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How Many Wild Edible Plants Do We Eat—Their Diversity, Use, and Implications for Sustainable Food System: An Exploratory Analysis in India

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Wild edible plants are still eaten by a large section of the global population and ensure both affordable food and nutritional security. We tested this in an Indian context, where an enormous diversity of such plants constitutes a significant part of the rural diet and their acceptance has been high. In this study, we assessed the diversity of wild edible plant resource and the importance of species based on the use and its pattern. We have also shortlisted a set of plants to make an informed decision on prioritization. We found a great variety of plants (1,403 species) from 184 families were consumed across India, although the first 44 families (24%) contributed largely to the (75%) diversity. Leguminosae followed by Compositae, Poaceae, Malvaceae, and Rosaceae, were the families with the highest number of species. We note that a few species from the large pool were extensively used throughout the country while another few were valued for their multiple edible plant parts. Leafy shoots (722 species) followed by fruits (652 species) were the two most-eaten plant parts. Our results strengthen the fact that: (a) wild edibles have been an integral part of the diet; (b) their widespread assimilation into local food culture suggests an untapped potential to ensure easy availability and access to micronutrients for sustainable food systems, and thus in social welfare; and (c) they should be incorporated into the national food policy for formal cultivation and promotion.

Keywords: wild uncultivated plants, edible flora, sustainability, food system, hidden hunger, micronutrient, leafy greens, nutritional security

INTRODUCTION

Food has been central to human biological and socio-cultural existence, providing energy and nutrition. Sourcing food from the wild had been closely entangled with humanity for millions of years (Gosden and Hather, 2004). It allowed humans to develop an intricate knowledge base about the environment and provided them with a diverse collection of animal and plant derived foods, procured through numerous ingenious ways (Anderson et al., 2011; Chevalier et al., 2014a; Harris and Hillman, 2014). Today, nearly thirty domesticated species comprise a significant portion of dietary diversity and only three principal cereal grains (rice, wheat, and maize) contribute to more than half of the world's calorie intake (FAO, 2010). Thousands of edible species remained wild or semi-wild, and were left-out in the course of domestication; however, these underutilized edible floral elements hold the potential to transform our food systems toward being more nutritious, sustainable, and resilient to climate change (Hunter and Fanzo, 2013; Powell et al., 2015). A diverse range of wild uncultivated plants and their parts (e.g., leafy shoots, fruits, seeds, underground organs, and flowers) are still being consumed regularly and complement human adaptability and a variety of human gastronomic choice. They tend to supplement proteins, essential minerals, micronutrients, and vitamins that enrich dietary quality (Ogle, 2001) and thus provide an affordable source of nutrition for rural and semi-urban societies across cultures and continents (Rowland et al., 2016; Jones, 2017). Diverse diets have largely been recommended for optimum human nutrition, good health, and overall well-being (FAO et al., 2012). While poor quality staple-centric diets lacking diversity may represent the diets of most low-income households in low- and middle-income countries (Jones, 2017), the acceptance and use of wild food is vibrantly alive to this day, especially in remote economically impoverished corners of the world (Christiensen, 2002; Lykke et al., 2002; Paumgarten and Shackleton, 2011; Cruz-Garcia and Price, 2012; Angelsen et al., 2014; Wunder et al., 2014; Ickowitz et al., 2016). However, the exponential growth of industrial agriculture, rapid urbanization, and the dwindling of forest and semi-forest lands have heavily affected the food system (Padoch and Sunderland, 2014; Broegaard et al., 2017; Ickowitz et al., 2019). The obvious consequences are the decimation of wild populations and loss of the knowledge system required to harvest and process these foods, which eventually led to food system homogenization, micronutrient deficiency, undernourishment, and over-nutrition manifesting in overweight or obesity (Pretty, 1995; Labadarios, 2005; Pinstrup-Andersen, 2007; Pingali, 2015).

The culture of consumption of wild edible plants (henceforth WEP) as food and medicine has been widely exercised by the tribal groups and non-tribal communities living in rural

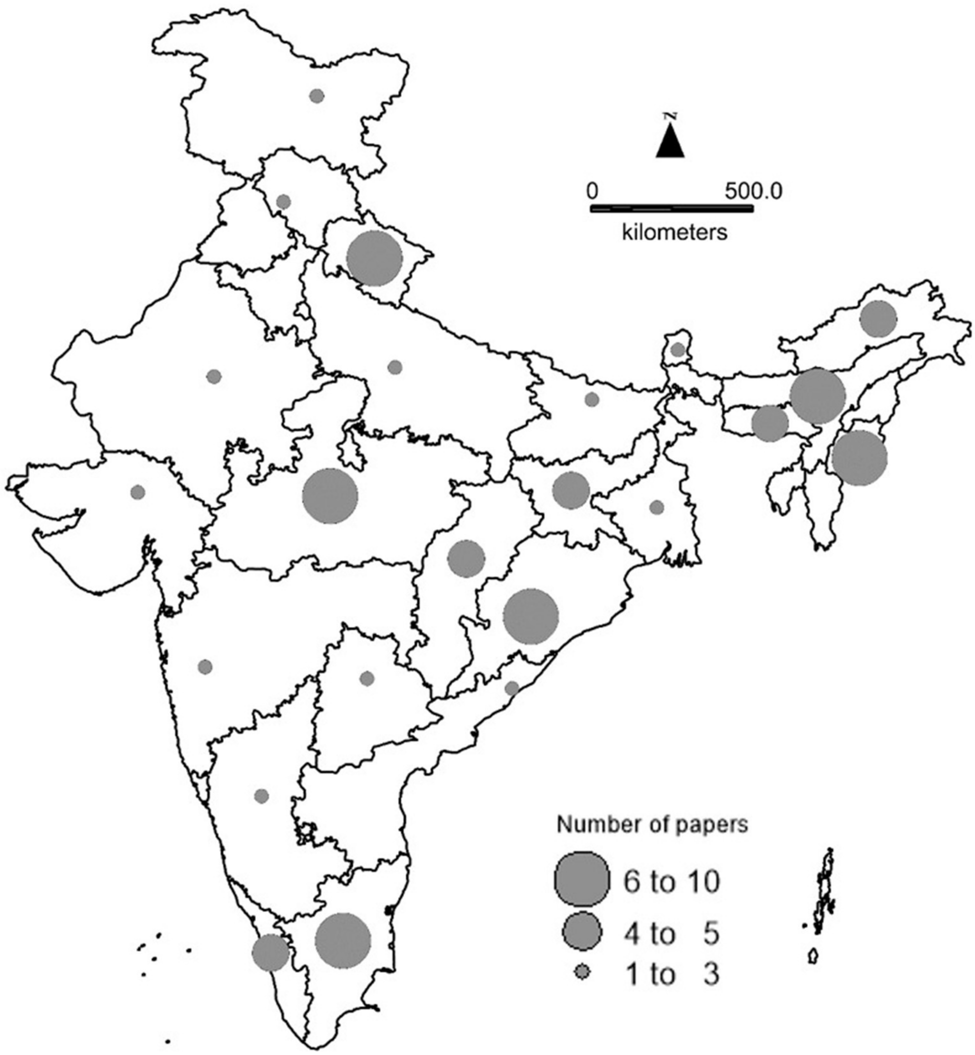

FIGURE 1 | Spatial locations of published articles considered in the current study (circle size is proportional to the number of studies reported from a state).

TABLE 1 | The list of studies and their broadly studied region.

References	Broad region
Agrahar-Murugkar and Subbulakshmi (2005)	North-east
Ajesh et al. (2012)	South
Angami et al. (2006)	North-east
Arinathan et al. (2007)	South
Ayyanar and Ignacimuthu (2005)	South
Barua and Tomar (2014)	Central
Bedi (1978)	West
Behera et al. (2008)	East
Bhatt et al. (2005)	North-east
Binu (2010)	South
Biswas and Das (2011)	East
Chaithanya et al. (2015)	South
Chand et al. (2017)	North
Chauhan et al. (2014)	Central
Chauhan et al. (2018)	West
Chorol et al. (2018)	North
Choudhary et al. (2008)	West
Cruz-García (2006)	South
Devi et al. (2010)	North-east
Devi et al. (2014)	North-east
Devi and Salam (2016)	North-east
Fatma and Pan (2012)	East
Gangte et al. (2013)	North-east
Ghatapanadi et al. (2011)	South
Ghosh-Jerath et al. (2015)	East
Ghosh-Jerath et al. (2016)	East
Horo and Topno (2015)	East
Ignacimuthu and Ayyanar (2006)	South
Jain and Tiwari (2012)	Central
Jain et al. (2011)	North-east
Jain et al. (2012)	North-east
Jain (1964)	Central
Jeeva (2009)	North-east
Kar (2004)	North-east
Kar and Borthakur (2007)	North-east
Kar and Borthakur (2008)	North-east
Katewa et al. (2003)	West
Khan and Kakde (2014)	South
Khaund and Joshi (2013)	North-east
Konsam et al. (2016)	North-east
Kumar (2013)	North
Kumar and Shiddamallayya (2014)	South
Kumar and Jain (2002)	Central
Mahapatra and Panda (2012)	East
Maikhuri et al. (1994)	North
Mao et al. (2009)	North-east
Medhi and Borthakur (2012)	North-east
Medhi et al. (2014)	North-east
Mishra et al. (2016)	East
Mishra and Shrivastava (2015)	Central
Misra et al. (2013)	East

(Continued)

TABLE 1 | Continued

References	Broad region
Misra et al. (2008)	North
Mohammed et al. (2004)	West
Mukherjee and Chaturvedi (2016)	East
Murugan et al. (2010)	North
Nair and Agrawal (2017)	Central
Namsa et al. (2011)	North-east
Nath and Maiti (2011)	North-east
Neogi et al. (1989)	North-east
Nongdam and Tikendra (2014)	North-east
Narayanan et al. (2011)	South
Nazarudeen (2010)	South
Padalia (2015)	North
Panda (2014)	East
Pandey (1998)	North
Pandey and Saini (2007)	Central
Pandey and Pande (2016)	North
Pandey et al. (2015)	North-east
Pandey and Bora (1997)	North-east
Pant and Samant (2010)	North
Parinitha et al. (2004)	South
Parisara and Kiran (2016)	South
Patiri and Borah (2007)	North-east
Phoze et al. (2001)	North-east
Pradhan and Badola (2008)	East
Radha et al. (2013)	North
Rajasab and Isaq (2004)	South
Ramachandran (2007)	South
Ramachandran et al. (2009)	South
Rana et al. (2012)	North
Rasingam (2012)	South
Samydurai et al. (2012)	South
Sasi et al. (2011)	South
Sasi and Rajendran (2012)	South
Sarvalingam et al. (2015)	South
Sathyavathi and Janardhanan (2014)	South
Satyavani et al. (2015)	South
Singh A. et al. (2013)	Central
Singh B. K. et al. (2013)	North-east
Singh et al. (2014)	North
Singh et al. (2011)	North-east
Sinha and Lakra (2007)	East
Srivastava (1998)	North
Sundriyal and Sundriyal (2001)	East
Sundriyal and Sundriyal (2003)	East
Suthari et al. (2014)	South
Swarnkar and Katewa (2008)	West
Thomas et al. (2011)	Central
Tiwari et al. (2010)	North
Upreti et al. (2010)	North
Vikneshwaran et al. (2008)	South
Vishwakarma and Dubey (2011)	Central
Yakang et al. (2013)	North-east
Yuhlung and Bhattacharyya (2014)	North-east
Yumnam et al. (2011)	North-east

and semi-urban settings. In particular, the availability of plants collected from anthropogenic landscapes (i.e., the vicinity of rice fields, homesteads, forest patches, or fallow lands) and their easy access have often allowed a large fraction of people to depend on them as a valuable nutritional resource. In spite of an unprecedented diversity of WEP in India and their widespread consumption, comprehensive studies describing the general pattern are almost absent, e.g., what is the extent of the diversity of wild food spectra? What are the frequently used taxa? How does the pattern of consumption change with geography? Isolated studies have explored the taxonomic diversity, the part(s) used, and the method of processing before consumption, but stopped short of linking the findings with a larger country-wise pattern, which are crucial to perceive the magnitude of dependence on the wild resources and its implication for the usage of WEPs to be incorporated into food policy in order to make it more sustainable. In this study, we collected data to answer the following questions: (i) what is the taxonomic diversity of WEPs and their family-wise distribution? (ii) what is the pattern of use by parts? and (iii) how could an informed-decision be made to prioritize for policy on nutritional security?

MATERIALS AND METHODS: (DETAILS IN SUPPLEMENTARY METHODS S1)

Study Plan, Data, and Source

The studies suggest that the WEPs or their habitat are always under minimal to moderate direct or indirect manipulation (Turner et al., 2011). So, we adhered to this inclusive definition to consider WEP in our study and we have shortlisted 105 published articles describing the consumption of wild flora (**Figure 1**, **Table 1**). We carefully made the selection so that a fair representation of the food plant choice of the Indian subcontinent is reflected in our choice. We have tabulated the wild plant species, family, part(s) used, geographic location of the study, and the consuming communities. Species identity was confirmed through The Plant List (2010).

Taxonomic Diversity, Distribution of Wild Edible Plants, and Use-Frequency

We determined the diversity of food plants and evaluated species distribution across families. Further, in order to gain an insight into how the families contribute to the total species pool (number of species), we plotted total species (%) against the number of families. In order to assess the popularity of a species, relative frequency of citation (RFC) was calculated.

The Pattern of Use by Parts

To gain an understanding of the use by parts, the total species pool is divided into six broad categories depending on the edible parts documented, i.e., seeds or grains, leaves and leafy shoots (including pteridophytes), flowers, fleshy fruits, underground parts (including true roots or various below-ground storage organs, such as, bulbs, corms, tubers, and rhizomes), and the others broadly following the classification by Turner et al. (2011). The creation of a sixth heterogenous group as "others" included plant parts other than first five, e.g., aril, bark, cambium, peduncle, sap, bulbil, fruit body, petiole, pith, etc. Further, we also examined species distribution across families separately for each of the plant parts.

TABLE 2 | Taxonomic diversity of the edible species, total and part-based.

Plant parts	Family	Species
Total	184	1,403
Seeds	39	155
Leaves or shoots	134	740
Flowers	59	153
Fruits	110	657
Underground parts	70	219
Others	69	167

In order to uncover the importance of a species in terms of its edible parts, we have calculated the relative use value (RUV) of a selected set of species whose number of edible parts were equal to or >3. In addition, we have also determined consensus value for plant part (CPP) for selected high-ranking species derived from RUV and RFC values.

Prioritization

We sought to shortlist species building on information captured in two indices, RFC and RUV; it allowed us to formulate a scientifically-informed way of selecting a few from a large pool that could enable policy formulation.

RESULTS

Taxonomic Diversity of Wild Edible Plants and Use-Frequency Spectra

We found a total of 1,403 species belonging to 184 families (**Table 2**, **Supplementary Table 1**). In terms of species count, Leguminosae ranked first with 119 species with Compositae (57), Poaceae (53), Malvaceae (49), Rosaceae (48), Rubiaceae (42), Lamiaceae (41), Moraceae (39), Amaranthaceae (38), and Araceae (32) following it (**Figure 2**). When the species count was plotted against the number of families, it showed the top 17 families (9.2% of the total families) contributed to nearly 50% (646 species) and the first 44 families (23.9% of the families) captured about 75% (971 species) of the total species count (**Figure 3**).

RFC value segregated species based on their mentioned use in the number of studies and it varied from 0.012 to 0.46 (**Table 3A**). For instance, *Oxalis corniculata, Amaranthus spinosus, Phyllanthus emblica, Colocasia esculenta,* and *Solanum americanum* were the top five species with citation-frequencies of 0.46, 0.393, 0.371, 0.348, and 0.348, respectively.

The Pattern of Use by Parts

On grouping total species according to the edible plant parts, the highest number of species seemed to be used as leafy greens (740 species from 134 families). Consumption as fruits ranked next to it (657 species from 110 families), followed by seeds, underground parts, and flowers (**Table 2**). When analyzed at a family level, Leguminosae was a highly speciose food plant family and topped the list in most of the categories, i.e., leaves-shoots (60 species), seeds (47 species), and flowers (27 species). In the other two categories, fruits and underground parts, Rosaceae (52 species) and Dioscoreaceae (23 species) had the highest number of edible species, respectively (**Figures 4A–E**).

The range of relative use-value (RUV) varied from 0.5 to 1, however, only one species, *Nymphaea nouchali* demonstrated a RUV of one, followed by *Nymphaea rubra* and *Cannabis sativa* each with RUV 0.83. There were 10 species (e.g., *Nelumbo nucifera, Tamarindus indica, Spondias pinnata, Typha domingensis,* etc.) with a moderately high RUV of 0.67 (**Table 3B**). Around 33 species (e.g., *Boehmeria glomerulifera, Ficus hispida, Urtica parviflora*, several *Allium* species) demonstrated a RUV of 0.5 (data not shown).

Ranking based on CPP value uncovered a list of edible plant parts which are widely consumed, and its value ranged from zero to one (**Tables 4A**,**B**). Since the index quantified the acceptability of a plant part among consumers and scored it accordingly, it thereby segregated species in terms of their most valued plant part(s). A few examples of this are: seeds of *Cajanus scarabaeoides* (0.44), *Cannabis sativa* (0.33), *Euryale ferox* (0.357), *Nelumbo nucifera* (0.218); leaves and shoots of *Amaranthus spinosus* (0.97), *Centella asiatica* (0.85), *Oxalis corniculata* (0.8), *Ipomoea aquatica* (0.95); flowers of *Bauhinia variegata* (0.625), *Typha domingensis* (0.362), *Moringa concanensis* (0.285); fruits of *Ficus racemosa* (0.91), *Ziziphus jujuba* (0.846), *Spondias pinnata* (0.727), and underground parts of *Dioscorea bulbifera* (0.896), *Dioscorea pentaphylla* (0.889), *Asparagus racemosus* (0.77), etc.

Prioritization

We shortlisted a set of species for prioritization based on RFC and RUV values (**Table 5**) in the following manner: (i) highest priority species: it included species which populated both lists, one with a top 25 species scoring 50% of the RFC value (0.213) and the other with an RUV (0.5). fFour species, s *Tamarindus indica*, *Phyllanthus emblica*, *Colocasia esculenta,* and *Spondias pinnata,* were on the list; (ii) high priority: The rest of the 20 species were in the top 24 species that scored 50% of the RFC value (0.213) or above, e.g., *Oxalis corniculata, Amaranthus spinosus, Centella asiatica, Ziziphus jujuba, Solanum americanum, Amaranthus viridis, Commelina benghalensis, Dioscorea pentaphylla,* etc; (iii) medium to high priority: a set of nine species with four or more edible parts

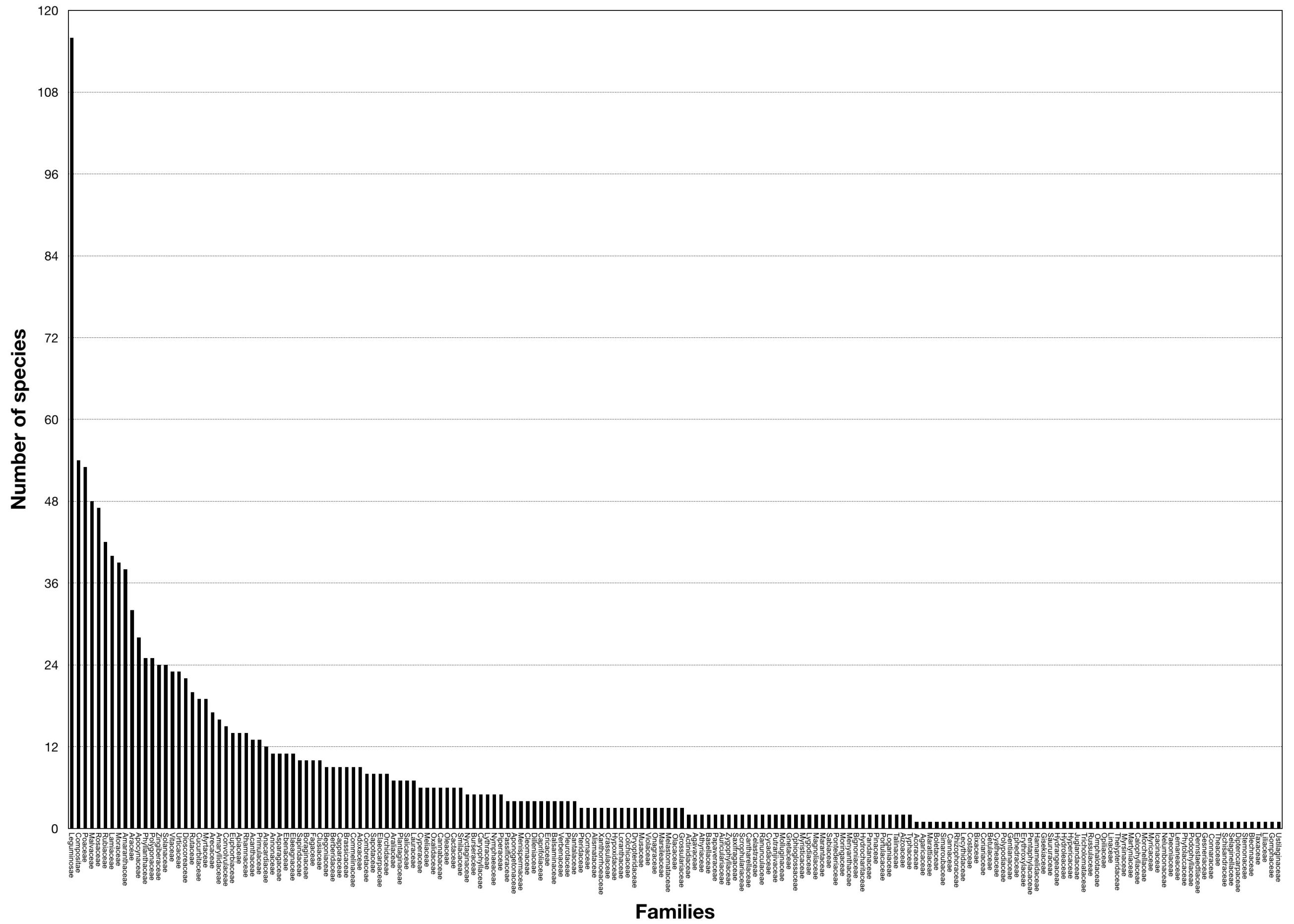

FIGURE 2 | Distribution of species across families.

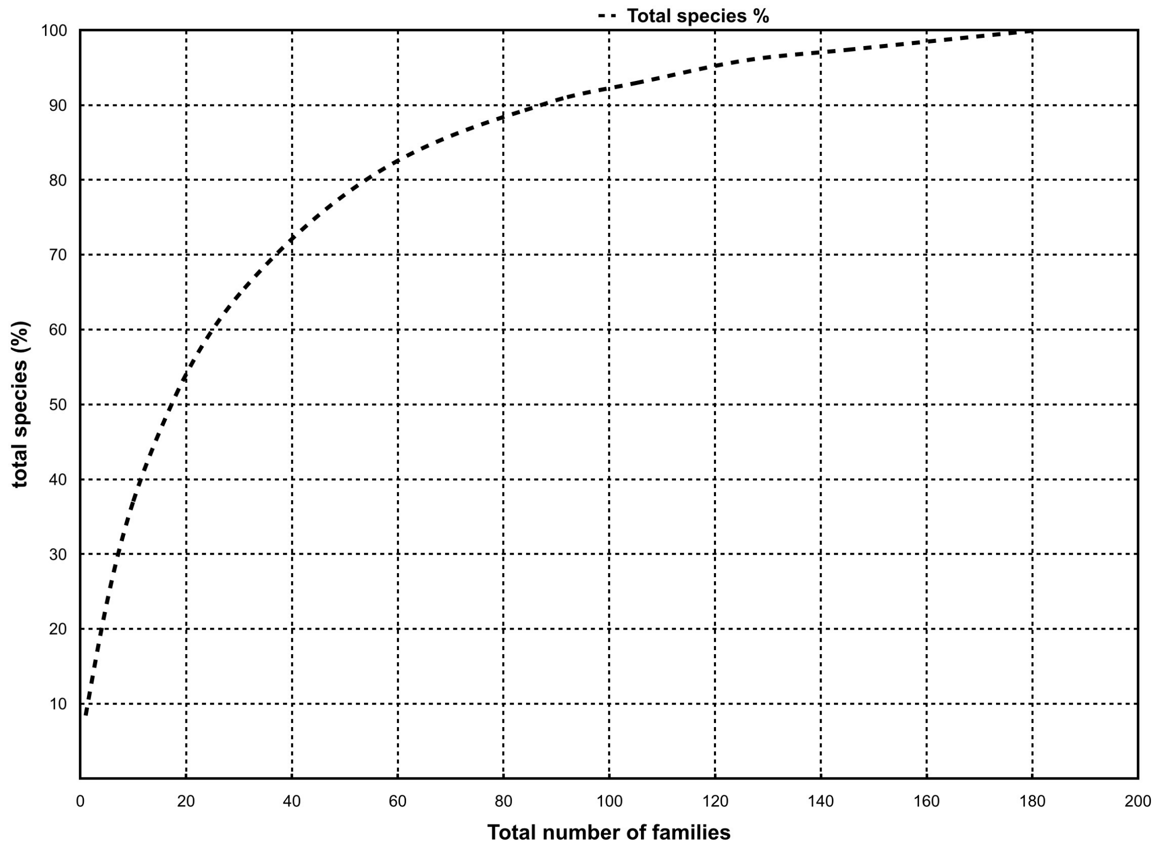

FIGURE 3 | Contribution of families to the total species pool (%).

based on an RUV value between 1 and 0.67 were enlisted, such as *Nelumbo nucifera, Nymphaea rubra, N. nouchali, Justicia adhatoda, Cannabis sativa,* etc. Relying on the above information, we selected a set of 32 species based on RFC and RUV values for prioritization. This collection of species has been widely used as food sources throughout the country, even in disjunct geographic regions, implying greater acceptance among communities.

DISCUSSION

A culture of WEP collection from nearby forested patches, fringes of agricultural fields, or from the homestead has been ubiquitous in developing and many developed countries. It constituted a healthy and sustainable food system widely documented across the globe (Scoones et al., 1992; Mazhar et al., 2007; Bharucha and Pretty, 2010; Rowland et al., 2016). Determining the popularity of such an exercise within India revealed a remarkable diversity of wild flora in regular use. Of which, many of these have been used across widely divergent cultural geographic regions or have multiple useful edible organs. In addition, being a standard component of daily diet, the contribution of wild food to food uncertainty, shortages, and agricultural regression has widely been acknowledged (Ertug, 2014). It suggests the habit of eating wild plants falls in the larger domain of human environment interactions and has evolved over many generations to help manage natural resources.

Taxonomic Diversity

A series of regional studies have uncovered the great wealth of wild flora being used as food that has not entered into mainstream cultivation (Singh and Arora, 1978; Sinha and Lakra, 2005; Angami et al., 2006; Jeyaprakash et al., 2011). Similarly, the diverse spectra of edible plant species (1403 species) belonging to nearly 200 families reflect that it has been a deep-rooted practice in India. Inclusion of a wide variety of plants of different habits, growth forms, and usable organs in the dietary repertoire also underscores their acceptance and assimilation into food culture. The breadth of plant use is high compared to the other countries or regions (such as Southeast Asia or the Mediterranean), which seems plausible given the enormous size of the country and its inherent bio-cultural diversity (Loh and Harmon, 2005; Maffi and Woodley, 2012). The choice of food or medicinal species is often governed by many factors, where plant availability is a primary driver. Plant availability and distribution are largely determined by environmental parameters, e.g., soil type, temperature, altitude, rainfall, etc., that significantly affect the peoples' choices (Turner et al., 2011; Chevalier et al., 2014b). India covers a large geographic expanse with a high

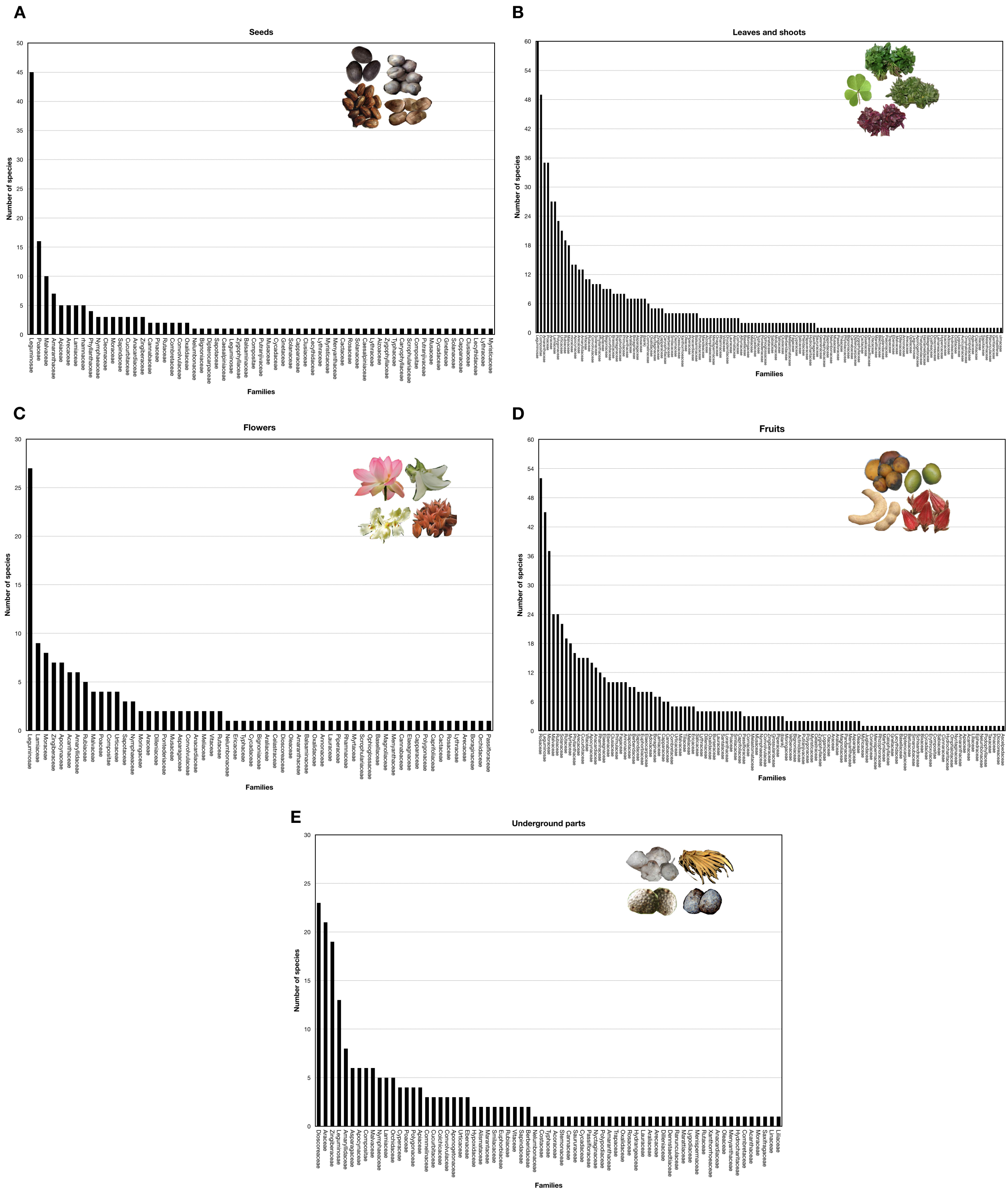

FIGURE 4 | Distribution of species across families based on individual edible plant part: **(A)** seeds, **(B)** leaves and leafy shoots, **(C)** flowers, **(D)** fruits, and **(E)** underground parts.

floral diversity, which harbors many biogeographic zones and hotspots that shelter a wide diversity of plants (Nayar, 1996). In addition, the high bio-cultural diversity has resulted in the divergent human adaptation to manage and use an enormous variety of plant resources in a dynamic manner (Berkes, 2009; Maffi and Woodley, 2012; Chevalier et al., 2014b). This fact is

TABLE 3A | A list of species with high RFC value (up to 50% of the maximum).

Species	Number of studies mentioning use	RFC
Oxalis corniculata	41	0.39
Amaranthus spinosus	35	0.33
Phyllanthus emblica	33	0.31
Colocasia esculenta	31	0.295
Solanum americanum	31	0.295
Centella asiatica	31	0.295
Amaranthus viridis	29	0.28
Chenopodium album	28	0.27
Dioscorea bulbifera	27	0.26
Commelina benghalensis	26	0.25
Alternanthera sessilis	26	0.25
Dioscorea pentaphylla	26	0.25
Ziziphus jujuba	24	0.23
Portulaca oleracea	23	0.22
Senna tora	22	0.22
Boerhavia diffusa	22	0.22
Ipomoea aquatica	22	0.22
Ficus racemosa	21	0.2
Tamarindus indica	21	0.2
Asparagus racemosus	21	0.2
Aegle marmelos	21	0.2
Diplazium esculentum	21	0.2
Solanum torvum	20	0.19
Moringa oleifera	19	0.181
Spondias pinnata	19	0.181

TABLE 3B | A list of species with multiple edible parts and RUV value (between 0.67 and 1).

Species	Number of edible parts	RUV
Nymphaea nouchali Burm.f.	6	1
Nymphaea rubra Roxb. ex Andrews	5	0.83
Cannabis sativa L.	5	0.83
Nelumbo nucifera Gaertn.	4	0.67
Tamarindus indica L.	4	0.67
Justicia adhatoda L.	4	0.67
Spondias pinnata (L. f.) Kurz	4	0.67
Ensete superbum (Roxb.) Cheesman	4	0.67
Typha domingensis Pers.	4	0.67
Bauhinia variegata L.	4	0.67
Aesculus indica (Wall. ex Cambess.) Hook.	4	0.67
Phyllanthus emblica L.	4	0.67

also reflected in the array of WEP species regularly consumed by people.

Although a rich collection of WEP is in the spectrum of food choice, we uncovered a preponderance of a handful of families (forty-four families make up about 75% of the total species count). Human preference for a narrow subset from a large pool of floral families is a common trend that has been previously observed in medicinal plant use, and researchers strove to explain the underlying reason (Moerman, 1996; Leonti et al., 2003). The same trend of over- and under-use has also been noted in wild edibles, though not explicitly stated (Turner et al., 2011). The predominance of Leguminosae (8%) has been reported from elsewhere in Southeast Asia; likewise, the top ten speciose families shown in our results, such as Poaceae, Rosaceae, Moraceae, Lamiaceae, Compositae, Araceae, etc., have also been reported from studies carried out in Southeast Asia (Cruz-Garcia and Price, 2011; Sujarwo et al., 2014; Shin et al., 2018). On the other hand, the peoples' choices in European countries remained with Rosaceae, Liliaceae, Lamiaceae, Asteraceae, and Apiaceae members, whereas there was a visible absence of Poaceae, Moraceae, Amaranthaceae, Malvaceae, and a minimal presence of Leguminosae (Leonti et al., 2006; Tardío et al., 2006; Pardo-de-Santayana et al., 2007; Hadjichambis et al., 2008; González et al., 2011; Dogan et al., 2013). The underlying reason of the sharing of edible flora could be due to a strong biogeographic affinity between South and Southeast Asia, where the Indo-Malayan biota represented a major fraction (Mani, 1974). A study carried out in South Africa by Ogle and Grivetti (1985a) revealed a prevalence of selected families, such as Compositae, Myrtaceae, Moraceae, Rubiaceae, Leguminosae, and Amaranthaceae that broadly overlap with Asian assemblage.

Likewise, a strong bias in choosing certain species has also been observed. It seems that some species were more overly used than others, a fact which was reflected in their RFC value spectrum. The index also signified an apparent importance of the species in terms of its frequency of use (i.e., how many times it has been cited considering all the studies?) and the degree of its acceptance among various communities (i.e., what is the spatial limit of its use?). For example, *Alternanthera sessilis,* a high-rank species with a magnitude of RFC 0.29, is a plant which has been widely used from southern to north-eastern through eastern India. Likewise, there were many members which demonstrated a similarly wider acceptance, e.g., *Oxalis corniculata, Amaranthus spinosus, Centella asiatica,* etc. Throughout literature, the choice of certain taxa has widely been reported from studies on Asia, Europe, and Africa; only the preferred set of species varied with geography (Ogle and Grivetti, 1985a,b; Tardío et al., 2006; Hadjichambis et al., 2008; Cruz-Garcia and Price, 2011; Sujarwo et al., 2014). The underlying drivers of peoples' choices could be multiple, e.g., abundance, easy accessibility, taste, prior knowledge or experience, etc. (Chevalier et al., 2014b; Albuquerque et al., 2015). On the other hand, there were also instances where commonly available species had a narrow use in culinary practices, perhaps due to lack of information, or cultural inclination. Examples can be drawn from *Tephrosia purpurea, Albizia odoratissima, Leucas stricta,* and *Gmelina arborea* which are locally relished (RFC 0.011 for each).

Use by Parts

Plant/people interactions have been the backbone of human evolution, since all cultures have to subsist on plant resources (Cruz-Garcia and Ertug, 2014). Humans have employed a diverse collection of floral parts in their diets for a long time, e.g., fleshy leafy shoots, underground starch-rich parts, ripe and unripe fruits, flowers, and seeds. Additionally, many other parts are also regularly consumed, such as pith, bark, arils, peduncles, bulbils, latex, etc. Of these, prehistory is replete with examples of the harvest of various roots and tubers to derive starchy food (Ezell et al., 2006). Other examples, such as the charred remains of seeds or grains, were also often uncovered in archeological specimens (Harris and Hillman, 2014; Melamed et al., 2016); absent were the leaves or tender shoots or flowers. Altogether, the range highlights divergent human choice and their post-harvest processing that had established its roots from the hunting-gathering phase (Chevalier et al., 2014a,b).

In our study, the grouping of WEP based on edible parts has offered a deeper understanding of the underlying trend of use, i.e., how edible parts drive plant use, which parts are being eaten the most, etc. From total used species, it was revealed that most have been used as leafy greens (52.7%) and fruits (47.6%), followed by underground parts (15.7%), seeds (12.8%), and flowers (11.2%). Turner et al. (2011) underscored the preference toward the specific type of wild edible consumption and attributed it to prevailing climatic condition in an ecosystem that perhaps determines peoples' choice. They also highlighted the role of culture in shaping the type of wild edible use, such as the frequent use of leafy greens in east and south Asia being in vogue. In a study conducted by Cruz-Garcia and Price (2011), the highest edible species clustered in the "shoot" and "fruit" category; however, their grouping does not entirely match with the part-wise classification we implemented. Similar leaning on wild leafy green use has also been reported by Sujarwo et al. (2014) in Bali. The inclination toward leafy greens is a common observation across the east Asian countries, such as Korea (Pemberton and Lee, 1996), Thailand (Price, 2006), Vietnam (Ogle, 2001), and China (Hu, 2005) and is often termed as herbophilia (Luczaj, 2008) to refer to peoples' liking of leafy greens. It is in sharp contrast with northern Europe where wild vegetables have been used very little (Luczaj, 2008), or in the Amazon where they are hardly used at all (Katz et al., 2012).

When the edible species pool is broken into six categories of the basis of parts, Leguminosae outnumbered other families in most of the categories, i.e., seeds, flowers, and shoots. It is also the second largest family in the fruit category and the fourth largest in underground parts. One underlying reason could be the unprecedented species diversity of Leguminosae in the tropics. The predominance of Leguminosae members has also been a common finding in several similar studies from the southeast Asian countries where it contributes significantly to the floral diversity (Cruz-Garcia and Price, 2011). Likewise in the fruit category, an abundance of Rosaceous species could be a reflection of the overall high use

TABLE 4A | CPP value for selected plants with highest RFC value.

Species	Total number of citations of all parts	CPP(se)	CPP(l-sh)	CPP(fl)	CPP(fr)	CPP(u)
Oxalis corniculata	41	0.024	0.804	0.024	0.121	0
Amaranthus spinosus	35	0	0.971	0	0	0
Phyllanthus emblica	33	0.03	0.061	0.879	0	0
Colocasia esculenta	53	0	0.377	0.113	0	0.433
Solanum americanum	39	0	0.487	0	0.513	0
Centella asiatica	34	0	0.853	0	0	0
Amaranthus viridis	30	0.067	0.933	0	0	0
Chenopodium album	30	0.067	0.933	0	0	0
Dioscorea bulbifera	29	0	0.034	0	0.034	0.896
Commelina benghalensis	27	0	0.852	0	0	0.111
Alternanthera sessilis	26	0	1	0	0	0
Dioscorea pentaphylla	27	0	0	0.074	0	0.889
Ziziphus jujuba	26	0.038	0.115	0	0.846	0
Portulaca oleracea	22	0	0.909	0	0	0
Senna tora	23	0.086	0.826	0.043	0.043	0
Boerhavia diffusa	24	0	0.792	0	0.042	0.083
Ipomoea aquatica	23	0	0.957	0	0.043	0
Ficus racemosa	23	0	0	0	0.913	0.043
Tamarindus indica	33	0.152	0.242	0.091	0.515	0
Asparagus racemosus	22	0	0.091	0.091	0.045	0.773
Aegle marmelos	22	0	0.091	0	0.091	0
Diplazium esculentum	20	0	1	0	0	0
Solanum torvum	20	0	0.05	0	0.95	0
Moringa oleifera	30	0.033	0.4	0.233	0.333	0
Spondias pinnata	22	0.045	0.091	0.091	0.727	0

TABLE 4B | CPP value for selected plants with RUV value between 0.5 and 1.

Species	Total number of citation of all parts	CPP(se)	CPP(l-sh)	CPP(fl)	CPP(fr)	CPP(u)
Colocasia esculenta	53	0	0.377	0.113	0	0.434
Phyllanthus emblica	33	0.030	0.061	0	0.879	0
Tamarindus indica	33	0.152	0.242	0.091	0.515	0
Nelumbo nucifera	32	0.218	0.156	0.187	0	0.406
Moringa oleifera	30	0.033	0.4	0.233	0.333	0
Nymphaea nouchali	25	0.12	0.16	0.2	0.12	0.24
Spondias pinnata	21	0.048	0.095	0.095	0.762	0
Bauhinia variegata	16	0	0.25	0.625	0	0.0625
Euryale ferox	14	0.357	0.357	0	0.142	0.071
Ensete superbum	13	0.077	0.308	0.231	0.307	0
Ficus hispida	13	0	0.153	0.077	1	0
Dendrocalamus strictus	12	0.167	0.583	0.083	0	0.167
Typha domingensis	11	0.091	0.272	0.362	0	0.273
Rotheca serrata	11	0	0.455	0.273	0.091	0.182
Solena amplexicaulis	11	0	0.182	0	0.545	0.273
Justicia adhatoda	10	0	0.5	0.3	0.1	0.1
Cannabis sativa	9	0.333	0.333	0.111	0.111	0
Cajanus scarabaeoides	9	0.444	0.222	0	0.222	0.111
Alpinia galanga	9	0.11	0	0.22	0	0.67
Nymphaea rubra	8	0.25	0.125	0	0.25	0.25
Borassus flabellifer	8	0.125	0.125	0.125	0.625	0
Moringa concanensis	7	0	0.428	0.285	0.285	0
Holostemma ada-kodien	6	0	0.333	0.167	0.167	0.333
Dregea volubilis	6	0	0.333	0.167	0.5	0
Fagopyrum acutatum	6	0.167	0.667	0	0	0.167
Allium humile	5	0	0.6	0.2	0	0.2
Taraxacum campylodes	5	0	0.4	0.2	0	0.2
Flemingia procumbens	5	0	0.2	0	0.2	0.6
Aesculus indica	5	0.2	0	0	0.4	0.2
Leea asiatica	5	0	0	0.4	0.4	0.2
Abutilon indicum	5	0.2	0.4	0.2	0	0.2
Malva verticillata	5	0.2	0.6	0	0	0.2
Murraya paniculata	4	0	0.25	0.25	0.5	0
Boehmeria glomerulifera	3	0	0.333	0.333	0.333	0
Urtica parviflora	3	0	0.333	0.333	0	0.333
Allium carolinianum	3	0	0.333	0.333	0	0.333
Allium jacquemontii	3	0	0.333	0.333	0	0.333
Allium tuberosum	3	0	0.333	0.333	0	0.333
Trichosanthes tricuspidata	3	0.333	0.333	0	0	0.333
Fagopyrum acutatum	3	0.333	0.333	0	0	0.333

[CPP(se) - CPP value for seeds, CPP(l-sh) - CPP value for leafy shoots, CPP(fl) - CPP value for flower, CPP(fr) - CPP value for fruits, CPP(u) - CPP value for underground parts].

breadth of Rosaceae members, as reported from Mediterranean or European countries (Tardío et al., 2006; Luczaj, 2012). Rosaceae is an important family which generally shares major floral elements that have been formally cultivated for fruits. In the root and tuber category, members of Dioscoreaceae, Araceae, Zingiberaecae, and Amaryllidaceae outnumbered others, which is also in concord with other studies (Turner et al., 2011).

Evaluation of species' importance in terms of their multiple palatable plant parts made use of the index, RUV, that selected and ranked edible species based on the number of useful parts. Likewise, an inclusion of CPP value added a reliability measure to the various edible parts of species selected for prioritization. Collectively, the indices (RFC and RUV) allowed an informed decision on shortlisting species based on the analyses of the collected data.

TABLE 5 | A list prioritized species based on RFC and RUV values.

Highest priority species	High priority species	Medium to high priority species
Colocasia esculenta (L.) Schott	*Aegle marmelos* (L.) Corrêa	*Aesculus indica* (Wall. ex Cambess.) Hook.
Phyllanthus emblica L.	*Alternanthera sessilis* (L.) R.Br. ex DC.	*Bauhinia variegata* L.
Spondias pinnata (L. f.) Kurz	*Amaranthus spinosus* L.	*Cannabis sativa* L.
Tamarindus indica L.	*Amaranthus viridis* L.	*Ensete superbum* (Roxb.) Cheesman
	Asparagus racemosus Willd.	*Justicia adhatoda* L.
	Boerhavia diffusa L.	*Nelumbo nucifera* Gaertn.
	Centella asiatica (L.) Urb.	*Nymphaea nouchali* Burm.f.
	Chenopodium album L.	*Nymphaea rubra* Roxb. ex Andrews
	Commelina benghalensis L.	*Typha domingensis* Pers.
	Dioscorea bulbifera L.	
	Dioscorea pentaphylla L.	
	Diplazium esculentum (Retz.) Sw.	
	Ficus racemosa L.	
	Ipomoea aquatica Forssk.	
	Oxalis corniculata L.	
	Portulaca oleracea L.	
	Senna tora (L.) Roxb.	
	Solanum americanum Mill.	
	Solanum torvum Sw.	
	Ziziphus jujuba Mill.	

Prioritization—Inclusion in Policy for Nutritional Security

Assimilation of wild edible plants into the diet has much larger implications in terms of environmental sustainability, when the world is plagued with the grave crises of climate change and food insecurity, and could lessen the footprints of agriculture and allow for a shift toward more sustainable food systems. Judicious use of intrinsic resources with less negative impact has become critical and adoption of WEP resources could emerge as a sustainable strategy (Bharucha and Pretty, 2010). Wild food offers several advantages on this line, i.e., wide diversity, easy access to the local resource base, availability, time-tested reliability, little or no management, etc. (Mazhar et al., 2007; Bharucha and Pretty, 2010; Cruz-Garcia and Price, 2011; Turner et al., 2011). Moreover, the problem of micronutrient deficiency or "hidden hunger" that looms large over the global population cannot be erased by staple crops which lack essential micronutrients (Guralnik et al., 2004; Pingali, 2015; Ickowitz et al., 2019). Yet fortification of commercial food and production of bio-fortified food crops bred with increased micronutrient content have also been proposed to combat hidden hunger. Here, the untapped nutritional potential of wild food to enhance dietary diversity and nutritional outcome has a central role to play (**Table 6**). They are reservoirs of many vitamins andtrace elements, e.g., leafy shoots (e.g., *Boerhaavia diffusa*, *Aerva lanata*) are a source of vitamin A and Calcium, fruits (*Tamarindus indica*), are a source of iron and zinc, etc. Their health benefits have also been widely reported from various countries with a tradition of eating wild edibles (Ogle and Grivetti, 1985a,b; Cook et al., 2000; Ogle, 2001; Ogle et al., 2003; Simopoulos, 2004; Uusiku et al., 2010; Ranfa et al., 2014; Mishra et al., 2015; Hama-Ba et al., 2017). A couple of studies examining selected edible plants from various parts of India (such as Sikkim, Jharkhand, the north-eastern region, and South India) also supports the same fact (Rajyalakshmi et al., 2001; Sundriyal and Sundriyal, 2001; Bhatt et al., 2005; Ghosh-Jerath et al., 2015). In sum, positive health implications of wild edibles have long been acknowledged either formally through research or informally through age-long traditional wisdom. Nevertheless, owing to several entangled factors, the practice is currently at stake.

One of the largely agreed reasons is agricultural intensification that has substantially increased the staple crop production, but has significantly reduced farmland biodiversity and dietary diversity (Dewey, 1981; Fowler and Mooney, 1990; Pretty, 1995; Pingali, 2015). It has also brought in an intensive use of agrochemicals that acted in tandem with other factors like land-use change, forest fragmentation, and a change in governance to decimate the wild population of edible plants or their habitat (Pretty, 1995; Bharucha and Pretty, 2010; Padoch and Sunderland, 2014; Broegaard et al., 2017; Ickowitz et al., 2019). Many other cultural factors, e.g., changing food habit, loss of traditional knowledge systems, the overwhelming presence of dominant food culture, and easy access to store food have also acted hand in hand to erode the culture of eating wild food (Luczaj, 2012). The eventual outcome is a loss of dietary diversity and disruption of the sustainable food systems. Here, the lower strata of economic groups of developing countries are worst hit as the malnourishment owing to micronutrient deficiency is acute among rural populations (Von Grebmer et al., 2014). It is because the decline of wild edibles population robbed them of the easily obtainable nutrition and buying the equivalent food items from the market place always incurred an extra cost, thus impairing the access. It is especially imperative for a developing country like India, where a major section of the population cannot afford to buy essential nutrients from nearby markets for various reasons, price being the primary reason, and where the nutritional benefits of local resources in the form of wild edibles in social welfare cannot be undermined.

A potential way out could be the revival of the culture by promoting informal cultivation or moderate management in homesteads, fringes, pastures, or fallow lands (Broegaard et al., 2017). The issue deserves a synergy among research, education and outreach, and policy. For the resumption of such an exercise, a prioritization program would be a better point to commence if bolstered by data-driven inference; here we aim to objectively prioritize a handful of plants that might facilitate

TABLE 6 | Nutritional composition of a few selected wild edible plants (in mg/100 g).

Edible species	Parts	Vit A	Vit B1	Vit B2	Vit C	Vit E	Ca	Fe	Zn	Na	K	Cu	P	Mg	Mn	Se	Folic acid
Aegle marmelos	Fr	186	0.01	1.2	X	X	85	0.6	X	X	0.6	X	31.8	X	X	X	X
Aerva lanata	L, Sh	21.76	X	X	19	X	322	22.06	0.65	10.4	X	X	X	X	X	X	0.04
Aesculus indica	Se	X	X	X	X	X	8.20	8.50	705.9	X	81.00	0.6	X	X	0.5	X	X
Agaricus sp. *(Chiple)*	Fruit body	X	X	X	X	X	1.842	0.13	0.73	0.053	1.92	0.07	0.47	0.23	X	X	X
Agaricus sp. *(Patpate)*	Fruit body	X	X	X	X	X	1.53	0.11	0.6	0.06	2.17	0.09	0.76	0.34	X	X	X
Alternanthera sessilis	L, Sh	1.92	0	0.14	17	X	510	1.63	X	X	X	X	X	X	X	X	X
Amaranthus spinosus	L, Sh	3.56	0	X	33	X	800	22.9	X	X	X	X	X	X	X	X	X
Amaranthus tricolor	L, Sh	5.52	0.03	0.3	99	X	397	3.49	0.18	230	X	X	X	X	X	X	0.14
Amaranthus viridis	L, Sh	X	X	X	179	X	330	18.7	X	X	X	X	X	X	X	X	X
Antidesma acidum	L, Sh	X	X	X	X	X	1717	X	X	X	X	X	X	X	X	X	X
Aralia leschenaultii	Fr	X	X	X	X	X	0.31	0.6	X	0.6	1.89	X	0.47	0.25	X	X	X
Ardisia macrocarpa	Fr	X	X	X	X	X	0.29	0.02	0.31	0.04	0.89	0.07	0.13	0.31	X	X	X
Arisaema utile	Fr	X	X	X	X	X	0.92	0.83	X	0.09	2.4	X	0.69	0.62	X	X	X
Artocarpus lakoocha	Fr	0.25	0.02	0.15	135	X	50	0.05	X	X	X	X	X	X	X	X	X
Baccaurea ramiflora	Fr	X	X	X	0.27	X	0.16	0.08	0.6	0.04	0.73	0.08	0.13	0.5	X	X	X
Bambusa bambos	L, Sh	0	0.08	0.19	5	X	20	0.1	X	X	X	X	X	X	X	X	X
Bambusa tulda	L, Sh	X	X	X	1.42	0.61	4.06	3.19	0.72	19.96	408	0.44	X	X	X	X	X
Bauhinia purpurea	L, Sh	X	X	X	X	X	312	X	X	X	X	X	X	X	X	X	X
Boerhaavia diffusa	L, Sh	16.01	X	X	12	X	202	10.68	0.41	39.4	X	X	X	X	X	X	0.02
Cannabis sativa	L, Sh	X	0.4	0.1	X	90	145	14	7	12	859	2	X	483	7	X	X
Carissa carandas	Fr	X	X	X	X	X	21	X	X	X	X	X	X	X	X	X	X
Castanopsis indica	Fr	X	X	X	X	X	1540	2.6	1.53	0.03	4.33	0.77	80	12.68	2.35	0.0006	X
Celosia argentea	L, Sh	X	X	X	X	X	323	X	X	X	X	X	X	X	X	X	X
Centella asiatica	L, Sh	0.5	0.53	X	5	X	231	55.66	1.92	5.2	X	X	X	X	X	X	0.01
Chenopodium album	L, Sh	1.74	0.01	0.14	35	X	150	4.2	X	X	X	X	X	X	X	X	X
Choerospondias axillaris	Fr	X	X	X	0.04	X	1.58	0.11	0.83	0.04	0.67	0.06	0.16	0.68	X	X	X
Colocasia antiquorum	L, Sh	5.92	0.22	0.26	12	X	227	10	X	X	X	X	X	X	X	X	X
Colocasis esculenta	U	X	X	X	X	X	19	1.1	1.7	1	340	X	X	28	X	X	X
Commelina benghalensis	L, Sh	X	X	X	X	X	1431.6 ± 6.41	115.92 ± 5.51	2.68 ± 0.17	200 ± 7.02	390 ± 15.52	2.72 ± 0.09	X	220.8 ± 4.15	7.98 ± 0.26	X	X
Crotalaria juncea	L, Sh	X	X	X	X	X	200	X	X	X	X	X	X	X	X	X	X
Dendrocalamus strictus	L, Sh	X	X	X	2.43	0.58	139.5	2.91	X	0.08	X	X	58.13	0.17	X	X	X

(Continued)

TABLE 6 | Continued

Edible species	Parts	Vit A	Vit B1	Vit B2	Vit C	Vit E	Ca	Fe	Zn	Na	K	Cu	P	Mg	Mn	Se	Folic acid
Dioscorea bulbifera	U	0.3	X	X	4	X	20	4.09	0.38	0.08	X	X	X	X	X	X	0.028
Diospyros melanoxylon	Fr	0.361	0.01	0.04	1	X	60	0.5	X	X	X	X	X	X	X	X	X
Diplazium esculentum	Fr	X	X	X	X	X	1.02	0.56	0.58	0.08	2.37	0.04	0.5	0.51	X	X	X
Diploknema butyracea	Fr	X	X	X	0.03	X	0.82	0.18	0.86	0.07	0.82	0.04	0.09	0.61	X	X	X
Elaeagnus latifolia	Fr	X	X	X	0.07	X	1.47	0.18	1.19	0.05	0.91	0.05	0.09	0.54	X	X	X
Elaeagnus rhamnoides	Fr	X	X	X	0.26	X	0.17	0.06	0.88	X	X	0.02	0.31	0.31	X	X	X
Elaeocarpus sikkimensis	Fr	X	X	X	0.01	X	0.63	0.15	0.64	0.04	1.01	0.08	0.07	0.35	X	X	X
Ensete superbum	Fl	X	X	X	X	X	665.6 ± 5.94	518.4 ± 11.06	3.78 ± 0.15	600 ± 4.58	180 ± 6.11	4.46 ± 0.15	X	176.8 ± 4.86	11.74 ± 0.46	X	X
Enydra fluctuans	L, Sh	0.98	0.96	X	4	X	246	16.99	0.94	80	X	X	X	X	X	X	0.096
Euphorbia granulata	L, Sh	11.68	3.07	X	9	X	425	81.09	1.01	24.9	X	X	X	X	X	X	0.072
Ficus bengalenis	Fr	X	X	X	X	X	364	X	X	X	X	X	X	X	X	X	X
Ficus geniculata	L, Sh	0.53	X	X	5	X	672	8.89	4.63	11.3	X	X	X	X	X	X	0.012
Ficus racemosa	Bark	X	X	X	X	X	172.9	15.92	0.05	25.5	1197.5	0.52	X	19.62	0.19	X	X
Ficus sp.	L, Sh	8.2	X	X	X	X	295	2.77	0.8	7.5	X	X	X	X	X	X	0.039
Hibiscus cannabinus	L, Sh	6.97	0.07	0.39	20	X	172	2.28	0.27	X	X	X	X	X	X	X	X
Ipomoea aquatica	L, Sh	1.98	0.05	0.13	37	X	110	3.9	X	X	X	X	X	X	X	X	X
Kaempferia galanga	U	X	X	X	X	X	950	69.91	8.35	0.32	12.23	0.91	60	293.92	42.65	0.0012	X
Leucas cephalotes	L, Sh	18.46	X	X	8	X	236	20.02	0.8	10.6	X	X	X	X	X	X	0.01
Madhuca neriifolia	Fr	0.307	X	X	40	X	45	0.23	X	X	X	X	X	X	X	X	X
Marsilea minuta	L, Sh	X	X	X	X	X	53	X	X	X	X	X	X	X	X	X	X
Meyna spinosa	L, Sh	X	X	X	X	X	127	X	X	X	X	X	X	X	X	X	X
Moringa oleifera	L, Sh	6.78	0.06	0.05	220	X	440	0.85	0.16	X	X	X	X	X	X	X	X
Moringa oleifera	Fr	X	X	X	X	X	51	X	X	X	X	X	X	X	X	X	X
Nelumbo nucifera	Se	X	0.22	0.01	3.94	0.46	44.5	1.3	1.3	3.3	1630	1	X	165	5.7	X	X
Nymphaea nouchali	L, Sh	X	X	X	X	X	379.54 ± 0.58	3.59 ± 0.09	3.63 ± 0.13	643.58 ± 0.82	858.39 ± 0.68	1.77 ± 0.11	X	145.48 ± 1.11	X	X	X
Nymphaea rubra	U	X	X	X	14.43 ± 0.03	X	354.1 ± 018	28.14 ± 0.24	1.64 ± 0.01	34.1 ± 0.36	734 ± 0.74	1.12 ± 0.01	X	104 ± 0.06	1.34 ± 0.01	X	X
Oxalis corniculata	L, Sh	X	X	X	21	X	234	14.75	X	X	X	X	X	X	X	X	X
Phyllanthus emblica	Fr	X	X	X	X	X	27.6	3.3	1.8	4.2	282.0	0.28	28.2	11.8	1.1	0.24	X
Polygonum molle	Fr	X	X	X	X	X	0.15	0.32	0.28	0.09	2.02	0.06	0.27	0.43	X	X	X

(Continued)

TABLE 6 | Continued

Edible species	Parts	Vit A	Vit B1	Vit B2	Vit C	Vit E	Ca	Fe	Zn	Na	K	Cu	P	Mg	Mn	Se	Folic acid
Polygonum plebeium	L, Sh	X	X	X	X	X	194	X	X	X	X	X	X	X	X	X	X
Portulaca oleracea	L, Sh	X	X	X	15	X	227	16.17	X	X	X	X	X	X	X	X	X
Prunus cerasoides	Fr	X	X	X	0.32	X	0.2	0.21	0.2	0.02	0.47	0.01	0.18	0.59	X	X	X
Prunus napaulensis	Fr	X	X	X	608.9	X	1220	10.7	1.49	0.1	16.5	1.22	70	217.74	6.62	0.0005	X
Quercus robur	Fr	X	X	X	X	X	410	4.7	1.59	0.13	8.3	1.66	150	126	5.63	0.0002	X
Rhus chinensis	Fr	X	X	X	X	X	1020	4.17	2.37	0.03	8.41	0.63	160	111.1	X	0.0009	X
Schleichera trijuga	Fr	X	X	X	X	X	15	X	X	X	X	X	X	X	X	X	X
Semecarpus anacardium	Fr	X	X	X	X	X	295	6.1	X	X	X	X	X	X	X	X	X
Senna tora	L, Sh	10.512	0.08	0.19	82	X	520	12.4	X	X	X	X	X	X	X	X	X
Solanum torvum	L, Sh	0.078	X	X	2.686	X	22.15	7.68	2.14	X	X	0.26	X	X	1.95	X	X
Spondia pinnata	Fr	X	X	X	X	X	0.93	1.32 ± 0.02	X	1.54 ± 0.01	1.38 ± 0.80	1.23 ± 0.03	0.68 ± 0.01	X	X	X	X
Tamarindus indica	Fr	X	X	X	X	X	248.56 ± 1.3	7.14 ± 0.92	6.94 ± 0.51	28.83 ± 1.34	1315.28 ± 5.74	0.59 ± 0.16	369.47 ± 2.14	285.14 ± 2.82	0.81 ± 0.12	X	X
Terminalia chebula	Fr	X	X	X	X	X	0.81	0.03	0.44	0.08	1.27	0.04	0.04	0.3	X	X	X
Trianthema portulacastrum	L, Sh	X	X	X	70	X	100	38.5	X	X	X	X	X	X	X	X	X
Urtica dioica	Fr	X	X	X	X	X	1.31	1.31	X	0.07	1.87	X	0.27	0.42	X	X	X
Viburnum corylifolium	Fr	X	X	X	238.7	X	630	3.55	1.62	0.11	11.13	1.27	140	161.39	9.63	0.0002	X
Vicia hirsuta	L, Sh	0.55	X	X	23	X	215	7.78	4.11	33.18	X	X	X	X	X	X	0.07
Zanthoxylum rhetusa	Fr	X	X	X	X	X	0.88	0.05	1.16	0.02	0.72	0.12	0.14	0.35	X	X	X
Ziziphus jujuba	Fr	0.21	0.02	0.05	76	X	4	0.5	0.1	X	X	X	X	X	X	X	X

Vit A, Vitamin A; Vit B1, Vitamin B1; Vit C, Vitamin C; Ca, Calcium; Fe, Iron; Zn, Zinc; Na, Sodium; K, Potassium; Mg, Magnesium; Mn, Manganese; Se- Selenium; Cu, Copper; P, Phosphorous. L; Sh, leafy shoots/ shoots/ leaves; Fr, Fruits; Fl, Flowers; Se, Seeds; U, underground parts; roots/tuber.

(Wills et al., 1983; Barthakur and Arnold, 1991; Callaway, 2004; Pugalenthi et al., 2004; Sheela et al., 2004; Rathore, 2009; Ahmed et al., 2010; Andola and Purohit, 2010; Mohan and Kalidass, 2010; Mahadkar et al., 2012; Akoto et al., 2015; Zhang et al., 2015; Satter et al., 2016; Mishra et al., 2018).

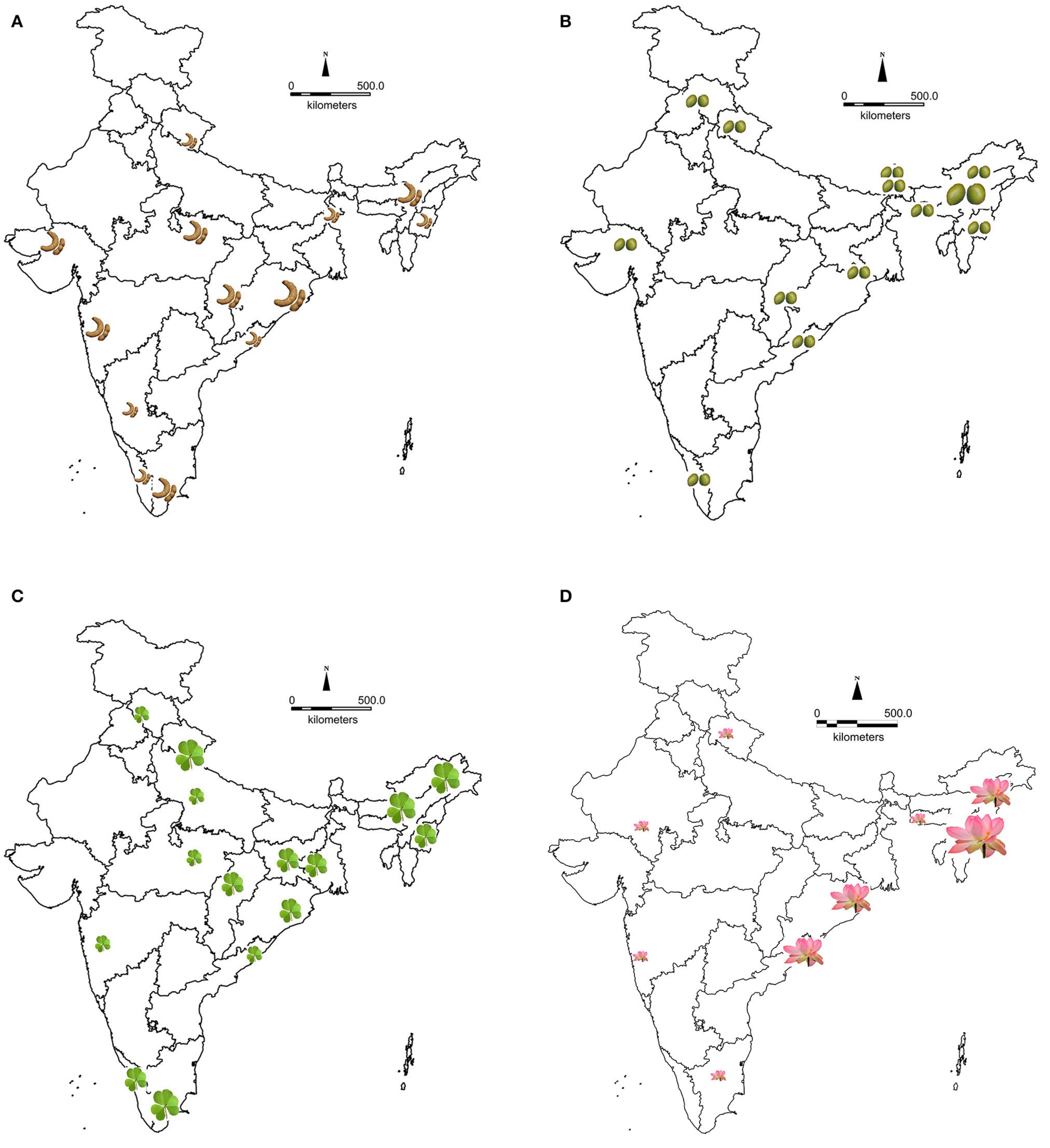

FIGURE 5 | Spatial distribution of a few prioritized species: species with higher RFC and RUV (dots represent spatial distribution and dot size is proportional to the number of plant part use)—**(A)** *Tamarindus indica* and **(B)** *Spondias pinnata*; species with higher RFC (dots represent spatial distribution and dot size is proportional to the number of papers cited from the area) **(C)** *Oxalis corniculata*; and species with higher use value (dots represent spatial distribution and dot size is proportional to the number of plant part use) **(D)** *Nelumbo nucifera*.

policy formulation. Our analyses have selected a small subset from the 1,400 edible species on the basis of their high RFC and RUV values. The indices stand for the easy availability, greater accessibility, and relatively wider acceptance among people residing in distant geographic regions and therefore these attributes justify their inclusion into the prioritization and policy formation. For example, the ubiquity of *Oxalis corniculata, Amaranthus spinosus, Solanum americanum, Centella asiatica, Alternanthera sessilis,* and *Ipomoea aqautica,* etc., indicates their easy procuring and cross-cultural assimilation. On the other hand, species such as *Nymphaea nouchali, N. rubra, Nelumbo nucifera, Cannabis sativa, Tamarindus indica, Spondias pinnata,* and *Dregea volubilis* also represent a high degree of usability for their use of three or even more parts (**Figures 5A–D**). Several reports have explicitly highlighted their nutritional benefits in terms of vitamins and minerals (**Table 6**). So, these prioritized plants deserve the attention of researchers, policymakers, and farmers to be integrated toward a sustainable food system. In the absence of appropriate policy, it could remain localized and may not widely exert its beneficial effect on nutritional security. Moreover, many were already well-assimilated into local or regional food culture, but have been eroded over time, and could be resurrected through a promotion to sensitize consumers and would gain momentum with policy in place.

CONCLUSION

It has largely been recognized that food security is ensured when all people have access to sufficient and nutritious food (World Food Summit, 1996). Nutritious food relates to dietary quality and diversity that are indicators of an adequate amount of micro-nutrients in the diet (World Health Organization, 2008; Royal Society, 2009; FAO and FHI 360, 2016). Yet strategies for ensuring food security often advocate for an intensified agriculture that focusses on the enhanced production of major cereals only (FAO, 2012; Jones, 2017), but remaining quite blind to dietary diversity, thus disrupting healthy food systems (Pingali, 2015). While there is a consensus that wild uncultivated foods cannot entirely erase the gap between supply and demand, the researchers underscore that the difference between supply and demand would be much wider if wild food was absent from our food system (Bharucha and Pretty, 2010).

Our study uncovered a great majority of WEP from nearly two hundred families has been consumed regularly around India. Various parts, leafy shoots, fruits, flowers, seeds, or underground organs are generally included in the food repertoire. Procured from anthropogenic landscapes, many of these have cross-cultural acceptance and are valued for their specific organ, while many are important for their multi-part usage; they can be prioritized for policy decisions. The diversity of edible flora, their multifarious usage across various cultural geographic regions, and wider mentions, strongly suggest the fact that the practice of eating from the wild has been an age-old exercise. This practice may have eroded over time but could be resurrected with the proper framework, policy, and information dissemination. It is also imperative to shift our focus from a small subset of plants and embrace a diverse food base in order to enrich our dietary quality. Additionally, a diverse resource base would enable our food system to be more resilient in the face of climatic changes.

DATA AVAILABILITY STATEMENT

The datasets generated for this study could be available from the corresponding author on request with proper justification and on mutual agreement.

AUTHOR CONTRIBUTIONS

AR and RR designed the study, collected, compiled, and analyzed the data. ES helped in data collection. AR and RR wrote the manuscript with inputs from ES.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsufs.2020.00056/full#supplementary-material

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