

Myiasis of wounds caused by *Lucilia sericata*: first report in Tunisia and literature review

Abstract

Human myiasis or the infestation of live humans with dipterous larvae is extremely rare in the northern hemisphere. A broad range of fly instars have been described as the etiology of myiasis, including different diptera families. One representative of the latter family is *Lucilia sericata*, which is commonly known as the green bottle fly. In this work, we provided the first demonstration of myiasis in a diabetic foot in Tunisia caused by *L. sericata*.

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Introduction

Human myiasis, is defined as the infestation of live humans with dipterous larvae which, at least for a certain period, feed on the host's tissue.¹ It is a common parasitosis in tropical and subtropical countries but extremely rare in the northern hemisphere.² According to the types of host-parasite relationship, myiasis are classified into obligatory and facultative.¹ Depending on the location, myiasis is divided into wound, cavitory and deep myiasis. Myiasis in diabetic patients falls into the wounded skin group. Different species of flies incriminated in wound myiasis such as *Lucilia* sp., *Calliphora* sp., *Sarcophaga* sp., *Fannia* sp. and *Eristalis* sp. *Lucilia sericata*, is commonly known as the green bottle fly.¹ In this work, we report the first case of wound myiasis in a diabetic foot in Tunisian patient caused by *L. sericata*.

Case report

A 60-year-old male patient from Bizerte, was admitted in the Department of Infectious Diseases of the Military Hospital of Tunis on September 2019 for management of diabetic foot wound. The patient had a type 2 diabetes for 28 years at the stage of degenerative complications, hypertension for 4 years, coronary disease and chronic renal failure for two years. Six months ago, he underwent amputation of the 2nd, 3rd and 4th toes of the right foot. After two months, he began the sessions of hyperbaric oxygen therapy (HBOT), during which, a whitish worm mobile, 12mm in length, was observed at the wound (Figure 1). The larvae were collected and transferred to the parasitology department. The species identification was made according to Zumpt criteria. These were L3 stage larvae of *Lucilia sericata*. The larva was semi-cylindrical with a tapered anterior end containing chitinous buccal hooks (Figure 2). In the posterior end there were respiratory spiracles (Figure 3) containing a narrow peritreme which forms a completely closed ring and surrounds a highly visible button. The spiracular plates had straight and parallel slits. The distance between the inner tubercles on the upper edge of the posterior cavity is approximately equal to that between the middle tubercles.

The biological assessment was without abnormalities including no eosinophilia. In addition to the mechanical removal of the larvae using

a clinical pincer, the lesion was rinsed with aqueous chlorhexidin solution and no systemic treatment was necessary. The dressing change was done twice a day. No larval infestation was observed during evolution. Wound healing has been accelerated by HBOT with good clinical progress.



Figure 1 larva of *Lucilia sericata* stage L3 (12mm).

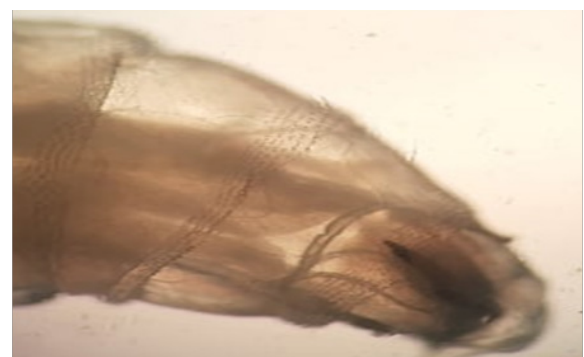


Figure 2 Anterior end of larva: chitinous buccal hooks.

Discussion

Myiasis comes from a Greek word "mya", or fly, and was first proposed by Hope in 1840 to define human diseases induced by

the larvae of Diptera.³ The larvae are deposited as eggs into living mammals where they feed and complete their life cycle. The egg requires about 8 to 12 hours hatching to conical larva and complete peritreme of posterior respiratory spiracles, and after approximately 4 to 12 days, larva develops and transforms into adult flies. The clinical manifestations of myiasis vary according to the fly species, the number of larvae and the localisation of the invaded area.^{1,3}

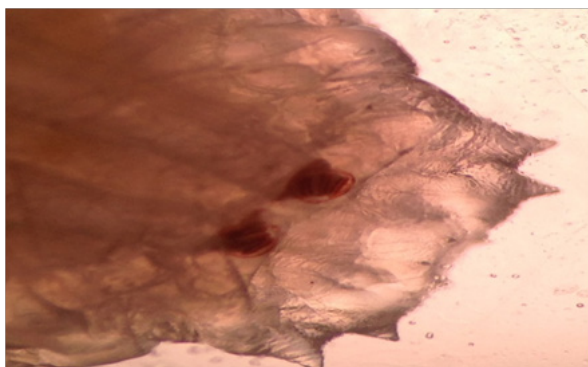


Figure 3 Posterior end of the larva: Respiratory spiracles.

The first case of myiasis caused by *L. sericata* was reported by Magen, from eyes, mouth and paranasal sinuses.⁴ We present here the first evidence of this species in Tunisia. Furthermore, many cases of myiasis remain unreported for various reasons social or cultural. A large multicenter prospective study in the United States, showed that 87% of cases of human wound myiasis were caused by flies of the family Calliphoridae, and the most common species isolated from

71% of the patients was *Lucilia sericata*.⁵ Uysal and al, reported a large series of cases of wound myiasis in diabetic foot and showed that *Lucilia sericata* was the most frequent parasitic species at second and third stage.⁶ In table 1, we summarized the recent case reports of human myiasis due to *Lucilia* in the literature.^{1,2,4,10-20}

Myiasis mainly affects the uncovered areas of the body where egg laying is easy. Worldwide, several localizations of human myiasis have been described, such as sinuses, nose, ear, eye, leg, foot, vulvar, oral cavity, tracheostomy wound, or lymph nodes. Alkaline discharges (pH 7.1 to 7.5) of the wounds were a major factor attracting flies.¹

Human myiasis occurs especially in elder, sometimes debilitated patients with psychiatric disorders, poor visual acuity.^{2,3} The mean age of patients in table 1 is 59 years old and the male gender is mostly concerned with myiasis in 56% of cases (9/16). Uysal et al. also reported male predominance.⁶ Sesterhenn et al. noted different diseases that favour insensibility of the wounds and increase the flies' contact such as otitis, diabetes, and coronary artery disease. For our patient, the neuropathic complication of diabetes was the reason for the lack of sensitivity in the wound.¹⁻³

In addition, myiasis frequently affect low socioeconomic level individuals with poor hygiene as the foul-smelling discharge from the wound attract the flies and favour the female's oviposition.^{1,2,6} Bacterial infections of wounds, exposed ulcers, tasks related to livestock rearing and alcoholism-related behaviors such as sleeping outdoors or lying on the ground, promote the risk of myiasis.⁶ The summer season has been listed many times as an important factor contributing to myiasis infestations because the density of fly population is highest.³ The current case occurred at the end of summer season.

Table 1 Overview of cases of human myiasis due to *Lucilia*

Author	Year	Country	Area	Age	Gender	Predisposing factors	Localisation	Treatment
Current case	2019	Tunisia	urban	60	male	- Diabetes - Exposed wound - Poor hygiene	Foot	- Mechanical removal - Desinfection
Hugo Martinez-Rojano ¹¹	2019	Mexico	Urban	13	male	- Unconsciousness and intubation (mechanical ventilation) - Poor oral hygiene - Low socio-economic condition	Upper buccal vestibule	- Removal of larvae - Sodium bicarbonate cleaning - Ivermectin
Hugo Martinez-Rojano ¹⁰	2018	Mexico	Urban	57	male	- Mechanical ventilation	nostrils	- Removal of larvae
Filiz Demirel-Kaya ⁴	2016	Turkey	rural	58	male	- Poor hygiene - Maxillary sinus carcinoma - Low socio-economic condition exposed wound	Maxillary-orbital region of the face	- Removal of larvae - Hydrogen peroxide Rinse - Surgical excision
Mehmet Dokur ¹²	2015	Turkey	rural	65	female	- necrotic diabetic wound	second, third, and fourth fingers of the right foot	- removal - antibiotic therapy
Ehsan ahmadpour ¹³	2015	Iran		78	female	- Comatose state	buccal cavity	mechanical removal (forceps)
Tanja Kalezić ¹⁴	2014	Serbia		87	female	- long-term mental and physical dependency - disturbed consciousness - open window without netting - hot climate (summer season)	conjunctiva	- Removal by forceps after Topical anesthetic - Antiseptic solution and oleum Chloramphenicol 1%.

Table Continued...

Author	Year	Country	Area	Age	Gender	Predisposing factors	Localisation	Treatment
Babamahmoudi, F ¹⁵	2012	Iran		74	male	- semi-conscious state - diabetic/hypertensive patient	Left nostril	- removal - washing by 2% solution of xylocaine - oral administration of 2 mg of ivermectin
Dariusz Kaczmarczyk ¹⁶		Poland		57	male	- homeless patient - poor hygienic condition	ear	- removal - antibiotic therapy
	2011	Poland		44	Female	- ear carcinoma	ear	- Removal of larvae - antiseptic dressing
Kemal Kılıç ¹⁷	2011	Turkey	rural	56	female	- Breast cancer surgery - exposed wound - Poor hygiene	Right breast	- Removal of larvae - Medical treatment - Mastectomy
Salimi M ¹⁸	2010	Iran	rural	86	male	- necrotic ulcer - elderly shepherd patient - poor hygienic condition	urethra and glans penis	- Removal of larvae - Debridement of the necrotic tissue with surgical scalpel - Povidone-iodine cleaning - antibiotic therapy - Removal of larvae - Hydrogen peroxide and metronidazole Rinse - Electrosurgical debulking
Sesterhenn AM et al ¹	2009	Germany	Urban	61	male	- Skin metastasis from oropharyngeal cancer - Summer season	Neck	- removal by nasal endoscope
Jae-Soo Kim ¹⁹	2009	Korea		76	female	- comatose state	nose	- removal by nasal endoscope
Gabriel JG et al ²	2008	Brasil	rural	72	female	- Exposed and neglected wound - Poor hygiene - Family abandonment	Cervico-facial (skin)	- Removal of larvae
		Kuwait				-Comatose state - presence of blood/mucus around the wounds -Hot/humid climate - ground floor location of the ICU	Nostrils and Right ear	- Removal of larvae

HCV: Hepatitis C Virus; ICU: Intensive Care Unit

Malignant wounds are described as a predisposing factor for myiasis especially due to *Lucilia sericata* species. Wollina et al. reported three cases of malignant wound maggot infestations in a retrospective search from 2001 to 2014 all associated with *Lucilia*.⁷

Table 1 shows that exposed, neglected wounds and poor personal hygiene, were the main reasons of the myiasis due to *L. sericata*. Also, the table shows that the localization of the infested lesion by *L. sericata* is frequently in the face in 68% (12/16) followed by the limbs and the trunk in 12.5% (2/16) each. Clinical symptoms are fever, chills, and fistula. Laboratory tests may show a predominantly neutrophilic leukocytosis and hypereosinophilia.^{3,8} The diagnosis is made by inspection of the larva in the wound. The presence of pain, movement sensation, or smelly pus must suspect the larva infestation.³

There is no suitable key for the identification of the immature stages of the fly so we used combination of several valid keys (Zumpt). In many cases because of lack of the necessary characteristics for specific morphological classification or when specimens are damaged, DNA barcoding techniques can be carried out^{3,9} such as the case of a Nosocomial pediatric Myiasis reported by Martinez et al.¹⁰ in Mexico.

In our case, the diagnosis was made in an early phase of the infestation and the patient was appropriately treated. But, a delayed diagnosis can cause critical damage, especially, if the diagnosis occurs after the larvae have penetrated into tissue.

The treatment consists in the removal of the larvae which can be facilitated by the use of 15% chloroform or ether to immobilize the larvae. In addition, this treatment should be combined with cleaning of the wound with an antiseptic solution and a daily change of dressings. Local application of ivermectin to the infested area may also be indicated.^{3,8} Oral anti-parasitic treatment is not indicated and further studies should be done to validate it.³

The use of mosquito nets is highly recommended to avoid maggots from reaching the skin. Field control of flies is of major importance and could be done by aerial spraying, hygiene practices, and destruction of animal carcasses. The sterilization of male maggots by ionizing radiation has been highly successful.^{3,8}

Interestingly, *L. sericata* is most commonly used in therapeutic purpose for various indications especially for the treatment of osteomyelitis wounds.⁸ There are three main beneficial effects

of maggot therapy on a wound: debridement of necrotic tissue, disinfection by bacterial digestion, and improvement of wound healing by stimulating the growth of granulation tissue.³

In addition, the knowledge of the life cycle of *L. sericata* can improve forensic research in both rural and urban regions. The sequence data of *L. sericata* as a specific marker for identification, appear to provide a valuable investigative tool in forensic entomology.⁵

Conclusion

In the present work, we prove that the exposed diabetic wound was the most important predisposing factor for wound myiasis. On the other hand, the poor hygiene of the patient and the insensitivity associated with diabetes, led to the development of myiasis in this patient. It can be concluded that diabetic patients with open wounds risk having myiasis infection, especially during the summer months, and the larvae can cause progressive infection of the wound.

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Conflicts of interest

The authors declare no conflicts of interest.

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