

## A review of the gekkotan lizards of Bénin, with the description of a new species of *Hemidactylus* (Squamata: Gekkonidae)

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### Abstract

The gecko fauna of Bénin is extremely poorly known, with only two species having previously been mentioned in the literature on the basis of voucher specimens. We provide evidence for the occurrence of seven additional species, bringing the national total to nine confirmed species. Another five species are known from localities to both the east and west of Bénin and almost certainly are part of the national fauna. One of the species confirmed for Bénin is a new species of *Hemidactylus*. This new form is distinguished by its 14–16 dorsal tubercle rows, enlarged median subcaudal scales, atuberculate tail dorsum, 38 precloacal-femoral pores, and 6–7 (usually 7) divided scansors beneath digit four of both the manus and pes. We also provide the first record of *Lygodactylus conraui* for Togo.

**Key words:** West Africa, Bénin, Togo, Gekkonidae, Eublepharidae, *Hemidactylus*, description

### Introduction

The herpetofauna of Bénin is among the most poorly documented of any African country. Bauer (1993) provided an estimate 125 reptile species for Bénin, including 31 lizard species. This, however, was based in large part on inference from broader distribution patterns and the presence of many of these species is not supported by the existence of voucher specimens in museum collections. A more recent estimate of 97 reptile species (World Resources Institute 2003) exists, but it is not known on what basis this total was calculated. Lizards, in particular, have been chronically understudied in most of West Africa, and this is perhaps most true for geckos, which, because of their nocturnal activity,

are rarely encountered by casual collectors. The gekkonid fauna of adjacent Togo has been much more well documented, starting with the extensive collections made during the German colonial period (Matschie 1893a, 1893b; Werner 1899; Tornier 1901) and continuing to the present (Hagedoorn 1985). Likewise Ghana, to the west, has also been more well studied (Booth 1956; Hughes 1988), as has Nigeria (Romer 1953; Grandison 1962; Blackwell 1967; Dunger 1968; Butler 1986; Sura 1986), although given the much larger size of these countries, especially the latter, sampling has still been inadequate.

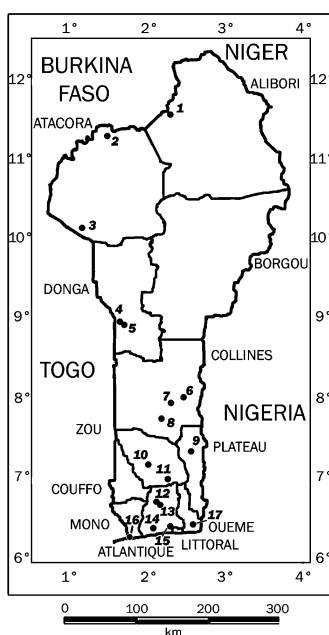
Unlike some African countries, such as Senegal and Algeria, Bénin (then Dahomey) was poorly researched and collected during the French colonial period. Indeed, the only published report mentioning geckos from Bénin prior to World War II was that of Chabanaud (1917), who reported on a variety of small collections made in Bénin and other then French administered areas of West Africa. Five collectors from the period 1910-1913 collected reptiles in Bénin: Bouet, Brot, de Girocourt, Gruvel and Waterlot. However, only the first of these collected more than a few specimens, and all but one of Chabanaud's Bénin gecko records are based on Bouet's material. Loveridge (1947), in his monographic treatment of the geckos of Africa, recorded representatives of only two gekkonid species in Bénin, *Hemitheconyx caudicinctus* (Duméril) and *Hemidactylus angulatus* Hallowell (as *H. brookii angulatus*), both of these based entirely on Chabanaud's (1917) earlier records.

Loveridge (1952) subsequently reported on a herpetological collection from Togo and Bénin, noting that Bénin had been "very much neglected" herpetologically. To underscore this, the new collection he reported on contained only a single gecko species, *Hemidactylus brookii angulatus*. Although adding no new species records to the fauna, Loveridge (1952), did provide some specific localities for this species: Abomey, Bassila and Koussokoingou (Fig. 1). Although a variety of later authors publishing on West Africa in general have ostensibly included some or all of Bénin in their area of study, none appear to have cited gecko specimens explicitly. As a case in point, Papenfuss (1969) included extreme northern Dahomey in his definition of "arid central West Africa," but included no specimen references from Bénin in his publication.

In order to better clarify and document the reptile fauna of Bénin, we have reviewed existing data regarding the occurrence of the lizard families Gekkonidae and Eublepharidae in Bénin. A small collection of geckos was made from localities throughout the country, as well as from neighboring Togo, by one of the authors (S. Tchibozo) during 2004–2005. This material has been deposited in the Institut Royal des Sciences Naturelles de Belgique (IRSNB). We have supplemented this new material with information from published records and additional specimens from other museum collections. We here present an overview of the species of gekkotan lizards known or suspected to occur within the territory of the République du Bénin along with the description of a new species of *Hemidactylus* Oken, collected during recent survey work.

## Material and methods

Specimens and/or specimen records for geckos from Bénin were obtained from the following museum collections: California Academy of Sciences, San Francisco (CAS), Field Museum of Natural History, Chicago (FMNH), Institut Royal des Sciences Naturelles de Belgique, Brussels (IRSNB), Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts (MCZ) and Yale Peabody Museum of Natural History, New Haven (YPM). Species for which no Bénin voucher specimens exist, but which, on the basis of known distribution and habitat preference, are predicted to occur within the country are also discussed.



**FIGURE 1.** Map of Bénin showing the localities referred to in the text. Coordinates are degrees north and east. Large font — neighboring countries, small font — départements. Numbered localities : 1 = Chutes de Koudou, Parc National du W du Bénin, 2 = Parc National de la Pendjari, 3 = Koussokoinga (=Koussoukoingou), 4 = Bassila, 5 = Manigri, 6 = Diho (=Idiho), 7 = Agougou (=Agouagon), 8 = Collines de Dassa-Zoumè, 9 = Kétou, 10 = Abomey, 11 = Lokoli, 12 = Niaouli, 13 = Attogon, 14 = Ouidah, 15 = Godomé, 16 = Grand Popo, 17 = Porto Novo.

The following measurements were taken with Brown and Sharpe Digit-cal Plus digital calipers (to the nearest 0.1 mm): snout-vent length (SVL; from tip of snout to vent), trunk length (TrunkL; distance from axilla to groin measured from posterior edge of forelimb insertion to anterior edge of hindlimb insertion), crus length (CrusL; from base of heel to knee); tail length (TailL; from vent to tip of tail), tail width (TailW; measured at widest point of tail); head length (HeadL; distance between retroarticular process of jaw and snout-tip), head width (HeadW; maximum width of head), head height (HeadH; maximum

height of head, from occiput to underside of jaws), ear length (EarL; longest dimension of ear); forearm length (ForeaL; from base of palm to elbow); orbital diameter (OrbD; greatest diameter of orbit), nares to eye distance (NarEye; distance between anteriormost point of eye and nostril), snout to eye distance (SnEye; distance between anteriormost point of eye and tip of snout), eye to ear distance (EyeEar; distance from anterior edge of ear opening to posterior corner of eye), internarial distance (Internar; distance between nares), and interorbital distance (Interorb; shortest distance between left and right supraciliary scale rows).

Scale counts and external observations of morphology were made using a Nikon SMZ-1000 stereomicroscope. Radiographic observations were made using a Faxitron closed cabinet x-ray system (30 seconds at 23 kV).

## The geckos of Bénin

### Eublepharidae

#### *Hemitheconyx caudicinctus* (Duméril, 1851)

This is the only eublepharid gecko occurring in the region. It is widespread, chiefly in savanna areas from Senegal to Nigeria (Loveridge 1947). Dunger (1968), who provided numerous localities for *H. caudicinctus* in Nigeria, considered it widespread across the Guinea Savanna. Both Loveridge (1947) and Grandison (1956) explicitly stated that the range of the species included Bénin, but apparently only on the basis of localities originally reported by Chabanaud (1917). This species is common in the pet trade and commercially purchased specimens from Bénin have also been used in laboratory studies, accounting for numerous museum specimens without specific locality data.

#### *Localities*

Kétou, Département du Plateau: CAS 165588; Diho (=Idiho), Département des Collines (8°05'N, 2°31'E) : USNM 199564-65; Agougon (=Agouagon), Département des Collines: Chabanaud (1917); Haute-Dahomey: Chabanaud (1917); no specific locality: FMNH 170554-55; MCZ R 104068-69; YPM 8126 (3 specimens), 8129, 8171 (12 specimens), 8416.

### Gekkonidae

#### *Cnemaspis spinicollis* (Müller, 1907)

Perret (1985, 1986) considered this species to have a broad range from Côte d'Ivoire to

Cameroon, but did not include Bénin in his summary of distribution. In Cameroon, where it is most well-documented, it has been recorded chiefly from forested habitats (Perret 1986; Lawson 1993) and from montane savanna (Böhme 1975). Dunger (1968) reported several localities in southwestern Nigeria (Akure, Yemoji, Ibadan) and Joger (1981) provided two localities in Togo. Although no material from Bénin has yet been identified, it is a virtual certainty that *C. spinicollis* is present.

### ***Lygodactylus conraui* Tornier, 1902**

This small, diurnal gecko is extremely widespread in West Africa from Sierra Leone in the west to Cameroon and possibly Equatorial Guinea in the east and south (Loveridge 1947; Pasteur 1965; Dunger 1968). Pasteur (1965) noted that no specimens had been recorded from either Togo or Bénin. The specimens reported here thus represent the first confirmed record for the country. In addition, we also report a specimen (IRSNB 17158) of this species from the Forêt de Dzogbegan (07°04'15"N, 00°38'15"E), Togo (Fig. 2), constituting the first record for this country as well. Variation within this species throughout its range is high (Perret 1963; Pasteur 1965; van Eijsden 1978). The specimens from Togo and Bénin both definitively key out to *L. conraui*, but they differ substantially from one another. Whether this reflects intraspecific variation or the presence of multiple taxa within *L. conraui* as presently construed requires further investigation. The Bénin specimens were collected in swamp forest.

#### *Locality*

Lokoli, Département du Zou: IRSNB 17161-1, 17161-2.

### ***Lygodactylus gutturalis* (Bocage, 1873)**

Loveridge (1947) listed numerous localities for this species (as *L. picturatus gutturalis*) elsewhere in both East and West Africa, but none in countries bordering the eastern Gulf of Guinea. Pasteur (1965) did not specify the localities of material he examined, but depicted the species' range as extending from Senegal and southernmost Mauritania to the Horn of Africa, and incorporating all but the southernmost parts of Bénin. We were unable to confirm vouchered records of this species for Bénin, but Dunger (1968) reported material from Kadur in western Nigeria and it is clear that this species must also be present in Bénin.

### ***Ptyodactylus ragazzi* Anderson, 1898**

Loveridge (1947) regarded *Ptyodactylus* from northern Togo as referable to *P.*

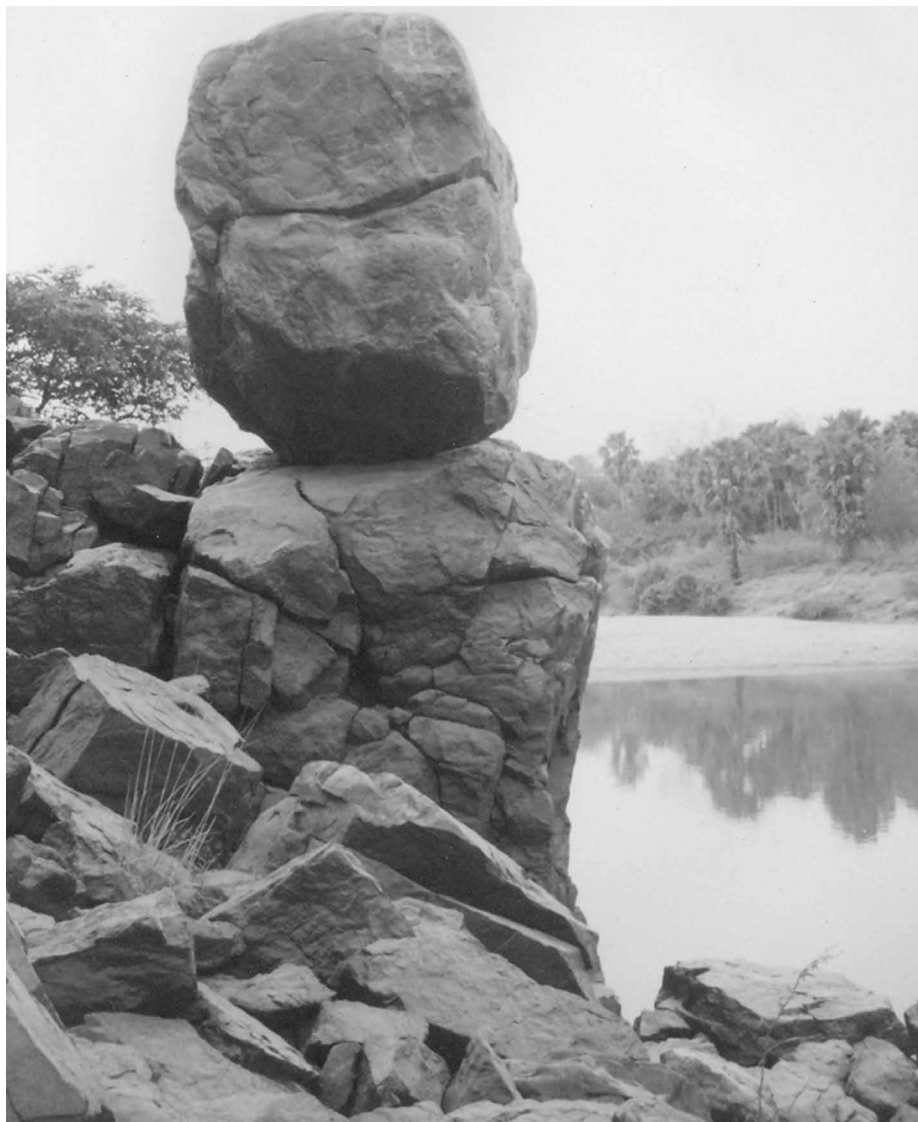
*hasselquistii togoensis* Tornier, 1901 and referred *P. h. ragazzi*, with its type from Eritrea, to the synonymy of *P. h. hasselquistii* Donndorff. However, Heimes (1987) demonstrated that *P.h. ragazzi* and *P.h. togoensis* were synonyms and resurrected the older name for the subspecies ranging across the central Sahara and the Sahel. He considered the range in West Africa to span from Côte d'Ivoire to Cameroon, but did not examine any material from Bénin. Schleich *et al.* (1996) subsequently accorded full species status to *P. ragazzi*, but without explicit justification. Baha El Din (1999) provided evidence of sympatry between *P. hasselquistii* and *P. ragazzi* in southeastern Egypt, demonstrating that they should indeed be considered distinct species. The species is widespread in northern areas of Nigeria (Dunger 1968; Butler 1986) and Cameroon (LeBreton 1999). Dunger (1968) considered *P. ragazzi* to be a rupicolous or crevice-dwelling savanna species, although Butler (1986) collected it at the Jebba crossing of the Niger River in western Nigeria in a small shed. There appear to be no prior published records of this species from Bénin. Our material was collected on boulders (Fig. 3) or abandoned buildings adjacent to boulders, confirming earlier ecological observations from Nigeria. The largest individual collected (IRSNB 17151-3) measured 77.7 mm SVL.

#### Localities

Chutes de Koudou, Parc National du W du Bénin, Département de l'Alibori (11°38'N, 02°18'E): IRSNB 17151-1, 17151-2, 17151-3; Parc National du W du Bénin, Département de l'Alibori: IRSNB 17154; without specific locality: IRSNB 17171-1, 17171-4.



FIGURE 2. Forêt de Dzogbegan, Togo. Habitat of *Lygodactylus conraui*.



**FIGURE 3.** Boulder habitat of *Ptyodactylus ragazzi* at Chutes de Koudou, Parc National du W du Bénin, Département de l'Alibori.

***Tarentola ehippiata* O'Shaughnessy, 1875**

Grandison (1961) clarified the taxonomic status of this species, recognizing it as distinct from *T. annularis* Geoffroy Saint Hilaire and indicating a broad range in West Africa, although she did not examine material from Bénin. Joger (1984) considered the species to range from the Côte d'Ivoire to Cameroon and north into Mali, Burkina Faso, Niger and Tchad, but implied that no specimens were actually recorded from Bénin, although he

considered their occurrence certain. Our record below is thus the first confirmed record of *T. epphiata* for Bénin. Dunger (1968) reported this species from fig trees and in- and outside human dwellings and other buildings in northern Nigeria. Our specimens were taken in savanna habitat.

#### *Locality*

Parc National de la Pendjari, Département de l'Atacora (11°23'N, 01°31'E); IRSNB 17170-1, 17170-2.

### ***Hemidactylus* Oken, 1817**

*Hemidactylus* is the dominant gekkonid genus in West Africa. Nonetheless, relatively few species are known from the region in comparison with other parts of the continent, most notably the Horn of Africa (Lanza 1983; Bauer 1993). The genus as a whole is nearly pantropical and also occurs in warm temperate regions. It is a hugely successful group, with at least 84 recognized species (Kluge 2001; Bauer and Pauwels 2002; Henle and Böhme 2003; Baha El Din 2003, 2005; Bauer et al., in press), making it the second most speciose of all gekkonid genera. Henle and Böhme (2003) recognized ten species in West Africa: *H. mabouia* (Moureau de Jonnés), *H. brooki* (= *H. angulatus* Hallowell), *H. matschiei* (Tornier), *H. fasciatus* Gray, *H. ansorgii* Boulenger, *H. richardsonii* (Gray), *H. kamdemtohami* Bauer & Pauwels, *H. echinus* O'Shaughnessy, *H. muriceus* Peters and *H. pseudomuriceus* Henle & Böhme. An eleventh species has recently been described from northern Cameroon (Bauer et al., in press). We here confirm the presence of five of these from the territory of Bénin and consider another two *Hemidactylus* as probable. In addition, among our collections are two specimens not referable to any named species, which we describe here as new.

### ***Hemidactylus angulatus* Hallowell, 1852**

This species was only recently elevated to specific rank, having been elevated from a subspecies of the Asian *H. brookii*, to which it is very distantly related (Carranza and Arnold 2006). It is widespread in tropical Africa. Loveridge (1947) recorded localities from Sudan to Angola and in neighboring Nigeria. Dunger (1968) considered it the most common and widespread of all Nigerian gecko species, occupying a diversity of natural and edificarian habitats. This is certainly also the most commonly encountered gecko in Bénin. It is highly variable in color pattern (Loveridge 1947; Dunger 1968) and may sometimes be confused for the broadly sympatric *H. mabouia*. The biology of this species was recently considered by Gramentz (2000). *Hemidactylus angulatus* is the only gecko species in Bénin to have been reported from multiple localities by multiple earlier authors



(Chabanaud 1917; Loveridge 1947, 1952). Chabanaud (1917) recorded specimens from Agougon (=Agouagon) as both *H. brookii* and *H. stellatus* Boulenger. Most of the new material was collected from edificarian habitats, but specimens from Niaouli were found in semi-deciduous forest. The largest Bénin specimen (IRSNB 17168-3) measured 66.2 mm SVL.

#### *Localities*

Ajuda (Ouidah), Département de l'Atlantique: Loveridge (1947); Zomai (Ouidah), Département de l'Atlantique: Loveridge (1947); Godomey (=Godomé), Département de l'Atlantique: Loveridge (1947); Attogon, Département de l'Atlantique (06°43'N, 02°09'E): IRSNB 17168-1, 17168-2, 17168-3, 17168-4; Niaouli, Département de l'Atlantique (06°44'N, 02°08'E): IRSNB 17173-2; Amou Oblo, Togo, IRSNB 17166-1, 17166-2; Grand Popo, Département du Mono: Loveridge (1947); Abomey, Département du Zou: Loveridge (1952); Porto Novo, Département de l'Ouémé: Loveridge (1947); Agougon (=Agouagon), Département des Collines: Chabanaud (1917); Collines de Dassa-Zoumè, Département des Collines (07°45'N, 02°10'E): IRSNB 17150-1; Bassila, Département de la Donga: Loveridge (1952); Manigri, Département de la Donga: IRSNB 17245-1–17245-9; Koussokoinga (=Koussoukoingou), Département de l'Atacora: Loveridge (1952), MCZ R 51759-60; Parc National de la Pendjari, Département de l'Atacora (11°23'N, 01°31'E): IRSNB 17170-3; without specific locality: IRSNB 17171-2, 17171-3; MCZ R 159974; YPM 8133 (39 specimens), 8422 (3 specimens).

#### ***Hemidactylus ansorgii* Boulenger, 1901**

*Hemidactylus ansorgii* is widespread in West Africa from Liberia to Cameroon (Loveridge 1947; Henle & Böhme 2003), although as yet there are no confirmed records from Bénin. Henle and Böhme (2003) clarified the status of this species, which has been frequently misidentified in the past, thus calling in to question the validity of literature records (Dunger 1968; van Eijsden 1978) that have not been verified in this new light. Perret (1975) considered *H. ansorgii* as a junior synonym of *H. intestinalis* Werner, 1897, but Henle and Böhme (2003) have presented compelling evidence that the latter is, in reality, a junior synonym of *H. muriceus*.

#### ***Hemidactylus fasciatus* Gray, 1842**

This large (to at least 95 mm SVL elsewhere in its range; Schmidt 1919; Burger et al. 2004) and distinctive species is broadly distributed from Liberia to the eastern Democratic Republic of Congo. It has been recorded from both forest (Loveridge 1947; Perret 1963; Lawson 1993; Bauer & Pauwels 2002; Pauwels et al. 2004) and edificarian habitats

(Romer 1953; Joger 1982; Ota *et al.* 1987; Lawson 1993) elsewhere in its range. There are numerous records from Togo (Matschie 1893b; Tornier 1901; Loveridge 1947; Joger 1981) and we also have material from the Forêt de Missahoé (IRSNB 17149, 17159, 17167), but the specimens noted here constitute the first published record of *H. fasciatus* for Bénin.

#### *Localities*

vic. of Kétou, Département du Plateau: CAS 165585; IRSNB 17149, 17167, 17159 ; no specific locality: YPM 8426.

#### ***Hemidactylus mabouia* (Moreau de Jonnés, 1818)**

Although very widespread in sub-Saharan Africa (Loveridge 1947; Kluge 1969; Broadley 1977), Dunger (1968) considered the species uncommon in Nigeria, and regarded populations in port areas as introduced. There appear to be no published records of this species from Bénin, so the specimens cited below constitute a new country record. This species shares with *H. angulatus* broad transverse subcaudal plates and largely overlapping ranges of precloacal pores and tubercle rows. It is possible that some literature records of *H. angulatus* may be referable to *H. mabouia*. The biology of this species was recently considered by Gramentz (2000, 2003). The largest Bénin specimen (IRSNB 17169) measures 67.6 mm SVL.

#### *Localities*

Godomey (=Godomé), Département de l'Atlantique (06°22'N, 02°21'E): IRSNB 17160, 17246.; Abomey, Département du Zou (07°11'N, 01°59'E): IRSNB 17169; Niaouli (06°44'N, 02°08'E): IRSNB 17173-1, 17173-3.

#### ***Hemidactylus matschiei* (Tornier, 1901)**

This poorly-known, savanna-dwelling species was described from Togo (Tornier 1901) and has subsequently been collected as far east as west central Nigeria at Yankari Game Reserve (Dunger 1968), suggesting that it also occurs in Bénin. It is possible that the apparent rarity of this species is yet another reflection of the long-standing confusion regarding the identity of many of the West African *Hemidactylus* (Henle & Böhme 2003).

#### ***Hemidactylus muriceus* Peters, 1870**

Allocation of literature records to this species are confounded by the long standing

confusion surrounding this and several other *Hemidactylus* that has only recently (Henle & Böhme 2003) been satisfactorily resolved. Loveridge (1947) listed localities from Liberia to the Democratic Republic of Congo. Henle and Böhme (2003) did not examine all available museum material, but confirmed *H. muriceus* from Côte d'Ivoire to Cameroon. This includes the holotype of *H. intestinalis* from Missahöhe (Missahocé), Togo (see also Perret 1975). This distribution strongly suggested that *H. muriceus* is present in Bénin as well, but the specimens cited here constitute the first confirmed records for the country. The biology of this species was recently considered by Gramentz (2000).

#### *Locality*

vic. of Kétou, Département du Plateau: CAS 165586-87.

#### ***Hemidactylus pseudomuriceus* Henle & Böhme, 2003**

This recently described species is known from two localities, one in the Parc National d'Azagny, Côte d'Ivoire and the other at Jingwe (Yingui) in western Cameroon. The species inhabits primary forest near *Raphia* swamps. This distribution suggests that the species may be found in Bénin, perhaps in habitats such as the swamp forest of Lokoli.

#### ***Hemidactylus beninensis* sp. nov.**

Figures 4–5

#### *Holotype*

Institut Royal des Sciences Naturelles de Belgique (IRSNB) 2617, adult male; Bénin, Département des Collines, Collines de Dassa-Zoumè, (07°45'N, 02°10'E); collected by Sévérin Tchibozo, 13 June 2005. **Paratype.** IRSNB 2618, subadult male; same data as holotype.

#### *Etymology*

The specific epithet refers to the occurrence of the new species in the République du Bénin.

#### *Diagnosis*

A moderate-sized *Hemidactylus*, snout-vent length at least 68 mm. One pair of greatly enlarged postmentals, in contact behind mental. 14–16 rows of relatively small tubercles. 49 scale rows across venter between lowest rows of tubercles. Six to seven enlarged paired scapulars beneath fourth toes of both manus and pes. A single row of 38 precloacal-femoral pores in adult males. Original tail atuberculate, with median subcaudal scales forming

broad transverse plates. Dorsal pattern with a series of four complete, dark crossmarkings between nape and sacrum, alternating with incomplete transverse bands extending dorsally from the flanks but failing to meet along the dorsal midline.

*Hemidactylus beninensis* may be distinguished from all other mainland West African congeners on the basis of (sympatric taxa with differing or non-overlapping character states indicated parenthetically): 14–16 rows of dorsal tubercles (0 rows in *H. matschiei*, 0–4 rows in *H. richardsonii*, 8–10 in *H. ansorgii*, 18–24 rows in *H. fasciatus*, 18–20 rows in *H. n. sp.* from Cameroon), preloacal-femoral pores in male in single row of 38 (fewer than 12 in *H. echinus*, *H. muriceus*, and *H. ansorgii*, 14–17 in *H. pseudomuriceus*, 45 in *H. n. sp.* from Cameroon), median subcaudal scale row greatly enlarged transversely (not enlarged or hexagonally enlarged in *H. echinus*, *H. kamdemtohami*, *H. pseudomuriceus*, *H. muriceus*, and *H. ansorgii*). Both *H. angularis* and *H. mabouia* share overlapping preloacal-femoral pore counts and transversely enlarged subcaudal scales with *H. beninensis*; however, both species have conspicuous tubercles on the dorsum of the tail, whereas that in *H. beninensis*. The new species is most similar in general appearance to a newly described species of *Hemidactylus* from Cameroon (Bauer et al., in press), with which it shares a mostly smooth dorsal tail surface (atuberculate in *H. beninensis*, very weakly tuberculate in *H. n. sp.*), transversely enlarged subcaudal scales, and a similar dorsal color pattern. However, these taxa differ with respect to (*H. beninensis* versus *H. n. sp.*): size (68 versus 100 mm SVL), scansors beneath the fourth toe (6–7 versus 10–11), preloacal-femoral pores (38 versus 45 in the respective holotypes), and rows of dorsal tubercles (14–16 versus 18–20).

*Description (based on the holotype, IRSNB 2617)*

Adult male, SVL 68.3 mm. Head long (HeadL/SVL ratio 0.29), relatively narrow (HeadW/HeadL ratio 0.67), somewhat depressed (HeadH/HL ratio 0.44), strongly distinct from neck. Lores and interorbital region slightly inflated. Snout moderate (SnEye/HeadL ratio 0.41), less than twice eye diameter (OrbD/SnEye ratio 0.57); scales on snout and forehead small, granular; scales on snout much larger than those on occipital region. Eye relatively large (OrbD/HeadL ratio 0.24); pupil vertical with crenelated margins; supraciliaries short, without spines. Ear opening oval, relatively small (EarL/HeadL ratio 0.06); eye to ear distance greater than diameter of eyes (EyeEar/OrbD ratio 1.22). Rostral approximately 1.5 times wider (3.0 mm) than deep (1.9 mm), incompletely divided dorsally by a deeply-incised rostral groove; two enlarged supranasals separated by a single internasal; rostral in contact with supralabial I, supranasals, and internasal; nostrils oval, each surrounded by supranasal, rostral, first supralabial (narrow contact), and three postnasals, the middle one of which smallest, with very narrow contact with nostril rim; each nostril with a recessed valvular scale at posteromedial border; 3–4 rows of scales separate orbit from supralabials. Mental triangular, minimally deeper (3.2 mm) than wide (2.9 mm) and much deeper than infralabials; one pair of greatly enlarged postmentals

meeting at a point behind the mental, each postmental bordered anteriorly by first infralabial, medially by mental, and laterally and posteriorly by a series of four chin shields, the lateralmost much enlarged and also bordering first and second infralabials; remaining three chinshields smaller, approximately four times the size of a granular gular scale. Infralabials bordered by a row of enlarged and axially elongated scales, decreasing in size posteriorly. Enlarged supralabials to midpoint of orbit 8 (left)–9 (right); supralabials to angle of jaws 10 (right)–13 (left); infralabials 10 (left)–9 (right); interorbital scale rows across narrowest point of frontal 14, between supraciliaries 36.



**FIGURE 4.** Dorsal view of the holotype of *Hemidactylus beninensis* **sp. nov.** (IRSNB 2617). Scale bar = 20 mm.

Body moderately slender, trunk relatively long (TrunkL/SVL ratio 0.40), oval in cross-section, with very feebly developed ventrolateral folds without denticulate scales. Dorsal scales heterogeneous, granular; regularly arranged, small (4 times size of granules), weakly conical to slightly keeled, erect to posteriorly-directed tubercles extending from behind occiput to tail base; no tubercles on temporal region; tubercles more or less uniform across dorsum, somewhat more prominent on flanks; tubercles in 14 rows at midbody. Ventral scales larger than dorsal tubercles, subimbricate; somewhat larger on abdomen than on chest, granular and much smaller in gular region; midbody scale rows across belly to lowest row of tubercles 49. Precloacal-femoral pores in a single row of 38,

with a single poreless scales in midline separating continuous series of 19 pored scales on each side, extending nearly to knees. Scales on palm and sole smooth, flat, rounded; scales on dorsal aspects of limbs heterogeneous – granular, intermixed with larger domed to conical tubercles, particularly on knees and shanks.

Fore- and hindlimbs moderately long, stout; forearm and tibia moderately long (ForeaL/SVL ratio 0.15; CrusL/SVL ratio 0.17); digits relatively short, strongly clawed; all digits of manus and pes webbed proximally only; distal portions of digits curved, arising from distal portion of expanded subdigital pad; scansors beneath each toe divided, except for distalmost and a few, basal scansors (usually 0–1); scansors from proximalmost at least twice diameter of palmar scales to distalmost divided scansor: 5-6-7-7-7 (left manus), 5-7-6-7-7 (right manus), 5-7-8-7-6 (left pes), 4-7-7-6-6 (right pes). Relative length of digits of manus:  $IV \approx III > V > II > I$ ; of pes:  $IV > III > V > II > I$ .



**FIGURE 5.** Dorsal view of the paratype of *Hemidactylus beninensis* **sp. nov.** (IRSNB 2618). Scale bar = 20 mm.

Original portion of tail depressed; regenerated portion more slender; length of partly regenerated tail approximately equal to snout-vent length (TailL/SVL ratio 0.97); basal part of original portion of tail covered dorsally with small, posteriorly-pointed, subimbricate to imbricate scales, atuberculate; scales forming regular transverse rows, about 8 such rows per distinct caudal segment (corresponding to underlying muscle

segments); ventral scales much larger, smooth, imbricate, with a median row of greatly enlarged subcaudal plates extending nearly across the width of tail. Regenerated portion of tail like original but without segmentation. One small, rounded postcloacal spur on each side of tail base.

Mensural features (holotype/paratype). SVL 68.3/54.3 mm, ForeaL 10.5/8.3 mm, CrusL 11.5/9.9 mm, TailL 66.5 (31.3 regenerated)/51.3 (5.9 regenerated) mm, TailW 7.3/5.1 mm, TrunkL 27.2/21.0 mm, HeadL 19.7/16.4 mm, HeadW 13.2/10.3 mm, HeadH 8.7/6.1 mm, OrbD 4.6/4.1 mm, EyeEar 5.6/4.3 mm, SnEye 8.1/6.4 mm, NarEye 5.5/4.2 mm, Interorb 2.4/1.7 mm, EarL 1.3/1.5 mm, Internar 2.1/1.5 mm.

### *Osteology*

Parietal bones paired. Stapes imperforate. Phalangeal formulae 2-3-4-5-3 for manus and 2-3-4-5-4 for pes. Presacral vertebrae 26, including 3 anterior cervical (without ribs), 1 lumbar, and 2 sacral vertebrae; 5 pygal and 8.5 post pygal caudal vertebrae to point of regeneration (18.5 in paratype). One pair of slender, crescentic cloacal bones present in both holotype and paratype. Endolymphatic sacs enlarged extracranially, extending to level of 4<sup>th</sup>–6<sup>th</sup> vertebrae in both specimens. Radiographs reveal that the holotype is skeletally mature, as is confirmed by its well-developed precloacal-femoral pores, whereas the subadult paratype exhibits incomplete ossification of the carpal and tarsal elements.

### *Coloration (in preservative)*

Body grayish with a series of dark grayish-brown crossbands with darker brown borders; one across nape, one behind axilla, one at mid-trunk, and one in lumbar position. These complete dorsal bands alternating with bands extending dorsally from flanks but not meeting in the dorsal midline, first over scapula. Tips of tubercles whitish, particularly on the flanks. Parietal and temporal regions of head with grayish-brown markings without darker margins. A thick white to cream stripe from lateral surface of rostral and anterior of first supralabial to anterodorsal corner of orbit - continuing behind orbit and on to occiput as a series of irregular pale blotches. This stripe bordered above by a grayish-brown stripe extending from nostril to top of orbit and below by a similarly colored triangular marking extending posteriorly from the 2<sup>nd</sup> to 3<sup>rd</sup> supralabial scales to ventral half of the anterior margin of the orbit. Limbs mottled with alternating brown and pale gray blotches, particularly distal to the knees and elbows, basal limb segments mostly grayish with faint darker irregular markings. Tail with alternating markings as on dorsum; two complete, dark-bordered brown bands on original portion of post-pygal tail; regenerated portion grayish-brown with darker speckles, without distinct pattern. Venter grayish-cream becoming pale gray subcaudally.

### *Variation*

The subadult paratype differs from the holotype in the following features: postmentals

bordered posteriorly by 3 chin shields; supralabials 11, 9 to midpoint of orbit (L), 8(R); infralabials 9 (L&R); dorsal tubercles in 16 rows at midbody; no precloacal or femoral pores; subdigital lamellae: (left manus) 4-6-7-7-7, (right manus) 4-7-7-7-6, (left pes) 4-7-7-7-6, (right pes) 4-7-7-7-6. Paratype similar in color to holotype, but more boldly patterned with four complete dark bands on original portion of post-pygal tail.

#### *Distribution and natural history*

At present known only from the type locality in the relatively hilly region of the Département des Collines in central Bénin (Fig. 6). The area lies adjacent to the Nigerian border and it is likely that this species occurs in that country as well. A juvenile *Hemidactylus angulatus* was collected at the same site as the types of *H. beninensis*. The holotype exhibits damage to the skin of the dorsum of the head (Fig. 1). Such damage is indicative of mechanically weak skin, which is associated with regional integumentary loss, an escape mechanism employed against certain predators by a variety of geckos (Bauer *et al.* 1989, 1993).



**FIGURE 6.** Type locality of *Hemidactylus beninensis* **sp. nov.** in the Collines de Dassa-Zoumè Département des Collines, central Bénin.

#### **Discussion**

Relationships within mainland African *Hemidactylus* remain largely unresolved. Carranza and Arnold (2006) have established patterns of relationship among several major groups within the genus, but their study did not sample heavily from West African species. Based on its large number of precloacal-femoral pores, transversely enlarged median subcaudal scales, and atuberculate tail, however, *H. beninensis* may be allied to *H. fasciatus* and a new species from Cameroon.

Systematic herpetological field work in Bénin has been almost non-existent until the very recent past, resulting in a significant lacuna in our knowledge of the West African reptile fauna. Interpolation based on the more well-studied faunas of Togo and Nigeria ,



which bracket Bénin, certainly provides a first estimate of the Bénin herpetofauna. However, it may be expected that some taxa that require habitat types that are rare or lacking within Bénin may be absent. The case of geckos also demonstrates that, despite its small size, Bénin harbors at least one species that has not yet been recorded from its neighbors. While we consider it unlikely that *Hemidactylus beninensis* is strictly endemic within the political boundaries of Bénin, its discovery highlights the need for more extensive and intensive systematic collecting of reptiles in order to establish a robust working checklist of the national fauna.

### Key to the geckos known or expected to occur in Bénin

- 1a. Moveable eyelids present, digits without adhesive scansors .....  
 ..... *Hemitheconyx caudicinctus*
- 1b. No moveable eyelids, eye covered by an immovable brille..... 2
- 2a. Pupils round, digits narrow, lacking adhesive scansors ..... *Cnemaspis spinicollis*
- 2b. Pupils vertical, digits with dilated adhesive scansors ..... 3
- 3a. Subdigital scansors fan-like and limited to the distal tips of the digits only.....  
 ..... *Ptyodactylus ragazzi*
- 3b. Subdigital scansors single or paired, not-fan-like, not restricted to tips of digits ..... 4
- 4a. Distal phalanx compressed and arising from within dilated portion of subdigital pad. 5
- 4b. Distal phalanx not compressed and not projecting from subdigital pad .....  
 ..... *Tarentola ephippiata*
- 5a. Digit I of manus and pes rudimentary and clawless..... *Lygodactylus* 6
- 5b. Digit I on manus and pes not reduced, bearing a well-developed claw. *Hemidactylus* 7
- 6a. Rostral scale enters nostril..... *Lygodactylus conraui*
- 6b. Rostral scale excluded from nostril ..... *Lygodactylus gutturalis*
- 7a. Body dorsum atuberculate..... *Hemidactylus matschiei*
- 7b. Tubercles in 9 or more rows across body dorsum..... 8
- 8a. Median subcaudal scales enlarged, males with 14 or more precloacal-femoral pores 10
- 8b. Median subcaudal scales not enlarged, males with 12 or fewer precloacal-femoral pores..... 9
- 9a. Tail somewhat depressed, cyclotetragonal, with prominent dorsal and lateral spines ....  
 ..... *Hemidactylus muriceus*
- 9a. Tail cylindrical in cross-section, lacking enlarged spines ..... *Hemidactylus ansorgii*
- 10a. Median subcaudal scales hexagonal in shape, males with 14–17 precloacal-femoral pores ..... *Hemidactylus pseudomuriceus*
- 10b. Median subcaudal scales forming broad transverse plates, males with 20 or more precloacal-femoral pores ..... 11
- 11a. Original tail (except for base) atuberculate or with very small, flattened tubercles .. 12
- 11b. Original tail with prominent, raised tubercles along most of length..... 13

- 12a. 18–24 rows of dorsal tubercles at midbody ..... *Hemidactylus fasciatus*  
 12b. 14–16 rows of dorsal tubercles at midbody ..... *Hemidactylus beninensis* **sp. nov.**  
 13a. Dorsal tubercles strongly keeled, separated from one another by approximately the width of one tubercle; tubercles usually prominent on dorsum of head; color variable, but often with some reddish or orange markings when in light phase .....  
 ..... *Hemidactylus angulatus*  
 13b. Dorsal tubercles not, or only weakly keeled, separated by one another by a distance greater than one tubercle width; dorsum of head atuberculate or with few, small tubercles; color variable, but typically without bright markings of any kind, usually ashy to pale grey-brown when in light phase ..... *Hemidactylus mabouia*

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