

**PRELIMINARY NOTE: TALPA AQUITANIA NOV. SP.
(TALPIDAE, SORICOMORPHA) A NEW MOLE SPECIES FROM
SOUTHWEST FRANCE AND NORTH SPAIN**

NOTE PRÉLIMINAIRE: *TALPA AQUITANIA* NOV. SP.
(TALPIDAE, SORICOMORPHA) UNE NOUVELLE ESPÈCE DE TAUPE DU
SUD-OUEST DE LA FRANCE ET DU NORD DE L'ESPAGNE

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ABSTRACT

A mtDNA based study of the population genetics of moles recently captured in France allowed us to discover a new species, *Talpa aquitania* nov. sp. We are giving here a preliminary description of the new species. Its distribution covers an area lying south and west of the course of the Loire river in France and beyond the Pyrenees, a part of Northern Spain.

Key words: mole, *Talpa aquitania* nov. sp., mtDNA, France, Spain.

RÉSUMÉ

Une étude, basée sur le mtDNA, de la génétique des populations de taupes récemment capturées en France nous a permis de découvrir une espèce nouvelle, *Talpa aquitania* nov. sp. Nous donnons ici une description préliminaire de la nouvelle espèce et de sa distribution. Cette dernière couvre une région se situant au sud et à l'ouest du cours de la Loire et, au-delà des Pyrénées, dans le nord de la péninsule ibérique.

Mots clefs : taupe, *Talpa aquitania* nov. sp., mtDNA, France, Espagne.

INTRODUCTION

From March 2012 to March 2015, moles were collected in different localities in France for which we obtained at least partial mtDNA sequences. The Bayesian analysis of the Cytb-mtDNA sequences presented in a previous publication (Hugot *et al.*, 2014) revealed that a part of the French and Spanish specimens of *Talpa europaea* (60 individuals: 21 males, 39 females) constituted a distinct lineage closely associated but divergent from the specimens of the Iberian mole *T. occidentalis* Cabrera, 1907, included in the analyses. This result strongly suggested that these specimens may belong to a different and not yet described species. A further examination of the external morphology and characters of the upper M1 mesostyle confirmed this hypothesis. In this preliminary note we define this lineage as a new mole species: *Talpa aquitania* nov. sp.

MATERIAL AND METHODS

The field collection numbers, name of the collectors, localities of collection and measurements of the specimens are given in **table 3 (annex 1)**. The methods for collecting moles, mtDNA sequencing, alignment and phylogenetic analysis are described in details in Hugot *et al.*, (2014). The study of the anatomical characters and the measurements of the skulls were performed using the "Microvu Vertex 251 HC" of the Morphometric Platform of the Museum National d'Histoire Naturelle of Paris.

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RESULTATS: *TALPA AQUITANIA* NOV. SP

Family Talpidae Fischer de Waldheim, 1817

Talpinae G. Fischer, 1814

Talpa Linné, 1758

Holotype

MNHN-ZM-2016-471 (VN1789). Collected in 2013. France-86280, Saint-Benoît, 46.546°N-0.348°W. Adult female: whole body preserved in ethanol. Measurements (gm & mm): Weight 73; HB 127,5; Tail-L 26; Foot-L 21; Head-L 42; Hand-L 24,5 with nails; Hand-Width 19. Genbank Cytb number: KU189595.

Paratypes

Tissues preserved in ethanol and RnaLater, skulls extracted (national collection number, field number, date of collect, locality and district of collection, geographic coordinates, name of collector, weight in gm, measurements in mm; see also **figures 1-2** and **table 1**).

MNHN-ZM-2016-472 (YA0346). 06/10/2013, France-63320, Crete, Issoire, 45.550°N-3.043°W, Bernard Pradier; Adult Female: WT 74; HB 149; Tail-L 29; Foot-L 21; Hand-L 22; Head-L 47. Genbank Cytb number: KU189627.

MNHN-ZM-2016-473 (YA0386). 13/04/2014, France-63190, Lezoux, alt. 833 m, 45.828°N-3.380°W, J-Michel Georgeon; Adult Female: WT 74; HB 153; Tail-L 28; Foot-L 21,5; Hand-L 22,5; Head-L 48. Genbank Cytb number: KU189653.

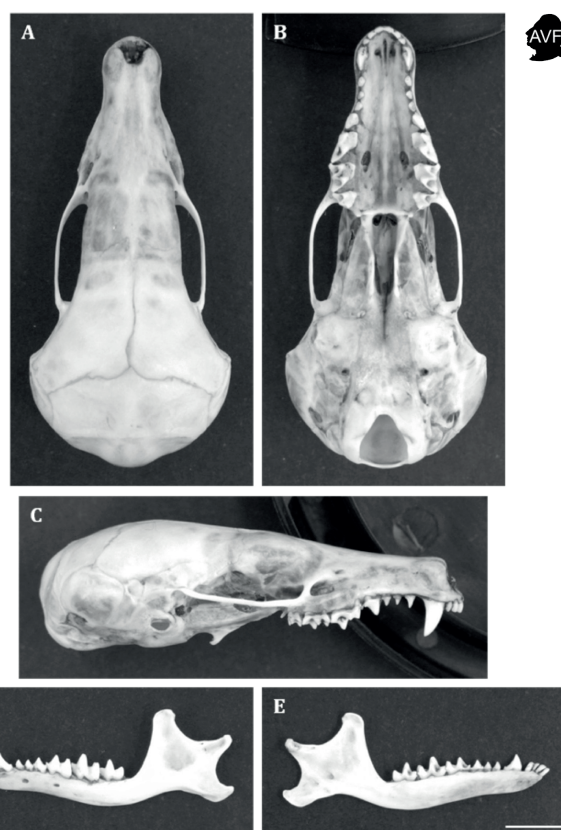


Figure 1: Skull of *Talpa aquitania* nov. sp. Paratype MNHN-ZM-2016-474 (YA0424): Dorsal (A), ventral (B) and lateral (C) views of the skull. Labial (D) and lingual (E) views of the left mandible. Scale bar: 5mm.

(mm)	YA0346	YA0386	YA0424	YA0425
WNAS	4.36	4.80	4.57	4.28
ROBR	8.93	9.37	9.09	8.71
CIO	7.58	7.70	7.37	7.30
WZYG	12.17	12.88	12.79	12.18
BRCA	16.83	17.32	17.02	16.56
LBT	4.52	4.72	4.65	4.59
PRCO	35.18	36.15	36.27	33.98
HEBA	30.38	31.28	31.35	29.01
HEPA	14.18	14.33	14.58	13.74
PCPA	8.82	9.71	8.52	8.55
LMDB	23.16	23.35	23.64	22.12

Table 1: Measurements in millimeters of the skull and mandible of the four paratypes.

WNAS: width of the nasal bones in the anterior part of the rostrum ; ROBR: greatest width of the rostrum ; CIO: width of interorbital constriction ; WZYG: width of zygomatic arches ; BRCA: greatest width of the braincase ; LBT: length of the tympanic bulla ; PRCO: condylobasal length ; HEBA: henselion-basion length; LMDB: length of the mandible; PCPA: height of the mandible, between the extreme points of the coronoid and angular processes.

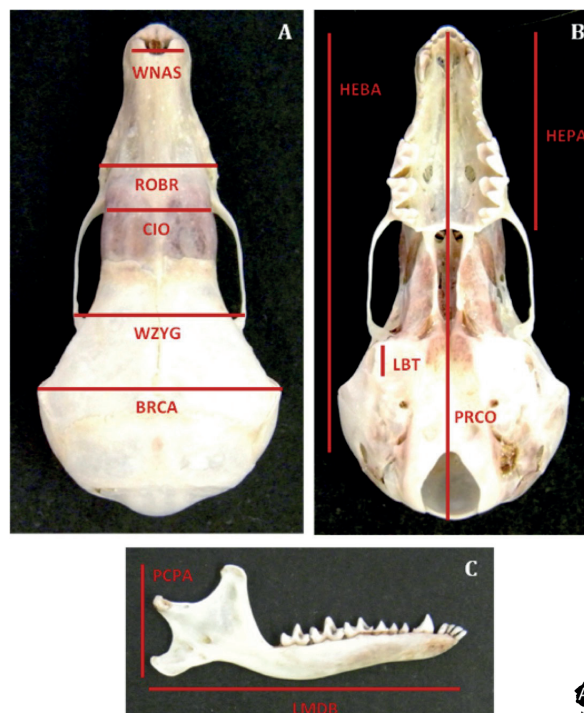


Figure 2: Cranial and mandibular measurements of the four paratypes recorded in this preliminary study (table 1).

MNHN-ZM-2016-474 (YA0424). 18/10/2013, France-33240, La-Lande-de-Fronsac, Libourne, private garden, 44.980°N-0.380°W, J-Luc Laclamette; Adult Male: WT 92; HB 143; Tail-L 29; Foot-L 21; Hand-L 29; Head-L 46, Test-L 5. Genbank Cytb number: KU189689.

MNHN-ZM-2016-475 (YA0425). 17/04/2014, France-24800, Nantheuil, Nontron, 45.4135°N-0.944°W, J-Luc Laclamette; Adult Female: WT 65; HB 142; Tail-L 23; Foot-L 21; Hand-L 22; Head-L 42. Genbank Cytb number: KU189690.

Habitat of holotype specimen

Subterranean area close to a private garden.

Distribution

West and south to the Loire river and extending to northern Spain (figure 3).

Derivation nominis

This name is given in reference to the ancient Roman province of Aquitania, created by August in 27 BC.

Diagnosis

The mitochondrial analysis (Hugot et al., 2014, Feuda et al., 2015) clearly separates three well defined lineages corresponding to: *Talpa europaea* L., 1758, *Talpa occidentalis* Cabrera, 1907 and the new taxon *Talpa aquitania* nov. sp. The new taxon forms a monophyletic clade with *T. occidentalis*. The Cytb K2P genetic distance between *T. aquitania* and *T. europaea* is 8.4% and is 7.7% with *T. occidentalis*. *T. aquitania* also differs from *T. europaea* by having sealed eyelids. *T. aquitania* share with *T. occidentalis* the character of the eyelids but is very different from this species by:

- its size; within genus *Talpa*, *T. occidentalis* may be considered as a dwarf species while *T. aquitania* is a giant species (table 2);

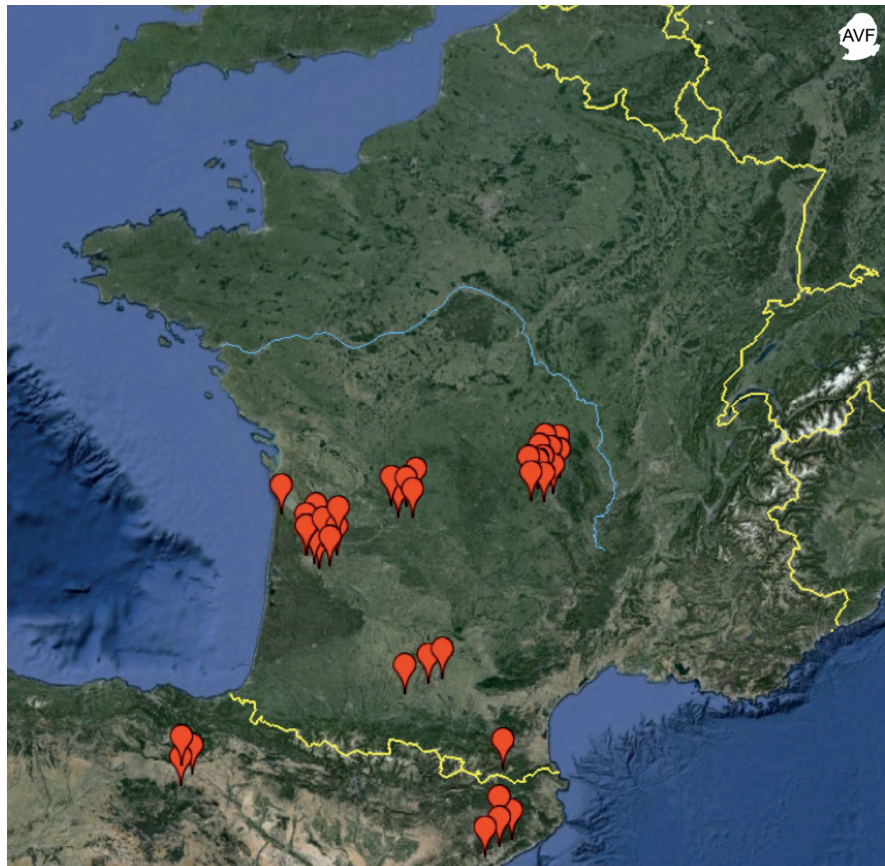


Figure 3: Distribution of *Talpa aquitania* nov. sp. Map of sampling points showing the distribution of the 60 specimens collected in France and identified as *Talpa aquitania* nov. sp. on the basis of mtDNA Cytb analyses. The map also shows the localities of origin of seven other specimens captured in Spain, for which Genbank sequences (Feuda et al., 2015) aggregate with our specimens in the analysis.

	Weight	H & Body	Tail	Foot	Head
MAX	130,0	165,0	51,0	25,0	38,0
MIN	36,0	100,0	20,0	16,0	30,0
MEAN	83,0	132,5	35,5	20,5	34,0
<i>Talpa europaea</i>					
MAX	147,0	192,0	38,0	48,0	50,0
MIN	47,0	117,0	19,0	17,0	18,0
MEAN	88,1	150,9	27,9	26,6	39,4
<i>Talpa aquitania</i> nov. sp.					
MAX	70,0	135,0	35,0	18,0	32,0
MIN	30,0	90,0	16,0	14,0	28,0
MEAN	50,0	112,5	25,5	16,0	30,0
<i>Talpa occidentalis</i>					

Table 2: Measurements of *Talpa aquitania* nov. sp. Measurements of 60 specimens (21 males and 39 females) captured for the purpose of our study. The measurements of *T. europaea* and *T. occidentalis* found in the bibliography are given for comparison (Aulagnier et al., 2008; Palomo et al., 2007).

- a different morphology of the mesostyle of the upper M1 (**figure 4**); *T. aquitania* has a simple mesostyle in upper M1, as in *T. europaea*, while it is double in *T. occidentalis*.

CONCLUSIONS

We consider that the results of our preliminary study allow us to classify the specimens corresponding to the French-Spanish mitochondrial lineage, also having different morpho-anatomical characters, into a different taxonomic group: *Talpa aquitania* nov. sp. A more detailed description and analysis of the different diagnostic characters is in progress and will be published soon.

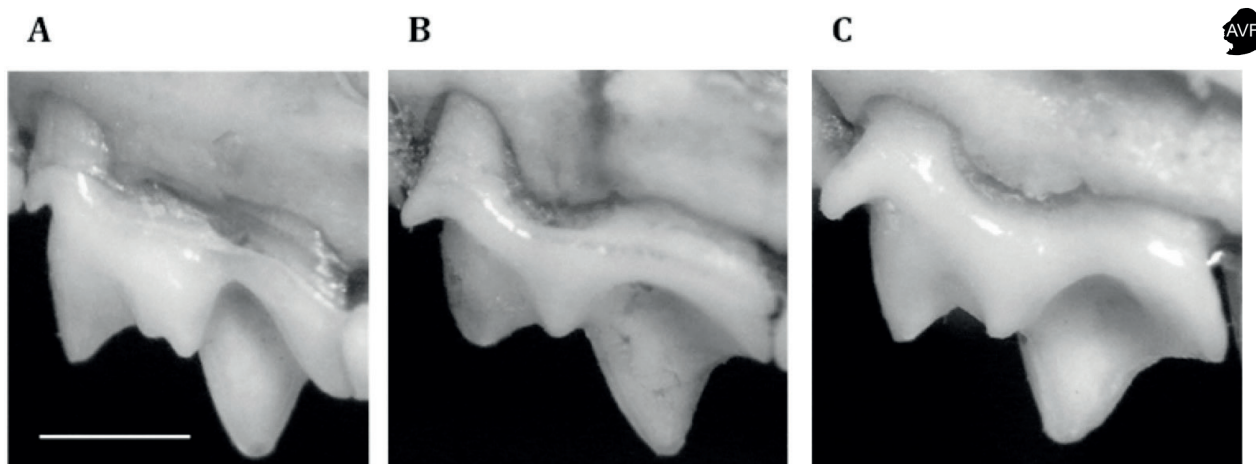


Figure 4: Mesostyle of the upper molar (M1).

A: *T. occidentalis*;

B: *T. europaea*;

C: *T. aquitania* nov. sp.

Specimen numbers: TO11.06.29.12 (A); MNHN-ZM-2016-476 (YA0296) (B); MNHN-ZM-2016-473 (YA0386) (C). Scale bar: 1mm.

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Field Nb	Date	Country	Province	Town	District	landscape	Collector	Latitude	Longitude	Genus	Species	Sex	Weight	H & Body	Tail	Foot	Hand	Head
YA0005	01/04/12	France	F-31600	Muret-Lherm	airport	grassland	ÉRIC LAFFONT	43.449	1.262	Talpa	aquitania	F	91,0	142,0	21,6	20,0	-	40,1
YA0006	11/04/12	France	F-31230	Pitoulet	Coueilles	street gutter	ÉRIC LAFFONT	43.343	0.900	Talpa	aquitania	F	67,0	122,8	20,7	18,1	-	47,2
YA0007	11/04/12	France	F-31320	Mervilla	Route des Crêtes	grassland	ÉRIC LAFFONT	43.507	1.476	Talpa	aquitania	M	86,0	147,1	27,2	19,9	-	46,1
YA0117	07/07/08	France	F-66360	Py	Prades	old school	CLAUDE GUIJSET	42.496	2.350	Talpa	aquitania	F	59,0	129,5	32,0	21,0	-	43,0
YA0125	22/05/13	France	F-33010	Arcins	Bordeaux	garden	J-LUC LACLAMETTE	44.798	-0.514	Talpa	aquitania	F	103,0	152,0	29,0	22,0	-	48,0
YA0126	05/06/13	France	F-33056	Blanquefort	Bordeaux	Parc de Majolan	J-LUC LACLAMETTE	44.900	-0.643	Talpa	aquitania	F	88,0	153,0	35,0	20,0	-	46,0
YA0127	05/06/13	France	F-33056	Blanquefort	Bordeaux	Parc de Majolan	J-LUC LACLAMETTE	44.900	-0.643	Talpa	aquitania	M	70,0	153,0	23,0	21,0	-	44,0
YA0128	05/06/13	France	F-33056	Blanquefort	Bordeaux	Parc de Majolan	J-LUC LACLAMETTE	44.900	-0.643	Talpa	aquitania	F	77,0	152,0	29,0	20,0	-	44,0
YA0129	05/06/13	France	F-33056	Blanquefort	Bordeaux	Parc de Majolan	J-LUC LACLAMETTE	44.900	-0.643	Talpa	aquitania	M	110,0	165,0	25,0	22,0	-	48,0
YA0130	01/05/13	France	F-33003	Ambarès-et-Lagrave	Bordeaux	Parc Kelheim	J-LUC LACLAMETTE	44.925	-0.484	Talpa	aquitania	F	106,0	156,0	30,0	22,0	-	45,5
YA0131	15/05/13	France	F-33363	Sadriac	Bordeaux	undergrowth	J-LUC LACLAMETTE	44.746	-0.433	Talpa	aquitania	F	100,0	154,0	cut	21,0	-	46,5
YA0132	16/05/13	France	F-33207	Izon	Libourne	rugby stadium	J-LUC LACLAMETTE	44.914	-0.427	Talpa	aquitania	F	84,0	151,0	19,0	19,0	-	39,0
YA0133	16/05/13	France	F-33207	Izon	Libourne	rugby stadium	J-LUC LACLAMETTE	44.914	-0.427	Talpa	aquitania	F	75,0	142,0	30,0	21,0	-	45,0
YA0134	16/05/13	France	F-33207	Izon	Libourne	rugby stadium	J-LUC LACLAMETTE	44.914	-0.427	Talpa	aquitania	M	147,0	164,0	35,0	23,0	-	49,0
YA0135	16/05/13	France	F-33207	Izon	Libourne	rugby stadium	J-LUC LACLAMETTE	44.914	-0.427	Talpa	aquitania	F	105,0	159,0	27,0	22,0	-	46,0
YA0136	16/05/13	France	F-33207	Izon	Libourne	rugby stadium	J-LUC LACLAMETTE	44.914	-0.427	Talpa	aquitania	F	92,0	152,0	31,0	20,0	-	46,0
YA0218	02/09/13	France	F-33460	Cantenac	Castelnau-de-Médoc	private garden	J-LUC LACLAMETTE	45.029	-0.655	Talpa	aquitania	M	82,0	146,0	24,0	21,0	-	45,0
YA0340	01/10/13	France	F-63270	Busseol	Vic-le-Comte	grassland	BERNARD PRADIER	45.691	3.254	Talpa	aquitania	M	101,0	144,0	29,0	21,0	23,0	46,0
YA0341	02/10/13	France	F-63270	Busseol	Vic-le-Comte	grassland	BERNARD PRADIER	45.691	3.254	Talpa	aquitania	F	64,0	130,0	22,0	20,0	21,0	43,0
YA0342	02/10/13	France	F-63270	Busseol	Vic-le-Comte	grassland	BERNARD PRADIER	45.691	3.254	Talpa	aquitania	M	100,0	148,0	34,0	22,0	24,0	45,0
YA0343	02/10/13	France	F-63270	Busseol	Vic-le-Comte	grassland	BERNARD PRADIER	45.691	3.254	Talpa	aquitania	M	100,0	146,0	30,0	21,0	22,0	45,0
YA0344	02/10/13	France	F-63270	Busseol	Vic-le-Comte	grassland	BERNARD PRADIER	45.691	3.254	Talpa	aquitania	F	65,0	136,0	22,0	17,0	22,0	43,0
YA0345	03/10/13	France	F-63270	Busseol	Vic-le-Comte	grassland	BERNARD PRADIER	45.691	3.254	Talpa	aquitania	M	97,0	155,0	30,0	22,0	22,0	46,0
YA0346	06/10/13	France	F-63320	Creste	Issoire	grassland	BERNARD PRADIER	45.550	3.043	Talpa	aquitania	F	74,0	149,0	29,0	21,0	22,0	47,0
YA0347	06/10/13	France	F-63320	Creste	Issoire	grassland	BERNARD PRADIER	45.550	3.043	Talpa	aquitania	F	74,0	145,0	27,0	19,0	22,0	45,0
YA0348	06/10/13	France	F-63320	Creste	Issoire	grassland	BERNARD PRADIER	45.550	3.043	Talpa	aquitania	F	74,0	143,0	26,0	19,0	23,0	44,0
YA0349	15/10/13	France	F-63320	Creste	Issoire	grassland	BERNARD PRADIER	45.550	3.043	Talpa	aquitania	M	114,0	152,0	29,0	21,0	23,0	45,0
YA0350	15/10/13	France	F-63320	Creste	Issoire	grassland	BERNARD PRADIER	45.550	3.043	Talpa	aquitania	M	112,0	150,0	30,0	22,0	25,0	47,0
YA0351	15/10/13	France	F-63320	Creste	Issoire	grassland	BERNARD PRADIER	45.550	3.043	Talpa	aquitania	F	85,0	148,0	28,0	20,0	23,0	46,0
YA0352	15/10/13	France	F-63320	Creste	Issoire	grassland	BERNARD PRADIER	45.550	3.043	Talpa	aquitania	F	74,0	145,0	28,0	22,0	23,0	46,0
YA0353	16/10/13	France	F-63320	Creste	Issoire	grassland	BERNARD PRADIER	45.550	3.043	Talpa	aquitania	F	80,0	144,0	28,0	22,0	25,0	46,0
YA0354	16/10/13	France	F-63320	Creste	Issoire	grassland	BERNARD PRADIER	45.550	3.043	Talpa	aquitania	F	72,0	147,0	25,0	20,0	23,0	44,0
YA0355	16/10/13	France	F-63320	Creste	Issoire	grassland	BERNARD PRADIER	45.550	3.043	Talpa	aquitania	M	109,0	155,0	32,0	23,0	24,0	46,0
YA0356	16/10/13	France	F-63320	Creste	Issoire	grassland	BERNARD PRADIER	45.550	3.043	Talpa	aquitania	M	91,0	152,0	34,0	22,0	24,0	46,0
YA0357	16/10/13	France	F-63320	Creste	Issoire	grassland	BERNARD PRADIER	45.550	3.043	Talpa	aquitania	F	76,0	145,0	32,0	21,0	24,0	44,0
YA0358	18/10/13	France	F-63320	Creste	Issoire	grassland	BERNARD PRADIER	45.550	3.043	Talpa	aquitania	F	72,0	139,0	28,0	20,0	23,0	43,0
YA0359	18/10/13	France	F-63320	Creste	Issoire	grassland	BERNARD PRADIER	45.550	3.043	Talpa	aquitania	M	99,0	155,0	26,0	23,0	24,0	45,0
YA0380	20/02/14	France	F-63920	Peschadoire	Lezoux	Picgu	J-MICHEL GEORGEON	45.827	3.493	Talpa	aquitania	M	109,0	166,0	28,0	23,0	24,0	48,0

YA0381	27/02/14	France	F-63230	Vulcania	Saint-Ours-les-Roches	grassland	J-MICHEL GEORGEON	45.813	2.940	Talpa	aquitania	F	94,0	142,0	23,0	22,0	22,0	43,5
YA0382	27/02/14	France	F-63230	Vulcania	Saint-Ours-les-Roches	grassland	J-MICHEL GEORGEON	45.813	2.940	Talpa	aquitania	F	89,0	153,0	27,5	23,0	22,0	47,5
YA0383	27/02/14	France	F-63230	Vulcania	Saint-Ours-les-Roches	grassland	J-MICHEL GEORGEON	45.813	2.940	Talpa	aquitania	F	91,0	143,0	24,0	23,0	23,0	46,0
YA0384	14/03/14	France	F-63320	Champeix	Issoire	grassland	J-MICHEL GEORGEON	45.589	3.129	Talpa	aquitania	F	85,0	151,0	23,0	21,5	21,0	45,0
YA0385	14/03/14	France	F-63320	Champeix	Issoire	grassland	J-MICHEL GEORGEON	45.589	3.129	Talpa	aquitania	F	64,0	136,0	20,0	22,0	19,0	41,5
YA0386	13/04/14	France	F-63190	Lezoux	Lezoux	grassland	J-MICHEL GEORGEON	45.828	3.380	Talpa	aquitania	F	74,0	153,0	28,0	21,5	22,5	48,0
YA0412	09/09/13	France	F-33910	St-Ciers d'Abzac	Libourne	foot stadium	J-LUC LACLAMETTE	45.031	-0.275	Talpa	aquitania	M	72,0	142,0	28,0	21,0	19,0	46,0
YA0413	09/09/13	France	F-33910	St-Ciers d'Abzac	Libourne	foot stadium	J-LUC LACLAMETTE	45.031	-0.275	Talpa	aquitania	F	73,0	146,0	29,0	20,0	21,0	47,0
YA0414	09/09/13	France	F-33910	St-Ciers d'Abzac	Libourne	foot stadium	J-LUC LACLAMETTE	45.031	-0.275	Talpa	aquitania	F	65,0	147,0	28,0	20,0	18,0	43,0
YA0424	18/10/13	France	f-33240	La Lande de Fronsac	Libourne	jardin privatif	J-LUC LACLAMETTE	44.980	-0.380	Talpa	aquitania	M	92,0	143,0	29,0	21,0	29,0	46,0
YA0425	17/04/14	France	F-24800	Nantheuil	Nontron	jardin privatif	J-LUC LACLAMETTE	45.413	0.944	Talpa	aquitania	F	65,0	142,0	23,0	21,0	22,0	42,0
YA0426	17/04/14	France	F-24800	Nantheuil	Nontron	jardin privatif	J-LUC LACLAMETTE	45.413	0.944	Talpa	aquitania	M	99,0	152,0	25,0	23,0	23,0	45,0
YA0427	18/04/14	France	F-24800	Nantheuil	Nontron	jardin privatif	J-LUC LACLAMETTE	45.413	0.944	Talpa	aquitania	F	62,0	144,0	26,0	20,0	20,0	43,0
YA0428	18/04/14	France	F-24800	Nantheuil	Nontron	jardin privatif	J-LUC LACLAMETTE	45.413	0.944	Talpa	aquitania	F	71,0	147,0	25,0	20,0	23,0	43,0
YA0440	15/04/14	France	F-33330	St-Emilion	Libourne	jardin privatif	J-LUC LACLAMETTE	44.893	-0.154	Talpa	aquitania	F	96,0	154,0	28,0	23,0	26,0	45,0
YA0453	25/01/15	France	F-33003	Ambarès-et-Lagrave	Bordeaux	Parc Kelheim	J-LUC LACLAMETTE	44.925	-0.484	Talpa	aquitania	M	115,0	180,0	30,0	21,0	23,0	48,0
YA0454	25/01/15	France	F-33003	Ambarès-et-Lagrave	Bordeaux	Parc Kelheim	J-LUC LACLAMETTE	44.925	-0.484	Talpa	aquitania	M	90,0	173,0	26,0	22,0	23,0	39,0
YA0459	04/04/15	France	F-33930	Vandays-Montalivet	Nord-Médoc	garden	J-LUC LACLAMETTE	45.356	-1.059	Talpa	aquitania	F	74,0	160,0	24,0	21,0	19,0	44,0
YA0477	03/12/14	France	F-33056	Blanquefort	Bordeaux	garden	J-LUC LACLAMETTE	44.900	-0.643	Talpa	aquitania	M	109,0	188,0	28,0	28,0	27,0	47,0
YA0478	03/12/14	France	F-33056	Blanquefort	Bordeaux	garden	J-LUC LACLAMETTE	44.900	-0.643	Talpa	aquitania	F	77,0	172,0	27,0	22,0	22,0	46,0
YA0479	18/02/15	France	F-24530	Quinsac	Nontron	garden	J-LUC LACLAMETTE	45.430	0.706	Talpa	aquitania	F	73,0	176,0	29,0	24,0	21,0	45,0
VN1789	05/07/05	France	F-86280	Saint-Benoit	Poitiers	garden	VIOLAINE NICOLAS	46.546	0.348	Talpa	aquitania	F	73,0	127,5	26,0	21,0	24,5	42,0
Genbank KF801510		Spain		Fogars de Montclús	Barcelona			41.728	2.444	Talpa	aquitania							
Genbank KF801507		Spain		Sant Pere De Vilamajor	Barcelona			41.685	2.390	Talpa	aquitania							
Genbank KF801508		Spain		Montseny	Gerona			41.750	2.380	Talpa	aquitania							
Genbank KF801509		Spain		Montseny	Gerona			41.750	2.380	Talpa	aquitania							
Genbank FN640556		Spain		Haro	La Rioja			42.343	-2.504	Talpa	aquitania							
Genbank FN640557		Spain		Haro	La Rioja			42.343	-2.504	Talpa	aquitania							
Genbank KP717323		Spain		Haro	La Rioja			42.343	-2.504	Talpa	aquitania							

Annex 1 = Table 3: List of the specimens used for this preliminary study.