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## HATCHABILITY OF DUCK EGGS AND WARMING TREATMENTS DURING STORAGE

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In East Asia, where duck's eggs are yet stored and artificially incubated by traditional methods, the hatchery-man stores the duck's eggs at a temperature below or near to the physiological zero ( $18^{\circ}$ - $20^{\circ}$ C) and, once a day, he heats eggs in the bright sun for a short period (2, 6, 5, 4). This technology is not strange since copy the natural behaviour of most ducks which are used to remain on the nest for some time before the lay of each egg and gave good results when applied to long storage of *Anas platyrhynchos* L. (Pekin variety) (7). The hypothesis tested in this trial was that warming treatments during storage, which reproduce the natural behaviour of ducks, may increase embryo viability in eggs of *Cairina moschata* L. (Muscovy duck).

Eggs weighing between 65 to 112 g were collected from an Italian strain of Muscovy duck. The experiment involved 3522 eggs, collected over a 2 day period. Each day the eggs laid were gathered, placed with small end down on metallic egg flats, washed and fumigated. The second day all eggs were transported to the hatchery for the storage and divided randomly into six experimental groups. Three of the six groups were stored at a constant temperature of  $18 \pm 1^{\circ}$ C, while the other three groups were stored at  $18^{\circ}$ C and daily warmed for half an hour to  $37^{\circ}$ C. Each experimental group of the two storage treatments were subjected to one of three different storage periods: 3, 7, or 14 days. All eggs were daily turned. The temperature of  $18^{\circ}$ C was chosen as it has been recommended that duck's eggs be stored at  $16$ - $18^{\circ}$ C for storage less than 7 days and  $11$ - $12^{\circ}$ C for storage longer than 7 days. Incubation was carried out in an automatic incubator with hourly turning of 60. The eggs were daily sprayed from the 10th to the 30th days, according to the technology used for ducks eggs (1, 2). Candling was done at the 10th and the 30th day of incubation and the infertile and with embryo dead eggs were broken and dead checked by direct examination of the yolks. The relationship between fertility, mortality, and hatchability with treatments was analysed using log-linear models and the chi-square test of independence (SYSTAT).

With 3 days of storage, hatchability was not affected by treatments. With 7 days of storage the best results were obtained by daily warmed eggs and with 14 days of storage, hatchability decreased so greatly in both group (probably due to the relatively high temperature of storage chosen) that the best results obtained by daily warmed eggs did not differ significantly from the unwarmed eggs (table 1). Incidence of dead embryos followed the trend of hatched ducklings but with 14 days of storage a tendency to higher mortality rate and a significative higher fertility rate than in the eggs kept always below the physiological zero was observed in daily warmed eggs. Since longer storage determine very early mortality (by increasing the number of eggs which fault of restart cell division), most of the eggs classified as infertile to candling and to the following brochure and examination of the yolks were probably incorrectly assigned to the infertile group; it is presumably that some eggs were not infertile but with embryos which faulted the restart of cell division (very early dead embryos). The daily warming, evidently allow to a higher number of eggs, than unwarmed eggs, to restart cell division; however the effect of the long storage time is not completely cancelled and some embryos, which succeeded in restarting growth, showed later a mortality resulting in a trend to higher incidence of dead embryos. The results of the present research show that also in Muscovy duck the warming of the eggs during storage may reduce the negative effects of the storage time.

Table 1. Effect of daily warming and storage-length on hatching results.

effect on infertile eggs	STORAGE - LENGTH						Total
	3 days		7 days		14 days		
CONTROL	n. 34	a	57	a	151	b	242
	% 6.97	NS	9.12	B	23.5	B	13.8 B
DAILY WARMING	n. 27	a	37	a	99	b	163
	% 5.59	NS	5.85	A	15.2	A	9.24 A
TOTAL	n. 61		94		250		405
	6.28	a	7.48	a	19.32	b	11.5

effect on dead embryos	STORAGE - LENGTH						Total
	4 days		7 days		14 days		
CONTROL	n. 88	a	222	b	264	b	574
	% 18.0	NS	35.5	B	40.9	NS	32.7 NS
DAILY WARMING	n. 108	a	184	b	298	c	590
	% 22.4	NS	29.1	A	45.9	NS	33.4 NS
TOTAL	n. 196		406		562		1164
	20.2	a	32.3	b	43.4	c	33.0

effect on hatched ducklings	STORAGE - LENGTH						Total
	4 days		7 days		14 days		
CONTROL	n. 366	c	346	b	229	a	941
	% 75.0	NS	55.4	A	35.6	NS	53.6 A
DAILY WARMING	n. 348	a	411	b	253	c	1012
	% 72.1	NS	65.3	B	38.9	NS	57.3 B
TOTAL	n. 714		757		482		1953
	73.5	c	60.2	b	37.25	a	55.5

Note: values with different letters in a column (A, B) or row (a,b,c) are significantly different (P<.05).

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