

Growing fruit trees, medicinal plants and spices in the state of Goa, India

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Abstract

Fruit trees, spices and medicinal plant species are essential components of the home gardens in India. Traditional medicinal knowledge, in particular Ayurvedic medicine, are frequently adopted by urban gardeners and urban residents, in general. This contribution explores the multiple functions of urban agriculture in the Indian state of Goa. The research hypothesis is that the adoption of organic agriculture by the urban households contributes for environmental sustainability and increases the resilience of tropical humid coastal cities, to climate change. The main objective is to report on the role of the ethno-medicines and food gardened in the front- and backyards of coastal cities and touristic agglomerations. This paper uses a comparative method that puts localism at the service of abstraction. Time and space are both part of the analysis, because the urban settlements of Goa, and several Malabar Coast Indian places, were colonised by Portugal (1510–1961). Archival research permits us to cross-examine plant consumption through times, and previous investigation conducted in Kochi allows comparisons within India. Results show that Indian urban farming systems are adapted to ancient cultural and religious beliefs that European presence did not change completely. Traditional medicinal knowledge is an essential alternative for low-income urban households and is an integrative part of Indian culture, for healing is a holistic practise in India. The persistent cultivation of kitchen gardens, associated to the option for less dense urban tissues than elsewhere in India, permitted the survival of several low-lying coastal settlements of Goa to the monsoon floods.

Keywords: sustainable cities, coastal agglomerations, ethno-medicines.



1 Introduction

The Indo-Portuguese period of Goa lasted four hundred and fifty-one years. Old Goa (*Velha Goa*) was the first most important settlement of the Portuguese Indian State (*Estado da Índia*) and became the capital city of a vast territory, extended from the Cape of Good Hope (now in the Republic of South Africa) and Macau (China). The head of the Portuguese Indian State was definitely settled at Panaji (*Panjim*), in 1843. Whereas the colonisation of most part of these overseas territories was littoral, based on fortresses built in geopolitical locations intended to favour and protect European navigation along the oriental coast of Africa or throughout the South and Southeast Asia; Goa, located between 14°53'N and 15°47'N of the Equator, was an effectively occupied territory, without interruption from the year (1510) the governor Afonso de Albuquerque conquered the area and led the colonisation process, to the moment India (1961) invaded Goa [1–3]. The exceptions were a three months blockade conducted by an Anglo-Dutch fleet, in 1622, and a series of annual Dutch blockades that occurred between the years 1636 and 1663 [4].

The state of Goa is currently the smallest of India, situated along a stretch of the western coast called *Konkan*, where the people speak *Konkani* [1]. The climate is tropical humid, and the monsoon lasts from June to September, whilst the temperatures range from 24° to 28°C [2]. The maximum width of the state is 60 km, and therefore most cities are either coastal or located close to the seashores. Goa has a good number of beaches but also rich forests inland [1, 2]. The fieldwork took place during dry season and included the northern beach settlement of Candolim, where 42% of the interviews were conducted; followed by the capital city of Panaji, located in the central island of Tiswadi, where Portuguese colonization started, with 34% of the informants; through the trade post of Mapusa, in Bardez, where 12% of the interviews were gathered; then came the old southern commercial hub of Margão, with 6% of the informants, in Salcete; to finalise in a spice farm of Ponda district, situated further away from the sea, to the east of Panaji [5].

The survey totalled fifty interviews. The urban agglomerations investigated during 2014 fieldwork totalled seven. All of them display distinctive marks of Portuguese colonisation [3], both in architecture (Fig. 1) and urban planning, as in gardening (Fig. 2). This unique cultural identity gave Goa its own personality, within the Indian subcontinent, exacerbated by the fact that it was (together with Daman and Diu, located to the North of India) the territory where the impact and duration of the Portuguese presence lasted for over four centuries. The main objective of this research paper is to report on the role of the ethno-medicines and food gardened in the state of Goa, predominantly in coastal cities. Cross-examination of early Portuguese colonisation preferences (16th and 17th centuries) and the 21st century fruits, spices and medicinal flora gardened, traded and applied by healers in the researched space, will be a specific objective. The research hypothesis is: the adoption of organic agriculture by the urban households contributes for their environmental sustainability and increases the resilience of tropical humid coastal cities, to climate change.





Figure 1: Church of Panaji, a typical example of a Portuguese religious temple in India. Source: photo by the author, 2014.



Figure 2: Garden of Panaji, displaying the chicoo tree to the right side of the house, a species introduced from America during the Portuguese colonization. Source: photo by the author, 2014.

2 Materials and methods

The research process was twofold:

1. Archival examination of manuscripts written about plant species used as food and medicine, in the early years of Portuguese colonization, was the first step;
2. Surveys containing standard questions about the medicinal flora consumed in Goa constituted the next phase.

Regarding the historical data gathered, the focus in this paper will be the first herbal published in India, in 1563, by the Portuguese-Jewish doctor Garcia d'Orta, who lived in Goa most of his adult life [6]. The second manuscript under examination is authored by Manuel Godinho Erédia, available in 1612, an herbalist and cartographer born in Malacca in 1560, which family moved to India when he was thirteen years old. He lived in the Indian subcontinent for about thirty years, namely in Goa and Kochi [7]. Their findings contained a total of one hundred and thirty-four (134) different plant species, illustrated in Erédia's Codex.

As to the second phase of the research process, the 2014 surveys conducted at the service of the Portuguese Tropical Research Institute (IICT) used sample questionnaires, similar to the ones applied in previous Latin American fieldwork [8–9]; they are equal to the ones used in the case study of Kochi, located in the Indian Kerala state, gathered in 2013 [10], and those applied in Malacca, Malaysia, later in the same year [11]. Three focus groups were involved in the process:

- 1) The urban gardeners and spice farmers who grew medicinal flora were twenty-six (52% of the interviews);
- 2) The fruit, spice and herb traders, including the plant pharmacists totalled twenty-two (44%);
- 3) The plant therapists, herbalists and traditional healers were two (4%).

Data collected during the 2014 survey used qualitative methodology [12], in line with previous investigations. Information gathered includes a photographic record of the local flora so as to permit the design of an illustrated plant catalogue. In order to identify the plants used as food and medicine, which totalled one hundred and fifty (150), the characterization and the scientific denomination were obtained in the publications of Sahni [13], Prendergast *et al.* [14], Mendes Ferrão [15], and Proença da Cunha and Roque [16]. The taxonomy was updated using the Missouri Botanical Garden database, available online [17].

3 Results

The sustainable agriculture movement is concerned with the environment, considering organic farms as an approximation to wild nature [18]. Whenever organic cultivation is continually practiced within the urban tissue or in peri-urban areas, the phenomenon is designated urban gardening or peri-urban farming, respectively [19, 20]. In India, herbal medicine is a millenary practise mostly associated with Ayurvedic therapeutics. In the state of Goa gardens display a diverse number of spices, legumes, medicinal herbs and fruit trees. Chemical-free

urban plots dominate, because Hinduism and Ayurvedic medicine reject such un-natural consumption, both in food as in healing plants.

Table 1 presents the top-ranking medicinal plants, fruits and spices consumed in Goa, and cross-examines the modes of preparation and the affections they heal these days, with the diseases the same species cured in Renaissance times. Results show that cow manure is the preferred method of fertilization in the twenty-six gardens explored. Organic input in front and backyards corresponds to 57.7%. Chemical fertilization was applied by three gardeners (11.5%), all of them Christians. Even so, eight urban cultivators didn't fertilise their front and backyards (30.8%), because they considered the urban soil didn't require such care. Another important result from the survey was that in fifteen houses of the first focus group interviewed (57.7%), the urban gardeners, possessed wells and used to regularly irrigate the spices, medicinal herbs and fruit trees they grew.

The top-ranking plant species consumed in Goa is tulsi or Krishna tulsi, used in Hinduism for prayer; besides having the virtue of blessing the house and the family, the Lamiaceae cures respiratory ailments, such as cough and colds, and is preferred to heal children. Tulsi wasn't described by any of the Renaissance authors examined, but it is by far the most important plant gardened in India's front and backyards, even in pots, in tiny gardens, as research conducted in Kochi evidenced [10], and also among the Indian community established in Malacca, Malaysia [11]. *Am* or mango, in Konkani, follows suit, another native plant species that has been expanded all over the tropical world. Mango bark is consumed against diabetes in Goa, the same application found in Belen, Brazil, in 1998 [8, 9].

During Renaissance, Indians used the leaf of mango trees against dysentery, a medicinal application that didn't endure in India nor in any Latin American country investigated at the service of the IICT (Brazil, Mexico, Peru, Chile, Argentina, Uruguay, Costa Rica and Cuba). Papaya trees, chilli (named Portuguese Peri-Peri in Goa), the pineapple and the *chicoo* tree were introduced in India by the Portuguese [15]. In fact, if the pineapple and the papaya were illustrated and described in the 1612 manuscript of Erédia [7] in the 1563 Orta's Codex there was no mention to these fruit species [6]. American fruits and spices were easily transported from Brazil, because the trade winds frequently obliged ships to navigate deep into south-western Atlantic waters. Extra cargo was then added as the ships navigated practically empty from Lisbon to Goa, where they were loaded of spices.

Navigation used the Cape of Good Hope route and gave way to paradoxical food and cooking habits, such as current preference for *Capsicum annum* in Goa (the American chilli), in detriment of native *Piper nigrum*. Results from the 2013 Kochi survey also reported this phenomenon; in fact, chilli presented the 5th post on the list of top-ranking consumptions and pepper the 9th [10]. Black pepper was the most relevant spice for the Europeans during Renaissance, as it soon became in Brazil, as found in Belen [9, 21]. Truth is the 19th century Japanese immigrants to the Amazon Region were the main farmers of the Indian spice; however the preference preceded the cultivation, because maritime trade of spices brought it to

Table 1: Evolution in consumption of top-ranking plant species in Goa.

Vernacular name (Konkani)	Botanical name	Applications during Renaissance	Current mode of preparation	No.
1. Tulsi	<i>Ocimum sanctum</i> L. LAMIACEAE	Not recorded	Infusion/concoction of the leaf or flower against cough, colds, asthma. The oil with honey purifies the blood and resolves kidney infections	26
2. Am Mango	<i>Mangifera indica</i> L. ANACARDIACEAE	The leaf cured dysentery. The fruit of the Indian species was eaten, and expelled intestinal worms	Cultivated in the gardens. The ripe fruit is eaten raw. The green fruit is cooked in curry. The bark is used against diabetes together with others	19
3. Papaya	<i>Carica papaya</i> L. CARICACEAE	Fruit tree introduced by the Portuguese	Fruit eaten raw for its digestive powers	15
4. Aloe	<i>Aloe vera</i> (L.) Burm f. XANTHORRHACEAE	Sap was considered strong diuretic and used to purge, consumed against kidney and bladder infections	Sap applied against skin rashes, burns, wounds. Ingested for heart diseases	14
5. Nutmeg, Mace	<i>Myristica fragrans</i> Houtt. MYRISTICACEAE	Spice. The nut chewed prevented halitosis. Anti-dysenteric, the oil was calming balm	Spice. The nut resolves diarrhoea, joint pains, and rheumatism	14
6. Coconut	<i>Cocos nucifera</i> L. ARECACEAE	Skin application as anti-septic. Coconut water was digestive and used to purge. The pulp was anti-venom	Skin application as anti-septic	13
7. Curry	<i>Murraya koenigii</i> (L.) Spreng. RUTACEAE	No record	The oil is rubbed to strengthen the gums. Spice tree grown in the gardens. The leaf is chewed to lower blood pressure and against diabetes	11
8. Payam, Banana, Indian Fig Tree	<i>Musa paradisiaca</i> L. MUSACEAE	The fruit was considered diuretic, aphrodisiac and was cooked in wine and cinnamon. The latex of the tree was calming balm	Cultivated in the gardens and consumed in Goa. The fruit is also fried in chips and the young leaf wrapped in betel to strengthen the gums and teeth	11
9. Ginger	<i>Zingiber officinale</i> Roscoe ZINGIBERACEAE	Anti-fever, anti-flu, spice and good appetiser	Root consumed in relaxing concoction. Also against cough, colds, indigestion, arthritis, circulatory problems	11

Table 1: Continued.

Vernacular name (Konkani)	Botanical name	Applications during Renaissance	Current mode of preparation	No.
10. Portuguese Peri-peri	<i>Capsicum annuum</i> L. SOLANACEAE	American spice introduced by the Portuguese	The fruit is spice	10
11. Cardamom	<i>Elettaria cardamomum</i> (L.) Maton var. <i>major</i> and <i>minus</i> ZINGIBERACEAE	Spice. Chewed prevented halitosis, sometimes combined with Areca nut	Spice. Also ingested in infusion for weight loss. Concoction of the seed improves the memory and cures depression	9
12. Pineapple	<i>Ananas comosus</i> (L.) Merr. BROMELIACEAE	Digestive. Excessive consumption provoked fever and indigestion	Digestive fruit cultivated in the gardens	9
13. Haldi, Turmeric	<i>Curcuma longa</i> L. ZINGIBERACEAE	Root is anti-septic, spice and cured scabies together with coconut oil	Spice. The root applied to the skin is anti-septic. Anti-inflammatory, analgesic and anti-cough, ingested with honey and lime	9
14. Chicoo	<i>Manilkara zapota</i> (L.) P. Royen SAPOTACEAE	American fruit introduced by the Portuguese	Fruit tree cultivated in the gardens, very nutritious fruit	9
15. Carim Watermelon	<i>Citrullus lanatus</i> (Thunb.) Matsum and Nakai CUCURBITACEAE	Diuretic, anti-fever. Nutraceutical eaten against liver and kidney problems	The fruit is appreciated and the seeds are consumed toasted	8
16. Lemon grass	<i>Cymbopogon citratus</i> (DC.) Stapf POACEAE	Not recorded	Infusion of the leaf consumed against cough and colds. Oil drops on the skin against acne. In water for depression	7

Source: Survey by the author.

America, either en route to Europe or in separate fares. The spice route established by the Portuguese fomented the expansion of medicinal flora and spices all around the world and promoted the early botanical trade of exotic flora from Asia to America and back to Europe [22].

Nevertheless, the analysis of Table 1 shows that native plants are favoured in Goa, including other spices, namely cardamom, curry, turmeric, and ginger. Moreover several Indian spices and medicinal plants kept similar therapeutic uses to the ones reported by early herbalists and plant doctors [6, 7], as in the case of nutmeg and mace, ginger, Indian turmeric or the American pineapple, a fruit frequently gardened in Goa. It is the case with the Pacific coconut tree too, that is sometimes considered Indian native [7, 15]. The result that stands out is the enormous diversity of the home gardens of Goa, in line with previous research conducted in Brazil, in locations where Portuguese colonisation lasted over three hundred years, as is the case of Belen and St. Louis [8, 9, 19, 21, 23].

Biodiversity within the state of Goa reached one-hundred and fifty taxa (150) and, therefore, the garden flora far overcame the eighty-eight plant species



registered in Kochi, in a similar sample of fifty interviews. Even though many species were gathered in trading posts, the fruit trees dominated in both sites, about 39.3% in Goa; the medicinal flora followed with 33.9% in the *Konkan*; spices had a percentage of 17.9%; and vegetables and staples presented 8.9% within the state of Goa. Regarding the plants gardened, their purpose was the self-consumption, restricted to the extended household, as is normal in Indian culture, because parents usually continue living in the whereabouts of their adult offspring.

The similarity of results obtained in the surveys conducted in the Kerala state city of Kochi, in 2013, and in the seven settlements explored in Goa, in 2014, fuels the hypothesis that gardening in India, at least in locations colonised by the Portuguese during Renaissance, might be associated to cooking and healing traditions practised within the households and transmitted through generations. Kitchen gardening should be the tag of this specific form of urban agriculture. Our hope is that further research in coastal fortresses and trading posts might be developed, in the future, favouring port cities that had a past of European colonisation, in order to confirm or infirm the hypothesis.

4 Discussion

Assessments made by Rodrigues dos Santos and Mendiratta about Pedro Barreto de Resende's images (16th century), as their surveys on the iconographic work of Manuel Godinho de Erédia, allow informed analysis about the urban and peri-urban areas existent within the walls of the city of Goa, during Renaissance. The emphasis should go to the extension of the rice pads and areca nut palm trees [24], that covered the *extramuros* (outside the walls) rural realm, in the central island of Tiswadi. In our days rice paddies no longer dominate the island, as the urban tissue is considerably more extensive, because of the city of Goa (now Old Goa), but also on account of the new capital city Panaji, and their satellite settlements. These urban and peri-urban areas are dominated by the horizontality of the buildings, of which the house in Fig. 2 (quite similar to a typical house of southern Portugal) constitutes a staggering example.

However, the areca palms still lay alongside the rivers, and particularly along the seashores (Fig. 3), most vigorously on the beaches, in Tiswadi as in Bardez (N) and Salcete (S), giving evidence of the importance of this long sought medicinal nut, that both marvelled and distressed the herbal doctor Garcia d'Orta [6]. In fact, *Areca catechu* L. was consumed in 1563 to strengthen the gums and against halitosis. Erédia wrote about the virtue of the leaf of this palm tree to cure haemorrhages, particularly sought after by women [7]. The Areca nut was also used to purge, a common practise in medicine, those days, yet an application that endured to present. Consumed wrapped in betel leaf (*Piper betle* L.) with camphor, khat (*Catha edulis* Forssk.), aloe and amber, in narcotic mixture to preserve the teeth, it gave Orta the certainty that the mouth of the Indians, both female and male, was always occupied and full with coloured saliva, quite repulsive. Fortunately the mixture is not so popular in present time, except for a group of faithful consumers.



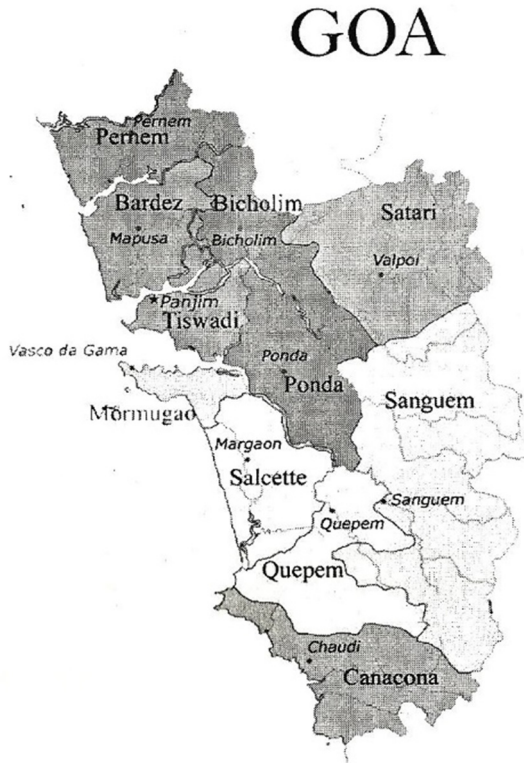


Figure 3: The State of Goa and the three islands investigated: Bardez, Tiswadi and Salcette. Source: Brito [2].

The set of Pedro Barreto de Resende's images investigated in 2011 [24], as the well-documented cartographic analysis of the geographer Raquel Soeiro de Brito, in 1966 [2], to finalise with the photographic record gathered at the service of the IICT, in 2014, prove that the total area of the state of Goa (3 611 km²) has not greatly changed over the length of five hundred years. The coast line remains practically unaffected, in spite of the dominance of lowlands in the islands, giving evidence that Goa survived the monsoons and frequent flooding. We argue that the persistence of urban gardening and peri-urban farming as the option for the maintenance of areca nut forests along the seashores had a positive effect on Goa. Gardens are spaces of infiltration that favour the hydrological cycle and regulate the temperature.

Annual rainfall ranges from 2,400 and 3,000 mm annually [2], but the soil, the water and forest management have been wisely exploited and developed, providing evidence that the option for horizontality in construction as well as the persistent cultivation of spices, medicinal plants and fruit trees within the city is vital for climate change mitigation. Additionally, urban agriculture contributes for food and health sufficiency [25], giving lower-income households' better quality of life. Both the literature examined and data gathered during fieldwork confirm

the research hypothesis that the adoption of organic agriculture by the urban households contributes for their environmental sustainability and increases the resilience of tropical humid coastal cities, to climate change.

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