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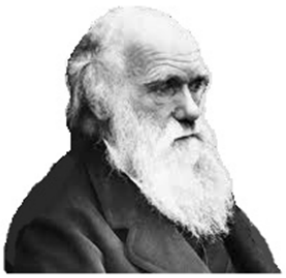

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Botanical Survey of Home Gardens with *Moringa oleifera* Lam; Popularity, Usage, and Domestication in Ibadan, South Western Nigeria

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ABSTRACT

Moringa oleifera (MO) Lam. is a medicinal plant that has crossed tribal, provincial and national boundaries in recent times, with its use and domestication cutting across different ethnic and geographical borders of the world in general and Nigeria in particular. In view of this observation, this present study was aimed at examining the contributing factors to the high diversity of this much prized economic and medicinal species in Nigerian gardens. The survey was conducted among 17 populations, from which a total of One Hundred and Four respondents were purposively drawn from the wards that make-up the Ibadan North Local Government Area of Oyo State. The purposive technique allowed at least 6 individual respondents to be randomly selected from each ward, based on their interest in home gardening, and their attached importance, domestication and accessibility to MO. The approach thus provided the opportunity to obtain an understanding of its medicinal importance, side effects and possible need for conservation. The respondents, who are of different backgrounds, were interviewed using semi-structured questions. Data collected were analysed qualitatively and quantitatively using descriptive statistics. The results of the study revealed that 50% of the respondents were home gardeners, while 40% are without gardens, although 80% showed the desire to own same. Also, 80% believed home gardens should provide food (Vegetables, spices and fruits etc.) and herbs (health-care). Over 95% of respondents claimed to have information about or cultivated Moringa, and 89% of them agreed to the important roles of agencies, as well as the media (radio, newspapers, etc.) in the dissemination of relevant information about this species. Moreover, close to 90% also have access to the plant from different sources: own garden (25%), friends' or neighbors' garden (44.2%) or market (13.5%), while 13.5% patronize all these sources. The part(s) mostly used are leaves & flowers (52.9%), followed by all parts (21.2%) and pods (seeds) (19%), while stem and bark are least employed (1.9%). In addition, a majority of respondents claimed that Moringa has solved some of their health concerns (64%) and thus, recommended it to someone or

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vice-versa (80%) with 65% claiming, no side effects. Consequently, many widely endorsed the conservation of MO and other MAPs (80%), with over 60% alluding to individuals, and government as major players in this responsibility. We conclude, therefore, that gardens, particularly home-based, play a valuable role in the conservation of not only the plant emphasized in this study, but many other useful plant species, most especially medicinals, that have become the cornerstone of health delivery in most developing nations. This study, therefore strongly recommends the strengthening of this strategy.

Keywords**:** *Moringa oleifera*, medicinal plants, domestication, home gardens, conservation

1. INTRODUCTION

The use of herbal preparations is gaining grounds in developing nations of the world where health care is not only expensive but also inaccessible in many cases. Even, developed countries are also increasing the exploitation of same, for instance, over 25% of the UK population relies on herbal medicine (Vines, G. Herbal harvests with a future: towards sustainable sources for medicinal plants, Plantlife International, 2004, www.plantlife.org.uk) as quoted by Canter et al. (2005). An increase in the consumption of herbal medicines by majority of the world's population is supported by the World Health Organization's (WHO) reports. Regrettably, most medicinal plants are mostly sourced from the wild as only small percentage of these species have so far been brought into domestication with very few in commercial cultivation in nations of the world. An increasing concern about the diminishing populations, loss of genetic diversity, extinctions and habitat degradation hold sway in these regions (Canter et al., 2005). Medicinal plants are in high demand as they serve other functions in our lives. Although a good numbers of these species are of little use or substituted by others of better values (Ved, 2007). Some are either presently underutilized and or threatened by neglect, while some are extinct, and an appreciable number are also vulnerable to extinction, meanwhile few have already lost their germplasm (Borokini, 2014). Over 164 plants comprising 16 critically endangered, 132 vulnerable plants with 120 trees; 16 shrubs; 6 epiphytes and 2 lianas in Nigeria have thus far been listed by the IUCN (Borokini, 2013; Manokari *et al*, 2016). Those that are very much relevant today are proned to overexploitation or overuse and consequent scarcity, a result of overdependence, lack of conservation strategy and domestication (Fasola & Ogunsola, 2014). In order to meet the demands of these plant species, Fasola & Ogunsola (2014) stressed the need for an increase cultivation especially of medicinal plants in a bid to fight not only adulteration, counterfeiting, accidental substitution but also provide a regular supply base of these valuable species. Also of importance is the improvement of drug plants which is only possible under cultivation (in-situ or ex-situ). Plant domestication is undoubtedly an ancient practice! The early man was believed to gather seeds of plant species proven to be of use and importance in a variety of ways but primarily recognized those that would meet his immediate needs (food and shelter) before considering them for other uses. Increase in populations and human needs have fostered further experimental applications of these chlorophyllous creatures in other areas such as dyeing, cosmetics, scouring and worthy of mention is medicine. Medicinal plants occupy an enviable position in our present world with her contribution to medicine and pharmacy (in combating diverse range of diseases claiming thousands of lives annually). In addition, the increasing appearance of chronic diseases that have defied treatments and cure

from conventional medicine, its expensive nature, proven ineffectiveness in some cases as a result of negative actions or complications often suffered by patients.

All these make herbal products a rallying point for health care delivery. Thus, studies are geared towards developing new drugs from plant materials in order to fight diseases rampaging our world. Domestication or cultivated species according to the Convention on Biological Diversity (CBD) simply means species in which the evolutionary process has been influenced by humans to meet their needs. Home garden as domestication centre plays a prominent role in the conservation of plant species due to the high diversity of species it supports. It serves as a refuge to a number of plant species most importantly, medicinal species, particularly those not widely grown in the larger agroecosystem. Also, they are, according to Eyzaguirre and Laures, (2004), source of enormous indigenous knowledge. The study of indigenous cultivation, food production, local medicinal knowledge and varied use of vegetal species has implication for food nutrient augmentation as well as discovery of new medicines according to Aworinde et al. (2013). Although, little is known or documented on the fate of cultivated MAPs in Nigeria, domestication of plants in home gardens is nevertheless not a new development especially among the aboriginals and urban settlers alike.

Moringa oleifera (MO) is one of such plant species that has received prominent attention from gardeners, farmers, institutions as well as researchers. It was once regarded by Price (2007) as "probably been the most popular plant in ECHO seed bank of underutilized tropical crops." MO's wide recognition, acceptance and usefulness among the various ethnic groups in this part of the world was attested to by Popoola and Obembe (2013) as they reported the highest fidelity level for the use of the species under review as food and medicine. An ample socioeconomic and ecological importance is attached to the high demand of the plant because of its importance in the production of food and other products such as firewood, fodder, spices, medicinal plants and ornamental as Chrisanty (1985) noted.

High presence of phytochemicals, micro and macro nutrients prominently in proteins, vitamin A and potassium among others have been reported by researchers and much value attached/attributed to the medicinal activities of this species (Mensah *et al.*, 2014; Adeyemi *et al.*, 2014). Some of the properties as emphasized by Farooq *et al.* (2012) include: Antimicrobial, ant helmintic, anti-asthmatic, anti-oxidant, anti-spasmodic and antiulcer effect, antifertility cardiac and circulatory stimulant, analgesic activity, antipyretic activity, antihypertensive, diuretic and cholesterol lowering activities, antidiabetic and antitumor.

Although, there have been wide studies and publications on *moringa's* medicinal importance worldwide. However, scanty reports exist on its acclaimed popularity among Nigerians, thus the emphasis of this study is on the usage and conservation through domestication of the species.

2. MATERIALS AND METHODS

Study area

This study was carried out in Ibadan North L.G.A of Ibadan city (Figure 1). Ibadan is the capital city of Oyo State in the south-western Nigeria. The city lies in tropical rainforest, latitude 7°23'47"N and longitude 3°55'0"E with bimodal rainfall pattern and lies about 48 km inside the northern boundary of lowland rain forest zone of western Nigeria. The principal inhabitants of the city are the Yoruba Muslims; others are Christians and Yoruba traditional

religion disciples. There are 11 Local Governments Areas (LGAs) in Ibadan metropolitan consisting of five urban Local Governments in the city (Ibadan North, Ibadan North- East, Ibadan North-West, Ibadan South-East, Ibadan South-West) and six semi-urban local governments. The LGAs are the third tiers of government in Nigeria. The survey was conducted within Ibadan North local government area to capture the urban populace.

Interview and questionnaire

A total of 104 respondents were randomly interviewed in Ibadan North L.G.A in February, 2017 through convenience sampling. A free, prior and informed consent was solicited from each respondent. The researcher explained to each respondent the objectives of the study. Information was gathered through face to face interviews guided by a semi-structured questionnaire that asked the following: (a) socio-demographic characteristics of respondents, (b) questions on Interest in gardens, (c) questions bordering on access to information and popularity of moringa, and (d) questions on medicinal significance and conservation of moringa.

Data analysis

Data obtained were analysed using spss version 21. The results are also presented in frequency tables, bar and pie charts.

3. RESULTS

Demography

With 104 randomly selected questionnaire administered to respondents which included; civil servants, student, professionals, unemployed and self employed (business owners) that constitute home owners and tenants within the research area setting. These were within the age 20 and above.

The number of male and female was at par ((51) spread along religion divides (Christians - 76% and Muslims - 23%) and educational qualification (University, 43.3%, Polytechnic, 2.3%; Secondary, 9.6%; Primary, 1.0% while 1.0% had no formal education (Table 1).

Table 1. Demographic characteristics of respondents.

	Demographic Features	Number	Percentage (%)
Age of Informants (years)	20-30	53	51.0
	31-40	35	33.7
	41-50	9	8.7
	51 and above	7	6.7

Sex	Male	51	49.0
	Female	51	49.0
Religion	Christianity	79	76.0
	Islam	24	23.1
Educational Qualification	University	45	43.3
	Polytechnic/Colleges	44	42.3
	Secondary	10	9.6
	Primary	1	1.0
	Others	1	1.0
Occupation	Civil Servant	16	15.4
	Self Employed	47	45.2
	Unemployed	7	6.7
	Student	32	30.8

Home garden: Acceptance, composition and importance

Table 2. Plants' use and possession of home garden

S/N	Questions	Strongly agree	Agree	Undecided	Disagree	Strongly disagree	Total
		FREQUENCY PERCENTAGE (%)					
1.	I have home garden (where I raise Plants)	20 19.2	30 28.8	16 14.4	27 26.0	12 11.5	104 100.0
2.	I would like to posses/owns a personally garden.	44 42.3	35 33.7	11 10.6	7 6.7	3 2.9	100 96.2
3.	The plants in my/our garden are mainly source of food (Vegetables, Spices, Fruits etc)	31 29.8	39 37.5	8 7.7	15 14.4	9 8.7	102 98.1

4.	The plants in my/our garden are for medicine (herbs)	15 14.4	35 33.7	19 18.3	28 26.9	5 4.8	102 98.1
5.	The plants in my/our garden both serve as foods as well as medicine (dual use or purpose)	45 43.3	39 37.5	7 6.7	12 11.5	1 1	104 100.0

Respondents were sharply divided on the possession of home garden; while 48% agreed ownership, 35% disagreed and 11.6% were undecided. Though, 76% had the intention of establishing a garden in the future, 9.6% seemed not interested and 10.6% unsure about their decision on this matter. Although, about 70% of respondents believed home garden should harbour only foods such as vegetables**,** spices and fruits, almost 25% opposed this while 7.7% did not take position. However, 50% gave preference for herbs as sole plants to be found in their homes, 19% were undecided on the subject as 32% were in the opposition. Consequently, the highest percentage of interviewed persons widely agreed (81%) that gardens situated in homes should be fortified with both foods and herbs, though, 12.5% differed as 6.7% were unresolved on it.

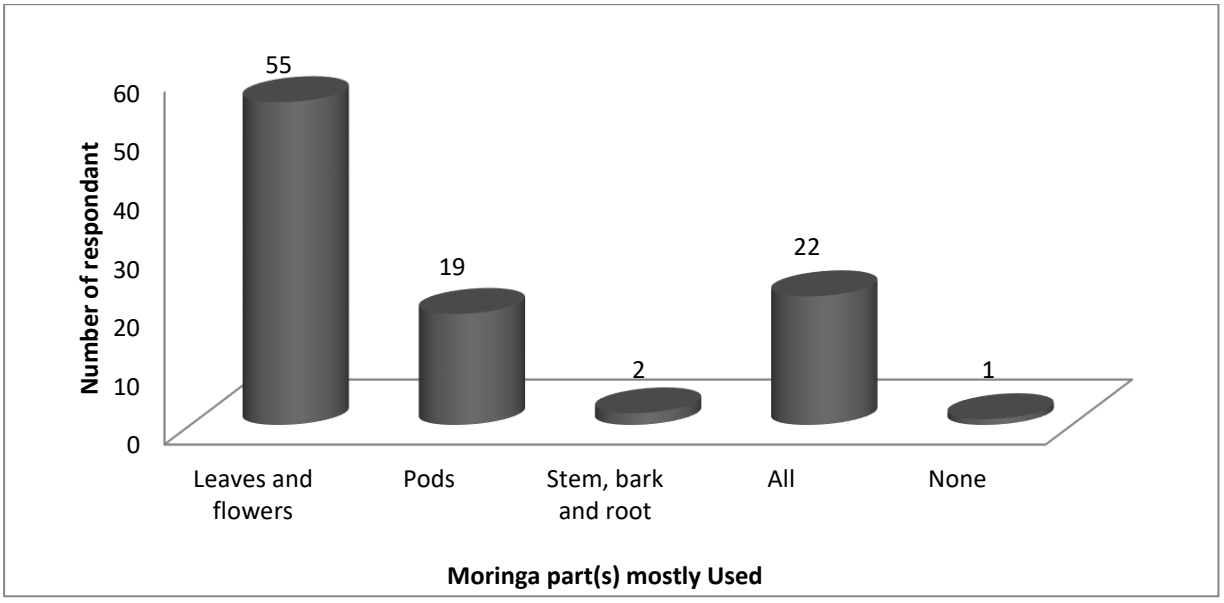

Figure 1. Preference for *Moringa's* part(s)

Popularity and usage of *Moringa*

As shown in Table 3 below, majority of respondents admitted to have heard about, seen or own(ed) MO plant (92%) as 80% claimed to have access to the plant stating different sources such as personal garden (25%), friends' or neighbours' garden (44%), market (14%) while 14% patronized all the stated sources (Fig. 2). Leaves and flower were reported to be of

highest usage (55%), Pods (Seeds) were used by 19%, as stem, root and bark were barely used (2%) by the respondents while 21% employed all the parts mentioned. 39% of respondents maintained that friends/neighbours with MO growing in their compounds are less than five persons; 21% above 5; only 4% had more than 10 familiar persons while 30% reported to know many individual home growers of the species (Fig. 3).

Table 3. Accessibility, information, usage and popularity of *Moringa*

S/N	Questions	Strongly agree	Agree	Undecided	Disagree	Strongly disagree	Total
		FREQUENCY PERCENTAGE (%)					
1.	I have heard about, seen or own a *Moringa* plant (tree)	63 60.6	36 34.6	1 1	2 1.9	1 1	103 99.0
2.	Radio, Television, Internet adverts and Social media contribute in no small measure to my awareness of *Moringa*.	36 34.6	53 51.0	5 4.8	7 6.7	2 1.9	103 99.0
3.	I have access to *Moringa* parts	46 43.3	37 35.6	4 3.8	13 12.5	3 2.9	102 98.1

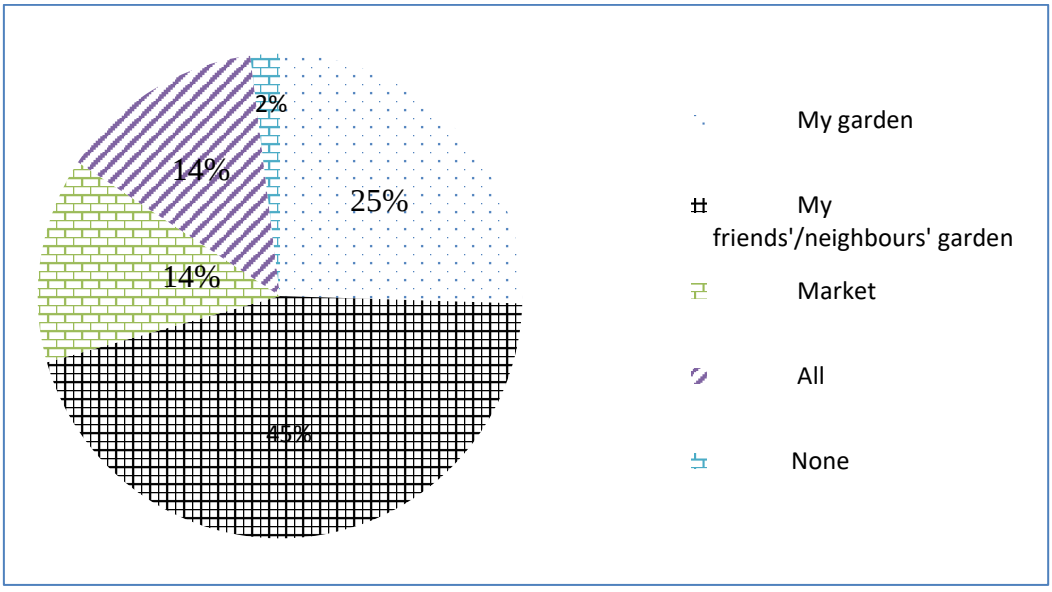

Figure 2. *Moringa* source (s)

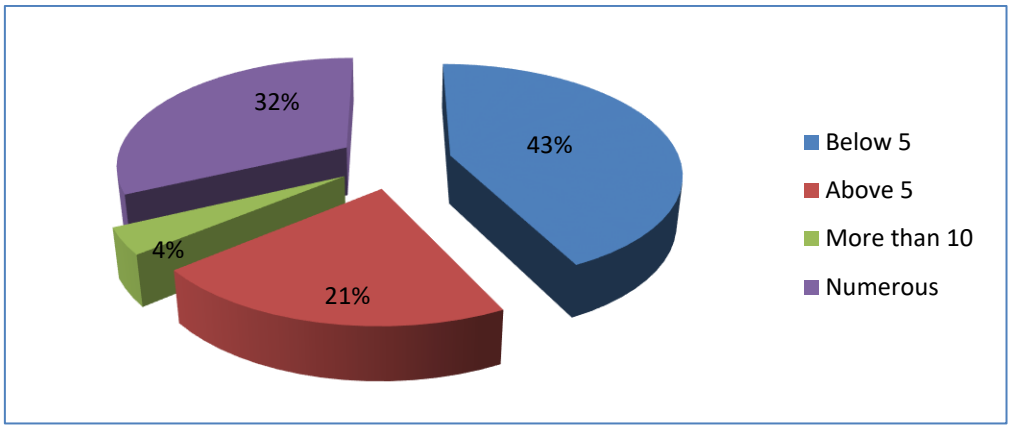

Figure 3. *Moringa* domestication by friends/neighbours**.**

Moringa in health care

Over 60% respondents claimed that MO's part(s) has/have proven effective in fighting some of their health concerns, 19% were undecided while 17% disagreed with about 80% claiming to have either recommended the species to someone or vice-versa, while 3% were undecided, 16% disapprove this assertion. More than 65% said they have not experienced any side effect(s) using MO, although nearly 16% averred to have experienced negative consequences after use, while 18% were unsure. Consequently, 10% reported to have suffered one or more symptoms such as; nausea (2), stomach upset (3), purging (3), stomach upset and purging (2) and itching (1) (Table 4).

Conservation of *Moringa* and other important MAPs

As illustrated in Figure 4, conservation of *Moringa* was largely embraced by respondents (80%), with 10% undecided and 9% opposing the practice. Subsequently, they are of the opinion that the conservation of priceless MAPs like MO be the responsibility of individuals (23%), government (11%) and both (Individuals and Government), 66%) as depicted in Figure 4.

Table 4. Side effects *of Moringa* and its Conservation

S/N	Questions	Strongly agree	Agree	Undecided	Disagree	Strongly disagree	Total
		FREQUENCY PERCENTAGE (%)					
1.	*Moringas*' part(s) has/have solved some of my health challenges.	31 29.8	35 33.7	20 19.2	12 11.5	5 4.8	103 99.0

2..	I have recommended or someone recommended *Moringa* to me as a medicine (herb)	31 29.8	52 50.0	3 2.9	13 12.5	4 3.8	103 99.0
3.	The conservation of *Moringa* is essential bearing in mind its importance	32 30.8	51 49.0	10 9.6	5 4.8	4 3.8	102 98.1
4.	I have experienced side effect(s) while using *Moringa*	7 6.7	9 8.7	18 17.3	39 37.5	29 27.9	102 98.1

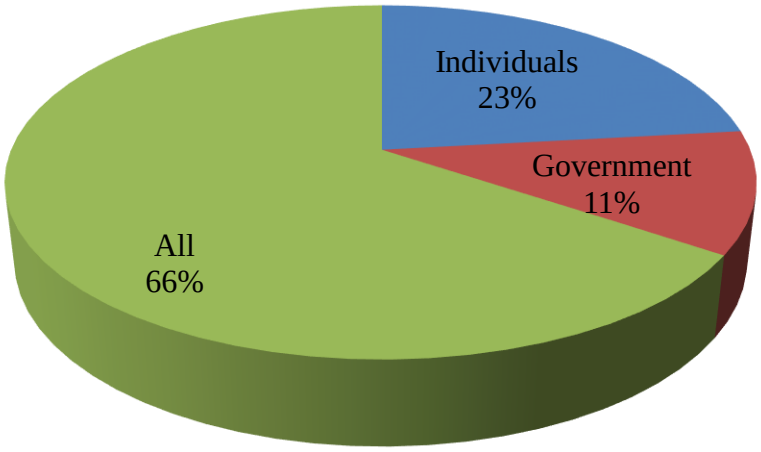

Figure 4. Conservation agents of Medicinal and Aromatic Plant (MAPs)

4. DISCUSSION

The Nigerian home garden like other nations' is a worthy in-situ conservation strategy as it contains high species diversity and rich floristic composition; harbours enormous quantity of plants of high medicinal values (Aworinde *et al.*, 2013) which forms a rallying point for health care provision as a result of its easy accessibility and availability at low or no cost. MO in recent times has become a part of these vast species kept under the watchful eyes of home owners, gardeners, institutions and researchers alike that see it as candidate for drug discovery.

In this study, it is revealed that majority of respondents were within the age of 20-30 (53%) with people between the age of 51 and above constituting the least of the interviewers (6.7%). This might not be unconnected to the fact that the study was set in an urban area, a high level of youths is thus expected in such settlement. Though, about 50% reported to possess home garden, 76% were interested in having one in the future.

The major source of the species under study was from friends' and neighbours' gardens (44%). This also gives room for the exchange of information on medicinal use of MO and useful MAPs. The influence of relatives, friends and neighbours on health-care seeking

preferences for herbal medicines was been reported by (Osikoya *et al.*, 2008) which corroborates with the finding in our present study. This is also confirmed by the percentage (79.8%) of people that agreed to have recommended the plant to someone (friends, relatives or neighbours) or vice-versa. The species was also reported to have solved health concerns of respondents or associates. This might not be unrelated to important phytochemicals and associated medicinal activities as reported elsewhere (Monica *et al.*, 2010; Farooq *et al.*, 2012). It is also noticed that better use was accorded the leaves and flowers by majority compared to other parts of the species (Sharma, 2012; Giuda, 2018; Answar, 2007; Takaoka, 2017; Caceres, 1992).

5. CONCLUSION

With only few botanical gardens, reserve forests etc. in degradable and predictable status; most of which are under the watchful eyes of government and related institutions or agencies, which are unfortunately, often mismanaged; mostly uncoordinated and poorly monitored, thus, encouraging uncontrolled deforestation, burning, and resulting urbanization and similar development. Though may be limited by space and population of species it holds, home garden remains an alternative for efficient conservation as revealed in the case of MO. The successful sheltering of medicinal floras like the species in this study supports the continuous use of gardens and similar approach in the retention of our indigenous species. This present study has therefore acknowledged and recommended the adoption of similar approach in upholding indigenous knowledge, continuous supply and conservation of other species of high medicinal values.

Recommendations

Improvement of this conservation strategy and species; development of better cultivars or varieties and guarantying availability of germplasm to growers in adequate quantity and increasing the activities of beneficial secondary metabolites (improved standardization) present through biotechnology should also be considered. Public domestication programmes are also important to improve not only the cultivation of the species under study, but also other valuable and promising MAPs.

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