Produced and Distributed by:
Produit et Distribué par:
B. E. D. I M.
Secretariat / Secrétariat:
c/o Unité d'Enseignement et de Recherche
en Zoologie Générale et Appliquée
Faculté Universitaire des Sciences Agronomiques
2 Passage des Déportés
B-5030 Gembloux; Belgique / Belgium

Avec l'appui financier de / With the sponsoring of:
Food and Agricultural Organization of the
United Nations F.A.O. / AGAP (Dr.R.Branckaert)
Viale delle Terme di Caracalla
I-00100 Roma ; Italy

Rédacteur en Chef / Editor-in-Chief:
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Faculté Universitaire des Sciences Agronomiques
2, Passage des Déportés B-5030 Gembloux
Belgique

ISSN 0779-3642

B . E . D . I . M .

Bureau for Exchange and Distribution of Information on Mini-Livestock

Bureau pour l'Echange et la Distribution de l'Information sur le Mini-Elevage

Semestrial Bulletin of Information on Mini-Livestock

Bulletin Semestriel d'Information sur le Mini-Elevage

Volume 6, N° 1, 1997

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EDITORIAL

Chers amis,

Après une procédure administrative assez longue, la personnalité juridique a finalement été accordée à B.E.D.I.M. comme association internationale de droit belge à but scientifique et pédagogique concernée par le mini-élevage. Les statuts, approuvés par un Arrêté Royal du 4 septembre 1996, ont paru aux Annexes du Moniteur Belge du 12 décembre 1996.

Le programme du Conseil d'Administration provisoire de BEDIM envisage de poursuivre la production du Bulletin Semestriel, et de continuer à apporter des conseils à tous ceux qui veulent entreprendre des recherches ou de la production dans le domaine du mini-élevage. L'association BEDIM n'est cependant pas en mesure de financer des activités, mais elle est susceptible de réaliser, seule ou avec d'autres organisations, des projets si le financement en est assuré.

L'association BEDIM est ouverte à toute personne ou institution qui désire en faire partie. Trois catégories de membres sont prévues par les statuts : effectifs (impliqués à temps plein ou partiel par le mini-élevage; éligibles comme administrateurs; cotisation à 100 % du montant de base), adhérents (intéressés sans être impliqués sur le plan professionnel; non éligibles; cotisation à 20 %), et d'honneur (choisis par le conseil d'administration; non éligibles; cotisation nulle). Des cotisations réduites peuvent être accordées à des candidats originaires des pays en développement et y travaillant. La cotisation de base a été fixée pour 1997 à 15 ECU ou 600 BEF.

Nous serions heureux de vous compter parmi nos membres, à qui il est prévu que certains avantages soient accordés (prix réduit pour la vidéo-cassette sur le mini-élevage, tarif réduit pour l'abonnement au Bulletin, ...). Ceux qui souhaiteraient des précisions (comment payer? copie des statuts? ...) peuvent écrire au Secrétariat. Il est certain que le poids de BEDIM en faveur du développement du mini-élevage sera d'autant plus grand que notre association comptera plus de participants.

Le Président
J. Hardouin

Le Secrétaire
E. Thys

EDITORIAL

Dear Friends,

Following a rather long administrative procedure, B.E.D.I.M. has been recognized, under Belgian legislation, as an International Association with Scientific and Pedagogic Aim in the field of Minilivestock. The statutes have been approved by a Royal Decree dated 4 September 1996 and issued in the Appendices of the Official Gazette (Annexes du Moniteur Belge) dated 12 December 1996.

The provisional Board of Trustees will continue the publication of the Semestrial Bulletin and the supply of advices when requested. Producers, extension officers, scientists ... concerned by minilivestock can keep contact with our Secretariat. However, B.E.D.I.M. is NOT in a position to finance projects, but is able to implement, with local organizations, projects if already funded. It is reminded here that in principle requests for external funds have to be submitted to the cooperation agencies in the country concerned.

Membership to our association is welcome from individuals or institutions. There are three types of memberships: effective members (annual fee at 100 % of the basic amount); adherent members (fee at 20 %); honorary members (no fee). Reduced fees can be envisaged for candidates from and living in developing countries. Annual basis fee has been fixed for 1997 at ECU 15.00 or Belgian Francs 600. Only effective members are eligible as trustees.

Effective (= full) members are, according to the statutes, persons involved, full-time or part-time, in minilivestock; adherent members are persons interested by but not involved in minilivestock; honorary members are identified by the Board of Trustees.

It will be an honour to have you with us. It is foreseen that some advantages will be offered to BEDIM members, like reduced price for the video-cassette on minilivestock (see other paper). Candidate members who would like to have more information (how to pay? copy of the statutes? ...) or submit a membership application can write to the Secretariat.

The more the members the heavier the power BEDIM will have for the development of minilivestock production.

J. Hardouin
President

E. Thys
Secretary

ACTUALITÉS

On annonçait dans le numéro précédent du Bulletin que la vidéo-cassette sur le mini-élevage en milieu forestier tropical était terminée. Elle est actuellement disponible pour la vente. Celle-ci a été confiée par B.E.D.I.M. aux Presses Agronomiques de Gembloux à qui B.E.D.I.M. transmettra toutes les commandes qui auront été reçues à notre Secrétariat. Des commandes directes peuvent également être faites à :

Presses Agronomiques de Gembloux
Passage des Déportés 2
B-5030 Gembloux (Belgium)
Fax : 32-81-614544
E-mail : pressesagro@fsagx.ac.be

Les prix suivants sont applicables :

prix normal : 980 francs belges + frais de port

prix avec réduction :

- ressortissants des pays en développement :	588 BEF
- membres de BEDIM et des Presses Agronom. :	784 BEF
- au moins 11 cassettes, par cassette :	784 BEF.

Frais de port : doivent DANS TOUS LES CAS être ajoutés au montant correspondant à la commande par cassette et selon la destination :

- Belgique :	+ 100 BEF
- Union Européenne, y compris Autriche, Finlande et Suède :	+ 150 BEF
- Reste de l'Europe :	+ 150 BEF
- Reste du monde :	+ 180 BEF.

(frais valables pour 1997)

Les cassettes peuvent également être commandées par l'intermédiaire d'un libraire.

Ne jamais oublier de préciser deux choses lors de la commande :

a) la langue souhaitée pour le commentaire de la cassette qui est disponible en français, en anglais ou en espagnol,
b) le standard souhaité parmi PAL, SECAM ou NTSC.

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NEWS

It was mentioned in the previous issue of the Bulletin that the video-cassette on minilivestock in the tropical forest habitat was ready. It is now available. It has been decided that the cassette will be sold by the Presses Agronomiques de Gembloux to which all orders received by the BEDIM Secretariat will be transmitted. Direct orders can be placed also to the Presses at the following address :

Presses Agronomiques de Gembloux
Passage des Déportés 2
B-5030 Gembloux (Belgium)
Fax : 32-81-614544
E-mail : pressesagro@fsagx.ac.be

The video-cassettes can also be ordered through booksellers.

Never forget the two following points when ordering :

a) the language required (French, English or Spanish)
b) the standard needed : PAL, SECAM or NTSC.

Prices are :

normal price :	980 BEF + mailing cost
reduced prices :	
order placed by people in a developing country	588 BEF + mailing cost
order placed by a member of BEDIM or the Presses	784 BEF + mailing cost
order of 11 or more cassettes, by cassette	784 BEF + mailing cost

Mailing costs : must IN ANY CASE be added to the amount of the order, with due consideration to the appropriate price (normal or reduced) and the address where the cassette has to be sent :

- Belgium :	+ 100 BEF
- Europe :	+ 150 BEF
- Rest of the World : (applicable in 1997).	+ 180 BEF

La définition des méthodes utilisées pour la MESURE DES RONGEURS est essentielle selon le Professeur Dr Erik Van der Straeten du Département de Biologie du Centre Universitaire d'Anvers (Belgique) (RUCA) qui nous écrit aussi pour confirmer l'importance de l'utilisation de noms scientifiques dans les publications.

En effet, comme il existe différentes méthodes cela peut amener à des différences d'interprétation. Ainsi, lors de la mesure de la longueur du pied, il est important, suivant lui, de préciser si la mesure a été faite avec ou sans l'ongle. Il conseille d'ailleurs de faire les deux mesures pour permettre plus facilement des comparaisons ultérieures.

Celui qui veut en savoir plus peut consulter l'article suivant, qui néanmoins est rédigé en Néerlandais :
VAN DER STRAETEN E. (1975) De Belgische Zoogdieren in verband met braakballenonderzoek. 2. Lagomorpha. Belgische Nationale Vereniging der leraren in de Biologie, 1 (21), 17 : 24.
L'adresse de l'auteur : Laboratorium voor algemene Dierkunde. Groenenborgenlaan 171. 2000 Antwerpen.

***

Des CLÉS D'IDENTIFICATION sont toujours utiles. on trouvera en page 3 de couverture un schéma permettant d'identifier les familles de rongeurs. Ce tableau est emprunté au même ouvrage que celui qui avait fourni l'illustration sur les mesures dans le précédent numéro.

***

The methods adopted for the MEASUREMENTS OF THE RODENTS must always been described or quoted, writes Prof. Dr Erik Van der Straeten (Biology Department, Antwerp Universitary Centre RUCA, Belgium) with reference to the text issued in the previous Bulletin in pages 4-5. Different methods exist indeed which can lead to confusion. It is for instance important for the foot lenght mentioning if it is with or without the length of the claw. It is even better providing the two measures made. Our correspondent confirms also the importance of the scientific names in the publications.

Those who would like to know more on the subject can read the following article, written however in Dutch : VAN DER STRAETEN E. (1975) - De Belgische Zogdieren in verband met Braakballenonderzoek. 2. Lagomorpha. Belgische Nationale Vereniging der leraren in de Biologie, 1 (21), 17-24. Author's address : Laboratorium voor algemene Dierkunde, Groenenborgenlaan 171, b-2000 Antwerpen, Belgium.

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IDENTIFICATION KEYS are always usefull. A graph to identify the families of the rodents is reproduced in page 3 of the cover. The source of the graph is the same as that for the drawings issued in the previous Bulletin.

La PRODUCTION CONTROLÉE D'ASTICOTS semble constituer une activité très curieuse et mal comprise pour de nombreux lecteurs, alors que quelques-uns au contraire sont bien au courant de la procédure à suivre et des possibilités offertes. Il est toutefois exact qu'il n'existe pas beaucoup de données publiées à ce sujet. Le Secrétariat tente, avec ce numéro, de monter une série d'essais coordonnés afin de tirer des conclusions, au moins provisoires, et de les diffuser auprès de tous.

Afin d'éviter toute confusion, on appelle "asticot" la larve de la mouche domestique *Musca domestica*, et par extension la larve d'autres espèces de mouches. Il ne s'agit donc JAMAIS de vers de terre ni de larves de moustiques.

Le grand principe à suivre est de produire des lots d'asticots d'âge uniforme pour les mettre à la disposition des animaux domestiques susceptibles d'en profiter : volailles, poissons, grenouilles, ... Il s'agit en effet d'une source intéressante de protéine animale et de graisse obtenue sur place, à partir de détritus et en monnaie locale, ou même sans dépenses du tout.

Les lecteurs intéressés trouveront plus loin dans ce numéro un protocole simple, que chacun pourra appliquer chez lui, dans les conditions ambiantes. Il ne faut pratiquement aucun investissement, et l'essai sera très vite terminé. Chacun pourra alors envoyer une copie de ses observations au Secrétariat, où une synthèse sera faite. Tous ceux qui auront participé seront informés directement des résultats.

Il est cependant bien précisé qu'aucune aide financière n'est disponible pour cet essai très simple.

Ultérieurement, on pourrait envisager de lancer, à travers tous les pays tropicaux où le Bulletin est lu, un autre essai coordonné qui permettrait de mesurer l'intérêt zootechnique et économique de l'emploi des asticots dans la croissance ou l'engraissement de poulets.

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CONTROLLED PRODUCTION OF MAGGOTS looks very curious to many readers who do not understand its justification. Luckily others know very well how to work and why to produce maggots. It is true however that the literature is very scarce on the topic. The Secretariat tries here to set up in different countries coordinated tests in order to better know the results and let them made available to all readers of the Bulletin.

First of all, the term "maggot" refers to the larva of the domestic fly *Musca domestica* and at large other flies. It NEVER refers to earthworms, manure worms or mosquito's larvae.

The main objective is the production of lots of maggots having the same age in order to provide a feed with relatively stable composition to domestic animals which can use them well : poultry, fish, frogs, ... The maggot is indeed a protein and fat source which can be obtained locally, without investment costs and making use of wastes.

Simple guidelines are given in following pages. It is expected that everyone can implement the test and obtain very quickly results. A copy of the observations made should then be sent to the BEDIM Secretariat where a synthesis will be written and sent to each participant. The advantage of coordinated tests is that more general results are usually collected as the tests are undertaken under different conditions (locations, climates, ...).

There are no funds to assist you for these coordinated tests, unfortunately.

If the results are promising, another coordinated test could be launched later with the aim of assessing the advantage (weight gains, production costs reduction, ...) of using maggots in poultry keeping.

Bulletin BEDIM 1997, 6, 1

PRODUCTION ET UTILISATION CONTROLÉES D'ASTICOTS

Protocole d'Essais Coordonnés

J. Hardouin

1. Objectifs.

Mettre au point et fournir des chiffres concernant l'organisation de la production d'asticots, ou larves de mouches, pour contribuer à l'amélioration de l'alimentation des volailles (poules, pintades, ...) en exploitation villageoise.

2. Essais à mettre en place.

2.1. Identifier un sous-produit ou un déchet de composition relativement stable, disponible régulièrement (chaque jour), et sur lequel il est connu que les mouches viennent pondre.

2.2. Pendant 7 journées consécutives, disposer chaque jour au matin une quantité constante et connue (poids ou volume) de substrat frais. Chaque lot sera identifié de A à G et placé avec les autres à l'air libre, à l'abri du soleil et des pluies.

2.3. Protéger totalement chaque lot dès le premier jour contre les volailles en divagation d'une part, et dès le soir du premier jour contre les mouches par une moustiquaire pour que les asticots qui naîtront soient tous du même âge.

2.4. Examiner chaque jour ce qui se passe dans chaque lot et noter ce qui est observé. Exemple : lot A premier jour (date) pas d'asticots, ... 4ème jour nombreux asticots qui bougent vers le fond quand on remue le tas, 5ème jour apparition de pupes (immobiles, foncées, ...) ...

2.5. Lorsque suffisamment de larves (asticots) sont présentes, permettre à des volailles (poules, poussins, pintadeaux, ...) d'y venir et observer ce qui se passe. Vérifier après une certain temps s'il reste des asticots.

2.6. Noter les conditions climatiques (saison, pluies ou pas, ...) et si possible les températures avec les dates et heures des observations.

3. Rapport.

3.1. Une note très simple sera envoyée au Secrétariat de BEDIM lorsque l'essai sera terminé, probablement 8 jours environ après avoir installé le 7ème lot.

3.2. Mentionner le nom de celui qui a fait l'essai, son adresse, l'institution où il travaille, l'endroit où l'essai a été fait avec le plus de précisions possible (lieu, distance d'une grande ville, altitude/latitude/longitude si c'est connu ou si cela peut être trouvé sur une carte, type de végétation / cultures ...), les dates de l'essai, ...

3.3. Prendre contact avec un spécialiste local pour connaître le nom scientifique de la mouche. Si ce n'est pas possible, placer quelques pupes en incubation et capturer les mouches qui en sortiront puis les envoyer à BEDIM, ou envoyer des pupes dans des tubes.

4. Conclusions.

La synthèse sera faite par le secrétariat de BEDIM. Tous les participants seront mentionnés, les résultats seront communiqués à tous. On essaiera de les publier.

ATTENTION !

CEUX QUI reçoivent ce numéro 1 du volume 6 (1997) et N'ONT PAS ENCORE ENVOYE au Secrétariat LES DEUX COUPONS REPONSES INTERNATIONAUX, comme l'année précédente, NE RECEVRONT PAS LE NUMERO SUIVANT (2) déjà en préparation.

CONTROLLED PRODUCTION AND USE OF MAGGOTS

Coordinated tests guidelines

J. Hardouin

1. Objectives.

Collect datas and determine the best techniques to obtain maggots as a locally produced animal feed for poultry keeping under village conditions.

2. Organization of the tests.

2.1. Identify a by-product or an organic waste regularly available (every day, even if in a limited period only), with relatively stable composition, and which is known as a product where domestic flies lay eggs in the nature.

2.2. During 7 following days, put every day in the early morning a constant and known (weight or volume) quantity of the fresh substrate selected. Each daily lot (basin, bucket, ...) will be identified from A to G and placed next to the previous ones in the open air but under some protection against sun and rains.

2.3. Protect totally against free-roaming poultry and birds the lots since the beginning of the test. Cover with a piece of mosquito-net each lot at the late evening of the first day, and leave each lot with the net for the following days. The aim is to collect all maggots of the same age.

2.4. Examine every day what happens in each lot and write down the observations. Example : Lot A first day (date), no maggots; ... 4th day (date) many maggots crawling ...; 5th day presence also of pupae (= immobile, dark) but maggots (=larvae, mobile) still present; ...

2.5. When very many maggots are present, put the substrate with the maggots (and some pupae) of one given lot near poultry (days-old or adults chicken, guinea fowls, ...) and observe what happens. Verify some time later if maggots or pupae are still present.

2.6. Write down daily the climatic conditions prevailing (season, rains or not, ...) and, if possible, temperatures (never put the thermometers in the sun) and the dates and hours when reading.

3. Report.

3.1. A short note will be sent to the BEDIM Secretariat when the test is terminated. This will probably happen about 8 days after starting with the 7th lot.

3.2. Please mention clearly (block-letters) surname and names of the person who undertook the test, his address, institution, place of the test, dates, ... All the datas available concerning the place of the test should be mentioned : name of the place, distance of a town, altitude/latitude/longitude if known or found on a map, type of vegetation/land use, ...

3.3. Contact a local specialist (entomologist) to know the scientific name of the fly which laid eggs. If not possible, put some pupae in protected place and let them incubate; keep the adults and send them to specialists for determination, or eventually to the BEDIM Secretariat (pupae can also be sent).

CAREFUL !

THOSE WHO receive this issue n. 1 volume 6 (1997) and HAVE NOT SENT YET to the Secretariat THE TWO INTERNATIONAL REPLY COUPONS requested like last year WILL NOT RECEIVE THE FOLLOWING ISSUE n. 2 already in preparation.

Bulletin BEDIM 1997, 6, 1

LES GRENOUILLES, UNE SOURCE DE PROTÉINES ANIMALES À DÉVELOPPER AU BÉNIN

Chikou A.*, Laleye Ph.* et Nonfon M.**

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** Projet Pêche Lagunaire, Direction Nationale des Pêches, Cotonou, Bénin

Trois mois durant, 139 ressortissants de 6 villages ou villes des départements de l'Atlantique et de l'Ouémé ont été "enquêtés" dans un cadre global de connaissances générales sur l'exploitation des grenouilles au Bénin. Il ressort des enquêtes que le Sud-Bénin dispose de nombreux marais où se concentre une diversité remarquable d'amphibiens du groupe des anoures. Plusieurs espèces de grenouilles y sont chassées et *Rana occipitalis* (Günther, 1858) est l'espèce dominante dans les captures. La saison des pluies reste la période d'abondance. Deux techniques de captures ont été révélées par les enquêtes : la ligne simple ou canne à pêche appâtée (utilisée surtout en période de hautes eaux, tôt le matin ou le soir au coucher du soleil) et l'usage de la lampe torche pour les chasses de nuit. D'importantes quantités (sur lesquelles les statistiques manquent) sont chassées et capturées dans les marécages. Les diverses méthodes traditionnelles de traitement de la grenouille, si celle-ci n'est pas consommée fraîche, sont le fumage, le séchage et la friture à huile. Les principaux demandeurs restent les restaurateurs de la ville de Cotonou et certaines personnes (béninoises ou expatriées) qui accordent aux cuisses de grenouille une place non négligeable dans leurs repas. Des circuits existent dans le pays pour ravitailler ceux-là et même pour l'exportation frauduleuse de grenouilles entières fumées vers les pays voisins comme le Nigéria. Les prix de cession varient entre 25 à 100 FCFA l'unité dans les villages et entre 300 à 400 FCFA les 12 paires de cuisses dans les restaurants où le plat (des 12 cuisses) est vendu entre 2.500 et 2.800 FCFA. Congelées, les 12 paires de cuisses sont vendues dans les supermarchés entre 700 et 1.000 FCFA. Les mesures effectuées sur 35 spécimens de *Rana occipitalis* destinés à la consommation ont donné des poids de 12,1 à 107,6 g pour la paire de cuisses (bassin non compris) avec une moyenne de 39,51 g. En pourcentage du poids sec, la chair fraîche de cette grenouille analysée au laboratoire contient 76,26 % de protéines brutes totales, ce qui dépasse largement la teneur en protéines brutes de certaines espèces de poissons dont *Sarotherodon melanotheron* chez qui on a trouvé 64,33 %.

Summary.

The most frequent species found in swamps of South Benin is *Rana occipitalis*. Two harvesting techniques were identified during the survey: by fishing-rod at dusk and down, or by torch-light during the night. Frogs are sold the following day or treated (dried, smoked, fried). Prices are 25-100 FCFA per unit in villages, 300-400 FCFA for 12 pairs of legs to restaurants where the same are billed 2,500-2,800 FCFA. Frozen legs are sold in supermarkets at 700-1,000 FCFA for 12 pairs. Fraudulent exports of entire smoked frogs to Nigeria exist. The average weight of a pair of legs (without the pelvis) is 39.5 g, and the total crude protein content of the frog flesh is 76.26 %.

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Shell Morphology, Growth, Reproduction and Aestivation by giant African snails : laboratory observations on *Archachatina marginata suturalis*, *Achatina achatina* and *Achatina fulica*.

Stievenart C. (Mrs)

Abstract of the Ph.D. Thesis

Inquiries into the growth, the reproduction and the aestivation of giant African snails are made through observing three generations of a Gabonese strain of *Archachatina marginata suturalis* (AMS) maintained in laboratory in Antwerp (Belgium) and through investigations carried out on two collections of Achatinids shells. Some aspects of the growth of AMS, like shell shape are compared with two Ivorian stocks of *Achatina achatina* (AA) and *Achatina fulica* (AF). The impact of the rearing method and of the management of the animals is underlined.

AMS realizes most of its shell increase before attaining sexual maturity. Shell increase governs the development of the soft tissues of the snail. In the three species, three habituses are identified. They are characterized by the activity of the snail (active or aestivating) and by the rate of stripping

off the nacreous side of the shell aperture. In AMS, the best growth is achieved when the snail remains active without stripping off the nacreous side of the shell aperture (habitus I) provided that the shell increase is not blocked by traumatism. When the snail (active or aestivating) strips off the nacreous side of the shell aperture, its growth is disrupted. At those two last habituses, liveweights are lower than liveweight in habitus I.

Based on observations mainly of AMS, traumatic rearing conditions visible or not through detecting damages of the shell labrum affect the growth and the breeding. In all cases growth performances decrease with either simple growth pauses or smaller size at first breeding and at shell bordering. In severe case, dwarfism appears. Growth troubles affect the breeding, firstly by delaying the age at first breeding, secondly in severe case by decreasing the number of animals attaining sexuel maturity, and by decreasing the size of the eggs and the number of eggs per clutch.

A mechanical model explaining the labrum reaction against shocks identifies the main parameters involved. These are the intensity of the strength applied to the labrum, the thickness and the curvature of the labrum, and the distance from the edge of the labrum to the place were the strength is applied. Labrum length is not involved in the process.

The rearing technique can interfere with the life cycle of AMS. Among three rearing methods evaluated, the best method consists of rearing the snail a) without traumatisms, b) in groups regularly reorganized in order to put together animals of same size and in density adapted to their growing size, c) on soil containing manure worm, d) and feeding them on varied food and chalk both given ad libitum. Through such rearing system, AMS achieves sizes at shell bordering at least equal to the size of bordered wild snails.

The life cycle of AMS is completed in less than one year in laboratory at about 24°C in very humid environment. First eggs are produced at the age of 11 months, average clutch weight is about 12g with on average 9 to 10 eggs (range 1-30) of 1.2 to 1.3 each, incubation duration is of 25 days. The number of eggs per clutch is independent of egg weight. The egg size is correlated with the age and the size of the breeder at the first reproduction. Individual egg production varies around one clutch monthly or bimonthy per breeder. From the beginning of egglaying, egg size increase is negligible and the number of eggs per clutch and the clutch weight do not vary significantly. Aestivation is without effect on egg size, on number of eggs per clutch, and on clutch weight. Significant egg production is not obtained from mature snails confined by pairs while those confined by three or four per box breed abundantly. Individuals isolated from a breeders stock and maintained confined individually during several months laid several fertile clutches with the shortest interval of

13.5 days between successive ovipositions of same individual as recorded at several times on several snails.

Incubation is also investigated. Vitellus presence in AMS eggs is not found. Development of the embryo of AMS is described. Despite high embryonation rate (97.25% of eggs containing one embryo), hatching rates are low. Eggs containing a foetus filling nearly the entire egg volume and supposed to hatch spontaneously during the next days are detected by candling the eggs at the 21st day of incubation carried out at 24°C. However, foetal mortality during the incubation end induces a difference of 15% between hatching rate and "hatchability" rate. "Hatchability" rate is the percentage of eggs where the embryonic development leads to the presence of a viable foetus. The management of the incubation interferes on the hatchability of the eggs as well as the size of the eggs. The best "hatchability" rates are achieved with fresh eggs placed in incubation directly after oviposition. Under the best incubation conditions, the "hatchability" rate of eggs weighing 1.2g varies around 50% while it exceeds 80% with eggs of 1.7g.

At hatching, giant African snail shows shell length around the egg length. As achatine egg is much smaller than archachatine egg, the time required from egglaying up to snails weighing 1g is 3 to 4 weeks and 9 to 10 weeks respectively with AMS and with AA. From 3g to 15g, snails remaining in habitus I, AA grows slower than AMS in term of weight gain.

A study on shell shape based on 205 AMS, 30 AA, 41 AF points out great variabilities in shell shape inducing great variabilities in liveweight and corresponding gains in size and in weight during the growth. The best prediction of liveweight in habitus I based on one shell dimension is achieved using firstly shell length. Adding shell witdth as second shell parameter and labrum shell length as third shell parameter increases significatively the precision of the prediction. Without aestivation, the weight of the edible part of AMS of ± 10 cm shell lenght in habitus I is positively correlated to shell dimensions but not the meat yield. Aestivation causes water loss and soft tissues slimming. Simple contact with water allows rapid rehydration and returning in 24 hours to 95% of the liveweight before aestivation. Meat yield is however decreased by the aestivation.

In conclusion, these pecularities of giant African snails should be taken into consideration as much in farming as in experimental studies.

SURVEY OF THE LITERATURE

EDIBLE TROPICAL RODENTS

Alogninouwa T., Agba K.C., Agossou E. & Kpodekon M. - Anatomical, histological and functional specificities of the digestive tract in the male grasscutter (*Thryonomys swinderianus*, Temminck 1827).

Source : Anatomia, Histologia, Embryologia, 1996, 25 : 1, 15-21.
Language : English
Address : Ecole Nationale Vétérinaire, 1 Avenue Bourgelat B.P. 83, 69280 Marcy - L'Etoile, France.
Abstract : Using standard methods on 20 male grasscutters, weighing 3-4.5 kg, information is given on the anatomy, histology and histochemistry of the mouth, oesophagus, stomach, small and large intestine, rectum, anus and anal glands. Interesting is the size of the caecum, which fills 60% of the abdominal cavity, and the presence of large anal glands.

Muller W. - Is enterotoxaemia in grasscutters (*Thryonomys swinderianus*) caused by *C. perfringens* toxovars?

Source : Journal of Veterinary Medicine. Series B, 1995, 42 : 9, 569-571.
Language : English
Address : Section of Hygiene, Institute of Animal Production in the Tropics and Subtropics, University of Hohenheim, (480/110), D-70593 Stuttgart, Germany.
Abstract : In 1985, in a colony of domesticated grasscutters in Cotonou/Benin (West Africa), an endemic disease that caused severe losses of up to 50% of the population was found. The animals regularly showed a necrotic small intestine. *Clostridium perfringens* strains were isolated later from the faeces of healthy animals and typed; 81.6% belonged to type C. The disease was eradicated by vaccination.

Younan M., Muller W. & Borowy N. - Vaccination of grasscutters with a multicomponent clostridial vaccine.

Source : Journal of Veterinary Medicine. Serie B. 1995, 42 : 6, 369-375.
Language : English
Address : Institute of Animal Production in the Tropics and Subtropics, Department of Animal Hygiene, University of Hohenheim, D-70593 Stuttgart, Germany.

Abstract : Seasonally high losses of grasscutters in captivity were attributed to *C. perfringens* enterotoxaemia and a polyvalent vaccine has been used to stop the outbreaks. Antibody titres were evaluated in captive, vaccinated grasscutters and in wild grasscutters captured in Benin. It is suggested that domestication has an immunosuppresive effect on the grasscutter and that there is effective autoimmunization in the wild.

Ladele A.A., Joseph K., Omotesho O.A. & ijaiya T.O. - Sensory quality ratings, consumption pattern and preference for some selected meat types in Nigeria.

Source : International Journal of Food Sciences and Nutrition, 1996, 47 : 2, 141-145.
Language : English
Address : Faculty of Agriculture, University of Ilorin, Ilorin, Nigeria.
Abstract : Sensory quality attributes, consumption pattern and preference for some selected Nigerian meat types (beef, goat meat, mutton, grasscutter (*Thryonomys swinderianus*), African giant rat (*Cricetomys gambianus*) were investigated. It was found that beef was the most consumed meat followed by goat meat, then mutton, grasscutter and lastly African giant rat. Consumption of grasscutter was constrained by availability and cost. Goat meat was the most preferred, followed by beef, grasscutter, mutton and African giant rat. In laboratory sensory rating of the meat types, grasscutter had the greatest acceptability followed by goat meat, mutton, African giant rat and lastly beef. Results showed that grasscutter was the most acceptable because of its good meat color, flavour, tenderness and juiciness.

Smythe N. & Brown de Guanti O. - The domestication and breeding of the paca (*Agouti paca*).

Source : FAO Conservation Guide n°26; DIN A4, 91 pages, 8 tables, 29 photos, 14 figs, 35 refs, FAO, Roma, 1995.
Language : English or Spanish
Address : FAO Distrib. and Sales Section, Viale delle Terme di Caracalla, I-00100 Roma, Italia.
Abstract : The booklet describes the methods and techniques for domesticating and breeding the paca *Agouti paca*, a wild rodent from the dense forests of Latin America. It describes how by changing the original behaviour of this animal during the first stages of its life, the paca can

become a sociable and tame animal and lose agressiveness. Living in groups instead of couples can increase reproductive rates, and its production can become economically profitable. The captive management of the paca is an interesting activity since its meat is highly appreciated. Moreover, it can contribute in diminishing hunting pressure in wild populations. Chapters deal with production systems and materials, captive breeding and reproductive management, feeding, health and methods and receipes for preparing paca meat. It can be considered the best and more complete reference on the production of *Agouti paca*.

Casinos A.*, Bodini R. & Renous S. - Locomotion of *Capybara* : biomechanical constraints and ecological role.

Source : Annales des Sciences naturelles, Zoologie, Paris; 13° Série, 1996, vol. 17, fasc. 3, pp. 113-122.
Language : English
Address* : Departament de Biologia Animal (Vertebrats), Universitat de Barcelona, Diagonal 645, E-08028 Barcelona, Spain.
Abstract : Based on a film, dissections and measurements, the authors calculated stresses on bones and muscles. Results correspond to those expected for a typical cursorial mammal. These results are contrasted with those published in previous studies, mainly on ungulates.

EDIBLE TROPICAL SNAILS

De Grisse A. - Beschrijving van en resultaten bekomen met de vlaamse kweekmethode voor consumptieslakken [Description of and results obtained by the Flemish snail farming].

Source : Med. Fac. Landbouww. Univ. Gent, 1996, 60/1, 85-117.
Language : Dutch (+ summary)
Address : Vakgroep Gewasbescherming, RUG
Coupure Links 653, B-9000 Gent (België)
Abstract : A detailed description is given of the Flemish snail farming method by which snails can be produced all year round in Flemish snail fattening batteries. A description is given of the reproduction, incubation of the eggs, prenursery, nursery and fattening in batteries and in fattening pens. A few results are given concerning population densities, egg production and fattening in batteries and in pens. An estimation is given of the hours of work and surface needed for the weekly production of 15.000 snails. Details are given by 8 drawings, graphs and photographs together with 4 tables. Using *Helix aspersa maxima* (Gros gris), 15 g feed (containing 25 % chalk and 10 % sand) are required to obtain a 25 g liveweight in 4 months. Weekly manpower required is 35 hours.

De Grisse A. - Mise en application de la batterie hélicicole suspendue par son inventeur A. De Grisse [Practical use of the suspended snail battery by its inventor A. De Grisse].

Source : Le Nouvel Observateur Hélicicole n°40, 1997, 9-30 (Quarterly of the Assoc. Hélicole Belge, Ch. de Namur 47, B-5030 Gembloux, Belgium).
Language : French
Address : Schoonmeersstraat 37, B-9000 Gent, Belgium
Abstract : See above for the abstract. This text is the translation in French of the original text written in Dutch and commented just above.

De Grisse A., Defloor J. & Vercauteren F. - Invloed van het toevoegen van enkele grondsoorten aan het voeder op de groei van de consumptieslak *Helix aspersa maxima* (Gros gris) [Influence of adding some soil types to the feed offered to snail *Helix aspersa maxima* (Gros gris)].

Source : Med. Fac. Landbouww. Univ. Gent, 1996, 60/1, 129-140.

Language : Dutch (+ summary)
Address : Faculteit Landbouwkundige en Toegepaste Biologische Watenschappen, Universiteit Gent, Coupure Links 653, B-9000 Gent (België)
Abstract : The influence of mixing chalk, sand, wheat flower, leaf mold or peat with a composed meal for snails, on the growth of *Helix aspersa maxima* in "hors sol"-conditions is described. It was proved in two experiments with twenty different meal-mixtures that the growth of the edible snail *Helix aspersa maxima* improved when as well chalk as sand , leaf mold, peat or wheat flower was added to the existing snail food. A food conversion factor of 0.5 was repeatedly obtained.

De Grisse A. & Kong Y. - Egg production with the edible snail *Helix aspersa maxima* (Gros gris) using the flemish snail battery.

Source : Med. Fac. Landbouww. Univ. Gent, 1996, 60/1, 75-84.
Language : English
Address : Department of Crop Protection, Faculty of Agricultural and Applied Biological Sciences, University of Gent, Coupure Links 653, B-9000 Gent (Belgium)
Abstract : As there is a growing interest for snail eggs sold after transformation as "snail caviar", a study was made on the possibilities of snail egg production using the Flemish snail battery. A total of 789 egg clutches (133 eggs per clutch and mean weight of 53 mg per egg) was obtained from 600 breeders of *Helix aspersa maxima*.

De Grisse A. & Defloor J. - Invloed van grond als kruipsubstraat en als toevoegsel aan het voeder op de groei van de consumptieslak *Helix aspersa maxima* (Gros gris) [Influence of creeping substrate and of a mixture artificial diet + soil on the growth of the edible snail *Helix aspersa maxima*].

Source : Med. Fac. Landbouww. Univ. Gent, 1996, 60/1, 119-128.
Language : Dutch (+ summary)
Address : Vakgroep Gewasbescherming, Faculteit Landbouwkundige en Toegepaste Biologische Watenschappen Gent, Coupure Links 653, B-9000 Gent (België)
Abstract : By mixing 5 % or 10 % of different soils with an artificial diet for snails, the growth of *Helix aspersa maxima* increased. The growth also increased when not mixed feed was given

but when the soils were used as creeping substrate, but the increase was higher with mixed feed.

Tomiyama K. - Mate-choice criteria in a protandrous simultaneously hermaphroditic land snail *Achatina fulica* (Férussac) (Stylommatophora : Achatinidae).

Source : J. Moll. Stud., 1996, 62, 101-111.
Language : English
Address : Dep. Environm. Sci., Ibaraki Univ., Bunkyo 2-1-1, Mito 310, Japan
Abstract : Old *Achatina fulica* adults have more opportunities to mate compared with young adults. Old adults, which are capable of producing both sperm and eggs, were more favoured as mating partners than young adults which produce only sperm. Mate choice by size is age-dependant in old adults but not in young adults.

Aboua F. & Boka K. - Some physical characteristics and processing of giant African edible snails with reference to Ivory Coast - Les escargots géants comestibles d'Afrique : quelques aspects physiques et préparation en Côte d'Ivoire.

Source : Nature et Faune, 1996, vol 12, n°4, 2-9.
Language : English + Français
Address : Centre Ivoirien de Recherches Technologiques (CIRT), 09BP922 Abidjan 09, Côte d'Ivoire.
Abstract : The experiment was undertaken with natural snails *Achatina achatina* L. purchased from a local market in Abidjan and compared with some *Archachatina marginata*. Physical characteristics, proximate composition and mineral content of raw and processed snail meat are provided. Traditional processing of snail meat is also described.

Stiévenart C. (Mrs) - Morphologie coquillière, Croissance, Reproduction & Estivation chez les escargots géants africains : observations au laboratoire sur *Archachatina marginata suturalis*, *Achatina achatina* et *Achatina fulica* [Shell Morphology, Growth, Reproduction and Estivation by giant African snails : laboratory observations on *Archachatina marginata suturalis*, *Achatina achatina* and *Achatina fulica*].

Source : Ph. D. thesis n°5, 1996, 206pp.

Language : French
Address : Institut de Médecine Tropicale Prince Léopold
Département de Production et Santé Animales Tropicales
155 Nationalestraat, B-2000 Antwerpen, Belgique.
Abstract : The full text of the abstract can be found in the present issue of the Bulletin in pages 14-16.

Desbuquois C. & Daguzan J. - The influence of ingestive conditioning on food choices in the land snail *Helix aspersa* Müller (Gastropoda : Pulmonata : Stylommatophora).

Source : J. Moll. Stud., 1995, 61, 353-360.
Language : English
Address : Laboratoire de Zoologie et d'Ecophysiologie, Faculté des Sciences, Université de Rennes I,
Avenue du Général Leclerc, 35042 Rennes Cedex,
France
Abstract : An experiment of food choice in one-day-old naïve land snail *Helix aspersa* Müller was carried out, involving three phases : a training period on a monophagous diet of leaf discs, an intermediate phase with animals not fed for 24 hours and finally food choice tested over 24 hours when animals could eat leaf discs of each species of plant used for training. A coefficient of food preference was calculated. The length of the training phase did not reduce the percentage of individuals preferring the plant previously consumed. The experiment highlighted the feeding behaviour plasticity of *H. aspersa*.

MANURE WORMS

Boboc V. - Research on purifying role of earthworm capital (*Eisenia foetida*) within the biodegradation and reduction of manure polluting level.

Source : Proceed. of World Poultry Congress, 2-5 Sept. 1996, vol IV.
Language : English
Address : Institute of Research and Technology for Poultry and Small Animals, Balotesti, 8113, Romania
Abstract : Natural biodegradation methods constitute a solution to lower the polluting level of manure. Earthworm is used to stimulate these biodegradation methods, avoiding costly investments to protect environment. Biodegradation process relies on the metabolic activity of worms as well as on some organisms decomposing and resynthesizing naturally without any involvment of man. To test results, physico-chemical, bacteriological and toxicological condition monitered the evolution of the biodegradation and of the influencing factors. Multiplication of worms was also surveyed stuying the effect of natural factors in the stimulation. Three months were needed for each series of experiences, also monitoring the increasing levels of the aviary residue. The optimal stabilization time of the manure was determined by the evolution of biodegradation. By composition analysis, correlation between C/N, pH, Ca/Mg, enzymatic content and influence on environment was established.

INSECTS

Sherman R. A. & Wyle F. A. - Low-cost, low-maintenance rearing of maggots in hospitals, clinics, and schools.

Source : Am. J. Trop. Med. Hyg., 1996, 54(1), pp : 38-41.
Language : English
Address : Department of Medicine and Pathology, University of California, Irvine CA 92697-4800, U.S.A.
Abstract : Resurgence in the interest and use of maggot therapy took place recently, and blow fly rearing can be expected to increase. The rearing of these necrophagous flies is technically simple, but can be expensive, malodorous, and wasteful of space. There are numerous references to general maggot rearing in the older literature. The authors describe several strategies for rearing blow flies that have proven useful in hospital-based insectary.

FROGS

Cunningham A. A.*, Langton T. E. S., Bennett P. M., Lewin J. F., Drury S. E. N., Gough R. E. & Macgregor S. K. - Pathological and microbiological findings from incidents of unusual mortality of the common frog (*Rana temporaria*).

Source : Phil. Trans. R. Soc. Lond. B, 1996, 351, 1539-1557.
Language : English
Address* : Veterinary Science Group, Institute of Zoology, Regent's Park, London NW1 4RY, U.K.
Abstract : An investigation into mass mortalities of *Rana temporaria* resulted in two main disease syndromes being found : one characterized by skin ulceration and one characterized by systemic haemorrhages. The bacterium *Aeromonas hydrophila* was isolated significantly more frequently from haemorrhagic frogs than from those with skin ulceration only. An iridovirus-like particle has been identified, iridovirus-like inclusions have been detected in livers, an adenovirus-like particle has been cultured from one haemorrhagic frog, and a poxvirus-like particle described previously from diseased frogs has now been identified as a melanosome. The authors hypothesize that primary iridovirus infection, with or without secondary infection with opportunistic pathogens such as *A. hydrophila*, may cause natural outbreaks of 'red-leg', a disease considered previously to be due to bacterial infection only.

Drewes R. C.* & Altig R. - Anuran egg predation and heterocannibalism in a breeding community of East African frogs.

Source : Tropical Zoology 9, 1996, 333-347.
Language : English
Address* : Department of Herpetology, California Academy of Sciences, San Francisco, CA 94118-4599 U.S.A.
Abstract : Most frogs are carnivores. The results of the work undertaken in a dry coastal forest in Kenya indicate that egg predation and cannibalism on developing tadpoles of other local species are normal in the tree-frog *Afrixalus fornasinii*.

Williamson I.* & Bull C. M. - Population Ecology of the Australian Frog *Crinia signifera* : Adults and Juveniles.

Source : Wildlife Research, 1996, 23, 249-66.
Language : English
Address* : School of Life Science, Queensland University of Technology, GPO Box 2434, Brisbane, Qld 4001, Australia.

Abstract : In a population of the common Australian frog *Crinia signifera* studied in South Australia, some individual males and females participate in at least four consecutive breeding seasons. Metamorphosis occured from October to January and most individuals reached maturity only in the second breeding season following metamorphosis. Survival of juveniles ranged from 5 to 72% per annum, with individuals emerging early having higher survival than those that metamorphosed late.

Castanet J.*, Esteban M. & Garcia-Paris M. - Use of bone histology in estimating the age of frogs (*Rana perezi*) from a warm temperate climate area.

Source : Can. J. Zool., 1996, 74, 1914-1921.
Language : English
Address* : Equipe de Recherche "Formations Squelettiques" et Unité de Recherche Associée n° 1137 du Centre National de la Recherche Scientifique, Université Paris VII, Case 7077, 2, Place Jussieu, 75005 Paris, France.

Abstract : The expression of annual bone growth marks of Iberian water frogs (*Rana perezi*) from a warm temperate climate region (southwestern Spain) differ markedly from the pattern observed in colder climate populations. Forty-eight percent of winter growth marks appeared to be annuli in the bones. It seems that variations in climate have a strong influence on growth-mark formation. Males and females are sexually mature in their second year, although some males mature at 1 year of age and some females at 3 years. The oldest males were 4 years old, 1 year younger than males from northern populations. The wide range of body sizes (18-44 mm) among the 1-year-old froglets can be explained by the extended period of metamorphosis, from July to November.

Bourgat R., Roure C. & Kulo S.-D. - Nouvelles données sur les Trématodes d'Amphibiens d'Afrique Occidentale. Description d'*Haematoloechus aubriae* n. sp. [New data on the Trematodes of Amphibians from Western Africa. Description of *Haematoloechus aubriae* n. sp.]

Source : Revue suisse de Zoologie, 1996, 103(2) : 383-394.
Language : French
Address : Laboratoire de Biologie, Université, 52 avenue de Villeneuve, F-66860 Perpignan Cedex, France.

Abstract : The article mentions and describes 5 Nematode species found in amphibians collected in Niger, Bénin and Togo. One of these helminths is a new species.

Mastura A. B.*, Ambu S., Chandra S., Kiew B. H. & Rosli R. - A preliminary survey of frogs for *Spirometra* sp. infection - a food borne human parasite.

Source : Tropical Biomedicine, 1995, 12, 81-84.
Language : English
Address* : Division of Medical Ecology, Inst. for Medical Research, Jalan Pahang, Kuala Lumpur, Malaysia.

Abstract : A survey of frogs for *Spirometra* sp. infection was carried out in paddy fields and swamps in some states of Malaysia. *Rana cancrivora* was found heavily infected; the incidence of the tapeworm *Spirometra* on 11 other frog species is reported.

Mastura A. B*., Ambu S., Hasnah O. & Rosli R. - Spargana infection of frogs in Malaysia.

Source : J. E. Asian J. Trop. Med. Public Health, 1996, 27, 1, 51-52.
Language : English
Address* : Division of Medical Ecology, Institute for Medical Research, Jalan Pahang, 50588 Kuala Lumpur, Malaysia.

Abstract : Frogs caught from two States in Malaysia were examined for spargana of *Spirometra* sp. Infected frogs usually show no marks of infection but some had swelling and bleeding at the infection site. The infection status in relation to human health is discussed.

MINILIVESTOCK

Chardonnet Ph. (1996) - African Wild Fauna / The Forgotten Resource [Faune Sauvage Africaine / La Ressource Oubliée].

Source : Office des Publications officielles des Communautés Européennes, Luxembourg. Tome I : Synthèse, 416p; Tome II : Monographies, 288 p.
Language : French
Address : CIRAD-EMVT Service Edition BP 5035; F-34032 Montpellier Cedex 1, France ou IGF, 15 Rue de Téhéran, F-75008 Paris, France. General public price including postage (both volumes), France and abroad (Surface mail) : 425 French Francs.

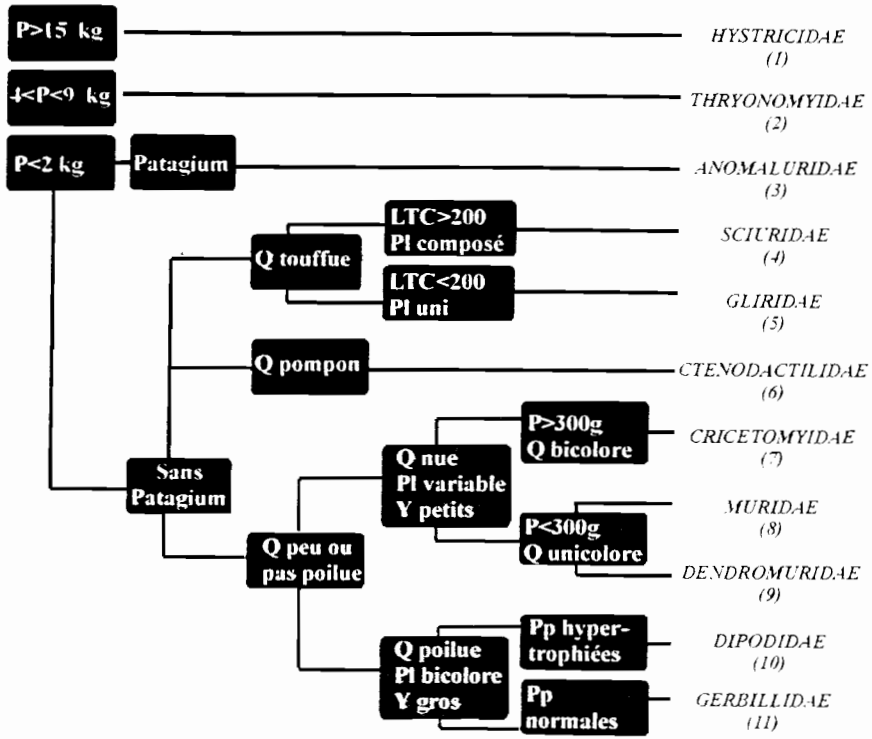
Abstract : This excellent document is the result of contributions by a dozen of well known specialists in fauna, under the coordination of Philippe Chardonnet; the Fondation Internationale pour la Sauvegarde de la Faune and the Département d'Elevage et de Médecine Vétérinaire CIRAD-EMVT have been also deeply involved. Although the books deal with classical aspects of African fauna, some sub-chapters give information on some animals belonging to minilivestock (grass-cutters, giant snails, porcupines, ...).

Hardouin J. & Thys E. - Le mini-élevage, son développement villageois et l'action de BEDIM. [Minilivestock, village development and the role of BEDIM.]

Source : Biotechnol. Agron. Soc. Environ. 1997, 1(2), 92-99.
Language : French
Address : Secrétariat BEDIM. Unité de Zoologie générale et appliquée. Faculté universitaire des Sciences agronomiques de Gembloux. Passage des Déportés, 2. B-5030 Gembloux (Belgique).
Abstract : Minilivestock encompasses all animals of small size, and little-known in terms of production but usable as food, feed or revenues if not eaten. Sustainable breeding becomes possible, and should progressively replace uncontrolled gathering in the wild. Amongst vertebrates, an important meat supply is based on edible rodents like *Thryonomys, Cricetomys, Xerus, Atherurus, Tenrec; Hydrochoerus, Dasyprocta, Myocastor, Capromys, Dolichotis, Agouti,* etc. The same applies to the guinea-pig *Cavia porcellus* and to frogs. Invertebrates farming is also practised through breeding of maggots, termites, butterflies (pupae and adults) for consumption or sale; giant snails are also highly appreciated in many African countries. Minilivestock development is usually a back-yard activity, hence its interest as it relies on local species, substrates and raw materials for infrastructure. The demand for minilivestock is not an utopia, and a country like Papua-New-Guinea, which has officially adopted minilivestock production as a tool to help to develop remote villages, is an excellent example of succes.

RONGEURS / RODENTS

Clé de détermination des familles
Identification Key of families



Source : voir volume 5 (1996), n°2, page 3 de couverture.