

基于人体健康的 3 种城市森林夏季林内紫外线照射环境特征比较研究

孙睿霖 王成 张昶 殷鲁秦

(中国林业科学研究院林业研究所 北京 100091)

摘 要: 紫外线辐射对人体健康具有多种生物学影响, 城市森林能够为居民提供温和的紫外辐射环境。为了了解林下紫外线环境特征是否存在树种间差异, 对北京市夏季 3 种常见遮荫树种的林下紫外辐射 (UV) 强度、林内与林外 UV 辐射的比值 (SR)、UVB 在总 UV 辐射中占比 (UVB/UV), 以及 VD 合成和红斑效应两种人体作用有效辐射强度 (UVVD、UVer) 进行了测算。结果表明: (1) 三种林分林内紫外辐射总量是林外的 3% — 10%, 不同林分的林内 UV 强度具有显著差异, 元宝枫林对 UV 屏蔽能力最强, 其次是栎树林和国槐林; (2) 三种林分林冠对不同波长上紫外辐射能量的屏蔽能力具有明显的一致性, 林冠对 UVB 的屏蔽能力没有在 UVA 波段强和稳定, 林内 UVB/UV 普遍高于林外, 其中元宝枫林最高, 其次为栎树林, 国槐林最低; (3) 林冠明显改变了日光 UVVD 和 UVer 两种人体作用光谱曲线的形态, 三种林分内的人体作用光谱曲线形态相似, 强度上, 林内外 UVVD/UVer 值均接近 1, 不同林分间没有显著差异; (4) 胸径、无截取散射、平均叶倾角、叶面积指数和叶片透光性等树种特性或林冠结构特征会影响林内 UV 的强度, 但林内 UV 光质和光谱分布的树种间差异不明显。

关键词: 紫外线; 城市森林; 人体健康; 城市光环境

Comparing the Summer Ultraviolet Characteristics in the Shade of 3 Urban Forests Based on Human Health Effects

SUN Ruilin, WANG Cheng, ZHANG Chang, YIN Luqin

(Research Institute of Forestry CAF, Beijing 100091, China)

Abstract: Ultraviolet (UV) radiation has multiple biological effects on human health, and urban forests can provide a moderate UV radiation environment for residents. In order to understand whether there are inter-species differences in the characteristics of UV environment in canopy shade, the UV intensity, the ratio of UV radiation in shade and in the open (Shade Ratio, SR), the proportion of UVB in total UV radiation (UVB/UV), and the intensity of two types of human-acting effective radiation for vitamin D synthesis and erythema effect (UVVD and UVer) in shade of three groves were measured in Beijing in summer. The results showed that: (1) The total amount of UV radiation in the three groves was 3% -10% of that in the open. There were significant differences in UV intensity between different groves. Mono maple had the strongest UV screening effect, followed by golden raintree and pagoda tree; (2) Similarity in effectiveness of screening UV radiation at different wavelengths in each grove was found. The screening effectiveness of the canopy in UVB band is not as strong and stable as which in the UVA band, and the UVB/UV values in shade were generally higher than that in the open; (3) The canopy significantly changed the curves of daylight UVVD and UVer spectrum, but the spectral curves in different grove shades were similar. In terms of intensity, the UVVD/UVer values in each shade and in the open were close to 1, and there was no significant difference between different groves; (4) The diameter at breast height (DBH), diffuse non-interceptance (DIFN), mean tilt angle of the leaves (MTA), leaf area index (LAI), leaf transmission, and other features of tree species or canopy structure, could affect the intensity of UV in tree shade, but no inter-species differences in the characteristics of UV light quality or spectral distribution were found.

Key Words: UV Radiation; Urban Forest; Human Health; Light environment