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## Wild edible plants of Jharkhand and their utilitarian perspectives

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The wild edible plants (WEPs) form an important constituent of traditional diets of the tribal community of Jharkhand. Most of the rural populations residing in different parts of Jharkhand depend on plants and their parts to fulfil their daily needs and have developed unique knowledge about their utilization. The present study has been conducted to document the indigenous knowledge related to the diversity and uses of wild edible weeds in day to day life of tribal in Jharkhand. A total of 77 different herbs, shrubs, and small trees have been recorded belonging to 38 families of which 73 are edible either as a vegetable or as medicine or in both forms directly or after proper processing. The common wild edible herbs frequently distributed in the study area are *Hemidesmus indicus* R. Br. (51 quadrats out of 134) and *Cynodon dactylon* (L.) Pers. (47 quadrats out of 134). Similarly, the most frequent edible shrubs are *Clerodendrum viscosum* Vent., nom. superfl. (40), *Lantana camara* L. (35), *Croton oblongifolius* Roxb. (34) and *Flemingia strobilifera* (L.) R.Br. (20). The diversity of WEPs in Jharkhand has found to be depleted due to their over exploitation and unsustainable harvesting for foods, medicines as well as because of various other biotic interferences including grazing, herbivory and anthropogenic fire. Therefore, there is an urgent need to conserve these valuable Wild edible plants (WEPs) and use it in a sustainable manner to ensure future demand. Besides, further research is also warrant to explore the therapeutic potentials as well the nutritive values of WEPs, so that, it can give a scientific basis for the further development of herbal drugs and traditional foods.

**Keywords:** Edible plants, Jharkhand, Medicinal uses, Tribal population

**IPC Code:** Int. Cl.<sup>20</sup>: A23B 9/00, A61K 9/00, A61K 36/00

India is one of the 17 mega diversity nations with over 45,000 plant species representing about 7% of the world's flora. It holds the 10<sup>th</sup> position among the 25 most plant-rich countries of the world with 24.39% forests cover<sup>1</sup>. India has *ca.* 800 edible plant species that are grown in the wild and consume mainly by tribal populations<sup>2</sup>. Jharkhand is one of the biodiversity rich states of India with extensive forests resources (29.65% of the total geographic area) because of its origin, diverse physiographic and climatic conditions<sup>3</sup>. Besides, it is well known for its rich mineral resources with over 40% of the country's total mineral reserve. Wild plants and its parts are used by most of the rural Indian populations (*ca.* 85%) as traditional medicines, diet supplements, and for livelihood security, socio-economic upliftment<sup>4,5</sup>. Indigenous communities of both industrialized and developing countries use wild plants for various day to day activities and the mean use of wild plant is 120 species per community<sup>6</sup>. Wild plants are used in several ways from timbers, fuelwoods, foods, wild vegetables, spices, wild fruits, thatch, construction materials, and raw materials for

industries, and often as traditional medicines. WEPs are those naturally grown plants and their parts including roots, shoots, leafy greens, fleshy fruits, nuts, grains and seeds that can be used for food if gathered at the appropriate stage of growth<sup>7</sup>. It is commonly grown in forests, agriculture and non-agriculture fields as well as along the roadsides, drains and wastelands. WEPs can be classified on the basis of economic importance<sup>8,9</sup> or based on the utility of plants as a whole or any plant parts<sup>10</sup>. WEPs may be herbs, shrubs or trees and can be used directly or after cooking and processing. Forests of Jharkhand are mainly tropical deciduous type and highly species rich<sup>11</sup>. The state of Jharkhand has a large tribal population (26.3%) with a total of 32 tribes predominant in 17 districts out of the total 24<sup>1</sup>. Knowledge of harvest and preparation of WEPs is important<sup>12</sup> and the indigenous communities reside in different parts of Jharkhand have a rich knowledge of WEPs and have developed unique knowledge of their mode of utilization. The dependency on WEPs are quite high in Jharkhand as forests are considered as a high value commodity across the state. Most of the indigenous peoples' of Jharkhand are dependent on forests as well as on

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agriculture to fulfil their sustenance needs. In general, tribal used to live in close association with nature and maintain a connection between man and the environment<sup>13</sup>. Besides, agriculture holds an important place in the rural economy of Jharkhand as *ca.* 80% of the total population of Jharkhand depend on agriculture and associated activities for their livelihood<sup>14</sup> and the major crops are paddy, maize, wheat and vegetable followed by pulse and oilseeds. The traditional knowledge of uses of various medicinal plants is well known and evident in several literatures<sup>15,16,17</sup>. According to ethnobotanical surveys, more than 30,000 plant species are edible, of which *ca.* 7,000 species have been used for nourishment<sup>18</sup>. Wild fruits can supplement the daily diet requirement and minimize the use of exotic fruits<sup>19,20</sup>. WEPs play a significant role in the livelihood and food security of tribal and poor rural communities in many areas in the world<sup>21,22</sup>. WEPs mainly the leafy vegetables use to have high nutritive and medicinal values<sup>23</sup> and are integral part of daily diet of indigenous people of Jharkhand, Odisha and West Bengal<sup>24</sup>. Besides, it can be used for erosion control, traditional medicines, and also for the supply of organic matter and mineral nutrients to the soil. WEPs are used as food to maintain good health as it is an important source of vitamins, minerals and all other required nutrients. Very limited studies have been done so far to document the status, diversity and uses of edible weeds in Jharkhand. Therefore, the present study attempted to document indigenous knowledge related to the diversity and uses of edible weeds in day to day life of tribal in Jharkhand.

## Materials and methods

### Study area

The present study is conducted in 13 (out of 18) randomly selected blocks of Ranchi, Jharkhand, viz., Burmu, Namkum, Ormanjhi, Ratu, Mandar, Bero, Nagri, Lapung, Kanke, Angara, Itki, Chano and Khelari. Ranchi lies in south chotanagpur administrative division located at 23.35°N latitude, 85.33°E longitude near to the Tropic of Cancer and altitude varies from 500 to 700 m above mean sea level (MSL). The district is bounded by Ramgarh and Hazaribagh districts in the north, Khunti and Saraikela Kharsawan in the south, Gumla, Latehar and Lohardaga in the east and Saraikela Kharsawan, and Purulia district of West Bengal in the west. Ranchi has a relatively moderate climate compared to rest of state of India with hilly topography. The total geographical area of Ranchi is 5097 sq. km divided into Ranchi and Bundu sub-divisions. Ranchi is home to tropical moist deciduous and tropical dry deciduous forests with a total forests cover of 1164 sq. km (22.84%), out of which 63 sq. km (5.41%) very dense, 364 sq. km (31.27%) moderately dense and 737 sq. km (63.31%) open forests<sup>1</sup>.

### Sampling techniques

The study is conducted by laying 134 different quadrats of 1 m x 1 m size (134 m<sup>2</sup> sampled plots) for the enumeration of edible weeds, including small trees, shrubs, herbs, and grasses in 67 different locations (**Fig. 1**) during October 2017 to September 2018. Knowledge regarding the WEPs and their mode

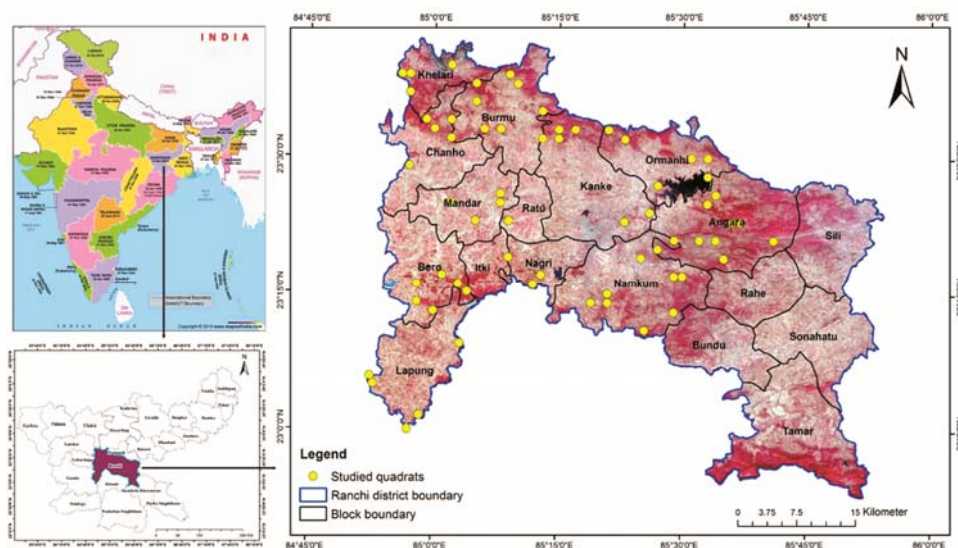


Fig. 1 — Map of the study sites (selected blocks of Ranchi, Jharkhand) showing the locations (67) of studies quadrats

of uses have been recorded by the interview based field work with selected respondents (a total of 26 individuals) from 13 different blocks of Ranchi.

### Results and discussions

Because of little land holding and low profitability of land, most of the tribal families of Jharkhand are keeping up a differentiated example of occupations including daily wage, crafting, small scale business including selling vegetables and essentials in local markets. Forests act as the second major contributor to livelihoods of the underprivileged indigenous people of Jharkhand after agriculture. Socioeconomic conditions had exhibited a significant positive correlation with the livelihood dependency on forests<sup>25</sup>. Work cooperation of tribal ladies is viewed as vital for the survival of tribal families and they play a crucial role on sustenance gathering, rope making, nectar gathering, natural restorative plant accumulation, container making by bamboos and rattans, as well as fishing and chasing<sup>26</sup>. Forests provide a wide array of livelihoods for rural tribal communities in the form of direct employment, self-employment and secondary employment in India<sup>27,28</sup>. The present study has recorded a total of 77 different herbs, shrubs and small trees belonging to 41 families, and out of which 73 are edible either as medicine or as vegetable or both collected from 134 studied quadrats of 67 different forests. Various species of WEPs belonging to different genera and family are consumed by the local and tribal population in Jharkhand as per their availability. Fabaceae is the most dominant family with 7 species (9.59%) followed by Rubiaceae with 6 (8.22%), Apocynaceae with 5 (6.85%), Asteraceae and Poaceae with 4 each (5.48%), Acanthaceae, Malvaceae and Euphorbiaceae with 3 each (4.11%), Amaranthaceae and Verbinaceae with 2 species each (2.74%) and rest 34 families are monotypic contributing 46.57% of the total species richness (Fig. 2). Out of 73 edible plant species, 27 species (36.99%)

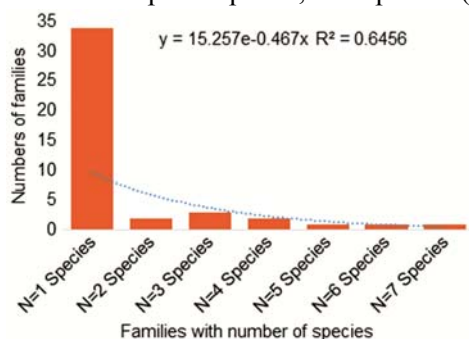


Fig. 2 — Distribution of families according to species number of Wild edible plants (WEPs)

contain hundred percent edible portions and of which 4 shrubs, 18 herbs, and 5 ferns, fungi and climbers. The consumable portion of 19 species (26.03%) is leaf or leafy shoots (EL), one of them is tree, 11 shrubs (*C. viscosum*, *Barleria cristata* L., *Sida cordifolia* L., *Scoparia dulcis* L., *Chenopodium album* L., etc.), 05 herbs (*Oxalis corniculata* L., *Alternanthera paronychioides* A. St.-Hil., *Desmodium triflorum* L., *Mesosphaerum suaveolens* (L.) Kuntze., etc.) and 02 ferns, fungi and climbers (*Lygodium japonicum* (Thunb.) Sw., *Marsilea minuta* L.). Six species have edible root or tubers (RT) among them 01 is tree (*Elaeodendron glaucum* (Rottb.) Pers., 01 shrub (*Ventilago maderaspatana*) and 04 herbs (*H. indicus*, *Arisaema heterophyllum* Blume, *Evolvulus nummularius* L. and *Curculigo orchioides* Gaertn.). The consumable portion of 05 species (6.85 %) is fruits and leaves (FL), 02 of them are trees (*Meyna laxiflora* Robyns., and *Woodfordia fruticosa*), 01 shrub (*Carissa spinarum* L.), 01 herb (*Phyllanthus niruri* L.) and 01 fern, fungus and climber (*Vitis repanda* (Vahl.) Wight & Arn.). Three species (4.11%) have edible leaves and root (LR), among them 02 shrubs (*C. opaca* Stapf ex Haines and *Murraya koenigii* (L.) Spreng.), and 01 herb (*Cyperus rotundus* L.). The consumable portion of 05 species (6.85%) is leaves and seed (LS), 03 of them are shrubs, and 01 each is tree and herb. The consumable portion of 08 species (10.96%) is miscellaneous edibles parts (M), among them 03 trees (*Wendlandia heynei* Schult.) Santapau & Merchant, *Madhuca longifolia* (J. Koenig ex L.) J.F.Macbr. and *Holarrhena pubescence* Wall. ex G. Don), 03 herbs (*Asparagus densiflorus* (Kunth) Jessop, *Drimia indica* (Roxb.) Jessop and *Curcuma aromatica* Salisb.) and 02 shrubs (*Urena lobata* L. and *Randia aculeate* L.) (Fig. 3). Details of WEPs of Jharkhand are listed in Table 1 arranged on the basis of edible parts.

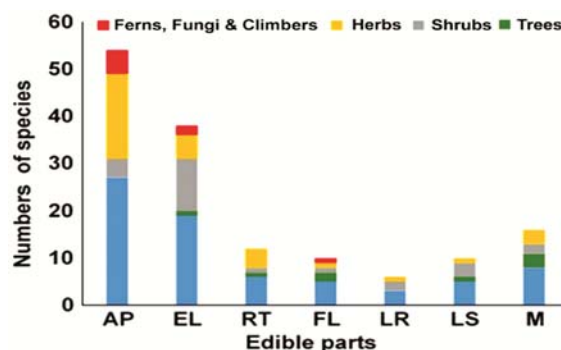


Fig. 3 — Wild edible plants (WEPs) bearing edible parts. AP=Plants bearing all edible parts, EL=Edible leaves or leafy shoots, RT=Edible roots or tubers, FL=Edible fruits and leaves, LR=Edible leaves and roots, LS=Edible leaves and seeds, M=Miscellaneous edible parts

Table 1 — List of wild edible plants (WEPs) used by tribal of Jharkhand, Eastern India

Sl.No	Species Name	Family	Local name	Habit	IUCN Red listed category
<b>Edible entire plants (AP)</b>					
1.	<i>Agaricus bisporus</i> (J. E. Lange) Imbach, 1946	Agaricaceae	Mushroom	F	
2.	<i>Ageratum conyzoides</i> L.	Asteraceae	Gandhari, Puru	S	LC
3.	<i>Andrographis paniculata</i> (Burm. fil.) Nees	Acanthaceae	Kaalmedh	H	
4.	<i>Baccharoides anthelmintica</i> (L.) Moench	Asteraceae	Ironweed	H	
5.	<i>Cissus quadrangularis</i> L.	Vitaceae	Hadjod	C	
6.	<i>Coccinia grandis</i> (L.) Voigt	Cucurbitaceae	Kundri	C	
7.	<i>Croton oblongifolius</i> Roxb.	Euphorbiaceae	Croton	S	
8.	<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	Common Grass	H	
9.	<i>Dolichos trilobus</i> L.	Papilionaceae	Van Kurthi	H	
10.	<i>Elephantopus scaber</i> L.	Asteraceae	Mayur Jhanti	H	
11.	<i>Eleusine indica</i> (L.) Gaertn.	Poaceae	Goosegrass	H	LC
12.	<i>Emilia sonchifolia</i> (L.) DC. ex Wight	Asteraceae	Tasse Flower	H	
13.	<i>Euphorbia hirta</i> L.	Euphorbiaceae	Dudhi	H	
14.	<i>Flacourtia indica</i> (Burm. f.) Merr.	Salicaceae	Ramontchi	S	LC
15.	<i>Geastrum saccatum</i> Fr. 1829	Geastraceae	Rugra	F	
16.	<i>Heliotropium indicum</i> L.	Boraginaceae	Hathi-Sura	H	
17.	<i>Ichnocarpus frutescens</i> L.	Apocynaceae	Dudhi Latar	H	
18.	<i>Leucostegia immersa</i> Wall. ex C. Presl	Hypodematiaceae	Davallia	H	
19.	<i>Mimosa pudica</i> L.	Fabaceae	Lajwanti	H	LC
20.	<i>Oldenlandia diffusa</i> (Willd.) Roxb	Rubiaceae	Pitpapra	H	LC
21.	<i>Panicum maximum</i> Jacq.	Poaceae	Guinea Grass	S	
22.	<i>Peucedanium dhana</i> Ham	Apiaceae	Hill Carrot	H	
23.	<i>Spermacoce hispida</i> L.	Rubiaceae	Shaggy Button Weed	H	
24.	<i>Spermacoce ocyroides</i> Burm.f.	Rubiaceae	Button weed	H	
25.	<i>Swertia chirata</i> (Roxb.) Karst.	Gentianaceae	Chirayta	H	
26.	<i>Thespesia lampas</i> (Cav.) Dalzell & A. Gibson	Malvaceae	Ban Kapas	H	
27.	<i>Tinospora cordifolia</i> (Willd.)	Menispermaceae	Giloy	C	
<b>Edible leaves or leafy shoots (EL)</b>					
28.	<i>Alternanthera paronychioides</i> A. St.-Hil.	Amaranthaceae		H	
29.	<i>Amaranthus viridis</i> L.	Amaranthaceae	Jungali Chaulayi	H	
30.	<i>Bambusa vulgaris</i> Schrad. ex J.C.Wendl., nom. cons. prop	Poaceae	Bamboo	T	
31.	<i>Barleria cristata</i> L.	Acanthaceae	Philippine Violet	S	
32.	<i>Chenopodium album</i> L.	Amaranthaceae	Bathuwa	S	
33.	<i>Clerodendrum viscosum</i> Vent., nom. superfl.	Verbinaceae	Ghanto	S	
34.	<i>Desmodium triflorum</i> L.	Papilionaceae	Kudaliya	H	LC
35.	<i>Flemingia strobilifera</i> (L.) R.Br.	Papilionaceae	Kanphuta	S	
36.	<i>Mesosphaerum suaveolens</i> (L.) Kuntze.	Lamiaceae	Ban Tulsi	H	
37.	<i>Ipomoea carnea</i> Forst. fil.	Convolvulaceae	Thethar	S	
38.	<i>Lantana camara</i> L.	Verbinaceae	Putus	S	
39.	<i>Lygodium japonicum</i> (Thunb.) Sw.	Lygodiaceae		F	
40.	<i>Marsilea minuta</i> L.	Marsileaceae	European water Clover.	F	LC
41.	<i>Oxalis corniculata</i> L.	Oxalidaceae	Netho Sag	H	
42.	<i>Scoparia dulcis</i> L.	Scrophulariaceae	Ban Dhania	S	
43.	<i>Senna tora</i> (L.) Roxb.	Fabaceae	Chakor	S	
44.	<i>Sida cordifolia</i> L.	Malvaceae	Bala	S	
45.	<i>Sida rhombifolia</i> L.	Malvaceae	Sida	S	
46.	<i>Smilax zeylanica</i> L.	Acanthaceae	Ramdatwan	S	

(contd.)

Table 1 — List of wild edible plants (WEPs) used by tribal of Jharkhand, Eastern India (contd.)

Sl.No	Species Name	Family	Local name	Habit	IUCN Red listed category
<b>Plants bearing edible root or tubers (RT)</b>					
47.	<i>Arisaema heterophyllum</i> Blume	Araceae	Dancing Crane	Cobra Lily	H LC
48.	<i>Curculigo orchioides</i> Gaertn.	Hypoxidaceae	Kaki	Musli	H
49.	<i>Elaeodendron glaucum</i> (Rottb.) pers	Celastraceae	Ratangaura	T	DD
50.	<i>Evolvulus nummularius</i> L.	Convolvulaceae	Dwarf Morning Glories.	H	
51.	<i>Hemidesmus indicus</i> R. Br.	Asclepidaceae	Anantmul	H	
52.	<i>Ventilago maderaspatana</i> Gaertn	Rhamnaceae	Pitti	S	
<b>Plants bearing edible fruits and leaves (FL)</b>					
53.	<i>Carissa spinarum</i> L.	Apocynaceae	Karanda	S	
54.	<i>Meyna laxiflora</i> Robyns.	Rubiaceae	Katai	T	
55.	<i>Phyllanthus niruri</i> L.	Euphorbiaceae	Bhumi Amla	H	
56.	<i>Vitis repanda</i> (Vahl.) Wight & Arn.	Vitaceae	Pani Bel	C	
57.	<i>Woodfordia fruticosa</i> (L.) Kurz	Lythraceae	Dhawai	T	LC
<b>Plants bearing edibles leaves and seeds (LS)</b>					
58.	<i>Agave americana</i> L.	Agavaceae	Moraba	S	
59.	<i>Senna sophera</i> (L.) Roxb.	Caesalpinaceae	Chakara	S	
60.	<i>Senna obtusifolia</i> (L.) H.S.Irwin & Barneby	Fabaceae	Sicklepod	S	LC
61.	<i>Shorea robusta</i> Gaertner f.	Dipterocarpaceae	Sakhua	T	LC
62.	<i>Spermacoce articularis</i> L.f.	Rubiaceae	Button Weed	H	
<b>Plants bearing edible leaves and roots (LR)</b>					
63.	<i>Carissa opaca</i> Stapf ex Haines	Apocynaceae	Karanda	S	
64.	<i>Cyperus rotundus</i> L.	Cypraceae	Motha	H	
65.	<i>Murraya koenigii</i> (L.) Spreng.	Rutaceae	Kadhi Patta	S	
<b>Plants bearing miscellaneous edible parts (M)</b>					
66.	<i>Asparagus densiflorus</i> (Kunth) Jessop	Asperagaceae	Satawari	H	
67.	<i>Curcuma aromatic</i> Salisb	Zingiberaceae	Jangli Haldi	H	
68.	<i>Drimia indica</i> (Roxb.) Jessop	Asparagaceae	Ban Piaz	H	
69.	<i>Holarrhena pubescens</i> Wall. ex G.Don	Apocynaceae	Koriya	T	LC
70.	<i>Madhuca longifolia</i> (J. Koenig ex L.) J.F.Macbr.	Sapotaceae	Mahua	T	
71.	<i>Randia aculeata</i> L.	Apocynaceae	Mona Kata	S	LC
72.	<i>Urena lobata</i> L.	Malvaceae	Bherlattha	S	
73.	<i>Wendlandia heynei</i> (Schult.) Santapau & Merchant	Rubiaceae	Tilai	T	

T= Tree, S= Shrubs, H= Herbs, F= Fern and Fungi, C= Climber, LC= Least concern, DD= Data deficient

Local healers have significant knowledge, information, understanding of a wide range of medicinal plants, their formulations and curative properties that are useful to cure the common ailments<sup>15</sup>. Some common wild edible medicinal plants, which are frequently used by local tribal of Jharkhand to cure various ailment are shown in Fig. 4. In the present study, WEPs and its parts such as leaves, barks, roots, tubers, bulbs, and seeds are mentioned as useful to treat one or more human health problems (Table 2). The common wild edible herbs of frequent occurrence in the studied forests are *H. indicus* (51 quadrats out of 134), and *C. dactylon* (47 quadrats out of 134). Similarly, the most frequent edible shrubs

are *C. viscosum* (40), *L. camara* (35), *C. oblongifolius* (34) and *F. stobilifera* (20). In terms of density, *C. dactylon* was the most dominant plant with the highest density (54925 individuals ha<sup>-1</sup>) followed by *D. triflorum* (30149 individuals ha<sup>-1</sup>), *C. viscosum* (2865 individuals ha<sup>-1</sup>) and *C. oblongifolius* (2059 individuals ha<sup>-1</sup>). Out of the 77 recorded WEPs, 14 species (18.18%) are IUCN Red-listed including *A. heterophyllum*, *D. triflorum*, *Eleusine indica* (L.) Gaertn, *Flacourtia indica* (Burm. f.) Merr., *W. fruticosa*, *M. minuta*, etc. 14 WEPs (18%) are exotics in origin, viz., *Ageratum conyzoides* L., *M. suaveolens*, *Mimosa pudica* L., *Agave americana* L., etc.



Fig. 4 — Some important medicinal plants of *Sal* forests of Ranchi, Jharkhand (a) *Mesosphaerum suaveolens* (L.) Kuntze (b) *Asparagus densiflorus* (Kunth) Jessop (c) *Heliotropium indicum* L. (d) *Arisaema heterophyllum* Blume (e) *Andrographis paniculata* (Burm. fil.) Nees (f) *Smilax zeylanica* L.

The diversity of edibles plants (species richness in terms of herbs, shrubs and small trees) are maximum in Kochbong village in Namkum blocks (22 species) followed by Bhasanda village in Bero (21 species) and least in Hotwar in Kanke blocks (05 species).

Species richness in terms of edibles shrubs and small trees are shown in Fig. 5. The food habits of people generally developed according to the availability of food materials in their surroundings<sup>29</sup>. Among *kharif* weeds, *Senna tora* L., *A. sessilis*, *Amaranthus viridis*

Table 2 — List of medicinal wild edibles plants (WEPs) and their uses

Species Name	Family	Parts consumed	Medicinal properties
<i>Agaricus bisporus</i> (J. E. Lange) Imbach, 1946	Agaricaceae	Whole Plant	Antimicrobial, and anticandidal <sup>34,35</sup>
<i>Agave americana</i> L.	Agavaceae	Leaves, Sap, Seeds	Antibacterial, and antifungal properties <sup>36</sup>
<i>Ageratum conyzoides</i> L.	Asteraceae	Whole plant	Anti-bacterial, and anti-fungal properties <sup>37</sup>
<i>Alternanthera paronychioides</i> A. St.-Hil.	Amaranthaceae	Leaves and young shoots	Antioxidant, and antiglycotoxic <sup>38</sup>
<i>Amaranthus viridis</i> L.	Amaranthaceae	Leaves	Diuretic, and purgative <sup>39</sup>
<i>Andrographis paniculata</i> (Burm. fil.) Nees	Acanthaceae	Whole Plant	Anticancer, and antimicrobial <sup>40</sup>
<i>Arisaema heterophyllum</i> Blume	Araceae	Root, Tubers	Subsidence of induration and swelling, quicken the blood clotting, and relieve pains, and kill intestinal parasites in humans, and animals <sup>41</sup>
<i>Asparagus densiflorus</i> (Kunth) Jessop	Asperagaceae	Leaves, Tubers	Antidiarrhoeal potential, and antimicrobial <sup>42</sup>
<i>Baccharoides anthelmintica</i> (L.) Moench	Asteraceae	Whole Plant	Anthelmintic <sup>43</sup>
<i>Barleria cristata</i> L.	Acanthaceae	Leaves	Used traditionally in toothache, and antiinflammatory <sup>44</sup>
<i>Carissa opaca</i> Stapf ex Haines	Apocynaceae	Leaves, Roots	Antimicrobial, and antioxidant, used in jaundice, and hepatitis <sup>45</sup>
<i>Carissa spinarum</i> L.	Apocynaceae	Leaves, Fruits	Vermifuge, and antianthelmintic properties <sup>46</sup>
<i>Senna sophora</i> (L.) Roxb.	Caesalpinaceae	Seeds, Roots, Barks	Strong analgesic <sup>47</sup> , and antiasthmatic <sup>48</sup>
<i>Chenopodium album</i> L.	Amaranthaceae	Leaves, Shoots, Seeds, Flowers	Used in abdominal pains, eye disease, and throat troubles <sup>49</sup>
<i>Cissus quadrangularis</i> L.	Vitaceae	Whole Plant	Wound healing and molluscidal activity <sup>50</sup>
<i>Clerodendrum viscosum</i> Vent., nom. superfl.	Verbinaceae	Leave	Used as strong anthelmintic, antioxidant, and anti-nociceptive activities <sup>51</sup>
<i>Coccinia grandis</i> (L.) Voigt	Cucurbitaceae	Whole Plant	Antidiabetic, anti-inflammatory, and antimicrobial activities <sup>52</sup>
	Euphorbiaceae	Whole Plant	Treatment of pain, and stomach diseases <sup>53</sup>
<i>Curculigo orchioides</i> Gaertn.	Hypoxidaceae	Tubers	Piles, diarrhoea, gonorrhoea, skin diseases, impotence, jaundice, urinary disorders, and leucorrhoea <sup>54</sup>
<i>Curcuma aromatic</i> Salisb	Zingiberaceae	Rhizomes	Used in bruises, sprain, hiccough, bronchitis, cough, leukoderma and skin eruptions <sup>55</sup> , and also in wound healing <sup>56</sup>
<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	Whole Plant, Roots	Traditionally used as an agent to control diabetes in India <sup>57</sup>
<i>Cyperus rotundus</i> L.	Cypraceae	Leaves, Tubers	Antiparasitic, antipyretic, analgesic, hypolipidemic, and weight control <sup>58</sup>
<i>Desmodium triflorum</i> L.	Papilionaceae	Leaves	Antibacterial <sup>59</sup> , anticonvulsant, and antioxidant <sup>60</sup>
<i>Dolichos trilobus</i> L.	Papilionaceae	Whole Plant	Used for abortion in the first three months <sup>61</sup>
<i>Drimia indica</i> (Roxb.) Jessop	Asparagaceae	Leaves, Bulbs	Antiulcerous, antinematodal, antitumorous, and anthelmintic <sup>62</sup>
<i>Elaeodendron glaucum</i> (Rottb.) Pers.	Celastraceae	Root	Snake bite <sup>63</sup>
<i>Elephantopus scaber</i> L.	Asteraceae	Whole Plant, Root	Anti-inflammatory, wound healing and tonic <sup>64,65</sup>
<i>Eleusine indica</i> (L.) Gaertn.	Poaceae	Whole Plant	Treatment of influenza, hypertension, oliguria and urine retention <sup>66</sup>
<i>Emilia sonchifolia</i> (L.) DC. ex Wight	Asteraceae	Whole Plant, Flowers	Treating diarrhea, night blindness, and sore throat <sup>67</sup>

(contd.)



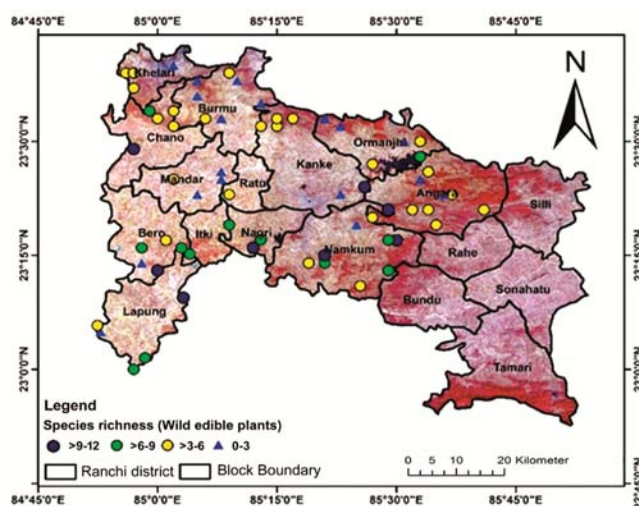
Table 2 — List of medicinal wild edibles plants (WEPs) and their uses (contd.)

Species Name	Family	Parts consumed	Medicinal properties
<i>Euphorbia hirta</i> L.	Euphorbiaceae	Whole Plant	Used traditionally for female disorders, digestive problems, and tumors <sup>68</sup>
<i>Evolvulus nummularius</i> L.	Convolvulaceae	Roots	Anthelmintic <sup>69</sup> , and wound healing <sup>70</sup>
<i>Flacourtia indica</i> (Burm. f.) Merr.	Salicaceae	Whole Plant	Antimalarial <sup>71</sup> , anti-inflammatory, and antimicrobial <sup>72</sup>
<i>Flemingia stobilifera</i> (L.) R. Br.	Papilionaceae	Tender shoots and leaves	Anthelmintic <sup>73</sup>
<i>Heliotropium indicum</i> L.	Boraginaceae	Whole Plant	Used for the treatment of ophthalmic disorders, erysipelas, and pharyngodynia <sup>74,75</sup>
<i>Hemidesmus indicus</i> R. Br.	Asclepidaceae	Root	Antidiarrheal <sup>69</sup> , and anticancerous <sup>76</sup>
<i>Holarrhena pubescens</i> Wall. ex G. Don	Apocynaceae	Bark	Used as astringent, anthelmintic, antidotalgic, stomachic, febrifuge, antidropsical, diuretic, also in piles <sup>77</sup> , as well as chronic amoebaasis, immune stimulant <sup>36</sup>
<i>Mesosphaerum suaveolens</i> (L.) Kuntze.	Lamiaceae	Leaves, Stems, Inflorescence	Used for treating boils, eczema, and diabetes mellitus <sup>78,79</sup>
<i>Ichnocarpus frutescens</i> L.	Apocynaceae	Whole Plant	Used in fever, and skin eruption <sup>80,81</sup>
<i>Ipomoea carnea</i> Forst. fil.	Convolvulaceae	Leaves, Shoots	Antibacterial <sup>82</sup>
<i>Lantana camara</i> L.	verbinaceae	Leaves	Antibacterial, anticancer, antihyperglycemic, and antioxidant <sup>83</sup>
<i>Leucostegia immersa</i> Wall. ex C. Presl	Hypodematiaceae	Whole Plant	Used in boils, antibacterial, and constipation <sup>84</sup>
<i>Lygodium japonicum</i> (Thunb.) Sw.	Lygodiaceae	Tender leaves	Antiviral, and antimicrobial <sup>85</sup>
<i>Madhuca longifolia</i> (J.Koenig ex L.) J.F. Macbr.	Sapotaceae	Flowers, Fruits	Antipyretic, hepatoprotective, anti-inflammatory, analgesic, antitumor, antiprogestational, antiestrogenic, and wound healing <sup>86</sup>
<i>Marsilea minuta</i> L.	Marsileaceae	Leaves	Antibacterial, antioxidant, neurodegenerative disorders, anticonvulsive <sup>87</sup>
<i>Meyna laxiflora</i> Robyns.	Rubiaceae	Fruits, Leaves	Antioxidant <sup>88</sup>
<i>Mimosa pudica</i> L.	Fabaceae	Whole Plant	Analgesic, anti-inflammatory <sup>89</sup> , also used in blood pressure <sup>90</sup>
<i>Murraya koenigii</i> (L.) Spreng.	Rutaceae	Leaves, Roots	Anthelmintic, and also used in blood disorders <sup>91</sup>
<i>Oldenlandia corymbosa</i> L.	Rubiaceae	Whole Plant	Used to treat skin sores, sore throat, and pelvic inflammatory diseases <sup>92</sup>
<i>Oxalis corniculata</i> L.	Oxalidaceae	Leaves	Antioxidant, anticancer, anthelmintic, anti-inflammatory, analgesic, antimicrobial, antiamoebic, antifungal, and diuretic <sup>93</sup>
<i>Panicum maximum</i> Jacq.	Poaceae	Whole Plant	Pain-killers, and antidiabetic <sup>94</sup>
<i>Peucedanium dhana</i> Ham	Apiaceae	Whole Plant	Used in stomach pain, treatment of jaundice, controlling infestation due to hook worms <sup>95</sup>
<i>Phyllanthus niruri</i> L.	Euphorbiaceae	Leaves, Fruits	Used to reduce blood sugar <sup>96</sup> , and also antimalarial <sup>97</sup>
<i>Randia aculeata</i> L.	Rubiaceae	Leaves, Roots, Seeds, Barks, Fruits	Used in diarrhea, and dysentery <sup>98</sup>
<i>Bambusa vulgaris</i> Schrad. ex J.C. Wendl., nom. cons. prop	Poaceae	Shoots	Used in epilepsy, fainting, and loss of consciousness in feverish diseases <sup>99</sup>
<i>Scoparia dulcis</i> L.	Scrophulariaceae	Roots, Stems	Analgesic, antiinflammatory <sup>100</sup> , and also used in neurotrophic activity <sup>101</sup>
<i>Senna obtusifolia</i> (L.) H.S. Irwin & Barneby	Fabaceae	Seed, leaves	Used in diarrhea, fever, and cough <sup>102</sup>
<i>Senna tora</i> (L.) Roxb.	Fabaceae	Leaves	Antioxidant, antimicrobial, antihepatotoxic, and antidiuretic <sup>103</sup>

(contd.)

Table 2 — List of medicinal wild edibles plants (WEPs) and their uses (contd.)

Species Name	Family	Parts consumed	Medicinal properties
<i>Shorea robusta</i> Gaertner f.	Dipterocarpaceae	Leaves, Flowers	Analgesic <sup>104</sup> , treatment of circulatory, digestive, endocrine, respiratory and skeletal systems as well as in infectious diseases <sup>105</sup>
<i>Sida cordifolia</i> L.	Malvaceae	Leaves	Used as antirheumatic, analgesic, antipyretic, antiasthmatic, nasal anticongestant, antiviral, laxative, diuretic, aphrodisiac, hypoglycemic <sup>106</sup>
<i>Sida rhombifolia</i> L.	Malvaceae	Leaves	Antiinflammatory <sup>107</sup>
<i>Smilax zeylanica</i> L.	Acanthaceae	Leaves	Used in dysentery <sup>108</sup> , and skin diseases <sup>109</sup>
<i>Spermacoce articularis</i> L.f.	Rubiaceae	Leaves, Seeds	Antifungal and antimicrobial <sup>110</sup>
<i>Spermacoce hispida</i> L.	Rubiaceae	Whole Plant	Antihyperlipidaemic <sup>111</sup>
<i>Spermacoce ocyroides</i> Burm.f.	Rubiaceae	Whole Plant	Used against hookworm and ringworm <sup>112</sup>
<i>Swertia chirayta</i> (Roxb.) Karst.	Gentianaceae	Whole Plant	Mitigate inflammation, relaxing to the pregnant uterus, and never ending fevers <sup>98</sup>
<i>Thespesia lampas</i> (Cav.) Dalzell & A. Gibson	Malvaceae	Whole Plant	Antidiabetic <sup>113</sup>
<i>Tinospora cordifolia</i> (Willd.)	Menispermaceae	Whole Plant	Anticancerous <sup>114,115</sup>
<i>Urena lobata</i> L.	Malvaceae	Fruits, Seed	Antimicrobial, and antioxidant <sup>116</sup>
<i>Ventilago maderaspatana</i> Gaertn.	Rhamnaceae	Root	Antidiabetic, antihyperlipidaemic, and antioxidant <sup>117,118</sup>
<i>Vitis repanda</i> (Vahl.) Wight & Arn.	Vitaceae	Fruits, Leaves	Used in pains in joints, swelling of the testicle, and piles <sup>119</sup>
<i>Wendlandia heynei</i> (Schult.) Santapau & Merchant	Rubiaceae	Flowers, Barks, Twigs	Twigs recommended to clean teeth, the flower is used for miscarriage <sup>120</sup>
<i>Woodfordia fruticosa</i> (L.) Kurz	Lythraceae	Leaves, Fruits	Leprosy, toothache, leucorrhoea, fever, dysentery, and bowel disease <sup>121</sup>

Fig. 5 — Species richness of WEPs in studied *Sal* forests of Ranchi

L., *M. minuta* and *Amaranthus spinosus* L. are quite popular and eaten by all the tribes during the rainy season. During *rabi* season, *C. album*, *C. rotundus*, *Rumex maritimus*, *Geastrum saccatum* Fr. 1829 and *Emilia sonchifolia* (L.) DC. ex Wight, etc. used to be quite dominant and collected by tribes as per their

availability. Besides, few species, viz., *Centella asiatica* L., *Limnophila conferta* Benth, *C. dactylon*, *O. corniculata* and *Euphorbia hirta* L. are available throughout the year. *C. asiatica*, *E. granulata* Forssk., *Limnophila conferta* Benth. and *M. minuta* are commonly found in marshy and damp areas. Some common edible plants frequently used by local people of Jharkhand are shown in Fig. 6. The common threats to the WEPs recorded in the present study are overharvesting by local tribal for vegetable, medicine, and to sell in the local market, recurrent to occasional grazing (almost in all study site and cow, goat, buffalo and sheep are the common grazers), occasional fire (both natural and manmade), and rock mining (in some places), forage and fuelwood collection as well as insect herbivory. Fuelwood collection is one of the major threat for seedling and saplings survival of trees<sup>30</sup> and also for the existence of WEPs in natural forests of Jharkhand. 57% households use fuelwood for cooking and heating purposes in Jharkhand and it ranks 11<sup>th</sup> in terms of fuelwood use<sup>31</sup>. The livelihood dependency on forests of fully and partially dependent communities differ in various regions and it should be taken into consideration in designing the forests



Fig. 6 — Some important wild edible vegetables of *Sal* forests of Ranchi, Jharkhand (a) *Senna obtusifolia* (L.) H.S. Irwin & Barneby (b) *Amaranthus viridis* L. (c) *Senna sophora* L. Roxb. (d) *Chenopodium album* L. (e) *Alternanthera paronychioides* A. St.-Hil. (f) *Murraya koenigii* (L.) Spreng

conservation and management plans<sup>32</sup>. The exploration of novel, high quality, inexpensive sources of food has always remained a chief concern of all agencies involved in providing passable food and improving the nutritional eminence of the population. In this context, these indigenous, cost-effective, nutritious foods of tribal will play a vital role in food and nutritional security of the nation, as their economic value is beyond dispute. Communities' involvement and participation in the management of forests and delegation of power through access and ownership rights ensures greater security and improved forest management and conservation<sup>32</sup>. Forests and forests dwellers used to have an intrinsic relationship as they used to get most of their sustenance needs including foods, fuels, construction materials, medicines and recreational, social, religious and cultural identity from the forests. There is a mutualistic relationship between the forests and the forest dwellers that ensured the fulfilment of their daily needs, and in return the protection of forests and environment as a whole<sup>33</sup>.

### Conclusions

Forests play an important role in the livelihoods of local tribal people through enormous goods (WEPs in terms of fruits, vegetables, medicines, etc.) and services (regulating, provisioning, social, and

economic). The present study has recorded a great diversity of WEPs (73 different species) in the 13 different blocks of Ranchi. The diversity of WEPs in Jharkhand is depleting due to overexploitation and unsustainable harvesting of foods, medicines, as well as due to various other biotic interferences including grazing, herbivory and anthropogenic fire mainly for the collection of flowers of *M. longifolia* during summers (March to May) for the preparation of traditional alcoholic beverages. Therefore, there is an urgent need to conserve these valuable WEPs and use it in a sustainable manner to ensure future demand. On the one hand, this information could help the policy makers to promote these local plants, aiming at improved food and nutrition security. Besides, further research is also warrant to explore the therapeutic potentials as well the nutritive values of WEPs, so that, it can give a scientific basis for the further development of herbal drugs and traditional foods.

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