

# PHENOTYPICAL DESCRIPTION OF HAIRLESS RABBITS APPEARED IN THREE DIFFERENT HERDS

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**Abstract** - Three lines of hairless rabbits issued from three different places are described from a phenotypical and histological point of view. Two of them look like the furless mutation already described in 1928 by SAWIN. They have a coarse coat with very few downs. Rabbits of the third line own very scarce downs and no bristles. The coat is looking like athymique nude mouse. The mutation described for several other species is named : naked mutation. No ultimate conclusion about the genetic origin can yet be exposed. This conclusion is only proved for one of them.

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## INTRODUCTION

Breeders observe sometimes, at weaning, some young rabbits bearing very light coat made of only one type of hair. They call and describe them as « nude rabbits ». We can also see this characteristic in different species such as rat, mouse, hamster, dog, cat... (BOUCHER, 1993 ; BOUCHER & NOUAILLE, 1996 ; GUENET, 1995 ; SEARLE, 1968). During the last years, we have had an opportunity to collect several rabbits with different kind of sparse coat issued from three different raisers. The purpose of our paper is to describe the coats and to propose an analysis of the different items collected and observed and to propose a genetic hypothesis.

ROBINSON (1958) reported the different phenotypes of rabbit with coat characteristics different from wild type. KILOVSKI (1928), SAWIN (1955) have described naked or hairless rabbits, appeared from time to time in some herds. The early mortality of the animals or the elimination by the raisers has never allow to prove a genetic hypothesis about the transmission of this feature. However, every author give as sure this hypothesis. The weak number of hair follicles and arector muscles associated to a thin derm and epiderm is noticed.

Animal are described to have a tough and horny skin with a stratum granulosum being about twice as thick as normal. The hair follicles appear in the usual number but are horny in structure. The downs fail to develop and only the bristle hair erupt through the skin. In any case they are mostly sterile.

In 1933, CASTLE described another mutation « furless » and gave a genetic interpretation through a recessive gene called « f ». The bearing rabbits own long scarce hair all over the body but the head, tail and legs coat was a wild type. An early keratinization appears, affecting sebaceous glands function and the internal sheath. Hair is then wasted away. He observed also a frequent sterility of these animals (ROBINSON 1958). Of course no clear genetical demonstration is done on the transmission of this feature.

Another coat mutation is described by NACHTSHEIM (1937) with « pelt loss mutation ». Homozygotic animals own a very thick skin with horned hair follicles. Only the strongest guard hair are growing, downs growth is stopped and as the former description these rabbits are sterile.

SAWIN (1955) describes another genetic mutation : the « whirehair » which could be given by a dominant gene called Wh. The rabbit bearer of this gene has an aspect very close to a furless rabbit and its coat is mainly composed of bristles

On top of that SAWIN gives a description of rabbits keeping a wild coat up to 3 weeks and losing hair on shoulders, head and back. The rabbit is then naked except on top of tail and legs. The coat is usually growing a

few weeks later. He calls, once more, this modification of the pelt growth : a new mutation « juvenile hairlessness ». No genetic test has been done or related about these observations.

## MATERIAL AND METHODS

### Origin of animals

Our first animals (line 1) are three of them, proceeding from an Artificial Insemination center out of Vendée (western part of France) and from two different litters. Youngs were born after A.I. of heavy breed does with mixed sperm. So it was impossible for us to find the rabbits' sir again. Line 2 is proceeding from a brittany raiser. The first rabbits have been bought by Magneraud Station of INRA. This station succeeded to feed and raise properly the first animals and they obtained some litters. For the time being, Magneraud Station owns several rabbits of this line (FERCHAUD 1992, VERGERON 1995). A last rabbit (line 3) issued again from an A.I. of a common coat dam was still arising from Vendée.

### Method

*Observation* - Animals are carefully described following the official advices of Commission des Standards de la Fédération Française de Cuniculture (FFC 1993).

*Breeding* - The 3 rabbits of the 1st line are dead before reproduction as well as the 3rd origin rabbit. The « line 2 » was made of one male and two females of common coat (heterozygotes). The young born issued from the 3 rabbits were naked and they all died before 8 weeks. Beside we increased the genetic stock by several crosses with « common coat rabbits » and after 3 years and many backcross we succeeded to obtain « naked rabbits » of both sexes able to give litters. We call this group of rabbits a small line (THEBAULT, 1996).

*Histology* - On the dead rabbits, samples of skin have been collected and from different other components. Preparation was fixed in 10 % diluted formol or Bouin. The choosen colorations for the skin was nuclear fast red, aniline blue and G. orange. For living rabbits, biopsy skin samples were collected and processed the same way.

### *Metrology* -

Hair length : high of hair was measured using a double decimeter to within 0,5 mm.

Hair diameter and bristle rate : they were measured using the method described by THEBAULT *et al.*, 1995.

Coat compacity : compacity was measured with a specific tool called « compacimetre ». The measure is based on the thickness of hair grown on a given wideness of skin. It is a sort of fork with two parallel prongs precise spaced out of 5 mm. The 5 mm hair band is then submitted to a standard pressure between two parallel jaws ; the distance between the jaws is function of the number of hair enclosed.

## RESULTS

### Observed phenotypes

It is possible to describe rabbit coats of line 1 and 2 on the same way. A large variation between rabbits and according to the age and season is to be noticed

Just born, rabbits are shiny and bright during few days. This aspect is due to a glabrous skin. So, it is easy to find them out in a nest with other « common » rabbits. Gradually, after two weeks, the skin becomes thick and some long sticky and steady hair are growing. They are properly distributed all over the body. On the head, tail, legs, hair density is higher and covers the animal up to the neck, the knees, the elbows. The rabbit has bristles and hair ears.

At one year old, hair density may have increased on some rabbits. They kept a rough pelt but covering the whole skin. When mature (after 9 months) the rabbits seem not queer although their pelt is made of long and taut hair. We have also observed some scattered downs. Some other adult rabbits show a rough, harsh pelt

grown on a thick skin covered with a yellow, greasy coating. This coating is sticky for the hairs. So the rabbit has no longer the appearance of a rabbit. However, extremities are still well covered with hair.

A detailed study of the coat shows a rate of bristles almost 3,5 time higher than on a « savage pelt ». Hair length and diameter of the different kind of hair are similar also. We have noticed a small difference between males and females. Males have a longer, thicker and harsher coat than the females.

The one rabbit of line 3 is dead at 80 days of age with a stomach ulcer, a stricture of pylorus and a pneumonia symptoms. This rabbit was totally naked, head, legs, ears and tail included. No hair, no whiskers, except on a small surface of 6 cm<sup>2</sup> on the neck.

### Histological and metrological results

*Line 1* - The three 6 months old rabbits had immature testis. PLASSIART (1995) registered a keratin deposit on epidermis and follicles. Most of the follicles are at telogene stage and very few follicles are working most of the time. They are a pile epithelial undifferentiated cells without sweat gland.

*Line 2* - See tables 1 and 2

**Table 1 : Histological and metrological study of hairless fibres.**

|                          | Females |                    | Males |                    |
|--------------------------|---------|--------------------|-------|--------------------|
|                          | mean    | standard deviation | mean  | standard deviation |
| Bristles length (mm)     | 31.67   | 6.24               | 35.33 | 3.00               |
| Downs length (mm)        | 18.00   | 4.32               | 24.33 | 1.25               |
| Compacity (mm)           | 0.13    | 0.04               | 0.21  | 0.06               |
| Bristles rate (%)        | 6.32    | 2.38               | 6.95  | 2.37               |
| Tylotriches diameter (μ) | 44.59   | 3.55               | 51.04 | 11.14              |
| Bristles diameter (μ)    | 50.98   | 3.15               | 58.33 | 6.70               |
| Awns diameter (μ)        | 27.59   | 2.78               | 25.68 | 3.45               |
| Downs diameter (μ)       | 14.21   | 1.06               | 15.12 | 0.62               |

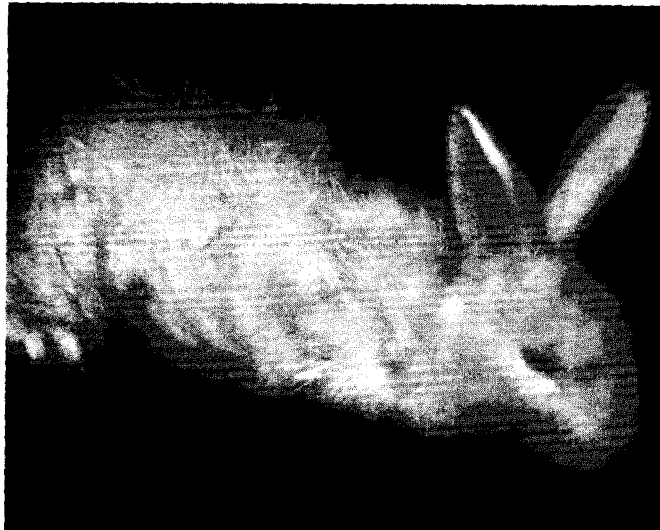
**Tableau 2 : Inter-breed comparison**

| Breed                 | Common | Angora | Rex   | Hairless | Ang x Rex | Hair x Rex |
|-----------------------|--------|--------|-------|----------|-----------|------------|
| Bristles length (mm)  | 34.17  | 100.83 | -     | 33.50    | 38.50     | 35.33      |
| Standard deviation    | 1.21   | 1.86   | -     | 5.44     | 4.50      | 2.13       |
| Downs length (mm)     | 24.83  | 68.33  | 19.00 | 21.17    | 27.17     | 22.17      |
| Standard deviation    | 1.77   | 7.45   | 0.47  | 4.49     | 3.58      | 1.86       |
| Compacity             | 0.27   | 0.41   | 0.36  | 0.17     | 0.41      | 0.31       |
| Standard deviation    | 0.01   | 0.04   | 0.02  | 0.06     | 0.07      | 0.10       |
| Bristles rate (%)     | 1.93   | 1.75   | 0.16  | 6.63     | 1.93      | 1.54       |
| Standard deviation    | 0.46   | 0.50   | 0.02  | 2.40     | 0.88      | 0.59       |
| Tylotriches diam. (μ) | 48.33  | 47.26  | -     | 48.46    | 54.96     | -          |
| Standard deviation    | 5.24   | 5.34   | -     | 9.46     | 5.17      | -          |
| Ratio s/p             | 40.64  | 51.22  | 40.43 | 18.38    | 49.23     | 39.95      |
| Standard deviation    | 2.89   | 5.22   | 3.00  | 5.38     | 5.06      | 2.81       |
| Bristles diameter (μ) | 58.54  | 45.20  | -     | 54.66    | 58.37     | 47.42      |
| Standard deviation    | 5.50   | 5.04   | -     | 6.40     | 4.06      | 2.72       |
| Awns diameter (μ)     | 30.79  | 29.53  | 28.22 | 26.64    | 25.84     | 26.29      |
| Standard deviation.   | 2.98   | 5.10   | 3.50  | 3.28     | 2.59      | 4.22       |
| Downs diameter (μ)    | 13.33  | 13.93  | 13.01 | 14.66    | 12.89     | 12.74      |
| Standard deviation    | 0.70   | 1.16   | 0.80  | 0.98     | 1.21      | 1.39       |

**Strain 1 : at 5 months**



**Strain 2 : I.N.R.A. adult**



**Strain 3 : at 80 days**



The number of rabbits was enough to try a statistical treatment of the biopsies and a comparison with different rabbits.

Analysis given on Table 1 did not show any significative difference between the males and females on the hair measurements (length and diameter of each kind of hair) and coat compacity. We reach nearly the signification on down length. The comparison with other rabbit types (Table 2) shows a large decrease of the number of downs per hair follicle group. The other measurements are similar to the other kind of present hairs.

*Line 3* - On the unique rabbit follicle density is variable. All case are of small size and look like secondary follicles.

On the front and the sides we observed keratine deposit.

## DISCUSSION

Rabbits from line 1 and 2 are phenotypically very close to each other. The description is similar to CASTLE (1933) and we called these rabbits Hairless.

The total lack of hair in line 3 seems to give reason to another kind of naked rabbit. The pathologic features including keratosis deposit, atrophy of secondary follicles and immature testis is in favor of a junction with line 1 and 2. On the opposite, atrophy and displasy of follicles it could exist an aplasy of primary follicles. From this point of view this rabbit could be compared with the description of 1928.

In the past, we did not see any picture. So a common origin for the three phenotypes described similar to the description done 70 years ago is not to be given.

A genetic study would be of interest and we will try to keep deep frozen some ADN samples in order to planify a comparison between the different origins.

All the rabbits observed are more cold sensitive. From all autopsies of dead rabbits, many stomach ulcer, ceecal paresy and pylorus stricture.

Each rabbit has an absence of fat reserve and a high food conversion rate. They probably need more energy than « savage pelted rabbits » for the thermoregulation. The usual temperature for these animals was of 37° celcius, versus 39°C.

The usual word « naked » rabbit gather different features and characteristics. We meet this phenomenon in several mammalians and further studies on genetics or physiological determination of hair growing would be of large interest for fur selecting programs.

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**Description phénotypique des lapins Hairless apparus dans trois troupeaux différents** - Trois souches de lapins nus provenant de trois origines différentes sont décrites phénotypiquement et histologiquement. Les deux premières sont semblables à la mutation furless déjà décrite en 1928 et ont un pelage grossier peu riche en duvet. La dernière souche, pratiquement glabre sur tout le corps possède quelques poils de duvet. Elle est à rattacher à la mutation naked et présente de grandes similitudes avec d'autres espèces comme la Souris nude athymique. La seule observation qui a pu donner lieu à vérification de l'hypothèse d'un gène récessif est la deuxième.

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