Human myiasis in rural South Africa is under-reported

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Background. Myiasis is the infestation of live tissue of humans and other vertebrates by larvae of flies. Worldwide, myiasis of humans is seldom reported, although the trend is gradually changing in some countries. Reports of human myiasis in Africa are few. Several cases of myiasis were recently seen at the Mthatha Hospital Complex, Mthatha, Eastern Cape Province, South Africa (SA).
Objective. Because of a paucity of literature on myiasis from this region, surgeons and scientists from Walter Sisulu University, Mthatha, decided to document myiasis cases presenting either at Nelson Mandela Academic Hospital or Umtata General Hospital from May 2009 to April 2013. The objective was to determine the incidence, epidemiology, patient age group and gender, and fly species involved. The effect of season on incidence was also investigated.
Results. Twenty-five cases (14 men and 11 women) were recorded in the 4-year study period. The fly species involved were *Lucilia sericata*, *L. cuprina, Chrysomya megacephala, C. chloropyga* and *Sarcophaga* (*Liosarcophaga*) *nodosa*, the latter being confirmed as an agent for human myiasis for the first time. The patients were 3 - 78 years old (median 56). Cases were most numerous during spring and summer, and were associated with underlying pathologies typical of ageing.
Conclusion. Myiasis is a more common medical condition than expected in the Mthatha region. The study shows that human myiasis is still frequently encountered in SA, and there is a need to understand its epidemiology better.

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Infestation of live tissue of humans and other vertebrates by larvae (maggots) of flies is termed myiasis. The disease most commonly occurs in the tropics and subtropics.[1-2] Clinically, human myiasis may be classified according to the location of the body invaded by maggots (ocular, nasal, oral, intestinal, etc.).[1-2] Cutaneous myiasis may be divided further into three main types: furuncular, creeping and wound myiasis.[3] Wound myiasis is the most prevalent type.[4]

Different fly species cause myiasis in different regions of the world. There are approximately 50 species of Diptera (mostly in the families Oestridae, Calliphoridae and Sarcophagidae) that regularly

cause myiasis in humans.[1] Flies of the genus *Lucilia* are the most common causes of myiasis.[1,5] Cases of human myiasis have been documented from many countries in Africa, most of them caused by the blowfly *Cordylobia anthropophaga* (Table 1). Some of the earliest cases of myiasis reported in Africa involved livestock and larvae of the family Oestridae, with several outbreaks reported between 1920 and 1960 in South Africa (SA) and Namibia.[6]

Myiasis is usually treated by removal of the larvae and treatment of associated infections. However, some maggots are deliberately used in wound treatment, technically referred to as maggot debridement therapy.[7] Maggots are known to benefit wounds by removing dead and necrotic tissue, secreting antimicrobial compounds and sometimes stimulating wound healing.[8] The commonest species used for this purpose is *L. sericata*,[7] which is distributed throughout the world, infesting humans in the Americas, Africa, Europe and Asia.[1,8]

From May 2009, surgeons working in the Mthatha Hospital Complex (MHC), Mthatha, Eastern Cape Province, SA, noted several patients presenting with cutaneous myiasis. This led to the involvement of scientists from Walter Sisulu University (WSU) and a decision to document the incidence of myiasis in the Eastern Cape, especially the Transkei region, and to identify the fly species responsible.

Methods

The study group constituted patients presenting with cutaneous myiasis and admitted between May 2009 and April 2013 to the MHC, which comprises Nelson Mandela Academic Hospital (NMAH) and Umtata General Hospital (UGH). Biodata for relevant patients were captured and included gender, age, geographical location, diagnosis and management. Examination of patients was carried out by surgeons and their diagnoses were recorded. Samples of live maggots were extracted from the wounds, which were then irrigated

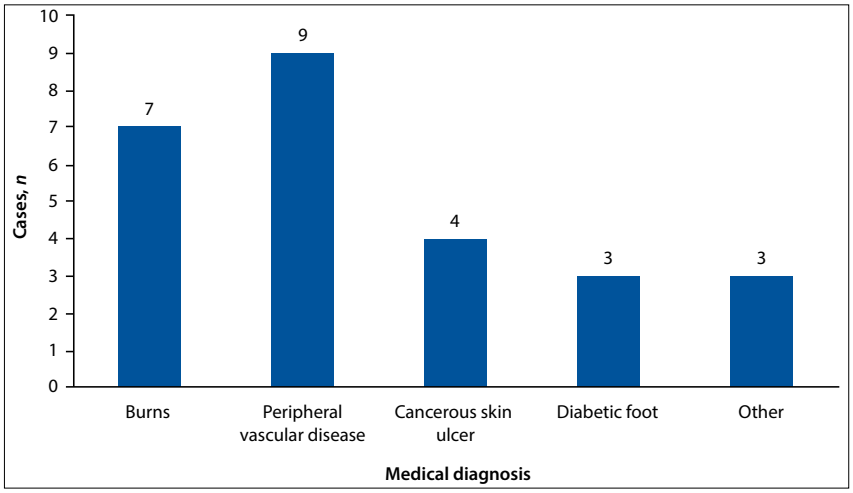

Fig. 1. Medical conditions predisposing to human myiasis.

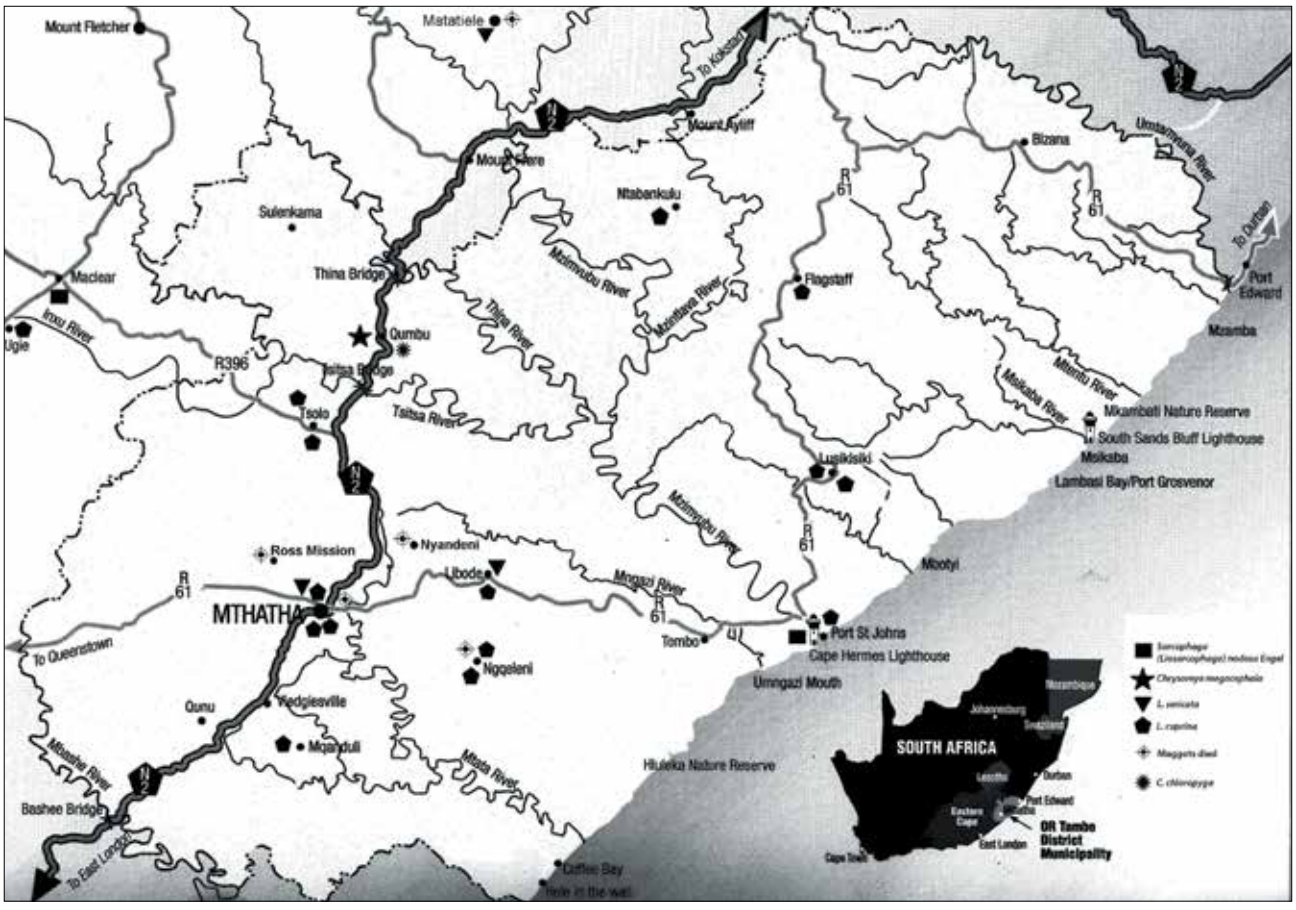

Fig. 2. Distribution of patients with myiasis, classified by associated fly species.

with weak hydrogen peroxide to kill any remaining maggots. Subsequent treatment depended on the patient's diagnosis.

Live maggots were submitted to the WSU entomology laboratory. Since identification of fly larvae is difficult, the extracted maggots were fed on minced beef in the laboratory until they pupated. The emerging adult flies were collected and identified to species level. In a few cases, maggot samples failed to survive in the laboratory.

Since adult myiasis-causing flies are poikilothermic, their activity is affected by weather conditions (mainly temperature[9]). Temperature data for Mthatha were obtained from the South African Weather Service to determine the relationship of season to human myiasis.

Results

In total, 25 cases (14 men and 11 women) of cutaneous myiasis were recorded. Cases most commonly occurred in February and March, almost all in summer and autumn (Table 2). The ages of the patients ranged from 3 to 78 years (median 56) (Table 2). The most commonly diagnosed medical condition predisposing to human myiasis in this series was lower limb gangrene due to peripheral vascular disease, followed by burns, cancerous ulcers and diabetic ulcers (Fig. 1). Anatomically, lower limb infestation was the most common (Table 2).

The distribution of patients with myiasis, classified by associated fly species, is shown in Fig. 2. Five fly species were identified from the infestations: *L. sericata* (Meigen) (*n*=3), *L. cuprina* (Wiedemann) (*n*=14), *Chrysomya chloropyga* (*n*=1), *C. megacephala* (*n*=1), and *Sarcophaga* (*Liosarcophaga*) *nodosa* Engel (*n*=2); in five cases the maggots died before reaching adulthood (Table 2). In two cases maggots belonging to two fly species were collected from one patient: *L. cuprina* and *S. nodosa* in one case and *C. megacephala* and *C. chloropyga* from the other.

The cases were drawn from a wide area of the Eastern Cape (Fig. 2), which is the catchment area that falls under the management of the MHC located in Mthatha. There was little difference between summer and autumn temperatures in Mthatha during the study period (Table 3). The highest temperature recorded for summer was 38.6°C in 2009/2010 and for autumn 38.1°C in 2012. There were no extreme weather conditions in Mthatha (Table 3).

Discussion

Human cutaneous myiasis may be more widespread in the Eastern Cape than previously reported (Fig. 2). In 4 years 25 cases were seen, representing to our knowledge the highest number of individuals with human myiasis to be reported from SA. Owing to the paucity of literature on myiasis literature from this region, it is difficult to estimate the incidence of myiasis in the country. The majority of cases were concentrated around NMAH and UGH, but given the widespread occurrence of the species involved,[1,10] there is a strong possibility that cases are seen in other medical facilities in the Eastern Cape but

Table 1. Cases of human myiasis reported in Africa, classified by infestation site

Type of myiasis	Species of fly	Locality	Reference
Ocular	*Oestrus ovis*	Libya – Aljabal Algharbi	15
		South Africa	16
		Botswana – Kalahari Desert	17
		South Africa – Onderstepoort	18
		Zimbabwe – Gwale	19
		South Africa	20
Ocular and nasal	*O. ovis*	Morocco	21
Cutaneous	*Cordylobia anthropophaga*	Cameroon	22
		Congo	23
		DR Congo	24
		Namibia	25
		Nigeria – Harcourt	26
		Nigeria – Niger Delta	27
		Senegal (3 cases)	28, 29, 30
		Sierra Leone	31
		Sudan – Gazira state	32
		The Gambia – Fajara	33
		Zimbabwe – Harare	34
		Zimbabwe – Harare	35
	C. rodhaini	Ethiopia	36
	Cordylobia spp.	South Africa – Pretoria	37
Furuncular	*C. anthropophaga*	Angola	38
		East Africa	39
		Gabon	40
		Ghana	41
		Ghana – Accra	42
		Nigeria – Aba, South East	43
		Southern Africa	39
		Tanzania – Ntagatcha	44
		Uganda	45
		West Africa	39
	C. rodhaini	Ghana	46
Gastrointestinal	*Gasterophilus* sp.	Zimbabwe – Harare	35
	Sarcophaga spp. and *Oestrus* sp.	Egypt – Minia Governorate	47
Intestinal	*Chrysomya chloropyga*	South Africa	48
Rectal	*Muscina stabulans*	Zimbabwe	35
Urinogenital	*Sarcophaga* sp. *and Eristalis tenax*	Zimbabwe	35
Sanguinivorous	*Auchmeromyia luteola*	Zimbabwe – Harare, Mutare and Hwange	35

Table 2. Details of patients presenting with cutaneous myiasis at the MHC

Age (years)	Gender	Diagnosis and anatomical part involved	Maggot collection date	Fly species
3	F	Post skin graft, chest	24 November 2010	Maggots died
15	M	Contracture release, neck	19 December 2011	Maggots died
19	M	Donor skin, right thigh	7 March 2011	*L. cuprina*
22	M	Burns, left knee	5 May 2009	*S. nodosa*
22	M	Kaposi's sarcoma, both lower limbs	21 February 2011	*L. cuprina*
24	F	Gangrenous autoamputation, left foot	4 March 2013	*L. cuprina*, *S. nodosa*
34	M	Biobrane dressing, facial burns	28 March 2011	*L. cuprina*
38	F	Ulcerative cancer, right breast	2 April 2013	*L. cuprina*
48	F	Burns, right hand	20 February 2013	*L. cuprina*
50	M	Cancer, mouth floor	29 October 2010	*L. cuprina*
51	M	Gangrene, right foot	28 February 2011	*L. cuprina*
54	M	Diabetic ulcer, right foot	11 March 2011	*L. cuprina*
56	M	Necrotising fasciitis, penis, perineum and anterior abdominal wall	8 March 2011 (afternoon)	*L. sericata*
57	M	Gangrene, right dorsum of foot	7 May 2009	*L. cuprina*
63	F	Diabetic ulcer, right foot	23 May 2011	*L. cuprina*
64	M	Amputated stump, left leg	2 March 2011	*L. cuprina*
64	F	Burns, right foot	12 May 2009	Maggots died
66	F	Lymphoedema, left leg	11 August 2011	*L. sericata*
68	M	Dog bite, left leg	18 February 2011	*L. cuprina*
70	F	Symes amputation stump, right foot	8 March 2011 (morning)	*L. sericata*
71	M	Diabetic ulcer, left foot	21 February 2011	*L. cuprina*
72	F	Cancerous ulcer, right leg	3 June 2010	*C. megacephala*, *C. chloropyga*
74	M	Gangrene, right foot	17 January 2012	Maggots died
75	F	Gangrene, left leg	24 April 2012	Maggots died
78	F	Burns, back	17 January 2012	*L. cuprina*

F = female; M = male.

Table 3. Seasonal mean (standard error of the mean), minimum and maximum temperatures (°C) obtained from the Mthatha weather station (May 2009 - May 2013) (South African Weather Service)

	Seasons											
	Summer (December - February)			Autumn (March - May)			Winter (June - August)			Spring (September - November)		
Year	Mean (SE)	Mx	Mn	Mean (SE)	Mx	Mn	Mean (SE)	Mx	Mn	Mean (SE)	Mx	Mn
2009				21.03 (0.30)	36.0	9.9	14.12 (0.36)	31.4	-0.9	17.84 (0.41)	37.5	3.5
2009/2010	22.06 (0.37)	38.6	10.9	19.72 (0.37)	36.6	3.2	14.59 (0.37)	36.0	1.1	18.83 (0.41)	38.6	4.8
2010/2011	21.76 (0.28)	35.7	12.2	18.90 (0.41)	35.5	3.2	12.49 (0.29)	34.5	-0.1	17.88 (0.35)	39.4	4.0
2011/2012	22.24 (0.31)	37.6	10.8	18.56 (0.38)	38.1	1.7	13.50 (0.36)	35.2	0.3	16.99 (0.33)	35.0	1.8
2012/2013	21.74 (0.32)	37.1	9.4	18.44 (0.42)	37.9	4.3	14.74 (0.33)	35.3	-0.2			

Mx = maximum; Mn = minimum.

are not reported. To estimate the extent of human myiasis in SA in general, there is a need to sensitise medical practitioners to document and report all human myiasis cases across the other provinces.

Several fly species are known to cause human myiasis. The commonest species in Africa is *C. anthropophaga* (Table 1), which does not occur in Eastern Cape because the climate is too cool. Outside the geographical distribution of *C. anthropophaga*, the usual causes of human myiasis worldwide are *L. sericata* and *L. cuprina*.[1] Our study has shown that *L. cuprina* is the most commonly involved species around Mthatha. *C. chloropyga* and *C. megacephala* have been reported in myiasis cases elsewhere (Table 1), so their occurrence in the Eastern Cape is not surprising. However, *S. nodosa,* previously only suspected of causing myiasis in animals,[1] was shown to cause human myiasis for the first time only in 2009.[11] The collection of two species from the same case is an unusual infestation that is rarely reported.[7] All species

are associated with decaying animal material and have wide distributions in Africa.

All the cases we recorded were cutaneous myiases. There was no obvious gender bias. Previously identified factors that predispose humans to myiasis include poverty, an immunosuppressed state, alcohol, unhygienic conditions and old age.[3] Results suggest that debilitating diseases, especially in advanced age (the elderly being prone to infection, cancer and diabetes), predispose to cutaneous myiasis. Older patients may be more frail or sleep more than younger individuals, and may fail to fend off flies that lay their eggs in open wounds.[12] Maintenance of cleanliness in both homes and hospitals may reduce the incidence of myiasis. There is therefore a need to educate people who care for the elderly on how to avoid or minimise fly infestations.

In the USA, it has been reported that myiasis infestations tend to occur in late summer (August - October).[13] In the Eastern Cape the observation was different, with 52% of cases (n=13) occurring in autumn (March - May) and 32% (n=8) in summer. In summer and autumn, the weather conditions recorded at Mthatha are favourable for fly activity and reproduction. However, in the current study, infestations were also reported in spring (n=2) and winter (n=2), before adult fly populations would have built up significantly,[14] because the generally warmer weather conditions in Mthatha allow flies to be active throughout most of the year.[9]

Only cutaneous wound myiasis was recorded in our study, probably because the surgeons involved in the study are attached to the burns and general surgery specialties and do not see patients managed by specialties such as otorhinolaryngology or ophthalmology, who are more likely to encounter nasal or ocular myiasis, respectively.

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