Open Access

Hasanuddin J. Anim. Sci.
Vol. 3, No. 2:61-69 November 2021
pISSN 2621-9182 eISSN 2621-9190
Doi: 10.20956/hajasv362.18094

Performance of Eggs White-Nest Swiftlet (*Collocalia fuciphaga*) on Artificial and Natural Hatching

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Abstract

White-nest swiftlet (*Collocalia fuciphaga*) has a high export economic value. The nest is produced from the saliva of the swiftlet. Presently, its method of producing swiftlet chick is through the natural breeding process. Until now, white-nest swiftlet has not been cultivated so that the method of procuring Swiftlet chicks is still using the parent. Therefore, to see the prospects for the cultivation of this bird, another way is needed to procure swiftlets by incubating the eggs using an incubator and looking at the physical characteristics of the eggs. This study aims to examine the performance of white-nest-swiftlet eggs in natural and artificial hatching in producing swiftlet chicks. The method was used the descriptive analysis method and t-test. The physical characteristics obtained were an average egg weight of 1.94±0.13 g, egg diameter 13.28±0.56 mm, egg length 21.01±0.78 mm, shell thickness 0.14±0.02 mm. Artificial hatching results obtained were 83%, hatchability 44%, and hatching weight 1.37±0.13 g. Age of embryonic death obtained early: 38.5%, middle: 9.8%, late: 21%. Natural hatching resulted in 100% fertility, 100% hatchability, hatching weight 1.42±0.11 g., and 0% mortality. Artificial hatching is an alternative for developing white nest-swiftlet.

K**eywords** : Natural, artificial, fertility, hatchability, mortality

INTRODUCTION

Indonesia is the world's largest producer of Edible Bird Nest (EBN), with production reaching 79.55 percent of world production (Nasution *et. al*., 2020). Nests made from swiftlet's saliva are believed to contain health benefits. Currently, EBN is widely using as healthy food due to its high nutritional values and therapeutic benefits. The market value of EBN ranges from $1 000 to $10 000 per kilogram depending on its grade, type, and origin (Looi and Omar, 2016).

The swiftlet business is currently being cultivated by many ranchers, but it is still limited to preparing a house where swiftlet breeds (Mursidah *et al.*, 2020), without any breeding or feeding process. Swiftlet farming is conducted in man-made buildings (birdhouses) that imitate a cave-like environment to provide alternative nesting sites and attract the swiftlet birds. The ranchers do not control the birds' movement, breeding, or even their diets. (Chua and Zukefl, 2016).

Swiftlet nests are used by swiftlet mothers to lay their eggs, incubate the eggs until they hatch, and a place to care for their young until they can fly on their own. The swiftlet's nest will be harvested by the community for sale (Suarni *et al.*, 2019) to use as medicine or luxury ingredient in foods (Ito *et al*., 2021). In the harvesting process, three methods can be used; firstly, the nest is harvested when the eggs have not been laid. The second method is harvested when the eggs are already there or when the eggs are incubated by the mother and the third method is harvested when the swiftlet chicks are big and can fly on their own.

Nests harvested when the eggs have not yet come out are of good quality and clean, but usually the size of the nest is small, so production is also low. If the harvest is carried out when the eggs have hatched or the swiftlet chicks have flown, a dirty nest will be obtained because it is polluted by the rest of the eggshell and the swiftlet's droppings and the price of this nest is cheaper. The nest of hatching quality looks dirty because it is contaminated with eggshell residue and feces of swiftlet chicks (Busono, 2004).

To get maximum production and good nest quality, nests are harvested when the eggs have been laid are often called discarded egg harvests (Rajardjo and Sinurat, 1998). However, if the harvesting of eggs is continuously carried out in an uncontrolled manner, ie without allowing the swiftlet to produce offspring, the population will decrease because there is no regeneration. Careless harvesting techniques have diminished the swiftlet population and the production of swiftlet nests, threatening its sustainability (Connolly, 2016). One effort to solve this problem is by developing swiftlet farming (Mursidah *et. al*., 2020).

Therefore we need a method that can maintain and even increase the population while still able to get good quality nests using artificial hatching. In addition, incubating swiftlet eggs carried out by the incubator will make the swiftlet will immediately produce nests again.

In swiftlet farming, three things must be considered, namely increasing the swiftlet population, increasing nest production, and improving nest quality. Through artificial incubation hatching, the swiftlet will continue to produce neat rather than incubatory the eggs To get them can be done by artificial hatching method. The hatching of swiftlet eggs should not be carried out by the swiftlet mother so that the swiftlet mother strives to continue to produce nests (Saepudin, 2007). The increase in population by artificially incubating eggs will encourage birds to make nests again, thus it is expected that the number of nest harvests in each year will increase. This study aims to assess the success rate of the artificial hatching method for producing swiftlet chicks.

MATERIALS AND METHODS

Experimental Condition

This research was carried out at the Swiftlet's House at a temperature of 26-28ºC, humidity 85%. The eggs used were harvested at the same time. Eggs selected according to the following criteria: normal shape, selected, clean shell condition, not cracked. A total of 300 eggs were used for the artificial incubation. While the natural hatchery takes data from 5 nests filled with two eggs each in the swiftlet house.

Automatic turning eggs according to user settings, moving eggs are like a parent turning the eggs by being shifted automatically. Temperature and humidity were detected through a digital display mounted on the outer wall of the machine.

Placement of eggs is done in a horizontal position as the eggs were naturally in the swiftlet nest. The hatching temperature used imitates the temperature of the swiftlet parent, which is 35-36°C, and humidity set at 70%. The weather has no effect on the temperature of the eggs at the time of incubation of the mother. The temperature in the room is very influential when the eggs are being left by the mother for a relatively long period (Erham, 2009). Candling is done on days 4-7 to find out how many fertile eggs. Meanwhile, to determine the mortality rate on the 25th day, eggs that did not hatch were cruck individually to determine the mortality rate in the early, middle, and late stages of embryonic death. Eggs that do not hatch at the end of the incubation period are broken down for macroscopic examination to determine early embryonic death (between days 0-7 of incubation), intermediate embryonic death (between days 8-14 of incubation), or late embryonic death (between days 15-17 of the incubation period) at incubation period and at the time of piping) (Taha, 2011).

Research Methods

The variables observed in this study were egg length, egg width, egg weight, shell thickness, as initial data to determine the performance of eggs to be hatched. At the hatching stage, observations were made of the fertility rate, hatchability, hatching weight, and age at the death of the embryo. Fertility was calculated based on the number of fertilized eggs divided by the number of eggs hatched, while hatchability was the number of eggs hatched compared to the number of fertile eggs and was expressed as in percent.

$$\text{Rate of Early embryo mortality (\%)} = \frac{\text{Number of early embryonic mortalities}}{\text{Total number of fertile eggs}} \times 100\%$$

$$\text{Rate of middle embryo mortality (\%)} = \frac{\text{Number of mid-embryonic mortalities}}{\text{Total number of fertile eggs}} \times 100\ \%$$

$$\text{Rate of Late embryo mortality (\%)} = \frac{\text{Number of late embryonic mortalities}}{\text{Total number of fertile eggs}} \times 100\ \%$$

Embryo temperature is considered to be an important factor influencing embryonic development, hatchability, and performance after hatching (Lourens *et. al*., 2005). Embryos are very sensitive to lower or higher hatching temperatures, lower hatching temperatures will slow it down, and the higher the incubation temperature will accelerate the growth and development of the embryo (Elsayed, 2009). The data was discussed descriptively and a t-test was performed.

RESULTS AND DISCUSSION

Quality of Swiftlet Eggs (*C. fuciphaga*)

The results of observations of the quality of swiftlet eggs obtained varied (Table 1). A total of 10 eggs were measured and weighed, the average egg weight was 1.94±0.13, with a range of 1.72-2.12 g. when compared to the weight of quail eggs, the weight of swiftlet eggs is 5-6 times the weight of quail eggs. The results showed that the average egg weight was 11.18±0.79 g/egg (Rania, 2017). Physically, the color of the swiftlet eggs is pure white (Figure 1). Several characteristics, including egg weight, eggshell thickness, eggshell pore characteristics, egg shape index, and egg content consistency are very important for embryonic development and satisfactory hatching achievement (Alasahan and Copur, 2016).

Figure 1. White-Nest Swiftlet's egg (A), mother of a white-nest swiftlet swallow incubating her eggs (B), and artificial hatchery (C) (Source: Amin documentation, 2021)

The average weight of swiftlet eggs is 1.92 g ranging from 1.68-2.19 g (Susanti, 2002). There is a slight difference that occurs because variations in egg age and egg origin. The diversity of egg weights according to Oktalina (1998) can occur due to the different ages of the eggs, a long period will cause a lot of evaporation which causes the swiftlet eggs to have a low weight, white swiftlet eggs have a lower weight, while the white swiftlet eggs have a lower weight. Reddish white or pink has a high weight. Egg weight used in hatching is an important aspect that must be considered egg weight has a positive correlation with hatching weight which can be used as an indicator of hatching weight (Okatama *et. al*., 2018).

Egg width from the results of this study was obtained 13.28±0.56 with a range of 12.2-14.1 mm. While the average egg length is 21.01±0.78 mm, with a range of 20.2–22.7. This is by the results of research conducted by Oktalina (1998) which showed that the width of the eggs ranged from 12.20 to 14.50 mm.

Tabel 1. Quality of swiflethatching egg (*Collocalia fuciphaga*)

Parameter	Range	Average
Egg Weight (g)	1.72–2.12	1.94±0.13
Egg Width(mm)	12.20–14.1	13.28±0.56
Egg Length (mm)	20.2–22.7	21.01±0.78
Shell Thickness (mm)	0.11–0.17	0.13±0.02

The eggshell protects the embryo inside the egg, so its thickness affects the embryo (Maurer *et al.,* 2015). If it is too thin, the egg will break easily, while if it is too thick, it will be difficult for the swiftlet chicks to do the pipping, resulting in the death of the embryo in the egg. The average thickness of the shell from the results of this study was 0.13±0.02, with a range of 0.11 – 0.17 mm.

Swiftlet Egg Hatching *(C. Fuciphaga*)

To determine the hatching quality of eggs, it is measured by the percentage of fertility, hatchability (Iqbal *et al.,* 2014), hatching weight, and mortality. Fertility is measured by how many eggs are fertilized, which usually can be determined by observing the eggs on the third day of hatching (Adeqbenjo *et al.,* 2012). If blood spots and blood vessel tissue are found, the egg contains an embryo (Richard, *et al.,* 2018).

From the results of hatching, swiftlet eggs obtained a fertility rate of 83%. While the fertility rate obtained by Saepudin (2007), amounted to 78.83%. The high fertility rate was obtained because, in addition to the egg-laying period, the number of eggs was only a pair, the frequency of mating in swiftlets was also quite high. The frequency of mating behavior increases until the nest-building process is complete (29 times/day), during the nest-building phase, the frequency of swiftlet's mating behaviour has an average of 11.62 times/day (Mardiastuti, 1998). Fertility is also affected by the age of the birds. The fertility in the first year is usually lower, reaches its peak in the second or third year, and declines gradually (Bogenfurst, 2017). The fertility of the eggs is affected by genetics, female, age, sex ratio, yolk size, number of production cycles, temperature, light, sexual behavior, nutrition, housing system, and health of the birds (King'ori, 2011; Salamon, 2016).

Hatchability is the percentage of eggs that hatch divided by the number of fertile eggs. Hatchability is the percentage of fertile eggs that hatch (King'ori, 2011; Taplah *et. al.*, 2018). The hatchability of swiftlet eggs in the artificials in this study was 44%, compared to natural hatching of 100%. Busono's research (2004) found that the hatchability of swiftlet eggs in the original nest was 100%, the artificial nest was 85%, and the incubator was 90%. The results obtained by Busono were very high in artificial hatching, but when viewed from the number of eggs hatched only 20 eggs. This low hatchability may be caused by various factors, mainly because the eggs fail to hatch due to the large number of eggs produced by young parents. This uncontrolled broodstock also did not lay eggs at the same time and was taken randomly. Factors that affect hatchability include strain, broodstock age, ration nutrients, eggs (weight, quality, storage), and hatching machine temperature (King'ori, 2011).

Tabel 2. Performance *C. fuciphaga* white nest swiftlet on artificial and natural hatching

Parameter	Artificial	Natural
Fertility Rate (%)	83.0	100
Hatchability Rate (%)	44.0	100
Hatch Weight (g)	1.37±0.12	1.42±0.11
Embryo Mortality Rate		
Early (%)	38.5	0
Middle (%)	9.8	0
Late (%)	21.0	0

Newly hatched swiftlets are reddish with a very weak condition but already can grip and sound loud enough. The weight of the newly hatched swiftlet chicks in this study was 1.37±0.13 (g), with a range between 1.21–1.6 g. The results of weighing the swiftlets are almost the same as those of Saepudin (2007), ranging from 1.25-1.66 g. The results of the observation of the average hatching weight and the t-test analysis in table 3. showed that there was no significant difference between the natural and artificial hatching weight observations.

Tabel 3. The results of hatching weight average

Parameter	Average (g)		T.count
	Natural	Artificial	
Hatching weight	1.42	1.37	0.942 ^{ns}

ns:non significant

Natural hatching weight yielded the highest yield of 1.42 g, and the lowest was artificial hatching weight of 1.37 g. Early mortality is the death of the embryo at the beginning of hatching, which is the day the egg is put into the incubator until the 10th day. At this stage the embryo mortality is quite high, 38.5% because the early hatching period is critical embryonic organs are developing. In addition, taking eggs from the mother's nest for hatching takes time in transit. Meanwhile, the middle mortality was 9.8%, and the late mortality was 21%. Most causes and problems associated with poor hatchability are early embryonic death, egg rots, broken yolk, dead in shell chicks, prolonged pre-incubation storage, poor breeder nutrition, breeder age, incubator, and hatchery malfunctions (Malecki *et. al.*, 2005).

The hatching period experiences a critical period at the beginning of the incubation period when the circulatory system develops, while at the end of the incubation period there is a physiological change from the allantoic respiratory system to air bubbles (North and Bell, 1990). Many failures in hatching occur in the critical period, namely the first three days after the eggs were incubated and the last three days before hatching. There are two critical periods during the incubation process in poultry, with the peak of death occurring in early embryonic life, and shortly before hatching (Bogenfurst, 2004).

CONCLUSION

The performance of swiftlet eggs natural hatching was higher (100%) than artificial, with a fertility rate of 83%, hatchability of 44%, and mortality rates obtained early: 38.5%, middle: 9.8%, late: 21%.

REFERENCES

Adeqbenjo, A. O., L. Liu, and M.O. Ngadi. 2020. Non-Descructive assessment of chichen egg fertility. Sensors, 20(19): 5546. doi: 10.3390/s20195546.

Alasahan, S., and A. G. Copur. 2016. Hatching characteristics and growth performance of eggs with different egg shapes. Rev. Bras. Cienc. Avic. 18(1): 1-8.

Bogenfurst, F. 2004. The Hatching Handbook. Gadza Kiado Publ., Budapest, Hungary. pp:278.

Bogenfurst, F. 2017. Handbook of Goose Breeders. Forum Publisher, Udine, Italy.

Busono, W. 2004. Evaluasi Beberapa Metode Penetasan untuk Pengembangbiakan Walet. Makalah Seminar Nasional Teknologi Peternakan dan Veteriner. Fakultas Peternakan, Universitas Brawijaya Malang. Malang.

Chua, L. S., and S.N. Zukefl. 2016. A comprehensive review on edible bird nests and swiftlet farming. J. Integr. Med. 14(6): 415–428.

Connolly, C. 2016. A landscape political ecology of 'swiftlet farming' in Malaysian cities. Thesis. Faculty of Humanities, University of Manchester. UK.

Elsayed, N.A.M., E.E. Allan, S. E. Amina,and E. Y.Hassan. 2009. New Suggested Schemes for Incubation Temperature and Their Effect on Embryonic Development and hatching Power. Asian J. Poult. Sci. 3(1): 19-29.

Erham. 2009. Perilaku Selama Periode Perkembangbiakan pada Burung Walet (*Collocalia fuciphaga*) Rumahan di Kecamatan Sidayu Kabupaten Gresik. (Tesis) Bogor: Sekolah Pascasarjana, Institut Pertanian Bogor.

Iqbal, J., S.H. Khan, N. Mukhtar, T. Ahmed, and R. A. Pasha. 2014. Effect of egg size (weight) and age on hatching performance and chick quality of broiler breeder. Journal of Applied Animal Research : 1-11. http://dx.doi.org/10.1080/09712119.2014.987294

Ito, Y., K. Matsumoto, A. Usup, and Y. Yamamoto. 2021. A sustainable way of agricultural livelihood: edible bird's nest in Indonesia. Ecosystem Health and Sustainability, 7(1): 1-11. https://doi.org/10.1080/20964129.2021.1960200

King'ori, A. M. 2011. Review of the factors that influence egg fertility and hatchability in poultry. J. Poult. Sci. 10(6): 483-492.

Looi, Q. H., and A. R. Omar. 2016. Swiftlets and edible bird's nest industry in Asia. Pertanika J. Scholarly Res. Rev. 2(1): 32–48.

Lourens, A., H. Van den Brand, R. Meijerhof, and B. Kemp. 2005. Effect of eggshell temperature during incubation on embryo development, hatchability, and posthatch development. Poult. Sci. 84:914-920.

Malecki, I. A., J. O. Harbanczuk, C. E. Reed and G. B. Martin. 2005. The ostrich (*Struthio camelus)* blastoderm and embryo development following storage at various temperatures. Br. Poult. Sci. 46: 642-660.

Mardiastuti, A. 1998. Teknik Pengusahaan Walet Rumah, Pemanenan Sarang dan Penanganan Pasca Panen, Kertas Kerja Riset Unggulan Terpadu IV Bidang Teknologi Perlindungan Lingkungan. Jakarta: Kantor Menteri Negara Riset dan Teknologi Dewan Riset Nasional.

Maurer, G., J. S. Portugal, M.E. Hauber, I. Miksik, D.G.D. Russell, P. Cassey. 2015. First light for avian embryos: eggsshell thickness and pigmentation mediate variation in development and UV exposure in wild bird eggs. Functionsl Ecology, 29: 209-218. doi: 10.1111/1365-2435.12314.

Mursidah, Lahjie, M. Abubakar, Masjaya,Rayadin,Yaya, Ruslim, and Yosep. 2020. The Ecology, Productivity and Economic of Switflet (*Aerodramus fuchiphagus*) Farming in kota Bangun, East Kalimantan, Indonesia. http://repository.unmul.ac.id/handle/123456789/6140.

Nasution, D.D., dan Nidia Z. 2020. Kuartal I 2020. Ekspor Sarang Burung Walet Tembus Rp 1,5 T" https://www.republika.co.id/berita/q96j89383/kuartal-i-2020-ekspor-sarang-burung-walet-tembus-rp-15-t. 15 Sep. 21.

North, N.O., and D. D. Bell. 1990. Commercial Chicken Production Manual. Fourth Edition. Newyork University of California Poultry Specialist.

Okatama, M. S., S. Maylinda, dan V. M. A. Nurgiartiningsih. 2018. Hubungan bobot telur dan indeks telur dengan bobot tetas itik dabung di kabupaten Bangkalan. Jurnal Ternak Tropika, 19(1): 1-8.

Oktalina,S. 1998. Penetasan Telur dan Pengaruh Pemberian beberapa tipe pakan terhadap pertumbuhan dan daya hidup Anak Walet. Fakultas Pertanian. IPB. Bogor.

Rahardjo, Y.C., and A.P. Sinurat, 1998. A study on the edible-nest swiftlet management and production in North Sumatera. Bulletin of Animal Science, suplement edition: 408-414.

Rania, A., El Samahy., Gh.A.El-Sayiad, D.E. Abou-Kassem, and E.A.Ashour. 2017. Pre-hatch performance of Japanese quail egg weight categories incubated after several storage Periods. Zgazig J. Agric.Res. 44 (2). 563-570.

Richard, S., A. Brun, A. Tedesco, B. Ballois, N. Taqhi, P, Dantan, J. Sequin, and V. Fleury. 2018. Direct imaging of capillaries reveals the mechanisme of arteiovenous interlacing in the chick chorioallantoic membrane. Communication Biology, 1(235): 1-11. DOI: 10.1038/s42003-018-0229-x

Saepudin, R. 2007. The study of swiftlet (*Collocalia fuciphaga*) egg hatchery. JSPI. 2(2): 72-78.

Salamaon, A.,and J.P. Kent. 2016. Yolk size and ovulation order determine fertility double-yolked duck (Anas Platyrhynchos domesticus) eggs. Reprod.Fertil. Dev., 28: 440-445.

Suarni, A., Asriati, S. Masnan, Fitriani. 2019. Factors motivating the local community of Belawa Wajo Regency, South Sulawesi Province to engage in edible bird's nest industry in the perpesctive of islamic business ethics. Muhammadiyah International Journal of Economic and Business, 2(2): 183-194.

Susanti, A.D. 2002. Korelasi antara Bobot telur dengan bobot tetas pada walet. Fakultas Peternakan, Universitas Brawijaya.

Taha, A. E. 2011. Analyzing of quail eggs hatchability, quality, embryonic mortality, and malpositions to their shell colors. Online J. Anim. Feed Res. 1(6):267-273.

Taplah Jr, A. J., D. C. Suministrado, R. M.C. Amango, F. O. Paras Jr, J. C. Elauria, and D. P. Torkpah. 2018. Economic analysis of duck eggs incubation using hot spring as heat source. J. Dev. Agric. Ecom. 10(2): 38-44.