

A NEW SPECIES OF AGAMA (SAURIA: AGAMIDAE) FROM MAURITANIA

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A new agama species of the *Agama agama* species group, is described from the Adrar Mountains of Mauritania, in the Meridional Sahara. This species is morphologically similar and genetically related to *Agama impalearis*. It is characterized by small size (snout-vent length of adults: 67.6-74.88 mm); long hind legs; gular region with brown irregular longitudinal lines; 10 preanal pores; fourth finger longer than first; small nuchal crest (composed of six spines) and absence of caudal crest; reddish eyelid in males; smooth head scales; regular keeled and mucronate dorsal scales; ventral scales smaller than dorsals; 55-63 scales around mid body; 10-12 surpralabials; 9-12 infralabials; 8-9 group of spines between the anterior margin of the ear opening and the shoulder; 12 lamellae under fourth finger; 19-21 lamellae under fourth toe. It is a solitary rock dweller inhabiting extremely dry habitats with scarce vegetation.

Key words: Africa, *Agama castroviejoi*, lizard, mtDNA, Sahara

INTRODUCTION

Information on north-west African reptiles, from the Mediterranean to the Saharan region, has increased notably in the last 20 years (Schleich *et al.*, 1996). Countries like Morocco, Western Sahara and Mali have received special attention (Joger, 1981; Böhme *et al.*, 1996; Joger & Lambert, 1996; Bons & Geniez, 1996; Geniez *et al.*, 2000), and recently also Mauritania (Ineich, 1997; Böhme, 2000; Böhme *et al.*, 2001). As a result, taxonomic work has been carried out on several complex groups and some new species have been described (Salvador, 1982; Joger, 1984; Mateo *et al.*, 1998; Wilms & Böhme, 2001). Nevertheless, new species are discovered only occasionally (Joger, 1980; Joger & Lambert, 1996; Geniez & Foucart, 1995; Brown *et al.*, 2002), indicating that we have still not reached a complete knowledge of the reptile diversity in north-western Africa, above all in the Saharan region, where vast areas still remain unexplored.

Four *Agama* species have been cited for Mauritania: *Agama agama* (Linnaeus, 1758), *Agama boueti* Chabanaud, 1917, *Agama boulengeri* Lataste, 1886 and *Agama impalearis* (Duméril & Duméril, 1851) (Chabanaud, 1917; Dekeyser & Villiers, 1956; Ineich, 1997; Lambert & Mullié, 1998; Böhme *et al.*, 2001). During field-work carried out in Mauritania, only the first three species were found. *A. agama* is a typical species from Sahel savannah, but it also inhabits human settlements (Joger, 1979) and is common in Southern Mauritania (pers. obs.). *A. boueti* is also a typical inhabitant of the sandy savannahs of southern Mauritania. Although Chabanaud (1917) reported *A. impalearis* for Mauritania (“Mauritanie Saharienne”), Joger (1979) stated that this species did not occur there and that the

nearest record would be that of Segouia el Hamra (Western Sahara). Despite *A. agama* being cited for the Village Chinguetti in the Adrar region (Dekeyser & Villiers, 1956) it was not found by the author. Only *A. boulengeri* and five specimens of an unidentified *Agama* species could be collected in this area. These five specimens were discovered on a tableland (“Dahr”) from the Adrar Mountains, in the Sahara Region. They are morphologically similar to *A. impalearis*, but some morphological differences in scalation count characters were found. Nevertheless, some works have demonstrated great morphological and genetic variation among populations of *A. impalearis* (Brown & Znari, 1998; Brown *et al.*, 1999; Brown *et al.*, 2002) and have recognized a vicariant lineage as a putative new species (Brown *et al.*, 2002). In fact, the diversity of the group is higher than previously supposed. Therefore, a genetic comparison among the aforementioned species was also necessary to clarify the identity of Adrar population. The results indicate the specimens collected in the Adrar Mountains do not correspond to any of the known North African agamid species. The aim of this paper is to describe these specimens and to clarify their possible relationship with *A. impalearis*.

MATERIAL AND METHODS

Specimens of the new species are deposited in Museo Nacional de Ciencias Naturales (MNCN), Madrid (Spain). Other specimens examined are listed in Appendix 1. Geographical localities were obtained with a Garmin E-Trek GPS receiver. Colour slides of the specimens were taken in the field. All measurements of the specimens are in millimetres and were taken with a digital calliper (to the nearest 0.01mm). Specimens were collected the 20 May 2002 during a field-trip to the Adrar plateau of Mauritania. They were sacrificed by injection of a dilution of nicotine, fixed with 10 % formalin and preserved in 70% ethanol. Tissue samples for

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DNA studies were obtained from four specimens of the new species (MNCN 41776-79) and preserved in absolute ethanol.

The following 27 morphological characters were obtained from each specimen: (1) 16 linear body dimensions: SVL, snout-vent length; TAL, tail length; TAH, tail height (at the base of the tail); TAW, tail width (at the base of the tail); RTAL, relative tail length (% of SVL); HL, head length; HW, maximum head width; HH, maximum head height; FOOT, foot length (from heel to the tip of the longest toe, including the claw); HAND, hand length (from wrist to the tip of the longest finger, including the claw); FINGER, length of the fourth finger (from the joint with the hand to the tip, including the claw); TOE, fourth toe length (from the joint with the foot to the tip, including the claw); TL, tibia length; FL, femur length (shank length); EN, eye-nostril distance (from the posterior margin of the nostril to the anterior corner of the eye); EE, distance ear opening-eye (from the posterior corner of the eye to the anterior margin of the ear opening); (2) 11 scalation counts characters: VE, number of ventral scales (from the inguinal region to the level of the axilla); EMB, number of scales around midbody; SL, number of supralabials scales; IL, number of infralabial scales; SO, number of supraocular scales; RSLE, rows of scales between supralabials and eye; GNS, groups of neck spines; IP, number of inguinal pores; LFF, number of lamellae under fourth finger; LFT, number of lamellae under fourth toe; SC, number of spines of the nuchal crest.

Scalation count characters of males of the two forms of *A. impalearis* were provided by Brown (*in litt.*). Comparisons with *A. boueti* and *A. boulengeri* were based on data from Joger (1979) and personal observations; and on *A. agama* from personal observations.

Partial DNA sequences of the 16S rRNA mitochondrial gene were obtained for four specimens of the new species and compared with previously published 16S rRNA sequences of *A. impalearis* from Morocco (Brown *et al.*, 2002). *Laudakia atricollis* from Tanzania was used as outgroup (Brown *et al.*, 2002).

Accession numbers for the MNCN specimens sequenced are as follows: MNCN 41776=AY522926; MNCN 41777= AY522927; MNCN 41778=AY522928; MNCN 41779= AY522929. Total genomic DNA extraction followed standard protocols described elsewhere (Carranza *et al.*, 1999, 2000). Primers used in both amplification and sequencing were L2510 (5'-CGCCTGTTTATCAAAAACAT-3') and H3062 (5'-CCGGTTTGAACCTCAGATCA-3') from Lenk *et al.* (2001).

Mitochondrial sequences were aligned in ClustalX (Thompson *et al.*, 1997) with default parameters. Only two gaps had to be postulated to align the new species with *A. impalearis*. In total, 464 base pairs of 16S rRNA mitochondrial DNA were included in the phylogenetic analysis, of which 84 were variable and 27 parsimony-informative. The results of the alignment are available

from the author upon request. The aligned data set was analyzed using maximum-parsimony (MP) in PAUP* 4.0B10 (Swofford, 2002), and include heuristic searches involving tree bisection and reconnection (TBR) branch swapping with 100 random stepwise additions of taxa. Gaps were included as fifth state. Nodal support for the MP tree was assessed using bootstrap analysis (Felsenstein, 1985) involving 1000 pseudo-replications.

RESULTS

AGAMA CASTROVIEJOI SP. NOV. FIGS. 1-8

Types. Holotype: MNCN-41779 an adult male from Dahr Chinguetti, on the road between Atar and Tidjikja (20° 26.547'N/12° 49.407'W), Wilaya of Adrar. Collected by José M. Padial, 20 May 2002.

Paratypes. MNCN-41778 an adult female, MNCN-41780 a subadult female and MNCN-41776, 41777 two young females (same data as the holotype).

Etymology. This species is a patronym for Dr Javier Castroviejo (Galicia, Spain), for his help and encouragement and in recognition of his great effort in funding the study and conservation of biodiversity in Spain, Africa and Latin America.

Diagnosis. A species morphologically similar to *Agama impalearis* with the following combination of



FIG. 1. Male (holotype, MNCN 41779) of *Agama castroviejo* sp. nov. Picture taken in the Adrar Mountains, Mauritania.

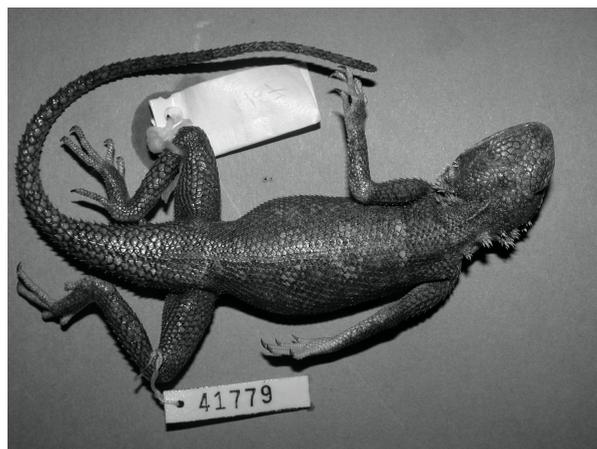


FIG. 2. Dorsal view of the male MNCN 41779 (holotype) of *Agama castroviejo*.



FIG. 3. Lateral view of the head of the male MNCN 41779 (holotype) of *Agama castroviejo*.

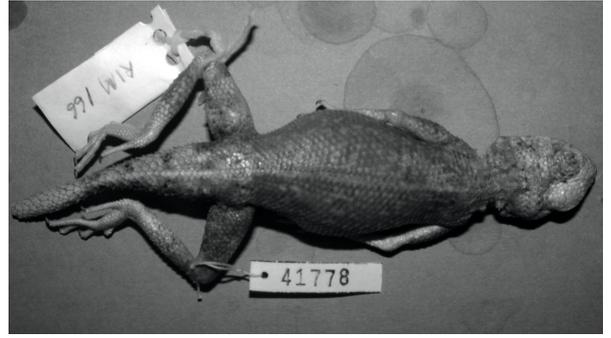


FIG. 6. Dorsal view of an adult female MNCN 41778 (paratype) of *Agama castroviejo*.

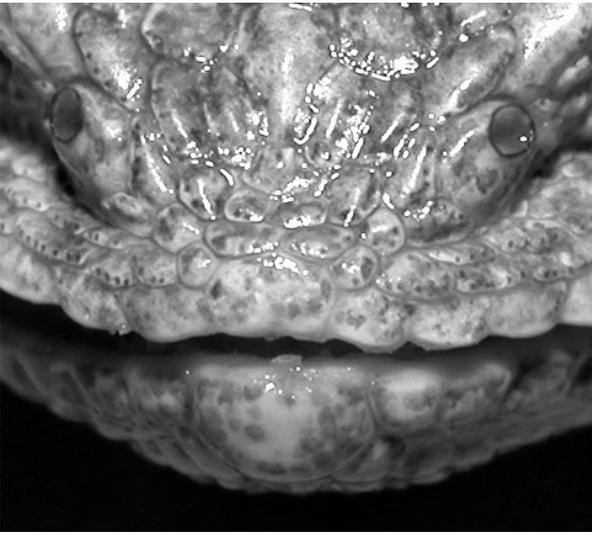


FIG. 4. Frontal view of the snout of the male MNCN 41779 (holotype) of *Agama castroviejo* showing the orientation of the nostrils.

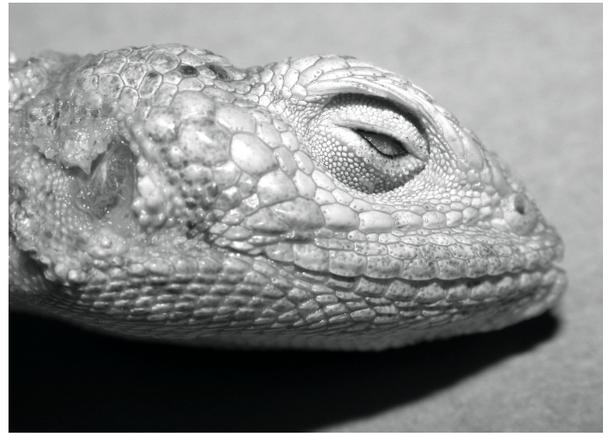


FIG. 7. Lateral view of the head of an adult female MNCN 41778 (paratype) of *Agama castroviejo*.

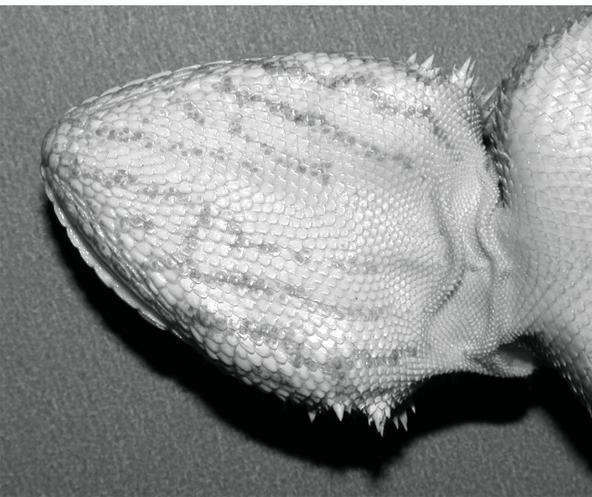


FIG. 5. Ventral view of the gular region of the male MNCN 41779 (holotype) of *Agama castroviejo*.



FIG. 8. Frontal view of the snout of an adult female MNCN 41778 (paratype) of *Agama castroviejo*, showing the orientation of the nostrils.

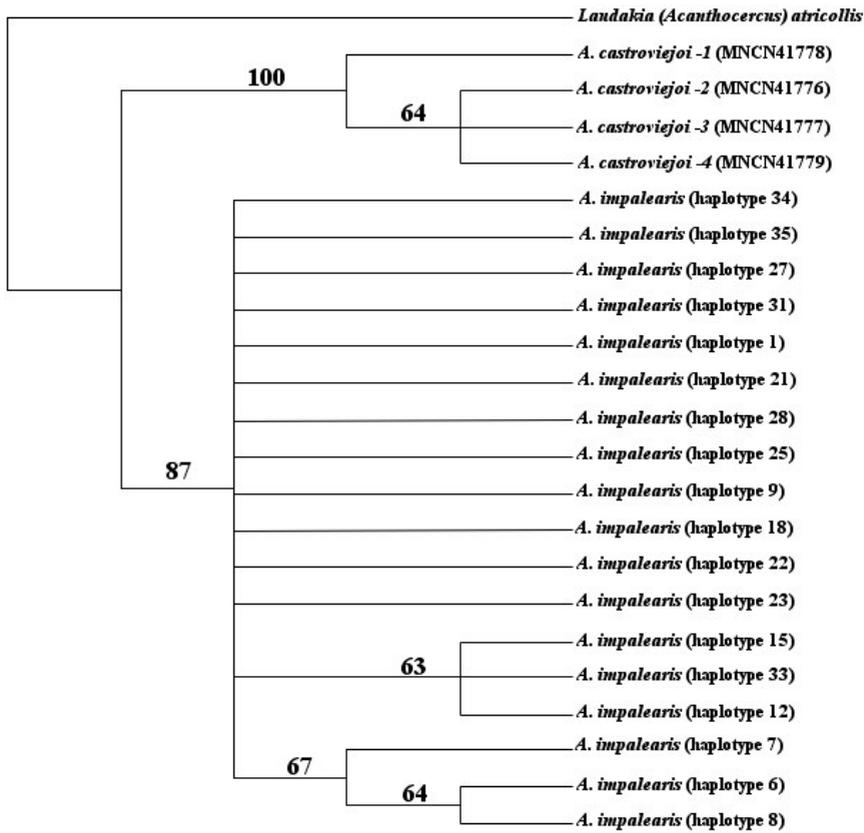


FIG. 9. Strict consensus of 19 equally parsimonious trees showing the phylogenetic relationships between *A. implearis* and *A. castroviejoii*. Tree-length= 97 steps, CI= 0.750 and RI= 0.922 (both under exclusion of uninformative sites). Bootstrap support values are shown above the nodes. Haplotype numbers refer to Brown *et al.* (2002).

characters (see Figs. 2-8): long, narrow and low head; scales on head smooth; small nuchal crest; nine groups of spines on each side of the head; nostrils oriented dorsolaterally; plicate throat, with two gular folds and one mite pocket on each side of the neck; regular keeled and mucronate scales in dorsum, keels converging toward midbody; less keeled and mucronate dorsal scales in females; relative length of fingers $3 > 4 > 5 = 2 > 1$; relatively long hind legs (always reaching the anterior margin of the ear opening, some reaching the eye); base of the tail weakly compressed; tail scales keeled and mucronate; absence of caudal crest; tail one and 3/4 to twice as long as SVL; gular region with brown irregular longitudinal lines; ten preanal pores; live male with reddish eyelid; ventral regions of the body, tail and extremities immaculate white; dorsal surfaces of female light (sandy) brown with dark brown subocular and labial bars and some transverse dark brown bands on back; males with dorsal surfaces grey-blue with light brown spots. Distinguished from the north-west African species (characters of the other species in parentheses) (see also Table 2): from *Agama implearis* by relative length of finger and toes; smaller nuchal crest and absence of caudal crest; reddish eyelid in males and different colour pattern; some scalation count characters (Table 3), and 4.3% difference in the 16S rRNA mitochondrial region sequenced for this study. The phylogenetic analysis presented in Fig. 9 shows that *A. castroviejoii* and *A. implearis* form two reciprocally

monophyletic groups supported by relatively high bootstrap values. Distinguished from *Agama boueti* by gular region with brown irregular longitudinal lines (immaculate); red eyelid in males (brown); 8-9 groups of neck spines (4-7); 10 preanal pores (12); 12 scales on fourth finger (9-10); 19-21 scales on fourth toe (15-17); different relative length of fingers and toes; longer hind legs. Distinguished from *Agama agama* by very smaller size and very different colour pattern and sexual dimorphism (metallic blue body and bright orange on heads of adult males). Distinguished from *Agama boulengeri* by its smaller size; very different colour pattern (specially sexual dimorphism); fewer number of scales around midbody; smooth head scales; higher number of group of spines on the sides of the head and shoulder and by absence of caudal crest.

DESCRIPTION OF THE HOLOTYPE

An adult male with head scales smooth, occipital scale big; dorsal scales homogeneous, large rhomboidal, keeled and mucronate, all keels converging towards the vertebral line; keels on arms and limbs mucronate; throat plicate, with two gular folds and one mite pocket on each side of the neck; ventral scales smooth; relative finger length $3 > 4 > 5 = 2 > 1$; tail twice as long as SVL; base of the tail weakly compressed; tail scales keeled and mucronate; nostrils oriented upwards and backwards.

Measurements (mm): Snout-vent length 74.88, tail length 116.70, head length 19.84, head width 15.99,

TABLE 1. Linear body measurements (mm) and scalation count characters of the type series of *Agama castroviejei* sp. nov. See methodology for abbreviations.

Linear body measurement and dimension	MNCN 41779 (male)	MNCN 41777 (juv. female)	MNCN 41778 (female)	MNCN 41776 (juv. female)	MNCN 41780 (female)	Range
SVL	74.21	59.91	74.88	59.31	67.60	59.31-74.88
TAL	116.40	105.1	-	-	90.17	90.17-116.4
TAH	8.81	6.92	7.25	6.75	6.87	6.92-8.81
TAW	11.46	8.20	10.55	8.13	9.84	8.13-11.46
RTAL	63.75	57.0	-	-	74.97	57.0-74.97
HL	19.84	17.16	19.65	15.91	18.40	15.91-19.84
HW	15.99	13.58	15.67	13.21	15.11	13.21-15.99
HH	9.69	8.88	9.67	8.67	9.86	8.67-9.69
EN	4.76	3.0	3.98	3.11	4.35	3.0-4.76
EE	6.01	4.37	4.80	4.61	5.33	4.37-6.01
HAND	14.55	12.04	12.80	11.53	14.14	11.53-14.55
FOOT	23.64	19.69	21.04	18.82	22.61	18.82-23.64
FINGER	6.77	6.23	5.75	5.19	6.67	5.19-6.77
TOE	12.02	9.64	9.75	9.20	11.74	9.20-12.02
TL	21.21	20.31	21.75	19.77	21.34	19.77-21.75
FL	19.36	17.58	19.86	15.44	20.29	15.44-20.29
HL/SVL	0.27	0.29	0.26	0.27	0.27	0.26-0.29
HB/SVL	0.22	0.23	0.21	0.22	0.22	0.21-0.23
HL/HB	1.24	1.26	1.25	1.20	1.22	1.20-1.26
TL/SVL	0.29	0.34	0.29	0.33	0.32	0.29-0.34
FL/SVL	0.26	0.29	0.27	0.26	0.30	0.26-0.30
EN/SVL	0.24	0.17	0.20	0.20	0.24	0.17-0.24
EE/SVL	0.30	0.25	0.24	0.29	0.29	0.24-0.30
TOE/SVL	0.16	0.16	0.13	0.16	0.17	0.13-0.17
FOOT/SVL	0.32	0.33	0.28	0.32	0.33	0.28-0.33
Scalation count characters						
VE	63	59	61	58	59	58-63
EMB	61	58	55	60	63	55-63
SL	10	11	11	11	12	10-12
IL	9	11	11	11	12	9-12
SO	6	7	6	7	7	6-7
RSLE	4	3	4	4	4	3-4
GNS	9	8	8	8	9	8-9
IP	10	-	-	-	-	-
LFF	12	12	12	12	12	-
LFT	19	19	21	19	20	19-21
SC	6	6	7	7	7	6-7

head height 9.69, hand length 14.55 (from posterior end of wrist to top of longest finger), foot length 23.64 (from posterior end of heel to top of longest toe), limb length 19.36, tibia length 21.21, length of fourth finger (to join with third) 6.77; length of fourth toe 12.02; eye-nostril length (from the anterior border of the eye orbit to the nostril) 4.76; ear-eye length (from the anterior border of the tympanum to the posterior border of the eye orbit) 6.01; tail width 11.46; tail height (at the base) 8.81.

Pholidosis. 63 ventral scales between inguinal fold and the beginning of the arm; 61 scales around midbody; 11 supralabials; 9 infralabials; 6 rows of supraoculars; 4

rows of scales between supralabials and suboculars (including the subocular row); 9 groups of spines between the anterior margin of the ear opening and the shoulder. In each group, the central spines are largest; 10 anal pores; 12 lamellae under fourth finger; 19 lamellae under fourth toe; nuchal crest composed of 6 spines.

Colour in life. Ventral regions of the body, tail and extremities immaculate white; dorsal surfaces grey-blue with dark brown subocular and labial bars; gular region with brown irregular longitudinal lines; some transverse dark brown bands on the back; a perpendicular thin beige band in the anterior margin of the back

TABLE 2. Diagnostic characters for *Agama castroviejoi* sp. nov., *Agama impalearis* and *A. boueti*.

	<i>A. castroviejoi</i>	<i>A. impalearis</i>	<i>A. boueti</i>
SVL	67.6-74.88	to 120	to 99
TL	90.17-116.4	150	to 160
EMB	55-63	?	50-62
Dorsal scales	keeled	keeled	keeled
Head scales	smooth	smooth	smooth
Nuchal crest	small	strong	small
GNS	8-9	3-9	4-8
Caudal crest	absent	present	absent
Relative length of fingers	3>4>5≥2>1	3≥4>5≥2>1	3>4>2>5≥1
Relative length of toes	4>3≥5>2>1	3=4>5≥2>1	3≥4>5>2>1
Gular region	brown lines	brown lines	white to yellow
Sexual dichromatism	low	low	low
Sociability	solitary	solitary	solitary
Habitat	desert rocky areas	semidesert rocky areas	sandy savannah

and one in the posterior margin; two beige irregular circumferences in the middle of the back.

Colour in alcohol. Ventral regions of the body, tail and extremities immaculate white; gular region with brown irregular longitudinal lines; all dorsal and dorso-lateral regions grey-blue (slate grey) with some light brown spot on the head, back and forearms; hands yellow; a perpendicular thin beige band in the anterior margin of the back and one in the posterior margin; two beige irregular circumferences in the middle of the back.

VARIATION

For variation in morphometrics see Table 1. The only males has more ventral scales and fewer labial scales than females. The dorsal scales of the male are more mucronate than in females. There is colour difference between sexes, females being paler than males. In life, females have almost no colour differences: they have light brown head with dark brown subocular stripes; the dorsal region is beige to light brown with transverse dark brown bands from the scapular region to the middle of the tail; each dark band is composed of 3-7 scales; they have a thin longitudinal light stripe. The ventral region is immaculate white, with subgular longitudinal brown stripes. In alcohol, the colour becomes faded but the pattern is retained; the feet and hands become light yellow.

From the genetic point of view, there is a single base pair difference (and A-G transition) between specimen MNCN 41778 and specimens MNCN 41776, MNCN 41777, MNCN 41779 in the 464 of the 16S rRNA mitochondrial region sequenced for this study (Fig. 9).

DISTRIBUTION AND ECOLOGY

Specimens are only known from the type locality. They were found on a tableland (*dahr*) 679 m above sea level, in the Adrar region in Mauritania. This region is part of the "Sahara Meridional Occidental", and is characterized by annual rainfall of about 100 mm and average annual temperatures of 30°C, with minimum temperatures in January rarely descending below 10°C (Le Houérou, 1990). The habitat is a rocky plain with little vegetation, composed of sparse bushes and some small trees (*Acacia* spp.). All specimens were found alone and separate by few kilometres from each other. The first specimen encountered was active at 09.20 hr (air temperature of 28.6°C). The other specimens were found perching around the middle of the day, and were easily caught when they moved under solitary stones.

DISCUSSION

Among the four *Agama* species (*A. agama*, *A. boulengeri*, *A. boueti*, *A. impalearis*) inhabiting the arid and semi-arid regions of NW Africa, the last two show

TABLE 3. Some scalation counts characters of male (holotype) of *Agama castroviejoi* and two geographical forms of *A. impalearis*. (a) southern form (Tan Tan, Morocco); (b) northern form (Chefchauen, Morocco). See methodology for abbreviations.

	SL	IL	GNS	LFF	LFT	IP
Holotype	10	9	9	12	19	10
a (n=6)	11-13	10-15	10-11	14-16	16-18	12-14
b (n=4)	11-13	11-13	10-11	15	16-19	12-13

superficial resemblance with *A. castroviejo*. Nevertheless, morphological quantitative and meristic characters distinguish *A. castroviejo* well from the other species recorded for Mauritania (*A. boulengeri*, *A. agama* and *A. boueti*) and also from the two Moroccan forms of *A. impalearis*. MtDNA analyses demonstrate the identity of *A. castroviejo* and its close relationship to *A. impalearis* and the vicariant form from south and east of the Atlas mountains.

Furthermore, distributional, social and ecological factors also allow a clear separation among species. *A. castroviejo* is solitary and inhabits extremely dry rocky areas of the Adrar plateau. *Agama boueti* is solitary and inhabits the semi-desert sandy plains and savannahs of the Sahel region of southern Mauritania and the Atlantic Coast. *Agama impalearis* is a typical solitary rock dweller (Schleich *et al.*, 1996). Its distribution ranges from the Mediterranean coast (Bons & Geniez, 1996) to Seguia el Hamra, in Western Sahara (Geniez *et al.*, 2000). Although it was cited for “Mauritanie Saharienne” (Chabanaud, 1917) and despite appearing widely distributed across the country in Le Berre’s (1989) distribution map for this species, there are actually no confirmed records for Mauritania. Moreover, Joger (1979) noted that this species did not occur in the Adrar and that the nearest record corresponded to Seguia el Hamra. The presence of this species in the country is still plausible in rocky areas similar to those of the Zemmour Mountains (Geniez *et al.*, 2000), but this requires confirmation. *A. boulengeri* is a species from the Sahel Savannah that inhabits rocky areas and forms social groups. We found this species as far north as Oued Choûm (21° 22.6’N/12° 58.6’W), near the border with Western Sahara. At this latitude, it is always associated to wet rocky gorges (*Gueltas*) in the mountains. *A. agama* is another social species, reported to be associated with human settlements in the Adrar region (Dekeyser & Villiers, 1956). In the south of the country, this species prefers trees from the Sahel savannahs but it shows high habitat plasticity (pers. obs.).

Miocene vicariance events have been found to be responsible of the variation and differentiation in *A. impalearis* in NW Africa (Brown & Znari, 1998; Brown *et al.*, 2002). The uplift of the Atlas mountains constituted a great geographical barrier causing allopatric fragmentation of the populations. *A. castroviejo* is isolated in a rocky tableland surrounded by lowland sandy plains of the Sahara that could serve as a barrier for a rock dweller. Also *in situ* selection-mediated responses to the ecological current conditions of the isolated populations are responsible of the morphological variation of *A. impalearis* (Brown & Znari, 1998). Present ecological conditions of the Adrar are very extreme, and is probably one of the hottest areas of the Sahara (Le Houérou, 1990). As demonstrated by Brown & Znari (1998), variation in scalation is significantly associated with different temperature conditions. Therefore, both isolation and ecological differentiation could be implicated in the differentiation of *A. castroviejo*.

Although the Adrar belongs to the Meridional Sahara (Le Houérou, 1990), this area shows a complex history, with its faunas and floras comprising a mixture of Mediterranean, Saharan and Sahelian species (Dekeyser & Villiers, 1956). Probably *A. castroviejo* constitutes an example of a Saharan endemic of the Adrar Mountains, as some invertebrate species and also vertebrate subspecies (Dekeyser & Villiers, 1956). Nevertheless, the phylogeographic affinities of *A. castroviejo* remain unclear, since it could have a Sahelian or Saharan origin. A more thorough phylogenetic comparison among North African agamas will help to resolve this question.

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APPENDIX 1

Additional specimens of *Agama* species examined for this work. EBD: Estación Biológica de Doñana, Seville, Spain; CET: Centro de Estudios Tropicales, Sevilla, Spain. Locality and coordinates in parentheses.

Agama agama. CET(RIM)-028 (near Bouli, 15° 25.803' N/11° 55.562' W, Mauritania); CET(RIM)-328-329 (El Wad-Zoueina, 15° 42.689' N/9° 39.906' W, Mauritania); CET(RIM)-331-335 (El Wad-Foulania, 15° 31.682' N/9° 48.896' W, Mauritania).

Agama boueti. CET(RIM)-287-291, 336 (Ayoûn el Atroûs, 16° 37.412' N/9° 37.441' W, Mauritania).

Agama boulengeri. CET(RIM)-016-018 (Bougari, 16° 32.034' N/10° 47.892' W, Mauritania); CET(RIM)-021-022 (between Timbedgha and Ayoûn El Atroûs, 16° 26.890' N/9° 14.690' W, Mauritania); CET(RIM)-066 (Terjît, 20° 15.578' N/13° 05.854' W, Mauritania); CET(RIM)-094-96 (Guelta Molomhar, 20° 34.873' N/13° 07.630' W, Mauritania); CET(RIM)-116-117 (Oued Choûm, 21° 22.654' N/12° 58.581' W, Mauritania); CET(RIM)-174-175 (Zig, between Lekhcheb and Tîchît, 18° 34.487' N/9° 48.379' W, Mauritania); CET(RIM)-256-261 (Guelta Oumm Lebare, 16° 29.472' N/10° 49.822' W, Mauritania); CET(RIM)-338 (Ayoûn el Atroûs, 16° 37.412' N/9° 37.441' W, Mauritania); CET(RIM)-344 (Guelta Matmata, 17° 53.571' N/12° 07.467' W, Mauritania).

Agama impalearis. EBD-11352 (Mount Marcan-Kbir, Tetuán, Morocco); EBD-20222 (Taklim, Morocco); EBD-22084 (Yassinen, Morocco); EBD-24515 (Bab Bou Ichir-Fritissa, Morocco); EBD-6552 (El Aioum, Western Sahara).