

An Improved Technique of the Artificial Insemination in Ducks

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(Tables 1-3; Pls. 1-2)

INTRODUCTION

Duck-raising is an important industry in South-Eastern Asia. A great majority of inhabitants in this region are good duck-raisers who are keeping ducks around their living houses. They purchase ducklings from hatcheries and rear them by providing only kitchen or garden refuges, sometimes with an amount of paddy or bran, while most part of feeds is sought by ducklings themselves in such nearly lying water places as ditches, brooks, pools, rice-fields, etc. The total amount of eggs and meat thus produced is enormous, although the most part of them is consumed as home food. In Japan also, duck-raising is not at all negligible, especially in those prefectures as Ōsaka, Kyōto, Niigata, etc.

Undoubtedly duck-breeders should not be exceptional in getting the largest possible number of progeny from an outstanding male by means of artificial insemination.

Several techniques for obtaining the semen in the water-fowl have been reported. SEREBROVSKII & SOKOLOVSKAJA (1934) succeeded for the first time in obtaining semen from the drake and the gander by electric stimulation. Further, ŌNISHI *et al.* (1950; 1955) with ducks and ROSE (1953) and JOHNSON (1954) with geese successfully obtained the semen by massage, and they carried out the artificial insemination with success. The present author in collaboration with SUGIMORI (1955, 1957) have recently reported more in detail the results of collecting the semen by the massage and of insemination with the semen thus recovered. It was found that the semen could be obtained by applying the irritable massage of thighs of the drake with the thumb on one side and the middle finger on the other, the bird being fixed on a specially constructed table.

Nevertheless, it was found that the success of massage method depends exclusively upon the psychological factor of the individual bird. It is an elaborate work to train the drake for 10~15 days until it shows a response to the massage. The time required for inducing the ejaculation and the volume of semen obtained vary exceedingly according to the individual and some birds cannot react at all. As regards the technique of semen injection, the orientation of vaginal orifice and inducing the insemination tube were entirely performed by palpation. It needs naturally a certain skilfulness for manipulation and traumatic injuries or bacterial infection of the uterine wall cannot always be avoided.

From this standpoint of view, further experiments were undertaken for the improvement of the technique both in collection and injection of semen.

The ducks here used were of the Japanese Improved Breed, the so-called "Ōsaka-duck", which was incubated in the Ōsaka Duck-Hatchery and raised further in our laboratory pens. Eight males for semen collection and ten females for insemination were employed; all of them were likewise 361 days old at the commencement of the experiment.

The author wishes to acknowledge the helpful encouragement during this work of Dr. J. YAMANE, formerly Dean of the Faculty of Fisheries and Animal Husbandry, Hiroshima University.

EXPERIMENTS

A. Collecting the semen by electric stimulation

For the electric stimulation, an apparatus constructed for applying to the goat and the sheep by FHK Co. Ltd., Tokyo, was applied (Pl. 1, Fig. 1).

For fixing the drake a small wooden table with a height of 25 cm, a width of 21 cm and a length of 24 cm was employed, having been equipped with a side plate of 45 cm in height and 8 cm in width (WATANABE & SUGIMORI, 1957). An electric pole, a sharp needle, attaching to the said apparatus was stuck to the hypoderm of the sacral region and the other one, a blunt rod, was inserted into the vent. 30 volts and 0.06~0.08 amperes of an alternating current was turned on for 3 seconds and repeated by using a contact-breaker from three to five times with an interval of 5 seconds. At every turning of the current the bird shows a momentary rigidity. Upon sufficient stimulation, the bird flaps reflexively its tail revealing the emission of semen. In contrast with the massage in which the penis unexceptionally elongates outside the vent (WATANABE & SUGIMORI, 1957, Figs. 2 & 4), this organ remains always *in situ* though it shows some stiffness. By pressing the stiff penis by a hand, the semen can be received in a graduated tube of funnel shape. The collected semen was examined with respect to volume, sperm density and pH-value. In counting the number of sperm the percentage of deformity was taken also in consideration, the total number of sperm counted varying from 500 to 1,200. As control, the massage previously reported was parallelly applied to two drakes in the same season: April 25 to July 22, 1957.

For judging the fertility of semen thus obtained, it was diluted ten times with the physiological saline solution (0.85%) and 0.3 cc. of this mixture was inseminated to each duck. Further technique of insemination will be described in the following pages.

Results of experiments on collecting semen are summarized in the Table 1.

At statistical treatment of the above data, it was found that there is a significant difference in the number of sperm per unit volume of semen, revealing

$$t_0 = 2.807 < t = 6.446$$

As a matter of fact, the semen obtained by electric stimulation shows always thick, creamy color whereas in the case of massage method it is thin and milky white in color. For the volume of single ejaculate, in consequence, the total number of sperm per ejaculate, it was hardly possible to find out any statistical significance because of technical difficulties of determining the exact volume below 1 ml. With respect to the pH-value and the percentage of deformed sperm there seemed to be no significant difference between both the methods, since it resulted

for the pH-value of semen $t_0 = 2.807 > t = 0.847$ and

for the percentage of deformed sperm $t_0 = 2.807 > t = 0.814$

The semen obtained by the electric stimulation was tested for its fertility by artificial

insemination during a span of May 19th to June 3rd, 1957. Eggs laid after the insemination were put into an incubator at 10.00 a. m. every day and candled on the 5th day of incubation which was continued during a week after the apparent cessation of development.

Results of incubation test are summarized in the Table 2.

Table 1. Volume, sperm density, pH-value and deformity percentage of the semen collected in two ways.

	Method of collection	Number of ejaculates	Mean	Range	Confidence limits (95%)
Volume of a single ejaculate (ml)	Electric stimulation	19	0.326	0.10~0.75	±0.08
	Massage	6	0.233	0.05~0.45	±0.14
Number of sperm in 1mm ³ of semen (million)	Electric stimulation	19	4.624	2.210~8.660	±0.89
	Massage	6	0.883	0.340~1.360	±0.45
Total number of sperm (hundred million)	Electric stimulation	19	16.082	4.420~51.960	±6.12
	Massage	6	2.137	0.680~5.625	±2.09
pH-value	Electric stimulation	19	6.78	6.4~7.0	±0.09
	Massage	6	6.73	6.6~6.8	±0.10
Deformity percentage (%)	Electric stimulation	19	20.13	16.06~23.44	±0.98
	Massage	6	20.87	19.32~23.94	±1.66

As a whole, the fertility test in the artificial insemination of poultry can be determined from two points of view, i. e. the rate of the number of fertilized females to the total number of females inseminated, viz. the absolute fecundity and the rate of the number of fertilized eggs to the total number of eggs produced, viz. the relative fecundity. In the present experiment with ducks it was found that the absolute and relative fecundity amounted to 66.7% (6 : 9) and 86.3% (19 : 22) respectively.

Aside from the low fecundity of ducks due to the unfavorable season,¹⁾ there seems to be no difference between the fertility of semen collected by electric stimulation and massage, since the relative fecundity in the former method was 86.3% (19 : 22) and in the latter 85.0% (124 : 146) as already reported (WATANABE & SUGIMORI, 1957).

It is not out of place here to mention that the drake employed in the electro-ejaculation above described did not show subsequently any unfavorable influences upon the health, the body weight, productivity of the semen, etc.

1) During the insemination experiment, all ducks were more or less coming to the non-productive period.

Table 2. Results of artificial insemination with semen collected by electric stimulation.

Duck No.	Days following insemination											A	B	C
	1	2	3	4	5	6	7	8	9	10	11			
1	-	+	+	+	+	+	+	0	0	-	0	6	6	6
2	-	-	+	-	-	-	-	-	-	0	0	1	2	1
3	-	-	-	-	-	-	-	0	0	0	0	-	-	-
4	0	0	0	0	0	0	0	+	0	-	-	1	1	1
5	0	0	0	0	0	0	0	0	0	0	0	-	-	-
6	-	-	-	-	-	-	0	-	0	0	0	-	-	-
7	-	-	-	-	0	0	0	0	0	0	0	-	-	-
8	-	+	+	+	-	-	0	-	0	-	-	3	3	3
9	-	+	+	-	+	+	-	+	0	0	0	7	7	5
10	-	+	+	0	+	0	0	0	0	0	0	4	3	3
Total												22	22	19
Mean												3.6	3.6	3.1

Absolute fecundity 66.7% (6 : 9)
 Relative fecundity 86.3% (19 : 22)

Remarks :

- A. Duration of fertility of semen in days.
 B. Total number of eggs laid from the second day after insemination until the disappearance of fertilized egg.
 C. Number of fertilized eggs per duck.
 + Fertilized egg; - Unfertilized egg; 0 Not laid.

Data of the duck No. 5 was excluded from the calculation of means because of complete infecundity during the whole experiment.

B. Technique of insemination by applying a special speculum

A metallic speculum was devised for orienting the vaginal orifice and inducing the insemination pipette through it. The inserting part of the speculum is 7 cm in length, 1.3 cm in depth and 1.5 cm in width and its handle bending at 145°, measures 14 cm in direct length. The bent of the handle enables the speculum to fix it in the palm of the operator's hand (Pl. 2, Figs. 7 & 8).

Semen injection was performed with a glass pipette of 10 cm length and 0.3cc. content which was equipped with a rubber bulb at its hind end. After evacuating the bowl, the duck is carried by an assistant holding its vent upwards, its belly being directed against the operator. The operator, after cleaning the vent with absorbent cotton, inserts the sterilized speculum through which the firmly closed rectal orifice can directly be found in the center of vent by it. On the upper left side of the vent lies the vaginal orifice which is loosely closed. The full length of speculum can easily be inserted through it. Hereupon, the insemination pipette sterilized beforehand is introduced along the speculum until its tip reaches the fore end of the speculum, and the content is injected by pressing its rubber bulb (Pl. 2, Figs. 9-12).

The time needed for the whole procedure from insertion of the speculum to the semen injection did not exceed more than one minute; it can be performed with a striking readiness without worry of infection or injury.

In the fertility test of the semen thus injected, the absolute and relative fecundity revealed 80% (8 : 10) and 88% (22 : 25) respectively, as shown in Table 3.

Table 3. Results of artificial insemination in ducks.

Duck No.	Days following insemination										A	B	C	
	1	2	3	4	5	6	7	8	9	10				
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	+	+	+	+	-	-	-	-	-	4	4	4	
3	-	+	-	-	-	-	-	-	-	-	1	1	1	
4	0	+	-	0	+	+	-	-	-	-	5	4	3	
5	-	+	+	+	0	-	-	-	-	-	3	3	3	
6	-	+	+	+	-	-	-	0	0	0	3	3	3	
7	-	+	-	-	-	-	-	-	-	-	1	1	1	
8	-	+	+	+	-	-	+	-	-	-	6	6	4	
9	-	-	-	-	-	-	-	-	-	-	-	-	-	
10	-	+	+	+	-	0	-	-	-	-	3	3	3	
Total											26	25	22	
Mean											3.3	3.1	2.8	

Absolute fecundity 80% (8 : 10)

Relative fecundity 88% (22 : 25)

Remarks : The same as the preceding table.

It can be concluded, therefore, that there is no difference both in absolute and relative fecundity of the semen between the palpation and the speculum application, while the time required for injection is incomparably short in the latter case.

SUMMARY

1) An improved technique of artificial insemination in ducks has been described in comparison with the manual method previously reported.

2) Semen of the drake could be collected momentarily with a striking readiness by intermittent turning 30 volts and 0.06~0.08 amperes of an alternating current. It is more advantageous than the massage method in which the psychological response of the bird is a prevailing factor.

3) For injection of semen, the application of a special speculum and a glass-pipette made the manipulation exceedingly easy. There is no more worry of infection and injuries to the female genital tract.

4) In view of the fertility of semen, no difference was found between the electric stimulation and the massage, in both the methods the relative fecundity being about 85~86%.

5) The technique above described is, therefore, practically more applicable for the duck-raising industry.

REFERENCES

- JOHNSON, A. S. 1954. Artificial insemination and the duration of fertility of geese. *Poultry Sci.*, **33** : 638-640.
- ŌNISHI, N., FUTAMURA, K., KATO, Y. & AKAMATSU, S. 1950. Studies on the artificial insemination in ducks. *Chikusan-no-kenkyū (Animal Husbandry)*, **4** : 19-20 (in Japanese).
- ŌNISHI, N., KATO, Y. & FUTAMURA, K. 1955. Studies on the artificial insemination in ducks. *Bull. Nat. Inst. Agric. Sci., Series G. No. 11*.
- ROSE, R. 1953. Artificial insemination of geese. *Magazine of Ducks and Geese*, **4** : 14.
- SEREBROVSKIĬ, A. S. & SOKOLOVSKAJA, I. L. 1934. Electric ejaculation in fowl. *Anim. Breed. Abstr.* **3** : 73-74.
- WATANABE, M. & SUGIMORI, Y. 1955. Studies on the artificial insemination in ducks. *Jap. J. Animal Reprod.*, **1** : 3 (in Japanese).
- WATANABE, M. & SUGIMORI, Y. 1957. Studies on the artificial insemination in ducks. *Zootecnica e Veterinaria, Anno XII*, N. 3 : 119-124.

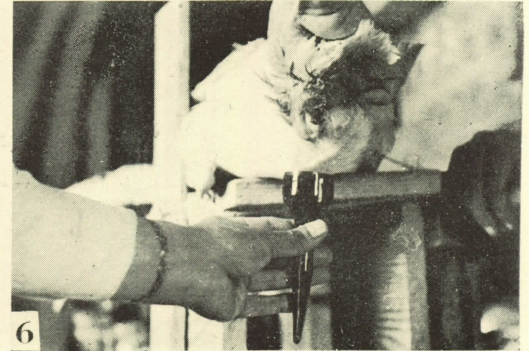
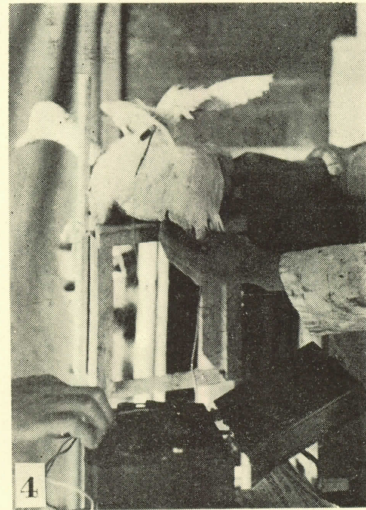
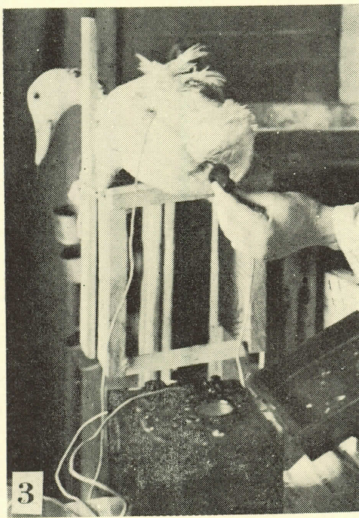
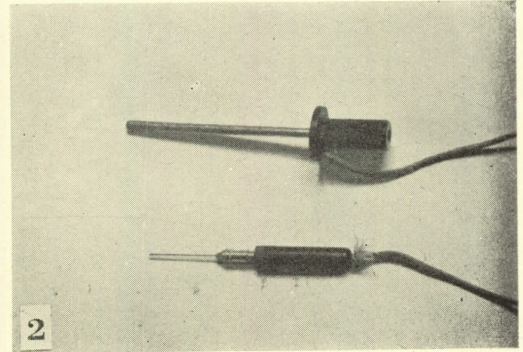
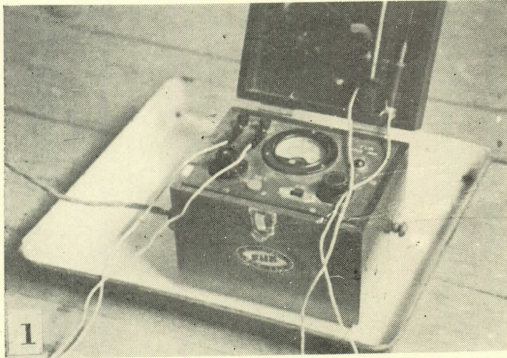
EXPLANATION OF PLATES 1-2

Plate 1

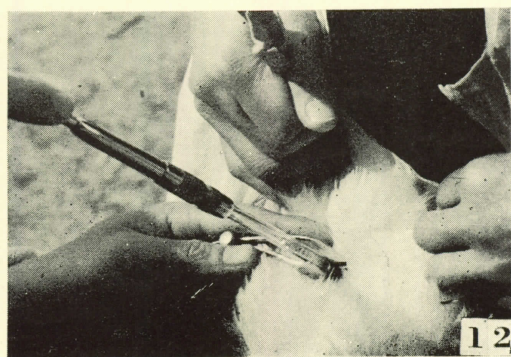
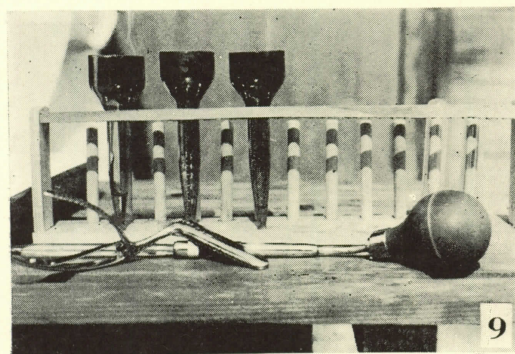
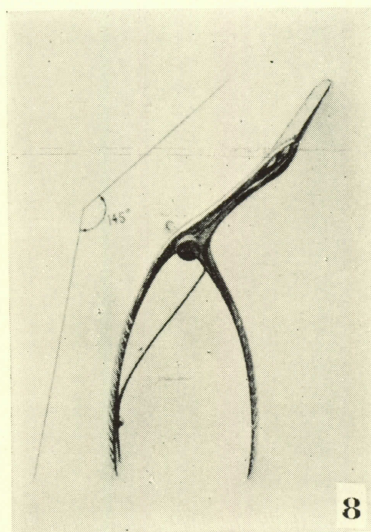
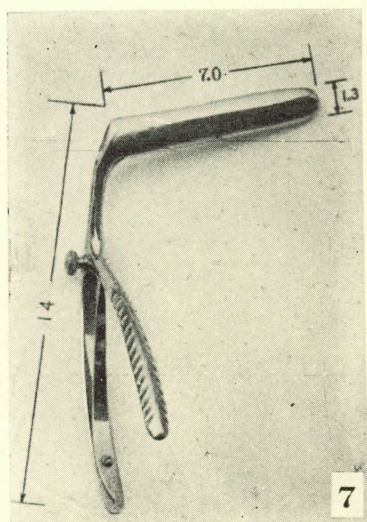
- Fig. 1. An electro-ejaculator for goat and sheep constructed by FHK Co. Ltd., Tokyo, which was applied to drake in the present experiment.
- Fig. 2. Two electric poles : the sharp one for sticking to the hypoderm of the sacral region and the blunt rod for inserting into the vent.
- Fig. 3. A drake prepared for turning the current, two poles being attached.
- Fig. 4. At the moment of turning the current, the bird showing rigidity.
- Fig. 5. Pressing of the stiff penis by fingers.
- Fig. 6. Collection of ejaculated semen into a funnel-shaped tube.

Plate 2

- Fig. 7. A vaginal speculum, side view.
- Fig. 8. The same, upper view.
- Fig. 9. Equipments for semen injection.
- Fig. 10. Orienting of the vaginal orifice in the vent.
- Fig. 11. Insertion of the speculum through the vaginal orifice.
- Fig. 12. Insertion of an insemination pipette along the speculum.



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