INTENSIVE TROPICAL WILDLIFE [NON-DOMESTIC] PRODUCTION SYSTEMS

MODULE # IV
Unit # 15: Species Model-The Agouti
[*Dasyprocta leporina*]
With contributions

by Roxann Brown-Uddenburg

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Module IV : Some Species Production Modeling

Unit 15 : A Rodent Species Model- The Agouti (*Dasyprocta leporina*)

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15.1 The Learning Objectives

1. to be able to describe the animal production factors affecting the agouti;

2. to understand the animal production coefficients and parameters for the agouti and to see how this would relate to production of this species in captivity;

3. to become familiar with an approach to the intensification of agouti production.

15.2 Factors Affecting Agouti Production:

- Housing:

The agouti is a neo-tropical rodent and is therefore adapted to humid tropical conditions.

The housing must not be inundated and must provide the animal with the opportunity for isolation.

-Feeding and Nutrition:

The animal is a fruit eater [FRUGIVOUR] and can survive on fruits, vegetables and seeds.
As it is a rodent it needs to be exposed to a variety of feedstuffs which would afford it the opportunity work down its incisors.

-Reproduction and Breeding:

See Section 15.3

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-Diseases:

Experience with the agoutis reared in captivity has not presented any major disease problems.

-Economic:

In countries where the agouti is considered a desirable wild meat the population is under threat. So that there is always a high demand for agouti meat.

Some specific considerations of these factors applied to Agouti Production in Captivity:

- supply of breeding stock;
- security;
- source of feeding materials [Fruits, Vegetables, Coconut, Coconut Meal, Beans , Amaranths or even cooked flour- bread or roti]

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15.3 Concepts in Developing an Intensive Animal Production Model for the Agouti:

CONSIDERATIONS FOR SPECIES PRODUCTION MODELING

The Species: Dasyprocta leporina (Agouti)
Mammal
Rodent

[I] The Objectives of the Production System or Model

(1) To develop and manage an intensive agouti breeding colony.
(2) To grow out the captive reared agouti to market weight for meat.
(3) To grow out the captive born agouti for breeding :
- fast growing males for use as breeding males
- fast growing and healthy females for use as replacement breeders.

[II] The Species Life Cycle

Adult Male and Female
Neonates
Weaned Growing Young
Adult

[III] The Physiological States for the Production Flow

1. Adult Breeding Male
2. Adult Non-pregnant Female
3. Adult Pregnant Female
4. Lactating Female
5. Suckling Neonates

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6. Weaned Growing Young

7. Mature Female

8. Mature Male

[IV] Performance Coefficients or Growth Parameters

Characteristics	**Parameter**
Body Length	42 to 62 cms
Tail Length	1 to 3.5 cms
Body Weight	
Male	1.3 to 3.5 kg
female	1.3 to 5 kg

[V] Reproductive Parameters

Characteristics	**Parameter**
Gestation Length	3-4 months (104 days)
Length of estrous cycle	34 +/- 2.1 days ??????????????

This is an area in need of research
Methods of Estrus Detection need to be addressed.

Next estrous after parturition	SEE TABLE
Puberty	6 to 8 months
Sex Ratio Male: Female	1: 1 to 1 : 10

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Lactation Period	20 weeks
Weaning Age	12 weeks

VI] Animal Specific Needs as influenced by the Factors Affecting animal Production

Needs: - **Housing**

- **Nutrition and Feeding**-

- The animal is a hindgut fermentator.
- The digestive system should be similar to that of the guinea pig and the rabbit.
- Feeding Systems similar to that for rabbits could be used.

Health and Disease Control-

No Major Problems.

Reproductive Management-

Ratio of 1 Male to 4 or 5 Females, animals would have to be kept together for at least 60 to 80 days to ensure conception. Then the females could be separated from the males.

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[VII] Animal Behavior and Sociology

Females at giving birth need to be separated from males and sometimes other females.

[VIII] Design of the Physical Environment Required

Use cages and facilities which are suitable for rabbits. Hollowed out logs and hiding places required as it is generally a shy animal.

[IX] Management Routines Required

- Daily

Feeding and watering

- Weekly

Animal inventory

General cleaning and sanitation

- Monthly

- Seasonally

- Annually

[X] Variable Inputs Required

Feed and Water

[XI] Output Expectations of the Model/ Production Process Flow

????????

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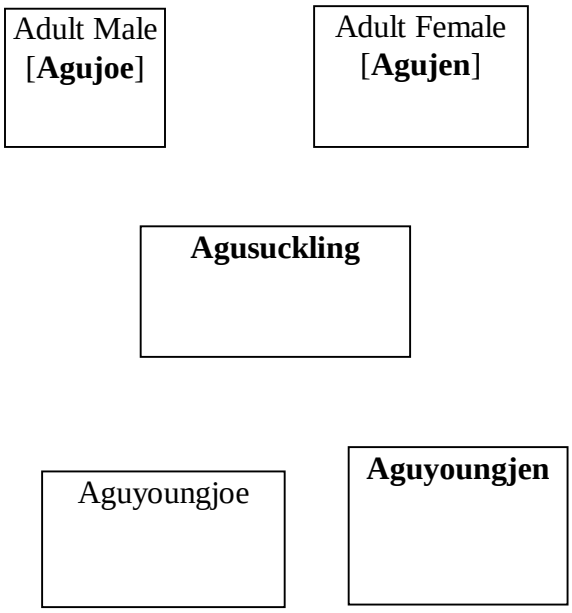
15.4 An approach at developing an Intensive Animal Production System for the Agouti:

In order to develop your Agouti production system you must first begin with the end in mind, i.e. what are the objectives of your production system and what products or animals are you going to sell. This would determine what you do.

THE LIFE CYCLE OF THE AGOUTI

Figure 1: The Life Cycle of the Agouti



THE PHYSIOLOGICAL STATES OF THE AGOUTI

Breeding Females [Agujen]

Breeding Males [Agujoe]
Suckling Young Agouti [Agusuckling]
Young Growing Post Weaning but Sexually Immature Females [Aguyoungjen]
Young Growing Post Weaning but Sexually Immature Males [Aguyoungjoe]
Sexually Mature Females [Replacement Agujen]
Sexually Mature Males [Replacement Agujoe]

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PRODUCTION UNITS

Unit 1: Breeding Unit [Group Housing]
Breeding Females [Agujen]
Breeding Males [Agujoe]
Suckling Young Agouti [Agusuckling]
Ratio of Agujoe: Agujen = 1:5 to 1: 10

Unit 2: Grow Out Unit [Group Housing]
Young Growing Post Weaning but Sexually Immature Females [Aguyoungjen]
Young Growing Post Weaning but Sexually Immature Males [Aguyoungjoe]

Unit 3: Replacement Females Unit [Group Housing]
Sexually Mature Females [Replacement Agujen]

Unit 4: Replacement Breeding Males [Individual Cages]
Sexually Mature Males [Replacement Agujoe]

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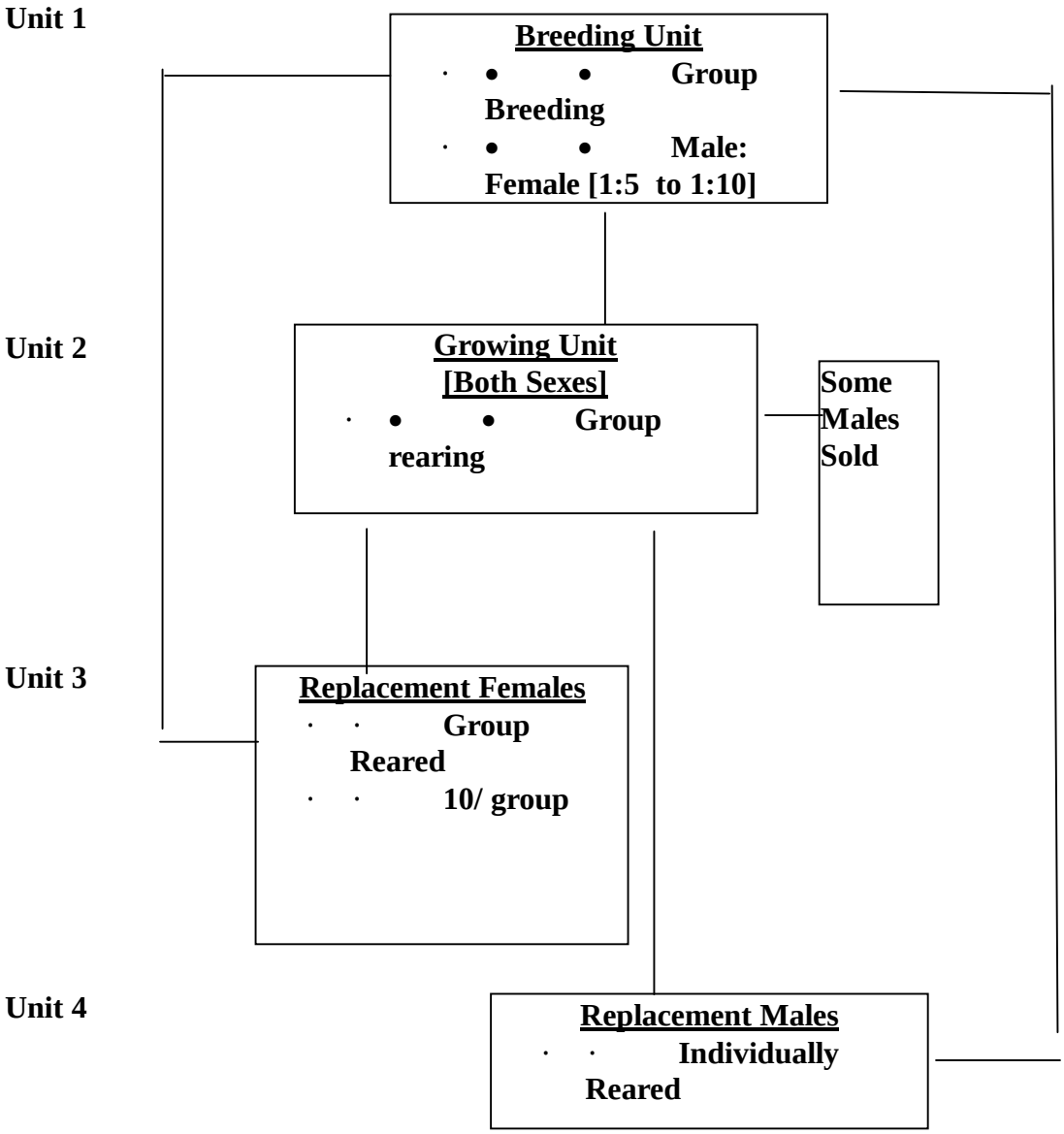
AGOUTI PRODUCTION UNITS PROCESS FLOW

Figure 2: Agouti Production Units Process Flow



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FEATURES OF HOUSING FOR AGOUTI

The **Main Housing elements for the intensive production of Agouti** are as follows:

- Hiding Areas for the newborn and young
- Clean water supply daily
- Shallow ponds for soaking their feet during the day
- Sand pit for digging and hiding food
- Good Ventilation
- Good Animal Visibility
- Secure gates
- Rodent Control and Prevention of Entry of Large Rats which would attempt to carry away weak young [this can be done by enclosing the Breeding Unit with 1 inch square wire];
- Control of Snakes and
- The height of the walls from the ground could be as high as three (3) feet, to minimize the incidence of escape when a human is entering the pen, and to minimize the entrance of dogs.

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BACKGROUND TO THE AGOUTI PRODUCTION MODEL

The work of the Intensive Agouti Production Unit in of the **Open Tropical Forage-Animal Production Laboratory [OTF-APL]** at the University of the West Indies, Trinidad, Trinidad and Tobago [and reported on by Brown-Uddenberg (2001) in her M.Phil Thesis] gathered the following information for the Intensive production of the Agouti:

1] Agoutis could be intensively reared;

2] Agoutis are not seasonal breeders;

3] Agoutis could be reared and reproduce successfully in rabbit sized cages, open enclosures or large cages [semi-intensive] or large enclosures with trees [extensive];

4] Agoutis could be weaned at eight weeks; showed signs of sexual maturity at 13.5 to 14.5 months and a female agouti could produce her first litter at 17-18 months;

5] Agoutis could be managed in a group breeding system, with the males continuously present with the females and suckling animals *pre-* and *post partum*; but the animals must not be stressed for food or space, and ample hiding and private places must be provided for the young; [this is because the males are the best detectors of estrus and the signs of estrus in the agouti female is not yet known];

6] Agouti breeding groups could be one (1) male to at least five (5) females, but the upper limits of the male to female ratios have not yet been determined but male: female ratio of 1:9 or 1:10 should be possible;

7] if Agouti males are limiting, a male could be left with a group of females for at least 20 to 36 days to ensure conception of all the females in that breeding colony;

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8] if Agouti males are limiting in an ongoing breeding operation the males should be introduced into a colony of **pregnant females** [but the males must be slowly introduced to the females] at least one [1] to two [2] weeks ***pre-partum*** and then be left there for between **20 to 36 days *post partum*** to ensure conception;

9] care must be taken when introducing new males or other animals into a group, they must be slowly exposed to the group by placing the new animal into an adjacent pen or into a smaller pen within the larger pen, so that they become accustomed to that animal through sitght and smell;

10] when females within the group are observed pregnant, by the distention of the teats, cover page and figure # 12, they could be placed into a portable smaller pen within the larger pen for parturition and in order to ensure identification of the litter size and the animals within the litter;

11] our observations suggest that the Agouti would go into oestrus [heat] while lactating;

12] sex determination in agoutis involved physically restraining the animal, followed by applying digital pressure in the region directly anterior the urethra and anus respectively; the protrusion of a cylindrical structure represented the penis of the male Agouti, and no protrusion indicated that the Agouti was a female [Figures #8, 9 and 11;

13] the manifestation of external signs of pregnancy included the protrusion of two pairs of teats in the thoracic region two weeks prior to parturition; and the noticeable decrease in appetite the day before parturition;

14] **Agoutis are not generally prolific breeders**, because the female agoutis would give birth to an average of 1.25 litters per year (with a range of 1-2); with an average of 1.7 offspring being produced per litter (with a range of 1-3); however three (3) litters / year is possible with efficient breeding management and there is scope for improvements in litter sizes [from 1.7 to 6] through selection;

15] Agoutis practiced coprophagy like the rabbit and the guinea pig;

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16] Agoutis practices food hoarding in the caged environment;

17] after prolonged and continuous exposure to Agouti some people may develop an allergic reaction which involves watering of the eyes, sneezing or allergic type upper respiratory tract conditions;

18] female Agouti like many mammals also eat the "after birth" after parturition;

19] no major disease problems are encountered with the intensive rearing of the Agouti, the only health problems encountered are those associated with trauma and infection due to fighting or the attacking of young by adult Agoutis.

In all instances the Agouti species being referred to is the *Dasyprocta leporina*.

Target Performance Coefficients

The results of our work of have produced some production performance parameters, which could be used as "Target Performance Coefficients" for the intensive production of agoutis. These "Target Performance Coefficients" should give the agouti production model some level of predictability [Table 1].

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Table 1: Target Performance Coefficients for Agoutis

Age of Sexual Maturity	13 $^{1}/_{2}$ - 14 $^{1}/_{2}$ months
Age at First Litter	17-18 months
Breeding	Year round
Length of Gestation	104-112 days
*Postpartum Oestrous	To be verified
Number of Offspring per Litter (litter size)	2 (range 1-6)
Minimum Number of Litters per Year per Female	1.25 (range 1-3)
Number of days between successive parturition (parturition interval)	163 days
Number of days between Union of Males and Females to Conception	Individual breeding: 20-36 days Group breeding: 1-19 days
Birth Weights: **Male** **Female**	307.40 g 288.12 g
Birth Lengths : **Male** **Female**	21.90 cm 22.44 cm
Weaning Age	8 weeks
Weaning Weight: **Male** **Female**	1096.80 g 1199.70 g
Weaning Length **Male** **Female**	29.80 cm 32.40 cm
Mortality Rate: Offspring	15.5 %
Mature Agoutis	10.8 %

* While completing the thesis it was observed that the number of days between two successive parturition with one pair of agoutis where the male was kept with the female at all times was 123 days. Assuming that gestation lasts about 104 days the average number of days between parturition and the next conception postpartum was therefore 19 days.

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A feasibility study of Agouti Farming in Trinidad and Tobago was done in 1986 by Miller and Miller (1986). This was done based on farmers' experiences with the Agouti in Trinidad and Tobago. They suggested a male: female ratio of 1:9, and assumed two litters /year / female, with a litter size of two. Out of this only males were to be sold for the first three years. The suggested opening stock was 26 males and 255 females.
Their financial calculations suggested a negative cash flow for the first three (3) years. Their animal projections seemed feasible based on the observed and calculated litter interval of 163.

SOME HUSBANDRY PRACTICES AND GUIDELINES

Practical Agouti Housing

- Avoid using wood as structural or enclosure elements.
- Always attempt to have logs 10 to 20 cms in diameter within the enclosures so that animals would have an item or items on which to work the agoutis incisors.
- The height of the housing could be about 6 feet, and the walls could be about 3 feet high.
- Water Supply:
    - <u>Drinking Water Containers</u>
    - should be narrow so that only their head will fit and the rim should be about 3 to 4 inches from the ground;
    - should be easily cleaned;
    - should not be easy for the animal to be immersed in the water;
    - filling should be semi-automatic to minimise labour requirements for daily routines;
    - must not be made of plastic, but could be of very thick PVC.
    - <u>Water Ponds within the pen</u>
    - should be about 15 to 30 cms square as the animals like to cool their feet in it;

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- should be only 3 to 6 cms deep to avoid young and new born from drowning;
- should be easily cleaned;
- filling and cleaning should be semi-automatic to minimise labour requirements for daily routines;
- must be made of cement.

- Sand Pits:
  - should be about 15- 30 cms square;
  - should be 6 to 10 cms deep;
  - should be filled with sand.

Practical Agouti Feeding

- avoid feeding dusty materials;
- fruits should be cut up;
- do not discard the seeds of the fruits, the Agouti will eat the seeds, whole dried coconuts are good;
- the generalized Agouti Diet should look like this
  - Starchy or Sweet Fruit or Vegetables in Season
  - Mono-gastric Animal Pelleted Feed e.g. Pig Grower Pellets [this contains about 14 to 16% Crude Protein and is low in Fibre]
  - Any type of Seeds or Dried Peas
  - Drinking Water must be available at all times
  - Molasses Water [1molasses : 3 water] or Brown Sugar Water Solution.

Need for Chewing Items within the Cages or Enclosures

As stated earlier, this could be logs, but could include dried coconuts, or pieces of wood.

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Breeding and Culling Practices

- As the production system will be based on the group breeding system, it is IMPERATIVE that ALL AGGRESSIVE young and adult males be culled. As soon as signs of aggression are observed remove the animal from the group.

Daily Routines

Daily Observation of Animals:

- Observe for sick animals
- Observe for changes in stool / faeces texture
- Observe for animals with wounds and treat as soon as possible
- Observe for signs of pregnancy through engorged teats
- Observe for the onset of parturition
- Observe for animals going off feed
- Ensure water supply is OK
- Observe the Breeding Males for any signs of abnormalities around the reproductive areas.

Feeding of Animals:

- Ensure a good daily feeding routine

Daily Observations of Pens:

- Look for signs of rodents becoming pests
- Look for signs of entry of snakes and other predators.

Monthly Routines

- Prepare new pens for incoming weaned or adult animals

Seasonal Routines

- Keep in touch with other Agouti farmers for purposes of
  - Sharing information and experiences
  - Exchanging Breeding Males [Avoid using males on their daughters].

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SOME COMMENTS ON WHAT RESEARCH THAT STILL HAS TO BE DONE WITH THE AGOUTI

Further research is needed to determine the limited space requirement needed for an intensive production system, which would not have a negative effect on the offspring survival rate. Further work is also needed to design water and feeding systems, which would minimise the daily labour requirement of the intensive production system.

There is also the need for research to be done on the nutrient requirement and ration formulation of the agouti at given levels of production and physiological state. In addition, the feeding values of the feeding stuff to be used in the formulation of a ration for the agouti should also be investigated.

15.5 References

Anon, (1992). REPORT AT THE WILDLIFE SECTION, FORESTRY DIVISION, MINISTRY OF AGRICULTURE, TRINIDAD & TOBAGO. 23/01/92.

Anderson, S., Jones, Jr., and Knox, J. (1984). ORDERS AND FAMILIES OF RECENT MAMMALS OF THE WORLD. John Wiley and Sons, Inc. NY

Asibey, E.O.A. (1984). EVALUATION AND DEVELOPMENT OF WILDLIFE RESOURCES IN TRINIDAD AND TOBAGO. THE ECONOMIC ROLE OF WILDLIFE IN TRINIDAD AND TOBAGO. United Nations Development Program Food and Agriculture Organization of the United Nations, Trinidad & Tobago Office, Trinidad & Tobago, WI (unpublished).

Baas, E.J., Potkay, S. and **Bacher, J.B.** (1976). The Agouti (Dasyprocta sp.) in Biomedical Research and Captivity. LABORATORY ANIMAL SCIENCE. Vol. 26. No. 5. pp. 788-796.

Brown, C.E. (1936). Rearing wild animals in captivity, and gestation periods. JOURNAL OF MAMMALOGY Vol.17, pp. 10-13.

PDF created with FinePrint pdfFactory trial version www.pdffactory.com

Clark, D. J. & Olfert, E. D. (1986). ZOO AND WILD ANIMAL MEDICINE . W.B. Saunders Company, London. pp. 728-747.

Cournand, T. (unpublished). An Examination of the Internal & External Parasites of the Agouti, and their Possible impact upon Agouti Farming. Student project, University of the West Indies, Faculty of Agriculture and Natural Sciences, Department of Food Production, Livestock Unit, St. Augustine.

Edwards, M. S. ; Crissey, S. D. ; Oftedal, O. T.; and Rudran, R. (1990). Fibre concentrations of natural vegetation fed upon by various sympatric species in the llanos of Venezuela, 1990 PROCEEDINGS AMERICAN ASSOCIATION OF ZOO VETERINARIANS . 74-80

Enders, R.K. (1931). Parturition in the Agouti, with notes on Several Pregnant Uteri. JOURNAL OF MAMMALOGY 12 (4): 390-396.

Federe, K.E. (1969). Susceptibility of the Agouti (*Dasyprocta aguti*) to Foot-and-Mouth Disease Virus. *Pan American Foot-and-Mouth Disease Center, Pan American Health Organization*, Rio de Janeiro pp. 851-852.

Garcia, G.W., Adogwa, A., and Baptiste, Q..(unpublished personal communication). A Study of the Digestive System of the Agouti (*Dasyprocta leporina*). Department of Food Production, Faculty Agriculture & Natural Sciences. The University of the West Indies, Trinidad & Tobago. [Submitted for publication]

Granham, P.C.C. (1965). The Leishmanias, with Special Reference to the Role of Animal Reservoirs. AMERICAN ZOOLOGIST. 5 (1) : 141-151.

Grzimek, B. (1975). GRZIMEK'S ANIMAL LIFE ENCYDOPEDIA. Van Nostrand Run Hold Company, USA. Vol. 2. pp. 441-450.

Hanzak, J., Veselovsky, Z., and Stephen, D. (1971). COLLINS ENCYCLOPEDIA OF ANIMALS. Collins, London and Glasgow. pp. 206-207.

Jones, R. (1834). Some notes on the dissection of an Agouti (Dasyprocta Aguti), III PROC. ZOOL. SOC. LONDON: 82-84.

Kleiman, D. G. (1974). Patterns of Behavior in Hystricomorph Rodents. . *In* THE BIOLOGY OF HYSTRICOMORPH

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RODENTS., I. W. Rowlands and B. J. Weir, Editors. Academia Press. No. 34 pp. 171-209.

Matthews, H. L. (1971). THE LIFE OF MAMMALS. VOL 2. Pg 207-208. Editor R. Carrington. R. , The Weindenfeld & Nicoloson.

Meritt, D. A. (1978). The Natural History and Captive Management of the Central American Agouti (*Dasyprocata punctata*) Gray and Agouti (*Dasyprocta aguti*) Linne. AMERICAN ASSOCIATION OF THE ZOOLOGICAL PARKS AND AQUARIUMS, ANNUAL CONFERENCE PROCEEDINGS. Denver, Colorado, 17-21 Sept. 1978. pp 177-181.

Meritt, D.A. (1983). Prelimanary Observations on Reproduction in the Central American Agouti, *Dasyprocta punctata*. ZOO BIOLOGY Vol 2, Pg. 127-131.

Molyneux, D. H. and Ashford, R. W. (1983). THE BIOLOGY OF TRYPANOSOMA AND LEISHMANIA, PARASITES OF MAN AND DOMESTIC ANIMALS. Taylor and Francis, London.

Morris, D. (1965). The mammals - A Guide to the Living Species**.** ZOOL. SOC. LONDON. pp. 229.

Nowak, R. M. (1991). WALKER'S MAMMALS OF THE WORLD VOL II. The John Hopkins University Press, Baltimore and London. Fifth Edition, Vol 2. pp. 918.

Pocock, R. I. (1922). On the External Characters of some hystricomorph rodents. PROC. ZOOL. SOC. SOC. LOND. 1922: 365-427.

Ramdial, B. S. & Ramdial, B. P. (1974)**.** THE NATURAL HISTORY AND ECOLOGY OF THE AGOUTI. (DASYPROCTA AGUTI). A LITERATURE REVIEW. Mapping & Control Section, Lands & Surveys Division, Trinidad & Tobago.

Riberio, R. D. and Barretto, M. P. (1977). Estudos Sobre Reservatoriors E Vectores Silvestres Do Trypanpsoma Cruzi. LXIV. Infeccao Natural Da Cutia, *Dasyprocta Aguti* (Linnaes 1766) Pelo T. cruzi. REVIEW BRAZIL BIOL. 37(2) 233-239.

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Roth-Kolar, H. (1957). Beitrage zu einem Aktionssystem des Aguti (*Dasyprocta aguti aguti L.*). Z. TIERPSYCHOL. 14: 362-375.

Smythe, N. (1970a). Relationships Between Fruiting Seasons and Dispersal Methods in a Neotropical Forest. AM. NAT. 104: 25-35.

Smythe, N. (1970b). THE NATURAL HISTORY OF THE CENTRAL AMERICAN AGOUTI (*DSAYPROCTA PUNCTATA*). SMITHOSONIAN CONTRIBUTION TO ZOOLOGY. Smithsosnian Insinuation, Washington, D.C.

Sousa, D. E. (1970). Development of Adult Echinicoccus from Hydatid of Naturally Infected Agoutis. JOURNAL OF PARASITOLOGY 56: 197-198.

Walden, N.B. (1990). RABBITS. A COMPENDIUM. University of Sydney Postgraduate Foundation in Veterinary Science. University of Sydney, Australia.

Wallach, J.D., and Boever, W.J. (1983). DISEASES OF THE EXOTIC ANIMALS,
MEDICINAL SURGICAL MANAGEMENT. W. B Saunders Company.

Weir, B.J. (1971). Some Observations on Reproduction in the Female Agouti, *Dasyprocta aguti*. JOURNAL OF REPRODUCTION AND FERTILITY. 24: 205-211.

Weir, B. J. (1974). Reproductive Characteristics of Hystricomorph Rodents. *In* THE BIOLOGY OF HYSTRICOMORPH RODENTS, W. I. Rowlands. and B. J. Weir, Editors , Academia Press.No. 34. pp. 265-301.

Wiltshire,B.(undated). WILDLIFE FARMING-BACKYARD REARING OF AGOUTI. Wildlife Section and Forestry Division, Ministry of Agriculture, Republic of Trinidad & Tobago. Unpublished

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