

## Acute haemorrhagic conjunctivitis epidemics and outbreaks of *Paederus* spp. keratoconjunctivitis ('Nairobi red eyes') and dermatitis

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An epidemic of acute conjunctivitis in Dar es Salaam in 2010 demonstrated the importance of a strong infectious diseases epidemiological surveillance network to minimise disease outbreaks. Misunderstanding of the causes and management of diseases explains the repetitive nature of acute haemorrhagic conjunctivitis (AHC) in Dar es Salaam. This paper discusses AHC

and *Paederus* spp. keratoconjunctivitis and periorbital oedema ('Nairobi red eyes') that are confused as being associated with recurrent epidemics of conjunctivitis in Dar es Salaam.

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Many cases of conjunctivitis were reported in mid-2010 in Dar es Salaam,<sup>1</sup> of a kind that has been reported in the region since the 1980s. Conjunctivitis is generally caused by an allergic reaction or infection (usually viral but sometimes bacterial).<sup>2</sup> The causes have been confused by health care personnel in developed and developing countries. Conjunctivitis epidemics in Tanzania, regardless of their causes, are called 'Nairobi red eyes' or 'Nairobi eyes'. The resulting labelling of all conjunctivitis epidemics in Dar es Salaam as 'Nairobi red eyes' is incorrect because Nairobi red eyes or *Paederus* spp. (Nairobi fly, Rove beetle) keratoconjunctivitis occurs very rarely.<sup>3,8,20</sup>

Conjunctivitis epidemics in Dar es Salaam have been due to enteroviruses 70 (EV-70), coxsackie virus A24, adenoviruses and gonococcal ophthalmia,<sup>4</sup> which cause photophobia, watering, foreign body sensation, eyelid oedema, conjunctival haemorrhages and superficial punctate keratitis (acute haemorrhagic conjunctivitis).<sup>5</sup> They are not associated with Rove beetle/Nairobi fly.<sup>3,8,20</sup>

### *Paederus* conjunctivitis ('Nairobi eyes') and dermatitis outbreaks

*Paederus* dermatitis and conjunctivitis outbreaks have been reported since the earliest recorded times. The third and fourth plagues in Exodus in the Old Testament are believed to have been due to *Paederus arferi*.<sup>6</sup> In Africa, *Paederus* dermatitis was first reported in 1915<sup>7</sup> and documented in East Africa (then British East Africa) in 1916.<sup>8</sup> The effects of *Paederus* species have been reported in Leopoldville (Kinshasa) in 1921,<sup>9</sup> in Freetown in 1925,<sup>10</sup> India in 1933,<sup>11</sup> Sudan in 1958,<sup>12</sup> and in Nyasaland (now Malawi) and Tsumeb (Namibia) in 1962.<sup>13</sup> More recently, *Paederus* conjunctivitis and dermatitis have been reported in India,<sup>14</sup> China,<sup>15</sup> Iran,<sup>16</sup> Nigeria,<sup>17</sup> Sri Lanka<sup>18</sup> and Guinea.<sup>19</sup>

In Tanzania, *Paederus* dermatitis and conjunctivitis occurs mainly during the rainy season (March and October) in the north (Kilimanjaro and Arusha),<sup>20</sup> with no cases in the coastal region, so excluding *Paederus* (Nairobi fly) as a cause of conjunctivitis in Dar es Salaam, as reported by many.

Conjunctivitis from *Paederus* is rare. The beetle affects mostly the skin after contact with the body and releasing pederin toxins.<sup>20</sup> Conjunctivitis results from transferring toxins by finger to the eyes (Nairobi eyes).<sup>16-20</sup> The rapid spread and mechanism of transmission of conjunctivitis reported in Dar es Salaam are unlike that of *Paederus* conjunctivitis, which is slow and occurs rarely.

### Rove beetles (*Paederus* spp.)

Several species of *Paederus* cause 'Nairobi red eyes'. The genus *Paederus* is widely distributed worldwide and belongs to the family Staphylinidae of the order Coleoptera.<sup>21</sup> Of the approximately 3 000 species of Staphylinidae, 600 occur in tropical and temperate climates. In the order Coleoptera, only Meloidae, Oedemeridae and Staphylinidae release vesicant chemicals that cause dermatitis and conjunctivitis (the first two release cantharidin and the latter, pederin).<sup>14</sup> The genus *Paederus* comprises more than 622 species.<sup>21,22</sup>

The name 'Nairobi fly' is applied to *Paederus sabaues* Erichson and *Paederus crebrepunctatus* that both cause dermatitis and conjunctivitis in East Africa.<sup>20,23</sup> They are morphologically similar, with a narrow body, black head, at least two abdominal segments, and the prothorax and the first 5 abdominal segments are russet coloured<sup>14</sup> (Fig. 1). They range in length from 10 - 15 mm, can fly but prefer to run, neither bite nor sting, cause irritation and blistering if crushed against the skin or eye, and are attracted to artificial light sources.<sup>16-24</sup>



Fig. 1. *Paederus* beetle ('Nairobi fly').

*Paederus* breeds in wet, rotting leaves and soil. Their population increases rapidly in the rainy season and diminishes in the dry season. In East Africa, outbreaks of *Paederus* dermatitis and conjunctivitis were mostly reported in Kenya and northern Tanzania after the 1997/1998 El Niño rains.<sup>20,25</sup>

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*Paederus* dermatitis is caused by accidentally crushing the insect against the skin, so releasing coeleomic fluid that contains pederin, a potent vesicant. This causes an acute irritant-contact dermatitis within 24 hours, which may be associated with bullae or pustulae. 'Kissing lesions' can occur after spreading of pederin to adjacent skin surfaces, usually flexural e.g. the elbow. Skin lesions heal after 10 - 12 days, with transient post-inflammatory hyperpigmentation; they may be confused with allergic or irritant-contact dermatitis, thermal burns, herpes zoster, dermatitis artefacta, herpes simplex, bullous impetigo and phytophotodermatitis.<sup>16-24</sup>

Ocular involvement is usually secondary to rubbing the eyes with hands contaminated with vesicant fluid. Oedema, conjunctivitis and excess lacrimation are common and termed 'Nairobi eyes'.<sup>20</sup> The effect of toxins is usually limited to the conjunctiva, and corneal scarring and iritis are rare.<sup>20,24</sup> Bilateral *Paederus* conjunctivitis is uncommon, providing further proof that 'Nairobi fly' is not responsible for epidemics in Dar es Salaam, where most cases were of bilateral conjunctivitis.

In East Africa, local remedies (e.g. toothpaste and mud) are used to treat *Paederus* dermatitis, though all are ineffective.<sup>20</sup> The use of cold compressed magnesium sulphate is replacing older remedies. Cases are managed as irritant dermatitis: removal of irritant, initial washing with soap and water, and application of cold wet compresses followed by steroid and antibiotics, if there is a secondary infection.<sup>16-24</sup>

*Paederus* beetles can be prevented by increasing public awareness and applying methods used in the prevention of other insect-borne diseases (insect-proof mesh, insecticides etc.)<sup>20,21,24</sup>

### Acute haemorrhagic conjunctivitis (AHC) epidemics

The magnitude of an epidemic of conjunctivitis in 2010 in Tanzania can be directly linked to enterovirus 70 and coxsackievirus A24. Numerous epidemics have been documented worldwide, and the clinical and epidemiological features of conjunctivitis in Dar es Salaam are similar to those in other countries. Outbreaks of conjunctivitis in Dar es Salaam move rapidly, and are associated with AHC rather than *Paederus* spp. conjunctivitis ('Nairobi red eyes'). A few cases of gonococcal ophthalmia were reported 1984,<sup>4</sup> but increasing numbers of cases have since been reported in Dar es Salaam and neighbouring regions, affecting people living in densely populated areas such as slums.<sup>4</sup> The epidemiology and disease trend prove that the infections are likely to be viral or bacterial, and not Nairobi red eye.

Viral conjunctivitis, with bilateral involvement with symptoms such as hyperaemia, congestion, haemorrhage, follicles, corneal involvement and lymphadenopathy, was first reported in 1909.<sup>26</sup> The first outbreak of AHC caused by enterovirus 70 was in Ghana in 1969 (named 'Apollo' as it coincided with the Apollo XI moon mission).<sup>27</sup> From 1969 to 1972, the pandemic disease spread from Ghana across tropical and subtropical Western and Central Africa to the Middle East and other parts of Asia, and remains common today.<sup>28</sup> In the Western world, the disease was reported in 1981 when the pandemic (originating from Kenya in 1980) reached South America, Central America, the Caribbean islands and the USA.<sup>29,30</sup> Owing to limited investigative facilities, the agent causing epidemics of conjunctivitis in Dar es Salaam since the early 1980s had not been determined. A coxsackievirus A24 causing AHC was first isolated in Singapore in 1970,<sup>31</sup> and outbreaks were then reported in America and in the Caribbean after 15 years of being dormant in south-east Asia.

The genus enterovirus belongs to the family picornaviridae comprising 66 human serotypes that are classified into 5 groups: (i) poliovirus serotypes 1 - 3; (ii) human enterovirus A (HEV-A), including 11 serotypes of coxsackievirus A and EV 71; (iii) human enterovirus B (HEV-B) with

38 serotypes including all coxsackievirus B, all echoviruses, EV69, EV73, and CA9; (iv) human enterovirus C (HEV-C), including 11 serotypes of coxsackievirus A; and (v) human enterovirus D (HEV-D) with only 2 serotypes - EV68 and EV70. Coxsackievirus A24 belongs to HEV-C.<sup>29</sup> This genus, together with adenovirus, is associated with epidemics of conjunctivitis all over the world.

Enterovirus infections have many clinical outcomes e.g. poliomyelitis, aseptic meningitis, hand-foot-mouth disease, herpangina and acute haemorrhagic conjunctivitis. Many epidemics of AHC are linked with influenza pandemics and other enterovirus serotypes e.g. poliovirus type 1 (wild).<sup>32</sup> AHC occurs mostly in tropical coastal areas during and after rainy seasons (in some parts of the world, AHC epidemics occur during dry, dusty, windy seasons). Large epidemics of AHC are limited to the eastern hemisphere and Africa, where overcrowding and unhygienic living conditions contribute to its spread.<sup>30-32</sup>

The disease affects all age groups, is self-limiting and is characterised by abrupt onset of ocular pain, eyelid oedema, foreign body sensation, rash, redness of eyes with subconjunctival haemorrhages and epiphora (Fig. 2).<sup>33</sup> Initially unilateral, it becomes bilateral within 24 hours and may persist for 3 - 7 days before spontaneous resolution. Mismanagement (including self-medication and consulting traditional healers) can result in corneal perforation, panophthalmitis and blindness.<sup>30-33</sup> In Asia, rare cases of polio-like paralysis have been linked to enterovirus 70 and coxsackievirus A24.<sup>32</sup>



Fig. 2. Acute haemorrhagic conjunctivitis.

In settings with limited resources, AHC can be diagnosed clinically or by excluding common bacterial infections (bacterial cultures: absence of bacterial growth prepared from the conjunctival swabs of patients, denotes viral or fungal infections), but tissue cultures and virus isolation, nucleic acid detection methods and serology testing are recommended.<sup>34</sup>

AHC epidemics can be prevented by personal hygiene, discouraging the sharing of towels and toiletries etc., frequent hand washing, and elimination of crowded living conditions.<sup>32,34</sup>

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