Reproduction and growth characteristics of ducks and local white Muscovy in Indonesia

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Abstract. Currently at IRIAP, MASTER ducks have been produced as stock superior laying ducks. Efforts to maintain consistency its egg production, both of the parent stock of MASTER duck namely the Alabimaster-1 Agrinak and Mojomaster-1 Agrinak ducks have been selected based on egg production. In addition, PMp ducks have been produced as broiler ducks that can be mated with Muscovy to produce mule ducks. The productivity related to the growth and eggs production in those ducks has been widely disclosed, however, information on their reproductive characteristics was still very limited. Therefore, the aim of this study was to evaluate the reproductive characteristics of ducks and white Muscovy that were being developed in IRIAP. The materials in this study were 515 birds consisted of Alabimaster-1, Mojomaster-1, PMp and white Muscovy that were in the layer phase. The variables observed were reproductive characteristics and the growth of ducks in the starter period. The results showed that the fertility obtained was relatively high namely ranging 93% in layer ducks, 85% in PMp ducks and 76% in Muscovy. The hatchability rate of layer ducks was included in the medium category with values ranging 63%. Meanwhile, the hatchability of PMp duck and Muscovy was in the low category, namely 50% and 14% respectively. Embryonic mortality in ducks was relatively moderate, namely 35–37%, while in Muscovy was relatively very high, i.e around 93%. The growth of ducks and Muscovy in starter period were normal stage.

1. Introduction
Currently in IRIAP, MASTER ducks have been produced as superior layer ducks. MASTER ducks were categorized as superior layer ducks, because they have a relatively high average annual egg production of around 71%, peak production reaches 94% and the age at first laying eggs is between 18-20 weeks [1]. The superiority of ducks produced from these crosses must be maintained in the consistency of egg production by increasing genetic uniformity in both parent lines. Efforts that can be made to achieve genetic uniformity in these broodstock are through a selection program for each line. The program of selection was based on egg production criteria, because of these characteristics were expected to be uniform. The selected population of ducks was called strain/line, while ducks in the field or in their natural habitat were called breed/class. In the duck population as a result of this selection, line release has also been carried out based on the Decree of the Minister of Agriculture No.360/Kpts/PK.040/6/2015 for Alabimaster-1 Agrinak ducks and No.361/Kpts/PK.040/6/2015 for Mojomaster-1 Agrinak. Both lines were pure lines, however have a higher egg production than breeds in the field, because they have been selected.
In addition, in IRIAP, PMp ducks have been produced as special of broiler ducks and have been released as new breeds of ducks based on the Decree of the Minister of Agriculture No.10/KPTS/PK.040/ M/1/2020. The beginning of the formation of PMp ducks was in line with the increasing demand for duck meat and the community began crossing muscovy with ducks called mule ducks (serati or tiktok ducks in Indonesian language). However, the mule ducks produced by the community still vary, both in their plumage color and in their productivity. To anticipate this condition, the IRIAP has pioneered the formation of broiler ducks, namely PMp ducks, which have the potential to be developed as a female line to form mule ducks because of their relatively large body weight of 2.2–2.5 kg at the age of 10 weeks [2]. The formation of mule ducks can be done by crossing female PMp ducks with male muscovy. The results of the crossing were mule ducks namely EPMp as the final stock, with both white of plumage and carcass appearance, the body weight almost uniform i.e >2 kg at the age of 12 weeks.

To obtain mule ducks population were relatively large and white, the selection program based on egg production in the PMp ducks population. After undergoing the selection program for 5 generations, the PMp line have egg production rate of 50–55% per year and body weight relatively stable i.e 2.2–2.5 kg/bird at 10 weeks of age [3]. Based on theirs productivity, PMp ducks have been considered a stable female line of broiler ducks. Meanwhile, muscovy as male lines were only raised for maintenance and have not yet been developed as breeding stock. at IRIAP, efforts to build of breed stock from local muscovy that will be used as male lines to form mule ducks have been carried out through germplasm collection activities since 2006. Susanti et al (2006) reported that caged duck maintenance was able to increase egg production to 25–27% during the year of observation with a coefficient of variability of 12.3%. The coefficient of diversity indicates that duck egg production among individuals was still relatively high. This was an opportunity that the production of local Muscovy eggs can still be increased through the selection breeding program. As a reference in developing a breeding program strategy through selection, the technical standards for local white duckling cultivation need to be known, especially the reproductive characteristics, because the local white Muscovy as fowls reproduce by hatching eggs. Meanwhile, there was very little information on the production and reproduction characteristics of the local white Muscovy. In addition, efforts to reproduce mule ducks were closely related to production and reproduction factors, both female and male parents [4].

Much informations have been disclosed regarding productivity related to growth and egg production of ducks that have been released, however information regarding their reproductive characteristics were still very limited. Therefore, the aim of this study was to evaluate the reproductive characteristics of local Indonesian ducks and white Muscovy that were being developed in IRIAP.

2. Materials and method

2.1. Research time and location
The research was conducted from January to June 2020, in the cage and laboratory of duck complex, Indonesia Research Institute for Animal Production, Bogor Residence, West Java.

2.2. Research materials
The materials used in this study were Alabimaster-1 Agrinak ducks consisted of 120 females and 30 males, Mojomaster-1 Agrinak ducks comprised 60 females and 15 males, PMp ducks consisted of 120 females and 30 males; and local white Muscovy as many as 110 females and 30 males. The parent duck population was about 12 months old, while the Muscovy population was around 14–27 months old. Even though their ages varied, all the animals observed were in the egg production phase and the number of eggs to be hatched were relatively the same, namely 1,120–1,200 egg. The mating system for Alabimaster-1 and Mojomaster-1 ducks was done through artificial insemination (AI), while for PMp ducks and Muscovy was done naturally.
2.3. Research design
The all of eggs of ducks and Muscovy were recorded every day and hatched using a hatching machine every week. Before the eggs of ducks and Muscovy were being put into the hatching machine, the eggs were collected for a week, then cleaned using a dry cloth to remove stuck dirt. The first candling was done after the eggs were incubated in the hatching machine for 3 days to choose fertile and infertile eggs. The second candling was carried out on the 25th day for ducks and 30th day for Muscovy, as well as being transferred to the hatcher machine. The duck eggs will hatch on the 27th–28th day, while Muscovy eggs will hatch on the 34th–35th day.

2.4. Research procedure
Alabimaster-1 and Mojomaster-1 ducks were kept in individual cages measuring 0.45x0.60x0.45 m³, while PMp and Muscovy ducks were kept in litter cages. Each measuring 3x3.5x0.5 m³ for PMp ducks and 3x3.5x2 m³ for local white Muscovy. Litter cages for ducks and Muscovy were distinguished by a high fence, because Muscovy still have high flying properties.

The feeding of the white Muscovy local were adjusted to the standard nutritional requirements of ducks at each stage of their growth. In the phase growth of starter (DOD-8 weeks) will be fed with protein content of 18% and energy of 2,700 kcal EM/kg [5]. During period of the grower (8–20 weeks) will be fed with 15% protein content and 2,600 kcal EM/kg [6]. Whereas at the laying stage, the white Muscovy local will be fed with protein content of 17% and energy of 2,650 kcal EM/kg [7]. The drinking water was given ad-libitum.

2.5 The measured variables
The variables observed were reproductive characteristics included fertility, hatchability and embryonic mortality. In addition, the resulting Day-Old Duck (DOD) was then sexing and weighed for each duck and Muscovy. Observations were continued on the starter period of growth of ducks and Muscovy.

2.6. Data analysis
The data analysis on reproduction variables included fertility, hatchability and embryo mortality were stated in %. Meanwhile, DOD weight was stated in grams. The all data were analyzed descriptively.

3. Results and discussion
The results of observations on the reproductive characteristics of ducks and Muscovy were listed in table 1.

| Variables                      | Alabimaster-1 | Mojomaster-1 | PMp       | Muscovy   |
|--------------------------------|---------------|--------------|-----------|-----------|
| Number of eggs                 | 1,209         | 1,130        | 1,121     | 1,174     |
| Fertility (%)                  | 93.22±2.65    | 93.54±2.57   | 85.6±5.23 | 76.66±6.23|
| Hatchability (%)               | 64.80±1.90    | 63.85±8.59   | 50.55±10.44 | 14.60±6.96|
| Embryo Mortality (%)           | 35.20±1.90    | 36.15±8.59   | 37.40±9.15 | 93.18±10.57|
| Number of DOD hatched (birds)  | 724           | 673          | 489       | 131       |
| Number of male DOD (birds)     | 342           | 337          | 249       | 78        |
| Number of female DOD (birds)   | 359           | 314          | 240       | 53        |
| Number of abnormal DOD (%)     | 3.17          | 3.27         | 0         | 0         |

Based on table 1, it appears that the number of eggs hatched ranged from 1,120 to 1,200 for each duck and Muscovy during the observation from January to June 2020. The fertility rate obtained in this study was relatively high on layer ducks, namely 93% either in the Alabimaster-1 or Mojomaster-1. Meanwhile, on broiler ducks about 85% for PMp ducks and 76% for Muscovy. The fertility rate of the Muscovy was lower than the results of the study by [8] which obtained a fertility rate of 97.09% of the Muscovy was achieved at 1: 5 sex ratio (with more than one drake in a group) and 93.41% at 1:8 sex
ratio (with a single male in a group). Rashid et al (2009) reported that the fertility rate of Peking ducks was 80.96% and Muscovy was 86.69%. The difference in the fertility rate obtained, even though the mating pattern was almost the same ratio of males to females, might be caused by factors such as genetic quality, feeding and management systems [9].

The hatchability rate of ducks was included in the medium category with values ranging between 63-64%, 50% for PMp ducks. Meanwhile, the hatchability rate of Muscovy was very low category i.e only 14.6%. The hatchability rate of the Alabimaster-1 and Mojomaster-1 ducks obtained in this study were almost the same as the Peking duck's hatchability of 62.91% [9].

The rate of hatchability using incubation machines obtained in this study was much lower than the hatchability through natural incubation around 76–77% [10]. The average rate of hatchability using incubation machines ranges from 10–20% [11–13]. Harun et al [1998] recommended the use of natural incubation, because the hatching through natural incubation was higher than those reported for artificial incubation of Muscovy duck eggs. However, knowledge of nesting behaviour must be taken during management of the duck flocks during breeding season. If natural hatching is carried out, what is needed is an artificial nest. Artificial dumping proves to be an optimal solution for the abandoned nests. In addition, the duration of reproduction cycle affects the hatching rate and consequently the number of clutches per duck per year have to be accounted [10].

The embryonic mortality in ducks was relatively moderate, namely 31–36%, while in Muscovy was relatively very high, namely around 96%. The results of this study were relatively the same as those of [9] who obtained embryo mortality of 37.10% for Peking ducks and 45.70% for Muscovy. High embryo mortality was influenced by environmental factors such as temperature, humidity, turning, etc.

The average abnormal ducklings produced were about 3.17% in the Alabimaster-1 and 3.27% in Mojomaster-1 as layer ducks. Meanwhile the broiler ducks, namely PMp and entok, had no abnormal DOD. These results were consistent with the research of [9] who obtained abnormal DOD were 3.99% for Peking ducks and 2.78% for Muscovy.

The growth in the starter period of Alabimaster-1 Agrinak and Mojomaster-1 Agrinak as layer ducks was listed in Figure 1, while the growth in the starter period of PMp ducks and Muscovy as broiler duck was listed in figure 2.

Based on figure 1, it appears that the Alabimaster-1 Agrinak and Mojomaster-1 Agrinak ducks as layer ducks grew normally. This was indicated by the increasing body weight from 1 day to 8 weeks of age. At the end of the starter period, which was at the age of 8 weeks, the body weight of the layer duck has reached 1 kg.

![Figure 1. Growth in the starter period of Alabimaster-1 Agrinak and Mojomaster-1 Agrinak ducks as layer ducks at IRIAP](image-url)
Figure 2. Growth in the starter period of PMp and Muscovy as broiler ducks at IRIAP

For figure 2 as a picture of the growth of broiler ducks, it appears that at the beginning of growth PMp ducks have a body weight that was almost the same, even slightly higher than Muscovy. However, at the end of starter growth, which was 8 weeks old, the male Muscovy body weight was slightly higher than the PMp duck. Rashid et al (2009) reported that initial live weight of Pekin ducklings and Muscovy ducklings were 47.05 g and 46.39 g respectively [9]. It was observed that live weight up to 6 weeks of age was similar but from 6 to 10 weeks of age Muscovy grew faster than that of Pekin. Based on figure 2, it can also be seen that in the Muscovy there was a sex dimorphism of the body weight, namely the male Muscovy body weight was greater than the female Muscovy.

4. Conclusion
The results showed that the fertility obtained was relatively high in layer ducks, but moderate in PMp ducks and Muscovy. The hatchability rate of layer ducks was included in the medium category. Meanwhile, the hatchability of PMp duck and Muscovy was in the low category. Embryonic mortality in ducks was relatively moderate, while in Muscovy was relatively very high. The growth of ducks and Muscovy in starter period were normal stage.

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