



Histopathological changes in experimental infestation of *Paederus fuscipes* in rats

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Keywords

Beetle, *Paederus fuscipes*, Dermatitis, Histopathologic, Rat

Abstract

The genus *Paederus* consists of approximately 621 species associated with outbreaks of dermatitis. Our aim was to determine gross and microscopic changes induced by *Paederus fuscipes*. Adult *P. fuscipes* beetles were collected from infested house and then sent to laboratory. In the first group beetles were placed on the shaved parts over the shoulders of each rat. In the second group smashed insect materials were rubbed over the ear of examined animals. Gross changes after 12 hr were noticed as erythematous papules and in 72 hr the red elevated area became bigger and swollen. Microscopic examination revealed edema and mild infiltration of inflammatory cells (lymphocytes and eosinophils) after 12 hr, cell swelling and vacuolar

degeneration in basal and squamous cells after 24 hr, but by 72 hr the epidermal cells were necrotic with intense accumulation of fluid and vesicles formation. Gross and microscopic changes were compared between rats exposed with squeezed beetle materials and rats exposed to live beetles. The typical gross changes were maculopapules on the skin that histologically showed dermal edema and infiltration of lymphocytes and eosinophils.

Abbreviations

P. fuscipes: *Paederus fuscipes*

H&E: Hematoxylin and Eosin

Introduction

The *Paederus fuscipes* Curtis or rove beetle belongs to family Staphilinidae, order Coleoptera [1]. The genus *Paederus* is widely distributed worldwide and consists of approximately 621 species [2]. These beetles are usually 7-10 mm long and 0.5 mm wide when they are adult [3]. Their bright color is a warning signal for the potential predators [4]. *Paederus* beetles breed in moist areas, wetlands and salt marshes among rotting vegetation [5]. Although these insects are able to fly, they prefer to run; when running, they frequently raise the tip of their abdomen. This makes them easier to be recognized [6]. *Paederus* beetles have been associated with outbreaks of dermatitis in various countries, in Japan [7], Malaysia [8], Sri Lanka [9] and Iran [10,11]. The outbreak of *Paederus* dermatitis described both in southern [10] and Northern [11] of Iran. The *Paederus* dermatitis usually occurs in hot weather and causes numerous cases of cutaneous lesions every year. The lesions are a kind of contact dermatitis which are characterized by one or more lines of red, swollen, and blistered. The biology underlying these skin reactions are not fully understood, but inflammatory reaction is thought to be caused by a substance called pederin, when the insect is crushed on the skin. These lesions are peculiar to *Paederus* and knowing its pathological and clinical features will prevent misdiagnosis [12]. The present study was performed to determine gross and microscopic changes induced by experimental dermatitis by *P. fuscipes*.

Results

The gross appearance of the skin of rat exposed to *P. fuscipes* after 12 h showed erythematous papule and in 72 hr the red elevated area became bigger and swollen. Microscopical examination revealed edema in dermis with stratum corneum detachment from epidermis in 12 hr (Figures 1 and 2). Variable degree of epidermal spongiosis and vesicle formation with mild infiltration of inflammatory cells was evident after 24 hr (Figure 3). Squamous cell swelling eventually led to necrosis and bigger volume of fluid filled the space under stratum corneum in 72 hr (Figure 4).

Discussion

Paederus dermatitis may affect people of any sex, age, race, or socioeconomic status. The risk

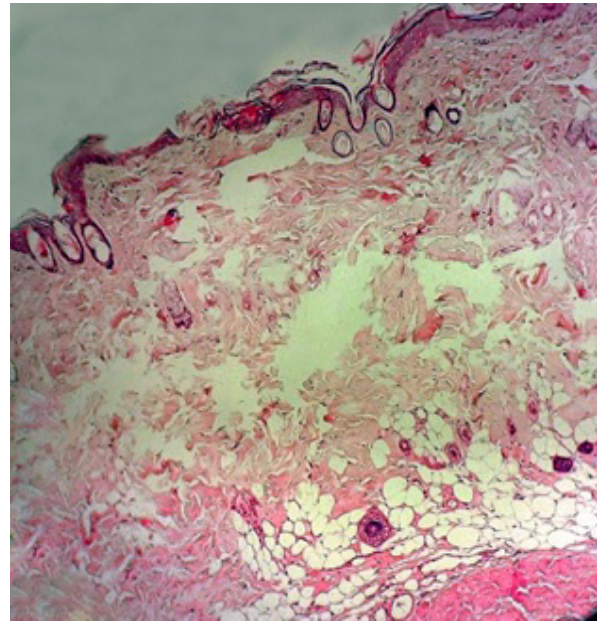


Figure 1
Sections from rat skin tissue showing edema in dermis 12 hr after exposure to *Paederus fuscipes*. H&E, 100x.

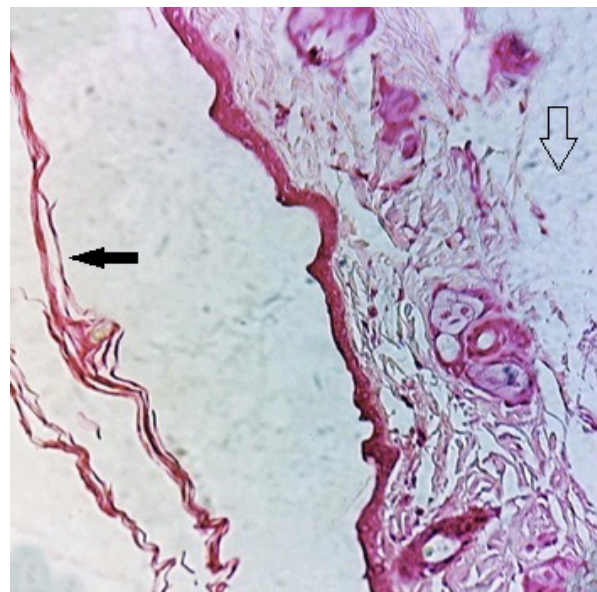


Figure 2
Skin tissue from rat 12 hr after exposure to *Paederus fuscipes* showing stratum corneum detachment from epidermis (black arrow) and edema in dermis (white arrow). H&E, 100x.

depends on the person activities and the insect habitat; exposed skin areas are at higher risk [14]. The incidence of *Paederus* dermatitis increases during the rainy season and since this organism is nocturnal, it explains the timing of skin lesions [12].

Insects produce tissue reactions by different means, some bite and some of them with spe-

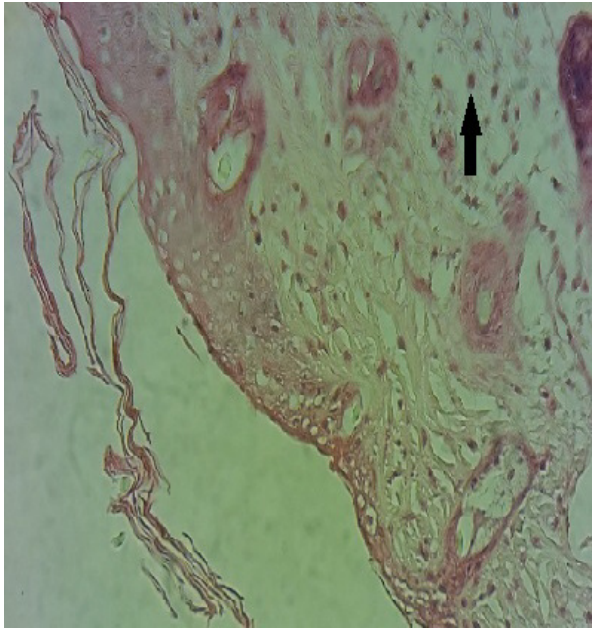


Figure 3
Spongiosis and stratuum corneum detachment from epidermis with dermal infiltration with lymphocytes (black arrow) H&E, 200x.

cial body part sting and inflict skin injuries with their venom, but some such as beetles, locust, and moths cause skin reactions with their body fluids feces or body parts.

The *Paederus* beetle does not bite or sting, but releases toxic hemolymph when it is accidentally crushed on the skin; this hemolymph is called pederin which is responsible for an inflammatory reaction known as *Paederus* dermatitis [13, 14].

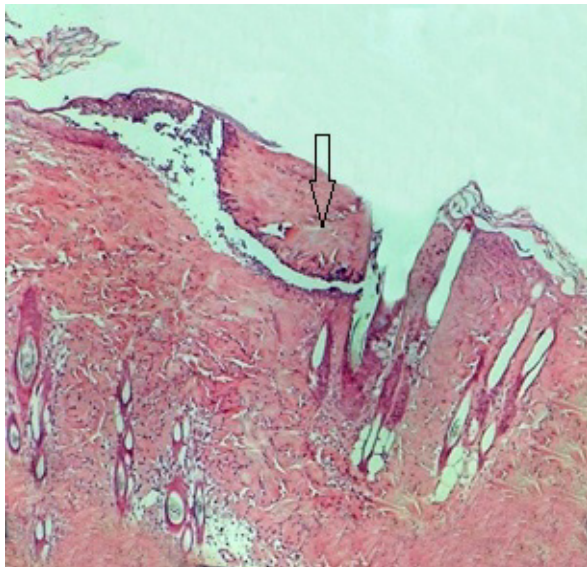


Figure 4
Skin tissue from rat 72 hr after exposure to *Paederus fuscipes* showing loss of epithelium and necrosis (white arrow). H&E, 100x.

In this study gross and microscopic changes of *Paederus* dermatitis mainly were observed in rats that exposed with squeezed beetle materials in comparison with the group that live beetles were used.

The typical gross changes that were observed were maculopapuls on the skin that histologically showed dermal edema and perivascular infiltration of lymphocytes and eosinophils. The severity of lesions depends to the species. Different types of *Paederus* sp. are more toxic and thus produce more severe lesions. The mechanisms that lead to these skin reactions are not fully understood, but are probably caused by the release of epidermal proteases and can be concluded that type I and type III hypersensitivity reactions are involved. The pathological findings are similar to the other insect bite skin reactions such as mosquito bite, black flies, louse, bed bugs and fleas [15-18].

Similar gross signs and histological changes reported by others. Intracellular accumulation of fluid results in cytoplasmic swelling of keratinocytes, and if swelling is severe, the keratinocytes may rupture resulting in microvesicle formation [10, 19, 20]. In conclusion, this study confirmed that *P. fuscipes* dermatitis is induced by crushing body materials of the insect on host body.

Materials and Methods

4.1. Beetles

Wild-caught adult *P. fuscipes* beetles were collected from infested house from Sari, Mazandaran province of Iran. Beetles transferred into dry plastic vials containing a few fresh



Figure 5
Plastic rings placed over the shoulders containing *Paederus fuscipes* beetles.

grass leaves, and were covered by a lid containing several minute holes. Vials were properly kept under optimal condition at room temperature for a few days in order to maintain beetles alive, and then they were sent to the laboratory and kept in laboratory condition until use [21].

4.2. Animals

Adult male rats (250 g weight) obtained from The University of Urmia central animal breeding house were used in this experiment. Rats were anaesthetized by intraperitoneal injection of Ketamine hydrochloride (200 mg/kg). Beetle were applied to a clipped area over the shoulders of each rat and contained within gauze-covered light plastic rings (2.5 cm diameter) glued to skin [22] (Figure 5). In the second group smashed insect materials were rubbed over the ear of examined animals.

Gross changes in infested animals were recorded. Rats were euthanized 12, 24 and 72 hr after infestation and the skin samples from the infested rats were collected in 10% buffered formalin and processed for histopathology. Paraffin blocks were made; 4-5 micron sections were cut and stained with hematoxylin and eosin. They were examined under light microscope and observations were recorded.

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Author Contributions

All authors contributed to the design of study, data analysis and manuscript preparation.

Conflict of Interest Statements,

The authors declare that there is no conflict of interest.

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