Herpetology Notes, volume 4: 303-306 (2011) (published online on 18 October 2011)

More in our mind than in their mouth? A preliminary inspection inside the oral cavity of two house Geckos: *Hemidactylus frenatus* Schlegel, 1836 and *Hemidactylus aquilonius* McMahan & Zug, 2007

Madhurima Das[1,2], Rajeev K. Brahma[3] and Jayaditya Purkayastha[4,5]*

Abstract. This paper presents a preliminary investigation on the micro flora residing in the oral cavity of two species of house gecko, *Hemidactylus frenatus* and *Hemidactylus aquilonius*, in Guwahati city, Assam, India and the potential implications of a bite induced by the geckos. This investigation revealed presence of Gram-positive *Staphylococcus* strains of bacteria.

Keywords. Oral micro flora, *Staphylococcus*, *Hemidactylus*, bite, myth, Assam, India.

Introduction

Reptiles have been associated with bacterial infections, which may serve as a cause of population declines (Gibbons et al., 2000). Infections in reptiles may be enteric, oral or occur on any part of their body. A relatively high number of intestinal infections have previously been reported in reptiles (e.g. Criscione and Font, 2001; Gupta, Bhaskar and Gupta, 2009; Goldberg, Bursey and Kraus, 2010) along with oral microbial flora (Goldstein et al., 1981; Yogiara and Erdelen, 2001; Ibarguengoytia et al., 2005).

As well as infecting natural populations, oral microbiota can cause serious infections of captive lizards when periodontal infections are produced, which can lead to disease and death of these animals (McCracken and Birch, 1994; McCracken, Fowler and Miller, 1999). However, information about the oral microbial flora of lizards in their natural environment is scarce (Ciofi, 1999). Several examples have been presented by Shek et al. (2009), Ferronato et al. (2009), Yogiara and Erdelen (2001) and Ibarguengoytia et al. (2005). A study on a Patagonian tropidurid lizard of the genus *Diplolaemus* revealed the presence of as many as five species of microbe, which were etiologic agents of a number of human and animal infections (Ibarguengoytia et al., 2005).

In many areas of the world lizards are associated with infectious bites. For example, throughout much of India geckos are considered to be venomous animals, capable of inflicting poisonous bites and even causing diseases such as leprosy and vitiligo (Evans, 2002). Several other cases have been described by Evans (2002); ancient Egyptians believed geckos to be hazardous to human health, while in South Africa *Chondrodactylus anguliifer* and *Pachydactylus maculatus* are believed to be venomous. In Madagascar, geckos of the genus *Uroplatus* are regarded with such dread that buildings where they are found have occasionally been burned. In Mexico, *Coleonyx* species are believed to have a poisonous skin. In Malaysia, Dyak natives believe that a bite from *Crytodactylus* spp. is poisonous, and finally, in Pakistan, *Eublepharis macularius* is believed to be

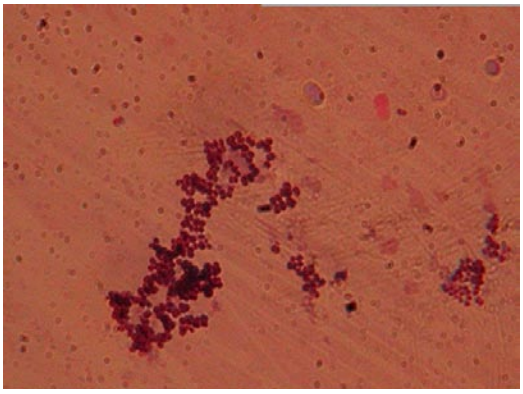

Figure 1. Gram positive Coccus forms in the culture from a mouth swab of *Hemidactylus frenatus*.

1 Asian Institute of Management & Technology, Guwahati, Assam, India; e-mail: madhuherp@gmail.com
2 Help Earth, Guwahati, Assam, India;
3 Department of Molecular Biology and Biotechnology, Tezpur University, Napaam, Tezpur, Assam, India; e-mail: rajeevkungur@gmail.com
4 South Point School, Barsapara, Guwahati, Assam, India; e-mail: jaya_ditya@rediffmail.com
5 Zoology Department, Arya Vidyapeeth College, Guwahati, Assam, India.
*Corresponding author.

Table 1. Results of three biochemical tests carried out on the oral swab of *Hemidactylus frenatus* and *Hemidactylus aquilonius.*

Strain Test	*E. coli*	*H. frenatus*	*H.aquilonius*
Catalase	-	+	+
Protease	-	-	-
Coagulase	-	+	+

even more poisonous than the cobra.

An earlier case study involving a lizard bite administered to a small child has been documented from India. The bite was reported to have caused swelling and bleeding at the site of infection (Taksande et al., 2008). However, worldwide only two lizards are known to be capable of delivering a venomous bite that may be serious to humans; *Heloderma suspectum* (Cope, 1869) and *Heloderma horridum* (Wiegmann, 1829). Additionally, recent studies mention a venom system at work in *Varanus komodoensis* (Fry et al., 2009)

In the current article we tried to address the possible implications of bites performed by the common house geckos *Hemidactylus frenatus* and *Hemidactylus aquilonius* from Guwahati city of Assam, India. Through analysis of the microflora residing in their oral cavity, the potential impact on human welfare is addressed.

Materials and methods

Two species of house gecko of the genus *Hemidactylus*: *H. frenatus* (Duméril & Bibron, 1836) and *H. aquilonius* (McMahan and Zug, 2007) were used as models for study as they are commonly found in the study area (Guwahati city: Assam, India).

Mouth swabs were obtained by euthanizing the lizards using chloroform. Sterilized cotton swabs were used to obtain saliva from the buccal cavity. The swab was streaked onto nutrient agar medium comprising: peptone (0.3g), beef extract (0.5g), sodium chloride (0.5g), sucrose (0.5g) and agar (1.5g), for 100ml of media preparation. Chemicals and reagents were obtained from Merck (India) and nutrient medium from Himedia (India).

The culture plates were incubated at 27-28°C for microbial growth and were observed after 24-36 hrs. Gram staining (Prescott, Harely and Klein, 2002) was performed using crystal violet, and the slides were observed at 100x magnification (using a binocular microscope, Metzer Biovision, India). To determine the strain of bacteria, further biochemical tests were performed. A catalase test was performed by adding 4-5 drops of 3% hydrogen peroxide (v/v) to the culture plates. A protease test was also performed by testing bacteria for proteolysis of casein by streaking it onto agar medium containing casein. Incubation was conducted at 28°C for 12 hours. *Escherichia coli* were taken as a control in each case. A coagulase test was performed by using chicken blood obtained in tri-sodium citrate (1:9) from freshly killed poultry.

Table 2. Colony characteristics of microbial flora isolated from mouth swab of *Hemidactylus frenatus* and *Hemidactylus aquilonius*.

Strains Colony characters	*H. frenatus*	*H. aquilonius*
Colony shape	Irregular	Irregular
Colony color	Whitish	Whitish
Opacity	Opaque	Opaque
Colony elevation	Umbonate	Umbonate
Colony margin	Lobate	Lobate

Blood plasma was prepared by centrifuging the blood at 3000 rpm (Unilab India) for 20 minutes. A part of the bacterial culture was inoculated into 1000 µl (1 ml) of blood plasma and incubated at 37°C for 4-12 hours for further study.

Results

The culture plates obtained after 24 hours for both *H. frenatus* and *H. aquilonius* indicated the presence of microbial colonies. These colonies were mainly whitish in colour in both cases. The colonies were opaque with an irregular shape. The margins of the colonies were thick, finger-like or lobate, and the elevation was umbonate. (Table 2)

The number of colonies differed between species. An average of 22 colonies was observed.

The Gram staining indicated the presence of Gram-positive coccus bacteria (Fig. 1). Subsequent catalase, protease and coagulase tests confirmed the bacterial strain *Staphylococcus* sp. to be resident in the oral cavity of both *H. frenatus* and *H. aquilonius* (see Table 1).

Discussion

The results indicate the presence of a *Staphylococcus* strain, which is an aerobic Gram-positive bacterium. We did not encounter any other species of bacteria in the oral cavity of *H. frenatus or H. aquilonius*. The *Staphylococcus* strain is known to be pathogenic in mammals (Clausen and Duran-Reynalds, 1937) and can cause infections such as skin diseases, bacteremia and septicaemia (Fry et al., 2009; Heffelfinger et al., 2010). However, such infections are not fatal and are a cause for concern only when the strain infects the bloodstream.

Geckos of the genus *Hemidactylus* generally have rather small teeth (Fig. 2) and weak jaws, and are therefore not capable of causing severe human injury through biting. Bites usually just cause teeth marks, minor scrapes or, at worst, some puncture marks without any other symptoms. This is contrary to the common belief in the region that the house lizard is capable of

Figure 2. Bite impact and teeth of a *Hemidactylus* ssp. from Guwahati, Assam, India.

delivering a life-threatening bite. Additionally, geckos, like other reptiles, do not carry the rabies virus, and are therefore not a cause for serious concern.

The myth surrounding lizard bites, as well as the belief that urine or faecal pellets can be poisonous, is yet another issue which is beyond the scope of this paper. However, similar beliefs about geckos can hinder conservation efforts. From this preliminary investigation it can be concluded that, although the oral cavity of house lizards does contain pathogenic (i.e. *Staphylococcus*) microbes, their bites are rarely severe enough to be of serious concern.

Acknowledgements. JP was support by Rufford Small Grants (10203-1). We would like to thank Aaron Bauer and Gernot Vogel for their valuable inputs on this manuscript. Thanks are also due to the Principal, Arya Vidyapeeth College, South Point School, Guwahati and President, HOD (Dept. of Biotechnology)Asian Institute of Management and Technology; Guwahati.

References

Ciofi, C. (1999): The Komodo dragon: on a few small islands in the Indonesian

Archipelago, the world's largest lizard reigns supreme. Sci. Am. **280**: 64-71.

Clausen, H.J., Duran-Reynalds, F. (1937): Studies on the experimenteal infection of some reptiles, amphibia and fish with *Serratia anolium*. Am. J. Pathol. **13**: 441-541.

Criscione, C.D., Font, W.F. (2001): The guest playing host: colonization of the introduced Mediterranean Gecko, *Hemidactylus turcicus*, by helminth parasites in Southeastern Louisiana. J. Parasitol. **87(6)**: 1273-1278.

Evans, L. (2002): Poisonous geckos: the validity of an ancient Egyptian belief. BASE **13**: 47-55.

Ferronato, O.B., Marques, T.S., Souza, S.L., Verdade, L.M., Matushima, E.R. (2009): Oral bacterial microbiota and traumatic injuries of free ranging *Phrynoffs geoffroanus* (Testudines: Chelidae) in Southeastern Brazil. Phyllomedusa **8(1)**: 19-25.

Fry, B.G., Wroe, S., Teeuwisse, W., Matthias J., Osch, P., Moreno, K., Ingle, K., McHenry, C., Ferrara, T., Clausen, P., Holger, S., Winter, K.L., Greisman, L., Roelants, K., Weerd, L., Clemente, C.J., Giannakis, E., Hodgson, W.C., Luzm, S., Martelli, P., Krishnasamy, K., Kochva, E., Kwok, H.F., Scanlon, D., Karas, J., Citron, D.M., Goldstein, E.J.C., Mcnaughtan, J.E., Norman, J.A. (2009): A central role for venom in predation by *Varanus komodoensis* (Komodo Dragon) and the extinct giant Varanus (Megalania) priscus. Proc. Natl. Acad. Sci. **106**: 8969-8974.

Gibbons, J.W., Scott, D.E., Ryan, T.J., Buhlmann, K.A., Tuberville, T.D., Metts, B.S., Greene, J.L., Mills, T., Leiden, Y., Poppy, S., Winne, C.T. (2000): The Global decline of reptiles, déjà vu amphibians. Biol. Sc. **50**: 655-666.

Goldberg, S.R., Bursey, C.R., Kraus, F. (2010): Helminth records for the madagascan giant day gecko, *Phelsuma grandis* (Gekkonidae) from Hawaii. In: Evenhuis, N.L., Eldredge, L.G. Eds., Records of the Hawaii biological survey for 2008, Occasional papers. Bishop Museum, Honolulu **108**: 49–52.

Goldstein, E.J.C., Agyare, E.O., Vagvolgyi, A.O., Halpern, M. (1981): Aerobic bacterial oral flora of garter snakes: Development Of normal flora and pathogenic potential for snakes and Humans. J. Clin. Microbiol. **13(5)**: 954-956.

Gupta, N., Bhaskar, M., Gupta, D.K. (2009): Gastro-intestinal invasion in *Hemidactylus flaviviridis* with a new species of *Parapharyngodon* (Oxyuroidea: Pharyngodonidae), Zootaxa. **2165**: 39-51.

Heffelfinger, R.N., Loftus, P., Cabrera, C., Pribitkin, E.A. (2010): Lizard bites of the head and neck. J. Emerg. Med. doi:10.1016/j.jemermed.2010.04.030.

Ibargüengoytía, N.R., Bird, P.S., Uzal, F.A., Cipolla, A. (2005): Oral microbiota of patagonian lizards of genus *Diplolaemus* (leiosauridae): fable to facts. Cuad. Herpetol. **18 (2)**: 37-41.

McCracken, H., Birch. A. (1994): Periodontal disease in lizards: a review of numerous cases. Proc. Am. Assoc. Zoo Vet. Pittsburgh. 108-115.

McCracken, H., Fowler, M., Miller, R. (1999): Periodontal disease in lizards. Zoo and wild animal medicine: Current Therapy **4**: 252-257.

Montgomery, J.M., Gillespie, D., Sastrawan, P., Fredeking, T.M., Stewart, G. (2002): Aerobic salivary bacteria in wild and captive Komodo dragons. J. Wildl. Dis. **38(3)**: 545-551.

Prescott, L.M., Harley, J.P., Klein, D.A. (2002): Introduction to Microbiology. 5th edition. New York, The Mcgraw−Hill Companies, Inc.

Shek, K.C., Tsui, K.L., Lam, K.K., Crow, P., Ng, K.H.L., Ades, G., Yip, K.T., Grioni, A., Tan, K.S., Lung, D.C., Lam, T.S.K., Fung, H.T., Que, T.L., Kam, C.W. (2009): Oral bacterial flora of the Chinese cobra (*Naja atra*) and bamboo pit viper (*Trimeresurus albolabris*) in Hong Kong SAR, China. Hong Kong Med J. **15**: 183-190.

Taksande, A.M., Murkey, P., Kumar, A., Vilhekar, K.Y. (2008): Case report lizard bite in Indian child: case report. J. Indian Acad. Forensic. med. **30(1)**: 24-25.

Yogiara, S.A., Erdelen, W. (2001): Antibiotic resistence and genetic diversity of *E. coli* isolated from Indonesian monitor lizards (*Varanus* sp.), Jurnal Mikrobiologi. **6(2)**: 45-49.

Accepted by Wouter Beukema