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**Bureau for Exchange and Distribution of
Information on Minilivestock**

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

Semestrial Bulletin of Information
on Minilivestock

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sur le Mini-Elevage

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NOUVELLES DE L'ASSOCIATION

Le Conseil d'Administration du BEDIM s'est réuni le 10 octobre 2006 et a définitivement décidé d'arrêter la publication du Bulletin semestriel d'information sur le mini-élevage à partir du numéro 15.2 qui paraîtra au début de l'année 2007. Celui-ci sera donc remplacé par la mise à jour semestrielle des publications récentes sur le mini-élevage au niveau du site internet du BEDIM.

Le travail visant à améliorer le site internet actuel du BEDIM a démarré. La mise en œuvre de ce nouveau site en trois langues (français, anglais et espagnol) est prévue pour le début de l'année 2007. L'arborescence du site prévoit une page d'accueil invitant les chercheurs, les techniciens et les éleveurs à communiquer des informations sur le mini-élevage (annonces, textes, photographies, nouvelles intéressantes, etc.) par mail à l'adresse électronique du BEDIM (bedim@fsagx.ac.be). Après sélection, ces informations apparaîtront comme actualités, de même que les nouvelles de l'association, et seront archivées au niveau d'un espace spécialement réservé au public cible du BEDIM (Votre espace d'information sur le mini-élevage). Le site offrira également une liste d'experts pour les différentes espèces animales concernées auxquels on pourra s'adresser pour toute demande de renseignements techniques. L'internaute pourra donc visiter cette partie du site s'il recherche, par exemple, des personnes ressources possédant des géniteurs, offrant des possibilités de stage, effectuant des activités de recherche dans un domaine bien précis, s'occupant d'un projet de développement bien spécifique, etc.

Le site comprendra également un espace fournissant toutes les informations nécessaires sur l'association BEDIM concernant la structure du Conseil d'administration, les statuts de l'ASBL, les commandes, les paiements, le montant des cotisations, etc. Toutes ces informations sont déjà disponibles sur le site actuel du BEDIM (<http://www.bib.fsagx.ac.be/bedim>).

Les publications récentes pour les différentes espèces animales concernées seront remises à jour tous les six mois. Elles seront ensuite archivées par espèce ou sujet au niveau d'une page spéciale qui comprendra les rubriques ci-après : mini-élevage (général), nutrition humaine, suidés sauvages, rongeurs, cobayes, grenouilles, escargots, vers, insectes et divers. Pour pouvoir bénéficier de l'information scientifique répertoriée au niveau des 30 bulletins d'information qui ont été édités au cours de ces 15 dernières années, ceux-ci seront consultables au niveau d'une rubrique spéciale (fichiers en format PDF). Enfin, l'internaute aura aussi accès à l'information ou à un téléchargement des guides techniques, vidéos, CD et livres élaborés par le BEDIM.

Le Conseil d'administration du BEDIM espère que cette formule profitera à tout le monde au moindre coût et reste attentif à toute amélioration possible en matière de communication sur le mini-élevage

Grâce à cette nouvelle initiative, les personnes intéressées par le mini-élevage disposeront toujours d'une information en ce qui concerne l'évolution de la science dans ce domaine, mais le Conseil d'Administration du BEDIM espère que ce nouveau mode de communication profitera davantage aux techniciens et producteurs et, peut-être aussi, aux étudiants. Bien entendu, même si la communication par voie électronique sera largement développée dans le futur, des échanges par courrier postal resteront toujours possibles.

NEWS OF THE ASSOCIATION

The Board of Trustees of BEDIM met on October 10, 2006 and decided to definitively stop the publication of the biannual Bulletin of information on mini-livestock from the number 15.2, which will be published at the beginning of the year 2007. The Bulletin will be replaced by a biannual update of the recent publications on the BEDIM website.

The work aiming at improving the current BEDIM website started already. The application of this new site in three languages (French, English and Spanish) is foreseen for the beginning of 2007. The structure of the site forecasts a welcome page inviting researchers, technicians, and breeders to send information on mini livestock (announcements, texts, photographs, interesting news, etc.) by mail at the electronic address of BEDIM (bedim@fsagx.ac.be). After selection, these information's as well as the news of the association, will appear as news and later be archived by species in a special section devoted to the targeted public of BEDIM (Your own space of information on mini-livestock). The website will also provide a list of experts for the various relevant species, whom we can address for any demand of technical information. The internet user can thus visit this part of the website if he looks for resourceful persons 1° enable to provide sires, 2° offering training possibilities, 3° conducting research activities in a precise field or 4° implementing a specific development project, etc.

The site will also provide all the necessary information about BEDIM, i.e. the composition of the Board of trustees, the status of the international association BEDIM, the purchase orders, the payments, etc. All this information is already available on the current website of BEDIM (<http://www.bib.fsagx.ac.be/bedim>).

The recent publications for the various animal species will be updated every six months. They will then be archived by species or subject in a special page comprising the following list: mini-livestock (general), human nutrition, wild suiforms, rodents, guinea pigs, frogs, snails, worms, insects and others. To beneficiate of the scientific information listed in the 30 Bulletins published during the last 15 years, the later will be available for consultation in a special section (files in PDF format). Finally, the internet user will access to the

information or to the downloading of the technical guides, videos, CD-rom and books edited by BEDIM.

The Board of trustees hopes that this formula will benefit everybody at low cost and pays attention to all possible improvements concerning the communication on mini-livestock.

* * *

PUBLICATIONS

Global Advances in the Ecology and Management of Golden Apple Snails

Edited by Dr. Ravindra C. Joshi and Dr. Leocadio S. Sebastian - 2006

Here in one publication is all information so far known about golden apple snails (GAS) and the rice systems and countries they have afflicted. Around 500 pages of information are devoted to this species that continue to expand their distribution. With this complete publication, the knowledge vacuum on the ecology and management of GAS will be filled. Some 24 chapters cover various aspects of snail taxonomy (traditional as well as molecular tools), impacts of GAS on aquatic ecosystems and farmers' health, and pesticide abuse/misuse. Even GAS-invaded countries have submitted their separate country reports.

Further, some chapters are dedicated to the utilization of GAS as food and as natural paddy weeder, with some information available on the biorational approach in its management and control.

The publication ensures comprehensive reference on the topic, written by experts around the world for the benefit of all researchers, students, and various organizations and libraries who need information on the subject.

600 pages, hardbound

Dimensions: 7.78 cm x 25.4 cm Weight: 1.6 kg

ISBN 978-971-9081-31-9

Price:

Developed countries US\$102, Developing countries US\$52

Please make check and postal money order payable to:

Philippine Rice Research Institute

Shipping Rates:

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NOVEDADES DE LA ASOCIACIÓN

El Consejo de Administración de BEDIM se reunió el pasado 10 de Octubre de 2006 y decidió de abandonar definitivamente la publicación del Boletín semestral de información sobre la mini-cría a partir del número 15.2 que aparecerá a comienzos de 2007. Este será reemplazado por la actualización semestral de publicaciones recientes sobre la mini-cría en nuevo portal Internet de BEDIM.

El trabajo dedicado a la mejora y actualización del portal Internet ya ha comenzado. El estreno de este nuevo Web site en tres idiomas (francés, inglés y español) esta previsto para comienzos de 2007. La estructura del portal Internet consiste en una pagina de acogida invitando a investigadores, técnicos y criadores a comunicar información sobre la mini-cria (anuncios, textos, fotos, novedades, informaciones de interés etc.) por correo electrónico a la dirección de BEDIM (bedim@fsagx.ac.be).

Estas informaciones serán seleccionadas para aparecer como noticias y novedades, al igual que las diferentes informaciones de la asociación y serán archivadas en un nuevo espacio especialmente reservado para el publico de BEDIM.

Este espacio Internet ofrecera igualmente una lista de expertos sobre las diferentes especies de mini-cría, las cuales podrán ser dirigidas diferentes preguntas y solicitudes de información técnica. El Internauta podrá por tanto dirigirse a esta parte del portal para toda solicitud de información técnica. Allí podrá encontrar por ejemplo información sobre personas que dispongan de animales reproductores para vender, o personas ofreciendo posibilidades de periodos de aprendizaje en su granja, o efectuando actividades de investigación sobre un tema específico o llevando a cabo un proyecto de desarrollo rural sobre una especie determinada.

El espacio Internet contiene también un espacio dedicado a todas las informaciones relativas a la vida de la asociación (estructura del Consejo de Administración, Estatutos de AISBL (Asociación Internacional Belga), pedidos, pagos y tipos de cuota, informaciones todas ellas disponibles en la dirección <http://www.bib.fsagx.ac.be/bedim>)

Igualmente se podrán encontrar las publicaciones mas recientes sobre cada especie que serán actualizadas cada seis meses. Estas serán a posteriori archivadas por especie o tema en una página especial en la cual se podrán encontrar los apartados siguientes: mini-cria en general, alimentación humana, suidos silvestres, roedores silvestres, cobayas, ranas y batracios, caracoles, gusanos, insectos y varios.

Para poder acceder a la información científica clasificada y aparecida en los 30 boletines de información anteriores producidos durante los pasados 15 años, estos se podrán consultar en forma de archivos PDF en un apartado específico. Para terminar, el internauta también podrá obtener información mediante la descarga de guías técnicas, videos, CDs y libros producidos por BEDIM.

El Consejo de administración de BEDIM espera y desea que esta nueva plataforma de intercambio de información sea provechosa para un máximo de personas alrededor del mundo al menor coste y permanecerá atento a toda mejora posible en materia de comunicación sobre la mini-cria.

La Secretaría de Bedim ha recibido dos nuevos manuales respecto a la crianza del *Agouti paca* y del *Pecari tajacu* :

Montes Pérez R. y Reid Góngora A., 2000. Manual para la crianza de tepezcuintle o jaleb en solar. Universidad Autónoma de Yucatán

Montes Pérez R., 2005. Crianza del kitam o pecarí de collar (*Pecari tajacu*) en corral. Universidad Autónoma de Yucatán.

Los manuales proporcionan información básica para las personas que desean empezar una crianza y recomendaciones de manejo respecto a la instalaciones, la reproducción, las enfermedades y la alimentación del aguti y del Pecari. También se detallan los trámites para registrar legalmente en México un criadero de estos animales silvestres.

Para pedir los manuales o recibir mas informaciones, manden un email al Dr. Ruben Montes Pérez, de la Facultad de Medicina Veterinaria y Zootecnia de la Universidad Autónoma de Yucatán, a la dirección electrónica siguiente : mperez@tunku.uady.mx.

SURVEY OF THE LITERATURE

BDB ref. : Corresponds to the Identification code of the document in the BEDIM DATABASE.

INASP : International Network for the Availability of Scientific Publications.
<http://www.inasp.info/ajol/whatis.html>

HUMAN NUTRITION

Malaisse F. – Human Consumption of lepidoptera, Termites, Orthoptera, and Ants in Africa

Source: Paoletti, M.G., Editor. Ecological Implications of Minilivestock; role of rodents, frogs, snails, and insects for sustainable development, pp 175-230.

Language: English

Address: Laboratoire d'Ecologie, Faculté Universitaire des Sciences Agronomiques de Gembloux, Passage des Déportés, 2, B-5030 Gembloux Belgium. E-mail: malaisse.f@fsagx.ac.be

Abstract: Human consumption of lepidoptera, isoptera, orthoptera, and formicidae in Africa is reviewed based on published literature and recent inquiries carried the author's request. This information is analyzed according to species diversity, ethnolinguistic groups concerned, chemical composition, as well as ecological aspects such as caterpillar food plants, diversity of items eaten litaria, etc. At least 100 caterpillar species provide human food in Africa, of which 85 been evaluated. Values are respectively known for 25-30 ethnospesies and for isoptera, 89 of about 120 species of orthoptera, and at least a tenth of edible ant species-more than 250 species altogether. From a chemical point of view, large diversities exist at various levels according to taxa involved (at family as well as species level). Discussion focuses on the importance of uptake, sustainable management, preliminary knowledge needed, and choice of valuable species. It has been noted that caterpillars are the most convenient wild edible food entering sustainable production. The future of large termitaria and *Macrotermes* species is dark, even if the present biomass remains tremendous. More accurate studies are needed.

BDB ref.: BEDIM 543

Tchiboza¹ S., Huis² A.V. & Paoletti³ M.G. – Notes on edible insects of south Benin: A source of protein

- Source:** Paoletti, M.G., Editor. Ecological Implications of Minilivestock; role of rodents, frogs, snails, and insects for sustainable development, pp 245-250.
- Language:** English
- Address:** Laboratoire d'Ecologie Appliquée, Faculté des Sciences Agronomique, Université d'Abomey-Calavi 04 B.P., 0385 Cotonou, Bénin. Tel. and Fax +229 303084, E-mail: Tchisev@avu.org ²Dépt. des Sciences de Production Végétale, Laboratoire d'Entomologie B.P. 8031, 6700 EH Wageningen, Les Pays-Bas, E-mail: arnold.vanhuis@users.ento.wag-ur.nl and arnold@vanhuis.com ³Dept. Biology, Padova University, 35100-Padova Italy, E-mail: paoletti@civ.biounipd.it
- Abstract:** Insects have been and still are consumed in South Benin. They are a very important source of animal protein able to successfully substitute some meats and improve the health of badly nourished children. Four kinds of insects are principally collected in South Benin-*Oryctes* spp., *Rhynchophorus phoenicis* (Fabr.); *Braachytrupes membranaceus* (Drury), and *Macrotermes falciger*. The species mostly eaten in Benin are *Macrotermes falciger* and *Oryctes* spp. (Tchiboza, 2002). The various aspects investigated here are: the species eaten, techniques of gathering, culinary usages, communities consuming them and their economic importance.
- BDB ref.:** BEDIM 543

Mitsuhashi J. – Edible insects in Japan

- Source:** Paoletti, M.G., Editor. Ecological Implications of Minilivestock; role of rodents, frogs, snails, and insects for sustainable development, pp 251-262.
- Language:** English
- Address:** Dept. of Bioscience, Tokyo University of Agriculture, 1-1 Sakuragaok 1-chome, Setagaya-ku, Tokyo 156-8502, Japan. E-mail: Junmths@nodai.ac.jp
- Abstract:** In Japan, the most popular edible insect is a grasshopper, *Oxya yezoensis* or *O. japonica*, an insect rich in proteins. It is consumed in large amounts even today. The mixtures of river-living insect larvae are particularly relished. The larvae and pupae of a wasp, *Vespa lewisi*, are consumed in considerable amounts while pupae and female adults after oviposition are the preferred stages of *Bombyx mori*; the pupae are particularly rich in nutrients. All of these insects are cooked with soy sauce and sugar, and are sold as canned foods. In addition to these insects, the larvae of cerambycid beetles are preferentially eaten in the countryside.

Larvae of the dobsonfly, *Protohermes grandis* (Neuroptera) has been consumed as a traditional medicine.

BDB ref.: BEDIM 543

Ramos-Elorduy J. – Insects: a hopeful food source

Source: Paoletti, M.G., Editor. Ecological Implications of Minilivestock; role of rodents, frogs, snails, and insects for sustainable development, pp 263-291.

Language: English

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Abstract: Insects as a major animal group possess an enormous biodiversity and form a colossal biomass in nature that is generally wasted. Insects offer us many benefits, including use in human and animal nutrition medicine, religion, art and handicrafts. They are also efficient recyclers of organic matter and provide a source of economic gain for the poor through their sale. Even if developed nations consider insects to be an emergency food or non conventional food of low prestige, they are part of the daily diet of the greater part of humanity, where they are regarded as healthy, nutritious and tasty food, at times constituting the only significant source of quality protein for these people. To date, around 2,000 edible insect species have been identified throughout the world. Because of their high nutritive value not only in proteins but also in fats, minerals and vitamins, and their ubiquitous presence, insects are a "potential" source of sustainable food for humans. Once we select suitable species and develop appropriate breeding methods, insects would be able to provide a reliable and sustainable source of high-quality animal protein.

BDB ref.: BEDIM 543

Paoletti^{1} M.G. & Dufour² D.L. Edible Invertebrates among Amazonian Indians: A critical review of disappearing knowledge*

Source: Paoletti, M.G., Editor. Ecological Implications of Minilivestock; role of rodents, frogs, snails, and insects for sustainable development, pp 293-342

Language: English

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Abstract: For the indigenous populations of Amazonia, invertebrates constitute an important component of the diet. Information on entomophagy for 39 ethnic groups (and three other post-Columbian settlers) or about 21.4% of the 182 groups known at the

Amazon Basin is presented here, but utilisation of this non-conventional food resource is surely much more widespread. A database is given of all the information available for each ethnic group regarding the species included in the diet, scientific and the ethno name if known, stage of life cycle consumed, manner of preparation and when known, host plant. This database lists 209 scientifically identified species. Information on an additional 426 species and ethnic names, with an insecure link to Linnean taxonomy suggest that local knowledge is very extensive. The database represents not only an easy-to-consult resource, but also a support for further research. Caterpillars, termites, leafcutter ants, bees, wasps, and Coleoptera seem to be the more collected items, together with a few aquatic ones. The most intensively collected are those dependent on forest leaves and litter, representing in general the higher biomass, so much work needs to be done for other groups including caterpillars, aquatic insects, grasshoppers, snails, and spider. Knowledge of the relations between indigenous populations and ecosystems is indeed the base for the preservation of natural and cultural biodiversity. We are at the beginning of a survey that has to be expanded.

BDB ref.: BEDIM 543

Onore G. – Edible Insects in Ecuador

Source: Paoletti, M.G., Editor. Ecological Implications of Minilivestock; role of rodents, frogs, snails, and insects for sustainable development, pp 343-352.

Language: English

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Abstract: In Ecuador the ancestral tradition of entomophagy still exists, particularly in the countryside where the native population is relatively isolated from technological progress. Eighty-two (82) edible species are listed for the country; none is a main dish but many are used to complement other animal protein sources in diet. The most common edible insects belong to orders Coleoptera and Hymenoptera and are consumed at either the larval or the adult stage.

BDB ref.: BEDIM 543

Cerda¹ H., Araujo² Y., Glew³ R.H. & Paoletti⁴ M.G. – Palm Worm (Coleoptera, Curculionidae: Rhynchophorus palmarum) A Traditional Food: Examples from Alto Orinoco, Venezuela

Source: Paoletti, M.G., Editor. Ecological Implications of Minilivestock; role of rodents, frogs, snails, and insects for sustainable development, pp 353-366.

Language: English

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Abstract: Current knowledge about the so-called palm worms, weevil beetles, and Curculionidae widely used as food in the Amazon is summarised. The Indians gather the palm worms from damaged or fallen palm stems and eat them raw or roasted. We analyzed the nutrient composition of the palm worm and found that it is an excellent source of protein, fat, vitamins A and E, and minerals. Development of a local, controlled, small-scale palm worm production system implemented by the Indians in the Amazonas is described. Larvae are bred using wild palm materials and traditional Indian plants. Larval survival and density in each palm substrate were analyzed together with their nutrient composition. These data were compared with the mother palms *cucurito* (*Maximiliana maripa*), *seje* (*Jessenia bataua*), and *moriche* (*Mauritia flexuosa*). Finally, the palatability of the palm worm to non-Amerindian tourists is assessed. The nutrient composition of the palm worm, the simplicity of a more controlled local production system and the acceptability of the palm worm to tourists make this nonconventional resource promising, both as a nutritional food and as a source of cash income for the Indians.

BDB ref.: BEDIM 543

Yen A.L. – Insect and other Invertebrate foods of the Australian Aborigines

Source: Paoletti, M.G., Editor. Ecological Implications of Minilivestock; role of rodents, frogs, snails, and insects for sustainable development, pp 367-387.

Language: English

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Abstract: Most information on the use of insects as food among the Australian Aborigines consists of a small number of well-known examples such as honey ants, sugar-bag bees, witchetty grubs

and, to a lesser extent, Bogong moths. The high profile nature of these taxa has masked several aspects about entomophagy in Australia: (1) diverse nature of the Australian environment; (2) diverse nature of Aboriginal cultures; and (3) full extent of entomophagy among Australian Aborigines. The issue of entomophagy has been further confused by linguistics, incorrect and often unsubstantiated use of common and scientific names, and lack of taxonomic and life history studies on some of the important food taxa. The importance of insects varies geographically and Aborigines living in the harsher semiarid and arid regions probably utilized a greater range of invertebrate foods than those with greater access to freshwater and marine resources. These included species of freshwater crustaceans, termites, bugs, grasshoppers and crickets, beetle larvae, moth larvae and adults, ants, and honey. The importance of invertebrates as food in different parts of Australia was related to the availability of other foods such as plants and mammals birds, snakes, lizards, and fish.

BDB ref.: BEDIM 543

Meyer-Rochow V.B. – Traditional Food Insects and Spiders in Several Ethnic Groups of Northeast India, Papua New Guinea, Australia, and New Zealand

Source: Paoletti, M.G., Editor. Ecological Implications of Minilivestock; role of rodents, frogs, snails, and insects for sustainable development, pp 389-413.

Language: English

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Abstract: Taxonomic identifications and vernacular names of some insects and spiders, consumed by the following ethnic communities, are presented: Ao-Naga (Northeast India: Nagaland), Meeteis (Northeast India: Manipur), Chimbu (Central Highlands. Papua New Guinea), Onabasulu (Southern Highlands: Papua New Guinea), Kiriwina (Trobriand Islands: Papua New Guinea), Walbiri (Central Australia, Pintupi (Central Australia), and Maori (New Zealand/Aotearoa). Differences and similarities of entomophagous habits among the groups are briefly examined with regard to cultural, ethnic, and linguistic relationships. It is postulated that prehistorically two centres in the region under discussion existed where entomophagy evolved and from where the practice spread: Southern India and Southeast Asia. It is further postulated that not protein-rich, but sugar and fat-containing insects were the first species to find a place in the regular diet of prehistoric man. Species containing mostly protein were added to the local food spectrum later. According to this scenario, the food insect preferences of the Australian Aborigines reflect those of the

earliest insect-eating humans. Evidence is also presented that domestication of the silkworm and use of its product (i.e., silk) could have arisen in Northeast India as early as 4000 years BC as a consequence of eating wild silkworm larvae and pupae.

BDB ref.: BEDIM 543

Yhoung-Aree¹ J. & Viwatpanich² K. – Edible insects in the Laos PDR, Myanmar, Thailand and Vietnam

Source: Paoletti, M.G., Editor. Ecological Implications of Minilivestock; role of rodents, frogs, snails, and insects for sustainable development, pp 415-440.

Language: English

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Abstract: The contribution that insects make to life is enormous. During consultant missions to the Laos PDR, Myanmar, and Vietnam, the authors conducted anthropological study of edible insects in these countries. Informal conversations were held with food insect vendors and consumers. Field notes pertaining to these missions and those obtained from rapid appraisals in Thailand were compiled and analyzed. The results demonstrate that the selected countries share common forest and watershed resources as they all form part of the Mekong River Basin. Due to comparable ecological and environmental condition, as well as certain sociocultural practices, people living in these countries have similar preferences regarding insect foods. Approximately 164 insect species are eaten: these include beetles (61 species), termites (2 species), bugs (11 species), moths (47 species), cicadas (11 species), dragonflies (4 species), bees and ants (16 species) as well as crickets and locusts (22 species). The study confirmed that 44 species of insects are eaten in northeastern Thailand alone. The diversity of insect foods is greater in urban areas than in rural areas. Rural folk eat insects their main dish, whereas urban people eat insects either as a main dish or snack, or both. Moreover, although insects are a nutritious food source, cooking methods may alter their quality. Rural consumers or indigenous migrants may obtain fewer calories from insect foods as they prefer meals that are low in fat. Urban consumers, however, have several different ways of preparing insect foods using fat (frying, frittering) and can obtain a greater variety of insects. At present, insect foods are increasingly in demand and the marketing of edible insects is becoming more lucrative. Insect food distributors may earn a net profit of approximately 800-4,200 Baht/day (19-30 US \$) for those selling in slum areas and about 2,000 Baht/night (49 US \$), if they operate in tourist zones. On a

commercial scale, entrepreneurs may earn as much as 600-700 million Baht per year (14.8-17.3 million US \$ yr⁻¹). However, the significant quantity of edible insects collected is having an adverse effect on the ecosystem and food chain, resulting in a biodiversity crisis. Nevertheless, the farming of insects as a human food source has real potential. For instance, studies are underway in Thailand on the farming of certain crickets, bamboo moths, and sago beetles. Modified technologies are needed, however, to yield the same quality of insects as those obtained from the natural environment. Financial support for edible insect research is one important means of maintaining biodiversity on the planet.

BDB ref.: BEDIM 543

Tommaseo-Ponzetta¹ M. & Paoletti² M.G. – Lessons from traditional foraging patterns in West Papua (Indonesia)

Source: Paoletti, M.G., Editor. Ecological Implications of Minilivestock; role of rodents, frogs, snails, and insects for sustainable development, pp 441-457.

Language: English

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Abstract: Insects and terrestrial invertebrates are presumed to have consistently contributed to the diet of our ancestors and it is estimated that nearly 2,000 insects still contribute worldwide to human nutrition. As elsewhere in the tropical world, insects are a part of the diet of West Papua (ex-Irian Jaya) populations. The distribution of insect food consumption on the western half of the island of New Guinea follows different patterns, depending on the environment and population subsistence economy. In the forest biome of the peripheral montane areas, many different insect species are collected but in small numbers, mainly by women and children. Insect collection occurs by chance, but is frequent, and possibly helps those most vulnerable to food shortages to complement their diet with some extra protein and fat. In the western lowlands, a complex cultural system is centered around the traditional staple: sago (*Metroxylon sagu* and *M. rumphii*). The pith of this palm, which grows spontaneously in the swampy forest plains, contains a high amount of starch and is easily gathered by the local people. The beetle *Rhynchophorus ferrugineus papuanus* is strictly associated with the sago palm and oviposits especially on damaged or felled trees. Villagers so manage the sago palms to increase palm-worm oviposition and to collect a consistent number of larvae about 6 weeks later. This ancient sago culture, favored by an abundant and reliable resource, has developed a rich ceremonial life connected with

sago larvae consumption. Ecological, economic, and cultural factors influencing the variety of insect consumption modalities are taken into account here. The development of local small-scale invertebrate breeding systems can contribute to the development of sustainable, renewable resources, and protect tropical forests from degradation.

BDB ref.: BEDIM 543

Novelli E., Giaccone V., Balzan S., Ghidini S. & Bracchi P.G. – Study on dietetic-nutritional value of snail: Comparison among species and between wild collected samples and reared ones (Italy) [Indagine sul valore dietetico-nutrizionale della lumaca. Confronto fra specie e fra soggetti raccolti in natura e allevati (Italia)].

Source: Annali-della-Facolta'-di-Medicina-Veterinaria 2002, 22:49-56

Language: Spanish

Address: Universita'-degli-Studi-di-Parma (Italy), Dipartimento di Produzioni Animali, Biotecnologie Veterinarie, Qualita e Sicurezza Alimentare Padua Univ. (Italy). Dipartimento di Sanita Pubblica, Patologia Comparata ed Igiene Veterinaria.

Abstract: A comparative study aimed at evaluating proximate composition and fatty acid composition of the edible part of some of the most consumed species of terrestrial snails in Italy (*H. pomatia*, *H. aspersa*, *H. lucorum*, *H. aperta*, *H. vermiculata*) has been carried out. Samples submitted to analysis were the ones collected during the phase of Winter dormancy from different areas of Italy; samples reared in arranged breeding were also included in the study. Results obtained showed differences in protein and ash content, probably due to the origin of species; *H. lucorum* and *H. vermiculata* contain respectively the highest protein and ash content on fresh matter. The analysis of fatty acids composition revealed a reduced content of saturated compounds (less than 25%) and a high content of polyunsaturated fatty acids, principally linoleic acid and arachidonic acid. An intra-specific comparison between wild collected samples and breeding samples did not put in evidence differences neither in proximate nor in fatty acid composition.

BDB ref.: BEDIM 558

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WILD SUIFORMS

Berger¹ E.M., Leus K., Vercammen P. & Schwarzenberger F. – Faecal steroid metabolites for non-invasive assessment of reproduction in common warthogs (*Phacochoerus africanus*), red river hogs (*Potamochoerus porcus*) and babirusa (*Babyrousa babyrussa*)

Source: Animal Reproduction Science 2006, 91:155-171

Language: English

Address: Departement of Natural Science, Biochemistry, University of Veterinary Medicine, Veterinärplatz 1, A-1210 Vienna, Austria

Abstract: The objectives of this study were to analyse faecal steroid metabolites in African and South East Asian wild suiforms species kept in European zoo. Faecal samples were collected 1-3 times per week from non-pregnant captive female warthogs (n=9), red river hogs (n=7) and babirusa (n=5). Enzyme-immunoassays for faecal progesterone, androgen and oestrogen metabolites were tested for their ability to determine follicular and luteal phases. In all three species, oestrus cycles could be monitored with 20 α -OH and 20-oxo-pregnane essays. In contrast, oestrogens and androgens were not useful in characterising follicular activity during the oestrus cycle in any species. Faecal 20 α -OH and 20-oxo-pregnane values were correlated. Faecal pregnane concentrations revealed species-specific differences. Luteal phase values of 20 α -OH-pregnanes were considerably higher than 20-oxo-pregnanes. Regular oestrus cycles had a length of about 35 days in all three species. Results indicated a seasonal influence on the occurrence of reproductive cycles in the warthog with anoestrous periods in the European summer. The red river hog was found to be a seasonal and poly oestrous breeder. Oestrus cycles started by January and continued until summer. In contrast, the babirusa showed non-seasonal ovarian cyclicity. In pregnant red river hogs, progesterone metabolites were comparable to luteal phase values of the oestrous cycle during the first 3 months of gestation, but did further increase during the last month of pregnancy. In summary, the reproductive biology of the three exotic pig species was studied using non-invasive faecal steroid analysis and these methods were used for comparative investigations of oestrous cycles, pregnancy and seasonality.

BDB ref.: BEDIM 544

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EDIBLE AND USEFUL RODENTS

Adu¹ E.K., Otsyina H.R., & Agyei A.D. – The efficacy of different dose levels of albendazole for reducing faecal worm egg count in naturally infected captive grasscutters, Tryonomys swinderianus, Temminck.

Source: Livestock research for Rural developmeent 17(11) 2005: paper 128

Language: English

Address: Animal Research Institute, CSIR, P.O. Box AH 20, Achimota, Ghana.

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Abstract: The efficacy of different dose levels of albendazole for reducing faecal worm egg count in naturally infected captive grasscutters was investigated in an in-door trial using weaned grasscutters weighing between 325 and 925 g, in an complete randomised block design from 20 September 2004 to 10 November 2004. The drug was administrated after impregnation into cane sugar pieces at three dose levels: A (0 mg/kg BW), B (2.5 mg/kg BW, ½ of the manufacturer's recommendation), C (5 mg/kg BW) and D (7.5 mg/kg BW), using the recommendation for small ruminants. The efficacy of the drug for reducing the faecal egg count was determined using the percentage faecal egg count reduction (FECR%) technique. The most important finding in this study was that albendazole is efficacious for reducing faecal egg count in captive grasscutters at a dose of 2.5 g/kg BW. Though there was no significant difference in the live weight gains of treated animals compared to animals in the control group, growth rates in all treated animals tended to decline. This is speculated to be due to a possible toxicosis of albendazole in the grasscutter. The ease with which the animals accepted the cane sugar pieces when impregnated with albendazole also indicates that the drug can easily be administered with little technical supervision.

BDB ref.: BEDIM 545

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GUINEA PIGS

Niba¹ A.T., Kud² C., Tchoumboue¹ J., Zoli¹ A.A., Fonteh¹ F.A. & Komtangi³ M.C. – Influence of birth and litter size on the preweaning growth performance and survival of guinea pigs (*Cavia porcellus* L.)

Source: Journal of the Cameroon Academy of Sciences Vol. 4 No. 1 (2004): 19-25

Language: English

Address: ¹Dpt. Of Animal production, Faculty of Agriculture, P.O. Box 222 Dschang Dschang-Cameroon ²Dseale-Hayne, Faculty of Agriculture, Food and Land Use, University of Plymouth, Newton Abbot, Devon TQ126NQ, United Kingdom ³ Dept. Of Animal Biology, Faculty of Sceince, Univrsity of Dschang

Abstract: Birth records, preweaning growth and mortality data recorded in two consecutive parities on 121 kids of 39 females guinea pigs were analysed to determine the influence of birth weight (BW) and litter size (LS) on preweaning growth and survival. Results show highly significant differences ($P < 0.01$) in the mean birth weight (MBW) between single males (97.82 g) and twin males (78.69 g). The same trend was also observed for the females being 86.17 g for single births as against 73.72 g for twins. Corresponding mean weaning weights (MWW) at 3 weeks of age, independent of sex, were higher for single births than twins births. Comparison for the mean daily weight gain (MDWG) as reflected by the birth weight ranges (BWR) showed a highly significant variation. A higher MDWG was consequently observed with BWR above 90 g followed by 70-89.9 and 50-69.9 BWR, respectively. As a result, the highest mean weaning weights were obtained with the higher weight ranges. Preweaning mortality records showed a survival percentage for the four different BWR (<49.9, 50-69.9, 70-89.9, > 90 g) to be 16.67, 64.52, 95.83, and 96.65%. The difference between single and twin birth in the percentage survival was 6.10%. Higher BW and single litters were observed to be associated with higher survival and growth rates. Therefore, management practices which could increase BW seems a very tempting option for guinea pig productivity in the region.

BDB ref.: BEDIM 562

Niba¹ A.T., Djoukam¹ J., Tegui¹ A., Kud² A.C., & Loe³ J.O. – Influence of level of cottonseed cake in the diet on the feed intake, growth performance and carcass characteristics of guinea pigs in Cameroon

Source: Tropicultura (2004), 22, 1: 32-39

Language: English

Address: ¹DPt. Of Animal production, Faculty of Agriculture, P.O. Box 222 Dschang Dschang-Cameroon ²Dseale-Hayne, Faculty of Agriculture, Food and Land Use, University of Plymouth, Newton Abbot, Devon TQ126NQ, United Kingdom

Abstract: An eight-week trial was conducted to evaluate the influence of graded levels (0, 25 and 50 of cottonseed cake (CSC) based diets used as supplement for *Pennisetum purpureum* and *Desmodium intortum* basal diets on feed intake, growth rate and carcass characteristics of guinea pigs. Considering the type of feed, there was a highly significant ($P < 0.01$) difference between consumption of *Pennisetum*, *Desmodium* and concentrate within sexes and for all the treatments. The percent forage dry matter intake increased from 85.30% for 0% CSC to 88.90% for 50% CSC. Respective mean weekly weight gains for 0, 25 and 50% CSK were 13.2, 13.4 and 10.6 for males and 12.1, 10.6 and 6.3 for females. There were significant differences ($P < 0.05$) in the within treatment sex differences, for these values in treatments 25 and 50% CSC. Overall mean weekly weight gain for the treatment were 12.6, 12.1 and 8.4 g for 0, 25 and 50% CSC, respectively. Feed efficiency values showed a linear increase from 0% CSC (8.78) to 50% CSC (17.57). Overall mean mortality figures also showed a similar trend with 0 and 25% CSC having the same value of 6.67% and 50% CSC having a numerically higher value of 33.33%.

BDB ref.: BEDIM 563

Tchoumboue¹ J., Niba¹ A.T. & Kenfack A. – Comparative studies on the influence of supplementation with two legumes (*Arachis glabrata* Benth and *Desmodium intortum*) on the reproductive and growth performance of guinea pigs (*Cavia porcellus* L.)

Source: Bulletin of Animal Health and Production in Africa (2001), 49: 74-83

Language: English

Address: ¹DPt. Of Animal production, Faculty of Agriculture, P.O. Box 222 Dschang, Dschang-Cameroon

Abstract: Forty eight adult guinea pigs comprising 45 females and 3 males were used in a fourth-month study to compare the effect of supplementation with *Arachis glabrata* or *Desmodium intortum* of a basal diet containing *Trypsacum laxum* and a rabbit feed on their reproductive and growth performance. Animals were divided into three equal groups (1 male and 15 females each) corresponding to the experimental diets namely the basal diet group (BDG), the *Arachis* supplemented group (ASG) and the *Desmodium* supplemented group (DSG). The results showed that the fertility

rate was significantly higher ($P < 0.01$) for ASG (93.3%) and DSG (73.3%) than BDG (40.0%). Birth weights and viability at weaning which were respectively 100.1g, 98.9g and 96.9g and 100%, 84.7% and 50% followed the same trend. No significant difference was observed for the birth weights. Contrarily, viability at birth showed a significant variation ($P < 0.01$) between ASG and the other groups. Mean values for the daily weight gain were higher in DSG (4.5g) than ASG (3.5g), and BDG (1.5). Values for this parameter were significantly higher in ASG and DSG than in BDG. The mean weaning weights for ASG, DSG and BDG were 173.6, 194.7 and 161.4g respectively. No significant differences were observed for the weaning weights. The results revealed that feeding guinea pigs with additional vegetable improved reproductive and growth performances.

BDB ref.: BEDIM 564

Tedonkeng Pamo¹ E., Niba A.T., Fonteh F.A., Tendonkeng F., Kana J.R., Boukila B. & Tsachoung J. – Effect of supplementation with Moringa oleifera or multinutritional blocs on post partum weight and pre-weaning growth of Guinea pigs (Cavia porcellus L.). [Effet de la supplémentation au Moringa oleifera ou au blocs multinutritionnels sur l'évolution du poids post partum et la croissance pré-sevrage des cobayes (Cavia porcellus L.)]

Source: Livestock research for Rural development 17(4) 2005: paper 46

Language: French

Address: Laboratoire de Nutrition animale, Département des Productions animales, FASA, Université de Dschang, P.O. Box 222 Dschang, Cameroun. E-mail: Pamo_te@yahoo.fr

Abstract: The effect of supplementation with *Moringa oleifera* or multi-nutrients blocs on the postpartum weight and pre-weaning growth of guinea pigs was studied from December 2002 to April 2003 at the teaching and research farm of the University of Dschang in West-Cameroon. 32 females (5 months age) and 4 males guinea pigs weighing 460 g on average were put on breeding for a period of 31 days. The animals were distributed into four groups of 8 females. The first group represented the control group and received no supplement. The second, third and fourth groups received respectively a supplement 2.5 g of *Moringa*, 5 g of *Moringa* and 5 g of multi-nutrients blocs. The results of this study showed that multi-nutrients blocs had high value of pretein (37.4%) compared to *Moringa* (26.4%), and that the later had a higher cellulose content. No significant difference was observed between the weights of females before birth. At birth, the average weights of young guinea pigs were 85, 73, 94 and 125 g respectively for the control group and the supplement groups with 2.5 g and 5 g of *Moringa*, and 5 g of multi-nutrients blocs. The weight of young animals in the later group where significantly higher. The daily weight gains of the females between the start of the experiment and weaning were respectively 4, 4, 5 and 7 g for the control group, and

the supplement groups with 2.5 g and 5 g of *Moringa*, and 5 g of multi-nutrients bloks. The *Moringa* leaves seem to be a supplement that can be used to improve the growth performances of guinea pigs at very low cost in rural area.

BDB ref.: BEDIM 549

Fonteh¹ F.A., Niba A.T., Kud² A.C., Tchoumboue J.T. Tendonkeng F & Awah-Ndukum. – Influence of weaning age on the growth performance and survival of weaned guinea pigs

Source: Livestock research for Rural development 17(12) 2005: paper 133

Language: English

Address: ¹ Department of Animal Production, Faculty of Agriculture, P.O. Box 222 Dschang, Cameroon. E-mail fonthflorencia@yahoo.com ² Seale-Hayne, Faculty of Agriculture Food and Land Use, University of Plymouth, Newton Abbot, Devon TQ12 6NQ, United Kingdom

Abstract: A study was carried out to investigate the influence of weaning age on the growth performance and survival of guinea pigs in the western highlands of Cameroon. 94 Kids from 56 breeding females were used for the study. Breeding females were divided into four groups corresponding to the different weaning ages for kids : T21 = weaning at 21 days; T16 = weaning at 16 days; T11 = weaning at 11 days and T84 = no weaning until 84 days of age. Weaning weight was significantly higher for kids weaned at 84 days of age than in other treatment. However, the mean daily weight was highest (2.48 g) for kids weaned at 11 days of age and lowest (1.70 g) in kids weaned at 84 days. The greatest survival was recorded for kids from T21 (83 %) while lowest rate (63 %) was in T84. The highest mean litter size was observed in T16 (1.4) and the lowest in T84 (1.1). In conclusion, early weaning in guinea pigs will bring about significant improvement in kid's growth performance and survival. Where efficient feeding strategies can be developed, weaning at 11 days of age will permit an increase in the overall productivity and economic returns.

BDB ref.: BEDIM 546

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FROGS

Harckewicz K.N. – Maintenance of Bombina species of frogs

Source: Seminars in avian and exotic pet medicine (2004),13(4): 229-233
Language: English
Address: Berkeley dog and cat hospital, 2126 Haste St., Berkeley, CA 94704
Abstract: Of four common species of *Bombina* frogs (*B. orientalis*, *B. bombina*, *B. variegata*, *B. maxima*), the Oriental fire-bellied toad (*B. orientalis*) is the most commonly kept and bred species. *Bombina* frogs have specialised glands in their skin that secrete a toxin which can cause irritation to other animals either ingesting or otherwise coming into contact with the frogs. Care should be taken when handling these frogs, and handling of the frogs should be kept to a minimum. Enclosures indoors can be simple or complex in nature. It is possible to keep these species outdoors in temperate parts of the United States, although a winter hibernation (brumation) period is necessary. *Bombina* species are easy to care for, demonstrate few health problems, and can live up to twenty years in captivity.
BDB ref.: BEDIM 550

Lima¹ S. L., Casali² A.P. & Agostinho³ C.A. – Performance of bullfrog tadpoles (Rana Catesbeiana) raised in the "amphifarm" system and feeding tables [Desempenho zootécnico e tabela de alimentação de girinos de rã-touro (Rana catesbeiana) criados no sistema anfigranja]

Source: Revista Brasileira de Zootecnia (2003),32(3): 512-518
Language: Portuguese
Address: ¹samuel@ufv.br; ²apcasali@lince.tdnet.com.br
³agostinho@fca.unesp.br
Abstract: The objective of this work was to evaluate (under field conditions), the performance of bullfrog tadpoles raised on commercial frog farms using the "Amphifarm" systems, and, at the same time, to estimate daily food intake in order to obtain a reference table for feeding the animals. The results founded on 249 mil animals showed the following indexes: mortality (%) from 0.7 to 35.2, the average being 5.9%; weight gain (g/day) varied from 0.03 to 0.22 (0.11 g/day on average); feed conversion ranged from 0.92 to 2.75:1, the average being 1.5:1. Compared to previous data, these results indicate a significant improvement in performance indexes, showing that there was a relative gain in productivity due to the improvement of management techniques. The reduction in average feed conversion was caused mostly by adequate use of the reference table, the values of which were confirmed during a follow-up of the observation units. This table allows the

calculation of daily food offer, based on tadpole average weight and on estimated intake as a percentage of body weight, for water temperatures varying from 18 to 29°C and body weight ranging from 0.1 to 26 g.

BDB ref.: BEDIM 551

**Ramos¹ E.M., Gomide¹ L.A.M., Fontes¹ P.R., Ramos¹ ALS & Peternell² L.A.–
*Meat color evaluation and pigment levels in bullfrogs (*Rana catesbeiana*)
slaughtered by different methods***

Source: Aquaculture (2005), 245(1-4): 175-182

Language: English

Address: ¹Departamento de tecnologia de alimentos (DTA), Universidade Federal de Viçosa (UFV, Campus Universitário, CEP: 36571-000, Viçosa-MG, Brasil ² Departamento de Informática (Setor Estatística), UFV, Brasil

Abstract: This work aimed to evaluate the muscle colour and heme pigment content of bullfrog muscles after electrical or thermal stunning and use or not of bleeding. Stunning method did not influence ($P>0.05$) the instrumental colour or the total heme pigment content of the meat or the relative chemical forms of heme pigments. However, muscle myoglobin content was lower in electrically stunned frogs. Overall, the myoglobin content of bullfrog meat was similar to that of avian white muscles. Bleeding enhanced the final quality of meat. Meat from bled animals was whiter and had an important contribution of the yellowness value to its colour. Muscle hemoglobin content of bled frogs was lower ($P<0.05$) than that of un-bled frogs, and negatively correlated with slaughter weight. Oxymyoglobin, reduced myoglobin and metmyoglobin contents were, respectively, highly correlated with lightness, redness and yellowness.

BDB ref.: BEDIM 552

Martínes-Gárdenas¹ L. & Flores-Nava – *Do granular substrates enhance microbiota availability and growth in cultured *Rana catesbeiana* tadpoles?*

Source: Aquaculture Research (2005), 35: 616-621

Language: English

Address: ¹Centro de Investigación y Estudios Avanzados-IPN Unidad Mérida, Antigua Carretera a Progreso, km. 6, Mérida, Yucatán, Mexico. E-mail: aflores@mda.cinvestav.mx

Abstract: A comparison was made of growth performance in bullfrog tadpoles and biogenic capacity in culture tanks with gravel, sand and hard bottoms. Stage 25 (Gosner) tadpoles from a single cohort were stocked in 1 m² fiberglass tanks at 50 m⁻². Two treatments and a control were employed, with three replicates each: T1 = tadpoles reared in tanks with 0.02 m deep layer sterilised silica gravel; T2 = tadpoles reared in tanks with 0.02 m

deep layer sterilised beach sand; and C = a control treatment with no substrate (conventional method). Tadpoles were fed on a 40% protein, powdered specific bullfrog feed at 13% body weight day⁻¹. Results for survival, timing to metamorphosis, specific growth rate and weight gain exhibited no statistical differences between treatments. However, tadpoles in T1 had apparent overall better performance based on numerically indicators. Biotic colonisation was also statistically similar between treatments, showing overall poor biogenic capacity for the tested substrates. Only three taxa, at low abundance, were recorded for phytoplankton and Phyto-benthos. Zooplankton was represented by two microinvertebrate groups, rotifera and protozoa. The statistical similarities between treatments may reflect that bullfrog tadpoles do not exploit naturally occurring aquatic biota when sufficient suspended feed particles are present.

BDB ref.: BEDIM 553

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SNAILS

Ebenso, I. E. - Dietary calcium supplement for edible tropical land snails Archachatina marginata in Niger Delta, Nigeria

Source: Livestock Research for Rural Development 2003, 15(5): paper 6
Language: English
Address: Department of Animal Science, University of Uyo, PMB 1017, Uyo, Nigeria.
Abstract: Eighty-four *Archachatina marginata* hatchlings (mean weight 9 plus or minus 1 g) were fed for eight weeks on green fresh chopped *Carica papaya* fruits ad libitum as control and in combination with five powdered calcium sources from egg shell, limestone, wood-ash, oyster shell, bone meal, at levels of 10, 20, 30 and 40% of diet DM. The 20% oyster shell dietary supplement gave the best weight gain.

BDB ref.: BEDIM 554

Omole, A. J., Ayodeji, I. O. & Raji, M.A. - The potential of peels of mango, plantain, cocoyam and pawpaw as diets for growing snails (*Archachatina marginata*)

Source: Livestock Research for Rural Development 2004, 16(12): paper 102
Language: English
Address: Institute of Agricultural Research and Training Moor Plantation, Obafemi Awolowo University, Ibadan, Nigeria.
Abstract: 90 growing snails (*Archachatina marginata*) of mean weight 64.3 plus or minus 2.56 g were used to investigate the nutritive potential of the peels of mango, plantain, cocoyam and pawpaw. Fresh pawpaw leaf served as the control. The study lasted 180 days. The peels of the different fruits had similar composition but were considerable lower in DM, crude protein and ash content compared with the pawpaw leaves. Growth performance was adequate on all the fruit peels but was best with ripe pawpaw peel, which gave results comparable to the control diet of pawpaw leaves. It is concluded that all the peels were suitable for feeding as the sole diet of snails.
BDB ref.: BEDIM 555

Omole, A. J., Sansi, J.A. & Osayomi, J. O. - The effect of particle size of feed on growth, reproduction and nutrient digestibility of snails (*Archachatina marginata*)

Source: Livestock Research for Rural Development 2004, 16 (12): paper 101
Language: English
Address: Obafemi Awolowo University, Ile Ife, Nigeria.
Abstract: 180 growing snails (*Archachatina marginata*) of mean weight 90.6 plus or minus 3.8 g were used to study the effect of feed particle sizes on performance and nutrient digestibility. The treatments were diets that were ground in a hammer mill with 5, 4, 3 and 2 mm diameter screen sizes. A completely randomized design was used to compare the four treatments. All growth and reproductive traits, and digestibility coefficients, were improved or tended to improve as the particle size of the feed was reduced.
BDB ref.: BEDIM 556

Egonmwan, R. I., Fortunato, H. & Golding, D. W. - Maturation timing in the land snails *Archachatina marginata ovum* (Pfeiffer) and *Limicolaria flammea* (Muller) (*Pulmonata: Achatinidae*).

Source: Invertebrate Reproduction & Development 2004, 46(2/3): 159-171.
Language: English
Address: Department of Zoology, University of Lagos, Akoka, Lagos, Nigeria.

Abstract: The timing of gonadal maturation was studied in two edible species of West African achatinid snails, *Archachatina marginata* ovum (Pfeiffer) and *Limicolaria flammea* (Muller), using light microscopic observation of gametogenesis in the ovotestis and oviposition. Additionally, the growth of the reproductive system was analysed by weekly measurement of body weight, shell length and reproductive system in both laboratory-bred and wild snails of both species. The ovotestis in *A. marginata* ovum and *L. flammea* produces oocytes and spermatozoa simultaneously. The five active and two inactive gametogenic stages observed in the two species are described and compared. Genitalia development start after the onset of gametogenesis in both species with the male system developing before the female system. The growth of the albumen gland follows the maturation of the gonad in *L. flammea*, but in *A. marginata* ovum the growth is cyclical and seasonal. The first oviposition occurs at approximately 19 months of age in *A. marginata* ovum and 5 months in *L. flammea* bred in the laboratory. *L. flammea* breeds almost throughout the year, whereas this process is restricted to March-October in *A. marginata* ovum. In *L. flammea*, the reproductive investment is nearly 200% of parental body weight and the species is estimated to produce 375 young with full size biomass of 1,725 g, while the 140 young produced by *A. marginata* ovum represent 97% of parental body weight in 3 years and have at full size a biomass of 54,740 g.

BDB ref.: BEDIM 571

Ebenso, I. E. - Dietary calcium supplement for edible tropical land snails Archachatina marginata in Niger Delta, Nigeria

Source: Livestock Research for Rural Development 2003, 15(5): article 6

Language: English

Address: Department of Animal Science, University of Uyo, PMB 1017, Uyo, Nigeria.

Abstract: Eighty-four *Archachatina marginata* hatchlings (mean weight 9 plus or minus 1 g) were fed for eight weeks on green fresh chopped *Carica papaya* fruits *ad libitum* as control and in combination with five powdered calcium sources from egg shell, limestone, wood-ash, oyster shell, bone meal, at levels of 10, 20, 30 and 40% of diet DM. The 20% oyster shell dietary supplement gave the best weight gain.

BDB ref.: BEDIM 572

Yildirim, M. Z., Kebapci, U. & Gumus, B. A. - Edible snails (terrestrial) of Turkey

Source: Turkish Journal of Zoology 2004, 28(4): 329-335
Language: English
Address: Burdur Education Faculty, Suleyman Demirel University, Burdur, Turkey.
Abstract: Edible snail species and their distribution in Turkey were studied. The absence of *Helix pomatia*, a species reported to occur in Turkey in resources in various disciplines, is mentioned, while 7 species of edible snails determined (*Theba pisana*, *Eobania vermiculata*, *Cryptomphalus aspersus*, *Cantareus apertus*, *Helix asemnis*, *Helix cincta* and *Helix lucorum*) are described in detail by means of morphology, distribution, systematical positions, and a key to the species is given. Additionally, problems about the future of snail harvesting in Turkey and standards to be applied are discussed.
BDB ref.: BEDIM 575

Estoy G.F. Jr – Size and age of first copulation and spawning of the golden apple snail, *Pomacea canaliculata*.

Source: Pest-Management-Council-of-the-Philippines, Inc., College, Laguna (Philippines): Bureau of Agricultural Research, Department of Agriculture, Diliman, Quezon-City (Philippines). Proceedings of the 33rd Anniversary & Annual Scientific Meeting of the Pest Management Council of the Philippines, Inc. College, Laguna (Philippines). 8-10 May 2002: p. 96.
Language: English
Address: Philippines Rice Research Inst. Maligaya, Munoz, Nueva Ecija (Philippines). UPLB, 4031 College, Laguna - Philippines. E-mail: vga@mudspring.uplb.edu.ph; agris@library.uplb.edu.ph
Abstract: The size and age at first copulation and spawning of the golden apple snail, *Pomacea canaliculata* Lamarck were determined at three levels under laboratory conditions (14:10 L:D; 25 deg C). Males fed at low food levels started copulation at smaller sizes than males at higher food level. However, age at first copulation was similar among snails at all food levels. The food level appeared to affect the penis sheath length at maturity, although the difference did not reach at statistically significant level. Females fed at low food levels delayed both first copulation and spawning longer than those at higher food levels. Consequently, their size at first copulation and spawning were smaller. The albumen gland of poorly fed snails was smaller at first copulation but comparable at maturity. The adaptive significance of these patterns in sexual maturity and their possible implications for the integrated management of this are discussed.
BDB ref.: BEDIM 565

Kiebre-Toe M.B., Borges E., Maurin F., Richard Y. & Kodjo A. – Study of Gram negative bacteria flora in breeding snails (*Helix aspersa*) [Etude de la flore bactérienne aérobie a Gram négatif de l'escargot d'élevage (*Helix aspersa*)].

Source: Revue de Médecine Vétérinaire (France) 2003, 154(10) : 605-610.

Language: French

Address: Ecole Nationale Vétérinaire de Lyon, Marcy l'Etoile (France). Unité de Microbiologie)

Abstract: The nature and the evolution of Gram negative bacterial composition of healthy breeding snails (*Helix aspersa*) were studied in investigating three French "mixed helix farms". Results showed that in breeding conditions, these gasteropods are early, highly and permanently colonised with multiple species of bacteria. The flora mainly remained dominated by *Enterobacteriaceae* and *Aeromonadaceae* whatever the farm considered. Enterobacteries and aeromonads accounted for 62% and 25% respectively of Gram negative bacteria in young snails. At the end of the fattening stage, *Enterobacteriaceae* and *Aeromonadaceae* accounted for 80% and 7% of Gram negative bacteria. Within enterobacteries, species belonging to *Eischeichia*, *Klebsiella* and *Pantoea* genus were most important in terms of prevalence and intensity. Within aeromonads, only *A. caviae* and *A. hydrophila* were isolated. Pseudomonads and other non fermentive Gram negative bacteria were inconstantly isolated and disappeared at the hibernation stage. This study may help to a better knowledge of some infectious disease in these ectothermic animals.

BDB ref.: BEDIM 569

Ejidike, B. N. - Growth performance and nutrient utilization of African giant land snail (*Archachatina marginata*) hatchlings fed different protein diets.

Source: Journal of Food, Agriculture & Environment 2004, 2(1): 160-162

Language: English

Address: Fisheries & Wildlife Department, Federal University of Technology, P.M.B. 704, Akure, Nigeria.

Abstract: Growth performance and nutrient utilization of *A. marginata* hatchlings fed three iso-caloric formulated diets containing varying levels of protein were assessed. The diet protein levels ranged from 15% to 25% crude protein at 5% increments, and were designated treatments I-III respectively. *A. marginata* hatchlings (5.3 plus or minus 1.0) numbering thirty were randomly grouped and assigned to the diet treatments, each treatment duplicated and the hatchlings fed at 2% body weight/day in wooden cages filled with loamy soil up to 15 cm thickness for 70 days. Daily weight gain, body weight gain, shell length, shell width, shell aperture increased with increase in the diet protein level. The mean body weight gain of the hatchlings fed 20% or 25% crude protein diets were similar ($p>0.05$); both being significantly ($p<0.05$) higher than

those fed on 15% crude protein diet. Morphological parameters (shell length, shell width, shell aperture) of the hatchlings followed similar trend. Weight gain, protein efficiency ratio and feed conversion efficiency increased with increasing diet protein level significantly ($p < 0.05$). *A. marginata* hatchlings fed lower diet protein level (15%) performed significantly lower in growth at the end of the feeding trial.

BDB ref.: BEDIM 557

Wacker, A. & Baur, B. - Effects of protein and calcium concentrations of artificial diets on the growth and survival of the land snail Arianta arbustorum.

Source: Invertebrate Reproduction & Development 2004, 46(1): 47-53

Language: English

Address: Department of Integrative Biology, Section of Conservation Biology, University of Basel, St. Johannis-Vorstadt 10, CH-4056 Basel, Switzerland.

Abstract: Animals depend on a large set of essential compounds in their food. However, not all units of food are equal from a nutritional point of view. A reduced supply of protein and calcium might be critical for the growth, reproduction and survival of herbivorous gastropods. We experimentally examined the effects of different protein and calcium supplies on the growth and survival of the land snail *Arianta arbustorum*. Groups of snails were reared on agar-based diets with each of three levels of protein and calcium (nine treatments). Snails fed a high-protein diet grew faster and reached adulthood earlier and at a larger adult size than snails fed intermediate- and low-protein diets. Surprisingly, the calcium concentration did not affect shell growth and adult size. Snails reared on intermediate- and low-calcium diets increased their consumption rates, but, despite this compensatory feeding, these snails were unable to take up the amount of calcium required for metabolism and shell growth and had a higher mortality. The calcium deficiency could partly be mitigated by the snails' internal calcium storage and reallocation capacity. A depletion of internal calcium reserves adversely affects the entire nutrient metabolism and was the probable cause for the high mortality rates associated with the intermediate- and low-calcium diets observed in the present study.

BDB ref.: BEDIM 559

Soares E.D.R., Armada J.L.A., Silva H.D., Pereira M.B., Leitao G.R. & Azevedo P.C.N. – Effect of inbreeding on sexual maturity and fertility of edible snail *Helix aspersa* [Efeito da endogamia sobre a maturidade sexual e fecundidade do escargot da especie *Helix aspersa*].

Source: Arquivo-Brasileiro-de-Medicina-Veterinaria-e-Zootecnia (Brazil) 2003, 55(5): 634-638.

Language: Portuguese

Address: CENAGRI, CP 02432, 70.849-970 Brasilia, DF - Brasil.

Abstract: The effect of inbreeding on two reproductive traits (number of birth per clutch and percentage of sexually mature animals per clutch) on three consecutive generations of full sibs of edible snails raised under laboratory conditions (20-25 °C temperature; 70-90 % relative humidity) was studied. Inbreeding effect was negative for both traits. When F values increased from 0.25 to 0.50, percentages of sexually mature animals after 120 days from birth, decreased from 59 to 18% and the number of birth per clutch decreased from 94 to 53. Population size of at least 100 non related mating snails replaced after 10 generations to avoid inbreeding effect is recommended.

BDB ref.: BEDIM 561

Otchoumou¹ A., N'Da K. & Kouassi K.D. – The edible African snails farming: inventory of wild vegetables consumed by *Achatina achatina* (Linné 1758) and dietary preferences. [L'élevage des escargots géants commestibles d'Afrique : inventaire des végétaux sauvages consommés par *Achatina achatina* (Linné 1758) et préférences alimentaires]

Source: Livestock research for Rural developmeent 17(3) 2005: paper 28

Language: French

Address: Laboratoire de Biologie et Cytologie animales (Unité de Formation et de recherches en Sciences de la Nature), Université d'Abobo-Adjamé, 02 BP 801 Abidjan 02 : atcho@aviso.ci ou aotchoum@jouy.inra.fr

Abstract: The edible giant snail consumed wild plants of which an inventory was realised in the laboratory. The four most appreciated plants fed by pairs to the snails in a dietary preference experiment and their chemical components were determined. *Archatina archatina* consumes micellaneous wild plants but prefers *Cercropia peltata* and *Laportea aestuans*.

BDB ref.: BEDIM 547

Otchoumou¹ A., Dupont-Nivet M, N'Da K. & Dosso H. – The edible African snails farming: effect of diet quality and dietary calcium on the reproduction performances of *Achatina fulica* (Bowdich 1820). [L'élevage des escargots géants commestibles d'Afrique : effets de la qualité du régime et du taux de calcium alimentaire sur les performances de reproduction d'*Archatina fulica* (Bowdich 1820)]

Source: Livestock research for Rural development 17(10) 2005: paper 118

Language: French

Address: Laboratoire de Biologie et Cytologie animales (Unité de Formation et de recherches en Sciences de la Nature), Université d'Abobo-Adjamé, 02 BP 801 Abidjan 02 : atcho@aviso.ci ou aotchoum@jouy.inra.fr

Abstract: Juveniles Archatina, 0.52 g body weight and 1.37 cm shell length, were given two vegetable (R1 and R2) and four concentrate diets (RT, R3, R4 and R5) with variable calcium contents (0.05%, 0.59%, 6.82%, 14.03% and 16.01% respectively) in order to compare the two type of diets and determine calcium content, advancing sexual maturity, inducing early eggs laying and better reproductive performances. Sexual maturity was achieved at two month old and the first laying occurred at three month old with 6.82% dietary calcium content (RT). The reproductive performances were better with concentrate.

BDB ref.: BEDIM 548

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INSECTS (see also under "human nutrition")

Aoniyi T. A. M., Adetuyi F. C. & Akinyosoye F. A. – Microbiological investigation of maggot meal, stored for use as livestock feed component.

Source: Journal of Food, Agriculture & Environment 2004, 2(3/4): 104-106

Language: English

Address: Department of Animal Production & Health, The Federal University of Technology, PMB 704, Akure, Nigeria.

Abstract: The fresh and 9-month stored samples of freshly harvested dried, milled housefly larvae (maggots of *Musca domestica*) were investigated for the presence of microbes for the determination of its suitability for inclusion in livestock diet. The predominant bacteria species isolated in the samples include *Bacillus cereus*, *Corynebacterium pyogenes*, *Micrococcus tetragenus*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Streptococcus faecalis*. The fungi isolated include *Aspergillus flavus*, *Fusarium moniliformis* and a yeast (*Saccharomyces cereus*). The mean plate counts of bacteria were 2.56×10^3 and 1.1×10^3 cfu g⁻¹ in the fresh and stored samples respectively, those of fungi were 0.21×10^3 and 3×10^3 cfu g⁻¹ for the fresh and stored samples respectively. From the proximate analysis, the percentage moisture, fibre and ash contents of the stored maggot meal were higher (23, 7.5 and 12.5%, respectively) than for the fresh meal. Since the moisture in the stored maggot meal (23%) was higher than the peak figure of 12% stipulated by FAO for stored food product, it was concluded that the stored maggot meal was prone to deterioration by the population of fungi and bacteria in the improperly stored sample.

BDB ref.: BEDIM 566

Awoniyi T. A. M., Adebayo I. A. & Aletor* V. A. – A study of some erythrocyte indices and bacteriological analysis of broiler-chickens raised on maggot-meal based diets.

Source: International Journal of Poultry Science 2004, 3 (6): 386-390

Language: English

Address: Department of Animal Production and Health, Federal University of Technology, P. M. B. 704, Akure, Nigeria.

Abstract: Five treatment groups of 18 broilers each from age 4-9 weeks were fed diets in which maggot meal (MGM) replaced 0, 25, 50, 75 and 100% of fish meal (FM) on equi-protein basis. EDTA-treated blood samples were taken from each of the groups and subjected to total erythrocyte counts, packed cell volume, mean corpuscular haemoglobin, mean corpuscular haemoglobin concentration and mean corpuscular volume. Results showed no significant ($P>0.05$) difference and also compared favourably with the normal physiological values for these indices in healthy chickens. Isolation and characterization of bacterial organisms in the different broiler diets formulated with varying levels of maggot meal obtained from fresh droppings of the experimental chickens and some visceral organs in addition to development medium of the maggot were carried out. Results revealed that most bacteria associated with the broilers fed maggot meal-based diets in this study are by far those that are commonly experienced by man and animals in their day-to-day exposure and to which their bodies have developed some relative immunity. In conclusion, since MGM inclusion in the diets of broilers does not negatively influence the erythrocyte indices and that the bacterial flora isolated from the different parts of the experimental chickens were similar to those found in fish meal fed diets, MGM could effectively replace the more expensive FM without threatening the blood physiology of the chickens and health of consumers of such broiler-chickens.

BDB ref.: BEDIM 567

Stelinski L. L. & Gut L. J. – A simple and effective method for capturing viable adult blueberry maggot flies, *Rhagoletis mendax* (Diptera: Tephritidae).

Source: Journal of the Kansas Entomological Society 2004, 77 (2): 147-151

Language: English

Address: Department of Entomology, Michigan State University, East Lansing, MI 48824, USA.

Abstract: This paper describes a simple and effective method for capturing viable male and female blueberry maggot fly (*R. mendax*) adults, through the use of funnel traps, in both abandoned and commercial highbush blueberry (*Vaccinium* spp.) plantations. Experiments conducted in 2000 and 2001 in Fennville, Michigan, USA showed that it is possible to capture substantial numbers of blueberry maggot flies using the funnel trap design described herein. However, the funnel trap prototype was less effective in an intensely managed

commercial blueberry plantation compared with an abandoned plantation, where the population density of the blueberry maggot was substantially higher. Therefore, the use of this trap design to capture live blueberry maggot flies may be more successful under heavier fly infestations. Majority (65-72%) of the flies collected were female, which is in line with previous studies showing that blueberry maggot fly females (and other tephritid species) exhibit greater attraction to ammonia (used in these experiments as bait) than males. Both sexes of flies survived under laboratory conditions for approximately one week. Such field-captured, live blueberry maggot flies could be used in the laboratory for toxicological studies, electrophysiological investigations, behavioural assays, or genetic analyses of specific populations.

BDB ref.: BEDIM 568

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MINILIVESTOCK

Hardouin, J., Thys, E., Joiris, V. & Fielding, D. - Mini-livestock breeding with indigenous species in the tropics.

Source: Livestock Research for Rural Development 2003, 15(4): paper 3

Language: English

Address: BEDIM, Unité de Zootechnie, Faculté Universitaire des Sciences Agronomiques, 2 Passage des Déportés, B-5030 Gembloux, Belgium.

Abstract: Mini-livestock encompasses small indigenous vertebrates and invertebrates which can be produced on a sustainable basis for food, animal feed and as a source of income. It includes bush rodents, guinea-pigs, frogs, giant snails, manure worms, insects and many other small species. Mini-livestock production is suitable for backyard family production and can contribute to increased food security. Extension and research are still lacking in many countries due to a traditional emphasis on large domestic animals and a lack of related training and education. However, whilst promoting mini-livestock it should be noted that some of these small animals can represent a serious threat as crop pests. Any zoonotic implications also need to be identified. Mini-livestock development is associated with the desirable long-term preservation of biodiversity. Given the need, awareness and increasing information now available on mini-livestock species it is time for increased investment in this form of sustainable production.

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