Insects are part of the phylum of animals called Arthropoda. The word insect comes from the Latin word insectum which means “separated into segments” such as head, thorax and abdomen. After getting in contact with insects, people present a wide range of reactions, local and/or systemic, whether caused by insect bites or venom injections, sucking blood or exposure to insect’s body and their secretions [1, 2]. Following a bite, the venom may cause local toxic reactions at the bite site. Massive local reactions, as well as life-threatening anaphylaxis are based on the allergic reaction mediated by IgE antibodies [2]. Clinical manifestations include erythema, wheals, papules and blisters followed by intensive pruritus [1], as well as angioedema [3]. Apart from allergic reactions, severe clinical complications may occur, such as acute interstitial nephritis, acute toxic hepatitis and acute myocardiitis [4], rhabdomyo-
olysis and hemolytic-uremic syndrome following fire ant bite [5, 6]. Furthermore, following insect stings people may develop some atypical reactions, for instance exotropia, diplopia, optic neuritis, neurological disorders, Myasthenia gravis, Guillain-Barre syndrome, anxiety and insomnia, or even anaplastic large cell lymphoma [1, 7–11]. Insects are also vectors in transmission of many diseases such as malaria, leishmaniasis, tularemia, typhus, trypanosomiasis [1, 12].

During the last few decades, more frequent occurrence of Simulium erythrocephalum bites have been noticed in Serbia. Simulium erythrocephalum is an aggressive, anthropophilic kind of simulium, whose bites result in many skin disorders in humans. Skin changes are mostly located on lower extremities, and besides edema and erythema lesions may have a hemorrhagic component [1, 13–15].

In order to prevent exposure to insects, protective clothing as well as physical protection with a net, insecticides and repellents are used. The treatment depends on the severity of clinical manifestations. Symptomatic therapy with local application of heat, antihistamines and corticosteroids is commonly used. In the case of anaphylaxis it is essential to monitor the patient appropriately and implement resuscitation measures [1, 2, 16].

We present a case series indicating the significance and frequency of Simulium erythrocephalum bites in Serbia, as well as its effects on human health.

Case Series

A total of 30 patients who presented a local reaction to an insect bite were examined in the period from April to July, 2006, at the Clinic of Dermatovenerology Diseases, Clinical Center of Vojvodina. The data collected from medical histories, clinical manifestations on the skin, and consultations with entomologists from the Faculty of Agriculture, revealed that the skin lesions were mainly caused by insect bites of a fly known as Simulium erythrocephalum. In all patients the skin lesions were located on the extremities, mostly on lower legs. The number of bites varied from two to more than ten. All patients were either outdoors on the riverside, or their residence was nearby the Danube river. The clinical examinations showed that the bite sites were surrounded by areas of purpura and more or less evident edema, accompanied by pain and itch (Figure 1). In most cases, erythema affected a large skin area (Figure 2). The therapy included desloratadine tablets at a dose of 5 mg twice a day during ten days, while in more severe cases prednisone tablets were used at a dose of 20 mg once a day during five days, as well as fluocinolone acetonide; compression and limb elevation were recommended. In most cases the skin lesions regressed within a week, but in some patients they lasted for several weeks. None of the patients developed a systemic reaction, such as anaphylaxis or life-threatening conditions, so resuscitation was not necessary.

Discussion

Simulium erythrocephalum is an insect which belongs to the family Simuliidae (genus Simulium, order Diptera, suborder Nematocera). This group of insects is relatively small and it has 2.151 species worldwide [1, 17]. It was first described by De Geer in 1776, in Sweden, as Tipula erythrocephala [18]. During the last decades, many reports have been published that indicate its ubiquity in Europe, from Scandinavia in the north, Ireland, Great Britain, France, Spain in the west, Lithuania and Russia in the east [18–22], while in Serbia its endemic habitat is near the town of Golubac, which explains its broadly accepted name “Golubac fly” [14, 23].

Simulium erythrocephalum is a black fly with wide wings, about 3–3.5 mm in size (Figure 3) [13]. Its life cycle occurs in running water, such as streams, streamlets and rivers where the larva is fed by water filtration. Hydrometeorological conditions have a crucial impact on the development of these
insects. It is known that Simulium erythrocephalum is most active in spring and summer, while high water level and low temperatures are to the benefit of their progress. Preferred nutrition differs among various species of Simulium, some of them expressing severe anthropophility. Females typically feed on blood and their saliva contains histamine responsible for inflammatory reactions in humans. Males do not bite and they feed on nectar [13, 24].

Following a Simulium erythrocephalum bite, humans present with local and/or systemic reactions. The bite itself is painless, with gradual increase of extreme pain accompanied by itch and formation of the central crust. Furthermore, erythematous area and edema with appearance of ecchymosis, nummular eczema and nodules on lower extremities may also appear [1, 14, 15]. Our patients had erythema and edema as well as punctiform and confluent hemorrhagic lesions associated with intense pruritus. The majority of bites were located on limbs, especially on uncovered body parts, which is in accordance with literature data [14]. Systemic reactions in the form of fever, weakness and generalized lymphadenitis may also appear and cause “black fly fever” [15], which was not detected in our patients, so hospitalization was not necessary and all patients completely recovered after several weeks. Apart from the previously mentioned conditions, Simulium erythrocephalum can be a vector in transmission of a disease known as ‘river blindness’ (onchocerciasis), tularemia and myxomatosis [1, 15, 22, 25].

Throughout the last few decades, there have been several reports on massive Simulium erythrocephalum attacks on humans in Serbia, mostly in the region near the Danube, but also along the Tisa river where around 2,000 clinical cases of bites were registered in humans [14, 26, 27].

On the territory of the city of Novi Sad, in spring of 1999, there was a massive appearance of Simulium erythrocephalum related to high water level of the Danube [24], but no epidemiological data are available on the exact number of patients. A team of experts from the Faculty of Agriculture, University of Novi Sad, pointed to a higher risk of black fly bites in the circumstances when the Danube water level is above 450 cm, in the vicinity of the river, rural and semi-rural regions within 5 km from the water [24, 28].

Apart from its extreme anthropophilic character and high impact on human health, Simulium erythrocephalum also has a role in veterinary medicine. Its bites in animals may cause toxic allergic reactions resulting in frequent animal mortality and significant livestock losses [24, 29]. Simulium erythrocephalum may also transmit a parasite from the genus of Leucocytozoon that infests birds [23].

**Conclusion**

Preventive eradication of the Simulium erythrocephalum in the larval stage along the Danube is almost unfeasible because of the water speed, breadth of the river, bridges, barriers for air-treatment, harmful insecticides, and the volume of water that flows in the unit of time. The available preventive measures may include removal of underwater plants and stones in the Danube and all its tributaries, use of repellents, avoiding dark-colored clothing and application of antiperspirants and fragrances.

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