The Mystery behind Burrowing of Mole Crickets

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This study aims to investigate the physiological characteristics and burrowing behavior of mole crickets, Gryllotalpa orientalis. The movement of thirty adult mole crickets on transparent hydrogel soil during burrowing was recorded in slow motion. The Fundamental Earthmoving Equation by Reece was used to analyze the leg motion characteristics. In one cycle, it stretches the forelegs and thrusts them into the ground, extends its forelegs and sweeps the dirt sideways while rushing forward. Other behaviors are also observed, for example, the interaction with hard objects, head rotation, and turn around. By modelling terrain's radius of curvature resulting from excavation, the relationships between the angle and time, angular velocity and time while extending its forelegs and a weak relation of forelegs extended angle and depth were disclosed. The anatomic studies showed that three body parts consist of the thoracic, abdominal parts, and segmented forelegs called coxa, femur, and tibia have similar function as a hinge joint. The expanding motion of forelegs was important in terms of both energy and time spent. The mole crickets had to create a sufficient cavity size as time for the slippage of the soil and the time when head moved down to the cavity. From the accumulated data, the rotational motion equation was proposed to determine the power of the underground excavation equipment. The impact of nature inspired algorithms on motion characteristics of the appendages of mole crickets during burrowing influences design of tunneling mechanisms and underground excavation equipment. Keywords: mole cricket, burrowing, forelegs, algorithm.

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