

ISVD Case of the Month Submission June 2024

History/Signalment: A 2-year-old Longhorn cow, in Texas, presented with a 2-month history of proliferative skin disease starting in late June, characterized by multifocal to coalescing areas of hyperkeratosis throughout the haircoat, but most severe along the topline. She had been treated with dilute betadine scrubs and sprays with no resolution of clinical symptoms. Punch biopsies from areas on the topline were submitted for histological evaluation.

Figure 1.



Figure 2.



Figure 3.



Figure 4. Haired skin; H&E 2x magnification; Scale bar=500μm.

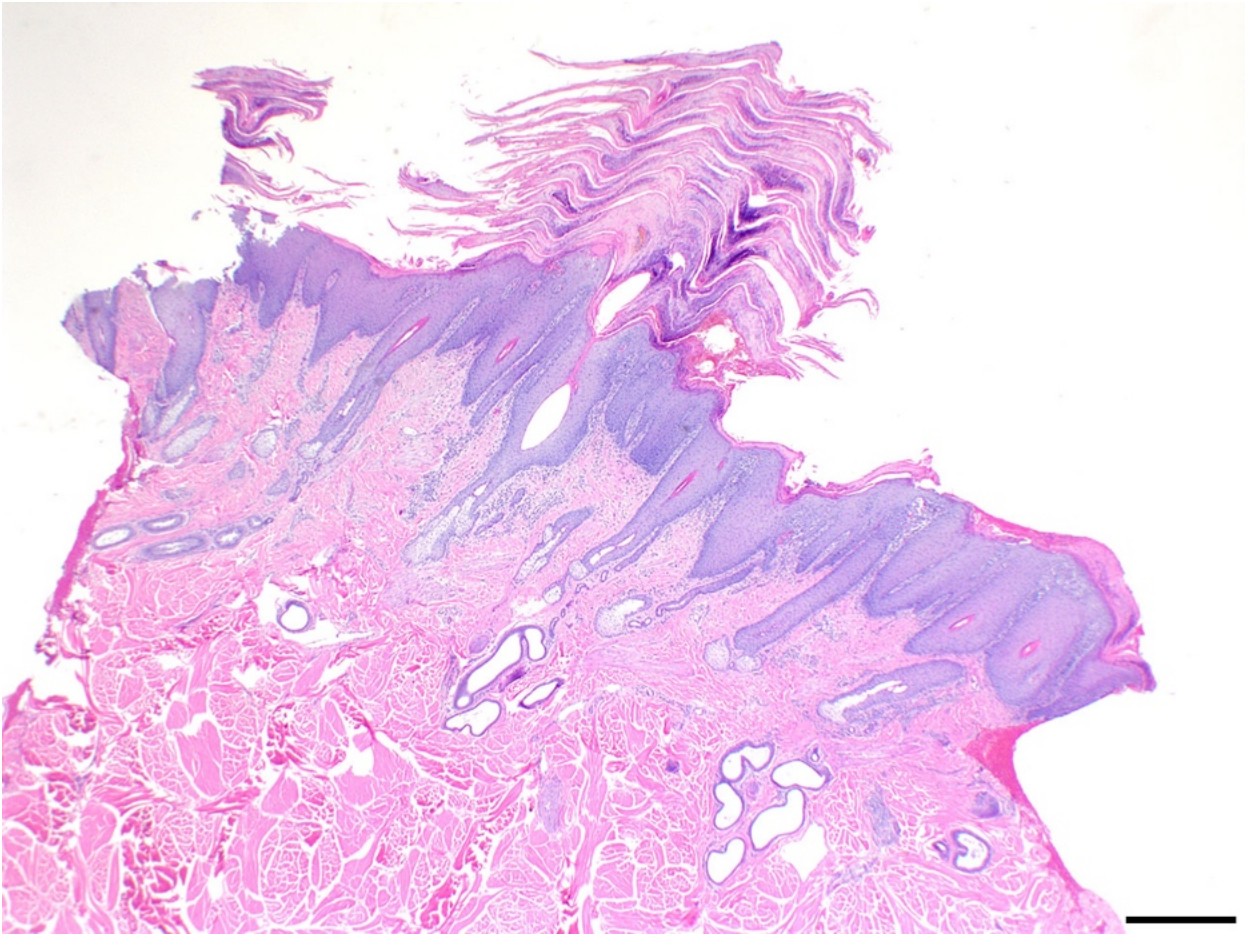


Figure 5. Haired skin; H&E 20x magnification; Scale bar=50μm.

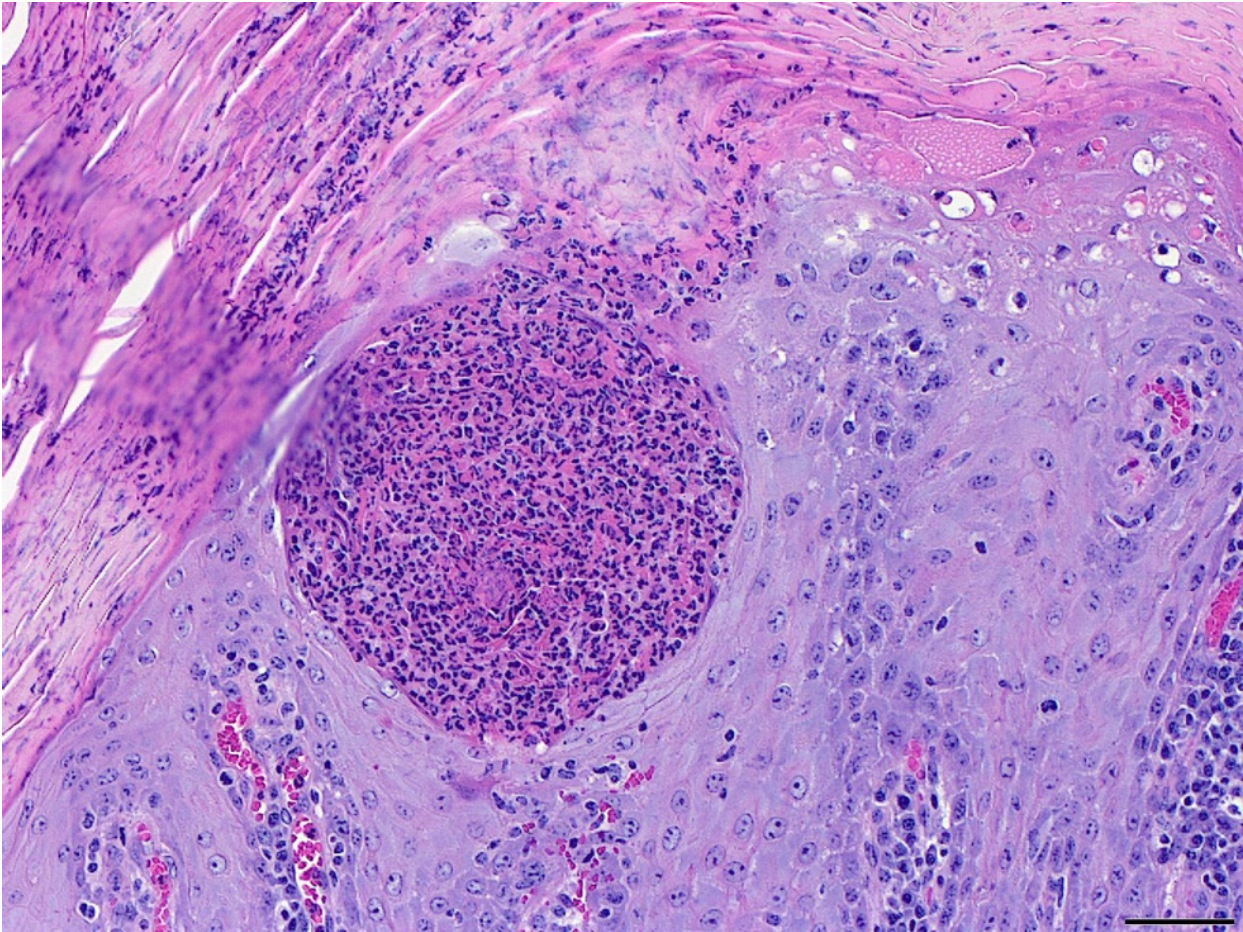


Figure 6. Haired skin; H&E 10x magnification; Scale bar=100μm.

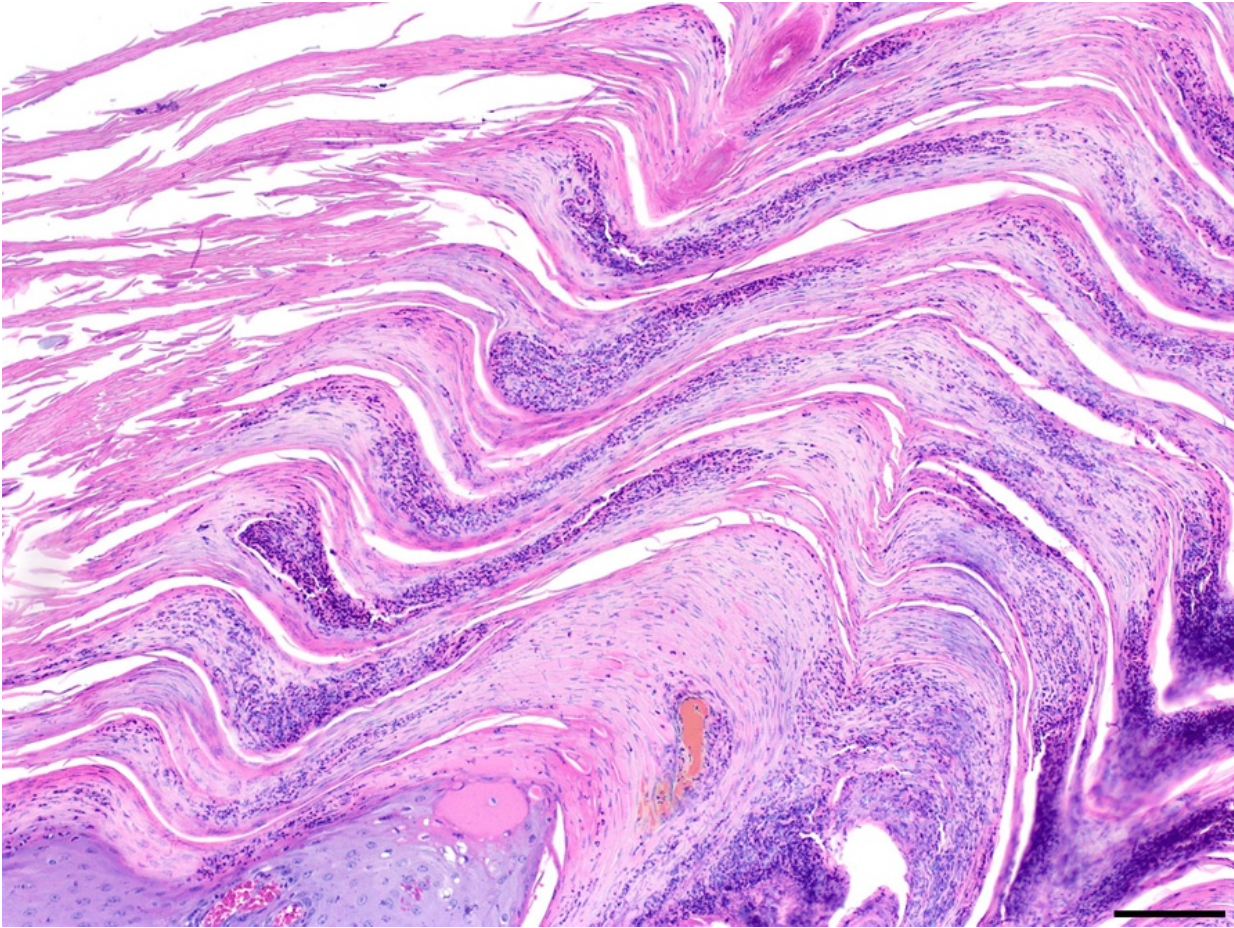


Figure 7. Haired skin; H&E 60x magnification; Scale bar=20μm.

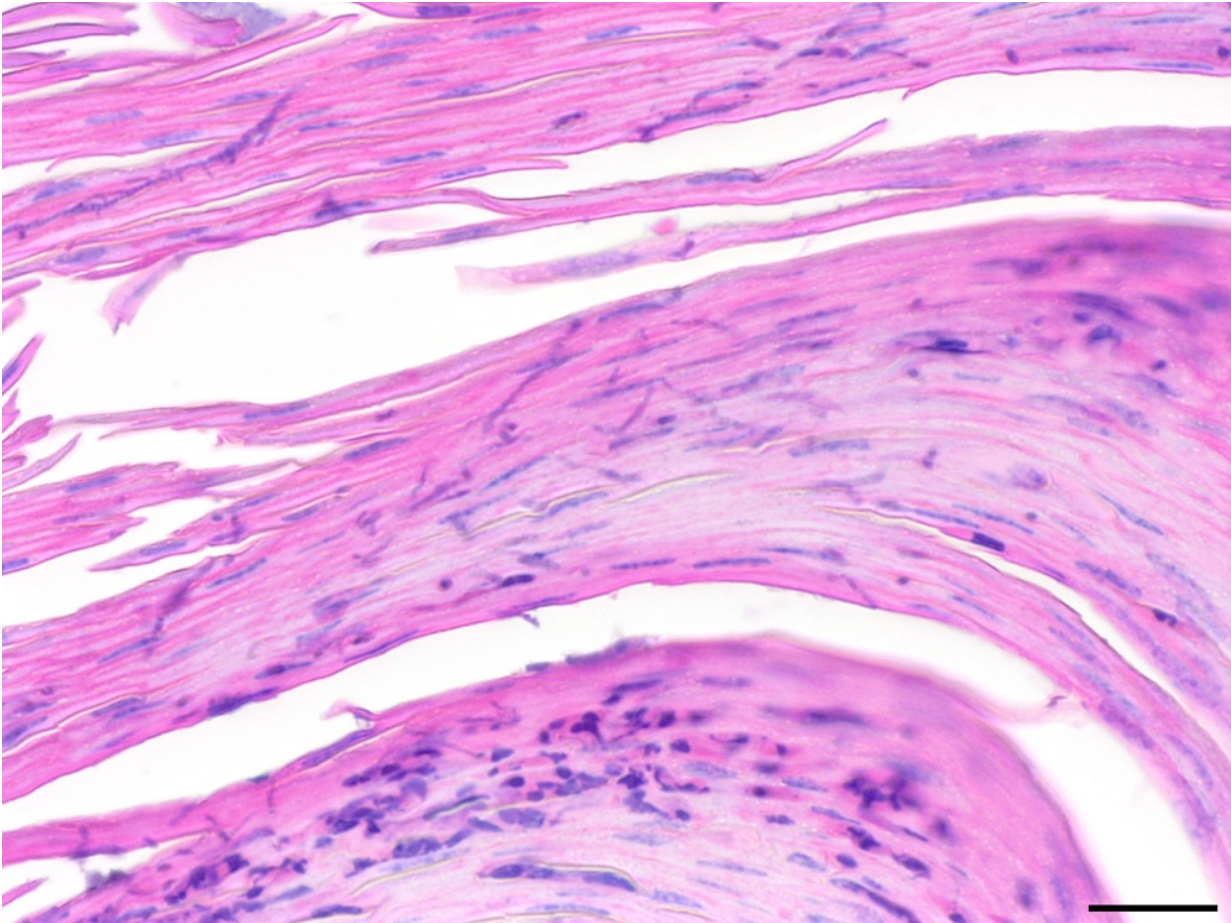


Figure 8. Haired skin; Gram Hucker-Twort stain 60x magnification; Scale bar=20μm.

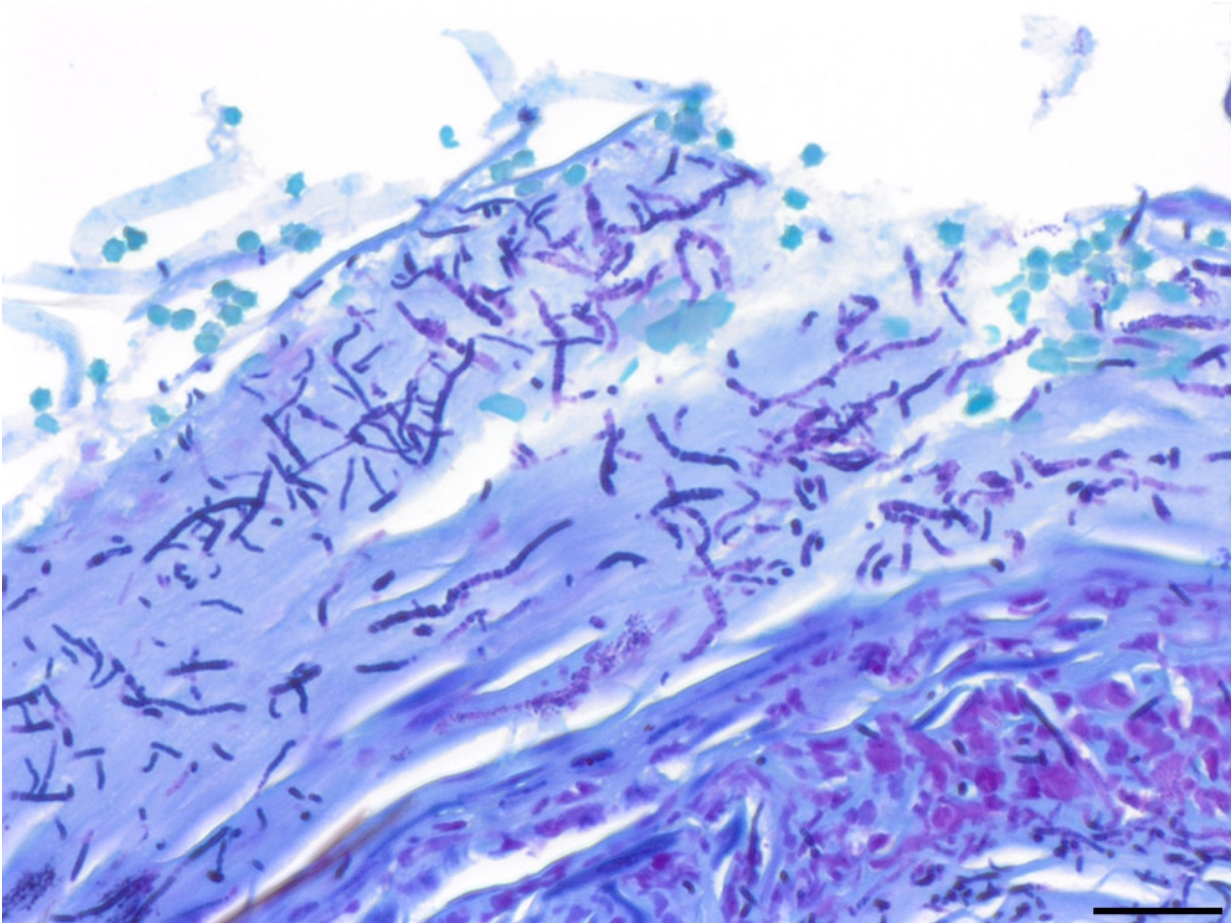


Figure 9. Haired skin; GMS stain 60x magnification; Scale bar=20μm.

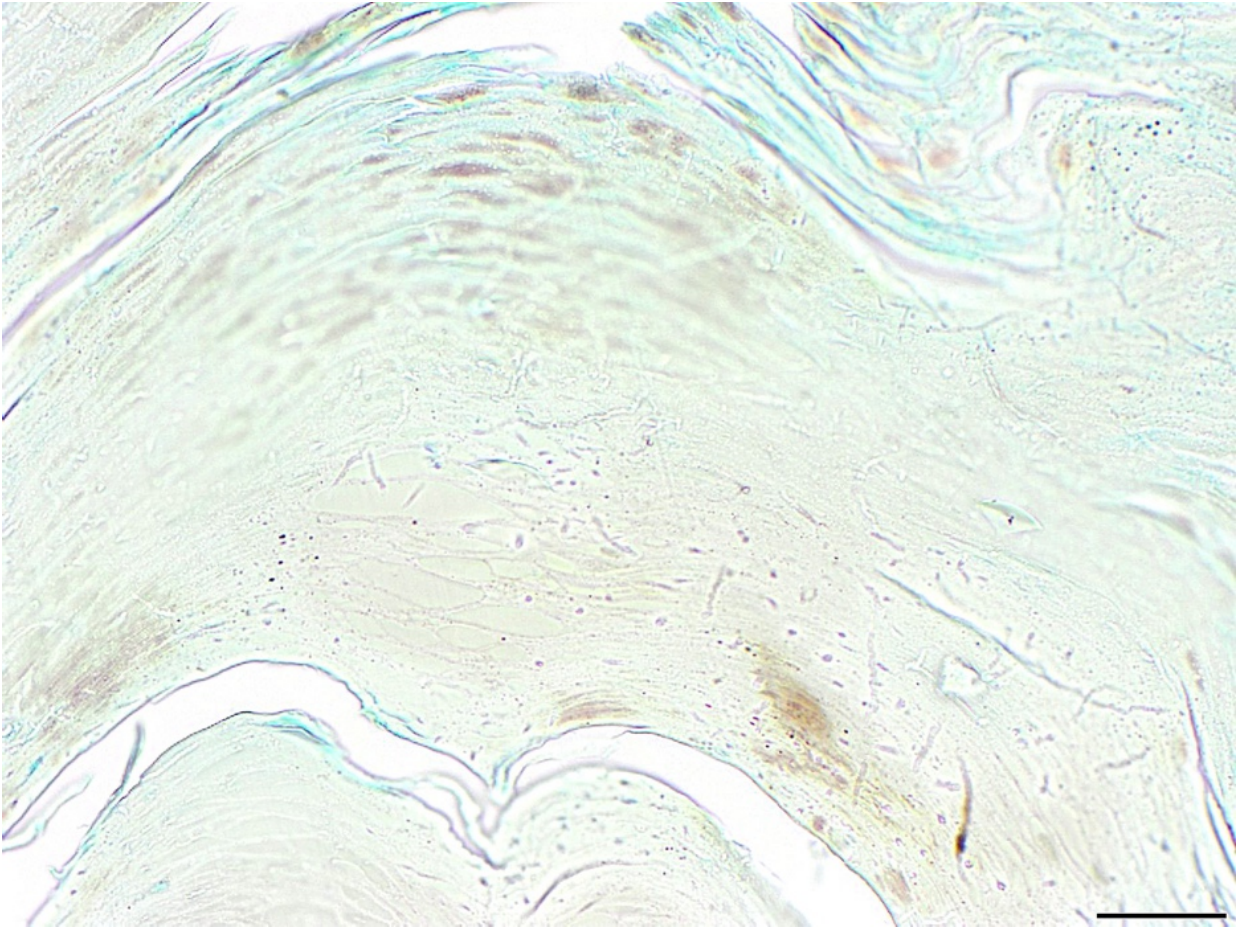
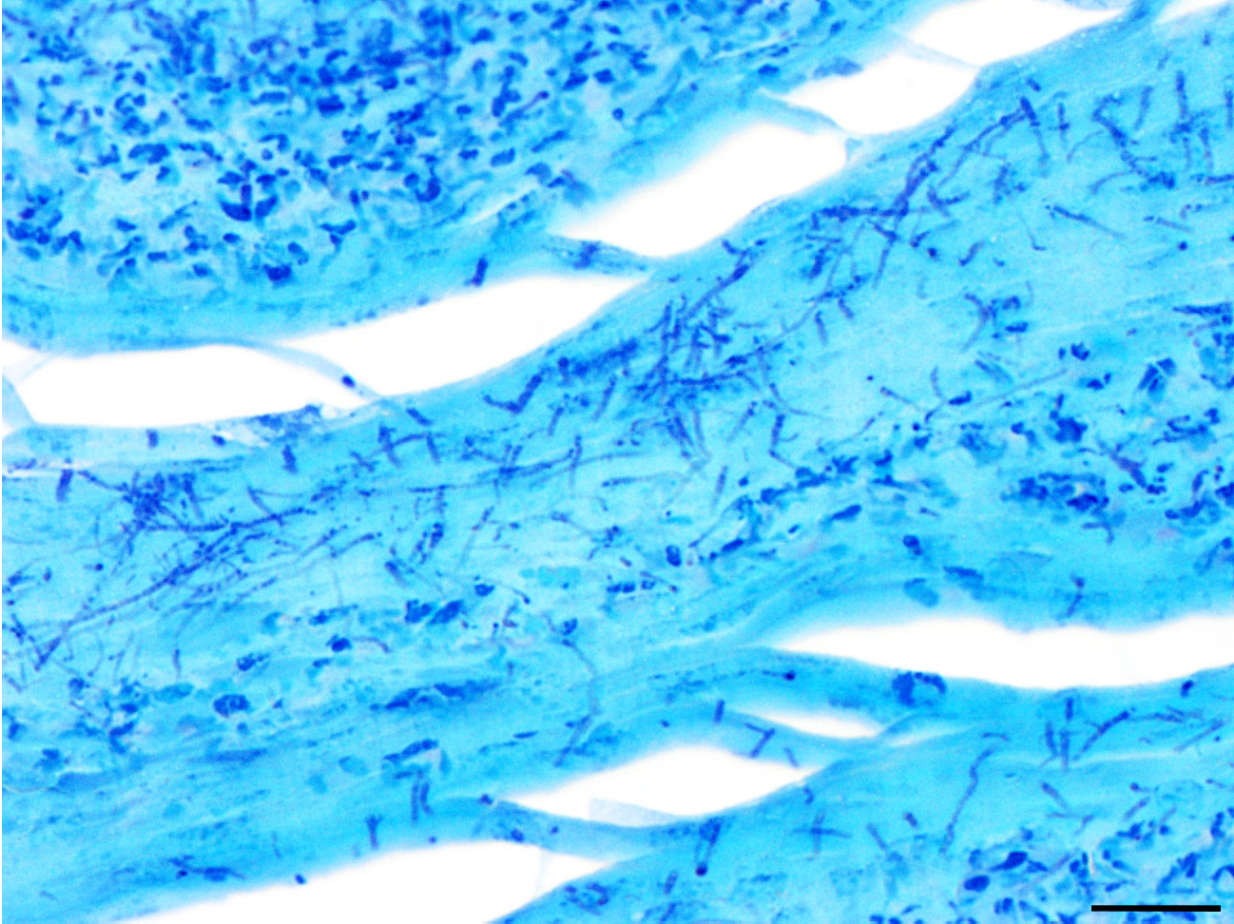


Figure 10. Haired skin; Giemsa stain 60x magnification; Scale bar=20μm.



Which of the following is the most likely etiology?

- A. *Treponema vincentii*
- B. *Trichophyton verrucosum*
- C. ***Dermatophilus congolensis***
- D. *Dichelobacter nodosus*

Histopathologic description:

Diffusely, the epidermis is moderately and irregularly hyperplastic with formation of anastomosing rete ridges. The epidermis is multifocally eroded and covered by an up to 2 mm-thick serocellular crust composed of alternating laminations of abundant orthokeratotic and parakeratotic keratin (hyperkeratosis), numerous viable and degenerate neutrophils, and necrotic cellular debris. Diffusely throughout the crust are numerous 1-2 micrometer, paired, gram positive cocci arranged in long, branching filaments resembling railroad tracks. Multifocally within the superficial epidermis beneath these crusts are small intracorneal pustules containing numerous neutrophils. Within the superficial dermis and surrounding blood vessels are moderate numbers of plasma cells with occasional histiocytes and Mott cells. There is mild dermal fibrosis.

Morphologic Diagnosis: Moderate, diffuse, chronic, exudative and proliferative epidermitis with superficial, gram positive diplococci and branching filaments (cutaneous dermatophilosis).

Comments: Dermatophilosis is an infectious cutaneous disease caused by an actinomycete bacterium, *Dermatophilus congolensis*. Dermatophilosis has a worldwide distribution, but the disease is most economically important in tropical climates, especially in the rainy season.

Dermatophilus congolensis is a gram-positive, non-acid fast, facultative anaerobic actinomycete. The bacterium has a multimorphic life cycle including a motile (flagellate) zoospore form, a branching filamentous form, and a multiplanar septate form. The branching filaments (1-5 um in diameter) ultimately fragment, by both transverse and longitudinal septation, into packets of coccoid cells, that then mature into flagellated ovoid zoospores (0.6-1 um in diameter). Being a bacterium, *D. congolensis* will stain with gram and Giemsa staining but should not stain with PAS or GMS. Although never isolated, it is thought to be a saprophyte in the soil, and infection is transmitted by direct contact or by vectors such as insects, arachnids, or fomites. Animals are at an increased risk when factors such as prolonged wetting by rain,

high humidity, high temperature, and various ectoparasites that permeate the natural defense barriers of the epidermis are present. In cattle, those infested with *Amblyomma variegatum* ticks appear to be predisposed and carry a more severe disease course than tick-free cattle. *D. congolensis* can exist in a latent form within the epidermis until infection is exacerbated by climatic conditions, particularly during the rainy season, giving rise to the lay term “rain rot”. Moisture facilitates the release of zoospores, allowing them to further penetrate the epidermis and establish new foci of infection throughout the body.

Initially, dermatophilosis manifests as a discrete focus of exudative dermatitis with erosion, suppuration, and the formation of an exudative crust that forms at the base of the hair and entraps it. In the acute form, especially with increased rainfall, the exudative crusting is usually thin and appears as multifocal individual foci that eventually coalesce to form larger lesions. When climatic conditions are favorable, this form of dermatophilosis is extremely transmissible to other animals. A more chronic form occurs when there is less moisture, and deep encrustations build up along tufts of entrapped hair. The crusts grow as increased moisture releases a new mass of zoospores, which causes the crust to be pushed away from the skin by new hair growth. After approximately 2 weeks after a herd infestation, frequently the areas of crusting are mostly on the distal ends of the hairs and resemble caked mud.

The diagnosis of dermatophilosis is centered on the presence of thick lamellated crusts in association with characteristic filaments of gram-positive coccoid bodies in parallel rows (railroad track configuration), forming from transverse and longitudinal septation. Cornification of the keratinocytes is the initial host response, and after the bacteria is walled off from the dermis by an infiltration of neutrophils, progenitor cells of the follicular epithelium propagate further, forming a new layer of epidermis. Subsequent invasion of the new layer causes a repetitive cycle, ultimately forming the thick lamellar crust with entrapped hair follicles that are characteristic of the disease histologically and grossly.

Dermatophilosis can affect many species including cattle, sheep, goats, and horses most frequently, and rarely pigs, dogs, and cats. *D. congolensis* is an important pathogen of alligators and crocodiles, causing ventrally located ulcers between the scales commonly known as “brown spot disease.” The bacteria can also be transmitted to humans by direct contact with an infected animal. Currently, the recommended treatment includes topical and systemic antibiotics and husbandry changes to ensure animals are kept dry.

The other foils in the multiple-choice question are all important infectious agents that cause skin disease in cattle. *Treponema vincentii* is a gram-positive, spiral shaped bacterium that is thought to play a role in the development of digital dermatitis, a common cause of lameness in cattle. *Trichophyton verrucosum* is the most common dermatophyte species involved in cattle ringworm, and although it also causes hyperkeratosis, the fungus is morphologically distinct

when seen microscopically. *T. verrucosum* should also not stain with gram stain, but will stain with PAS and GMS as it is a fungus unlike *D. congolensis*. *Dichelobacter nodosus* is a gram-negative, anaerobic bacterium that is considered one of the causes of interdigital dermatitis. This bacterium is found in the environment where cattle reside and invades through a breach in the interdigital skin and may progress to a systemic infection.

References:

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Acknowledgements

Clinical images provided by Dr. Dusty Nagy, DVM, PhD, DACVIM-LAIM – Large Animal Clinical Sciences at Texas A&M University, College Station, Texas, USA.

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