



Diagnostic Exercise

From The Davis-Thompson Foundation*

Case: **182**; Month: **February**; Year: **2022**

Answer Sheet

Title: *Yellow fungus disease in a bearded dragon*

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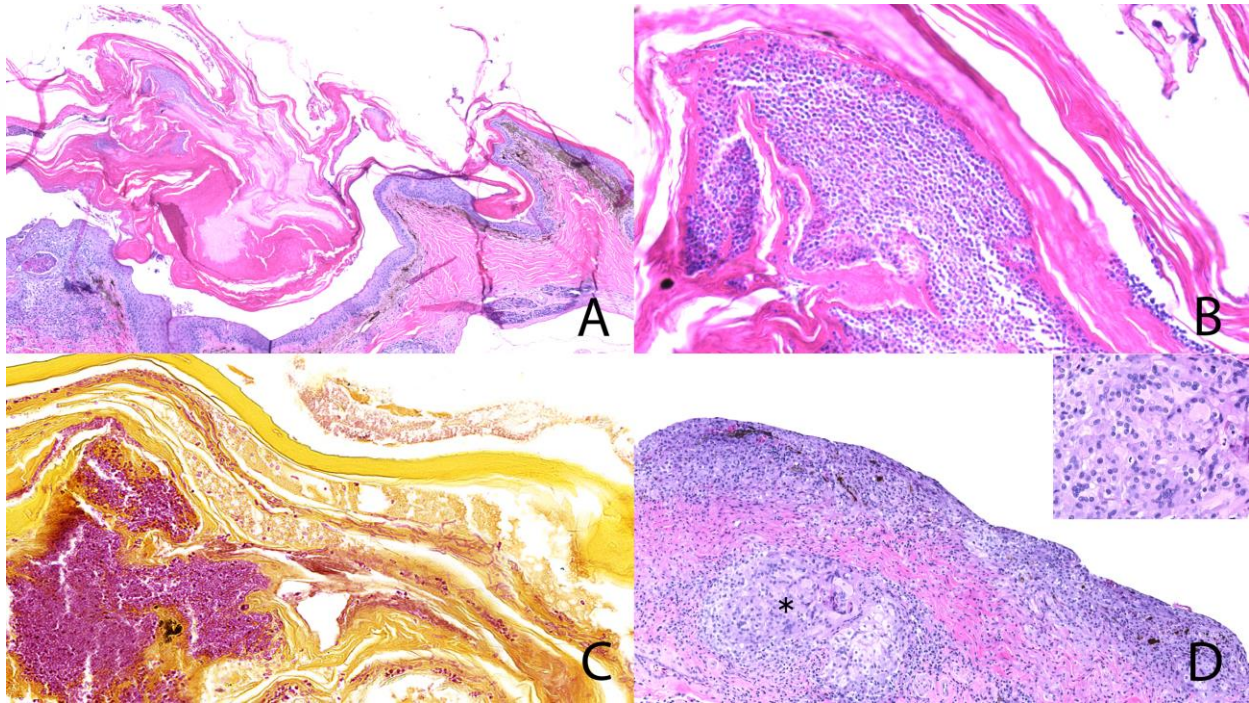
Clinical History: An adult of unknown age, intact female bearded dragon (*Pogona* sp.) had multiple ulcerative foci in the skin, especially noted in the ventral neck and along the inguinal area. Due to the severity and extension of the epidermal/dermal lesions, as well as, the deleterious animal condition, the owners elected humane euthanasia and postmortem examination was performed.

Necropsy Findings: The skin at the level of the ventral mandible, neck, thorax, and inguinal areas was replaced by multifocal to coalescing ulcerative foci ranging from 1.5 x 2 x 0.3 cm to 2.5 x 2.5 x 0.3 cm associated with sloughed epithelium covered by a thin yellow to light brown friable material (Figure 1A-C). Similar material was noted above the right eye and the abdomen. No other significant alterations were noted.

Gross images:



Microscopical images:



Microscopical findings: Skin, bearded dragon. **A.** The epidermis has severe orthokeratotic hyperkeratosis and epidermal crust. H&E, 50x. **B.** Within the stratum corneum, there are abundant numbers of septate with occasional irregular branching intralesional hyphae and numerous tufts of arthroconidia. H&E, 400x. **C.** Intralesional arthroconidia are highlighted in red. Gridley stain. 200x. **D.** The epidermis is also ulcerated and has multifocal to coalescent ulcerative areas replaced by abundant numbers of heterophils and macrophages (asterisk) mixed with fibrin and hemorrhage that extend to the dermis. Note abundant numbers of epithelioid macrophages and multinucleated giant cells (inset). H&E, 10x and 40x, respectively.

Morphologic Diagnosis: Skin: Ulcerative heterophilic and granulomatous dermatitis, chronic, multifocal to coalescing, severe and orthokeratotic hyperkeratosis with intralesional hyphae and arthroconidia

Disease: Yellow fungus disease

Etiology: *Nannizziopsis* spp. (*Chrysosporium* anamorph of *Nannizziopsis vriesii* complex; CANV-complex)

Discussion:

Superficial and deep/systemic mycosis in reptiles was associated with *Chrysosporium* anamorph of *Nannizziopsis vriesii* (CANV) infection (8). However, further DNA sequence analysis reclassified CANV into CANV-complex comprising three genera: *Nannizziopsis* spp, *Ophidiomyces* spp, and *Paranannizziopsis* spp (7).

CANV-complex comprises ascomycetous fungi with keratinolytic activity that use the stratum corneum as a substrate to grow (2-4,6). *Nannizziopsis guarroi* is reported

to be the most commonly associated agent with yellow fungi disease (YFD) in bearded dragons (8).

Ascomycetous fungi have septate hyphae with ascoma fruiting bodies, which is a type of ascus filled with ascospores produced after meiosis (4). The life cycle of the fungus involves the formation of clavate or piriform single-celled or 2 celled aleurioconidia, alternate and fission arthroconidia with a restrictive growth at 37°C (6). Epidemiologic studies demonstrated that CANV-complex is a rare normal microbiota of the skin in healthy reptiles when compared with *Aspergillus* spp, *Paecilomyces* spp, and *Penicillium* spp (6) and CANV-complex is isolated less than 1% of the cases (8). Therefore, the rarity of CANV-complex fungi in healthy reptile skin samples suggested that this is not an opportunistic fungal organism (1,2,6). The risk factors associated with the infection in YFD are substandard husbandry, improper diet, environmental stresses, trauma and existing dermatitis (1-3,6).

Clinical signs are variable and include focal to multiple crust formation, color change, ulceration, and necrosis of the skin (neck, head, limbs, ventrum, or dorsum) and oral cavity, which could ultimately lead to a systemic infection and death (6). Originally described as YFD, the crusts found on bearded dragons tend to have a yellow discoloration (6). *Nannizziopsis* spp infection in bearded dragons tends to be aggressive and invades the muscles and bones. Dissemination into the liver had also been described (6). Histopathological lesions include granulomatous dermatitis, cellulitis and myositis with granuloma formation in visceral organs (8). Diagnostic testing involves full-thickness biopsies submitted for histopathology, culture, and/or PCR. Culture is the gold standard diagnostic method for CANV-complex (2,5,6). Treatment requires the use of topically and systemic antifungals most commonly used are triazoles (ketoconazole, itraconazole, or voriconazole) (2,3,6).

CANV-complex has been associated with disease in humans mostly reported in immunocompromised individuals (6). Individuals that work with reptiles should consider CANV-complex infection as a potential zoonotic risk and proper precautions should be taken (6).

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