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PARASITIC PERIFOLLICULAR DERMATITIS IN THE EGYPTIAN LESSER BLIND MOLE RAT (*Spalax leucodon* egyptiacus)

Omar A. S. Tamam*

Department of Natural Resources, Environmental Studies & Research Institute
University of Sadat City, Egypt

ABSTRACT

A field study of outdoor cultivated habitats was conducted in the northern part of the Western Desert in Egypt (Al Dabaa – Marsa Matroh Governorate) between March 2010 and August 2013. Samples were collected from skin lesions occurring on the Egyptian lesser blind mole rat (*Spalax leucodon* Egyptiacus). Gross examination of the lesions showed alopecia and grey, circumscribed nodules, average size 2-5mm, in the hair-free thigh regions of the animals, varying from three to ten in number. Skin scrapings revealed numerous *Lynxacarus egyptiacus*, as well as other ectoparasites including *Polyplax serrata* and gamasid mites. Histopathological examination of the skin lesions showed features of demodetic perifollicular inflammation with aggregations of eggs in the dermis and in the keratin layer. Destroyed hair follicles were associated with fibroblastic proliferation and lymphocytic infiltration. Invasion with *Polyplax serrata* and gamasid mites resulted in keratinolysis, itching, and slight haemorrhage.This study is the first study to report on mixed lice infestations, and their associated histopathological changes, occurring in the Egyptian lesser blind mole rat. Since the population of this species is in decline, data relating to pathologies that occur in the Egyptian mole rat are of significance.

Key words: Egyptian lesser blind mole rat, *Spalax leucodon*; *Lynxacarus egyptiacus*, *Polyplax serrata*, perifollicular dermatitis

INTRODUCTION

Ectoparasites in moles can invade the skin and cause alopecia and pruritis (Tamam and Omar, 2009). We previously identified larval, nymphal, and adult male mites in the Egyptian lesser blind mole rat and named them *Lynxacarus egyptiacus*,after their host (*Spalax leucodon* Egyptiacus) (Tamam and Omar, 2009). The most prominent clinical signs seen in these seven mole rats were alopecia, intense gingivitis, and periodontitis, with notable swollen, ulcerating, and bleeding gums. *Lynxacarus* spp. belong to family Listrophoridae, which mainly infest rodents, but *Leporacarus gibbus* can also cause mange in domesticated rabbits, and *Lynxacarus radovskyi* affects domesticated and wild cats (Mounsey *et al.*, 2009; Philips, 2000; Lohse*et al.*, 2002). Other ectoparasites that are reported in wild cats, such as *Polyplax serrata* (Nelson *et al.*, 1979), show a sequence of inflammatory skin changes in mice infested with the louse, which are recognisable as acanthosis, fibrosis, tissue lymphocytosis, and monocytosis, as well as a sustained increase in mast cell numbers accompanied by mast cell degranulation. Some mites that infest the skin, such as Sarcoptidae and *Knemidocoptes*, can tunnel into the skin and live within these burrows. Others live on the skin surface (non-burrowing mites), fur, and other sites (Hoppmann and Barron, 2007; Jimenez *et al.*, 2010; Kahn *et al.*, 2010; Lohse *et al.*, 2002). Fox *et al.* (2006) add that *Polyplax* lice can cause specific lesions in mice that can be identified as small (up to 2 mm), whitish, cyst-like dermal nodules on the legs, back, trunk, abdomen, shoulders, and head.

With this background in mind, the objective of this study was to describe the histopathological changes associated with *Lynxacarus egyptiacus*, *Polyplax serrata*, and gamasid mites in the Egyptian lesser blind mole rat (*Spalax leucodon Egyptiacus*).

MATERIALS AND METHODS

Twenty-five Egyptian lesser blind mole rats were caught between May 2006 and August 2013 by excavating their tunnels, manual capture, and subsequent release after hair collection and biopsy of the skin lesions. All compound microscope and stereoscope. *Lynxacarus* mites < 500 um were identified by their laterally compressed body and characteristic grasping of the hair shaft between the gnathosoma and palpi. *Polyplax serrata* were

*Corresponding e-mail address: tamam@nextgenediting.com

parasites collected from the bodies of the host were preserved in 70% ethanol in the field. In the laboratory, individual specimens were dehydrated in a series of graded ethanol solutions (30%, 50%, 70%, 80%, 90%, 95%, and 100%) before being cleared in a mixed solution of pure ethanol and xylene (Guo *et al.*, 1996; Guo & Qian, 2001) and being mounted on glass slides. Specimens were then examined thoroughly using both a external parasites collected from the bodies of the host were preserved in 70% ethanol in the field. In the laboratory, individual specimens were dehydrated in a series of graded ethanol solutions (30%, 50%, 70%, 80%, 90%, 95%, and 100%) before being cleared in a mixed solution of pure ethanol and xylene (Guo *et al.*, 1996; Guo & Qian, 2001) and being mounted on glass slides. Specimens were then examined thoroughly using both a differentiated from *P. spinulosa* by identification of the sternal plate, which is triangular in *P. serrata* and pentagonal in *P. spinulosa*, and the fourth lateral abdominal plate has septa of unequal length in *P. serrata* and equal length in *P. spinulosa*. Other species were identified by microscopy. Skin biopsy samples were collected and fixed in 10% neutral buffered formalin, dehydrated, embedded in paraffin, sectioned at 5-7um, stained by H&E, and examined by light microscopy.

RESULTS

Moles that exhibited signs of itching and alopecia had well-defined circumscribed grey nodules measuring an average of 2-5mm in size in the thigh area free of hairs, varying from one to five in number (Fig. 1A). Skin scrapings from these areas showed flap-like external extensions of elongated *Lynxacarus egyptiacus*mites encircling the hair with a clasp-like hold around the hair shaft; in total, over 400 *Lynxacarus* mites were collected from each animal using a toothbrush Fig. 1B) and over 100 *Polyplax serrata* were collected from each animal using the same method (Fig. 1C). In contrast, gamasid mites were fewer in number (<20 specimens from each animal; Fig. 1D).

Fig. 1. (A) Circumscribed nodules in areas free from hairs in the thigh region of the Egyptian lesser blind mole rat (*Spalax leucodon* Egyptiacus). (B) Flap-like external extensions of elongated-shaped *Lynxacarus egyptiacus* mites encircle the hair with a clasp-like hold around the hair shaft. (C) *Polyplax serrata* associated with the nodules on the thigh of the Egyptian lesser blind mole rate (*Spalax leucodon* Egyptiacus). (D) Gamasid mites were recorded in low numbers and no obvious pathological significance.

Tissue sections revealed the presence of elongated to rounded structures above the epidermis, and collections of these eggs were also found supra-epidermally within and above the keratin layer (Fig. 2A). In these regions where mites were observed above the epidermis, the dermis exhibited a granulomatous reaction (Fig. 2B). Collections of eggs were also found invading the hair follicles in the dermis and encircled by a thin layer of fibrous connective tissue (Fig. 2C), with fibroblasts and lymphocytes surrounding and encircling the eggs in the dermis, forming granulomas (Fig. 2D).

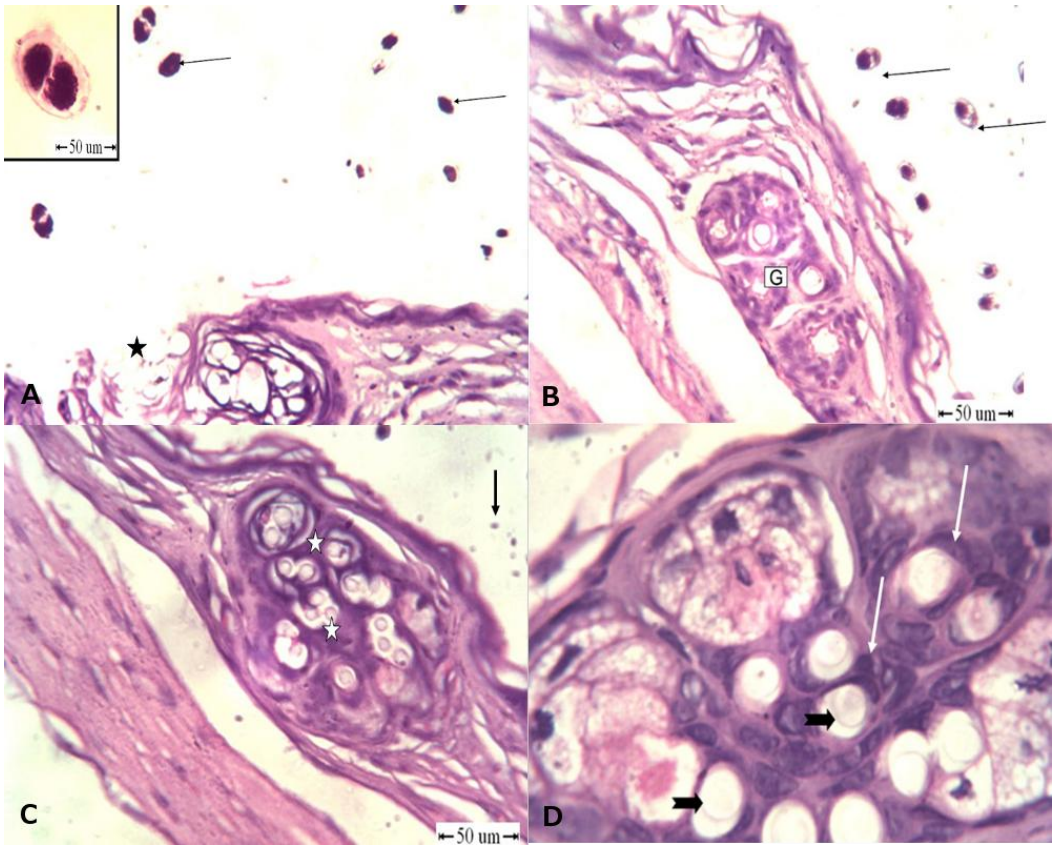

Fig. 2. (A) Several elongated to round structures above the epidermis (approximately 10-15 mm; arrow); collection of rounded eggs (star). The inset shows the elongated mite. H&E. (B) Several elongated to round structures above the epidermis (arrow). Note the granulomatous reaction in the dermis (G). H&E. (C) *Lynxacarus radovskyi* above the epidermis (arrow). Encircled eggs invaded the hair follicles in the dermis (star). H&E. (D) Fibroblasts (arrow) encircle the eggs in the granulomas.

Sometimes the eggs were arranged in circles or in a crown-like pattern above the hair follicles and surrounded by prominent fibroblasts (Fig. 3A). Fig. 3 shows that fibroblasts and lymphocytes constituted the dermal granulomatous reaction. Remnants of the hair shaft were surrounded by intense fibroblastic proliferation and lymphocytes were also noted (Fig. 3B). *Polyplax serrata* lice were observed in association with *Lynxacarus egyptiacus* (Fig. 3C), and were sometimes associated with haemorrhage and keratinolysis where the lice had invaded (Fig. 3D).

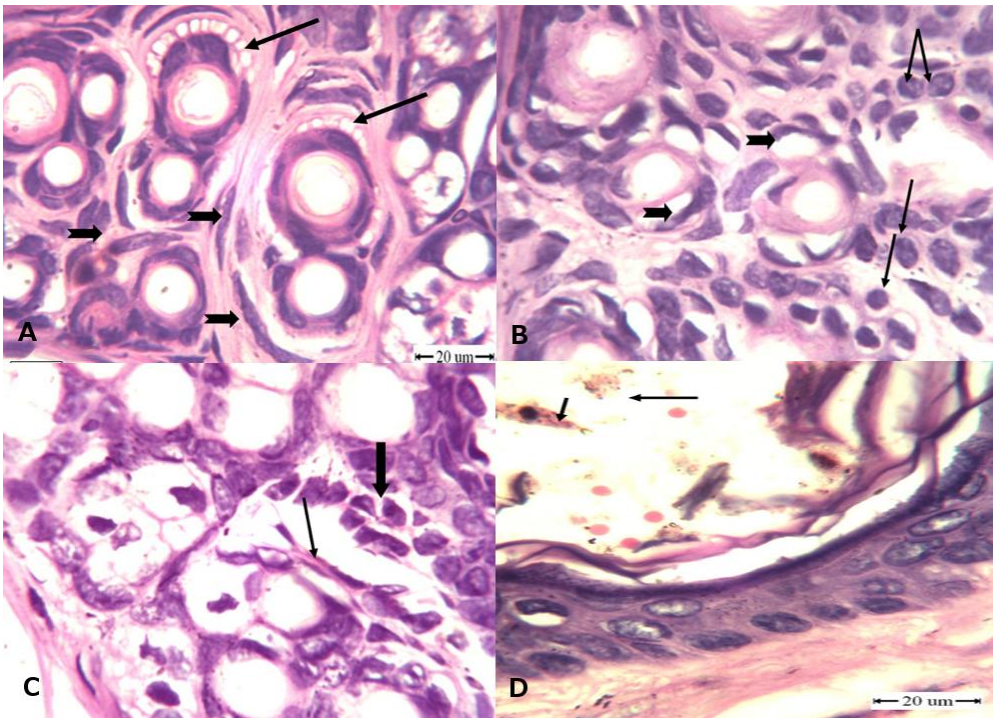

Fig. 3. (A) Hair follicles invaded by *Lynxacarus egyptiacus* eggs (crown-like, arrow) and surrounded by fibroblasts (arrow head). H&E. (B) Destroyed hair follicles surrounded by fibroblasts (head arrows) and lymphocytes. H&E. (C) Remnants of the hair shaft (arrow) surrounded by fibroblasts (head arrow) and lymphocytes. H&E. (D) *Polyplax serrata* invading the keratin layer of the epidermis (arrow) with keratinolysis and minor haemorrhage. H&E.

DISCUSSION

In the present study, well-circumscribed nodules were identified in the thigh region devoid of hairs in the Egyptian lesser blind mole rat. These nodules were either single or multiple but generally small in size (2-5mm). Moreover, skin scrapings from these areas showed flap-like external extensions of elongated *Lynxacarus egyptiacus* mites, which encircled the hair shaft with a clasp-like hold, as previously described (Tamam and Omar, 2009). The nodules observed in this study can be attributed to mixed infestation with both *Lynxacarus egyptiacus* and *Polyplax serrata*, in agreement with Fox *et al*. (2006), who observed that the *Polyplax* lice can cause specific lesions in mice, namely small (up to 2 mm), whitish, cyst-like dermal nodules on the legs, back, trunk, abdomen, shoulders, and head. In addition, Romeiro *et al*. (2007) stated that infestation with *Lynxacarus radovsky*iin domestic cats can lead to alopecia of the dorsal and lateral areas of the hind limbs and evidence of self-mutilation with papules and crusts on the hind limbs.

In the present study, the histopathological analysis revealed a perifollicular reaction in the dermis consisting of lymphocytes and fibroblasts, together with the presence of eggs around the hair follicles or mites and eggs above the epidermis. These results suggest that *Lynxacarus egyptiacus* and *Polyplax* lice may have the ability to burrow through the epidermis or secrete toxins. Some mites that infest the skin, such as Sarcoptidae and *Knemidocoptes*, can tunnel into the skin and live within burrows. Others live on the skin surface (non-burrowing mites), fur, and other sites (Hoppmann and Barron, 2007; Jimenez *et al*., 2010; Kahn *et al*., 2010; Lohse *et al*., 2002). Nemeth *et al*. (2013) described lesions occurring in the white-tailed deer (*Odocoileus virginianus*) that microscopically consisted of epidermal crusts and cutaneous nodules with mild perifollicular lymphoplasmacytic inflammation. Gamasid mites were observed in association with *L. egyptiacus*and *P. serrata* in the present study, and were

attached to the epidermis and resulted in destruction of keratin layer but with no significance histopathological changes.

In conclusion, mixed heavy infestations of the lesser blind mole rat with *L. egyptiacus* and *P. serrata* results in a perifollicular reaction in the dermis consisting of lymphocytes and fibroblasts with the presence of eggs around the hair follicles or mites and eggs above the epidermis.

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