ISSN 1644-0714
ISSN 2300-6145 (online)
www.asp.zut.edu.pl

ACTA SCIENTIARUM POLONORUM *Acta Sci. Pol. Zootechnica 14(2) 2015, 33–44*

ASSESSMENT OF ULTRAVIOLET LIGHT EFFECT IN HATCHING EGGS DISINFECTION ON HATCHABILITY TRAITS OF TWO BREEDS OF QUAILS AND CHICKENS

Karrar I.A. Al-Shammari[1,2], Justyna Batkowska[1], Magdalena M. Gryzińska[1]

[1]University of Life Sciences in Lublin, Poland
[2]Al-Musaib Technical College, Al-Furat Al-Awsat Technical University, Babylon, Iraq

Abstract. This study was carried out to investigate the effectiveness of ultraviolet light (UV) (262 nm, 10 mW · cm^{-2}) used as a disinfectant of hatching eggs for two breeds of chicken; Greenleg Partridge (GP) and Polbar (Pb), and two strains of quails: meat type (MTQ) and laying type (LTQ). Fertility, hatchability, periodical and total mortality of the set were established. In all, 720 hatching eggs for all breeds: GP, Pb, MTQ and LTQ, 180 eggs per each breed were randomly divided into 3 groups each. The 1st group was negative control (NC), without disinfection, the 2nd group were control (F), fumigated with formaldehyde gas eggs, 3rd group were eggs exposed to UV at for 30 minutes (UV). Then eggs were hatched artificially using a BIOS hatching apparatus under standard conditions of incubation. The results revealed that eggs disinfected with UV did not significantly differ in hatchability and total mortality from NC and F eggs in each strains of both, hen and quail eggs. 1st and 2nd periodical embryonic mortality did not significantly differ between groups in GP, Pb, LTQ but in 1st embryonic mortality the overall quail eggs was affected ($P \leq 0.01$) by UV group. In 2nd embryonic mortality, UV was significantly less intensive ($P \leq 0.05$) in MTQ. According to these the documented results, using UV as a disinfectant for hatching eggs could be potentially as safe as formaldehyde without any negative and detrimental effect on hatchability and embryonic development.

Key words: hens, quails, hatchability, disinfection, UV

Corresponding author: Karrar I.A. Al-Shammari, Department of Biological Basis of Animal Production, University of Life Sciences in Lublin, Akademicka 13, 20-950 Lublin, Poland, e-mail: karrar.al-shammari@up.lublin.pl

INTRODUCTION

Eggshell disinfection is a basic measure of the hatchery to minimize the prevalence and existence of severely harmful pathogens for reproduction e.g. *Salmonella*, *Escherichia* or *Enterobacter*, molds and yeasts, which are primarily located on egg shell [De Reu 2006, De Reu et al. 2006]. De Reu et al. [2008] and Chousalkar et al. [2010] stated that egg shell is dominated by Gram-positive bacteria, which are spoilage microorganisms, while Gram-negative bacteria are best equipped to strike the antimicrobial defence system of the egg. Therefore, sanitisation of egg shells is an optimal procedure for hatching eggs due to the critical incidence of pathogenic contamination [Turblin 2011].

Fumigation by formaldehyde has been used for many years as traditional disinfectant to limit and control microorganisms by acting on the surface of the eggshell without penetrating the interior of the egg [Williams 1970, Cadirci 2009]. However, this involves handling of hazardous chemicals by employees who can be possibly exposed to the gas after mixing and possible exposure to the dangerous and toxic fumes released [Sheldon and Brake 1990, Hayretda and Kolankaya 2008, Debes and Basyony 2011].

Ultraviolet light (UV) is widely used for various food and water sanitation processes, the absorption of UV by living tissue causes a photochemical reaction that has the ability to alter the genetic material (DNA and RNA) of a cell [Koutchma et al. 2009, Wells 2011] thus, UV is lethal and germicidal by preventing aerobic bacteria, yeast, and mould populations from successful replication [Kuo et al. 1997, Gao et al. 1997]. In poultry scope, UV was the most commonly used for egg disinfection with not negative effect on the embryo [Goerzen and Scott 1995, Coufal et al. 2003]. Koutchma et al. [2009] mentioned that UV dose requirements for destroying microbial cells are relatively valuable and dependent on the microorganism, intensity and exposure time. The range of UV wavelength is situated between 200 and 400 nm and is divided into three divisions: UV-A (Long wave and black light with 315–400 nm), UV-B (medium wave with 280–315 nm) and UV-C (short wave and germicidal with 200–280 nm) [ISO 21348-2007, Turtoi and Borda 2014].

The aim of this present study was undertaken to evaluate the hatchability performance in two strains of quails, meat type (MTQ) and lying type (LTQ), and two breeds of hens, viz., Greenleg Partridge (GP) and Polbar (Pb) after disinfecting their hatching eggs by UV rather than fumigation by formaline.

MATERIAL AND METHODS

GP and Pb are Polish native chicken breeds considered as Polish genetic resources. They were registered in the World Watch List for Domestic Animal Diversity by the Food and Agricultural Organization [Scherf 2000]. GP is distinguished by green legs and partridge-like plumage. It is perfectly adapted for rearing in open ranges or pastures in natural environmental conditions, largely resistant to low temperatures and diseases, extensive feeding and lays valuable eggs with lower cholesterol levels [Krawczyk et al. 2005, Red 2013]. Pb is autosexing breed created by professor Laura Kaufman in the years 1946–1954 in the Department of Breeding Biology of the Institute of Animal Breeding in Pulawy. The main target in the breeding of Pb was sex determination shortly after hatching [Kaufman 1963, Gryzińska and Niespodziewański 2009]. Meat (MTQ) and egg types (LTQ) of quails were reared as model animals for molecular genetic researchers. All these birds are maintained at the Laura Kaufman Didactic and Research Station of Small Animals belonging to the University of Life Sciences in Lublin (Poland).

720 fresh hatching eggs for each hen breeds (GP and Pb) and quail breeds (MTQ and LTQ), namely, 360 eggs per each breed were randomly divided in 3 groups before incubation, 120 eggs per experimental group, 4 replication groups in each, with average egg weight 44.71, 46.36, 9.76 and 10.18 g for GP, Pb hens, MTQ and LTQ quails respectively. Before being placed in the incubator, 1st group was not disinfected (NC), 2nd group was disinfected by fumigation with formaldehyde gas (F), 3th group were disinfected by exposure to UV. UV disinfection chamber (UV – disinfection system) has a wavelength of 262 nm with intensity of approximately 10 $mW \cdot cm^{-2}$ was used. The chamber was designed with 1 side for 1 tray as close as possible to the eggs and the exposure time for one egg was 30 minutes.

The eggs were hatched artificially using a BIOS hatching apparatus. Standard conditions of incubation were maintained, the temperature was 37.6–38.0°C with 50–65% relative humidity in the setting compartment, and 37.0–37.5°C with 75–80% relative humidity in the hatching compartment. The eggs were turned 8 times a day during the incubation period. On the 6th and 18th days of incubation (for hen eggs) and on 14th of incubation (for quail eggs) were candled to determine the number of infertile eggs, dead embryos during 1st and 2nd embryonic development 1–14, 15–17.5 and 1–18, 19–21 days of incubation for quails and hens, respectively. Then eggs were moved from the setter to the hatching compartment on 18th and 14th day of incubation for hen and quail eggs respectively. Fertility, hatchability and periodical embryonic mortality parameters was calculated.

The data were analyzed with the use of statistical package SPSS 20.0PL (IBM 2011). The normality of data was verified using Kolmogorov-Smirnov test. The

one-way ANOVA with Duncan's post-hoc test was carried out as well as non-parametrical χ^2 test.

RESULTS

The eggs fertility (%) for GP and Pb breeds was highly significant ($P \leq 0.01$) and influenced by different treatments, depending on the group and UV treatment. High value of these traits (92.06 and 94.44%) for GP and Pb respectively (Table 1) were reordered but the egg fertility in meat and lying type quails was not influenced by the treatment. Also, in hatchability and total mortality of fertile and set eggs did not differ significantly under the effect of different treatments for all groups of birds. MTQ strain had highly significant increment ($P \leq 0.01$) under UV treatment effect in 1st periodical mortality of fertile and set eggs (1–15 days) which registered the high value (21.69 and 14.65%) compared with NC (1.60 and 1.33%) and F (5.48 and 3.66%) respectively, however, in 2nd periodical mortality of fertile and set eggs (15–17.5 days) MTQ strain started to be less significantly influenced ($P \leq 0.05$) depending on the group under UV effect which achieved a lower value (3.52 and 3.07%) compared with NC (17.49 and 11.83%) and F (16.29 and 11.19 %) respectively. With respect to GP, Pb and LTQ, in the 1st and 2nd periodical mortality of fertile and set eggs was not significantly influenced by different treatments.

In Fig. 1 and Fig. 2 generally showed the effect of different treatment (NC, F and UV) on hatchability and total mortality of fertile and set eggs for hen breeds (GP and Pb) and quail strain (MTQ and LTQ), there was lack of significant differences among all experimental treatments considerably depending on a group with respect to these traits.

The obtained findings in Fig. 3 and Fig. 4 confirmed that quail breeds had significantly bigger number ($P \leq 0.01$) of dead embryos, which was stated in a group disinfected with UV (10.0 and 9.0%) during 1st periodical mortality of fertile and set eggs respectively depended on the group. Anyway, the number of dead embryos in quail breeds in 2nd periodical mortality of fertile and set eggs was not significantly influenced by all experimental treatments. Generally, in hen breeds, there was not any significant differences depending on group between all treatments with respect to the number of dead embryo during 1st and 2nd periodical mortality of fertile and set eggs.

DISCUSSION

The high increment in meat type quail strain with respect to first period of mortality in this study can be likely attributed to the eggs size genetics between

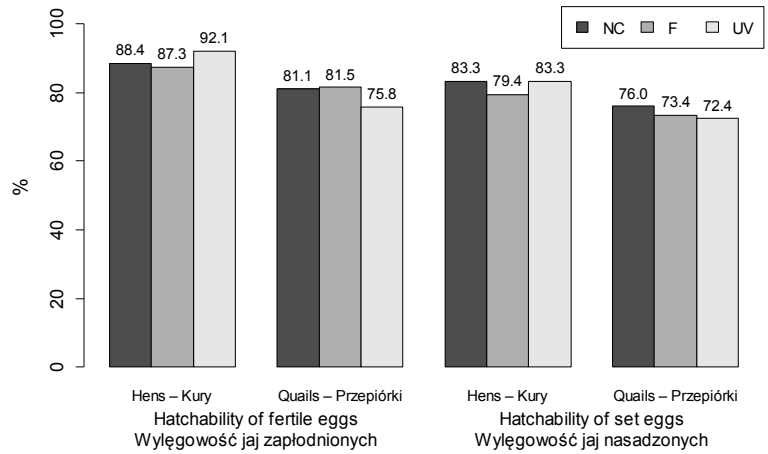

Fig. 1. Hatchability of eggs in particular experimental groups by species

Rys. 1. Wylęgowość jaj w poszczególnych grupach doświadczalnych w zależności od gatunku ptaków

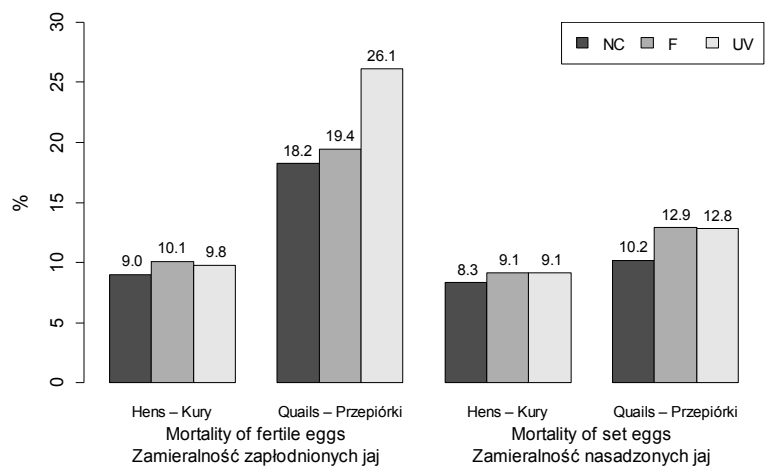

Fig. 2. Total mortality of embryos in particular experimental groups by species

Rys. 2. Śmiertelność zarodków w poszczególnych grupach doświadczalnych w zależności od gatunku ptaków

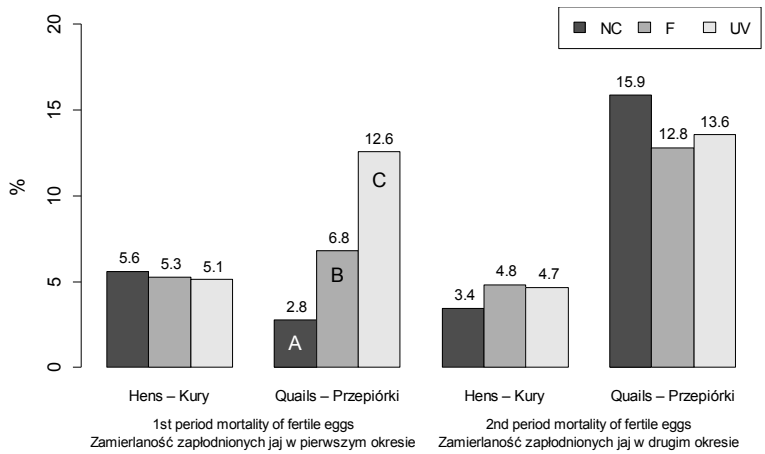

Fig. 3. Periodical mortality of embryos in relation to fertile eggs in particular experimental groups by species; A, B, C – mean values differ at $P \leq 0.01$.

Rys. 3. Okresowa zamieralność zarodków w jajach zapłodnionych poszczególnych grupach doświadczalnych w zależności od gatunku ptaków; A, B, C – średnie różnią się istotnie przy $P \leq 0.01$.

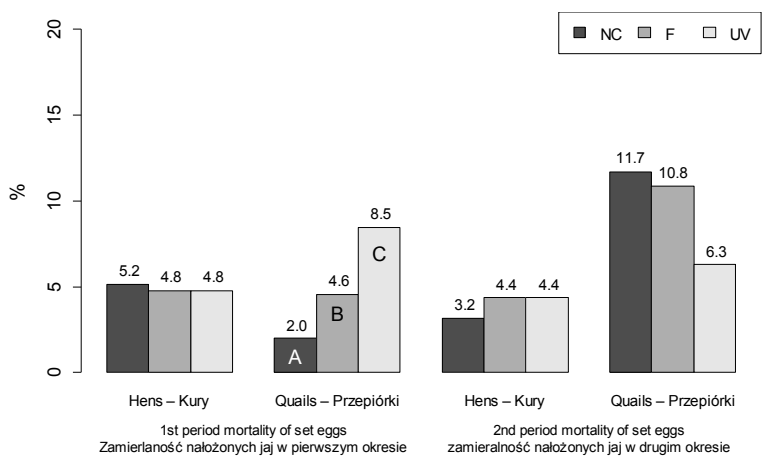

Fig. 4. Periodical mortality of embryos in relation to set eggs in particular experimental groups by species; A, B, C – mean values differ at $P \leq 0.01$.

Rys. 4. Okresowa zamieralność zarodków w jajach nałożonych w poszczególnych grupach doświadczalnych w zależności od gatunku ptaków; A, B, C – średnie różnią się istotnie przy $P \leq 0{,}01$.

the two types of birds (quails and hens). In this frame, Bayliss and Waites [1982] and Wells et al. [2011] stated that hen eggs with higher initial microbial load and likely greater amounts of organic material would easily react with the H_2O_2 or UV as egg sanitizers and reduce embryonic mortality. The same situation in fertility of GP and Pb.

Table 1. Hatching parameters of eggs from different experimental groups, %

Tabela 1. Parametry wylęgowości w poszczególnych grupach doświadczalnych, %

Parameter Parametr	Breed Rasa		Experimental group Grupa doświadczalna			χ^2 (p-value)
			NC	F	UV	
Eggs fertility Zapłodnione jaja	hens kury	GP Pb	91.27 92.86	90.48 90.48	92.06 94.44	0.000 0.000
	quails przepiórki	MTQ LTQ	83.79 88.59	83.80 88.89	84.68 85.53	0.979 0.958
Hatchability of fertile eggs Wylęgowość zapłodnionych jaj	hens kury	GP Pb	90.24 86.55	88.60 86.09	88.60 95.61	0.896 0.958
	quails przepiórki	MTQ LTQ	80.91 81.20	78.23 84.85	74.79 76.88	0.991 0.749
Hatchability of set eggs Wylęgowość nastawionych jaj	hens kury	GP Pb	84.92 81.75	80.16 78.57	80.16 86.51	0.759 0.875
	quails przepiórki	MTQ LTQ	77.62 74.38	73.94 72.93	70.95 73.77	0.999 0.968
Total mortality of fertile eggs Ogółem zamieralność zapłodnionych jaj	hens kury	GP Pb	6.96 11.11	7.02 13.16	11.21 8.40	0.395 0.575
	quails przepiórki	MTQ LTQ	19.09 17.38	21.77 17.07	25.21 26.98	0.661 0.084
Total mortality of set eggs Ogółem zamieralność nastawionych jaj	hens kury	GP Pb	6.35 10.32	6.35 11.90	10.32 7.94	0.184 0.634
	quails przepiórki	MTQ LTQ	6.17 14.21	9.86 15.26	13.90 11.76	0.615 0.150
1st periodical mortality of fertile eggs Zamieralność zapłodnionych jaj w pierwszym okresie	hens kury	GP Pb	5.22 5.98	1.75 8.77	6.90 3.36	0.395 0.262
	quails przepiórki	MTQ LTQ	1.60 3.93	5.48 8.09	21.69 3.41	0.000 0.445
2nd periodical mortality of fertile eggs Zamieralność zapłodnionych jaj w drugim okresie	hens kury	GP Pb	1.74 5.13	5.26 4.39	4.31 5.04	0.110 0.963
	quails przepiórki	MTQ LTQ	17.49 14.22	16.29 9.32	3.52 23.58	0.022 0.098
1st periodical mortality of set eggs Zamieralność nastawionych jaj w pierwszym okresie	hens kury	GP Pb	4.76 5.56	1.59 7.94	6.35 3.17	0.440 0.296
	quails przepiórki	MTQ LTQ	1.33 2.67	3.66 5.46	14.65 2.28	0.000 0.479
2nd periodical mortality of set eggs Zamieralność nastawionych jaj w drugim okresie	hens kury	GP Pb	1.59 4.76	4.76 3.97	3.97 4.76	0.120 0.945
	quails przepiórki	MTQ LTQ	11.83 11.54	11.19 10.50	3.07 9.48	0.025 0.168

Generally, the data from this experiment demonstrated that UV treatment did not significantly affect the hatchability and mortality parameters but at the same

time, did not have any negative effectiveness on these traits. The hatchability of eggs is strictly and directly correlated with microbial load (bacteria, molds and yeasts) on eggshell [Cox et al. 2000]. Perhaps as a result of this situation, the effectiveness of UV light to increase hatchability depends on such factors as sufficient UV exposure to achieve maximum killing of microbes on eggshell [Lewis and Gous 2009], UV intensity and strain of microorganisms Koutchma et al. [2009] or the effectiveness of UV did not effectively change hatchability, what could attributed to the inability of the UV light to penetrate all areas where the microbes are situated [Goerzen and Scott 1995] or incompatibility of UV with temperature of incubator after egg exposure. These results are in accordance with other researchers who did not get any negative effects on egg hatchability with reduction contamination of egg when exposed to UV. Bailey et al. [1996] stated that UV application (254 nm, 146 mW $\cdot$ s^{-1}) to disinfect hen eggs through the last 3 d of incubation did not change hatchability. Also, exposure of broiler breeder eggshells to continuous UV (254 nm) during 21d of incubation have shown no effect on hatchability [Berrang et al. 1995]. In line with this presumption, Coufal et al. [2003] did not find any deleterious effect of hatchability of eggs disinfected by UV light (254 nm, 14 mW $\cdot$ cm^{-2}) for a period of 3 or 4 minutes. Recently, Wells et al. [2011] proved that not improvement in hatchability of egg disinfected with 1.5% H_2O_2 followed by UV irradiation (11 mW $\cdot$ cm^{-2}) for 8 min. during egg storage and prior to set. Moreover, Scott [1993] treated hatching eggs with a commercial sanitizer, 1% formalin, or water and then incubated in an incubator equipped with a UV light/air filtering system and there was an increase in embryonic viability.

Although, there was not any significant improvement in hatchability of egg sanitized by UV, it could be important to use UV as a disinfectant tool for hatching eggs rather than formalin, which has a potentially carcinogenic compound [Hayretda and Kolankaya 2008], irritation to eyes and nose with lingering noxious odour [Debes and Basyony 2011]. Additionally, it was shown that eggs treated with formaldehyde during embryonic development have an increased respiratory risks of hatched chicks [Nighot et al. 2002] and resulted in a reduction in hatchability [Sander et al. 1995]. Broadly, it is necessary to highlight that formaldehyde is toxic, not only to birds but also to farm workers or hatchery personnel [Sheldon and Brake 1990, Hayretda and Kolankaya 2008].

CONCLUSIONS

UV was used in this experiment as a hatching egg sanitizer. It did not show adverse effects on embryo viability or egg hatchability, thus it may be used as a professional strategy as an active, economical and precautionary method of egg-

shell disinfection in management programs in poultry hatcheries as substitute for egg evaporation by formalin without reduction in hatchability.

REFERENCES

Bailey, J.S., Buhr, R., Cox, N.A., Berrang, M.E. (1996). Effect of hatching cabinet sanitation treatments on *Salmonella* cross-contamination and hatchability of broiler eggs. Poultry Sci., 75, 191–196.

Bayliss, C., Waites, W.M. (1982). Effect of simultaneous high intensity ultraviolet irradiation and hydrogen peroxide on bacterial spores. Int. J. Food Sci. Technol., 17, 467–470.

Berrang, M., Cox, N.A., Bailey, J.S. (1995). Efficacy of ultraviolet light for elimination of *Salmonella* on broiler hatching eggs. J. Appl. Poult. Res., 4, 422–429.

Cadirci, S. (2009). Disinfection of hatching eggs by formaldehyde fumigation – a review. Arch. Geflugelk., 73(2), 116–123.

Chousalkar, K.K., Flynn, P., Sutherland, M., Roberts, J.R., Cheetham, B.F. (2010). Recovery of *Salmonella* and *Escherichia coli* from commercial egg shells and effect of translucency on bacterial penetration in eggs. Int. J. Food Microbiol., 142, 207–213.

Coufal, C.D., Chavez, C., Knape, K.D., Carey, J.B. (2003). Evaluation of a method of ultraviolet light sanitation of broiler hatching eggs. Poultry Sci., 82, 754–759.

Cox, N., Berrang, M.E., Cason, J.A. (2000). *Salmonella* penetration of egg shells and proliferation in broiler hatching eggs: A review. Poult. Sci., 79, 1571–1574.

Debes, A., Basyony, M. (2011). The use of oregano (*Origanum vulgare* L) and ginger (*Zingiber officinale*) oils as alternative hatching eggs disinfectant versus formaldehyde fumigation in leghorn and matrouh eggs. Egypt. Poult. Sci. J., 31(4), 755–765.

Gao, G., Stewart, L.E., Joseph, S.W., Carr, L.E. (1997). Effectiveness of ultraviolet light irradiation in reducing the numbers of *Salmonella* on eggs and egg belt conveyor materials. J. Res. Applicat. Agric. Engine., 13, 355–359.

Goerzen, P.R., Scott, T.A. (1995). Ultraviolet light sanitation for broiler hatching eggs. Poult. Sci., 74 (Suppl.), 83(Abstract).

Gryzińska, M., Niespodziewański, M. (2009). Jak powstała autoseksingowa rasa kur polbar (Pb) [History of the autosexing breed of Polbar (Pb) hens]. Wiad. Zootech., 260, 31–35 [in Polish].

Hayretda, S., Kolankaya, D. (2008). Investigation of the effects of pre-incubation formaldehyde fumigation on the tracheal epithelium of chicken embryos and chicks. Turkish J. Vet. Res. Anim. Sci., 32, 263–267.

IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.

ISO 21348-2007. Space environment (natural and artificial) – process for determining solar irradiances, ISO copyright office , Switzerland.

Kaufman, L. (1963). Polbar – nowa rasa drobiu [Polbar – a new autosexing breed]. Rocz. Nauk. Rol., 82, 361–372 [in Polish].

Koutchma, T.N., Forney, L.J., Moraru, C.I. (2009). Ultraviolet light in food technology: principles and applications. Microbial inactivation by UV light CRC Press. Baton Rouge, FL, 72–73.

Krawczyk, J., Cywa-Benko, K., Wężyk, S., (2005). Effect of housing system on egg yolk cholesterol levels in native breeds of hens [In:] Proceedings of International Conference "First International Scientific Poultry Days", Nitra, Slovakia, 12–14 Sept. 2005, 18–20.

Kuo, F.L., Ricke, S.C., Carey, J.B. (1997). Shell egg sanitation: UV radiation and egg rotation to effectively reduce populations of aerobes, yeasts, and molds. J. Food Prot., 60, 694–697.

Lewis, P.D., Gous, R.M. (2009). Responses of poultry to ultraviolet radiation. World's Poult. Sci. J., 65, 499–510.

Nighot, P. K., Kolte, G. N., Ghalsasi, G. R. (2002). Physiopathology of avian respiratory diseases. Poult. Int., 41(9), 24–29.

Rossi, G. (2013). Genetic characterization and population structure of local Polish and Italian chickens breeds. MSc thesis. Department Of Agronomy, Animals, Foods, Natural Resources And Environment. University of Padua, Italy.

Reu, K., De, Grijspeerdt, K., Herman, L., Heyndrickx, M., Uyttendaele, M., Debevere, J., Putirulan, F.F., Bolder, N.M. (2006). The effect of a commercial UV disinfection system on the bacterial load of shell eggs. Letters Appl. Microbiol., 42, 144–148.

Reu, K., De. (2006). Bacteriological contamination and infection of shell eggs in the production chain. Ph.D. Thesis, University of Ghent, The Netherlands.

Reu, K., De, Messens, W., Heyndrick M., Rodenburg, T.B., Uyttendaele, M., Herman, L. (2008). Bacterial contamination of table eggs and the influence of housing systems. World's Poult. Sci. J., 64, 5–19.

Sander, J.E., Wilson, J.L., Van Wicklen, G.L. (1995). Effect of formaldehyde exposure in the hatcher and of ventilation in confinement facilities on broiler performance. Avian Dis., 39, 420–424.

Scherf, B.D. (ed.) (2000). World Watch List for Domestic Animal Diversity (3rd edition). Rome, Italy: FAO.

Scott, T. (1993). The effect of ultraviolet light and air filtering system on embryo viability and microorganism load on the egg shell. J. Appl. Poult. Res., 2, 19–25.

Sheldon, B.W., Brake, J. (1990). Method for sanitizing and improving the hatchability of hatchery eggs. US Pat No. 4.932.359.

Turblin, V. (2011). Good quality chicks from disinfected eggs. World Poult., 27, 1–3.

Turtoi, M., Borda, D. (2014). Decontamination of egg shells using ultraviolet light treatment. World's Poult. Sci. J., 70, 265–278.

Wells, J.B., Coufal, C.D., Parker, H.M, Kiess, A.S., Young, K.M., McDaniel, C.D. (2011). Hatchablility of broiler breeder eggs sanitized with a combination of ultraviolet light and hydrogen peroxide. Int. J. Poult. Sci., 10(4), 320–324.

Williams, J.E. (1970). Effect of high-level formaldehyde fumigation on bacterial populations on the surface of chicken hatching eggs. Avian Dis., 14, 386–392.

OCENA EFEKTU ZASTOSOWANIA DEZYNFEKCJI PROMIENIAMI UV NA WYLĘGOWOŚĆ JAJ KURZYCH I PRZEPIÓRCZYCH

Streszczenie. Celem pracy była ocena skuteczności promieniowania ultrafioletowego (UV) (262 nm, 10 mW · cm^{-2}) stosowanego do dezynfekcji jaj wylęgowych dwóch ras kur: zielononóżki kuropatwianej (GP) i Polbara (Pb) oraz dwóch typów użytkowych przepiórki japońskiej: mięsny (MTQ) i nieśny (LTQ). Oceniano procent zapłodnienia, wylęgowość oraz całkowitą i okresową zamieralność embrionów. Łącznie nałożono 720 jaj wylęgowych dla grup ptaków (GP, Pb, MTQ i LTQ). W obrębie każdego genotypu jaja podzielono losowo na 3 podgrupy. Grupa pierwsza stanowiła kontrolę negatywną (NC), nie dezynfekowaną, grupę drugą dezynfekowano tradycyjnie parami formaliny (F), jaja z grupy trzeciej poddano działaniu lampy promieniowania UV przez 30 minut (UV). Następnie jaja wylęgano sztucznie w aparacie wylęgowym BIOS z zachowaniem standardowych warunków inkubacji. Wyniki wykazały, że jaja dezynfekowane UV nie różnią się znacznie pod względem wylęgowości i ogólnej śmiertelności zarodków w stosunku do grup NC i F, zarówno wśród kur jak i przepiórek. Śmiertelność zarodków zarówno w I, jak i w II okresie inkubacji również była zbliżona dla jaj od GP, Pb and LTQ, aczkolwiek śmiertelność embrionów przepiórczych (niezależnie od typu) w I okresie pozostawała pod istotnym ($P \leq 0{,}01$) wpływem czynnika doświadczalnego (UV). W drugim okresie inkubacji znacznie niższą zamieralność zarodków odnotowano u LTQ ($P \leq 0{,}05$). Zgodnie z uzyskanymi wynikami wykorzystanie promieniowania UV do dezynfekcji jaj wylęgowych może być równie efektywne jak tradycyjnie wykorzystywana formalina nie wywierając jednocześnie negatywnego wpływu na wylęgowość i rozwój zarodkowy ptaków.

Słowa kluczowe: kury, przepiórki, wylęgowość, dezynfekcja, UV

Accepted for print: 10.04.2015

For citation: Al-Shammari, K.I.A., Batkowska, J., Gryzińska, M.M. (2015). Assessment of ultraviolet light effect in hatching eggs disinfection on hatchability traits of two breeds of quails and chickens. Acta Sci. Pol. Zootechnica, 14(2), 33–44.