

## Note

 $\alpha_{S1}$ -Cn<sup>D</sup>, another allele associated with a decreased synthesis rate at the caprine  $\alpha_{S1}$ -casein locus

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**Summary** — A seventh allele of the caprine  $\alpha_{S1}$ -casein locus, called  $\alpha_{S1}$ -Cn<sup>D</sup>, was observed in French *Alpine* and *Saanen* breeds. Its frequency in a large herd ( $N=198$ ) was 0.025. Like  $\alpha_{S1}$ -Cn<sup>B-</sup>,  $\alpha_{S1}$ -Cn<sup>F</sup> and  $\alpha_{S1}$ -Cn<sup>O</sup>, this allele is associated with a decreased synthesis rate, its approximate mean contribution being 0.6 – 0.8 g/l, very close to that of  $\alpha_{S1}$ -Cn<sup>F</sup>.

**goat –  $\alpha_{S1}$ -casein – polymorphism – quantitative variations**

**Résumé** —  $\alpha_{S1}$ -Cn<sup>D</sup>, un autre allèle à taux de synthèse réduit au locus de la caséine  $\alpha_{S1}$ -caprine. Un septième allèle du locus de la caséine  $\alpha_{S1}$ -caprine,  $\alpha_{S1}$ -Cn<sup>D</sup>, a été observé dans les races *Alpine* et *Saanen* françaises. Sa fréquence dans un grand troupeau ( $N=198$ ) était de 0,025. Comme  $\alpha_{S1}$ -Cn<sup>B-</sup>,  $\alpha_{S1}$ -Cn<sup>F</sup> et  $\alpha_{S1}$ -Cn<sup>O</sup>, cet allèle est associé à un taux de synthèse réduit, sa contribution moyenne étant d'environ 0,6 à 0,8 g/l, donc très proche de celle d' $\alpha_{S1}$ -Cn<sup>F</sup>.

**chèvre – caséine  $\alpha_{S1}$  – polymorphisme – variations quantitatives****Introduction**

Grosclaude *et al.* (1987) have recently concluded that the polymorphism of goat  $\alpha_{S1}$ -casein is under the control of a minimum of 6 alleles. Alleles  $\alpha_{S1}$ -Cn<sup>A</sup>,  $\alpha_{S1}$ -Cn<sup>B</sup> and  $\alpha_{S1}$ -Cn<sup>C</sup> were found to be associated with a high  $\alpha_{S1}$ -casein content (approximate mean contribution of each allele being 3.6 g/l) compared to  $\alpha_{S1}$ -Cn<sup>F</sup> and  $\alpha_{S1}$ -Cn<sup>B-</sup> which are associated respectively with a low content (0.6 g/l) and an intermediate content (1.6 g/l), while  $\alpha_{S1}$ -Cn<sup>O</sup> appeared to be a true null allele.

In the same publication, the authors mentioned the presence in the electrophoregrams of some milks, of an additional band, called x, which reacted in immunoblotting with anti- $\alpha_{S1}$ -casein antibodies. We show in the present note that this band corresponds in fact to a seventh allele of the  $\alpha_{S1}$ -casein locus.

## Material and Methods

Individual milk samples were obtained from the "Station de Testage Caprin" near Moissac, Sainte-Croix Vallée Française, France or from private farms located in west central France. All techniques were as described in Grosclaude *et al.* (1987).

## Results and Discussion

Band x (Fig. 2 in Grosclaude *et al.*, 1987), hereafter called D, migrates slightly more slowly than  $\beta$ -casein (Fig. 1) in SDS-polyacrylamide gel. Because of unavoidable variations in the electrophoretic conditions, this band may be masked by the  $\beta$ -casein band, but, in all cases, its presence can be ascertained by immunoblotting.

In order to establish the genetic determinism of fraction D, our family data were screened for the presence of sires transmitting this fraction to their daughters. One such sire, numbered A316, was found, with a total of 16 dam-daughter pairs. In the progeny of this sire, fraction D appeared to be controlled by an allele of the locus  $\alpha_{S1}$ -Cn because it was transmitted in alternance with variant F, the proportion of the 2 classes of daughters not being significantly different from the 1: 1 ratio (Table I).

In addition, 12 dams possessed fraction D, together with either variant F (9 cases) or variant B- (3 cases). Except in one dam-daughter pair, suspected to be a case of incorrect parentage, these family data were also in accordance with the hypothesis that fraction D is controlled by an allele of locus  $\alpha_{S1}$ -Cn. Among their 20 other daughters, issued

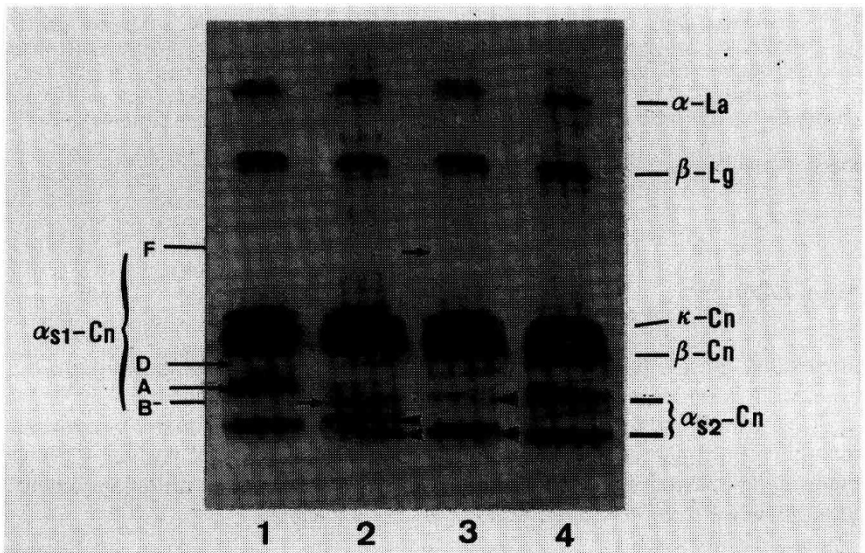


Fig. 1. SDS-polyacrylamide gel electrophoresis of milk from 4 individual goats. Sample 2 is heterozygous at the locus  $\alpha_{S2}$ -Cn ( $\alpha_{S2}$ -Cn<sup>A</sup>/ $\alpha_{S2}$ -Cn<sup>B</sup>); the  $\alpha_{S1}$ -casein phenotypes are as follows: 1=AD; 2=B-; 3=DF; 4=AB-.

**Table I.** Inheritance of  $\alpha_{S1}$ -casein D in the family of the sire A 316.

Dams		Daughters		
N°	Genotype*	Phenotype	Genotype*	Allele received from the sire*
1	B-/F	F	F/F	F
2	B-/F	FD	F/D	D
3	F/O	D	D/O	D
		F	F/F	F
4	B-/B	B-D	B-/D	D
		B-F	B-/F	F
5	B-/F	F	F/F	F
6	B-/F	FD	F/D	D
		B-F	B-/F	F
7	B-/F	F	F/F	F
8	A/F	AF	A/F	F
9	C/F	CF	C/F	F
10	B-/B-	B-F	B-/F	F
		B-F	B-/F	F
11	F/F	FD	F/D	D
12	B-/B-	B-D	B-/D	D

\* For B-, read  $\alpha_{S1}$ -Cn<sup>B</sup>, etc... The sire A 316 transmitted  $\alpha_{S1}$ -Cn<sup>D</sup> 6 times and  $\alpha_{S1}$ -Cn<sup>F</sup> 10 times to his 16 daughters. All the above data were ascertained by immunoblotting.

from sires which did not transmit fraction D, 8 did and 12 did not receive D, a proportion which again was not significantly different from the 1:1 ratio.

Grosclaude *et al.* (1987) reported that, curiously, fraction x (here D), present in the milk of certain dams, was not transmitted to their daughters, an observation at variance with the conclusions of the present note. Re-examination of the surviving dam-daughter pairs among the 7 considered by these authors suggests the probable occurrence of 2 parentage errors in this sample. The non-transmission of fraction D in the 5 remaining pairs is attributable to mere chance ( $P \approx 0.03$ ).

Allele  $\alpha_{S1}$ -Cn<sup>D</sup> is the seventh allele identified at the goat  $\alpha_{S1}$ -casein locus. Its frequency in the large *Alpine* herd of Moissac ( $N = 198$ ) was 0.025. It was also observed in the *Saanen* breed. Grosclaude *et al.* (1987) estimated that the frequencies of  $\alpha_{S1}$ -Cn<sup>O</sup> were 0.05 in *Alpine* and 0.03 in *Saanen*. Because in their data  $\alpha_{S1}$ -Cn<sup>D</sup> was not distinguished from  $\alpha_{S1}$ -Cn<sup>O</sup>, these values in fact apply to the combined frequencies of  $\alpha_{S1}$ -Cn<sup>O</sup> and  $\alpha_{S1}$ -Cn<sup>D</sup>. The frequencies of each of these 2 alleles are thus rather low in both breeds.

On immunoblots, as well as on SDS-polyacrylamide gels, variant  $\alpha_{S1}$ -Cn<sup>D</sup> appears much weaker than variants  $\alpha_{S1}$ -Cn<sup>A</sup>, B or C. Quantification of this variant by rocket-immunoelectrophoresis, carried out on individual milk samples from four animals with the genotype  $\alpha_{S1}$ -Cn<sup>D/F</sup>, indicated that the approximate mean contribution of allele  $\alpha_{S1}$ -Cn<sup>D</sup> was  $\approx 0.6 - 0.8$  g/l, a low value, close to that found for  $\alpha_{S1}$ -Cn<sup>F</sup> (0.6 g/l). Allele  $\alpha_{S1}$ -Cn<sup>D</sup> is thus the fourth out of a total of 7 alleles associated with a decreased synthesis rate at the goat  $\alpha_{S1}$ -casein locus. The biochemical particularities of variant  $\alpha_{S1}$ -Cn<sup>D</sup> are under investigation.

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## Reference

Grosclaude F., Mahé M.-F., Brignon G., Di Stasio L. & Jeunet R. (1987) A Mendelian polymorphism underlying quantitative variations of goat  $\alpha_{S1}$ -casein. *Génét. Sélect. Evol.* 19, 399-412