

Not in *Heloderma* ... A revised taxonomy and new genus for the Gila Monster.

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ABSTRACT

The basis of this paper is an overdue review of the taxonomy of the icon lizard the Gila Monster. While it is clearly a member of the family Helodermatidae Gray, 1837, recently obtained molecular evidence has confirmed long-standing morphological and fossil evidence that it is clearly misplaced in the genus *Heloderma* Wiegmann, 1829.

While it is astounding that no herpetologist has rectified the obvious error of placement to date, this paper does exactly that.

In accordance with the Zoological Code (Ride *et al.* 1999), the new genus *Maxhosersaurus* is created to accommodate the species originally described as *Heloderma suspectum* Cope, 1869, as well as fossil material attributed to this species taxon.

To take into account the fossil Helodermatidae material that has emerged since the original description of the family and more likely to emerge in the future, both genera *Heloderma* and *Maxhosersaurus gen. nov.* are also formally placed within a single tribe defined herein.

Keywords: Taxonomy; nomenclature; Gila Monster; Helodermatidae; *Heloderma*; *horridum*; *suspectum*; Varanidae; *Varanus*; Bryan Fry; false claims; new genus; *Maxhosersaurus*.

INTRODUCTION

The Gila Monster and Beaded Lizards (Genus *Heloderma* Wiegmann, 1829) do not need an introduction as such, due to the fact they are known globally as the only "venomous" lizards in the world. While it is suggested that they sit on the cusp between merely having toxic saliva and being venomous, the final decision in terms of which view to take is dependent on a classification of the delivery system, rather than the compounds within the saliva itself. However a discussion of the venom delivery system of these lizards is not the purpose of this paper.

An excellent account of the Gila Monster, until now known as *Heloderma suspectum* Cope, 1869 can be found in the literature, perhaps the best readily available account for most people being that within Campbell and Lamar (2004). Likewise for the so-called Beaded Lizards, until recently grouped within a single species known generally as *Heloderma horridum* (Wiegmann, 1829), with Campbell and Lamar (2004) perhaps again being the best readily available account of the detail of the group.

In 2013, Reiserer *et al.* published results of a molecular study that showed deep divergences between the two then recognized living species of *Heloderma*. Confirming the similar findings in an earlier study they wrote: "Beaded lizards and Gila monsters (*H. suspectum*) are hypothesized to have diverged from a most-recent common ancestor in the late Eocene ~35 mya (Douglas *et al.* 2010, p. 163)."

On the molecular evidence alone, there would be absolutely no question that species with such deep divergence should be

placed in separate genera. The fossil record as documented by Bogert and del

Campo in 1956 and Beck in Pianka *et al.* (2004) (p. 518) also broadly corroborates this situation.

Campbell and Lamar (2004) provide a detailed morphological account of both *Heloderma horridum* and *H. suspectum* which highlight numerous morphological differences between the two species as recognized by them in their detailed book.

On the basis of the preceding, it is clear that there is no question that *Heloderma horridum* and *H. suspectum* should not be placed in the same genus. Because *Heloderma horridum* is the type species, it remains within *Heloderma*. The species *suspectum* Cope, 1869 is the one that needs to be placed in another genus. As no name is available under the Zoological Code (Ride *et al.* 1999), one is formally defined herein for the first time.

The only vaguely logical or potentially current argument against the placement of the species *suspectum* Cope, 1869 into a new genus is the commonly raised argument against the creation of numerous monotypic genera within a given family. While I would as a matter of course reject such an argument for such deeply divergent species, the argument is now redundant after the publication of Reiserer *et al.* (2013).

These authors elevated four previously described subspecies of *Heloderma horridum* to full species status on the basis of deep

divergences spanning millions of years, between each allopatric population.

This time frame for the various species divisions was within the time range of between 9.7 and 5 million years before present for the relevant species.

With the argument relating to the potential creation of two monotypic genera within a family in effect being removed, there would in the normal course of events be no obvious dissent to my creation of a new genus within the global herpetological community.

However it is appropriate that I herein raise the inevitable response this paper will generate from a group known widely as the "truth haters" or "Wüster gang", the name coming from the ringleader of the group, Wolfgang Wüster, who is a pseudoacademic from Wales in the UK. These men will use all sorts of illegal, unethical and improper means to try to stop the use of the new nomenclature formally proposed within this paper. Their mode of operation is in fact outlined by the gang in Kaiser *et al.* (2012a, 2012b) (the second of these documents not having been written by Kaiser, even though it is referred to as being his), in turn properly dealt with by Hoser (2012b), and again by the Wüster gang in Kaiser *et al.* (2013) (this document not having been written by Kaiser, even though it is referred to and widely cited as being his), in turn properly dealt with by Hoser (2013).

The papers Hoser (2012a, Hoser 2012b and Hoser 2013) all deal with a vast number of cases of taxonomic and nomenclatural misconduct, vandalism, scientific fraud, criminal fraud, lies, dishonest and unethical practices and other serious matters committed by the Wüster gang in the period spanning 1998 to 2013.

In summary, all claims made by the Wüster gang in the follow-up to publication of this paper, should be ignored. This includes their comments in "social media" posts in places like "Twitter", "Facebook", internet chat forums, predatory "journals" and/or PRINO Journals ("peer reviewed in name only" Journals) they or their close friends exercise despotic editorial control over, tabloid news media and elsewhere.

Due to the vast body of literature published on the living members of the Helodermatidae and the fact that much of it is widely available, including on the world-wide web, including for example the highly relevant paper of Reiserer *et al.* (2013), I do not seek to rehash this readily available material herein.

Instead, the main purpose of this paper is to define the new genus according to the Rules of Zoological Nomenclature (Ride *et al.* 1999) to accommodate the species originally described by Cope as *Heloderma suspectum* Cope, 1869 to enable it to be properly named and classified by others according to its obvious phylogenetic origins.

The body of literature on lizards of the Helodermatidae is vast and key references over the last couple of centuries include the following: Aminetzach *et al.* (2009), Angeli (2005), Anzueto and Campbell (2010), Ariano-Sánchez (2006), Ariano-Sánchez and Salazar (2007, 2012, 2013), Beaman *et al.* (2006), Beck (2005), Beck and Jennings (2003), Beck and Lowe (1991), Bernstein (1999), Bogert and Del Campo (1956), Bonetti (2002), Boulenger (1885, 1981), Boundy *et al.* (2012), Campbell and Lamar (2004), Campbell and Vannini (1988), Canseco and Muñoz (2007), Cobarrubias *et al.* (2012), Cooper jr. and Arnett (2003), Cope (1869), Davis and DeNardo (2010), Degenhardt *et al.* (1996), Domínguez-Vega *et al.* (2012), Douglas *et al.* (2010), Duméril and Bibron (1836), Fischer (1882), Funk (1966), Furrer (2004), Garman (1890), Gienger and Beck (2007), Günther (1885), Hanley and Hanley (2003), Hartdegen and Chiszar (2001), Köhler (2000), Kunz (2004, 2007), Kwiatkowski *et al.* (2008), Lemos-Espinal *et al.* (2003), Liner (2007), Lock (2009), Lovich and Beaman (2007), McDiarmid (1963), Meléndez (2006), Monroy-Vilchis *et al.* (2005), Pregill *et al.* (1986), Pyron *et al.* (2013), Reiserer *et al.* (2013), Reisinger (2006a, 2006b),

Sánchez-De La Vega *et al.* (2012), Schmidt and Shannon (1947), Seward (2006), Smith (1935), Smith *et al.* (2010), Stebbins (1985), Stejneger (1893), Sumichrast (1864), Sullivan *et al.* (2004), Taylor (1938, 1969), Trutnau (1984), Wiegmann (1829, 1834), Weins (2008), Wilms (2006a, 2006b) and sources cited therein.

GENUS *HELODERMA* WEIGMANN, 1829.

Type species: *Trachyderma horridum* Wiegmann, 1829.

Diagnosis: Ear exposed. A gular fold. Digits with a series of transverse lamelle inferiorly. Upper surfaces uniformly tubercular; abdominal scales flat, juxtaposed. Labial shields present. Colouration is blackish brown above, spotted with yellow, the latter colour sometimes forming regular rings round the tail, (adopted from Boulenger, 1885).

Diagnosics for the separation of *Heloderma* from *Maxhosersaurus gen. nov.* is given in the description of *Maxhosersaurus gen. nov.* given below.

Distribution: Mexico, being found in the coastal areas from Oaxaca to Sonora; Sinaloa, Jalisco, Morelos, Guerrero, Chiapas, Nayarit, Michoacan, as well as Guatemala.

Content: *Heloderma horridum* (Wiegmann, 1829) (type species); *H. alvarezi* Bogert and Del Campo, 1956; *H. charlesbogerti* Campbell and Vannini, 1988; *H. exasperatum* Bogert and Del Campo, 1956.

GENUS *MAXHOSERSAURUS* GEN. NOV.

Type species: *Heloderma suspectum* Cope, 1869.

Diagnosis: Until now, the genus *Maxhosersaurus gen. nov.* would have been diagnosed as being within *Heloderma* on the basis of the characters outlined below for the new tribe (which was formerly the diagnosis for a genus including all living Helodermatidae as given by Boulenger in 1885).

However, the genus *Maxhosersaurus gen. nov.* is separated from *Heloderma* by the following suite of characters: The tubercles on the back are separated by wide granular interspaces as opposed to being close in *Heloderma*.

For *Maxhosersaurus gen. nov.* the colouration is yellowish or orange, with blackish network on the back and cross bands on the tail. By contrast the colouration of *Heloderma* is blackish brown above, spotted with yellow, the latter colour sometimes forming regular rings round the tail.

Maxhosersaurus gen. nov. are also separated from *Heloderma* by the absence of enlarged post nasal scales, versus usually two in *Heloderma*.

In *Maxhosersaurus gen. nov.* there are only one pair of infralabials in contact with the chin shields, versus two pairs in *Heloderma*.

Differences in habitat preferences also separate the two genera by microhabitat where they occur sympatrically. *Heloderma* are longer, more lanky and arboreal inclined species than *Maxhosersaurus gen. nov.*

Maxhosersaurus gen. nov. are readily separated from *Heloderma* by their proportionately shorter tail being no more than 55 per cent of the snout-vent length, versus at least 65 per cent of the snout-vent length in all four *Heloderma* species.

The tongue in *Maxhosersaurus gen. nov.* is usually black, versus pink as it is in most *Heloderma*.

Reiserer *et al.* (2013), rejected the hypothesis that there were three subspecies of *Maxhosersaurus suspectum* on the basis of molecular evidence.

In common with *Heloderma*, *Maxhosersaurus gen. nov.* are further diagnosed with the following traits: Ear exposed. A gular fold. Digits with a series of transverse lamellae inferiorly. Upper surfaces uniformly tubercular; abdominal scales flat, juxtaposed. Labial shields present.

Distribution: United States of America in the areas of south-east California, Southern Nevada, South-west Utah, Arizona, New Mexico and immediately adjacent Mexico.

Etymology: Named in honour of my cousin, Max Hoser of Campbelltown, NSW, Australia for services to herpetology.

Content: *Maxhosersaurus suspectum* (Cope, 1869) (monotypic).

TRIBE HELODERMINI TRIBE NOV.

Terminal taxon: *Trachyderma horridum* Wiegmann, 1829.

Diagnosis: Ear exposed. A gular fold. Digits with a series of transverse lamellae inferiorly. Upper surfaces uniformly tubercular; abdominal scales flat, juxtaposed. Labial shields present (adopted from Boulenger, 1885).

Distribution: United States of America in the areas of south-east California, Southern Nevada, South-west Utah, Arizona, New Mexico, south through Mexico, including being found in the coastal areas from Oaxaca to Sonora; Sinaloa, Jalisco, Morelos, Guerrero, Chiapas, Nayarit, Michoacan and into Guatemala.

Content: *Heloderma* Wiegmann, 1829; *Maxhosersaurus gen. nov.*

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CONFLICT OF INTEREST

The author has no conflicts of interest in terms of this paper or conclusions within.

The Gila monster (*Heloderma suspectum*) is a species of venomous lizard native to the southwestern United States and northwestern Mexican state of Sonora. A heavy, slow-moving lizard, up to 60 cm (2.0 ft) long, the Gila monster is the only venomous lizard native to the United States and one of only two known species of venomous lizards in North America, the other being its close relative, the Mexican beaded lizard (*H. horridum*). Though the Gila monster is venomous, its sluggish nature means it The venom of the gila monster (*Heloderma suspectum*) contains exendin-3 and exendin-4, two peptides that stimulate insulin secretion in response to increases in glycemia and modulate gastric emptying to slow the entry of ingested sugars in the blood. The 39 amino acid peptide exendin-4 has been developed into an injectable drug (Exenatide), which was approved for the treatment of type-2 diabetes by the US Food and Drug Administration in 2005.²

Frog Venoms. Peptides with insulin-releasing activity have been isolated from the skin secretions of the frogs *Agalychnis litodryas* and *Hoplobatrachus r...* There are two species of venomous lizards in the world. Both species belong to the genus *Heloderma* and are found in the Americas. Gila Monster (*Heloderma suspectum*). Gila Monster, Maricopa Co., AZ. Photo by Jim Rorabaugh. Within the 100-Mile Circle, the Gila Monster (*Heloderma suspectum*) is unique among lizards for its size (it is our the largest lizard, < 360 mm SVL, < 570 mm total length), its beaded skin, and it is our only venomous lizard. It is also the sole representative of the family Helodermatidae in Arizona and the USA. At least six other genera in the family are extinct. Until recently, the Gila Monster and Beaded Lizard were thought to be the only venomous lizards in the world. However, recent work has shown that some Monitor Lizards (*Varanidae*) and Iguanas (*Iguanidae*) also produce venom. An adult Gila Monster is unmistakable.

The Gila Monster (*Heloderma suspectum*) is a large, venomous lizard protected throughout its distribution in the southwestern United States and northwestern Mexico. Rapid urban growth in key areas of its range and increased encounters with humans prompted us to investigate translocation as a conservation tool with "nuisance" Gila Monsters. Twenty-five Gila Monsters reported as nuisances by residents in the northeastern Phoenix Metropolitan Area were translocated from 0 to 25,000 m from their point of capture. Gila monsters are only found in the Sonoran, Mojave and Chihuahuan deserts in the southwestern United States and northwestern Mexico. Gilas spend around 95 percent of their lives in their homes, which are underground burrows located in rocky foothills, according to National Geographic. Habits. The other venomous lizard is the Mexican beaded lizard (*Heloderma horridum*), which is closely related (in the same genus). This lizard does use its venom to kill its prey. Gila monsters can only run about 1 mph (1.6 km/h). Gilas use their big tails for balance while they walk. There is a drug for the management of Type 2 diabetes based on a protein from Gila monster saliva. The drug has the nickname "lizard spit," according to the San Diego Zoo. Additional resources. Genus. *Heloderma*. Conservation status. Near Threatened. Gila Monster Evolution. Many experts believe that the Gila Monster is one of the most advanced species of Lizards in terms of survival and intelligence. It is possible that they could be closely related to snakes since they are one of the two only venomous species of Lizards. These areas include sections of Arizona, New Mexico, California, Utah, and Nevada. They have also been found in areas of Mexico. They love the desert areas and so several of them are also living in the Mojave, Chihuahuan, and Sonoran Desert areas. Gila Monster Diet and Feeding Habits. For the Gila Monster mating takes place during the summer when they have the most food. They live alone with the exception of when they are looking for a mate. Lizard guide for Gila Monsters, *Heloderma suspectum*, Venomous lizard facts and information, lizard care, food, and habitat, *Helodermatida* pictures of Reticulated Gila Monster and Banded Gila Monster. Guide to lizard taxonomy to help identify lizards, description for lizard families and species, lizard classification with a list of all types of lizards. Pet Lizards. Choosing a pet lizard, facts about different types of lizards and a list of the best beginner lizards, information on how to keep and handle lizards, lizard pet care, cages, food and breeding. *Heloderma suspectum suspectum*, the Reticulate Gila Monster, occurs south and east of the range of *H. s. cinctum*. A 2010 study (Douglas et al. *Molecular Phylogenetics*). Genus. *Heloderma*. Gila Monsters and Beaded Lizards. *Heloderma* - Greek helos - a nail or stud and derma - skin - refers to the rough texture of the skin of this genus *suspectum* - Latin - mistrusted or suspected - refers to a venomous nature which was suspected but not proven at time of naming. *cinctum* - Latin - belted - referring to the broad double crossbands.