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Coats and moults of the water vole *Arvicola sapidus* Miller, 1908 (Rodentia, Arvicolinae) in southern Navarra (Spain)

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Abstract

On the basis of 363 specimens captured in southern Navarra (Spain), the characteristics of the moults and coats of *Arvicola sapidus* were studied. The study of the moults was carried out on pigmentation present on the reverse side of the skins. The water vole has a first or juvenile coat which is less dense, shorter, and darker than later ones. After a certain period of time a juvenile moulting takes place, which is age-related, regular, and of a sublateral type. Most of the individuals that have gone through this moulting phase are immature (82 % ♂♂–93 % ♀♀). Following the juvenile moulting, the water vole acquires its second or subadult coat which, unlike the first coat, is lighter in colour and greater in hair density and length. In *A. sapidus*, the second or subadult moult takes place quickly and, like the first, is age-related and a sublateral type. Nevertheless, the second moulting phase is less regular. During the process of this moulting phase the specimens reach sexual maturity (78 % ♂♂–70 % ♀♀). This moult gives the water vole its third adult coat, which is longer and lighter. It forms one of the adult coats, which are indistinguishable except for winter coats. These are longer and thicker than summer coats. A series of seasonal adult moults takes/place without interruption after the adult coat has been acquired. The autumn moult is similar to the second or intermediate moult, which displays regular prints, at least in its first phase. The spring moult, which is less obvious, displays significantly irregular topographies. The development of the adult moult is also influenced by age and, in the case of the females, by the reproduction process.

Key words: *Arvicola sapidus*, coat, moult, Rodentia, Spain

Introduction

The information available on coats and moults of *A. sapidus* is scarce, which is not the case for other arvicolines. The first observations were made by Le Louarn and Saint-Girons (1977) and Gosálbez (1982) and more recently by Ventura and Gosálbez (1990). Others have concentrated almost exclusively on skin pigmentation in different subspecies (Miller 1912; Cabrera 1914; Rode and Didier 1946; Saint-Girons 1973; Reichstein 1982; Zabala 1983).

The aim of this study is to analyse and describe the moulting process of *A. sapidus* from southern Navarra, including coat characteristics, along with such relative factors as age, biometrics, sexual state, and seasons of the year.

Material and methods

363 specimens captured between 1983 and 1990 in southern Navarra (Spain) were analysed. The sample was divided into six classes of relative age (0–V), according to a series of morphological and bio-

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metrical characteristics: cranial and mandibular morphology, body weight, head and body length (HBL), condylo-basal length (CBL), and eye lens weight (EW) (GARDE et al. 1993). The samples were classified according to the following sexual stages: immature, submature, and mature (GARDE and ESCALA 1996b).

In order to determine the stage of moult, the melanin prints on the inner surface of the skin were examined. The physiological development of the moult in *A. sapidus* was the same as described by MOREL (1981) for *Arvicola terrestris* and followed the same model as observed in other rodents (ESPAÑA et al. 1985; PALOMO and VARGAS 1988).

As sexual differences were not observed in the coats and moults, the information obtained from males and females was evaluated jointly, excluding exceptions.

Results and discussion

First coat

This first coat is also known as the nest or juvenile coat (MOREL 1981; PALOMO and VARGAS 1988). Two individuals were examined (Weight = 30.0–34.4 g; EW = 5.3–5.5 mg; HBL = 105–111 mm; CBL = 27.0–27.25 mm) in the final stages of acquiring the first coat. A fully pigmented surface in the specimens suggested a rapid acquisition of the first coat. This corroborates the observations made by MOREL (1981) regarding *A. terrestris* and ESPAÑA et al. (1985) in *Mus spretus*, who concluded that these two species acquire their first coat at three weeks of age. BECKER (1952) observed a similar time span in *Rattus norvegicus* and PALOMO and VARGAS (1988) in *M. spretus*. STEIN (1960) observed in *Microtus arvalis* a time span of 14–21 days and KAHMANN and TIEFENBACHER (1970) in *Eliomys quercinus* 28–32 days. It was therefore extremely probable that the above-mentioned specimens of *A. sapidus* likewise displayed a fully developed first coat three weeks after birth.

Five specimens displaying a perfectly constituted coat and not lacking any melanin prints in the coat reverse (1.38 % of the total sample) were analysed. *A. sapidus* from southern Navarra has a distinctly coloured first coat: it is dark, almost black, with a dark grey ventral area and greyish-brown back and flanks. The hair of this first coat is the least thick and the shortest of all subsequent coats (GARDE 1992).

VENTURA and GOSÁLBEZ (1990) also observed the darkest colour in the first coat in *A. sapidus* from the Ebro River Delta, a characteristic common in most rodents: *A. terrestris* (MOREL 1981; VENTURA 1988), *Microtus chrotorrhinus* (MARTIN 1973), *M. spretus* (ESPAÑA et al. 1985).

The specimens studied with this coat presented biometrical data demonstrating a significant time span (Weight = 62.9 ± 13.2 g, n = 5; EW = 7.2 ± 0.8 mg, n = 4; HBL = 134.8 ± 9.1 mm, n = 5; CBL = 30.51 ± 1.57 mm, n = 5), which suggested that this coat is normally maintained for a certain period of time. Such a conclusion is supported by the observations made by PALOMO and VARGAS (1988) on *M. spretus*. These authors noted a period of 10–22 days from the acquisition of the first coat until the start of the first moult. The measurements of the two *A. sapidus* specimens with first coats which VENTURA and GOSÁLBEZ (1990) studied are included in the data.

All the first-coat animals showed signs of sexual immaturity.

First moult

Thirty-one specimens (8.56 %) with melanin prints corresponding to the first moult were studied. All of them had a totally or partially developed first coat and, with one exception, displayed regular pigmentation marks.

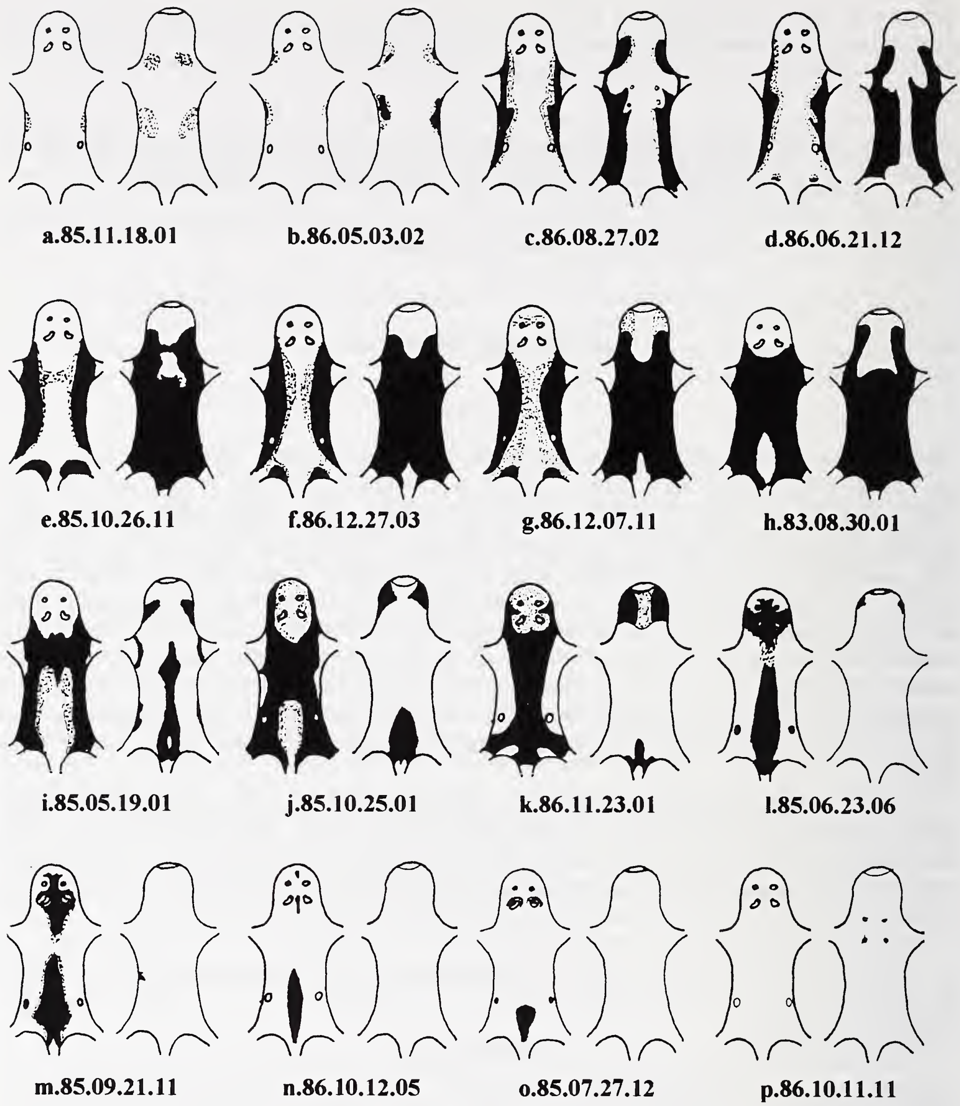

Fig. 1. Sequence of the first coat change in *A. sapidus* from southern Navarra. The silhouettes correspond to the inner surface of the skin. The black areas illustrate the accumulation of melanin and the spotted areas illustrate the low concentration of pigment.

This first change of coat in *A. sapidus* specimens from southern Navarra is a sublateral type and shows a regular topography, as was reported by Ventura and Gosálbez (1990). This is the most common model found in rodents: Saint-Girons (1967) and Sans-Coma et al. (1987) in *Apodemus sylvaticus*; Kahmann and Tiefenbacher (1970) in *E. quercinus*; Martin (1973) in *M. chrotorrhinus*; Morel (1981) in *A. terrestris*; España et al. (1985) in *M. spretus;* Sans-Coma et al. (1987) in *Rattus rattus.* However, the moulting process in the water vole shows certain unique features (Fig. 1: a–p). The pigment appears at four points simultaneously: two in the mid-ventral area and the other two near the neck. The pigment gradually progresses towards the flanks, then slowly to the back and much more rapidly in the direction of the abdomen, finally reaching the pectoral and cephalic zones. The reabsorption of pigment starts at the central-ventral region and continues on, disappearing according to the pattern of its original appearance.

Certain minor variations in this general process have been observed, with one specimen displaying a completely atypical moult pattern. España et al. (1985) described similar cases in *M. spretus* attributing them to individual variations.

Table 1. Distribution of *A. sapidus* from southern Navarra according to age and moulting phase. "A. 1st coat": acquisition of the first coat.

Age	0	I	II	III	IV	V	Total
A.1st coat	2	–	–	–	–	–	2
1st coat	4	1	–	–	–	–	5
1st moult	2	24	5	–	–	–	31
1st phase	2	8	–	–	–	–	10
2nd phase	–	9	–	–	–	–	9
3rd phase	–	6	5	–	–	–	11
irregular	–	1	–	–	–	–	1
2nd coat	–	1	3	–	–	–	4
2nd moult	–	–	17	59	–	–	76
1st phase	–	–	6	2	–	–	8
2nd phase	–	–	11	21	–	–	32
3rd phase	–	–	–	19	–	–	19
irregular	–	–	–	17	–	–	17
3rd coat	–	–	–	–	29	27	56
3rd moult	–	–	–	–	109	80	189

Table 2. Values of *A. sapidus* from southern Navarra corresponding to the first moult (1st, 2nd, 3rd phase or irregular) or second coat. n: number of specimens; x: average; s: typical deviation; t: results from Student test on comparisons between successive phases; level of significance: ns = not significant; * = $p < 0.05$; ** = $p < 0.01$: *** = $p < 0.001$.

	Phase	n	x	s	Range	t
EW	irregular	1	9.7	–	–	–
	1st	9	9.0	0.7	7.8–10.3	4.88**
	2nd	9	10.5	0.6	10.0–11.6	2.58*
	3rd	10	11.4	0.9	10.5–13.3	2.47*
	2nd coat	3	13.1	1.2	12.1–14.9	–
WEIGHT	irregular	1	128.9	–	–	–
	1st	10	86.0	16.3	53.1–113.7	3.83*
	2nd	8	111.9	12.7	83.2–130.3	4.13***
	3rd	11	138.0	15.1	100.3–157.8	2.12 ns
	2nd coat	4	155.9	12.0	143.6–173.5	–
HBL	irregular	1	163	–	–	–
	1st	10	146.2	5.4	138–155	5.82***
	2nd	8	160.2	4.6	153–167	3.91**
	3rd	11	172.0	7.5	161–184	0.99 ns
	2nd coat	4	176.2	6.2	172–187	–
CBL	irregular	1	34.30	–	–	–
	1st	10	31.96	0.91	30.50–33.50	4.64***
	2nd	9	33.75	0.75	33.15–35.40	4.78***
	3rd	11	35.85	1.13	35.20–37.30	0.75 ns
	2nd coat	4	36.31	0.61	35.80–37.35	–

It was observed that the end of the first moult coincided with the start of the second change of coats in three specimens. This gave rise to overlapping moults, an event that has been observed in other rodents (Kahmann and Tiefenbacher 1970; Sans-Coma et al. 1987). The three specimens were captured between September and December, which could indicate that the proximity of winter speeds up the onset of the second moult.

Despite the reduced size of the sample, it is possible to establish a relationship between the sequence of the first moult and the relative age of the animals (Tab. 1). Taking into account the division of the ventral fringe of melanin and the division of the dorsal fringe, the process of the first moult is comprised of three phases: first (Fig. 1: a–h), second (Fig. 1: i–k), and third (Fig. 1: 1–p).

There is also a clear relationship between the duration of the moulting phases and growth, which shows statistically significant biometrical differences (Tab. 2). These values are similar to those given by Ventura and Gosálbez (1990) in specimens of water vole captured at the Ebro River Delta, which had undergone the first moult. It can be inferred that both the start as well as the process of the first moult depends entirely on the age of the animal, suggesting that it is genetically controlled (Sans-Coma et al. 1987 for *A. sylvaticus*).

In other species the first change of coat took place between the first 3–8 weeks of life, as in the case of *A. terrestris* (Morel 1981) and *M. arvalis* (Stein 1960), 4–8 weeks in *M. spretus* (España et al. 1985; Palomo and Vargas 1988) and *R. rattus* (Sans-Coma et al. 1987) or 6–11 weeks in *R. norvegicus* (Becker 1952) and *E. quercinus* (Kahmann and Tiefenbacher 1970).

Most of the specimens undergoing the first change of coat were immature (81 % male and 93 % female) (Garde and Escala 1996 b). The presence of mature specimens among first moulters has been mentioned by España et al. (1985) in *M. spretus*, Sans-Coma et al. (1987) in *A. sylvaticus* and Ventura (1988) in *A. terrestris.*

Given that in the first months of the year hardly any young animals are captured (Garde and Escala 1996 a) would seem to confirm the fact that the moulting process develops irrespective of the time of year. It can therefore be assumed that both the start and the progression of the first moult depend entirely on age.

Second coat

In four specimens, the second or subadult coat (Morel 1981) showed no signs of melanin prints. This leads to the assumption that this coat lasts only a short time as it is followed soon thereafter by a second moult. This observation has been confirmed by other authors: Kahmann and Tiefenbacher (1970) in *E. quercinus*, España et al. (1985) and Palomo and Vargas (1988) in *M. spretus*, Sans-Coma et al. (1987) in *R. rattus* and by Ventura (1988) in *A. terrestris.*

A thicker and lighter coloured coat differentiates the second coat *A. sapidus* from the juvenile one (Garde 1992). These characteristics have also been observed in other rodents such as *M. spretus* (España et al. 1985), *R. rattus* (Sans-Coma et al. 1987), *A. terrestris* (Ventura 1988). The prevailing colour in the ventral region is light-grey, unlike the dark grey colouring found in the first coat. This is due mainly to the fact that in this second coat the hair appears to be longer and lighter in colour. The prevailing colour of the hair in the flanks and the dorsal region is a greyish-brown.

The age (Tab. 1) and biometrics (Tab. 2) of the second-coat specimens were similar to those of the group in the process of completing the first moult. The only significant differences were detected in the EW, which confirmed the brief duration of the second coat. The four second-coat specimens consisted of one sexually mature male and 3 immature females.

Second moult

76 specimens with melanin prints corresponding to the second moult were analysed. The three specimens previously mentioned displaying an overlap of the first and second moult were not included. The second change of coat in *A. sapidus* from southern Navarra is sublateral and is similar in some aspects to the first one, although its development is rather irregular, as can be observed in figure 2 (a–l).

In addition to some variations described in the model, 17 specimens displayed totally irregular designs, with no apparent relationship to the moult sequences already described. However, these designs can be said to belong to the second moult, by reason of the age (class III) of the specimens as well as the fact that most of the designs show a slight resemblance to the second and third moult phases, typified by an overlaying, irregular distribution common for adults.

Several specimens displayed melanin prints corresponding to the third moult without having reached even the end of the second moult (Fig. 3: i–l). Most of the specimens with overlying designs were captured in autumn or at the beginning of winter.

The second moult, also known as the intermediate, postjuvenile or subadult moult was also observed in different species of rodents (Becker 1952; Stein 1960; Kahmann and Tiefenbacher 1970; Martin 1973; Morel 1981; España et al. 1985; Sans-Coma et al.

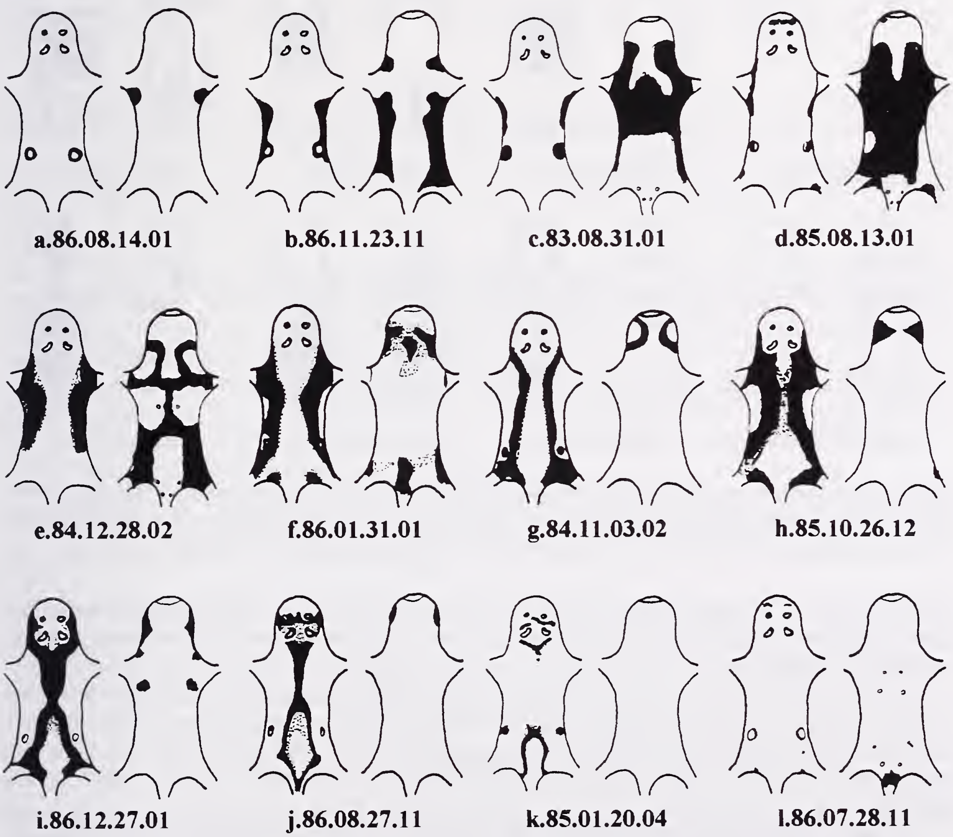

Fig. 2. Sequence of the second moult in *A. sapidus* from southern Navarra.

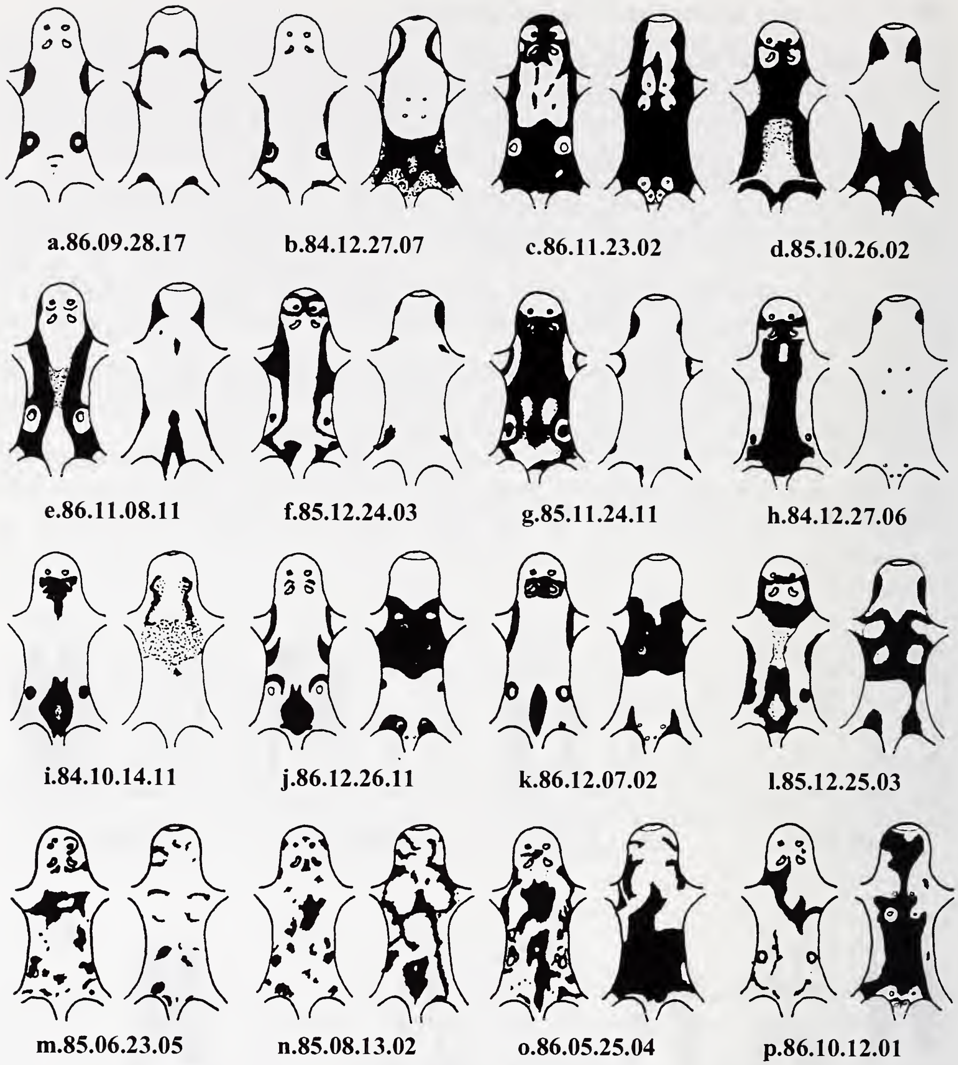

Fig. 3. Adult moults in *A. sapidus* from southern Navarra: sequence corresponding to the first phases of the seasonal moult (autumn moult) (a–h), specimens with the second moult overlying the third moult (i–l), displaying scattered melanin prints (m–n) and extensive pigmented marks (o–p).

1987; Palomo and Vargas 1988; Ventura 1988). Moreover, the authors agree on the fact these specimens develop the second moult more irregularly than the first, with obvious individual variations.

In the second moult, as in the first, the split of pigment markings in the ventral region to the cephalic and caudal regions and the separation of the dorsal fringe divide the process into three phases: first (Fig. 2: a–e), second (Fig. 2: f–j) and third (Fig. 2: k–l). It was impossible to include those specimens that displayed irregular moults in any of the phases.

A clear relationship exists between the duration of the moulting phases, age (Tab. 1), and growth (Tab. 3). Furthermore, the biometric differences observed in the consecutive

Table 3. Values of *A. sapidus* from southern Navarra corresponding to the different phases of the second change of coat (1st, 2nd, 3rd and irregular). n: number of specimens; x: average; s: typical deviation; t: results from Student test on comparisons between successive phases; significance level: ns = not significant; * = p < 0.05; ** = p < 0.01; *** = p < 0.001.

Phase	n	x	s	Range	t	
EW	1st	6	13.8	1.6	11.9–15.9	2.78**
	2nd	27	16.2	1.9	11.9–18.9	2.92**
	3rd	14	17.9	1.5	14.6–20.5	
	irregular	9	17.6	1.8	15.4–20.8	
WEIGHT	1st	8	161.1	22.1	125.3–198.2	1.75 ns
	2nd	29	176.8	22.6	144.7–248.2	2.01*
	3rd	17	191.2	24.7	159.3–260.0	
	irregular	14	181.5	18.3	147.8–207.1	
HBL	1st	8	180.4	8.2	172–197	3.39**
	2nd	30	188.4	5.2	179–198	0.55 ns
	3rd	18	191.1	9.6	170–202	
	irregular	15	189.0	7.0	169–197	
CBL	1st	8	37.25	0.82	36.1–38.5	2.33*
	2nd	32	38.05	0.87	36.8–39.9	2.97**
	3rd	16	38.78	0.64	37.8–40.1	
	irregular	17	38.39	0.96	37.0–40.5	

moulting phases were statistically significant in most cases. This was also the case with the other parameters of the third phase of the first moult and the first phase of the second moult. Nevertheless, the differences between the second coat specimens and those still undergoing the first phase of the second moult were not quite as significant, which reinforces the hypothesis suggested earlier concerning the brief duration of the second coat.

Specimens with irregular moults displayed intermediate biometric values (Tab. 3) between the second and third phase of the moult and no significant differences were evident. These data support the aforementioned theory of a possible similarity between these designs and those typical for the phases.

Among those specimens undergoing the second moult, and captured from autumn to the beginning of winter, 22 % of the males and 30 % of the females were immature. This attests to the delay of the onset of sexual maturity for animals born at the end of the reproductive period (Garde and Escala 1996 b).

A. sapidus from southern Navarra reaches sexual maturity mainly during the second moult, like the water vole from the Ebro River Delta (Ventura and Gosálbez 1990) and several other species of rodents (Morel 1981; España et al. 1985; Sans-Coma et al. 1987).

Most of the animals which were in the process of a second moult were captured between the end of the summer or in mid-winter, coinciding with the capture of those animals from classes II and III (Garde and Escala 1996 a). Hence one might believe that the second moult also is mainly determined by age.

Adult coats

Once the second moult has finished, the animals acquire a third coat which is the first adult coat. Later on the specimens will go through a series of moults, influenced by environmental conditions, sex and age, which will lead to the acquisition of the adult coats.

56 specimens (22.8 % of the adults), with totally formed adult coats and without melanin prints, were studied. This small amount suggests that little time elapses between the two consecutive moults. Although it was not possible to distinguish between the adult coats themselves, two types of coats associated with the seasons were differentiated; one in the winter, which is thick and made up of much longer hair, and one in the summer. Such observations have been made by Ventura and Gosálbez (1990) in *A. sapidus* from the Ebro River Delta.

The pigmentation of the adult coat is lighter than that of the second coat, a characteristic which becomes more noticeable with age. In some older individuals, yellowish markings are displayed which vary from one individual to another (Garde 1992).

The 56 sample specimens all belonged to age classes IV and V (Tab. 1), which confirms the existence of several coats following the first adult coat. All the specimens with third or later coats, with no evident signs of moult were sexually mature, except for two males corresponding to age class IV, captured in February and in December (Garde and Escala 1996 b). The disproportion that existed between the males (16 specimens–11.6 % of the adult males) and the females (40 specimens–37.4 % of the adult females) was striking. These data suggest that the onset of a new moult in females might be influenced by physiological processes connected with reproduction.

The distribution of adult specimens with the third coat throughout the year reaches a maximum in March (35 %) and in September (36 %). These months coincide with the end of winter and summer and are periods with lowest moulting activity. However, it is likely that this monthly sequence is also influenced by the sexual activity of the female as previously mentioned.

Adult moults

In the analysed sample of the 245 specimens with totally formed adult coats, 189 (77.2 %) showed signs of moulting. All were sexually active, except 9 (6 males and 3 females), and were captured between November and February (Garde and Escala 1996 b).

Moulting adult specimens could be found every month of the year (64–87 %). The monthly frequencies of moult were higher between October and January and lower in February and March. The higher frequencies seem to correspond to a possible autum moult. The increase in percentage of moult beginning in April could be due to the commencement of spring moult and to the beginning of mating activity (Garde and Escala 1996 b).

The identification of two coat types in the adult specimens, one in winter and one in summer, suggests an autumn and spring moult. These two moults allow the animals to acquire the above-mentioned coats. Some authors (Saint-Girons 1967; Morel 1981) refer to such changes in adult coats as "seasonal moults", owing to their relationship with the environment.

Other authors, e. g. España et al. (1985) for *M. spretus* and Sans-Coma et al. (1987) for *R. rattus* insist on there being no relationship between the changes of the adult coat and the time of year; both cases were observed in southern Spain.

Only 20 % of the specimens (20 males and 18 females) showed uniform designs. The majority (28) was captured between September and January and all belonged to age class IV, which suggests that the first adult moults maintain a certain uniformity but, show variations with time.

This group of young adults displaying a regular moult undoubtedly corresponded to samples that had just reached adult age at that time of the year and were going through the autumn moult. In fact, several animals that were going through the third phase of the second moult displayed overlying melanin prints typical for the third moult (Fig. 3: i–l), and thus corresponded to the autumn moult. As has already been stated, this moult normally takes place between September and January. Most of its sequence was established (Fig. 3: a–h), except for the final phases, either due to the lack of specimens displaying those markings or because the final reabsorption of pigment was irregular. The autumn moult started from the lateral glands. The remainder of the process was very similar to the subadult moult (Fig. 2), although its development was somewhat more variable and irregular. The characteristics of the autumn moult for *A. sapidus* coincide with MOREL's (1981) observations in *A. terrestris.*

It was impossible to determine the sequence of the spring moult since all the specimens captured during this season displayed irregular topographies. It is therefore probable that its development is more irregular, unlike the autumn moult, as noted by VENTURA (1988) for *A. terrestris.*

The majority (80 %; n = 151) of specimens with adult moults displayed irregular markings. Nevertheless, it should be pointed out that in several specimens there was a variation in pigmentation as well as in the way the hairs were renewed in the lateral gland region. This fact, which was observed by QUAY (1968), has also been confirmed by VENTURA and GOSÁLBEZ (1990) in *A. sapidus* from the Ebro River Delta. In some females a similar variation was also observed near the mammary glands (Fig. 3: c, p), which also was mentioned by VENTURA (1988) in *A. terrestris.*

The appearance of small melanin prints distributed as a mosaic pattern over the whole reverse coat (Fig. 3: m–n) was also observed in specimens from age class V. These "scattered" designs are a clear sign of the absolute irregularity that characterises coat changes in older individuals and observed by MOREL (1981) in *A. terrestris.*

The existence of irregular designs of large melanin spots (Fig. 3: o–p) was also recorded. This widespread pigmentation is a sign of a fast moulting process. 21 specimens, 3 males and 18 females (12 of which were in gestation) displayed these characteristics. Most of the specimens (12) which displayed this design, did so between May and August, the months of greatest sexual activity. If the female sexual activity was an influencing-factor in the onset of a new moult, these results now seem to strengthen the idea that sexual activity also affects the adult moulting process in *A. sapidus* from southern Navarra.

These observations coincide with those made by MOREL (1981) in *A. terrestris*, who pointed out that during the reproductive period the females in gestation displayed significant delays in their moults, which were later completed at the end of the gestation period or slowed down and took place between two pregnancies. This was noticed by the appearance of simultaneous hair growth. Similar effects have been found in other rodents, for example, in *A. sylvaticus* (SAINT GIRONS 1967).

Zusammenfassung

Felle und Fellwechsel bei Arvicola sapidus Miller, 1908 (Rodentia, Arvicolinae), aus dem Süden von Navarra (Spanien)

Es werden Angaben zu den Besonderheiten von Fell- und Haarwechsel einer Population von *Arvicola sapidus* (n = 363) aus dem Süden von Navarra gemacht. Die Untersuchungen beziehen sich auf Pigmentierungsflecke der Hautinnenseite. Die südwesteuropäische Schermaus zeigt ein 1. oder jugendliches Haarkleid, das weniger dicht, kürzer und dunkler ist als die folgenden. Danach erfährt sie einen 1. oder juvenilen Haarwechsel, der in Zusammenhang mit dem Alter steht; er ist sehr regelmäßig und vom sublateralen Typ. Der größte Teil von in diesem Haarwechsel befindlichen Tieren ist sexuell unreif (82–93 %).

Danach bekommt die Schermaus ihr 2. oder subadultes Haarkleid, das dichter, länger und heller als das vorangehende ist. *A. sapidus* beginnt bald mit ihrem 2. oder subadulten Haarwechsel, der mit dem Alter korreliert und von sublateralem Typ ist. Im Unterschied zum 1. Haarwechsel verläuft er unregelmäßiger. Während des Haarwechsels erreichen die Tiere allmählich ihre sexuelle Reife (78–70 %).

Der subadulte Haarwechsel führt zum 3. Haarkleid, das länger und heller als das 2. Haarkleid ist. Diesem 3. Haarkleid entspricht die Gesamtheit der adulten Haarkleider, die ununterscheidbar sind; das Winterfell ist von größerer Länge und Haardichte als das Sommerfell.

Nach der Bildung des adulten Haarkleids unterliegen die Tiere ständig einer Reihe von saisonalen Haarwechseln: Herbstlicher Haarwechsel, der ähnlich wie der subadulte Haarwechsel verläuft und auch eine gewisse Regelmäßigkeit zeigt, zumindest in den ersten Stufen, und der etwas weniger ausgeprägte Frühlingshaarwechsel, der Topographien von auffallend hoher Unregelmäßigkeit zeigt. Der Verlauf des Haarwechsels der adulten Tiere wird auch durch das Alter beeinflußt und im Falle der Weibchen durch die Fortpflanzungsprozesse.

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