



Original Contribution

POTENTIAL OF USING SEXUAL DIMORPHISM IN PLUMAGE COLOUR FOR SEXING MANCHURIAN GOLDEN QUAILS

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ABSTRACT

Making an early reliable and precise sex determination in birds is very important in poultry industry management. This is especially true with regard to quail rearing. The optical and Japanese methods could hardly be applied because of their small size. Sexual dimorphism referable to plumage colour in the quails could be used as the earliest possible determination of their sex. This fact informed our aim to investigate the rate of feathering and the colour of feathers of the ventral part of the neck in Manchurian Golden Japanese quails in order to determine their sex. The study showed that sexual dimorphism in Manchurian Golden quails is associated with the neck colour, with differences occurring in the genders by the age of 14 days. This thus allows the separation of both genders to be done between the 14th and the 17th days of age. The accuracy of this determination for the different ages is 80.76% at the age of 14 days, 92.6% at the age of 17 days and 97% at the age of 21 days respectively.

Key words: Japanese quails, Manchurian Golden breed, sexual dimorphism, early determination of the sex.

INTRODUCTION

Japanese quails (*Coturnix japonica*) are subjects of human economic activity since the second half of the last century. The beginning of selection of this species dates back from 1910 when the Japanese selectioner, Katora Oda, succeeded in selecting several pairs of birds with better meat and egg-laying traits among a thousand of domesticated singing quails, used at the time (1). From Japan, quails spread to other Asian countries and, in the period 1930-1950, were introduced in the USA, Europe, The Near East and Central Asia, where their rearing assumed an industrial scale.

A serious problem impeding the narrow specialization of quail rearing is related to the limited possibility for early determination of the sexes in these birds. The Japanese method could hardly be applied because of their small size. With the exception of Japan and China, this method is not used in other countries with

developed quail rearing practices. For twenty years, the Chinese white autosexing population is almost exclusively used in the industrial poultry rearing in China, that rules out the application of the Japanese method of sexing in this country (2). The use of optical methods is limited by the discrepancy between the size of used optical tips and the small size of newly hatched quails. Furthermore, the high cost of sexoscopes and the optical tips combined with increased mortality rates due to the resulting traumas of their use, are another obstacle to the application of optical methods in the practice, where small-capacity farms are prevailing.

Separation of the male and female can be done after 14 days of age, when the body begins to be covered with feathers, showing clear sex dimorphism according to the colour of the plumage (3).

The precise differentiation of quails' gender without using special methods, could be done at the age of 17–20 days in birds with clear sexual dimorphism in plumage colour and at the age of 30–35 days in coloured breeds, lines and strains. In this period, 30 to 100% of expenses related to the rearing are spent, that makes the elimination of unnecessary males ineffective (4). This is the

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main reason for producers' efforts in choosing between general-purpose breeds or crosses of light egg-laying and heavier strains. The offspring of the latter is characterized by high egg productivity and satisfactory meat traits. Furthermore, due to the heterosis effect, the birds are more vital and more resistant to stress (5). The aim is to obtain, along with the primary production of eggs, quality meat production conforming to market's standards from unnecessary males and removed females.

One of the breeds, used over the last years for industrial purposes, is the Manchurian Golden quail. Resulting from a mutation in the colour, the breed is among the six registered in the International Book of Breeds and Lines of Japanese quails (6). The colour of feathers according to most authors is a blend of yellow and brown, which produces an overall golden appearance (6, 7). Kornilova and Kadenkova (5) describe the plumage colour of Manchurian quails as varying between light yellow and brown. According to Marsh (3) the breast of females are beige-yellow with distributed diffusion black points. The breasts of males are brown or rust - brown. According to Bondarenko (8), the colour of feathers in the region of the neck, back and wings is brown with straw-yellow middle. The author describes the colour of male birds as more intensive compared to that of females.

The review of literature makes clear that the information about the plumage colour in Manchurian Golden quails is not sufficient. At the same time, the quails from this breed exhibit an apparent sexual dimorphism in plumage colour that could be used in the earliest possible determination of their sex. This fact informed our aim to investigate the rate of feathering and the colour of feathers of the ventral part of the neck in Manchurian Golden Japanese quails with regard to the practical application of sexual dimorphism in the determination of sex in birds.

MATERIAL AND METHODS

The experiment was performed in the experimental vivarium of the Poultry Breeding section during October-December 2006.

The determination of the sexes in Manchurian Golden quails was initially done at the time of the control weighing at the age of 14 days, on the basis of sexual dimorphism in feather colour of the ventral neck. Throughout the weighing at the age of 17

days, the sex was determined once again, taking into account the mistakes in the previous sex determination. The final determination of the sexes was done at the age of 21 days.

RESULTS

At hatching, Manchurian Golden quails have a yellow down, whose colour varies from lemon-yellow to banana. On the back, there are three black stripes of 1-3 mm in width. The major part of birds has very distinct stripes with width of 2-3 mm. In some birds, the stripes are narrower (about 1 mm) and not very distinct (**photograph 1.1**). As a rule, these individuals exhibit deviations in the plumage colour in adulthood.

Between the 7th and the 10th day, an intensive growth of feathers occurs, with development of flight, tail and covert feathers in the lateral pectoral areas by the 10th day.

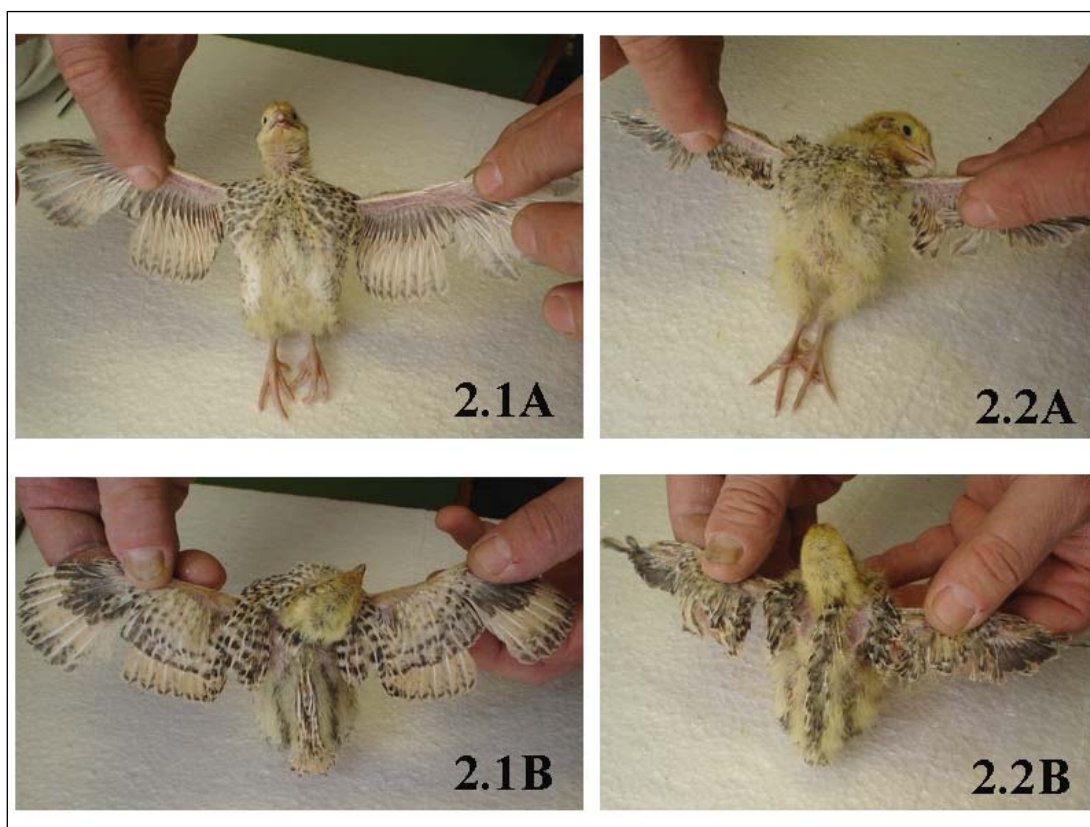
Between the 10th and the 14th day, the feathers from the mentioned topographic area are grown and shaped (**photograph 2.1A**). At that time, appeared the feathers in the lateral neck region, the medial back area (between the scapulae) and the dorsal synsacrum (**photograph 2.1B**). The characteristic for adult birds spots on feather tips are outlined in feathers of ventral and lateral areas of the distal neck (**photograph 1.2**). About the 14th day, the covert feathers in the parietal area of the head do appear.

By the age of 17 days, the neck, medial back zone, the primary and secondary flight feathers, the lateral pectoral areas are relatively well-feathered. The coloration of the neck ring is well differentiated. Most body feathers are with a well-formed feather tips permitting the separation of birds by sex according to the different feather colour.

By the 21st day of age, the external feathers at different parts of the body are well-developed, with a thick feather tip and contrasting colour. The sexual dimorphism in the colour of the ventral neck is very well expressed. In male birds, this area has a homogenous rusty brown colour and in females is characterized with diffuse black spots on a beige background (**photograph 3.1**). The parietal region and the neck ring are well defined with specific gender-related differences. In male quails, the ring is with a saturated rusty-brown colour (**photograph 3.2A**) and in females, with black-brown colour (**photograph 3.2B**).



Photograph 1. 1.1. One day-old Manchurian Golden quails; 1.2. Ten-days old Manchurian Golden quail



Photograph 2. Ten-days old Manchurian Golden quails. 2.1. Normal grow feathers; 2.2. Slow grow feathers.

The solution of the problem with the early, reliable and precise sexing in birds is one of the most important in poultry industry management. **Table 1** presents data about studied broods of Japanese quails, in which sexing accuracy was at the age of 14, 17 and 21 days. Our data indicate that by the age of 14 days, the sex of 80-84% of birds could be reliably determined on the basis of sexual

dimorphism in the ventral neck, the precision of identification being higher in males (**photograph 4.1**). The individual features in the growth rate of external feathers are a major obstacle to the possibility of identifying the gender in 10.5-16.5% of birds, in which feather growth is delayed (**photographs 2.2A; 2.2B, 4.2**).



Photograph 3. 21-day old Manchurian quails. 3.1. In left - male, in right – female quails; 3.2A. Male quail; 3.2B. Female quail.



Photograph 4. 14 day old Manchurian quails. 4.1. Male bird; 4.2. Bird, which sex cannot be determined.

Table 1. Reliability in sex identification of quails from Manchurian Golden breed

<i>Hatch</i>	<i>Age, days</i>	<i>Total number of birds</i>	<i>Precise determined sex</i>	<i>Doubtful sex</i>	<i>Inexact determined sex</i>	<i>Indeterminate sex</i>
I hatch	14 days, n.	280	225	0	9	46
	%	100	80,36	0	3,21	16,43
	17 days, n.	280	257	13	5	5
	%	100	91,78	4,64	1,79	1,79
	21 days, n.	280	271	2	7	0
	%	100	96,79	0,71	2,50	0
II hatch	14 days, n.	153	129	0	8	16
	%	100	84,31	0	5,23	10,46
	17 days, n.	153	144	7	0	2
	%	100	94,12	4,57	0	1,31
	21 days, n.	153	149	2	0	2
	%	100	97,38	1,31	0	1,31
Average	14 days, n.	433	354	0	17	62
	%	100	81,76	0	3,93	14,31
	17 days, n.	433	401	20	5	7
	%	100	92,61	4,62	1,15	1,62
	21 days, n.	433	420	4	7	2
	%	100	97	0,92	1,62	0,46

By the age of 17 days, it was found out that the error in the preceding sex determination (14th day) was 3-5%. Out of quails identified as male, 1.5-4.5% were females and out of those specified as females, 5-7% were actually male. By the 17th day, the gender of the major part of birds with lower feathering at the age of 14 days has been determined. At this age, the gender of 91.8-94.1% of quails was accurately determined. From birds with unidentified sex by the age of 14 days, suspicions about the gender arose in 4.6% of birds. The delayed growth of feathers and the inadequate feathering, even at the age of 17 days, are the cause for the failure to detect the sex in 1.3-1.8% of quails.

At the time of the next examination (age of 21 days), the precision of sexing was about 97%. Even though, the determination of the sex at the age of 21 days could be wrong, mainly because of deviations in the normal colouration of birds, the error amounted to 1.8%.

DISCUSSION

The results from the present study showed that the first sexing in Manchurian Golden quails could be performed by the age of 14 days. The investigation of the feathering and the colour nuances in this breed showed that at that age, the feathers of the ventral and lateral areas of the distal neck are exhibiting the specific colour patterns of adult birds. In

male, feathers with rusty-brown pigmentation could be observed laterally to the down-covered zone (**photograph 4.1**). By the 14th day, the external feathers of the parietal area of the head are appearing and the neck ring is formed, that helps the inspector to correctly assess the gender of quails. By that time as well, in about 15% of birds, the zones for sex identification are still covered with down, this reducing the accuracy of determination (**photograph 4.2**).

By the age of 17 days, the zones for sex identification in Manchurian Golden quails are relatively well feathered – the neck, the medial part of the back, the primary and secondary flight feathers, and the lateral pectoral areas. The colour of the neck ring begins to differentiate. The colour of feathers that cover the ear holes is very distinct. This is very useful to the person inspecting the sex. Nevertheless, even at that age, the sex of some birds could be misjudged, but the relative share of quails with wrongly defined gender was 2.5 times lower compared to the preceding evaluation. The birds, whose gender could be hardly determined by the age of 17 days, are also exhibiting a retarded body mass increase apart the problem with feathering. This is a reason to recommend them for elimination that would increase the accuracy of sexing at the age of 17 days by about 1.6-1.8%.

By the 21st day, the external feathers

from the different parts of the body are well developed, with a thick feather tip and a distinct colour. The parietal region and the neck ring are well outlined (**photographs 3.2A; 3.2B**). The sexual dimorphism in the colour of the ventral neck area is marked, thus being a pre-requisite for a rapid and exact determination of the sexes (**photograph 3.1**).

The analysis of our data showed that the age of 14 days was optimal for sexing Manchurian Golden quails. The reliability of this procedure at that age is adequately high and allows separating and fattening up the major part of male birds. The higher error percentage in the identification of female quails at the age of 14 days was not an obstacle to the organization of industrial production of stock eggs from Japanese quails, as females are continuously being reared and later, at the age of 17 or 21 days, the mistake could be corrected. The separation of most surplus male birds that do not assist the production of eggs is an important issue in increasing the efficiency of egg production. The future selection for enhanced rates of feathering in Manchurian Golden quails could have a positive impact with regard to the reduction of the share of poorly feathered birds at the age of 14 days.

CONCLUSION

The sexual dimorphism in Manchurian Golden quails is the most obvious in the colouration of the neck. The differences between genders in that area are perceptible by the age of 14 days and that allows the separation of both genders to be done between the 14th and the 17th days of age. The accuracy of sexing for the different ages is 80.76% at

the age of 14 days; 92.6% at the age of 17 days and 97% at the age of 21 days respectively.

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