

# Has the Golden Sparrow replaced the Black-faced Dioch in West Africa?

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## Introduction

The balance between the Black-faced Dioch (*Quelea quelea*) and the Golden Sparrow (*Passer luteus*) has been severely altered during the last 25 years in the Lake Chad area and in West Africa. While *Quelea* was formerly the most abundant pest species, *P. luteus* is currently destroyed. Since it is claimed, especially in Nigeria, that *Quelea* has been reduced artificially, it has been suggested that the recent increase of *P. luteus* is the result of *Quelea*'s eradication, these two species being potential competitors. As an alternative explanation, it is proposed (JONES, 1976; COPR, 1977) that the cyclical fluctuations of these avian populations are a response to climatic variations. The purpose of this paper is to discuss the first hypothesis — competition — through a comparison of both species.

## Systematics and distribution

*Passer luteus* and *Quelea quelea* are both small passerines of the Ploceidae. *P. luteus* (Passerinae) is the most numerous and the most colonial sparrow in tropical Africa. It ranges over the Sahel from the Atlantic Ocean east to the Red Sea whence it enters South Arabia as the sub-species *euchlorus*. The genus *Quelea* (Ploceinae) has only 3 species restricted to the Ethiopian region. The nominal species *Quelea quelea* is by far the most important and we shall deal only with the West African sub-species *quelea* which ranges from the Atlantic coast to Lake Chad.

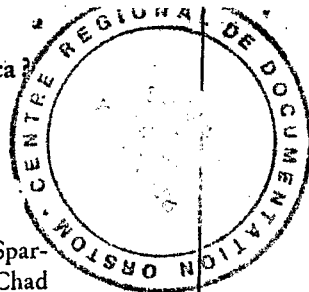
## Plumage and moult

*Quelea* has a seasonal and sexual dimorphism but outside the breeding season, both sexes are identical. *P. luteus* has permanent sexual dimorphism and the only change in breeding dress is the black bill of the male.

In non-breeding dress, male and female *Quelea* have an identical plumage, which may help reduce aggressiveness and make social life easier (WYNNE-EDWARDS, 1962). The Golden Sparrow presents an interesting denial to this hypothesis since the males keep their conspicuous yellow plumage all the year round which does not appear to hinder their social life. The permanent "breeding dress" enables the sparrow to breed at any season and can be an opportunistic adaptation. The plumage of the Golden Sparrow is also noteworthy. It is the only sparrow to have such a rich dress and one cannot help but compare it with the plumage of the savanna weavers (*Ploceus*) which is also bright yellow.

## The habitat

It extends, broken only by two rivers, from the Ocean to Lake Chad. It lies within the tropics, with an annual mean temperature of 29° C and rains of the monsoon type



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in summer. Despite an apparent monotony, the habitat heterogeneity is amazingly high, because the rainfalls are seasonal and of unpredictable importance (*P. luteus* ranges within the 100/500 mm isohyets; *Quelea* within the 200/1,200 mm isohyets) and because also the gentle relief and the soil diversity create conditions for a complex plant community (VALENZA & DIALLO, 1972).

They feed only on grass seeds which they hull. *Quelea*, at the start of the dry season, feeds on medium-sized and well concentrated seeds, easy to collect (especially *Panicum laetum* and *Echinochloa colona*). Then, as the dry season progresses, *Quelea* takes seeds smaller and smaller and more scattered: *Dactyloctenium aegyptium*, *Chloris* sp., *Schoenefeldia* (WARD, 1965).

The Golden Sparrow's diet is comparable to *Quelea*'s but shows several peculiarities: a very high percentage of *P. laetum* and a total absence of *Echinochloa* (MOREL & MOREL, unpubl.).

The crops *Sorghum* and *Pennisetum* are damaged by *Quelea* and the sparrow as well but rice is eaten only by *Quelea*, a remarkable difference. Besides, each species has its own feeding behaviour: *Quelea* forages in enormous flocks which accounts for the heavy losses it inflicts, especially on flood plains where the wild seed crop is abundant. *P. luteus*, which is more a desert bird, is better adapted to exploit a patchy or scattered food on grounds of lower productivity. This sparrow's ability to range up to the desert border and to exploit vast arid plains (e.g. the Ferlo south of the Senegal river) where *Quelea* is never found, is consistent with this statement.

## Reproduction

Both species are colonial but, while the Golden Sparrow breeds in the dry season, *Quelea*, as a rule, breeds in the rainy season. The Golden Sparrow breeds only in the thorn-bush but *Quelea* can also breed on reeds in swamps and on sugar-cane. For convenience, we shall restrict this study to the colonies of the rainy season located in the thorn-bush.

## Structure of the vegetation in a colony

It has been recently analysed in the Chad area by GASTON (1976), who recognized several conditions for *Quelea*: a) a percentage of tree cover of 20 to 50 %, where thorny trees 4 to 6 meters high are dominant and cover is also preferably regular; b) the grass layer (mainly Gramineae) is of variable height (30 to 200 cm) but with 100 % cover; c) the area is fairly humid, rarely saturated; d) there must be rich and open grass areas in the neighbourhood. Those conditions have also been met in Senegal and Mauritania.

The vegetational structure of the Golden Sparrow's colonies has only recently been given some attention. But it immediately looks different. The nests are built also on thorny trees, *Acacia* and *Balanites*, but their density per hectare is usually lower than for *Quelea*. Sometimes, both species breed alongside in the same area (e.g. in Mali; BORTOLI, 1977). The vegetation structure is a very important element of the habitat so it is likely that any serious alteration would cause changes in the bird distribution. Recently, the vegetation of this region has badly suffered from the drought (POUPON & BILLIE, 1974). In many other places, the tree cover necessary for *Quelea* disappeared

almost completely through the combined action of man and climate. It is not too far-fetched to assume that *Quelea* may leave an area when the trees are getting scarce. If *Quelea* moved to the south because of the alteration of its habitat, among other things, it is unlikely it will make a come-back soon considering the time the woody vegetation needs to recover (POUPON, 1977).

#### The nest

The nests of these two species are strikingly different. *Quelea* builds a typical weaver's nest, an elongated sphere, made of long, green, supple grass. Unlike other weavers, *Quelea* does not add any lining to its nest. This loosely woven nest is however fairly strong and withstands the stormy rains very well. Several nests happen to be woven together indicating a very weak territoriality and obvious adaptation to colonial life. On the other hand, the nest by itself is a rather poor deterrent to predators (MOREL & BOURLIÈRE, 1956).

The Golden Sparrow's nest is not comparable. It is an enormous sphere of thorny twigs with a cup of soft material. Indeed, it is unique among sparrows. But, really, it is just an adaptation of the domed nest. Cavities would never meet the demand of colonial nesting. Straw nests would collapse during the strong rains and would easily be torn open by any bird of prey of average size. It is well adapted to colonial life, to adverse weather and to predation. But its necessary positioning in thorny trees is a shortcoming.

#### Colonial breeding

*Quelea* and *P. luteus* are two colonial species, which breed during the rains in the same thorn-bush. But the similarity does not go farther. Both species are roughly subjected to the same environmental pressures but each species evolved its own response. In an unstable and unpredictable environment, a wise strategy seems to spread out the breeding season so that the hazards are divided. This is the Golden Sparrow's strategy. Conversely, the reproduction of large fractions of this population at the same time may produce disaster if the best breeding requirements are not met. *Quelea* has evolved just this second solution, but the timing and the synchronization of breeding are good and the fledging success is unusually high.

##### a) *Quelea*

The breeding season depends upon two closely related factors: a) green grass stalks. They are supple enough for weaving for a short period, so the birds have responded by synchronized and fast building. This clearly favours colonial behaviour. The grass is good for weaving after 200 mm rainfall, which occurs in the second half of the rainy season. b) food of nestlings. They are fed fresh grass seeds, still in a dough stage, and insects. It is not clear whether the time of breeding depends more on building material or the nestling's food, since the two factors are closely linked. Hatching occurs when the insect production is rather on the decline. In addition, the fresh seeds, which are given to the nestlings, produce less calories than fully mature seeds, which means consequently more visits and more distance for the parents to cover. And we have some evidence that the parents are already working near their limit (WARD, 1965 b). The

breeding must take place also when there is a maximum of rain ponds. Some do not last more than a few weeks and we know of several colonies in jeopardy for lack of water. *Quelea*'s big colonies (hundreds of thousands of nests can be packed over a small surface) seem, after numerous observations, to be free of any significant predation. This remarkable condition is largely attributed to the size and short duration of the colonies. It has been called "the swamping effect", i.e., the size of the prey population is too big for any predator. Natural evidence for this hypothesis is given by the small colonies which suffered, in several instances, heavy destruction (THIOLLAY, 1975).

Clearly, the colonial reproduction of *Quelea* is the result of several intertwined factors which are very difficult to separate. Thus, *Quelea* copes successfully with an unstable environment thanks to fast and synchronized reproduction at the right time.

##### b) *Passer luteus*

The reproduction of the Golden Sparrow depends primarily upon the insects which are given to the young and to a lesser extent upon the twigs for the nests. These requirements differ strikingly from those necessary for *Quelea* (MOREL & MOREL, 1973; MOREL & MOREL, 1976). Though our knowledge of the production of insects is very crude, everyone agrees it is unpredictable and variable. It is still impossible to establish any logical relationship between rainfall and insect abundance let alone between the rainfall pattern and the sudden peak of one or several species. The peak of abundance of insects is sometimes fairly short, and some colonies, perhaps even fractions of colonies, must experience food shortage. Given these environmental constraints, we can understand why the Golden Sparrow colonies are unsynchronized. They are also very loose since the average number of nests per tree is no more than two (compare with *Quelea* figures). The scattering of the colonies is related to several possible factors: a) males' aggressiveness at the nest-building stage. Although this sparrow is a seed-eater most of the year, during the breeding season they behave like an insectivorous bird so that pairs need to be spaced out to get a sufficient amount of prey. Surprisingly, the crop (which is used during the dry season to store the seeds) is not utilized to carry the insects which are instead taken one by one. b) dispersion of the breeding population over large areas of suitable vegetation to adjust as closely as possible to local variations of food supply. c) the nest materials, though we lack positive evidence, could be a limiting factor. The nest is made of thorny twigs, of about 15 cm in length, picked under or near the trees. On the other hand, termites, which are numerous and very active, destroy any accumulation of dead wood under the trees. So, although actual figures are lacking, suitable twigs may sometimes be in limited supply.

The site of the colony can be occupied about two months, for the birds arrive gradually. The synchronization of the colony is not great. The Golden Sparrow's loose strategy has several drawbacks.

The Golden Sparrow's colonies thinly scattered over large areas, with conspicuous nests, for about two months should be an extraordinary bait for predators. But the nest is a formidable challenge for most of them. For snakes and monitors, the nest is defenseless and we actually found those animals in the nest; but the reptiles, although they surely feast upon the nestlings as much as they can, do not represent the same danger as birds of prey, especially migrants, which can come together in fairly big numbers.

The lack of a true synchronization also requires the Golden Sparrow males to watch constantly over their nest during the nest-building stage to drive away neighbours trying to steal nest material. Nest-building takes 10 days for the sparrow (as against 2—3 for *Quelea*) and this period is even longer since all the males did not begin together. The male must also guard against its neighbours attempting to copulate with its own female. Again, these efforts are mainly due to the loose synchronization. Conversely, *Quelea*, with its rapid and synchronized reproduction, has brought all these efforts to an absolute minimum.

#### Conclusion

This comparative study of two species has brought out the important differences which characterize each of them. Although they live more or less in sympatry and on comparable food, each species shows a definite preference for a particular environment and a more or less dry climate. It is also interesting to note how two species which belong to two distinct sub-families show at the same time convergence and divergence in their behaviour. We can thus conclude that the decline of the Dioch and the increase of the sparrow are primarily due to environmental variations, more precisely to deterioration of the habitat.

#### References

- BORTOLI, L. (1977): *Quelea quelea* dans la zone ouest. P.N.U.D./Recherche pour la lutte contre les oiseaux granivores "*Quelea quelea*". SR 271. 24 p. miméogr.
- C.O.P.R. (Ed.) (1977): *Quelea* Investigations Project, Nigeria. Final Report 1972—1975, 57 p. mimeo. College House Wrights Lane. London W 85 SJ. Centre for Overseas Pest Research.
- GASTON, A. (1976): Recherches sur la lutte contre les oiseaux granivores *Quelea quelea* N'Djamena-Tchad. Bilan de quatre années de travaux phyto-écologiques en relation avec la lutte contre le *Quelea*. Rapport final. Phases I et II. Etude agrostologique en sous-traitance, I.E.M.V.T., Maisons-Alfort, 25, 219 p. miméogr.
- JONES, P. J. (1976): *Spectrum* 146, 7—9.
- MOREL, G., & R. BOURLIÈRE (1956): *Alauda* 24, 97—122.
- MOREL, G., & M.-Y. MOREL (1976): *Terre et Vie* 30, 493—520.
- MOREL, M.-Y., & G. MOREL (1973): *Oiseau* 43, 97—118.
- POUPON, H. (1977): *Cah. O.R.S.T.O.M. Sér. Biol.*, 283—291.
- POUPON, H., & J.-C. BILLE (1974): *Terre et Vie* 28, 49—75.
- THIOLLAY, J. M. (1975): *Terre et Vie* 29, 31—54.
- VALENZA, J., & A. K. DIALLO (1972): Etude des pâturages du Nord-Sénégal. Etudes agrostologiques et agro-pastorales, I.E.M.V.T., Maisons-Alfort, 34, 311 p. miméogr. + 1 c. coul.
- WARD, P. (1965 a): *Ibis* 107, 173—214.
- WARD, P. (1965 b): *Ibis* 107, 326—349.
- WYNNE-EDWARDS, V. C. (1962): *Animal Dispersion in Relation to Social Behaviour*. Edinburgh. Oliver and Boyd. 653 p.