中央研究院生物多樣性研究中心
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Terrestrial Biodiversity and Ecosystems

How does Behavior Modulate Species Interactions in Changing Thermal Environments ?

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Time: 2023. 03. 17 Fri. 14:00

Venue: Auditorium, 1st Floor,
Interdisciplinary Research Building
跨領域科技研究大樓1樓演講廳

Host: Dr. Sheng-Feng Shen沈聖峰研究員

[Doctoral Dissertation Defense Presentation]

~Attendee are suggested to wear mask~
~與會者建議配戴口罩~

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Abstract

Predicting how species interact under changing thermal environments due to anthropogenic environmental changes (e.g., climate & land-use changes) is crucial for forecasting future population sustainability. Here, we used mathematical models and field experiments on burying beetles (*Nicrophorus nepalensis*) and blowflies (*Calliphoridae* spp.) that compete for resources in common to tackle the questions. We found that land-use changes (i.e., deforestation) increase temperature variability and exacerbate the competitive disadvantage of nocturnal burying beetles. Furthermore, we also show that exploitative competition is critical in modulating competitive interaction between the two species with distinct temporal niches. On the other hand, we found that declines in the population density of the cooperative burying beetles also reduce their resistance to blowfly competition in warmer low elevations in deforested landscapes. The above results show two distinct categories of behavioral mechanisms modulating species interactions in changing thermal environments: (1) behaviors that determine the thermal environment experienced by the organisms and (2) behaviors that modify the thermal niche of the organisms. The results also highlight the importance of incorporating behavior and physiology to predict species interactions in the ongoing global environmental changes.

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摘要

預測人為的氣候變遷和土地利用改變所導致的熱環境變化將如何影響物種間的交互作用，對於預測物種在面臨全球環境變遷下族群的可持續性至關重要。在本研究中，我們透過建立數學模型，並對共同競爭資源的尼泊爾埋葬蟲(*Nicrophorus nepalensis*)和麗蠅(*Calliphoridae* spp.)進行實驗來回答這個問題。我們發現，土地利用的變化 (即森林砍伐) 導致日溫差的增加，在原本適合埋葬蟲的高海拔山區，加劇了來自麗蠅蛆的種間競爭壓力，導致夜間活動的埋葬蟲的競爭劣勢。此外，我們還透過理論模式說明，開採型競爭(exploitative competition)對於調節具有不同時間生態棲位的物種間的關係尤其重要，且日溫差會加劇此種競爭對夜行性物種的負面影響。另一方面，我們發現森林減少會透過降低尼泊爾埋葬蟲的族群密度，使行合作繁殖的尼泊爾埋葬蟲無法組成大的合作群體，進而降低了它們在溫暖環境下對麗蠅競爭的抵抗能力。綜合上述的研究結果顯示，在變動的熱環境中，有兩類不同的行為機制可以調節物種間的交互作用：(1)決定生物體所經歷的熱環境的行為，例如時間的生態棲位；(2)改變生物體的熱生態棲位的行為，例如合作。我們的研究結果也凸顯了同時從行為和生理兩個角度來預測全球環境變遷下物種交互作用的重要性。