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THE INFLUENCE OF DIFFERENT BREEDING UNITS AND BREEDING SYSTEMS ON REPRODUCTIVE RESULTS OF COCKATIELS (*NYMPHICUS HOLLANDICUS*)

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Abstract. The aim of this study was to evaluate the influence of breeding units and two housing systems on the reproductive effects of cockatiels (*Nymphicus hollandicus*). The study was taken in an amateur breeding in the Masovian voivodeship in 2013. The material of the study was 10 pairs of cockatiels (*Nymphicus hollandicus*), half of which was bred in an aviary gregarious system, the rest of the birds was kept indoor in individual cages in pairs. The analysis of the breeding work is based on indicators: the number of eggs, the number of chicks reared and demises of birds in the two systems of breeding. The observed pairs of cockatiels characterized good reproductive indicators. However, the significant differences were found between the systems of rearing. All pairs had 2 clutches per year, but at the end of the breeding season the birds kept in the aviary reared a total number of 44 chicks. In comparison, the birds kept in individual cages reared only 22 chicks.

Key words: cockatiel (*Nymphicus hollandicus*), reproductive rates, breeding systems

INTRODUCTION

Cockatiel (*Nymphicus hollandicus*), after budgerigar, is the most common species of parrots kept in amateur breedings [Grabowski 2002, Gardner 2011]. The

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place of cockatiel's origin is Australia, the vast savannah hardly covered with trees [Blakers et al. 1984, Kruszewicz 2003]. As birds living in dry, open spaces, the main feed of cockatiels contains seeds of grass and weeds, but they also like the green forage, fruit, vegetables and even small insects, especially during the breeding season [Forshaw 1992, Gardner 2011]. In their homeland it is common to see cockatiels in large flocks, constantly migrating in search of food and water [Forshaw and Cooper 1981, Kruszewicz 2005]. Both food and water birds often find in farmlands, that is why they are considered pests and massively eradicated by farmers in many parts of Australia [Grabowski 2002]. Many species of parrots are still at risk of extinction because of poaching and the loss or destruction of their natural habitats. Therefore, it is crucial to breed those species in captivity. This way ensures the genetic provision and the possibility of restitution their population by complementing their natural habitat with birds from private breedings [Neuman et al. 2013]. Cockatiels (*Nymphicus hollandicus*) were first identified in 1700 [Gardner 2011]. The first wild cockatiels were brought to Europe and then to France in 1840. Since then they have been exported to all parts of the world [Gardner 2011] and the breeding success was recorded in 1858. For a long time the birds defied the breeding degradation, as the first albino birds appeared in 1951 [Moll 1996]. There is a belief among breeders, that cockatiels should be reproduced in pairs. The adoption of this method of breeding is important in creating pure breeding lines and fixing new color mutations. From the biological point of view of the species there are either parrots living only in pairs or those living in flocks, including the breeding period. Therefore, the aim of this study was to evaluate the influence of breeding units and two housing systems on the reproductive effects of cockatiels (*Nymphicus hollandicus*).

MATERIAL AND METHODS

The study was taken in an amateur breeding in the Masovian voivodeship in 2013. The material of the study was 10 pairs of cockatiels (*Nymphicus hollandicus*), half of which was bred in an aviary gregarious system (Phot. 1) with dimensions $3 \times 3 \times 2$ m (length $\times$ width $\times$ height), the rest of the birds was kept indoor in individual cages in pairs (Phot. 2) with dimensions $1.2 \times 0.8 \times 0.8$ m.

All pairs had two clutches in the considered period. The diet of birds contained mainly grass seeds – millet (yellow and red), canary seed, wheat, oat, corn, sunflower seeds, flax and hemp. Every two days the birds were given fresh fruit (apples), vegetables (carrots) and fruit trees twigs, birch and willow. In addition, during the breeding season their diet was enriched with egg mixture and cuttlefish. The cockatiels had constant access to fresh water. The breeding room provided the same fittings to both groups of parrots – poles, feeders and nesting boxes

Phot. 1. The cockatiels in an aviary gregarious system

Fot. 1. Nimfy w systemie wolierowym

Phot. 2. The cockatiel in individual cages

Fot. 2. Nimfy w klatkach

with dimensions 25 × 25 × 35 cm (one in every breeding cage), while the aviary provided twice as many nesting boxes as pairs in order to reduce the aggression of birds during settling. The analysis of the breeding work is based on indicators: the number of eggs, the number of chicks reared and demises of birds in the two systems of breeding. Statistical differences between the samples were measured using Fisher's Exact Test.

RESULTS

The cockatiels kept in an external aviary system started the first clutch at the beginning of May, while the first eggs of pairs placed in individual cages were observed in the last week of May. Females settling the aviary gave respectively: four females 5 eggs each, one female 7 eggs, whereas each of the caged females laid 4 eggs (Fig. 1). The offspring from the first breeding developed very well in both areas, most of them were healthy and strong. There was only one case of demise (the chick in the booth was pulped). After leaving the boxes in the aviary, there were no more demises, all the chicks were big and strong. However, after leaving nests by the caged chicks, they were harassed by their parents and siblings, resulting in mutilation and, in consequence, death of 8 of 20 hatched chicks. The reason for this could be too high density of birds in cages.

The second clutch was started in the 2nd week of September by all pairs of cockatiels. Those kept in the aviary had 6 eggs in each nest. The caged ones, in contrast: three females 5 eggs each, and two had 4 eggs each (Fig. 2). Like the previous time, all the chicks in booths grew normally, without any complications. It was until the time of leaving the booths in the aviary – the rapid deterioration of their condition was observed, some chicks were listless and apathetic, they neither received food unassisted, nor from adult birds feeding them. After a few days after leaving the nests to the aviary 12 of the chicks died. Putative reason for this was the fact that the period of leaving nests coincided with a period of bad weather, autumn (fall of the temperature, rain and strong wind). While leaving the nests by caged chicks, likewise, there were some complications, but in this case once again harassing chicks by older siblings and adults was the problem. This resulted in the death of 13 of the 23 chicks that left the booths in the first 2 weeks.

DISCUSSION

Cockatiels (*Nymphicus hollandicus*), as a monogamous species with long-term pairing, have specific relationships in pairs [Brereton 1963, Myers et al. 1988, Yamamoto et al. 1989, Stone et al. 1999, Spoon et al. 2004, Spoon et al. 2007]. To maximize an individual's reproductive success, switching better conspecific mates may be a benefit [Ens et al. 1993]. Those species with long–term monogamy may find a new partner just to increase reproductive prospects [Fowler 1995]. Despite the monogamy of these birds, some authors assume that some of the cockatiels sometimes abandon their partner, especially when the higher–quality mate finding is possible [Ramsay et al. 2000, Streif and Race 2001]. The research of some authors suggest that interactions between mates were characterized by lower level of aggression, closer proximity, greater behavioral synchrony

and greater sexual behavior [Spoon et al. 2004]. The authors' research also noted some better reproduction indicators in couples of birds linked on the principle of free choice, than in couples paired by breeders [Yamamoto et al. 1989]. This is consistent with the observation in this study, perhaps because the conditions in the aviaries were more similar to natural ones, provided more space and limited human interference. This resulted in twice as many offspring in aviary as birds kept in cages. This is also confirmed by the observations of other researchers, that the problem of birds bred in captivity is often mixing and matching pairs by breeders, let alone limited opportunity of a courtship and mating behavior as the natural expression, that can lead to fewer fertilized eggs and fewer chicks reared in the clutch [Neuman et al. 2013]. There are studies attempting insemination in order to increase the efficiency of fertilization [Brock 1991, Samour 2002, Neumann et al. 2013]. In studies of Neumann et al. [2013] with the use of artificial insemination techniques on cockatiels (*Nymphicus hollandicus*) it was shown that artificial insemination resulted in fertilization of 17 of 23 (73.9%) eggs. Furthermore, the amount of eggs per pair was slightly lower when compared to the insemination of females that have had no contact with the man performing the procedure [Neumann et al. 2013].

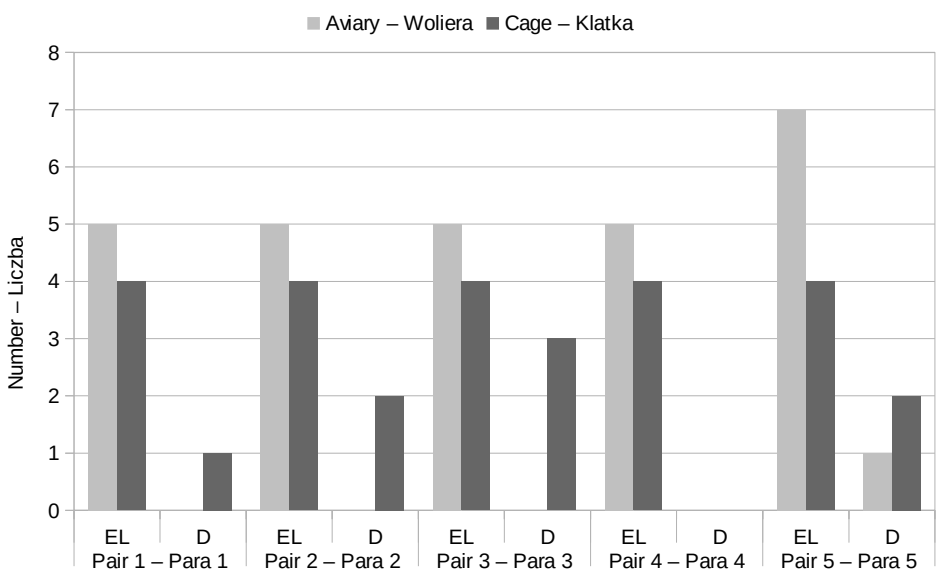

Fig. 1. Breeding results of the cockatiel pairs in the first clutch; EL – Eggs laid, D – Deaths

Rys. 1. Wskaźniki reprodukcyjne par nimf w pierwszym lęgu; EL – jaja zniesione, D – upadki

Generally, cockatiels have gentle disposition, but in situations when there are several males in one cage, the expression of a dominant male aggression towards the others may occur [Gardner 2011], what also affects the reproductive results of birds kept in aviary system. Such behavior was not observed during this study. Our observation indicates that the birds kept in cages showed aggression in relation to their chicks, and the chicks also competed with each other, resulting in the greater number of demises. The situation when young and inexperienced parents leave their nests and refuse feeding chicks may also happen sometimes [Gardner 2011]. In this case, it is good to plant chicks to other young pair of birds having same-aged chicks, but this method rarely brings good results.

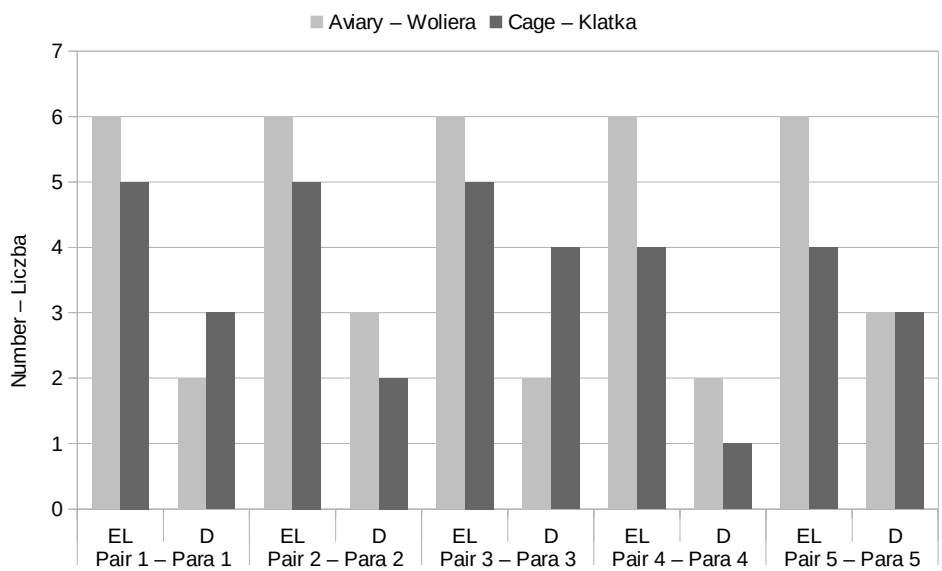

Fig. 2. Breeding results of the cockatiel pairs in the second clutch; EL – Eggs laid, D – Deaths

Rys. 2. Wskaźniki reprodukcyjne par nimf w drugim lęgu; EL – jaja zniesione, D – upadki

Cockatiels live in captivity approximately 15–20 years, males mature earlier, at the age of about 12 months, and the females at the age of about 18 months [Gardner 2011]. Females lay eggs about a week after mating, usually in amount of 4–8 eggs, twice a year. The incubation period is 21 days [Gardner 2011]. Cockatiels usually nest in cavities, both sexes incubate eggs and feed chicks [Spoon 2006]. It has been proved that pairs with a high level of compatibility mate have larger clutches, show greater coordination of incubation duties, a greater propor-

tion between hatched and fertilized eggs and rear more chicks than the pairs with lower behavioral compatibility [Spoon et al. 2006]. It was also shown that the mating behavior of budgerigar males has the impact on reproductive rates because it was observed, that males spending more time in the nest during incubation period have better results in breeding indicators [Baltz 1994]. Some authors suggest that reproductive activity of parrots is dependent on the sexual stimulation evoked by various environmental factors [Yamamoto et al. 1989]. Some research also shows that the reproductive success depends on the age of the birds [Curio 1983]. It was found that older birds have better reproductive rates than the younger ones [Coulson and Horobin 1976, Dunnet and Ollason 1978]. As to the older females, it is possible to reach worse reproductive rates because a follicular ageing comes with age. Besides, a few years of intensive breeding may lead to a decline of older birds laying ability [Saino et al. 2002, Holmes et al. 2003]. The research of Banaszewska et al. [2014] showed that, with age, female budgerigars laid less eggs. However, some individual variation was observed among females. Breeding success in older birds can be attributed to many factors, including greater experience of the breeder or greater survival of birds [Ryder in 1980, Harvey et al. 1985, Not and Smith 1987].

CONCLUSIONS

The observed pairs of cockatiels characterized good reproductive indicators. However, the significant differences were found between the systems of rearing. All pairs had 2 clutches per year, but at the end of the breeding season the birds kept in the aviary reared a total number of 44 chicks. In comparison, the birds kept in individual cages reared only 22 chicks. The results of the present study establish a basis for further observations of reproduction factors and incubation behavior of the cockatiels (*Nymphicus hollandicus*) and can be used as a comparison of this kind of studies carried out in nature.

REFERENCES

Baltz, A.P. (1994). Social influences on reproductive decision-making in budgerigars (*Melopsittacus undulatus*). Ph.D. dissertation, Binghamton University, Binghamton, New York.

Banaszewska, D., Biesiada-Drzazga, B., Ostrowski, D., Andraszek, K., Wereszczyńska, A. (2014). Assessment of Budgerigar (*Melopsittacus undulatus*) hatching in private breeding. Acta Sci. Pol. Zootechnica, 13(3), 29–36.

Blakers, M., Davies, S.J.J.F., Reilly, P.N. (1984). The atlas of Australian birds. Carlton. Australia. Melbourne Univ. Press.

Brereton, C.K. (1963). The life cycles of three Australian parrots: some comparative and population aspects. Living Bird., 2, 21–29.

Brock, M. (1991). Semen collection and artificial insemination in the Hispaniolan parrot (*Amazona ventralis*). J. Zoo. Wildlife Med., 22(1), 107–114.

Coulson, J.C., Horobin, J. (1976). The influence of age on the breeding biology and the survival of the Arctic Tern, *Sterna paradisaea*. J. Zool. London, 178, 247–260.

Curio, E. (1983). Why do young birds reproduce less well? Ibis, 125, 400–404.

Dunnet, G.M., Ollason, J.C. (1978). The estimation of survival rates in the Fulmar, *Fulmaris glacialis*. J. Anim. Ecol., 47, 507–520.

Ens, B.J., Safriel, U.N., Harris, M.P. (1993). Divorce in the long-lived and monogamous oystercatcher, *Haematopus ostralegus*: incompatibility or choosing the better option? Anim. Behav., 45, 1199–1217.

Forshaw, J.M., Cooper, W.T. (1981). Australian Parrots, 2nd edn. Lansdowne Editions, Melbourne.

Forshaw, J. (1992). Papugi, Encyklopedia – Zwierzęta [Parrots, Encyclopedia – Animals]. Wydawnictwo ELIPSA Warszawa, 338–344 [in Polish].

Fowler, G.S. (1995). Stages of age–related reproductive success in birds: simultaneous effects of age, pair-bond duration and reproductive experience. Am. Zool., 35, 318––328.

Gardner, C. (2011). Protocols for the hand-raising and care of cockatiels (*Nymphicus hollandicus*). Rehabber's Den.

Grabowski, T. (2002). Nimfy [Cockatiels]. Agencja Wydawnictwo Egros [in Polish].

Harvey, P.H., Stenning, M.J., Campbell, B. (1985). Indywidual variation in seasonal breeding success of Pied Flycatchers (Ficedula hypoleuca). J. Anim. Ecol., 54, 391–398.

Holmes, D.J., Thomson, S.L., Wu, J., Ottinger, M.A. (2003). Reproductive aging in female birds. Exp. Gerontol., 38, 751–756.

Kruszewicz, A.G. (2003). Hodowla ptaków ozdobnych [Breeding of ornamental birds]. MULTICO Oficyna Wydawnictwo Warszawa [in Polish].

Kruszewicz, A. G. (2005). Ptaki w domu [Birds at home]. MULTICO Oficyna Wydaw. Warszawa [in Polish].

Moll, F. (1996). Nimfy [Cockatiels]. MULTICO Oficyna Wydawnictwo Warszawa [in Polish].

Myers, S.A., Millam, J.R., Roudybush, T.E., Grau, C.R. (1988). Reproductive success of hand-reared vs. parent-reared cockatiels (*Nymphicus hollandicus*). The Auk, 105, 536–542.

Neumann, D., Kaleta, E.F., Lierz, M. (2013). Semen collection and artificial insemination in cockatiels (*Nymphicus hollandicus*) – A potential model for psittacines. Tierärztl. Prax., 41 (K), 101–105.

Not, E., Smith, J.N.M. (1987). Effects of age and breeding experience on seasonal reproductive success in the Song Sparrow. J. Anim. Ecol., 56, 301–313.

Ramsay, S.M., Otter, K.A., Mennill, D.J., Ratcliffe, L.M., Boag, P.T. (2000). Divorce and extrapair mating in female black-capped chickadees (*Parus atricapillus*): separate strategies with a common target. Behav. Ecol. Sociobiol., 49, 18–23.

Ryder, J.P. (1980). The influence of age on the breeding biology of colonial nesting seabirds. Pp. 153–168 in Behaviour of marine animals: current perspectives in research, 4 (J. Burger, Ed.). New York, Plenum Press.

Saino, N., Ambrosini, R., Martinelli, R., Møller, A.P. (2002). Mate fidelity senescence in breeding performance and reproductive trade-offs in the barn swallow. J. Anim. Ecol., 71, 309–319.

Samour, J.H. (2002). The reproductive biology of the budgerigar (*Melopsittacus undulatus*): Semen preservation techniques and artificial insemination procedures. J. Avian Med. Surg., 16(1), 39–49.

Spoon, T.R., Millam, J.R., Owings, D.H. (2004). Variation in the stability of cockatiel (*Nymphicus hollandicus*) pair relationships: the roles of males, females, and mate compatibility. Behaviour, 141, 1211–1234.

Spoon, T.R. (2006). Parrot reproductive behavior, or who associates, who mates, and who cares. In: Manual of Parrot Behavior (Ed. By A. Luescher). Oxford. Blackwell, pp. 63–77.

Spoon, T.R., Millam, J.R., Owings, D.H. (2006). The importance of mate behavioural compatibility in parenting and reproductive success by cockatiels (*Nymphicus hollandicus*). Anim. Behav., 71, 315–326.

Spoon, T.R., Millam, J.R., Owings, D.H. (2007). Behavioural compatibility, extrapair copulation and mate switching in a socially monogamous parrot. Anim. Behav., 73, 815––824.

Stone, E.G., Millam, J.R., Halawani ,M.E.E., Phillips, R.E., Redig, P.T. (1999). Determinants of reproductive success in force-re-paired cockatiels (*Nymphicus hollandicus*). Anim. Behav. Sci., 63(3), 209–218.

Streif, M., Rasa, A.E. (2001). Divorce and its consequences in the common blackbird *Turdus merula*. Ibis, 143, 554–560.

Yamamoto, J.T., Shields, K.M., Millam, J.R., Roudybush, T.E., Grau, C.R. (1989). Reproductive activity of force-paired cockatiels (*Nymphicus hollandicus*). The Auk, 106, 86–93.

WPŁYW POMIESZCZEŃ HODOWLANYCH I SYSTEMU HODOWLI NA EFEKTY REPRODUKCYJNE NIMF (*NYMPHICUS HOLLANDICUS*)

Streszczenie. Celem pracy była ocena wpływu pomieszczeń hodowlanych i dwóch systemów utrzymania na efekty reprodukcyjne nimf (*Nymphicus hollandicus*). Badania przeprowadzono w amatorskiej hodowli na terenie województwa mazowieckiego w roku 2013. Obiektem badań było 10 par nimf (*Nymphicus hollandicus*), z których połowa hodowana była systemem stadnym w wolierze zewnętrznej, reszta ptaków utrzymywana była parami w pojedynczych klatkach. Przeprowadzoną w pracy analizę lęgów oparto na wskaźnikach: liczba zniesionych jaj oraz liczba odchowanych piskląt i upadków w dwóch systemach odchowu ptaków. Obserwowane pary nimf charakteryzowały się dobrymi wskaźnikami reprodukcyjnymi. Jednak stwierdzono wyraźne różnice pomiędzy systemami ich odchowu. Wszystkie pary wyprowadziły po 2 lęgi rocznie, jednak na koniec sezonu lęgowego ptaki utrzymywane w wolierze dochowały się łącznie 44 piskląt, a ptaki hodowane w pojedynczych klatkach jedynie 22 pisklęta.

Słowa kluczowe: nimfa (*Nymphicus hollandicus*), wskaźniki reprodukcyjne, system hodowli

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