

Review

ACID BUG (NAIROBI FLY) AN UNWANTED GUEST

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Abstract

Nairobi fly is an important pest in recent times which gained medical importance in terms of controlling of it from infecting us and the distribution of this pest across world and in India and its effects on humans and its statistical data of infection among people and species involving in it and about its morphology and habitat and chemical toxins. There are some preventive and curative measures need to be followed. It has producing and its chemical structure and its effect on the human body and also its preventive and curative measures need to be taken before prior infection.

Keywords: Nairobi fly, *Paederus spp*, Pederin, Toxin, Nairobi eye.

Introduction

In literature 1901 it was first reported by Vorderman, at the light house Anjet Kidoel he reported that the first outbreak of dermatitis took place in Jawa caused by insects that were known locally as (semoet kalong). In India they are distributed among various regions like foothills of the eastern Himalayas across Indian north-eastern states, Bhutan and Nepal are seeing one of its hottest July summers, 2.5°C higher than the normal average temperature of 25.6°C [6]. In June–July 2022, Nairobi fly dermatitis (blister beetle dermatitis) outbreak was reported in Sikkim and northern cities in West Bengal in India, which were followed by Samtse and Chhukha districts in Bhutan and Birtamode, Dharan, Jhapa and Bardibas along the south-eastern belt in Nepal. While Bhutan reported more than 300 cases, the number of cases detected in other places in the region is difficult to determine, because of lacking systematic reporting mechanism. The cases that are reported in Sikkim, India are mostly among college-going students, while cases in Bhutan were reported among both the adults and children. In the last 10 years, the higher Himalayan region has witnessed the invasion with tropical vectors. It is important to be aware of health and travel-related impacts of climate change in regions where the health system may not have adequate precautionary measures to tackle the re-emerging and re-emerging infections and vector-borne conditions. *Paederus* or rove beetles prefers warm tropical climate and also temperate climate around the world around 600 species have link with causing of dermatitis. Despite their local name, East African *Paederus* don't fly, and some other species also follow the same pattern. [7,8]. Most of the species prefers moist soil, decaying matter, and around fresh water areas and can be attracted towards various light sources that are miles away from them and its population increases rapidly at the end of rainy season and decreases with the onset of dry weather conditions. *Paederus* beetles sometimes fly in large numbers as a swarm during warm nights, particularly after heavy rains or floods. [7,9]. Two species belonging to rove beetles of genus *Paederus* includes the fly namely

OPEN ACCESS

CITATION

Sai Thilak K, D. N. Parmar and R. D. Dodiya. Acid bug (nairobi fly) an unwanted guest. *AgriSustain-an International Journal*, 2024, 02(2), 18-23.

ARTICLE INFORMATION

Received: June 2024

Revised: June 2024

Accepted: July 2024

DOI: 10.5281/zenodo.13834767

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Nairobi fly. They are native of east Africa evolved from Tanzania [1]. These bugs consist of toxic substance which is corrosive called as “pederin” which leads to chemical burns when it comes in contact with the human skin [2,3]. Due to its high concentration when it comes in contacts with human skin it’s replaces the cell fluid of human skin cells that leads to burning of skin at the point of infection.

Taxonomic classification:

Kingdom	:	Animalia
Phylum	:	Arthropoda
Class	:	Insecta
Order	:	Coleoptera
Family	:	Staphylinidae
Genus	:	<i>Paederus</i>
Species	:	<i>eximus, sabaeus & crebinpunctatus</i>

Morphology:

Adult bugs are mostly red and black in colour and it measures about 6-10mm in length and 0.5-1.0mm in width [4]. lower part of abdomen possesses black colour along with head and elytra also is in black colour, thorax and upper abdomen is in red colour [5]. They posse's slender abdomen with three pairs of legs. And lack of wing in most of the situation. Releases acid from the anal end. High in number during the crop harvesting period.



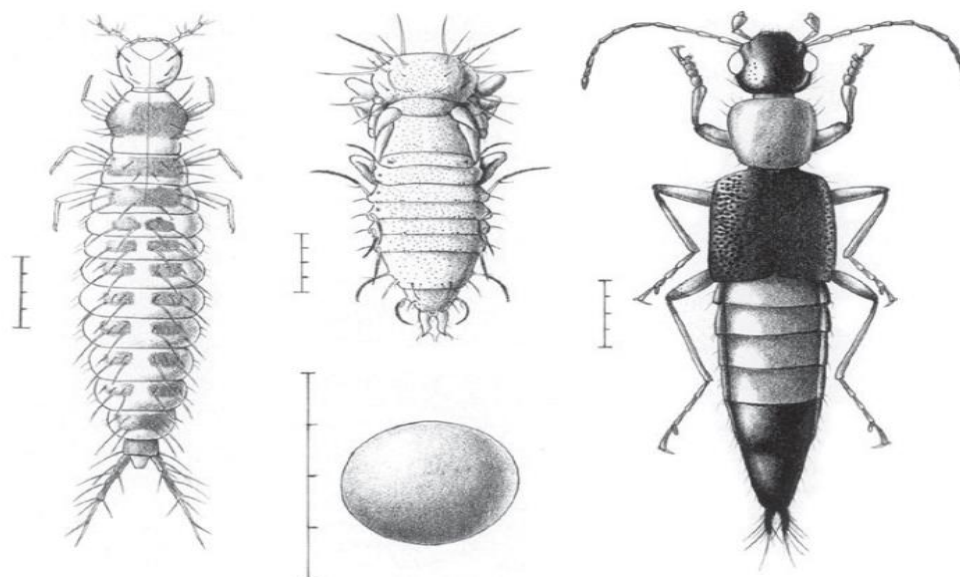
Paederus in juba South Sudan (US Army Public Health Command)

Biology:

The bugs mostly prefer the moist habitat for survival and spread and they are often beneficial in agriculture perspective because they predate on crop pest that incur losses to field crops [5]. Heavy rainfall due to El-Nino events, creates the favourable conditions for their population to multiply exponentially. Some of the outbreaks that took place in 1998, [3] 2007, 2019, and 2020.

In India mainly the species that are found are *Paederus melampus* Erichson. Further, the toxins have been noticed to be present in very few of the species in the subtribe, most of which belong to the genus *Paederus*, whereas their presence could not be demonstrated in some species of the subtribe that have been tested. For the present, we must conclude that the toxins are absent from some, perhaps most, species of the subtribe. The toxins are described under Pederin.

They are oviparous which has 4 stages in life cycle i.e, egg, larva, pupa and adult. And the feeding habits of larva and adults differs from one another and typically the adults' release the acid after they developed functional poison sac.



Paederus is a significant predator that is linked to numerous crop pests globally and could aid in the biological management of these pests. Adults display cannibalism, necrophagy and polyphagy.[23] Their primary sources of food include other insects, moths, live tadpoles, soil nematodes, and decomposing organic debris; they do not consume plant tissues. [24, 25]

Human Infection:

Paederus dermatitis and its chemical composition are like more over half of all known living things on Earth are insects, and they have a significant impact on human existence. They could bite, sting, or spread disease to people. A few toxins found in insects like *Paederus* cause irritation to the skin.



Phototaxis Movement:

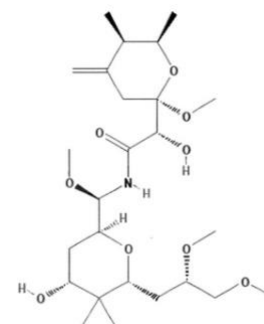
When flying or running, *Paederus* beetles show positive phototaxis [19] and show a preference for long wave ultraviolet and white light over orange and yellow light, which they are comparatively insensitive to. [20, 21] An outbreak of *Paederus dermatitis* was stopped in Tanzania when mercury lights that emitted UV light were replaced with incandescent bulbs that emitted yellow light [22].

Infection begins as 10cm diameter erythematous patch with no proper border within 24 hours of infection and it enlarges with grey border with necrotic centre. And it effects the body parts that are usually not covered by clothes. After noticing the lesion within 24 hrs it causes only mild discomfort and after 2 days

of infection the pain increases significantly with a large central vesicle surrounded by small vesicles scattered in patch along its circumference.

The bugs neither sting nor bite, pederin that is present in its haemolymph is a potent toxin that leads to blistering and *Paederus dermatitis*. Chemical structure of pederin consists of two tetrahydropyran rings with chemical formula ($C_{25}H_{45}NO_9$). Pederin is a complex non-proteinaceous secretion and that is not produced by the beetle itself but the endosymbiont living inside it namely bacteria *Pseudomonas aeruginosa* species, produces it.

[8,10]. It releases toxin when the bug is crushed or manually disturbed during the night time, or when sleepers unintentionally wipe off the insect from their faces. Here people are advised to just to blow the insect when it comes in contact with skin without disturbing it [3,5]. and it takes 7 to 28 days for healing of infection. There is no evidence of secondary transmission from the primary infection when it's get contacted. In Africa the infection mostly takes place in preorbital area with associated conjunctivitis known as "Nairobi eye". The mucosal surfaces are relatively less affected by pederin comparing with the infection caused on the skin, if the eyes get infected it causes intense pain and even temporary blindness [11]. It concluded that the upper dermal layers are more effected with pederin than the basal and supra basal layers after examination of pederin toxin because below layers undergoes mitotic changes and apoptotic changes, such as chromatin condensation and DNA fragmentation [12].



Pederin chemical structure. National Centre for Biotech information. U.S National Institutes of Health

Diagnosis of Symptoms:

The following criteria are used to confirm the infestation of *Paederus dermatitis* based on the previous history of infection and clinical symptoms. Histopathological are not considered as diagnostic features and are not included.

1. skin eruptions and burning and itching sensations at the place of infection.
2. linear or streaky pattern of lesions with red marginal lesions.
3. It's an endemic type of infection.

Types of Lesions and Pattern of Infection:



Preventive and curative measures:

Preventive measures like reduce the use of bright lights, especially fluorescent and neon lights and avoid resting and working under it and use insect electrocution devices (Eg: Bug Zappers) and use ultraviolet light to attract insects [13,14,15,16]. Use long sleeve shirts and hats during the night time to reduce the chances of contacting insects and use of wired mesh proof doors and for windows to prevent the entry of beetles inside the house and removal of decayed vegetation around house which acts has a breeding ground. And if a person came in contact with *Paederus* beetle on his clothing or skin, the person should gently shake or brush it off with something other than his or her hands [8,16]. Usage of mosquito light traps, sticky traps, glue boards, or shallow containers filled with water and a few drops of dishwashing detergent should be set out at night under bright light sources to trap adult beetles. Pederin is known to be soluble in alcohol, so be careful when handling alcohol that has been used to preserve *Paederus* beetle specimens [17]. Prevention involves wearing full sleeve clothing, using bed nets and avoiding sitting under bright light spots at nights.

Management measures like treatment includes washing the affected skin, cold and wet compression, antihistamines, topical steroids and topical antibiotics in cases of superinfection and also application of calamine lotions or topical corticosteroids [18].

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