Inheritance of plumage colour in Japanese quails

AZMAT ALAM KHAN1, S K MISHRA2, S O PRATAP3 and RAJ NARAYAN4

ICAR-Central Avian Research Institute, Izatnagar, Uttar Pradesh 243 122 India

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Plumage colour variation in birds has a strong genetic component. A number of quail plumage variations were studied, several linkage and epistatic relationships explored (Minvielle et al. 2003) and, new loci described (Tsuzuki 2008). Several plumage colour genes were mapped like silver (Minvielle 2010) and lavender (Bedhom et al. 2012). Different plumage colour genotypes affect hatchability, body weight and egg production traits in Japanese quails (Dowarah and Sethi 2013, Islam et al. 2014), which emphasize the need to study plumage colour genetics.

A complete 4 × 4 diallel cross involving 480 sires and equal number of dams (120 from each line) using 4 populations of Japanese quail namely CARI-Uttam, CARI-Ujjwal, CARI-Sweta and CARI-Pearl was carried out. These 4 quail populations are maintained as closed flocks at Central Avian Research Institute, Izatnagar. Both CARI-Uttam and CARI-Pearl possessed a wild type of plumage called as Pharao and other two, CARI-Ujjwal and CARI-Sweta possessed White breast and White plumage pattern, respectively. The fertile eggs collected from all the mating combinations were labeled. Eggs were cleaned and stored before setting them in an automatic incubator. Eggs were incubated for 17 days (14 days setter plus 3 days hatcher) using pedigree boxes for the last 3 days. During hatching, day-old chicks from each cross were identified and counted on basis of plumage (down colour) as Pharao, White breast and White to arrive at respective proportions.

Both the absolute values (numbers) of progeny plumage colour as well as proportion of the progeny carrying different plumage types along with the putative genotype of parents and progeny are presented in Table 1. From 16 crosses, 4 crosses involved Pharao males and females, 1 cross each of White breast males and females and White males and females, 2 each of Pharao × White breast and Pharao × White, reciprocal of these 2 crosses, 1 cross of White breast × White and its reciprocal cross.

All the 4 crosses involving Pharao parents gave rise to Pharao progenies only. The crosses involving Pharao and White breast parents yielded progeny that were predominantly White breast (60–80%), followed by Pharao (15–30%) and White (1–18%). However, visible differences between the reciprocal crosses of Pharao and White breast particularly with respect to proportion of White plumage colour were observed. Pharao × White breast produced 1% White plumage chicks, while as White breast × Pharao (reciprocal cross) had 11% White chicks. Similarly, a cross of White breast × White gave rise to a progeny comprising 90% White breast and 10% White off-springs. Lastly inter-se cross of White breast gave rise to 87.5 and 12.5% White breast and White off-springs only. White × White cross produced only White progenies, Pharao × Pharao predominantly Pharao progenies and a few Whites, and White breast × White breast gave rise to White breast and Pharao when compared with the fact that cross of Pharao × White gave rise to more of Pharao and less of white and, White breast × Pharao gave rise to more of White breast, followed by Pharao and White in that order, led us to infer that White breast should be dominant over non-white breast and Pharao be dominant over white. Accordingly, putative genotypes were worked out (Table 1) for parents and offsprings involving two loci. White breast (Wb/wb) and Panda (S/s). Mention needs to be made that White plumage variant used in our study was described as a recessive mutation termed as ‘Pand’ and ‘Dotted white’ (Tsudzuki et al. 1993). Both the variants were present in our quail population, but for the purpose of this study they were referred to as whites only. The plumage colour distribution in CARI-Ujjwal population termed as White breast in this study did not exactly match the description of White breast quail population as described by Cheng and Kimura (1990) and in contrast to our findings, Cheng and Kimura (1990) described White breast plumage pattern as a recessive trait. However, Mishra et al. (2011) who also studied inheritance of White breast plumage in CARI-Ujjwal population have described it as dominant mutation. The recessive nature of White ‘s’ was also reported by Miwa et al. (2006) and Mishra et al. (2011).
The results indicated dominant nature of White breasted and the recessive nature of White feather colour mutations. Therefore the inheritance of plumage colours Pharao, White breasted and White could be explained on the basis of 2 autosomal plumage color loci. For the locus coding for White breasted, the ‘Wb’ (White breasted) appears to be dominant over ‘wb’ (non White breasted) while at the other unlinked locus, ‘ss’ resulted into White plumage pattern, and S_ was the genotype associated with pharaoh plumage.

**SUMMARY**

A complete 4 × 4 diallel cross involving 4 quail populations, 2 of which possessed Pharao, plumage and other 2, White breasted and White plumage pattern was performed and the plumage colour of progeny in different crosses was recorded. The results indicated dominant nature of White breasted and the recessive nature of White feather colour mutations. The inheritance of plumage colours of Pharao, White breasted and White could be explained on the basis of two autosomal plumage color loci.

**REFERENCES**


