HEREDITARY COMPONENT OF ADAPTEDNESS OF CATTLE TO LOW TEMPERATURES

Composant héréditaire de l'adaptation des bovins aux baisses températures

Componente hereditario de la adaptación del ganado vacuno a las bajas temperaturas

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Under the conditions of continental cold climate of Siberia, it is necessary to take into account the adaptedness of domestic animals to cold.

In order to verify the possibilities of selection of cattle for beter adaptedness to cold, the response of cows and calves of the Black-Spotted breed to — 15 °C was studied.

At the beginning of the experiment, the animals were exposed to cold for 2 hours, and considerable individual differences in their heat-production were found. A part of animals increased their heat production in the cold, while others decrease it (Table 1). The animals who decreased their heat production are referred to as «adapted», and those who increased it — as «non-adapted».

The adapted animals had a lower heat production level in the cold than the non-adapted ones. On the average, the difference in heat production between the animals of the two types at — 15 °C was 0.43 kcal/hr/Kg, and between the extreme variants, 0.81 kcal/hr/Kg.

When the animals of both types were kept at — 15 °C for a long time (for 2 months), the heat production remained lowered in adapted and increased in non-adapted animals.

The stability of reaction type during ontogenesis was confirmed by repeated studies of adult animals in 2 years and by determining the reaction type of the young ones at the age of 4 months and 3.5 years.

The type of reaction to cold has a considerable genetic component which is confirmed by the data of coupling of features (Table 2).

In this case, out of 30 calves, 23 inherited the type of response to cold characteristic of their mothers.

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TABLE 1

DIFFERENCES IN RESPONSE TO DECREASE OF TEMPERATURE BETWEEN ADAPTED AND NON-ADAPTED GROUPS OF BLACK -SPOTTED CATTLE

Groups	n	Heat production Kcal/hr/Kg at - 15 °C	Change of heat production that at + 10 °C, %	
			All the animals	Extreme variants
Adapted	34	1.30 ± 0.03	— 12.8	— 28.0
Non - adapted ...	33	1.73 ± 0.05	+ 22.7	+ 53.1

TABLE 2

INHERITANCE BY MOTHER REACTION TYPE BY PROGENY

Mothers	Calves at 4 month age		
	Adapted	Non - adapted	
Adapted	9 (5.16)	3 (6.84)	12
Non - adapted ...	4 (7.84)	14 (10.16)	18
Σ	13	17	

(In brackets, theoretical frequencies are given.)
$\chi^2 = 8.2$, $n = 1$, $P = 0.01$.

When kept in cold for a long time, the adapted animals consumed less food by 100 Kg body weight per day than the non-adapted ones; 1.94 and 2.26 food units respectively ($P = 0.05$), the milk yield being equal, i. e. 16 litres per day.

The most characteristic feature of adapted animals, unlike in the non-adapted ones, was their ability to reduce oxygen consumption in the cold at the expense of reduction of lung ventilation (Table 3).

TABLE 3

CHANGE OF LUNG VENTILATION AND OF PERCENTAGE OF O_2 CONSUMPTION IN COWS OF DIFFERENT REACTION TYPES, UNDER LOWERING OF TEMPERATURE (EXTREME VARIANTS)

t^o	Lung ventilation (1/min/100 Kg)		% of O_2 consumption	
	Adapted	Non - adapted	Adapted	Non - adapted
+ 10 °C	15.9 ± 1.3	14.4 ± 1.9	3.39 ± 0.17	3.17 ± 0.08
— 16 °C	10.3 ± 1.4	15.2 ± 2.5	3.69 ± 0.2	4.47 ± 0.17
Reaction (%) ...	— 35.2	+ 5.6	+ 8.8	+ 41.0
Significance of difference... ...	$P < 0.05$	$P > 0.05$	$P > 0.05$	P 0.01

Beside this ability, the adapted animals, with lowering temperature are mostly capable of increasing the angle of rasing their hair to greater extent, which enables them to lose less heat from body surface.

SUMMARY

Among the black-spotted cattle bred in Siberia, one can select animals having better tolerance to low temperatures. This tolerance has a genetical component, sufficient for selection. The characteristic of animals having better tolerance to cold is their ability to reduce their pulmonary ventilation, without any considerable increase of oxygen consumption.

RESUME

Parmi le bétail de race à taches noires en Sibérie, on peut sélectionner des animaux qui tolèrent mieux les basses températures. Cette tolérance a un componant génétique, suffisant pour la sélection. La caractéristique d'animaux tolérant mieux le froid est leur abilité à réduire leur ventilation pulmonaire, sans un accroissement considérable de consommation d'oxygène.

RESUMEN

En la raza de ganado berrendo en negro de Siberia se pueden seleccionar animales con más tolerancia a las bajas temperaturas. Esta tolerancia tiene un componente genético suficiente para la selección. La característica de los animales con mejor tolerancia para el frío es su capacidad para reducir la ventilación pulmonar sin ningún aumento considerable en el consumo de oxígeno.