CASE SERIES

DERMATITIS CAUSED BY *PAEDERUS FUSCIPES* CURTIS, 1840 (COLEOPTERA: STAPHILINIDAE) IN STUDENT HOSTELS IN SELANGOR, MALAYSIA

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Abstract. We report a series of dermatitis cases caused by the staphilinid beetles, *Paederus fuscipes* Curtis, among university students staying in the residential college in Puncak Alam, Selangor, Malaysia from 1 January to 31 December 2010. A total of 360 cases (6.0%) were recorded in the Student Health Center throughout the year; the majority of patients stayed at a hostel near an oil palm plantation. Skin symptoms included erythema, edema, vesicular papules, painful blisters, burning sensation, pruritus, hyper pigmentation and peeling of skin. The commonly involved sites were the face, neck, shoulders and arms. Most students noticed the symptoms upon awakening in the morning. The patients were treated with fusidic acid cream and the symptoms resolved within 5 days. These beetles are nocturnally active and enter the room whenever a light source is available. The unintentional crushing of these beetles during sleep causes the release of its hemolymph (paederin) which is the cause of the dermatitis.

Keywords: *Paederus fuscipes*, dermatitis, student hostel, Malaysia

INTRODUCTION

Medically important beetles are mainly from the families Meloidae, Oedemeridae and Staphilinidae (Nikbakhtzadeh and Tirgari, 2008). The rove beetle, *Paederus fuscipes* Curtis, 1840, is a member of the family Staphilinidae, order Coleoptera (Li and Zhou, 2009). The genus *Paederus* is widely distributed worldwide and consists of approximately 621 species, with its only absence in Antarctica (Frank, 1988). The body sizes of the adult beetles are 7-10 mm long and 0.5 mm wide (George and Hart, 1990). They have a black head; the pronotum and abdominal segments III to VI are orange, the elytra is metallic blue and abdominal segments VII to VIII are black. The appendages are partly orange and partly black. The bright colors of *Paederus* are a warning sign (aposematism) to potential predators that they are venomous and inedible (Lott and Anderson, 2011). *Paederus* beetles breed in moist areas, wetlands and salt marshes

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among rotting vegetation; the beetles appear to be predacious (Triplehorn and Jonson, 2005). Although these insects are able to fly, they prefer to run; when running, they frequently raise the tip of their abdomen (Triplehorn and Johnson, 2005); this particular behavior is useful for identification (Vegas *et al*, 1996). *Paederus* beetles are beneficial insects in the agricultural sector because they prey on crop pests (Frank and Kanamitsu, 1987). A study conducted in Malaysia found that *Paederus fuscipes* is an aggressive leafhopper predator in rice fields (Manley, 1977).

Outbreaks of paederus dermatitis have been reported in various countries, including Argentina (Dallas, 1939), Australia (Todd *et al*, 1996), Brazil (Diógenes, 1994), China (Li, 1990; Jiang *et al*, 2008; Huang *et al*, 2009), the Congo (Vasudevan and Joshi, 2010), Ecuador (Campos, 1927), Egypt (Assaf *et al*, 2010), Guinea-Conakry (Vanhecke *et al*, 2010), India (Verma and Agarwal, 2006; Padhi *et al*, 2007; Gnanaraj *et al*, 2007), Iran (Zargari *et al*, 2003; Abbasipour and Taghavi, 2005), Iraq (Al-Dhalimi, 2008), Italy (Gelmetti and Grimalt, 1993; Veraldi and Süss, 1994), Japan (Armstrong and Winfield, 1969), Kenya (Van Schayk *et al*, 2005), Malawi (Deneys and Zumpt, 1963), Namibia (Deneys and Zumpt, 1963), Nigeria (George and Hart, 1990), Peru (Alva-Davalos *et al*, 2002), Sierra Leone (Qadir *et al*, 2006), South Korea (Kim *et al*, 1989; Kim *et al*, 1995), Sri Lanka (Kamaladasa *et al*, 1997), Sudan (Lewis, 1958), Taiwan (Huang *et al*, 2010), Tanzania (Fox, 1993; Mbonile, 2011), Thailand (Papasarathorn *et al*, 1961; Suwannahitatorn *et al*, 2007), Turkey (Sendur *et al*, 1999), Uganda (McCrae and Visser, 1975) and Venezuela (Rivas *et al*, 2001). Norton and Lyons (2002) even proposed the invasion of paederus dermatitis in Egypt by *Paederus alfierii* as the plagues that were mentioned in the Exodus.

In Malaysia, paederus dermatitis was first reported in 1919 (Raju, 2002). Mokhtar *et al* (1993) reported an outbreak among 12 medical students in Universiti Sains Malaysia at Kubang Kerian Campus, Kelantan. The second outbreak was reported in a primary school in Terengganu involving 36 pupils (Rahman and Norjaizah, 2008). In September 2002, two thousand people living in high rise flats and dormitories in Penang were affected by dermatitis caused by *P. fuscipes*.

We report a series of dermatitis cases caused by the staphilinid beetles, *Paederus fuscipes*, among the university's students who stay in Puncak Alam, Selangor, Malaysia from 1 January to 31 December 2010.

CASE SERIES

The cases of dermatitis were first noted in July 2009 at university hostels on Puncak Alam campus, Selangor (3° 12'12'' N 101° 27'5''E) which is located about 47 km from Kuala Lumpur. There are 12 student colleges on the campus with around 6,000 students.

A total of 360 cases were recorded at the Student Health Center throughout the year (Fig 1). The majority of patients stayed in a hostel located near an oil palm plantation. The student ages ranged 18-20 years. The skin symptoms included erythema, edema, vesicular papules, painful blisters, burning sensation, pruritus, line lesions, hyper pigmentation and skin peeling.

The common sites of involvement were the face, neck, shoulders and arms (Fig 2), while the other parts of body, such as the periorbital region, chest, abdomen and legs were rarely involved. Most students noticed the symptoms

Fig 2–Sites of involvement (arrow) seen in paederus dermatitis cases. A, face (chin area); B, neck; C, right shoulder; D, left forearm. Note the typical line lesion in A, B and D.

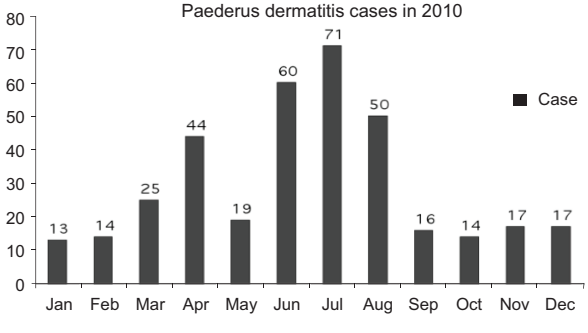

Fig 1–Total cases of paederus dermatitis recorded at the Student Health Center at Puncak Alam campus, Universiti Teknologi MARA in 2010.

upon arising in the morning. Some of the students sought medical treatment at the Student Health Center, which is located on the campus, but many ignored their symptoms or self-treated, with antiseptic cream or calamine lotion. Those who saw the medical officer at the Health Center were prescribed fusidic acid cream and the symptoms resolved within five days. In some cases linear scars and hyper pigmentation developed and persisted after treatment.

The students found a large quantity of these beetles around their residences. The

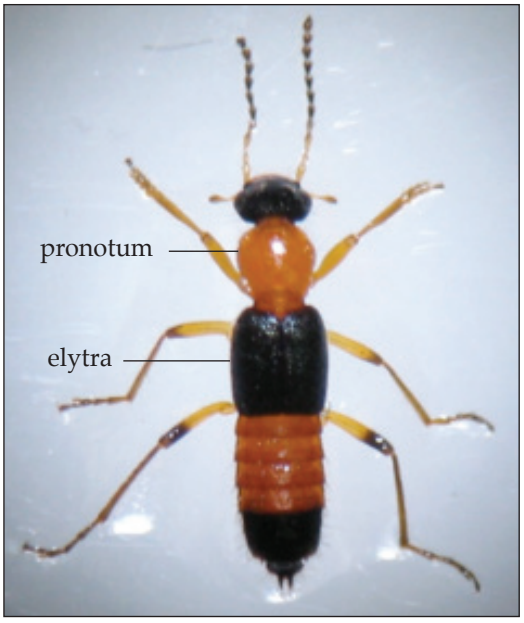

Fig 3–Adult beetle of *Paederus fuscipes* (Coleoptera: Staphilinidae). The length of elytra is longer and wider than the pronotum.

beetles were found in their rooms, in the corridors, in the toilets and on the walls. Most of the students claimed to have no previous history of skin allergies. They had been warned by the senior students regarding the skin lesions caused by an ant-like insect, which they call *semut kayap*, *semut semai* or *charlie*. However, not all students were able to recognize the *Paederus* beetles correctly.

We carried out an entomological investigation to identify the etiologic agent that caused the dermatitis outbreak. Beetle specimens were collected from the student rooms, toilets and the hostel corridors. The specimens were preserved in 70% ethanol and then sent to the last author for identification. The beetles were subsequently confirmed to be *P. fuscipes* (Fig 3).

Paederus fuscipes is identified based on the features described by Lott and Anderson (2011).

DISCUSSION

Paederus dermatitis may affect people of any sex, age, race or socioeconomic status. The risk depends on the parson's activities and the insect habitat, exposed skin areas are at higher risk (Singh and Ali, 2007). The incidence of paederus dermatitis increases during the rainy season (Mokhtar *et al*, 1993; Vegas *et al*, 1996; Frank and Kanamitsu, 1987). Rahmah and Norjaiza (2008) noted there was more rainfall in February 2005 than February 2004; this could be an explanation for the increase in these beetles. In Tanzania, paederus dermatitis and conjunctivitis occurs during the rainy season in the north (Fox, 1993). Recently, Senel and Sahin (2011) stated global warming may cause an increase in the incidence of paederus dermatitis, since higher temperatures influence the ecological dynamics of the insect species.

In our study, the peak incidence was noticed from June to August 2010. This may be due to the matriculation of new students at that time. Many new students became aware of the skin condition for the first time, having never been exposed to this kind of skin condition before. The incidence decreased after September. Most of the patients did not seek treatment at the Health Center; as they may have gotten used to the situation, ignored the symptoms or self-treated. There was a semester break at the end of the year. Hence, only few cases were reported. We assume the actual incidence was higher but many cases were not reported to the Student Health Center.

The *Paederus* beetle does not bite or sting, but releases toxic hemolymph when it is accidentally crushed on the skin; this hemolymph produces an inflammatory reaction known as paederus dermatitis or

dermatitis linearis (Gelmetti and Grimalt, 1993; Singh and Ali, 2007). We believe the students crushed the beetles during sleep since the beetles were present in their room at night, since these beetles are nocturnally active and attracted to light. Some students admitted to having contact with these beetles.

Paederus dermatitis is a self-limiting skin condition, that includes erythematous and bullous lesions on exposed areas of the body after contact with the hemolymph which contains paederin, a potent vesicant (Frank and Kanamitsu, 1987; Singh and Ali, 2007). Paederin ($C_{25}H_{45}O_9N$) is more potent than the venom of a black widow spider (*Lactrodectus*) and it is the most complex non-proteinaceous insect defensive secretion (Mullen and Durden, 2009). The synthesis of paederin relies on the activities of an endosymbiont bacterium in the female beetles (Piel, 2002); this bacterium is passed from the mother to the offspring in the eggshells, which are eaten by the emerging larvae (Kellner, 2003). Borroni *et al* (1991) found paederin caused a wide spectrum of histopathology changes, such as epidermal necrosis and blistering during the early phase and acanthosis with mitotic figures in the later phase. Ocular involvement, known as "Nairobi eyes", is usually secondary to rubbing eyes with hands contaminated with paederin. Edema, conjunctivitis and excess lacrimation are common symptoms (Fox, 1993). In some cases, paederus conjunctivitis can result in temporary blindness (Frank and Kanamitsu, 1987). An interesting account of keratitis among motorcyclists induced by *Paederus* beetles was reported by Huang *et al* (2010).

A dermatitis outbreak in Terengganu was initiated by a beetle invasion in a classroom of 36 schoolchildren, when they were attending a night class (Rahmah and Norjaiza, 2008). Similarly, an outbreak of paederus dermatitis was reported at a suburban hospital in Sri Lanka where the staffs have been working during the night shift two days prior to the onset of symptoms (Kamaladasa *et al*, 1997). In our case, the students tended to open the window at night to promote air ventilation and then switched on the fluorescent lights when they were studying. As a result, the *Paederus* beetles were attracted into the room and came into contact with humans.

Mokhtar *et al* (1993) found the face was the most common site of involvement, followed by the neck; pruritus was the most common symptom among 12 medical students. Rahmah and Norjaiza (2008) found 89% of cases presented with itchiness as their first symptom, followed by periorbital edema and erythematous vesicular plaques in 58% of cases. Sixty-six point seven percent of cases among schoolchildren presented with burning sensation. Mokhtar *et al* (1993) observed 83% of patients had a complete recovery while 16% had residual hyperpigmentation. Wang *et al* (2004) reported the scar caused by *P. fuscipes* could remain as long as nine months. The patients in our study had similar experiences. One student reported the degree of pruritus increased during sweating.

The adult *P. fuscipes* are commonly found in marshes, paddy fields and school fields (Armstrong and Winfield, 1969; Kamaladasa *et al*, 1997). In Terengganu, paederus dermatitis was reported to be associated with paddy fields (Rahmah and Norjaiza, 2008). There were no paddy fields near the hostels but the majority of affected patients came from the hostel adjacent to an oil palm plantation, suggesting the oil palm plantation might be a natural habitat for *P. fuscipes*. However,

the first author observed *P. fuscipes* on Shah Alam campus, Universiti Teknologi MARA (3°3′57″N 101°29′58″E), where it is urbanized and highly populated. We suspect these beetles are not confined to agricultural lands, but may also live in developed areas. A few cases of paederus dermatitis have also been noticed in the student hostel on the Shah Alam campus.

As a self-healing skin disorder, paederus dermatitis needs no specific treatment. Application of wet dressings and topical steroids should be sufficient. Antibiotics can be prescribed to prevent bacterial infection, if necessary (Gelmetti and Grimalt, 1993). Vasudevan and Joshi (2010) found the combination of steroid, antibiotic application and oral antihistamines was effective in treating 94% of cases. In our study, only fusidic acid cream was given to the students to prevent secondary infection. Some students did not attend the clinic but self-treated using calamine lotion, but they claimed it had little effect. The same observation was made by Fox (1993) where the patients in East Africa used toothpaste and mud to treat paederus dermatitis. These methods were found to be ineffective.

We recommend the installation of window mesh, fogging of insecticide, setting up physical traps, improving environmental sanitation and enhancing the public awareness to decrease the incidence of paederus dermatitis. This includes educating the students to recognize the *Paederus* beetle and avoid handling or crushing the insects. Washing skin exposed to the beetles with soap and water immediately can greatly diminish the effect of paederin. Rahmah and Norjaiza (2008) observed the beetle population is reduced by closing classroom doors and windows and fixing the screen to ventilation panes. Excess vegetation on the school compound should be cleared since the beetles live in this habitat. Rahmah and Norjaiza (2008) also suggested thermal fogging at the school and residual spraying on the walls of the classroom and ceiling around the lights since these beetles are susceptible to insecticides. The teachers in the school were advised to use aerosol insecticide spray whenever they detected *Paederus* beetles. Some students in our study made their own physical traps using adhesive tape to trap or immobilize beetles in their room. Adhesive can be placed near lights and trap beetles effectively at night.

Paederus dermatitis may be misdiagnosed. A student from Shah Alam campus was prescribed acyclovir. Other causes of allergic contact dermatitis (*eg*, millipede dermatitis) and liquid burns may be diagnosed instead (Gelmetti and Grimalt, 1993).

Awareness of this condition and its clinical features, especially during the rainy season, and a careful history taking (*eg*, contact with the insect) should enable the clinician to arrive at the right diagnosis. There may be variation in presentation and this problem should be kept in the differential diagnosis of dermatitis. This is the third case series report of paederus dermatitis in Malaysia. We hope to enhance concern among the medical community about the presence of this beetle dermatitis in this region.

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REFERENCES

Abbasipour H, Taghavi A. Study on rove beetles, *Paederus* spp. (Col: Staphylinidae), the agents of skin dermatitis in north of Iran. [Abstract]. In: Lee C-Y, Robinson WH, eds. Proceedings of the Fifth International Conference on Urban Pest, 2005: 487.

Al-Dhalimi MA. Paederus dermatitis in Najaf province of Iraq. *Saudi Med J* 2008; 29: 1490-3.

Alva-Davalos V, Laguna-Torres VA, Huaman A, *et al*. Epidemic dermatitis by *Paederus irritans* in Piura, Peru at 1999, related to El Nino phenomenon. *Rev Soc Bras Med Trop* 2002; 35: 23-8.

Armstrong RK, Winfield JL. *Paederus fuscipes* dermatitis: An epidemic on Okinawa. *Am J Trop Med Hyg* 1969; 18: 147-50.

Assaf M, Nofal E, Nofal A, Assar O, Azmy A. Paederus dermatitis in Egypt: a clinicopathological and ultrastructural study. *J Eur Acad Dermatol Venereol* 2010; 24: 1197-201.

Borroni G, Brazzelli V, Rosso R, Pavan M. *Paederus fuscipes* dermatitis: A histopathological study. *Am J Dermatopathol* 1991; 13: 467-74.

Campos F. El género *Paederus*, su importancia en material médica. Especies encontradas en el Ecuador. *Rev del Colegio Nacional Vicente Rocafuerte* 1927: 227-30.

Dallas ED. Coleópteros que origem dermatitis en al Republica de Argentina. Seventy International Congress of the Entomological Proceedings 1939; 2: 678-82.

Deneys JB, Zumpt F. Rove beetle dermatitis in South West Africa. *S Afr Med J* 1963; 37: 1284-5.

Diógenes MJ. Contact dermatitis by pederine: clinical and epidemiological study in Cear· State, Brazil. *Rev Inst Med Trop Sao Paulo* 1994; 36: 59-65.

Fox R. *Paederus* (Nairobi fly) vesicular dermatitis in Tanzania. *Trop Doct* 1993; 23: 17-9.

Frank JH, Kanamitsu K. *Paederus*, *sensu lato* (Coleoptera: Staphilinidae): Natural history and medical importance. *J Med Entomol* 1987; 24: 155-91.

Frank JH. *Paederus, sensu lato* (Coleoptera: Staphylinidae): An index and review of the taxa. *Insecta Mundi* 1988; 2: 97-159.

Gelmetti C, Grimalt R. Paederus dermatitis: an easy diagnosable but misdiagnosed eruption. *Eur J Pediatr* 1993; 152: 6-8.

George AO, Hart PD. Outbreak of paederus dermatitis in southern Nigeria. *Int J Dermatol* 1990; 29: 500-1.

Gnanaraj P, Venugopal V, Mozhi MK, Pandurangan CN. An outbreak of Paederus dermatitis in a suburban hospital in South India: A report of 123 cases and review of literature. *J Am Acad Dermatol* 2007; 57: 297-300.

Huang C, Liu Y, Yang J, *et al*. An outbreak of 268 cases of Paederus dermatitis in a toy-building factory in central China. *Int J Dermatol* 2009; 48: 123-31.

Huang FC, Chen WJ, Shih MH. *Paederus*-induced keratitis. *Cornea* 2010; 29: 941-3.

Jiang XF, Li Q, Liao YZ, *et al*. Investigation on the outbreak of Paederus dermatitis during drought in ChongQing. *Modern Prev Med* 2008; 2008-04.

Kamaladasa SD, Perera WDH, Weeratunge L. An outbreak of paederus dermatitis in a suburban hospital in Sri Lanka. *Int J Dermatol* 1997; 36: 34-6.

Kellner RLL. Stadium-specific transmission of endosymbionts needed for pederin biosynthesis in three species of *Paederus* rove beetles. *Entomol Exp Applic* 2003; 107: 115-24.

Kerdel-Vegas F, Goihman-Yahr M. Paederus dermatitis. *Arch Dermatol* 1966; 94: 175-85.

Kim JO, Kim SW, Kim DS, Pyun SH. Epidemiologic study of paederus dermatitis prevailing in the Midwest area of Kyungpuk province. *Korean J Dermatol* 1995; 33: 821-9.

Kim YP, Chun IK, Hur SG, Ha BS. Clinical and entomological studies of paederus dermatitis. *Korean J Dermatol* 1989; 27: 402-11.

Lewis DJ. Coleoptera of medical interest in the Sudan Republic. Proceedings of the

Royal Entomological Society of London. 1958; 33: 37-42.

Li SR. [A study on investigation of an outbreak of paederus dermatitis in the city of Yantai]. *Zhonghua Yu Fang Yi Xue Za Zhi* 1990; 24: 149-50.

Li XY, Zhou HZ. A review of Chinese species of the subgenus *Paederus s. str.* (Coleoptera: Staphylinidae: Paederinae) with description of a new species. *Zootoxa* 2009; 2083: 46-64.

Lott DA, Anderson R. The Staphylinidae (rove beetles) of Britain and Ireland. Part 7 and 8: Oxyporinae, Steininae, Euaesthetinae, Pseudopsinae, Paederinae, Staphylininae. Handbooks for the identification of British Insects. London: Royal Entomological Society, 2011: 12.

Manley GV. *Paederus fuscipes* (Coleoptera: Staphylinidae): A predator of rice fields in west Malaysia. *Bio Contl* 1977; 22: 47-59.

Mbonile L. Acute haemorrhagic conjunctivitis epidemics and outbreaks of *Paederus* spp keratoconjunctivitis ('Nairobi red eye') and dermatitis. *S Afr Med J* 2011; 101: 541-3.

McCrae, AWR, Visser SA. *Paederus* (Coleoptera: Staphylinidae) in Uganda. I: Outbreaks, clinical effects, extraction and bioassay of the vesicating toxin. *Ann Trop Med Parasitol* 1975; 69: 109-20.

Mokhtar N, Singh R, Ghazali W. Paederus dermatitis amongst medical students in USM, Kelantan. *Med J Malaysia* 1993; 48: 403-6.

Mullen GR, Durden LA. Medical and veterinary entomology. 2nd ed. Amsterdam: Elsevier, 2009: 102-3.

Nikbakhtzadeh MR, Tirgari S. Medically important beetles (Insecta: Coleoptera) of Iran. *J Venom Anim Toxins Trop Dis* 2008; 14: 597-618.

Norton SA, Lyons C. Blister beetles and ten plagues. *Lancet* 2002; 359(9321): 1950.

Padhi T, Mohanty P, Jena S, Sirka CS, Mishara S. Clinicoepidemiological profile of 590 cases of beetle dermatitis in western Orissa. *Indian J Dermatol Venreol Leprol* 2007; 73: 333-5.

Papasarathorn T, Areekul S, Chermsirivatana S, *et al*. Study of the rove beetle (*Paederus fuscipes* Curtis) causing vesicular dermetitis in Thailand. *J Med Assoc Thai* 1961; 44: 60-81.

Piel J. Polyketide synthesis-peptide synthetase gene cluster from an uncultured bacterial symbiont of *Paederus* beetles. *Proc Nat Acad Sci USA* 2002; 99: 14002-7.

Qadir SNR, Raza N, Rahman SB. Paederus dermatitis in Sierra Leone. *Dermatol Online J* 2006; 12: 9.

Rahmah E, Norjaiza MJ. An outbreak of Paederus dermatitis in a primary school, Terengganu, Malaysia. *Malays J Pathol* 2008; 30: 53-6.

Raju M. Information on rove beetle. *Seberang Perai Municipal Council Bull* October 2002. [Cited 2012 Feb 20]. Available from: URL: http://www.mpsp.gov.my/image/roveeng.pdf

Rivas LG, Parra JJ, Flores OR. Dermatitis por *Paederus* en el estado Cojedes, Venezuela. *Dermatol Venezuela* 2001; 39: 93-8.

Sendur N, Savk E, Karaman G. Paederus dermatitis: A report of 46 cases in Aydin, Turkey. *Dermatology* 1999; 199: 353-5.

Senel E, Sahin C. A warmer world means more beetles and more dermatitis. *Indian J Occ Env Med* 2011; 15: 47.

Singh G, Ali SY. Paederus dermatitis. *Indian J Dermatol Venereol Leprol* 2007; 73: 13-5.

Suwannahitatorn P, Jatapai A, Rangsin R. Paederus dermatitis: an outbreak in 266 Thai soldiers. [Abstract]. Bangkok: The Joint International Tropical Medicine Meeting 2007, 29-30 November 2007:66.

Todd RE, Guthridge SL, Montgomery BL. Evacuation of an aboriginal community in response to an outbreak of blistering dermatitis induced by a beetle (*Paederus australis*). *Med J Aust* 1996; 164: 238-40.

Triplehorn CA, Johnson NF. Borro and DeLong's introduction to the study of insects. 7th ed. Belmont: Thomson-Brooks/Cole, 2005: 409-11.

Van Schayk I, Agwanda R, Githure J, Beire

JC, Knols BGJ. El-Nino causes dramatic outbreak of Paederus dermatitis in East Africa. In: Puk Sum Low, ed. Climate change in Africa. New York: Cambridge University Press, 2005: 240-7.

Vanhecke C, Malvy D, Guevart E, Laloge V, Ezzedine K. Paederus dermatitis: A retrospective study of 74 cases occurring in 2008 in Guinea-Conakry. *Ann Dermatol Venereol* 2010; 137: 189-93.

Vasudevan B, Joshi DC. Irritant dermatitis to staphylinid beetle in Indian troops in Congo. *Med J Armed Forces India* 2010; 66: 121-4.

Vegas FK, Yahr MG, Venezuela C. Paederus dermatitis. *Arch Dermatol* 1996; 94: 175-83.

Veraldi S, Süss L. Dermatitis caused by *Paederus fuscipes* Curt. *Int J Dermatol* 1994; 33: 277-8.

Verma R, Agarwal MS. Blistering beetle dermatitis: An outbreak. *Med J Armed Forces India* 2006; 62: 42-4.

Wang ZX, Shen JL, Xia XF, Wang BT, Wang XH. An experimental observation on the toxin of *Paederus fuscipes* and its causative dermatitis. *Acta Parasitol Med Entomol Sin* 2004; 11: 107-10.

Zargari O, Kimyai-Asadi A, Fathalikhani F, Panahi M. Paederus dermatitis in northern Iran: a report of 156 cases. *Int J Dermatol* 2003; 42: 608-12.