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Four new species of snake from Central Africa (Serpentes: Colubridae) and (Serpentes: Lamprophiidae).

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ABSTRACT

An audit of rainforest snakes found on both sides of the Dahomey Gap in West Africa found that a number of species were in fact composite.

Some of these were found to include taxa for which there were no available names.

This paper formally names four of them according to the Zoological Code (Ride *et al*. 1999).

The species now effectively divided in two, based on morphological, distributional and geological evidence are as follows: the Emerald Snake *Hapsidophrys smaragdina* (Schlegel, 1837); the Black-lined Green Snake *Hapsidophrys lineatus* Fischer, 1856; African Banded Snake *Chamaelycus fasciatus* (Günther, 1858) and the Leach's Wolf Snake *Lycophidion irroratum* (Leach, 1819).

In every case the nominate form is now confined to the forested region west of the Dahomey Gap, commencing from about Ghana and progressing west to include the forests of Guinea, with the newly described taxa being found in the region to the east of Benin and including the main forested Central African region.

Keywords: Taxonomy; nomenclature; snakes, Africa; *Hapsidophrys*; *Chamaelycus*; *Lycophidion*; new species; *pintaudii*; *daranini*; *euanedwardsi*; *woolfi.*

INTRODUCTION

The Dahomey gap in the region of Togo/Benin West Africa has long been recognized as a barrier to forest species dispersal in geologically recent times (Maurin *et al.* 2007; Murphy and Collier 1999; Weber 2001; White 1983).

Across various zoological disciplines, populations of animals thought to consist a single species on both sides of the Dahomey Gap have been found to be sufficiently divergent to warrant being classified as two separate species Murphy and Collier (1999) for fish and Lenk *et al.* (1999) for snakes.

An audit of species of snake found on both sides of the Dahomey Gap did show many recognized as single species to be composite, as in being different on both sides of the gap.

This is clearly the result of the same drying factors that have separated entire ecosystems and all the species within them, allowing each side to continue evolving and speciating independently.

In terms of the snakes found to be different, the vast majority of composite species were also found to have available names.

That is earlier workers (usually from the 1800's) had proposed names for the relevant species populations, only to have them relegated to synonymy later on by others in later reviews.

Since then and more recently, myself or others have found these named species to represent different taxa to the similar earlier described forms from across the Dahomey Gap.

One such example was the relegation of *Bitis rhinoceros* into synonymy with *B. gabonica* for many years until Lenk *et al.* (1999) resurrected the former as a full species, which is a position I concur with.

The physical barrier separating the divergent forest viper populations was the Dahomey Gap.

The audit of the species of snake affected by this barrier did also find two viper species to have diverged across the barrier, the result being each unnamed population needed to be formally described.

That has been done in two other papers published at the same time as this one.

Those species split into two were, *Bitis* (*Macrocerastes*) *nasicornis* Shaw, 1802 and *Causus lichtensteini* Jan, 1859.

In the case of both species, it was the populations east of the Dahomey Gap that were described as new species.

In terms of snakes within the Colubridae, two species (as generally accepted at the present time) within the genus *Hapsidophrys* were found to each consist of two allopatric species, being found on either side of the Dahomey Gap.

These were the Emerald Snake *Hapsidophrys smaragdina* (Schlegel, 1837) and the Black-lined Green Snake *Hapsidophrys lineatus* Fischer, 1856.

As a result, for each taxon group, I have described the unnamed species taxa below.

For the West African Lamprophiidae, two species groups were found to have diverged into allopatric species populations, each with one population needing to be formally named at the species level.

These are the snakes currently recognized as the African Banded Snake *Chamaelycus fasciatus* (Günther, 1858) and the Leach's Wolf Snake *Lycophidion irroratum* (Leach, 1819).

Although this was not planned, it turned out that in each case the nominate forms were found west of the Dahomey Gap, with the populations east of there being the unnamed ones.

While each new species is diagnosed below and in accordance with the Zoological Code (Ride *et al.* 1999), it will be easiest for most field herpetologists to simply assume that specimens formerly attributed to the split species in the countries east of Nigeria (including Nigeria), will in fact be the newly described taxa, derived from the same species groups.

Due to the fact that the newly named species have generally been regarded as being no different to the species from where they have been split as already noted, there is little if any relevant literature on the comparative taxonomy of the relevant snakes.

My own review consisted of an audit of literature, live specimens, dead specimens and images with reliable locality data, in order to ascertain the taxonomic status of the relevant snakes.

That has in effect been the "material and methods" of this study.

Because of the known distribution of the "old" and "newly described" species, most published material on the "old" species can be readily extrapolated to the new, if appropriate and based on the location of the subject specimens.

As a result, I think it is important to cite key literature in terms of each of the newly described species and those from where they have been split.

The most obvious morphological differences between the species described and those with which they have been lumped with to date are given in the descriptions below. This will enable people to identify given species in the absence of locality data, although I note for many people, locality data will in effect be sufficient to define which species they have in hand and usually be the easiest alternative to use in terms of accurate species-level identification.

The Colubrid genus *Hapsidophrys* as presently recognized consists of just three species, namely, *Hapsidophrys lineatus* Fischer, 1856, *Hapsidophrys principis* (Boulenger, 1906) and *Hapsidophrys smaragdina* (Schlegel, 1837).

Hapsidophrys principis (Boulenger, 1906) occurs on São Tomé and Príncipe Islands in the Gulf of Guinea, off the African coast. The other two, as recognized prior to the publication of this paper, were found on both sides of the Dahomey Gap in forested sub-Saharan and central Africa.

The taxonomy of *Hapsidophrys principis* (Boulenger, 1906) and to a lesser extent the rest of the genus was dealt with by Jesus *et al.* (2009).

Other important publications in terms of the three species of *Hapsidophrys* include the following: Barnett (2001), Barnett and Emms (2005), Blanc and Fretey (2000), Bocage (1895), Böhme *et al.* (2001), Boulenger (1894, 1897, 1906), Branch and Rödel (2003), Broadley (1966, 1998), Broadley and Howell (1991), Burger *et al.* (2004), Capocaccia (1961), Chifundera (1990), Chirio and Lebreton (2007), Cope (1861), Doucet (1963), Fischer (1856), Gossmann *et al.* (2002), Günther (1896), Hallowell (1844, 1854, 1857), Hofer (2002), Jackson (2008), Jackson *et al.* (2007), Lawson *et al.* (2005), Loveridge (1936), Luiselli (2000), Manacas (1858), Pauwels and David (2008), Pauwels and Vande weghe (2008), Pauwels *et al.* (2002, 2004, 2007), Rödel and Mahsberg (2000), Schatti and Loumont (1992), Schlegel (1837), Schmidt (1923), Sclater (1891), Segniagbeto *et al.* (2011), Sinsin and Bergmans (1999), Spawls *et al.* (2001), Sternfeld (1917), Trape and Roux-Esteve (1995), Werner (1899, 1902), Williams and Wallach (1989) and sources cited therein.

Important publications in terms of the African Banded Snake *Chamaelycus fasciatus* (Günther, 1858) and the other species in the same genus include Angel (1934), Bogert (1940), Boulenger (1893, 1919), Broadley (1998), Chifundera (1990), Chippaux (2001), Chirio and Lebreton (2007), Günther (1858), Hughes (1983), Lebreton (1999), Loveridge (1936), Mocquard (1902), Pauwels and Vande weghe (2008), Pauwels *et al.* (2002), Schmidt (1923), Segniagbeto *et al.* (2011), Sinsin and Bergmans (1999), Spawls *et al.* (2001), Sternfeld (1917), Trape and Roux-Esteve (1990, 1995), Werner (1899), Witte (1963) and sources cited therein.

The genus *Lycophidion* as currently recognized includes about 19 species. However a number of phylogenies, including those of Pyron *et al.* (2011 and 2013) both show the genus to be paraphyletic at the genus level. However important publications in terms of the Leach's Wolf Snake *Lycophidion irroratum* (Leach, 1819) include Barnett (2001), Barnett and Emms (2005), Böhme and Schneider (1987), Boulenger (1893), Broadley (1992, 1998), Broadley and Hughed (1983), Chifundera (1990), Chirio and Lebreton (2007), Günther (1858, 1868, 1896), Laurent (1968), Leach (1819), Segniagbeto *et al.* (2011), Trape and Mane (2006), Werner (1897) and sources cited therein.

HAPSIDOPHRYS PINTAUDII SP. NOV.

Holotype: A specimen at the Field Museum of Natural History, (FMNH), Division of Amphibians and Reptiles, Roosevelt Road at Lake Shore Drive, Chicago, Illinois, 60605, USA. Specimen number 214773 from the Democratic Republic of Congo. This is a facility that allows access to its collection by scientists.

Paratype: A specimen at the Field Museum of Natural History, (FMNH), Division of Amphibians and Reptiles, Roosevelt Road at Lake Shore Drive, Chicago, Illinois, 60605, USA. Specimen number 145179 from the Democratic Republic of Congo. This is a facility that allows access to its collection by scientists.

Diagnosis: This species was until now treated as the eastern variant of the Emerald Snake *Hapsidophrys smaragdina* (Schlegel, 1837).

Hapsidophrys pintaudii sp. nov. is separated from *H. smaragdina* by the fact that in *Hapsidophrys pintaudii sp. nov.* the lower postocular is noticeably smaller than the upper one. In *H. smaragdina* both postoculars are of similar size.

In *Hapsidophrys pintaudii sp. nov.* there is a dark blackish streak running along each side of the head, through the eye and to the nostril or just before it, with the streak being sufficiently wide as to run across the entirety of the lower postocular.

By contrast in *H. smaragdina* the streak running along each side of the head is relatively indistinct and narrow (or entirely absent), and is never of sufficient width to run across the entirety of the lower postocular.

In *Hapsidophrys pintaudii sp. nov.* the yellowish-green lower labials have some darker speckling on the scales. This is absent in *H. smaragdina.*

Both *Hapsidophrys pintaudii sp. nov.* and *H. smaragdina* are diagnosed as follows: Rostral is broader than deep, visible from above; internasals longer than the praefrontals; frontal is one and a half times as long as broad, as long as or a little longer than its distance from the end of the snout, or as long as or slightly shorter than the parietals; loreal is two to three times as long as deep, sometimes confluent with the praefrontal; one praeocular, in contact with or narrowly separated from the frontal; two postoculars; temporals 1+2; nine (rarely 8) upper labials, fifth and sixth or fourth and fifth entering the eye. Five or

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six lower labials are in contact with the anterior chin-shields, which are shorter than the posterior. There are 15 dorsal mid body scale rows (15 anterior and 11 posterior), all strongly keeled and distinctly striated. There are 150-174 ventrals, divided anal and 140-172 subcaudals. The colour is a dark bluish green above, commonly green but with blue between the scales, being pale yellowish or green ventrally and on the upper lip. While there is usually some form of demarcation along each side of the head, which passes through the eye, this is noticeable in particular in *Hapsidophrys pintaudii sp. nov.*, rather than in *H. smaragdina* (see the diagnosis above).

Distribution: Forested areas east of the Dahomey Gap, being the countries from Nigeria and east of there in forested Central Africa. This includes far northern Angola, the Democratic Republic of the Congo (Zaire), Congo (Brazzaville), Gabon, Equatorial Guinea, Cameroon, Central African Republic, Nigeria and Tanzania.

Specimens formerly referred to as *H. smaragdina* from São Tomé und Principé in the Gulf of Guinea, are now referred to the species *Hapsidophrys principis* Boulenger, 1906 (Jesus *et al.* 2009).

Etymology: Named in honour of Vince Pintaudi in recognition of his services to reptile conservation and welfare through his managerial role at the Melbourne, Victoria, Australia, business, "Amazing Amazon" a shop in Glen Waverley, Victoria, Australia, that specializes in reptiles and fish, as well his work as a snake and reptile relocator in Melbourne's south-eastern suburbs.

HAPSIDOPHRYS DARANINI SP NOV.

Holotype: A specimen at the American Museum of Natural History, Division of Vertebrate Zoology (Herpetology), 79th Street and Central Park West, New York, New York 10024, USA, specimen number 12131 from Medje in the Democratic Republic of Congo, Africa. This is a government owned facility that allows access to its material by scientists.

Paratype: Specimens at the American Museum of Natural History, Division of Vertebrate Zoology (Herpetology), 79th Street and Central Park West, New York, New York 10024, USA, specimen numbers 12132, 12133 and 12129 also from the Democratic Republic of Congo, Africa. This is a government owned facility that allows access to its material by scientists.

Diagnosis: This species was formerly regarded as the eastern variant of *Hapsidophrys lineatus* Fischer, 1856.

Hapsidophrys daranini sp. nov. is separated from *H. lineatus* by the fact that the upper postocular is nearly twice the length of the lower one, versus being of similar length or slightly longer only in *H. lineatus.*

Hapsidophrys daranini sp. nov. is also diagnosed by the size and shape of the loreal scale. In *Hapsidophrys daranini sp. nov.* it is of similar or same size as the two labials it borders below. By contrast in *H. lineatus* the loreal is noticeably narrower than the two labials it borders below.

In both *Hapsidophrys daranini sp. nov.* and *H. lineatus* there is black etching to the scales on the head. However in *Hapsidophrys daranini sp. nov.* this does not overflow onto the scales of the side of the head, which is the case in *H. lineatus.*

Both *Hapsidophrys daranini sp. nov.* and *H. lineatus* are diagnosed as follows: Nostril is broader than deep being just visible from above. The internasals are as long as the praefrontals; frontal is one and half to one and two thirds as long as broad, as long as or a little longer than the distance from the end of the snout, as long as the parietals; loreal at least twice as long as deep; one praeocular (rarely two) not touching the frontal; two postoculars only; temporals 2+2 (rarely 1+2); eight or nine upper labials with the fourth and fifth or fifth and sixth entering the eye; four to six lower labials in contact with the anterior chin-shields, which are as long as or a little shorter than the posterior.

There are 15 dorsal mid body scale rows (15 anterior and 11 posterior), striated and keeled, the outer row without or with a very faint keel. 158-170 ventrals, single anal, 95-158 subcaudals. Dorsally the colour is a striated black and green, each scale green in the middle and black on the sides; upper lip and lower parts are pale green or yellowish green.

In *H. lineatus* the upper lip (labials) is a pale green colour, whereas in *Hapsidophrys daranini sp. nov.* the upper lip is a distinctive yellow colour, running across the upper labials, but only including the lower parts of the first two, and then the entire labial scales for the second trio, which means this yellow region meets the lower eye.

Distribution: Forested areas of central Africa, east of the Dahomey Gap. This includes Uganda, Western Tanzania, Kenya, Rwanda, Burundi, the Democratic Republic of the Congo (Zaire), Congo (Brazzaville), Gabon, Equatorial Guinea, Cameroon, Nigeria and the Central African Republic.

Etymology: Named in honour of Dara Nin of Ringwood, Victoria, Australia, in recognition of many years of active wildlife conservation and education through his role with Snakebusters, Australia's best wildlife displays, including in 2012 taking a bite from an adult female venomoid Death Adder *Acanthophis bottomi* to shatter the repeated lie peddled by Ron Waters of the Victorian Department of Sustainability and Environment and his criminal associates that the snakes have regenerated venom and are dangerous.

Other than having a chewed up forearm, nothing happened to Dara!

CHAMAELYCUS EUANEDWARDSI SP. NOV.

Holotype: A specimen at the United States National Museum (USNM) Washington, DC, USA, specimen number: 570889 from Mt. Nlonako, Cameroon, Africa. The United States National Museum is a government-owned facility that allows access to its specimens by researchers.

Paratypes: Two specimens at the United States National Museum (USNM) Washington, DC, USA, specimen numbers: 570891 and 570890 from Mt. Nlonako, Cameroon, Africa. The United States National Museum is a government-owned facility that allows access to its specimens by researchers.

Diagnosis: Until now this taxon has been treated as a variant of the African Banded Snake *Chamaelycus fasciatus* (Günther, 1858) a species commonly placed in the genus *Lycophidion* until the genus *Chamaelycus* Boulenger, 1919 was resurrected by de Witte in 1963.

However *Chamaelycus euanedwardsi sp. nov.* is most readily separated from *C. fasciatus* by the fact that the venter is uniformly grey as opposed to being whitish in colour in *C. fasciatus* the ventral scales in *C. fasciatus* in fact being grey in colour but etched with white at the posterior side, the etching being about half the scale width, thereby giving the whitish in colour view at a distance.

In *Chamaelycus euanedwardsi sp. nov.* the head is entirely without markings, whereas in *C. fasciatus* the head is a light greyish brown in colour with a darker and slightly indistinct temporal streak of about two scales width on either side.

Chamaelycus euanedwardsi sp. nov. has 30 or more narrow dark cross-bands, interrupted along the mid-dorsal line, sometimes presenting as alternating transverse spots, versus usually less than 30 narrow dark crossbands or sets of such markings in *C. fasciatus.*

Both *Chamaelycus euanedwardsi sp. nov.* and *C. fasciatus* are diagnosed by the following traits: The diameter of the eye is much greater than its distance from the mouth. The rostral is twice as broad as deep, visible from above; internasals at least as large as the nasals, one half to two fifths the length of the prefrontals, which are broader than long; the frontal is as long as broad or broader than long, as long as or a little shorter than the parietals; loreal longer than deep; praeocular as large or a little smaller than the supraocular, forming a short suture with the

frontal; seven upper labials, third fourth and fifth entering the eye, sixth being the largest; anterior chin shields longer and wider than the posterior ones and in contact with four or five lower labials. 17 dorsal mid-body scale rows (17 anterior and 15 posterior), 175-198 ventrals, single anal, 34-56 subcaudals.

Chamaelycus euanedwardsi sp. nov. has a known ventral range of 175-198 versus 180-189 for *C. fasciatus.*

Distribution: Forested areas of central Africa, east of the Dahomey Gap. This includes the Democratic Republic of the Congo (formerly Zaire), Congo (Brazzaville), Gabon, Equatorial Guinea, Cameroon, Nigeria and the Central African Republic.

Etymology: Named in honour of Gold-coast, Queensland Australia herpetologist Euan Edwards in recognition of a stellar career in herpetology spanning some decades and including long stints of research in the United States, Madagascar and elsewhere and for his largely unseen (by most people) contributions to the taxonomy and nomenclature of the world's reptiles.

LYCOPHIDION WOOLFI SP. NOV.

Holotype: A female specimen at the American Museum of Natural History, Division of Vertebrate Zoology (Herpetology), 79th Street and Central Park West, New York, New York 10024, USA, specimen number 12035 from Garamba in the Democratic Republic of Congo, Africa. This is a government owned facility that allows access to its material by scientists.

Paratype: A female specimen at the American Museum of Natural History, Division of Vertebrate Zoology (Herpetology), 79th Street and Central Park West, New York, New York 10024, USA, specimen number 12041 from Dungu in the Democratic Republic of Congo, Africa. This is a government owned facility that allows access to its material by scientists.

Diagnosis: Until now, this species has been treated as a regional variant of the Leach's Wolf Snake *Lycophidion irroratum* (Leach, 1819).

Lycophidion woolfi sp. nov. is most readily separated from *L. irroratum* by colour pattern. Unlike *L. irroratum* in *Lycophidion woolfi sp. nov.* the colouration is entirely blackish-brown above and below and without a trace of spots.

By contrast specimens of *L. irroratum* are brown above, with or without a dark vertebral line; a series of transverse dark brown or black spots usually present along each side of the back, these spots wide apart and usually alternating with those on the other side; head is speckled or vermiculated with dark brown; a yellowish, dark-edged streak from the eye to the angle of the mouth; ventrals and subcaudals are dark brown or olive brown in the middle and yellowish speckled with brown on the sides.

Both *Lycophidion woolfi sp. nov.* and *L. irroratum* have similar physical traits and scalation, diagnosed as follows: The diameter of the eye is greater than the distance from the mouth. The rostral is twice as broad as it is deep, visible from above; internasals are hardly as large as the nasals; praefrontals are a little longer than broad; frontal is as long as it is broad or a little longer, shorter than its distance from the end of the snout which nearly equals the length of the parietals; loreal longer than deep; praeocular is nearly as large as or larger than the supraocular, broadly in contact with the frontal; two postoculars, both in contact with the parietal; temporals 1+2; eight upper labials with the third, fourth and fifth entering the eye; seventh is the largest; chin-shields are very small, the anterior in contact with four or five lower labials. 17 dorsal mid-body scale rows (17 anterior and 15 posterior); 164-189 ventrals; single anal; 37-52 subcaudals. The tail is between 11 and 13 percent of the total body length.

Distribution: Known from the forested areas of central Africa, east of the Dahomey Gap, including the Central African Republic, Cameroon and the Democratic Republic of the Congo (formerly Zaire). It is also presumably present in adjacent countries with similar forested habitats.

Etymology: Named in honour of Paul Woolf, of Walloon, west of Brisbane, Queensland, Australia, in recognition for his contributions to herpetology spanning some decades, including as foundation president of the Herpetological Society of Queensland (HSQI) and a considerable amount of research work on Australian reptiles and other wildlife, most of which has been conducted without fanfare or publicity and in the face of intense harassment at times by corrupt wildlife officers motivated solely by personal greed.

For a while he lived in Sydney, NSW, but like many other herpetologists (including for example Shane Black, Michael Cermac, Brian Bush, John Scanlon, Matthew Lebreton, Greg Wallis, Trevor Sullivan and Kaj Bulliard), he fled the ongoing harassment by corrupt wildlife officers working for the NSW National Parks and Wildlife Service, AKA NPWS (see Hoser 1993 and 1996 for details), including the ever present risk of illegal violent armed raids in the middle of the night or at dawn and has been living in Queensland for more than ten years as of 2013.

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CONFLICT OF INTEREST

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