

Study on Artificial Incubation and Rearing of Sparrows in China

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Abstract: This experiment was designed to study on wild sparrows artificial incubation and feeding in order to search effect methods on biological pests preventing, aimed at minimizing use of pesticides and reaching to harmonious development between ecological environment and economy. Moreover, it plays a positive role on local eco-environment protection and income gaining of fruits farmers. Total 162 sparrow eggs were collected to study the influence of the temperature and humidity on hatchability of the fertilized eggs from the sparrows. The sparrow eggs were sorted to three groups randomly, each group was 54 eggs. Then 60 chick sparrows aged 1 day old were selected from artificial incubation nestles as samples to study the effect of different feeds on body weight and length. The sparrows were assigned to two groups randomly, experimental and control groups, the test group fed with Tenebrous, the control group fed with feed. The results show: the hatchability of the sparrows' fertilized eggs is relatively high when the temperature was 38.0, 37.6 and 37.2°C and the incubator humidity was 62, 55 and 67% at the early stage, the medium-term and the latter of incubation, respectively. The results of artificial feeding experiment show that compared with the control group, the average daily gain of sparrows in experimental group is higher significantly by 8.65% ($p < 0.05$), the feed/weight ratio lower by 34.07% dramatically ($p < 0.01$), there were no differences ($p > 0.05$) on the body length. There is no report on artificial incubation and feeding of sparrows.

Key words: Sparrow, artificial, incubation, artificial feeding, biological method, pest

INTRODUCTION

Sparrow is a kind of omnivorous bird distributing worldwide with close relationship with human been and it distributes extensively in China. In the past, due to wrong awareness, it was recognized as a kind of pests and selected as killing subject as a result, there is few data and documents on its biology aspect. Sparrow mainly live in the plant and the grass seed in shell. The groups raising test show that sparrow addicted to crop. The plant accounts for over 53% of the total feeds of the year (Luo *et al.*, 1990). However, during the reproduction period, insect is its mainly food, accounts for 85-95% of the total food. Moreover, reproduction period of sparrow is according with the dynamic period of the insect pest in the pastoral area. So concerning this advantage, it is supposed to be a reasonable solution to prevent pest by making best use of sparrow in this way, both crop and fruit forest can be protected, both agriculture and forestry are benefit from it and it also play a crucial role in the ecological balance. In recent year, because of impacts from agricultural, industrial pollution, ill and other environmental factors, population of sparrow in the world decline extremely (Fu *et al.*, 2005).

There are intensive and study on biology and ecology of the sparrow in the international sphere (Caro *et al.*, 2010; Wada and Breuner, 2008; Freeman-Gallant *et al.*, 2006; Chang and Karasov, 2004; Ruan, 1989). The unique role and function of the sparrow in the ecosystem are highlighted (Ruan, 1989). However, there is little report on the artificial incubation and rearing of sparrow. This study was designed to conditions fitting to artificial incubation of sparrow and the methodology in artificial rearing of nestling, aimed at receiving the best methodology on artificial reproduction of sparrow. In general, it is the significance of the research, increasing population of sparrow, decreasing use of pesticides, taking Biological Control and protecting ecosystem balance.

MATERIALS AND METHODS

Incubation equipment and appliances: Two incubator for automatic flat, temperature difference 0.02°C egg Candler, 1 Disinfection cabinet, 1 calipers, 1 TD2002B E said, ZDR-20 intelligent temperature and humidity recorder.

Table 1: Goups sorting and processing design

Groups	No. of eggs hatching	Temperature (°C)			Relative humidity (%)		
		Former	Medium	Later	Former	Medium	Later
I	54	37.6	37.4	37.3	60	55	65
II	54	37.8	37.6	37.4	62	55	67
II	54	38.0	37.6	37.2	62	55	67

Former phase (0~4 day), medium (5~8 day), later (9~11-12 day)

The resource of eggs and grouping: About 160 eggs were collected by stimulate spawning, egg weigh 1.85~2.58 g. Samples were sorted into 3 groups, each group 54 eggs incubating under different temperature and humidity.

Sparrow groups: Select 60 similar weights 1 day old Sparrow nestling from the artificial incubation and randomly divided into two groups, control group and experimental group. All the Sparrow chicks have been numbered, weighed and body length measured. Control group was fed artificial feed; test group was fed with tenebrous (Table 1).

Artificial incubation experiment

Disinfection of hatching eggs: In this study used following disinfection methods: first time disinfection, before deposit fumigated with formalin (at 1 m³ volume with 30 mL formalin, 15 g potassium permanganate fumigation 20-30 min). Second round disinfection when hatching use with 0.1% Baidusha disinfectant and soaked in 2 min for disinfection and wash the egg surface dirt after wash and drain hatching.

Hatching eggs selection and conservation: Egg size and egg shape index determined before incubation and one by one labeling. Eggs produced within 1 week, storage temperature should not exceed 20°C, relative humidity should be controlled at about 75%.

Determination of incubation conditions: Take the wild birds hatching conditions as reference, set the temperature and humidity conditions of artificial incubation. The rest of incubation practice refer to special poultry incubation hatching practice. After disinfection, hatch eggs put into the hatch machine for the hatching.

Artificial feeding test of sparrow nestling: As to artificial feeding test of sparrow nestling, the composition and nutrient levels of basal diets (DM basis, %) are shown in Table 2. Nutrient composition and content of larvae of tenebrio are shown in Table 3.

Raising and management: Electric hot plate was put in the foam board box, adjust temperature to 35°C, the small basket with the sparrow was placed on the electric board

Table 2: Composition and nutrient levels of basal diets (DM basis, %)

Component of feedstuff	Percentage
Raw materials	
Yolk	22.00
Corn flour	19.85
Soybean meal	20.00
Wheat	10.00
Fish meal	20.00
Yeast	5.00
Milk powder	3.00
Vitamins	0.05
Minerals	0.10
Nutrient levels	
Metabolic energy (MJ kg ⁻¹)	12.18
Cp (%)	42.00
Lysine	1.26
Methionine+Cystine	0.69
Ca	1.12
AP	0.60

Table 3: Nutrient composition and content of larvae of tenebrio

Nutrients	Percentage
Crude protein	42.86
Lysine	3.12
Methionine+Cystine	1.31
Calcium	2.57
Phosphor	0.60
Metabolic energy (MJ kg ⁻¹)	12.56

put grass and wool into a useful nest in the basket, the small sparrow was placed in the nest and keep warm. From 8:00 am to 8:00 pm, feed a once every 2 h *ad libitum* and drinking, clean sparrow droppings when feeding. While fed control group, the artificial feed and water was mixed into a paste at a 1:1 ratio and then knead into strip shape by hand and then fed as small pieces, recording the amount of each feeding; test group was fed alive tenebrio and recorded each feeding amount.

Indicators (index) recorded: In artificial Incubation test, eggs size, length, short track before hatching was measured then labeled, fertilization rate, hatchability of fertilized eggs, number of squab, birth weight of nestling should be recorded.

In artificial feeding of sparrow nestling, before the trial began, body weight and body length of per sparrow was measured chicks every 2 days and calculate the average daily gain and growth of the body length.

Statistical analysis: Experimental data are express as mean±standard deviation using the statistic software SPSS13.0 for data analysis among these, statistical

analysis on the data of artificial incubation was used the single factor analysis of variance, multiple comparison with Duncan method; statistical test data from artificial breeding was analyzed using independent sample t-test.

RESULTS AND DISCUSSION

The general traits of sparrow eggs: According to records (Hongwei *et al.*, 2007) egg type index of sparrow eggs in Harbin area is generally in 1.35 around. In this study, egg type index is about 1.40, this may be because sparrow eggs in different regions exist certain differences in general character (Table 4).

The influence of different temperature and humidity on hatchability: The Table 5 shows, fertilization rate of the incubation egg in test group III was low 2.13 and 4.16% that of test group I and test group II, respectively. However, hatching rate of the fertilized egg in test group III was high 32.45 and 17.82% that of test group I and test group II, they were very significant difference ($p < 0.01$).

The influence of different forage on sparrow growth performance: The Table 6 shows, during the remaining in the nest, average daily gain of test group was high 8.65% that of control group and they were significant difference ($p < 0.05$); average daily feed consumption of test group was low 28.16% that of control group and they were significant difference ($p < 0.05$), feed-weight ratio of test group was low 34.07% than that of control group and they were very significant difference ($p < 0.01$).

Change regulations of sparrow weight during the remaining in the nest: Figure 1 shows change regulations of sparrow weight during the remaining in the nest. Range

from 1-5 day age, weight growth speed between test group and control group was almost equal after 5 day age, weight difference was beginning enlargement from the effect of increase weight during from 1-5 days old, sparrow weight growth speed was highest on 11 day age, the weight attained most high peak that of test group was 19 g that of control group was 18 g then sparrow nestling weight was beginning decline, on 15 day age, weight was low 1-2 g than highest.

The influence of different feed on body length of sparrow nestling: As shown in Table 7, 15 day age, sparrow nestling body length growth of test group was 90.13 mm, average daily growth was 6.01 mm, body length growth of control group was 90.96 mm, average daily growth was 6.06 mm but the effect of body length growth between test group and control group was insignificant ($p < 0.05$).

The effect of temperature on Hatchability of sparrow: The most important factor affecting embryo metabolic rate is the temperature, high temperature can enhance growth of embryo while lower temperature can decrease the embryo metabolic rate. There is a fittest temperature range for egg to hatch, adapting to embryo development. It is the fittest hatching temperature when embryo metabolism reaches

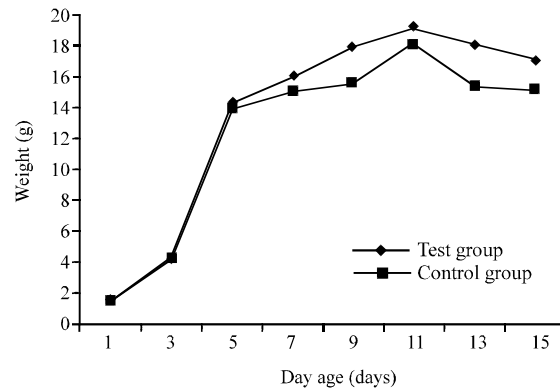


Fig. 1: The curve with sparrow growth

Table 4: The general traits of sparrow eggs

Item	Weight (g ⁻¹)	Diameter (cm ⁻¹)	Short track (cm ⁻¹)	Egg type index
Mean	2.22	2.00	1.44	1.39
Range	1.85~2.58	1.82~2.19	1.29~1.59	1.38~1.41

Table 5: The effect of temperature and relative humidity on hatchability

Group	The number of incubation egg	Fertilization rate (%)	Hatching rate of fertilized egg (%)	The number of healthy nesting	Average birth weight (g)
Test group I	54	87.04±3.25	57.45±5.41 ^{Bc}	27	1.47±0.19
Test group II	54	88.89±4.76	64.58±3.22 ^{Bb}	31	1.49±0.11
Test group III	54	85.19±2.97	76.09±3.97 ^{Aa}	35	1.53±0.26

Within the same line, data with a same letter showed insignificant ($p > 0.05$), data with a different small letter showed significant difference ($p < 0.05$), data with a different capital letter showed very significant difference ($p < 0.01$)

Table 6: The effect of different feed on growth performance of sparrow nestling

Groups	Birth weight	Final weight	Average daily gain	Average daily feed consumption	Feed-weight ratio
Test group	1.58±0.13 ^a	18.52±0.51 ^a	1.13±0.25 ^a	2.04±0.15 ^a	1.80±0.22 ^A
Control group	1.59±0.17 ^a	17.19±0.41 ^b	1.04±0.37 ^a	2.84±0.32 ^b	2.73±0.42 ^B

Within the same line, data with a same letter showed insignificant ($p > 0.05$), data with a different letter showed significant difference ($p < 0.05$), data with a different capital letter showed very significant difference ($p < 0.01$)

Table 7: The effect of different feed on body length of sparrow nestling

Groups	Birth body length	15 day age body length	Body length growth
Test group	31.25±0.15 ^a	121.38±1.54 ^a	90.13±1.20 ^a
Control group	33.15±0.09 ^a	124.11±3.66 ^a	90.96±3.24 ^a

Within the same line, data with a same letter showed insignificant ($p>0.05$), data with a different letter showed significant difference ($p<0.05$).

balance. Different hatching stage has its fittest temperature. When in early stage, embryo is in the forming period, need stable and high temperature for fast development with embryonic age increasing, Metabolism increase and the embryo produce more energy accordingly as a result, hatching temperature should be (Cui *et al.*, 2006). The results of this experiment show high hatchability of sparrow egg can be reached when early, medium and later period of hatching is 38.0, 37.6, 37.2°C, respectively.

The effect of humidity on hatchability: Humidity is the second important factor affecting embryo development. Suitable incubation humidity can make the water evaporation to maintain a certain speed and to ensure the normal development of embryos and get moderate birth weight at. Loss of moisture inside the eggs has 2 reasons: for one the formation of sufficient gas chamber for breathing at the late embryonic stage and pecking shell before 1 day of hatching; secondly, keep the body water content of newly hatched chicks the same as newly producing eggs. If too much water loss, dehydration of embryo will be caused and vice versa embryo will be drown by the water produced during metabolic period (Yang *et al.*, 2007).

In whole hatching period, principles of humidity is high in the beginning and end, low in the middle, the higher humidity in early stage make the eggs heated even since of less weight loss in the middle stage, embryo itself need to lower the humidity to rule out metabolic products; in order to help egg to distribute the heat and make egg shells loose in Late period, need to increase the humidity. During this hatching period, when humidity is 62, 55 and 67% in early, medium and later stage, respectively get highest hatchability.

Different feeds on the growth performance of the sparrow nestlings: Sparrows are omnivorous bird species, weighing up to 5 g of sparrow chicks are able to take food grain as staple (Guo-Zhen, 1964). But in terms of food around the nestlings, insect-eating is mainly food of chicks, accounts for 85-95% of total food intake (Ruan, 1989). In this experiment, bionic principle was used,

sparrow chicks of the test group fed with tenebrous in order to study feed on growth performance of the sparrow, the control group was designed, fed with concentrate feed. The results show: as for 15 days mean weight, the test group is significantly higher than the control group ($p<0.05$) as to mean daily gain, the test group higher 8.65% than that of control group ($p<0.05$): as to rate (feed vs weight gain), the test group lower 34.07% that of control group, the difference was significant ($p<0.01$). This study shows that brood of sparrows fed Tenebrous grew faster than fed artificial diet, the sparrow in nest stay has a higher the absorption and utilization rate of animal products feed. This conclusion is consistent with Ling (2003), sparrow chicks in nature mainly lived on insects.

Weight changes of sparrow in nest period: Qingxia *et al.* (2003)'s studies show body weight of nature sparrow chicks after birth 1-10 days body weight is in the rapid growth, body weight reached maximum at 10 days and then gradually decreased, body weight stabilized at 14 days old. The weight change of sparrow chicks fed with artificial feed is according with that of the natural sparrows. However, body weight of artificial feed is lower than that of nature except from the 3-5th day. The reasons are as followings, firstly in nature, sparrow nestlings mainly lived in insects, insect-eating capacity accounts for 87.37% of their food intake and natural sparrow nestlings of many edible insects more are Larvae of Lepidoptera, Homoptera class, Coleoptera class (Ling, 2003). These larvae nutrient-rich and relatively soft, easily digested. This test mimics the natural environment food categories; sparrow chicks mainly were fed with Coleoptera Tenebrio class but relatively simple. Secondly, in this experiment, the control group is artificial feeding and weigh and measuring body length in every 2 days, artificial stress is strong. For three, studies have found that the sparrows living in nature at brood period, average rate of return to the nest nursery can amount to 51.5 times (Hongwei *et al.*, 2007) the consumption of the chick in the nest was about 39 g of dry weight material, per gram dry weight can produce about 640 calories (Smith, 1998). In this study, the experimental group were regularly feeding, *ad libitum*. In whole experiment period, DM intake of experiment group is 30.6 g, the control group is 42.6 g difference on feed intake and digestibility between artificial and natural status affected the weight sparrow chicks. So concerning this, in the future should try to imitate the temperature, variety of feed and feed intake of natural environment, reduced the impact from food type and quantity on the sparrow weight.

Body length and body size gain at birth of sparrow chick:

As shown from the results, there is no significant difference on body length between birth and 15 days so during the sparrow growth process, body length is mainly affected by genetic factors, little by feed types.

CONCLUSION

In this experiment at former, medium and later stage, temperature is 38.0, 37.6 and 37.2°C, respectively humidity is 62, 55, 67%, respectively the hatchability of fertilized eggs of sparrow can be reached, experimental studies on the best artificial incubation conditions of sparrow need to be further. Under this experiment condition in the artificial feeding process of sparrow, weight gain from sparrow fed with tenebrous is higher than that of feed while feed has little effect on body length of sparrow. In conclusion, in brood time, tenebrous has better effect than other feeds. Further studies on artificial rearing of sparrow nestling need to be conducted.

ACKNOWLEDGEMENTS

This research is supported by the Project of Xinjiang Forestry Bureau Artificial Attract of Insectivorous Birds and Breeding Technology-Study on Artificial Assistance Breeding and Breeding Technology.

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