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# Exploring the historical distribution of *Dracaena cinnabari* using ethnobotanical knowledge on Socotra Island, Yemen

Abdulraqeb Al-Okaishi

## Abstract

**Background:** In this study, we present and analyze toponyms referring to Socotra Island's endemic dragon's blood tree (*Dracaena cinnabari*) in four areas on the Socotra Archipelago UNESCO World Heritage site (Republic of Yemen). The motivation is the understanding of the past distribution of *D. cinnabari* trees which is an important part of conservation efforts by using ethnobotanical data. We assumed that dragon's blood trees had a wider distribution on Socotra Island in the past.

**Methods:** This research was based on field surveys and interviews with the indigenous people. The place names (toponyms) were recorded in both Arabic and the indigenous Socotri language. We grouped all toponyms into five different categories according to the main descriptor: terrain, human, plant, water, and NA (unknown). Also, this study identified current and historical Arabic names of dragon's blood trees of the genus *Dracaena* through literature review.

**Results:** A total of 301 toponyms were recorded from the four study areas in Socotra Island. Among names related to plants, we could attribute toponyms to nine different plants species, of which six toponyms referred to the *D. cinnabari* tree, representing 14.63% of the total phytotoponyms in the category. Three historical naming periods prior to 2000 could be identified. The most commonly used name for dragon's blood trees (*D. cinnabari*, *D. serrulata*, *D. ombet*) appears to be "ahrieb" "رهب" and its resin "dum al-akhawin" "دم ال خو ن" while derived (mixed-cooked) products are called "eda'a" "عدا" , while regionally different names can be found.

**Conclusion:** The place names that refer to *D. cinnabari* are herein suggested to represent remnant areas of once large populations. Therefore, the toponyms may support known hypotheses based on climate models that *D. cinnabari* had a wider distribution on Socotra Island in the past. This study also confirmed the historical importance of dragon's blood.

**Keywords:** Ethnobotany, Toponymy, Phytotoponym, Socotra Island, Dum al-akhawin, Dragon's Blood Tree

Correspondence: [abdulraqeb07@yahoo.com](mailto:abdulraqeb07@yahoo.com)

Department of Forest Botany, Dendrology and Geobiocoenology, Faculty of Forestry and Wood Technology, Mendel University in Brno, Zemědělská 3, 613 00 Brno, Czech Republic



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## Background

### Ethnobotany and toponymy

Since the beginning of civilization, people have used plants for food and medicine, as well as materials for construction and the manufacture of crafts and many other products [1]. In addition, plants have extensive symbolic uses, such as in art, mythology, and literature [2]. Interactions between people and plants have accumulated large bodies of traditional ecological knowledge built by a group of people through generations living in close contact with nature. It includes a system of management of resources, classification, and observations [3]. The term *ethnobotany* was designated by Harshberger [4], originally linked to the description of plant materials use by Aboriginal Australians. Ethnobotany later became a more ecological term, focusing on relationships, interrelationships, and interaction with a cultural perspective [5]. Harshberger [4] considered that ethnobotany could also help in studying the past distribution of plants.

People need to give names to areas to label, identify, and locate them in space [6]. When the indigenous inhabitants give such names, they often use them for distinctive spatial orientation, landscape features, natural phenomena, fauna, flora, natural substances, and names of tribes or important individuals [7]. Toponyms are conservative, and although the language and wording may evolve, the roots of place names are not likely to be altered by changes in human activities in the landscape through time [8–10]. Toponyms can be easy to record and may provide useful information about the history of a land and its resources [11]. According to Berkes [12], systematic meaning through toponyms, oral history, and spiritual relationships form part of a dimension of traditional ecological knowledge. Place names may also reflect intensity of land use, the extent of traditional ecological knowledge and population density of the associated society [13], historical-cultural environmental development [14], settlement history [15], and archaeology [16]. They can be used for studying current environmental issues such as tracking recent climate changes and perceptions of those changes [17–19], water issues [20], and the climatic environment [21]. The systematic study of indigenous place names can be an approach to the mapping of ethnoecological knowledge and understanding of the evolution of the landscape [22]. Toponyms concerning plants (phytotoponyms) and animals (zootoponyms), named according to what people used to see in their everyday life, can be the indicators of the present, or former, presence of certain species [23–26].

Phytotoponyms may provide information on spatial locations, temporal information, and landscape [27]. They have been used to study landscape ecology and botany [10], vegetation cover, and long-term vegetation

degradation [28]. According to Cunningham et al. [11], local knowledge may sometimes be the only evidence that remains where some plant species used to occur. Phytotoponyms, not just the common plant names, also describe the usage of the species as food, medicine, fabric, or other activities [29, 30] and their interaction with the surrounding environment [31, 32]. Therefore, these specific types of place names can be used for the reconstruction of past events, specific vegetation, or certain species [10, 33–38].

Socotra Island, the largest island of the Socotra Archipelago (Yemen), located at the crossroads between the Red Sea, the Arabian Sea, and the Indian Ocean, was recognized as a regional center of biodiversity. The archipelago is not only rich in biodiversity with spectacular endemic species, with more than 37% of endemic plant species [39], but also rich in traditions that conserve this biodiversity until today. The landscape changes over the last centuries and/or millennia have rarely been studied. Paleoclimate studies indicate wetter periods in the Holocene on Socotra [40, 41]. However, there is very little paleontological or data available for the reconstruction of historic and prehistoric landscapes on the island [42]. In the more recent past (decades to a century), landscape changes were investigated with relation to vegetation, using historical photographs [43], a combination of old aerial photographs, satellite images, and repeated field measurements to study changes in population of *Dracaena cinnabari* and *Boswellia elongata* [44]. More recently, Rezende et al. [45] studied land productivity on Socotra using NDVI derived from satellite images in the last 20 years, showing a highly dynamic system.

The current Socotra landscape is the witness of dynamic changes in the past. It was subjected to the centuries of human land-use pressures. One of the most important was resin (incense, myrrh, dragon's blood) harvesting, resulting in the numerous wounds on dragon's blood trees [46] and the decline of dragon's blood trees' distribution [47]. The stone walls that cover large areas of the Socotra landscape refer back to the intensive management system of dragon's blood, frankincense, and aloe for which Socotra was famous [48]. Currently, Socotra faces the effect of overgrazing [49], climate change [44], and unsustainable harvesting of dragon's blood [46]. This research contributed to Socotra nature conservation, focusing on dragon's blood trees' distribution in the past using traditional environmental knowledge. This research is one of the first in the region which uses toponyms to explore the past environment and vegetation and the first research of its kind on Socotra. It is considered a pioneering research that will pave the way for other researchers. This research participates in the documentation of the Socotra traditional knowledge and its language.

### 137 Socotra and dragon's blood

138 The genus *Dracaena* is classified in the family Aspara-  
 139 gaceae subfamily Nolinoideae (The Linnean Society of  
 140 London 2016). *Dracaena cinnabari* balf. Socotra  
 141 dragon's blood tree belongs to the dragon's tree group  
 142 which contains 14 species as reviewed by Madèra et al.  
 143 [50] based on Marrero et al. [51] and Marrero [52]. The  
 144 Socotra dragon's blood tree (*Dracaena cinnabari*) is a  
 145 flagship species of Socotra [53, 54]. It was a very import-  
 146 ant tree in ancient times due to a historically highly  
 147 prized product called dragon's blood, a red resin ex-  
 148 tracted for a wide range of uses including coloring and  
 149 local medicine [39, 50]. Some believe that the name So-  
 150 cotra could even be derived from "Sukkatira" or  
 151 contracted from "suq qatra," where suq is the Arabic  
 152 word for "market" and qatra for "dragon's blood," which  
 153 means "drop" related to the dropping of the liquid resin  
 154 pieces from the stem of the plant before drying it [55,  
 155 56]. The first who mentioned *D. cinnabari* resin was the  
 156 unknown author of the Periplus of the Erythrean Sea  
 157 around the mid-first century AD, who called it "cinnabar"  
 158 [57]. Dioscorides (90 AD) mentioned the resin in his  
 159 book "On Medical Material" as Kinnabari "cinnabari,"  
 160 brought from Africa [58].

161 Names of dragon's blood tree and its resin have been  
 162 recorded by old Arabic literature [59–63], by researchers  
 163 who visited Socotra [55, 64–67], and recently by [39, 46,  
 164 68, 69].

165 Several local names for *Dracaena* may indicate the sig-  
 166 nificance of the ethnobotanical knowledge as an import-  
 167 ant source of information that can be used for tracking  
 168 the history of these names or link them to the land by  
 169 studying place names (toponyms). The aim of this study  
 170 is to use this ethnobotanical knowledge to explore the  
 171 spatial distribution of toponyms related to *Dracaena cin-  
 172 nabari* tree and its potential as an information source to  
 173 assess the past distribution of this unique flagship spe-  
 174 cies on Socotra Island.

## 175 Material and methods

### 176 Study area

177 Socotra Island is part of the unique Socotra Archipelago  
 178 natural UNESCO World Heritage Site (Republic of  
 179 Yemen), with a total area of 3,675 km<sup>2</sup> [70–72]. Live-  
 180 stock grazing, fishing, agriculture (mainly date palm  
 181 plantation), and collection of non-timber forest products  
 182 are the main activities of people; the latter includes gath-  
 183 ering resins such as frankincense, myrrh, and dragon's  
 184 blood and harvesting of aloe juice [39]. Socotra was fam-  
 185 ous for these products in ancient times [39]. There are  
 186 approximately 100 thousand inhabitants currently esti-  
 187 mated, most of them live in coastal areas especially in  
 188 the main cities of Hadibu and Qalansia. The main lan-  
 189 guage is Socotri which is one of the Semitic languages

[73], and Arabic is the official and commonly spoken 190  
 language. Socotra Archipelago is recognized as a regional 191  
 center of biodiversity, announced as a UNESCO 192  
 World Natural Heritage Site since 2008 [71]. The Socotri 193  
 people live in a relatively isolated area and are 194  
 strongly connected to their land. Socotra is approxi- 195  
 mately 350 km far from the nearest mainland Yemen 196  
 and in the past has been reached only by ships, being 197  
 disconnected from the mainland during the monsoon 198  
 months that makes the island more isolated till the 199  
 opening of Socotra airport in 2000, which opened So- 200  
 cotra to the outside world [74]. 201

### 202 Study areas selection

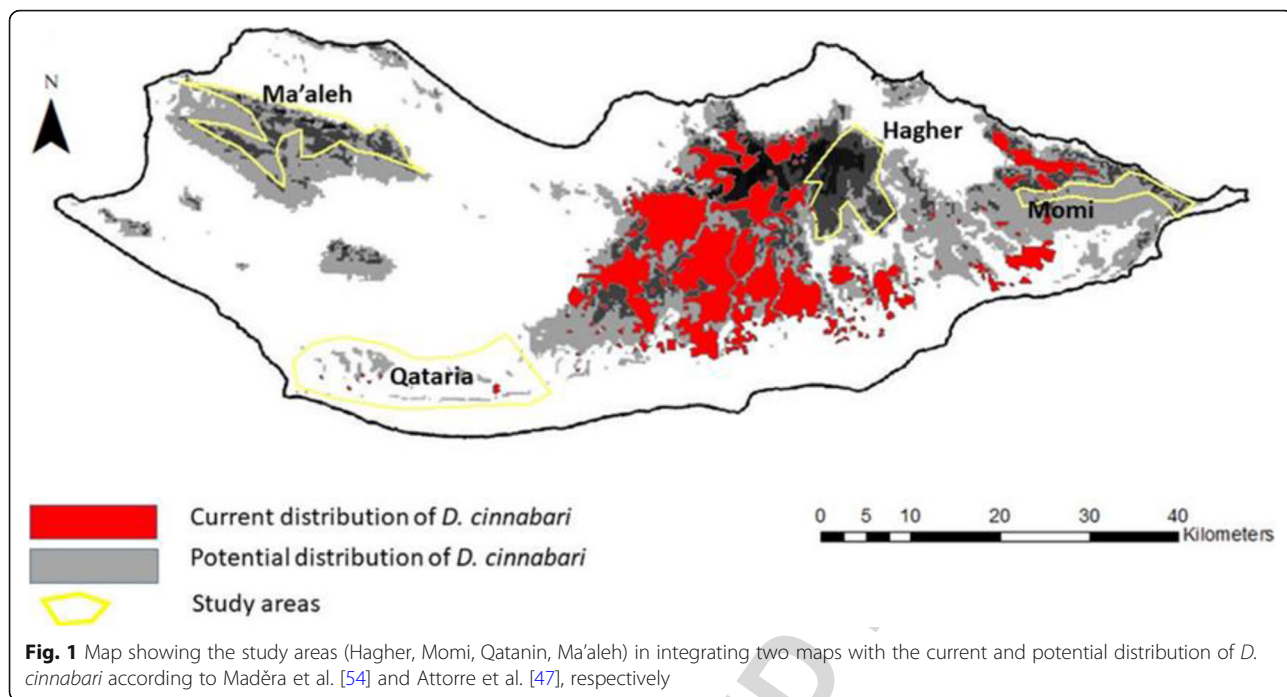
203 Four areas have been selected by overlapping of two  
 204 maps belonging to different datasets. The first map con-  
 205 tains the current distribution of *D. cinnabari* [54], and  
 206 the second map is the potential distribution of *D. cinna-  
 207 bari* according to its ecology [47]. The areas of the po-  
 208 tential distribution not overlapped by the current  
 209 distribution were selected for the study (Fig. 1).

F1

### 210 Data collection

#### 211 Survey technique and toponym meaning

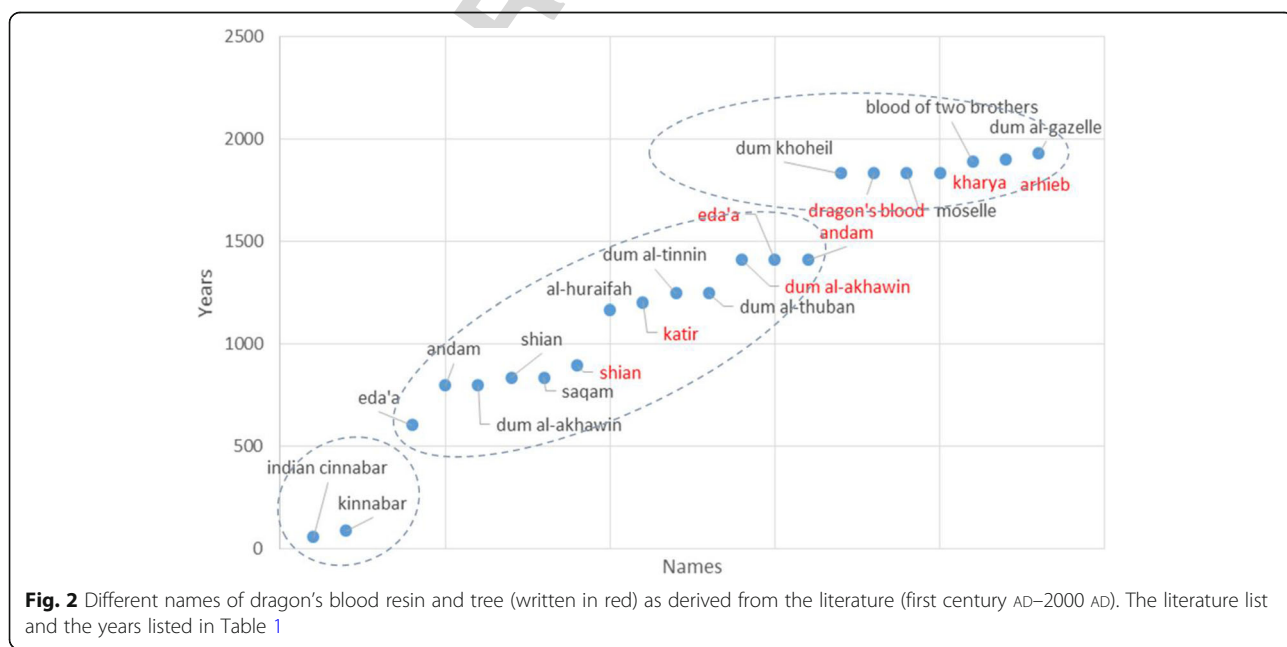
212 Fieldwork was carried out by visiting the areas and inter-  
 213 viewing people residing in the area. The place names  
 214 were collected, and the meaning was directly obtained  
 215 on the spot in collaboration with a local guide. The  
 216 meaning of the names was discussed in detail with the  
 217 indigenous people. The positions of the places have been  
 218 recorded as possible by GPS. During the fieldwork, three  
 219 types of data were recorded: (1) toponyms, (2) visual ob-  
 220 servation of existing *D. cinnabari* trees in nature, and (3)  
 221 interview with the people about the area, in particular,  
 222 the occurrence of *D. cinnabari* in the area. Three areas  
 223 were visited personally (Hagher, Momi, Qataria), and  
 224 due to logistic limitations, the place names for the fourth  
 225 area (Ma'aleh) were recorded remotely through commu-  
 226 nication with local people. The place names were re-  
 227 corded by fieldwork and remotely further confirmed by  
 228 sending them to the other two residents to ensure the  
 229 meaning. Local people also have been asked if there are  
 230 any names related to the dragon's blood tree and its dis-  
 231 tribution. GIS ArcMap was used to plot the georefer-  
 232 enced toponyms for three areas (Hagher, Momi, and  
 233 Qataria) and those from Ma'aleh by approximation. A  
 234 detailed literature review of Arabic and Western sources  
 235 was carried out to investigate current and old names for  
 236 the dragon's blood tree and its resin. Somali names for  
 237 *D. ombet* were collected by direct communication with  
 238 Mr. Ahmed Ibrahim Awale, and the same for Sudani  
 239 names for *D. ombet* by indirect communication with Dr.  
 240 Iqbal Madani.



f1.1 **Fig. 1** Map showing the study areas (Hagher, Momi, Qatanin, Ma'aleh) in integrating two maps with the current and potential distribution of *D.*  
 f1.2 *cinnabari* according to Madèra et al. [54] and Attorre et al. [47], respectively  
 f1.3

241 **Results**  
 242 **Tracking dragon's blood names through history**  
 243 From literature, we can distinguish three naming periods  
 F2 244 (Fig. 2). A variety of names for dragon's blood appear  
 245 during the golden era in science in the Islamic Arabic  
 246 world (ca. 800–ca. 1500 AD). The last period represents  
 247 the new western renaissance and scientific exploring  
 248 missions, especially from Europe. The described period  
 249 in this study begins in the year 60 AD, with the

appearance of the first name referred to dragon's blood, 250  
 and ends in the year 2000 with the opening of Socotra 251  
 to the outside world—the opening of Socotra Inter- 252  
 national Airport. The horizontal oval shape shows that 253  
 the naming was at close intervals, while the oblique oval 254  
 shape indicates that the naming appeared at long inter- 255  
 vals (Tables 1 and 2). 256 **T1T2**  
 Depending on the number of sources for each time, 257  
 the frequency of names can be limited (e.g., few first- 258



f2.1 **Fig. 2** Different names of dragon's blood resin and tree (written in red) as derived from the literature (first century AD–2000 AD). The literature list  
 f2.2 and the years listed in Table 1  
 f2.3



t1.1 **Table 1** Appearing of dragon's blood names (resin/tree) from the first century AD to 2000 AD

t1.2	No.	Author	Referred to	Dragon's blood name	Year	Notes
t1.3	1	Breasted [57]	Marchant	Indian cinnabar	60	Resin
t1.4	2	Breasted [57]	Dioscorides	Kinnabar	90	Resin
t1.5	3	Abu Hanifa [60]	Al-sulaik	Eda'a	605	Resin
t1.6	4	Ibn Manzur and Mukarram [61]	Al-asmai	Andam	800	Resin
t1.7	5	Ibn Manzur and Mukarram [61]	Al-asmai	Dum al-akhawin	800	Resin
t1.8	6	Ibn Sallam [59]		Shian	838	Resin
t1.9	7	Ibn Sallam [59]		Baqam	838	Resin
t1.10	8	Abu Hanifa [60]		Shian	869	Tree
t1.11	9	Ibn Manzur and Mukarram [61]	Ibn Barii	Al-huraifah	1165	Tree
t1.12	10	Abi Umran [75]		Katir	1204	Resin
t1.13	11	Ibn Al-baitar [76]		Dum al-tinnin	1248	Resin
t1.14	12	Ibn Al-baitar [76]		Dum al-thuban	1248	Resin
t1.15	13	Al-Firuzabadi [62]		Dum al-akhawin	1410	Tree/resin
t1.16	14	Al-Firuzabadi [62]		Eda'a	1410	Tree/resin
t1.17	15	Al-Firuzabadi [62]		Andam	1410	Tree/resin
t1.18	16	Wellsted [64]		Dum khoheil	1835	Resin
t1.19	17	Wellsted [64]		Dragon's blood	1835	Tree/resin
t1.20	18	Wellsted [64]		Moselle	1835	Resin
t1.21	19	Balfour [65]	B.C.S	Kharya	1835	Tree
t1.22	20	Breasted [57]	Bent	Blood of two brothers	1893	Resin
t1.23	21	Forbes [55]		Arhieb	1899	Tree

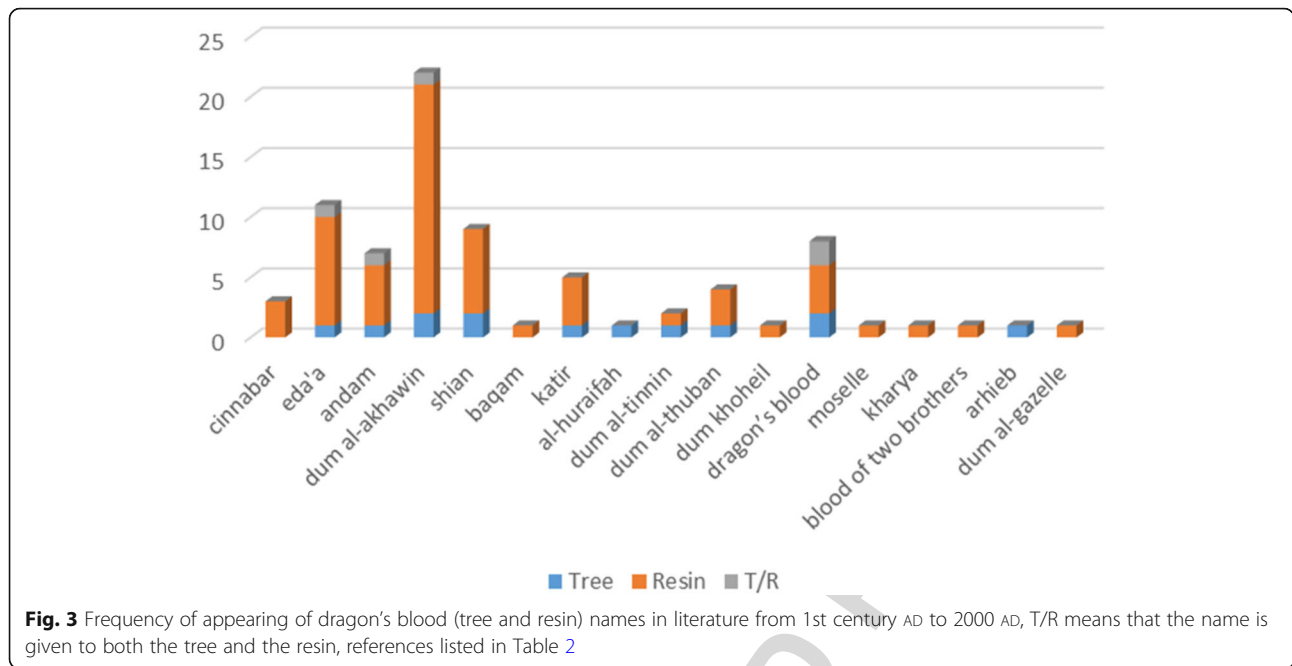
t2.1 **Table 2** Dragon's blood names (resin/tree) frequency from the  
t2.2 first century AD to 2000 AD

t2.3	No.	Name	Frequency			Authors
t2.4			R	T	T/R	
t2.5	1	Cinnabar	3			[57, 77]
t2.6	2	Eda'a	9	1	1	[59–64, 75, 78–82]
t2.7	3	Andam	5	1	1	[59, 61–63, 76, 80, 83]
t2.8	4	Dum al-akhawin	19	2	1	[59, 61–63, 75, 76, 78–90]
t2.9	5	Shian	7	2		[59, 63, 75, 76, 79–82, 90]
t2.10	6	Baqam	1			[59]
t2.11	7	Katir	4	1		[63, 66, 75, 78, 87]
t2.12	8	Al-huraifah	1			[61]
t2.13	9	Dum al-tinnin	1	1		[63, 76]
t2.14	10	Dum al-thuban	3	1		[63, 76, 80, 82]
t2.15	11	Dum khoheil	1			[64]
t2.16	12	Dragon's blood	4	2	2	[55, 57, 64, 65, 77]
t2.17	13	Moselle	1			[64]
t2.18	14	Kharya		1		[64]
t2.19	15	Blood of two brothers				[57]
t2.20	16	Arhieb		1		[55]
t2.21	17	Dum al-gazelle		1		[63]

century AD sources). High-frequency words are the occur- 259  
 rences of eda'a, dum al-akhawin, and dragon's blood; 260  
 medium frequency words are cinnabar, andam, and katir; 261  
 other names are in low frequency. Most of the names referred 262  
 to the resin, and a few referred to the tree (shian, al- 263  
 huraifah, and kharya). The two names for the resin appearing 264  
 in the first period (Fig. 3) were treated as one name because 265 **F3**  
 they came from the same origin "cinnabar." Four common 266  
 names for the dragon's blood tree appear to be "dum al- 267  
 akhawin," "eda'a," "al-huraifah," and "shian," besides the 268  
 English name "Dragon's Blood Tree," of course. 269

The contemporary names (Table 3) were written accord- 270 **T3**  
 ing to where they occur in the references; names from 271  
 Yemen, Saudi Arabia, and Sudan were written in simplified 272  
 English by the author. The names representing four species 273  
 of *Dracaena* distributed in the Arab World are presented in 274  
 five languages (Socotri, Arabic, Hadandawa, Somali, and 275  
 Amazigh). All names in the table are for dragon's blood tree, 276  
 and the names of the resin "emszolah" and "iydiha" are 277  
 added from Socotri. The word "dum al-akhawin" is used as a 278  
 name for the tree and the resin. 279

**Toponyms** 280  
 A total of 301 toponyms were recorded from the four study 281  
 areas in Socotra Island (Table 4), which characterize how the 282 **T4**



**Fig. 3** Frequency of appearing of dragon's blood (tree and resin) names in literature from 1st century AD to 2000 AD, T/R means that the name is given to both the tree and the resin, references listed in Table 2

283 Socotri people view their landscape. Toponyms were clustered in six broad categories based on their meaning:

- 285 1. Animal: place name referring to animals such as livestock, birds, other
- 286
- 287 2. Human: place names referring to human body parts, names, feeling, interaction, tools
- 288
- 289 3. NA: place name with unknown meaning
- 290
- 291 4. Plants: place names referring to plant species, density
- 292
- 293 5. Terrain: place names referring to the shape and color of the landscape
- 294
- 295 6. Water: place names referring to water such as rain, streams

296 Most toponyms were recorded from the Hagher, and the lowest number were recorded from Ma'aleh as this was through indirect communication.

It is clearly visible (Fig. 4) that the most represented toponyms were related to terrain (37.5%). People not only describe the topography of the land such as mountain, hill, flat, and rock but also describe the general view of those areas such as open, narrow, protected, high, and low; the people also describe the soil and color of the land. Terrain toponyms followed by names referring to human characters and activities (24.3%). Interestingly, most of these names referred to human activities such as playing, jumping, relaxing, or giving, and that can be related to a once frequent activity in the place, yet they also use feelings such as hunger and fear and parts of the body like the ears, neck, and teeth if they resembled the topography by human parts. There are no naming places after people except two names for the tribes. The plant names represent 13.6%, varying between 8.7 and 15.6% among study areas (Fig. 5). These three categories have a higher percentage within all study areas (Fig. 5).

F4

F5

t3.1 **Table 3** Contemporary names of dragon's blood (tree/resin) in the Arabic region [39, 46, 68, 69, 91]

t3.2 Area ( <i>D. species</i> )	Dragon's blood names (tree/resin)				
t3.3 Socotra ( <i>D. cinnabari</i> ) [39, 46]	A'arhiyib	lydiha <sup>a</sup>	Emzoloha <sup>a</sup>	Ahrieb	Dum al-akhawin
t3.4 Yemen ( <i>D. serrulata</i> ) [68]	Airob	Kasar	Kasl	Arrab	Khwas Faliqat al-gawz
t3.5 Saudia ( <i>D. serrulata</i> ) [69]	Arab	Khazm	Khazami	Arrab	Khaws Azaf
t3.6 Oman ( <i>D. serrulata</i> ) [91]	Areeb			Ariab	Ayrob
t3.7 Sudan ( <i>D. ombet</i> ) <sup>b</sup>	Embet	Emet	Ras al-shitan	Shagart al-Tinnin	
t3.8 Somalia ( <i>D. ombet</i> ) <sup>b</sup>	Dinaw	Mooli			
t3.9 Morocco ( <i>D. draco</i> ) <sup>b</sup>	Ajgal				

t3.10 <sup>a</sup>Dragon's blood resin

t3.11 <sup>b</sup>By communication (see data collection)

t4.1 **Table 4** Distribution of the toponyms among categories and areas

t4.2 Category/area	Hagher	Ma'aleh	Momi	Qataria	Total
t4.3 Animal	7	8	6	5	26
t4.4 Human	26	15	17	15	73
t4.5 NA	9	7	10	6	32
t4.6 Plant	17	8	6	10	41
t4.7 Terrain	43	21	24	25	113
t4.8 Water	7	0	6	3	22
t4.9 Total	109	59	69	64	301

317 Toponyms related to animals and water have a lower  
 318 percentage of 9% and 6.9%, respectively, and there are  
 319 names of unknown meaning (10.6%).

320 Given the importance of plants for people in Socotra, it is not  
 321 surprising that the names referred to plants come in the third  
 322 position. Based on further analysis, we divided the plant names  
 T5 323 into five subcategories (Table 5) based on their meaning;

- 324 1. Unidentified: place names referring to the  
 325 unidentified plant species
- 326 2. Identified: place names referring to the identified  
 327 plant species such as the Socotri word "Tayf" for  
 328 Aloe
- 329 3. General: place names referring to the word "plant"  
 330 without any specification
- 331 4. Density: place names referring to the plant density
- 332 5. Grass: place names referring to grassland

333 We found six records of phytotoponyms related to *D.*  
 334 *cinnabari*, which represent 2% from all toponyms

recorded, 14.6% from the phytotoponyms, and 27.3%  
 335 from the subcategory of phytotoponyms referring to  
 336 identified plant species (Figs. 6 and 7).  
 337 F6 F7

**Reconstruction of dragon's blood tree distribution** 338

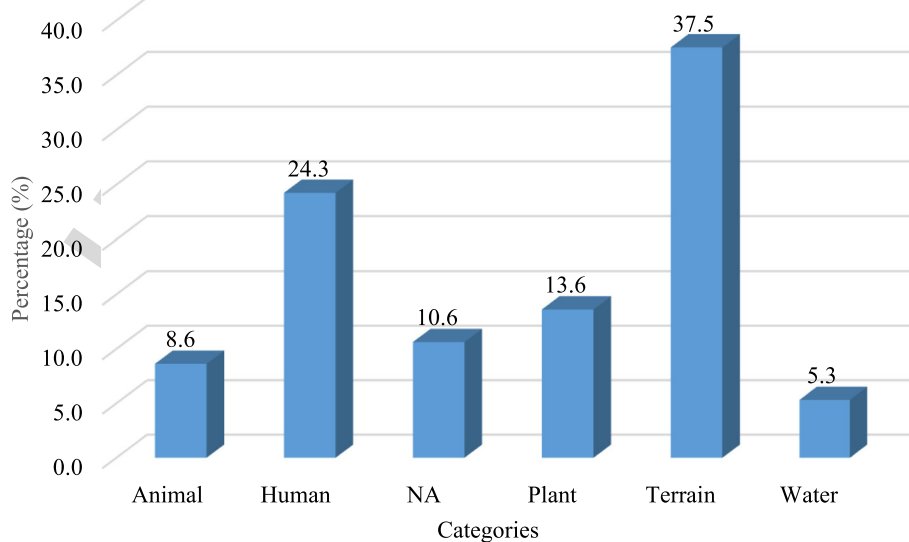
Among the six phytotoponyms referring to *Dracaena*  
 339 (Fig. 7), there is one located in the far end of Ma'aleh  
 340 Mountains and two on the eastern edge of Momi plat-  
 341 eau, and both far from the currently known *D. cinnabari*  
 342 distribution. The other toponyms include three localities  
 343 in Qataria where few remaining trees are known (Ma-  
 344 dëra et al. [54]) and one in the Hagher, at the border of  
 345 the current distribution of *D. cinnabari*. People in those  
 346 areas have been interviewed individually, within-group  
 347 discussion and communication, and the results are pre-  
 348 sented in the map (Fig. 8). The people from Hagher  
 349 F8 speak about possible sites for *D. cinnabari* close to the  
 350 areas of current distribution, and people in Qataria and  
 351 Momi speak about the possible sites for *D. cinnabari* in  
 352 the cliffs towards the sea; however, we could not confirm  
 353 this during the study visit. During the fieldwork, we re-  
 354 corded new sites with *D. cinnabari* (Fig. 8) where the  
 355 trees have been observed. Both possible and new sites  
 356 need further research.  
 357

**Discussion** 358

**Tracking dragon's blood tree phytotoponyms** 359

**Names through history** 360

According to the estimates based on genetic research,  
 361 Socotra was inhabited ca. 6000 years BP [92]. From the  
 362 old manuscripts, cinnabar was derived from the ancient  
 363 Greek name for red mineral (mercury sulfide HgS) and  
 364 adapted as the scientific name for Socotra dragon's  
 365



**Fig. 4** Frequency of toponym categories in the four selected areas on Socotra, summary of 301 names

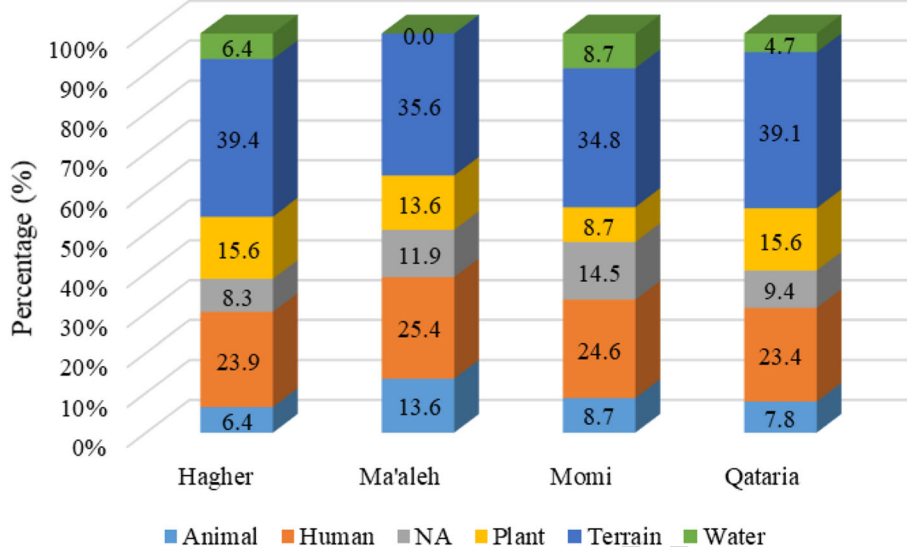


Fig. 5 Frequency of toponym categories within each area

f5.1  
f5.2

366 blood tree (*Dracaena cinnabari*) and has no relation to  
 367 current or historical Arabic names only perhaps by  
 368 color. Arabic literature [59, 61, 84, 86] use dum al-  
 369 akhwin as a common Arabic name for dragon's blood  
 370 resin, sometimes for the tree without specification of the  
 371 sources and for the resin brought from Socotra, and this  
 372 name continued to be used from the past until today.  
 373 "Eda'a" is the only local Socotri name that appears sig-  
 374 nificantly in Arabic literature [60, 87] especially for the  
 375 resin of dragon's blood tree due to its famous use in  
 376 medicine. Other Arabic old names for dragon's blood  
 377 such as "andam" [76, 83], "dum al-thuban" [76], and  
 378 "shian" [79] are also used for other products, as an ex-  
 379 ample, "andam" used for logwood. "Dum al-tinnin" [76]  
 380 is the Arabic translation of dragon's blood, and "katir" is  
 381 the general name for drops. The first record for the local  
 382 name of dragon's blood tree was in 1899 by Forbes [55],  
 383 but *eda'a* and *emsello* ("moselle") have been mentioned  
 384 also by Wellsted [64]. Cabo González and Bustamante  
 385 Costa [93] suggested that there is a weakness in diction-  
 386 aries and confusion of terminology related to dragon's  
 387 blood names and gave an example of "andam" and  
 388 "baqam." However, *andam* with its red color can bring  
 389 some confusion but *baqam* before 1500 AD was rarely  
 390 mentioned in Arabic literature, in my review just once  
 391 by Ibn Manzur and Mukarram [61]. From their reviews,

392 "shian" is a popular name for dragon's blood in Morocco  
 393 which is of Persian origin; however, the translation of  
 394 dragon's blood to Persian is "khun-siawshan" which ap-  
 395 pears in 1205 by Abi Umran [75], who divided the  
 396 names by area: Arabia "dum al-akhawin and eda'a,"  
 397 Morocco "shian," and Persia "khun-siawshan." In their  
 398 review, three other names of dragon's blood appear "Itr  
 399 mansham," "Hagun," and "Tabdigha" referenced to Abu  
 400 al-khair (ca 1200) [80], and according to them, "Tabdiga"  
 401 is from the Amazigh language.

402 There is no sign of loss of cultural knowledge as a  
 403 consequence of Arabic intervention. Only one name ap-  
 404 pears from Arabic (name of the plant) and that could be  
 405 from an individual perspective or newly named, but  
 406 there are still names that cannot be explained by the  
 407 local people and that show their ancient roots. Although  
 408 a large part of Socotra is uninhabited intensively by  
 409 people—around 100 thousand inhabitants in 3625 km<sup>2</sup>,  
 410 many spaces have no urbanization. The human inter-  
 411 action is very clear: by giving names for each patch of  
 412 land (personal observation), this confirms that the Socotri  
 413 people have strong knowledge, understanding, inter-  
 414 action, and connection with places, and the huge walls  
 415 "eggehon" dominating the landscape especially in the  
 416 higher altitudes has been claimed as circumstantial evi-  
 417 dence that the wall system on Socotra might be a sign of  
 418 past historical intensive farming activities for incense,  
 419 dragon's blood, or aloes [48].

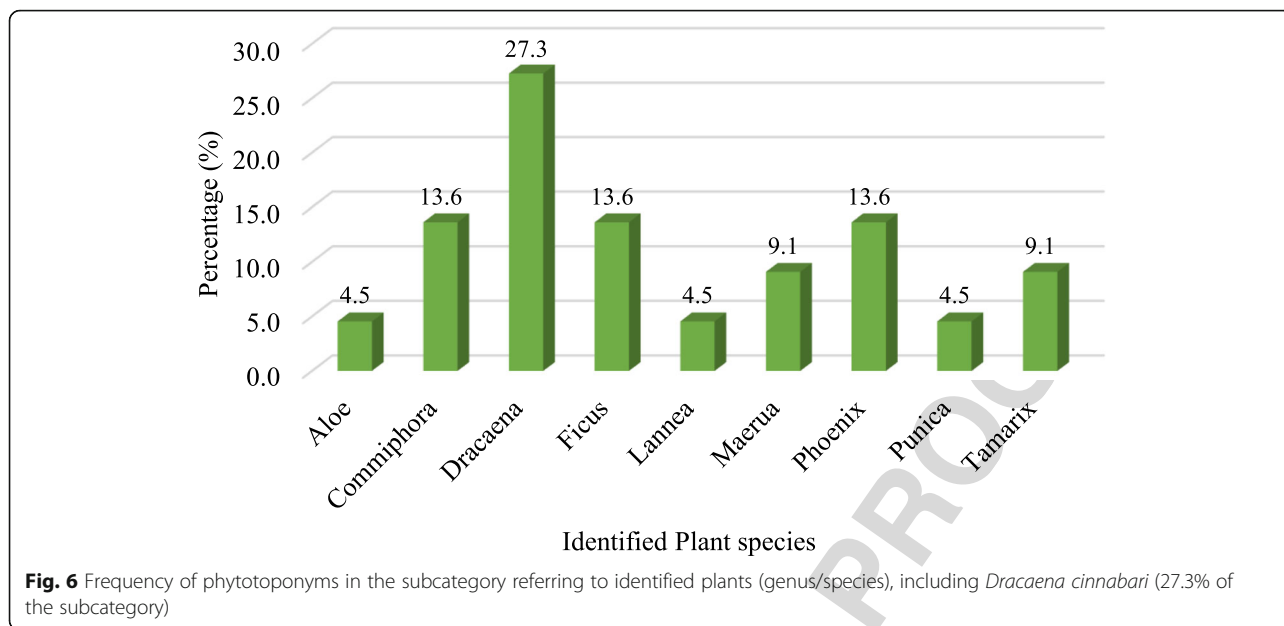
t5.1 **Table 5** The frequency of place names in individual sub-  
 t5.2 categories of the phytotoponyms

t5.3 Sub-category	Unidentified	Identified	General	Density	Grass
t5.4 Number	5	22	6	6	2
t5.5 Percentage (%)	12.2	53.7	14.6	14.6	4.9

**Current names**

420 There are four dragon's blood trees in the Arabic-  
 421 speaking regions, *D. cinnabari* in Socotra; *D. serrulata*  
 422 in Yemen, Oman, and Saudi Arabia; *D. ombet* in Saudi  
 423

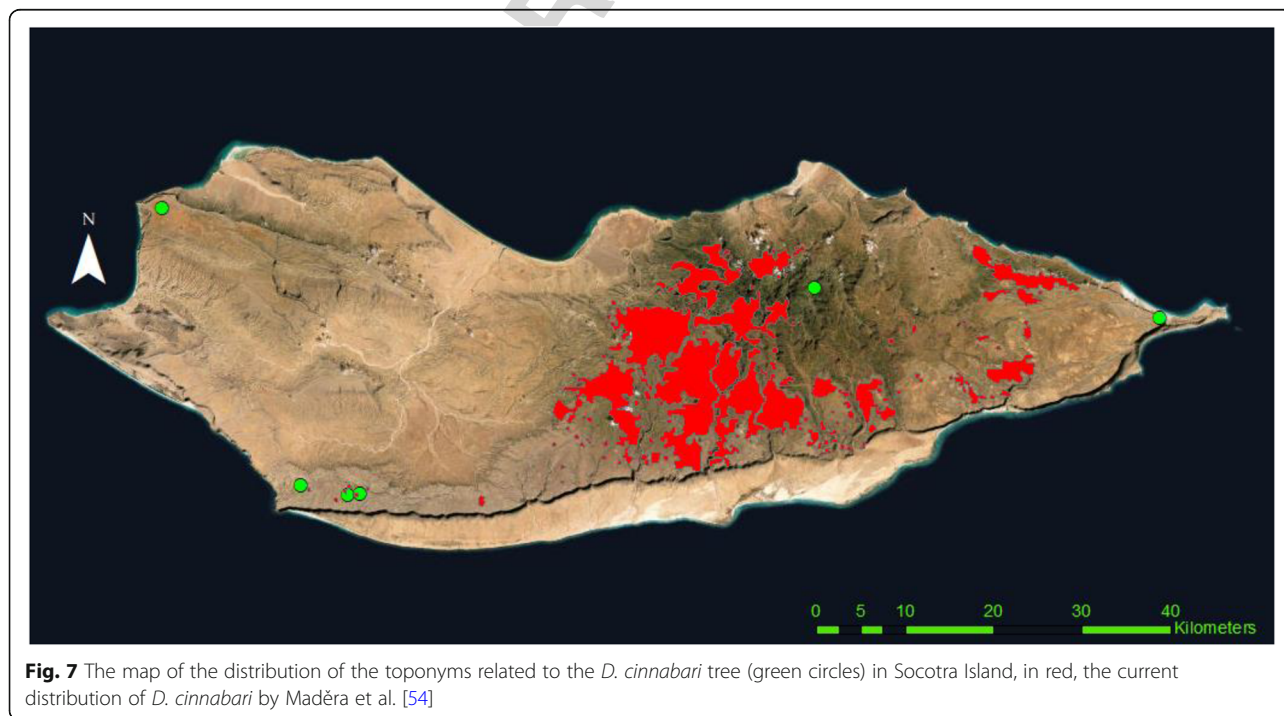




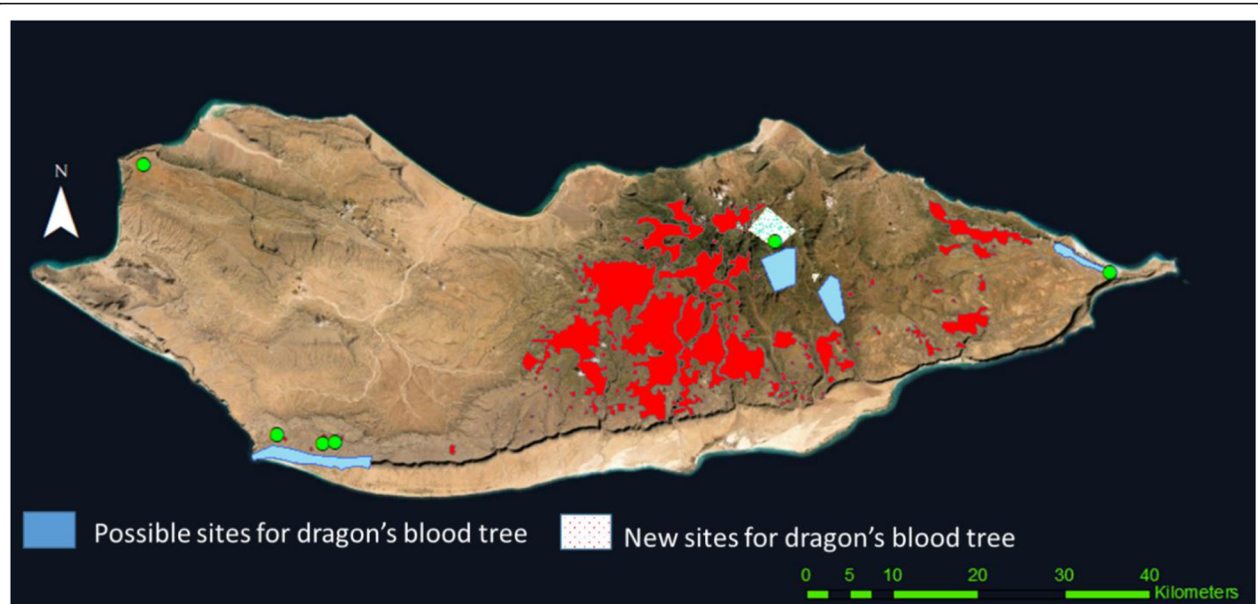
f6.1  
f6.2  
f6.3

424 Arabia, Sudan, Egypt, Ethiopia, and Somalia; and *D.*  
 425 *draco* subsp. *ajgal* in Morocco. We have seven groups of  
 426 names according to the area (Table 2). In my opinion,  
 427 “Ahrieb” with its different form of writing and pronuncia-  
 428 tion is the common local name for all dragon’s blood  
 429 tree species in Arabic region (Yemen, Socotra, Oman,  
 430 and Saudia Arabia) (Table 3) [39, 46, 68, 69, 91]. Differ-  
 431 ent names appear such as “Ajgal” in Morocco in the  
 432 Amazigh language, “Embet” in Sudan in the Hadandawa

433 language, and “Mooli” in Somalia in the Somali lan-  
 434 guage. In Socotra, there is only one local name for the  
 435 dragon’s blood tree which is “ahrieb;” other names such  
 436 as “emsello” is for the pure product or “eda’a” is the  
 437 mixed product with tree bark [39, 46, 68], and due to  
 438 the difference in dialect, people of western Socotra call it  
 439 “ahrieb,” with “ ” instead of “ ”. Other current Arabic  
 440 local names linked the leaves and their similarity with  
 441 palm leaves such as “khwas” and “khazm;” the same is



f7.1  
f7.2  
f7.3



f8.1 **Fig. 8** Map of new sites of dragon's blood tree from the fieldwork (white polygon with dots), not published by Maděra et al. [54] (red color), and  
 f8.2 possible sites for dragon's blood tree according to the local community for further field research (blue polygons), toponyms related to *D.*  
 f8.3 *cinnabari* (green points)  
 f8.4

442 used for the leaves of dragon's blood tree in Socotra  
 443 "sa'af" which is also used for palm leaves. The names in  
 444 Morocco, Sudan, and Somalia are not linked to Arabic;  
 445 "ajgal" and "ombet" are in local languages and have been  
 446 used for the scientific name.

#### 447 **Toponym**

448 The use of geographical-/ecological-based toponyms  
 449 stands as a potentially useful tool for aiding the recon-  
 450 struction of historical changes. Toponyms have rarely  
 451 used as a biogeographic indicator of species or  
 452 vegetation-type occurrences [35]. Analyzing the topo-  
 453 nyms (Fig. 5) shows a high frequency of names referring  
 454 to the terrain. Zeini et al.'s [94] study in Sinai (Egypt)  
 455 classified 69.9% of their recorded place names as refer-  
 456 ring to the landforms followed by names that referred to  
 457 water. Human place names are typically metaphorical,  
 458 alluding to a resemblance between some physical feature  
 459 of a site and the shape of the organ after which it is  
 460 named [13]. In Socotra, human place names describe  
 461 where things happen and places where people harvest,  
 462 gather the goats, collect water, or play and they have a  
 463 general name for a whole area or landmark (like a  
 464 mountain). Plotting the distribution of plant names in  
 465 Socotra is another way to appreciate and display the eco-  
 466 logical niche and knowledge.

467 Plant names (phytotoponyms), which are our focus in  
 468 this research, come in the third position with a fre-  
 469 quency of 13.6%. Most of the phytotoponyms are for  
 470 general names or uses, while 53.7% of all phytotoponyms

could be identified by scientific names and 12.2% could  
 471 not be identified (Table 4). This shows a strong connection  
 472 between the people and the plants. The identified plants are  
 473 important for food, fodder, and firewood (*Phoenix*, *Tamarix*,  
 474 *Punica*), famous for their products such as (*Dracaena* and  
 475 *Aloe*) [39]. Similarly, Shi et al. [28] mentioned that plant  
 476 names often used in daily life appear frequently in phytoto-  
 477 ponyms. In Socotra, trees and large shrubs easily distin-  
 478 guished in the landscape, such as *Commiphora* and *Maerua*,  
 479 represent landmarks (Wolf 1998: Camarda 2005 cited by  
 480 Pinna et al. [37]), and these categories give a good sign for  
 481 orientation and recognizing the landscape. Water was in the  
 482 last position, with 5.3% names related to water existence or  
 483 its amount. Comparing within areas, we found out that east-  
 484 ern sites have more place names related to water than west-  
 485 ern site, which looks logically correct with eastern Socotra  
 486 having a higher amount of water than the western areas [42].  
 487 Names related to cows and goats represent the main animal  
 488 toponyms because they are the main livestock on the island.  
 489 All areas have a similar percentage of names referring to ani-  
 490 mals that can be explained by the fact that grazing is com-  
 491 mon in the selected areas and on the island in general.  
 492 Names with unknown meaning could be linked to ancient  
 493 language as suggested by Wagner (1960–1964) cited by  
 494 Pinna et al. [37].  
 495

#### 496 **Potential implications for past dragon's blood tree** 497 **distribution**

498 Dragon's blood tree name appears 6 times which repre-  
 499 sent 14.6% of the phytotoponyms, four occurrences in

500 western Socotra with two different variants and two in  
501 eastern Socotra with also two different variants. Pérez  
502 [95] also noted three different variants of the phytotop-  
503 onyms “drago” in the Canary Islands, exploring the local  
504 dialects. All the names in the western areas of the island  
505 are not single names but linked with other words, *D.*  
506 *cinnabari* pool, *D. cinnabari* sign, *D. cinnabari* place,  
507 and *D. cinnabari* stand. The six names include two  
508 names associated with the existing *D. cinnabari* tree,  
509 one name associated with a place close to *D. cinnabari*  
510 trees and where there have been trees before, one name  
511 associated with a place close to *D. cinnabari* tree but no-  
512 body remembers that there was a tree before, one name  
513 with no tree near but according to the local people it  
514 could exist, and one name with no trees and historically  
515 nobody knows of the trees existence on the area.

516 Half of the *D. cinnabari* place names occur in Qataria,  
517 the area with a few limited isolated trees. Qataria is the  
518 farthest western site of current *D. cinnabari* distribution  
519 on the island, and the place names of *D. cinnabari* are  
520 near and around the remnant *D. cinnabari* trees. Ac-  
521 cording to the local people in the area, there is a possi-  
522 bility of a small dragon’s blood trees in the cliffs towards  
523 the sea, which provides an opportunity for discovering  
524 new *Dracaena* sites in the area. This area is the western  
525 end of the ridge stretching from the central Hagher  
526 Mts., and it indicates that the entire ridge could be likely  
527 covered by *Dracaena* forests in the past, even though  
528 Attorre et al. [47] did not assign most of this area to the  
529 model of potential *Dracaena cinnabari* distribution. In  
530 the second area in Momi, on the eastern side of the is-  
531 land, there is a *D. cinnabari* place name, but according  
532 to the local community, there is also the possibility of *D.*  
533 *cinnabari* trees on the cliffs towards the sea. In fact, this  
534 area is not far from the recent *Dracaena* population and  
535 was included in the potential *Dracaena* occurrence  
536 made by Attorre et al. [47].

537 The third place is Ma’aleh (in the west), where *D. cin-*  
538 *nabari* is a place name but no more information is avail-  
539 able and there was no opportunity for visiting the site.  
540 This finding is the most important because is the fur-  
541 thest from recent *D. cinnabari* distribution. In the entire  
542 western part of Socotra, there is no one current record  
543 of *Dracaena* occurrence beyond Qataria [54] and this  
544 toponym would also confirm the model of potential  
545 *Dracaena* occurrence in the Ma’aleh’s highland pub-  
546 lished by Attorre et al. [47].

547 The last *D. cinnabari* place name in the Hagher is  
548 close to *D. cinnabari* population, but the name is for a  
549 place without *D. cinnabari* trees and they do not know  
550 the presence of the tree in the place before; another *D.*  
551 *cinnabari* place name was also recorded from Hagher  
552 towards To’ahor’s campsite-outside or study area (com-  
553 munication with local people).

In all investigated areas, there are still some preserved 554  
plant species accompanying dragon’s blood tree wood- 555  
lands as *Boswellia ameero*, *B. elongata*, *Buxanthus pedi-* 556  
*cellatus*, *Commiphora planifrons*, *Euphorbia socotrana*, 557  
or *Euryops arabicus* [96–102]. The occurrence of these 558  
plants can serve as an indirect indicator of previous *D.* 559  
*cinnabari* distribution according to the associated plant 560  
communities. 561

Generally, the *D. cinnabari* place names seem to be as- 562  
sociated with the current and potential distribution. A 563  
similar result was obtained by Pérez [95] for *Dracaena* 564  
*draco* on Gran Canaria. In his map, there are 42 phyto- 565  
toponyms: 2 names associated with existing *D. draco* oc- 566  
currence and others are close to the current distribution 567  
of individual trees or in the area of potential distribution. 568  
The population decline of *Dracaena draco* is much lar- 569  
ger than thus documented on Socotra Island by many 570  
authors [43, 47, 103–106]. Overgrazing destroying the 571  
natural regeneration [107] and very slow growth of re- 572  
cruitment [49] do not allow the trees to escape from the 573  
browsing zone [50, 54, 108]. Therefore, these are known 574  
as the main reasons for the population decline. The loss 575  
of each tree leads to a decrease in biodiversity, as 576  
dragon’s blood trees are important nurse trees [53] and 577  
habitats for animals also [109, 110]. The loss of dragon’s 578  
blood trees may also affect the hydrological cycle as 579  
these plants capture horizontal precipitation [111]. 580

## 581 Conclusion

In Socotra, luckily, the landscape still has its original 582  
characteristic with relatively little human interventions 583  
[74], although the natural and human landscape is rap- 584  
idly changing [112]. Ethnobotanical knowledge has been 585  
preserved within its unique language [39]. We can 586  
summarize our conclusions in seven main points: 587

- 588 1. *Dracaena cinnabari* toponyms exist in Socotra and 589  
seem related to areas where currently no trees are 590  
present, yet they were historically a feature of the 591  
place; this could support the argument that the 592  
distribution of *Dracaena* was larger in the past [47]. 593
- 594 2. The *D. cinnabari* trees could be distributed to the 595  
whole medium to higher altitude areas on the 596  
island, potentially from the west in Ma’aleh to the 597  
east in Momi, before humans inhabited the island. 598
- 599 3. Currently, the Arabic common name for dragon’s 600  
blood resin is “dum al-akhawin” and that for the 601  
tree is “ahrieb” and can be generalized. 602
- 603 4. The local name that appeared in history for the 604  
main product is “eda’a” (mixed-cooked dragon’s 605  
blood), and this can be a sign that “eda’a” was the 606  
main product exported from Socotra.
- 607 5. There could be potentially new areas for finding *D.* 608  
*cinnabari* trees especially in the cliff areas towards 609



606 the sea in Qataria and Momi, also the northeastern  
 607 slopes of Hagher towards Momi plateau in the east,  
 608 and Noged plain to the North.  
 609 6. This result can be an important part of  
 610 conservation efforts, and those areas with *D.*  
 611 *cinnabari* toponyms could be potential areas for  
 612 future reforestation of this species, where ecological  
 613 conditions allow.  
 614 7. The study has stressed the need for documenting  
 615 place names and knowledge related as part of  
 616 preserving the cultural heritage related to plants of  
 617 the Socotra Archipelago and the importance of  
 618 using this knowledge for sustainable resource  
 619 management. This study is just a first step for  
 620 further use of toponyms and can be repeated for  
 621 other important species or historical land use.

#### 622 Acknowledgements

623 Special thanks to my supervisor Prof. Petr Maděra for his wholehearted  
 624 scientific guidance, encouragement, and support during the design, data  
 625 analysis, and write-up phases. I am also grateful for Dr. Kay Van Damme for  
 626 his valuable comments and encouragement. Thanks to the people of Socotra  
 627 for their kindness, generosity, and support. Special thanks are given to Dr.  
 628 Sa'ad Amer, Dr. Nooh Al-Alimi, Ing. Ahmed Al-rumaili and Ing. Ahmed Al-  
 629 terbhi for their great support, advice, reviewing, and commenting on the  
 630 meaning of Socotri's names. My great thanks are extended to all friends who  
 631 support me during this work.

#### 632 Author's contributions

633 The author read and approved the final manuscript.

#### 634 Authors' information

635 The author have been living and working in Socotra Island for more than 20  
 636 years. The author works in natural conservation especially with local  
 637 communities.

#### 638 Funding

639 No funding, as the research is part of my PhD study in Mendel University in  
 640 Brno, Czech Republic

#### 641 Availability of data and materials

642 All data generated or analyzed during this study are included in this  
 643 published article (and its supplementary information files).

#### 644 Declaration

#### 645 Ethics approval and consent to participate

646 Not applicable.

#### 647 Consent for publication

648 Not applicable.

#### 649 Competing interests

650 The author declares that he has no competing interests.

651 Received: 11 January 2021 Accepted: 15 March 2021

652 Published online: 01 April 2021

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