Original Research Article

An Investigation of the Effect of Giloy (*Tinospora cordifolia*) Herb and Ascorbic Acid Along with Different Bedding Materials on Japanese Quail's Sexual Maturity During the Laying Season

ABSTRACT

It is investigated in this study whether giloy and ascorbic acid supplementation and different bedding materials (sand, saw dust and wheat straw) influence the age at sexual maturity and weight at sexual maturity of Japanese quails (Coturnix coturnix japonica).A total of 432 Japanese quails (7 day old) were divided into three groups based on bedding material and each group further divided into four groups based on supplementation (control, giloy, ascorbic acid and combination of both). As a result, the birds were randomly distributed in 12 treatment groups, each consisting of 36 birds, and each group was further divided into two replicates, each consisting of 18 birds. The quails were fed a basal diet supplemented with 5 g/kg giloy, 240 mg of ascorbic acid, or a combination of 5 g/kg giloy and 240 mg of ascorbic acid. It was found that incorporating supplements and bedding material significantly affected the age and weight of Japanese quail at sexual maturity ($P < 0.01$). During the experiment, the interaction effect of bedding material and supplementation was non-significant. Sawdust had a numerically lower sexual maturity age than other bedding materials. Sand bedding material had the highest weight at sexual maturity. Using dietary supplements of giloy and ascorbic acid significantly reduced the sexual maturity age and increased the weight at sexual maturity.

Keywords: Sexual maturity age, ascorbic acid, giloy, japanese quail, weight at sexual maturity.

1.INTRODUCTION

Poultry is one of the fastest growing components of the agricultural sector in India. India ranks fourth in the world in total poultry meat production (Basic Animal Husbandry Statistics, 2019). The total poultry population in the country has increased by 16.80% from the last census and the total number of poultry in the country is 851.81 million in 2019 (All India Report on 20th Livestock census, 2019).

Japanese quail (Coturnixcoturnix japonica) is one of the most efficient biological machines for converting feed into animal protein with high biological value (Das et al., 2012). Japanese quail have a lower feed requirement (about 20-25 g per day) compared to chickens (120-130 g per day) (Ani et al., 2009).

The recent trend in broiler production is to offer feed with feed additives to improve efficiency and achieve maximum yields in the shortest possible time. Different types of feed additives such as antibiotics, enzymes, hormones, prebiotics, probiotics, herbal products, etc. are used in poultry production as growth promoters. Tinosporacordifolia, also known as heart-leaved moonseed, guduchi, and giloy, is an herbaceous vine in the Menispermaceae family native to the tropical regions of the Indian subcontinent (Sengupta et al., 2011).This herb has immunomodulator, antioxidant property which enhance the growt of poutry by improving health status and immunity level. Giloy is a rich source of proteins and micronutrients such as iron, zinc, copper, calcium, phosphorus and manganese. (Saeed et al., 2020). The most clearly demonstrated functional role of vitamin C concerns collagen biosynthesis. Ascorbic acid has a positive effect on the synthesis of “repair” collagen (Bera et al., 2010). Under normal conditions, poultry can synthesize vitamin C in the body itself, but endogenous synthesis may not be sufficient to meet all of the poultry's needs at all times; in particular, the demand for this vitamin may increase during heat stress (Lin et al., 2006).

Wood sawdust is the most commonly used bedding material, but there are many alternative materials that can be used, such as peanut shells (Lien et al., 1998), rice and wheat straw (Benabdeljelil and Ayachi, 1996), leaves (Willis et al., 1997), rice husk ash (Chamblee and Yeatman, 2003), and other dry, absorbent, inexpensive organic materials. In addition, sand is occasionally used as a bedding material (Shields et al., 2005).Bedding material show their effect on growth and body weight gain in birds by providing their absorbance of smell and moisture; by providing less infectious environment to birds.

Therefore, the present experimental design was planned to investigate the effect of bedding materials such as sand, wheat straw, and sawdust with a dietary supplement of giloy herb (Tinospora cordifolia) and ascorbic acid and their combination on age at sexual maturity and weight at sexual maturity in Japanese quail.

2. MATERIALS AND METHODS

2.1 Location of the study area

The present study was carried out in the poultry department of Livestock Farm Complex, University of Veterinary and Animal Science, Bikaner, Rajasthan University of Veterinary and Animal Sciences, Bikaner, Rajasthan.

2.2 Experimental design of study

The study was conducted on four hundred and thirty-two (432) seven-day-old Japanese quail chicks purchased from the Central Poultry Development Organization in Chandigarh. Of the 432 birds, 72 birds were slaughtered at 8 weeks of age to evaluate carcass traits, and the remaining 360 birds continued to be used for the remaining traits (growth traits and egg production traits) until the end of the experimental series. The study was conducted over a 24-week period. A factorial design (3x4) was chosen for the present study. The 432 seven-day-old Japanese quail chicks were evenly and randomly divided into twelve treatment groups according to feed supplement and different bedding materials, and each treatment group was divided into two subgroups (R1-R2) to ensure uniformity among the different treatment groups. Chicks were raised on sand, sawdust, and wheat straw in groups B1, B2, and B3, respectively, to investigate the effects of litter material on various traits. In addition, each litter material was divided into a control group and three feed treatment groups (Giloy, ascorbic acid, and a combination of both), designated T0, T1, T2, and T3, respectively, to study the effects of feed on traits. Thus, the total number of interaction groups in this study was 12.

Table 1: Random distributions of birds (Japanese quail) and experimental feeds offered in different treatment groups

S.N.	Type of bedding materials	Treatments Groups		Treatment details	Number of birds (Japanese quail)
1.	B_1 (sand)	T_{10}	$T_{10}R_1$	Basal diet	18
			$T_{10}R_2$	Basal diet	18
		T_{11}	$T_{11}R_1$	Basal diet + 5 g/kg giloy**	18
			$T_{11}R_2$	Basal diet + 5 g/kg giloy**	18
		T_{12}	$T_{12}R_1$	Basal diet + 240 mg/kg ascorbic acid**	18
			$T_{12}R_2$	Basal diet + 240 mg/kg ascorbic acid**	18
		T_{13}	$T_{13}R_1$	Basal diet + mixture of 5 g/kg giloy and 240 mg/kg ascorbic acid**	18
			$T_{13}R_2$	Basal diet + mixture of 5 g/kg giloy and 240 mg/kg ascorbic acid**	18

2.	B_2 (saw-dust)	T_{20}	$T_{20}R_1$	Basal diet	18
			$T_{20}R_2$	Basal diet	18
		T_{21}	$T_{21}R_1$	Basal diet + 5 g/kg giloy**	18
			$T_{21}R_2$	Basal diet + 5 g/kg giloy**	18
		T_{22}	$T_{22}R_1$	Basal diet + 240 mg/kg ascorbic acid**	18
			$T_{22}R_2$	Basal diet + 240 mg/kg ascorbic acid**	18
		T_{23}	$T_{23}R_1$	Basal diet + mixture of 5 g/kg giloy and 240 mg/kg ascorbic acid**	18
			$T_{23}R_2$	Basal diet + mixture of 5 g/kg giloy and 240 mg/kg ascorbic acid**	18
3.	B_3 (wheat straw)	T_{30}	$T_{30}R_1$	Basal diet	18
			$T_{30}R_2$	Basal diet	18
		T_{31}	$T_{31}R_1$	Basal diet + 5 g/kg giloy**	18
			$T_{31}R_2$	Basal diet + 5 g/kg giloy**	18
		T_{32}	$T_{32}R_1$	Basal diet + 240 mg/kg ascorbic acid**	18
			$T_{32}R_2$	Basal diet + 240 mg/kg ascorbic acid**	18
		T_{33}	$T_{33}R_1$	Basal diet + mixture of 5 g/kg giloy and 240 mg/kg ascorbic acid**	18
			$T_{33}R_2$	Basal diet + mixture of 5 g/kg giloy and 240 mg/kg ascorbic acid**	18
	Total birds				432

** Prepared at farm by manual mixing of giloy and ascorbic acid in basal diet.

2.3 Composition of experimental ration and feeding:

Commercial starter and finisher and layer rations were procured and feed additives such as Giloy (Tinosporacordifolia) and ascorbic acid were added. Giloy (Tinosporacordifolia) and ascorbic acid were added at doses of 5 g/kg and 240 mg/kg, respectively (NRC 2001).

2.4 Litter materials

Different litter materials such as sand, saw dust and wheat straw were used as per the experimental design. During first seven days, newspapers were spread on litter material and from8^{th} day onward till the completion of experiment chicks were reared on respective litter material of about 6 inches of depth.

2.5 Parameters studied

2.5.1 Age at sexual maturity (day)

The age of sexual maturity, which is critical for egg production in quail, was evaluated as the age at first egg laying. The age at first egg laying is significant because it indicates the age of sexual maturity.

2.5.2 Sexual maturity weight (g)

The weight of sexual maturity was determined when the quails laid their first eggs in each coop

2.6 STATISTICAL ANALYSIS

The data obtained in the experiment were statistically analysed for the main effect of ascorbic acid alone, as well as for the interaction (× ascorbic acid) and the effect of different bedding materials, and for the interaction with feed supplementation in the factorial design (3×4) by factorial analysis of variance interaction design technique (Snedecor and Cochran, 1989) using the statistical package SPSS software (ver. 26.0, 2005). The means of the different experimental groups were tested for statistical significance using Duncan's New Multiple Range Test (DNMRT) by Kramer (1956).

3. RESULTS AND DISCUSSION

3.1 Age at sexual maturity (days)

Age of sexual maturity (age at 5% laying) was determined when Japanese quail laid their first eggs in each pen. The age at 5% laying, which is critical for egg production in quail, was evaluated as the age at first egg laying. The age at first egg laying is significant because it indicates the age of sexual maturity.

3.1.1 Effect of dietary supplementation, bedding material and their interaction on age at sexual maturity

The statistical analysis of variance of data revealed highly significant ($P<0.01$) effect of incorporation of supplements, different bedding material on age at sexual maturity of Japanese quail during experiment (Table 2). But interaction of dietary supplements and bedding materials did not exhibit any significant effect on age at sexual maturity in present study. The age at sexual maturity (age at 5% lay) of Japanese quail on the basis of dietary supplements, bedding material and interaction groups were presented in Table 2.a,2.b and 2.crespectively.

Table 2: Mean sum of squares for Age at sexual maturity

Source of variation	DF	MEAN SQUARES
Supplement	3	4.81**

Bedding	2	12.32**
Interaction (TxB)	6	0.12
Error	12	0.40

*= significant (P≤0.05), **= highly significant(P≤0.01)

3.1.1.1 Effect of dietary supplementation on Age at sexual maturity

The minimum age at sexual maturity was recorded in T_3 group (39.75 days) followed by T_2 (40.58 days), T_1 (41.25days)and then control group T_0 (41.83 days). It is because of natural alternatives as herbs to artificial antibiotic are growth promoters and helpful in solve the problems of drug resistance associated with use of antibiotic and increasing consumer demand for products free from antibiotic residues. Thus in group of combination fed birds age at sexual maturity decreased as compare to other group. In the present study, there was no significant difference between age at sexual maturity in the T0 (control) and T1 (supplemented with Giloy) groups. The results of the above experiment were in close agreement with the results of Ipek (2006), Nazlıgul et al. (2001) and Testik et al. (1993) in Japanese quails.

Table 2.a: Effect of dietary supplements on Age at sexual maturity

Supplement effect	Age in days
T_0	41.83^{c}
T_1	41.25^{bc}
T_2	40.58^{b}
T_3	39.75^{a}
SEM	0.26

Means having different superscripts in a column differ significantly (P≤0.05)

3.1.1.2 Effect of bedding materials on Age at sexual maturity

The age at sexual maturitywas found to be 41.93, 39.5 and 41.12 days in B_1, B_2, and B_3 group respectively. Statistically significant difference of age at sexual maturity in different bedding material was observed and numerically minimum age at sexual maturity was found in sawdust as compared to the sand. It may be due to high absorbance capacity of moisture, smell in saw dust bedding material which provide birds a comfort zone for growth.So birds show earlier sexual maturity in this bedding material as compare to sand and wheat straw bedding material.Maximum age at sexual maturity was found in sand then rest of the other bedding materials.

Table 2.b: Effect of bedding materials on Age at sexual maturity

Bedding effect	Age in days
B_1	41.93^{c}
B_2	39.5^{a}
B_3	41.12^{b}
SEM	0.22

Means having different superscripts in a column differ significantly (P≤0.05)

3.1.1.3 Interaction Effect of dietary supplements × bedding materials on Age at sexual maturity

The age at sexual maturity (days) in different interaction groupswas shown in Table 2.c.Further the comparison of means showed that minimum age at sexual maturity was recorded in T_{23} group. The highest age at sexual maturity was found in the T10 group. Thus, overall, the study shows that sawdust with an addition of giloy and ascorbic acid has a positive effect on the age of sexual maturity of Japanese quail. It is due to sawdust bedding material provide easiness to growth by their absorbance power of moisture and smell and combination feeding is beneficial for birds in improving their health status, immunity level etc.

Table 2.cEffect of dietary supplement × bedding material Interaction on Age at sexual maturity

Interaction Effect	Age in days
T_{10}	43
T_{11}	42.25
T_{12}	41.75
T_{13}	40.75
T_{20}	40.25
T_{21}	40.25
T_{22}	39.25
T_{23}	38.25
T_{30}	42.25
T_{31}	41.25

T_{32}	40.75
T_{33}	40.25
SEM	0.45

Means having different superscripts in a column differ significantly (P≤0.05)

3.2 Weight at sexual maturity (g)

The weight at sexual maturity (g) was determined when the Japanese quails laid their first eggs in each pen. Weight at first egg is of importance since it indicates the sexual maturity weight.

3.2.1 Effect of dietary supplementation, bedding material and their interaction on weight at sexual maturity

The statistical analysis of variance of data revealed highly significant (P<0.01) effect of incorporation of supplements, different bedding material on age at sexual maturity of Japanese quail during experiment (Table 3). But interaction effect of dietary and bedding materials was found non-significant on weight at sexual maturity in present study. The weight at sexual maturity (age at 5% lay) of Japanese quail on the basis of dietary supplements, bedding material and interaction groups were presented in Table 3.a,3.b and 3.c respectively.

Table 3: Mean sum of squares for Weight at sexual maturity.

Source of variation	**DF**	**MEAN SQUARES**
Supplement	3	704.29**
Bedding	2	63.61**
Interaction (TxB)	6	0.82
Error	12	0.42

*= significant (P≤0.05), **= highly significant (P≤0.01)

3.2.1.1 Effect of dietary supplementation on Weight at sexual maturity

The weight at sexual maturitywas found to be 178.11, 182.57, 189.76 and 202.91 gm in T_1, T_2, T_3 and T_4 group respectively, which were also statistically, differ in numerical values. Further the comparison of means showed that maximum weight at sexual maturity was recorded in T_3 group followed by T_2, T_1 and then control group T_0. So the overall study indicates that there is beneficial effect of incorporation of giloy and ascorbic acid in the diet on weight at sexual maturity of the Japanese quails.Combination of giloy and ascorbic acid show favorable effect on immunity level, health status and disease resistant power of birds. So birds show high growth

rate in combination feeding and gain highest body weight at age at sexual maturity as compare to other feeding groups.

The results of the above experiment are in close agreement with Ipek (2006), who also found maximum weight at sexual maturity in the group with a combination of 240 mg vitamin E and 240 mg vitamin C in quail.

Table 3.a: Effect of dietary supplements on Weight at sexual maturity

Supplement effect	Weight in gm
T_0	178.11^a
T_1	182.57^b
T_2	189.76^c
T_3	202.91^d
SEM	0.26

Means having different superscripts in a column differ significantly (P≤0.05)

3.2.1.2 Effect of bedding materials on Weight at sexual maturity

The weight at sexual maturitywas found to be 191.36, 187.36 and 185.78 gm in B_1, B_2, and B_3 group respectively. Statistically significant effect of bedding material was observed and numerically maximum weight at sexual maturity was found in sand as compared to the wheat straw. Minimum weight at sexual maturity was found in wheat straw then rest of the other bedding materials. So the overall study indicates that there is beneficial effect of sand on weight at sexual maturity of the Japanese quails.It may be because of sand bedding material show less risk of respiratory infection and other infections also, because it does not desiccates droppings, it does not retain moisture or decay inside the coop.

Table 3.b: Effect of bedding materials on Weight at sexual maturity

Bedding effect	Weight in gm
B_1	191.36^c
B_2	187.87^b
B_3	185.78^a
SEM	0.22

Means having different superscripts in a column differ significantly (P≤0.05)

3.2.1.3 Interaction Effect of dietary supplement × bedding material on Weight at sexual maturity

The weight at sexual maturitywas found to be 181.63 in group T_{10}, 185.93 in group T_{11}, 192.06 in group T_{12}, 205.82 in group T_{13}, 176.83 in group T_{20}, 181.86 in group T_{21}, 189.86 in group T_{22},

202.95 in group T_{23}, 175.87 in group T_{30}, 179.92 in group T_{31}, 187.36 in group T_{32} and 199.96 in group T_{33}.Further the comparison of means showed that maximum weight at sexual maturity was recorded in T_{13} group. Minimum weight at sexual maturity was found in T_{30} group. So the overall study indicates that there is beneficial effect of sand with supplementation of both giloy and ascorbic acid on weight at sexual maturity of the Japanese quails.It is due to both are beneficial to birds growth as bedding material sand provide less infectious environment to birds, while combination feeding improve their health status and weight gain.

Table 3.c: Effect of dietary supplement × bedding material Interaction on Weight at sexual maturity.

Interaction Effect	Weight in gm
T_{10}	181.63
T_{11}	185.93
T_{12}	192.06
T_{13}	205.82
T_{20}	176.83
T_{21}	181.86
T_{22}	189.86
T_{23}	202.95
T_{30}	175.87
T_{31}	179.92
T_{32}	187.36
T_{33}	199.96
SEM	0.45

Means having different superscripts in a column differ significantly (P≤0.05)

4. CONCLUSION

Reduced age at sexual maturity was obtained in birds which fed combination of giloy and ascorbic acid both and kept at saw dust bedding material. For weight at sexual maturity sand with combination supplementation show best result.In present experiment sand bedding material was found beneficial for weight at sexual maturity. The interaction effect of dietary

supplementation with litter material on age at sexual maturity and weight at sexual maturity was not found to be significant.

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