

# On the elusive origin of the wild goat, *Capra aegagrus* Erxleben, 1777, on the island of Montecristo (Italy)

Marco Masseti

International Union for the Conservation of Nature Species Survival Commission, e-mail: [marcomasseti55@gmail.com](mailto:marcomasseti55@gmail.com)

## ABSTRACT

The origin of the wild goats currently living on the small island of Montecristo in the northern Tyrrhenian Sea (Italy) is still discussed. Their phenotypic characteristics, described as those of the Asia Minor wild goat, also called pasang or Bezoar goat, *Capra aegagrus* Erxleben, 1777, would point to an initial nucleus introduced around the Neolithic age. There are, however, also those who hypothesise the importation of the ungulates by the monks who colonised Montecristo from the 5<sup>th</sup> century AD onwards. Some authors are instead of the opinion that a small herd of goats from the - not better identified - kingdom of Montenegro was introduced by the Crown Prince of the House of Savoy, Vittorio Emanuele III, at the end of the 19<sup>th</sup> century, with the aim of restocking the local big game. It seems that this rumour began to spread in the aftermath of his marriage to Jelena (Elena), the daughter of the ruler of Montenegro. If that was indeed the case, the question would arise as to what kind of domestic or wild goats these animals from Montenegro might have been. In the latter case, the debate should involve the improbable diffusion of the Asia Minor pasang in the Balkan peninsula.

## KEY WORDS

Bezoar goat; pasang; coat colour phenotypes; *agrimi*; Montenegro.

Received 21.07.2022; accepted 28.08.22.2020; published online 16.09.2022 - Proceedings of the 6th International Congress “Taxonomy, Speciation and Euro-Mediterranean Biodiversity”, October 11th-13th, 2019 - Sofia (Bulgaria)

## INTRODUCTION

Located almost halfway between the western Italian coast and Corsica (Fig. 1), the small Tyrrhenian Island of Montecristo (Italy) is a granite cone that rises to 645 m above sea level, with an area of 10.39 km<sup>2</sup> (Fig. 2). The local wild goat is a strong medium-sized ungulate characterised in adult males by long scimitar-shaped horns that curve backwards (Cagnolaro et al., 1981; Masseti, 1981; Spagnesi & Toso, 2003; Masseti, 2009). According to Toschi (1953, 1965) and Ghigi (1954), the general appearance of the animal differed in nothing from that of the Asia Minor wild goat, also called pasang or Bezoar goat, *Capra aegagrus* Erxleben, 1777, and

from the *agrimi*, *C. aegagrus cretica* Schinz, 1835, the wild goat of the Greek island of Crete. Highlighted by the accurate studies of Spagnesi et al. (1982), Spagnesi et al. (1986), and Spagnesi & Toso (2003), the coat colour phenotypes of the Montecristo wild goat can be summarised in two main groups (Fig. 3).

### *The agrimi phenotype*

The males of the Asia Minor wild goat or *agrimi* phenotype are long-bearded and usually have a prominent pelage pattern consisting of a dark spinal stripe, transverse shoulder stripe and a flank stripe from the axilla to the groin (Harrison, 1968) (Fig.

4). Both sexes have a dark stripe on the front of the lower legs, extending down to the dark grey hooves, and strongly contrasted with the cream colour of the sides of the metapodials. The belly is generally whitish, and the colour of the rest of the coat varies from tawny to greyish. Mature males have blackish-brown marks on the face, beard and throat, with a neck collar spreading into a breast plate. Out of the rutting season, the markings of the males are fainter, as are those of the females throughout the year. There is apparently a clearly marked seasonal



Figure 1. Montecristo is a small island in the Tuscan archipelago, located in the Northern Tyrrhenian Sea (N42°20', W10°9'), about halfway between Corsica (23 marine miles) and the coast of central Italy (24 marine miles).



Figure 2. The island of Montecristo is a granite cone that rises to 645 m above sea level, with an area of 10.39 km<sup>2</sup> (photo by Piero Landini).

variation in colour and development of the pelage, which also varies with age. Old males, for example, display a tendency towards pale and whitish tones. The iris is pale yellow, and the pupil is transverse and slit-shaped. In certain individuals, however, the coat colour can be dominated by a recessive character, in which a dark belly extends to the dark area of the flanks. This last character falls within the phenotype of *C. aegagrus pictus* Erhard, 1858, the subspecies described for the islands of Samothrace, in the northernmost part of the Aegean Sea, and Antimilos (Erimomilos), located five marine miles off the north-western coast of Milos (Western Cyclades, Aegean Sea) (Fig. 5). Together with the latter subspecies and the already mentioned Cretan wild goat, the wild goat from the island of Youra, *C. aegagrus dorcus* Reichenow, 1888, in the northern Sporades (Aegean Sea) is also included in the *agrimi* phenotype (Schultze-Westrum, 1963; Masseti, 2009, 2012).

In the course of an estimate of the number of the Montecristo wild goats carried out on behalf of the Corpo Forestale dello Stato (CFS) – Ufficio territoriale per la Biodiversità di Follonica – in the summer of 1998, the *agrimi* phenotype still represented 30% of the entire population (Ciani & Masseti, 1998; Masseti, 2015). Ciani & Masseti (1991) suggest including the extant Montecristo goat in the nomenclature of the caprines of the Aegean islands, and more specifically in the subspecies *C. aegagrus pictus*, on the basis of the observation of its phenotypical patterns and the consciousness of its ancient anthropochorous introduction.

### The “Montecristo” phenotype

In general, we can observe that in the extant population of Montecristo, a large proportion of the coat colour of the Asiatic pasang shows itself as diluted compared to the *agrimi* phenotype, very likely as a result of the management measures – consisting of debatable restocking utilizing domestic breeds and randomized selective hunting – adopted in relation to this insular population in recent decades, at least since the 1960s (Masseti, 2015, and references therein). This has led to the expression on the part of the caprine population of a peculiar phenotype of coat colour, which has been described as the ‘Montecristo phenotype’, but is simply the consequence of the management measures we have just



Figure 3. Adult males of the Montecristo goat. The individual portrayed on the right side of the photograph falls within the character of the so-called Montecristo phenotype, while the other on the left is characterised by the *agrimi* one. The latter goat falls within the phenotypic range of the Aegean wild goat, *Capra a. pictus* (photo by Massimo Piacentino).



Figure 4. Adult Montecristo male photographed on the small Tyrrhenian island in the 1920s, few years after the end of the First World War (courtesy of Orlando Franchi). Note the absolute phenotypic correspondence with the wild goat, *Capra aegagrus* Erxleben, 1777, from the Near East, later observed by Toschi (1953) and Ghigi (1954).



Figure 5. The Aegean wild goat is the typical subspecies of the Greek islands, where it became extinct on Samothrace before the end of the 1980s, but is still surviving on the islet of Antimilos (Erimomilos), five marine miles off the N-W coast of Milos (W-Cyclades, Aegean Sea) (Schultze-Westrum 1963; Sfougaris & Lymberakis 2009, Masseti 2009, 2012). The coat colour of *C. a. pictus* can appear sometimes dominated by a recessive character, with a dark belly extending to the dark area of the flanks (Masseti, 2009; Spagnesi et al., 1986).



Figure 6. The so-called “Montecristo phenotype” (Spagnesi et al., 1986; Spagnesi & Toso, 2003) is characterised by a brown coat, noticeably varying from darker to lighter tones, sometimes shading to buff, where black markings are lacking, being replaced by a more brownish tinge that also more or less characterises the dorsal line, the muzzle, the legs, the tail and the beard (photo by Marco Masseti). Note, among other things, the lack of the whitish belly in the adult male.

mentioned. It consists of a brown coat, noticeably varying from darker to lighter tones, sometimes shading to buffy, where black markings are lacking, being replaced by a more brownish tinge that also more or less characterises the dorsal line, the muzzle and the beard (Spagnesi et al., 1986; Spagnesi & Toso, 2003; Masseti, 2015) (Fig. 6). The

whitish belly is often absent as well. Not infrequently, this phenotype may show white patches on the flanks and legs (Mattoli, 1970; Pejrone, 1970; Spagnesi et al., 1986; Masseti, 2015), clear evidence of cross-breeding that the island’s primitive population has undergone with domestic animal introductions.



According to the account of Augusto Toschi (1953), who had the opportunity to stay on the island and see for himself the appearance and condition of the local goat population, the “Montecristo” phenotype must have been completely unknown up to the early 1950s. Apparently, however, the current phenotypic appearance of the Montecristo goats prefigures itself as the result of a cross-breeding undergone, at an as yet unspecified though very recent time, with animals of as yet unknown origin. In any case, these must have been goats characterised by the aforementioned “Montecristo” phenotype, absent from the island until Toschi’s visit. As already keenly observed by Cagnolaro & Perco (1975), the extant Montecristo goat population is characterised by the presence of different phenotypic traits, together with a residual character that clearly recalls the ancestral, wild type of the Near Eastern Bezoar goat. Even photographic documentation of the occurrence of the latter phenotype on the island is apparently only available from after World War II onwards (Masseti, 2015). Why have the *agrimi* phenotype so drastically decreased over the last decades? What has happened to the original goat population of Montecristo?

#### ***On the origin of the Montecristo goat population***

All the populations of wild goats that populate the Mediterranean islands today are the result of ancient anthropochorous introductions (Masseti, 2009). In fact, fossil evidence for the natural spread of *C. aegagrus* in the European subcontinent and its islands has not been found (Schultze-Westrum, 1963; Azzaroli, 1983). The natural range of the wild goat extends from Anatolia and the remaining south-western Asia to the Himalayas and the north-west Indian subcontinent (Corbet & Hill, 1991; Masseti, 2009; Groves & Grubb, 2011). The large majority of domestic goats is derived from *C. aegagrus*, whose earliest domestication originates in the Near East, approximately 12,000 years ago (Peters et al., 1999; Schmidt, 1999). From there the species was introduced by humans onto the Mediterranean islands starting as early as the Mesolithic and Pre-Pottery Neolithic (Masseti, 2012, and references therein). Among the earliest remains of Bezoar goats beyond their natural diffusion, should be mentioned those that were recovered in the Pre-Pottery Neolithic site of

Shillourokambos on Cyprus, dating to around the end of the ninth/eight millennium BC (cf. Guilaine et al., 2000). In the Aegean region, as in the case of Youra (Northern Sporades), instead, goats appeared only between the eighth and seventh millennium BC, but still in Mesolithic cultural contexts (Masseti, 2012) (Fig. 7). Archaeological evidence of the introduction of *C. aegagrus* is available also for Crete since the Pre-Pottery Neolithic (Jarman, 1996; Masseti, 2012), while, according to Melas (1985), this artiodactyl may have also existed in Karpathos in early times. Given the still unperceived morphological variations from the true wild form, it is believed that in this first artificial westward diffusion, *C. aegagrus* had not yet been domesticated but had only undergone a sort of cultural control on the part of humans (Logan et al., 1994; Masseti, 1997, 2012, and references therein).

The archaeological exploration of Crete and Youra has led to the discovery of remains of animals characterised by long scimitar-shaped horns, in adult males, quite similar to the goats still found on the large Greek island, on Antimilos, and Montecristo (Masseti, 2012, and references therein). Osteological material recorded from the archaeological site of Festos, however, documents the occurrence on Crete of two distinct forms of goat since the Terminal Neolithic (about 3000 BC)



Figure 7. Left hemimandible of a wild goat from the Mesolithic levels of the Cave of Cyclops on the island of Youra, in the Northern Sporades (Aegean Sea, Greece) (photo by Marco Masseti).

(Wilkins, 1996). It is precisely from this time that the appearance of a different horn phenotype is documented in domestic goats, which begin to show a development that is no longer scimitar-shaped but spiral. This variation in cranial appendices became established in the Near East from the Early Bronze age, i.e. from the end of the 3<sup>rd</sup> - beginning of the 2<sup>nd</sup> millennium BC (Clutton-Brock, 1981; Trantalidou, 2003, 2011).

The phenotype expressed by the extant wild goats of Youra does not appear to correspond to that of the animals introduced in Mesolithic times. An examination of the morphological patterns displayed by the local prehistoric ungulates, compared to the extant specimens, reveals how much they differ in the development of the cranial appendices. The goats of the Upper Mesolithic reveal scimitar-shaped horns, much smaller than those of the extant Cretan *agrimi*, twisted horns being found only from Neolithic chronologies onwards (Trantalidou, 2003, 2011). Thus, the animals which occur today on Youra are more similar to the Neolithic goats than to the caprines present on the island in prehistoric times. In this regard it could be interesting to make a comparison between the genetic material of the Mesolithic goats of Youra and that of the current *C. a. dorcas* still present on the island (Masseti, 2009a, 2012).

A wild goat phenotypically related to the extant Youra population also survives on the island of Mallorca, in the Spanish Balearic archipelago (Masseti, 2014).

### *The earliest importations*

The earliest occurrence of *C. aegagrus* in the Italian islands, and in Sardinia in particular, dates to no earlier than the end of the 7<sup>th</sup>-6<sup>th</sup> millennium B.C. (Masseti & Vianello, 1991; Masseti, 1997). Bökönyi (1977) would place this event in continental Italy between the middle of the 6<sup>th</sup> and the 5<sup>th</sup> millennium B.C., while Pino Uriá & Tagliacozzo (2006) put it around 7000 BP. Also at Offida, near Ascoli Piceno (Central Italy), the impressive remains of an adult male of *C. aegagrus* were recovered from the local Neolithic site, dated from 3800 to 3100 B.C. (Rustioni et al., 2007). The context in which the latter animal was found undoubtedly implies its association with an anthropic settlement, even if the morphological characteristics of the goat

suggested that it was a specimen that had not yet manifested any of the phenotypic modifications favoured by domestication.

From the earliest times, it is very likely that wild populations of goats were released on even very small islands because they could reproduce and provide, at any time, a supply of fresh meat that would be readily available along the maritime routes of antiquity (Masseti, 1998, 2003). For centuries, if not millennia, these islands were better known for their richness in free-ranging ungulates, most useful as a source for meat than for their faunal repertoire in general (Masseti, 1998, 2018). It cannot be excluded that even the small Montecristo was most likely affected by a Neolithic human settlement (cf. Radmilli, 1975), as has been documented for other islands in the Tuscan archipelago such as Elba, Pianosa, Giglio and Giannutri (Masseti & Vianello, 1991, and references therein; Masseti, 1993). Unfortunately, the granitic nature of the island does not allow the fossilisation process of bones to take place. Consequently, we have no such documentation. Therefore, to try to understand what the earliest introduction of goats on Montecristo might have been, we must rely solely on the observation of their current external morphology which, as we have already seen, shows almost identical phenotypes of the wild progenitor from Asia Minor. Among these characters should be highlighted the complete absence of the sub-gular tassels, the cartilaginous outgrowths found at the base of the throat in many domestic goats. Furthermore, as we have already seen, the horns of the extant Montecristo goats do not hint at the slightest spiral twist, but are highly



Figure 8. The ruins of the church of the Benedictine monastery of San Mamiliano, in Montecristo, originally dating back to the 10<sup>th</sup> century (photo by Marco Masseti).

scimitar-shaped, emerging fairly close together on the forehead and may diverge considerably at the tips, curving variably inwards or outwards (Masseti, 2009). In adult males, they can exceed the maximum length of 70 cm (Spagnesi & Toso, 2003).

### *The goats of the House of Savoy*

There are some authors who argue for an introduction of goats on Montecristo that would have taken place in much more recent times, between the 5<sup>th</sup> and 16<sup>th</sup> centuries AD, when the island was first inhabited by anchorites and then by Benedictine monks (Mori, 1904; Bruno & Sauli, 1976). In actual fact, a community of anchorites began to settle on the island from the 5<sup>th</sup> century AD, later founding an important monastery (Masseti & Zuffi, 2011) (Fig. 8). However, it is not known for sure whether they had brought goats with them and what breed they were.

Other authors stated that goats from the - not better identified - kingdom of Montenegro were imported by Vittorio Emanuele III, Crown Prince of the House of Savoy, on Montecristo with the aim of restocking the local big game (Mattoli, 1970; Leporati, 1971; Bruno & Sauli, 1976; Spagnesi et al., 1986; Sandolo, 2014; Gotti et al., 2014). The future king of Italy had very close relations with this Balkan state and, in 1896, Montecristo became the honeymoon destination of him and Jelena (later to become Elena), the daughter of Nicholas I Petrović Njegoš, Prince (later King) of Montenegro. This

was, and still is, a small Balkan country which features rugged mountains, medieval villages and a tongue of narrow beaches along the coastline of the Adriatic Gulf. It borders Serbia to the northeast, Croatia to the west, Bosnia and Herzegovina to the northwest, Kosovo to the east, and Albania to the southeast. Thus, after 1899, Montecristo became a royal hunting ground for Vittorio Emanuele's exclusive use. However, the importation of still unidentified goats from Montenegro would not be dated to this period but to a later time between 1922 and 1945, a period when Bastiana and Francesco Tesi served the House of Savoy as guardians of Montecristo. This was told to Raffaele Sandolo (2014) by Elena, daughter of the guardian couple, stating that among the various tasks of the two workers was that of taking care of the introduction of "new goats from Montenegro" in the early years of their assignment. It therefore seems that an introduction of animals from abroad actually took place. The question arises as to what species these goats from Montenegro might have been; and whether their numbers were able to influence the phenotypic changes in the pre-existing population to some extent. The possibility that they were domestic animals cannot be excluded. Thus, we need to understand what new phenotypic traits should have appeared on the island along with the new animals. To do this, we need to look at what domestic breeds might have been used for the purpose, since there is no evidence of the natural dispersion of *C. aegagrus* in the Balkan Peninsula in recent historical times.

The two main breeds of domestic goat seen in the Balkan peninsula are the Carpathian race (especially in Romania) and the Balkan breed of Albania, Bulgaria, former Yugoslavia and Greece (Porter, 1996) (Fig. 9). The Carpathian is a small animal, on average about 63 cm tall and weighing 17 kg, characterised by very large twisted horns in the adult males, and with the coat colour varying from different shades of grey to red, white, black or pied. The hair is quite long (7-10 cm) over a fine down undercoat (Porter, 1996). The Balkan goat is also an indigenous breed (Žujović et al., 2009; Caro-Petrović et al., 2012). Its body is overgrown with a medium-long or long shiny coat of different pigmentation (reddish or grey, but can also be black, as well as chestnut, brown, patchy, and white). The horns grow on the top of the frontal bones, bend



Figure 9. Red mountain goat in the mountains of Montenegro.



backwards, first parallel, and then separate, so that with age the tips move away, and in goats they also twist slightly. Žujović et al. (2009) and Caro-Petrović et al. (2012) are of the opinion that this domestic breed derives from wild goats that inhabited the area of the Balkan Peninsula. This is despite the fact that local domestic breeds do not have scimitar horns, emerging close together on the forehead and displaying a parallel development more or less divergent at the tips. The wild goat, if it ever existed, was probably extinct in Bulgaria around 1891, according to Van den Brink (1967). Although we have already seen that *C. aegagrus* is completely extraneous to the biogeography of the European subcontinent (Masseti, 2009; Ahmed et al., 2016), it cannot in fact be ruled out that some animals were introduced there from the Near East as far back as the Neolithic chronologies. From these times, wild goats were brought by the people as a live stock at first on islands and then in the mountains in Northern Greece (Masseti, 1997, 2012; Genov et al., 2009; Ahmed et al., 2016). One specimen (horns with 7 rings) was nevertheless killed in the Parnar Dag mountains although it is doubtful whether it was a pure-bred wild individual (Van den Brink, 1967). Several populations of *C. aegagrus* have been, however, introduced by humans to continental Eastern Europe during the last century. In this regard, we can mention that of the Parnitha National Park in Attica (Greece) (Sfougaris & Lymberakis, 2009), or those in the Czech Republic's High Tatras and the Palav hunting reserve (Wolf, 1983; Dungal & Gaisler, 2002).

Another explication on the origin of the 'Montecristo' phenotype has been proposed by Masseti (2015) as follows.

### The "Montecristo sporting club"

As we have just noted, an introduction of goats from Montenegro that may have had some influence on the current phenotypes that characterise the goat population of Montecristo seems rather improbable and, in any case, not very easily circumstantiated. One fact is certain, however. Compared to the description of the Montecristo goats compiled by Toschi (1953), most of those present on the island today show phenotypic characters rather different from those of the Bezoar goat or the Aegean *agrimia*. As early as the 1950s, various authors, in-



Figure 10. Company logo of the Montecristo Sporting Club, inaugurated in 1970 (photo by Marco Masseti). The heraldic symbol of the sea, in the middle of which rises a mountain surmounted by the Latin cross, is taken from the seal of Abbot Martin: one of the earliest testimonies to monastic life in Montecristo (8<sup>th</sup> century A.D.) (Mattoli, 1970).

Figure 11. Montecristo Sporting Club trophy scorecard (from Mattoli, 1970).

cluding Toschi (1953), Kahmann (1959), and Guidi (2007), lamented a drastic reduction in the number of the island's ungulates, most likely attributable to excessive illegal hunting (Masseti, 2015). So, it must have happened that when the private company "Oglasa", which had in the meantime taken over the island's concession, decided to turn it into an elite sporting and yachting club (Fig. 10) (Mattoli 1970, Pardossi 1971, Bruno & Sauli 1976, Baccetti 1977; Ferrari, 2017, 2020), it must have found itself short of big game to offer its exclusive members (Figs. 11, 12). This would be inferred from the fact that, all of a sudden, there appeared goats that no longer

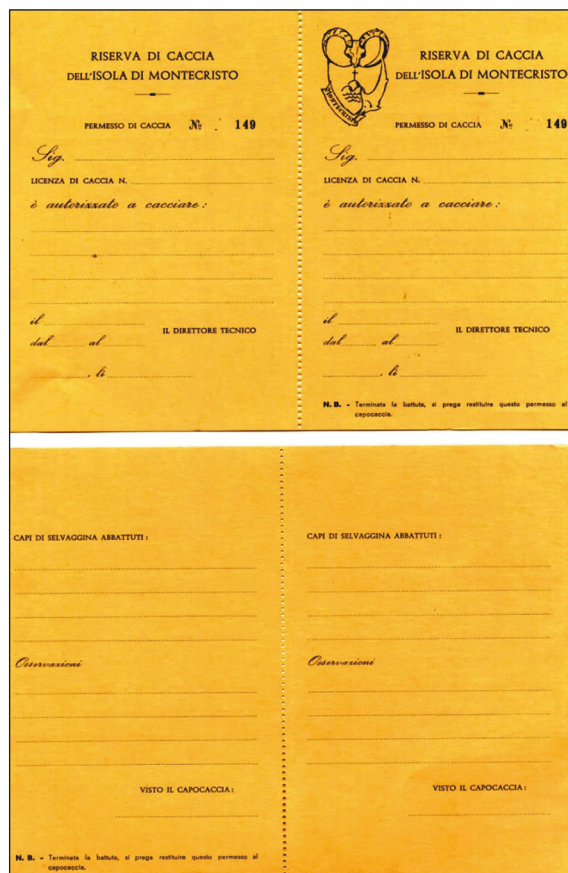


Figure 12. Hunting permission issued by the *Riserva di caccia dell'Isola di Montecristo* (courtesy of Mario Ferrari).

respond the description offered by Toschi (1953 and 1965). In actual fact, when the Montecristo Sporting Club was being set up, the regulations stated “*in relation to the killing of hircus goats ... hunters are kindly requested, as far as possible, to preferably shoot those individuals that display clear patterns of hybridism [sic!] (white spots on ribs and legs)*” (Mattoli, 1970). As soon as the Oglasa company acquired the island on concession from the Italian government, it also began to perform an action of effective control on the local goats (Baccetti 1977), putting an end to the illegal hunting and also taking other practical measures aimed at increasing the big game of the island. Mattoli (1970), in fact, clearly states that since 1954, the company Oglasa: “*has exerted an assiduous vigilance over the goats, monitoring them also from a veterinary aspects*”. The non-pure blooded patterns now occurring in the goat population of Montecristo would, therefore, suggest the introduction onto the island of a group

of other animals, possibly domestic goats. This would not, however, have been the alleged importation to Montecristo of a few fictitious “goats from Montenegro”, nor the consequence of another improbable importation carried out by the same Italian king, this time, however, from an unidentified Greek island, as suggested by Guidi (2007), but rather the appropriate restocking of the island big game.

The current phenotypic similarity of the majority of the Montecristo goats to the so-called “ancient Corsican breed” would at least suggest that this - or a race with similar phenotypic characteristics - was the ethnic type used for the restocking of its ungulate population. According to Porter (1996), the original Corsican domestic breed displays a range of colours often chestnut, or grey, as well as red, chamois-coloured, dark brown or black with tan, plain black, light brown roan, often with pale belly, and with or without areas of white and assorted patterns on their long coats. Moreover, Lauvergne (1986, 1988) observes that the vast majority have erect ears of medium size, and straight scimitar horns, but about half of them had tassels. It cannot, however, be ruled out a priori that the population of Montecristo may also have undergone some contribution from other domestic races with primitive characteristics, such as the so-called “chamois coloured” goat, a short-haired domestic race still bred in the Alps, with the typical dark areas particularly pronounced, as also assumed by Silvestri (1985). Both the ancient Corsican breed and the “chamois coloured” goat are characterised by scimitar-shaped horns. Nevertheless, despite the crossing with these domestic animals, the Montecristo goats never display the occurrence of tassels (Masseti, 2015). Following very likely Masseti (2015), Mayol (2015) is also of the opinion that: “*goats of Corsican origin may even have been introduced during the second half of the 20th century to give the Montecristo goats new blood*”.

### Conclusive remarks

In light of what we have already observed, it therefore seems that the phenotypic purity of Montecristo’s wild goats was most likely contaminated by the massive contribution of primitive domestic breed goats, perhaps from nearby Corsica. The government authorities in charge of managing and pro-



protecting the Montecristo population, the only one of wild goats in Italy and perhaps in the entire central-western Mediterranean (Masseti, 2014), have never wanted to take this into account, so much so that they did not even consider this aspect in the most recent research conducted on the subject (Gotti et al., 2014; Raganella Pelliccioni et al., 2015). Instead of protecting the last individuals still partly or fully characterised by the *agrimi* phenotype, it has been preferred to slaughter them regardless of the genetic traits they bear, thus favouring the further depletion of this significant nucleus of surviving goats. The environmental vicissitudes that devastated Montecristo's ecosystem in the first half of last decade, with the random launch of nearly 14 tonnes of poisoned bait to eradicate the local population of black rats, *Rattus rattus* (L., 1758) (Sposimo, 2014), then did the rest, dramatically reducing the representation of ungulates with an *agrimi* phenotype that were still present on the island.

Photographic evidence has made it possible to document the survival of the *agrimi* phenotype on the island, after the questionable "environmental redevelopment" actions carried out there around 2014. This phenotype is still documented by the occurrence of individuals such as a young male pho-

tographed among the buildings in Cala Maestra on 29 July 2016 (Fig. 13). It would be advisable for the authorities in charge of managing Montecristo to finally take note of this occurrence and decide to launch a concrete programme to safeguard and enhance what still remains of the primitive local wild goat population.

## ACKNOWLEDGEMENTS

I am grateful to Marcello Camici, Associazione Amici di Montecristo no profit, Portoferraio (Isola d'Elba, Livorno); Mario Ferrari, former mayor of Portoferraio (island of Elba); Paul Mazza, Department of Earth Sciences, University of Florence; Cesare Scarfò and Amy Bond, Island of Giglio (Grosseto), for their valuable suggestions and help during the realisation of this paper.

## REFERENCES

- Ahmed A., Vlasheva A., Kitanova S. & Genov P., 2016. Bezoar wild goat (*Capra aegagrus* Erxleben, 1777) - History and opportunities for development of the species in Bulgaria. *Annuaire de l'Université de Sofia "St. Kliment Ohridski". Faculté de Biologie First National Conference of Reintroduction of Conservation-reliant Species*, Sofia 2015. Sofia University Press: 171–175.
- Azzaroli A., 1983. Biogeografia dei mammiferi della Sardegna. *Lavori della Società Italiana di Biogeografia*, 8: 35–52.
- Baccetti B., 1977. Montecristo: una riserva naturale scientifica. *Quaderni de 'La ricerca scientifica'*, 98: 3–13.
- Bökönyi S., 1977. The early Neolithic fauna of Rendina: a preliminary report. *Origini*, 82: 345–350.
- Bruno S. & Sauli G., 1976. Montecristo. *Natura e montagna*, 33: 7–27.
- Cagnolaro L. & Perco P., 1975. Relazione sulla prima spedizione di studio all'isola di Montecristo nell'ambito della ricerca sulla capra e sui mammiferi (25, 26 e 27 aprile 1975). Unpl. Manuscript for the Museo civico di Storia naturale di Milano, 28.04.1975: 3 pp.
- Cagnolaro L., Perco F. & Spagnesi M., 1981. Capra selvatica di Montecristo *Capra aegagrus* Linnaeus, 1758. In: *Corpo Forestale dello Stato e delle Regioni Autonome*, Istituto di Entomologia dell'Università di



Figure 13. Young male (left) and adult female of Montecristo goat. Despite the fairly dark coat, the former still shows *agrimi* phenotype patterns, and strong scimitar-shaped horns, as well as the absence of sub-gular tassels (Montecristo, 28 July 2016; photo by Mario Ferrari). Note the absence of the whitish belly and much of the characteristic dark patterns in the coat of the female, that are instead evident in the other animal.

- Pavia (Eds.), Distribuzione e biologia di 22 specie di mammiferi in Italia. Consiglio Nazionale delle Ricerche, Roma, pp. 163–166.
- Caro-Petrović V., Ilić Z., Ružić-Muslić D., Petrović M. P., Petrović M. M., Tomić Z. & Marinkov G., 2012. Analysis of environmental and genetics factors in growth characteristics of Balkan goat. *Biotechnology in Animal Husbandry*, 28: 275–282. <https://doi.org/10.2298/bah1202275c>.
- Ciani F. & Masseti M., 1991. Considerazioni preliminari sull'origine della popolazione ircina dell'isola di Montecristo, nel Mar Tirreno settentrionale. Elementi per un confronto cronologico-culturale con l'antica diffusione dell'egagro (*Capra aegagrus* Erxleben, 1777) nelle isole del Mediterraneo orientale. In Randi E. & Spagnesi M. (Eds.), *Atti del Convegno "Genetica e Conservazione della fauna"*. Supplementi alle Ricerche di Biologia della Selvaggina 18, pp. 123–133.
- Ciani F. & Masseti M., 1998. Stima della popolazione di capra selvatica (*Capra aegagrus* Erxleben, 1777) dell'isola di Montecristo (Mar Tirreno settentrionale, Italia). Unpl. Manuscript for the Gestione Ex Azienda di Stato per le Foreste Demaniali. ConSDABI, National Focal Point F.A.O., Circello (Benevento, Italy), 9 pp.
- Clutton-Brock J., 1981. Domesticated Animals from Early Times. Heinemann and British Museum (Natural History), London, 208 pp.
- Corbet G.B. & Hill J.E., 1991. The mammals of the Indomalayan region. Natural History Museum, London/Oxford University Press, Oxford, 488 pp.
- Dungel J. & Gaisler J., 2002. Atlas savců. Vydala Academia, Praha, 150 pp.
- Ferrari M., 2017. Itinerari di architettura moderna. Il territorio immaginato ... nei piani di sviluppo della Società Oglasa. *Lo Scoglio*, 11: 9–13.
- Ferrari M., 2020. Montecristo: il progetto ritrovato. *Lo Scoglio*, 120: 50–51.
- Genov P., Georgiev G. & Georgiev V., 2009. Persian wild goat (*Capra aegagrus* Erxleben) - Biology, ecology and possibilities for its re-introduction in Bulgaria. *Biotechnol. & Biotechnol. Eq.* 23/2009/Se XI Anniversary Scientific Conference Special Edition/on-line 120 years of Academic Education in Biology.
- Ghigi A., 1954. Capra selvatica e foca monaca. Caratteristiche della fauna di Montecristo. *Il Resto del Carlino*, 1<sup>st</sup> January 1954.
- Gotti C., Palladini A. & Raganella Pelliccioni E., 2014. La Capra di Montecristo, una popolazione unica in Mediterraneo. In: Zanichelli F., Giannini F., De Pietro F. & Puppo F. (Eds.), *Quaderni del Parco, documenti tecnici volume 2 PROGETTO LIFE+ MONTECRISTO 2010, Eradicazione di componenti florofaunistiche aliene invasive e tutela di specie e habitat nell'Arcipelago Toscano*. Parco Nazionale Arcipelago Toscano, Portoferraio (2014): 34–43.
- Groves C. & Grubb P., 2011. Ungulate taxonomy. Johns Hopkins University Press, Baltimore, pp. 317.
- Guidi R., 2007. Il vento fin qua. Addictions-Maneges Editoriale, Milano, 159 pp.
- Guilaine J., Briois F., Vigne J.-D. & Carrér I., 2000. Découverte d'un Néolithique précéramique ancien chypriote (fin 9<sup>e</sup>, début 8<sup>e</sup> millénaires cal. BC), apparenté au PPNB ancien/moyen du Levant nord. *C.R. Acad. Sci. Paris, Sciences de la Terre et des Planets*, 330: 75–82.
- Harrison D., 1968. The mammals of Arabia. Vol. II. Ernest Benn Ltd, London: 193–381.
- Jarman M.R., 1996. Human influence in the development of the Cretan mammalian fauna. In: *Pleistocene and Holocene Fauna of Crete and Its First Settlers* (Ed. by D.S. Reese). Prehistory Press, Madison, WI, USA: 211–239.
- Kahmann H., 1959. Notes sur le statut actuel de quelques mammifères menacés dans la région méditerranéenne. *Mammalia*, 3: 329–331.
- Lauvergne J.J., 1986. Les ressources génétiques ovines et caprines en France. Bureau des Ressources Génétiques/Lavoisier, Paris, 105 pp.
- Lauvergne J.J. (Ed.), 1988. Traditional populations and first standardised breeds of ovocaprines in the Mediterranean. *Proceedings, Gontard/Manosque (France)*, 30 June–2 July 1986. Institut National de la Recherche Agronomique, Paris, pp. 203–208.
- Leporati L., 1971. Sopralluogo all'isola di Montecristo. *Natura e Montagna*, Marzo, pp. 39–42.
- Logan G.T., Brown J.H., Husband T.P. & Nicholson M.C., 1994. Conservation biology of the Cretan agrimi. *Biologia Gallo-hellenica*, 22: 241–246.
- Masetti M., 1981. La capra selvatica nel Mediterraneo. *L'Universo*, 40: 177–218.
- Masetti M., 1993. Post-Pleistocene variations of the non-flying terrestrial mammals on some Italian islands. *Supplemento alle Ricerche di Biologia della Selvaggina*, 21: 209–217.
- Masetti M., 1997. The prehistoric diffusion of the Asiatic mouflon, *Ovis gmelini* Blyth, 1841, and the Bezoar goat, *Capra aegagrus* Erxleben, 1777, in the Mediterranean area beyond their natural distributions. In: Hadjisterkotis E. (Ed.), *Proceedings of the Second International Symposium on Mediterranean Mouflon "The Mediterranean mouflon: management and conservation"*. Game Fund of Cyprus/IUCN Species Survival Commission, Caprinae Specialist Group, Nicosia, pp. 1–19.
- Masetti M., 1998. Holocene endemic and anthropochorous wild mammals of the Mediterranean islands. *Anthropozoologica*, 28: 3–20.

- Masseti M., 2003. Fauna toscana. Galliformi non migratori, Lagomorfi e Artiodattili. Agenzia Regionale per lo Sviluppo e l'Innovazione nel settore Agricolo-forestale (ARSIA)/Regione Toscana, Firenze, 311 pp.
- Masseti M., 2009. The wild goats, *Capra aegagrus* Erxleben, 1777, of the Mediterranean Sea and the Eastern Atlantic Ocean islands. *Mammal Review*, 39: 141–157.
- Masseti M., 2012. Atlas of terrestrial mammals of the Ionian and Aegean islands. De Gruyter, Berlin, 302 pp.
- Masseti M., 2014. Las cabras salvajes, '*Capra aegagrus*' Erxleben, 1777, de las islas del Mediterráneo/The wild goats, "*Capra aegagrus*" Erxleben, 1777, of the Mediterranean islands. In: Seguí B. (Ed.), *Balearian Boc. Four millennia of history, ten years of homology*. Consell de Mallorca. Palma de Mallorca, pp. 94–107.
- Masseti M., 2015. The wild goat, *Capra aegagrus* Erxleben, 1777, of the island of Montecristo (Northern Tyrrhenian Sea, Italy): does it still exist? *Mammalia*, 80: 125–141.  
<https://doi.org/10.1515/mammalia-2014-0168>
- Masseti M., 2018. The long-term redefinition of the non-volant vertebrate horizons of the Eastern Mediterranean islands. In: Sfenthourakis S., Pafilis P., Parmakelis A., Poulakakis N. & Triantis K.A. (Eds.), *Biogeography and Biodiversity of the Aegean*. Broken Hill Publishers Ltd., Nicosia (Cyprus): 191–222.
- Masseti M., Vianello F., 1991. Importazioni preistoriche di mammiferi alloctoni nelle isole del Mar Tirreno centro-settentrionale. *Rivista di Scienze Preistoriche*, 43: 275–292.
- Masseti M. & Zuffi M.A.L., 2011. On the origin of the asp viper *Vipera aspis hugyi* Schinz, 1833, on the island of Montecristo, Northern Tyrrhenian Sea (Tuscan archipelago, Italy). *Herpetological Bulletin*, 117: 1–9.
- Masseti M., 2014. Las cabras salvajes, '*Capra aegagrus*' Erxleben, 1777, de las islas del Mediterráneo/The wild goats, '*Capra aegagrus*' Erxleben, 1777, of the Mediterranean islands. In: (Seguí B., ed.) *Balearian Boc. Four millennia of history, ten years of homology*. Consell de Mallorca. Palma de Mallorca, pp. 94–107.
- Mattoli L., 1970. Montecristo ovvero "Del Privilegio". *Yachting & Sporting Clubs d'Italia/Art*. Romana, Roma: 16 pp.
- Mayol J., 2015. Feral ungulates in the Mediterranean and Macaronesian islands. *Convention on the Conservation of European wildlife and natural habitats*. 35<sup>th</sup> meeting Strasbourg, 1–4 December 2015, pp. 1–35.
- Melas E.M., 1985. The islands of Karpathos, Saros and Kasos in the Neolithic and Bronze Age. *Studies in Mediterranean Archaeology*, 68. Paul Åströms Förlag, Göteborg, 337 pp.
- Mori A., 1904. L'isola del re. Una escursione a Montecristo. Il secolo XX, luglio 1904.
- Pardossi L., 1971.- Il problema della tutela paesaggistica nelle isole di Capraia e Montecristo. Unpl. manuscript. Master (Laurea) thesis, 1970–1971. Istituto di Geografia della Facoltà di Magistero, University of Florence, 134 pp.
- Pejrone G., 1970. Una caccia autunnale nell'isola di Montecristo. Amilcare Pizzi, Cinisello Balsamo (Milano), 16 pp.
- Peters J., Helmer D., von den Driesch A. & Saña Seguí M., 1999. Early animal husbandry in the northern Levant. *Paléorient*, 25/2, 27–47.
- Pino Uriá B. & Tagliacozzo A., 2006. *Capra aegagrus* in Italia? Un frammento problematico tra i resti faunistici del Neolitico antico di Favella della Corte (Cosenza). In: Fiore I. & Tagliacozzo A. (Eds.), *Atti 5° Convegno Nazionale di Archeozoologia*. Museo Civico di Rovereto, Rovereto: 131–134.
- Porter V., 1996. *Goats of the world*. Farming Press, Ipswich (UK), 179 pp.
- Radmilli A.M., 1975. Il popolamento umano dell'Arcipelago Toscano prima dell'età romana. *Lavori Società Italiana di Biogeografia*, 5: 899–916.
- Raganella Pelliccioni E., Lazzaro L., Gotti C. & Baccetti N., 2015. Piano di gestione e conservazione della capra di Montecristo: sintesi del contesto e azioni. PROGETTO RESTO CON LIFE - LIFE13NAT/IT/000471.
- Rustioni M., Mazza P. & Magnatti M., 2007. Multivariable analysis of an Italian Late Neolithic archaeofauna. *Journal of Archaeological Science*, 34: 723–738.
- Sandolo R., 2014. I guardiani di Montecristo (1890–2009). Associazione Amici di Montecristo no profit, Portoferraio.
- Schmidt K., 1999. Frühe tier- und menschenbilder vom Göbekli Tepe - Kampagnen 1995–98. Ein kommentierter katalog der grossplastik und der grossplastik und der reliefs. *Istanbuler Mitteilungen*, 49: 5–21.
- Schultze-Westrum T., 1963. Die Wildziegen der ägäischen Inseln. *Säugetierkundliche Mitteilungen*, 13: 145–182.
- Sfougaris A.I. & Lymberakis P., 2009. *Capra aegagrus* Erxleben, 1777. In: Legakis A. & Maragou P. (Eds.), *The red data book of endangered animals of Greece (in Greek with English summary)*. Hellenic Zoological Society, pp. 373–375.
- Silvestri A., 1985. Le capre di Montecristo. Osservazioni sui fenotipi presenti, con particolare riferimento alla *Capra aegagrus hircus* L. *Natura e Montagna*, 32: 3–10.
- Spagnesi M., 1993. INFS Istituto Nazionale per la Fauna Selvatica. Publication produced to celebrate the 60<sup>th</sup> anniversary of the Institute founded on 3 January



1933. Istituto Nazionale per la Fauna Selvatica, Ozzano dell'Emilia (Bologna), 64 pp.
- Spagnesi M. & Toso S., 2003. *Capra hircus* (Linnaeus, 1758). In: Boitani L., Lovari S. & Vigna Taglianti A. (a cura di), Fauna d'Italia. Mammalia. Carnivora – Artiodactyla. Edizioni Calderini de Il Sole 24 Ore Edagricole, Bologna: 355–360.
- Spagnesi, M., L. Cagnolaro & Perco F., 1982. Caratteri e variabilità della capra (*Capra aegagrus hircus*) dell'isola di Montecristo. 1 Posters. Istituto Nazionale di Biologia della Selvaggina, Ozzano dell'Emilia (Bologna), 4 pp.
- Spagnesi M., Cagnolaro L., Perco F. & Scala C., 1986. La Capra di Montecristo (*Capra aegagrus hircus* Linnaeus, 1758). Istituto Nazionale di Biologia della Selvaggina, Ozzano dell'Emilia (Bologna), 147 pp.
- Sposimo P., 2014.- L'eradicazione del ratto nero 3 a Montecristo. In: Zanichelli F., Giannini F., De Pietro F. & Puppo F. (Eds.), Quaderni del Parco, documenti tecnici volume 2 PROGETTO LIFE+ MONTECRISTO 2010, Eradicazione di componenti florofaunistiche aliene invasive e tutela di specie e habitat nell'Arcipelago Toscano". Parco Nazionale Arcipelago Toscano, Portoferraio (2014): 20–25.
- Toschi A., 1953. Note sui vertebrati dell'Isola di Montecristo. Ricerche di Zoologia Applicata alla Caccia, 23: 1–52.
- Toschi A. (Ed.), 1965. Fauna d'Italia. Mammalia. Lagomorpha, Rodentia, Carnivora, Ungulata, Cetacea. Edizioni Calderini, Bologna, 647 pp.
- Trantalidou K., 2003. Faunal remains from the earliest strata of the Cave of Cyclope, Youra. In: Galanidou N. & Perlès C. (Eds.), The Greek Mesolithic. Problems and perspectives. British School at Athens, Studies 10. London, 143–172.
- Trantalidou K., 2011. From Mesolithic Fisherman and Fish Hunters to Neolithic Goat herders: The transformation of an island economy in the Aegean. In: Sampson A. (Ed.), The Cyclops cave on Youra, Alonnessos. Vol. II. INSTAP Academic Press, Philadelphia, pp. 53–150.
- Van den Brink F.H., 1967. Field Guide to the Mammals of Britain and Europe. Collins, London, 208 pp.
- Wilkens B., 1996. Faunal remains from Italian excavations on Crete. In: Reese D.S. (Ed.), Pleistocene and Holocene fauna of Crete and its first settlers. Prehistory Press, Madison (Wisconsin) pp. 241–261.
- Wolf R., 1983. Československá myslivost. Vydáno K IV. Sjezdu ČMS. Státní Zemědělské Nakladatelství, Praha, 160 pp.
- Žujović M., Stanišić N. & Memiši N., 2009. Autochthonous Balkan goat breed: composition and traits of kid carcass. Biotechnology in Animal Husbandry, 25: 411–420.  
<https://doi.org/10.2298/BAH0906411Z>.