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Characteristic of the Skin of European Bison and Domestic Cattle Hybrids

[With 3 Tables, 1 Fig. & Plate VIII]

There are described physicommechanical and chemical properties of 18 raw hides obtained from hybrids of the European bison and domestic cattle, the animals being at the age of 0.5—8 years. For comparison 1 hide of a 5 years old European bison and 10 skins of the cattle belonging to the lowland black and white breed were used. The hybrid hides are characterized by the mass ranging from 21 kg and the area from 260 dcm² (in a half-year-old individual) up to 106 kg and 798 dcm² (in a 8 years old individual). These values considerably exceed the analogous data on the cattle hides. Hybrids of the F₁ generation had particularly heavy and large hides, this fact being related to the effect of heterosis. In respect of chemical composition hybrid hides show a higher protein content, particularly collagen, and a lower fat content in comparison with cattle hides. The results obtained indicate that hybrid hides may be used for tanning, technical and nutritive purposes.

I. INTRODUCTION

Hybrids of the European bison with domestic cattle obtained in the Mammals Research Institute PAS in Białowieża in the years 1960—1970 were the subject of complex studies including morphologic analysis of body structure, individual development, inheritance of physiological properties, fertility of the hybrids and estimation of their practical value (Kraśińska, 1969; Fedyk & Kraśińska, 1971; Szulc *et al.*, 1971). This study constitutes a consecutive part of these investigations and was aimed at characterization of the skin of the European bison and cattle hybrids. Analysis of technical properties of these skin will be the subject of a separate elaboration.

Animal skins are a valuable material for tanning and food industries. They serve as an intermediate product during production of skin glues

and photographic, pharmaceutical and edible gelatin. They are used for the production of artificial sheath for sausages, for production of membranes, sponges, surgical threads and collagen fibres in artificial leathers. Since hides belong in our country to imported raw materials every new possibility of their increased supply to the market is worth of consideration.

II. MATERIAL AND METHODS

The studied material consisted of skins deriving from 18 hybrids of the European bison and domestic cattle (12 skins of males and 6 of females). The animals belonged to different generations bred in the Mammals Research Institute PAS in Białowieża and were in the age ranging from 0.5 to 8 years (Table 1). As the comparative material served 1 skin of a male European bison 5 years old and 10 skins of the cattle belonging to the lowland black and white breed (*b.w.*) in the age of 0.5—10 years (Table 2).

Skins were removed from carcasses immediately after slaughtering and conserved by the wet-salting method, with salt containing 2% sodium fluorosilicate. After a few to a dozen or so weeks the hides were subjected to chrome tanning according to a technology commonly employed in the industry.

In order to obtain a full characteristics of the examined hides the following analyses were carried out: estimation of total protein by Kjeldahl method, collagen according to Zajdies *et al.* (1964), lipids by the method of Soxhlet, as well as determination of physicochemical properties (weight, area and thickness). For chemical analyses there were used samples of 3 hides of the hybrid generation F_1 and B_2 in the age of 2 to 5 years (Fatima, Fenix and Fez), of 3 hides of the cattle in the age of 6 to 9 years. The samples were taken from 3 topographic skin places: shoulder, back and side. Each sample was divided into three layers: grain, middle and flesh layers.

Additionally some histological preparations were made from various layers and different places of the skin tissue of an European bison, a hybrid (Fakir) and the cattle in the age of 6—9 years.

III. RESULTS

1. Physical Properties of Hides

Skins of male hybrids reach a large mass of 21—27 kg already in the age of 6 months (Table 1). In 3 to 5 years old hybrids the hide weight ranges from 40 to 60 kg, and in older males amounts to 100 kg. The net weight of hide (as used in tanning industry) is proportionally lower.

The area of useful skin of hybrid calves exceed 260 dcm², in older animals exceed 500 dcm², and in adults reaches over 700 dcm².

Raw hides measured in standard points (Fig. 1) in B_1 calves, females and males are the thickest in the back, whereas in the oldest F_1 males at the shoulder (Table 1). In 0.5 year old hybrids they are 2.5—4.0 mm thick, in the group of 2—5 years old are 3.0—5.0 mm thick, and in the

Table 1

Physical measurements of hides deriving from the hybrids of the European bison and domestic cattle and of the European bison.

No	Name	Group	Age in yrs.	Weight of raw hide		Area of hide, in dcm ²		Thickness of raw hide, in mm					
				Gross	Net	Raw	Tanned	Bl	Br	Sl	Sr	Shl	Shr
MALES													
1	Felon	B ₁	0.5	27	21	266	207	3.9	4.0	2.5	2.8	2.8	2.7
2	Fest	B ₁	0.5	21	16	260	205	3.6	3.5	2.2	2.4	2.5	2.4
3	Feld	B ₁	1.5	25	22	469	451	3.7	4.0	2.5	2.8	2.6	2.7
4	Festyn	B ₁	2.5	36	28	400	304	3.7	4.0	2.6	2.9	4.7	2.7
5	Feb	B ₁	3.5	51	35	385	319	4.0	3.9	3.0	3.2	3.6	3.5
6	Fen	B ₁	3.5	45	31	536	414	4.2	4.4	3.5	3.6	4.0	4.0
7	Fetysz	B ₁	4.5	56	40	508	453	4.5	4.7	4.9	4.8	5.0	4.6
8	Fez	B ₁	4.5	52	44	522	437	3.8	3.8	3.0	3.0	4.8	4.8
9	Fakir	F ₁	5.0	63	51	578	470	5.5	5.0	3.8	3.5	4.2	4.2
10	Fenix	B ₁	5.5	59	48	526	380	5.6	4.0	3.5	4.3	4.0	2.1
11	Farad	F ₁	6.5	106	90	798	694	5.5	5.8	5.5	5.5	8.0	8.0
12	Filip	F ₁	8.0	—	62	724	519	6.8	6.7	5.0	5.3	7.0	7.1
FEMALES													
13	Felly	B ₁	1.0	22	19	360	261	3.5	3.4	2.0	2.0	2.3	2.2
14	Ferma	B ₁	1.5	20	17	360	270	3.8	3.6	2.4	2.2	2.4	2.6
15	Fatima	F ₁	2.0	37	30	354	257	5.0	5.0	3.0	3.0	3.0	3.0
16	Fema	B ₁	2.5	23	16	366	268	3.7	3.7	2.3	2.2	2.4	2.4
17	Fela	B ₂	3.0	27	24	410	321	4.8	4.7	2.9	2.8	3.0	3.0
18	Filutka	F ₁	7.0	—	56	585	400	6.0	6.1	5.7	5.5	5.8	5.7
	Wisent	o	5.0	—	48	475	361	5.5	5.6	4.0	3.8	6.0	6.2

F₁ — first generation of hybrids; B₁ — backcrosses (1/4 wisent, 3/4 domestic cattle); B₂ — backcrosses (1/8 wisent, 7/8 domestic cattle); Gross hide weight = total hide weighted immediately after slaughtering. Net hide weight = the profiled hide without unnecessary parts for tanning industry, weighted after several weeks salt curing.

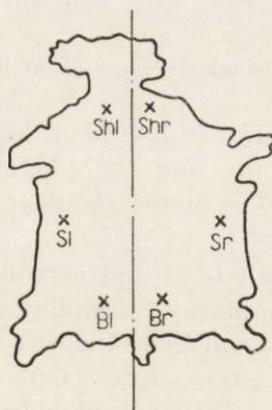


Fig. 1. Points of determination of the hide thickness.

Abbreviations: Shl — shoulder left; Shr — shoulder right; Sl — side left; Sr — side right; Bl — back left; Br — back right.

oldest F_1 males they approach 7–8 mm. The skin of the European bison has the mass and area similar to those of B_1 hybrid skins in a similar age.

The skins of hybrids, both calves and adults, are considerably heavier and of larger surface area than those from the cattle (*b.w.*) (Table 2). Skins from the cattle calves in the age of 6 months have 8–12.5 kg, and from adult individuals 18–35 kg, hence the differences between the cattle and hybrids in the mass and skin surface exceed 100% in a few cases. The thickness of the hide from hybrids in the age of 1.5–4 years is similar to hides of the cattle weighting 18–35 kg.

Table 2

Physical measurement of hides deriving from the domestic cattle.

No.	Approximate animal age, in yrs	Hide weight, in kg	Area of raw hide, in dm^2	Thickness, in mm					
				E1	Br	Sl	Sr	Shl	Shr
1	0.5	10.0	133	2.1	2.2	1.8	1.8	2.4	2.4
2	0.5	12.5	150	2.3	2.2	2.0	2.0	2.5	2.5
3	6–9	20.1	250	3.9	3.0	3.5	3.4	3.0	3.0
4	6–8	18.5	245	3.8	3.5	2.8	2.8	3.2	3.5
5	6–9	20.7	262	4.0	3.2	3.0	3.0	3.1	3.2
6	7–10	22.3	359	3.3	3.5	3.0	3.0	3.0	3.5
7	7–10	22.2	356	4.0	2.0	2.5	2.5	2.0	2.0
8	7–10	25.0	404	4.5	3.5	3.5	3.5	3.5	3.5
9	6–9	24.7	377	4.5	4.2	3.5	3.0	3.2	3.2
10	7–10	35.0	464	5.5	5.0	3.7	3.7	5.0	5.0

The skins obtained from males and females of the F_1 generation are characterized by a larger mass, area and thickness than in B_1 hybrids.

2. Chemical Properties of Hides

The fat contents in the hides of hybrids is lower than of cattle (Table 3) and ranges from 1.3% at the side to 2.0% at the back. Cattle skins contain more fat: from 3.2% in the shoulder to 8.8% at the back and over 26% in the flesh layer.

The protein content, both total and as collagen, is higher in hybrid hides independently of the place of sampling and amounts to 79.34% of total protein and 68.76% of collagen. The corresponding figures for cattle hides are 70.86 and 61.01%, respectively. Only in the middle layer cattle hides contain more collagen than hybrid hides. The proportion of collagen to total proteins is slightly higher in hybrid hides and amounts on the average to 86.4% comparing to 85.8% in cattle hides.

3. Histological Features of Hides

Hybrid skins differ slightly in respect of structure from the skin of the European bison and cattle (Phot. 1—3). They have thicker fibres of more loose texture than cattle hides. The arrangement of fasciculi of collagen fibres is the simplest in the European bison where it forms a less dense tangle in comparison with the hides of hybrids, and particularly in comparison with cattle hides.

Table 3

The content of total protein, collagen and lipids in per cent of dry mass in the raw hides of the hybrids and domestic cattle (means of 3 estimations).

Point of sampling	Hybrids			Cattle		
	Total protein	Collagen	Fat	Total protein	Collagen	Fat
Shoulder — grain layer	79.02	70.92	—	74.07	60.45	1.0
Shoulder — middle layer	80.38	72.97	—	78.46	75.55	1.2
Shoulder — flesh layer	79.24	38.62	—	54.57	48.54	24.6
Shoulder — whole	79.52	68.83	1.5	68.03	61.51	3.2
Side — grain layer	81.71	73.44	—	71.26	58.16	1.6
Side — middle layer	81.10	73.18	—	71.37	69.74	0.1
Side — flesh layer	79.80	68.71	—	62.72	49.18	5.7
Side — whole	80.87	51.77	1.8	68.45	59.02	3.4
Back — grain layer	79.24	69.19	—	78.68	65.60	1.7
Back — middle layer	79.77	70.62	—	79.69	76.18	0.14
Back — flesh layer	75.42	57.22	—	69.96	45.77	26.5
Back — whole	78.14	65.68	2.0	76.11	62.51	8.8

The outer part of the dehaired and tanned leather differs in the three groups of animals, in the hybrids being intermediate in comparison with the European bison and cattle (Phot. 4—6, Plate VIII).

IV. DISCUSSION

The obtained results indicate that the hides of hybrids exceed in several aspects the cattle hides. First of all the hides of hybrids at the age of 6 months reach the weight and area typical for adult cattle of the lowland black and white breed, *i.e.* 21—27 kg of gross weight. Such hides constitute a great majority of all cattle hides purchased in the country. The weight and area of hybrid hides obtained from 5—8 years old individuals reach 100 kg and 8 m² of area, whereas the hide of a 5 year old European bison had the weight of 50 kg and the area of approxi-

mately 5 m², and the largest cattle skins produced abroad from a specially fattened cattle reach 35—50 kg. It should be emphasized that especially F₁ hybrids have the hides of a very large weight and area, this fact being dependent on the effect of heterosis.

The chemical composition of the hybrid hides is also advantageous due to a higher protein content, especially collagen, as well as lower amount of lipids than in cattle hides.

The results of histological examinations indicate that hybrid hides have a more loose texture than cattle hides. This fact reduces to a certain degree their utilization by the tanning industry. Nevertheless the obtained results indicate the possibility of their utilization for industrial and nutritive purposes (cf. also Pietrzykowski & Krasińska, 1972).

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CHARAKTERYSTYKA SKÓR MIESZAŃCÓW ŻUBRA Z BYDŁEM DOMOWYM

Streszczenie

Przedstawiono cechy charakterystyczne skór mieszańców żubra z bydłem domowym. Przedmiotem badań były skóry 18 (12, 6) hybrydów w wieku 0,5—8 lat. Do porównań użyto 1 skórę żubra 5 letniego oraz 10 skór bydła rasy nizinnej czarno białej w wieku 0,5—10 lat (Tabela 1, 2).

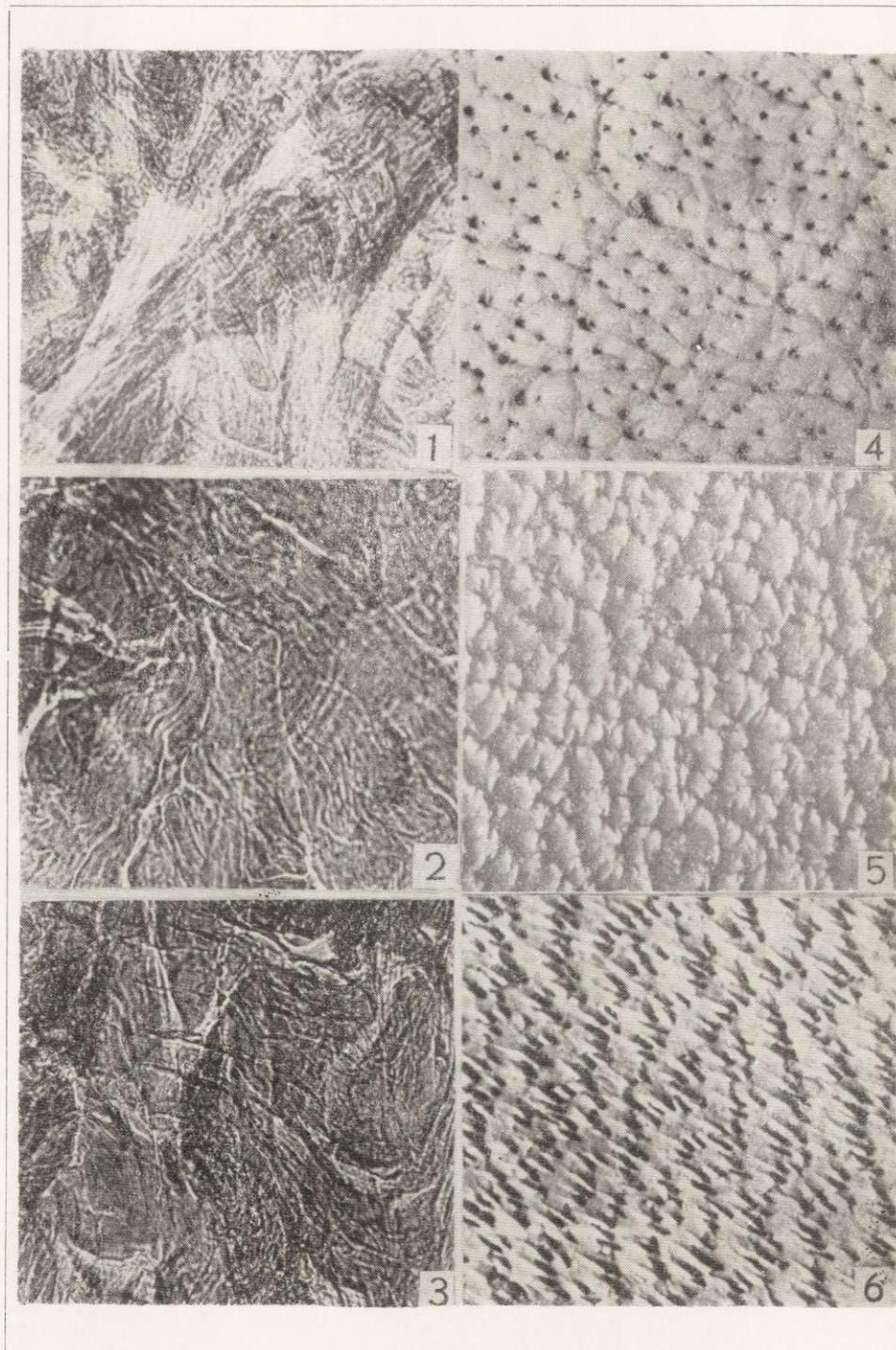
Skóry były zdejmowane z tusz bezpośrednio po uboju, konserwowane metodą mokro-solną, a następnie poddane wyprawie chromowej. Wykonano analizy chemiczne (oznaczanie białka ogólnego, kolagenu, tłuszczu), określono właściwości fizyko mechaniczne skór oraz wykonano preparaty histologiczne skór.

Skóry mieszańców zarówno cieląt jak i sztuk dorosłych są znacznie cięższe i mają większą powierzchnię i grubość niż skóry bydła rasy ncb (Tabela 1, 2). Szczególnie mieszańce pokolenia F_1 charakteryzują się skórą o największej masie i powierzchni w czym widać wpływ heterozji.

Pod względem składu chemicznego skóry mieszańców charakteryzują się wyższą zawartością białka, a zwłaszcza kolagenu i niższą zawartością tłuszczu niż skóry bydła (Tabela 3). Uzyskane wyniki wskazują, że skóry mieszańców mogą znaleźć zastosowanie do celów garbarskich, technicznych i spożywczych.

EXPLANATION OF PLATE VIII

- Phot. 1. Histological section through the skin of a 5 years old European bison, \times 1800.
- Phot. 2. Histological section through the skin of hybrid, \times 1800.
- Phot. 3. Histological section through the cattle skin, \times 1800.
- Phot. 4. Outer part of the skin of a years old European bison, \times 17.
- Phot. 5. Outer part of the skin of a hybrid, \times 17.
- Phot. 6. Outer part of the cattle skin, \times 17.



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