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TRADITIONAL FOOD PLANTS CULTIVATED AND MANAGED IN HOME GARDENS IN SOUTH AFRICA'S EASTERN CAPE PROVINCE

Alfred Maroyi

Department of Botany, University of Fort Hare, Private Bag X1314, Alice 5700, South Africa.

✉ amaroyi@ufh.ac.za

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ABSTRACT

This study aimed to document the diversity of traditional food plants in South Africa's Eastern Cape province. The survey was carried out in six local municipalities in the province, between March 2016 and September 2020. Information on the socio-economic characteristics of the informants and on traditional food plants collected from the wild and cultivated and managed in home gardens was recorded using questionnaires, personal observations, and guided field walks with 145 informants. A total of 58 edible plants belonging to 46 genera and 29 families were recorded. The plant families with the largest number of species were Solanaceae (six species), followed by Amaranthaceae and Asteraceae (five species each), Rosaceae (four species), and Apiaceae, Cactaceae, and Fabaceae *sensu lato* with three species each. The main uses of the documented species were edible fruits (56.9%), leafy vegetables (29.3%), and edible tubers (12.1%). Species that were categorized as valuable, with relative frequency of citation (RFC) values exceeding 0.3, were *Solanum tuberosum*, *Allium cepa*, *Zea mays*, *Beta vulgaris*, *Cucurbita moschata*, *Brassica oleracea*, *Spinacia oleracea*, *Cucurbita maxima*, *Daucus carota*, and *Lycopersicon esculentum*. The findings highlight the significance of edible plant species to the well-being of local communities in the Eastern Cape province within the context of food provisioning.

Contribution/Originality: This study documented edible plants cultivated and managed in home gardens. This study also documented Indigenous knowledge of edible plants. There is an increasing realization of the need to increase our understanding of edible plants in home gardens to preserve and protect the traditional knowledge associated with this practice.

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1. INTRODUCTION

Plant species growing in natural or semi-natural ecosystems and agroecosystems play an important role in the provision of food and other nutritional needs (Carvalho & Barata, 2016; Turner et al., 2011; Vincent et al., 2013). Galhena, Freed, and Maredia (2013) argued that the plants growing and managed in home gardens are an important component of food systems and agricultural landscapes. Literature studies have shown that plant species managed by households in home gardens contribute to food security, human nutrition, enhanced incomes, and other ecosystem

goods and services associated with maintaining or increasing local biodiversity (Galhena et al., 2013; Guell et al., 2021; Ngcaba & Maroyi, 2021). Turner et al. (2011) argued that people living in the same community have different food choices determined by biodiversity levels, necessity or opportunity, and territorial differences or resource availability. Similarly, Garn and Leonard (1989) argued that there are about 30,000 edible plant species on the planet, of which approximately 7,000 are either cultivated or collected from the wild as food (Chivenge, Mabhaudhi, Modi, & Mafongoya, 2015; Marrelli, Statti, & Conforti, 2020; Motti, Bonanomi, Lanzotti, & Sacchi, 2020). Nevertheless, research by Prescott-Allen and Prescott-Allen (1990) showed that about 20 plant species account for approximately 90% of the planet's food requirements, with wheat (*Triticum aestivum* L.), rice (*Oryza sativa* L.), and maize (*Zea mays* L.) accounting for 60% of the human diet. Therefore, edible plants harvested from the wild or cultivated or managed in home gardens play a significant role in maintaining human culture, as well as nutritional needs (Bacchetta et al., 2016; Borelli et al., 2020; Gębczyński, Bernaś, & Słupski, 2022; Ray, 2022). For example, Van Wyk (2011) listed more than 120 plant species in South Africa with commercial potential as food plants. Although the food plants of South Africa are relatively well studied compared to those of other developing countries (Bhat & Rubuluza, 2002; Fox & Norwood, 1982; Liengme, 1981; Magwede, Van Wyk, & Van Wyk, 2019; Moffett, 2010), other researchers, like Welcome and Van Wyk (2019), have emphasized the need for detailed research on the traditional food plants of South Africa. Therefore, this study aimed to document the diversity of traditional foods in South Africa's Eastern Cape province.

This study forms part of a wider research project on floristic composition and plant utilization patterns in Eastern Cape province conducted by a multidisciplinary team composed of social and natural scientists (Atyosi, Ramarumo, & Maroyi, 2019; Maroyi, 2017; Thinyane & Maroyi, 2019a, 2019b). Eastern Cape province is the second-largest province of South Africa, covering 168,966 km² of land area (Statistics South Africa (STATS SA), 2018). It is regarded as a rural province and is inhabited mainly by isiXhosa-speaking people of Cape Nguni descent, and some of the local communities are highly dependent on natural resources for their livelihoods (Hamann & Tuinder, 2012).

2. MATERIALS AND METHODS

2.1 Study Area

This study was carried out in six local municipalities in Eastern Cape province, namely Elundini, Mbhashe, Mbizana, Ntabankulu, Raymond Mhlaba, and Umzimvubu (see Figure 1).

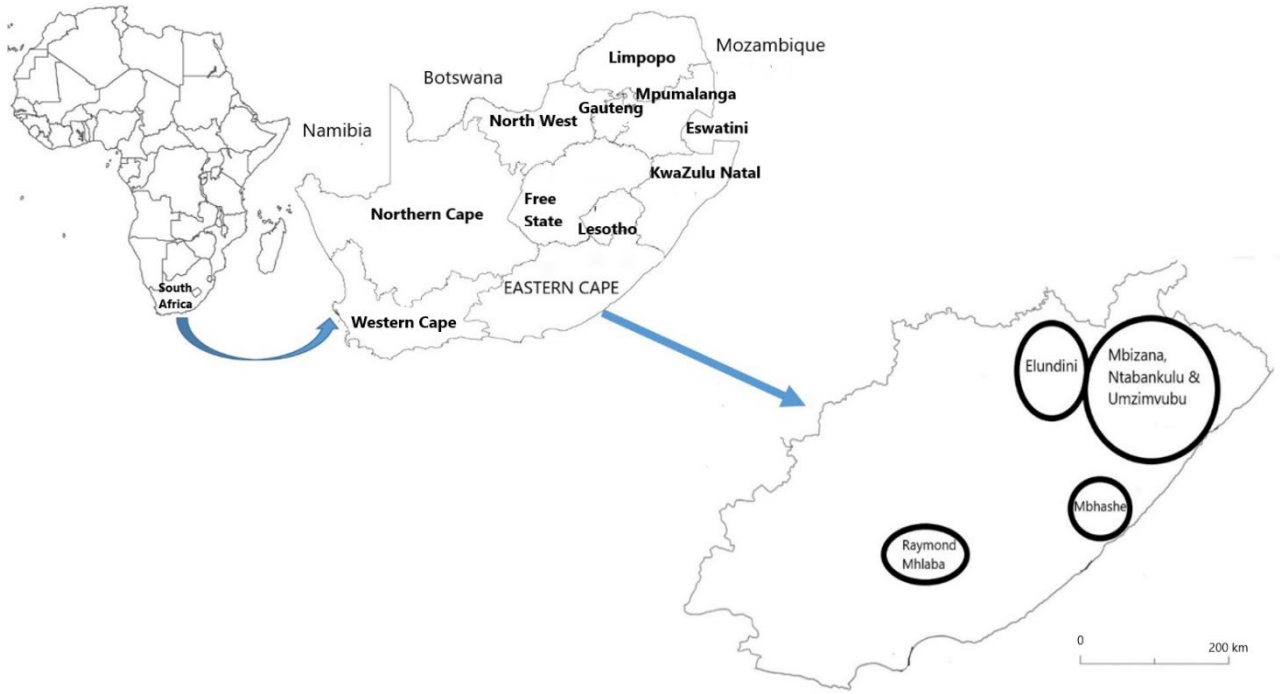

Figure 1. Map of South Africa showing the geographical position of the sites.

All six local municipalities are in the Savanna Biome (Mucina & Rutherford, 2006) dominated by grasslands, succulent plants, thickets, and *Acacia* bushveld. The altitude of the study area is between 0 and 1860 m a.s.l., with summer rainfall and dry frosty winters with approximately 500–1069 mm precipitation per year (Jari & Fraser, 2012; Manyevere, Muchaonyerwa, Laker, & Mnkeni, 2014). Mean monthly temperatures range from 38°C in summer to 4°C in winter (Jari & Fraser, 2012; Manyevere et al., 2014; Palmer, Timmermans, & Fay, 2000).

2.2 Data Collection

The sampling occurred during a series of one-week field excursions conducted between March 2016 and September 2020. Sampling was carried out in six local municipalities (Figure 1). Standardized plant sampling procedures were used to collect specimens (Bridson & Foreman, 1998; Victor, Koekemoer, Fish, Smithies, &

Mössmer, 2004). This involved transect walks in home gardens, farms, and the surrounding landscapes. Interviews and discussions were conducted in isiXhosa and translated into English with the assistance of an interpreter. We recorded plant names, their uses, plant parts used, different plant use categories, and preparation methods of useful plants. A list of edible plant species and plant-use categories, such as edible fruits, culinary herbs, leafy vegetables, cereals, edible roots, seeds, and tubers, was developed, and documented species were placed into these plant-use categories. These categories were expanded or modified based on information obtained during fieldwork, focus group discussions, and field observations. Germishuizen and Meyer (2003) and the Plants of the World Online (2021) were used to authenticate the plant names.

Ethnobotanical data were gathered from 145 purposively sampled participants using a snowball sampling approach (Etikan, Alkassim, & Abubakar, 2016; Heckathorn, 2011; Waters, 2015). The participants were asked to sign an informed consent form (MAR011). Most of the informants (56.6%) were female, and their ages ranged from 18 to 84 years (see Figure 2). More than three-quarters of the informants (83.4%) were more than 59 years of age, while 31.0% were less than 40 years of age. The majority of the participants were single (43.4%), followed by married (29.7%), widowed (15.2%), and divorced (11.7%). Close to half of the sample (46.2%) had completed primary level education, while 23.4% of the informants had completed secondary level education, and 15.9% and 14.5% of the informants had attained tertiary education or had no formal education, respectively. About half of the informants (49.7%) were unemployed, surviving on South African government social grants and remittances from relatives.

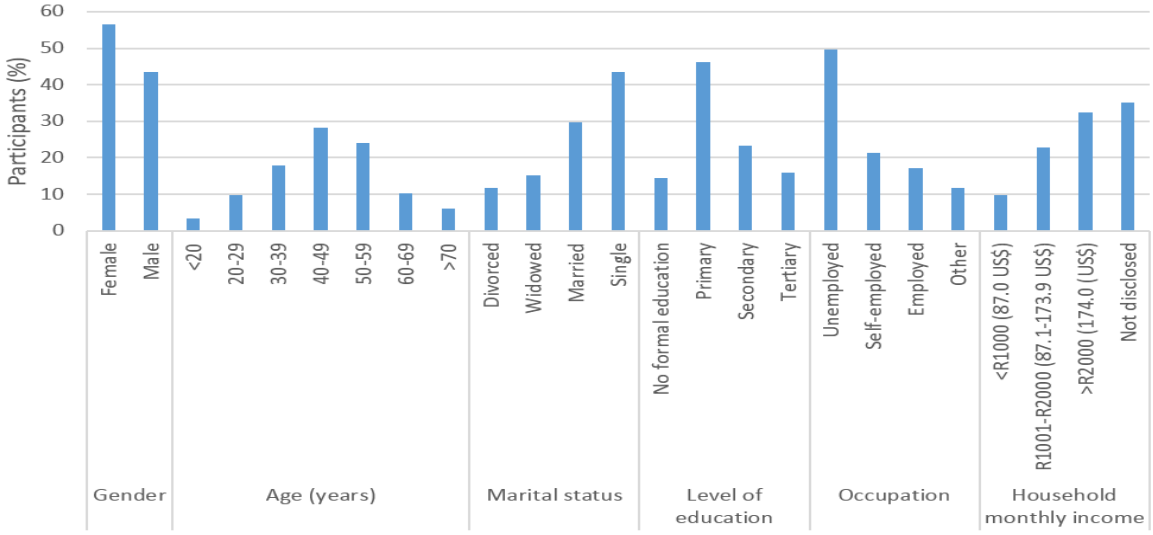

Figure 2. Participants' demographic information.

2.3. Data Analysis

The relative frequency of citation (RFC) of the species was determined using the following equation:

$$RFC = FC/N \ (0<RFC<1)$$

This index shows the significance of each species as determined by the frequency of citation (FC) and the number of participants (Ahmad et al., 2014; Faruque et al., 2018).

3. RESULTS AND DISCUSSION

3.1. Floristic Composition

This study recorded 58 species widely utilized as food plants in the Eastern Cape province (see Table 1). Of the recorded species, 15 species were native to South Africa (25.9%), and 43 species (74.1%) were exotic, mainly naturalized as agricultural weeds in home gardens. The high proportion of exotic species observed in this study was consistent with observations made by Akinnifesi et al. (2006); Akinnifesi et al. (2008a); Akinnifesi et al. (2008b); Akinnifesi et al. (2010), who argued that the introduction of exotic species often offers protection to indigenous species against over-exploitation.

Some exotic plant species categorized as problem plants and invasive weeds, which were introduced in South Africa but are now widely grown and collected from natural or semi-natural ecosystems in the Eastern Cape province, included *Caesalpinia decapetala* (Roth) Alson, *Harrisia balansae* (K.Schum.) N.P.Taylor & Zappi, *Opuntia ficus-indica* (L.) Mill., *Opuntia monocantha* Haw., *Psidium guajava* L., and *Rubus fruticosus* L. (Table 1). According to the South African National Environmental Management Biodiversity Act (NEMBA), Act Number 10 of 2004 enacted on 1 October 2014, these species must be managed, controlled, or eradicated as they are aggressive invaders, capable of forming dense thickets with the potential to displace native vegetation and thereby transform the landscape (Bromilow, 2018).

Therefore, the balance between their valuable contribution to food production and their invasive potential requires careful consideration.

Table 1. Diversity of food plant species in the Eastern Cape province. Plants with an asterisk (*) are not indigenous to South Africa.

Species name	Family	Vernacular name	Habit	Parts used	Uses	RFC
**Allium cepa* L.	Amaryllidaceae	Itswelle	Herb	Bulbs	Edible bulbs	0.57
**Allium sativum* L.	Amaryllidaceae	Ivimbampunzi	Herb	Bulbs	Edible bulbs	0.16
**Amaranthus hybridus* L.	Amaranthaceae	Nomdllomboyi	Herb	Leaf	Leafy vegetable	0.07
**Amaranthus spinosus* L.	Amaranthaceae	Utyuthu	Herb	Leaves	Leafy vegetable	0.05
**Beta vulgaris* L.	Amaranthaceae	Bhettruthi	Herb	Leaf and tubers	Tubers and leaves sold in local markets	0.41
**Bidens pilosa* L.	Asteraceae	Umhllabangulo and ucadollo	Herb	Leaf	Vegetable	0.08
**Brassica oleracea* L.	Brassicaceae	Ikhaphetshu	Herb	Leaf	Vegetable sold in local markets	0.67
**Brassica* spp.	Brassicaceae	-	Herb	Leaves	Leafy vegetable sold in local markets	0.12
**Caesalpinia decapetala* (Roth) Alson	Fabaceae	Bobo	Shrub	Fruits	Edible fruits	0.03
**Capsicum annuum* L.	Solanaceae	Itshilisi	Herb	Fruits	Edible fruits sold in local markets	0.25
Carissa bispinosa (L.) Desf. ex Brenan	Apocynaceae	Beta-umtumzi	Shrub	Fruits	Edible fruits	0.02
Catha edulis (Vahl.) Endl.	Celastraceae	Iqwakka	Tree	Leaf	Leafy vegetable	0.12
Centella coriacea Nanf.	Apiaceae	Unongottyozana	Herb	Leaves	Leafy vegetable	0.05
**Chenopodium album* L.	Amaranthaceae	Iphunga	Herb	Leaves	Leafy vegetable	0.06
**Citrus limon* (L.) Burm. f.	Rutaceae	Lamunni	Tree	Fruits	Edible fruits sold in local markets	0.12
**Citrus sinensis* (L.) Osbeck	Rutaceae	Iorrenji	Tree	Fruits	Edible fruits sold in local markets	0.18
**Colocasia esculenta* (L.) Schott	Araceae	Idumbe	Herb	Tubers	Edible tubers	0.03
**Cucurbita maxima* Duchesne	Cucurbitaceae	Ithannga	Creeper	Fruits	Edible fruits sold in local markets	0.48
**Cucurbita moschata* Duchesne ex Poir.	Cucurbitaceae	Ithannga	Creeper	Fruits	Edible fruits sold in local markets	0.52
**Daucus carota* L.	Apiaceae	Kharothi and umnqathi	Herb	Taproots	Edible taproots sold in local markets	0.33
Diospyros lycioides Desf.	Ebenaceae	Umbhonngisa	Shrub	Fruit	Fruits	0.03
Dovyalis caffra (Hook. f. & Harv.) Hook. f.	Salicaceae	Incaggolo	Shrub	Fruit	Fruits	0.05
Dovyalis rhamnoides (Burch. ex DC.) Burch. ex Harv. & Sond.	Salicaceae	Umkhamgwinnqi	Shrub	Fruit	Fruits	0.06
**Ficus carica* L.	Moraceae	Ikwiwwane	Tree	Fruits	Edible fruits	0.03
**Foeniculum vulgare* Mill.	Apiaceae	Imboziso	Herb	Leaves	Culinary herb	0.04
Grewia occidentalis L.f.	Malvaceae	Umgaqqombo and umvilani	Shrub	Fruit	Fruits	0.03
Harpephyllum caffrum Bernh.	Anacardiaceae	Umggwenye	Tree	Fruits	Edible fruits	0.06
**Harrisia balansae* (K.Schum.) N.P.Taylor & Zappi	Cactaceae	Ukatyi	Shrub	Stems	Fruits	0.02
**Ipomoea batatas* (L.) Lamm.	Convolvulaceae	Bhattata	Creeper	Roots	Edible tubers sold in local markets	0.21
**Lactuca sativa* L.	Asteraceae	Ilethasi	Herb	Leaves	Leafy vegetable sold in local markets	0.11
**Lycopersicon esculentum* Mill.	Solanaceae	Tumata	Climber	Fruits	Edible fruits sold in local markets	0.35
**Malus domestica* Borkh.	Rosaceae	Apile	Tree	Fruits	Edible fruits	0.14
Mentha longifolia (L.) Huds.	Lamiaceae	Inxxina	Herb	Leaf	Culinary herb	0.04
**Musa* X *paradisiaca* L.	Musaceae	-	Tree	Fruits	Edible fruits sold in local markets	0.17
**Opuntia ficus-indica* (L.) Mill.	Cactaceae	Itolofiya	Tree	Fruit	Fruits sold in local markets	0.19
**Opuntia monocantha* Haw.	Cactaceae	Tollofiya	Shrub	Fruits	Fruits	0.06

Species name	Family	Vernacular name	Habit	Parts used	Uses	RFC
**Persea americana* Mill.	Lauraceae	-	Tree	Fruits	Edible fruits	0.11
**Phaseolus vulgaris* L.	Fabaceae	Mbottyi	Herb	Seeds and fruits	Edible fruits and seeds	0.16
**Pisum sativum* L.	Fabaceae	Erityisi	Herb	Fruits	Edible fruits sold in local markets	0.12
Portulaca oleracea L.	Portulacaceae	Igwannisha	Shrub	Leaf and stem	Leafy vegetable	0.03
Portulacaria afra Jacq.	Didiereaceae	Igwanisha	Shrub	Leaves and stems	Leafy vegetable	0.02
**Prunus armeniaca* L.	Rosaceae	-	Tree	Fruit	Fruits	0.03
**Prunus persica* (L.) Batsch	Rosaceae	Ippesika	Tree	Fruit	Fruits	0.13
**Psidium guajava* L.	Myrtaceae	Gwavva and ugwava	Shrub	Fruit	Fruits sold in local markets	0.17
**Punica granatum* L.	Lythraceae	Rhanati	Tree	Fruits	Edible fruits	0.03
**Rubus fruticosus* L.	Rosaceae	Qunnube	Shrub	Fruit	Fruits and wine	0.03
Solanum aculeastrum Dun.	Solanaceae	Umthuma	Shrub	Fruits	Edible fruits	0.02
**Solanum nigrum* L.	Solanaceae	Umsobo	Herb	Fruits	Edible fruits	0.06
Solanum retroflexum Dun.	Solanaceae	Umsobbo wehllathi	Shrub	Fruit and leaves	Ripe fruits are eaten, and leaves used for flavor when cooking	0.02
**Solanum tuberosum* L.	Solanaceae	Amazzambane	Herb	Tubers	Edible tubers sold in local markets	0.56
**Sonchus asper* (L.) Hill	Asteraceae	Irwabbe	Herb	Leaves	Leafy vegetable	0.03
**Sonchus oleraceus* L.	Asteraceae	Ihlaba	Herb	Leaves	Leafy vegetable	0.02
**Spinacia oleracea* L.	Amaranthaceae	Imifuno	Herb	Leaf	Vegetable sold in local markets	0.54
**Syzygium paniculatum* Gaertn.	Myrtaceae	Irharinati	Tree	Fruits	Fruits	0.03
**Taraxacum officinale* Weber	Asteraceae	Ikhokhhoyi	Herb	Leaves	Leafy vegetable	0.04
**Vitis vinifera* L.	Vitaceae	Umdiliya	Climber	Fruits	Edible fruits sold in local markets	0.08
Zantedeschia aethiopica (L.) Spreng.	Araceae	Ntebbe	Herb	Bulbs	Edible tubers	0.02
**Zea mays* L.	Poaceae	Umbonne	Grass	Fruits	Edible seeds and fruits sold in local markets	0.86

Note: Plants with an asterisk (*) are not indigenous to South Africa.

The species used as traditional foods were distributed among 29 families and 46 genera. Most of the food plants (68.6%) used in the Eastern Cape province were from 14 families (see Table 2). The families with the largest number of food plant species were: Solanaceae (six species), followed by Amaranthaceae and Asteraceae (five species each), Rosaceae (four species), Apiaceae, Cactaceae, and Fabaceae *sensu lato* (three species each), Amaryllidaceae, Araceae, Brassicaceae, Cucurbitaceae, Myrtaceae, Rutaceae, and Salicaceae (two species each). The remainder of the plant families were represented by a single species each (Table 1). Bennett (2011) categorized 58.6% of the plant families recorded in the current study as important for human activities, that is, Anacardiaceae, Apiaceae, Brassicaceae, Convolvulaceae, Cucurbitaceae, Fabaceae *sensu lato*, Lamiaceae, Lauraceae, Malvaceae, Moraceae, Musaceae, Myrtaceae, Poaceae, Rosaceae, Rutaceae, Solanaceae, and Vitaceae. Similarly, Hammer and Khoshbakht (2015) argued that Fabaceae, Asteraceae, and Poaceae are among the most important plant families in the world as these families have high numbers of domesticated and semi-domesticated species. Previous research conducted in South Africa by Welcome and Van Wyk (2019), focusing on edible plant species, categorized 55.2% of the plant families recorded in this study as important sources of food, that is, Amaranthaceae, Anacardiaceae, Apiaceae, Apocynaceae, Asphodelaceae, Asteraceae, Brassicaceae, Convolvulaceae, Cucurbitaceae, Ebenaceae, Fabaceae *sensu lato*, Lamiaceae, Malvaceae, Moraceae, Poaceae, and Solanaceae. The genera with the largest number of species used for food were *Allium*, *Amaranthus*, *Brassica*, *Citrus*, *Cucurbita*, *Dovyalis*, *Opuntia*, *Prunus*, *Solanum*, and *Sonchus* with at least two species each.

3.2. Growth Habit and Use Categories

Herbs (43.0%) are the most frequent type of food plants in Eastern Cape province, followed by shrubs (24.0%) and trees (22.0%) (see Figure 3A). Similar research findings were reported by Reta (2016), who recorded 44.6% herbs, 27.1% shrubs, 24.8% trees, and 6.2% climbers as the most dominant forms of edible plants in the Hawassa region of Ethiopia. The different plant parts used as sources of traditional foods included bulbs, leaves, fruits, roots, seeds, stems, taproots, and tubers.

Table 2. Plant families with the highest number of food plant species (≥2 species) in the Eastern Cape.

Plant family	Number of food plant species	%
Solanaceae	6	10.3
Amaranthaceae	5	8.6
Asteraceae	5	8.6
Rosaceae	4	6.9
Apiaceae	3	5.2
Cactaceae	3	5.2
Fabaceae *sensu lato*	3	5.2
Amaryllidaceae	2	3.4
Araceae	2	3.4
Brassicaceae	2	3.4
Cucurbitaceae	2	3.4
Myrtaceae	2	3.4
Rutaceae	2	3.4
Salicaceae	2	3.4

The plant parts most frequently consumed were fruits (55.2%), followed by leaves (32.3%), tubers (6.9%), stems (5.2%), bulbs (3.4%), roots, seeds, and taproots (1.7% each) (see Figure 3B). The majority of encountered species (56.9%) were collected or grown for their edible fruits, compared to 32.8% of species that were sold in local markets and 29.3% of species that were collected or grown as leafy vegetables (see Figure 4). Other use categories for the documented species (in descending order of importance) included edible tubers (12.1%), culinary herbs (5.2%), edible seeds (3.4%), cereals, edible taproots, and wine production (1.7% each) (Figure 4). These findings corroborate observations made by Welcome and Van Wyk (2019), who argued that edible fruits are the most valuable use category of traditional food plants, and this plant part is usually followed by leaves and perennial storage organs, like bulbs, rhizomes, roots, and tubers. The dominance of *Zea mays* as a cereal crop and the important role of leafy vegetables and fruits as supplementary food crops are widely acknowledged in South Africa (Lerato, Stefan, Sarel, Catharina, & Rie, 2010; Maroyi, 2021; Mosina & Maroyi, 2016; Nemudzudzanyi, Siebert, Zobolo, & Molebatsi, 2010). Similarly, research by Van Wyk and Gericke (2018) classified food plants in South Africa into six main categories, namely, nuts and seeds, cereals, berries and fruits, bulbs, tubers, roots, vegetables, and beverages.

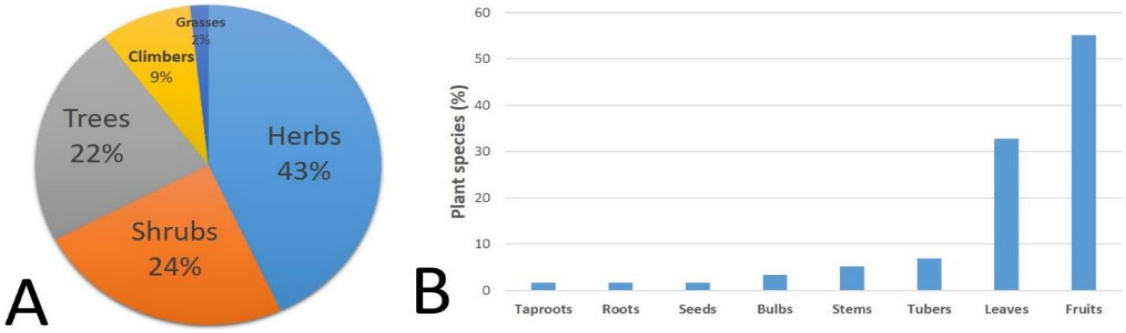

Figure 3. Characteristics of the plant species used as sources of traditional foods in the Eastern Cape province. A: Plant habit shown in pie chart; B: Utilized plant parts shown in bar graph.

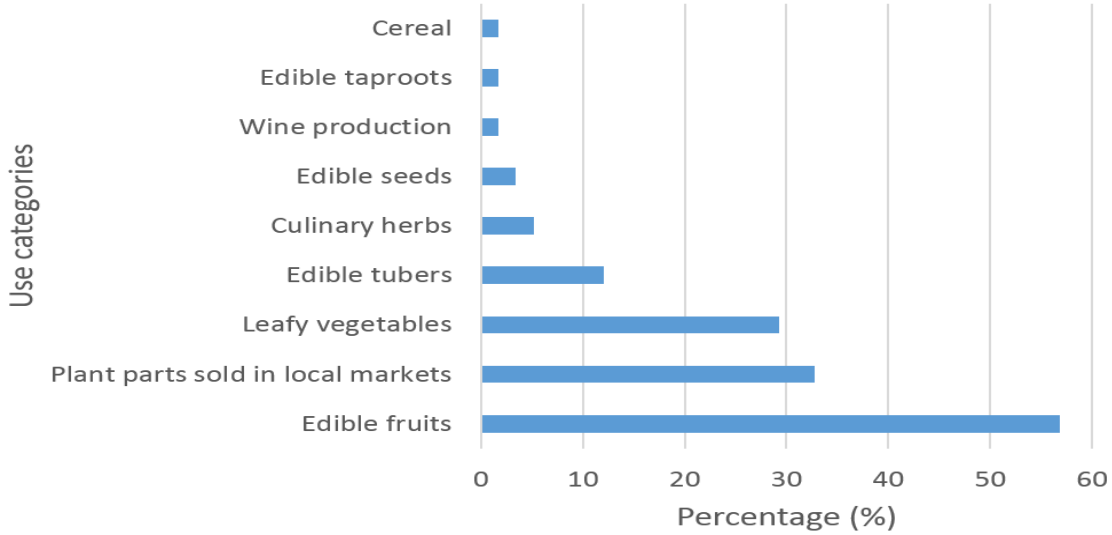

Figure 4. Major plant use categories identified in the study. Some plant species are represented in more than one use category.

The species regarded as important with RFC values >0.3 (in descending order of importance) were: *Zea mays* L. (cereal, edible seeds and fruits sold in local markets), *Brassica oleracea* L. (leafy vegetable), *Allium cepa* L. (edible tubers), *Solanum tuberosum* L. (edible tubers sold in local markets), *Spinacia oleracea* L. (leafy vegetable sold in local markets), *Cucurbita moschata* Duchesne ex Poir. (edible fruits sold in local markets), *Cucurbita maxima* Duchesne (edible fruits sold in local markets), *Beta vulgaris* L. (edible tubers and leaves sold in local markets), *Lycopersicon esculentum* Mill. (edible fruits sold in local markets), and *Daucus carota* L. (edible taproots sold in local markets) (Table 2). Plant species reported to have little value, with RFC values of 0.02, were *Carissa bispinosa* (L.) Desf. ex Brenan (edible fruits), *Harrisia balansae* (K. Schum.) N.P. Taylor & Zappi (edible fruits), *Portulacaria afra* Jacq. (leafy vegetable), *Solanum aculeastrum* Dun. (edible fruits), *Solanum retroflexum* Dun. (ripe fruits are eaten and leaves used for flavor when cooking), *Sonchus oleraceus* L. (leafy vegetable) and *Zantedeschia aethiopica* (L.) Spreng. (edible tubers) (Table 1).

4. CONCLUSION

The results of this study have shown that locally harvested plants provide essential food and some cash income for local communities. These research findings contribute to the wider body of knowledge on ecosystem goods and services derived from plant species, livelihood benefits derived by local communities from plant species, and how these benefits influence local support for plant resource management initiatives in the region and other provinces of South Africa.

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