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NUTRITIONAL AND MEDICINAL VALUES OF SELECTED WILD CUCURBITS AVAILABLE IN SIMILIPAL BIOSPHERE RESERVE FOREST, ODISHA

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Keyword

Cucurbitaceae, Similipal Biosphere Reserve, Diversity

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ABSTRACT: Cucurbitaceae commonly known as "Guard family" is distributed throughout India. Most of them, are perennial climbers with attractive flowers. The family includes plants having food as well as medicinal values. The species of the family are collectively known as cucurbits. They grow wild as well as cultivated throughout the state in Odisha in general and Similipal Biosphere Reserve (SBR) forest and its adjoining areas in particular. The major cucurbits available in SBR and its adjoining areas are *Coccinia grandis* L., *Cucumis melo* L., *Lufa acutangula* (L.) Roxb., *Luffa cylindrica* (L.) Roem., *Solena amplexicaulis* Lam., *Mukia madraspatana* (L.) Roem., *Trichosanthus cucumerina* L., *Trichosanthus tricuspidata* Lour. and *Diplocyclos palmatus* (L.) Jeffrey. The food values of some of these cucurbits have been assessed. Phytochemical analysis and antibacterial activity of the plant parts have shown potent medicinal values. Present paper highlights the diversity of wild cucurbits (WC) at SBR along with their nutritional and medicinal importance.

INTRODUCTION: Forests play a major and indispensable role in improving the food security of rural and tribal people. Wild edible plants are important in the livelihood strategies of forests dwellers[1, 2]. India has 42 millions of tribal population [3] of which about 60 percent live in forest areas and depend upon edible forest product [4, 5] for their food. In many situations, wild foods are not directly staples. They provide nutritionally valuable supplements in the form of ingredients, vegetables and beverages. In Odisha, particularly at SBR, there are many wild food plants available on which the tribal and rural people are dependent upon and many of them are cucurbits.

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The major WC are *Coccinia grandis* L., *Cucumis melo* L., *Cucumis hardwickii* Royle., *Diplocyclos palmatus* (L.) Jeffrey., *Luffa acutangula* (L.) Roxb., *Luffa cylindrical auct.non* (L.) Roem. *Momordica charantia* L., *Momordica dioica* Roxb. ex Willd., *Mukia maderaspatana* (L.) Roem. *Solena amplexicaulis* Lam., *Trichosanthes cucumerina* L., *Trichosanthes tricuspidata* Lour. *and Zehneria maysorensis* Wight & Arn. Among them *Coccinia grandis* L., *Cucumis melo* L., *Luffa acutangula* (L.) Roxb., *Luffa cylindrica auct.non* (L.) Roem. *Momordica charantia* L., *Momordica dioica* Roxb. ex Willd. and *Solena amplexicaulis* Lam. are edible, *Trichosanthus tricuspidata* and *Diplocyclos palmatus* are used for medicinal purposes.

They are mostly herbs, and rarely shrubs, prostrate or climbing by means of tendrils. Leaves are alternate exstipulate, simple, palmately lobed or pedately divided, rarely pinnately lobed or pinnately compound, palminerved; lamina variable

in the same species or even in the same plant. Tendrils mostly present, solitary, lateral, simple or divided. Inflorescence axillary, racemose, umbellate or solitary, clustered or paniculate. Flowers small or large and 5-merous. Fruits usually a fleshy berry. Seeds usually many in pulp [6, 7]

Knowledge on non-domesticated cucurbits in this region is part of traditional, unstated ecological knowledge, and is largely transmitted through social, cultural and household activities. The contribution of WC to the food security of these people can be categorized as follows: (a) providing a supplementary source of food (b) used as seasonal food, and (c) as emergency food supplies during food crisis. Many wild cucurbits available in SBR region are believed to posses edible and medicinal values are not domesticated yet. So, there is an urgent need to explore, analyze and document the WC available and consumed by the rural and tribal communities of SBR and its adjoining areas. Hence an attempt has been made to document the major wild cucurbits available in SBR and evaluate their nutritional and medicinal importance.

METHODOLOGY

Study Area: The study was conducted during 2011 to 2012 in Simlipal Biosphere Reserve Forest (SBR) and its adjoining areas of Mayurbhanj districts of Odisha. SBR is located in the centre part of the district, close to the interstate boundary with West Bengal in the North-East and Jharkhand in the North-West. It contains three protected habitats within its precincts, namely Simlipal Tiger Reserve, Sanctuary and National Park.

The SBR is having a compact mass of natural forests spreading over an area of 5,569 sq. km lying between 21º 10' to 22° 12' N and 85° 58' to 86° 42' E, ranging elevation between 300 m to 1,180 m above sea level with numerous rolling hills with semi-evergreen forest, moist deciduous forest, dry deciduous hill forest, Sal forest, grass land and savanna. The core area occupies 845 sq km, which is intensively protected and absolutely undisturbed, secured legally and managed scientifically.

The core area includes Simlipal Tiger Reserve and Simlipal National Park. No biotic interference is permitted in the 2,129 sq. km buffer zone [8, 9] that surrounds the core [10] zone. The core and buffer zones of the Biosphere Reserve are under the administrative control of the three forest divisions: Karanjia, Baripada and Rairangpur .

There are four villages inside the core area having innate beauty of Sal (*Shorea robusta*) forest and rich biodiversity of flora and fauna. The climate of the SBR is warm and humid. Three distinct seasons are felt during the year, such as rainy season (mid June till October), winter (mid October to February) and summer (March to mid June). The annual rainfall varies from 1200 mm to 2000 mm and the temperature ranges about from 9.8° to 41.5°C.

The southern and western regions are cooler and northern and eastern regions are warmer. Periodic earth tremors, thunder storms with rains and dust storms are felt in late May and early June. The dominant tribes in the district are Kharia, Mankidia, Santhal, Kol, Bhumija, Bhuyan, Mahalis, Sounti and Saharas. Some of the tribes namely Kharia and Mankidia are still in the primitive state of living. These tribes till today depend upon the wild foods[11, 12, 13] available in the forest zones.

Enumeration of selected WC: The enumeration of WC available in SBR and their taxonomic characterization was done by Prakash Kumar Tripathy and Sanjeet Kumar using Flora's Book[6, 7].

Ethnobotanical survey: A field survey was carried out from 2010 to 2013 in different seasons in SBR [14] and its adjoining areas. The information on WC used as food and as traditional medicine against different diseases and disorders were collected through questioners with different tribal communities of SBR. The claims were confirmed by cross check with informants. The identification of plants was done by Sanjeet Kumar following Flora's book [6, 7].

Collection of plant materials: The plant materials for assessment of food values, detection of bioactive compounds and evaluation of antibacterial activity, were collected from Kalyani, Kalikaparsad, Padampur, Angarpada and Gurguria villages of SBR. Collected plant materials were washed thoroughly by tap water followed by

distilled water twice and, were air dried. The dried materials were crushed to powder with mechinal device and were kept it in air tight container for phytochemical and antibacterial activity. Nutritional analysis [15] was done using raw materials.

Preparation of Plant extracts: Solvent extract was prepared using percolation method [15] from 5 gm of leaf powder which was macerated in solvent (50 ml) for 12 h in refrigerator. After 12 h the sample was filtered and residue was again macerated in same solvent. For each solvent process was repeated thrice. Aqueous extract was prepared separately by taking the powder in distilled water followed by filtration. Filtrate were dried and concentrated to get semisolid mass.

Phytochemical assays [16, 17, 18, 19, 20] .

Test for Tannin: 0.7 ml of the extracts was dissolved in 50ml of distilled water and was heated for 10 minutes. After cooling few drops of 1% ferric chloride was added. Colour of sample changed from yellow to green and dark green precipitate was observed.

Test for Saponin: 5 ml of extract was dried and to it, 1ml of Ethyl acetate was added and filtered. The residue was collected and distilled water was added. The mixture was shaken vigorously and observed for persistent foam which lasted for at least 15 minutes.

Test for Flavonoids: 0.5 ml leaf extract was taken in a flask and dissolved in 10% NaOH. Few drops of HCl was added. Yellow colour turned to colourless.

Test for Terpenoid: 1 ml of extract was mixed with 1 ml of chloroform. Then to the mixture 0.5 ml of sulphuric acid was added. A reddish brown interface indicates presence of terpenoids.

Test for Alkaloids: 1 ml of extract was taken and few drops of Dragendorff's reagent wasadded. Occurrence of orange-red precipitate indicates the presence of alkaloids.

Test for Phenolic compounds: 0.5 ml of extract was treated with 3-4 drops of ferric chloride solution. Formation of bluish black colour indicated the presence of phenolic compounds.

Test for Steroids: In 0.5 gm of extract, 2 ml of chloroform was added. The solution was cooled well in ice followed by the addition of 1 ml conc. H_2SO_4 carefully. Development of red and green layers indicated the presence of a steroidal ring.

Antimicrobial activity: The aqueous extracts of selected WC were screened for antibacterial activity against a Gram positive bacteria *Streptococcus pyogenes* (MTCC 1926). Antimicrobial activity was done using Agar Well Diffusion assay adopted from Allen *et al.,* (1991) [21] with slight modification. Wells (6 mm) were made using sterile borer.

Stock solutions of samples were prepared in 100 % DMSO (Sigma) and twofold serial dilutions were made in amount of 100 µl per well ranged from 0.5 mg / ml. 100 µl of samples were added by sterile syringes into the wells and allowed to diffuse at room temperature for 2 h. Plates were incubated at 35 ± 2°C for 18-24 h. Kanamycin served as standard control. Triplicates were maintained and the experiment was repeated thrice. For each replicates the readings (diameter of zone of inhibition in mm) were taken and the mean values were recorded.

Media used: Nutrient broth was used to maintain broth cultures. The constituents of the nutrient broth included 0.5 g NaCl, 0.5 g peptone and 0.3 g beef extract per 100 ml. An additional 1.5 g of agar was added to make the nutrient agar medium.

RESULTS AND DISCUSSION:

Field survey indicated the rich diversity of WC at SBR. Some of the species studied are enumerated below.

Enumeration of WC at SBR [6, 7]

Trichosanthus tricuspidata Lour.: It is a large climber having attractive fruits like red bulb along bright white flowers. Stem is suffruticose, branches long pendent. Leaves are broadly ovate, simple or deeply palmately 3-5 lobed, cordate, denticulate, with large green glands near base, upper surface smooth and bright green when fresh but very scabrous when old, lower surface paler with

cystoliths on the nerves when dry. Flowers- white and dioecious. Fruit- brightscarlet, globose, on axillary short stout peduncle. Seeds embedded in dark green pulp, oblong, flattened, slightly narrowed at base.

***Trichosanthus cucumerina* L.:** It is a climber having tri-branched tendrils along beautiful white flowers. Stems often angled. Leaves long-petioled, orbicular-reniform or broadly ovate, or lobed, deeply cordate, denticulate from the mucronate nerve endings. Leaves are also pubescent or somewhat scabrous beneath, puberulous above. Flowers monoecious, male and female arising from the same axil. Fruits spindle-shaped rostate, green with white strips when young and red without strips when ripen.

***Solena amplexicaulis* Lam.:** It is a forest cucurbit, usually found on the foot hills at SBR. It is prostrate or climbing herb. Stem is angled and smooth. Leaves are polymorphic, ovate, lobed, cordate, hastate at base. Tendrils simple. Flowers white. Fruits are ellipsoid with red pulp. Seeds slightly compressed and white. Roots are in tuberous form.

***Mukia maderaspatana* (L.) Roem.:** It is soft spiny, branched and monoceious cucurbit with red ripen berry in groups of three fruits. It as scarbous climbing herb. Leaves are ovate or deltoid, angular and acute. Flowers are yellow and small. Fruits are scarlet, globose, green when young and turned red when ripen.

***Momordica dioica* Roxb. ex Willd.:** It is a slender, nearly glabrous climber. Stem is angular. Leaves are simple or lobed, ovate, deeply cordate and often sinuately denticulate. Flowers are solitary, yellow and dioecious. Fruits are ellipsoid, ovoid and covered with soft fleshy spines. Seeds are ellipsoid and closely inverted with an aril-like integument.

***Momordica charantia* L.:** It is monaecious, softly hairy climbing annual herb. Leaves are lobed, 3-7foliate with entire margin. Tendrils are simple. Flowers are yellow. Fruits ovoid or fusiform with tapering end. Fruits green when young and gradually turn to yellow when ripen and finally turn to red. Seeds are compressed, ovate, sculptured on surfaces.

***Luffa cylindrica* auct. non (L.) Roem.:** It is a weed in SBR. It is big climber having angular glabrous stem. Leaves are orbicular to hastate-acuminate. Flowers are yellow. Male and female flowers borne in the same axils. Fruits are cylindric and not angled but often with darker coloured stripes. Seeds grey-black with smooth surfaces.

***Luffa acutangula* (L.) Roxb.:** It is annual, climber having angular stem. Leaves are lobed-angled and deeply cordate. Tendrils are trifid and subhispid. Flowers are yellow. Male and female are in same axils. Fruits are clavate-oblong with 10 angled and apex obtuse. Seeds black, ovate, compressed and 9-10 mm long.

***Diplocyclos palmatus* (L.) Jeffrey.:** It is a climbing herb with smooth stem. Leaves are orbicular ovate, deeply lobed slightly scarbid above and almost smooth beneath. Leaf margin is minutely denticulate. Flowers are small, yellowish and both clustered in the same axils. Fruits globose, smooth and green with white strips and turn to red with stripes when ripen. Seeds are embedded in blue green pulp. They are pyriform, surrounded by a thick ring on either side which project like "Shivaling", so it is locally known as "Shivilingi".

***Cucumis melo* L.:** It is a prostrate procumbent annual herb. Stem is thickened towards the base, scabrid and hispid with hairs. Leaves are orbicular, ovate with shallow rounded sub-angular lobes. Leaf margins are denticulate. Flowers are yellow and both present in the same plant. Fruits are spherical, ovoid obtuse at ends. Fruits appear as green striped and turns to yellow when ripen.

***Coccinia grandis* (L.) voigt.:** It is a climbing herb having attractive white flower. It is a common weed in SBR. Stem angular and glabrous. Leaves are ovate, entric and lobed. Frequently several large circular glistening glands are seen near the base. Tendrils are simple. Fruits are oblong and narrowed apically. It is green when young and turn red when ripen. Seeds are oblong and compressed.

The nutritional values of selected WC are evaluated and results revealed that fruits of *Momordica charantia* showed high concentration of carbohydrate (33.73 %), protein (21.10 %) and lipid (6.05 %). Fiber content was high in fruits of

Luffa acutangula (5.7 %) followed by *Momordica dioica*(3.65 %), *Momordica charantia*(3.6 %), *Luffa cylindrica* (3.1 %) and *Coccinia grandis* (1.8 %). Fiber is very useful against constipation [22], so in this context, these WC are very effective for the health of rural and tribal communities of SBR.

PLATE 1: (A) FRUITS OF *TRICOSANTHUS CUCUMERINA*, (B) *DIPLOCYCLOS PALMATUS* AND (C) *CUCUMIS MELO*

FIG 1: ETHNOBTANICAL COLLECTION OF *DIPLOCYCLOS PALMATUS* FROM TRIBAL COMMUNITY AT KALYANI AND SANUSKI VILLAGES OF SBR

Carbohydrate is the source of energy, therefore the fruits of *Momordica charantia* as WC and other WC might play good role in providing energy as content high carbohydrate values of these WC available in SBR. Protein is known as body building bio-molecules, so the fruits of *Momordica charantia* and other WCs are very effective as they posses good amount of protein. Field survey and results of questionnaire with ruraland tribal communities of SBR and adjoining areas indicated the sound ethnobotanical uses of WC available in study areas. Fruits of *Cucumis melo* is used against teeth decay; seeds of *Diplocylos palmatus* used to reduce joint pain. Tiku Mankardia (Primitive Tribal group) of Durdura village claimed that root juice of *Trichosanthus tricuspidata is* ood in reducing blood sugar. Fruits of *Luffa acutangula* used in indigestion and fruits of *Momordica charantia* is taken to reduce blood sugar. The qualitative analysis of bioactive compounds of the WC in aqueous extract was studied and found excellent results. The study revealed that the WC are rich in bioactive compounds. Tannin, saponin, phenolic compounds and glycosides were present in aqueous extract of *Coccinia grandis* fruit.

Tannin and saponin were present in aqueous extract of *Luffa cylindrica* fruit. Steriods, tannin and flavonoids present in aqueous extract of *Luffa*

acutangula. Glycosides, tannin and phenolic compounds were present in aqueous extract of *Diplocyclos palmatus* seeds. Glycosides and saponin were present in aqueous extract of *Trichosanthus tricuspidata* root.

FIG 2: COLLECTION OF LEAVES AND FRUITS OF *TRICHOSANTHUS TRICUSPIDATA* AND *DIPLOCYCLOS PALMATUS* FOR EXPERIMENTAL WORK

PLATE 2: FRUITS OF (D) *LUFFA CYLLINDRICA*, (E) *COCCINIA GRANDIS* AND (F) *MOMORDICA CHARANTIA*

TABLE 1: APPROXIMATE ANALYSIS OF NUTRITIONAL VALUES OF SELECTED WC OF SBR

Botanical name	Plant parts	Fiber	Carbohydrate	Protein	Lipid
Coccinia grandis	Fruits	1.85 ± 0.07	4.42 ± 0.23	1.26 ± 0.04	0.11 ± 0.01
Luffa cylindrical	Fruits	3.15 ± 0.07	10. 27 ± 0.74	1.82 ± 0.11	0.22 ± 0.02
Luffa acutangula	Fruits	5.7 ± 0.28	5.10 ± 0.14	1.37 ± 0.53	0.15 ± 0.01
Momordica charantia	Fruits	3.6 ± 0.56	33.73 ± 0.70	21.10 ± 0.14	6.05 ± 0.07
Momordica dioica	Fruits	3.65 ± 0.35	14.20 ± 0.28	3.42 ± 0.03	4.67 ± 0.03

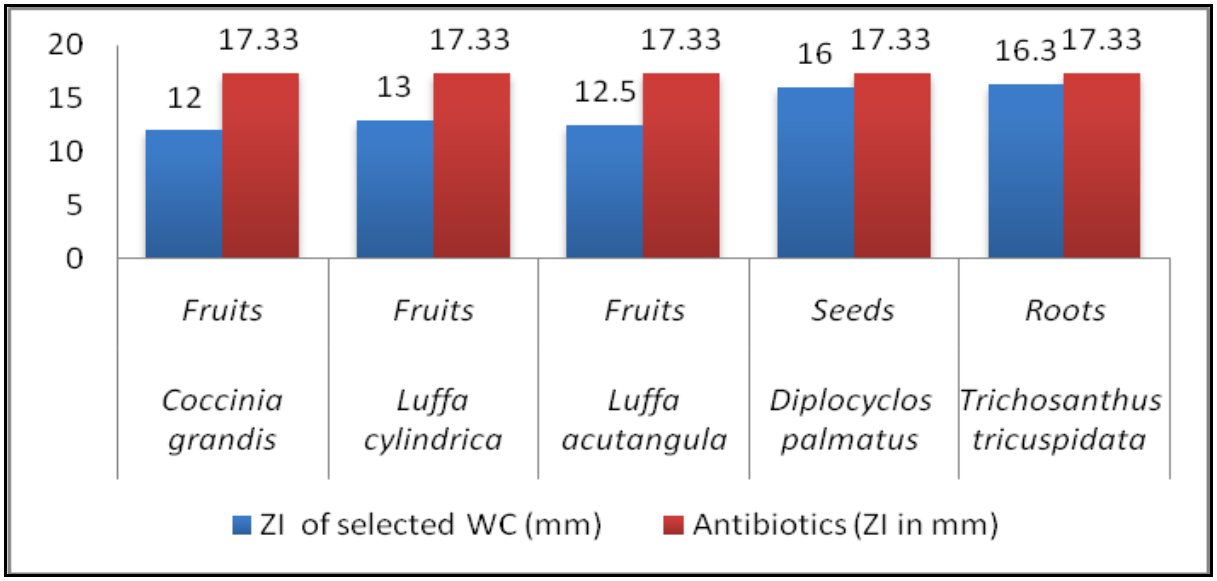
(n=4, mean± SD)

TABLE 2: ETHNOBOTANICAL DATA OF SELECTED WC OF SBR

Botanical name	Local name(s)	Plant part(s) used	Informant(s)	Collection site(s)	Use(s)
Cucumis melo	Bhui dimbu	Fruits	Ram Ho	Padampur	Fruits paste is used to cure teeth decay.
Diplocyclos palmatus	Shivalingi	Seeds	Gulia Ho	Angarpada	Seeds paste is applied to reduce joint pain.
Trichosanthus tricuspidata	Mahakaal	Roots	Tiku Mankardia	Durdura	Roots juice is used to reduce blood sugar.
Luffa acutangula	Pito torai	Fruits	Adan Marandi	Kendumundi	Fruits are used as vegetables to cure indigestion and stomach pain.
Momordica charinta	Kolera	Fruits	Dasharathi Majhi	Kalikaparsad	Fruits are boiled and eaten as vegetables to reduce blood sugar.

TABLE 3: QUALITATIVE SCREENING OF BIOACTIVE COMPOUNDS IN AQUEOUS EXTRACT OF SELECTED WC OF SBR

Botanical name	Plant parts	Extracts	Bioactive compounds detected
Coccinia grandis	Fruits	Aqueous	Tannin, Saponin, Phenolic compounds, Glycosides
Luffa cylindrical	Fruits	Aqueous	Tannin, Saponin
Luffa acutangula	Fruits	Aqueous	Steriods, Tannin, Flavonoids
Diplocyclos palmatus	Seeds	Aqueous	Glycosides, Tannin, Phenolic compounds
Trichosanthus tricuspidata	Roots	Aqueous	Glycosides, Saponin



(ZI: Zone of Inhibition; Antibiotics: Kanamycin)

FIG 3: ANTIMICROBIAL ACTIVITY OF AQUEOUS EXTRACT OF SELECTED WC OF SBR AGAINST *STREPTOCOCCUS PYOGENES*

Tannin is responsible for anti-microbial activity [23], therefore fruits of *Coccinia grandis*, fruits of *Luffa cylindrica*, fruits of *Luffa acutungula* and seeds of *Diplocyclos palmatus* posses anti-bacterial activity as tannin present in aqueous extract of all above used plant parts. Flavonoids and phenolic compounds have antioxidant activity [24, 25] so the fruits of *Coccinia grandis*, fruits of *Luffa acutangula* and seeds of *Diplocylos palmatus* might be posses the anti-cancer activity as present of flavonoids. Flavonoids are known to have anti-fungal [26] activities. Saponin is very good against skin infections and showed anti-fungal activity, therefore fruits of *Coccinia grandis*, fruits of *Luffa cylindrica* and roots of *Trichosanthus tricuspidata* might be posses anti-fungal activity and their extract might be good to cure skin infections.

Glycosides were present in aqueous extract of *Coccinia grandis* fruits; aqueous extract of *Diplocyclos palmates* seeds and aqueous extract of *Trichosanthus tricuspidata* roots, which is effective for heart problems [27]. The antibacterial activity of aqueous extract of selected WC showed excellent zone of inhibition (in mm) compared with a standard antibiotic Kanamycin. The aqueous extract of *Trichosanthus tricuspidata* root showed highest (16.3 mm) zone of inhibition followed by the aqueous extract of *Diplocyclos palmatus* seeds (16.00 mm), aqueous extract of *Luffa acutangala* fruits (12.50 mm), aqueous extract of *Luffa culindrica* fruits (13.00 mm) and aqueous extract of *Coccinia grandis* fruits (12.00 mm) against *Streptococcus pyogenes* (MTCC 1926).

Antibacterial activity revealed the potent pharmacological values of WC available at SBR. The above observations support the presence of bioactive compounds in WC and justify the usefulness of these WC in the treatment of various diseases as in practice by the rural and tribal people of these localities. Further work can be carried out to evaluate the specific bioactive compounds using modern techniques against specific pathogens and

successful use of these compounds to preparation in future medicines.

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