

Minimum temperature requirements per aridity class of the mangrove genera *Avicennia* and *Rhizophora* at their upper latitudinal limits

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Abstract

In earlier studies we found no common isotherms that define the range limits of the two mangrove genera *Avicennia* and *Rhizophora*. However, along the same coastline where other environmental conditions are similar, the coldest month and yearly average of air temperature (AT) and sea surface temperature (SST) are warmer at *Rhizophora* limits than at the correspondent *Avicennia* limits. In addition, there is an impact of aridity on temperature requirements of mangroves at their latitudinal limits. Today, we present the minimum temperature requirements per aridity class (defined below) of the mangrove genera *Avicennia* and *Rhizophora* at their upper latitudinal limits. Our hypotheses are (1) the minimum temperature required by mangroves increases with increasing aridity, and (2) *Rhizophora* requires higher temperatures than *Avicennia* for each aridity class.

We divided all *Avicennia* and *Rhizophora* limits into four aridity classes based on precipitation: (1) limits with a wet climate, (2) limits with a moderate wet climate, (3) limits with a dry climate and (4) limits with a very dry climate. Next, we derived seven temperature-based variables from monthly values of AT and SST. Finally, we extracted the limiting isotherms per aridity class for each mangrove genus.

For all aridity classes except one, we could define a limiting temperature. The average of mean AT and mean SST for *Rhizophora* was ranging from 21.6°C for the wet class to at least 26.8°C for the very dry class. At the very dry *Avicennia* limits, the coldest month AT (15.7°C) and the average of mean AT and mean SST (> 23.8°C) were at least 2.7°C warmer than at the wet *Avicennia* limits. Differences of limiting temperatures between *Avicennia* and *Rhizophora* limits were larger with increasing aridity class. To conclude, we found different temperatures limits for *Avicennia* and *Rhizophora* based on aridity class, and we could derive two useful schemes of minimum temperature requirements per aridity class for both mangrove genera.

Keywords

biogeography, climate, habitat compensation, niche