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Research Article

Identification of Corticolous lichens associated with the Argan tree, *Argania spinosa*, in Arganeraie Biosphere Reserve (Central-Western Morocco)

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Abstract

Corticolous lichen research associated with the argan tree has primarily focused on coastal regions within the Arganeraie Biosphere Reserve. Therefore, this study expands to encompass more continental areas. Field surveys conducted within Targua N'Touchka and Bounaamane rural communes and subsequent laboratory identification revealed a total of 11 lichen taxa, namely: *Anaptychia ciliaris* (L.) Körb. ex A. Massal., *Athallia pyracea* (Ach.) Arup, Frödén & Søchting, *Diploicia canescens* (Dicks.) A. Massal., *Lecanora campestris* (Schaer.) Hue, *Physcia sterallis* (L.) Nyl, *Punctelia sp*., *Ramalina lacera* (With.) J.R. Laundon, *Teloschistes chrysophthalmus* (L.) Th. Fr., *Teloschistes villosus* (Ach.) Norman, *Tornabea scutellifera* (With.) J. R. Laundon, and *Xanthoria parietina* (L.) Th. Fr. The taxa *Anaptychia ciliaris* (L.) Körb. ex A. Massal., *Physcia sterallis* (L.) Nyl, *Punctelia sp*., and *Teloschistes chrysophthalmus* (L.) Th. Fr. are newly recorded as associated with the argan tree. This research underscores the necessity for further studies to fully comprehend the composition, ecology, and distribution of corticolous lichen species within the Arganeraie Biosphere Reserve.

Keywords: Corticolous lichen, *Argania spinosa*, identification, Arganeraie Biosphere Reserve, Morocco

Introduction

The Argan tree, *Argania spinosa* (L.) Skeels are an endemic tree in Central-western Morocco, where the habitat is semi-arid to arid, and they occupy around one million hectares (Aabd et al., 2019). It is found in a large and diverse geographical area within the region, comprising coastal, inland, plains, and mountainous areas (Msanda et al., 2005). The argan tree has a vital ecological role, especially in water preservation, mitigation of climate change, and stabilizing the soil of its region, which is at threat from biophysical processes like desertification and erosion progression (Parish & Funnell, 1996; de Waroux & Lambin, 2012; Alba-Sánchez et al., 2015).

The initial investigations into lichens associated with the argan tree commenced in the 1920s, primarily conducted by lichenologist R.G. Werner, with a focus on Cap Ghir (Agadir) (Ajaj et al., 2007). Various researchers carried out subsequent identification studies in different locations, including Mogador Sud (Werner, 1972), the coastal region of Agadir (Alonso & Egea, 1977), areas near Mirleft (Bouharroud et al., 2015), and coastal regions of Agadir and Essaouira (Bouchar et al., 2023). These studies highlight the scarcity and fragmented nature of lichen research. Furthermore, their geographical scope primarily focuses on coastal or near-coastal areas within the Arganeraie Biosphere Reserve. Consequently, there is a clear need to extend lichen identification efforts to areas located farther away from the coastline. This study aimed to identify corticolous lichens associated with the argan tree in more continental areas.

Martial and methods

Study area

This study was carried out during the summer of 2022 in two rural areas: Targua N'Touchka commune, specifically at the geographical coordinates 29°54'31.7"N 9°13'12.5"W, and Bounaamane commune around the geographical coordinates 29°31'8.499"N 9°45'57.853"W. At each site, a total of 100 argan trees were selected randomly, and all lichens observed in trunks, branches, and twigs were noted. Samples of the collected lichen species were conserved as a herbarium at the Regional Center of Agricultural Research of Agadir.

Identification of collected lichens

The lichen species were collected and brought to the laboratory for identification. Two methods were utilized for lichen identification: morphological identification, which involved observing the type, color, and shape of the thalli and apothecia, as well as the shape and color of asci and

ascospores. The second method was chemical spot tests, which utilized a 10% aqueous solution of potassium hydroxide (KOH) and hydrogen chloride (HCl). The identification was performed using an interactive key (Beeching et al., 2024) and relevant identification keys (Ozenda, 1970; Kirschbaum & Wirth, 1997; Tievant, 2001; Mishra et al., 2020).

Results

A total of 11 lichen taxa of lichen were recorded in association with the Argan tree, 4 of these lichen species were foliose, 4 species were fruticose, and 3 were crustose (Table 1). 10 lichen specimens were identified up to species level, and one specimen up to generic level using morphological, anatomical and chemical characters of lichens.

Table 1. Lichen taxa and their growth form associated with the argan tree were identified in the study sites.

Species	Family	Growth type
Anaptychia ciliaris (L.) Körb. ex A. Massal.	Physciaceae	Subfoliose
Athallia pyracea (Ach.) Arup, Frödén & Søchting	Teloschistaceae	Crustose
Diploicia canescens (Dicks.) A. Massal.	Physciaceae	Crustose
Lecanora campestris (Schaer.) Hue	Lecanoraceae	Crustose
Physcia sterallis (L.) Nyl	Physciaceae	Foliose
Punctelia sp	Parmeliaceae	Foliose
Ramalina lacera (With.) J.R. Laundon	Ramalinaceae	Fruticose
Teloschistes chrysophthalmus (L.) Th. Fr.	Teloschistaceae	Fruticose
Teloschistes villosus (Ach.) Norman	Teloschistaceae	Fruticose
Tornabea scutellifera (With.) J. R. Laundon	Physciaceae	Fruticose
Xanthoria parietina (L.) Th. Fr.	Teloschistaceae	Foliose

Several identified species had previously been documented as associated with the argan tree. However, *Anaptychia ciliaris* (L.) Körb. ex A. Massal (Fig. 1), *Physcia stellaris* (L.) Ny (Fig. 2), *Punctelia sp*. (Fig. 3), and *Teloschistes chrysophthalmus* (L.) Th. Fr (Fig. 4) was newly recorded as such.

Figure 1. *Anaptychia ciliaris* images: A- lichen thallus on Argan tree branch. B- *A. ciliaris* cilia. C- lichen's apothecia disk. D- *A. ciliaris* ascospores

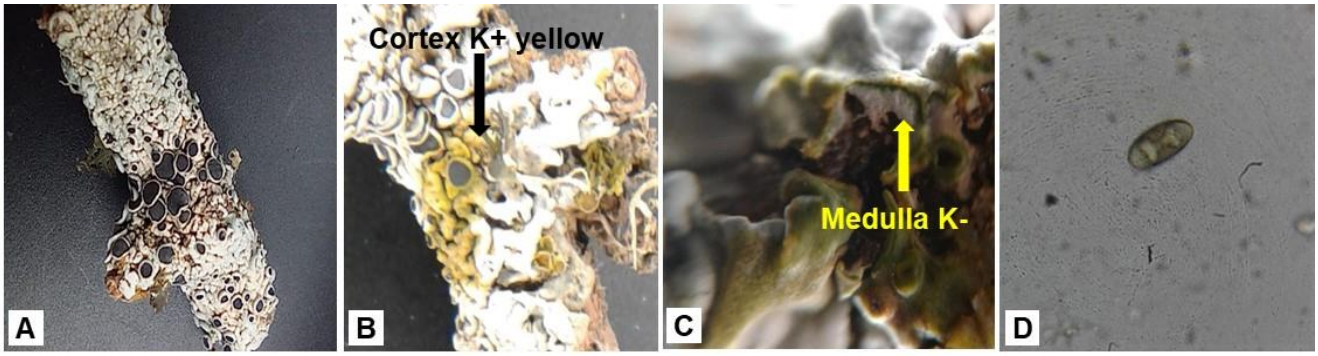

Figure 2. *Physcia sterallis* images: A- Lichen on Argan tree branch. B- Positive spot test (KOH) on cortex C- Negative spot test (KOH) on the medulla. D- *P. sterallis* ascospore.

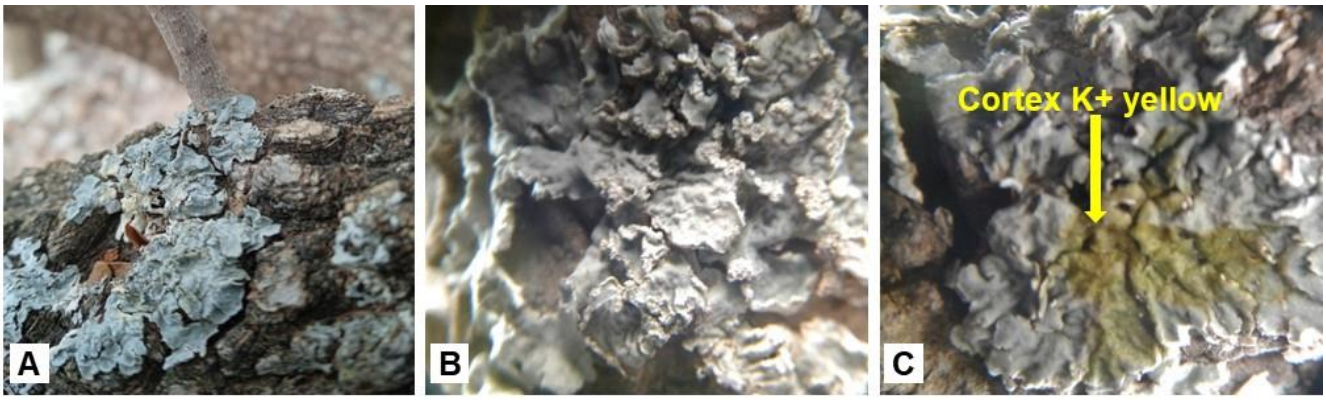

Figure 3. *Punctelia sp*. Images: A- Lichen on Argan tree branch. B- Thallus with marginal soralia. C- Positive spot test (KOH) on cortex.

Figure 4. *Teloschistes chrysophthalmus* images: A- Lichen on Argan tree branch. B- Thallus with cilia. C- Positive spot test (KOH) on apothecia disc.

Discussion

Other lichen species have already been observed on the argan tree than those identified in this study. In the case of *Punctelia sp*., it was not identified at the species level due to certain differentiating characteristics from other members of the genus. Morphologically, the species was similar to *P. jeckeri*; nevertheless, its margins did not exhibit pale brown coloration, and thalli close to the outer margin were not consistently pruinose. Additionally, the soralia did not exhibit C+ red reaction. As a result, a more comprehensive and detailed identification process is deemed necessary.

The lichen richness observed in the study sites is lower than that reported in coastal areas by Bouchar *et al*. (2023), where 26 lichen species were documented. This difference confirms that lichen richness is influenced by the climatic conditions of the environment, which play a significant role in their development. As highlighted by Bouchar *et al*. (2023), the number of species comprising the association is closely linked to continentality, with a decrease in this number observed as one moves further away from the sea. In addition to climatic conditions, lichens are influenced by tree density, forest composition, and substrate specificity (Jüriado *et al*., 2008). Furthermore, their biomass can vary among tree species and within trees (Liu *et al*., 2000). Lichens are not phytopathogenic species; they typically develop on parts of old trees, such as rough bark and withering branches. Epiphytic lichens play a crucial role in forest nutrient cycling and water cycling by enhancing canopy interception of precipitation (Van Stan & Pypker, 2015). Additionally, nutrients derived from the atmosphere become available to the forest system through lichen epiphyte leachate (Ellis, 2012). Regarding the argan tree, numerous studies are still needed to understand lichen species composition, ecology, and distribution comprehensively.

Conclusion

In conclusion, this study expands our understanding of lichen species richness associated with the argan tree, particularly in more continental areas. By identifying previously undocumented species and noting differences in lichen richness compared to coastal regions, the importance of considering both climatic conditions and geographical factors in studying lichen communities is underscored. Much remains to be explored regarding the lichen species associated with the argan tree to understand the biodiversity linked to the argan tree comprehensively. Such research highlights the significance of conserving the argan tree, thereby preserving its diversity of associated lichens.

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References

Aabd, N.A., Bouharroud, R., Tahiri, A., Wifaya, A., Mimouni, A., & Mousadik, A.E. (2019). Genetic Diversity and Breeding of Argan Tree (*Argania spinosa* L. Skeels). In: J. Al-Khayri., S. Jain & D. Johnson (Eds.), Advances in Plant Breeding Strategies: Nut and Beverage Crops. (pp, 31–56). Springer, Cham. https://doi.org/10.1007/978-3-030-23112-5_2

Ajaj, A., El-Assfouri, A., Ouazzani Touhami, A., Benkirane, R., Fennane, M., & Douira, A. (2007). Inventaire de la collection des lichens et champignons lichénicoles de l'Herbier national" RAB" de l'Institut Scientifique (Rabat, Maroc). Documents de l'Institut Scientifique, 21, 1-70.

Alba-Sánchez, F., Lopez-Saez, J.A., Nieto-Lugilde, D., & Svenning, J. C. (2015). Long-term climate forcings to assess vulnerability in North Africa dry argan woodlands. Applied Vegetation Science, 18, 283–296. https://doi.org/10.1111/avsc.12133

Beeching S., Lowe N. & Pickering J. (2024). Georgia Lichens USGA -- identification guide -- discover life. Retrieved July, 2024 from https://www.discoverlife.org/mp/20q?guide=Lichens_USGA

Bouchar, A., Sellal, Z., Maazouzi, S., Msairi, S., El Kholfy, S., Benkirane, R., Ouazzani Touhami, A., & Douira, A. (2023). Inventory of Corticolous Lichens and Argan Wood Fungi. In: J. Kacprzyk., M. Ezziyyani., & V.E. Balas (Eds.), International Conference on Advanced Intelligent Systems for Sustainable Development. AI2SD 2022. Lecture Notes in Networks and Systems 713. (pp, 521–527). Springer, Cham. https://doi.org/10.1007/978-3-031-35248-5_47

Bouharroud, R., Qessaoui, R., Mimouni, A., Ajerrar, A., & Amarraque, A. (2015). Lichens et arganier:

situation actuelle. In: Proceedings of the Third International Argan Congress, ANDZOA. (pp, 97-101).

de Waroux, Y.P., & Lambin, E.F., (2012). Monitoring degradation in arid and semi-arid forests and woodlands: the case of the argan woodlands (Morocco). Applied Geography, 32, 777–786. https://doi.org/10.1016/j.apgeog.2011.08.005

Ellis, C. J., (2012). Lichen epiphyte diversity: a species, community and trait-based review. Perspectives in Plant Ecology, Evolution and Systematics, 14, 131-152.

Jüriado, I., Liira, J., Paal, J., & Suija, A. (2008). Tree and stand level variables influencing diversity of lichens on temperate broad-leaved trees in boreo-nemoral floodplain forests. Biodiversity and Conservation, 18, 105-125.

Kirschbaum, U., & Wirth, V. (1997). Les lichens bio-indicateurs: Les reconnaître, évaluer la qualité de l'air. Eugen Ulmer.

Liu, C., Ilvesniemi, H. & Westman, C.J. (2000). Biomass of arboreal lichens and its vertical distribution in a boreal coniferous forest in central Finland. Lichenologist, 32, 495-504. https://doi.org/10.1006/lich.2000.0288

Mishra, G. K., Upreti, D. K., Nayaka, S., Thell, A., Kärnefelt, I., Lőkös, L., Hur, J.-S., Sinha, G. P., & Kondratyuk, S. Y. (2020). Current Taxonomy of the Lichen Family Teloschistaceae from India with Descriptions of New Species. Acta Botanica Hungaricae, 62(3–4), 309–391. https://doi.org/10.1556/034.62.2020.3-4.5

Msanda, F., El Aboudi, A., & Peltier, J.P., (2005). Biodiversité et biogéographie de l'arganeraie marocaine. Cahiers Agricultures, 14(4), 357–364.

Ozenda, B. P. P., & Clauzade, G., (1970). Les Lichens, Etude biologique et flore illustrées. Masson.

Parish, R., & Funnell, D., (1996). Land water and development in the High Atlas and Anti-Atlas Mountains of Morocco. Geography, 81(2), 142–154. http://www.jstor.org/stable/40572759

Tievant, P., 2001. Guide des lichens. Delacaux et Niestlé.

Van Stan, J.T., & Pypker, T.G. (2015). A review and evaluation of forest canopy epiphyte roles in the partitioning and chemical alteration of precipitation. The Science of the total environment, 536, 813-824.

Werner, R.G. (1972). Lichens et champignons de la plaine marocaine. Bulletin de l'Académie Lorraine des Sciences, 10(2), 83–97.