeny will carry

Morphological traits

As per the Standard proforma developed by the Indian Council of Agricultural Research – National Bureau of Animal Genetics Resources (ICAR-NBAGR) the data on morphological characters (Comb types, colour of the shank, skin, ear lobe, eye, etc.,) were collected at 20 week aged birds.

Production and Reproduction traits

Age at first egg (AFE), cumulative egg production up to 120 weeks, and Hen Housed Egg Production from 21 weeks of age, hatchability, sex ratio, rate of inbreeding, age of culling and mortality rate were recorded.

Statistical Analysis

The data on qualitative characters were expressed as percentages. The descriptive statistics for various production performance were analyzed based on least square analysis.

RESULTS AND DISCUSSION

The number of adult breeding birds in the farms varied from 850 to 12600 at the time of visit with the overall mean of 5302±372.53 birds. Among the 52 farms surveyed, 5.77% of the farmers had breeder stock less than 2000, 42.31% had 2001 to 4000, 23.08% had 4001 to 6000, 9.62% had above 6001 to 10000 and above 10000 adult breeders. The Aseel breeders are housed in deep litter system. The number of poultry sheds in each farm varied from 1 to 11 with the overall mean value 3.02±0.27. The size of the individual sheds ranged from 880

to 9020 sq.ft with the mean of 3810 sq.ft. The total building space in different farms ranged from 1650 to 37620 sq. ft. with an average of 11380 sq. ft. Among the 52 farms, 9.62 % had less than 5000, 40.38% had 5001 to 10000, 25.00% had 10001 to 15000, 11.53% had 15001 to 20000, 9.61 % had 20001 to 25000 and 3.85 % had more than 25000 sq. ft total building space. The length of the sheds varied from 70 to 410 feet with an average of 173.63±5.57 (n=157). The breadth of the house ranged from 16 to 30 feet with an average of 21.85±0.14 feet (n=157).

The Aseel breeder birds are housed in layer shed at an average of 92.94 ± 1.76 weeks age in various farms. The average age of housing at layer shed was 92.94±1.76 weeks. The number of birds housed in each batch varied between the farms. The lowest number of birds housed in one batch was 850 and the highest was 12600 with the overall average of 5302±373. A high standard error value indicates wide variation in breeding stock reared in different farms. The sex ratio maintained in these farms ranged from 1:6.88 to 1:11.5 with an overall average of one male to eight females.

Table 1. Morphological characters in Aseel chicken expressed in percentage (n= 250)

Morphological trait	Type/ Size/ Color	Percentage (%)
Comb pattern	Pea comb	97
	Strawberry	2
	Single	1
Presence of Wattle	Male	74
	Female	Absent
Presence of Spur	Male	97
	Female	Absent
Colour of Ear lobe	Red	93
	White	4
	Black	3
Eye color	Black	100
Skin color	White	99
	Yellow	1
Shank color	Yellow	62
	Black	21
	White	17
Beak color	Yellow	98
	Black	2

Prediction of the Effective Population Size and Rate of Inbreeding

The effective population size (N_e) ranged from 352.94 to 4781.16 and the overall mean Ne in the Aseel population was 2086.59±148.35. Comprehensive estimate of N_e/N ranged from 29.44 to 44.77. The mean of N_e/N estimates that included all relevant variables was 39.53±0.46 in pooled comprehensive data sets (Table 2). The estimate of N_e/N from the multiple regression equation utilizing fluctuation in population size, variance in family size and unequal sex-ratios was 1:8 for the pooled data set. The unequal numbers of males and females in a population introduce a systematic variance in contribution between male and female parents and thus a reduction in effective size. Unequal sex-ratio, variance in family size and fluctuations in population size are the major variables predicted to affect Ne (Falconer, 1996). Zulu *et al.,* (2015) found that the N_e in Zimbabwe and South African village chicken population ranged from 2.17 to 7.10. N_e is generally much lower than N in natural populations (Frankham, 1995). The effective population size is required to predict the rate of inbreeding and loss of genetic variation in Aseel parent population. The predicted rate of inbreeding (ΔF) in next generation Aseel population was almost zero (0.000105 to 0.00142), which is lower than the ΔF (0.0930 - 0.13) that found in South Africa and Zimbabwe village chicken (Zulu *et al.,* 2015).

Table 2. Population structure, Production and Reproduction performance of Aseel breeder birds in Tamil Nadu.

Trait	Range	Mean ± SE
Number of birds in farm (N)	850 - 12600	5302.19± 372.56
Effective population size (Ne)	352.94 - 4781.16	2086.59± 148.35
Effective Population size/actual population size (Ne/N) in farms	29.44 - 44.77	39.53 ± 0.46
Rate of inbreeding (ΔF)	0.000105-0.00142	0.0003± 0.00003
Sex ratio (Male : Female)	1:6.88 - 1:11.5	I: 8
Average age of housing (days)	80 -100	92.94 ± 1.76
Age at First Egg (Days)	127 – 157	139 ± 1.94
Hen Housed Egg production (number)	117 - 194	164.48 ± 0.72
Hen Housed Egg production from 21 weeks of age (%)	19.77 – 45.13	29.72 ± 1.60
Cumulative Egg up to 120 weeks Per bird (number)	117.4 – 185.8	160.59 ± 0.59
Hatchability (TES) (%)	74.89 – 78.29	77 ± 1.88
Age of culling (weeks)	105 - 120	117.18 ± 1.00

Morphological Traits

Morphological characters such as plumage, comb, shank, ear lobe, eye and skin color observed in Aseel are presented in Table 1.Aseel birds had multicolored plumage, predominantly dark, black, red, golden and white with solid feather patterns normally distributed all over the body (Fig. 1). The Aseel birds had compact and firm body structure, strong appendages, strong legs, etc., Body stature of Aseel chicken had firm, compact muscular bodies held in a distinct upright position with strong shank, short curved beaks and broad skulls. The back was straight with a typical majestic gait and a slanting appearance from the neck to the tail. The long, glossy tail feathers drooping down wards gives a beautiful look to the birds. Different feather colors and plumage colors in Aseel breed have been reported by various authors (Panda and Mohapatra, 1989; Suganti, 2014; Rajkumar *et al*., 2017).

Almost all the birds (97%) had pea combs. However, strawberry (2%) and single (1%) comb were also observed. Singh (2001) revealed that the pea comb was the breed characteristic of Aseel birds with minor variations. Churchil *et al*. (2019) reported 80% pea and 20% rose conb in Aseel make chickens. (Sarkar *et al*., (2012) observed the presences of strawberry comb (24.05%) in Aseel population of Bangladesh. Wattles were absent or rudimentary in female (Sarkar *et al*., 2012, Rajkumar *et al.,* 2017; Churchil *et al*., 2019). However, wattles were observed in 74% of male birds. Most of the birds (98%) had yellow colored beak and 2% of the birds had black beak. Ear lobes were red in color in 93% birds and white and black were observed in 3 % and 4% birds respectively. Red, white and black ear lobes were observed by Rajkumar *et al*., (2017) in Andhra Pradesh. Compact and circular black eye color was observed in whole population. Long neck with uniformly thick lustrous multicolored plumage were present depends on the body plumage pattern. White (99%) and yellow (1%) skin colors were observed. Similar findings were reported in Aseel by Rajkumar *et al.,* (2017) and Singh (2001). Most of the males had fur (97%), but absent in females. Yellow (67%), black (21%) and white (17%) shank were recorded by Rajkumar *et al.,* (2017).

Fig. 1. Assel birds and chicks in the parent farms in Tiruppur district of Tamil Nadu

Production and Reproduction Performance

The age at first egg (AFE) in these farms was as low as 127 days and as high as 157 days. The average AFE of Aseel hen in the breeder farms was 139±1.94 days. The age at sexual maturity was comparatively lower than the reports on Rajkumar *et al.,* (2017) and Mohan *et al.,* (2008). However, similar observations on AFE were reported by Valavan *et al*., (2016). The hen-housed egg production had wide variation between the farms with lowest valve of 117 to a highest value of 194 eggs with an overall average of 164.48±0.72 eggs. The overall intensity of laying in terms of hen housed egg production (HHEP) from 21 weeks of age till culling was 29.72±1.60% with a range of 19.77 % to 45.13% in different farms. Contrary to these findings, HHEP percentage was higher in the study of Valavan *et al*., (2016). This might have been because of considering the egg production data till culling age of the Aseel bird in our studies. The cumulative egg production up to 120 weeks per bird in this study ranged from 117.4 to 185.8 eggs, with an overall mean egg production of 160.59±0.59 eggs per bird. However, Singh *et al*., (2000) reported an average egg production of 33.17 eggs per hen per year under field conditions. In contrast, the egg production was recorded as 159 eggs at 20 to 72 weeks by Valavan *et al.,* (2016).

The hatchability is influenced by many environmental factors. The hatchability percentage on Total Egg Set (TES) among various farms ranged from 74.89 % to 78.29% and the mean hatchability (TES) was 77.00±1.88%. But a lower hatchability (TES) of 70.72% was reported in Aseel birds by (Mohan *et al.,* 2008).The variation might be due to the differences in age of the birds, different genetic group of birds and environmental condition. The mortality during one month period preceding the visit ranged from 0.00 to 4.27% with the overall mean of 1.07 ±0.13%. The breeder birds were culled after their economic egg production period was completed and the culling age varied between the farms from 105 to 120 weeks. With the average culling age of Aseel breeders of 117.18±1.00 days.

CONCLUSION

Aseel birds had multicolored plumage, with solid feather patterns normally distributed all over the body. Pea combs, strawberry and single comb were observed in the population in 52 Aseel breeding farms in 23 villages of Tiruppur district of Tamil Nadu. Average cumulative egg production up to 120 weeks per bird was 160.59±0.59 with the 77% hatchability. The age at first egg (AFE) in these farms was as low as 127 days and as high as 157 days. The average AFE of Aseel hen in the breeder farms was 139±1.94 days. The changes in production performance indicates selection in the population in farmers flocks and the changing scenario for the local need for indigenous breeds.

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