

Ecology and Control of Infectious Disease in Vampire Bats



**Hematophagous bats in the Brazilian Amazon:  
distribution, human aggression and rabies**

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PCMBrazil

foto divulgação Anavilhana Jungle Lodge

**Diversity of Hematophagous Bats**



*Desmodus rotundus*      *Diaemus youngii*      *Diphylla ecaudata*

- Only 3 of the 1200 species of bats feed on blood
- Subfamily Desmodontinae and Family Phyllostomidae
- Geographical distribution only in Latin America

Photo: W.Uieda

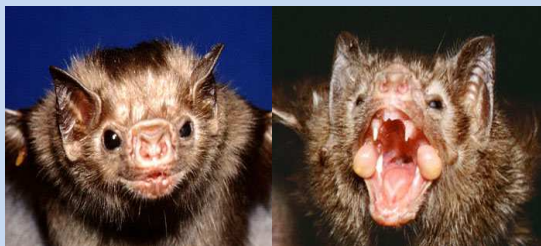
### Three Species of Hematophagous Bats



*Desmodus rotundus* is the most common and studied species. It is versatile and specialized in mammalian blood, including from human, but can also be fed in poultry. The brown coat is more common, but the orange color also occurs.



*Diphylla ecaudata* is a rare and specialized in blood birds



*Diaemus youngii* is a rare and specialized species in the blood of birds. A pair of oral glands and stress call are characteristic of this species.

Photos: W.Uieda

### Daytime Shelters of Hematophagous Bats

Are always **inner roosts**, where environmental differences are minimal or no fluctuations.

## Diurnal Roosts of *Diaemus* and *Diphylla*



Hollow tree is the common daytime shelter of the harems of *Diaemus youngii*.



Cave is the frequent daytime shelter harems of *Diphylla ecaudata* but abandoned houses are also used .



Photos: W.Uieda

## Diurnal Roosts of *Desmodus rotundus*



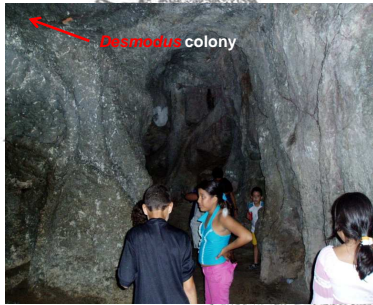
Caves are the main natural daytime shelters where *D. rotundus* living with the harem (Photos: W. Uieda and C. Ciapina)

Cohabitation with many species, but always without body contact with these species

Abandoned houses, culverts and other buildings are often used as a refuge by *D. rotundus* (Photos: C. Ciapina)



### Diurnal Roost of *Desmodus rotundus* in Amazon Region



*Desmodus* colony with 30 bats  
Maruaga cave in Presidente Figueiredo, State of Amazonas



*Desmodus* colony with females and pups

Artificial cave in Rodrigues Alves Park, downtown Belém, State of Pará

Photos: W.Uieda

### Wild Food Sources for *Desmodus rotundus*



Wild *Desmodus* flying around and landed on a deer (*Odocoileus*)



Photos from internet



Wild *Desmodus* landed on the back of an anteater (*Myrmecophaga tridactyla*)



Sea lion (*Otaria flavescens*)



Capybara (*Hydrochoerus hydrochaeris*)

## Wild Food Sources of *Desmodus rotundus*



Tapir (*Tapirus terrestris*) (Photo: W.Uieda)



Peccary (*Tayassu pecari*) (Photo: Giovanni)

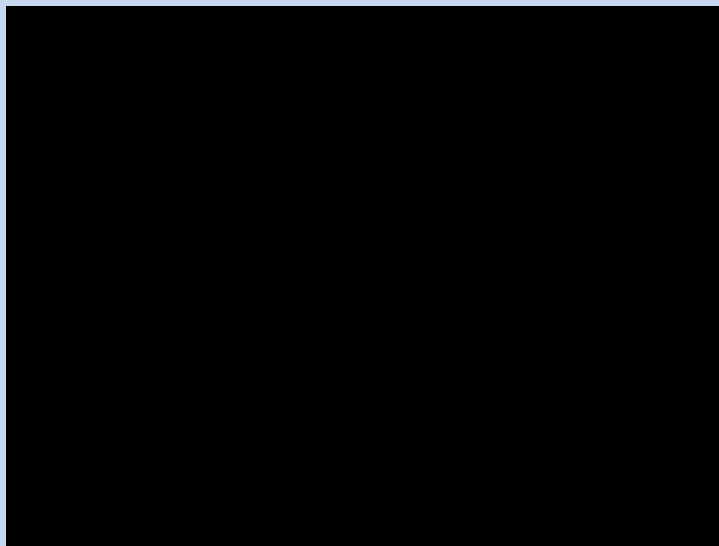


Wild pig (*Pecari tajacu*) (Photo: Internet)

Most American mammals have nocturnal habits and living in small flocks. These behaviors are great obstacles for food supply to *Desmodus rotundus*.

In well-preserved forests, this bat is a rare species.

## Two individuals of *Desmodus* landed on the back of a wild pig (*Sus scrofa*)



***Desmodus rotundus* pursues its prey on trails in the forest**



When the prey is active at night, the bat has to chase the prey to get its meal



Cattle in the corral are more accessible to *Desmodus rotundus* than released in the pasture

Photos: Unknown author

**Local Hunters and Hematophagous Bats**

Many people living in the Amazon region hunt wild animals for food and this locally reduces wild food sources of hematophagous bats, especially of *Desmodus rotundus*.



Peccary



Deer



Paca

Photos: W.Uieda

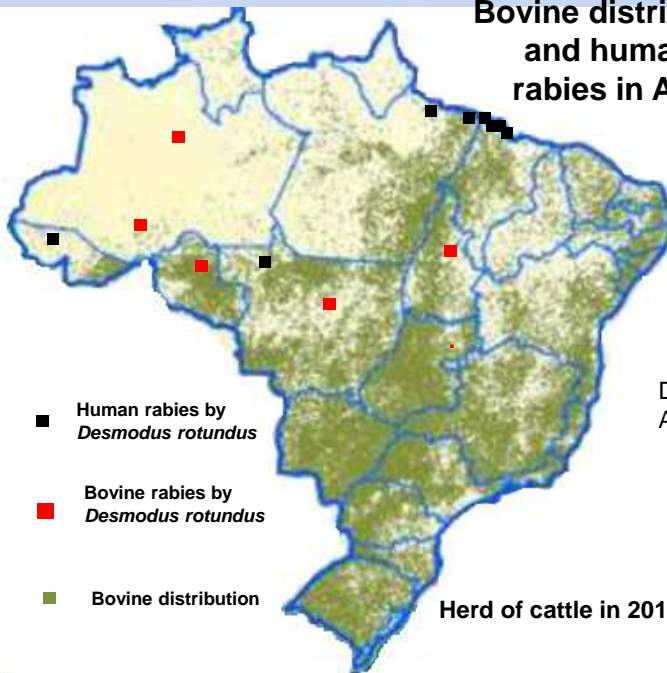
Domestic mammals are diurnal animals and can not defend themselves from the attacks of *Desmodus rotundus*



Photos: W.Ujeda and internet

European colonization of the Americas brought new sources, more accessible and more abundant, domestic mammals

**Bovine distribution in Brazil and human and bovine rabies in Amazon region**



Data: Ministerio da Agricultura do Brasil

Herd of cattle in 2015: 210 million head

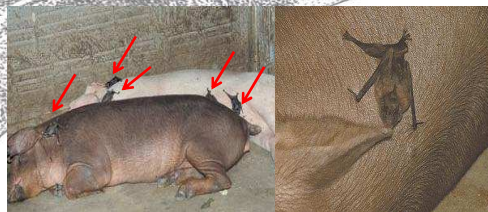
### **Desmodus** and Domestic Mammals



**Desmodus** bleeding the back and the foot of a bovine (Photos: I. Sazima and W.Uieda).



**Desmodus** bleeding ear and vulva of horses while resting on the body of the prey (Photos: W.Uieda).



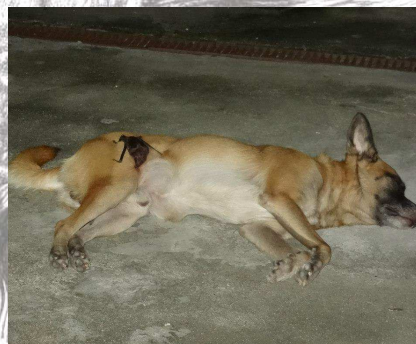
**Desmodus** bleeding pigs, at rest, while landed in the body of the prey (Photos: W.Uieda).

### **Desmodus rotundus** feeding on a dog from the urban area of State of Rio de Janeiro, Southeastern Brazil



The bat up on the leg of the dog that is sleeping

Photos: Unknown author



The bat is fed into a bite on leg of dog that is sleeping peacefully



### Chicken as Food Source of Hematophagous Bats



*Diaemus youngii* hanging on tree branch under a chicken (Photo: A. Bredt).



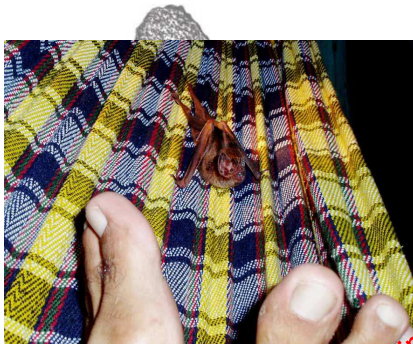
*Desmodus rotundus* hanging on the perch of the post of a rooster and bleeding its foot (Photo: W. Uieda)



*Diphylla ecaudata* hanging on the tail feathers of a chicken and bleeding the cloacal region (Photo: W. Uieda).

(Fotos: WUieda)

### Humans as Food Source for *Desmodus rotundus*



People of riverine communities in the Interior of the Amazon region of Brazil

Photos: W.Uieda



3 year old girl newly bitten by *Desmodus* on the toe, while sleeping in her hammock in the Amazon region of Brazil. Look spots of blood on the foot, leg and hammock (Photo: W. Uieda).

### *Desmodus* and Human Beings

Photos: W.Uieda



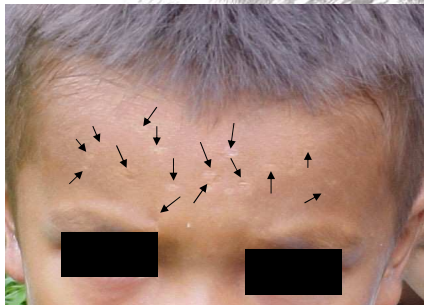
The most frequently bitten site by bat was the foot (toes), but the head is the most traumatic place because of blood running down the face and the permanent scars.

Feet of Indigenous children were frequently bitten by *Desmodus* at the village Baú, Jacareacanga, PA.



A 11 year-old boy was bit several times before the outbreak of human rabies in Portel, State of Pará, in 2004. See several permanent scars on his forehead (Photo: A. Tenório).

## Scars Forever



Bites on the face leave permanent scars that do not fade with time. In girls these scars cause psychological trauma, especially in teenager girls who try to hide the scars located on the forehead, fringed with hair (Photo: L. Paleari)

## Houses of people who died of rabies transmitted by *Desmodus rotundus* in Portel, State of Pará, Brazil, in 2004

Photos: W.Uieda



(Fotos: WUieda)

Inhabited house used as nocturnal shelter by  
*Desmodus rotundus*

Photos: W.Uieda



Black feces of *Desmodus* on the inner wall of the inhabited house. That inner wall was used by bats as a night shelter, before they return to their diurnal roost.



House in the Community Riverine Cristo Rei, Benjamin Constant, State of Amazonas



Amazon municipalities (N = 41) with Human Aggressions Cases by hematophagous bats (2002-2015). (Total N = 62 municipalities)

Data: Fundação Vigilância em Zoonoses-SUSAM

## Drinking blood in *Desmodus* and *Diaemus*



*Desmodus* and horse



*Diaemus* and chicken



Lower face of the tongue

*Diphylla* *Desmodus* *Diaemus*

Grooves

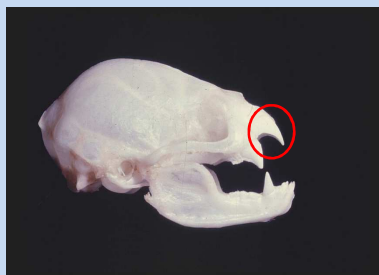
- They suck blood and not lick.

- Blood ascend through the grooves on the lower face of the tongue by capillarity

- The tongue touches about 900 times the injury during a meal 30 minutes

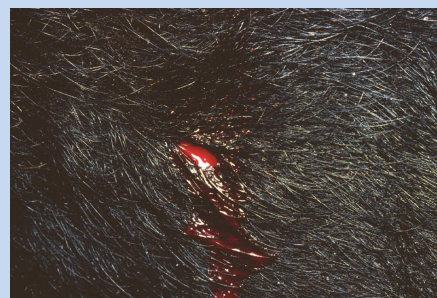
- A bat consumes a meal 20 to 30 ml of blood per night

## The Bite of *Desmodus*



- The two upper incisors make a single superficial bite in the animal's skin, removing a piece of skin that is usually not consumed by the bat.

- During a meal, the bat takes all the blood that will be ingested.



Photos: I. Sazima and W.Uieda

### ***Desmodus* drinking human blood**



From Discovery Max video - [Morcego Hematófago X Homem](#), Isla del Diablo, Guianas, Youtube, 26/10/2016

### ***Desmodus* drinking human blood**



From the National Geographic video: [Mundo Selvagem - Morcegos Vampiros](#) by Richard Rasmussen, Youtube – 26/10/2016

## Why to control Hematophagous bat populations?

- *Desmodus rotundus* is a rare species in unmodified forests, where depending only on food from wild sources .
- Today, *Desmodus* is a common bat in almost all of Latin America and in some regions is extremely common. In Brazil, it is also taking place in urban areas of large cities such as São Paulo, Rio de Janeiro, Belo Horizonte, Salvador, Recife, Olinda, Belém and Manaus.
- Importance to public health due to the rabies transmission to humans throughout Latin America, but especially in Peru, Colombia, Venezuela and Brazil

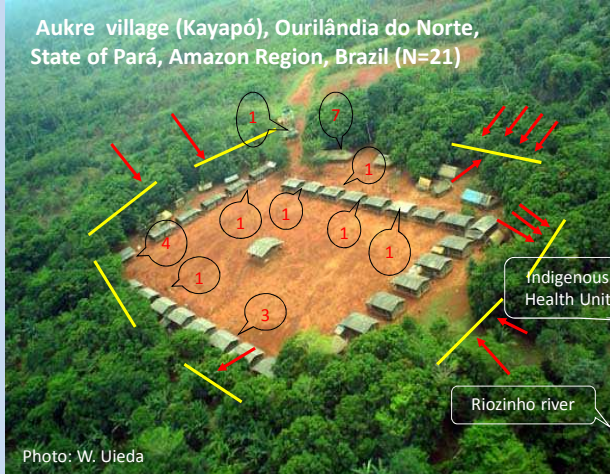
Economic and Public Health



## How to control?

- *Desmodus rotundus* control in three indigenous villages of the Amazon region, after human rabies outbreaks in the states of Pará and Maranhão between 2004 and 2005.

The population control of hematophagous bats were performed with mist nets and vampiricid gel in 2006.



Aukre village (Kayapó), Ourilândia do Norte, State of Pará, Amazon Region, Brazil (N=21)

21 people were bled by *Desmodus*

4 nights (20:00-03:00h) – moonlight nights

Captured: 13 *Desmodus* (10 Males and 3 females)

Vampiricid gel in 7 Males and 3 females)

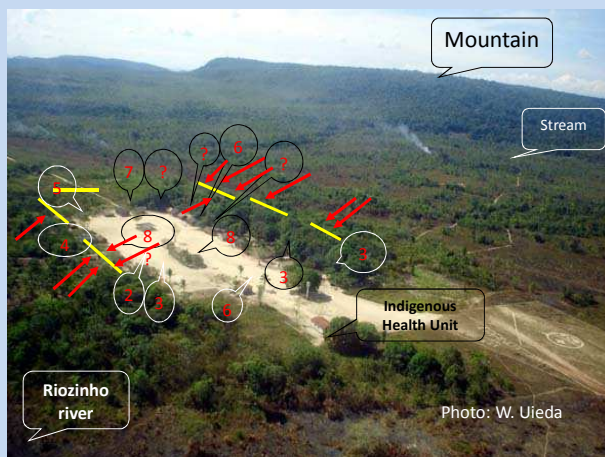
Rabies Exam: 2 males (negative)

Didatic Collection: 1 male

People, dogs and chickens were bled in Aukre village

Other hematophagous: *Diphylla* on chickens

**Kunbenkrankrein village (Kayapó), Ourilândia do Norte, State of Pará , Amazon Region, Brazil (N=58)**



58 people were bled by *Desmodus*

4 nights (22:00-03:00h)

Captured: 13 *Desmodus* (7 males and 6 females)

Vampiricid gel: 3 males and 6 females

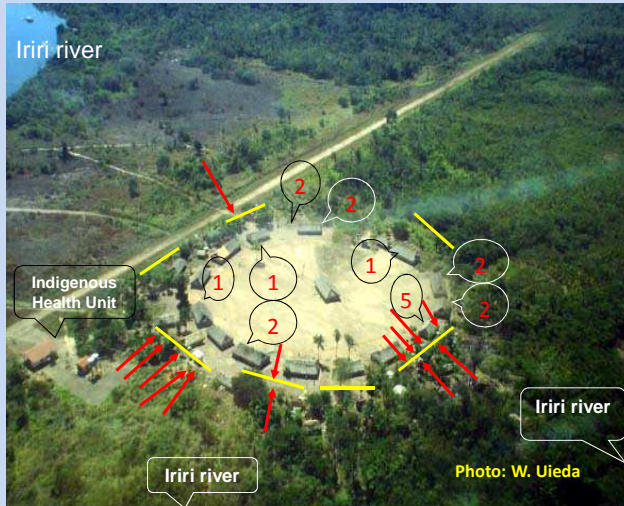
Rabies exam: 3 males (negative)

No other hematophagous bats

People, dogs and chickens were bled by *Desmodus* in the village



**Kendjan village (Kayapó), São Félix do Xingu, State of Pará, Amazon Region , Brazil (N=23)**



23 people were bled by *Desmodus*

3 nights (23:00-04:00h)

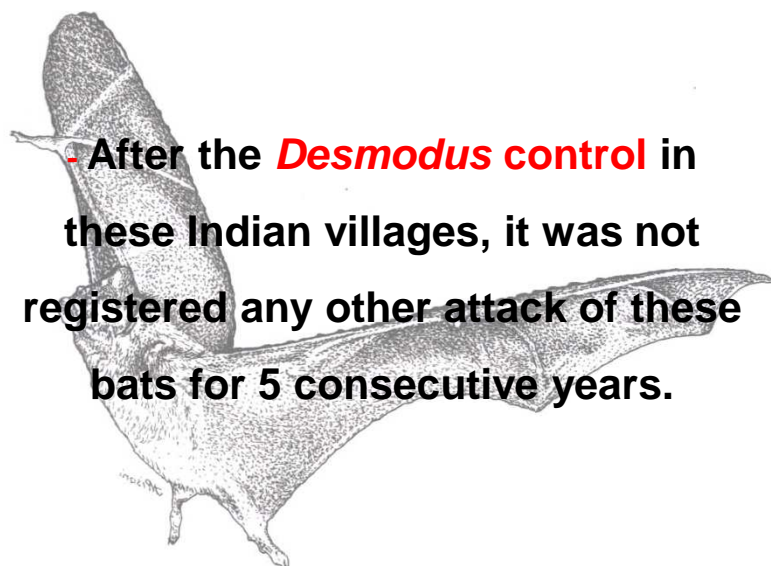
Captured: 12 *Desmodus* (7 males and 5 females)

Vampiricid gel: 3 males and 5 females

Rabies exam: 4 males (negative)

No other hematophagous bats were observed.

People, dogs and chickens were bled by *Desmodus*.



- After the *Desmodus control* in these Indian villages, it was not registered any other attack of these bats for 5 consecutive years.



**Thank you for attention**

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Prevention of Prostate Cancer

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