*Indian Journal of Animal Sciences* **85** (6): 634–637, June 2015/Article

# Evaluation of Vanaraja male line (PD1) for different production and egg quality traits

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Received: 28 July 2012; Accepted: 12 March 2015

ABSTRACT

Vanaraja male line (PD1) was evaluated for different production traits up to 60 weeks of age and egg quality traits were recorded at different ages. Body weight at 20 and 40 weeks of age were 2037 and 2903 g, respectively. Least square estimate for age at sexual maturity was 180.30 days. Egg production up to 40 and 60 weeks of age were 42.34 and 92.06 eggs, respectively. There was increase of 2.07 mm shank length between 16 to 20 weeks of age. Heritability estimates for age at sexual maturity, body weight at 20 and 40 weeks of age, egg production upto 40 weeks and egg weight at 32 weeks of age were low in magnitude. However, heritability estimates for Shank length at 20 and first egg weight showed moderate to high heritability. Genetic correlation between shank length and egg production up to 40 weeks of age was positive, however, body weight at 40 weeks of age with egg production showed negative correlation and moderate in magnitude. Egg quality parameters showed significant difference between different age of measurements and as the age increases the egg quality parameters decreases. Results indicated that most of the production traits in PD1 line have less additive genetic variation which should be considered in the selection programme.

**Key words**: Body weight, Egg production, Egg quality, Genetic parameters, Vanaraja

Backyard poultry production is an important activity practised by rural poor and tribal people. Though the farmers are used to rear mostly indigenous birds, of late different exotic varieties were developed for the backyard farming. Breeders use to improve the desired traits in pure lines through selection to get maximum heterosis in crossbreds. Vanaraja, a commercial variety is developed by two way cross at ICAR - Directorate of Poultry Research, Hyderabad. Vanaraja male line is a mediocre coloured broiler line, is being selected for shank length as it plays an important role in faster movement of the birds enabling them to escape from predators in the field (Niranjan *et al*. 2011). Performance of Vanaraja commercial was reported in literature (Padhi *et al*. 2012a). However, there are very few reports in respect to Vanaraja male line. Therefore, the present study was undertaken to evaluate Vanaraja male line for different production and egg quality traits.

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## MATERIALS AND METHODS

Vanaraja male line (PD1) was under selection for higher shank length at 6 weeks of age for last 3 generations. The data used for the present study was collected from 282 females selected from a flock produced in four hatches using 50 sires and 150 dams. The birds were reared upto 60 weeks of age in individual cages with nipple drinkers. Birds were kept on restriction feeding schedule from 6$^{th}$ week onwards to maintain the target body weight during the laying period for better egg production. They were maintained in a broiler grower ration from 6 to 20 weeks of age and broiler breeder ration till the end of the experiment. Different production parameters traits were recorded along with shank length at 16 and 20 weeks of age. For egg quality study eggs were collected randomly (40 to 115 eggs) late afternoon at 40, 52 and 64 weeks of age and were kept at room temperature overnight for evaluation of egg quality in the next day as per standard procedure.

Egg quality data were subjected to one-way analysis of variance and significance of different means were tested as per Snedecor and Cochran (1994). The pedigreed data for different traits were analysed using least square technique (Harvey 1990) and the hatch corrected data for some important traits were utilised for estimating heritability estimates by variance component analysis (Kings and

Henderson 1954). Genetic and phenotypic correlations were estimated from variance and covariance component analysis (Becker 1975).

## RESULTS AND DISCUSSION

*Body weights:* Least square estimates for body weight at 16, 20, 40 and at sexual maturity (WASM) are presented in Table 1. There was body weight gain of only 175 g during 16 to 20 weeks of age as the restriction programme was followed up to 20 weeks of age. However, the body weight at 40 weeks of age was increased by 866 g from 20 to 40 weeks of age. The body weight obtained at 20 weeks of age was comparable to the report of (Padhi and Chatterjee 2012); however, 40 weeks body weight was higher in the present study indicating higher gain during the period. Weight at sexual maturity was found to be 2396 g in the present study. Rajkumar et al. (2012) reported higher body weight in a naked neck meat type population.

*Shank length:* There was an increase of 2.07 mm shank length from 16 to 20 weeks of age (Table 1). The shank length recorded in the present study at 20 weeks of age was higher than the report in PD1 (Padhi and Chatterjee 2012). Higher shank length at 20 weeks of age in this line may improve the shank in the commercial crosses which will be useful for the faster running of bird in the field to escape from the predators.

*Production traits*: Age at sexual maturity observed to be 180.30 days (Table 1) which was higher than the report of Padhi and Chatterjee (2012), may be due to environmental effect. The age at sexual maturity in this breed was higher than the available literature in other meat type birds (Rajkumar *et al.* 2011, 2012). Egg production obtained in the present study upto 40 weeks of age (Table 1) was similar to the finding of Niranjan *et al.* (2011) in the same line. Higher egg number was reported in naked neck (Rajkumar *et al.* 2012). There was production of 49.62 eggs during the period from 41 to 60 week of age indicating that the egg production was better during the later part of the laying cycle in this line (Table 1).

Table 1. Least square estimates of different traits during growing and laying period

| Traits | mean±SE |
|---|---|
| Shank length at 16 weeks (mm) | 108.81±0.06 |
| Shank length at 20 weeks (mm) | 110.88±0.01 |
| Body weight at 16 weeks (g) | 1862±0.46 |
| Body weight at 20 weeks (g) | 2037±0.51 |
| Weight at sexual maturity (g) | 2396±0.59 |
| Body weight at 40 weeks (g) | 2903±0.91 |
| Age at sexual maturity (d) | 180.30±0.05 |
| Egg production up to 40 weeks (no) | 42.34±0.05 |
| Egg production up to 60 weeks (no) | 92.06±0.66 |
| First egg weight (g) | 46.24±0.07 |
| Egg weight at 32 week (g) | 51.09±0.01 |
| Egg weight at 36 week (g) | 54.26±0.01 |
| Egg weight at 40 week (g) | 56.49±0.02 |
| Egg weight at 60 week (g) | 61.04±0.69 |

*Egg weight:* Egg weight recorded at 32, 36, 40 and 60 weeks of age along with first egg weight are summarised in Table 1. The egg weight revealed that as the age advances the weight increased which is in agreement with the reports of (Rajkumar *et al.* 2012, Padhi *et al.* 2013). First egg weight was similar to the egg weight reported in PD1 at 28 weeks of age but higher egg weight was observed in the present study for egg weight at 32 and 40 weeks of age as reported by Niranjan *et al.* (2011). This may be due to higher body weight of the birds during the present study. However, the egg weight obtained in the present study was lower than the report in meat type stock (Rajkumar *et al.* 2011, 2012). It is to be mentioned here that as the PD1 is used as a male line for the production of back yard poultry Vanaraja where the egg weight is less importance and lower egg weight will be of more towards desi fowl which are popular in the rural areas.

*Genetic parameters:* The heritability estimates from different variance component for some important production traits along with shank length at 20 weeks of age are presented in Table 2. Heritable estimates is moderate in magnitude for age at sexual maturity and the dam component was higher indicating the presence of dominance and maternal effect for this trait. Higher estimate for this trait was reported by Niranjan *et al.* (2011). Similar heritability estimates was reported in naked neck birds (Rajkumar *et al.* 2012). Body weight at 20, 40 and at sexual maturity showed heritability low to moderate in magnitude and as the age advances the estimates from sire + dam component variance increased (Table 2). Though moderate to high heritability estimates was reported for body weight in the PD1 line by Padhi and Chatterjee (2012) but the findings was in agreement with, as the age advances, the heritability estimates increases. Lower magnitudes may be due to less variation in the population. Higher heritability estimates for laying period body weight was reported by Rajkumar *et al.* (2012). Except weight at sexual maturity the dam component was higher than the sire component variance estimates indicating the presence of higher maternal effect for these traits. The variation in heritability estimates might be due to breed, environment effect and sampling errors.

Table 2. Heritability estimates of some production traits

| Traits | | Heritability | | |
|---|---|---|---|---|
| | | $h^2_S$ | $h^2_D$ | $h^2_{S+D}$ |
| Age at sexual maturity | | - | 0.49±0.41 | 0.20±0.24 |
| Body wt. | 20 wks | 0.16±0.20 | - | 0.05±0.21 |
| | WASM | 0.26±0.22 | 0.07±0.35 | 0.17±0.22 |
| | 40 wks | 0.04±0.21 | 0.34±0.38 | 0.19±0.0.24 |
| Egg production | 40 wks | 0.02±0.21 | 0.41±0.39 | 0.22±0.23 |
| SL20 | | 0.54±0.29 | 0.62±0.36 | 0.58±0.27 |
| FEW | | 0.76±0.30 | 0.16±0.31 | 0.46±0.22 |
| EW32 | | - | 0.56±0.42 | 0.23±0.28 |

ASM, age at sexual maturity;WASM, weight at sexual maturity; SL20, shank length at 20 weeks; FEW, first egg weight; EW32, egg weight at 32 weeks.

Table 3. Genetic correlation (S±D component) between different traits

| Traits | SL 20 | BW40 | WASM | ASM | EP40 | FEW | EW32 |
|---|---|---|---|---|---|---|---|
| SL20 | | 0.24±0.51 | –0.22±0.54 | 0.40±0.44 | 0.43±0.41 | –0.24±0.32 | 0.32±0.58 |
| BW40 | 0.05 | | 0.43±0.74 | 0.68±0.45 | –0.32±0.73 | 0.30±0.50 | 0.38±0.75 |
| WASM | 0.05 | 0.14 | | - | 0.39±0.72 | 0.10±0.56 | 0.81±0.37 |
| ASM | 0.06 | 0.04 | –0.02 | | - | –0.06±0.53 | 0.13±0.84 |
| EP40 | 0.05 | –0.22 | 0.00 | –0.34 | | –0.11±0.51 | 0.06±0.82 |
| FEW | –0.04 | 0.07 | 0.07 | –0.07 | –0.04 | | 0.26±0.51 |
| EW32 | –0.08 | 0.07 | 0.02 | 0.02 | 0.03 | 0.07 | |

Value above diagonal genetic correlation and below diagonal phenotypic correlation. ASM, Age at sexual maturity; WASM, weight at sexual maturity; SL20, shank length at 20 week; FEW, first egg weight; BW20, body weight at 20 weeks; EP40, egg production up to 40 weeks; EW32, egg weight at 32 weeks.

The heritability estimates for shank length at 20 weeks of age was high in magnitude (Table 2). Since this is a conformation trait it is expected to be high in magnitude and this indicates presence of additive gene effect suggesting the scope for improvement of the traits through selection. The heritability estimates for egg production to 40 weeks of age was low to moderate in magnitude and the dam component estimates was higher than the sire component indicating the presence of maternal effect (Table 2). Similar finding was also reported by Padhi and Chatterjee (2012) in PD 1 line and the dam component estimates was higher. The heritability estimates for first egg weight was moderate to high in magnitude (Table 2) and the sire component was higher compared to dam component indicating the considerable additive genetic variation for this trait in the population. However, the heritability estimates for egg weight at 32 weeks of age was moderate to high in magnitude and higher dam component indicates the maternal effect is important which is expected as it is a sex limited trait. Similar observation for egg weight in PD1 was also observed by Padhi and Chatterjee (2012).

Genetic and phenotypic correlation estimated from sire+dam component of variance and covariance for different traits are presented in Table 3. Shank length was positively correlated with egg production and body weight. Positive correlation of shank length with body weight was reported by Padhi and Chatterjee (2012). Higher genetic correlation between juvenile body weight and shank length at 6 weeks of age was reported by Padhi *et al.* (2012b). ASM was positively associated with body weight and egg weight at 32 weeks but low in magnitude which is in agreement with the report of Niranjan *et al.* (2011). Weight at sexual maturity was positively correlated with body weight, egg production and egg weight. Egg weight and egg production was positively correlated but low in magnitude which is in agreement with the findings of Niranjan *et al.* (2011). Body weight and egg production was negatively correlated and may be considered to improve the egg production by reducing the body weight at desired age. Phenotypic correlations between different traits were very low in magnitude except for egg production to 40 weeks of age and age at sexual maturity which was moderate in magnitude.

Table 4. Egg quality parameters at different ages

| Parameters | 40 week (40) | 52 week (115) | 60 week (56) |
|---|---|---|---|
| Egg wt | 56.39±0.53[b] | 59.96±0.41[a] | 61.04±0.69 [a] |
| Shape index | 76.80±0.63 [a] | 74.76±0.51 [b] | 73.20±0.56 [b] |
| Yolk colour | 6.23±0.19 [b] | 7.37±0.07 [a] | 7.09±0.16 [b] |
| Haugh Unit | 73.46±1.45 [a] | 72.81±1.04 [ab] | 70.36±1.47 [b] |
| Albumen index | 0.06±0.003 | 0.06±0.002 | 0.06±0.002 |
| Yolk index | 0.40±0.003 | 0.41±0.002 | 0.41±0.003 |
| Shell thickness (mm) | 0.33±0.004 [b] | 0.34±0.002 [a] | 0.33±0.003 [b] |
| Albumen% | 58.86±0.45 [a] | 59.15±0.20 [a] | 56.85±0.46 [b] |
| Yolk% | 32.27±0.38 [b] | 31.92±0.20 [b] | 35.34±0.45 [a] |
| Shell% | 8.87±0.12 [a] | 8.93±0.07 [a] | 7.81±0.13 [b] |

Value in parenthesis in first row is number of eggs. Means showing different superscript in a row differ significantly $P<0.05$.

Egg quality: Different egg quality parameters measured at 40, 52 and 64 weeks of age are presented in Table 4. Egg weights at different weeks of age differ significantly and the weight increases as the age of measurement increases. The result is in agreement with the reports of Padhi *et al.* (2013). Shape index differ significantly and the index decreases with increase in age of measurement. Colour of yolk differs significantly and the yolk colour was higher at 52 and 60 weeks of age compared to 40 weeks of age. Haugh unit significantly decreased at 60 weeks of age compared to 40 weeks indicating decrease of internal quality of eggs at later part of production cycle. Shell thickness differs significantly and was significantly higher at 52 weeks of age than at 40 and 60 weeks. Albumen, yolk and shell% differ significantly at different age of measurement and albumen% decreased and yolk% increased significantly at 60 weeks of age compared to 40 to 52 weeks of age. The age effects on different egg quality parameters in PD1 line is in agreement with the reports of Tumova and Gous (2012), Padhi et al. (2013), Padhi *et al.* (2014) in pure lines and crosses.

The results revealed that in PD 1 line egg production was low and the egg weight increased with increase in age. Heritability for important production traits are low to moderate in magnitude and dam component was higher than the sire component for most of the traits. Genetic correlation between egg production and egg weight was negative. Most of the egg quality traits showed significant difference between different age of measurement and as the age advances the internal quality decreases.

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