

## Assessment of reproductive parameters of privately bred ring-necked parakeets (*Psittacula krameri*)

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The aim of this study was to assess the reproductive parameters of privately bred ring-necked parakeets (*Psittacula krameri*). The study was carried out in an amateur breeding facility in the Masovian voivodeship in 2013–2017. Observations were carried out on four pairs of ring-necked parakeets kept year round in outdoor aviaries. The analysis was based on the following indicators: number of eggs laid, number of chicks hatched, and number of chicks reared from two broods each year. The reproductive parameters of the pairs of ring-necked parakeets were varied. There were marked differences between individual pairs of birds concerning both the number of eggs in the clutch and the number of chicks reared. Most pairs reared two broods each year. In the first year of observation, the birds reared eight chicks from 13 laid eggs, while in the last year of data collection they reared 11 chicks from 16 eggs.

**KEY WORDS:** ring-necked parakeet (*Psittacula krameri*), reproductive parameters

The ring-necked parakeet (*Psittacula krameri*) (phot.) is one of the most popular parrots bred in captivity [21, 22]. One reason for its popularity is its striking plumage and multiple colour mutations. Furthermore, it is easy to tame and to maintain and has a long life expectancy and excellent mimicking abilities. For these reasons, this bird has long been found in homes and breeding facilities [3]. The ring-necked parakeet is a medium-sized parrot of the Psittaculidae family [2]. In natural conditions, it lives on the Indian subcontinent and Sri Lanka and in central Africa. The ring-necked parakeet is one of the most commonly introduced parrots in the world, with natural populations found in 35 countries [7, 16, 24]. It has been introduced to North America and to the Near and Far East. In Europe, the species has expanded its climate niche to colonize habitats much colder than their natural range [1]. In several European countries, including Poland, we can find colonies of these exotic birds – descendants of individuals that have escaped from breeding facilities [36]. The ring-necked parakeet is found in many types of habitats: moist secondary forests, alluvial forests, mangrove forests, areas covered with spiny shrubs, grassy savannah, and

agricultural areas with few trees, as well as parks and gardens. They easily colonize forests and parks surrounded by urban habitats [36]. They usually occupy habitats located below 2,000 m above sea level [14, 17]. They are very social birds, and especially outside the breeding season they form large, noisy flocks, sometimes numbering thousands of individuals. Usually, however, they are seen in groups of 20–30 individuals. The flocks are mainly concentrated around food sources. The flight of the birds is fast and straight with powerful wing beats [10, 11, 26]. The diet of the ring-necked parakeet consists mainly of cereals, seeds of wild grasses and trees, nuts, fruits, flowers and nectar. The birds primarily use their left foot to take food [4, 5, 18, 19, 29]. As ring-necked parakeets are very social birds, they do not show excessive territoriality during nesting. Their nesting places include natural enlarged hollows of local woodpeckers and other hole-nesting birds, high above the ground, as well as rock crevices or farm buildings. The breeding period in Africa, India and the Arabian Peninsula lasts from December to May, and in Sri Lanka from November to June. Courtship lasts a few minutes and is followed by copulation. The female usually lays 3-4 eggs (up to 6), which are incubated from 21 to 24 days. The female incubates the eggs herself from the time the first egg is laid. When the chicks hatch, both parents take care of them, but the female does so more regularly and persistently. Six to seven weeks after hatching, the young leave the nest [28, 43, 44, 45, 46, 47]. As the available literature contains little information on the breeding behaviour of the ring-necked parakeet, observations were conducted on the reproductive ethology of this species in captivity. The aim of this research was to investigate the mating behaviour and reproductive parameters of the ring-necked parakeet.



Phot. The ring-necked parakeet  
(phot. Dominik Ostrowski)

## Material and methods

The research was carried out at an amateur breeding facility in the Masovian Voivodeship in 2013-2017. The subject of the research was 4 pairs of ring-necked parakeets (*Psittacula krameri*) kept year-round in outdoor aviaries placed side by side, with dimensions of 1.5 x 3 x 2.5 m (width x length x height). All aviaries additionally contained insulated winter houses, where the birds could take shelter during severe frosts and inclement weather. Each aviary was identically equipped with feeders, water dispensers, perches and 30 x 30 x 50 cm nest boxes with an entrance 8 cm in diameter. To provide optimal conditions for breeding, each year at the beginning of December nest boxes were hung in the winter houses; the birds adapted these for their nests. The first brood period was at the end of December and beginning of January. The first eggs were laid during this time. When the young left the nest boxes at the end of April, they were taken away and resettled in separate aviaries. The second breeding period was provoked by placing the nest boxes in the aviaries again at the end of May. The first eggs of the second brood were laid in the second half of June, and the young left the boxes at the end of October. The juveniles from the second brood were transferred to an unheated indoor aviary measuring 3 x 3 x 2.5 m (width x length x height) due to variable weather conditions outdoors.

The pairs of birds were of different ages (Table 1). The diet of the birds consisted mainly of various species of millet (yellow and red), canary grass, oats, wheat, maize and sunflower. In addition, the birds received fresh fruit and vegetables (apple, carrot and beet), as well as branches of willow, birch, hawthorn, apple and cherry. During the breeding period, the diet was enriched with an egg mixture. The birds had uninterrupted access to fresh water and cuttlefish.

**Table 1**

Age of birds at the beginning of the observation (2013)

Age of bird (years)							
1		2		3		4	
♂	♀	♂	♀	♂	♀	♂	♀
2.5	4	3	3	3	3	4	5

Analysis of breeding results was based on the following parameters: number of eggs laid, number of chicks hatched, and number of chicks reared from two broods each year by each pair.

## Results and discussion

The breeding period of the ring-necked parakeets began at the end of December and beginning of January. The females laid from 1 to 6 eggs (Table 2). The first eggs were always

laid by the female from pair 4. In the first year of observation the females laid a combined 13 eggs, of which the most were obtained from the females from pairs 4 and 1, with 5 eggs each, while the female from pair 3 did not lay any eggs. Ten chicks hatched from the 13 eggs, with the highest losses observed in pair 1, with only 2 chicks hatched from 5 eggs (Table 3). Of 10 hatched chicks, the birds reared 8. The second brood proved very unsuccessful for most of the pairs in the first year of observations; only pair number 1 reared one chick. In the second year of observations, breeding was unsuccessful in the case of pair 3, which did not lay any eggs. In contrast, the female from pair 4 reared 5 strong, healthy chicks from 6 laid eggs (Table 4). The female from pair 1 laid 5 eggs, one of which was unfertilized. Ultimately this pair reared three chicks. The female from pair 2 laid 4 eggs, and all of them hatched, but one died immediately after hatching, and another when it was nearly fledged, probably suffocated by the adult birds or its siblings. Thus the birds finished the second breeding season with 2 chicks reared. The most favourable reproductive parameters were observed in the third year of observations. In three of the pairs, a total of 13 chicks hatched, all of which were reared. The most eggs were laid in the last (fifth) year of observations. However, of the 16 eggs laid, 14 chicks were hatched, and 3 of these died within a day after hatching. The most eggs and offspring were obtained from pair number 4. This was the oldest pair, and in total for the 5 years of observations the pair reared 23 chicks from 27 eggs laid. Breeding failure was noted in pair number 3, in which only 3 eggs were laid and none hatched.

The observations of ring-necked parakeets indicate that by providing suitable conditions acceptable to birds, breeding can be carried out for most of the year in amateur conditions. When the nest boxes had been placed in the aviaries, the birds carefully examined the new elements. The size of the opening of the boxes was 8 cm for each pair, but most of the birds enlarged it with their beaks while exploring the box, giving it an irregular shape. The birds left the resulting sawdust in the box as an additional nesting material (sawdust was already present in the nest boxes).

All of the birds remained in monogamous pairs without changing partners throughout the research period. During courtship, the ring-necked parakeets presented a variety of mating behaviours. The males straightened their bodies, sticking out the breast. They stamped their feet on the branches (perches) hanging in the aviaries, and the size of their pupils changed when they did this. The males also turned their heads from side to side in a figure-eight movement, and then brushed beaks with the females and fed them. The females crouched on the branches, leaned forward and opened their wings, and their pupils also changed in size. Copulation took place immediately after courtship. Courtship and copulation were repeated several times a day. Throughout the breeding season, the male ring-necked parakeets look after the females. They stay close to the nest and feed the females, allowing them to look after the nest, eggs and chicks. This behaviour was presented by the males until the young appeared in the opening of the nest boxes, i.e. just before leaving them. When the young left the nest boxes, they were fed mainly by the male.

The favourable reproductive parameters obtained in this study for ring-tailed parakeets may be linked to its very good natural ability to adapt to various environmental conditions. Studies on the behaviour of the ring-tailed parakeet and related parrot species have been conducted by many authors [8, 35, 39, 42], because ring-necked parakeets have been introduced to Europe, and at least [24, 37]. Studies even indicate that this species may be invasive [7, 16, 38, 42]. The birds most often choose older forests near urban areas, probably due to the presence of suitable nesting cavities in old-growth forests and greater availability of food, which ensures them conditions for survival and reproductive success [9, 30]. However, despite their very good capacity for evolutionary adaptation to new environments, parakeets choose to settle in the milder climate of the Mediterranean, and most of continental Europe is too cold for colonization by this species [32, 37].

According to Pithon and Dytham [27], the first researcher to observe the mating behaviour of this parrot species was Hume [15]. Observations by Hume [15] and Lamb [23] indicate that they prefer openings in trees with narrow entrances that curve into a larger breeding chamber, which probably serves as a protective barrier against predators. Bird observations in the United Kingdom show that these parakeets begin to form pairs and search for nests in autumn [12, 13]. This strategy gives them an advantage over other bird species, as they have a wider selection of breeding sites. Pithon and Dytham [27] observed that females of this species in the UK lay eggs from the beginning of March. According to observations described in the Surrey Bird Report [40], females lay 2 to 5 eggs, which is confirmed by our research. Only in the last year of observations did one of the females lay 6 eggs. According to Simwat and Sidhu [34] and Shivanarayan et al. [33], the incubation time is about 3 weeks, and the time from hatching to fledging is about 7 weeks. This was confirmed in our own research. Observations of breeding of these parakeets in natural conditions near London indicate low reproductive performance (0.25 to 1.2 chicks per nest) [27]. Perhaps this is due to mating of related birds, as inbreeding in small bird populations has been found to cause lower hatching rates [20].

**Table 2**

The number of eggs laid by the female ring-necked parakeet during 5 years of observation (I and II brood)

Number of the pair	Number of eggs laid										total
	2013		2014		2015		2016		2017		
	I	II	I	II	I	II	I	II	I	II	
1	3	2	3	2	3	2	3	2	3	2	25
2	2	1	4	–	2	2	3	1	3	1	19
3	–	–	–	–	1	–	1	–	–	1	3
4	4	1	2	4	3	2	3	2	6	–	27
Total	9	4	9	6	9	6	10	5	12	4	74

**Table 3**

Number of hatched chicks by the female ring-necked parakeet during 5 years of observation (I and II brood)

Number of the pair	Number of hatched chicks										total
	2013		2014		2015		2016		2017		
	I	II	I	II	I	II	I	II	I	II	
1	1	1	2	2	3	2	3	2	3	2	21
2	2	1	4	–	2	1	2	1	3	1	17
3	–	–	–	–	0	–	0	–	–	0	0
4	4	1	2	4	3	2	3	2	5	–	26
Total	7	3	8	6	8	5	8	5	11	3	64

**Table 4**

Number of reared chicks by pairs of the female ring-necked parakeet during 5 years of observation (I and II brood)

Number of the pair	Number of reared chicks										total
	2013		2014		2015		2016		2017		
	I	II	I	II	I	II	I	II	I	II	
1	1	1	2	1	3	2	2	2	2	2	18
2	2	0	2	–	2	1	2	1	3	0	13
3	–	–	–	–	0	–	0	–	–	0	0
4	4	0	2	3	3	2	3	2	4	–	23
Total	7	1	6	4	8	5	7	5	9	2	54

Breeding failure may also be caused by the inability of adults to defend the eggs or chicks from predators [27]. In Germany, 2.6 chicks per nest have been observed [48].

According to Low [25], ring-necked parakeets are among the easiest parakeet species to breed in an aviary system. It has also been shown that reproductive success may be linked to food availability and diet [41]. Reproductive success depends on the age of the birds as well. According to Saether [31] and Bunin et al. [6], younger birds have a tendency towards lower reproductive performance, possibly due to difficulty finding a suitable partner of the right age. In the present study, the oldest pair achieved the best reproductive parameters, in comparison to the slightly younger couples (by 1 to 1.5 years).

The observed pairs of ring-necked parakeets had varied reproductive parameters.

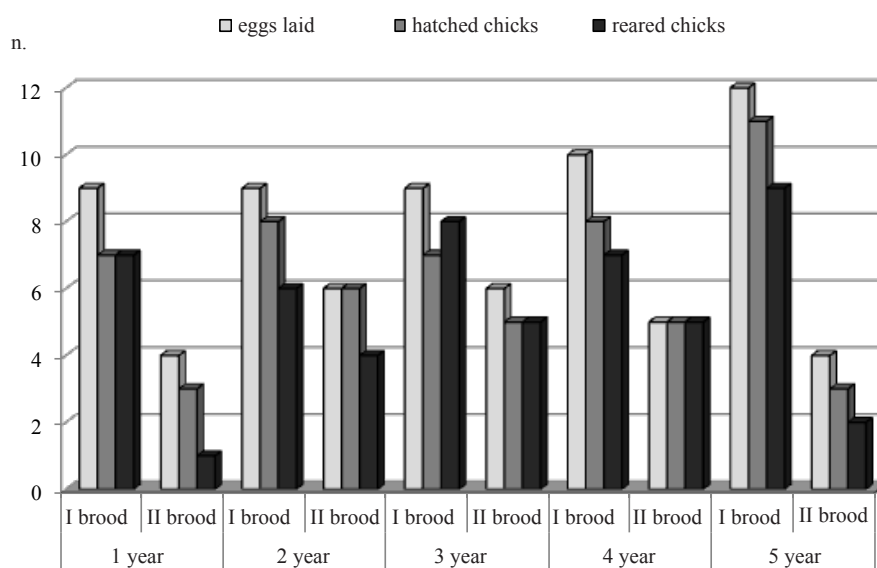


Fig. Reproductive parameters of the ring-necked parakeet during 5 years of observations

The best results were achieved by pair 4, which comprised a 4-year-old male and a 5-year-old female in the first year of observation. During the 5 years of observation, these birds laid 27 eggs, of which 26 were fertilized and from which 23 chicks were reared. The female of this pair laid at most 6 eggs in one brood and at least one egg. The worst reproductive results were presented by pair 3, composed of 3-year-old birds. During the first 2 years of observation, the female of this pair did not lay any eggs. In the following years, the female from pair 3 laid only one egg a year, but none of the eggs was fertilized and the pair did not obtain any offspring. The results of the present study may constitute the basis for further observations of the reproductive performance and incubation behaviour of the ring-necked parakeet and can be used in comparisons with this kind of study carried out in nature.

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