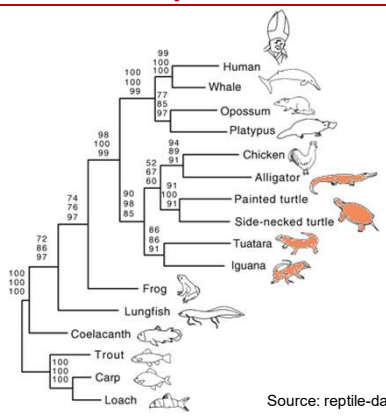
Ranavirus infections in squamate reptiles

Rachel E. Marschang

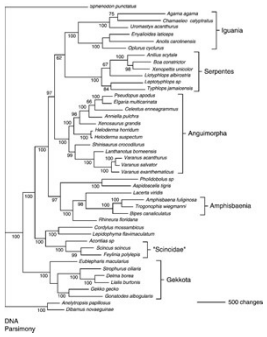
LABOKLIN GmbH & Co. KG, Bad Kissingen, Deutschland

Reptiles



Source: reptile-database.org

Phylogeny of squamate reptiles based on parsimony analysis of molecular data only, showing the single shortest tree (length = 29,616 steps).



John J. Wiens et al. Syst Biol 2010;59:674-688

Systematic Biology

Ranaviruses in squamates

- First description in snakes:
  - Green tree pythons (*Chondropython viridis*) imported from Indonesia to Australia (Hyatt et al., 2002)
  - Ulceration and necrosis of the oral and nasal mucosa
  - Hepatic degeneration and necrosis

Journal of Wildlife Diseases, 38(2), 2002, pp. 239–252
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FIRST IDENTIFICATION OF A RANAVIRUS FROM GREEN PYTHONS (*CHONDROPYTHON VIRIDIS*)

A. D. Hyatt,[1,4] M. Williamson,[1] B. E. H. Coupar,[1] D. Middleton,[1] S. G. Hengstberger,[1] A. R. Gould,[1] P. Selleck,[1] T. G. Wise,[1] J. Kattenbelt,[1] A. A. Cunningham,[2] and J. Lee[3]

Ranaviruses in squamates

- First case in lizards:
  - Leaf tailed gecko in Germany, captive bred
  - Kept together with other reptiles and a toad
  - Died after 2 weeks of anorexia
  - Other reptiles and toad as well as offspring healthy

Journal of Zoo and Wildlife Medicine 36(2): 295–300, 2005

ISOLATION OF A RANAVIRUS FROM A GECKO (*UROPLATUS FIMBRIATUS*)

Rachel E. Marschang, Dr. med. vet., Sabine Braun, Dr. med. vet., and Paul Becher, Dr. med. vet., PD

Ranaviruses in squamates

- Pathology:
  - Granulomatous lesions on the tongue and tail:
    - ulcerative necrotizing glossitis with bacterial colonies
  - Focal necrosis in the liver with periferal bacterial colonies

Ranaviruses in squamates

- Second case: lizards:
  - Isolated from a *Lacerta monticola* in Portugal
  - Wild caught
  - With lizard erythrocytic virus

Photo courtesy of A.P. Alves de Matos

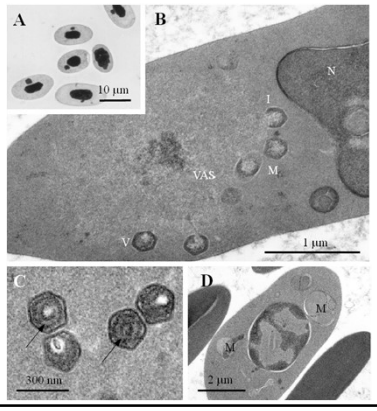
Microsc. Microanal. 17, 101–108, 2011
doi:10.1017/S1431927610094333

Microscopy and Microanalysis

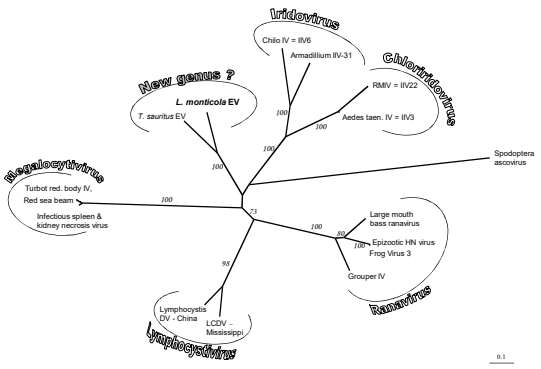
New Viruses from *Lacerta monticola* (Serra da Estrela, Portugal): Further Evidence for a New Group of Nucleo-Cytoplasmic Large Deoxyriboviruses

António Pedro Alves de Matos,[1,2,4] Maria Filomena Alcobia da Silva Trabucho Caeiro,[2,3] Tibor Papp,[4] Bruno André da Ganha Almeida Matos,[1] Ana Cristina Lacerda Correia,[1] and Rachel E. Marschang[4]

Erythrocytic viruses



Erythrocytic viruses



Ranaviruses in lizards

- Recent findings in various lizard species in Germany
- Most associated with skin lesions


Paper

Mass-mortality in green striped tree dragons (*Japalura splendida*) associated with multiple viral infections

H. Behncke, A. C. Stöhr, K. O. Heckers, I. Ball, R. E. Marschang


VETERINARY RESEARCH

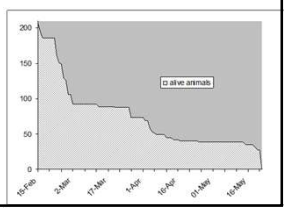
RESEARCH Open Access

Ranavirus infections associated with skin lesions in lizards

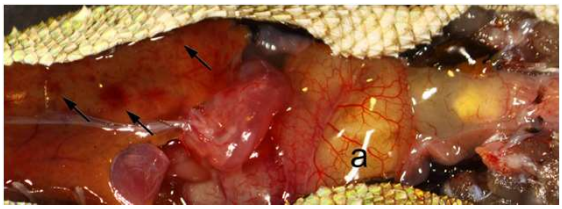
Anke C Stöhr, Silvia Blahak, Kim O Heckers, Jutta Wiechert, Helge Behncke, Karina Mathes, Pascale Günther, Peer Zwart, Inna Ball, Birgit Ruschoff and Rachel E Marschang

Japalura splendida

- Green striped tree dragons (*Japalura splendida*)
  - Imported from south-western China → to Florida → to Germany
- High mortality
  - Skin lesions
  - Systemic haemorrhage
  - Necrosis



Japalura splendida



Coelom: intestinal oedema(a) and ecchymosis of the liver (Pfeil)

Japalura splendida

Granulomatous necrotising skin lesion (black arow), open wound following removal of the crust (red arrow)

Formalin-fixed cachectic green striped tree dragon with miliar nodules on legs, tail and back

Japalura splendida

- 5 animals examined
- Viruses detected:
  - Ranavirus (PCR and cell culture)
    - Skin, lung, liver and kidney, and intestine of one animal
  - Adenovirus (PCR)
    - Intestine of 2 animals
  - IIV (PCR and cell culture)
    - Skin 5x, lung 5x, liver and kidney 3x

Invertebrate Iridoviruses (IIV)

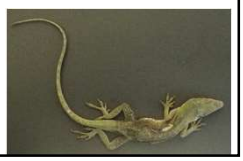
- Genus Iridovirus
- Relatively common in feeder insects in the pet trade
- Found regularly in lizards
- Pathogenicity in reptiles not proven
  - Associated with skin lesions
  - Sudden death in some cases

Anolis carolinensis

- Carolina anole (*Anolis carolinensis*)
  - Imported from Florida to Germany
  - Same importer as the Japaluras
- Multiple weakened animals
  - Dermatitis
  - Increased mortality

Anolis carolinensis

- 1 animal examined
- Viruses detected:
  - Ranavirus (PCR and cell culture)
    - Skin, liver, intestine
  - Adenovirus (PCR)
    - Intestine
  - IIV (PCR and cell culture)
    - Skin



Dopasia harti

- Asian glass lizards (*Dopasia harti*)
  - 570 animals Illegally imported into Germany from Asia
  - Wide range of species including anurans, urodeles, chelonians, and lizards and snakes
  - 82 Asian glass lizards
  - Confiscated and distributed to various zoological organizations

Dopasia harti

Bildnachweis: www.reptilia.de

Dopasia harti

- High mortality rate
  - Skin lesions

Dopasia harti

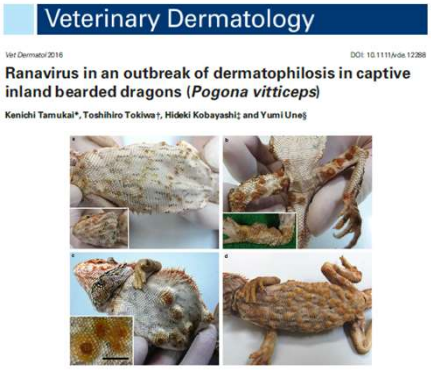
- 1 animal examined
- Viruses detected:
  - Ranavirus (PCR and cell culture)
    - Skin and mixed tissues
  - IIV (PCR and cell culture)
    - Skin and mixed tissues

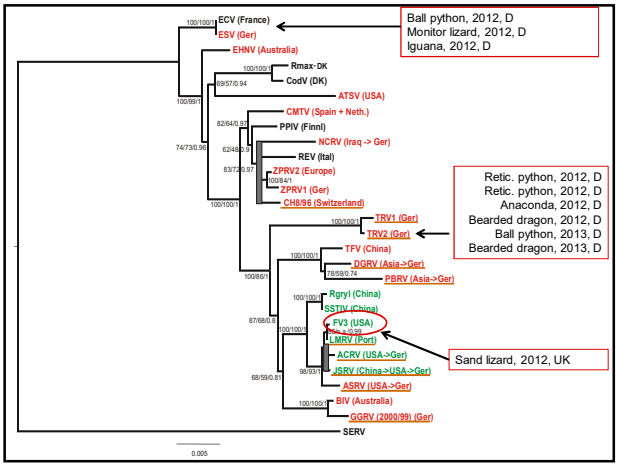
Pogona vitticeps

- First description:
  - Kept as a pet in Germany
  - Dermatitis, myositis and bone lysis in one leg
  - Euthanized
  - Ranavirus detected in skin, muscle, heart
  - Adenovirus detected in oral/cloacal swab

Pogona vitticeps

- Recent publication from Japan:

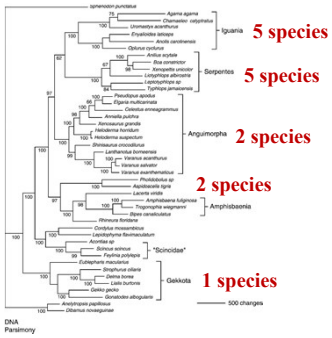




Host range: Squamates

- *Japalura splendida*
- *Pogona vitticeps*
- *Dopasia gracilis*
- *Anolis sagrei*
- *Anolis carolinensis*
- *Uroplatus fimbriatus*
- *Iguana iguana*
- *Varanus macraei*
- *Lacerta monticola*
- *Lacerta agilis*
- *Morelia (Chondropython) viridis*
- *Python brongersmai*
- *Python regius*
- *Python molurus*
- *Eunectes* sp.

Phylogeny of squamate reptiles based on parsimony analysis of molecular data only, showing the single shortest tree (length = 29,616 steps).



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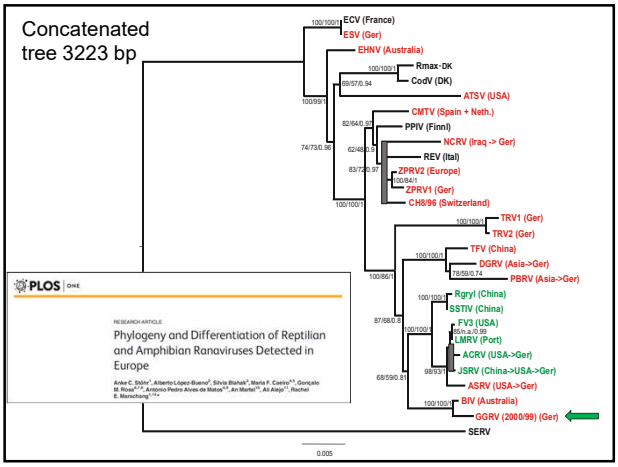
Systematic Biology

Concatenated tree 3223 bp



PLOS ONE

RESEARCH ARTICLE

Phylogeny and Differentiation of Reptilian and Amphibian Ranaviruses Detected in Europe

Diagnosis: samples

- Lizards:
  - Skin (oral and cloacal swabs)
  - Various tissues (liver, gastrointestinal tract)
- Snakes:
  - Only detected in dead animals so far
  - Various tissues (liver, gastrointestinal tract, oral mucosa)

Multiple infections

- Adenoviruses:
  - Commonly found in squamates
  - Genus Atadenovirus
  - Immune suppression?
- Reoviruses
  - Also commonly found in squamates
  - Respiratory and CNS disease?
- Invertebrate iridoviruses
  - Family *Iridoviridae*
  - Mostly infect insects
- Erythrocytic viruses
  - Family *Iridoviridae*
  - Possible new genus

Summary

- Ranaviruses found in reptiles are genetically variable
  - Cluster more closely to RV detected in amphibians than to each other
  - Transmission between different host classes
- More common than we realized
- Outbreaks?
- Pet trade?
- Pathogenicity?

Thank you for your attention