

鼯鼠爪趾几何结构量化特征分析 Quantitative Characteristic Features of Geometric Structures of Claws of Mole Rat

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摘要: 土壤洞穴动物鼯鼠具有极高的挖掘效率, 前足爪趾是其主要挖掘器官。分析了鼯鼠中重要种属——麝鼯 (*Scaptochirus moschatus*) 具有优良挖掘功能的前足爪趾的几何结构特征, 重点分析了前足爪趾触土面的几何结构。利用体视显微镜观察分析前足爪趾的宏观几何结构, 通过逆向工程技术获取爪趾三维数据点云进行特征曲线量化分析, 求得前足爪趾特征轮廓线的曲率及二阶导数的变化规律: 鼯鼠爪趾纵向轮廓曲率变化较小, 爪趾纵向表面平顺, 保证了挖掘出的洞道内壁的平整; 横向轮廓曲线曲率变化较大, 且横向轮廓线尖端弯曲小, 中后端弯曲大, 这种结构使爪趾更易入土和扩洞。Mole rat, as a typical soil-burrowing animal, has a high working efficiency in digging hole in earth, its fore claws are main digging organ. The geometric characteristics of the claws of mole rats (*Scaptochirus moschatus*) was analyzed by stereoscopy, the quantitative analysis of geometrically characteristic features of the surfaces was performed by reverse engineering, and the second derivative and curvature of the surface profile curves were calculated. The curvature variation of longitudinal profile of claw changes gently and the longitudinal surface was smooth, which assures the tidiness of inner wall when mole rat dug holes. The curvature variation of transverse fitted curves shows a rapid change, and the bending of the transverse fitted curves increase from tip to rear, this kind of structure is easier for cutting in and hole-enlarging. The results provide some information for the design of the soil-cutting tools and excavation tools in energy-saving property and cutting efficiency.

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