Full Length

EGG QUALITY TRAITS AND THEIR INFLUENCE ON REPRODUCTIVE PERFORMANCE IN CAPTIVE LORIKEETS AND LORIES

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ABSTRACT

The present study evaluated egg quality traits and their influence on reproductive performance in captive lorikeets and lories maintained under tropical aviary conditions. A total of 151 lorikeet eggs and 52 lory eggs were assessed for egg weight, shape index, fertility, fertile hatchability and total hatchability under artificial incubation. Egg weight differed significantly (P<0.01) among species in both groups, with lories recording higher egg weights than lorikeets. Shape index varied significantly among lorikeets but not among lories, and eggs of Loriinae were relatively more spherical than those of domestic poultry species. Fertility and total hatchability differed significantly among lorikeets, whereas no significant variation was observed among lories. Fertile hatchability did not differ significantly among species. Egg weight showed significant positive correlations with fertility and total hatchability in lorikeets, indicating superior reproductive performance in heavier eggs, whereas no such association was evident in lories. Shape index had limited influence on hatchability traits, although relatively spherical eggs in lories tended to be more fertile. The findings revealed marked interspecific variation in egg quality and reproductive traits and demonstrated the importance of egg weight in reproductive performance. The study provides baseline information for improving hatchability and chick output in captive lorikeet and lory breeding programmes

Key words: Lorikeets and Lories, Egg quality, Shape index, Artificial incubation, Reproductive performance, Captive breeding

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INTRODUCTION

Psittacine birds (order Psittaciformes) comprise a diverse group of over 350 avian species distributed across tropical and subtropical regions of the world (Collar, 1997). These birds are characterized by distinct morphological features such as a curved beak, zygodactyl feet and vibrant plumage, along with advanced cognitive and vocal abilities that make them highly valued in the pet trade and conservation programmes (Joseph *et al*., 2012; Wright *et al*., 2008).

In recent years, captive breeding of psittacines has gained considerable attention among aviculturists and zoological institutions to meet the growing demand for companion birds and to support conservation of threatened species (Butler, 2005; Peron, 2012; Davies *et al*., 2024). The expansion of legal and illegal parrot trade has further increased reliance on captive breeding systems worldwide.

Reproductive efficiency in aves is influenced by egg quality traits, incubation conditions and management practices. However, unlike domestic poultry, psittacines exhibit considerable variation in reproductive biology, physiology and ecological adaptations; therefore, direct extrapolation of poultry-based standards may not always be appropriate (Connor, 1984; Collar, 1997; Assersohn *et al*., 2021).

In domestic poultry, egg quality traits such as egg weight, shape index, shell quality and internal composition are closely associated with fertility, hatchability and embryonic mortality (Churchil *et al*., 2009; Gandhimathi *et al*., 2024). Egg weight has been identified as an important determinant of hatchability, with medium and large-sized eggs generally showing superior reproductive performance (Premavalli *et al*., 2020). Similarly, egg dimensions and shape index influence embryonic development and hatchability in White Leghorn populations (Churchil *et al*., 2010). Despite extensive studies in poultry, comparable information on lorikeets and lories remains extremely limited.

Artificial incubation is widely practiced in aviculture to improve reproductive efficiency and biosecurity, and successful incubation depends on proper regulation of temperature, humidity, ventilation and egg turning (Deeming, 2007; Masia *et al*., 2025). Since incubation physiology in psittacines differs from that of domestic poultry, species-specific studies are necessary to optimize hatchability and embryonic survival (Koutsos *et al*., 2001).

Scientific information on reproductive performance, incubation dynamics and egg quality traits of captive psittacines, particularly lorikeets and lories under tropical conditions, remains extremely limited. The present study was therefore undertaken to evaluate egg quality characteristics and their influence on fertility and hatchability in lorikeets and lories.

MATERIALS AND METHODS

Experimental birds and management

The study was conducted on captive lorikeets and lories maintained under aviary conditions at M/s. Cavin Solai Avian Breeding and Research Centre, Injambakkam, Chennai, Tamil Nadu, India (12.909° N latitude and 80.252° E longitude). The birds were housed in species-specific enclosures under standard management and feeding practices followed for captive psittacines. The study included different species of lorikeets and lories belonging to the subfamily Loriinae.

Egg collection and measurement of egg quality traits

Eggs were collected from the aviary twice weekly. After collection, eggs were cleaned with 70% alcohol, assigned a unique identification number and relevant information such as laying date, parent identification and egg weight was recorded. The eggs were stored at 15°C for a maximum period of 3–4 days before incubation. Eggs with visible cracks or deformities were excluded from the study.

Egg weight was measured using a digital balance and expressed in grams (g). Egg length and width were measured using digital Vernier calipers, and shape index was calculated using the following formula:

$$\text{Shape index} = \frac{\text{Egg width}}{\text{Egg length}} \times 100$$

Categorization of eggs

For studying the influence of egg weight on reproductive performance, lorikeet eggs were classified into four categories: below 6.00 g, 6.01–7.00 g, 7.01–8.00 g and above 8.00 g based on the distribution and range of the observed data. Lory eggs were classified into three categories: below 8.00 g, 8.01–9.00 g and above 9.00 g. For evaluating the influence of shape index, eggs were categorized into three groups: below 80.00, 80.01–85.00 and above 85.00.

Artificial incubation of eggs

All eggs were subjected to artificial incubation using an incubator (INCA-100, Spain) maintained at 37.3°C with an initial relative humidity of 45%, which was subsequently adjusted based on egg weight loss to reach 65-70% (or higher) during the last few days. Incubation temperature, relative humidity, ventilation and egg turning were regulated throughout the incubation period. Eggs were turned automatically at regular intervals and transferred to the hatcher during the final stage of incubation. Fertility, fertile hatchability and total hatchability percentages were recorded based on standard procedures.

Fertility (%) was calculated as:

$$\text{Fertility (\%)} = \frac{\text{Number of fertile eggs}}{\text{Total eggs set}} \times 100$$

Fertile hatchability (%) was calculated as:

$$\text{Fertile hatchability (\%)} = \frac{\text{Number of chicks hatched}}{\text{Number of fertile eggs}} \times 100$$

Total hatchability (%) was calculated as:

$$\text{Total hatchability (\%)} = \frac{\text{Number of chicks hatched}}{\text{(Total number of eggs set)}} \times 100$$

Statistical analysis

The data were analysed using one-way analysis of variance (ANOVA) following a completely randomized design. Significant differences among means were compared using Duncan's Multiple Range Test. Pearson's correlation coefficients were estimated to determine the relationships among egg quality and reproductive traits. Statistical significance was considered at P<0.05. Statistical analyses were performed using SPSS software version 20.0.

RESULTS AND DISCUSSION

Egg weight

Egg weight differed significantly (P<0.01) among species in both lorikeets and lories (Table 1). Among lorikeets, Swainson's lorikeet and Green-naped lorikeet recorded comparatively higher egg weights, whereas Scaly-breasted lorikeet produced the lightest eggs. In lories, Chattering lory and Black-capped lory recorded relatively higher egg weights, while Red lory and Yellow-bibbed lory showed lower values. The higher egg weight observed in lories may be attributed to interspecific differences in body size and genetic makeup, as egg size is closely associated with body mass and life-history traits (Ayorinde and Toye, 2021; Tyasi *et al*., 2024). Masello and Quillfeldt (2002) demonstrated a positive allometric relationship between egg mass and adult body weight across 29 wild psittaciform species, suggesting that variation in egg weight among lorikeets and lories may partly reflect species-specific differences in body size and reproductive investment. Egg weight in Loriinae was considerably lower than that reported in domestic poultry species such as Japanese quail (Kul and Seker, 2004), guinea fowl (Song *et al*., 2000), duck, turkey and goose (Wilson, 1991), and markedly lower than emu (Szczerbinska *et al*., 2003) and ostrich (Sales *et al*., 1996), indicating pronounced interspecific variation. Such variation in egg size across avian species is largely governed by evolutionary and ecological adaptations (Assersohn *et al*., 2021). Similar breed- and strain-dependent differences in egg weight have been reported in White Leghorn, Aseel and Siruvidai chickens (Gandhimathi *et al*., 2024), Japanese quail varieties (Kanagaraju *et al*., 2013) and White Leghorn strains (Narayanankutty *et al*., 2009), confirming the strong genetic influence on egg weight.

Phenotypic correlation analysis revealed a significant (P<0.01) negative correlation between egg weight and shape index in lorikeets, whereas the association in lories was weak and non-significant (Table 4). In contrast, Hristakieva *et al*. (2017) reported a positive correlation between egg weight and shape index in turkeys. The negative association observed in lorikeets suggests that heavier eggs tend to be relatively elongated rather than rounded, possibly due to species-specific differences in egg formation and reproductive adaptation. Egg weight showed significant positive correlations with fertility and total hatchability in lorikeets, indicating superior embryonic viability in heavier eggs. Similar positive effects of optimum egg weight on reproductive performance have been reported in Japanese quail, Aseel, Vanaraja, Gramapriya and White Leghorn chickens (Petek *et al*., 2003; Padhi *et al*., 2016; Premavalli *et al*., 2020; Vasanthi *et al*., 2025). Recent studies also confirmed the influence of genotype, egg weight and embryonic physiology on hatchability (Assersohn *et al*., 2021; Fathi *et al*., 2022; Jegede *et al*., 2025). However, Iqbal *et al*. (2016) reported superior fertility and hatchability in smaller broiler breeder eggs, suggesting species- and strain-specific variation. In contrast, no significant associations were observed in lories, indicating possible differences in reproductive biology and incubation responses. The limited information available in captive lorikeets and lories highlights the novelty of the present study and suggests that maintaining heavier eggs may improve chick output in captive breeding systems.

Shape index

Shape index varied significantly ($P<0.01$) among lorikeets, whereas no significant variation was observed among lories (Table 1). The overall shape index was comparable between lorikeets (82.58) and lories (82.67). Among lorikeets, Green-naped lorikeet produced relatively elongated eggs (79.77), whereas Scaly-breasted lorikeet produced more spherical eggs (85.27), indicating marked interspecific variation in egg shape. In contrast, the narrow range observed in lories indicated greater uniformity in egg shape.Compared to domestic poultry species such as chicken (78.59; Baishya *et al*., 2008), Japanese quail (74.90; Kul and Seker, 2004) and guinea fowl (79.57; Song *et al*., 2000), eggs of psittacine birds belonging to the Loriinae subfamily were relatively more spherical. Similar variation in shape index has been reported among chicken breeds (Gandhimathi *et al*., 2024) and Japanese quail varieties (Kanagaraju *et al*., 2013), confirming the influence of genetic factors on egg shape characteristics. Differences in egg morphology among psittacine species are likely associated with evolutionary adaptations related to reproductive biology and incubation requirements. Comparative studies have shown that egg characteristics vary considerably among parrot species and are linked with body size and life-history traits (Masello and Quillfeldt, 2002). Egg size and shape are species-specific traits shaped by evolutionary adaptations and incubation requirements (Rahn and Ar, 1980). These traits influence important aspects of embryonic development, including heat exchange, gas diffusion and embryo orientation during incubation. Therefore, the differences observed among lorikeets and lories may reflect species-specific reproductive adaptations and nesting ecology.

Phenotypic correlation analysis revealed negligible and non-significant correlations of shape index with fertility (-0.003) and total hatchability (-0.018) in lorikeets, indicating minimal influence of egg shape on reproductive performance (Table 4). In contrast, lories exhibited a significant positive correlation between shape index and fertility ($r = 0.29$; $P<0.05$), suggesting that relatively spherical eggs tended to be more fertile, although its association with total hatchability ($r = 0.23$) remained non-significant. The shape index is known to be highly heritable in birds (h^2

= 0.806) (John-Jaja *et al*., 2018), indicating scope for genetic improvement through selective breeding.Comparable avian studies have reported variable relationships between shape index and reproductive traits. Eggs deviating from normal shape index showed reduced hatchability and increased embryonic mortality (Jabbar *et al*., 2018), whereas intermediate shape index values were associated with superior fertility and hatchability in broiler breeders (Peşmen, 2025; Segura *et al*., 2024). These findings suggest that moderate egg shape favours embryonic development during incubation. However, the weak association observed in the present study indicates that shape index alone may not be a major determinant of hatchability in psittacine birds, possibly due to species-specific differences in egg morphology and incubation physiology.

The limited information available on shape index and reproductive performance in captive lorikeets and lories highlights a clear research gap, thereby reinforcing the novelty and scientific significance of the present study.

Fertility (%)

Fertility differed significantly (P<0.01) among lorikeets, whereas no significant variation was observed among lories (Table 1). Among lorikeets, Green-naped lorikeet recorded the highest fertility (95.00%), while Red-collared lorikeet showed complete infertility, resulting in an overall fertility of 52.31%. In lories, fertility ranged from 50.00% to 90.91%, with a comparatively higher overall value of 64.51%, indicating more stable reproductive performance across species. Species-specific differences in reproductive performance have also been documented in psittacine birds. Saunders (1982) reported considerable variation in breeding success and reproductive parameters in White-tailed Black Cockatoos, indicating that reproductive efficiency is influenced by inherent biological and ecological characteristics of individual species. The wide variation in fertility among lorikeets may be attributed to incompatible pairing, inbreeding and management conditions. Complete infertility observed in Red-collared lorikeet could be associated with behavioural incompatibility between breeding pairs, warranting continuous monitoring under captive systems. Nutritional imbalance and genetic factors may also contribute to reduced fertility. Reproductive performance in captive psittacines is also influenced by nutritional status, particularly dietary protein, vitamin A and calcium balance (Koutsos *et al.*, 2001). Further, pair incompatibility and behavioural factors are recognized causes of infertility in captive parrots (Speer *et al*., 1992). The fertility values observed in lories were comparatively lower than earlier reports in certain psittacine species (Kuehler and Good, 1990), indicating scope for improvement through optimized breeder management and nutrition.

Similar variation in fertility has been reported in poultry species, where reproductive performance is strongly influenced by genetic strain and management conditions. Fertility ranging from 85.87% to 89.20% has been reported among indigenous chicken genetic groups under artificial incubation (Vasanthi *et al*., 2022), while Jamima *et al*. (2020) documented mean fertility of 88.41% in indigenous Siruvidai chicken. Earlier studies in White Leghorn populations also demonstrated significant strain differences affecting fertility and hatchability traits (Churchil *et al*., 2009), as well as the influence of egg weight and genetic background on reproductive performance (Narayanankutty *et al.*, 2009).

Fertility showed strong positive correlations with total hatchability in both lorikeets and lories, indicating that improved fertility directly enhanced hatchability performance (Table 4). Similar associations have been reported in broiler chickens and guinea fowl populations (Wolc *et al*., 2010; Jegede *et al*., 2025). King'ori (2011) also emphasized the importance of fertility, egg quality and breeder management in determining hatchability. Published information on fertile hatchability in captive lorikeets and lories remains extremely limited, highlighting the novelty of the present study. Fertile hatchability of 70–80% appears essential for profitable pet bird farming, warranting improved management practices to enhance hatchability in species such as Scaly-breasted lorikeet.

Fertile hatchability (%)

Fertile hatchability did not differ significantly among species in either lorikeets or lories (Table 1). In lorikeets, fertile hatchability ranged from 64.71% to 85.71%, with an overall mean of 76.86%, whereas lories recorded comparatively higher values ranging from 75.00% to 100.00%, with an overall mean of 88.75%. Although statistically non-significant, lories exhibited relatively better embryonic survival following fertilization. The incubation conditions appeared uniformly effective across species.

The fertile hatchability observed in the present study was comparatively lower than values reported in indigenous chickens such as Siruvidai (95.28%) (Jamima *et al*., 2020) and Nicobari black and Aseel (93.47–94.24%) chickens under artificial incubation (Vasanthi *et al.*, 2022). Earlier studies in White Leghorn populations also reported fertile hatchability values above 82% under controlled incubation conditions. These differences may be attributed to species-specific reproductive physiology, egg characteristics and incubation requirements in psittacine birds.

Comparative studies in psittacine birds have demonstrated considerable interspecific variation in reproductive success and breeding performance, reflecting differences in reproductive biology and species-specific adaptations (Masello and Quillfeldt, 2002). The variation in fertility and hatchability observed among lorikeets and lories in the present study may similarly be attributed to inherent differences in reproductive potential and embryonic development under captive incubation conditions.Studies in poultry have shown that fertile hatchability is influenced by factors such as genetic strain, egg quality, egg dimensions, storage duration and embryonic mortality. Churchil *et al*. (2010)

reported significant associations between egg dimensions and hatchability traits in White Leghorn birds, highlighting the importance of external egg characteristics in embryonic development. Similarly, prolonged pre-incubation storage adversely affected hatchability due to increased embryonic mortality (Churchil *et al.*, 2009). Fertility exhibited a strong positive correlation with total hatchability in both lorikeets and lories (r = 0.77 and 0.81; P<0.01), emphasizing the importance of fertility in determining successful hatchability outcomes. Similar positive associations between fertility and hatchability have been reported in broiler chickens (Wolc *et al*., 2010) and guinea fowl populations (Jegede *et al*., 2025).

Published information on fertile hatchability in captive lorikeets and lories is extremely limited, highlighting the novelty of the present study. Fertile hatchability of 70–80% appears essential for profitable pet bird farming, warranting improved management practices to enhance hatchability in species such as Scaly-breasted lorikeet.

Total hatchability (%)

Total hatchability varied significantly (P<0.01) among lorikeet species, whereas no significant variation was observed among lories (Table 1). Among lorikeets, Green-naped lorikeet recorded the highest hatchability (70.00%), while Red-collared lorikeet showed zero hatchability, resulting in a low overall hatchability of 40.53%. In lories, hatchability ranged from 42.86% in Black-capped lory to 72.73% in Chattering lory, with an overall mean of 56.40%. The relatively higher hatchability observed in lories may be attributed to better fertility and possibly improved embryonic viability in this group.

The hatchability values observed in lorikeets were generally lower than earlier reports in Forsten's lorikeet (86%), Mitchell's lorikeet (50%), Western iris lorikeet (71%) and Goldie's lorikeet (75%) (Kuehler and Good, 1990). Similarly, hatchability in lories varied widely among species, ranging from 27% in Tahiti lory to 100% in Black lory (Kuehler and Good, 1990), indicating marked species-specific variation in reproductive performance among psittacines.Similar species-specific variation in reproductive performance has been reported in other psittacine birds. In a comparative analysis of 29 wild psittaciform species, substantial variation was observed in hatching success, fledging success and breeding output among species, reflecting differences in reproductive strategies and ecological adaptations (Masello and Quillfeldt, 2002). Saunders (1982) also noted that the breeding performance varied considerably among populations and breeding seasons and such observations support the contention that fertility and hatchability are strongly influenced by species-specific reproductive adaptations. Studies in poultry have shown that hatchability is influenced by genetic strain, egg weight, egg dimensions, incubation management and embryonic mortality. Significant variation in hatchability among indigenous chicken genetic groups has been reported in indigenous breeds like Siruvidai, Nicobari and Aseel chickens under artificial incubation (Vasanthi *et al*., 2022). Similarly, Premavalli *et al*. (2020) observed higher hatchability in optimum egg weight classes of Aseel chicken.

Fertility showed strong positive correlations with total hatchability in both lorikeets and lories, highlighting the importance of successful fertilization for optimum hatchability. The lower hatchability observed in certain lorikeet species indicates scope for improvement through better breeder and incubation management.

Influence of egg weight on reproductive performance

Egg weight categories significantly (P<0.01) influenced fertility, fertile hatchability and total hatchability in lorikeets, whereas no significant effect was observed in lories (Table 2). In lorikeets, fertility, fertile hatchability and total hatchability increased progressively with increase in egg weight, with heavier eggs consistently recording superior reproductive performance than lighter eggs.

The superior reproductive performance observed in heavier lorikeet eggs may be attributed to better nutrient reserves and enhanced embryonic development. Similar findings have been reported in poultry species, where optimum egg weight positively influenced fertility and hatchability. Premavalli *et al*. (2020) reported higher fertility, fertile hatchability and total hatchability in medium and large-sized Aseel eggs, while Narayanankutty *et al.* (2009) demonstrated positive associations between egg weight and reproductive traits in White Leghorn populations. Recent studies further confirmed the influence of genotype, egg weight and embryonic physiology on fertility and hatchability (Assersohn *et al*., 2021; Fathi *et al.*, 2022; Jegede *et al*., 2025). The absence of significant associations in lories suggests species-specific differences in reproductive biology and incubation responses.

The limited information available on egg weight and reproductive traits in captive psittacines, particularly lorikeets and lories, highlights the novelty and significance of the present study. From a practical perspective, maintaining heavier eggs may improve chick output and economic returns in captive pet bird breeding systems.

Influence of shape index on reproductive performance

The influence of shape index categories on fertility, fertile hatchability and total hatchability is presented in Table 3. In contrast, lories exhibited an opposite trend, where eggs with higher shape index showed significantly (P<0.05) better fertility, indicating that relatively spherical eggs tended to be more fertile in this group. Fertile hatchability and total hatchability were not significantly influenced by shape index categories in either lorikeets or lories (Table 3). The present findings therefore suggest that shape index exerted limited influence on hatchability traits in psittacines, although relatively spherical eggs appeared to be associated with improved fertility.

Similar inconsistent associations between egg shape and reproductive traits have been reported in poultry species. Churchil *et al.* (2010) observed significant associations between shape index and certain hatchability traits in White Leghorn birds, while other studies reported superior hatchability in eggs with normal or intermediate shape indices due to better shell stability and gas exchange during incubation.

The limited information available on the relationship between shape index and reproductive performance in captive psittacines further highlights the novelty and significance of the present study.

CONCLUSION

The present study demonstrated significant interspecific variation in egg quality and reproductive traits among captive lorikeets and lories maintained under tropical aviary conditions. Lories generally exhibited higher egg weight, fertility and hatchability than lorikeets, indicating comparatively better reproductive efficiency. Egg weight showed significant positive associations with fertility and hatchability in lorikeets, suggesting that heavier eggs possess superior embryonic viability and hatching potential. In contrast, shape index exerted limited influence on hatchability traits, although relatively spherical eggs in lories tended to exhibit better fertility. The findings further indicated species-specific differences in reproductive biology and incubation responses among psittacines, which is consistent with earlier reports describing considerable variation in reproductive performance among parrot species (Saunders, 1982; Masello and Quillfeldt, 2002). The scarcity of published information on egg quality and reproductive performance in captive lorikeets and lories highlights the novelty of the present study. From a practical perspective, maintenance of optimum egg weight together with improved breeder and incubation management may enhance hatchability and chick output in captive psittacine breeding programmes. The results provide valuable baseline information for future research and conservation-oriented breeding programmes in lorikeets, lories and other captive psittacine species.

Table.1. Egg quality and reproductive parameters in lorikeets and lories

Variety	Egg weight (g)	Shape index	Fertility (%)	Fertile hatchability (%)	Total hatchability (%)
Lorikeets					
RCL	6.31^{c}±0.10 (15)	82.14^{abc}±1.33 (15)	0.00^{c}±0.00 (15)	-	0.00^{c}±0.00 (15)
GNL	7.70^{a}±0.13 (20)	79.77^{c}±0.76 (20)	95.00^{a}±5.00 (20)	73.68±10.38 (19)	70.00^{a}±10.51 (20)
VNL	6.91^{a}±0.12 (12)	83.89^{ab}±1.63 (12)	58.33^{b}±14.86 (12)	85.71±14.29 (7)	50.00^{ab}±15.07 (12)
SWL	7.72^{a}±0.14 (62)	81.81^{bc}±0.59 (62)	67.74^{b}±5.98 (62)	83.33±5.82 (42)	56.45^{a}±6.35 (62)
SBL	5.73^{d}±0.11 (42)	85.27^{a}±0.86 (42)	40.48^{b}±7.66 (42)	64.71±11.95 (17)	26.19^{bc}±6.87 (42)
Overall	6.87±0.12 (151)	82.58±1.03 (151)	52.31±6.70 (151)	76.86±10.61 (85)	40.53±7.77 (151)
F value	42.75**	5.36**	12.75**	0.94NS	7.87**
Lories					
CTL	9.48^{a}±0.25 (11)	81.27±1.60 (11)	90.91±9.09 (11)	80.00±13.33 (10)	72.73±14.09 (10)
BCL	9.11^{a}±0.15 (21)	82.91±0.74 (21)	57.14±11.07 (21)	75.00±13.05 (12)	42.86±11.07 (21)
YBL	7.81^{b}±0.18 (10)	82.27±0.80 (10)	50.00±16.67 (10)	100.00±0.00 (5)	50.00±16.67 (10)
RDL	7.42^{b}±0.19 (10)	84.23±0.93 (10)	60.00±16.33 (10)	100.00±0.00 (6)	60.00±16.33 (10)
Overall	8.46±0.19 (52)	82.67±1.02 (52)	64.51±13.29 (52)	88.75±13.19 (33)	56.40±14.54 (52)
F value	24.96**	1.20^{NS}	1.62^{NS}	0.99^{NS}	0.91^{NS}

Mean values bearing different superscript within a column differ significantly (P<0.05)
**** Significant (P < 0.01); NS Not significant (P ≥ 0.05)**
RCL – Red collar lorikeet; GNL – Green naped lorikeet; VNL – Violet necked lorikeet; SWL – Swainson's lorikeet; SBL – Scaly breasted lorikeet; CTL – Chattering lory; BCL – Black capped lory; YBL – Yellow bibed lory; RDL – Red lory
Figures in parenthesis indicate number of observations

Table.2. Effect of egg weight categories on reproductive parameters in lorikeets and lories

Variety	Fertility (%)	Fertile hatchability (%)	Total hatchability (%)
Lorikeets			
<6.00 g	32.50^{b}±7.50 (40)	61.54^{b}±14.04 (13)	20.00^{c}±6.40 (40)
6.01 – 7.00g	38.46^{b}±7.89 (39)	53.33^{b}±13.33 (15)	20.51^{c}±6.55 (39)
7.01 – 8.00 g	75.56^{a}±6.48 (45)	79.41^{ab}±7.03 (34)	60.00^{b}±7.38 (45)
>8.00 g	88.46^{a}±6.39 (26)	100.00^{a}±0.00 (22)	88.46^{a}±6.40 (26)
F value	13.21**	5.03**	19.96**
Lories			
<8.00 g	57.89±11.63 (19)	100.00±0.00 (11)	57.89±11.64 (19)
8.01 – 9.00 g	69.23±13.32 (13)	70.00±15.27 (10)	46.15±14.39 (13)
>9.00 g	58.82±12.30 (17)	81.82±12.19 (11)	47.06±12.48 (17)
F value	1.15^{NS}	1.42^{NS}	1.63^{NS}

Mean values bearing different superscript within a column differ significantly (P<0.05)
**** Significant (P < 0.01); NS Not significant (P ≥ 0.05)**
Figures in parenthesis indicate number of observations

Table.3. Effect of shape index categories on reproductive parameters in lorikeets and lories

Shape index	Fertility (%)	Fertile hatchability (%)	Total hatchability (%)
Lorikeets			
<80	63.41^{a}±7.61 (41)	80.77±7.88 (26)	51.22±7.90 (41)
80.01–85	61.04^{a}±5.60 (77)	74.47±6.43 (47)	45.45±5.71 (77)
>85	37.50^{b}±8.70 (32)	81.82±12.19 (11)	31.25±8.32 (32)
F value	3.14*	0.25^{NS}	1.52^{NS}
Lories			
<80	28.57^{b}±18.44 (7)	100.00±0.00 (4)	28.57±18.44 (7)
80.01–85	64.29^{a}±9.22 (28)	77.78±10.08 (18)	50.00±9.62 (28)
>85	71.43a±12.53 (14)	90.00±10.00 (10)	64.29±13.29 (14)
F value	2.97*	0.48^{NS}	1.19^{NS}

Mean values bearing different superscript within a column differ significantly (P<0.05)
*** Significant (P < 0.05); NS Not significant (P ≥ 0.05)**
Figures in parenthesis indicate number of observations

Table.4. Phenotypic correlation among the egg quality attributes

Parameters	Egg weight	Shape index	Fertility	Total hatchability (%)
Egg weight	-	-0.20**	0.46**	0.52**
Shape index	-0.07^{NS}	-	-0.003^{NS}	-0.018^{NS}
Fertility	0.08^{NS}	0.29*	-	0.77**
Total hatchability	-0.01^{NS}	0.23^{NS}	0.81**	-

Values above the diagonal represent lorikeets, whereas values below the diagonal represent lories.
****Significant (P<0.01); * Significant (P<0.05)**

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