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# Hatchability of Bobwhite Quail Eggs Incubated in Various Temperature Combinations<sup>1</sup>

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**ABSTRACT** Five experiments were conducted to compare the effects of various incubation temperature combinations on the hatchability of Bobwhite quail eggs. A starting incubation temperature of 40.6 C resulted in numerically lower hatchability. Incubation at 37.5 C resulted in a greater number of pipped, unhatched eggs, and a later, less uniform hatch. Temperatures during the hatching period (22 to 25 days of incubation) of 36.9 C and 38.1 C resulted in lower hatchability than the hatching temperature of 37.5 C.

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## INTRODUCTION

Temperature during the incubation period is one of the most important physical factors that influences hatchability of avian eggs. The optimum temperatures for the incubation of chicken eggs has been reviewed by Landauer (1967). Only limited information has been reported on the incubation and hatching temperature requirements of Bobwhite quail eggs.

Romanoff (1934) obtained the best results with Bobwhite quail eggs at a continuous temperature of 38.3 C (101 F) in a natural draft electric incubator. An interaction which differs with the stage of incubation has been shown to occur between temperature, humidity, and air movement (Romanoff, 1938). For forced draft incubators the temperature and humidity normally recommended for quail eggs are 37.5 C and 61 to 65% RH during the first 20 days of incubation, and 37 C and 70 to 73% RH thereafter (Kealy, 1969; Krueger, 1972; Walker, 1974; Wilson *et al.*, 1975). These are also the conditions commonly used in research studies involving quail eggs (Pani, *et al.*, 1969; Miller and Wilson, 1976).

The present studies were conducted to compare the effects of various incubation temperature combinations on the hatchability of Bobwhite quail eggs.

## EXPERIMENTAL PROCEDURES

Three experiments were conducted in which six incubation temperature variations were compared in each experiment; a total of nine variations were tested. The eggs used in all experiments were from a closed flock of Bobwhite quail and had been stored at approximately 15 C for 1 to 28 days. Eggs were separated into 12 groups for each of the three experiments, two replicates per treatment. The replicates were placed in separate Jamesway Model 252 incubators for the treatment period (1 to 21 days). All eggs were removed from the incubators at seven days and candled to determine fertility. The number of fertile eggs tested for each treatment of the three experiments varied from 515 to 640.

Two incubators were maintained at 37.5 C for the entire treatment period and served as controls. Other incubators, two for each treatment temperature, were maintained at or adjusted to the temperatures required for each day. The treatments for all three trials are outlined in Table 1. All eggs were placed in the control incubators for hatching with the temperature decreased to 36.9 C. Humidity was adjusted to 61 to 64% RH for all incubators during the period 1 to 21 days and 70 to 72% for the 21 to 25 day period.

Chicks were counted and removed from the hatcher on days 22, 23, 24, and 25 of incubation. Pipped and non-pipped eggs remaining on day 25 were recorded.

In Experiments 4 and 5, quail eggs were incubated at 37.5 C and 61 to 65% RH until day

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TABLE 1. Treatment description for Experiments 1, 2, and 3

Treatment (Temperature/day(s) of incubation)	Experiment		
	1	2	3
A. 37.5 C/1 to 21	X	X	X
B. 37.5 C/1 to 21, eggs held at 23 ± 3 C 24 hr prior to set	X	...	...
C. 40.6 C/1; 37.5 C/2 to 21	X	...	X
D. 40.6 C/1 to 2; 37.5 C/3 to 21	...	X	...
E. 40.6 C/1; 40.0 C/2; 39.4 C/3; 38.9 C/4; 38.3 C/5; 37.8 C/6; 37.5 C/7 to 21	X	...	X
F. 40.6 C/1; 40.0 C/2; 39.4 C/3; 38.9 C/4 to 7; 38.3 C/8 to 14; 37.8 C/15 to 21	...	X	X
G. 40.6 C/1 to 2; 39.4 C/3; 38.9 C/4; 38.3 C/5; 37.8 C/6; 37.5 C/7 to 21	...	X	...
H. 38.9 C/1 to 7; 38.3 C/8 to 14; 37.8 C/15 to 21	X	X	X
I. 38.1 C/1 to 21	X	X	X

TABLE 2. Fertile eggs which hatched (%) and pipped but did not hatch (%) when incubated at various temperatures.

Treatment <sup>1</sup>	Experiment 1			Experiment 2			Experiment 3		
	# Fert	% FH	% Pip	# Fert	% FH	% Pip	# Fert	% FH	% Pip
A	640	69.0	21.0 <sup>ab</sup>	543	81.2	5.1	547	72.6	11.0
B	638	65.0	24.3 <sup>a</sup>	...	...	...	...	...	...
C	639	69.6	17.8 <sup>bc</sup>	...	...	...	515	56.8	12.0
D	...	...	...	529	62.9	5.5	...	...	...
E	613	76.8	9.3 <sup>d</sup>	...	...	...	523	60.2	7.0
F	...	...	...	532	61.8	6.4	530	49.1	9.2
G	...	...	...	527	63.3	4.6	...	...	...
H	635	74.1	10.9 <sup>d</sup>	565	69.0	6.5	544	63.8	5.7
I	610	70.0	14.6 <sup>cd</sup>	536	83.2	3.4	573	73.4	9.8

<sup>1</sup> See Table 1.<sup>a,b,c,d</sup> Means within a column without a common superscript are significantly different ( $P < .05$ ).

21, at which time they were divided into six replicate groups. Two replicates were placed in each of three treatments, each replicate in a separate incubator. The three hatching conditions tested were 36.9, 37.5, and 38.1 C and approximately 74% RH for days 21 to 25 of incubation. The number of chicks, pipped, and non-pipped eggs were determined on day 25 of incubation.

The data were subjected to analysis of variance procedures and treatment means were tested by multiple range test procedures. Differences in hatching time frequencies were determined by Chi Square.

## RESULTS AND DISCUSSION

In Experiment 1, 2, and 3 the hatchability of fertile eggs was not significantly changed from that of the control (37.5 C/1 to 21 days) by any of the treatment incubation tempera-

tures (Table 2). Most treatments resulted in considerable variation in results; however, incubating at 38.1 C for the first 21 days (Treatment I) gave consistent results which were

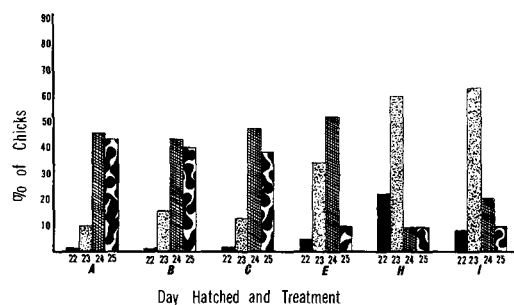


FIG. 1. The influence of various incubation temperatures on the hatching time (days of incubation) of Bobwhite quail chicks (Experiment 1).

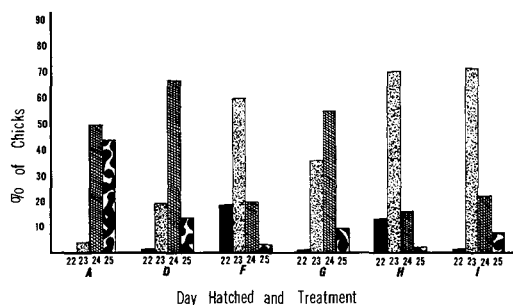


FIG. 2. The influence of various incubation temperatures on the hatching time (days of incubation) of Bobwhite quail chicks (Experiment 2).

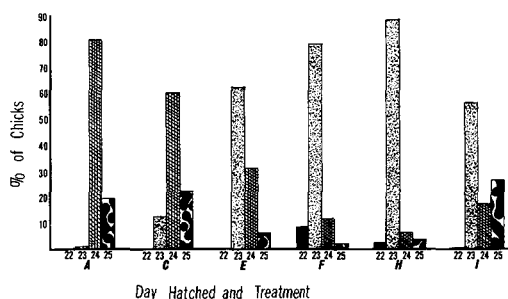


FIG. 3. The influence of various incubation temperatures on the hatching time (days of incubation) of Bobwhite quail chicks (Experiment 3).

numerically better than the controls. Starting incubation at 40.6 C (Treatments C, D, E, F, and G) tended to result in lower hatchability. The effect of these treatments on early quail embryos was somewhat more detrimental than that reported for late stage (16 day) chicken embryos in which incubation at 40.6 C for 48 hr had little effect on hatchability (Thompson *et al.*, 1976). Holding eggs at  $23 \pm 3$  C for 24 hr prior to setting (Treatment B) did not improve hatchability over that of eggs removed directly from the cooler (15 C) for setting (all other treatments).

The percent of fertile eggs which pipped, but did not hatch (Table 2), was somewhat higher for eggs incubated at 37.5 C for all or most of the test period (Treatment A, B, and C in Experiment 1 and A and C in Experiment 3). An incubation temperature of 37.5 C would, therefore, appear to be below optimum for quail eggs in the type of incubator used in these studies. A more definite indication of this was noted in the day of incubation at which the

embryos hatched (Fig. 1). The majority of embryos in Treatments A, B, and C in Experiment 1 hatched on days 24 and 25 of incubation while most embryos of treatments H and I hatched on days 23 (Figure 1). Treatments H and I also produced earlier hatching in Experiments 2 and 3 (Fig. 2 and 3, respectively). Treatments E and F also resulted in earlier hatching. The normal incubation period for Bobwhite quail has been reported to be 24 days (Romanoff, 1967) and 23 days (Walker, 1974). Therefore, an incubation temperature of 37.5 C during the first 21 days was low and resulted in delayed hatching while higher temperatures, e.g., Treatments H, I, and F, resulted in an earlier, more normal hatching time with a greater percentage hatching on one day.

In Experiments 4 and 5, the numerically lowest percent pips and highest percent non-pips were found at the 37.5 C hatching temperature (Table 3). The hatch of fertile eggs was numerically greater at a hatching temperature of 37.5 C. The 38.1 C hatching temperature

TABLE 3. Fertile hatchability, pips, and non-pips from Bobwhite quail eggs as influenced by hatching temperature (Experiment 4 and 5).

Hatching <sup>a</sup> treatment		Fertile hatch <sup>b</sup> (%)	Pips <sup>b</sup> (%)	Non-pips <sup>b</sup> (%)
	% RH			
36.9	74	76.2	15.2	8.6
37.5	74	79.8	11.4	9.4
38.1	74	77.8	14.2	8.2

<sup>a</sup> Hatching period was 21 to 25th days of incubation.

<sup>b</sup> Calculated according to the number of fertile eggs transferred.

produced a greater percent fertile hatch than the lower 36.9 C level. In the chicken, reducing the hatching temperature to 36.9 C during hatching is a common practice. However, in the Bobwhite quail it appears to be more beneficial to maintain a hatching temperature of 37.5 C during the last four days of incubation.

#### REFERENCES

- Kealy, R. D., 1969. Storage and incubation of game bird eggs. Page 45-52 in *First Texas Comm. Game Bird Mgt. Conf.*
- Krueger, W. F., 1972. Maximizing hatchability in game bird operations. *N. Amer. Game Breeders and Shooting Pres. Ass., Inc. Monthly Mag.* 3:18-19.
- Landauer, W., 1967. The hatchability of chicken eggs as influenced by environment and heredity. *Monograph. 1.* (Rev.) Storrs Agr. Exp. Sta., Storrs, CT.
- Miller, E. R., and H. R. Wilson, 1976. Hatchability of Bobwhite quail eggs as influenced by pre-incubation storage and turning. *Poultry Sci.* 55:2476-2478.
- Pani, P. K., T. H. Coleman, H. D. Georgis, and A. W. Kulenkamp, 1969. Between family synchronization of hatching time in Bobwhite quail. *Poultry Sci.* 48:655-667.
- Romanoff, A. L., 1934. Study of artificial incubation of game birds. I. Temperature requirements for pheasant and quail eggs. *Cornell University Agr. Exp. Sta. Bull.* 616.
- Romanoff, A. L., 1938. Study of artificial incubation of game birds. IV. Interrelation of temperature, humidity, and air movement in the incubation of pheasant and quail eggs. *Cornell University. Agr. Exp. Sta. Bull.* 687.
- Romanoff, A. L., 1967. Page 324 in *Biochemistry of the avian embryo.* John Wiley and Sons, New York.
- Thompson, J. B. III, H. R. Wilson, and R. A. Voitle, 1976. Influence of high temperature stress of 16-day embryos on subsequent hatchability. *Poultry Sci.* 55:892-894.
- Walker, W. S., 1974. Raising Bobwhite quail for commercial use. *Clemson Univ. Ext. Circ.* 514.
- Wilson, H. R., C. R. Douglas, and L. W. Kalch, 1975. Bobwhite quail production. *University of Florida Poultry Sci. Ext. Info. Ser.* 75-1.