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## REPRODUCTIVE BEHAVIOR OF THE SCALY DOVE (*SCARDAFELLA SQUAMMATA SQUAMMATA*)\*

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### ABSTRACT

*The following reproductive behaviors of the Scaly Dove, Scardafella squammata squammata were studied in nature and complemented by observations in captivity; relationship between the members of the couple; nest building; incubation; parental care of the nestlings and of the fledglings. Comparisons were made with other Columbidae.*

### INTRODUCTION

The purpose of this research was to study some aspects of the reproductive behavior of the Scaly Dove, both in nature as well as in captivity.

*Scardafella squammata squammata* belongs to the order Columbiformes, Family Columbidae (Schauensee, 1966). The genus *Scardafella* consists of two allopatric forms, *S. inca* and *S. squammata* (Goodwin, 1983).

The behavior of the Inca Dove, *Scardafella inca*, species of Central America was described by Johnston (1960).

Of the genus *Scardafella*, *S. squammata* is the only one of the two species encountered in South America (Pinto, 1949). There are two subspecies *S. squammata ridgwayi* and *S. squammata squammata*. The first one is found in Colombia, Venezuela, Isla Margarita and Trinidad (Harrison, 1961, Peters, 1961). *S. squammata squammata* occurs in Paraguay, and Central and Eastern Brazil. (Pinto, 1964).

The Brazilian subspecies inhabits semid-arid regions with open ground and some trees, scrub covers, cultivated areas, grassland and near human habitations (Lordello, 1954; Goodwin, 1983). Its social behavior was studied by Nogueira-Neto (1980) and Eston (1985).

The following reproductive behaviors of this species were studied in this research: relationship between the members of the couple; nest building; incubation; parental care of the nestlings and of the fledglings.

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## MATERIAL AND METHODS

The field research was done at two farms, Jatibaia and São Quirino, both in the Municipality of Campinas, State of São Paulo. A population of *S. squammata* already existed at the São Quirino Farm. It was captured with mist nets, marked with open colored rings and released. At Jatibaia Farm a population of Scaly Doves was reintroduced.

The field research was done with binoculars (10x50), a tape recorder and a camera. The nests were observed with a mirror (Marchant, 1960; Parker, 1972) and their height measured either directly with a meter or with a clinometer. The nests were measured with a ruler and the nestlings were ringed at this occasion.

The field work was complemented by captivity research which was done in the aviaries of the Zoological Park Foundation of São Paulo, and in Nogueirópolis and Jatibaia Farms, both in Campinas. The aviaries were supplied with nests made of rope or bamboo baskets; grass and roots were supplied as nest building material.

Due to the absence of sexual dimorphism, several techniques were used for the mating of the couples: 1. observation of the relationship between two individuals of indeterminate sex placed together; 2. observation of the relationship between several individuals placed together; 3. laparoscopy (Bush et al., 1978; Wildt et al., 1978).

In order to recognize the individual birds, open colored rings were used; nestlings were first marked with a colored spot made with atoxic ink and ringed at the age of 6 to 10 days.

The reproductive behavior of the species was observed. The measurements of the eggs were made with a calipers and the nestlings, fledglings and adults were weighed with a Pesola scale.

## RESULTS AND DISCUSSION

## 1. Relationship between the members of the couple

Observation in nature showed that the establishment of couples occurs in the beginning of the reproductive period. The members of the newly formed couple spend most of the time together, feeding, moving about or resting together. The three main behaviors which occur between the couple are: mutual preening, courtship feeding and copulation. During this occasion the boundaries of the territory are established by the song of the male and by vertical tail fanning. The territory consists of an area where several behaviors occur, such as courtship, nest building, rest and part of the feeding. The defense of this territory is usually done by the male; however the female may also defend it. According to Nice (1941) and Hinde (1956) this is a type B territory.

The basis of territorial research were established by Bernard Altum in 1868 (Nogueira-Neto, 1984) and later on detailed by other authors. Van Tyne & Berger (1976), described the territory as a limited area, which the male defends against other males of the same species, during at least part of the reproductive cycle. According to Scott (1972) territoriality developed where conditions occurred including the ability to recognize other individuals of the same species, a habitat which permits the effective defense of the border lines and a diurnal cycle of activities.

Territoriality limits competition between the males to the period of demarcation of the boundaries. Song and displays are used as admonishment by the owner of the territory against other males, but also to attract the female (Nice, 1941; Tinbergen, 1948; Etkin, 1964; Burt, 1967; Brown, 1975; Beer, 1975; Carthy, 1980).

Several explanations are given for the function of territorial behavior of birds according to different authors: (Nice, 1941; Collias, 1944; Davis, 1952; Hinde, 1956; Portmann, 1961; Etkin, 1964; Klopfer, 1969; Dimond, 1970; Pettingill, 1971; Dethier & Stellar, 1973; Brown, 1975; Morse, 1980;

Itô, 1980; Deag, 1981). Assuring adequate food supply; regulating population density by reducing the intraspecific competition for partners, nesting places and food; decreasing of loss due to predators. The territory offers a familiar place of refuge for the adults and reduces predation of the nests due to larger spacing, thus making them less conspicuous; prevents spreading of diseases; facilitates mating and the maintenance of the couple; reduces time spent in aggressions; reduces interference with copulation and other reproductive activities by other members of the species thus helping to isolate the couples; facilitates defense of the nest and the nestlings.

I observed that delimitation of the territory is important for *S. squammata* in order to keep away other sexually mature males which may interfere with copulation or other activities of the reproductive cycle of the couple.

My observations of the Scaly Dove in captivity showed that, due to the presence of different family groups in the same aviary, interference during the copulation of a couple may occur. The same happened between neighboring aviaries, where the male of one aviary threatened the male of the adjoining aviary while it was trying to reproduce. The male might stop copulation and reply to the menaces of the adjoining male.

In *S. squammata* the territory is also important to help in the maintenance of the couple. During the reproductive cycle, when the couple has already constructed the nest and there are eggs or nestlings, while one of the members of the couple remains on the nest, the other one is nearby in the territory. According to Etkin (1964), the persistence of territorial behavior beyond mating suggests that it is helpful in maintaining the association of the mates throughout the reproductive period. The co-ordination of the behavior of both mates during the long and complex sequence of activities that are necessary for effective bird reproduction is facilitated by the territory, as for example when both parents divide the task of incubating the eggs and feeding the nestlings, as is usual in the Columbidae.

My observations in nature showed that, if there is abundance of local food, courtship feeding and copulation may occur between two young individuals belonging to different family groups, before they have separated from their respective family groups and marked their own territory. Therefore, in *S. squammata* the territory seems not to be essential to assure the meeting of the sexes. According to Davis (1955), in many species pairing may occur before the establishment of territories.

In *S. squammata* I observed that the defense of the territory against invasion of other individuals of the same species is made chiefly by the male; however the female may also defend it. According to Eibl-Eibesfeldt (1974), Archer (1976) and Alcock (1979), the defense of the territory is in general made by the male. In monogamous birds, in which the males share the duties of incubation or care of the young, it may be advantageous that the female also participates in the defense of the territory (Collias, 1944; Morse, 1980).

In the Scaly Dove the male in general defends the territory from intruders by the behavior of supplanting attack and vertical tail fanning and by the persistent song during various hours of the day. According to Van Tyne & Berger (1976) and Wilson (1982), territories are defended against intruders not only by physical attack or the threat of it, but often merely by song or even by the conspicuous presence of the defending bird.

In *S. squammata* I observed that on occasions when invasions of the territory occurred, the owner was always the winner. According to Burt (1967), in a contest between a defender of the territory and an intruder, almost always the defender wins, as territorial animals are always dominant in their territories (Lorenz, 1970; Manning, 1977; Deag, 1981). In many species of birds and mammals, a certain individual will be aggressive or submissive, according to where the social meeting happens, either in his own territory or in that of the other individual (Dethier & Stellar, 1973; Hinde, 1974; Deag, 1981).

I observed that Scaly Doves are monogamous birds and the same couple may reproduce several times during the year, using the same territory and even reutilizing the nest. While the couple

remains together, both are owners of the territory; however if a separation of the couple occurs, the male continues owner of the territory and the female may mate with another male somewhere else. According to Levi (1963) and Gos (1981), Columbidae are monogamous birds and the same couple may remain paired during the whole life. Itô (1970) states that monogamous reproduction is a more efficient form of parental care. In birds in which the care of both parents is essential, the male gains more by investing in the first brood instead of spending its efforts in procreating an additional brood (Mock, 1983).

It was thought that in Brazil reproduction occurs during the rainy season, which includes spring and summer, from September to March (Ruschi, 1979). However I found nests during all months of the year, although in lesser numbers during winter (June and July). The same was observed by Dickey & Van Rossem (1938) in *S. inca*. In nature I observed that the most a couple was able to reproduce successfully in one year was three times. Several authors, referring to different species of Columbidae, state that they may reproduce several times during a year and even during the whole year (Craig, 1911; Cole, 1933; Lack, 1947; Skutch, 1950; Skutch, 1956; Johnston, 1960; Cramp, 1972; Murton et al., 1972; Bucher & Orueta, 1977; Holcomb & Jaeger, 1978; Naether, 1979; Westmoreland et al., 1986).

According to McNeillie (1978) and Delacour (1980), most Columbidae will reproduce during the whole year if there is enough food available and the winter is not too severe.

In nature I observed that the same couple may reproduce again, after a successful reproduction. Lack (1972) states that reproduction is more successful if the same couple is maintained in succeeding years. Birds which reproduce with the same partner are less aggressive and have a greater degree of synchronization of the couple, enabling them to reproduce faster and more efficiently. This results in an increase of successful reproduction and in a saving in time spent in courtship, permitting succeeding reproductions during a favourable season (Erickson & Morris, 1972; Emlen & Oring, 1977; Rowley, 1985).

In nature I observed that the immature birds, before they delimit the boundaries of their own territories, remain in the territory of their parents, even if these are already hatching a new brood, since they don't interfere with the reproduction of the parents. Additional observations made in captivity revealed the same behavior: the immatures of one or two previous broods of the same couple did not interfere with the reproduction of their parents, even if they remained in the same aviary. In contrast, when individuals of different families were placed together in the same aviary, they interfered with the reproduction of the couple.

My observations with Scaly Doves in captivity showed that the members of a couple after being separated during five months, when placed together again showed the behavior of mutual preening and courtship feeding at the same day when they were placed together. The only possible explanation for this fact, is that the two birds recognized each other, as I never observed the same behavior among two unknown individuals. The same fact was observed in *Streptopelia risoria* by Erickson & Morris (1972).

## 2- Nest building

In *S. squammata*, at the beginning of the reproductive period the male shows the behavior of vertical tail fanning in different places where a nest may be built. The female may then go to one of these places and stay there, while the male starts to fetch material for nest building. This shows that in *S. squammata*, while the male takes the initiative in the search for appropriate nest building sites, the final decision is made by the female. According to Collias & Collias (1984), many investigations show that in general the female chooses the final nest building site.

In general in the Columbidae nest building is done cooperatively by both members of the couple (Goodwin, 1983). My observations with *S. squammata* showed that during nest building the male selects and transports the material to the female which arranges it in the nest. The male carries

only one piece each time. The same was observed by Levi(1963) and Naether (1979) in other Columbidae.

In *S. squammata*, during nest construction, when the male reaches the nest with the material, it alights on the female's back, and passes the material over its head and places it in the nest. Afterwards the female catches the material with the beak and arranges it in the nest. According to Goodwin (1955) this same behavior is found in other Columbidae.

My observations also showed that during nest building the female may stay on the nest and not arrange the material brought by the male, or it may happen that the male goes to the nest without bringing any material. In my opinion, this is correlated with the degree of motivation of each member of the couple in relation to nest building.

*S. squammata* generally builds the nests in three consecutive days. The same was observed by Johnston (1960) in *S. inca*. In *S. squammata* nest building occurs mostly during the morning period, but may also occur during the afternoon.

I observed that when the nest is already finished, the female may remain sometimes on it even without eggs. This happens mainly one day before the first egg is laid. Skutch (1956) observed the same in *Columbina talpacoti*.

In captivity the Scaly Dove also showed that the nest may be built and not be used immediately. I observed an interval of up to 17 days from the moment when the nest building was concluded to the laying of the first egg. According to Lordello (1954), the completion of nest construction occurs practically on the same day as the female lays the first egg. On the other hand, Harrison (1960) describes that the Scaly Doves laid the first egg about one week after the building of the nest had started.

I observed that in captivity a couple may build two or three nests in different places and only use one of them. The same behavior was described by Johnston (1960) in *S. inca*. In this species frequently nests partially built are abandoned before the final nest is built. This behavior would be part of the ritual which leads to egg laying.

In nature my observations showed that *S. squammata* builds its nests on tree branches or even on constructions, such as stables and other inhabited constructions. The height of the nest from the ground varied from 2 to 15 meters. I even found in the Jatibaia Farm a nest of *S. squammata* built on farming machinery with two eggs, which were not successfully incubated. Heinroth & Heinroth (1958) describe that sometimes nests are built in absurd places, such as the middle of a street. These nests are in general abandoned as soon as incubation starts.

In captivity the Scaly Doves built their nest with preference in bamboo baskets, but also in rope nests or on perch crotches.

The nest of *S. squammata* is cup-shaped. This type of nest is more subject to predators than enclosed nests, but is easier to build and less limited as to the choice of the building sites, than nests in holes (Oniki, 1979a). I observed, both in nature and in captivity, that doves used rougher materials to start nest building and lined the inside with smoother materials. The same couple may use the same nest more than once and a small amount of lining is added before the new clutch.

The measures of the nests which I found in nature are shown in Table 1 and those found in captivity in Table 2. The measurements varied according to the number of uses. At the beginning, both the outer diameter and the height and depth increase, due to accumulation of feces of the nestlings on the rim of the nest. I observed that the same couple in captivity used again the same nest up to eight times. The repeated use of nests has also been described in other Columbidae (Yahner, 1983; Westmoreland & Best, 1985). By using again old nests, Columbids eliminate the time required for building. Thus it seems plausible that this evolved to reduce time between nesting cycles (Westmore & Best, 1986). According to Johnston (1960) the repeated use of the nest in *S. inca* is important for its stability. The excrements which accumulate during the first brood help to bind the sticks and grasses which, at the beginning of nest construction, are loosely arranged.

Table 1. General informations about nests: nature

	Measures (cm)			
	Diameter		Height	Depth
	External	Internal	External	
Number of Measures	13	13	13	13
Mean Value	10.15	6.88	3.50	1.81
Standard Deviation	0.71	0.85	1.22	0.41
Maximal Measure	11.0	8.5	5.5	2.5
Minimal Measure	9.0	5.0	1.5	1.0

Table 2. General informations about nests: captivity

	Measures (cm)			
	Diameter		Height	Depth
	External	Internal	External	
Number of Measures	39	39	36	36
Mean Value	10.77	6.27	3.05	1.94
Standard Deviation	1.02	0.60	0.98	0.45
Maximal Measure	13.0	7.5	6.0	3.0
Minimal Measure	9.0	5.5	1.5	0.5

### 3- Incubation

*S. squammata* lays two white eggs per clutch, in successive or alternate days. According to Lack (1947; 1948; 1972) in many species the number of eggs per clutch is limited by the amount of food which the parents can collect for their brood. Columbidae constitute a group of birds which doesn't show regional or seasonal variations in size of brood. They regurgitate the food for the nestlings as "doves milk", instead of collecting it, a process which seems to be independent of the day's length. The small clutch size may represent an accessory adaptation for repeated nesting (Foster, 1974).

According to Oniki (1979b), white eggs occur in Columbidae when the eggs are constantly covered by the adults. Continuous incubation may have developed, at least partially, as a mechanism to reduce visibility to predators (Westmoreland & Best, 1986).

Incubation is performed by both sexes and the eggs are constantly covered. The male starts to substitute the female between 8 and 11 AM, and remains on the nest until 3 or 5 PM; it is then substituted by the female, that incubates the eggs until the next morning. Incubation is shared by both sexes in probably all species of Columbidae (Kendeigh, 1952; Levi, 1963; Burley, 1980). Continuous incubation may account in part for the rapid development of the embryos (Skutch, 1945), thus reducing losses by diminishing the time eggs are exposed to predation (Skutch, 1962).

My observations of *S. squammata* showed that incubation lasted between 13 and 15 days, with a mean value of  $13.97 \pm 0.81$  days (n=30). The period of incubation was considered as lasting

from the laying of the last egg to its hatching, as proposed by Nice (1953). I observed a maximum period of incubation of 19 days, a case in which the eggs failed to hatch. Prolonged incubation is often observed in other birds when the eggs fail to hatch (Van Tyne & Berger, 1976).

I also observed that when an adult was incubating and I took away the eggs, the adult returned to incubate even when the nest was empty. According to Lorenz (1970), when there are eggs or the nestlings are small, even when the entire content of the nest is removed, this doesn't cause an immediate response of stopping to incubate.

In *S. squammata* both the male and the female may vocalize when on the nest incubating the eggs. The same happens with *S. squammata ridgwayi* (Friedmann & Smith, 1950) and with *S. inca* (Johnston, 1960). Vocalizations may be done both by the male or the female and would be territorial songs.

I observed that when substitution of incubation is about to happen, the nesting adult may leave before the partner arrives at the tree of the nest, or as soon as the mate arrives at a nearby tree or at the tree where the nest is. When a substitution occurs, one adult may leave the nest and the other one may replace it without any physical contact between the partners; however, mutual preening, courtship feeding and copulation may occur. These behaviors may be important for maintaining the couple together. My observations in nature showed that when the adult that is incubating leaves the nest for a short period, the other member of the couple may remain on the nest until the partner returns. Goodwin (1983) states that this behavior is usual in Columbidae.

In *S. squammata* the male sleeps on a neighboring tree, while the female sleeps on the nest incubating the eggs. Skutch (1956) observed the same in *Columbina talpacoti*.

In the Scaly Dove, after the first period of incubation the nest remains clean, without feces on the border, thus showing that the adults do not evacuate in the nest.

Both in nature and in captivity, a couple of Scaly Doves may use again the same nest more than once even after an unsuccessful clutch, by laying new eggs besides the eggs of the previous brood. In nature I observed that in a nest with two unhatched eggs, additional eggs were laid and a nestling of the second brood was born.

In *S. squammata* the smallest interval between layings was 39 days, when successful, and of six days when the eggs were abandoned. In other Columbidae short clutch intervals were also observed (Fitca, 1948; Skutch, 1956; Westmoreland & Best, 1987). For organisms that breed repeatedly within breeding seasons, the shorter the clutch interval, the greater the number of clutches that can be raised in a given amount of time (Burley, 1980).

I observed that the rate of successful reproduction in captivity was relatively low, but, when the intervals between layings were greater, the possibility for successful breeding increased. The same was observed in other Columbidae (Levi, 1963; Zanoni, 1987).

As to the size of eggs, the mean values of ten eggs measured in nature were: length  $22.7 \pm 0.67$  mm and width  $17.2 \pm 0.56$  mm. In captivity 103 eggs were measured and the following mean values were found: length  $23.1 \pm 1.49$  mm and width  $17.7 \pm 0.42$  mm. (Tables 3 and 4). Ihering (1900) found  $21.5 \times 17.0$  mm for two eggs of *S. squammata* and Lordello (1954) found  $22.5 - 24.5$  mm  $\times$   $18.0 - 19.0$  mm for the eggs of the same species.

#### 4- Parental care of nestlings

In *S. squammata*, after hatching of the eggs, the adult which is on the nest removes the bits of eggshell. This behavior has the main function of reducing the possibility of being found by predators as the shells are white and would leave the nest more conspicuous (Tinbergen, 1963; Burt, 1967).

Table 3. General informations about eggs: nature

	Measures (mm)	
	Length	Width
Number of Measures	10	10
Mean Value	22.7	17.2
Standard Deviation	0.67	0.56
Maximal Measure	23.7	17.8
Minimal Measure	21.4	16.0

Table 4. General informations about eggs: captivity

	Measures (mm)	
	Length	Width
Number of Measures	103	103
Mean Value	23.1	17.7
Standard Deviation	1.49	0.42
Maximal Measure	26.3	18.7
Minimal Measure	20.5	16.8

In this species generally two nestlings are born per clutch. Both sexes take care of the nestlings. They are fed by the adult which is covering them at the occasion; only one or both nestlings may be fed at the same time. When the nestlings are born, the period of permanence on the nest of each parent continues more or less the same as during incubation, during the first five days. After this period substitution is more frequent. My observations showed that frequently, after the nestlings had asked for food and the parent was unable to supply it, the adult left the nest, being substituted by the mate, which supplied the food as soon as it alighted.

According to several authors (Beams & Meyer, 1931; Patel, 1936; Lehrman, 1955; Naether, 1964; Bucher & Nores, 1973) nestlings of Columbidae are fed by regurgitation of the "doves milk" approximately during the first three days. After this period, grains collected in the vicinity are added, at the beginning small grains selected by the adult. During growth of the nestlings the supply of "doves milk" decreases exponentially and the amount of grains increases correspondingly.

In *S. squammata* I observed two ways of starting feeding. Up to the fourth day the parents take the initiative of feeding the nestlings and afterwards the young start to ask for food. The same was described by Collias (1952) in *Zenaida macroura*. The adult of Scaly Dove may feed two nestlings simultaneously. This behavior starts from the second day on, but was more frequent after the sixth day.

In *S. squammata* the nestlings may be born on the same day or on successive or alternate days. As incubation may start with the laying of the first egg hatching occurs also in intervals and thus a hierarchy of size may result among the nestlings. The nestling which was born first is also fed earlier, and thus, growing faster and being stronger than the other one, will be better able to ask for food (Levi, 1963; Naether, 1964).

I also observed that in captivity two nestlings of the same clutch may be born on the same day and one of them grow faster than the other one, as a result of unequal feeding by the parents. According to Goodwin (1983), there does not appear to be any deliberate attempt on the part of the parents to see that the young get fair shares.



Competition for food between siblings was described in different species by several authors (Lack, 1947; Tinbergen, 1962; Ricklefs, 1968; Murton et al., 1974; Werschkul & Jackson, 1979; Mock, 1985).

I observed that at the beginning nestlings are covered constantly by the parents. After the sixth day, the period during which nestlings are left alone in the nest increases. The same was described for other Columbidae (Skutch, 1949; 1956; 1959). The young of altricial species are covered constantly during the first days due to lack of thermic control, while after the development of the feathers they are gradually less covered by the parents (Mayaud, 1950; Wallace & Mahan, 1975).

From the eighth day on, I observed that the young of the Scaly Dove already lifts one wing or even both when menaced. According to Carvalho (1957), who observed the same in *Columbina passerina*, this would be a defense display. After the ninth day, the nestlings start to move more in the nest, open and close the wings and make movements as if attempting to fly. According to Wallace & Mahan (1975) during the days that precede leaving the nest, the nestlings make preparatory exercises.

I observed that the excrements of the nestlings are not removed from the nest by the adults and this is important for the stability of the nest (Sick, 1985).

Several nestlings were weighed in captivity with a Pesola balance. On hatching day the weight of the nestlings varied from 3.00 to 4.95 g, with a mean value of  $3.82 \pm 0.69$  g, which corresponds to about 6.5 % of the adult weight (58.5 g). The differences between the weights of the nestlings were due not only to individual variations but also to the hour of hatching in relation to the hour the weight was obtained. I observed a rapid increase in weight (Fig. 1), which already had doubled at the end of the second day. The nestlings leave the nest with a mean weight of  $32.18 \pm 3.28$  g, which represents an increase of the order of 742%.

Many factors may affect growth of the nestlings, such as temperature, parental care, lack of vitamins and even individual variations (Nice, 1922; Murton et al., 1963; Holcomb & Jaeger, 1978).

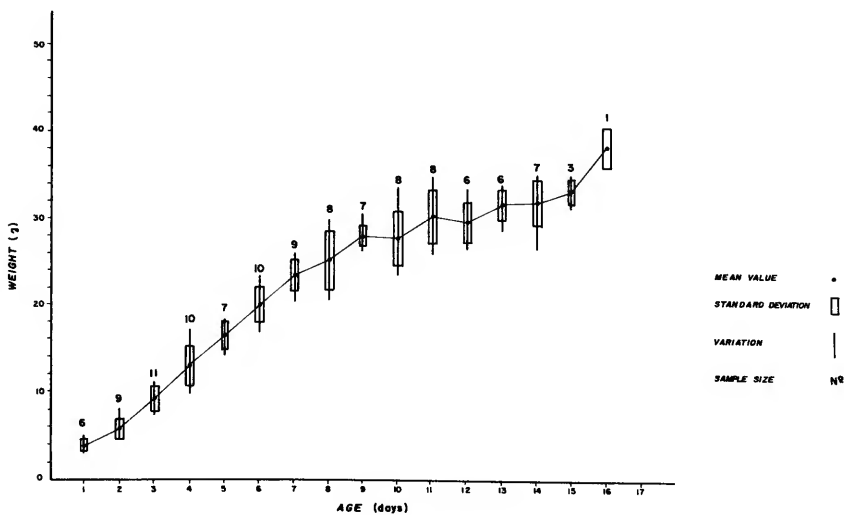


Fig. 1. increase of weight of nestlings of *S. squammata*.

### 5 - Parental care of fledglings

The young of the Scaly Dove leave the nest between the 14th and 16th day after birth. The same was observed for *S. inca* by Johnston (1960).

I also observed that the pattern of plumage of the young of the *S. squammata* when they leave the nest is similar to that of their parents. The same was observed by Frisch & Frisch (1964).

In *S. squammata* the first-born is usually bigger when it leaves the nest and flies better than the second one. The same was observed for *Columbina talpacoti* by Trollope (1974). The two fledglings may leave the nest at the same time or with a difference of a few hours.

In nature when the fledglings leave the nest they don't fly well and remain close to the nest, perching on the tree where the nest was built. One of the parents remains close to them or even leans on them. During the night, the young sleep between the parents. The fledglings are not able to escape from predators and their main reaction is to remain quiet in order not to be seen.

I observed that, in captivity, when the young leave the nest they remain most of the time on the ground of the aviary without moving. Delacour (1980) writes that young doves leave the nest before they can fly well, and only after a few days they can perch and fly about.

I observed that the young, after leaving the nest until they are about 30 days old, show the behavior of wing-fluttering when an adult comes close to them. Afterwards the young may ask for food or remain quiet. According to Smith (1980), wing-fluttering may be displayed in other contexts not related to feeding and serves sometimes to inhibit attack and thus is an appeasement behavior.

During the first days after the fledglings leave the nest, the parents go to them to feed them. As soon as the fledglings start to fly more easily, they go to their parents to ask for food. I observed in nature that this behavior of asking for food and being fed continued until the 42<sup>nd</sup> day of age of the fledgling. I even observed that this young, going to the nest where one of the parents was brooding a three day old nestling of a new clutch, asked for food and received it.

I observed a fledgling in captivity asking for food either from an adult female or from a male without any family relationship, and being fed or not; however the stranger in general doesn't feed the fledgling. This means that a genetic involvement is not necessary to feed a fledgling asking for food. It seems that the fledglings are able to recognize their parents, as they ask them more frequently for food, and when they ask, insist more than with a stranger. Ramsay (1951) describes that, in several species of birds, both the adults and the young largely acquire rather than inherit the ability to recognize other members of the family using color, voice, size and form as cues.

My observations showed that in nature the young remain in the territory of the parents until they establish their own territory, as they don't interfere with the reproduction of the parents. The same was described by Naether (1964) in other species of Columbidae. The field data show that the young of the Scaly Dove still follow the parent which is not at the moment covering the new brood. In captivity it was possible to raise a new brood without problems with the immature of the previous brood still remaining in the same aviary, thus complementing the data obtained in nature.

I observed that the groups of Scaly Doves found in nature are family groups formed by the parents and the immature of one or two previous broods (Eston, 1985). As sexual development proceeds, the individuals leave the family group and the new pairs formed establish their own territory.

Regarding the start of reproductive age, I observed in nature a male showing the behavior of vertical tail fanning at 77 days of age. Courtship feeding and copulation occurred among the members of a couple of which the female was with approximately 3 months of age (82 days). In nature I also observed another female starting to lay eggs and hatch them with success at the age of about 3½ months (103 days). According to Lack (1972) most species of birds breed in the season after that in which they were hatched, when they are a little less than one year old. A very few, including doves, start when less than six months old.

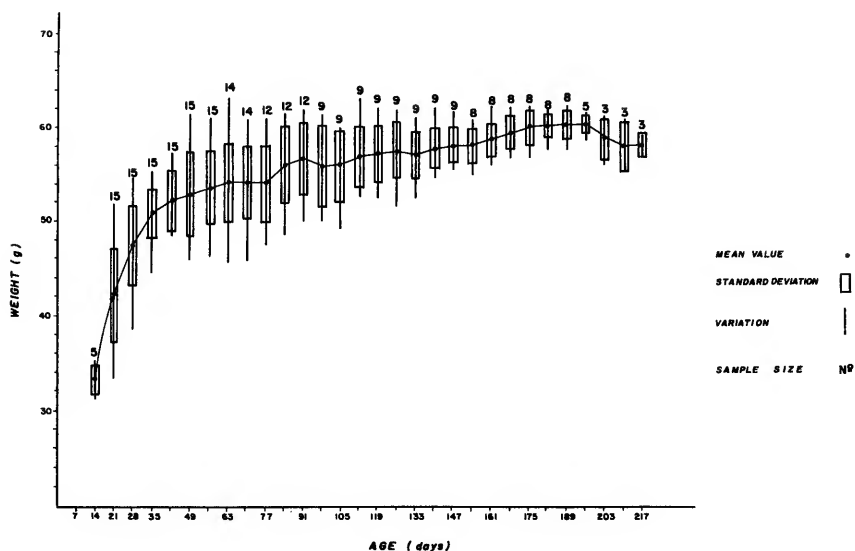


Fig. 2, increase of weight of fledglings of *S. squammata*

Table 5. Synopsis of the weight of adults

	male	female
Number of Measures (N)	9	8
Mean Value (g)	58.5	58.6
Standard Deviation	1.14	2.82
Total N		17
General Mean Value (g)		58.6
General Standard Deviation		2.04

The fledglings leave the nest with about 55% of the weight of the adult (Fig 2, Table 5). Soares (1983) described for *C. talpacoti* that the young leave the nest with approximately 52% of the weight of the adult. My observations showed that in captivity Scaly Dove reaches the weight of the adult about at the 4th or 5th month of age, but may reach this weight already at the end of the 2nd month. According to Baldwin & Kendeigh (1938) the differences of weight found in birds may depend on different factors, such as individual variations, age, sex, food, season of the year, temperature and hour of the day.

## CONCLUSIONS

In *Scardafella squammata squammata* the forming of couples occurs at the beginning of the reproductive period. The territory is marked by the male through peculiar singing and through the behavior of vertical tail fanning. The territory consists of an area where courtship, nest building, rest and part of feeding occurs. Its defense is usually done by the male, but the female may also defend it. Reproduction occurs during all months of the year, but there is less breeding during the winter months of June and July. The same couple is able to nest up to three times in one year.

At the beginning of the reproductive period the male shows the behavior of vertical tail fanning in different places where a nest may be built; however, the final choice is made by the female. Nest building takes about three days and is made cooperatively by both members of the couple. The choice of material and the carrying of it to the nest is done by the male, while the female arranges it in the nest. They use rougher materials to start nest building, and line the nest inside with smoother materials. The same nest may be used more than once and a small amount of lining is added before the next clutch. The following mean measures of the nest were found: external diameter 10.15±0.71 cm in nature and 10.77±1.02 cm in captivity; internal diameter 6.88±0.85 cm in nature and 6.27±0.60 cm in captivity; external height 3.50±1.22 cm in nature and 3.05±0.98 cm in captivity; depth 1.81±0.41 cm in nature and 1.94±0.45 cm in captivity. These measures varied according to the number of times the same nest was utilized.

*S. squammata* lays two white eggs per clutch, on successive or alternate days. Incubation is performed by both sexes and lasts between 13 and 15 days. The mean values of 10 eggs measured in nature were: length 22.7±0.67 mm and width 17.2±0.56 mm and of 103 eggs measured in captivity were: length 23.1±1.49 mm and width 17.7±0.42 mm.

Generally two nestlings are born per clutch during the same day or on successive or alternate days. Both sexes take care of the nestlings. They are fed by the adult covering them at the occasion, and one or both nestlings may be fed at the same time. The mean weight of the nestlings on hatching day obtained in captivity was 3.82±0.69 g, about 6.5% of the adult weight. At leaving the nest the mean weight was 32.18±3.28 g or about 55% of the adult.

Fledglings leave the nest between the 14 th and the 16 th day after birth, both at the same time or with a difference of a few hours. During the first day they remain perching on the nest's tree, as they still don't fly well. The parents still take turns and the fledglings are exclusively fed by them. During the first days parents go to the fledglings to feed them. As soon as they start to fly more easily the fledglings go to the parents to ask for food, a behavior which may continue in nature until the age of 42 days.

The immature birds in nature, before fixing the boundaries of their own territories, remain in the territory of their parents, even if these are already hatching a new brood, since they don't interfere with the reproduction of their parents. When the immature birds become sexually mature, they leave the parent's territory and mark their own.

In relation to the beginning of the reproductive age, the male may show the behavior of vertical tail fanning at the age of 77 days, and courtship feeding and copulation can occur among the members of a couple when the female is 82 days old. The starting of laying eggs and successful hatching can occur when the female is 103 days old.

The mean weight of several fledglings showed that they usually reach the adult weight at about the 4th or 5th month of age.

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