Folk medicine used to heal malaria in Calabria (southern Italy)

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Abstract
In Italy, malaria was an endemic disease that was eradicated by the mid-20th century. This paper evaluates the prophylactic and therapeutic remedies used by folk medicine to cure malaria in Calabria (southern Italy). The data has been collected by analysing works of physicians, ethnographers, folklorists and specialists of the study of Calabrian history between the end of the 19th century and the 20th century. The data collected have allowed us to describe the most common cures used by the Calabrian people to treat malaria and the most evident symptoms of this disease, such as intermittent fever, hepato-spleenomegaly, asthenia and dropsy. This approach uncovered a heterogeneous corpus of empirical, magical and religious remedies, which the authors have investigated as evidences of past "expert medicine" and to verify their real effectiveness in the treatment of malaria.

Background
Malaria is an infectious disease that is caused by the Plasmodium parasite. This disease is transmitted to humans via the Anopheles mosquito. Malaria is a very ancient disease, and although it was not possible to prove its presence in ancient human bones, this disease was probably present among Homo genus ancestors [1]. Different populations, such as the Sumerians, Assyrian-Babylonians, Indians, Egyptians and Chinese, experienced seasonal and intermittent fevers [2]. In the Mediterranean area, particularly in Italy, malaria was an endemic disease that was eradicated by the mid-20th century. Moreover, the persistent and lasting presence of malaria determined an interesting state of debility of the affected subjects and a consequent weakening of the labour force, which led to some important and detrimental socio-economic consequences [3]. Folk medicine approaches were used in an attempt to treat several of the most evident effects of malaria, such as intermittent fever, hepato-spleenomegaly, asthenia and dropsy.

It is our aim in this work to identify folk medical cures that were used by the Calabrian people for the treatment of malaria, as evidenced in writings produced between the 19th and 20th centuries. The authors have also examined whether same remedies were already described by Pliny the Elder, Dioscorides, Galen and Serenus Sammonicus, so to be considered as evidence of past "expert medicine".

Area of Study
It is interesting to point out that in some peninsular and insular areas of Italy, despite all the drainage attempts initiated in the 16th century, malaria-associated mortality was only recently eradicated in the mid-20th century (Figure 1) [4]. Among the southern regions of Italy, Calabria was one of the regions that was most affected by malaria. The disease was endemic along its coasts (about 738 km), along its most important rivers (Mesima, Lao, Crati, Tacina and Neto) and within the valleys of its broad streams. The disease was prevalent in 52% of the Calabrian territory (7,877.31/15,080.32 km²) (Figure 2) [5]. Calabria showed both natural and antropic factors that favoured the spread of Plasmodium, as well as the endemic and century-old presence of malaria in its territory. Physical features that may have affected the spreading of malaria are represented by a rich hydrographic reticle and the occurrence of seismic phenomena (bradyseisms and earthquakes), which, at that time, contributed to increase the hydro-geological disorder, thus creating many different wet areas (for example, the single earthquake of 1783 created about 215 lakes), which are the favourite environment of the anopheles mosquito [6]. The antropic factors are represented fundamentally by latifundia,
deforestation and the very poor social and economic conditions of the rural Calabrian people [7].

Calabria is the southernmost region of peninsular Italy; it borders with the Ionian Sea to the east and south, with the Tyrrenian Sea to the west, and with the region Basilicata to the north, and it extends for about 250 km from north to south in the middle of the Mediterranean Sea. Calabria reaches 15,080 km² and 42% of its territory is represented by mountains: the Apennine mountain range - the southern Apennines, calcareous, with Pollino Massif (Serra Dolcedorme, 2267 m a.s.l.)- and the Calabrian Apennines, mainly siliceous - with the Coastal Range (M. Cocuzzo,1541 m a.s.l.), Sila Massif (M. Botte Donato,1929 m a.s.l.), Serre Calabre (M. Pecoraro, 1423 m a.s.l.) and Aspromonte Massif (Montalto, 1956 m a.s.l.). 49% of Calabria’s territory is represented by hills and only 9% is flat. The plains are restricted to coastal areas and only three plains extend into the internal areas of the territory (Sibari plain, Saint’Eufemia plain and Gioia Tauro plain).

The climate is Mediterranean, with maximum precipitation during the winter and minimum in the summer and vice versa for the temperature. Precipitation is represented by about 1,041 mm of rainfall per year. The average temperature in the coldest month (January) is about 8.3°C and the warmest month (August) about 24.4°C, with an annual average of 15.8°C [8]. However strong meso-climatic variations occur depending on
altitude, topographic features and location with respect to the sea.

From both an anthropological and an ethnobotanical point of view, Calabria is an interesting region, for the historical presence of several populations (Greeks, Romans, Byzantines, Arabs, Normans and Spanish) in the past that influenced the local culture [9]. Finally, it is interesting to note that the Arbëreshe community, of Albanian origins, settled in this region since the 16th century and is currently located in 25 communes in the provinces of Cosenza, Catanzaro and Crotone [10].

Methods

This study is based on the analysis of works written by physicians, ethnographers, folklorists and specialists of the study of Calabrian history between the end of the 19th century and the 20th century, in particular when both ethnographic and anthropological research focused on the study of folk medicine. For this reason, the authors have also consulted the check-lists about works on calabrian folk medicine and beliefs, edited by Lombardi Satriani [11] and Cavalcanti [12]. The sources used in this work are listed in Table 1. The data collected has allowed us to describe the cures used by the Calabrian people to treat malaria and its most evident symptoms, such as intermittent fever, hepato-spleenomegalia, asthenia and dropsy. This approach uncovered a heterogeneous corpus of empirical, magical and religious remedies, which the authors have investigated as an “official medicine” to cure malaria in the treatises by Pliny the Elder (Naturalis Historia) [13-15], Dioscorides (De Materia Medica) [16], Galen (Opera Omnia) [17-21] and by Serenus Sammonicus (Liber Medicinalis) [22]. These authors, in fact, have influenced medical practice in latter centuries [23].

The plants used by Calabrian people to cure malaria (N = 53) have been identified as species because the

| Table 1 Sources used for the research |
|--------------------------------------|
| Author                        | Period | Description                                                                 |
|---------------------------------|--------|-----------------------------------------------------------------------------|
| Francesco Genovese             | 1912-1924 | Physician, malariologist who wrote about malaria in Calabria.               |
| Alessandro Adriano             | 1932   | Physician whose daily experiences provided information about folk Calabrian medicine. |
| Giovanni De Giacomo            | 1892-1896 | Folklorist who published many works about folk culture including therapeutic remedies to cure many diseases. |
| Gianbattista Marzano           | 1889-1928 | Folklorist and historian who wrote about folk traditions in Laureana di Bonello (province of Reggio Calabria). He published a vocabulary of south Calabrian dialect with historical and folkloric notes as well. |
| Raffaele Lombardi Satriani     | 1916-1951 | Folklorist and ethnographer who published many works about the Calabrian people. |
| Luigi Accattatis               | 1895   | Historian and linguist who published a vocabulary of north Calabrian dialect with historical and folkloric notes. |
| Filippo Jacopo Pignatari       | 1894-1895 | Man of letters who published many papers about Calabrian beliefs and traditions including the use of plants and animal to cure many diseases. |
| Luca De Samuele Cagnazzi       | 1811   | Mathematician who edited the statistical report of the Kingdom of Naples of 1811. |
| Vincenzo Donnarumma            | 1951   | Franciscan monk who wrote a book about the religious cult of the Madonna in the province of Cosenza. |
| Antonio Iannicelli             | 1991   | Writer who published a book about Calabrian folk traditions. |
| Vincenzo Romeo                 | 1946   | Physician who published a work about anti-malaria prophylaxis. |
| Leopoldo Pagano                | 1853-1901 | Historian and man of letters. He wrote an important book about the economy, history and environment of Calabria. |
| Placido Olindo Geraci          | 1957   | Man of letters was author of a paper about folk Calabrian medicine. |
| Biagio Lanza                   | 1853-1860 | Physician and author of a paper about folk medicine in Cassano (province of Cosenza). |
| Raffaele Corso                 | 1953   | Along with Lombardi Satriani, he was one of the most important Italian folklorists and ethnographers. He wrote many works about amulets. |
| Vincenzo Brancia               | 1853-1860 | Priest who wrote a paper about folk medicine in Nicotera (province of Catanzaro). |
| Lorenzo Galasso                | 1913   | Priest who wrote a book about the Calabrian people. |
| Michele Tenore                 | 1827   | Botanist who published a work on Prunus spinosa L. |
| Silvio Mollo                   | 1930   | Man of letters and author of a book about Calabrian folklore. |

* Refers to the year of publication of the works examined.
sources described them with their scientific name (34% of cases, 18/53), or with their Italian name (60% of cases, 32/53). In the latter case, we attributed a plant to a species only if we were absolutely sure about it (for example “olivo” (olive) = *Olea europaea* L.); in the other cases we classified the plants only through their genus (for example “quercia” (oak) = *Quercus* spp.). Furthermore, due to the presence of different dialects in Northern, Central and Southern Calabria, the analysis of the different historical sources required the use of two historical dictionaries of Calabrian dialects [24,25], which were used to translate several ancient terms (that are not used today) into Italian in 4% of cases (2/53). This has allowed us to attribute the local name “vruca” to the genus *Tamarix* spp., while it has not allowed us (2% of cases, 1/53) to attribute the local name “catabuzzico” [26] to any genus. Finally, the plants used to cure malaria in Calabria (N = 52) have been compared with their pharmacological and biological properties [27-48] and with their current use in Calabrian folk medicine, defined by recent fieldworks [49-51] [Table 2].

The family names of the plants recorded in this work follow the Angiosperm Phylogeny Group guidelines [52].

**Results**

**Empirical remedies**

The empirical remedies that were used by the Calabrian people, as evidenced by the sources consulted in this work, were used both prophylactically and therapeutically, and were based on drinks, objects, animals, plants and other sources; some of these elements were created *ex novo*, while others were inherited from the “official” medicine of 1th-3th century AD [Tables 3 and 4].

**Empirical prophylactic remedies.** One of the most commonly used prophylactic empirical remedies was bleeding (which was already described by Galen that affirmed “Saluberrimum igitur, ut prae circumcision est in febris venam incidere” (during the fever, as mentioned, it is very useful to incise a vein) (De Methodo Medendi XI, 15) [17]. Bleeding was performed preventively by “barbieri” (barbers) and “magare” (witches) during the month of March [53]. During the same period (when the cure was called “marziale”), Calabrian people drank different types of decoctions, such as those made with “durcamara” (*Solanum dulcamara* L.), “acropastu” (*Cynodon dactylon* (L.) Pers.), “strazza buttunni” (*Smilax aspera* L.) and “fumaria” (*Fumaria officinalis* L.) [11,54]. To prevent contagion of the disease during the night in the summer months, people slept for few hours and near a fire [54-56]. Moreover, they drank strong spirits or wine. In particular, they were advised to drink half a litre of wine on an empty stomach [57,58], eat garlic (*Allium sativum* L.) [59], smoke and chew tobacco and swallow the spittle [56,60], while always maintaining the pipe in the mouth [54-56]. On awaking, it was recommended to eat a macerate of raw garlic in vinegar [54]. Finally, people living on the coast used to spread olive oil mixed with absinth on their bodies, according to Dioscorides who affirmed “Itemque ex oleo peruncatum, culcices abigere, ne corpus tangant” (Rubbed on with oil it forbids the mosquitoes to touch the body) De Materia Medica, III, 23 [16,61] and according to Pliny “culcices ex oleo peruncitis abigit” (who use this oil keep mosquitoes away), *Naturalis Historia* XXVII, 28 [13].

**Empirical therapeutical remedies.** Fasting and purging were recommended for the treatment of malaria-associated fevers. Fasting was thought to appease fever, while purging was thought to remove the malaria-causing parasite from the affected organism. In general, purging was achieved via the administration of ricinus seeds (*Ricinus communis* L.) and by using the root of “savucu” (*Sambucus nigra* L.) [26]. Fasting and purging were inherited from Galenic medicine. Galen wrote the following about fasting: “(in tertiariiis) ... neque quotidie cibum dare oportet, sed alternis diebus abunde fuerit” (with tertian fevers ... food must not be offered every day, but on alternate days) (Ad Glauconem de medendi metodo I, 11) [18]; and about purging: “ac vaccatio quidem excrementorum omni febri est utilissima” (during the fever, no doubt, it is very useful to defecate) (Methodo medendi IX, 10) [17]. Other treatments aimed at purging and restoring the affected subjects were also used. These included the decoction of “gamumilla” (*Matricaria chamomilla* L.), “ordica” (*Urtica dioica* L., *Urtica urens* L.), and the decoction of the root of “alivu” (*Olea europaea* L.) or of the rhizome of “canna” (*Arrundo donax* L.) [26,62,63]. Several empirical therapeutic remedies against malaria-associated fevers were loathsome. These included the ingestion of the subject’s own urine, that of young virgin or that of a healthy woman (in particular, the affected subject was advised to drink 100 g of the urine of a non-affected woman early in the morning) [55-57,64], the consumption of various animals (or parts of animals), such as earthworms (*Lumbricus terrestris*) which were previously placed in the oven and pulverized, or two or three bedbugs (*Cimex lecturalius*) within a Host [56,58,64]. Moreover, patients were encouraged to eat pills of “pappici” (cob-web) [26,56,63-66], the head of a viper (*Vipera aspis*), fried and mixed with absinth [55], goat (*Capra hircus* dungs within a Host, eaten from morning until midday [26,57], one spoonful of coffee per hour [57] and pills of soot [67,68]. Alternatively, to cure hepato-spleenomegaly were used hedgehog (*Erinaceus europaeus*) or ox (*Bos taurus*) gall and goat (*Capra hircus*)
Table 2 Medical use of plants to heal malaria in Calabria, bio-pharmacological properties and current use in Calabrian folk medicine

| Plants used to heal malaria in Calabria | Current use in Calabrian folk medicine* | Pharmacological/ biological proprieties | Used part | References |
|----------------------------------------|----------------------------------------|----------------------------------------|-----------|------------|
| **Adoxaceae**                          |                                        |                                        |           |            |
| *Sambucus nigra* L. savucu [26,55]     | Antirheumatic, artherosclerosis, febrifugal, purgative, to treat swollen breast and legs, insect bites, toothache, colics, conjunctivitis | Diaphoretic, anti-inflammatory, diuretic | Fi, Fr, Le, Ba, Dfh | (49-51) FI, BA [27] |
| **Alliaceae**                          |                                        |                                        |           |            |
| *Allium cepa* L. cipuddra [60]         | To treat flu, cough and headache, antidiarrhoeic, vermifuge | Antibacterial, vermifuge, hypotensive, diuretic | Bl [49] | BL [27] |
| *Allium sativum* L. agliu [55,60]      | To treat insect bites, neuralgias, calluses, rheumatisms, hypotensive, tinea, scabies, tooth decay, cold, diarrhoea | Hypotensive, antibacterial, hypoglycaemic, lipid-lowering, anti-inflammatory | Bl, CI [49] | BL [27] |
| **Apocynaceae**                        |                                        |                                        |           |            |
| *Nerium oleander* L. leandru [58]      | Not Reported                           | Cardiotonic                            | Le [28]  |            |
| **Asteraceae**                         |                                        |                                        |           |            |
| *Achillea millefolium* L. millefoglio [58,71] | Emmenagogue                           | Eupeptic, cholagogic, choleretic, antisyptic | Ap [49] | FI, AP [27] |
| *Artemisia absinthium* L. erba janca [26,56,58,62,65,71] | Not Reported                           | Eupeptic, cholagogic, antisyptic | Fh, Le [49] | Fh, Le [27] |
| *Centaurea benedicta* (L.) L. centav [56,62,65,68] | Not Reported                           | Eupeptic                               | Fh, Le [49] | Fh, Le [28] |
| *Centaurea centaurium* L. centu gruppa [11] | Not Reported                           | Antioxidant                            | Ro [29]  |            |
| *Matricaria chamomilla* L. gamumilla [26] | Digestive, sedative, antispasmodic, antitussive | Anti-inflammatory, antibacterial, antifungal | Fh [49,50] | Fh [27] |
| **Boraginaceae**                       |                                        |                                        |           |            |
| *Borago officinalis* L. erva pignola [60] | Diaphoretic, reddening, burns, sunburns, tussis, rheumatism, refreshing, diuretic | Anti-inflammatory                      | Le, Ap [49,50] | OI [27] |
| **Capparaceae**                        |                                        |                                        |           |            |
| *Capparis spinosa* L. chiappara [62]   | Not Reported                           | Antiviral                              | BI [31]  |            |
| **Cactaceae**                          |                                        |                                        |           |            |
| *Opuntia ficus indica* (L.) Mill.** ficuniano [60] | Antispasmodic, antidiarrhoeic, diuretic, to treat bronchitis | Anti-inflammatory                      | Fl, Fr [49] | Fh [32] |
| **Cucurbitaceae**                      |                                        |                                        |           |            |
| *Ecballium elatium* (L.) A. Rich.** cucumeru [57] | Antirheumatic                          | Cholagogic                            | Fr [51]  | Frj [33] |
| **Dryopteridaceae**                    |                                        |                                        |           |            |
| *Dryopteris filix-mas* (L.) Schott. filici masculu [58] | To treat sores provoked by severe burns | Anti-helmintic, anti-amebic, anti-parasitic, antiprotozoal | Le [49] | Ro [34] |
Table 2 Medical use of plants to heal malaria in Calabria, bio-pharmacological properties and current use in Calabrian folk medicine (Continued)

| Family          | Species                      | Common Name | Uses in Calabria | Bio-pharmacological Properties                                           | Current Use in Calabrian Folk Medicine |
|-----------------|------------------------------|-------------|------------------|--------------------------------------------------------------------------|----------------------------------------|
| Euphorbiaceae   | Ricinus communis L.          | ricinu [26] | Not Reported     | Laxative Se [28]                                                         | Se [28]                                |
| Fabaceae        | Lupinus albus L.             | lupinu [56,58,62,68] | To treat dermatitis in cattle Ep [50] | Gingival anti-inflammatory Se [35]                                         |
| Fagaceae        | Quercus spp.                 | cerza [55,58] | Intestinal astringent, detoxifying, cicatrizing Dried bark of young stems and galls [50] | Anti-inflammatory, anti-diarrhoeic Ba [27] |
| Gentianaceae    | Erythraea centaurium (L.) Borkh. | brundulija [11,60] | Not Reported | Eupeptic, antidispeptic Le, Fl [27]                                        |
| Gentiana lutea L. | genziana [55]               | Not Reported |------- |------- | Antidispeptic, eupeptic Ro [27]                                           |
| Juglandaceae    | Juglans regia L.* nuci [68]  | Vermifuge, anti-diarrhoeic, stomatchic, to remove calluses, against excessive feet perspiration Hu, Le, Fr, Fle [49-51] | Anti-inflammatory Le [27]                                    |
| Hyacinthaceae   | Urginea maritima (L.) Baker cipuddazza [56,62] | Not Reported |------- |------- | Cardiotonic Bi [28]                                                   |
| Lamiaceae       | Ajuga chamaepitys Guss.      | campezio [72] | Not Reported |------- | anabolic, analgesic, anti-arthritis, antibacterial, anti-inflamatory, anti-hypertensive, antileukemic, antimalarial, antimycobacterial, antioxidant, antipyretic, cardiotonic, cytoxic, hypoglycemic, vasorelaxing activity°° Ep [36] |
| Ballota nigra L. | marrobi nero [63]           | Not Reported |------- |------- | Antioxidant Le [44]                                                 |
| Calamintha nepeta (L.) Savi niptella [64,69,70] | To cure insect and snake bites, cicatrizing Fle, Flh [49,50] | Antibacterial Eoi [45] |
| Hysopos officinalis L. | issopu [65]               | Not Reported |------- |------- | Emmenagogue Ro [27]                                                  |
| Rosmarinus officinalis L. | rosmarinu [64,70,71]    | To ripen abscesses quickly, carminative, digestive, to speed up the recovery of sores and wounds Fl, Le, Br [49] | Eupeptic, antidispeptic, emmenagogue, anti-inflammatory Le, Flh, Eoi [27] |
| Salvia officinalis L. | sarvia [64,70,71]          | Digestive, antiasthmatic, to speed up the recovery of sores and wounds, to treat tussis, to cure aphitas and stomatitis, to treat swollen testicles and related pains Le, Fl, Dle [49,50] | Antioxidant, anti-inflammatory Le, Ap [27] |
| Teucrium chamaedrys L. | cametriu [11,26,55,56,62,65] | Not Reported |------- |------- | Poisonous ------- [37]                                      |
| Family       | Species       | Common Name          | Synonyms                          | Properties                                                                 | Uses                                                                 |
|--------------|---------------|----------------------|-----------------------------------|---------------------------------------------------------------------------|----------------------------------------------------------------------|
| Lythraceae   | Punica granatum L. | granato              | [58]                               | Haemostatic, vermifuge                                                    | Frb, Rob [51] Emmenagogue Rob [27]                                      |
| Myrtaceae    | Eucalyptus spp. | calipsi              | [58,68]                            | Antiseptic of the respiratory tract                                       | Le [50] Antibacterial, anti-inflammatory, spasmyloytic, expectorant Le [27] |
| Oleaceae     | Olea europaea L. | alivu                | [62,68]                            | Cholagogic, hypotensive, astringent, suppurative, to treat small burns, tooth ache | Le, Rf, Ba, Oi [49-51] Hypotensive, diuretic, spasmyloytic, antipyretic Le [27] |
| Papaveraceae | Chelidonium majus L. | cucumaju             | [56]                               | To treat warts, calluses, gastric pains                                   | La, Le [49] Cholagogic, choleretic, hypotensive, antibacterial, antifungal, antiviral, anti-inflammatory, antidyseptic Ap [27] |
|             | Fumaria officinalis L. | fumaria             | [11]                               | Not Reported                                                              | —— —— Cholagogic, choleretic Ap [27]                                      |
| Piperaceae   | Piper nigrum L. | pipi nivuro          | [60,63,64]                          | Not Reported                                                              | —— —— Antioxidant, anti-inflammatory, anti-diarrhoeal, eupeptic Se [46] |
| Poaceae      | Arundo donax L. | canna                | [62]                               | Haemostatic, cicatrising, to treat throat inflammations and bronchitis    | Sa, Rh [49,50] Hypotensive, spasmyloytic Rh [38]                          |
|              | Cynodon dactylon (L.) Pers. | acropastu, addisa, graminhga | [11,54]                            | Diuretic, to alleviate rheumatic pains, inflammations of the digestive and urogenital system | Ap, Rh, Se [49-51] Diuretic, anti-inflammatory Ro [27] |
| Rosaceae     | Prunus spinosa L. | cucumele             | [24,69,72,73]                       | Not Reported                                                              | —— —— Anti-inflammatory Fr [27]                                          |
| Rutaceae     | Citrus bergamia Risso | bergamotto           | [64]                               | Cicatrising and antiseptic for wounds and chilblains, to cure anomalous vaginal secretions, as a contraceptive | Eoi [49] Antimicrobial Ba [47]                                            |
|              | Citrus limonum Risso | limuni               | [11,56,65,74]                       | Stomachic, to treat cough, slimming agent, chilblains, migraine (after drunkenness), toothache, rheumatism, oral hollow diseases | Frj, Fr, [49] Anti-inflammatory Frj [39]                                 |
|              | Ruta spp. | ruta                  | [64,70]                            | Anti-helminthic, to treat gastritis, abscesses, rheumatic pains, headache, intestinal inflammations and eye reddening | Ap, Le [49,50] Antibacterial Le [48]                                      |
| Salicaceae   | Salix spp. | salici                | [58]                               | Against fever and rheumatic pains                                        | Ba [50] Antipyretic, anti-inflammatory, analgesic Ba [27]                 |
Table 2 Medical use of plants to heal malaria in Calabria, bio-pharmacological properties and current use in Calabrian folk medicine (Continued)

| Family             | Scientific Name | Common Name | Active Constituents | Bio-pharmacological Properties | Current Use |
|--------------------|-----------------|-------------|---------------------|---------------------------------|-------------|
| Smilacaceae        | Smilax aspera L. | strazzu buttuni | [11] | Not Reported | Adaptogen | Ro [27] |
|                    | Solanum dulcamara L. | durcamara | [11] | Not Reported | To treat dermatitis | St [27] |
|                    | Capsicum annuum L. | pipi | [56,60,62,75] | To rise blood flow to superficial tissues | Fr [49] | Antidiyspeptic, anti-inflammatory | Fr [27] |
|                    | Capsicum annuum L. Var. acuminatum Fing. | ppi | [55,57,68,76] | Revulsive | Fr [49] | Antioxidant | Fr [40] |
| Tamaricaceae       | Tamarix spp. | vruca | [24,65] | Not Reported | Antioxidant, antibacterial | Fl, Le [41] |
| Uricaceae          | Panetaria officinalis L. | erba 1 muru | [56,62] | Diuretic, depurative, cholagogue, to treat bruises, haematomata, kidney stones, abscesses, skin inflammations, viper bite | Le, Ro, Ap, Ep [49-51] | Diuretic, uricosuric | Ap [42] |
|                    | Urtica dioica L. | urdica | [62] | Antirheumatic, hepatoprotective, to treat haemorrhoids, renal troubles | Ap, Ro, Le, To [49,50] | Diuretic, anti-inflammatory | Ap, Ro [27] |
|                    | Urtica urens L. | urdica | [63] | Not Reported | Diuretic, anti-inflammatory | Ap, Ro [27] |
| Valerianaceae      | Valeriana officinalis L. | malariana | [65] | Not Reported | Sedative | Ro [27] |
| Verbenaceae        | Verbena officinalis L.* | erba di la crucivia | [56,57,62] | Not Reported | Anti-inflammatory, analgesic | Le [43] |

* Plant used like magic remedy too (see text); ** plants used like magic remedy only (see text); Used parts of plant: Ap aerial part; Ba bark; Bl bulb; Br branches; Bu bud; Cl cloves; Cld cladodes; Dle dry leaves; Dfh dry flower heads; Eoi essential oil; Ep entire plant; Fh flower heads; Fi feminine inflorescences; Fl flowers; Fle flowers; Fr fruit; Frb fruit bark; Frj fruit juice; Hu husk; La latex; Le leaves; Oi oil; Rfr ripe fruit; Rh rhizome; Ro root; Rob root bark; Sa sap; Se seeds; St stem; To tops;

* Current use drawn from recent fieldworks

* The properties relating to certain species of the genus Ajuga

As three “Cantarelle” (Cantharis vesica-toria) minced in water were used as a diuretic against dropsy [55]. As three “Cantarelle” (Cantharis vesicatorea) minced in water were used as a diuretic against dropsy [55].

Calabrian people believed without any doubt in the remedies described above; however, they also used numerous plants to cure malaria. Some of these plants are still currently used in Calabrian folk medicine to cure various diseases [Table 1]. Many decoctions or infusions of various herbaceous species were used to cure malaria-associated fevers. These herbaceous plants included “issopu” (Hysopos officinalis L.), “valariana” (Valeriana officinalis L.), “filici masculu” (Dryopteris filix-mas (L.) Schott.), “lupini” (Lupinus albus L.), “cametriu” (Teucrium chamaedrys L.), “brundulijia” (Erythraea centaurium (L.) Borkh.), “centu gruppa” (Centauraea centaurium L.), “centarva” (Centauraea benedicta L.), “sarvia” (Salvia officinalis L.), “rosamarina” (Rosmarinus officinalis L.), “nepitella” (Calamintha nepeta (L.) Savi), “ruta” (Ruta spp.), “erba janca” (Artemisia absinthium L.), “cipuddra” (Allium cepa L.), “agliu” (Allium sativum L.), “millefoglio” (Achillea millefolium L.), “erva pignola” (Borago officinalis L.), “marrobo nero” (Ballota nigra L.), “campezio” (Ajuga chamaepitys Guss.), “elitropia” (Heliotropium europaeum L.) (which was ingested with white wine), “genziana” (Gentiana lutea L.) and “erba i la crucivia” (Verbena officinalis L.) [11,26,55-58,62,65,67-72]. Some lignonous species must be added to this list, particularly the following plants: the aerial parts of “vruca” (Tamarix spp.), and “leandru” (Nerium oleander L.); the leaves of “alivu” (Olea europaea L.) and “calipi”
| Plants Family/Scientific Name | Pliny | Dioscorides | Galen | Serenus Sammonicus |
|------------------------------|-------|-------------|-------|-------------------|
| **Adoxaceae**                |       |             |       |                   |
| *Sambucus nigra* L.          | To cure dropsy (Naturalis Historia XXV, 52) | To cure dropsy (De Materia Medica IV, 172) | To cure spleenomegaly (Galenii Opera Omnia XIII, 244) | To cure dropsy (Liber Medicinalis XXVI, 498) |
|                             | [13]  | [16]        | [21]  | [22]              |
| **Alliaceae**                |       |             |       |                   |
| *Allium cepa* L.             | To cure dropsy (De Materia Medica II, 181) |       |                   |                   |
|                             |       |             | [16]  |                   |
| *Allium sativum* L.          | To cure quartain fevers (Naturalis Historia XX, 23) |       |                   | To cure quartain fevers (Liber Medicinalis XLIX, 899) |
|                             | [15]  |             |       | [22]              |
| **Apocynaceae**              |       |             |       |                   |
| *Nerium oleander* L.         |       |             |       |                   |
| **Asteraceae**               |       |             |       |                   |
| *Achillea millefolium* L.    | To cure hepatospleenomegaly (Naturalis Historia XXVII, 28) | To cure dropsy and spleenomegaly (De Materia Medica III, 23) | To cure spleenomegaly (Galenii Opera Omnia XIII, 240) | To cure quartain fevers (Liber Medicinalis XLIX, 903) |
|                             | [15]  | [16]        | [21]  | [22]              |
| *Artemisia absinthium* L.    |       |             |       |                   |
| *Centaurea benedicta* (L.) L.| To cure fevers (De Materia Medica III, 6) | To cure fevers (Galenii Opera Omnia XII, 19) |       |                   |
|                             |       |             |       | [20]              |
| *Matricaria chamomilla* L.   |       |             |       |                   |
| **Boraginaceae**             |       |             |       |                   |
| *Borago officinalis* L.      |       |             |       |                   |
| *Heliotropium europaeum* L.  | To cure quartain fevers (Naturalis Historia XX, 29) | To cure tertian and quartain fevers (De Materia Medica IV, 190) |       |                   |
|                             | [15]  | [16]        |       |                   |
| **Capparaceae**              |       |             |       |                   |
| *Capparis spinosa* L.        | To cure spleenomegaly (Naturalis Historia XX, 59) | To cure spleenomegaly (De Materia Medica II, 204) | To purge; To cure spleenomegaly and dropsy (Galenii Opera Omnia XII, 9) |       |
|                             | [15]  | [16]        |       | [20]              |
| **Cactaceae**                |       |             |       |                   |
| *Opuntia ficus indica* (L.) Mill.** |       |             |       |                   |
| **Cucurbitaceae**            |       |             |       |                   |
| *Ecballium elatum* (L.) A. Rich.** | To cure dropsy (De Materia Medica IV, 154) | To cure jaundice (Galenii Opera Omnia XII, 122) |       |                   |
|                             | [16]  |             |       | [20]              |
Table 3 Medical use of plants to heal malaria in Calabria, mentioned by historical sources used for the research (Continued)

| Family               | Genus                     | To cure spleenomegaly | To cure dropsy |
|----------------------|---------------------------|-----------------------|---------------|
| Dryopteridaceae      | Dryopteris filix-mas (L.) Schott. | To cure spleenomegaly | To cure dropsy |
|                      |                           | (De Materia Medica IV, 158) | (Liber Medicinalis XVI, 511) |
|                      |                           | [16]                  | [22]          |
| Euphorbiaceae        | Ricinus communis L.       | To purge, To cure dropsy | To purge |
|                      |                           | (De Materia Medica IV, 141) | (Galeni Opera Omnia XII, 26) |
|                      |                           | [16]                  | [20]          |
| Fabaceae             | Lupinus albus L.          | To cure spleenomegaly | To cure spleenomegaly |
|                      |                           | (Naturalis Historia XXII, 74) | (De Materia Medica II, 132) |
|                      |                           | [15]                  | [16]          |
| Fagaceae             | Quercus spp.              | To expel urine         | To expel urine |
|                      |                           | (De Materia Medica I, 143) | (De Materia Medica I, 102) |
|                      |                           | [16]                  | [16]          |
| Gentianaceae         | Erythraea centaunium (L.) Borkh. | To cure dropsy         | To cure spleenomegaly |
|                      |                           | (De Materia Medica III, 7) | (Galeni Opera Omnia XII, 20) |
|                      |                           | [16]                  | [20]          |
|                      | Gentiana lutea L.         | To cure hepatomegaly   | To cure hepatomegaly |
|                      |                           | (De Materia Medica III, 3) | (De Materia Medica III, 175) |
|                      |                           | [16]                  | [16]          |
| Juglandaceae         | *Juglans regia* L.        |                       |               |
| Hyacinthaceae        | Urginea maritima (L.) Baker | To cure dropsy         | To cure dropsy and jaundice |
|                      |                           | (Naturalis Historia XX, 100) | (De Materia Medica II, 102) |
|                      |                           | [15]                  | [16]          |
|                      |                           | To cure hepato-spleenomegaly, To expel urine |
|                      |                           | (Galeni Opera Omnia XI, 746, 749) | (Galeni Opera Omnia XII, 155, XIII, 240) |
|                      |                           | [18]                  | [20,21]       |
| Lamiaceae            | Ajuga chamaephtys Guss.   | To cure dropsy         | To cure jaundice |
|                      |                           | (Naturalis Historia XXIV, 30) | (De Materia Medica III, 175) |
|                      |                           | [13]                  | [16]          |
|                      |                           | To expel urine; To cure spleenomegaly |
|                      |                           | (Galeni Opera Omnia XII, 155, XIII, 240) | (Galeni Opera Omnia XIII, 264) |
|                      |                           | [20,21]               | [21]          |
|                      | Ballota nigra L.          | To cure spleenomegaly | To cure hepatosplenomegaly |
|                      |                           | (Galeni Opera Omnia XII, 108) | (Liber Medicinalis XXII, 417) |
|                      |                           | [20]                  | [22]          |
|                      | Calamintha nepeta (L.) Savi | To cure jaundice       | To cure dropsy |
|                      |                           | (De Materia Medica III, 28) | (Galeni Opera Omnia XIII, 264) |
|                      |                           | [16]                  | [21]          |
|                      |                           | To cure spleenomegaly and dropsy |
|                      |                           | (Liber Medicinalis XXII, 419, XVI, 504) | (Liber Medicinalis XXII, 417, 504) |
|                      |                           | [22]                  | [22]          |
Table 3 Medical use of plants to heal malaria in Calabria, mentioned by historical sources used for the research (Continued)

| Plant Family   | Species          | Uses                                                                 | References                                                                 |
|---------------|------------------|----------------------------------------------------------------------|----------------------------------------------------------------------------|
|              | Hyssopus officinalis L. | To cure spleenomegaly To cure dropsy and spleenomegaly To cure dropsy | (Naturalis Historia XXVI, 48) (De Materia Medica III, 28) (Galeni Opera Omnia XIII, 263) |
|              | Rosmarinus officinalis L. | To cure hepato-splenomegaly To cure jaundice To cure jaundice | (Naturalis Historia XXIV, 59) (De Materia Medica III, 89) (Galeni Opera Omnia XII, 60) |
|              | Salvia officinalis L. | To expel urine To cure hepatomegaly | (De Materia Medica III, 35) (Liber Medicinalis XXII, 408) |
|              | Teucrium chamaedrys L. | To cure spleenomegaly and dropsy To cure spleen, To expel urine | (Naturalis Historia XXIV, 131) (De Materia Medica III, 102) (Galeni Opera Omnia XII, 153) |
|              | Lythraceae        |                                       |                                                                            |
|              | Punica granatum L. |                                       |                                                                            |
|              | Myrtaceae         |                                       |                                                                            |
|              | Eucalyptus spp.   |                                       |                                                                            |
|              | Oleaceae          |                                       |                                                                            |
|              | Olea europaea L.   | To expel urine                      | (De Materia Medica I, 141) |
|              | Papaveraceae      |                                       |                                                                            |
|              | Chelidonium majus L. | To cure jaundice To cure fevers | (De Materia Medica II, 211) (Galeni Opera Omnia XII, 156) |
|              | Fumaria officinalis L. | To expel urine To expel urine | (De Materia Medica IV, 108) (Galeni Opera Omnia XII, 8) |
|              | Piperaceae        |                                       |                                                                            |
|              | Piper nigrum L.    | To cure periodical fevers To cure quartain fevers To cure hepatomegaly | (De Materia Medica II, 158) (Galeni Opera Omnia XIV, 524) (Liber Medicinalis XXII, 384) |
|              | Poaceae           |                                       |                                                                            |
|              | Arundo donax L.    | To cure dropsy                       | (Naturalis Historia XXIV, 50) |
|              | Cynodon dactylon (L.) Pers. | To expel urine                    | (Galeni Opera Omnia XI, 810) |
|              | Rosaceae          |                                       |                                                                            |
|              | Prunus spinosa L.  |                                       |                                                                            |
|              | Rutaceae          |                                       |                                                                            |
|              | Citrus bergamia Risso |                                       |                                                                            |
(Eucalyptus spp.); the roots of “granato” (Punica grana-tum L.), “cucumele” (Prunus spinosa L.), “savucu” (Sambucus nigra L.), and “cerza” (Quercus spp.). The bark of “cucumele”, “cerza” and “salici” (Salix spp.) was also used [24,26,55,58,62,65,68,69,72,73].

Other remedies were similarly efficacious; these included the mesocarp of “nuci” (Juglans regia L.) chopped finely and mixed with wine, “bergamotto” (Citrus bergamia Risso), “limuni” (Citrus limonum Risso, which was broken, boiled and maintained fresh overnight, then drunk at breakfast for three mornings), “pipi nivuru” (Piper nigrum L.), “pepe arsente” (Capsicum annuum L.) and ten bitter seeds of decorticated “lupinu” (Lupinus albus L.), taken in the morning [11,56,58,60,62-65,68,74,75].

Other than fever, the most evident symptoms of malaria are hepato-spleenomegaly and dropsy. We also found descriptions of several remedies for these symptoms. There were many cures for hepato-spleenomegaly: a decoction of the root of “chiappara” (Capparis spinosa L.), or of “acropistu” (Urtica dioica L., Urtica urens L.), taken together with potassium nitrate in the morning; eating “cipuddra” (Allium cepa L.) or “pipi

| Table 3 Medical use of plants to heal malaria in Calabria, mentioned by historical sources used for the research (Continued) |
|---------------------------------------------------------------------------------------------------------------|
| **Citrus limonum** Risso                                                             | To cure dropsy | To expel urine; to cure dropsy | (De Materia Medica III, 45) | (Galenii Opera Omnia XII, 257) |
| **Ruta** spp.                                                                          |               |                                | [16]                          | [20,21]                     |
| **Salicaceae**                                                                         |               |                                |                               |                            |
| **Salix** spp.                                                                         |               |                                |                               |                            |
| **Smilacaceae**                                                                        |               |                                |                               |                            |
| **Smilax aspera** L.                                                                   |               |                                |                               |                            |
| **Solanaceae**                                                                         |               |                                |                               |                            |
| **Solanum dulcamara** L.                                                              |               |                                |                               |                            |
| **Capsicum annuum** L.                                                                 |               |                                |                               |                            |
| **Capsicum annuum** L. Var. acuminatum Fing.                                          |               |                                |                               |                            |
| **Tamaricaceae**                                                                       |               |                                |                               |                            |
| **Tamarix** spp.                                                                       |               |                                |                               |                            |
| **Urticaceae**                                                                         |               |                                |                               |                            |
| **Parietaria officinalis** L.                                                           |               |                                |                               |                            |
| **Urtica dioica** L., Urtica urens** L.                                               |               |                                |                               |                            |
| **Valerianaceae**                                                                      |               |                                |                               |                            |
| **Valeriana officinalis** L.                                                           |               |                                |                               |                            |
| **Verbenaceae**                                                                        |               |                                |                               |                            |
| **Verbena officinalis** L.                                                             |               |                                |                               |                            |

(Eucalyptus spp.); the roots of “granato” (Punica grana-tum L.), “cucumele” (Prunus spinosa L.), “savucu” (Sambucus nigra L.), and “cerza” (Quercus spp.). The bark of “cucumele”, “cerza” and “salici” (Salix spp.) was also used [24,26,55,58,62,65,68,69,72,73].

Other remedies were similarly efficacious; these included the mesocarp of “nuci” (Juglans regia L.) chopped finely and mixed with wine, “bergamotto” (Citrus bergamia Risso), “limuni” (Citrus limonum Risso, which was broken, boiled and maintained fresh overnight, then drunk at breakfast for three mornings), “pipi nivuru” (Piper nigrum L.), “pepe arsente” (Capsicum annuum L.) and ten bitter seeds of decorticated “lupinu” (Lupinus albus L.), taken in the morning [11,56,58,60,62-65,68,74,75].

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(Capsicum annuum L. Var. acuminatum Fing.), the latter together with a strong wine. Finally, another remedy involved the use of “cucumaju” (Chelidonium majus L.) [55-57,60,63,68,76]. To treat dropsy, which was called “acqua ‘ntà panza” (water in the stomach), Calabrian people used several diuretic remedies, such as “erba i muru” (Parietaria officinalis L.), “cipuddazza” (Urginea maritima (L.) Baker), and “cametriu” (Teucrium chamaedrys L.) [11,26,55,56,62,66].

**Magic remedies**

Because of the presence of malaria in the daily lives of Calabrian people, this disease was considered a normal life trouble; however, its most dangerous and deadly forms were considered by Calabrian people as a condition of supernatural nature. Therefore, they resorted to magic remedies that were believed to “link” the disease. These included, in particular, wearing a “nuci trischéra o a tri guarri” (a three-valve walnut shell) (Juglans regia L.), a spider that was enclosed between two shells of a walnut or skin, skeleton and fangs of snake, the latter extracted when animal was still alive, as it was believed that the disease would then affect the walnut, the spider or the parts of the snake, and not the subjects who wore these amulets [65,77]. Furthermore, a live “carputita” (Pachyiulus communis) was sewn into the clothes of the affected subject (without the patient realizing it) or a “paletta” (Opuntia ficus-indica (L.) Mill.) was placed near the fireplace. It was believed that when the animal died, or when the stem of the plant dried, the fever or the hepato-splenomegaly would disappear [26,60]. In an analogy with the ancient belief in the therapeutic principle of “contact”, to defeat spleenomegaly Calabrians were encouraged to place “erba i la crucivia” (Verbena officinalis L.) on the abdomen of the affected subject before sleeping, as it would absorb the “bad
blood” [56,57,62]. Finally, every morning the affected subject had to urinate on “cucuzzielli acriesti maturi”, the fruits of *Ecballium elaterium* (L.) A. Rich., to transfer the disease from the subject to the fruit [57].

**Religious remedies**

Calabrian people alternated or combined both empirical and magical remedies and, very often, used prayers and acts of devotion, as diseases were believed to be associated to divine punishment. Thus, in Cosenza (Northern Calabria) the “Madonna della Febbre” was invoked with prayers, *ex voto* and pilgrimages [78]; in Castrovillari (province of Cosenza), the prayer to the “Madonna d’Ittria” was as follows: “Madonna mia ’i L’Ittria, chi stai ’nganna a’sta jumara fammi passà ’sta freva ’i quartana c’a jurnu tuju non vugghiu mangià panu” (“My Lady of Ittria, close to the river, let the fever out and on your commemoration day I will not eat bread”) [79].

**Discussion**

The methodology based on the analysis of historical sources regarding Calabrian folk medicine remedies for the prophylaxis and treatment of malaria, if not compared with similar studies, can be seen as a case study where the ordinary methodologies of ethno-medical-biological research are combined with the methodologies pertaining to historical-anthropological sciences. In addition, this is part of a debate regarding the association between ethnobotany and ethnopharmacology and other disciplines, to improve our understanding of the human usage of plants [80]. Moreover, this work complies with De Natale et al. [81], who created a database of the historical use of plants in the popular medicine of the Mediterranean basin. However, this study has revealed some interesting and heterogeneous features regarding Calabrian popular medicine practices used to prevent and treat malaria, some of which were inherited by the Calabrian people from the “expert medicine” of the past centuries.

The first type of practices that we have described were characterized by a rational approach. Indeed, the use of medicinal plants, 69% of which (36/52) is recognized by the current pharmacopeia as having some pharmacological/biological properties, succeeded in assuaging temporarily the most evident sufferings associated with the disease (fever, hepato-spleenomegaly, asthenia and dropsy) as well as its complications, such as the prereness to bacterial infections, even if did not cure the malarial infection. 23% (12/52) of the plants which were used by Calabrian people to treat malaria, have pharmacological/biological properties which did not allow to relieve the symptoms of malaria; however, they did not damage the affected subjects. Finally, 8% (4/52) of these plants were characterized by some pharmacological/biological properties which could be harmful for a malarial subject; or these properties could even be poisonous both for the malarial and the healthy subject.

The second type of practices were linked to the magic tradition of Calabrian folk medicine which, like the traditions of all Southern Italian regions, is rich in myths, symbolism and fantastic representations [82]. Thus, malaria became a synonym of “malà”, or, as Pasquarelli [83] affirmed, it became “an aspect of paludism”. Malaria was thought to be a consequence of a malefic element that affected the behaviour and the life of an individual; therefore, only a magic cure could remedy the disease.

The third type of practices were characterized by a strong principle of ineluctability, which is currently present among the Calabrian society: the sick entrusted God with prayers or acts of devotion, with the conviction that only God would be able to provide recovery from the disease.

**Conclusions**

The use of plants combined with other cures, such as the use of spiders, cantharis and leeches, represents prophylactic or therapeutic elements inherited from ancient medical science, some of which were still used to treat malaria in hospitals and in general by 19th-century physicians, before the introduction of quinine. This element is very interesting; while the empirical and magic remedies were not based on the symptomatology of the disease (they were rather “psychological and protective” elements [82]), the use of plants represented a real treatment, and served as a popular medicine base to treat various diseases.

In conclusion, the remedies described in this work allow us to establish the link between malaria and Calabrian people, so that Turner’s statement that “the more widely or intensively a plant is used, the greater is its cultural significance” [84] can, in this case, be extended to malaria; the more folk remedies are used to cure malaria, the greater is the significance of its historical, medical and social meaning.

**Authors’ contributions**

GT conceived of the study, collected and analyzed the data, drafted the manuscript. AT and AP supervised the work at all its stages.

**Competing interests**

The authors declare that they have no competing interests.

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