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Building Materials and biometry of *Ploceus cucullatus* and *Ploceus nigerrimus* (Aves: Ploceidae) Nests in the monospecific colony at Kisangani city, Democratic Republic of the Congo

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Abstract
The comparative survey on the building materials and the nest biometry of *P. nigerrimus* and *P. cucullatus* in the monospecific colonies in Kisangani had for main objective the assessment of the knowledge of buildingmaterials of these two species in relation to their specificity. In total, 90 nests were equitably picked in six stationsfor the two species (i.e. 45 for *P. nigerrimus* and 45 for *P. cucullatus*).
Different measures were used in this survey, namelyt: the weight of nests (in gram), the height (in centimeter) (hl and h2) and the diameter of portal of entry (in centimeter) (dl and d2) were taken as well as the weights of each building material.
The results show that the inflorescences of *Poaceae* (*Bambusa vulgaris, Sporobolus pyramidalis, Maximum panicum, Penisetum purpureum* and *Eragrostis tenella)* and leaves of the host trees *(Mangifera indica, Acacia kirkii, Dacryoides edulis* and *Elaeis guineensis*) are the main nest building materials. These materials are exploited in different proportions and also play specific roles in the nests.
Out of 14 identified plant species, only five species were found in the nests of *P. nigerrimus (Elaeis guineensis, Bambusa vulgaris, Dacryoides edulis, Persea americana* and *Cassia siamea*); four in the nests of *P. cucullatus (Elaeis guineensis, Bambusa vulgaris, Mangifera indica* and *Raffia gilletii*). The average weight of the nests of *P. nigenimus* is of 53.02 g; while the one of *P. cucullatus* is of 67 g.

Keywords: *Ploceus cuculattus, Ploceus nigerrimus*, Monospecific colony, Kisangani city, Democratic Republic of the Congo

1. Introduction
Ploceus cucullatus Muller (1776) and *Ploceus nigerrimus* Veillot (1819) are robust birds of small or middle size having a big conical beak of the granivores. Commonly called "weavers", they are known by the fact that they are good builders of woven nests, nicelybuilt [1]. Mainly in nonospecific colony but also in polyspecific colony, often in association with *P. pelzelni* [2, 3] and *P. aurantus* [4], a colony associating four species of *P. cucullatus*, *P. nigerrimus*, *P. pelzelnis* and *P. aurantuses*, is rarely formed [2].
Therefore, the study of these two species raise a big ecological interest; on the one hand, the cohabitation, tolerance, the competition opposing them their fellows in the exploitation of area resourcesfor the selection of colonies, the access to food, the nest material to the man's company [2, 5]. On the other hand, the study of bird nests is a domain very interesting of research that permits to clarify some aspects of their ecology [6].
For *P. cucullatus*, males build woven nests in a genius way so that the portal of entry has a thick basis and well-padded, while *P. nigenimus*, its nests are globular, woven under way and suspended to the extremities of branches or herbs. Mainly, they use the cut twigs of *Elaeis guineensis* leaves in order to construct their nests [7].
The aim of this study is to determine the host trees, the nest weights and to compare qualitatively and quantitatively the materials used by these two species while they are living in monospecific colonies.

2. Materials and Methods
2.1 Study area
This study was carried out in the city of Kisangani, located to the Northeast of the Congolese Central basin. Its geographical coordinates are: 25° 11' of longitude East and 0°31' of latitude North. Its altitude varies between 376.5 m and 424.7 m. Kisangani has a surface of 1910 Km^2 [8].

2.2 Description of the collection site
The nests of *P. cucullatus* and *P. Nigerrimus* were collected in six sites of which three for *P. cucullatus* and three for *P. nigerrimus*.

a) *Ploceus cucullatus*
Site 1: Singa-Singa Avenue in the Lubunga district
Singa-Singa Avenue is in Lubunga district. The district where the nests were collected is situated at 25° 11.227' of longitude east and 0°30.145' of latitude north, to the left bank of the Congo River. The dominant vegetation in this part is essentially made of *Panicum maximum*, *Mangifera indica*, *Persea americana*, *Musa sp*, *Citrus lemonia*, *Elaeïs guineensis*, *Bambusa vulgaris*, and so on. This vegetation allows *P. cucullatus* to get their materials easily for the construction of their nests.

Site 2: Kikongo Avenue
Kikongo Avenue is in Kisangani district, at the bank ofCongo River at 25° 10.737' of longitude East and 0°30.585' latitude

north. Located at the East of Kisangani city where the dominant vegetation is constituted of *Mangifera indica, Spondias cytherea (*Myrtaceae*), Elaeïs guineensis, Bambusa vulgaris, Panicum maximum*, etc.

Site 3: 10thAvenue n°5, Kisangani district

Locatedin Kisangani district, (25°12.459' of longitude East and 0°31.990' of latitude north), the vegetation that dominates in this part is similar to the one of 7th Avenue Plateau Boyoma.

b) *Ploceusnigerrimus*

Site 1: 21st Trans, Kabondo district,

Located at the extension of the road that leads toward the cemetery of Kamba-Kamba, in Kabondo district, (25°11.012' of longitude east and 0°30.287 of latitude north), and the dominant vegetation is constituted of *Panicum maximum, Mangifera indica, Persea americana, Dacryoides edulis, Elaeis guineensis.*

Site 2: 7thAvenue Plateau Boyoma, Makiso district,

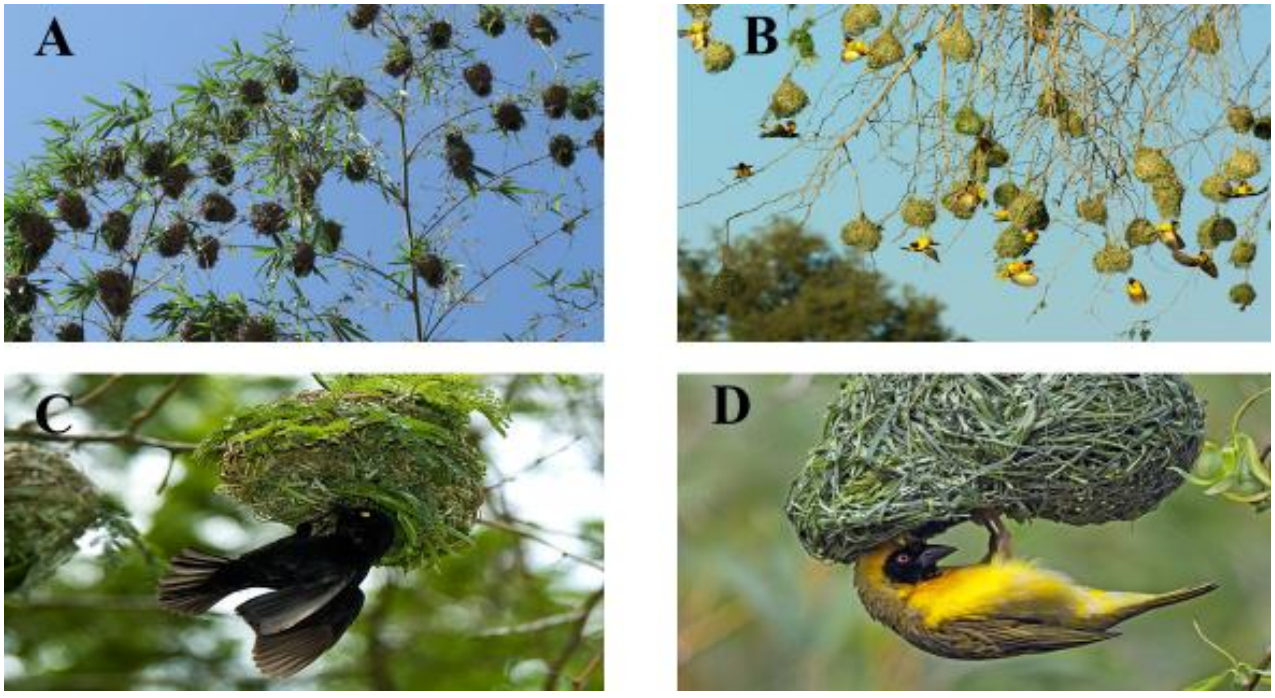
Situated in Makiso district (25°12.545' of longitude east and to 0°31.863' of latitude north), and the main vegetation found in this area is *P. maximum, E. guineensis, M. indica*. This habitat that is semi-flooded and also frequented by several other species of aquatic birds, namely: *Phalacrocolax africana, Anhinga rufa, Ardea purpurea*. The weavers frequently visit this biotope because they find enough food.

Site 3: Cimastan

The concession of Cimastan is situated at the bank of Congo Riverat 25°12.617' of Longitude east and 0°32.501' of latitude north. The collection of nests was done around the "Bamanisa" pond. This habitat is also semi-flooded and has the same vegetation that the one of the 7th Avenue Plateau Boyoma.

3. Methodology

The 15 occupied nests, picked in every colony allowed constituting a batch of 90 nests of which 45 for *P. cucullatus* and 45 for *P. nigerrimus*. The location of the nests was facilitated by the screams of the birds at the time of shifting. Others were localized on the other hand from the information that the inhabitants provided and by the presence of some plant species namely *E. guineensis* without of its limbs taken by weavers.



P. nigerrimus ***P. cucullatus***

Fig 1: Weavers and their nests.

In relation to the accessibility, the nests were collected either by hand, or a perch. Once collected, they were labeled respectively and kept separately in plastic sachets to avoid the loss and the mixture of the materials of different nests, then brought back to the laboratory of general Biology, Faculty of Sciences for the spoliation. In the laboratory, the nests were weighed by means of peson of 300 g, dried under the sun during one week, three days in the oven at 65 °C and weighed again to determine the dry weight.

4. Statistical analysis

For biometric data, the Snedecor F test [4] was applied to compare variances of the measures done on the nests of *Ploceus escucullatus* and *Ploceus nigerrimus*.

It is about four measures: The height (h1 and h2) measured to the" heart of the nest" using a gradual ruler (mm) while the opening of the portal of entry (d1 and d2) was measured by means of a caliper (Mitutoyo brand).

The S2 variances of the two samples to be compared are calculated using Microsoft Excel office 2007. These calculations allowed to determine S2 max and S2 min that indicates the calculated biggest and smallest variances respectively, from the analyzed samples.

$$\mathbf{Fcal} = \frac{\mathbf{S2\ max}}{\mathbf{S2\ min}}\ \mathbf{(1)}$$

The value of F calculated (F_{cal}) (1) is compared with the tabular F value (F_{tab}), to the significance level α=0.05. The degree of

freedom (df) is determined according to the size of the compared samples, in considering S2 max and S2 min which is in the F table of Snédécor. The comparison of F_{cal} and F_{tab} helps to statistically decide on the null hypothesis. Then, If $F_{cal} < F_{tab}$, then no significance difference; If $F_{cal} > F_{tab}$, then there is a significance difference. The nests were stripped in a tray, while pulling outtheir materials with care. The obtained materials were classified by species then weighed and were identified at the herbarium of the Faculty of the Science.

5. Results and Discussion

5.1 Host Trees of the colonies

Four plant species are kept as host trees for the two species of weavers of which *Mangifera indica*, *Acacia kirikii*, *Dacryoides edulis* and *Elaeis guineensis*. According to the proximity of host trees, a colony can construct its nests upon only one tree or two trees (rarely).

5.2 Weight of nests

The weight of nests in the monospecific colony of *P. cucullatus* oscillates between 41.7-117.89 g. The overall average is equal to 67.77 g; while *P. nigerrimus* varies between 18-88.47 g and the overall average is equal to 53.02 g. These weights showed a significantdifference. The weight of the nest doesn't increase according to the number of plant species.

5.3 Plant species incorporated in the nests

Considering the set of 90 nests in the monospecific colony of which 45 for *P. cucullatus* and 45 for *P. nigerrimus* it is noticed that *P. cucullatus* exploits 9 plant species to construct their nests while *P. nigerrimus* uses 14 plant species. The survey showed that they combine them in variable fraction (weight, frequency of removal), but not all species at the same time. The materials of erection of the nests are used under three shapes: thongs, whole leaves, and inflorescences. According to their origin, 60% of materials come from *Poaceae*.

5.4 Biometry of nests

The figures 2 & 3 give the biometry of *P. nigerrimus* and *P. cucullathus* in the monospecific colony.

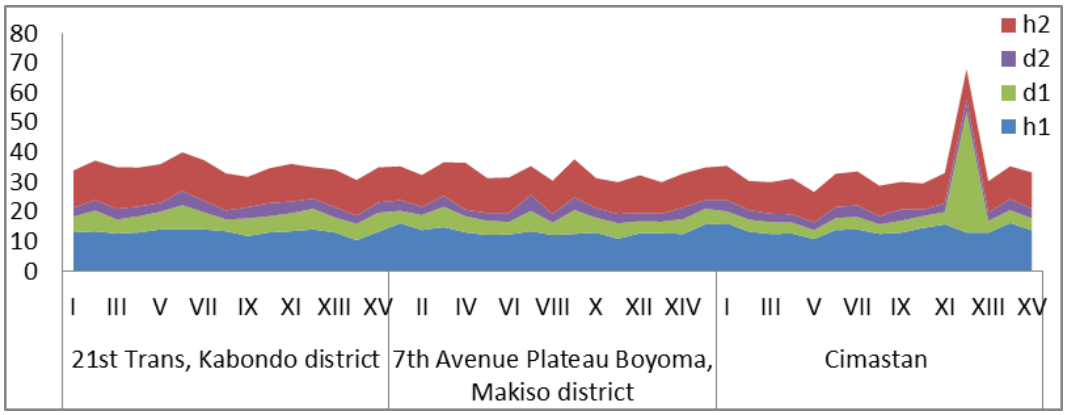


Fig 2: Biometry of *P. nigerrimus* in the monospecific colony

In comparing the two averages of h1 (13.29 cm) and h2 (11.53 cm) and d1 (5.81 cm) and d2 (3.38 cm) of a sample of 45 nests of *P. nigerrimus* indicates that h1 and h2 don't show a significant difference because $F_{cal} < F_{tab} = 1.130 < 2.48$ whereas d1 and d2 show a significant difference $F_{cal} > F_{tab} = 71 > 2.48$.

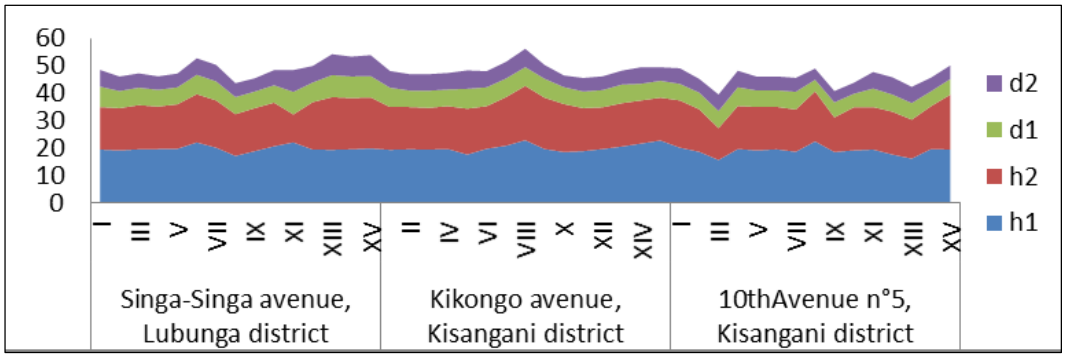


Fig 3: Biometry of *P. cucullatus* in the monospecific colony

In comparing the two averages of h1 (19.16 cm) and h2 (16.10 cm), and d1 (6.44 cm) and d2 (5.63 cm) of a sample of 45 nests of *P. cucullatus*, it comes outthat h1 and h2 ($F_{cal} < F_{tab} = 1.58 < 2.48$) doesn't show a significantdifference while d1 and d2 ($F_{cal} < F_{tab} = 1.42 < 2.48$) show a significant difference.

In the monospecific colony as in the polyspecific colony for *P. nigerrimus* and *P. cucullatus*, the choice carried on the host trees would be based on the strategy "available host tree" and guaranteed security". [5] and [9] noted that in a polyspecific colony, the nests of *P. cucullatus* weigh (33-88 g) and those of *P. nigerrimus* weigh (22-58 g) while in the monospecific colony, the nests of *P. cucullatus* are heavier (41.7-117.89 g) compared to the nests of *P. nigerrimus* (18-88.47 g). In the monospecific colony, the opening of the portal of entry (d1 and d2) and the

height (h1 and h2) are different while [5] found that the measures (d1 and d2) or (h1 and h2) were equal in the polyspecific colony. It was reported also that in a polyspecific colony, the number of plant species is of 4-5 for *P. nigerrimus* and 3-6 for *P. cucullatus* [5]. According to [10], this number varied between 3 and 5 for *P. cucullatus* and that is of 5 for *P. nigerrimus*. In general, in the monospecific colony, for the nest of *P. cucullatus*, the number of plant species is reduced between 2 and 8 versus between 2 and 11 for the nest of *P. nigerrimus*. It can qualify this behavior of strategy of compensation and concession for a non-conflictual cohabitation, because *P. cucullatus* used the coarse plant pieces; it is a wasteful species" of materials" while *P. nigerrimus* used fine plant pieces (rational management).

6. Conclusion

The present study analyzed 90 nests of weavers of which 45 for *Ploceus nigerrimus* and 45 for *P. cucullatus* in a monospecific colony. The weavers choose some tree species that answer the strategy "available host tree and guaranteed security" in order to build their colonies. In this small survey, four species of host trees were identified: *Mangifera indica* for *P. cucullatus* and *Elaeis. guineensis, Acacia kirikii* and *Dacryodes edulis* for the *P. nigerrimus*. In the monospecific colony, the nests of these two species of weavers present a significant difference in their weights. The nest of *P. cucullatus* weighs 67.77 g in average while the one of *P. nigerrimus* weighs 53.02 g in average.

The nests present a globally spherical shape but the portal entry opening of the nests of *P. cucullatus* has a circular shape and the one of *P. nigerrimus* presents an elliptical shape. The number of the plant species varies between two and eight for *P. cucullatus* and between two and 11 for *P. nigerrimus*; with the average values of four for *P. cucullatus* and five for *P. nigerrimus*.

7. References

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