

Exploring the Phytochemical Diversity and Antiplasmodial Potential of *Artemisia annua* and *A. afra* from Different Geographical Locations in Cameroon

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Introduction

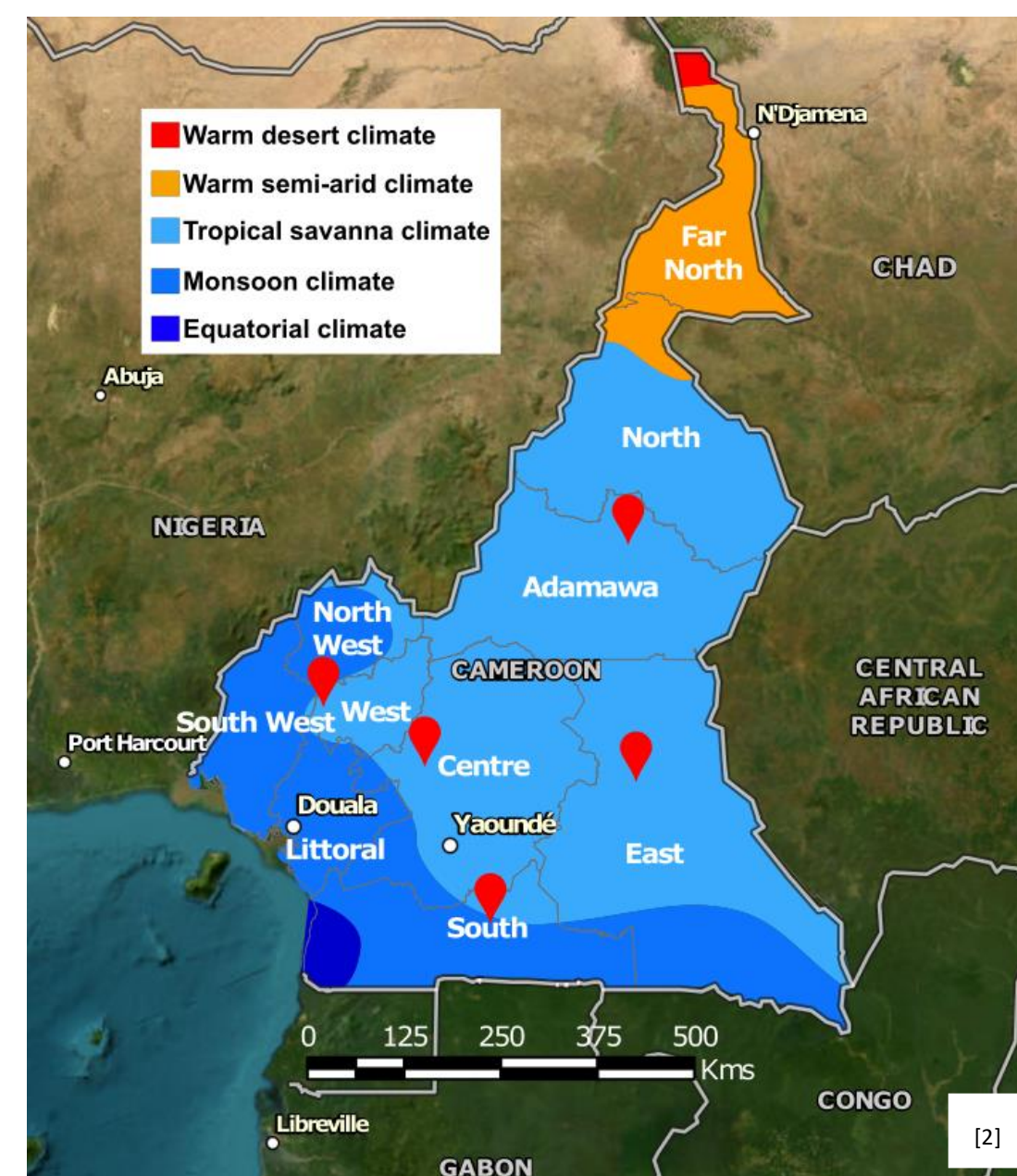
- Malaria remains a global health concern, and natural products are being explored as potential treatments.
- Artemisia annua* and *A. afra* are two plant species with potential anti-malarial properties, and their secondary metabolites have been extensively studied for their therapeutic effects against malaria and inflammation.
- Artemisia annua* and *afra* are used as both curative and preventive measure against malaria in Cameroon [1].

Objective

Assess whether there are variations in composition & efficacy based on the geographical locations of collection, aiming to determine if regional differences in *Artemisia* samples hold any significance in their potential as anti-malarial agents.

Methods

- Ten *Artemisia* samples were collected during the flowering stage from five regions, encompassing both the rainy season (RS) and the dry season (DS).
- Metabolomic profiles, as well as the content of artemisinin and polyphenols, were evaluated using HPLC-DAD (High-Performance Liquid Chromatography with Diode Array Detection).
- In-vitro antiplasmodial assays were conducted on the samples, following the method established by Trager and Jensen [3].
- Characteristics of the collecting site environments were retrieved from multispectral Earth Observation data (Sentinel-2 satellite from the European Copernicus programme) and integrated with the phytochemical and biological information obtained from the samples.
- This cross-linking approach provides a comprehensive understanding of the relationship between the phytochemical composition, geographical origin, and antiplasmodial activity of the *Artemisia* samples.



Results & Discussion

The NDVI (Normalised Difference Vegetation Index) is an index of the vegetation density and health based on the difference between the vegetation light reflectance in the Red and the Near-Infrared bands. An NDVI closer to 1 indicates a healthier vegetation. The NDVI indicated that the eastern region had lower levels of dense and healthy vegetation compared to other areas. Additionally, the NDVI analysis shows that the vegetation is healthier during the rainy season, as the precipitations favours the vegetation growth.

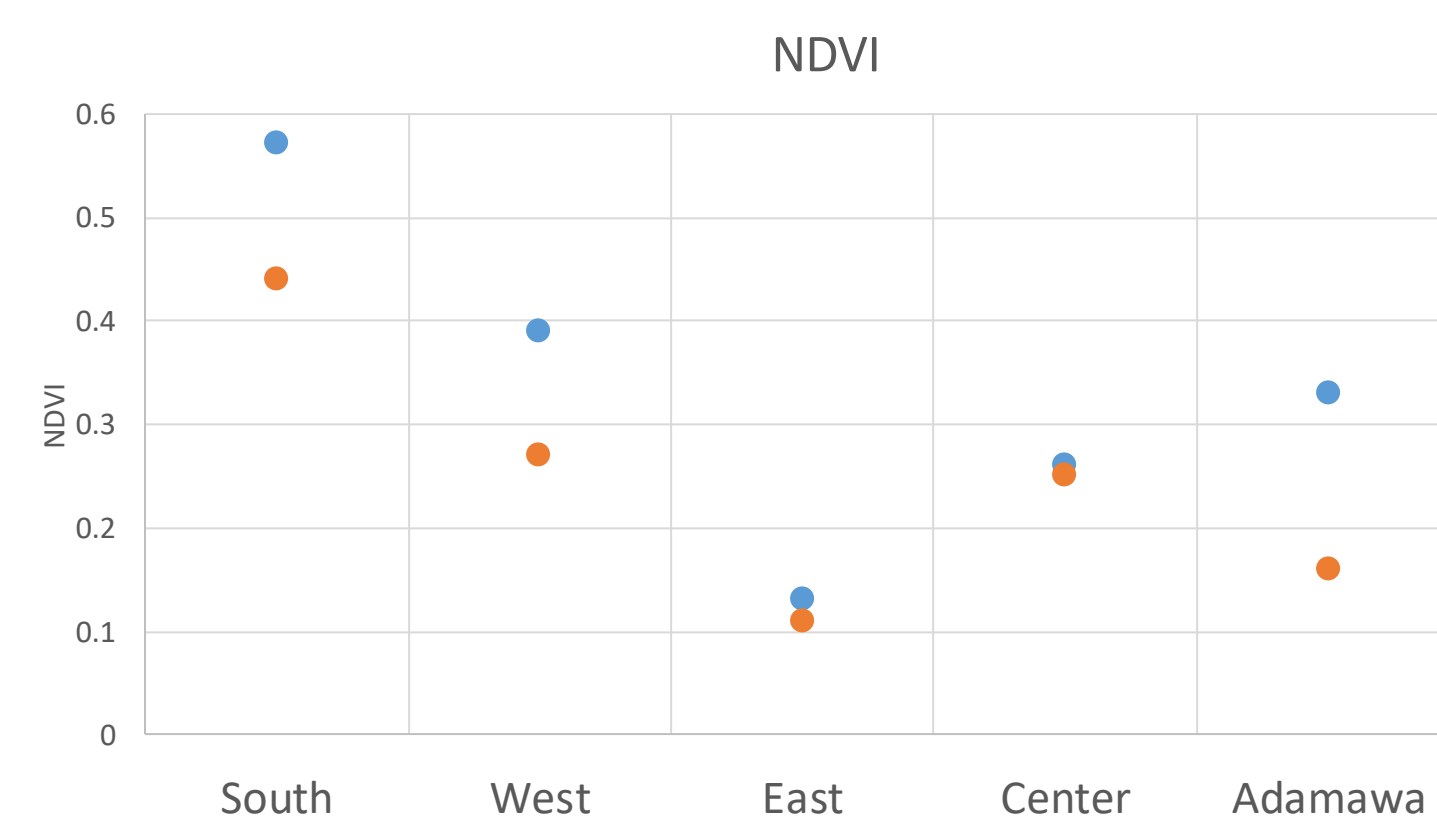
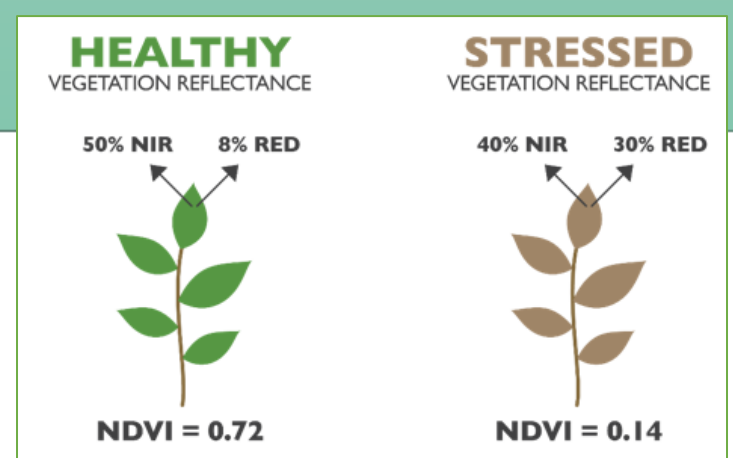


Figure 1: NDVI at the five collecting points and for the two seasons

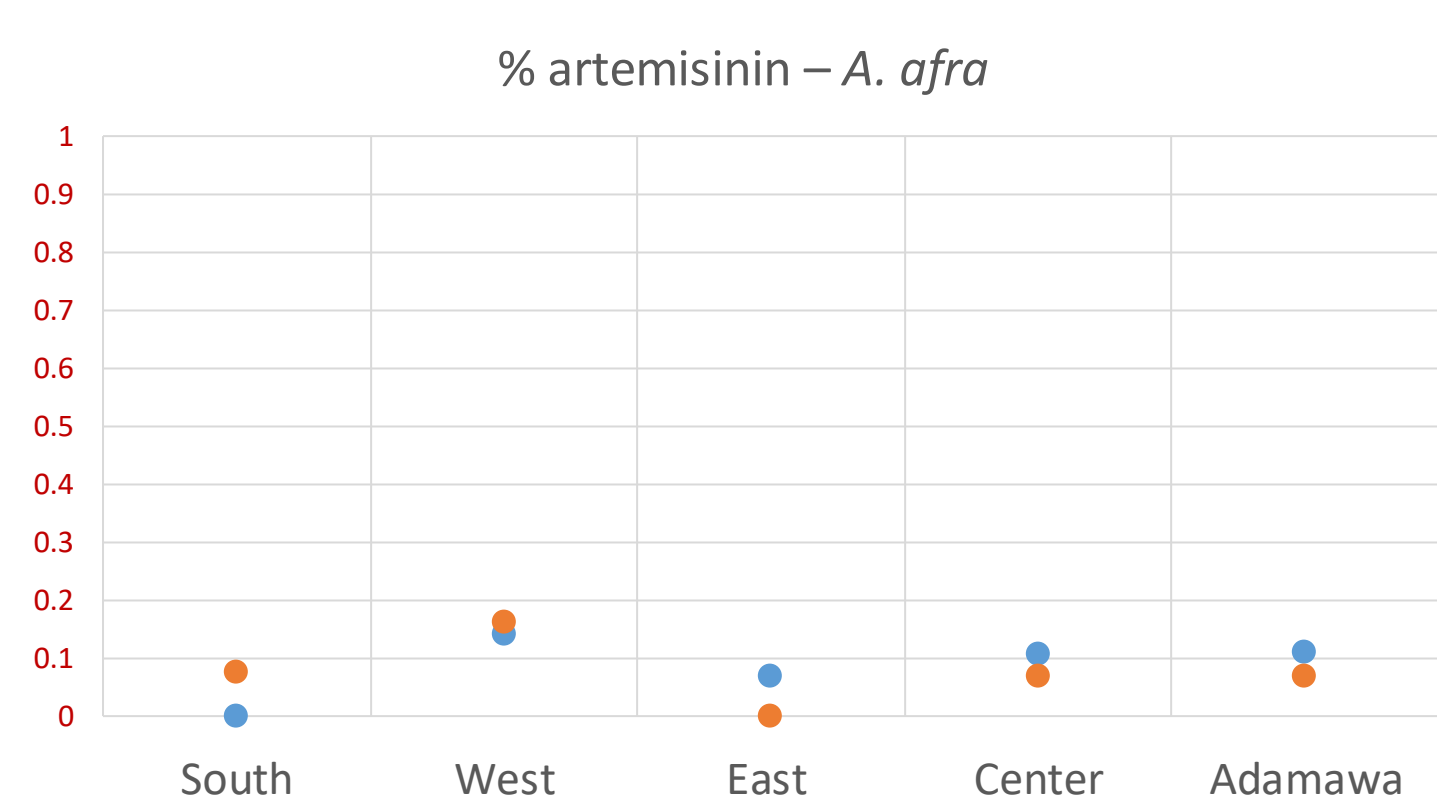
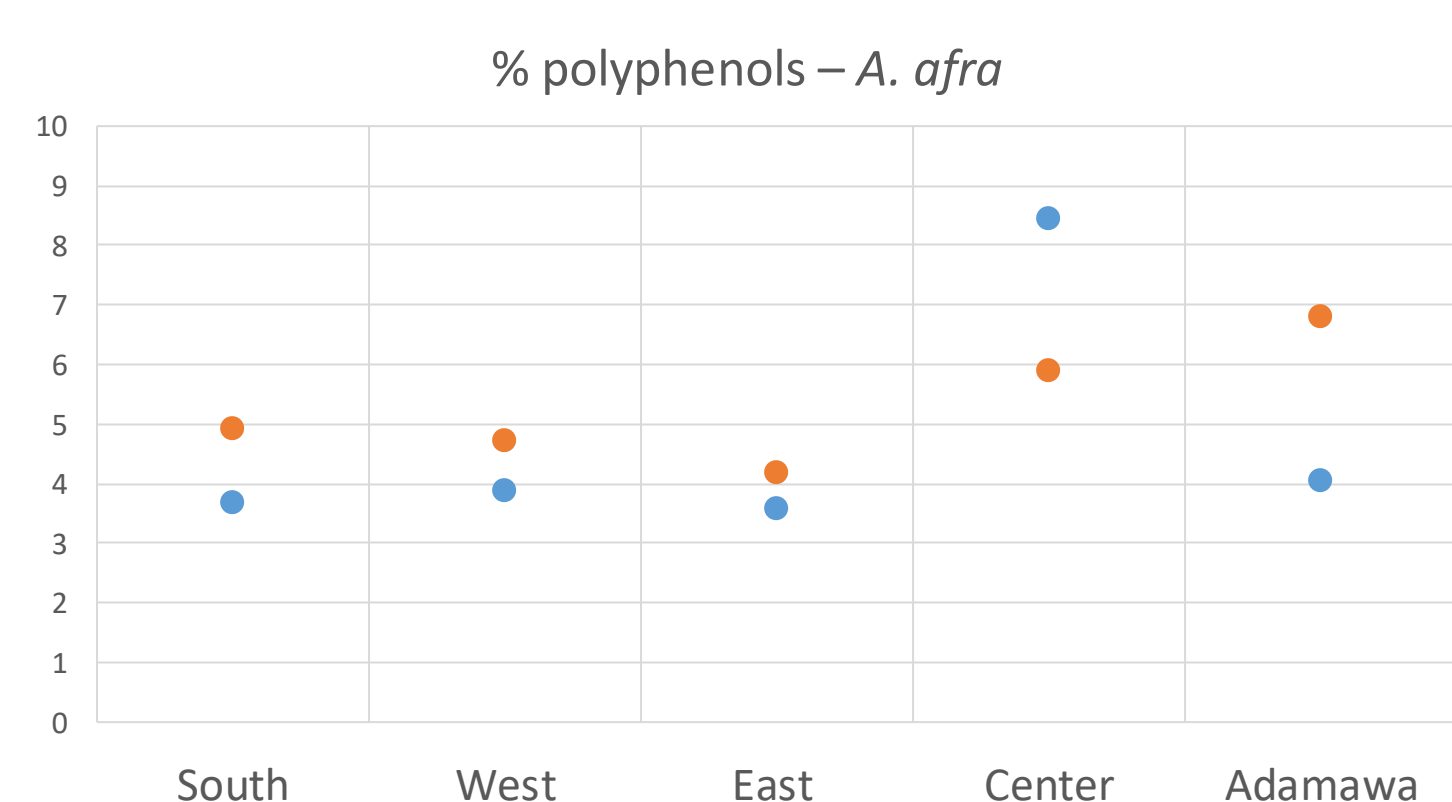
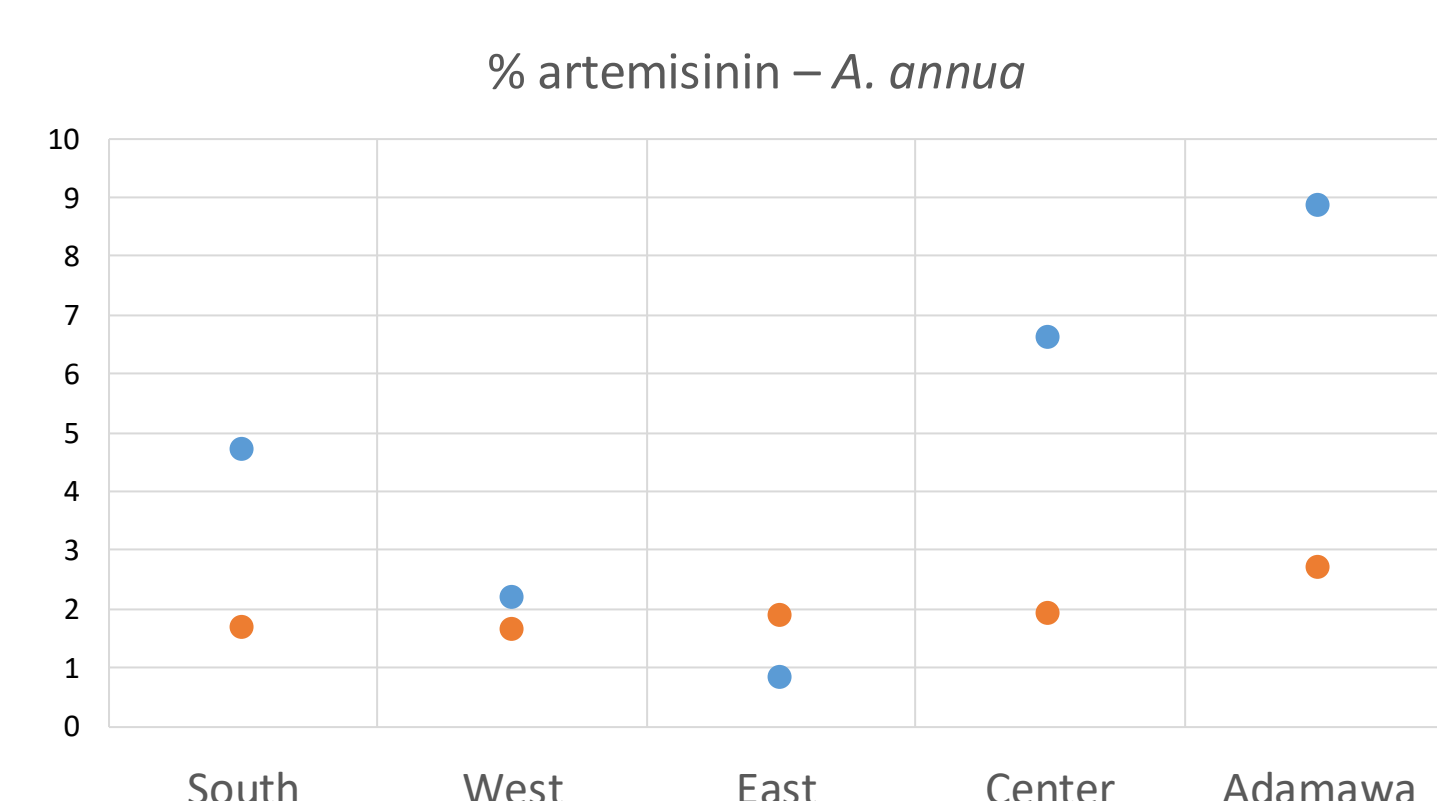
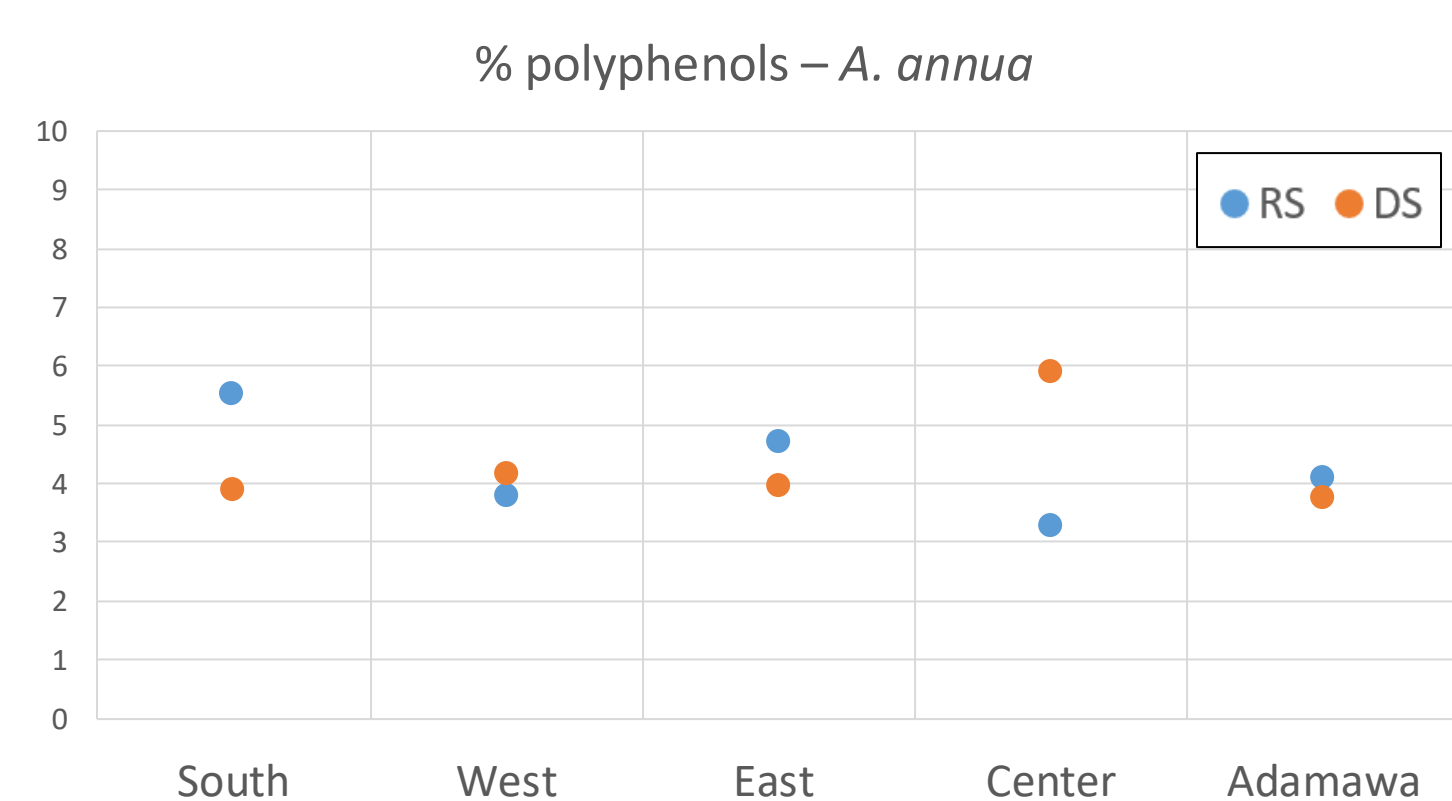


Figure 2: Polyphenolic content in *A. annua* (top) and *A. Afra* (bottom) collected in rainy season (blue) and dry season (orange)

Figure 3: Artemisinin content in *A. annua* (top) and *A. Afra* (bottom) collected in rainy season (blue) and dry season (orange)

The polyphenol content of *A. annua* did not show a correlation with season or location. However, for *A. afra*, there was a slight increase in polyphenol content in the central region during the rainy season. Artemisinin content in *A. annua* tended to be higher during the rainy season, particularly in the central and Adamawa regions. On the other hand, *A. afra* exhibited low levels of artemisinin across all conditions, with slightly higher amounts in the western region irrespective of the season.

[1] Lahngong et al. (2023), doi: 10.3390/metabo13050613. [2] Climate data from Beck et al. (2018), doi:10.1038/sdata.2018.214. [3] Trager & Jensen. (1976), doi: 10.1126/science.781740. [4] Moyo et al. (2019), doi: 10.1186/s12936-019-2694-1.

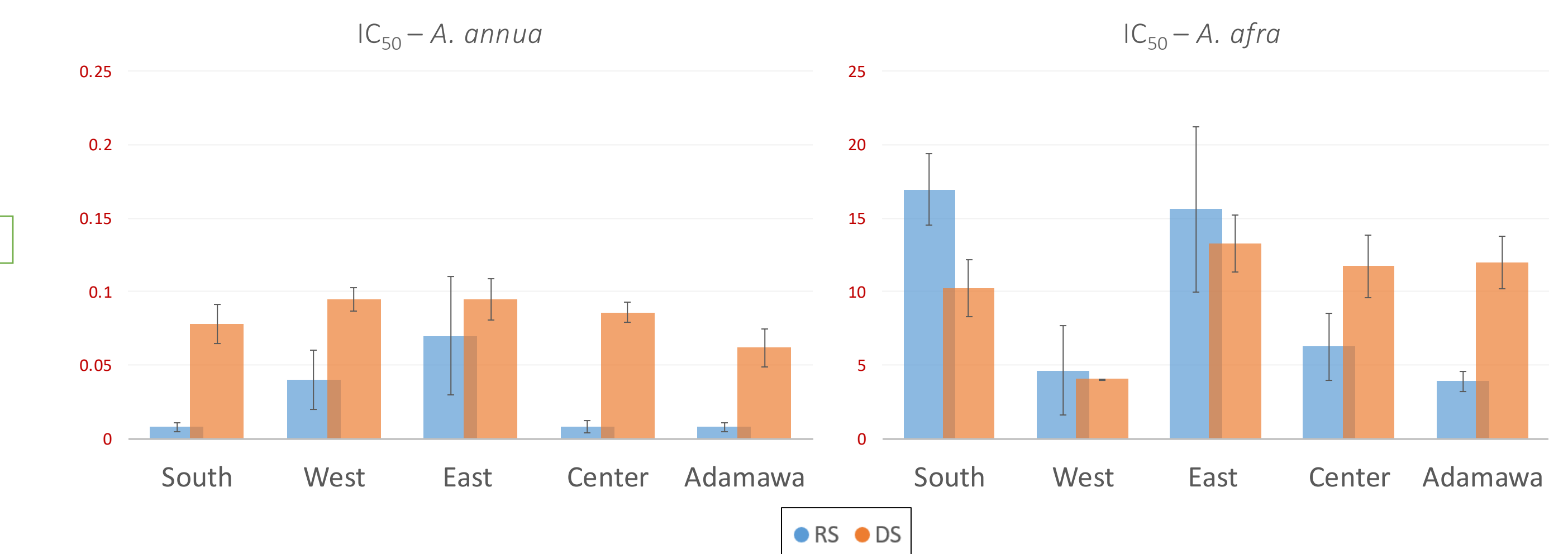


Figure 4: *P. falciparum* IC₅₀ of the acetone crude extracts of *A. annua* (right) and *A. afra* (left) collected in rainy season (blue) and dry season (orange).

Artemisia annua demonstrates superior activity compared to *A. afra* with IC₅₀ between 0,008 to 0,1 and 4,05 to 16,95, respectively, primarily attributed to its high artemisinin content, which is well-established. However, a consistent pattern reveals enhanced activity during the rainy season for *A. annua*, whereas the season does not seem to be an influencing factor for *A. afra*.

In the case of *A. annua*, the southern, central, and Adamawa regions exhibit the most noteworthy activity. Conversely, for *A. afra*, the western region (across both seasons), the central and Adamawa regions during the rainy season are particularly interesting in terms of activity.

Conclusions

Regarding *Artemisia annua*, collecting the plant during the rainy season when the vegetation is healthier appears to be relevant in terms of activity. This is likely linked to the presence of artemisinin. As for *Artemisia afra*, the factors investigated do not seem to correlate with its biological activity. This reinforces the hypothesis that the activity is not solely related to the artemisinin content it contains but rather to other constituents, such as the frequently mentioned guaianolides in the literature [4]. In terms of the Cameroonian region, it seems that East have the least vigorous vegetation, regardless of the season. Extracts from this region also exhibit lower activity. Therefore, analyzing the vigor of vegetation may be a relevant parameter for the selection of plants intended for prophylaxis and treatment purposes.

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