THE USE OF SUPERBRIGHT LIGHT EMITTING DIODES IN THE STUDY OF POPULATION DYNAMICS OF AQUATIC AND SEMI-AQUATIC BEETLES (INSECTA: COLEOPTERA)

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Currently, about 12.600 Coleoptera species have aquatic (True Water Beetles) representatives and are to be considered as aquatic (False Water Beetles and Phytophilous Water Beetles). [1]. They form a combined ecological group that includes representatives of all Coleoptera suborders (Adephaga, Polyphaga, Myxophaga, Archostemata). Each year, new taxons are described within this order. Aquatic and semi-aquatic beetles can serve as bioindicators of water quality [2]. The use of light traps is one of efficient methods to study the insect fauna composition. As a rule, either mercury-vapour lamps or fluorescent lamps are used as a light source to attract insects. However, they are not quite feasible for collecting samples in remote places because of their power demands which limit their mobility. Conversely, the use of light-emitting diodes (LEDs) reduces power consumption by 50–60%; moreover, this light source is more environmentally friendly [3], portable and can be adapted to the trichromatic colour vision of insects. Considering these requirements, trap applicators with super bright LEDs were developed in the ARRIBPP (All-Russian Research Institute of Biological Plant Protection) to collect insect samples [4].

The sample collection was conducted in June-September 2018 in the ARRIBPP grounds located in Krasnodar boundaries (45°02'56.5"N 38°52'22.1"E). The trap was placed at a height of 1.7 m.

A trap applicator was used to attract insects. Its structure includes a lid with a solar battery that is attached to two mutually perpendicular plates fastened to a light emitter cone. A cylinder with an imago container for insects caught forms the lower part of this device. There are light sensors which contain photosensing elements on the backside of the lid. Strips with LEDs of ultraviolet light (365–400 nm) in the upper part and LEDs of white light in the lower part (colour temperature: 5000 K) were used as guides toward the imago container to make insects come down into it. The LEDs were automatically activated at dusk thanks to the photosensing elements. At dawn the samples were collected from the trap and the species richness (S) was evaluated by using the Menhinick's index D that is the number of species divided by the square root of the number of individuals in the sample: $D = S/\sqrt{N}$; where S – the number of different species и N – the total number of individuals [5]. In parallel, the Margalef's diversity index was used: $\alpha = (S - 1)/\ln N$; where S – the number of species, N – the total number of individuals in the sample [6]. In total, 1252 specimens of Coleoptera were collected.

Nearly a third of the species diversity (33.8%) and the greatest part of the material collected (85.3%) were aquatic and semi-aquatic beetles which shows a certain selectivity of the trap applicator. The presence of artificial bodies of water built in the 1960s at a distance of over 100 m and the Kuban river 1 km away could have played an important role in obtaining these data.

Research conducted to date showed that the potential of using insect traps with superbright LEDs to collect coleopterans is rather good and they can be used as an eco-friendly technique for attracting insects. An important role here plays the selection of locations where the traps will be placed because the area within the city limit has light pollution that may compete with our traps.

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