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BREEDING PHENOLOGY AND SUCCESS OF THE WOODPIGEON (*COLUMBA PALUMBUS*) IN CYPRUS

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ABSTRACT

Breeding phenology and success of the woodpigeon, Columba palumbus, *were studied by means of nest surveys from 1992 to 1996 in three 1-3.5-km² study areas in the district of Pafos, Cyprus. Nests (n = 135) were found in eleven different species of trees and bushes, but most often in hermes oak,* Quercus coccifera *(44%), and terebinth,* Pistacia terebinthus *(15%). Average height of tree at which the nests were found was 3.4 ± 1.76 (SD) m (range 1-10 m). 487 eggs were laid in 250 nests (95% with 2 eggs, 5% with 1 egg). The largest monthly egg production was in May (30.2%) and coincided with ripening of the vetch,* Vicia sativa. *The second egg-production peak was in July (22.9%) during the harvest time of wheat,* Triticum durum, *barley,* Hordeum vulgare, *and broad beans,* Vicia faba. *Between the beginning of April until the beginning of September there were nests with either eggs or young, with a peak in early June, indicating a breeding season beginning at the least in early April and ending mid-September. Hatching success was 48.0% (234 hatched eggs in percentage of laid eggs) and breeding success 33.1% (161 fledged young in percentage of laid eggs). There was a higher survival rate for the eggs produced in July in comparison with the other months (60.4% vs 41.5-50.0%, P < 0.01). Fledging success (fledged young in percentage of hatched eggs) was higher towards the second half of the breeding season than during the first half (73.1%-81.0% vs 55.7%-64.4%, P < 0.01). Nestlings have a much better chance of survival than eggs, and 68.8% of all hatched eggs gave rise to flying young. It is suggested that the beginning of the hunting season must be delayed by one or two weeks (end of August or early September) to improve the survival of the last clutches.*

I. INTRODUCTION

The woodpigeon, *Columba palumbus*, is a resident of Cyprus (BANNERMAN and BANNERMAN, 1958; FLINT and STEWART, 1983; KOURTELLARIDES, 1998). It is postulated to be a winter visitor by BUCKNILL (1909-1910), BANNERMANS (1958, 1971), and STEWART and CHRISTENSEN (1971), but proof

is lacking (FLINT and STEWART, 1983). According to KOURTELLARIDES (1998), in case of very cold winters in northern Europe, large numbers of woodpigeons are visiting Cyprus to spend the winter there. The concentration of large numbers of woodpigeons in some parts of the island during the winter is a regular phenomenon. However, there is no evidence that these birds are a winter influx, or birds coming from all over the island, or both. During the winter, in the absence of most agricultural crops, large numbers of woodpigeons are attracted by olive plantations or by the Pafos Forest to feed on acorns (personal observations in 1985-1999). During the summer they are dispersed, feeding in agricultural crops all over the island.

The woodpigeon ranks second as a game bird in Cyprus after the chukar partridge, *Alectoris chukar cypriotes*. During the summer, which is the closed hunting season for chukar, woodpigeon hunting takes the form of a national sport. A problem facing the Game and Fauna Service of Cyprus is the timing of the summer hunting of this bird. Some hunters claim that the woodpigeon harvest should start early in August, because by this time they migrate from some areas in Cyprus, and no birds are left to harvest. Some others believe that the early shooting causes serious damage to woodpigeons because the nesting season has not ended by the beginning of August. Therefore, hunting should be allowed as late as possible, to avoid the risk of killing the parents and leaving the nestlings to perish.

Although there are numerous studies on the breeding ecology of the woodpigeon in other countries (COLQUHOUN, 1951; MURTON, 1965; SAARI, 1975, 1979; TOMIALOJC, 1979; GALLEGO, 1981; HERKENRATH, 1989), in Cyprus there are only occasional nesting records (BANNERMAN and BANNERMAN, 1959; FLINT and STEWART, 1983). Nests with two eggs were found in late April and mid-May in woods of pine, *Pinus brutia*, olive, *Olea europea*, and alder, *Alnus orientalis* trees. Nests with young were found in late April, June and early July (FLINT and STEWART, 1983). On the contrary, BENNETT (1979) notes that «There is no evidence of breeding by this species, but in view of its presence right through the appropriate season it would seem that this should be probable in the wooded areas of, say, the Paphos (Pafos) Forest». KOURTELLARIDES (1998) noted that the nesting period begins during the first days of April and lasts until August.

Faced with the desperate need of a sound management program, this investigation was undertaken with the objective to collect data on the breeding phenology and success of woodpigeons.

II. MATERIAL AND METHODS

II.1. STUDY AREAS

The study began in the spring of 1992 in two study areas in the district of Pafos (Figure 1). The first study area was a small valley near the village of Kili, and had a surface of about one square kilometer. The second area of similar size was located in a valley with steeper sides near the village of Stroumpi. A third study area of about 3.5 km^2 located near the village of Choulou was added in 1993.

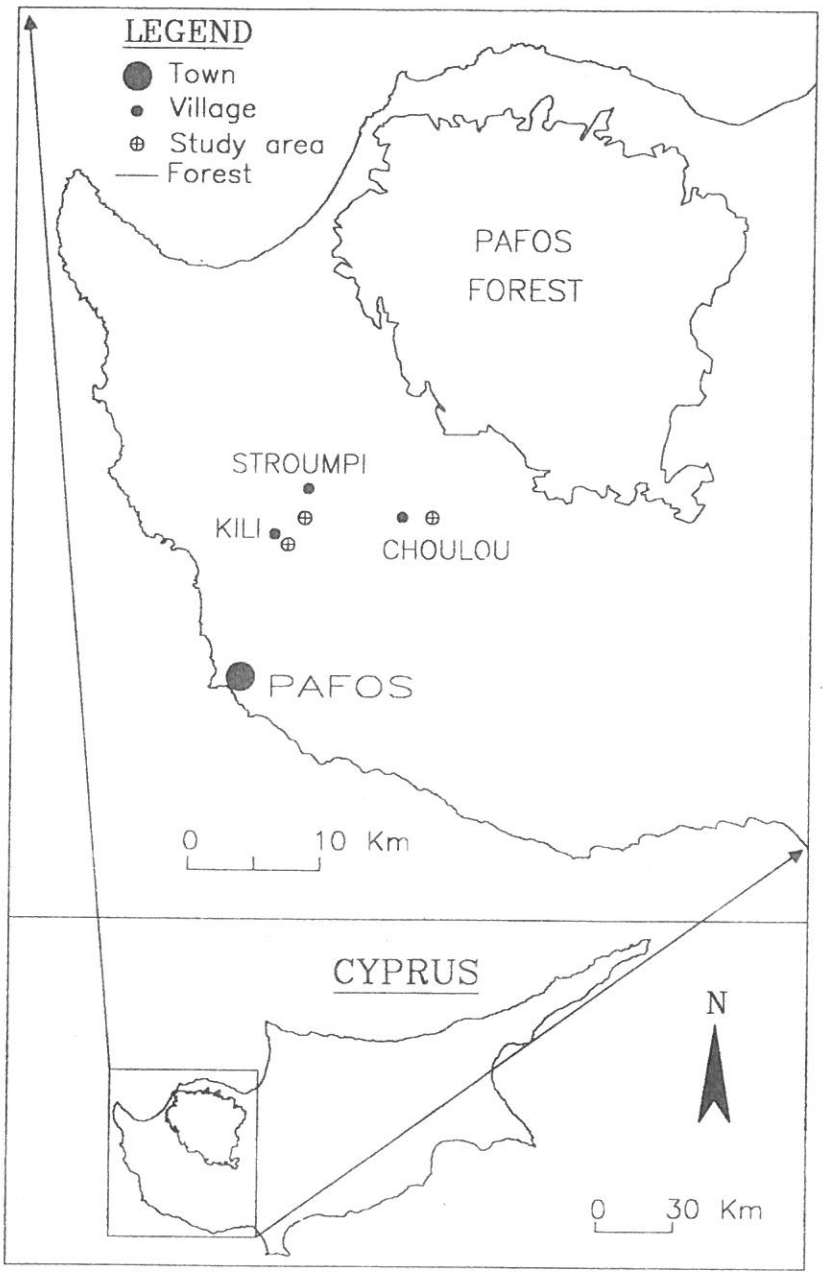

Figure 1: Location of the woodpigeon, *Columba palumbus*, study areas in the district of Pafos, Cyprus.

Figure 1: Localisation des zones d'étude du pigeon ramier, *Columba palumbus*, dans le district de Pafos, en Chypre.

At the bottom of each valley near Kili and Stroumpi there was a dry torrential creek. In some parts of the creek the soil was eroded creating steep banks of up to 15 meters high. The creek at Stroumpi was covered with dense hermes oak, *Quercus coccifera*, terebinth, *Pistacia terebinthus*, and storax, *Styrax officinalis*. The creek near Kili was covered with the above-cited trees and bushes but not as densely. Under these trees and bushes occasionally dense beds of bramble, *Rubus sanctus*, and green-brier, *Smilax aspera*, were growing, creating thorny barriers. Occasionally hawthorn, *Crataegus azarolus*, and almond,.*Prunus amygdalus*, trees were growing. The hillsides were cultivated mainly with carob, *Ceratonia siliqua*, trees, and a few almond trees. The study area in Choulou was a mixture of a cultivated area, an uncultivated area, a small creek, a steep cliff and a 1,000-m^2 olive plantation. The cultivated area was covered with olives, carob or grape vines, *Vitis vinifera*. The uncultivated area was covered with hermes oak, terebinth, olive trees, and carob. The creek was covered with hermes oak, terebinth and storax.

II.2. DATA COLLECTION AND ANALYSES

The study took place from the beginning of April until the end of September, from 1992 until 1996. Usually three people participated in the search for nests. One was examining all the trees and bushes in the creek, and the other two all the trees and bushes within 100 to 200 m at each side of the creek, depending on the terrain. During the first two years of the study it was unusual to find a nest outside this range and, consequently, I limited the search within these limits. Every tree and bush within the study area was searched each time. 7x35 binoculars were used to observe inaccessible nests from underneath or from the sides. Because of the dense cover it was impossible to locate a nest by standing on high ground above the tree. Since there was no cover under the nests, it was easy to spot them by walking or, in the case of dense vegetation, by crawling under the tree.

For the first two months in 1992, each nest was visited once a week. For the rest of the year the visits took place at 10-day intervals to reduce the risk of predation from exposing the eggs or the nestlings after flushing the parents off the nest (MURTON, 1965). In 1993 all visits took place approximately at fortnightly intervals because of problems with transportation. In 1994 and up to the end of the study in 1996, the visits took place every 10 days. Because of this difference in the frequency of observations, 1993 was excluded from the monthly comparisons of the numbers of nests with eggs, nests with young and occupied nests (i.e. with eggs or young).

Data recorded for each nest included the date the nest was found, and the number of eggs or nestlings in each nest. The tree type in which, and the tree height at which, the nest was found were recorded for 135 nests. Every pigeon nest was labeled with numbers engraved on 4-cm^2 zinc sheets which were suspended under the branch. A record card for each nest showed the dates of egg-laying, the number of eggs hatched, the number of birds fledged, the period of egg-laying, hatching and when the young fledged, together with other relevant changes taking place.

The breeding season was defined by the period during which there were nests containing eggs or young on each visit (MURTON, 1958). A *Z*-test was

used to test whether there were any significant differences in hatching and breeding success between certain statistical analyses.

Eggs which were found broken on the ground indicated rat, *Rattus rattus*, predation (MURTON, 1965).

III. RESULTS

III.1. NEST LOCATION

Nests (n = 135, Table I) were found most often in hermes oak (59 nests, 44%) followed by terebinth (20 nests, 15%), and storax and hawthorn (13 nests, 10%, for each species).

TABLE I

Tree type in which, and tree height (m) at which, the 135 nests of woodpigeons, *Columba palumbus*, were found in the study areas of Choulou, Kili and Stroumpi, Cyprus, 1992-1996.

TABLE I

Espèces d'arbres dans lesquels, et hauteurs (m) des arbres (moyenne, écart type, minimum et maximum) auxquelles, les 135 nids de pigeons ramier, *Columba palumbus*, ont été trouvés dans les zones d'étude de Choulou, Kili et Stroumpi à Chypre, entre 1992 et 1996.

Type of tree	Number of nests	Tree height (m) at which nests were found			
		Mean	SD	Min.	Max.
Hermes oak *Quercus coccifera*	59	3.49	1.881	1	10
Terebinth *Pistacia terebinthus*	20	3.02	1.650	1	6
Storax *Styrax officinalis*	13	3.53	1.853	2	7
Hawthorn *Crataegus azarolus*	13	3.11	2.103	1	8
Almond *Prunus amygdalus*	9	3.00	0.968	2	4
Carob trees *Ceratonia ciliqua*	8	3.87	1.125	3	5
Olive *Olea europaea*	7	4.36	1.248	2.5	6
Oak *Quercus luzitanicus*	2	6.00	-	5	7
Plum *Prunus* sp.	2	6.00	-	2	3
Honeysuckle *Lonicera etrusca*	1	1.50	-	-	-
White mulberry *Morus alba*	1	2.50	-	-	-
Total	135	3.42	1.762	1	10

The nests were under dense foliage, usually in the fork of a suitable tree or in creepers such as green-brier and honeysuckle, *Lonicera etrusca*, found growing round the main trunk, or between small branches forming a dense mass of leaves. One nest was built directly on honeysuckle, hanging from a carob tree.

New nests were fairly flimsy platforms and so shallow that the eggs could be seen through the bottom. Birds using old nests removed old droppings and added a few sticks, so that eventually the nests were fairly bulky. Occasionally more than one nest was found on the same tree. It was common for a bird to build a new nest about one meter from an abandoned one.

The average height of the tree at which the nest was found was 3.4 ± 1.76 (SD) m above the ground (Table I). Several nests were located on rather thin branches hanging over the steep banks of the creeks. Although these nests were at a height of only 2 to 3 meters from the top edge of the bank, they were at a height of up to 10 m from the bottom of the creek.

III.2. BREEDING SEASON

I found 250 woodpigeon nests with a total of 487 eggs. There were two eggs in 237 (95%) nests, and one egg in 13 nests.

Egg laying occurred mainly in May (30.2% of the eggs laid in the whole season, n = 487) and July (22.9%), decreasing to 0.4 % in September (Table II).

TABLE II

Seasonal variation in laying, and in the hatching, fledging and breeding success of woodpigeon, *Columba palumbus*, in Cyprus for the years 1992-1996.

TABLE II

Variations saisonnières (d'avril à septembre) des pontes (nombre et % d'œufs pondus par mois),des réussites des éclosions (nombre et % d'œufs éclos en % du nombre d'œufs pondus), des réussites de l'envol (nombre et % de jeunes volants en % des œufs éclos), et des réussites de la reproduction (jeunes volants en % des œufs pondus) chez le pigeon ramier, *Columba palumbus*, à Chypre entre 1992 et 1996.

Month	No. of laid eggs (monthly percentage)	No. of hatched eggs (in percent of number of laid eggs)	No. of birds fledged	Percent of hatched eggs giving fledged young	Percent of laid eggs giving fledged young
April	90 (18.5%)	45 (50.0%)	29	64.4	32.2
May	147 (30.2%)	61 (41.5%)	34	55.7	23.1
June	90 (18.5%)	40 (44.4%)	32	80.0	35.6
July	111 (22.9%)	67 (60.4%)	49	73.1	44.1
August	47 (9.6%)	21(44.7%)	17	81.0	36.2
September	2 (0.4%)				0.0
Total	487	234 (48%)	161	68.8	33.1

Between the beginning of April until the beginning of September there were nests with either eggs or young, with a peak in early June (Figure 2). Mean number of nests with eggs counted every 10 days between April and August (cumulated data for 1992 and 1994-1996) was 20.5 ± 9.2 (SD), range 6-39, number of counts n = 15, and mean number of nests with birds between April and September 9.8 ± 5.8 (SD), range 0-19, n = 18. Standard deviations (SD) for monthly mean numbers of nests counted three times a month were: with eggs from April to August for each month respectively 9, 9, 11.7, and 3; with young from April to September 2.6, 2, 1.2, 3.9, 4.0, and 3.6.

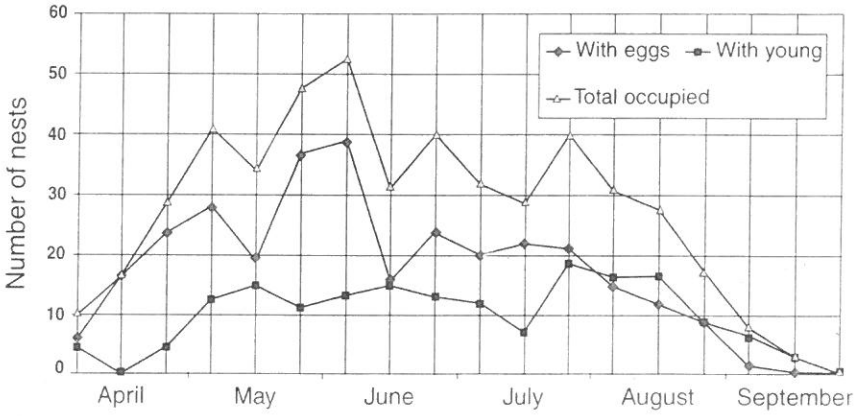

Figure 2: Number of woodpigeon, *Columba palumbus*, nests with eggs, with young, and total number of occupied nests (i.e. with eggs or young) found in Cyprus in 1992 and 1994-1996.

Figure 2 : Nombre de nids de pigeons ramier, *Columba palumbus*, avec œufs, ou avec jeunes, et nombre total de nids occupés (c.-à.-d. avec œufs ou jeunes), trouvés à Chypre en 1992 et entre 1994 et 1996.

III.3. BREEDING SUCCESS

The monthly distribution of nests with eggs, with young, and occupied (i.e. with eggs or young) differed, indicating differences in survival rates of eggs (Figure 3).

Hatching success (Table II) was fairly constant for all months, ranging between 41.5-50%, except in July (60.4%, $Z = 2.96$, $P < 0.01$).

Fledging success (percent of hatched eggs giving fledged young, Table II) was higher towards the second half of the breeding season than during the first half (73.1% to 81.0% in June-August *versus* 55.7% and 64.4% in April-May ($Z = 2.82$, $P < 0.01$).

Breeding success was 33.1% (161 fledged young in percentage of laid eggs, Table II).

Indirect evidence indicated that the lost eggs or nestlings usually were victims of predation or human disturbance. After the eggs were lost, 16 nests

were found to be occupied by rats. There was no indication of avian predation, although it cannot be ruled out. One nest was found to have been poked with a stick which was found left under the nest. Human footprints leading from nest to nest in four cases, indicated that people were searching for nestlings.

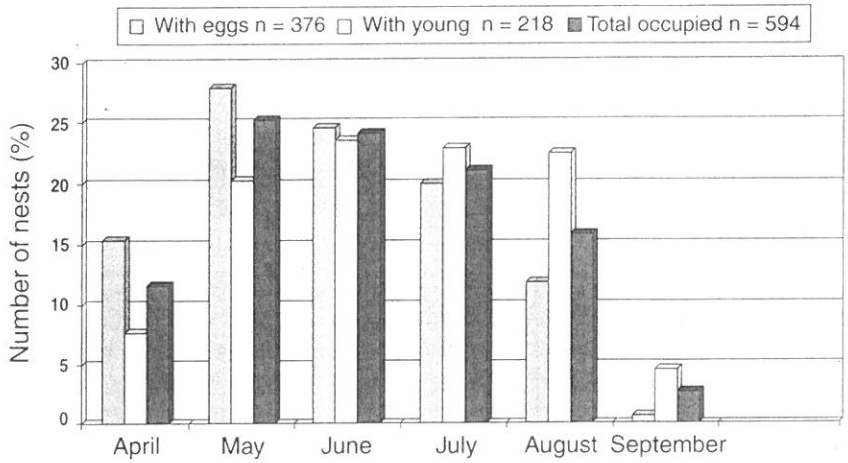

Figure 3: Monthly distribution (%) of the number of woodpigeon, *Columba palumbus*, nests with eggs, with young, and total number of occupied nests (i.e. with eggs or young) found in Cyprus in 1992 -1996.

Figure 3 : Distribution mensuelle (%) du nombre de nids de pigeons ramier, *Columba palumbus*, avec œufs ou avec jeunes, et nombre total de nids occupés (contenant des œufs ou des jeunes), trouvés à Chypre entre 1992 et 1996.

IV. DISCUSSION

IV.1. NESTING

It is the first time in Cyprus that the woodpigeon was found to nest in ten new species of trees and plants (Table I). In the past it was only known to nest in olive, pine and alder trees (FLINT and STEWART, 1983).

Since every tree and bush in the study area was searched regularly, the probability to find a new nest each month was the same. Therefore, finding new clutches each month indicates that most pairs were able to have more than three broods per season. According to MURTON (1965), woodpigeons lay repeat clutches following the failure of an earlier clutch due to adverse environmental factors. This leads to an accumulation of successful clutches and, hence, to the presence of nestlings at the optimum season of the year.

IV.2. BREEDING SEASON

This is the first time that the woodpigeon is reported to breed in Cyprus in August. The main nesting period is confined to April through August. In September,

only occasionally were nests found with nestlings, which were born in August. Since the study began in April, it is possible that nesting had also occurred in March because there were a few nests with young in early April (Figure 2).

The woodpigeon is usually considered to have a long breeding season, and eggs have been found in all months of the year in England (MURTON, 1965). MURTON (1958) in a study of woodpigeon in East Anglia reported that the breeding season of the woodpigeon extended from March to October. But he noted that most egg and nestling production was confined to the period from July to September, and that only about thirty percent of the woodpigeon population attempted to breed before this time. In 1957, a few clutches were laid in March and the last ones in October. The young from some of these nests flew off in early November. Such a case had never been observed in Cyprus. MURTON and ISAACSON (1962), in a population studied in England, noted that egg laying did not begin until late June in spite of the birds being physiologically capable of breeding before this time. No eggs nor young were found outside this period.

A breeding season lasting mid March-end of September has been reported in Norway, (HAFTORN, 1971), lasting April-October, with peaks in July and August, in Sweden (LJUNGGREN, 1969), lasting May-October, with peaks in August/September, in West Germany (HERKENRATH, 1989), lasting mid April-early October, with a peak in August, in Finland (SAARI, 1979), and lasting April-September, in Poland (TOMIALOJC, 1979). This indicates that the breeding season usually begins and ends later in northern European countries than in southern ones.

IV.3. BREEDING SUCCESS

Breeding success may vary between different sites and in different years, primarily because there are variations in the hatching success of eggs caused by different intensities of predation (MURTON, 1965; TOMIALOJC, 1979). Most nestlings in England hatched and were in their nests when grain or corn was ripe and most abundant, i.e. just at harvest time, and there were relatively few young outside the general grain period (MURTON, 1965). There was some egg-laying in June, but these eggs gave relatively few young, and it were the July and August clutches that resulted in the August-September peak of nestlings. Breeding success was reasonably good in March and April when spring-sown grain was available, but relatively low food supplies thereafter as well as predation of unguarded clutches and a low nestling survival rate resulted in low hatching success. The overall success from egg to fledged young is therefore low. The high peak of nesting observed during August in Finland is explained by the availability of cereals during August and September, which is the main food for woodpigeons in this country (SAARI, 1979).

It seems that similar factors regulating breeding success in Finland and England, and most probably in the other European countries as well, also occur in Cyprus. The highest number of eggs was produced in May and this coincided with the ripening of the vetch, *Vicia sativa*. Large numbers of woodpigeons were observed feeding on these crops throughout the Pafos district. The second nesting peak was in June-July, during the harvesting season of wheat, *Triticum durum*, barley, *Hordeum vulgare*, and broad beans, *Vicia faba*.

By August the ripening of the terebinth fruits provided a new food source in addition to the cereals and beans that had been left in the fields after harvesting. Although the percentage of the total number of occupied nests for the whole study period was 15.8% in August (Figure 3), the percentage of all nests with young was 22.5% in the same month. These nests are mainly found during the first 15-20 days of August (Figure 2). This indicates a higher survival rate for the eggs produced in July. Indeed, breeding success is greater towards the end of the summer. This might be due to the fact that in this time of the year there is more food available to the parents, and, therefore, they spend less time away from the nest, and the nest is not left unguarded. Another explanation is that due to the ripening of the carob fruits, grapes and other fruits in the area, the rats are able to find alternative food sources and are spending less time searching for eggs.

Nestlings have a much better chance of survival than eggs do, and about 68.8% of all those hatched give rise to flying young. The rate of survival observed by MURTON in 1965 in England was 72%. The higher survival rate of young compared to eggs may be partly attributed to the absence of predators likely to attack them. Corvids, *Corvidae*, rarely take nestling woodpigeons and then only very small squabs of them, and the incidence of other mammal and bird predators is too low to seriously affect the young (MURTON, 1965). A study by the author on predation on woodpigeon nests in 1990 indicated that the main predator affecting the eggs were rats (unpublished data). During the study the only potential avian predators seen flying over the three study areas were magpies, *Pica pica* and kestrels, *Falco tinnunculus*. Magpies nested near all the three study areas and a pair of kestrels was nesting in the cliffs of the study area of Choulou. Woodpigeons were never frightened when magpies or kestrels were flying over the valley. Hiding the nest from the air by using dense cover might be an important defense mechanism.

IV.4. BREEDING SEASON AND HUNTING SEASON

It is evident that in August a large number of woodpigeons have nestlings. By the 15th of August many woodpigeon nests have nestlings which need at least another week to fledge. About 9.6% of all produced eggs are laid in August which means having nestlings until the end of August and early September. In addition, 23% of the eggs laid in July will produce nestlings, a large number of which will remain in the nest at least until the first 20 days of August. Killing the parents condemns the nestlings to perish.

Opening of the hunting season has been postponed in West Germany (HERKENRATH, 1989) and in Finland (SAARI, 1975) to save unfledged young. In Finland most woodpigeons were shot in the first days of the hunting season, which began by August 10, just when the species is breeding. Woodpigeon hunting was allowed to protect waterfowl and tetraonids from overhunting. Nevertheless all species were overhunted. That is the reason for the hunting date postponement.

In Cyprus, woodpigeons are also hunted in November and December, which is the hunting season for chukar partridge and black francolin, *Francolinus francolinus*. However, woodpigeon hunting also continues in January and February. Since 1989, the Game and Fauna Service is collecting data on the number of woodpigeons shot per hunter. These unpublished data

show that from year to year the number of harvested birds is declining, which might be an indication of a declining population.

Therefore, it is suggested that hunting in Cyprus should start in early September or as late as possible in August, to save the unfledged young.

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PHÉNOLOGIE ET RÉUSSITE DE LA REPRODUCTION CHEZ LE PIGEON RAMIER (*COLUMBA PALUMBUS*) À CHYPRE

E. HADJISTERKOTIS

MOTS-CLÉS : Pigeon ramier, *Columba palumbus*, nidification, ponte, éclosion, envol, réussite de la reproduction, chasse, Pafos, Chypre.

RÉSUMÉ

La phénologie et la réussite de la reproduction du pigeon ramier, Columba palumbus *ont été étudiées à partir de relevés de nids faits entre 1992 et 1996 dans trois zones d'étude de 1 à 3,5 km² dans le district de Pafos, à Chypre. Des nids (n = 135) ont été trouvés dans onze espèces d'arbres et d'arbustes différentes, mais surtout dans les chênes kermès,* Quercus coccifera *(44 %)*