



## Cross-over Infection of *Linognathus africanus* and Its Economic Impact on Goat and Sheep Husbandry in Southwest Libya

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### Abstract:

A total number of 180 heads of sheep and goats were investigated for Pediculosis (*Linognathus africanus*). *Linognathus* infestation is one of the most common problems that cause economic loss in sheep and goats in southwest Libya with a bad effect on animal welfare. Pediculosis in southwest Libya is mainly caused by *linognathus africanus*. This study has found cross-over infection of the parasite in goats, heavy *linognathus* infestation in sheep, and goats is obviously seen in winter. The Infection is mainly correlated with increased food demand in winter. Transmission is caused by direct contact, with rapid spread in housed animals especially in overcrowded houses. Anemia, weight loss and death in young animals with decreased milk production in adults were observed. Administration of one dose of Ivermectin was enough to remove the parasite within 7-days, co-administration of Ivermectin with multivitamin was highly effective in eliminating the infection and keeping the animal bright and healthy.

**Keywords:** *Linognathus*, Sheep, Goat, Ivermectin, Libya.

العدوى المتبادلة بـ *Linognathus africanus* وتأثيرها الاقتصادي على تربية

الماعز والأغنام في جنوب غرب ليبيا

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### الملخص

تم فحص ما مجموعه 180 رأساً من الأغنام والماعز للتحري عن الإصابة بطفيل القمل *Linognathus africanus*. تُعد الإصابة بـ *Linognathus* من أكثر المشاكل شيوعاً والتي تسبب خسائر اقتصادية في الأغنام والماعز في جنوب غرب ليبيا، حيث تؤثر سلباً على صحة الحيوان. تعد الإصابة بالقمل في جنوب غرب ليبيا ناتجة بشكل رئيسي عن *Linognathus africanus*.

كشفت هذه الدراسة عن حالات انتقال للعدوى بين الأغنام والماعز، مع ملاحظة إصابات شديدة بالقمل في الأغنام والماعز خلال فصل الشتاء. وترتبط العدوى بشكل أساسي بازدياد الطلب على

الغذاء في الشتاء. يتم انتقال القمل من خلال التلامس المباشر، مع سرعة انتشاره في الحيوانات المحجوزة، خاصة في الأماكن المزدحمة. لوحظت أعراض مثل فقر الدم، وفقدان الوزن، ونفوق الحيوانات الصغيرة، وانخفاض إنتاج الحليب في الحيوانات البالغة. كان إعطاء جرعة واحدة من الإيفرمكتين كافياً للقضاء على الطفيل خلال 7 أيام، كما أن الإعطاء المشترك للإيفرمكتين مع الفيتامينات المتعددة كان فعالاً جداً في القضاء على العدوى والحفاظ على صحة ونشاط الحيوان.

**الكلمات المفتاحية:** لينوجناثوس ، إيفرمكتين، الأغنام، الماعز , ليبيا

## Introduction

*Linognathus* infestation or pediculosis is a parasitic disease of sheep and goats [1], *Linognathus africanus* is a hematophagous louse [2] characterized by severe irritation that causes infested animals to rub, scratch or bite themselves with hair or wool loss in severe infection, wool in the infested animal appears yellow in color, less bright with low quality, pediculosis occurs mainly in winter particularly among housed animals causing animal anemic and weakened [3] terminated by death [4]. The most important sucking lice of sheep are *linognathus ovillus*, *linognathus africanus*, *linognathus pedalis* [5]. These sucking lice are mainly remain attached to the skin of the host for a long time with limited movement [6], these species are wingless insects that live in mammals as ectoparasites, the mouthparts of this species are adapted for sucking blood and tissue fluids, the eyes are absent or reduced, eyes are absent in *linognathus africanus* which is known as African blue lice of sheep [5]. The parasite spends its entire life in the host with short life generation intermission, the laid eggs by the female attached to the base of wool or hair where they hatch in 7-14 days and develop to an egg-laying adult in 14-21 days, subsequently that population multiply rapidly and the population peak during the winter when the wool is long [7]. Generally, lice are highly host-specific and they feed on epidermal tissue debris, parts of feathers, sebaceous secretions and blood [8]. Many strategies have been developed for applying parasiticides to sheep, showers, dipping baths, spray races and application of pour-on formulation along the mid-line of the back, one dipping in organophosphorus compounds such as dioxathion and diazinon can eradicate lice infestation and can provide four months protection against re-infestation. [9]. Resistance of lice to synthetic pyrethroids, diflubenzuron and triflumuron was observed in Australian sheep, decreased susceptibility to organophosphorus compounds was also reported in one louse population, however this seems to be rare [10].

## MATERIALS AND METHODS

This study was carried out in 6 farms in Algatroun region in the west south part of south Libya. 180 heads of sheep and goats of all ages were investigated; the study included 60 sheep, 20 lambs, 70 goats and 30 kids. There is a variation in fleece length of the animals. The study was performed from February 2018 to July 2019. Animals in most of the farms were housed, on some farms animals were overcrowded, and there was a mixing between sheep and goats in the majority of the farms. The infested animal was checked through skin and wool inspection. Animals were classified into three groups; heavily infested group (14 kids, 7 lambs, 13 sheep and 9 goat), moderately infested group (11 kids, 9 lambs, 16 sheep and 22 goat) and mildly infested group (5 kids, 4 lambs, 31 sheep and 39 goat). The cleaning of the animal house and the use of antiparasitic agents were not reported. The parasites were removed from the infested animal via hand pick and collected in small bags

and delivered to the lab for examination, the lice were examined grossly and under a light microscope. Mortality rate was measured by average of death among the severely infected animals. The cases were selected according to clinical examination including hair and wool appearance and inspection. Animals were treated with two medications including Ivermectin (bremamectin) from BREMER PHARMA GMBH, Warburg, Germany and Multivitamins combined with mineral (Oligovit) from KELA N.V. Hoogstraten, Belgium.

#### STATISTICAL ANALYSIS

Chi-squared Test of Independence was used to determine if there is a significant association between Infestation Severity and Age Group using Prism GraphPad 8 ( $p < 0.05$ ).

#### RESULTS

A total of 180 sheep and goats (60 sheep, 20 lambs, 70 goats, 30 kids) from Algatroun, south-west Libya, were examined for *Linognathus africanus* infestation (Table 1). Cross-over infection of the parasite was observed in goats, particularly in poorly nourished individuals (14.3% of goats in the heavily infested group). Infestation severity peaked during winter, with 78% of kids (11/14) and 85% of lambs (6/7) in the heavily infested group succumbing to mortality (Table 2). Clinical manifestations included anemia (evidenced by pale conjunctiva, Figure 1D), hair loss (up to 10 cm diameter, Figure 1B), submandibular edema (Figure 1C), and wrinkled skin (Figure 1A). Post-mortem examinations revealed pale muscles, serous fluid accumulation in the abdominal cavity, and generalized debility.

Heavily infested animals exhibited restless behavior, itching, and reduced milk production in adults. Wool quality deteriorated, appearing yellow and less vibrant. Lambs and kids showed growth retardation, while postpartum adults suffered from agalactia. Microscopic examination of collected lice confirmed the morphology of *L. africanus* morphology: blue-oval bodies, conical heads with five-segmented antennae, and leg structures consistent with Soulsby [5] descriptions.

Table 1. Distribution of *Linognathus africanus* infestation severity by species and age group

Species	Age Group	Total Animals Examined	Mild Infestation	Moderate Infestation	Severe Infestation
Sheep	Adult	60	31	16	13
Sheep	Lamb	20	4	9	7
Goat	Adult	70	39	22	9
Goat	Kid	30	5	11	14
TOTAL		180	79	58	43

Table 2. Infestation severity by age group

Infestation Severity	Adults (Sheep + Goats)	Young (Lambs + Kids)	Total
Mild	70 <sup>a</sup>	9 <sup>b</sup>	79
Moderate	38 <sup>a</sup>	20 <sup>b</sup>	58
Severe	22 <sup>a</sup>	21 <sup>b</sup>	43
Total	130	50	180

Different letters within the same row indicate significant differences ( $p < 0.05$ , Chi-square test)

Treatment with a single dose of ivermectin (Bremamectin®) eliminated lice in 7 days, with no parasites detected during re-inspection. Co-administration of multivitamins (Oligovit®) improved animal vitality, reducing recovery time.

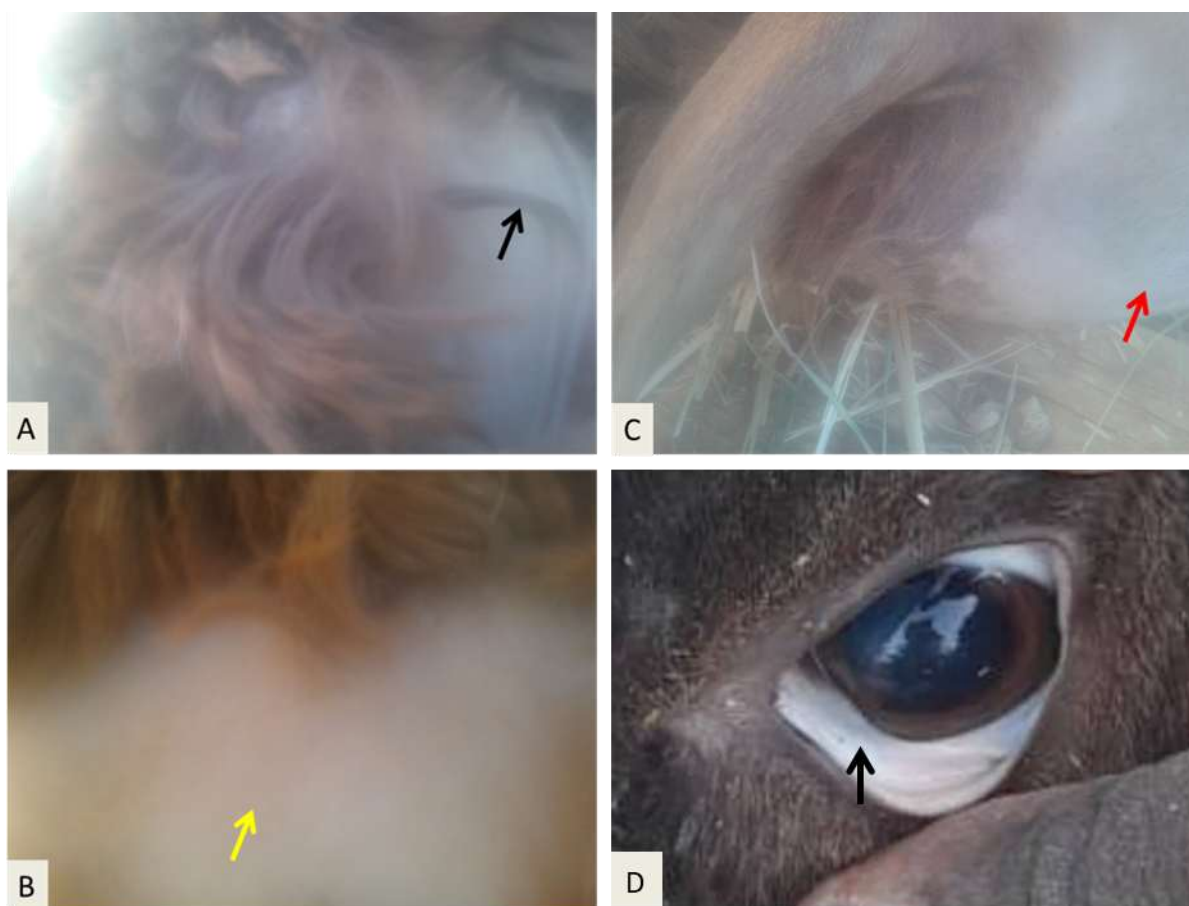


Figure 1 Heavily infested animals with African blue lice showed wrinkled skin (A), hair loss (B), submandibular edema (C) and anemia (D).

## DISCUSSION

This study highlights the adaptability of *Linognathus africanus* to cross-host transmission, particularly in undernourished goats—a finding aligned with O'Callaghan Beveridge [11]. The winter surge in infestations is correlated with increased nutritional demands and long wool growth, which provide ideal microhabitats for lice proliferation [7]. Overcrowding in mixed-species flocks exacerbated transmission, underscoring the role of poor husbandry practices in disease dynamics.

The high mortality in young animals (78–85%) reflects severe anemia and systemic stress caused by chronic blood-feeding, as reported by Guss, Koenig [12]. Submandibular edema and agalactia further emphasize the impact of the parasite on animal welfare and productivity. The economic ramifications are significant: reduced wool quality, growth delays, and milk loss directly threaten livelihoods in Algatroun's pastoral communities.

Ivermectin's efficacy aligns with prior studies [13], although the rapid recovery observed here may also stem from multivitamin co-administration, which likely mitigated immunosuppression [14]. However, reinfestation risks persist due to the parasite's short life cycle (7–14 days for egg hatching). A second ivermectin dose

after 10 days, coupled with improved nutrition and biosecurity (e.g., quarantining new arrivals), could enhance control.

These findings advocate for integrated management strategies in resource-limited settings, emphasizing seasonal monitoring, nutritional support, and routine antiparasitic use. Addressing overcrowding and improving housing conditions may further reduce transmission, safeguarding both animal welfare and economic stability in south-west Libya.

### Conclusion

This study has demonstrated cross over infection of *linognathus africanus* in goats particularly in poorly nourished goats. The infection is mainly correlated with winter time when food demand increases. Economic loss in winter is very common. Mortality in heavily infested young animals occurred due to severe anemia. Poor nutrition in winter with animal overcrowding predispose to lice infestation, particularly in long wool breeds. The Administration of Ivermectin with multivitamins was very useful for the treatment and control of lice infestation, the second dose of Ivermectin after 10 days could be beneficial to avoid re-infestation. Inspection of the newly arrived animals for pediculosis or isolation of them for 2-3 weeks after Ivermectin administration before introducing them into the flock should be considered. Good feeding and animals periodic check with the administration of Ivermectin can eradicate or diminish the incidence of *linognathus* infestation.

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