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EFFECT OF THE USE OF SYNTHETIC SOUND DURING INCUBATION IN CHICKEN

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Abstract: In the present work the effect of the use of synthetic sound during incubation in chicken of the Hampshire breed was studied. For the stimulation, an electronic sound generator with amplitude of power 1250 mV and time interval of 134 ms, 176 ms, 210 ms and 380 ms was used. The study was carried out in three experiments. In the 1 st experiment we tried to determine the influence of sound stimulation on the hatching of chickens from egg set of the variant of weight. In the 2 nd experiment we tried to determine the influence of the variant of the beginning of sound stimulation on chicken hatching. In the 3 rd experiment we tried to determine the influence of sound stimulation with constant amplitude of power and the variant of the time interval on chicken hatching. The most suitable eggs to be used for the stimulation with synthetic sound are the ones with the weight of 58.0 -60.0g. In this weight category, the chickens hatched earliest of all the groups and there was no decrease in hatchability either. In order to achieve an earlier beginning of beakclapping, a faster whole group beakclapping time, and a shorter hatching time of chickens, sound stimulation should begin at the 433 rd hour of hatching. At the constant amplitude of power of the stimulating sound, the earliest hatching was observed when the time interval was 176 ms. Less suitable for stimulation are the time intervals 134 ms and 380 ms.

Key words: synthetic sound, incubation, chicken.

I n t r o d u c t i o n

In the process of evolution the signals whose importance lies in the possibility of influencing other animal have been developed. Acoustic signals are just one

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kind of such signals (other ones being visual and chemical signals). Acoustic signals have a great range, they can be applied in thick vegetation as well as absolute darkness. However, for their emission animals expend a lot of energy (Franck, 1985).

It is a long known fact that the young of non – feed fowl are hatched collectively. According to Sliškovská (1984), experiments show that the hatching of chickens of domestic fowl depends on the pecking produced by chickens during the last days of their hatching. The number of sound signals per minute is predetermined. If the frequency of sound signals is increased, the chicken embryos start to adapt to a faster tempo, which results in their earlier beakclapping than the chickens from the control group in which the micro – groups were formed and their leaders let themselves be heard by means of beakclapping in a normal rhythm. Fowl embryos are not only able to respond to sounds coming from the outside (Zajančkovskij, 1971), but they themselves are able to produce different sounds as well (Heaton, 1972). The problem of exploiting sound stimulation of fowl embryos has been discussed by several authors (Impekoven, 1971; Vince, 1966). For sound stimulation in hatching they used tape recorders with recorded sound signals of hens calling chickens for feeding or with sounds of chickens themselves.

The aim of the work was to determine the influence of the synthetic sound by an electronic generator on chicken hatching of the Hampshire breed set eggs.

Material and Method

In the present work the Hampshire breed set eggs of the parental brood aged 35 – 52 weeks were used. Electronic generator of sound was applied for sound stimulation of chicken embryos during the incubation of egg sets. The electronic generator of sound consists of the proper instrument, where individual controls are located, power cord, loudspeaker located in the baffle and connecting the cable between electronic generator of sound and loudspeaker. The acoustic converter works as follows: after connecting the cord to an electric outlet the electronic generator produces electric impulse which move through the connecting cable to the loudspeaker (placed inside the hatchery) where they are converted to acoustic impulse with the set amplitude and determined time interval of the "pecking" stimulating synthetic sound.

The set eggs were hatched in the hatcheries of BIOS MONO 06 type. During the experiments, the egg sets were incubated at a temperature of 37.5 – 38.2°C and the humidity of the air in the hatchery was 55 – 65 % (during first eighteen days of incubation), and 65 – 90 % (during the last three incubation days). During the first eighteen days of incubation, the eggs were turned by 180° every hour, on the final three hatching days the eggs were not turned.

The study was carried out in three experiments:

In the 1 st experiment we tried to determine the influence of sound stimulation on the hatching of chickens from egg sets of the variant of weight. The egg sets were divided according to their weight into three groups: in the first control and experimental groups the weight of eggs was 55.0 – 57.0 g, in the second experimental and control groups the eggs weighed 58.0 – 60.0 g, and in the third control and experimental groups eggs with the weight 61.0 – 63.0 g were incubated. The control groups were not sound stimulated during incubation. The experimental groups were stimulated during the incubation by a sound with amplitude of power 1250 m V. Loudspeakers with a constant time interval of "pecking" sound, 176 m s, were placed into the hatcheries on the nineteenth day of incubation.

T a b. 1. - Influence of sound stimulation on the chicken hatching from the eggs with variant weight

Indicators	Units	1 st control group	1 st experimental group	2 nd control group	2 nd experimental group	3 rd control group	3 rd experimental group
weight of eggs	g	55.0 – 57.0	55.0 – 57.0	58.0 – 60.0	58.0 – 60.0	61.0 – 63.0	61.0 – 63.0
amount of incubated eggs	pieces	100	100	100	100	100	100
		x ± s	x ± s	x ± s	x ± s	x ± s	x ± s
beginning of beakclapping	hours	498.62± 4.21	496.93 ± 4.67	498.27 ± 3.84	494.08 ± 4.12	501.18 ± 5.03	501.90 ± 4.66
Whole group beakclapping time	hours	13.25 ± 1.52	12.65 ± 2.12	13.47 ± 2.03	+ C2 : E2 10.88 ± 1.03	13.81 ± 2.21	12.52 ± 1.62
Hatching time	hours	511.87 ± 5.33	509.58 ± 6.23	511.74 ± 5.92	504.96 ± 4.43	514.99 ± 5.02	514.42 ± 4.46
Hatchability	%	89.17 ± 2.02	88.03 ± 1.61	87.02 ± 1.73	88.81 ± 2.07	88.22 ± 0.91	89.41 ± 2.02

+ P ‹ 0,05

In the 2 nd experiment we tried to determine the influence of the variant of the beginning of sound stimulation on chicken hatching. The eggs set were hatched in the BIOS MONO 06 type hatcheries. The chicken embryos of the control group were not stimulated by a synthetic sound from an electronic generator. The experimental groups were sound stimulated by a "pecking" sound with amplitude of power 1250 m V and time interval 176 m s. The beginning of stimulation of chicken embryos was on the seventeenth day (385 th incubation hour) in the 1 st experimental group, on the eighteenth day (409 th hour) in the 2 nd experimental group, on the nineteenth day (433 rd hour) in the 3 rd experimental group, and on the twentieth day (457 th incubation hour) in the 4 th experimental group. The weight of eggs being 58.0 – 60.0 g.

In the 3 rd experiment we tried to determine the influence of sound stimulation with constant amplitude of power and the variant of time interval on chicken hatching. While in the control group the chicken embryos were not sound stimulated, in the experimental groups, the eggs were stimulated by the sound from acoustic sound converter with amplitude of power 1250 m V. In the 1 st experimental group, the time interval of the "pecking" sound was 380 m s, in the 2 nd experimental group the time interval of sound was 210 ms, in the 3 rd experimental group it was 176 m s and in the 4 th experimental group the time interval was 134 m s. The eggs weighing, on average, 58.0 – 60.0 g were hatched.

T a b. 2. - The influence of a variant beginning of sound stimulation on chicken hatching

Indicators	Units	Control group	1 st experimental group	2 nd experimental group	3 rd experimental group	4 th experimental group
Beginning of sound stimulation	hours		385	409	433	457
Amout of incubated eggs	pieces	85	85	85	85	85
		x ± s	x ± s	x ± s	x ± s	x ± s
Beginning of beakclapping	hours	501.75 ± 1.68	501.13 ± 1.47	499.25 ± 1.52	499.13 ± 2.13	500.88 ± 2.22
Whole group beakclappin time	hours	12.25 ± 0.56	11.75 ± 0.75	11.13 ± 1.39	+ C : E3 10.88 ± 0.55	11.88 1.14
Hatching time	hours	514.00 ± 2.24	512.88 ± 2.16	510.38 ± 2.56	510.00 2.67	512.52 3.15
Hatchability	%	90.31 ± 4.72	89.25 ± 1.13	90.88 ± 2.21	88.43 0.76	89.13 3.15

+ P ‹ 0,05

During hatching the following traits were observed at 30 minute intervals: beginning of beakclapping, the whole group beakclapping time, hatching time and hatchability. The final results, as shown in tables, were obtained from four consecutive repeatings. From the obtained results, the basic variative – statistic traits were calculated, and the observed differences were tested by a Student's test.

Results and Discussion

In the 1 st experiment the earliest to hatch were the chickens from the 2 nd experimental group (with the eggs set weight 58.0 – 60.0g), after 504.96 ± 4.43 incubation hours, and in the 1 st experimental group (with the weight of eggs set 55.0 – 57.0g) after 509.58 ± 6.23 hours of incubation (table 1). The earliest whole group beakclapping time, 10.88 ± 1.03 hours was recorded in the 2 nd experimental group. If compared with respective control group's whole group beakclapping time (13.47 ± 2.03 hours), the result is statistically conclusive

($P<0.05$). In all experimental groups we recorded shorter whole group beakclapping times than in respective control groups. The longest whole group beakclapping time was recorded in the 3 rd control group where it took 13.81 ± 2.21 hours. The chickens from the experimental groups took a shorter time to hatch than the chickens from the respective control groups. The highest hatchability, 89.41± 2.02%, was recorded in the 3 rd experimental group; the lowest one , on the other hand, was recorded in the 2 nd control group, 87.02 ± 1.73%. The results prove that the hatchability was balanced in all control and experimental groups and that the stimulation by a synthetic sound from an electronic generator did not have negative influence on the hatching.

In the 2 nd experiment, the earliest beginning of beakclapping was recorded in the 3 rd experimental group (after 499.13 ± 2.13 hours) in which the sound stimulation began after 433 incubation hours (table 2). Less than 500 hours was also needed for beakclapping to begin in the 2 nd experimental group (499.25 ± 1.52 hours). The earliest whole group beakclapping time was in the 3 rd experimental group, 10.88 ± 0.55 hours. The difference was statistically conclusive ($P < 0.05$) if compared with the control group and its 12.25 ± 0.56 hours of pecking. The shortest hatching time was observed in the 3 rd experimental group, 510.00 ± 2.67, and in the 2 nd experimental group, 510.38 ± 2.56 hours. Of the sound stimulated experimental groups, the latest to hatch, after 512.88 ± 2.16 incubation hours, were the chickens from 1 st experimental group into which loudspeakers of an acoustic converter of sound were placed after 385 hours of incubation. The latest to hatch were the chickens from the control group without sound stimulation, after as long as 514.00 ± 2.24 hatching hours. The hatchability was more or less constant in all the groups, the highest one was recorded in the 2 nd experimental group (90.88 ± 2.21%) and the control group (90.31 ± 4.72%), while in the 3 rd experimental group it was the lowest (88.43 ± 0.76%).

In the 3 rd experiment the first to peck were the chickens from the 3 rd experimental group, after 483.17±5.81 hours (table 3). The Hampshire breed chicken embryos from this group were during the incubation exposed to synthetic sound with the amplitude of power 1250 m V and a time interval of 176 m s. The shortest whole group beakclapping time was also in the 3 rd experimental group, it lasted 10.17 ± 2.88 hours. The second shortest time needed for the beakclapping of the whole group of chickens was recorded in the 2 nd experimental group (11.92 ± 0.97 hours). The longest beakclapping time was recorded in the control group with 14.62 ± 2.02 hours. The earliest to hatch were the chickens from the 3 rd experimental group, after 493.34 ± 5.67 incubation hours. The chickens from the 2 nd experimental group did not exceed a 500 hour limit either, the actual hatching time was 499.93 ± 4.98 incubation hours. In this group, the chicken embryos were stimulated by sound with the amplitude of power 1250 m V and a

time interval of the stimulating sound of 210 m s. The longest hatching time was taken by the chickens from the 4 th experimental group (the time interval of the stimulating sound was 134 m s). While in the 2 nd experimental group the hatchability was the highest of all the groups (98.72 ± 3.62%), in the 3 rd experimental group, on the other hand, it was the lowest (93.43 ± 4.97%).

The results of experiments show that chickens, with no previous exposure to the "pecking" sound imitating the beakclapping of the beak on the egg shell, responded to this synthetic sound produced by an acoustic converter. This confirms the findings of Franck (1996) about the inborn behaviour of chickens, which is genetically programmed and is transferred to successive generations. The inborn behaviour of animals varies according to the species (Slater and Halliday, 1994), which is manifested by the fact that the chicken (as young of non – feeding fowl) responded to the stimulating synthetic sound by an earlier beginning of beakclapping, shorter whole group beakclapping time as well as a shorter hatching time, while the young of feeding fowl did not show any response at all. The chickens are able to respond not only to original sounds recorded on tapes, but to synthetically produced sounds from acoustic instruments (Mc Gregor, 1992).

T a b. 3. - The influence of the stimulation by sound with constant amplitude of power and variant time interval

Indicators	Units	Control group	1 st experimental group	2 nd experimental group	3 rd experimental group	4 th experimental group
Time interval	m s	-	380	210	176	134
Amount of incubated eggs	pieces	100	100	100	100	100
		x ± s	x ± s	x ± s	x ± s	x ± s
Beginning of beakclapping	hours	488.67 ± 4.08	489.21 ± 3.26	488.01 ± 4.77	483.17 ± 5.81	491.03 ± 4.62
Whole group beakclapping time	hours	14.62 ± 2.02	13.48 ± 1.41	11.92 ± 0.97	10.17 ± 2.88	12.81 ± 4.14
Hatching time	hours	503.29 ± 6.28	502.69 ± 5.73	499.93 ± 4.98	493.34 ± 5.67	503.84 ± 4.74
Hatchability	%	94.65 ± 2.22	95.89 ± 2.94	98.72 ± 3.62	93.43 ± 4.07	97.21 ± 3.64

The experiments with a variant weight of the egg sets showed that of the sound stimulated experimental groups a faster hatching was recorded from the medium weight egg sets (58.0 – 60.0g). The results correspond with the conclusions of Wilson (1991) and Burke (1992). The best results of the sound stimulation on the chicken hatching (the earliest beginning of beakclapping, the fastest whole group beakclapping time as well as the shortest hatching) was recorded at the beginning of sound stimulation, at the 433 rd incubation hours,

which corresponds with Glazev (1990), but contradicts the conclusions of Vince and Toosey (1980) who achieved the best results when the stimulation began as late as the twentieth day of hatching. The chickens in the experiments responded by a gradual shortening of the hatching time only in the case of the following successive time intervals: 380 m s, 210 m s and 176 m s The time interval 134 ms did not elicit any further shortening of times in the monitored indicators. According to Deeming (1989), animals do not respond to all sounds, but only to those within the limit of the time interval specific for the given species. The chickens in our experiment were able to respond to the sounds coming from outside, which corresponds with the findings of Impekoven (1971) and Wilson and Sander (1998).

According to Vince (1966), the decrease in time interval of the sound signals causes a faster chicken hatching. In our experiments, the constant amplitude of power with variant time intervals of 380 m s, 210 m s and 176 m s, resulted in the shortening of time needed for the hatching of chickens. From the time interval of 134 ms, the hatching speed slowed down. It is also very important to point out that the influence of sound stimulation significantly shortened the time needed for the pecking out of the whole group of chickens, which corresponds with the results of Orcutt (1974).

Conclusion

The discussed problems will require more detailed ethological observations of the hatching process, resulting, among other things, in the determination of a more suitable working mode of the electronic generator, with specific values of the amplitude of power and time interval of the synthetic sound, for the speeding up of the chicken hatching process, with the lowest possible mortality rate.

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UTICAJ KORIŠĆENJA SINTETIČKE SONDE U TOKU INKUBACIONOG PERIODA PILIĆA

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R e z i m e

Ispitivan je efekat korišćenja sintetičke (“zvučne”) sonde za vreme inkubacije (leženja) pilića Njuhempšir rase kokoši. Za stimulaciju korišćen je generator električne sonde sa amplitudom snage 1250 mV i vremenski intervali od 134 ms, 176 ms, 210 ms i 380 ms. Pri tome su izvedena tri eksperimenta.

U prvom eksperimentu je učinjen pokušaj da se determiniše uticaj stimulacije sonda na izvodljivost pilića kod jaja različite (promenljive) mase, u drugom izmenjenog početka stimulacije sondom na vreme izvodljivosti pilića, a u trećem eksperimentu učinjen je pokušaj determinacije uticaja stimulacije sonde sa konstantnom amplitudom snage u promenljenim vremenskim intervalima.

Najpogodnija jaja za upotrebu stimulacije sa sondom su ona koja su imala masu 58,0-60,0 g. U ovoj težinskoj klasi, izleženi su ranije pilići od ostalih jaja i nije utvrdjeno povećanje izvodljivosti (leženosti) pilića. Pri korišćenju sintetičke sonde kucanje kljunom, odnosno pribijanje ljuske jajeta počelo je 433. časa od početka inkubacionog perioda. Pri konstantoj amplitudi snage stimulirajuće sonde, zapažena je ranija izvodljivost pilića kada je vremenski interval bio 176 ms. Manje pogodni za stimulaciju su vremenski intervali od 134 i 380 ms.

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