Breeding Performance and Egg Quality of Red Jungle Fowl (*Gallus gallus* L.) Under Confinement System

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Abstract

This study was conducted to assess the breeding performance, and egg quality traits of Red Jungle Fowl in selected areas of Leyte mated to native hens under confinement system. A total of six Red Jungle Fowl and two native roosters, and 16 native hens were randomly assigned to four treatments and eight replications. Each replicate was composed of one rooster and two hens that were randomly laid out in a Randomized Complete Block Design. The result on egg weight showed a highly significant difference at p value <0.01 and revealed heaviest weight (39.0 g) and lightest weight (35.75 g) on Native x Native and Baybay Red Jungle Fowl x Native, respectively. A comparable number of eggs per clutch, fertility and hatchability rates, yolk and albumen weights, shell weight, egg length and width, egg shape index and yolk color score were recorded.

Keywords: egg clutch, egg shape index, native chicken, hatchability rate

1.0 Introduction

Poultry breeding has become the most commercialized of all livestock species. Separate lines are developed according to purposes like broilers and egg layers. Both have made spectacular progress because of the high selection intensity possible. And also the groups are concerned with the viability and resistance to disease because only live broiler or hen produces income. Strategies for producing specific sires’ lines, dam lines and crosses that differ in production traits are continuing today. Crossbreeding is used to take advantage of heterosis and to combine stocks in which the performance traits complement each other or conversely to cover particularly poor performance of a pure strain for a commercially vital character.

The grand parental stocks in the Philippines are entirely dependent on imported stocks from the U.S.A., Canada, Netherlands, Israel, Thailand, Japan and Australia. These stocks have been bred so that they could not be genetically produced elsewhere.

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except in their own foundation farms (Arboleda, et al., 1986).

But the lack of performance and breeding records has always been the major problem to improve animal genetic resources in most developing countries like the native chickens in the Philippines. As a matter of fact, the native chicken still contribute to a high degree on the supply of meat and eggs in the markets especially in rural areas (Arboleda, 1987).

According to Bondoc (1999), native chickens constitute a special genetic niche evolved by natural selection which is crucial to the continued animal production in the country. Unfortunately, the information on the true potential of the different genetic groups of Philippine native chickens regarding some basic genetic parameters is still limited. Hence, this research is conducted to assess the breeding performance of Red Jungle Fowl (RJF) mated with native hens under confined management system; and to characterize the different egg traits of Red Jungle Fowl mated with native hens under confined management system.

2.0 Methodology

The Red Jungle Fowl (RJF) roosters were acquired from three places of origin (Baybay and Matalom, Leyte and Hinundayan, Leyte) and the native were from Hinundayan, Southern Leyte. The sixteen native hens were mated with the RJF and native roosters. The native hens used in the study laid eggs for the first time and had weight ranges from 1-1.5 kg.

A total of six Red Jungle Fowl and two native roosters and 16 native hens were used to assess the breeding potential. There were four treatments and a total of eight replications. Each replicate was composed of one rooster and two hens (a mating ratio of 1:2) that was randomly laid out in a Randomized Complete Block Design. The set up was as follows:

<table>
<thead>
<tr>
<th>T1Rj</th>
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<th>T1Rj</th>
<th>T1Rj</th>
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<tbody>
<tr>
<td>T2Rj</td>
<td>T2Rj</td>
<td>T2Rj</td>
<td>T2Rj</td>
</tr>
</tbody>
</table>

Rj: Red Jungle Fowl rooster
Native rooster

Where:
T0 Native (Rj) × Native
T1 Baybay Red Jungle Fowl (RJF) x Native
T2 Matalom Red Jungle Fowl (RJF) x Native
T3 Hinundayan Red Jungle Fowl (RJF) x Native

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On the egg traits assessment, the random sample of two eggs per treatment was collected and measured for the different egg quality parameters.

The following data was taken by the parental stock (PS) and F₁ progenies which includes the following:

a. Egg Production - is the number eggs produced in a clutch.

b. Egg Weight (g) - individually weighed using an egg weighing scale.

c. % Fertility

\[ \text{% Fertility} = \frac{\text{number of chicks hatched}}{\text{number of fertile eggs}} \times 100 \]

d. % Hatchability

\[ \text{% Hatchability} = \frac{\text{number of fertile eggs}}{\text{number of egg set}} \times 100 \]

e. Egg Quality Traits:

Yolk weight – after being separated from the albumen using a yolk separator, the yolk was weighed using a digital weighing scale.

Yolk color – under white background, yolk color was evaluated using the ROCHE Yolk Color Fan.

Shell weight with shell membrane, grams - egg shell with shell membrane was weighed using a digital weighing scale.

Egg shape index, %

\[ \text{Egg shape index, %} = \frac{\text{width of egg (mm)}}{\text{length of egg (mm)}} \times 100 \]

Data collected was subjected to analysis of variance using the Statistical Package for Social Sciences (SPSS) version 17 while comparison of treatment means was done using Tukey’s Honest Significant Difference (HSD) test.

3.0 Results and Discussion

Egg Production

Based on the results, the eggs produced in one clutch ranged from 8.50 to 10.50 (Table 1). Although not significant, the Native x Native exhibited slightly higher (10.5) followed by Matalom RJF x Native (9.0), Baybay RJF x Native (8.75) and Hinundayan RJF x Native (8.5). The result however, implies that any of the Red Jungle Fowls mated to Native hens were
comparable to pure native chicken stocks in terms of a number of eggs per clutch.

**Percent Fertility and Hatchability**

The different mating combinations did not differ significantly in terms of percent egg fertility and hatchability rates (Table 1). However, it should be noted that Native x Native exhibited slightly higher (86.67%) fertility rate. These were followed by Hinundayan RJF x Native (85.0%), Matalom RJF x Native (83.75%), and Baybay RJF x Native (79.86%).

Moreover, percent egg hatchability rates showed no significant difference among the four treatments. Although data proved comparable hatchability, it should be noted that Matalom RJF x Native manifested slightly higher rate (83.48%) than Hinundayan RJF x Native (82.34 %), Native x Native (80.97%), and Baybay RJF x Native (78.13%). Results suggest that the three Red Jungle Fowls from three origins were comparable with the native roosters on the percent egg fertility and hatchability rates. Aside from the breed and strains, the fertility and hatchability of eggs for the confined and scavenging chickens were attributed to unbalanced male to female ratio, storage condition and duration of the eggs; age of the bird, nutrition, disease, management and environmental factors (North & Bell, 1990).

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Table 1. Breeding performance of Native Chicken and Red Jungle Fowls in selected areas of Leyte under confinement system.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Fertility (%)</th>
<th>Hatchability (%)</th>
<th>Egg Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₀ (Native x Native)</td>
<td>86.67</td>
<td>80.97</td>
<td>10.50</td>
</tr>
<tr>
<td>T₁ (Baybay RJF x Native)</td>
<td>79.86</td>
<td>78.13</td>
<td>8.75</td>
</tr>
<tr>
<td>T₂ (Matalom RJF x Native)</td>
<td>83.75</td>
<td>83.48</td>
<td>9.00</td>
</tr>
<tr>
<td>T₃ (Hinundayan RJF x Native)</td>
<td>85.00</td>
<td>82.34</td>
<td>8.50</td>
</tr>
</tbody>
</table>

\( p \text{-value} \) | 0.687\textsuperscript{ns} | 0.750\textsuperscript{ns} | 0.071\textsuperscript{ns} |

\( \text{RJF} \): Red Jungle Fowl
\( \text{ns} \): Not significantly different (p > 0.05).

**Egg Weight**

Egg weights (Fig. 2) ranged from 35.75 grams to 39.00 grams and were significantly different among treatment means (Table 2). The Native x Native eggs (39.0 g) exhibited the heaviest (P<0.01) egg weight, although not significantly different from Matalom RJF x Native (37.0 g). The Matalom RJF x Native eggs (37.0 g) was slightly heavier than Hinundayan RJF x Native eggs (36.75 g). And Baybay RJF x Native eggs (35.75 g) got the lowest weight among the RJF roosters. Result proved that native chicken egg weight trait diverged...
slightly from those infused with Matalom RJF but highly differed from both Hinundayan and Baybay Red Jungle Fowls mating combinations. Alsoyabel et al. (1991) emphasized that the age of the hen plays the role in determining egg weight. The weight increases when the age increases, and the higher body weights are also associated with bigger eggs.

**Egg Quality Traits**

**Yolk weight.** Under confinement system, the yolk proved no significant difference among the four treatments (Table 2). It was noted that Native x Native yolk was slightly heavier. These were followed by Matalom RJF x Native (22.75 g), Hinundayan RJF x Native (21.71 g) and Baybay RJF x Native (20.57 g). It was observed that the yolk followed the same trend with the egg weight. Nevertheless, result showed comparable yolk weights among the different treatments. Crawford (1990) reported that genetic and non-genetic factors such as the age of the hen, length of storage and seasons played the significant role in determining albumen and yolk quality.

**Albumen Weight.** Data on albumen weight were also not significantly different among treatment means. The Native x Native displayed slightly heavier (11.17 g) albumen weight. It was followed by Hinundayan RJF x
Native (10.11 g), Baybay RJF x Native (9.92 g) and Matalom RJF x Native (9.34 g).

Shell weight. The shell weight ranged from a mean weight of 4.91g to 5.26g among the different treatments under confinement system (Table 2). The result was not significantly different among the four treatments. Surprisingly, the Baybay RJF x Native (5.26 g) slightly surpassed the mean shell weight of Native x Native (4.98 g), Hinundayan RJF x Native (44.94 g) and Matalom RJF x Native (4.91 g). The result proved that there was a comparable shell weight among the different treatments. It is important to note that the egg weight of Baybay RJF x Native was largely influenced by its shell as the result of a thick shell.

Egg Shape Index. Table 3 revealed no significant difference in the egg length, egg weight, and egg shape index among the different treatments. According to the Government of Alberta (2006), the shape of chicken egg is elliptical and varies a lot depending on size, age and health of the chicken. The strength of the egg shell was directly related to egg shape index. It varies according to the strain of the birds, size of the eggs and the position of the eggs in the clutch and the time of oviposition. The study supported by Mueller et al. (1990) emphasized that shape index increases until the 5th or 6th month of production then decreases gradually. The eggs laid during the 2nd year of production have significantly lower shape

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Egg weight</th>
<th>Yolk weight</th>
<th>Shell weight</th>
<th>Albumen weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0(Native x Native)</td>
<td>39.00a</td>
<td>22.85</td>
<td>4.98</td>
<td>11.17</td>
</tr>
<tr>
<td>T1(Baybay RJF x Native)</td>
<td>35.75b</td>
<td>20.57</td>
<td>5.26</td>
<td>9.92</td>
</tr>
<tr>
<td>T2(Matalom RJF x Native)</td>
<td>37.00bc</td>
<td>22.75</td>
<td>4.91</td>
<td>9.34</td>
</tr>
<tr>
<td>T3(Hinundayan RJF x Native)</td>
<td>36.75bc</td>
<td>21.71</td>
<td>4.94</td>
<td>10.11</td>
</tr>
</tbody>
</table>

p-value: 0.004** 0.150=( 0.705= 0.524=

RJF: Red Jungle Fowl

*Column means without common superscripts are significantly different (p<0.01)
**Highly significant (p<0.01)
Nonsignificantly different (p>0.05)

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Table 3. Egg length (mm), egg width (mm) and egg shape index (%) of Native Chicken and Red Jungle Fowls in selected areas of Leyte under confinement system.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Length</th>
<th>Width</th>
<th>Egg Shape Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₀ (Native x Native)</td>
<td>48.82</td>
<td>35.53</td>
<td>73.19</td>
</tr>
<tr>
<td>T₁ (Baybay RJF x Native)</td>
<td>48.83</td>
<td>32.78</td>
<td>67.89</td>
</tr>
<tr>
<td>T₂ (Matalom RJF x Native)</td>
<td>49.07</td>
<td>33.03</td>
<td>67.46</td>
</tr>
<tr>
<td>T₃ (Hinundayan RJF x Native)</td>
<td>47.54</td>
<td>32.29</td>
<td>67.99</td>
</tr>
</tbody>
</table>

*p-value 0.881<sup>ns</sup> 0.167<sup>ns</sup> 0.344<sup>ns</sup>

**Yolk Color.** The yolk color scores based on the Roche Yolk Color Fan manifested almost similar pale colors among treatments, and far below the acceptable color score of 9. It was noted that egg yolk color was probably affected by the confinement system and kind of diet given to the experimental chickens. It was not a relevant parameter to consider that yolk color was more affected by nutritional factors than breed or strain. North (1984)

Table 4. Yolk color scores of Native Chicken and Red Jungle Fowls in selected areas of Leyte under confinement system.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yolk Color Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₀ (Native x Native)</td>
<td>5</td>
</tr>
<tr>
<td>T₁ (Baybay RJF x Native)</td>
<td>4</td>
</tr>
<tr>
<td>T₂ (Matalom RJF x Native)</td>
<td>3</td>
</tr>
<tr>
<td>T₃ (Hinundayan RJF x Native)</td>
<td>5</td>
</tr>
</tbody>
</table>

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mentioned that some factors affecting yolk color were factors such as fat content of the ration, ingredients of the ration, and strain, and individual variations also played a significant role in determining yolk color of the egg.

**Other Behavioral Traits of Red Jungle Fowls**

During the conduct of the study, it was observed that Red Jungle Fowl roosters participated in the natural incubation process together with the hen. This behavior of RJF roosters under a confinement system was indicated as the stout instinct of RJF roosters. Particularly on the preservation of the species in the wild, such that they take turns with the hens in incubating eggs to ensure higher hatchability of the eggs. Due to domestication, this behavior has been naturally eliminated in the native chickens. As cited in Merck Veterinary Manual (1999), the central nervous system and body hormones provided for the expression and maintenance of this breeding behavior thru many years of environmental adaptation. For survival reasons, the reproductive, the maternal, and the fight-flight behavior showed precise species-characteristic patterns within their particular environment.

**4.0 Conclusion**

Therefore, the Red Jungle Fowl in the three selected areas of origin does not differ in terms of the breeding performance and egg traits. This indicates that the performances of RJF are comparable to the native chicken under a confinement system.

**5.0 References Cited**

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