Cross Fertility between the Wild Japanese Quail in the Weishan Lake Area and Domestic Quail*

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ABSTRACT : Cross fertility between wild Japanese quail and domestic quail was explored in an experiment conducted on 18（3♂, 15♀）wild Japanese quails in Weishan Lake area, 18（3♂, 15♀）medium-sized domestic quails and 18（3♂, 15♀）pint-sized domestic quails, which were divided into nine groups. This study demonstrated that wild quail could succeed in crossing with domestic quail,producing fertilized eggs and hatching first filial generation. The findings indicated that there were no reproduction isolation between the wild Japanese quail and domestic quail, and that the best cross combination was between wild male quail and medium-sized domestic female quail, in which the fertility rate and hatchability of fertilized eggs amounted to 42.86% and 29.63% respectively. Based on the results, a new way could be adopted to protect, exploit and utilize genetic resources of wild quail. ***(Asian-Aust. J. Anim. Sci. 2003. Vol 16, No. 10 : 1421-1423)***

Key Words : Wild Japanese Quail, Domestic Quail, Fertilization Rate, Hatchability

INTRODUCTION

Quail (*Coturnix japonica*) is a species belonging to Coturnix, Phasianidae, Callifermes, Aves (Chang, 1995). As a traditional poultry species, quail has a long history domestication. Domestic quail derived from Japanese quail. At present, academic circles think that Japanese quail was domesticated in Japanese Islands about 400 years ago, but it is at least 1,500 years in China. Resent studies prove that wild Japanese quail in Weishan Lake area and domestic quail share the same origin in fairly recent times, compared with wild Japanese quail and domestic quail (Chang et al., 2001). With the development of people's living standard, adaptation of food component and the exploitation of health protection food, the nutrition and taste of quail products have become more and more popular (Zhao, 1993; Chang, 1998). In addition to their specialty of easy feeding, convenient management, simple instruments, less investment, high benefit and high medical value, the quail has also produced a flourishing industry in recent twenty years (Bai, 1993; Liu, 1998). Nowadays, the number of quail being raised has amounted to one billion around the world. China has about two thousand million quails and ranks first in the world (Lin, 2000). The use of quail has a tendency to diversity. However, wild quail has greatly decreased in amount and is even extincted in some habitat regions due to the deteriorating ecological environment (Liu, 1998; Chang, 2001). The crossing feasibility between different cross combinations' effects was explored in the article to reveal the wild quail's effective amount by sending the domestic quails to wild environments, and to protect and utilize the natural resources, which also provide new bases of better utilization of quail genetic resources for modern biological technology.

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MATERIALS AND METHODS

Materials, sampling methods

The 18 (3 males, 15 females) wild Japanese quails, captured from Weishan Lake area during their migrate seasons, 18 (3 males, 15 females) medium-sized domestic quails and 18 (3 males, 15 females) pint-sized domestic quails, obtained in local aviary, were divided into nine groups according to the ratio of one male to five females (B. Wechsler and I. Schmid, 1998) (Table 1). Wild Japanese quail in the Weishan Lake area are different in shape but in other traits as color of feather stripe, beak shape and chirping are the same as domestic quail (Chang et al., 2001).

Management

Quails were raised in single-layer cages. After fifteen-days' pre-trial, the experiment was conducted from June 15, 2002, to October 10, 2002. The eggs were collected by group and hatched once a week. Data were statistically analyzed as follows:

Fertility rate = (fertilized eggs/hatched ones)×100%
Hatchability of fertilized eggs
= (survival quails/fertilized eggs)×100%
Hatchability of hatching eggs
= (survival quails /hatching eggs)×100%

Table 1. Different cross combinations within the crossing experiment

Group	1	2	3	4	5	6	7	8	9
cross combination	$a_1\times b_1$	$a_1\times b_2$	$a_1\times b_3$	$a_2\times b_1$	$a_2\times b_2$	$a_2\times b_3$	$a_3\times b_1$	$a_3\times b_2$	$a_3\times b_3$

a_1, a_2, a_3, b_1, b_2, b_3; Represents for the medium-sized domestic quail (♂), the pint-sized domestic quail (♂), the wild quail (♂), the medium-sized domestic quail (♀), the pint-sized domestic quail (♀) and the wild quail (♀), respectively.

RESULTS

Comparisons on fertility rate and hatchability between different female quails

The fertility rate of hatching eggs of medium-sized domestic quail showed significant difference between females from two different groups, while the other two females indicated no obvious difference. The three types of female quail also made no obvious difference in hatchability of fertilized and hatching eggs (Table 2).

Comparisons on fertility rate and hatchability between different male cross combinations

From Table 3 we can see that there were no significant imparity except the results between the pint-sized domestic quail and wild one. As far as the hatchability of fertilized and hatching eggs were concerned, the three types of male quail indicated no significant difference.

Comparisons on fertility rate from different cross combinations

The statistical results in Table 4 showed that the fertility rate indicated no significant difference between either of $a_1\times b_1$, $a_1\times b_3$, $a_2\times b_2$ and either of $a_2\times b_3$, $a_1\times b_3$, $a_2\times b_3$, $a_3\times b_3$. It manifested that no different fertility rate could be observed in the cross combinations of domestic male×wild female, domestic quail×domestic one or wild quail×wild one. The domestic male can succeed in mating with the wild female and producing fertilized eggs. In addition, there was no significant difference among $a_3\times b_1$, $a_3\times b_2$, $a_3\times b_3$, which indicated that wild male could produce fertilized eggs with domestic female, thus, the crossing was feasible, and no

Table 2. Comparisons on fertility rate and hatchability between different female quails

Female Types	Hatching eggs	Fertilized eggs	Survival quails	Fertility rate	Hatchability of fertilized eggs	Hatchability of hatching eggs
Medium-sized domestic quails	201	103	31	51.24^{a}	30.10^{a}	15.42^{a}
Pint-sized domestic quails	180	70	19	38.89^{b}	27.14^{a}	10.56^{a}
Wild quails	22	5	2	22.73^{b}	40.00^{a}	9.09^{a}

The different letters mean significant difference ($p<0.05$). The same letters mean insignificant difference ($p>0.05$).

Table 3. Comparisons on fertility rate and hatchability between different male quail cross combinations

Male Types	Hatching eggs	Fertilized eggs	Survival quails	Fertility rate	Hatchability of fertilized eggs	Hatchability of hatching eggs
Medium-sized domestic quails	141	65	19	$46.10^{a\,b}$	29.23^{a}	13.48^{a}
Pint-sized domestic quails	136	67	22	49.26^{b}	32.84^{a}	16.18^{a}
Wild quails	126	46	2	36.51^{a}	23.91^{a}	8.73^{a}

The different letters mean significant difference ($p<0.05$). The same letters mean insignificant difference ($p>0.05$).

Table 4. Comparisons on fertility rate and hatchability between different cross combinations

Cross combination	Hatching eggs	Fertilized eggs	Survival quails	Fertility rate	Hatchability of fertilized eggs	Hatchability eggs
$a_1\times b_1$	85	46	14	54.12^{aAB}	30.43^{a}	16.47^{a}
$a_1\times b_2$	43	15	3	34.88^{bcAB}	20.00^{a}	6.98^{ab}
$a_1\times b_3$	13	4	2	30.78^{acdAB}	50.00^{a}	15.38^{ab}
$a_2\times b_1$	53	30	9	56.60^{aA}	30.00^{a}	16.98^{a}
$a_2\times b_2$	80	36	13	45.00^{aceAB}	36.11^{a}	16.25^{a}
$a_2\times b_3$	3	1	0	33.33^{acdAB}	0^{a}	0^{ab}
$a_3\times b_1$	63	27	8	42.86^{aceAB}	29.63^{a}	12.70^{ab}
$a_3\times b_2$	57	19	3	33.33^{bdeAB}	15.79^{a}	5.26^{b}
$a_3\times b_3$	6	0	0	0^{bdB}	-	0^{ab}

The same letters indicate insignificant difference ($p>0.05$). The different letters indicate significant difference (The capital letters represent for $p<0.01$, otherwise, $p<0.05$).

prezygotic RIM has formed.

Comparisons on different cross combinations' hatchability of fertilized eggs

The hatchability of fertilized eggs between cross combinations showed no obvious difference except $a_3 \times b_3$ (Table 4), which manifested no significant difference between the cross combination and the natural mating ones.

Comparisons on different cross combinations' hatchability of hatching eggs

Table 4 indicated that no obvious difference existed except that between $a_3 \times b_2$ and either of $a_1 \times b_1$, $a_2 \times b_1$, $a_2 \times b_2$. It may be attribute to the relatively lower fertility rate and hatchability of fertilized eggs in $a_3 \times b_2$, compared with $a_1 \times b_1$, $a_2 \times b_1$, $a_2 \times b_2$.

DISCUSSION

No prezygotic reproduction isolation (RIM) exists between wild and domestic quail because they can succeed in crossing, producing fertilized eggs and hatching first filial generation. A higher fertility rate has been observed between wild male and domestic female than that between domestic male and wild female, which may account for the wild female seasonal reproduction, small annual-produced eggs and small mating frequency with the male (Xu et al., 2001).

Due to the large amount of wild quail captured and the deteriorating ecological environment, the wild quail resources has sharply decreased. The findings of this study demonstrated a feasible way for recovering the effective amounts of wild quail by crossing between domestic quail and wild one, which will protect the resources. The effect between wild male and domestic female is better than that between domestic male and wild female, but the cross combination of wild male to medium-sized female showed the highest efficiency. It may contribute to the domestic quail's nonseasonal reproduction, more annual-produced eggs and higher mating frequency.

In this experiment, the low hatchability of hatching eggs may result from the low fertility rate, hatchability of fertilized eggs, the small sampling scale and small amounts of eggs to be selected.

This study also showed that the wild male can succeed in mating with domestic female and producing fertilized eggs, while the mating between the wild quails failed, partly because of: (1) specialty of the experimental material and small sampling scale; (2) short-period domestication of the wild quail, their exclusion to the domestic environment and small amounts of eggs. Furthermore, the reproductive mechanism of the wild quail under natural condition needs to be further clarified.

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