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Morphometric Identification of Two Species of Achatinidae :*Achatina achatina* Linné, 1758 Et *Archachatinaventricosa* Gould, 1850

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----------**ABSTRACT**----------
The studies took place within the Animal Productions Pole of NanguiAbrogoua University (Abidjan-Ivory Coast) and aimed to search for measurable traits that would clearly distinguish between two species of Achatinidae, including species Achatinaachatina and Archachatinaventricosa. To achieve this, measurements were made on different parts of the shell of the snails concerned and reports were made notified. Values show that i) the Right side length (L_D) and Left side length (L_G) obtained in the species A. achatina are statistically higher than those measured in the species Arch. ventricosa, while the measured high side lengths (L_H) are statistically identical; ii) The length of the large diameter (L_{GD}) in A. achatina is statistically higher than that of Arch. ventricosa; iii) total shell length (L_T) and length Apex-Last suture ($L_{Ap\text{-}DS}$) in A. achatina are statistically higher than those of Arch. ventricosa.These results justify the fact that (i) the shell of the species A. achatina is longer than that of the species Arch. ventricosa ; ii) the shell opening of the species Arch. ventricosa is a little rounder than that of the species A. achatina which seems a little oval ; iii) the shell of the species Arch. ventricosa is less elongated and more ventric than that of the species A. achatina.
Keywords*: achatine, apex, belly, length, opening, shell*

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I. INTRODUCTION

The giant African snail is an animal species whose flesh is for many African people (Gold Coast, Togo, Benin, Nigeria, etc.), and more particularly the Ivorian people, a popular food. As a result, it is the subject of a flourishing tradefor many women in the markets, including those in Abidjan.The giant African snail belongs to the Achatinidae family. This family currently contains more than 60 species divided into 11 genera (Bequaert, 1950 ; Crowley & Pain, 1959, 1970 ; Mead, 1961 ; Abbott,1989), whose identification is based on morphological, anatomical and physiological criteria. (Marche-Marchad, 1965 ; Mead, 1979 ; Mouthon, 1982 ; Abbott, 1989 ; Hardouin et al., 1995 ; Codjia&Noumonvi,2002). In addition, some authors support the existence within the predefined species of many subspecies not yet clearly elucidated to date (Mead, 1979).

Indeed, in our opinion, the identification criteria previously used to distinguish each species or subspecies of Achatinidae, based essentially on morphological considerations, seem insufficient to explain, for example, the variability in the color of shell in individuals of the species A.achatina or Arch.ventricosa. In the case of A. achatina for example, although the coarse aspect of the shell does not show any particular difference between individuals coming from different horizons, however, there is a difference of color in the ornamentations of the shell. Some individuals have lighter ornaments while in others the ornaments are darker, to such an extent that they could be confused with individuals belonging to the species Arch.marginata.In view of the above, we have found it necessary to associate with the criteria of pre-existing morphological identifications, an approach based on morphometric parameters, hence the object of our study.This study therefore aims to find measurable traits that clearly distinguish between two species of Achatinidae, including A. achatina and Arch. ventricosa. To achieve this, we will search on the shell of these two species, parts (shell opening, apex, length of the shell) on which measurements can be made and thus define values that can characterize this or that species.

II-MATERIAL AND METHOD OF STUDY

2.1. Study area

Our study took place in the laboratory of unconventional breeding of the Pole of research in Animal Productions of the NanguiAbrogouaUniversity. This laboratory is located at the IREN (Research Institute for Renewable Energy) building inside the University.The NanguiAbrogoua University is located in the city of Abidjan, on the Adjamé-Abobo axis, in front of the companyFILTISAC. The city of Abidjan covers an area of 422 km^2. The climate is sub-equatorial, hot and humid, with a long rainy season (May-June-July), a short rainy season (September-November) and twodry seasons. The long dry season starts from December and ends at the end of March. Precipitation is abundant: more than 1,500 mm of water per year. The temperature hovers around 27 ° C and the average annual relative humidity is above 80%.

2.2. Biological material

The study focused on two species of Achatinidae: A. achatina(Fig.1) and Arch. ventricosa.(Fig.2).

Figure 1- Achatinaachatina (big red)
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Figure 2- Archachatinaventricosa (big black)
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The shell of the species A. achatina is ventric, with a pointed top and an opening with no border. It presents numerous and fine ridges of growth perpendicular to the turns. The ornamentation of the shell has dark or black bands perpendicular to the growth streaks, on a light brown background. The body of the animal is usually pigmented with black. Its live weight can reach 680 g (Hodasi, 1984 ;Zongo et al., 1990 ; Otchoumou, 1991).The species Arch. ventricosa has a shell swell or belly located on the side. The top of the shell is rounded, smooth and the opening has a border. This species has numerous growth streaks perpendicular to the turns. The ornamentation of the shell is in the form of light green bands on a dark green background. These bands are parallel to the growth streaks. The body of the animal is pigmented in light gray. Its weight can reach 300g (Hodasi, 1984 ; Otchoumou,1991, 1997).

2.3 - Method of study

One hundred and forty-eight specimens of A. achatina and Arch. ventricosa were collected here and there on the markets and measurements of some parts of the shell were made using a graduated ruler. The measurements made are as follows:

- Length side up (L_H), Length on the right side (L_D) and Length on the left side (L_G) (Fig. 3)
- Large Diameter Length (L_{GD}) and Small Diameter Length (L_{PD}) (Fig. 4)
-Total length of shell (L_T) and Length between Apex and last suture (L_{Ap-DS}) (Fig. 5)

Figure 3: measurement of the sides of the apex

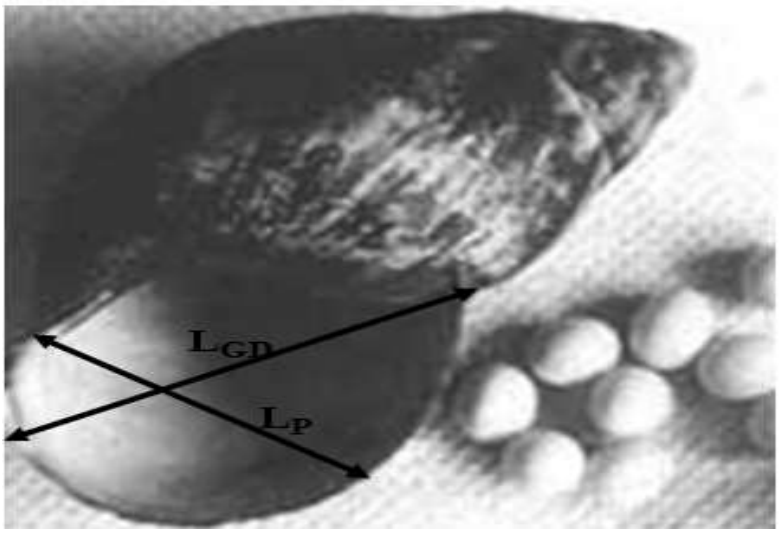

Figure 4: Measurement of the sides of the shell opening

Figure 5: measurement of parameters associated with shell length

2.4 - Statistical analyzes

Size variations were estimated using ANOVA (variance analysis) from the Excel software.

III. RESULTS AND DISCUSSION

3.1 - Results

The results of the measurements made are shown in the Table 1.

Table 1. Results of measurements

Measured parameters	Achatinaachatina	Archachatinaventricosa
Length high side (L_H)	34,6 ^{a} ± 6,6	32,6 ^{a} ± 7,7
Length on the right side (L_D)	38,8 ^{a} ± 7,4	33,8 ^{b} ± 6,2
Length on the left side (L_G)	29,5 ^{a} ± 5,7	24,3 ^{b} ± 6
Length Large Diameter (L_{GD})	70,6 ^{a} ± 10,2	64,4 ^{b} ± 10,3
Length Small Diameter (L_{PD})	36,2 ^{a} ± 5,6	36,9 ^{a} ± 7,2
Total length (L_T)	115,6 ^{a} ± 17,7	101,8 ^{b} ± 14,9
Length between Apex and last suture (L_{Ap-DS})	45,8 ^{a} ± 7,9	36,5 ^{b} ± 5,8

NB: The average values (mm) of the same line and indexed of the same letter, are not statistically different ($p > 0.05$)

The analysis of this table 1 shows that the two opposing sides Length on the right side L_D(38,8 ^{a} ± 7,4) and Length on the left side L_G (29.5 ^{a} ± 5.7) in the species A. achatina are statistically higher than L_D (33.8 ^{b} ± 6.2) and L_G (24.3 ^{b} ± 6) in the species Arch. ventricosa. The comparison between the length of the large diameter (L_{GD}) of the opening of the shell is statistically higher in the species A. achatina (70.6 ^{a} ± 10.2) against 64.4 ^{b} ± 10.3 for the species Arch. ventricosa. On the other hand, for the small diameter (L_{PD}), there is no statistical difference between the values obtained in the species Arch. ventricosa (36.9 ^{a} ± 7.2) and A. achatina (36.2 ^{a} ± 5.6).

Finally, the total shell length (L_T) and the Length between Apex and last suture (L_{Ap-DS}) were measured. The values obtained show that in the species A. achatina, the values obtained (115.6 ^{a} ± 17.7 and 45.8 ^{a} ± 7.9) are statistically higher than those obtained from the species Arch. ventricosa (101.8 ^{b} ± 14.9 and 36.5 ^{b} ± 5.8).
Relationships between measured parameters were performed and the following results were obtained (see Table 2):

Table 2. Relationships between measured parameters

Measured parameters	Achatinaachatina	Archachatinaventricosa
Lh/(Ld+Lg)	$0,5^{b} \pm 0,0$	$0,6^{a} \pm 0,0$
L_{GD} / L_{PD}	$2,0^{a} \pm 0,2$	$1,8^{b} \pm 0,3$
$L_{Ap\text{-}DS} / L_T$	$0,3^{b} \pm 0,0$	$0,4^{a} \pm 0,0$

NB: The average values (mm) of the same line and indexed of the same letter, are not statistically different ($p > 0.05$)

The ratio $L_h / (L_d + L_g)$ and $L_{Ap\text{-}DS} / L_T$ in the species A. achatina ($0.5^{b} \pm 0.0$ and $0.3^{a} \pm 0.0$) are statistically lower than those of the species Arch. ventricosa ($0.6^{a} \pm 0.0$ and $0.4^{a} \pm 0.0$). On the other hand, the ratio L_{GD} / L_{PD} are statistically higher for the species A. achatina ($2.0^{b} \pm 0.2$) than for the species Arch. ventricosa ($1.8^{b} \pm 0.3$).

3.2. Discussion

The values obtained at L_H, L_D and L_G show that the end of the shell of the species A. achatina is more elongated, with a sharp apex, compared to that of the species Arch. ventricosa which has a swollen end of the shell with a rounded and blunt apex. This corroborates the work of March-Marchad (1965), Mead (1979), Mouthon (1982), Abbott (1989), Hardouin et al. (1995), Stievenart (1996) et Codjia&Noumonvi (2002) who argue that the shell of the species A. achatina is ventric and has a pointed vertex with 6 turns unlike that the species Arch. ventricosa which presents a rounded and smooth top. This is also confirmed by the result of the ratio $L_h / (L_d + L_g)$. In fact, the low value obtained in the species A. achatina ($0.5^{b} \pm 0.0$) shows that the apex of the shell of this species is more tapered than that of the species Arch. ventricosa.

The comparison of the lengths of the large diameter of the species A. achatina ($L_{GD} = 70.6^{a} \pm 10.2$) and the species Arch. ventricosa ($L_{GD} = 64.4^{b} \pm 10.3$) shows that the first has an opening that tends to an oval shape ($L_{GD} / L_{PD} = 2.0^{a} \pm 0.2$). On the other hand, in the species Arch. ventricosa, the opening of the shell seems less oval.

Higher shell length values (L_T) in the species A. achatina compared to the species Arch. ventricosa show that the first presents in general a shell more elongated than the second. In addition, the $L_{Ap\text{-}DS} / L_T$ ratio values obtained show the coarse form of the shell of both species (ventrue form) with an accentuation in the species the species Arch. ventricosa.

Indeed, it is clear from the work of Memel (2009),that the shell length of the species A. achatina varies between 121.9 ± 6.2 mm (closed habitats) and 114.8 ± 5.6 mm (open habitats). And that for the species Arch. ventricosa, mean shell lengths range from 86.9 ± 27.8 mm (closed habitats) to 51.3 ± 25.8 mm (open habitats), which is significantly lower than A. achatina species. The morphological characters, usual criteria for identification of gastropod species, concern live weight and shell length in adulthood, the shape of the shell (elongate or bulging), the shape of the apex (sharp or blunt), the ornamentation of the shell (appearance and color of the streaks), the appearance of the suture, the presence or absence of shell edge, the color and texture of the flesh and the presence of a "V" (serrated fold) at the end of the pedal sole., Marche-Marchad, (1965)et Codjia&Noumonvi, (2002)clearly confirm the conclusions of the $L_{Ap\text{-}DS} / L_T$ reports in the two species A. achatina and Arch. ventricosa, especially with regard to the bulging form of the shell of these animals.

IV. CONCLUSION

This study shows that metric values can be associated with morphological characters to better identify the species A. achatina and the species Arch. ventricosa. Indeed, a better combination of morphological characters and metric values would be a good idea to explore for a better understanding of distinctive characters of snailsin general and Achatinidae in particular. Hence the need to guide our investigations in this area.

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