ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 01 | January - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

ASSESSMENT OF INBREEDING RATE OF PITALAH DUCK AS GENETIC RESOURCES IN WEST SUMATERA PROVINCE, INDONESIA

Genetics

Rusfidra* Faculty Of Animal Science, Universitas Andalas. *Corresponding Author
Y. Darmento Animal Science Study Program, Faculty Of Animal Science, Universitas Andalas.
Y. Heryandi Faculty Of Animal Science, Universitas Andalas.
Ediset Faculty Of Animal Science, Universitas Andalas.

ABSTRACT

The Pitalah duck, indigenous to West Sumatera Province, was designated as an Indonesian poultry genetic resource by the Indonesian Ministry of Agriculture in 2011. A survey was conducted in Nagari Batipuah Baruah, Tanah Datar Regency, West Sumatera Province, Indonesia, to assess the inbreeding rate of Pitalah ducks. Estimating the inbreeding rate of local ducks is crucial to prevent inbreeding depression. This study aims to determine flock composition, effective population size (Ne), and inbreeding rate (ΔF) of the Pitalah duck in an in-situ population. The census served as the primary research methodology. The findings indicated that the number of breeding males (Nm) was 675 heads, while the number of breeding females (Nf) was 2,445 heads. The male-to-female ratio (Nm/Nf) was 27,61%. The effective population size (Ne) was 2,115 heads. The inbreeding rate (ΔF) for the indigenous Pitalah duck population, based on the current flock size, was calculated to be 0.24%, suggesting that the population is not at risk of extinction. It is found that inbreeding depression did not arise in the Pitalah duck population.

KEYWORDS

Pitalah duck, inbreeding rate, effective population size, Tanah Datar, Indonesia.

INTRODUCTION

Indigenous chickens serve as a crucial reservoir of genetic resources, and their protection plays a technical role in the future advancement of the production system, as well as a socio-cultural one (Camacho-Escobar, 2008; Ajayi, 2012). Lariviere et al. (2007) asserted that genetic diversity in chickens is essential to prevent inbreeding within the chicken population. The recognition of the necessity to preserve these resources has prompted the initiation of a comprehensive strategy for the conservation of duck genetic resources. The size of a population significantly influences its dynamics; smaller populations exhibit a greater propensity for reduced reproductive capacity due to inbreeding (Klemetsdal, 1998; Thompson et al., 2000).

The Pitalah duck is a genetic resource from West Sumatra Province, Indonesia, recognized as a layer type (Rusfidra et al., 2015; Rusfidra et al., 2012). This study aims to assess the makeup of chicken flocks and the rates of inbreeding within the Pitalah duck breed population undergoing in-situ conservation in Batipuah Baruah Village, Tanah Datar Regency, Indonesia.

MATERIALS AND METHODS

A survey was conducted in eight sub-villages within the in-situ conservation area of Pitalah ducks in Batipuah Baruah villages. A semi-structured questionnaire was distributed to 121 chosen families. All the chosen homes possessed Pitalah ducks that were raised using an intensive production system. Farmers did not manage breeding or maintain records of their ducks because of the scavenging nature of production; instead, they selected ducks at the household level utilizing their indigenous knowledge, experience, and the performance of the Pitalah duck.

Flock composition data were calculated utilizing the mean process of statistics via SPSS (2010). Additionally, the inbreeding rate was assessed within the population. The effective population size (Ne) for a randomly mated population is computed using the formula $Ne = (4NmNf)/(Nm+Nf)$, where Ne represents effective population size, Nm denotes the number of breeding males, and Nf indicates the number of breeding females in the population. The inbreeding coefficient (ΔF) was derived from effective population size (Ne) using the formula $\Delta F=1/2Ne$ (Falconer and Mackay, 1996). The ratio of effective population size to actual population size (Ne/Na) serves as a measure of the anticipated genetic heterogeneity within a population. The male:female ratio (Nm/Nf) is defined as the quantity of breeding men relative to the quantity of breeding females in a population (Lariviere et al., 2011).

RESULTS AND DISCUSSIONS

The average flock composition among household farmers in the research area, along with the estimated Ne, Ne/Na, and Nm/Nf, is presented in Table 1. The current male to female ratio of 1:3.62 is comparatively smaller than the 1:12 ratio reported for Bayang ducks in the in-situ conservation area of Bayang Village (Rusfidra et al., 2012). The structure and dynamics of a flock facilitate the determination of the age and quantity of animals to be preserved within the breeding population (Okeno et al., 2012). The ratio of mature hens in a flock serves as an indicator for estimating egg and poultry output (Yakubu, 2010). The diminished sex ratio seen on the examined farms suggests a lack of control over the breeding system by the farmers (Zahraddeen et al., 2011).

The Ne/Na and Nm/Nf ratios for Pitalah ducks were 67.79% and 27.61% (1:3.62), respectively. This conclusion was relatively larger than that identified in the investigation on Bayang ducks under in-situ conservation at Bayang Village undertaken by Rusfidra et al. (2012). The Ne/Na and Nm/Nf ratios for Bayang ducks in Bayang Village were 28.36% and 8.31%, respectively. In comparison to the findings of Lariviere et al. (2011), the Ne/Na and Nm/Nf ratios of forty traditional Belgian chickens ranged from 57% to 89% and from 23% to 51%, respectively. In comparison to the findings of Rusfidra et al. (2014) on Kokok Balenggek chicken, the Ne/Na and Nm/Nf ratios were 75.35% and 33.54%, respectively. Meuwissen and Wooliams (1994) proposed that an effective population size (Ne) ranging from 30 to 250 is necessary for natural selection to mitigate inbreeding depression.

The effective population size (Ne) and the inbreeding rate (ΔF) for the indigenous Pitalah duck flock, based on the current flock size and management practices, were determined to be 2.115 individuals and 0.0024 (0.24%), respectively. Ne quantifies genetic variety within a population, with elevated values of Ne signifying greater variability and diminished values indicating reduced genetic variability (Maiwashe et al., 2006; Cervantes et al., 2008). In this study, when the inbreeding rate of Pitalah ducks was 0.24% each generation, it is presumed that 0.24% of heterozygosity is diminished in one generation. Inbreeding signifies the likelihood that two alleles at any locus within an individual are identical by ancestry from a base population (Falconer and Mackay, 1996). The inbreeding rate in the free-range Pitalah duck population was minimal. The minimal value of ΔF signifies that the Pitalah duck population is not endangered by extinction. A balanced breeding program that incorporates superior indigenous Pitalah duck genetics from neighboring villages or different ecotypes within the country may effectively mitigate the prevalence of inbreeding (Lariviere et al., 2011).

CONCLUSIONS

The composition of the Pitalah duck population within the in-situ conservation area consisted of day-old ducks (11,36%), grower ducks (25,33%), and adult ducks (63,31%). The male to female ratio (Nm/Nf) was 27,61% (1:3,62). The effective population size (Ne) was 2.115 individuals. The inbreeding rate of the Pitalah duck population was 0,24%. The minimal inbreeding rate within the indigenous Pitalah

duck population suggests that it is not in risk of extinction.

Acknowledgements
This research was funded by Directorate Reseach and Community Services, Directorate General of Research and Higher Education in program of "Penelitian Unggulan Perguruan Tinggi" and supported from LPPM Andalas University.

Table 1. Number of breeding males (Nm) and females (Nf), male:female ratio (Nm/Nf), actual population size (Na), effective population sizes (Ne), Ne/Na and rates of inbreeding per generation (ΔF) of Pitalah duck at batipauh baruah Villages.

No.	Village (Nagari)	Nm	Nf	Nm/Nf (%)	Na	Ne	Ne/Na (%)	ΔF (%)
1.	Batipuah Baruah Village	675	2,445	27.61	3,120	2,115	67.78	0.24

REFERENCES

(1) Ajayi, O.O., A. Yakubu, O.O. Jayeola, I. G. Imumorin, M.I. Takeet, M.O. Ozoje, C.O.N. Ikeobi and S.O. Peters. (2012). "Multivariate analysis of sexual size dimorphism in domestic turkeys (Meleagris gallopavo) in Nigeria". Trop. Anim. Health and Prod. 44: 1089-1095. (DOI 10.1007/s11250-011-0044-6).
(2) Camacho-Escobar, M.A., L. Ramirez-Cancino, I. Lira-Torres and V. Hernandez-Sanchez. (2008). "Phenotypic characterization of the guajolote (Meleagris gallopavo gallopavo) in Mexico". Anim. Genet. Resour. Inf. 43: 59–66.
(3) Cervantes, I., F. Goyache, A. Molina, M. Valera and J. P. Gutierrez. (2008). "Application of individual increase in inbreeding to estimate realized effective sizes from real pedigrees". J. Anim. Breed. and Genet. 125: 301–310.
(4) Falconer, D.S., and T.F.C. MacKay. (1996). "Introduction to Quantitative Genetic". Longman, London, New York.
(5) Klemetsdal, G. (1998). "The effect of inbreeding on racing performance in Norwegian cold blooded trotters". Gen. Sel. Evol. 30 : 812-821.
(6) Larivière, J.M., J. Detilleux and P. Leroy. (2011). "Estimates of inbreeding rates in forty traditional Belgian chicken breed populations". Arch. Geflugelk. 75 (1): 1-6.
(7) Larivière, J.M., and P. Leroy. (2007). "Status and conservation of native poultry breeds in Belgium". Ann. Anim. Sci. 1: Suppl. 87-91.
(8) Maiwashe, A., K.A. Nephawe, R.R. van der Westhuizen, B.E. Mostert and H.E. Theron. (2006). "Rate of inbreeding and effective population size in four major South African dairy cattle breeds". South African J. of Anim. Sci. 36: 50–57.
(9) Meuwissen, T.H.E., and J.A. Wooliams. (1994). "Effective sizes of livestock population to prevent a decline in fitness". Theoritical and Appl. Genet. 89: 1019-1026.
(10) Okeno, T.O., T.M. Magothe, A.K. Kahi and K.J. Peters. (2012). "Breeding objectives for indigenous chicken: Model development and application to different production systems". Trop. Anim. Health and Prod. DOI 10.1007/s11250-012-0191-4.
(11) Philipsson, J., J.E.O. Rege and A.M. Okeyo. (2006). ILRI-SLU Animal Genetics Training Resource, CD Version 2. ILRI (International Livestock Research Institute, Nairobi, Kenya, and SLU (Swedish University of Agricultural Sciences), Uppsala, Sweden.
(12) Rusfidra, Y.Y. Tumatra, M.H. Abbas, Y. Heryandi and F. Arlina. (2012). "Identification of biacoustics marker of Kokok Balenggek song fowl inside a captive breeding farm in "Agutalok" Solok Regency, Indonesia". J. Peternakan Indonesia. 14 (1) : 303-307.
(13) Rusfidra. (2004). "Characterization of phenotypic traits as early strategy on farm conservation of Kokok Balenggek chicken in West Sumatera Province". Ph.D Disertation (unpublished). Bogor Agricultural University.
(14) Rusfidra, Y.Y. Tumatra, M.H. Abbas, Y. Heryandi and F. Arlina. (2014a). "Characterization of number of crow and qualitative marker of Kokok Balenggek song fowl inside a captive breeding farm in Solok Regency, West Sumatera Province, Indonesia". Int. J. Poult. Sci. 13 (6): 343-346.
(15) Rusfidra, S. Dt. Tan Marajo, Y. Heryandi and B. Oktaveriza. (2014b). "Estimation of inbreeding rate in Kokok balenggek Chicken (KBC) population under ex-situ conservation". Int. J. Poult. Sci. 13 (6): 364-367.
(16) Rusfidra and F. Arlina. (2014c). "A review of "Long Crower Chickens" as poultry genetic resources in Indonesia". Int. J. Poult. Sci. 13 (11): 665-669.
(17) SPSS. (2010). Statistical Package for Social Sciences. SPSS Inc., 444 Michigan Avenue, Chicago, IL60611.
(18) Yakubu, A. (2010). "Indigenous chicken flocks of Nasarawa State, North Central Nigeria: Their characteristics, husbandry and productivity". Trop. and Subtrop. Agroecosyst. 12: 69-76.
(19) Zahraddeen, D., T. Ahemen and P.I. Aliyu. (2011). "On-farm studies on breeding characteristics of turkeys (Meleagris gallopavo) in parts of Jos Plateau Nigeria". Adv. in Appl. Sci. Res. 2: 179-184.