

The names of southwestern European goats: is Iberian ibex the best common name for *Capra pyrenaica*?

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Abstract

The names of southwestern European goats: is Iberian ibex the best common name for Capra pyrenaica? The common name designated to a species is important because it connects specialists with non–experts. The matter of the correct common name is relevant to the conservation and management of conspicuous or flag species. The English name 'Spanish ibex' to designate *Capra pyrenaica* is extensive in the scientific literature, and some have defended its appropriateness. However, in our opinion, it is not the best term to designate this species. We propose that 'Iberian wild goat' should be used. Herein, we review the etymology, history, taxonomy and public use of the names used to designate goats (domestic and wild) in southwestern Europe during the last two millennia. Used first by Pliny the Elder, the name 'ibex' has been applied most often for the Alpine wild goat (*C. ibex*), and few authors applied this name to *C. pyrenaica* until the 20th century when some influential works extended its use in the scientific literature. Adult males of *C. pyrenaica* have lyre–shaped, and typically smooth horns that do not match the ibex morphotype, which has scimitar–shaped knotted horns. Although *C. pyrenaica* and *C. ibex* are probably phylogenetically close, their common names do not necessarily have to match. The rules of common names differ from those of scientific names. *Cabra montés* or *cabra brava* (wild goat) is the common name used by most authors in the Iberian peninsula. This name is deeply entrenched in the Iberian languages and has been used since the earliest references to the species in mediaeval times. We propose the adoption of 'Iberian wild goat' for legal and scientific communication and when interacting with the media.

Key words: Caprinae, Wild goat, Spanish ibex, Conservation value, Historical taxonomy, *Capra ibex*.

Resumen

Los nombres de las cabras del sudoeste de Europa: ¿"Iberian ibex" es el nombre común más adecuado para designar a Capra pyrenaica? El nombre común asociado a una especie es importante porque sirve de nexo entre los especialistas y las personas no expertas. El uso correcto del nombre común es importante para la conservación y gestión de las especies clave o emblemáticas. En las publicaciones científicas en inglés es muy frecuente denominar "Spanish ibex" a *Capra pyrenaica* y algunos autores defienden la idoneidad de esta opción, pero en nuestra opinión no es el mejor término para designar a esta especie. En este artículo proponemos el término "Iberian wild goat" y revisamos la etimología, la historia, la taxonomía y el uso del público en general de los nombres usados para designar a las cabras (domésticas y salvajes) en el sudoeste de Europa durante los dos últimos milenios. Utilizado por primera vez por Plinio el Viejo, el nombre "ibice" se ha aplicado en la mayor parte de los casos a la cabra salvaje de los Alpes (*C. ibex*) y son pocos los autores que lo aplicaron a *C. pyrenaica* hasta el siglo XX, cuando algunas obras influyentes extendieron su uso en las publicaciones científicas. Los machos adultos de *C. pyrenaica* tienen cuernos lisos en forma de lira, que no se corresponden con el morfotipo de ibex, que tiene cuernos con nudosidades en forma de cimitarra. Aunque *C. pyrenaica* y *C. ibex* probablemente sean dos especies próximas desde el punto de vista filogenético, sus nombres comunes no necesariamente tienen que coincidir. Los nombres comunes siguen reglas diferentes a las de los nombres científicos. "Cabra montés" o "cabra brava" (wild goat en inglés) son los nombres comunes utilizados mayoritariamente por los autores de la península ibérica. Estos nombres están profundamente arraigados en las lenguas ibéricas y se han utilizado desde las primeras referencias a la especie en la Edad Media. Proponemos que se adopte el término "Iberian wild goat" en textos jurídicos y científicos y en la interacción con los medios de comunicación.

Palabras clave: Caprinae, Cabra montés, Íbice ibérico, Valor de conservación, Taxonomía histórica, *Capra ibex*.

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Introduction

As elements of animal production, hunting and mythology objects, goats (*Capra* genus) have attracted much attention throughout human history. The naming, description and classification of goats in southwestern Europe can be traced back to the first books of natural history by the Greek and Roman classics (Aristotle and Pliny the Elder, among others). The nomenclature and scientific classification of goats has been varied and controversial over the past two millennia (Ellerman and Morrison–Scott, 1951; appendix 1). Until Linnaeus and even later, the nomenclature was confusing, with common and pseudoscientific names being used interchangeably (Jonston, 1650; Pennant, 1793). Recently, with the generalization of molecular techniques, great advances have been made in the phylogeny of the genus, even though this is not completely resolved (Groves and Grubb, 2011).

The common name associated with a given taxon is important from scientific, conservation, and legislative perspectives. Common names have biological and practical importance given that they allow everyone from researchers to scientific popularisers and the general public to easily understand which species others are referring to. Usually, these names are recognizable, easy to pronounce and stable over time. The common names of the species should link the scientific world with lay people to increase the species conservation value (Stevens et al., 2014). Conversely, scientific names follow binomial nomenclature and are based on phylogenetic relationships, but they are written in Latin and are difficult to remember.

Capra pyrenaica is a conspicuous and endemic species of the Iberian peninsula, iconic for many nature enthusiasts, conservationists, and hunters. The matter of the correct common name is relevant to its conservation and management. The common name 'Spanish' or 'Iberian ibex' designating the species *C. pyrenaica* is widespread in contemporary English–language publications. However, a significant number of publications also use the term 'Iberian or Spanish wild goat' (appendix 2). In this work we provide arguments to support this latter option.

This work is divided into four sections. In the first two sections we conduct a detailed review of the names that goats have received in southwestern Europe, as well as the history of their taxonomic classification. In the third section we discuss the usefulness of using morphological and molecular criteria in establishing phylogenies, and in the last section we discuss the conservation value of common names regardless of the phylogenetic classification of the taxa.

We provide arguments to demonstrate that 'Iberian wild goat' is a more suitable common name than Iberian ibex for *C. pyrenaica*, and given the importance of common names for conservation and management, we suggest that the first term be adopted or used preferably over the second.

Methods

We searched the scientific literature for the origin, meaning, and use of the common names for *C. pyrenaica*. The search was restricted to the wild goats of southwestern Europe. The search went back to the time prior to modern Zoology (Gessner, 1551; Linnaeus, 1758), including the classical Natural History texts of the Greeks and Romans, which influenced the early modern scientists. We searched classic pre–Linnaean texts and their translations from Greek and Latin in free–open bibliographic databases including biodiversitylibrary.org, thelatinlibrary.com, archive.org, penelope.uchicago.edu, remacle.org, perseus.tufts.edu, bibdigital.rjb.csic.es, reader.digitale-sammlungen.de, es.scribd.com, books.google.es, en.wikipedia.org, gallica.bnf.fr, bl.uk, e-codices.unifr.ch, and private libraries including getty.edu, linnaean-online.org, merriam-webster.com, themorgan.org. For some classical texts in Spanish, especially hunting treatises, we used open–free databases such as aic.uva.es, bvpb.mcu.es, datos.bne.es, and especially the diacronic database of the Royal Spanish Academy (corpus.rae.es). Within classical texts, to determine their etymology and historical use, the words associated with wild goats (e.g., *ibex*, *capra*, *hircus*, *tragus*, *goat*, *Steinbock*, *bouquetin*) were searched. In addition, we sought the opinions of historians and etymologists who were familiar with Iberian fauna, particularly, *C. pyrenaica*.

Among post–Linnaean documents, we reviewed the history of the taxonomy of *Capra ibex* and *C. pyrenaica* based on original scientific descriptions. We also searched for the use of their common names in subsequent catalogs and reference treaties (Pallas, 1776; Erxleben, 1777; Pennant, 1793; Saint–Hilaire and Cuvier, 1824–1842; Cuvier et al., 1827–1835; Gray, 1850–1852; Lydekker, 1898; Ellerman and Morrison–Scott, 1951; Heptner et al., 1989; Pidancier et al., 2006; Groves and Grubb, 2011). We synthesized the information to identify the most frequently used common names for *C. pyrenaica* and to determine how the name 'Spanish ibex' had come into use in contemporary scientific literature. Recent studies (e.g., paleontological, morphological, molecular) on the phylogenetic relationships among species (*C. aegagrus*, *C. ibex*, *C. pyrenaica*) were evaluated.

In this paper, we followed Shackleton's (1997) taxonomic nomenclature for the *C. pyrenaica* subspecies, although their taxonomic status remains under debate (García–González, 2011; Angelone–Alassad et al., 2017; Ureña et al., 2018). The Alpine ibex is considered as a single species: *C. ibex*, and not as a subspecies (Aulagnier et al., 2008).

Nomenclature of bezoars and domestic goats

Domestic goats (*C. hircus*) and their attributed wild ancestors (*C. aegagrus* or bezoars) share a significant proportion of their genetic pools (Naderi et al., 2008; Colli et al., 2015), and hybridization between them is common (Couturier, 1962, p. 527). The genetic similarity is most pronounced in the goats of some

Mediterranean islands where they were introduced in the early stages of domestication (between 10,000 to 8,000 years BP) and are currently considered to be subspecies of *C. aegagrus* (Horwitz and Bar-Gal, 2006; Masseti, 2009; Geskos, 2013).

If it is assumed that *C. aegagrus* and *C. hircus* are the same species, the specific name for both should be *C. aegagrus* based on the Opinion 2027 of the International Commission of Zoological Nomenclature (ICZN, 2003), which, if applicable, assigns to each variety (wild or domestic) the category of subspecies. Although, some refer to the domestic goat as *C. aegagrus hircus* and the wild goat as *C. aegagrus aegagrus*, most refer to them as *C. hircus* and *C. aegagrus*, respectively. Until a consensus on the specific identity of bezoars and domestic goats is reached, we prefer to use the classical nomenclature for reasons of clarity and simplification.

Etymology of the common names of *Capra* spp. in Western Europe

Words of Greek origin (aegagrus, tragos, capra?)

In classical natural history texts, most descriptions of goats refer to domestic goats (Pliny the Elder, 77 AD; Gessner, 1551; Jonston, 1650; Aristotle and Thompson, 2004; Voultziadou and Tatolas, 2005). However, wild goats were mentioned as early as in the 8th century (C.) BC by Homer in the Iliad and the Odyssey. Both texts indicate that wild goats were abundant on the islands in the Aegean Sea (Buxton, 1892, p. 193). The primary classical Greek authors who mentioned wild goats referred to them as αἴγας ἀγρίας (transliterated *aiga agrios*), which means 'wild goat'. The contraction of those terms resulted in αἰγάγρος (*aigagros*), which became *aegagrus*, used to scientifically name *Capra aegagrus* Erxleben, 1777 (as early as the 5th C. Boethius explained that two separate terms did not have the same meaning after they had been combined into a single term (Migne, 1874); for example, a hippopotamus is not a 'river horse', and a blackbird *Turdus merula* is not any black bird; rather, it is a specific species). Today, the common name for *C. aegagrus* is agrimi, bezoar, or pasang, and some authors (Groves and Grubb, 2011) have argued that it is the 'true' wild goat, as opposed to the domestic goat *Capra hircus*.

One of the several observations about wild goats in Aristotle's 'History of Animals' is a description of their capacity to cure their own arrow wounds (Barthélemy-Saint-Hilaire, 1883), which was derived from their habit of feeding on dictame (*Dictamnus* sp.). On that account, this was perpetuated by others (De Funes y Mendoza, 1621; Pennant, 1793; Lindsay, 1911), reflecting the strong influence of classical authors on subsequent natural history texts.

Tragos (τράγος) is another Greek term associated with the common name of *Capra* which was used as a synonym of *Capra* in the early modern Zoology texts (Klein, 1751) and also to designate the male goat (De Funes y Mendoza, 1621; De la Huerta, 1624; Graells, 1897). Barney et al. (2006, p. 180) suggested that the

term is derived from the ancient tradition of paying Greek actors (tragedians, *tragoedus*) with a domestic goat. In addition, Greek texts use the word *aie* (αιε) which is equivalent to *caper* in Latin (Oppian, 215 AD in Graells, 1897; van Oppenraaij, 1998).

The origin of the term *Capra* is uncertain. For some (Barcia, 1902), it derives from the Greek word *Kápros* (κάπρος), which was used to designate the males of some wild species such as wild boar *Sus scrofa* (Coromines and Pascual, 1984). Thereafter, it evolved into the Latin terms *Capra* and *Caper* (De Funes y Mendoza, 1621). In early modern Zoology texts, it was used to describe domestic goats (Gessner, 1551; Jonston, 1650). Apparently, over time, the use of the term became restricted to females, and the terms used for males were *tragos* (of Greek origin), *hircus* (of Latin origin), or *buck* (of Germanic origin). For instance, in Spanish, the term *cabra* is used to designate females of *Capra* and chamois *Rupicapra*.

Words of Latin origin (caper, hircus, ibex)

Caper is equivalent to the Latin word *Capra* and the Greek *aie* (αιε) (van Oppenraaij, 1998). De Funes y Mendoza (1621) stated that it is derived from the Latin word *carpere* because of the goat's habit of browsing (Barney et al., 2006, p. 247). Some attribute *caper* to the same origin as *Capra*; e.g., *Kapro* from the Indo-European languages (Coromines and Pascual, 1984). The term *caper* was reserved for domestic goats (Linnaeus 1756) and also for castrated males (Klein, 1751). For example, in Spanish, *capar* is the verb to castrate, and *capado* means castrated (De la Huerta, 1624; Ray, 1693). In early modern Zoology texts, *caper* was a synonym of wild goat (*capra silvestris* or *caper montanus* or *ibex* (Gessner, 1551), and to name *Capra pyrenaica* (i.e. *Caper hispanica*, Jonston, 1650; Charleton, 1677).

Hircus is a word of Latin origin that originally meant male goat (Gessner, 1551; De la Huerta, 1624; Ray, 1693; Lindsay, 1911). Barcia (1902) suggested that it might have derived from the Sabine word *fircus*, a pre-Roman Italic people in the 4th C. In addition, some classical authors (Suetonius cited in Barney et al., 2006) stated that the word derived from *hirqui*, which means 'eye corner', because 'his eyes look side-ways on account of wantonness'. This was also noted by Oroz and Marcos (2004) and by Martínez de Espinar (1644). The latter stated "they have rapid view, able to see on their sides or in front, they have highly slanted eyes". That and other descriptions (e.g., 'dictame', above) were repeated for centuries in natural history texts until about the 18th C., demonstrating that many of the definitions and descriptions of animal species were replicated by one author after another in ancient texts, regardless of their veracity.

Later, in peri-Linnaean texts, the word *hircus* was used to designate both domestic goats and bezoars (Charleton, 1677; Erxleben, 1777; Cuvier, 1798). After being adopted as a genus name for some goat species (Gessner, 1602; Gray, 1850–1852), its use was restricted to domestic goats; i.e. *Capra hircus* (Klein, 1751; Cuvier, 1817; Ellerman and Morrison-Scott, 1951).

Although Charleton (1677) suggested that the term *ibex* is of Greek origin, the consensus is that it is of Latin origin (Klein, 1751; Barcia, 1902). For instance, Gessner (1551) did not doubt its Latin origin ('*quod nomen a Latino deductum non dubito*') and assigned to it a meaning similar to that of *Capricornus* ('*Ibex, vulgo Capricornus*'; Gessner, 1602, p. 304). After the description of Alpine ibex by Pliny (Bostock and Riley, 1855) (see below), in his famous book *Etymologiae*, Isidore of Seville (c. 556–636) was the first to apply the term *ibex* to wild goats (Lindsay, 1911). His sources were classic texts, specifically those of Aristotle, Suetonius, and Pliny (Oroz and Marcos, 2004). From the latter, he repeated the description of its habitat (the highest peaks) and the legend that describes that when it flees it lets itself fall on its horns, unharmed (Barney et al., 2006; Lib. I, cap. XII, epigr. 16). Isidore of Seville associated the etymology of *ibex* with *avex* (birds) and with Nile's *ibis* because they also live on cliffs, far from human settlements (Oroz and Marcos, 2004; Barney et al., 2006). That peculiar interpretation was repeated in several pre-Linnaean Natural History texts (Gessner, 1602; Topsell et al., 1658). The texts of Isidore of Seville were extremely influential in the Middle Ages and during the Renaissance, and the errors have been replicated by one author after another until today.

Words of Ancient Germanic origin (goat, stein-bock, bouquetin, ibex?)

The Modern English word *goat* comes from the Old English *gāt* 'she-goat, goat in general', which in turn was derived from the Proto-Germanic *gaitaz* (cf. Dutch/Icelandic *geit*, German *Geiß*, and Gothic *gaitis*) and, ultimately, from the Proto-Indo-European *ǵ'aidos*, which means 'young goat' (cf. Latin *haedus* 'kid'). In Old English, the male was referred to as *bucca* (giving rise to the modern term *buck*), and was replaced by *hegote*, *hegoote* in the late 12th C. (Watkins et al., 1975).

Steinbock derives from the Germanic *Bock* or *bod* meaning male goat and from the Latin prefix *stein* meaning rock. The term designates male goats from rocky places, that is, wild goats. In addition to being the current name in Germanic languages, other names have derived from this root; e.g., *bouquetin* in French (Couturier, 1962), which is derived from *Stein-bock* through a term permutation. The Italian *stambecco* has the same origin, as does the term *bucardo*, which is one of the common names for the Pyrenean wild goat in the Aragonese language (Kuhn, 2008). In his *Historia animalum*, Gessner (1551) indicated that, in the *anglica* language, the word *Capra* is equivalent to *gote* and the male *gote bucke*. In Old-English, the term *ibex* was not used to name the she-goat or the he-goat; rather, the terms were *Geiss* for females and *bucca* for males. The English word *buck* (used also for the male goat) originates from the ancient German word *bock*. Use of the term *ibex* came later as a result of the Latin description of the species (Ray, 1693; Linnaeus, 1756).

Couturier (1962, p. 7), in the chapter dedicated to the etymology and lexicology in his exhaustive book

on the Alpine ibex (*C. ibex*), investigated the origin of the common name *bouquetin* and included, among several meanings, the following:

"... on trouve encore dans le vieil allemand Ybschen et Krencke; en allemand ancien usité en Autriche ... Stolz (1570) appelait le jeune mâle de 4 à 5 ans Zapfen, le femelle Ybsch et le chevreau de l'année Stökl. En Suisse et dans le Tirol Ibsch, Ibschn, Ybsch, Ybschgeiss (Stumpf, 1548) et Eibsch-Geiss (Wagner, 1680), qui évoquent le mot ibex, désignent la femelle. ...Rappelons quelques appellations anciennes. En latin de moyen âge: *ibex, hibix, bix, boch, estagnus, stambechus*." (Couturier, 1962, p. 7).

It is difficult to know whether the Latin term *ibex* derives from Old German or *vice versa*. The term *Ibsch* (hence, *ibex*) might have come from an onomatopoeia of the alarm whistle of the female wild goat. Early settlers in the Alps might have used this term, and it was adopted by Latin Romans. New studies on the etymology of the term *ibex* might resolve that question.

In summary, 1) in the last 2,000 years multiple terms have been used to designate goats in Europe. Many synonymous terms have been used to designate the genus; e.g. *Caper* (Jonston, 1650), *Tragus* (Klein, 1751), *Hircus* (Charleton, 1677), *Ibex* (Pallas, 1776; Gervais, 1854). Finally, the Latin name *Capra* was adopted as the genus of all goats, wild or domestic (Linnaeus, 1758); 2) a few classical natural history texts (Aristotle, Pliny, Isidore of Seville, Gessner, Ray) had great influence on later texts until the 18th C. Some authors, almost up until the present day replicated the legends, with their hits and misses.

Etymology of the common name of *Capra p. pyrenaica*

The Pyrenean wild goat (*C. pyrenaica pyrenaica*), which was declared extinct in 2000 (García-González and Herrero, 1999), was the nominotypical subspecies of *C. pyrenaica* (Schinz, 1838). In Catalan and Spanish, the common names for the male are *erc* (*erg*, *herx*) and *bucardo* (appendix 3). Trutat (1878) asserted that Spaniards call the Pyrenean wild goat *herx*, which derives from the Latin term *hircus*. Asso (1784) stated that, in the Gistau Valley (Spanish Pyrenees), it was called *hircus*. The female goat is called *craba* (Vidaller, 2016).

Erc might have derived from the Latin term *hircus* or from the Occitan language. Old Occitan coexisted with Latin between the 1st and the 3rd C. (Nuñez, 2003). Cabrera (1911) affirmed that, in the Pyrenees, the wild goat was called *yerp*, and Rohlf's (1970 in Dendaletche, 1971) asserted that the Pyrenean name for the Pyrenean wild goat was *erc*, which derives from Gascon, a variant of Occitan. According to Nuñez (2003), the Proto-Basque language is closely related to Old Occitan. In the modern Basque language, the male goat is called *aker*.

Bucardo is the widely used current common name for the Pyrenean wild goat in the Central and Western Spanish Pyrenees (Vidaller, 2016). It derives from the root *buck* (male goat) and the suffix *-ardo*, a

disparaging augmentative related to their condition of wild (or non-domestic) animal and their big size (Kuhn, 2008).

In the French Pyrenees, the name *bouquetin des Pyrénées* (Saint-Hilaire and Cuvier, 1824–1842) was used. In *Livre de la Chasse*, the Count of Bearn (Phoebus, 1387) translated what might be the first description of the *bucardo*. He called it '*bouc sauvage*' (wild male goat) and stated that it is "as big as a red deer and its horns as thick as a man's leg". Apparently, in the Middle Ages, they were so highly abundant in the Pyrenees that 'their hunt had no merit' (Labarère, 1985). The excellent drawings in that manuscript are probably the first representations of the Pyrenean wild goat in various hunting scenes, which show the lyre horns of the Pyrenean morphotype (fig. 1). In the earliest scientific descriptions of the species, Saint-Hilaire and Cuvier (1824–1842) and Schinz (1838) quoted extensively from *Livre de la Chasse*.

In conclusion, the local common names of the Pyrenean wild goat (the nominate subspecies of *C. pyrenaica*) were derivations of 'goat' or 'wild goat', and none included the name *ibex*.

History of the common and scientific names of *Capra ibex* and their use in English texts

Classical and early modern texts

In his *Naturalis Historia* (77 AD), Pliny the Elder was the first to describe, or at least disseminate, the term *ibex* to refer to the wild goats that lived in the Alps. From the details in his work (Holland, 1601; De la Huerta, 1624; Brotier, 1779), it is clear that he refers to the wild goats in the 7th book only, and the meaning of the terms used are imprecise, probably leading to confusion throughout history. The paragraph in chapter 88 (this chapter number differs among translators) of the 7th book in the Karl Friedrich Theodor Mayhoff edition, reads as follows:

"... *Caprae tamen in plurimas similitudines transfigurantur. Sunt caprae, sunt rupicaprae, sunt ibices pernecitatis mirandae, quamquam onerato capite vastis cornibus gladiatorum ceu vaginis ... Sunt et oryges, soli quibusdam dicti contrario pilo vestiri et ad caput verso. Sunt et dammae et pygargi et strepsicerotes multaue alia haut dissimilia. Sed illa Alpes, haec transmarini situs mittunt.*" (Pliny the Elder and Mayhoff, 1906).

Bostock and Riley (1855, p. 346) translated the text as follows:

"There is no kind of animal, however, that is divided into a greater number of varieties than the goat. There are the *caprae*, the *rupicapra* or rock-goat, and the *ibex*, an animal of wonderful swiftness, although its head is loaded with immense horns, which bear a strong resemblance to the sheath of a sword. ... There are the *oryges* also, which are said to be the only animals that have the hair the contrary way, the points being turned towards the head. There are the *dama* also, the *pygargus*, and the *strepsicerotes*, besides many others, which strongly resemble them. The first mentioned of these animals, however, dwell in the Alps;

all the others are sent to us from the parts beyond sea."

Their 18th note states:

"It is not easy to determine what animals Pliny intended to designate. Cuvier employs the terms *chevreuils*, *chamois*, and *bouquetins* as the corresponding words in the French. In English we have no names to express these varieties; we may, however, regard them generally, as different species of wild goats" (Bostock and Riley, 1855).

In summary, Pliny used the terms *caprae*, *rupicaprae*, and *ibices* for the 'close' wild goats (particularly, those in the Alps), and *oryges*, *dammae*, *pygargi*, and *strepsicerotes* for the wild goats from beyond the sea (likely from Africa and the Middle East). These terms have been ascribed to various species depending on the translator (appendix 4).

Historia animalium by Gessner (1551) is considered the beginning of Modern Zoology. Like other pre-Linnaean works, it was strongly influenced by Pliny's *Naturalis Historia* (Findlen, 2006). Gessner applied the name *ibex* to the wild goats that lived in the Alps, following the description by Pliny, as follows:

"*Caprae (sylvestres) in plurimas similitudines transfigurantur. Sunt caprae, rupicaprae, ibices; Sunt & oryges, dammae, pygargi, strepsicerotes, multae alia haut dissimilia. Sed illa Alpes, haec transmarini situs mittunt, Plinius 8:53*" (Gessner, 1551, p. 319).

When referring to synonyms of the term *ibex* in various languages, he stated that Germans call it *Steinbock* and Transalpine Gallics call it *bouc étain* (Gessner, 1602, p. 304), which match the current common names for *C. ibex*, of Germanic origin. Swiss highlanders call female *ibex* *ybschen* or *ybschgeiss* ('whose name I do not doubt comes from Latin', Gessner, 1551, p. 331). In the description of the animal, Gessner stated that they are abundant in the Alp peaks and that males have heavy horns that are curved backwards (scimitar type), harsh, and knotted: '*Magni ponderis cornua ei reclinantur ad dorsum, aspera & nodosa*' (Gessner, 1602, p. 305). The knots in the horns are distinct in the drawings in the book, which are probably among the first drawings of *C. ibex* (fig. 2).

That same morphological description, more or less verbatim, was repeated by Ray (1693) and by Linnaeus (1756, 1758) in what is considered the official description of the species: "*Capra cornibus nodosis in dorsum reclinatis. le Bouc-étain. Ibex. Raj. quadr. 79*". Linnaeus was influenced by or copied the description of *C. ibex* from Ray (appendix 4) and used the French common name *Bouc-étain* (Linnaeus, 1756), and Ray (1693) followed Pliny, who is quoted in the description. The description was repeated in other Latin texts of the 18th C. (Klein, 1751; Erxleben, 1777; Asso, 1784).

The earliest English texts that mention wild goats

From the 16th C. until the mid-19th C., few zoology books were written in English. Most were written in French or German, as Cuvier et al. (1827–1835) indicated in the foreword of *The Animal Kingdom. The History of Four-footed Beasts and Serpents* (Topsell, 1658) was, perhaps, one of the first Modern Zoology



Fig. 1. Scene showing some 13 'bouquetins des Pyrénées' in a Pyrenean landscape; three are albinos. From *Le Livre de la chasse*, 1407, Gaston Phoebus, MS M. 1044, fol. 12—detail, with permission of © The Morgan Library & Museum, New York.

Fig. 1. Imagen en la que se muestran 13 cabras monteses en un paisaje pirenaico; tres de ellas son albinas. De *Le Livre de la chasse*, 1407, Gaston Phoebus, MS M. 1044, detalle fol. 12, con permiso de © The Morgan Library & Museum, New York.

books written in Old English. Topsell used the term *ibex* to designate Alpine *wilde goats*, possibly, because of the influence of Isidore of Seville, from whom he extracted the origin of the term *ibex*, which associates it with the Nile ibis.

Another of the early English texts mentioning *C. ibex* is the *Catalogue of the Museum Leveriani* by George Shaw (1791), in which Linnaean nomenclature is already used. This bilingual Latin–English edition includes a brief description of *Capra ibex* from Linnaeus (1758) (*Capra cornibus supra nodosis in dorsum reclinatis*), which is translated as "The Ibex. Dark–brown Goat, with large knotted horns reclining backwards". Shaw (1791) refers to *Ibex* and *steinbock* equivalently as the common name in English. Both terms are used synonymously in *The Animal Kingdom* by Cuvier et al. (1827–1835) and in Gray (1850–1852).

In summary, in Old English, the word *ibex* was not used to designate the female or the male goat; rather, *geit* and *buck* were used, respectively. The term *ibex* came later through the Latin influence by Linnaeus (1758), being copied from Ray (1693), who was influenced by Pliny (77 AD). Until the 19th C., *ibex*, *Steinbock*, and *bouc–etaïn* were used interchangeably as the common name for the Alpine ibex (*C. ibex*) in English. In the earliest descriptions and use in English

of the term *ibex*, there is no indication that suggests it included Iberian wild goat. Therefore, none of the interpretations based on the texts of Pliny justify the use of *ibex* as the common name for the Iberian wild goat.

History of the common name of *Capra pyrenaica* ('cabra montés')

Pre–Linnaean texts

Isidore of Seville was the first to apply the term *ibex* to Iberian wild goats, connecting its etymology to Nile's bird ibis (Barney et al., 2006, p. 248). Isidore of Seville (an ecclesiastical scholar) may not have had direct knowledge of Iberian wild goats and was limited to copying classical texts for its description, adding strange interpretations the origin of the term *ibex*.

Based on the Hispanic origin of Isidore of Seville, on the supposed Latin–Iberian origin of the term, and on the renowned *Diccionario etimológico de la lengua hispánica* by Coromines and Pascual (1984), Sarasa et al. (2012) justified the use of the term *ibex* as a common name for the Iberian wild goat. There are several reasons why that was unjustified: (a) Isidore of Seville mentions wild goats and *ibex*, but he does



Fig. 2. Alpine ibex or Steinbock (*Capra ibex*) from Gessner (1560). Probably one of the first illustrations of *Capra ibex* in a modern zoological text. Conrad Gessner (1516–1565) noted the typical character of the knots in the anterior face of the horn sheath, differentiating it from the Iberian wild goat (*C. pyrenaica*). www.biodiversitylibrary.org/item/131297, public domain (holding institution: Smithsonian Libraries, sponsored by: Biodiversity Heritage Library).

Fig. 2. *Cabra salvaje de los Alpes (Capra ibex) de Gessner (1560). Probablemente una de las primeras ilustraciones de Capra ibex en un texto zoológico moderno. Conrad Gessner (1516–1565) señaló el carácter típico de las nudosidades de la cara anterior del estuche de los cuernos, lo que la diferencia de la cabra montés (C. pyrenaica). www.biodiversitylibrary.org/item/131297, dominio público (institución depositaria: Smithsonian Libraries, patrocinado por: Biodiversity Heritage Library).*

not refer to Iberian species specifically; rather, he refers to wild goats in general. Furthermore, Gessner (1602, p. 304) felt that Isidore of Seville confused both terms ('*Isidorus dorcades, capreas & ibices imperitissime confundit*'). (b) Isidore of Seville gathered most of his information from Pliny the Elder (Barney et al., 2006, p. 14), who referred to *ibex* as the wild goat that lives in the Alps (see above). (c) In their book, Coromines and Pascual (1984, p. 553) confuse the current species of Southern chamois (*Rupicapra pyrenaica*) and wild goat (*Capra p. hispanica*). They created a hybrid Latin name *Rupicapra hispanica*, and state that ibex only occurs in Spain and not in the Alps. This is a significant error as Pliny (77 AD), Gessner (1602), Klein (1751), and Linnaeus (1758) (among others) make it clear that the ibex is restricted to the Alps. Consequently, given the limited taxonomic and biological background of Coromines and Pascual, their argument should be considered invalid. Contrary to what Sarasa et al. (2012) maintain, the book by Isidore of Seville is not a reliable source of information about the wild goats living in Iberia at that time.

The first texts written in medieval Spanish that referred to the Iberian fauna did not call *C. pyrenaica* ibex; rather, they were referred to as *cabra montés* (wild goat) in general or for females, and *cabrón* (he-goat). Most of the authors were hunters and knew wild goat very well, having observed them. For instance,

in *Libro de la Caza* (1325), Don Juan Manuel noted that wild goats were present in the County of Villena in the Kingdom of Murcia (Gutiérrez de la Vega et al., 1879). In the famous *Libro de la Montería* by King Alfonso XI (Argote de Molina, 1582), the wild goat is not mentioned, specifically, but several toponyms associated with wild bock are mentioned (Valverde, 2010), confirming the predominance given to the male to name the species in Classical and Modern texts (Gessner, 1551; appendix 3). In all the old treaties subsequently published in Spanish or Portuguese, the reference is to *cabras monteses* for females or for the species, and *cabrones* or *macho montés* for the male (Barahona de Soto, 1575; Martínez de Espinar, 1644; Calvo Pinto, 1754; Barboza du Bocage, 1857). Some texts reference *cabras silvestres* from the Canary Islands, which were used to supply vessels with fresh meat (Argote de Molina, 1582). Clearly, those were feral goats, *Capra hircus*, as there were no goats other than domestic ones in the Canary Islands. In summary, in the Iberian peninsula the term ibex was never used in hunting, wildlife, geographical dictionaries, or legal texts as a common name for Iberian wild goats (appendix 3).

In the section devoted to *Capris silvestribus*, Gessner (1551, 1602) did not mention Iberian wild goats, specifically. Rather, he indicated the names that were used in various languages. For the 'Hispanica'



Fig. 3. *Caper hispanicus* from *Historiae Naturalis* by Jonston (1650), one of the first representations of Iberian wild goat after the drawings in *Livre de la Chasse* (Phoebus, 1387). The drawing illustrates the typical lyre-shaped horns of the Pyrenean morphotype. www.biodiversitylibrary.org/item/137912#page/135/mode/1up, public domain (holding institution: Smithsonian Libraries, sponsored by: Biodiversity Heritage Library).

Fig. 3. *Caper hispanicus* de *Historiae Naturalis* de Jonston (1650), una de las primeras representaciones de la cabra montés posteriores a las ilustraciones de la publicación *Livre de la Chasse* (Phoebus, 1387). En la ilustración se observan los típicos cuernos en forma de lira del morfotipo pirenaico. www.biodiversitylibrary.org/item/137912#page/135/mode/1up, dominio público (institución depositaria: Smithsonian Libraries, p. Patrocinado por: Biodiversity Heritage Library).

language, he gave *cabra*, *cabrito*, *cabrón*, *cabronzillo montés*, but did not mention *ibex*.

Among the pre-Linnaean Natural History texts from the early Modern period, the first to show the Iberian wild goat was Jonston (1650), who called it *Caper hispanicus* (fig. 3). Probably, it is the first or one of the first images of the species after the *bouquetin* drawings in *Le livre de la Chasse* (Phoebus, 1387). Subsequently, the Latin name *Caper Hispanicus* was used by Charleton (1677) in his *Historia Naturalis* and he gave it the name 'Spanish wild goat'. The 'ibex', which was illustrated by a drawing copied from Gessner (1551), occurs in the Alps.

Post-Linnaean texts before the first scientific description of *C. pyrenaica* in 1838

Erxleben (1777) described five species in the genus *Capra*: *hircus*, *ibex*, *mambrina*, *depressa*, and *reversa*. In the *hircus* group he included *αἴγας* (*aigas*) and *τράγος* (*tragos*) from Aristotle, *Capra* from Pliny, several domestic goats described by various authors, and *C. aegagrus*, which was the first taxonomic description of the species recognized today. In that group, Erxleben included *Caper Hispanicus* based on Jonston (1650). These taxa were differentiated from the *ibex* group (Alpine *ibex* *Capra ibex*), for which he used the 1758 Linnaeus definition (*Capra cornibus nodosis in dorsum reclinatis*) and quoted Pliny, specifically.

Asso (1784) is one of the few in the 18th C. who remarked upon the fauna of the Aragon region in Spain. He differentiated three kinds of goats that occurred in the Pyrenees: *Capra Hircus* (domestic), *Capra Rupicapra* (chamois) and *Capra Ibex*, (living in Plan, Gistau Valley), and certainly was referring to the Pyrenean wild goat. He used that name because he followed Linnaeus faithfully and, at that time, *C. pyrenaica* had not been described scientifically. In the second half of the 18th C. and the early 19th C., various authors used the term *C. ibex* for wild goats in general (Klein, 1751; Pennant, 1793).

Cuvier et al. (1827–1835) used the common name *ibex* and the scientific name *Capra Ibex* for all the European wild goats. He presumed that they still existed in Candia (Crete), Greece, and the Carpathians. He stated that Iberian wild goats exist in the Asturias Mountains and in the Pyrenees 'where they are almost extinct'.

In summary, most of the pre- and post-Linnaean texts that describe the Iberian fauna did not refer to the Iberian wild goat as an *ibex*, but as '*cabra montés*' (wild goat). A few authors who do refer to it as *ibex* (Isidore of Seville, Asso, Cuvier G.) follow the inertia of naming all European wild goats as *ibex*, misinterpreting Pliny the Elder who used this term only for the wild goats from the Alps. The scientific description of *C. pyrenaica* was not achieved by Schinz until 1838.

Taxonomically, few have considered *Capra pyrenaica* an ibex

Scientific descriptions of the species in the 19th C.

In one of the first descriptions of *C. pyrenaica*, Saint-Hilaire and Cuvier (1824–1842) included extensively long passages from Gaston Phoebus's (1387) book. In the text, they called it *Bouquetin des Pyrénées*, but in the index it is referred to as *C. ibex*. They also reproduced a drawing of a young male in captivity in La Ménagerie (a private zoo in Paris) that is unrepresentative of the species (Sánchez Hernández, 2010, p. 41). The drawing was reproduced by Schinz (1838) in the first taxonomic description of *C. pyrenaica*. In the title and through the text he used *Pyrenäenbock* and *Steinbock der Pyrenäen* as the common name to differentiate it from the *Alpensteinbock*. Schinz's description of the new species was based on skins and drawings given to him by his colleague Carl F. Bruch (Sánchez Hernández, 2010). Ten years later, Schimper (1848) described a new species of *Capra* for Iberia, *C. hispanica*, based on specimens collected on an expedition to the Sierra Nevada (Spain). For the common names, he used the ones used locally, *cabra montés* (wild goat) or *Montesa* (wild she-goat).

The morphotype of *C. pyrenaica* differs from that of the other wild goats, at least from the Alpine ibex (fig. 4). Therefore, in one of the first catalogues of the British Museum, Gray (1850–1852) separated *C. pyrenaica* and the tur *C. caucasica* from the other *Capra* and assigned them the generic name *Aegoceros*. To *Ae. pyrenaica* he assigned the common name *Pyrenean tur*.

In his interesting treatise of mammals from Galicia, López Seoane (1861) noted the presence of *C. pyrenaica*, which was present in the NW Spanish sierras at that time, where it was called *craba brava* or *craba fera*, a vernacular term for wild goat (appendix 3). Graells (1897), following Gervais (1854), assigned the Iberian goats to the genus *Ibex* (*Ibex pyrenaicus*). He used the term *Ibex* as a synonym of *Capra*. For example, he called the Alpine ibex *Ibex alpinus* and the recently described (Schimper, 1848) wild goat of southern Iberia *Ibex hispanicus*. In some cases, the name *Ibex* had been used as a generic name instead of *Capra*; e.g., Frisch 1775 (cited in Parrini et al., 2009), Pallas (1776), Pennant (1793), Gervais (1854). For the common name, Graells (1897) used *cabra montés*.

Lydekker (1898) named *C. pyrenaica* the *Spanish tur* (probably following Gray) and assigned it an intermediate morphotype between the *Caucasian tur* and the 'true ibex' although more similar to the former. He also called it the Spanish wild goat (p. 255), but added "but it may best be called a tur rather than an ibex".

Classification and common names of *C. pyrenaica* in the 20th C.

In an influential paper, Cabrera (1911) defined the currently accepted subspecies of *C. pyrenaica* (Shackleton, 1997; Herrero et al., 2020). He used the common name *Spanish ibex* to refer to the species.

The work of Cabrera (1911) had a significant impact by substantially changing the taxonomy of the Iberian wild goats and contributed to the spreading of the inappropriate term *Spanish ibex* in the 20th C. Specifically, Cabrera (1911) combined into a single species (*C. pyrenaica*) the two species initially described by Schinz (1838), *C. pyrenaica*, and Schimper (1848), *C. hispanica*, designated each as a subspecies. He also described two new subspecies (*lusitanica* and *victoriae*). Camerano (1917) and others (Forsyth Major, 1879; Graells, 1897) advocated maintaining the two original species.

Probably, Cabrera's (1911) use of the term *Spanish ibex* was influenced by his relationship with English-speaking scientists (Casado, 2012) and by contemporary texts of English explorers (Buxton, 1892; Chapman and Buck, 1893, 1910) that he used in part to describe the species' distribution in Iberia. These English hunters who explored Iberia at the end of the 19th C. and earlier 20th C probably did not know the description of Iberian wild goats by Schinz and Schimper, whom they do not quote in their works, and adopted the generic term 'ibex' used for the European wild goats in general (see previous sections). In his monography on Iberian mammals, Cabrera (1914) provided a list of vernacular names used for the species in the Iberian peninsula. Almost all of them are variations of wild goat (*cabra montés*, *cabra salvatge*, *craba brava*, *cabra montez*, *bucardo*). In addition, he noted that in Old Spanish, it was named *ibis* or *ibice*, probably because of the influence of *Las Etimologías* by Isidore of Seville, which does not parallel the hunting or popular texts of the Medieval Period (appendix 3).

More recently, Ellerman and Morrison-Scott (1951) differentiated *C. pyrenaica* and *C. caucasica* (which includes *C. cylindricornis*) from the ibexes, and recognized five species for *Capra*: *C. hircus* (domestic goats and bezoars), *C. ibex* (ibexes *sensu lato*, see below), *C. caucasica* (Caucasian tur), *C. falconeri* (markhor), and *C. pyrenaica* (called Spanish ibex but included in a different subgenus *Turocapra*). In the renowned text *Mammals of the Soviet Union*, Heptner et al. (1989) proposed a taxonomy for the genus *Capra* that included eight species, which is similar to the nine accepted currently (Shackleton and Lovari, 1997; Groves and Grubb, 2011). Heptner et al. (1989) grouped *C. hircus* with *C. aegagrus* in one species. In their review, they referred to *C. pyrenaica* as Pyrenean goat, not Spanish ibex (appendix 1).

The phylogeography and systematic classification of Iberian wild goats (*Capra pyrenaica*) is unclear (Acevedo and Cassinello, 2009) although there are several hypotheses for their origin. An overview of these is presented in appendix 5.

In summary, *Capra pyrenaica* has been given a variety of common names (*Caper Hispanicus*, *Spanish tur*, *Spanish wild goat*). By a fortuitous occurrence, the term *Spanish ibex* has become common in scientific texts, but this does not mean that it is the most accurate or appropriate. The use of the term *Spanish ibex* began to appear in some English-language texts written in the 19th C. (Cuvier et al., 1827–1835;

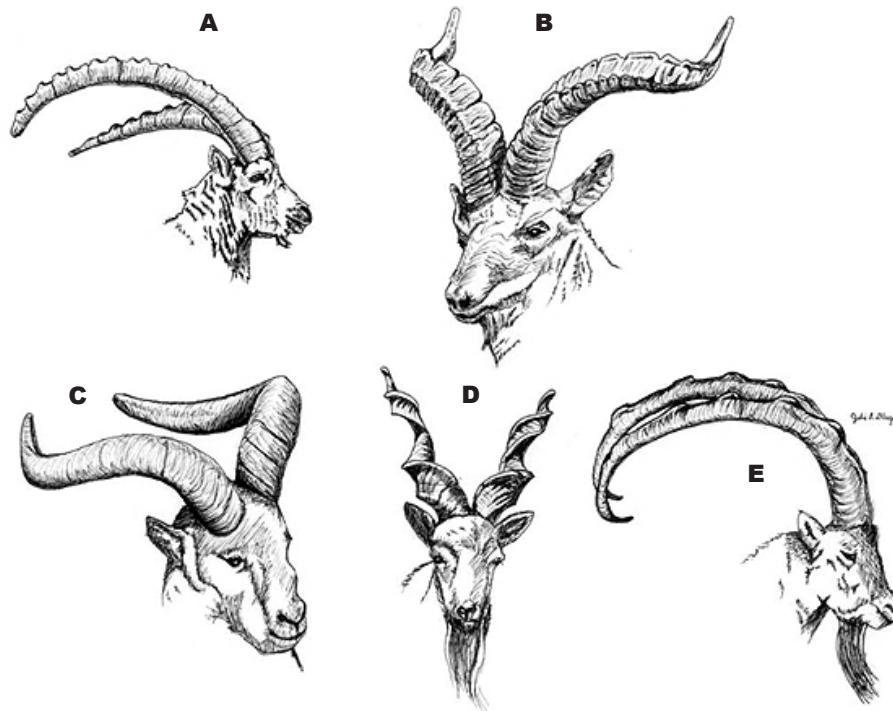


Fig. 4. Horn morphology of the five major *Capra* morphotypes: A, ibex-type (*C. ibex*, *C. nubiana*, *C. sibirica*, and *C. caucasica*); B, the Spanish goat type (*C. pyrenaica*); C, the Eastern tur (*C. cylindricornis*); D, the markhor (*C. falconeri*); and E, the bezoar-type (*C. aegagrus*). Artwork by Julie Dlugos (Pidencier et al., 2006, with permission from Elsevier).

Fig. 4. Morfología de los cuernos de los cinco morfotipos del género *Capra* principales: A, tipo íbice (*C. ibex*, *C. nubiana*, *C. sibirica* y *C. caucasica*); B, tipo cabra montés (*C. pyrenaica*); C, tur del Cáucaso oriental (*C. cylindricornis*); D, marjor (*C. falconeri*); E, tipo bezoar (*C. aegagrus*). Ilustración de Julie Dlugos (Pidencier et al., 2006, con permiso de Elsevier).

Busk, 1877) and it spread rapidly in the early 20th C. as English emerged as the predominant language of science. Several popular books about hunting stories by English hunters and explorers in Spain, such as Buxton (1892) and Chapman and Buck (1893, 1910), perpetuated the term Spanish ibex. This was aided by the influential paper by Cabrera (1911). Nevertheless, there was still no reason to use the name *ibex* in English to describe European wild goats other than Alpine ibex.

Horn morphology and molecular genetics

As seen in previous sections, the taxonomy of the *Capra* genus has been controversial and is not yet fully resolved today (Groves and Grubb, 2011; appendix 1). Until the incorporation of molecular techniques, it was mainly based on morphological and biogeographical criteria (Lydekker, 1898; Heptner et al., 1989). One of the most widespread criteria used the shape of the horns of adult males. For example, Pidancier et al. (2006) established five morphotypes for *Capra*:

the Spanish goat type (*C. pyrenaica*), the eastern tur (*C. cylindricornis*), the markhor (*C. falconeri*), the bezoar-type (*C. aegagrus*), and the ibex type (fig. 4; see also appendix 1). The last applies to a particular horn morphotype, in which adult males bear scimitar-shaped horns that have prominent knobs or ridges on their anterior surfaces (Ellerman and Morrison-Scott, 1951; Schaller, 1977). This is typical for several *Capra* species (*C. ibex*, partially in *C. caucasica*, *C. sibirica*, *C. nubiana*, and *C. walie*) and some authors considered they might be subspecies of *C. ibex* (Ellerman and Morrison-Scott, 1951; Couturier, 1962; Shackleton and Lovari, 1997). Adult males of the *C. pyrenaica* morphotype (also called the lyre-shaped morphotype) present double-curved and, normally, smooth horns (Schinz, 1838; Lydekker, 1898; Pidancier et al., 2006). The ibex and *C. pyrenaica* morphotypes differ so much that De Beaux (1949) proposed a new subgenus, *Turocapra*, only for the Iberian wild goat, although this has not been accepted and used in scientific publications.

Molecular genetic results do not necessarily correspond with morphological characteristics. For example,

Capra sibirica (of the ibex morphotype) is genetically quite distant from *C. ibex* (Alpine ibex) (Kazanskaya et al., 2007; Joshi et al., 2020). Several molecular analyses show *C. nubiana* (ibex morphotype) to be genetically more distant from *C. ibex* than from other *Capra* species of different morphotypes (Lalueza-Fox et al., 2005; Pérez et al., 2014). Conversely, markhor (*C. falconeri*) is relatively genetically close to *C. aegagrus* (Zvy chaynaya, 2010; Bibi et al. 2012) despite having radically different horn morphotypes (fig. 4 and appendix 1). *C. caucasica* and *C. cylindricornis* belong to two different horn morphotypes although some authors point out a close genetic relationship between the two (Manceau et al., 1999; Lalueza-Fox et al., 2005). Others (Kazanskaya et al., 2007) have also indicated this dissimilarity and consider that the ibex morphotype could be a plesiomorphic character for the *Capra* genus. These discrepancies are not particularly unusual since the genes that regulate the shape and size of the horns are evolutionarily easy to modify (Schaller, 1977), as livestock risers know.

However, neither external morphological features nor genetic distances based on particular molecular characters are suitable alone for a reliable diagnosis of taxonomic status. To be biologically meaningful, classifications must involve integration of genetic, morphological, physiological and behavioural data (Giacometti et al., 1997).

Most molecular studies have shown a close genetic relationship between *C. pyrenaica* and *C. ibex* (Manceaux et al., 1999; Ureña et al., 2018, even if horn morphotypes are completely different (fig. 4). Genetic closeness does not justify the adoption of a common name (Spanish ibex) which additionally is based on a morphotype that does not match *Capra pyrenaica*. The scientific nomenclature follows a rigorous regulation guided by phylogenetic relationships, which is not the case of common names. Common names are usually recognizable, easy to pronounce and stable over time, and they are intended to link the people of the territory with its species (Bowen-Jones and Entwistle, 2002).

The conservation value of common names and the use of the name 'wild goat'

Although scientists agreed to name the species of organisms based on the Linnaeus (1758) binomial system, the common names given to taxa are important to promote sound communication in fields such as science, conservation and legislation. Often, common names of species are linked to vernacular names that local people attribute to the plants and animals they know, and these become part of their cultural heritage. It is important to take this into account when using common names of species in monographs, catalogues, or legal documents, because the inhabitants of affected areas will be more committed to the conservation of these species (Duckworth and Pine, 2003; Stevens et al., 2014).

English common names are important in the public's perception of animals and are therefore essential for

flagship species (Bowen-Jones and Entwistle, 2002). *Capra pyrenaica* is a outstanding endemic species of the Iberian peninsula, and emblematic for many nature enthusiasts, conservationists, and hunters.

Some taxonomists (Ellerman and Morrison-Scott, 1951; Corbet, 1980; Groves and Grubb, 2011) have used the term *wild goat* preferably or exclusively for the attributed ancestor of domestic goats (*Capra aegagrus* or bezoar). Although the term *aegagrus* originated from the Greek *aiga agrios* ('wild goat'), this term is not exclusive for *C. aegagrus*. As has been shown throughout the preceding text, the term 'wild goat' has been used (in different forms and languages) for the last 20 centuries for several *Capra* taxa including *C. pyrenaica*.

The term *wild goat* has arisen because of the need to differentiate the domestic and wild forms of the same species (*C. aegagrus*). Subsequently, the common name *wild goat* was reserved exclusively for *Capra aegagrus*. However, originally, for Pliny and his followers, *wild goat* included other wild goats; e.g., the *caprea*, *rupicapra*, and *ibeces* from Pliny the Elder (77 AD), and the *Capra sylvestris* of Gessner (1551). To avoid mistakes, *C. aegagrus* is frequently called bezoar or pasang.

Some authors (Sarasa et al., 2012; Karaffa et al., 2012) assert that from the point of view of conservation, it is preferable not to use common names with pejorative connotations like *wild* or *killer*, avoiding the term *wild goat*. However, in our opinion, nowadays the term 'wild' can have positive connotations for a growing sector of the population that sympathizes with nature and wilderness. Consider for example, the now classic ideas of 'wildness' and 'wilderness' from Henry D. Thoreau and his followers ('In wildness is the preservation of the world'; Thoreau, 1854) or the more recent of 'rewilding' (the return of habitats to their natural state). A separate question is the term 'killer', improperly applied for example to *Orcinus orca* ('killer whale'), which is neither a whale and is certainly not a murderer. The argument of Sarasa et al. (2012) that the use of wild goat might reduce the conservation value of *Capra pyrenaica* because the general population might confuse them with 'stray or feral goats' is unrealistic. Since centuries ago in Iberia, people know perfectly well that *cabra montés* or *cabra brava* is a wild animal and not a domestic goat that has returned to a wild state. Regarding the latter, in Spanish, the term *cabra asilvestrada* or *cimarrona* (feral goat) is used.

Concluding remarks

This review aimed to show that the names used most frequently to designate the wild members of the *Capra* genus (*aegagrus*, *Steinbock*) are related etymologically to the term *wild goat*, with different forms influenced by the sex of the animal or the language of origin. The use of one term or another by different authors over the last 2,000 years has depended largely on popular use and the original sources that the academics used as the basis for their work.

Probably, the term *ibex* is of Latin origin, and the etymology provided by Isidore of Seville (c. 556–636), which associates it with *Ibis* of the Nile, is unlikely. In addition, he stated that ibices were exclusive of Iberia, which is incorrect. Pliny the Elder (77 AD), in his *Historiae Naturalis*, was the first to use the term *ibex* in Latin, which referred to the wild goats in the Alps. Other pre-Linnaean authors adopted the term. Gessner (1551), asserted the Alpine origin of ibices, and included in its description one of the main morphological features, viz., scimitar-shaped horns that have knots, and are curved backwards. That diagnostic feature was adopted by Ray (1693) and by Linnaeus (1758) in what became the officially accepted definition for the species *C. ibex* ('*capra cornibus nodosis in dorsum reclinatis*').

The use of Latin as the erudite and scientific language in Europe until the 18th C. greatly influenced those who followed the early Roman authors, especially Pliny the Elder. For instance, the term *ibex* appeared in some ancient academic texts such as that of Isidore of Seville (Lindsay, 1911). Nevertheless, in medieval books about law, hunting, or Natural History, the common names of *Capra* in their respective languages or their derivatives began to be used. For example, *cabra montes* in *Libro de la Caza* by Juan Manuel (Gutiérrez de la Vega et al., 1879), *bouquetin* in *Le Livre de la Chasse* by Gaston Phoebus (1387), and *Steinbock* and *Ibsch* in the medieval Germanic treatises (Couturier, 1962).

The use of the term *ibex* continued in post-Linnaean English-language texts, and some included all the known wild goats (Pennant, 1793; Cuvier, 1798; Gervais, 1854; Schwarz, 1935). Even a seminal Spanish paper (Cabrera, 1911) followed that nomenclature for *C. pyrenaica* and called it *Spanish ibex*. Subsequently, the term has been used extensively, although without a rational basis to do so, given that the first Natural History texts written in English used interchangeably *ibex*, *Steinbock* or *bouc-étagé* as the common name for *C. ibex*.

In the 19th and 20th C. from the first description of the species in 1838 by Schinz (*Pyrenäenbock*) to the prestigious catalogs such as Lydekker (1898) and Heptner (1989), few considered *C. pyrenaica* as an ibex, taxonomically. Several experts have defended the morphological distinction between Iberian wild goat and the ibexes (Gray, 1850–1852; De Beaux, 1949; Ellerman and Morrison-Scott, 1951; Pidancier et al., 2006). However, various mtDNA studies have identified a close genetic relationship between *C. pyrenaica* and *C. ibex* (e.g., Manceaux et al., 1999; Ureña et al., 2018) and some assert the common name for *C. pyrenaica* should therefore be 'Iberian ibex'. Nevertheless, genetic proximity does not necessarily mirror morphological similarity (Schaller, 1977; Bar-Gal et al., 2002). In addition to morphology, common names can reflect any other useful feature for locals to easily recognize a particular species (Duckworth and Pine, 2003). Common names do not have to follow the rules of scientific nomenclature based on phylogeny.

If we accept that the common name of an animal is the popular name used by the general population,

it should be noted no one in Portugal and Spain calls *C. pyrenaica* an ibex. There, they are referred to as *cabra montés*, *cabra salvatge* or *cabra brava* (among other similar vernacular names), which translate to *wild goat*. Experts and hunters use the same names, and when they speak about *ibex* they are referring to the Alpine ibex or to the ibex of other areas. We suggest that 'Iberian wild goat', a common name that has already been used in several languages for centuries and in scientific texts (see appendices 2 and 3), is the most appropriate common name for *C. pyrenaica* and that scientific, legal and popular media use this common name.

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Supplementary material

Appendix 1. Different taxonomic schemes for *Capra* genus, and species currently accepted.

Apéndice 1. Diferentes esquemas taxonómicos del género *Capra* y especies aceptadas actualmente.

Table 1s. Well-known taxonomic classifications of the genus during the last two centuries: ⁽¹⁾ In addition the authors include *C. jemlanica* (*Hemitragus*); ⁽²⁾ In addition the author include *C. himalayana* and *C. laevicornis*. ⁽³⁾ In addition the author includes *C. laervia* (*Ammotragus laervia*). ⁽⁴⁾ Heptner et al. (1989) state this name is artificial and mention some vernacular names: 'bun' in the Altai, 'tek' or 'teke' in the Tien Shan.

Tabla 1s. Clasificaciones taxonómicas bien conocidas del género durante los últimos dos siglos: ⁽¹⁾ los autores incluyen también *C. jemlanica* (*Hemitragus*); ⁽²⁾ el autor incluye también *C. himalayana* y *C. laevicornis*; ⁽³⁾ el autor incluye también *C. laervia* (*Ammotragus laervia*); ⁽⁴⁾ Heptner et al. (1989) afirman que este nombre es artificial y mencionan algunos nombres vernáculos: "bun" en Altai, "tek" or "teke" en Tien Shan.

	<i>C. pyrenaica</i>	<i>C. ibex</i>	<i>C. sibirica</i>	<i>C. nubiana</i>	<i>C. walie</i>	<i>C. caucasica</i>	<i>C. cylindricornis</i>	<i>C. falconeri</i>	<i>C. aegagrus</i>	<i>C. hircus</i>
Cuvier et al. (1827) ⁽¹⁾		<i>C. Ibex</i>			<i>C. jaela</i> (Abissinian Ibex)	<i>C. caucasica</i> (Caucasian Ibex)			<i>C. aegagrus</i> (The Aegagrus)	<i>C. hircus</i> (Domestic goat)
Gray (1850–1852) ⁽²⁾	<i>Aegoceros</i> <i>pyrenaica</i>	<i>C. ibex</i>	<i>C. sibirica</i>	<i>C. nubiana</i>	<i>C. valie</i>	<i>Aegoceros</i> <i>caucasica</i>				<i>Hircus</i> <i>aegagrus</i>
Lydekker (1913)	<i>C. pyrenaica</i>	<i>C. ibex</i>	<i>C. sibirica</i>	<i>C. nubiana</i>	<i>C. walie</i>	<i>C. caucasica</i>	<i>C. severtzovi</i>	<i>C. falconeri</i>	<i>C. hircus</i> (<i>C. aegagrus</i>)	
Schwarz (1935)			<i>C. ibex</i>				<i>Orthaegoceros</i>	<i>C. hircus</i>		
Ellerman and Morrison–Scott (1951)	<i>C. pyrenaica</i>		<i>C. ibex</i>		<i>C. caucasica</i>		<i>C. falconeri</i>	<i>C. hircus</i>	(<i>C. aegagrus</i>)	
Heptner et al. (1989)	<i>C. pyrenaica</i>	<i>C. ibex</i>	<i>C. sibirica</i>	<i>C. nubiana</i>		<i>C. caucasica</i>	<i>C. cylindricornis</i>	<i>C. falconeri</i>	<i>C. aegagrus</i> (<i>C. hircus</i>)	
Schaller (1977)	<i>C. pyrenaica</i>		<i>C. ibex</i>				<i>C. cylindricornis</i>	<i>C. falconeri</i>	<i>C. aegagrus</i>	<i>C. hircus</i>
Corbet (1980) ⁽³⁾	<i>C. pyrenaica</i>	<i>C. ibex</i>	<i>C. caucasica</i>				<i>C. cylindricornis</i>	<i>C. falconeri</i>	<i>C. aegagrus</i> (<i>C. hircus</i>)	
Shackleton and Lovari (1997)	<i>C. pyrenaica</i>	<i>C. ibex</i>	<i>C. sibirica</i>	<i>C. nubiana</i>	<i>C. walie</i>	<i>C. caucasica</i>	<i>C. cylindricornis</i>	<i>C. falconeri</i>	<i>C. aegagrus</i>	<i>C. hircus</i>
Wilson and Reeder (2005)	<i>C. pyrenaica</i>	<i>C. ibex</i>	<i>C. sibirica</i>	<i>C. nubiana</i>	<i>C. walie</i>	<i>C. caucasica</i>	<i>C. caucasica</i> subsp. <i>cylindricornis</i>	<i>C. falconeri</i>	<i>C. hircus</i> subsp. <i>aegagrus</i>	<i>C. hircus</i>
Groves and Grubb (2011)	<i>C. pyrenaica</i>	<i>C. ibex</i>	<i>C. sibirica</i>	<i>C. nubiana</i>	<i>C. walie</i>	<i>C. caucasica</i>	<i>C. cylindricornis</i>	<i>C. falconeri</i>	<i>C. aegagrus</i>	<i>C. hircus</i>
Common names	Iberian wild goat	Alpine ibex	Siberian ibex ⁽⁴⁾	Nubian ibex	Walia ibex	Eastern tur	Western tur	Markhor	Bezoar	Domestic goat

Fig. 1s. According with current IUCN classification (Shackleton and Lovari, 1997) or recent Ungulate Taxonomy from Groves and Grubb (2011), nine *Capra* species are acknowledged today, in addition to the domestic goat *C. hircus*: A, *C. ibex* (Alpine ibex); B, *C. sibirica* (Siberian ibex); C, *C. nubiana* (Nubian ibex); D, *C. walie* (Walia ibex); E, *C. caucasica* (Western tur); F, *C. falconeri* (markhor); G, *C. cylindricornis* (Eastern tur); H, *C. pyrenaica* (Iberian wild goat); and I, *C. aegagrus* (bezoar). (A, B, C, D and E form the 'ibex' morphotype group according to Pidancier et al., 2006).

Fig. 1s. Según la clasificación vigente de la UICN (Unión Internacional para la Conservación de la Naturaleza, Shackleton y Lovari, 1997) o la reciente publicación sobre taxonomía de los ungulados de Groves y Grubb (2011), hoy en día se reconocen nueve especies del género *Capra* además de la cabra doméstica, *C. hircus*: A, *C. ibex* (íbice alpino); B, *C. sibirica* (íbice siberiano); C, *C. nubiana* (íbice de Nubia); D, *C. walie* (íbice de Etiopía); E, *C. caucasica* (tur del Cáucaso occidental); F, *C. falconeri* (marjor); G, *C. cylindricornis* (tur del Cáucaso oriental); H, *C. pyrenaica* (cabra montés ibérica); I, *C. aegagrus* (bezoar). Según Pidancier et al. (2006), A, B, C, D y E, forman el grupo de morfotipo "ibex".



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Capra ibex (Alpine ibex). Habkern, Bern, CH
© mcoutdoor, Photo 67355348. Creative Commons licence (CC BY-NC 4.0)
<https://www.inaturalist.org/observations/42421524>

Capra sibirica (Siberian ibex)
© Martin Teschner (CC BY-ND 2.0) <https://creativecommons.org/licenses/by-nd/2.0/>
<https://www.iucnredlist.org/species/42398/10695735>

Capra nubiana (Nubian ibex)
© Brent Huffman / UltimateUngulate
<https://www.iucnredlist.org/species/3796/10084254>

Capra walie (Walia ibex)
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<https://www.iucnredlist.org/species/3797/10089871>

Capra caucasica (Western tur)
© Brent Huffman / UltimateUngulate
<https://www.iucnredlist.org/species/3794/10088217>

Capra falconeri (Markhor)
© Brent Huffman / UltimateUngulate
<https://www.iucnredlist.org/species/3787/97218336>

Capra cylindricornis (Eastern tur)
© Brent Huffman / UltimateUngulate
<https://www.iucnredlist.org/species/3795/91283066>

Capra pyrenaica (Iberian wild goat)
© Brent Huffman / UltimateUngulate
<https://www.iucnredlist.org/species/3798/10085397>

Capra aegagrus (Bezoar)
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Ibexes do not constitute a phylogenetic group, as has been confirmed through several studies (Heptner et al., 1989; Kazanskaya et al., 2007; Zvychnaynaya, 2010; Pérez et al., 2014; Bibi et al., 2012; Bover et al., 2019).

Several molecular studies have shown a close genetic relationship between *C. pyrenaica* and *C. ibex* (Manceau et al., 1999; Ureña et al., 2018). Schaller (1977, p.27) proposed that, in spite of the probable phylogenetic relationship between the two species, *C. pyrenaica* "should be called Spanish goat, leaving the name ibex to *C. ibex*". Several molecular studies of the genus *Capra* have shown that genetic proximity does not necessarily reflect morphological similarity. For example, *C. falconeri* shows horn morphology that differs significantly from that of *C. aegagrus*, despite its genetic proximity (Zvychnaynaya, 2010). According to Pérez et al. (2014), the Bayesian phylogenetic tree based on the complete mtDNA genomes indicates a longer divergence time between *C. ibex* and *C. nubiana* ('ibex' morphotype) than between the former and *C. pyrenaica* or *C. falconeri* ('lyre' and 'spiraling' morphotype, respectively).

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Appendix 2. Scientific publications in which Spanish or Iberian wild goat are used as the common name for *Capra pyrenaica*.

Apéndice 2. Publicaciones científicas en las que se utilizan los nombres comunes "Spanish wild goat" o "Iberian wild goat" para *Capra pyrenaica*.

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Appendix 3. Common and vernacular names for *Capra pyrenaica* in the Iberian peninsula in ancient texts.

Apéndice 3. Nombres comunes y vernáculos de *Capra pyrenaica* en la península ibérica en textos antiguos.

The oldest references to *Capra pyrenaica* in Romance language texts are masculine: *cabrón montés* (male goat). For example, in the Aragon Crown, the Vidal Mayor book (the first Aragonese law compilation written in 1247–1252), states '*ercum, es assaber cabrón salvage*' [*ercum (hircus)* is scilicet wild male goat] (Tilander, 1956). In the Teruel and in Albarracín charters, written about 1300, it is called *cabrón montés* (Gorosch, 1950; Riba, 1915). In the Kingdom of Castile, the Archpriest of Hita (1330–1343) writes about the *cabrón montés* (Blecua, 1992). The use of that term continues until the end of the 15th C., which was described in a royal hunt in Coca (Segovia province) in the reign of Enrique IV of Castile (Sánchez Parra, 1991). One of the few exceptions is in the General Estoria of Alfonso X (13th C.), in which the species is for the first time referred to using the female term *cabra montés* (Sánchez-Prieto and Horcajada, 1994). From the 15th C. onwards, use of the female term was widespread, probably because of the influence of the name of the domestic goat. In Spanish, as in other Romance languages, the names of domestic species are feminine because the usefulness of the animal derives from the female; e.g. production of eggs or milk by hens, sheep, goats, or cows.

Despite the gender inconsistency (*cabra*: female; *montés*; male) in common names, in the centuries that followed, the syntagma *cabra montés*, rather than *cabra montesa*, prevailed. This occurs in scientific, hunting, and literature texts. That name, along with some variants, is found in several dictionaries and vocabularies. For instance, in the *Diccionario Eclesiástico* by Rodrigo Fernández de Santaella (1499), *Caprea* is distinguished from *Ibex*. The former is translated directly as *cabra montés*, and the latter is described as an animal belonging to the deer or *cabra montés* lineages; i.e., similar but not equivalent to *cabra montés*. Similarly, Terreros y Pando (1787) defines *íbice* (the Spanish term for *Ibex*) as '*cabra montés del delfinado*' (Dauphiné). Nebrija (1495) and Percival (1591) mentioned *cabra montesina*, and the latter considered the term equivalent to wild goat. Covarrubias (1611) wrote *cabra salvaje, montesa, or montesina*; however, in the entry for *cabrón* (he-goat), the wild species is not mentioned. Vittori (1609) and Franciosini (1620) treated the term *cabra silvestre* or *montesina* as equivalent to *cabra montez*.

Classical hunting writers in the Spanish Gold Century (16–17th C.), such as Barahona de Soto (Anonymous, 1890), Martínez de Espinar (1644), and Pedraza Gaitán (Terrón, 1986) used *cabra montés*, only, and *macho montés* was used rarely (Calvo Pinto, 1754), even though the latter is used, occasionally, today. In several geographic texts from the 16th and 18th C., the most extended name in Spain was *cabra montés*. For example, in *Relaciones Topográficas* by Philip II, a survey of southern peninsular Spain between 1575 and 1579, the common name was *cabra montesa* in 23 localities in seven provinces (Ortega Rubio, 1918). The same term was used by Gómez de Bedoya (1765) in Fuencaliente (Ciudad Real province), by Ponz (1789) in Arenas de San Pedro (Ávila province) and Las Villuercas (Cáceres Province), and by García de la Leña (1789) in the Sierras de Málaga.

All of those references are from the southern Iberian peninsula, south of the Central Mountain Range. In the Northern Iberia, there is more variety of local names for the wild goat. In the Catalan Pyrenees, in the 18th C., Francisco de Zamora mentioned the name *herc* or *erc* and *buey silvestre* (wild ox) (Maluquer, 1992). In the Aragonese Pyrenees, the variant *yerp* was used (Graells, 1897). The name *herc*, obviously related to *hircus*, was used in the area since the Middle Ages to refer to the species (Tilander, 1956). *Buey silvestre* is equivalent to *bo do seixo* (literally rock ox) in Galicia, quoted by López Seoane (1861–1863). In the 18th C., Martín Sarmiento mentioned three local names for the species in Galicia: *craba brava*, *craba montés*, and *craba fera* (López Seoane, 1861–1863). In Northern Portugal (Serra de Gerês), Brito (1597) mentioned *cabras salvaigens*, and Carvalho (1706) called it *cabra brava*. In Asturias, the name was, *mueyu* in the municipality of Cabrales (Martínez Marina, 1802), and *mojo* was its Spanish form in the municipality of Amieva (Miñano, 1826).

The almost disappearance of *Capra pyrenaica* in the North Iberian mountain ranges in the 19th C. (i.e. extinction in the Cantabrian Range, drastic reduction in the Pyrenees) led to the disappearance of the local names. *Bucardo* (big buck) is the only local name that has survived, and *cabra montés* was the most commonly used name in Spanish-language scientific publications of the period (Machado, 1869; Martínez y Reguera, 1881; Cazorro, 1894; Graells, 1897). In Portugal, Barboza de Bocage (1863) called it *Cabra-montez*, although Gama (1957) valued equally *cabra montés*, *cabra do Gerez* (its last locality in Portugal), and *cabra brava*.

Ultimately, the designation *Ibex* in Spain and Portugal was a Latinism, an academic term that has no history of use as a common name in legal, hunting, geographic, or scientific texts. For that reason, it is unsurprising that Isidore of Seville used that term in the Early Middle Ages (Sarasa et al., 2012). He wrote in Latin, knew well classical works, but the term had nothing to do with the vernacular names that the general population used in the Iberian peninsula.

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Appendix 4. Names used by Pliny the Elder (77 AD) in his *Naturalis Historia* to designate the various wild goats that existed in Roman times, and their equivalents in several reference works: ⁽¹⁾ different types of wild goats referred in Pliny's Natural History original text (Book 8, Cap 53). The three first inhabit in the Alps (*sed illa Alpes*); the second four in "other Parts beyond the Sea" (*haec transmarini situs mittunt*). ⁽²⁾ equivalents of Pliny's wild goats according to the interpretation of different authors and translators of Pliny's Natural History. See references in the main text.

Apéndice 4. Nombres empleados por Plinio el Viejo (77 AD) en su *Naturalis Historia* para designar las varias cabras monteses que existían en la época romana y sus equivalentes en varias obras de referencia: ⁽¹⁾ en el texto original de la *Historia Natural de Plinio* (libro 8, capítulo 53) se mencionan varios tipos de cabra montés. Los tres primeros habitan en los Alpes (*sed illa Alpes*) y los cuatro segundos "en otras partes más allá del mar" (*haec transmarini situs mittunt*); ⁽²⁾ equivalentes de las cabras monteses de Plinio según la interpretación de diferentes autores y traductores de la *Historia Natural de Plinio*. Véanse las referencias en el cuerpo del texto.

Plinius (77 AD) <i>Naturalis Historia</i> ⁽¹⁾	Holland (1601, p. 96) ⁽²⁾	De la Huerta (1624 p. 497) ⁽²⁾	Brotier (1779 p. 476) ⁽²⁾	Bostock and Riley (1855 p. 346) ⁽²⁾	Gessner (1602 p. 291)	Ray (1693 p. 77)	Linnaeus (1758) <i>Sist. Nat.</i> ed.10	Probable present	
								scientific name	common name
<i>caprae</i>	the roe bucke (<i>Capreolus</i>)	<i>C. aegagrus</i> ?	1. <i>Caprea</i> . Caprea, 'le <i>Chevreuil</i> '	<i>Chevreuil</i> (<i>Cervus capreolus</i> according to Linnean name)	Capreolus? bezoar	1. <i>C. domestica</i> (The Goat)	Hircus. 1. C. cornibus carinatis. arcuatis Ref.biblio + Raj. quadr. 77. B. <i>Capra angolensis</i> .	<i>Capra aegagrus hircus</i>	Domestic goat
<i>rupicaprae</i>	the shamois (<i>Rupicaprae</i>)	Wild goats (in Spain cabra montés)	2. <i>Rupicapra</i> . <i>Rupicapra</i> , 'le <i>Chamois</i> '	Chamois (<i>Antelope rupicapra</i> according to Linnean name)	Alpine chamois	3. <i>Rupicapra</i> , Gallis <i>Chamois</i> , ...	<i>Rupicapra</i> . 3. C. cornibus erectis uncinatis. <i>Syst. Nat.</i> , 14. n. 5. citas biblio. Habitat in alpibus Helveticis summis inaccessis. Russo-fusca, sed alba fronte, vertice, gula, auribus intus. Le Chamois Buffon.	<i>Rupicapra r. rupicapra</i>	Alpine chamois
<i>ibices</i>	the wild goat called the Eveck (<i>Ibex</i>)	'From Helvetic Mts. Backwards knotted horns'. <i>Ibex</i>	3. <i>Ibices</i> . <i>Ibex</i> , 'le <i>Bouquetin</i> '	Bouquetins (<i>Capra ibex</i> according to Linnean name)	Alpine ibex (Magni ponderis cornua ei reclinantur ad dorsum, aspera & nodosa)	2. <i>Ibex</i> (Germanis <i>Steinbock</i>) ...	<i>Ibex</i> . 2. C. cornibus nodosis in dorsum reclinatis. <i>Syst. Nat.</i> , 14 n. 6.	<i>Capra ibex ibex</i>	<i>Alpine ibex</i>
<i>oryges</i>	Oryges	"African, black face, white body, stright & sharp horns" (likely <i>Oryx</i>)	4. <i>Oryges</i> . <i>Oryx</i> , teste <i>Plinio Libr. XI.</i> sect. 106. animal est unicorne & bisulcum. Unicornes, 'la <i>Licorne</i> ', ...	Antelope oryx				cf. <i>Oryx leucorys</i>	Arabian <i>oryx</i>
<i>damae</i>	Does (<i>Damae</i>)	"Horns like red deer but flat" (fallow deer, <i>Dama</i> ?)	5. <i>Dama</i> . Illi damæ sunt, de quibus <i>Plinius Libr. XI.</i> sect. 45.... ' <i>Dama</i> ille est le <i>Nanguer</i> ', ...	'a species of antelope'					
<i>pygargi</i>	Pygargi (a kind of fallow deer)	'a species of wild goat with bear' (<i>Ammotragus</i> ?)	6. <i>Pygargi</i> . <i>Pygargus</i> , 'l'Algazel, vel la <i>Gazelle</i> d' <i>Egypte</i> '	From the Greek <i>white buttocks</i> , 'Probably a kind of gazelle'					
<i>strepsicerotes</i>	<i>Strepsicerotes</i>	'named addax in Africa' (<i>Addax</i> ?)	7. <i>Strepsicerotes</i> . <i>Strepsicerotes</i> , 'l' <i>Antilope</i> .	"With twisted horns', 'a species of antelope'	From figure p. 309, likely <i>Addax</i>	4. African Gazella. <i>The Antilope</i> . <i>Strepsicerotes Plinii</i> quem Addacem Africa appellat, ...	<i>Cervicapra</i> . 8. C. cornibus teretibus dimidiato-annulatis contortis <i>Syst. Nat.</i> , 14. n. 7. <i>Gazella africana</i> . Raj. quadr 79. Capri-Cerva. Kaemph. amoen. 398. t. 398, t. 407, f. 1. Habitat in India, Asia. Color Capreoli, ventre albo, Cauda nigra. Bezoar orientale saepe in hujus quarto ventriculo.	<i>Addax nasomaculatus</i> , <i>Tragelaphus strepsicerotes</i>	kudu

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Appendix 5. Overview of current hypotheses for *Capra pyrenaica* phylogeography.

Apéndice 5. Visión general de las hipótesis filogeográficas actuales sobre *Capra pyrenaica*.

The phylogeography and systematic classification of Iberian wild goats (*Capra pyrenaica*) is unclear (Acevedo and Cassinello, 2009), although there are several hypotheses for their origin. Some palaeontologists suggest that they are close to the Caucasian goats (Crégut-Bonnoure, 1992; Rivals, 2004), even if the hypothesis of a common origin with Alpine ibex *C. ibex* has gained support (Lalueza-Fox et al., 2005; Pidancier et al., 2006; Zvychnaynaya, 2010).

The double-wave migratory hypothesis (fig. 2s–A) of Crégut-Bonnoure (1992, 2006) posits that the ancestors of *Capra ibex* from the Alps (of the type *C. camburgensis*) would have arrived in France in a first migratory wave coming from the Near East at the end of Middle Pleistocene (MIS 7–6). In a second migratory wave a common ancestor of *C. pyrenaica* and the complex *caucasica-cylindricornis* arrived at the Massif Central in France during the Eemian (130–115 ka BP). This ancestor named *C. caucasica praepyrenaica* evolved into *C. pyrenaica* which moved to the South of France and reached the Pyrenees in the Magdalenian (17–12 ky BP). Following this hypothesis, *C. pyrenaica* colonized the Iberian peninsula (Cabrera, 1911) starting from the Pyrenees after 18 ky (García-González et al., 2020).

For some years now this theory has been questioned in the light of the presence of *Capra pyrenaica* in Iberia for more than 40 ky (Sauqué et al., 2016), the high variability of the distinguishing morphological characters proposed by Crégut-Bonnoure (García-González, 2011; Magniez, 2009) and the kinship of *C. ibex* and *C. pyrenaica* supported by molecular (Manceau et al. 1999; Pidancier et al. 2006; Ureña et al., 2018) and morphological data (García-González, 2012; García González et al., in revision).

However, there seems to be also evidence of the presence of *C. ibex* in the Pyrenees during the Upper Pleistocene (Pales, 1976–1977; Delpech, 1983; García-González, 2012), and fossils of *C. camburgensis* (Sarrion, 2010) and *C. ibex* (Torres, 1974; Daura et al., 2017) have been found south of the Pyrenees, which provides grounds for a third hypothesis.

Possibly, former Pyrenean goats were not the ancestors of the extant Iberian subspecies; rather, they were the product of one or more hybridizations between ancestors of the current *C. ibex* (perhaps *C. camburgensis*) and the descendants of ancient Iberian goats in the second half of the Pleistocene. The later might be related to the ancient goats of the Lower Pleistocene in the Iberian peninsula (*C. iberica*, 2.0 Ma from Arribas and Garrido (2008) or *C. alba*, 1.3 Ma from Moyà-Solà (1987) or to the clade 'Arabian-Mediterranean goats' in accordance with Crégut-Bonnoure (2009), of which some genetic traces might remain in the modern population in Sierra Nevada, which appears the most genetically diverse of the Iberian goats in the southern Iberian peninsula (Pérez et al., 2002).

The southern location of Iberia, which is distant from north and central Europe, and the orographic barrier of the Pyrenees, caused the Iberian peninsula to work as a genetic refuge during Quaternary glaciations for species of animals and plants (Hewitt, 2004; Sommer et al., 2008). The role of the Pyrenean chain as a hybridogenic zone is well known ('suture-zones' from Taberlet et al., 1998) and, possibly, in the glacial periods, the inland European populations came encountered the refugee populations in the Iberian peninsula (Couturier, 1962; García-González, 2011). That process might have occurred once or repeatedly throughout the Upper and Middle Pleistocene, as has occurred in other mammals: roe deer (Randi et al., 2004), brown bear (Valdiosera et al., 2008), red deer (Skog et al., 2009), chamois (Rodríguez et al., 2010).

Hybridization is recognized today as an evolutionary process in the formation of new species (Corlatti et al., 2011; Shurtliff, 2013; Cahill et al., 2018), including the genus *Capra* (Ropiquet and Hassanin, 2006). The fossil record of *Capra* from the Lower and Middle Pleistocene in the Iberian peninsula is limited and a search for new specimens is needed to better understand the evolution and differentiation of *C. pyrenaica* in the Iberian peninsula.

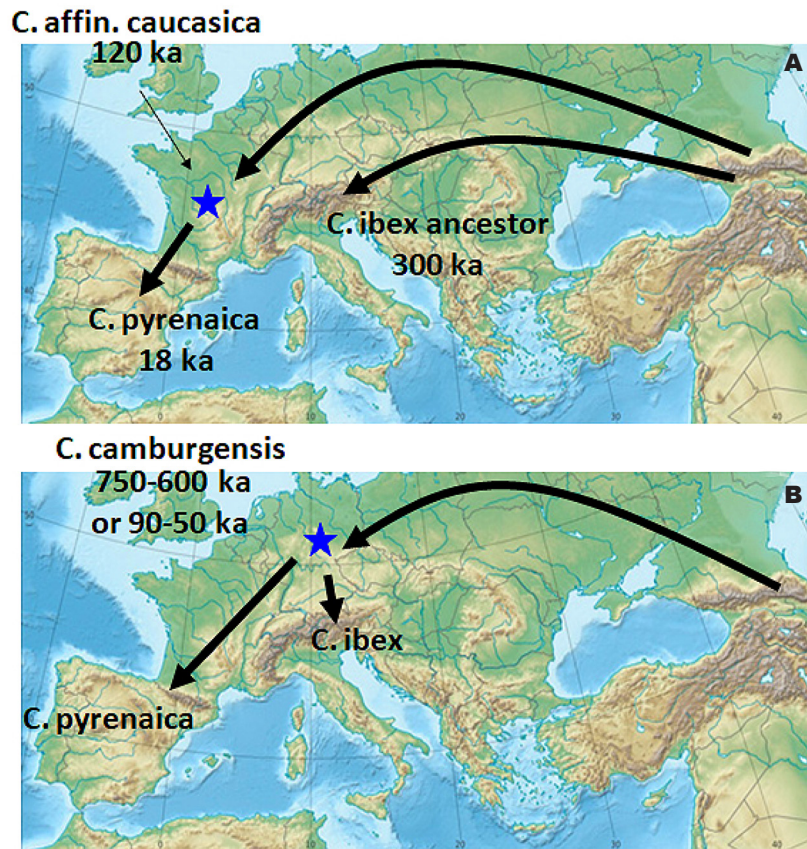


Fig. 2s. Schematic representation of the 'double-wave' (A) and 'one-wave hypothesis' (B) for filogeographic evolution of *Capra pyrenaica* and *C. ibex*. According to the first, *C. pyrenaica* originated from a common ancestor of the *C. caucasica*–*Cylindricornis* complex through the intermediary of the common ancestor *C. caucasica praepyrenaica* (Crégut–Bonnoure, 1992, 2006). The second hypothesis suggest a common origin between *C. pyrenaica* and *C. ibex* (Manceau et al., 1999; Ureña et al., 2018), perhaps sharing a common ancestor of the *C. camburgensis* type. The divergence time differs according to the authors: 720–600 ka or 90–50 ka.

Fig. 2s. Representación esquemática de las hipótesis de la doble oleada (A) y de la oleada única (B) para explicar la evolución filogeográfica de Capra pyrenaica y C. ibex. De acuerdo con la primera, C. pyrenaica se originó a partir de un ancestro común del complejo C. caucasica–cylindricornis a través del intermediario del ancestro común C. caucasica praepyrenaica (Crégut–Bonnoure, 1992, 2006). La segunda hipótesis sugiere un origen común entre C. pyrenaica y C. ibex (Manceau et al., 1999; Ureña et al., 2018), que tal vez compartan un ancestro común del tipo C. camburgensis. El momento de la divergencia difiere según el autor: 720–600 miles de años o 90–50 miles de años atrás.

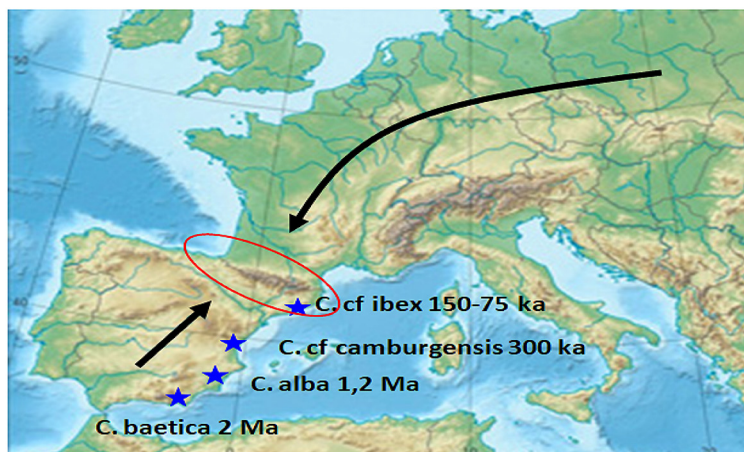


Fig. 3s. Schematic representation of the introgression or/and polyphyletic hypothesis (for explanation see text).

Fig. 3s. Representación esquemática de la hipótesis de la introgresión o polifilética (consúltese el texto para encontrar la explicación).

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