Zusammenfassung

Gleichzeitig mit dem Erscheinen der Kleine Weidestechfliege in Argentinien (Haematobia irritans irritans) im Oktober 1991, begann man gewisse Schäden am Rinderleder in der Gerberei Industrie festzustellen, mit den wirtschaftlichen Verlusten das dieses zur Folge hatte. Im Bestreben die Art des Schades zu ermitteln und die Bewandtheit zwischen dem Stich der Fliege auf der Haut und dem Endschaden am verarbeiteten und halbverarbeiteten Leder festzustellen, fand eine Studie statt, die verschiedenen Beobachtungs techniken auf dem Land und im Laboratorium zur Folge hatte. In letzterer benutzte man konventionelle Techniken der mikroskopischen Optik und der Rasterelektronischen Mikroskopie. Die Schäden am Leder bestehen in vereinzelten oder zusammengefaßten kraterförmigen Verletzungen oder kleine Löcher deren Lokalisierung mit den bevorzugten Ruhe- und Nahrungs aufnahme plätze dieser Fliege übereinstimmen, d.h., am Kreuz, Rücken und der Leistengegend. Da die Anzahl der Schäden überhaupt kein Verhältnis zu der Anzahl der auftretenden kleine Weidestechfliege am lebenden Tier zeigt, kann der Schaden das Ergebnis vieler hintereinander und nebeneinander erfolgter Stiche sein, oder durch Mikrobenansteckung oder beides zugleich.

Damage in the skin and leather caused by the horn fly (diptera: muscidae) in Argentina

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Summary

Simmultaneously to the appearance of the horn fly (Haematobia irritans irritans) in Argentina in October 1991, a new kind of defect was found in the cattle leather by the domestic tanning industry with the resulting economic losses. In order to characterize the type of injury and to determine a relation between the bites of the horn fly on the skin and the final damage to processed and semi-processed leather, a study was carried out that included different observational techniques in the field and in the laboratory. Within the leatter, conventional optical microscopy and scanning electron microscopy were used. The deffects in the leather consist of isolated or coalescent crater-like lesions or little hollows distributed coincident with the prefered areas of resting and feeding of the horn fly on the living animal, that is to say, the withers, back and groin. As the number of defects do not correspond to the number of horn flies present in the living animal, the deffect may be the result of several continuous and adjacent bites or the microbian contamination of some bites, or both.

Introduction

Many arthropods affecting cattle have been involved in producing different kinds of damage in the skin which are reflected in the finished leather resulting in economic losses in the tanning industry (Tancous et al. 1959). The defect has been classified as "pitting", making reference to the consequences in the leather as a result of the action of ticks, mites, fleas, lice and flies (Koeppen 1991).

Simultaneously to the appearance of the horn fly, Haematobia irritans irritans (L. 1758), in Argentina in October 1991, a new kind of defect was found in the cattle leather by the domestic tanning industry.

Due to the lack of information regarding this defect in Argentina, and considering that the export of cattle leather represents approximately 2.3% of the total Argentine's exportation (Secretaria Industria y Comercio Exterior Argentina 1990), the purpose of this research work was to study and characterize this defect in the skin and leather.

Materials and Methods

1 – Animals. From a group of 30 cows and steers at a cattle ranch in the Northwest of Santa Fe province (Argentina), 5 animals were killed and their skins removed and cut along the dorsal middle line into two parts. All the animals were of the Brangus breed, about two to five years old and naturally infested with horn flies (Haematobia irritans irritans). Sample of these flies were collected for identification and study. The animals were not affected neither by any other external parasite nor dermal disease.

Half of each skin was preserved in salt for tanning and the other halves were inspected, some areas cut into stripes and fixed in glutaraldehide (3.5% in water) for further inspection and processing for histologic examination.

2 – Leather. The salted preserved skins were tanned using the traditional industrializing methods. Both semi-processed and finished leather were studied.

a. Inspection of the surface: The surface of the leather was inspected with the naked eye, using stereoscopic microscopy and through a Scanning Electronic Microscopy (SEM). For the SEM, the leather cuttings were air dried under a bell, metalized with palladium gold and observed under a SEM Jeol J.S.M. -100.

b. Transversal cuttings: the leather was cut involving the defects found and inspected using traditional optic microscopy.

3 – Skin. The fixed stripes of skin were included in paraffin and sectioned at 8 µm, dyed with hematoxylin-eosin, mounted in Canada balsam slides and examined under a light microscope (Jenamed 2, Carl Zeiss Jena).

4 – Horn flies. Flies collected from the animals of this experience were inspected for precise identification and their mouth parts studied through a SEM. For this purpose, the flies were critical point dried, metalized and observed under SEM.

Their behavior with reference to the host (areas of preference, number of flies per animal, time of day) was monitored.

All types of observation were documented with photographs.

5 – Tannery. Several tanneries were visited in order to check the similarities of the defects, their distribution in the leather and their frequency and possible seasonality. The study of frequency and seasonality are still in progress.

Results

1 – Animals. The animals were naturally infested with about 200-1000 horn flies per animal preferentially distributed on the withers, back, belly and groin (figure 2b). Besides, other animals in the same ranch reached higher levels of infestation with the same distribution patterns (figure 2a).

2 – Leather. a. Surface: at inspection, crater-like lesions and little hollows were observed with the naked eye (figure 4). These were distributed in the regions corresponding to the withers and groin of the living animal as shown in figure 3. The number of defects found was not in relation to the number of horn flies present in each animal.

Looking at them more closely, they appeared as if they have been "pitted", with the resulting change of the hair direction (figure 5b).

b. Through the ordinary optic microscopy, the depressions were seen as depressed areas of weakened tissue. The change of hair direction is again manifested (figure 6a).

3 – Skin. Observed with the naked eye, no significant lesions were seen. Only slight changes in the color and orientation of the hair was detected. It seemed hirsute and slightly lighter in the area of the withers. Similarly, at the depilated skin, no important change was observed.

Microscopically, no healing process was found, but evidences of the fly injury were detected. There was a diffuse eosinophil infiltration in the dermis (figure 6c) and in the muscular tissue below the skin (figure 6d). There were light degenerative changes in the hair follicles (figure 6b).

4 – Horn flies. The flies were confirmed to be Haematobia irritans irritans. Its mouth parts are modified into a piercing organ named proboscis or haustellum (figure 1a,b). This organ is composed of the large and prominent labium with two short apical labellae (figs. 1a,b,c), the labrum (lr) and the hypopharynx (h) (fig. 1a,b). These are sclerotized components apt to fix the proboscis, to tear and to suck blood from the host's integument. The saliva is injected through a narrow tube formed ty the stylettiform hypopharinx, while the blood is drown up to the gut through a wider tube formed by the inner face of the labrum and the dorsal face of the hypopharinx (Baudet 1977, Cragg 1913).

5 – Tannery. The defects observed in different tanneries were morphologically similar and shown identical morphological patterns as the ones reported here.

Dicussion and Conclusions

The new type of defect found in the leather can be attributed to the mechanical and enzymatic action of the horn fly on the skin. The host responds inespecifically against the mechanical action an inumologically against different proteins of the saliva.

With regards to the mechanical action of the horn fly, it is accomplished by the proboscis, which tear the host's integument in order to reach the capillar thread, injecting saliva, containing anticoagulant agents as well as small quantitives of digestive enzimes. Those already detected in saliva are the glucolitic enzimes β-glucosidase, α-glucosidase (Hori et al. 1981) and β-galactosidasa, the aminopeptidase leucine, the phosphatases acid, alkaline and phosphoamidase, and the esterases C4, C8 and C14 (lipase) (Kerlin & Hughes 1992).

On the other hand, different components of the saliva induce the immune response of the host as evidenced by high levels of serum antibodies against saliva proteins, immediate hypersensitivity and increased peripheral blood eosinophil numbers (Kerlin & Allingham 1992).

The eosinophil infiltration found in this study confirms the presence of an immediate hypersensitivity, but in same way, this response would be inhibited in natural fly infestations as the inflamatory process was not fully developed according to our macroscopical and microscopical examintions.

With reference to the defects found in the leather, much lower numbers of "pittings" were found than would be expected according to the numbers of horn flies present on the animals. If we consider that there were at least 200 horn flies per animal, and each horn fly bites about 30 times per day (Harris 1974), that means that each animal would receive at least 6000 bites per day. As no such number of "pittings" were found in the leathers examined, each pitting would be the result of several continuous and adjacent bites or the microbian contamination of some bites, or both.

Acknowledgements

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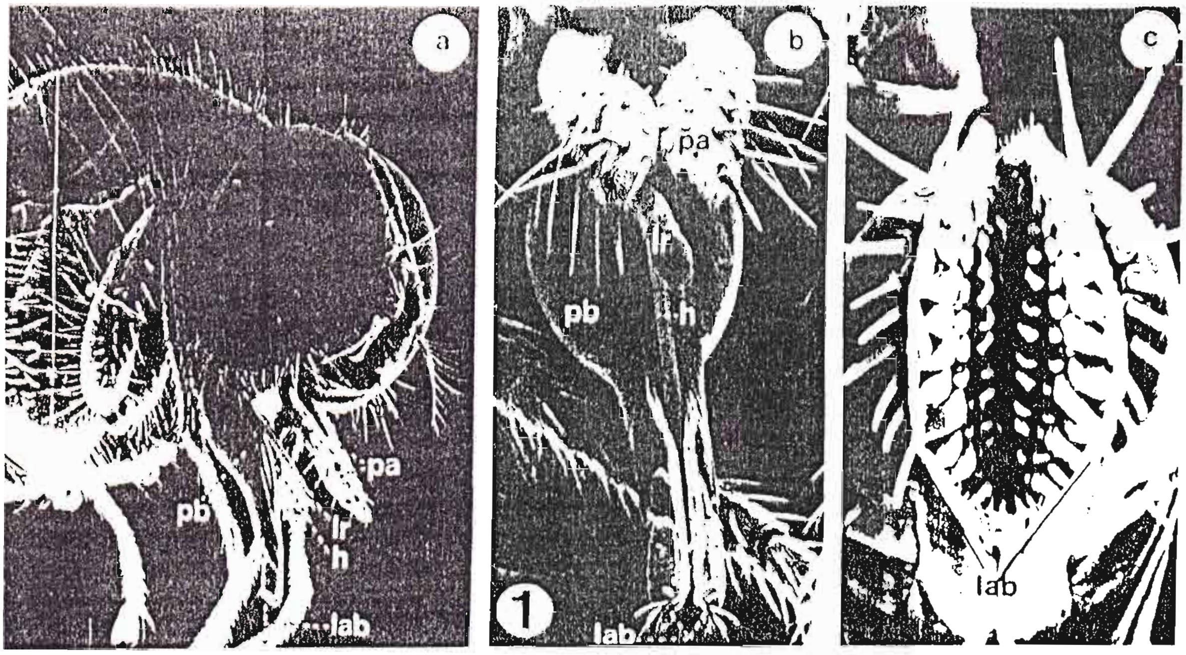

Figure 1: Haematobia irritans irritans seen under SEM. a. lateral view of head and thorax showing the mouth parts. b: details of the mouth parts, dorsal view. c: details of the labella showing the labellar teeth. Abbreviations. h: hypopharynx, lab: labella, lr: labrum, pa: palps, pb: proboscis or rostellum.

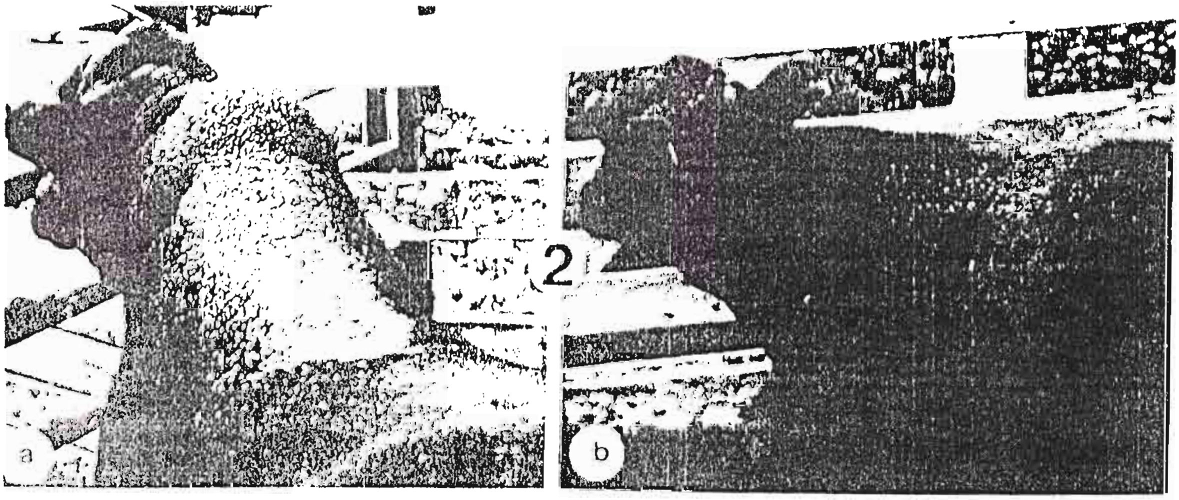

Figure 2: [illegible] (b) of the experimental group

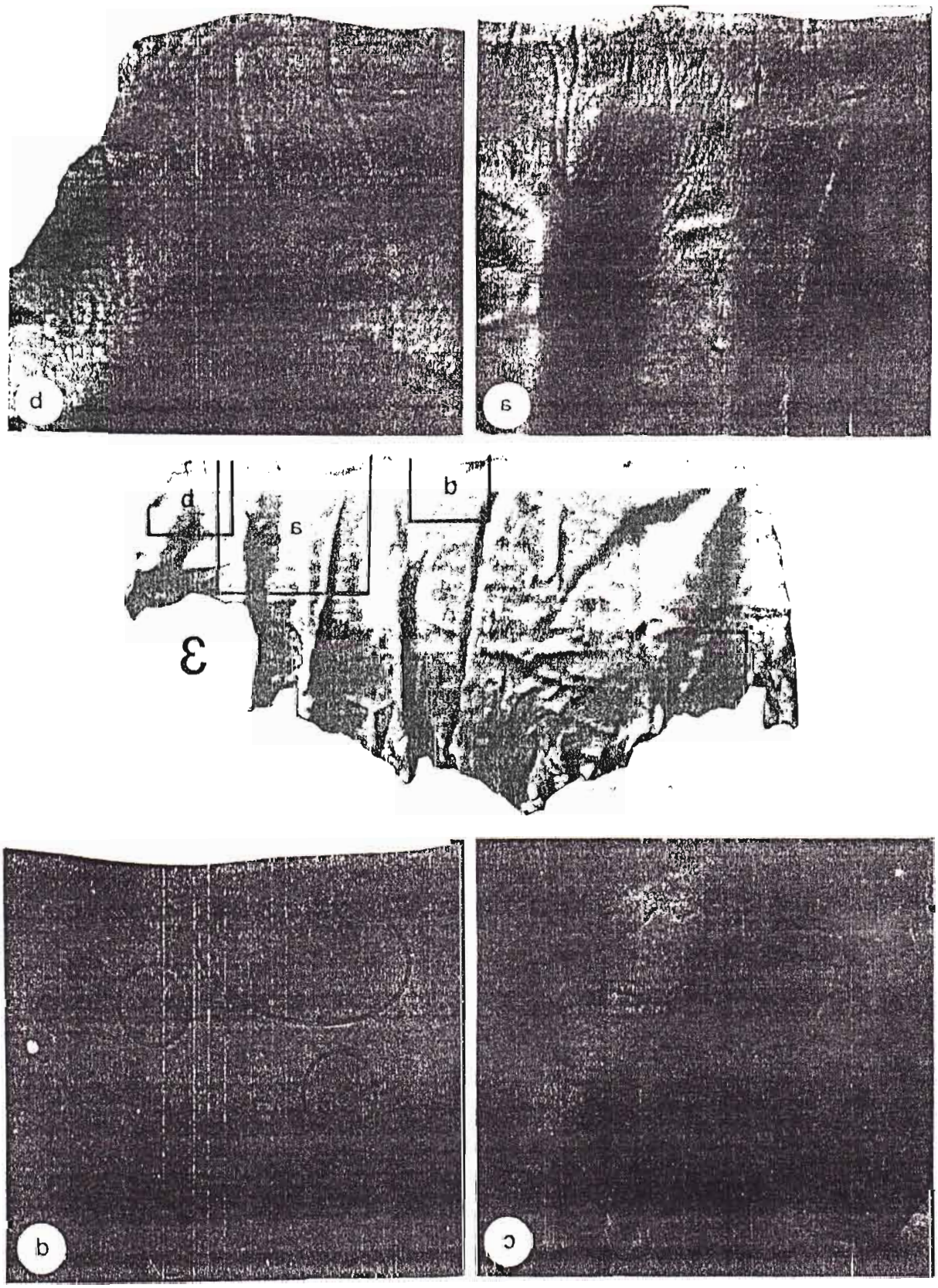

Figure 3: View of a chrome tanned leather hall showing different areas damaged and not damaged by the horn fly: a: neck and withers, b: fore neck, c: groin, d: back

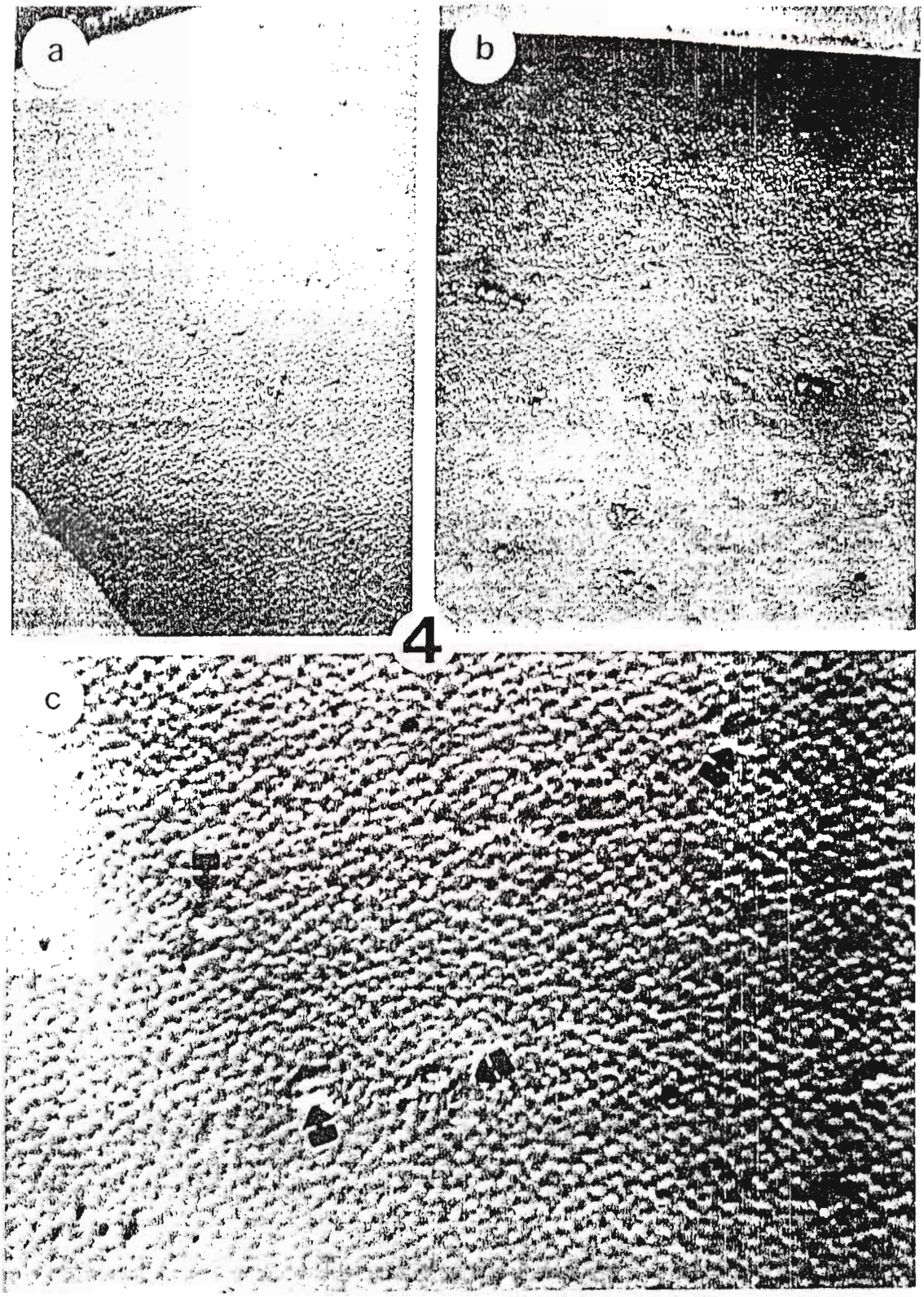

Figure 4. Photographs of the external surface of finished leather showing the damages caused by Haematobia irritans irritans with different magnifications. See text for explanation.

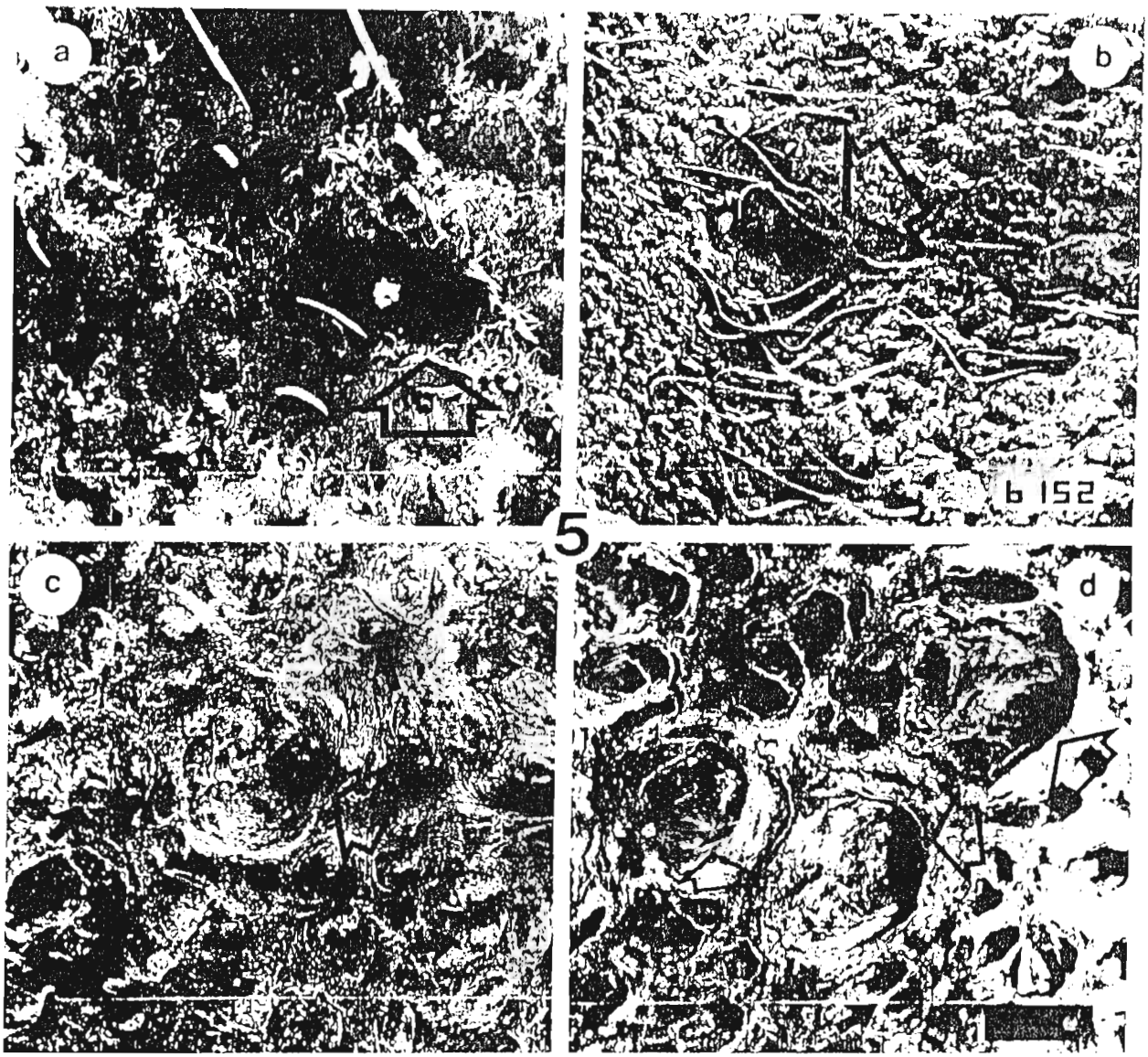

Figure 5: Pictures taken under SLM showing the damages caused by the horn fly on semi-processed leather with different degrees of brushing. Open arrows indicating the most conspicuous ones. a: on superficially brushed leather, b: medium-brushed leather. Note the remnants of hair follicles (bold arrows) and the crater-like damages (open arrows).

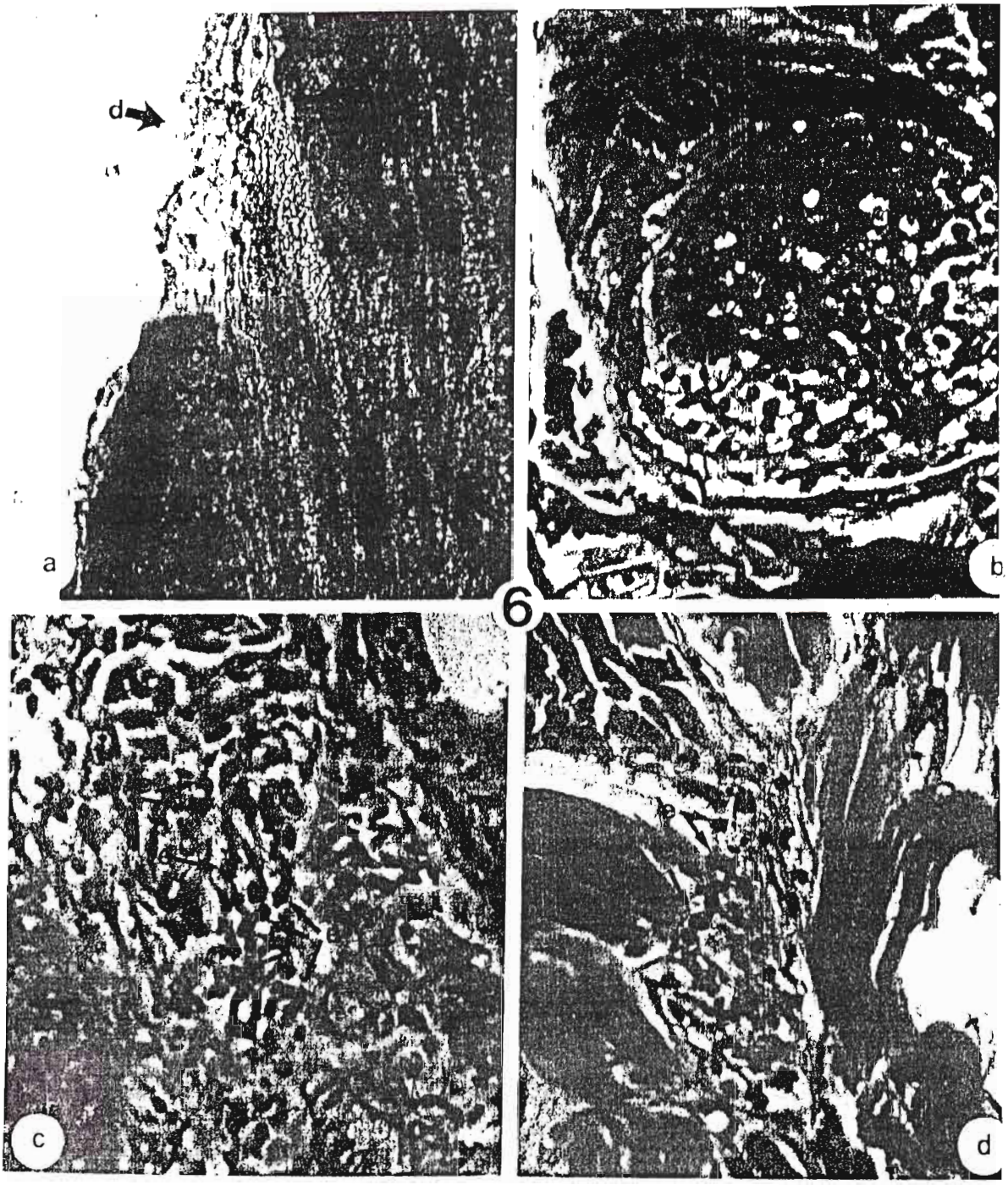

Figure 6. Histological cuttings of leather (a) and skin (b, c, d). a: thick cutting of unstained leather showing the weakened tissue of the damage (d) and the change of hair orientation (h). b, c, d: Thin sections of skin stained with hematoxylin eosin showing a slightly degenerated hair follicle (b), eosinophil (e) infiltration in the dermis (c) and in the muscular tissue below the skin (d)