Pathology and Leather Surface Appearance of Disease Afflicted Nigerian Small Ruminant Skins

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Abstract

The pathological and leather quality studies of the skins of 11 goats and nine sheep with diseases, as well as five goats and five sheep with normal looking skins as controls, were carried out after gross assessment. Chrome tanned leathers from the flayed skins were subjected to surface examination for aesthetics and grade. Generally, the predominant gross pathologic lesions were crusts and scabs, which mostly occurred because of either degeneration or traumatization as a consequence of an earlier primary lesion or lesions. Histopathologically, various epidermal reactions, ranging from hyperkeratosis, parakeratosis, lichenified stratum corneum and acanthosis, characterized many of the skin diseases. The dermal conditions were mostly inflammatory resulting in dermal fibers sometimes becoming disoriented. The leathers were generally hard, unsightly, and fibrosed with many tunnellings. The grain surfaces were coarse, rough, and holes pierced through several affected areas. The different diseases downgraded leather quality in various manners and marred their aesthetic appeals.

Keywords: Pathology, skin diseases, small ruminants, leather surface, aesthetics.

Introduction

More and more, leather continues to be the commodity for elite possession, and in this era of vinyls and attractive plastics, aesthetics dictate the market.

In recent times, leather is being manipulated technologically to achieve the surface appearance attractive to customers. Ultimately, the smoothness of the grain surface is especially required in the case of leather made from skins – coats of small animals, e.g., sheep and goats; while hides are those of large animals like cattle (Das et al. 1968). The aesthetic quality of leather depends to a great extent on the fine, smooth, outer or grain surface, which is exposed once the tanner removes the epidermis and hairs by means of chemicals during the early stages of processing (Haines 1978).

Many factors influence these properties and some of them are beyond the control of the tanner. In fact, most of the grain defects in leather occur during the life of the animal on the farm and, indeed, the quality of the leather lies very much in the hands of the farmer, but the farmer is generally unaware of the extent of the damage or the financial losses involved (Haines 1978).

The outer surface of the leather is frequently marred by damage to the skin during the life of the animal; damage caused by parasites, abrasion, dung, and injections applied by the farmer. The affliction by parasites especially, often results in skin diseases.

Recent observations have in fact shown that the skins exported from Nigeria have commanded low prices in the international
hides, skins and leather markets because of their declining quality (Paiko 2002), which has been strongly attributed to one of the technical constraints of livestock namely diseases (Bincan 1992). The declining trend was gradual, and was previously noticed that approximately 25 percent of the skins exported from Nigeria would have been graded higher but for lesions of parasitic and other skin diseases (Henderson 1937; Akerejola et al. 1979). Such skins resulted in rejected leathers, many commanded low prices, hence serious economic losses.

Quite a number of the skin diseases in small ruminants are characterized by skin conditions that may persist in the finished leather and thus lower its value, while there are others which cause no characteristics skin lesions, yet contribute to a substandard cure or preservation (Tancous et al. 1959).

The small ruminants skin diseases often caused by bacteria, viruses, fungi, and ectoparasites like lice, fleas and ticks show various types of lesions (Gbolagunte and Hambolu 2006). The appearance of skin lesions, however, may change with medication, self-inflicted trauma and secondary infections. Primary lesion varies slightly from its initial appearance to its full development. Later, through regression, degeneration and traumatization, it changes in appearance and in its new altered form becomes a secondary lesion (Muller and Kirk 1969). In the course of a disease like dermatophilosis for instance, infection is not established unless the immediate skin environment becomes unfavourable revealing in most cases, altered lesions (Marples 1969; Munz 1976; and Pascoe 1990). Classical structural lesions observed on the dermatophilosis infected bovine hide surface were exudation and scabbiness. The microscopic pathological changes were hyperkeratosis, edematous epidermal strata denoted by widening of intercellular spaces with loss of cellular contacts, total degeneration and necrosis of epidermal cells, detachment of basal epidermal cells from underlining basal laminae, breakages in continuities of basal laminae, collagen fibrillar destruction with spatial disorientation in the grain, and dislodgement of collagen bundles by excessive cellular infiltrates within the corium (Isitor and Gbolagunte 1987).

Such pathological diagnosis should then prove valuable in ascertaining the level of damage done to the various structures of Nigerian small ruminant skins by diseases. Knowledge of the pathogenesis of the various diseases afflicting small ruminant skins which adversely affect their leathers, is vital for effective control of the conditions of many of the various dermatoses.

It is therefore necessary to investigate the effects of the afflicting diseases on the surface and microscopic structures of these small ruminant skins as well as on the gross leather surfaces, as was investigated for bovine dermatophilosis afflicted hide where blemishes in form of pittings and wrinklings on the grain enamel were observed (Isitor and Gbolagunte 1987). This study has thus set out to undertake pathological studies of Nigerian sheep and goat dermatoses and, to also assess grossly, the effect of these dermatoses on the aesthetics of the sheep and goats leather surfaces, in order to be able to make relevant recommendations towards effective control.

### Materials and Methods

#### The Animals

A selection of some animals having apparent skin lesions was done at various animal markets and at the National Animal Production Research Institute (NAPRI), Shika and in the Zaria environs of Kaduna State, Nigeria. A total of 30 live animals (16 goats and 14 sheep) were purchased.

From these, 11 goats and nine sheep had observable skin lesions, while the remaining 10 animals (five goats and five sheep), showing no apparent skin lesions were used as controls. The animals were given identification numbers in sequence of their purchase as follows 1 – goat; 1.1 – sheep; 1.2 – sheep; 2 – goat; 2.1 – sheep; 2.2 – goat; 3 – sheep; 3.1 – goat; 3.2 – goat; 4 – goat; 4.1 – goat; 4.2 – goat; 5 – goat; 5.1 – sheep; 5.2 – sheep; 6 – goat; 6.1 – goat; 6.2 – sheep; 6.3 – sheep; 6.4 – sheep. Another set (normal looking) tagged A1, B1, C1, D1 and E1 all sheep and A 2, B2, C2, D2 and E2 all goats...
were also purchased (as controls).

The skins of all the animals were examined by inspection and palpation for any natural skin disease, thus separating the animals into two groups – those with natural skin diseases (9 sheep and 11 goats) and those without skin diseases (5 sheep and 5 goats).

**Skin Pathology**

All the animals with apparent skin lesions were examined grossly, clinically, and the observed lesions described. After gross examination of the animals, skin biopsy samples were taken from the areas of lesions on the live animals. Skin samples were similarly taken from normal looking animals.

The biopsied skin samples were fixed in 10% formol saline solution, then processed according to standard methods using an automatic tissue processor (Shandon Duplex Processor). Embedment was done in paraffin and tissue sections were cut at eight microns (μ) with a rotary microtome (Reichart Jung Model 90370).

Routine haematoxyline and eosin (H & E) staining was done according to standard methods. Special stain – Taylors Green stain (Luna 1968) was used for specific diagnosis of some Gram-positive and Gram-negative organisms, as well as or differentiating Actinomyces filaments in the skin tissue sections. The histological slides were examined under the microscope using various magnifications from low power to oil immersion.

**Leather quality**

The 30 flayed skins were subjected to tannage into wet blue upper leathers, thus converting them into non-putrescible materials using chromium oxide (chrome) powder according to the standard mineral tanning methods for upper leathers (Tuck 1981).

**Results**

The normal goat and sheep skins had no gross lesions and the microscopic sections revealed normal features (Fig. 1). Their leathers also had aesthetically appealing grain

with good nap (Fig. 2).

The predominant lesions on majority of the diseased animals were crusts and scabs (Figs. 3 and 4). Some of the animals had mixed lesions resulting in concurrent diseases.

Table 1 shows the summary of the gross lesions, microscopic appearance, diagnosis, and the nature of the leather surfaces from the afflicted skins. The generally observed histological lesions were exudative, degenerative, acanthotic, parakeratotic, pustular, cystic (epidermoid), ectoparasitic and, scabby types mostly caused by inflammatory reactions and alopecia (Figs. 5-14).

Leather grain appearance of most of the various skins with diseases indicated roughness unsightliness, depressions and holes (Figs. 15-17). These leathers were graded mostly as rejects.

**Discussion**

The lesions of the various skin diseases described in this investigation were concentrated on the surface of the skin (epidermis) or in the corium (dermis) or both and they had adverse aesthetic and physical effects on their leathers as also observed by Gbolagunte and Hambolu (2006). This is in agreement with the observations of Tancous et al. (1959), who asserted that a number of skin diseases in small ruminants are characterized by skin conditions that may persist in the finished leather and then lower its value. Dermatophilosis, for instance, which induces marked hyperkeratosis usually leaves behind pited grain appearance in the leather despite the fact that much of the keratinous materials are removed during processing. In severe cases with ulceration, there would be holes in the skin. Healing of such lesions is often by scar formation which may be visible in the leather (Tancous et al. 1959). It has also been reported that the dermis in very severe cases is infiltrated with inflammatory cells. These could be enough to separate the collagen of the dermis thereby resulting in fiber disorganization (Njoku and Alafiatayo 1984).

Scabs on four goats and seven sheep observed in this study conformed with the
histopathological descriptions on East African goats as indicated by Green (1956) and Bwangamoi (1976). Oduye (1976), also made similar observations in cattle, characterized by hyperkeratosis, parakeratosis and neutrophilic infiltrations. In the goat where pediculosis was diagnosed, the observed superimposed layer of scab and heavy dermal inflammation, were characteristic of arthropod reactions resulting from salivary secretions of allergens and/or toxins (Schwartzman and Kral 1967).

The crusts observed in the cases of dermatophilosis and pyoderma (abscess) in this study, agrees with the assertion of Yager and Scott (1985) that dermatophilosis and pyoderma are often characterized by crust formation, sometimes located at the ostia of their follicles.

Fleece rot encountered in one sheep, occurred on an adult sheep with a staple (hair) long enough to maintain moisture. The moisture predisposes to fleece rot by inducing an acute inflammatory reaction and by encouraging the proliferation of bacteria on the skin surface (Hollis et al. 1982). This sheep with fleece rot in this study had its hairs coming off easily, exposing a raw skin surface, obviously because of bacterial invasion. Because fleece rot occurs with continued wetness of the skin to produce partial maceration of the stratum corneum and debris suitable for profuse bacterial growth, and often with a mild non-specific dermatitis in the exudates of which bacteria grow abundantly (Pascoe 1990), are the reasons for the focal spot marring its leather surface.

Folliculitis in a sheep in this study had its skin looking raw and exuding pus, similar to its advanced stage observed by Tancous et al. (1959). The purulent exudates within the hair follicles agrees with the description by Nesbitt and Schmitz (1977). It is often asserted that folliculitis is not a skin disease, but rather, a condition of the skin which is sequel to a pre-existing skin affliction. It could then be a secondary infection to alopecia with which it exists in this study.

Usually, the animals with alopecia often have bald, scar-like patches which occur bilaterally symmetrical on the body of the animal, unlike the crust observed in the goat and the raw matty hairs observed in the sheep in this study. However, the abundant keratin filled hair follicles in the upper dermis in the animal in this study, was indicative of hairs in telogen being lost after anagen had stopped (Muller and Kirk 1969). Clinically, animals with little thyroid gland secretion have telogen hairs epilated, but replacement does not occur unless the imbalance is corrected by renewed thyroid output or by supplemental thyroid administration.

The epidermoid cysts observed in this study could have occurred from various causes. Some apparently arise from dilatation of the infundibulum, of occluded hair follicles. Other cysts arise from traumatic, developmental or surgical implantation of epidermal fragments into dermis or subcutis. These usually atrophy and disappear (Plummer 1956). Their persistence and development may be governed by host factors (Stannard and Pulley 1978). Persistent cysts may develop into well differentiated squamous carcinomas, which can metastasize (Ladds and Entwistle 1977; Kern and McCray 1980). However, cysts, as seen in this study, could only have developed from the dilatation of the infundibulum of occluded hair follicles mainly because of their retained connection with the skin surface. Moreover, there were no signs of atrophy, neither had they become carcinomatous.

The glaring atrophic sebaceous gland with pyknotic nuclei found in a goat initially gave the impression of mange. However, the dry crusty flaskes that showed grossly, meant that the sebaceous gland when atrophying, had reduced sebum production. This led to the diagnosis of Seborrhea sicca. Often, there are underlying causes like hormonal imbalances (hypothyroidism or hyperadrenocorticism), ectoparasitism (cheyletieliosis, pediculosis and demodecosis); endoparasitism, and dermatophytosis. Certain nutritional deficiencies like fatty acids, protein, vitamin A, Zinc and many other factors are also often contributory (Yager and Scott 1985).

Eczema is an epidermal disorder which varies from case to case and according to causative factors. The vascular and cellular reactions in the dermis seem to play a minor or secondary role (Percival et al. 1962). This...
lesion is caused by contact irritant, which in the early stages produce epidermal bullae (Muller and Kirk 1969). The case of eczema encountered in this study was regarded as being a long-standing one which had ceased, because it imparted a general hypertrophy to the epidermis, particularly marked by the thick layer of stratum corneum, and a dense papillary layer collagen. The corneum condition is lichenification, and is due to the disturbance of repeated bouts of eczema. However it would seem in part to be a congenital malformation, comparable to, but distinct from palmar, and plantar keratosis (Percival et al. 1962).

The intra-epidermal purulent exudates and sub-corneal lesions in this study have been termed abscess because of the general nature of their appearance. Actually, abscess is a localized collection of pus. When germs such as bacteria invade the body their presence sets up a reaction whereby white blood cells die. When millions of these cells containing dead germs collect together, they form the yellow substance called pus. There is of course no limit to the number of sites in the body where abscess can develop (Yager and Scott 1985). The diagnosis, however, could have otherwise been referred to as impetigo. But since the lesion here mostly spared the hair follicles, agreeing with the assertion of Mebus et al. (1968), it is believed to be abscess. Impetigos, especially in goats, are often anatomically limited to the udder, sometimes spreading to the perineum and ventral aspects of the tail, and predisposing to staphylococcal mastitis (Nesbitt and Schmitz 1977). The lesions in these cases were not so anatomically disposed as they were found on the dorsum of the body, the peri-orbital region and, at the dorso lumbar areas.

The appearance of demodex mites in bladder-like hair follicles was a characteristic and simple diagnosis of demodecosis, and it agrees with its description by Oduye (1975), and Abu-Samra and Ibrahim (1989), who also observed that the cysts contained a lot of Demodex mites, pus and debris.

Generally, the crust leathers from infested skins in this investigation, were unsightly, hard and fibrosed, with many tunnellings. The grain surfaces were coarse and rough. Numerous holes appeared on them. These observations are in agreement with those of previous workers (Knew 1952; Dempsey 1954; Green 1956, 1957, 1959; and Ibrahim and Abu-Samra 1988).

The leather from skin infested with ectoparasites in this study were characterized by spots (either circular or dented), as well as with hardness of the surfaces especially the areas of the rims around the spots. The leathers of animals with alopecia shared these characteristics too. The areas of the spots were referred to as "pits" by Tancous (1993). This parasitic defect is inherent from the farm level (Tancous et al. 1959; Haines 1978). Generally, however, according to Tancous et al. (1959), the lesions caused by lice may not be noticeable, depending on the degree of secondary infections. The damages done by biting and sucking lice are often eliminated by grain correction during the process of leather manufacture. The leather whose depressions looked like scratches was a consequence of the animal's effort to get relief from irritations by frequent rubbing of the body against an object as also explained by Tancous (1993).

Four animals exhibited grain surfaces described by Haines (1983) as being pitted. There was marked reduction in the aesthetic appeal and cutting areas of the prepared leathers. They were unsightly and fibrosed in the same manner as observed by Abu-Samra and Ibrahim (1989).

The presence of nodules with holes on the leather from a goat is typical of demodecosis and signifies that the follicular mange is in the later stages, and a grain correction cannot remedy this type of leather when split, as in upholstery leather (Tancous et al. 1959).

**Conclusion**

This study has revealed that among the skins available for tanning in Nigeria, disease would reduce the number of those that would be of top grade. Effects of the diseases often show on the grain of the afflicted leathers, detracting from the aesthetics.

The pathomechanism (pathophysiology)
of Nigerian small ruminant skin diseases, as well as the effect on the quality of leathers which they ultimately produce, have been established.

Effective and modern animal husbandry (with adequate prophylactic measures) as suggested by Ejila et al. (1992), will be the panacea to the nagging problem of Nigeria's declining hides and skins quality in the world market.

References


Fig. 1. Skin section of normal sheep. Similar appearance in normal goat. Note normal epidermis without hyperkeration parakeration or asanthosis. Also note normal hair follicles (HF) without dermis. Papillary layer has more abundant hair follicles in sheep as seen in this section than in the goat. H & E X 160.

Fig. 2. Leather grain surface of normal goat (without skin lesions). The surface shows normal goat grain pattern-undisturbed by any distortions or contours. The grain shows good ‘nap’.

Fig. 3. Goat (1), showing crusts grossly. Note scabs on the dorsolateral aspect.

Fig. 4. Goat(3.1) Close-up of scabby surface and unmistakable lichenification (L) resulting in extensive folds and wrinkles (Wr). Diagnosis: Dermatophilosis/epidermoid Cyst.

Fig. 5. Skin section of goat (5): Note acanthosis (A), parakeratosis (P) and Hyperkeratosis (H) of the epidermis. Very prominent is the purulent exudates (Ex) around the hair shaft forming an invagination into follicular pit. Diagnosis: Furunculosis. H & E X 250.

Fig. 6. Leather grain surface of sheep (6.2) with abscess. Note ragged spots appearing like marked strip (arrows).
Fig. 7. Goat (3.1) skin section. Note acanthosis (A) resulting in prominent rete pegs (arrows). There is slight parakeratosis (P) and marked hyperkeratosis. H & E X 250.

Fig. 8. Skin section of goat (6.1). Note extensive acanthosis (A) and an over-hanging layer of intra-keratin pustule (Ps). H & E X 160.

Fig. 9. Goat (1), histologically, epidermis had overhanging scab attached to a hair follicle. H & E X 160.

Fig. 10. Skin section of sheep (6.2) and a similar lesion appearing in 6.3 and 6.4 showing intra-epidermal pustule (Ps) or abscess.

Fig. 11. Skin section of goat (6), showing epidermoid cysts of various sizes (Epc). Note the cyst making direct contact with skin surface (arrow). Diagnosis: Derrodecosis/Epidermoid cysts. H & E X 160.

Fig. 12. Skin section showing heavy dermal inflammation (Chronic Inflammation). H & E X 250.
Fig. 13. Skin section of goat (4.1). This is a chronic dermatitis revealing perivascular cuffing (arrows) in the dermis as well as leucocytic inflammation in the upper dermis. Diagnosis: Alopecia. H & E X 160.

Fig. 14. Skin section of goat (6). Note the inflated bladder-like hair follicle (HF) (arrow) within which are Demodexmites eggs (Dm). Demodecosis. H & E X 160.

Fig. 15. Leather grain surface of goat (2.2) with dermatophilosis. Note scar (arrow) on hardened grain surface.

Fig. 16. Leather grain surface of sheep (1.2) with folliculitis/alopecia. Note unsightly striped portion (arrows).

Fig. 17. Leather grain surface of goat (2.2) with dermatophilosis. In addition to scars and hardness of grain there were depressions (arrow) also.

Fig. 18. Goat (5) with prominent scabs at the lower mid-side and on the gluteal areas of the body.
Fig. 19. Leather grain side of goat (5), with furunculosis. Note the areas with hole to the flesh side (arrows) as well as areas with deats forming scratches (arrows).

Table 1. Summary of Gross Lesions, Microscopic Appearance Diagnosis and Leather Surface Appearance of Nigerian Sheep and Goats with Dermatoses.

<table>
<thead>
<tr>
<th>Tag No.</th>
<th>Species</th>
<th>Gross Lesions</th>
<th>Microscopic Appearance</th>
<th>Diagnostics</th>
<th>Leather Surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Goat</td>
<td>Crust (with lice nits)</td>
<td>Acanthosis, slight hyperkeratosis, parakeratosis and scabs</td>
<td>Pediculosis</td>
<td>Unsightly with spots</td>
</tr>
<tr>
<td>1.1</td>
<td>Sheep</td>
<td>Scab/matted Coat (Some times showing bare skin)</td>
<td>Purulent exudates invading epidermis forming microabscesses and resulting in epidermal scab</td>
<td>Fleece Rot</td>
<td>Unsightly and dented spots</td>
</tr>
<tr>
<td>1.2</td>
<td>Sheep</td>
<td>Scab</td>
<td>Hyperkeratosis, hair follicles having purulent exudates in the interior (many filled with keratin); Predominant in upper dermis without contact with skin surface – evidence of exfoliation</td>
<td>Folliculitis/ Alopecia</td>
<td>Unsightly stripped portions</td>
</tr>
<tr>
<td>2</td>
<td>Goat</td>
<td>Crusts</td>
<td>Hair follicles filled with keratin; Prominent in upper dermis with no contact with skin surface; Collagen fibers appeared normal</td>
<td>Alopecia</td>
<td>Unsightly with scratches</td>
</tr>
<tr>
<td>2.1</td>
<td>Sheep</td>
<td>Scab (Not too prominent)</td>
<td>Heavily inflamed dermis; Upper dermis edematous while the dermis indicated chronic inflammation</td>
<td>Alopecia</td>
<td>Unsightly dented spots (especially on flesh side)</td>
</tr>
<tr>
<td>2.2</td>
<td>Goat</td>
<td>Crusts/ occasional Scabs</td>
<td>Purulent layers of scabs above the epidermis with filaments of Dermatophilus congolensis within</td>
<td>Dermatophilosis</td>
<td>Hardened with scratches (Reject)</td>
</tr>
<tr>
<td>3</td>
<td>Sheep</td>
<td>Matted hairs</td>
<td>Very thin epidermis;</td>
<td>Alopecic</td>
<td>Scattered small</td>
</tr>
<tr>
<td>Section</td>
<td>Animal</td>
<td>Description</td>
<td>Pathological Findings</td>
<td>Diagnosis</td>
<td>Comments</td>
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<tr>
<td>3.1</td>
<td>Goat</td>
<td>Scabs and unmistakable lichenification</td>
<td>Dermis jutted extensively into dermis resulting in rete pegs; Slight parakeratosis and marked hyperkeratosis; Epidermoid cysts with DC filaments within</td>
<td>Dermatophilosis/Epidermoid cyst</td>
<td>Checkered pattern and raised points</td>
</tr>
<tr>
<td>3.2</td>
<td>Goat</td>
<td>Crust mixed with hairs forming flakes extensively into dermis</td>
<td>Sebaceous gland atrophy with predominant pyknotic nuclei</td>
<td>Dermatophilosis/Epidermoid cyst</td>
<td>Lost during processing</td>
</tr>
<tr>
<td>4</td>
<td>Goat</td>
<td>Smooth patch (scabs and scars) along dorsum</td>
<td>Epidermal hypertrophy generally marked by pykeratotic stratum corneum</td>
<td>Eczema (longstanding)</td>
<td>Holes at lesion sites (reject)</td>
</tr>
<tr>
<td>4.1</td>
<td>Goat</td>
<td>Crusts and bald patches mostly on dorsum and sacral areas</td>
<td>A perivascular dermatitis without significant epidermal changes; The dermis (especially upper portion) inflamed with leucocytes</td>
<td>Alopecia</td>
<td>Pin-sized spots on hard grain (unsightly)</td>
</tr>
<tr>
<td>4.2</td>
<td>Goat</td>
<td>Wrinkles/scabs/crusts on neck, shoulder and lumbar region</td>
<td>Coccoid spores of D.conglolensis in Keratin portions especially in the hair follicles</td>
<td>Dermatophilosis</td>
<td>Wrinkles (unsightly)</td>
</tr>
<tr>
<td>5</td>
<td>Goat</td>
<td>Occasional crusts and prominent scabs on gluteal and lower right midside (Fig. 18)</td>
<td>Epidermal acanthosis, slightly parakeratotic and, hyperkeratotic; Purulent exudates around hair shaft jutting into the hair follicular pit</td>
<td>Furunculosis</td>
<td>Hole piercing leather to flesh side (reject) (Fig. 19)</td>
</tr>
<tr>
<td>5.1</td>
<td>Sheep</td>
<td>Matted hairs removing easily</td>
<td>Thin epidermis; Hair follicles with concentric interior keratin were abundant at the papillaris demis</td>
<td>Alopecia</td>
<td>Pin-sized spots (unsightly)</td>
</tr>
<tr>
<td>5.2</td>
<td>Sheep</td>
<td>Scabs, mostly covered by hairs on most of dorsum</td>
<td>Purulent exudates penetrated the epidermis; The hyperkeratotic areas of the epidermis formed scabs; Filaments of D.C. all over the epidermal scabby portions</td>
<td>Dermatophilosis</td>
<td>Hole piercing to flesh side (reject)</td>
</tr>
<tr>
<td>6</td>
<td>Goat</td>
<td>Nodules (predominant)</td>
<td>Demodex cysts (caprae) were</td>
<td>Demodecosis/Epidermoid cysts</td>
<td>Raised nodules and holes piercing to</td>
</tr>
</tbody>
</table>
and generalized crusts and patches abundant all over the dermis; The follicle resembled inflated bladder (Fig. 14); The adjoining collagen fibers were disrupted; Sections also revealed epidermoid cysts of various sizes and numbers with some, having contact with the skin surface (Fig. 11) flesh side (reject)

<table>
<thead>
<tr>
<th>6.1 Goat</th>
<th>Scab/Crust/Pustules (Fig. 10)</th>
<th>Prominent excoriations on dorsum and face revealing bare skins</th>
<th>Alopecia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Acanthosis in epidermis and an overhanging layer of intra-epidermal pustule</td>
<td>Light scars marked grain surface</td>
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<thead>
<tr>
<th>6.2 Sheep</th>
<th>Scab/Crust/Pustules (Fig. 10)</th>
<th>Prominent excoriations on dorsum and face revealing bare skins</th>
<th>Abscess</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Ragged sports, appearing like marked strips on the areas which manifested the lesions on the skins (Fig. 6); Small holes pierced through the flesh sides (Fig.16); The surface was unsightly</td>
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<tr>
<th>6.3 Sheep</th>
<th>Scab/Crusts/Pustules (Fig. 10)</th>
<th>Prominent excoriations on dorsum and face revealing bare skins</th>
<th>Abscess</th>
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<tr>
<th>6.4 Sheep</th>
<th>Scab/Crusts/Pustules (Fig. 10)</th>
<th>Prominent excoriations on dorsum and face revealing bare skins</th>
<th>Abscess</th>
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