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Crop wild relative diversity and conservation planning in two isolated oceanic islands of a biodiversity hotspot (Mauritius and Rodrigues)

P. Bissessur[1,2]*, C. Baider[3], N. Boodia[2], M.G.H. Badaloo[4], J.A. Bégué[5], Z. Jhumka[6], A. Meunier[7], Y. Mungroo[8], V. Gopal[9], S.P. Kell[10], J. Magos Brehm[10], I. Thormann[11]† and Y. Jaufeerally-Fakim[2]

[1]*Tropical Island Biodiversity, Ecology and Conservation Pole of Research, Department of Biosciences and Ocean Studies, Faculty of Science, University of Mauritius, Réduit 80837, Mauritius,* [2]*Faculty of Agriculture, University of Mauritius, Réduit 80837, Mauritius,* [3]*The Mauritius Herbarium, RE Vaughan Building, Agricultural Services, Ministry of Agro-Industry and Food Security, Réduit 80835, Mauritius.,* [4]*Plant Breeding Department, Mauritius Sugarcane Industry Research Institute, Mauritius Cane Industry Authority, Réduit 80835, Mauritius,* [5]*Mauritian Wildlife Foundation, Forest Quarters, Solitude R5128, Rodrigues,* [6]*Forestry Service, Ministry of Agro-Industry and Food Security, Botanical Garden Street, Curepipe 74213, Mauritius,* [7]*François Leguat Giant Tortoise and Cave Reserve, Anse Quitor R152, Rodrigues,* [8]*Agronomy Division, Agricultural Services, Ministry of Agro-Industry and Food Security, Réduit 80835, Mauritius,* [9]*National Parks and Conservation Service, Ministry of Agro-Industry and Food Security, Réduit 80835, Mauritius,* [10]*School of Biosciences, University of Birmingham, Edgbaston, Birmingham B15 2TT, UK and* [11]*Bioversity International, Via dei Tre Denari 472A, 00057 Maccarese, Italy*

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Abstract

The rising need for crop diversification to mitigate the impacts of climate change on food security urges the exploration of crop wild relatives (CWR) as potential genetic resources for crop improvement. This study aimed at assessing the diversity of CWR of the Indian Ocean islands of Mauritius and Rodrigues and proposing cost-effective conservation measures for their sustainable use. A comprehensive list of the native species was collated from The Mauritius Herbarium and published literature. Each species was assessed for the economic value of its related crop, utilization potential for crop improvement, relative distribution, occurrence status and Red List conservation status, using a standard scoring method for prioritization. The occurrence data of the priority species were collected, verified, geo-referenced and mapped. A total of 43 crop-related species were identified for both islands and 21 species were prioritized for active conservation. The CWR diversity hotspots in Mauritius included Mondrain, followed by Florin and Le Pouce Mountain. Although a wide diversity of CWR has been recorded on both islands, most do not relate to major economic crops in use, therefore only a few species may be gene donors to economic crops at the regional and global level. For example, coffee, a major global beverage crop, has three wild relatives on Mauritius, which could potentially be of interest for future predictive characterization.

Keywords: conservation and sustainable use, food security, Mascarenes, plant genetic resources, Republic of Mauritius

*Corresponding author. E-mail: prishnee2902@gmail.com
†Current address: Federal Office for Agriculture and Food, 53179 Bonn, Germany.

Introduction

Oceanic islands are part of many of the biodiversity hotspots (Myers *et al.*, 2000) as they host relatively high endemism and threatened flora (Caujapé-Castells *et al.*, 2010). Insular plants are more prone to habitat destruction, fragmentation and impacts of alien invasive species (Brooks *et al.*, 2002; Bruna *et al.*, 2009; Baider and Florens, 2011). Consequently, plant conservation on islands has mainly focused on understanding their biology and ecological interactions to inform management to prevent extinction (e.g. Brooks *et al.*, 2002; Kaiser-Bunbury *et al.*, 2010; Silva *et al.*, 2015; Downey and Richardson, 2016; Bissessur *et al.*, 2017). More recently, with the growing interest in crop wild relatives (CWR) (Maxted *et al.*, 2006), oceanic islands are being targeted for studies on CWR, as they may contain unique genetic diversity of value for crop improvement (Kell *et al.*, 2008).

CWR, which include crop progenitors, are inherently related to cultivated plants such as food and fodder crops, and species with medicinal, ornamental and forestry attributes (Maxted *et al.*, 2006). Populations of these wild species contain potential beneficial traits such as pest or disease resistance, tolerance to drought or heat stress, and greater yield, that can be bred into crops to address the varying environmental and market demands (Vincent *et al.*, 2013), and are therefore economically important for food security and environmental sustainability (Heywood *et al.*, 2007). Unfortunately, CWR, like other wild species, are vulnerable to an increasing range of threats (Maxted *et al.*, 2008; Maxted and Kell, 2009), including habitat degradation and fragmentation, unsustainable farming practices, urbanization, tourism development, invasive alien species, genetic pollution and climate change (Jarvis *et al.*, 2008; Bilz *et al.*, 2011; Ford-Lloyd *et al.*, 2011; Kell *et al.*, 2012). Here, we use the islands of Mauritius and Rodrigues as examples to identify and prioritize their CWR and propose conservation measures, especially since both islands have long documented botanical histories and are among the islands with the most human-impacted biodiversity (Rijsdijk *et al.*, 2011; Florens, 2013; Norder *et al.*, 2017).

Mauritius and Rodrigues harbour a relatively diverse flora (Baider *et al.*, 2010), well documented since the 18th century (Leguat, 1708; Bojer, 1837; Baker, 1877; Balfour, 1877), although new species or records are still being found (Le Péchon *et al.*, 2011; Baider and Florens, 2013, 2016; Byng *et al.*, 2015), as well as previously non-recorded taxa that went extinct at the onset of human colonization (van der Plas *et al.*, 2012; de Boer *et al.*, 2013). Research on their indigenous flora varies from distribution, ecology, conservation and restoration (e.g. Strahm, 1989, 1993; Hansen and Müller, 2009; Baider and Florens, 2011; Florens *et al.*, 2012; Florens and Baider, 2013) to traditional or new uses of medicinal plants (e.g. Mahomoodally and Aumeeruddy, 2017; Rummun *et al.*, 2018). In the agricultural sector, the most studied species is the cultivated sugar cane (*Saccharum officinarum* L.), given its economic importance, especially to develop new varieties adapted to the local conditions, like those with tolerance to pests and diseases and higher sugar content with less fibre (Ramdoyal and Badaloo, 2002), but also with high fibre content for energy production (Santchurn *et al.*, 2014).

While the importance of plant genetic resources (PGR) is recognized by the agricultural sector, until now no systematic study has addressed the CWR diversity of both islands. The lack of inventories of CWR on both Mauritius and Rodrigues is a major constraint for their conservation and potential use. The study thus aimed to create a comprehensive inventory of the native wild relatives for both islands and prioritize them for crop improvement and sustainable use.

Methods

Study sites

The Republic of Mauritius is one of the small island developing states (known as SIDS), located in the Indian Ocean, within the Mascarene archipelago, forming part of the Western Indian Ocean Biodiversity Hotspot (Myers *et al.*, 2000). Mauritius, centred at 20°15′S, 57°35′E is around 900 km east from Madagascar, whereas Rodrigues is centred at 19°43′S, 63°25′E and about 580 km east of Mauritius. Both are volcanic islands of about 8–10 million years old, with Rodrigues harbouring 47 endemic (31.3%) of its 150 known native angiosperm species, and Mauritius having higher levels of endemism (39%, or 273 species out of 691 recorded native angiosperms) (Baider *et al.*, 2010). However, their floras are among the most endangered worldwide (Hilton-Taylor, 2000), mainly because of massive habitat destruction for agricultural and infrastructural development. Virtually no forest remnants survive on Rodrigues, while on Mauritius, since its colonization in 1638, only 4.4% of native habitat survives (Hammond *et al.*, 2015), including 2% comprising of good quality native vegetation fragments dispersed across the island, with the largest continuous area found in the Black River Gorges National Park (Vaughan and Wiehe, 1937; Safford, 1997; Cheke and Hume, 2008; Florens, 2013).

On Mauritius, most of the remnants indigenous forests are found within protected areas (comprising of 4.7% of its land area, Baret *et al.*, 2013), but these are often heavily invaded by alien plants, especially the shade-tolerant strawberry guava, *Psidium cattleyanum* Sabine (Florens *et al.*, 2016), and alien mammals, such as rats (*Rattus rattus* (Linnaeus, 1758) and *R. norvegicus* (Berkenhout, 1769)), wild boars (*Sus scrofa* Linnaeus, 1758) and macaques

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(*Macaca fascicularis* Raffles, 1821), among others. Alien species also threaten the remaining native biodiversity of Rodrigues (Strahm, 1989, 1993), an island with almost no formal protected areas (0.6% of its land surface, Baret *et al.*, 2013).

With around 43% of the land area of Mauritius (ca. 806 km^2 of its 1864 km^2), under agriculture and most under sugarcane, this sector represents the third main source of revenue in the country (Statistics Mauritius, 2015). Agricultural production is even more important on Rodrigues (ca. 20 km^2 of its 108 km^2), since 38% of its local employment comes from the agricultural and forestry sector (Republic of Mauritius, 2017). Agriculture in Rodrigues is characterized mainly by the production of staple food, including red beans, lime, chillies, maize, cassava, bread-fruits, potatoes and sweet potatoes (Perrine, 2016). Other important food crops include onions, garlic, cabbage, tomatoes and creepers, including chayote, zucchini, cucumber and pumpkins. The production of coffee has also started on a pilot basis since 2015 (Republic of Mauritius, 2017).

Creation of the national CWR checklist

The national CWR checklist was generated through a process of data harmonization and cross-checking of the native flora of Mauritius and Rodrigues with the Mansfeld's World Database of Agricultural and Horticultural Crop (Hanelt and IPK, 2001). Only native genera having globally and locally cultivated taxa were compiled for each island. Family classification followed APG IV (Angiosperm Phylogeny Group, 2016), and for species (or infraspecies taxa), the nomenclature used followed *Flore des Mascareignes* (Bosser *et al.*, 1976-onwards), unless when superseded by newer literature. New species or new records published were also added to the checklist (e.g. Roberts *et al.*, 2004; Delmail, 2009; Le Péchon *et al.*, 2011; Baider *et al.*, 2012; Baider and Florens, 2013; Byng *et al.*, 2015; Fournel *et al.*, 2015).

The next step was to add accepted scientific names (family included) with their respective authority, occurrence status, global distribution, economic use category of related crop(s), the economic value of the related crop (based on global and local market values), the genetic potential of the CWR in crop improvement, taxonomic relationship to the crop and threat assessment (see online Supplementary Table S1 for more details). One given taxon could be listed in more than one economic use category.

Usually there is less information available on the market value of native species related to cultivated plants for medicinal, ornamental, aromatic and forestry purposes, thus the list was later restricted to the food-related category only, which is in general better documented. The prioritization process of the food-related species was done using four key criteria: (1) economic value of the related crop, (2) utilization potential as a gene donor, (3) IUCN Red List conservation status and (4) occurrence status (online Supplementary Table S1). Each criterion was assigned a score varying from 0 to 10 (online Supplementary Table S2), depending on their importance to derive total scores for each species (Given and Norton, 1993; Magos Brehm *et al.*, 2010), resulting in a ranked list of species. The total score number was an additive index, calculated by adding the values of the four parameters. Entry threshold of a species to the calculation started with economic parameter with the others added afterwards. Therefore, the highest possible score for a species was 35, when all parameters were attributed the highest score. This method has been successfully applied to a wide range of taxa of plants in studies ranking priority species for conservation globally (e.g. Sapir *et al.*, 2003; Magos Brehm *et al.*, 2008, 2010).

Once the priority CWR were identified, we collated occurrence data for each species, based on published literature including *Flores des Mascareignes*, IUCN Red List, reports (e.g. Page and D'Argent, 1997), journal articles (e.g. Dulloo *et al.*, 1999) and expert knowledge. Localities were geo-referenced using Google Earth Pro v. 7.3.1.4507, wherever the coordinates were missing, then mapped using Q-GIS v.2.18.7, and superimposed to the protected areas limits, to determine local hotspots for CWR in existing protected areas.

Results

The CWR checklist generated for Mauritius comprised of 528 species (97 families, 234 genera), accounting for 76% of the species of the Mauritian angiosperm flora, while for Rodrigues, it contained 142 species (59 families, 112 genera, including species believed extinct), or 95% of the flora of Rodrigues. However, only 43 species in the checklist for Mauritius (or 6%) and 10 species for Rodrigues (or 7%) were identified to be related to globally cultivated species at the genus level (Table 1). Most species in both checklists were related to cultivated crops with medicinal attributes and ornamental use, while others were related to food and fodder (Table 1). In the latter category, those with higher taxa richness were Myrtaceae, Moraceae, Poaceae and Rubiaceae, which comprised ca. 10% of all species included in the inventory. More than half of the recorded species had a wide geographic distribution, including 60% of native angiosperms of Mauritius and 72% of Rodrigues. The two islands shared 68 species in all. One-quarter ($N = 131$) and one-fifth ($N = 28$) of the species in the checklists of food CWR of Mauritius and Rodrigues, respectively, were single island endemics, with a further 15 and 6% of endemic species (not single island endemics)

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Table 1. Number of species per use category of selected families of native crop wild relatives of Mauritius and Rodrigues*

Use category	Major families	No. of species	Percentage of species
Fodder/forage	Poaceae	*3*	*0.6*
Food crop	Myrtaceae, Moraceae, Rubiaceae	*41*	*8.6*
Functional tree/forestry	Ebenaceae, Fabaceae, Sapotaceae	*65*	*13.6*
Medicinal and aromatic	Cyperaceae, Erythroxylaceae, Euphorbiaceae, Myrtaceae, Orchidaceae, Phyllanthaceae	*223*	*46.7*
Ornamental	Asparagaceae, Campanulaceae, Cyperaceae, Moraceae, Malvaceae, Orchidaceae	*113*	*23.6*
Others – indirect use	Arecaceae, Asteraceae, Pandanaceae, Rubiaceae	*33*	*6.9*

Percentage represented by each category out of total number of species in each family is provided.
*Some species might be represented in more than one 'Use category'.

Table 2. Economically important food crop genera and numbers of Mauritian and Rodriguan native CWR species related. Information of the species' global distribution: endemic to Mauritius (MAU), endemic to Rodrigues (ROD), endemic to the Mascarenes including Réunion (REU), endemic to the Western Indian Ocean islands (WIOI, which include Seychelles, Madagascar, Mayotte, Comoros) or beyond (Native)

Crop	Family	Genus	Number of CWR species	Distribution
Aloe	Asphodelaceae	*Aloe*	3	MAU and ROD
Asparagus	Asparagaceae	*Asparagus*	1	WIOI
Cabbage	Brassicaceae	*Rorippa*	1	WIOI
Coffee	Rubiaceae	*Coffea*	3	MAU and REU
Cowpea	Fabaceae	*Vigna*	1	Native
Fig	Moraceae	*Ficus*	5	MAU, REU and Native
Fonio, millet	Poaceae	*Digitaria*	2	Native
		Panicum	1	Native
Olive	Elaeocarpaceae	*Elaeocarpus*	2	MAU
	Oleaceae	*Olea*	2	WIOI and Native
Palm heart*	Arecaceae	*Dictyosperma*	1	MAU, ROD, REU
	Pandanaceae	*Pandanus*	1	MAU, ROD, REU
Pepper	Piperaceae	*Piper*	1	WIOI
Pigeon pea	Fabaceae	*Cajanus*	1	Native
Roseapple	Myrtaceae	*Syzygium*	16	MAU
Sweet potato	Convolvulaceae	*Ipomoea*	2	Native

*Locally produced in the Mascarenes.

occurring in both Mauritius and Rodrigues respectively. A total of 29% of the species were considered as probably native. A total of 13.5% of the species in these checklists, if assessed, would be placed in the category of Critically Endangered (CR) and 37% in Data Deficient (DD).

Within the most economically important food crop genera (Table 2), only 28 species were prioritized as related to major agricultural food cultivated crops (27 on Mauritius, 10 on Rodrigues, with nine of them present on both islands). Of those, in terms of the most important global and national priority crops, 21 species were selected, 52% ($N = 11$) of which were strict island endemics or Mascarene endemics (Table 3). Of these species, three endemic *Coffea* species may be of interest for coffee breeding and production. Some species of local importance were included, for example, *Dictyosperma album* (Bory) H. Wendl. & Drude, which is locally cultivated for its edible palm heart. The CWR most easily used in breeding programmes are those in Gene Pool (GP) 1b or Taxon Group (TG) 1b, which are the closest wild relatives to the crop (Maxted *et al.*, 2006). However, the ones identified in the Republic of Mauritius were mostly related at the secondary or tertiary

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Table 3. The priority CWR species of Mauritius and Rodrigues with their utilization potential, distribution and Red List status

Crop wild relative	Related crop	Name of crop	Utilization potential	Distribution	IUCN Red List Category
Acantophoenix rubra	*Acantophoenix rubra*	Palm heart*	Primary	MAS	CR
Aloe lomatophylloides	*A. vera*	Aloe	TG4	ROD	EN
Asparagus umbelullatus	*A. officinalis*	Asparagus	TG4	N	LC
Coffea macrocarpa	*C. canephora*	Coffee	Tertiary	MAU	VU
C. mauritiana	*C. arabica*			MAS	EN
C. myrtifolia	*C. arabica*			MAU	EN
Dictyosperma album	*Dictyosperma album*	Palm heart*	Primary	MAS	CR
Digitaria ciliaris	*D. exilis*	Fonio (millet)	Tertiary	N	DD
D. didactyla					DD
Elaeocarpus bojeri	*E. serratus*	Indian olive	Tertiary	MAU	CR
Elaeocarpus integrifolius	*E. floribundus*				CR
Ficus densifolia	*F. carica*	Fig	TG4	MAS	CR (MAU)
F. laterifolia				MAS	CR (MAU)
F. reflexa				N	LC
F. rubra				N	LC
Ipomoea pes-caprae subsp. *brasiliensis*	*I. batatas*	Sweet potato	TG4	N	LC
I. violacea				PN	NT
Olea europaea subsp. *cuspidata*	*O. europaea*	Olive	Secondary	N	NE (MAU)
O. lancea			Tertiary	N	LC
Pandanus utilis	*Pandanus utilis*	Fruits and young branches are consumed in curries, mainly on Réunion	Primary	MAS	EW (MAU); LC (ROD)
Panicum brevifolium	*P. miliaceum*	Millet	TG4	N	DD

The distribution of the species is denoted by MAS – Endemic to Mascarenes, MAU – Endemic to Mauritius, N – Native, PN – Probably Native, ROD – Endemic to Rodrigues. The Red List categories follow IUCN Red List Categories and Criteria version 3.1 (2001), but status for each island is given when it differs from the species global assessment. The data on utilization potential were derived from Vincent *et al.* (2013).
*Locally produced in the Mascarenes.

GP or TG level. The exception was the wild populations of palm heart which are primary wild relatives and they may be collected from the wild and brought into cultivation to increase diversity in cultivated populations, in case the species is globally exploited for consumption. None of the priority species have yet been characterized for their potential for crop improvement.

About 25% of the prioritized species are threatened (CR, EN or VU, according to the IUCN Red List Categories and Criteria, IUCN, 2001), all having at least one occurrence within protected areas. For Mauritius, 13 occurred within sites where invasive species are controlled (e.g. weeding of alien plants). For Rodrigues, 23 occurrences of all prioritized CWR were found within arboreta, Nature Reserves or private land managed for conservation purposes, with 27 others found in areas with no formal protection or not undergoing conservation management. The main threat in Mauritius to these CWR is the deleterious effects of invasive alien species, especially strawberry guava, *P. cattleyanum*, through competition, and by introduced animals such as rats and macaques that destroy large numbers of flowers, fruits and seeds of native species (e.g. Baider and Florens, 2006; Monty *et al.*, 2013; Florens, 2015). Other additional specific threats for some species as *Elaeocarpus bojeri* R.E. Vaughan include vegetation clearing (three of the ten known plants were recently cut to provide a viewpoint). In Rodrigues, soil erosion and overgrazing by cattle pose serious threats, besides impacts of invasive alien plants, especially *Vachellia nilotica* (L.) P. J.H. Hurther & Mabb. (*Fabaceae*).

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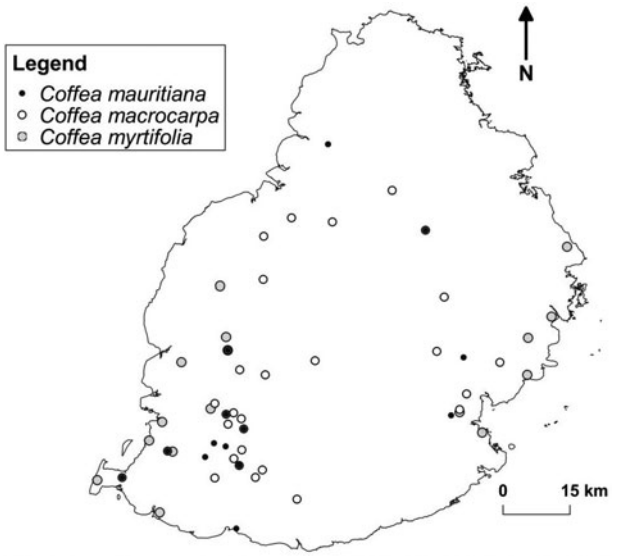

Fig. 1. Known distribution of the three *Coffea* species in Mauritius. Some sites had more than one species co-occurring.

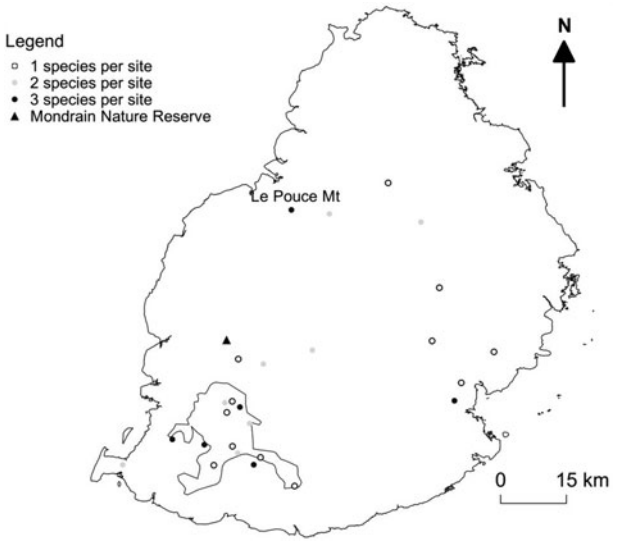

Fig. 2. The 21 food crop priority CWR species in Mauritius, grouped in areas comprising of one, two or three species in a same site. The Black River Gorges National Park is outlined.

The distribution of the priority species of both islands were grouped by the number of species co-occurring per site (Figs. 1–3). In Mauritius, Mondrain had six species co-existing, hence high valued for conservation of CWR. There were 24 sites that harboured at least three different species, 17–100% of the sites found within the Black River Gorges National Park, thus receiving some degree of protection like Pétrin, Florin or Brise Fer, where active conservation management (weed and pest control) is ongoing for decades. In Rodrigues, most of the species occurred in areas with no legal protection. On this island, there are only two mainland Nature Reserves (Grande Montagne and Anse Quitor), where most of the active conservation management is also ongoing for decades.

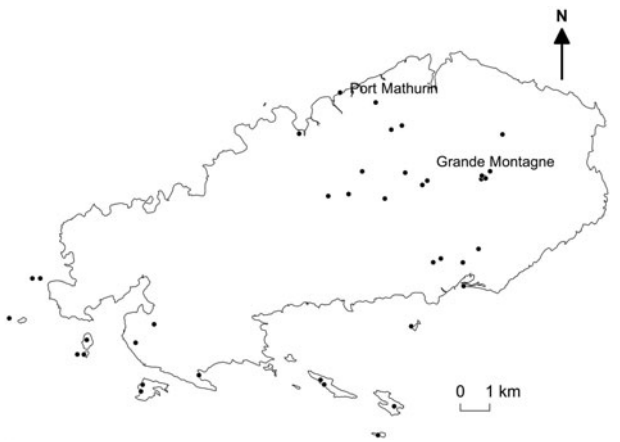

Fig. 3. Distribution of the 10 food crop priority CWR species in Rodrigues.

Discussion

To initiate any sustainable use and conservation programme of CWR, there is a need for baseline inventory (Maxted *et al.*, 2006, 2007; Heywood *et al.*, 2007). This has been achieved by creating the checklist of CWR for Mauritius and Rodrigues. As experienced by other countries like Venezuela or China (e.g. Berlingeri-González and Crespo, 2012; Kell *et al.*, 2015), the development of the CWR inventory can be time consuming as necessary information is not always readily available, and expert knowledge needs to be tapped on. Nonetheless, once the checklist is created, updates based on new information (from species distribution to crop management) are easy, motivating stakeholders involved to collaborate as well (Magos Brehm *et al.*, 2010). The Mauritius and Rodrigues CWR checklists were databased using a standard format to make it easily available online (such as the Harlan and de Wet CWR website (https://www.cwrdiversity.org/checklist/)), once the NBSAP is formally approved (Republic of Mauritius, 2016). Using global standards also facilitates updates and the exchange of information within the PGR or broader research community.

Despite the relatively high native plant diversity and endemism of Mauritius and Rodrigues, among oceanic islands (Kier *et al.*, 2009; Baider *et al.*, 2010), only 28 species were related to food crops. As expected, these islands are relatively CWR-poor partially because of their small geographical size, isolation and lower genetic variation compared with mainland areas (Frankham, 1997),

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but possibly also because most crops were developed in continental areas, and by default, their progenitors and wild relatives are also expected to be more species rich there. Although the CWR of Mauritius and Rodrigues may not be of immediate interest to plant breeders, they could be of value in the future and efforts to characterize material would therefore be expected to be worthwhile. For example, the three *Coffea* species have long seen to be of potential use for breeding programmes for two main reasons. Coffee is one of the most popular beverage worldwide (Heckman *et al.*, 2010), with *C. arabica* L. predicted to have up to 90% reduction of land with suitable bioclimatic conditions for its cultivation in the next 60 years due to climate change (Davis *et al.*, 2012). Secondly, there is also a demand for decaffeinated coffee (Castañeda-Álvarez *et al.*, 2016). The three *Coffea* of the Mascarenes may be potential candidates for eventual use as they might have climate change-resistant traits and also due to their low caffeine content (Dulloo *et al.*, 1998; Hamon *et al.*, 2015).

A number of species were identified for local use such as the palms *Dictyosperma album*, *Acanthophoenix rubra* (Bory) H.Wendl. and the screwpine, *Pandanus utilis* Bory, primarily due to their local economic importance. Palm hearts are considered as a delicacy, and a lucrative business within the tourism sector as palm hearts' dishes are marketed as part of the traditional cuisine of the islands. Wild populations of these palms could potentially be used not only to introduce new diversity to cultivated populations on the islands but could be of high value for crop improvement in case cultivation spreads to other countries, as even species with few surviving individuals on Mauritius have shown to hold relatively high genetic diversity (Bone, 2009). Improved cultivars could boost interest in these species for eventual regional or global production. In this specific case, there is the possibility that the cultivated individuals of *D. album* have a larger genetic diversity than the 30 or so remaining in the wild in Mauritius, therefore the crop may be useful to boost genetic diversity in the wild population.

The present study highlights the paucity of information on the potential of CWR as trait donors for crop improvement – a global issue limiting the use of CWR (Maxted *et al.*, 2008, 2012, 2015, 2016; Maxted and Kell, 2009; McCouch *et al.*, 2013; Dempewolf *et al.*, 2014; Kell *et al.*, 2017), and thus impacting their perceived value for conservation action. The 21 prioritized CWR species here are either closely related to the priority crops/crop groups or more distantly related. However, to distinguish whether this relatedness would actually benefit breeding programmes, it is necessary to investigate their potential use. Consequently, the database must be supplemented with genetic studies characterising each prioritized CWR to improve understanding of the structure of the genetic variation of the species. So far, the only full eco-geographic study for the region was done for the *Coffea* (Dulloo *et al.*, 1999). Similar studies should be encouraged, at least, for the local crop priority species.

CWR species prioritization is a dynamic process and largely depends on the method and scientific information available at the specific point in time (Magos Brehm *et al.*, 2010). Therefore, re-evaluation should be done regularly. In this study, around 62% of the priority species would be threatened with extinction according to the IUCN Red List categories and criteria. Many of the species are represented within protected areas on Mauritius, and nearly half of the CWR species of Rodrigues. However, despite presence in protected areas, their long-term survival *in situ* is not guaranteed due to the ongoing threats (Caujapé-Castells *et al.*, 2010; Florens *et al.*, 2016, 2017a). Consequently, there is a need to improve *in situ* conservation, through methods like use of *in situ* biocontrol for invasive alien plants, some of which have proved effective (e.g. Dumoulin, 2017; Florens *et al.*, 2017b). *Ex situ* facilities, as seed banks or living collections in botanical gardens or arboreta (Castañeda-Álvarez *et al.*, 2016), could serve as tools for eventual sustainable use of species. For instance, in Rodrigues, the Critically Endangered endemic species *A. lomatophylloides* Balf.f. is being propagated in the *ex situ* facility of the Forestry Service at Solitude (and also in botanical gardens abroad). This species, used topically against muscular pain and to increase menstrual flow (Gurib-Fakim and Guého, 1994), has only a small surviving population comprising of the eight mature plants situated at Grande Montagne.

It is also important to constantly evaluate success of conservation management (both *in situ* and *ex situ*) to ensure long-term survival of species and their potential for use. Use of tools such as diversity and gap analyses also help to identify the 'Most Appropriate Wild Populations', to be prioritized given the limited conservation resources (Maxted *et al.*, 2015). In the priority sites, proven cost-effective conservation management should be boosted or initiated (e.g. control of invasive alien species (plants and animals) (Baider and Florens, 2011; Monty *et al.*, 2013); with research on new or improved methods also being developed. Another step would be the identification of potential sites to establish 'genetic reserve' – an *in situ* designated area for regular monitoring of the genetic diversity and long-term protection and conservation of the CWR natural wild populations (Maxted *et al.*, 1997), a concept put forward already in the draft of the CWR National Biodiversity Conservation Strategy for both islands (Republic of Mauritius, 2016).

Non-indigenous species were not considered for the inventory, mostly because in both islands remnants of native vegetation are heavily invaded by invasive alien plants (Florens, 2013; Florens *et al.*, 2016, 2017a), therefore

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conserving alien plants *in situ* might be a risk for conservation of the native CWR.

Conclusion

The creation of the inventory and prioritization process of CWR for Mauritius and Rodrigues are part of an effort to support global food security by providing a baseline for further studies. The production of the checklist is of high importance locally to highlight the need to plan and implement an effective *in situ* and *ex situ* conservation strategy for these genetic resources, providing sustainability to eventual use and necessary conservation actions to ensure long-term survival of the CWR and their genetic value. Despite the low proportion of CWR identified and prioritized, they are still important since their potential as gene donors is yet to be determined and they may prove useful for eventual crop improvement. Further studies are needed to determine the relationship between each CWR taxon and its related crop. In particular, the *Coffea* genus requires in-depth understanding of how their tertiary-level relatedness can be valuable, despite the difficulty in crossing. The three Mascarene *Coffea* CWR are likely to warrant genetic studies on how local adaptation could eventually be used in one of the most lucrative global crops, which is highly threatened by climate change. It is unlikely that plant breeders can breed climate change-resilient varieties without access to the full range of conserved CWR diversity; hence it is crucial to share the information on international and reputed databases like the Harvard Dataverse (https://dataverse.harvard.edu/). Importantly, to provide sustainability to conservation actions, investigations on the potential use of the prioritized CWR could help halting extinctions, especially in the context of highly threatened species found on oceanic islands.

Supplementary material

The supplementary material for this article can be found at https://doi.org/10.1017/S1479262118000576

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