

Full Length Research Paper

Study of floral diversity from rural pockets of Odisha, India: Plants for fun and games

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In earlier days, children used to play in outdoors with plant parts and their products for fun making and games. However with modernity and advancement in science and technology, this indigenous knowledge is vanishing day by day. There is no scientific documentation of plants being used for fun and games by children. The present study carried out in different tribal and non-tribal village schools of Koraput and Khordha districts of Odisha, India in a systematic manner documented 90 plant species distributed in 85 genera spread over 44 families. The plant species recorded include 35 trees, 21 shrubs, 24 herbs and 10 climbers/creepers. The plants widely used as play material include *Artocarpus heterophyllus*, *Dendrocalamus strictus*, *Cocos nucifera*, *Calotropis gigantea*, *Ficus benghalensis*, *Mangifera indica*, *Musa paradisiaca*, *Phoenix sylvestris*, *Tamarindus indica*, etc. The different plant parts such as leaves, fruits, flowers, seeds etc. and their mode of use by the participating respondents have been recorded and discussed. It was noted that the most and frequently used plant parts as the source of play were fruits followed by leaves, flowers, and seeds. The economic importance of plants, besides their implications in teaching and learning along with their sustainable utilization and conservation is discussed.

Keywords: Plant biodiversity, conservation, fun, modernity, advancement, technology, utilization.

INTRODUCTION

The environment is the sum total of all components and factors that influence the life of an organism including human being from birth to death. One of the major concerns of the environment today is the loss of biodiversity that includes varieties of plants, animals, and microorganisms that exist on the surface of planet Earth (Baliga, 1996; Satapathy, 2007).

This rich biodiversity of life has ever been instrumental

in providing humanity with food security (Swaminathan and Bhavani, 2013), shelter, health care, and to certain extent, industrial goods and livelihood leading to improvement in people's standard of living in the modern world. Further, biodiversity has played a unique role in the evolution and differentiation of various species. It sustains the system we live in and forms a part of our daily lives and livelihood and constitutes resources upon

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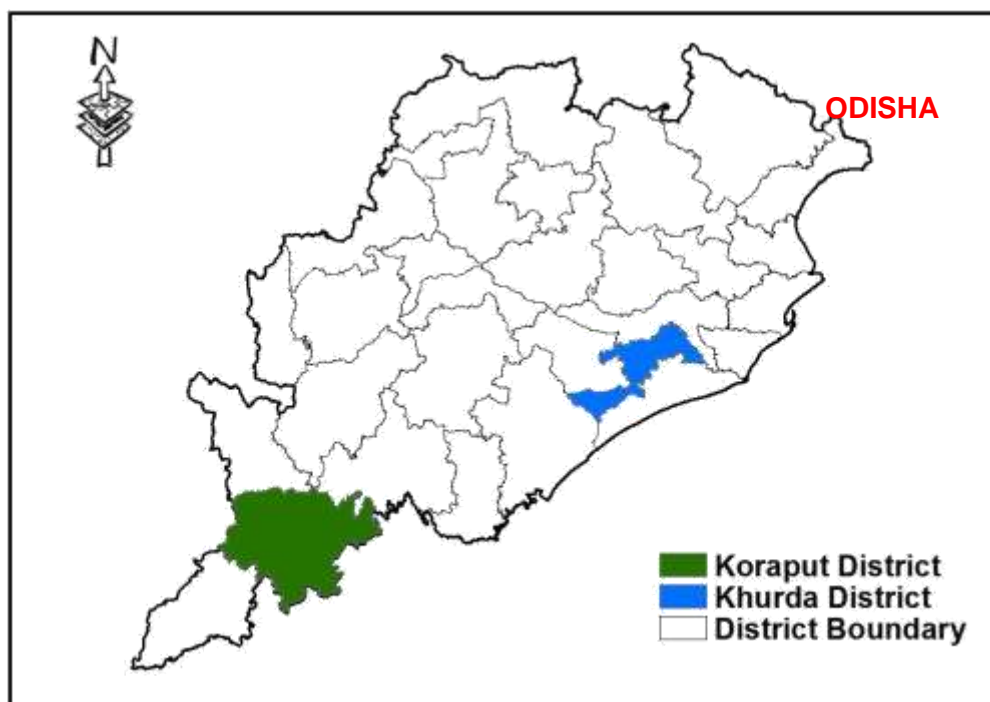


Figure 1. Map of Study site (Koraput and Khordha district Odisha, India).

which families, communities, nations and future generations do depend (Chavan et al., 2016). Worldwide, ten thousand species of higher plants and several hundred lower plants are currently used by human beings for a wide variety of purposes such as, household items, rituals, food, fuel, fiber, medicines, oil, spices, and as forage and fodder of domesticated animals (Haywood, 1992).

Trees are the symbol of environmental as well as socio-economic sustainability of the globe (Chavan, 2016). Traditionally, trees are being used for the interdependent benefit of 6Fs: food, fruit, fodder, fuel, fertilizer and fibre. The multivarious benefits and services generated from tree-based systems have helped to improve the livelihood of people globally, directly or indirectly. As such it sustains the lives we lead and the societies we form (Dutta, 2007; Silver, 1991).

Many investigations have been carried out pertaining to the economic and socio-cultural values (Khoshoo, 1994) of plant diversity such as food resources (Mohanty et al., 2013; Rout et al., 2007), source of medicines (Subudhi, 1992; Pattanaik, 2008; Panda, 2010; Kumar and Satapathy, 2011; Mohanty et al., 2015), sustaining livelihood (Chavan, 2016), rituals (Mohanty et al., 2011), and cultural functions.

However, no study has been made to understand their educational importance in terms of plants being used for fun and games. Under this background, the present study

has been carried out with the following objectives: i) to identify and document plant species used for fun and games from local biodiversity; ii) to know the plant part being used and the nature of its use; iii) to find out the economic value, if any of the plants identified.

MATERIALS AND METHODS

The present study was carried out in two districts, Koraput and Khordha of the State of Odisha. Koraput is located (18°13' to 19°10' N, 82°5' to 83°23' E) in the Southern part of Odisha, which is mostly tribal dominated with low literacy rate. Khordha district stands (19°40' to 20°25' N, 84°40' to 86°5' E) in the eastern part of the state and mostly influenced by modernity (Figure1). Twenty elementary and secondary schools were selected from each district for the present study. Ethnobotanical information of plants used for games, fun, and play was gathered through survey, structured oral interviews and informal conversation with school children, teachers, and local people (Huntington, 2000; Mohanty, 2011). The information included the local name of the plant, plant part, nature of its use, habitat of the plant etc. All the gathered information was cross checked with students and parents of the nearby schools. Besides fun and games, other economic and medicinal values of the plants, if any, were also recorded from the students, parents, and teachers. Ethnographic qualitative methods were used to summarize the major themes and categories of information collected from the respondents.

The plants along with their part(s) were collected and brought to the Department of Botany, Regional Institute of Education (NCERT), Bhubaneswar for identification. The plants were identified (Table 1) following the Flora of Odisha (Saxena and Brahman,

Table 1. List of Plants with their families and common names used for Fun and Games.

S/N	Name of the plant	Family	Common Name	Hindi Name	Part(s) used as play material	Mode of use
1	<i>Abelmoschus esculentus</i> L. Moench	Malvaceae	Lady's finger	Bhindi	Fruit Stalk	Used to make horns
2	<i>Abrus pricatorius</i> L.	Fabaceae	Indian liquorice	Ratti/Gunchi	Seed	Used for making necklace
3	<i>Abutilon indicum</i> (L.)	Malvaceae	Country Mallow	Kanghi	Fruit	Used for games and joy by joining two fruits
4	<i>Acalypha hispida</i> Burm.f.	Euphorbiaceae	Red hot cat's tail		Flower	Used to make tails while playing different games.
5	<i>Achyranthes aspera</i> L.	Amaranthaceae	Prickly chaff flower	Chirchita	Leaf	Leaf is used as crackers
6	<i>Adenanthera pavonina</i> L.	Mimosaceae	Red Lucky Seed	Badigumchi	Seed	Used to make necklace/bracelets as it is deep red in colour
7	<i>Aegle marmelos</i> L. Correa	Rutaceae	Wood apple	Bel	Fruit	Used as short foot for throwing
8	<i>Aeschynomene aspera</i> L.	Fabaceae	Sola, pith plant	Sola	Stem	Used to make boats and other craft items for playing as the it is the lightest wood among all the plants
9	<i>Albizia saman</i> (Jacq.) Merr.	Fabaceae	Rain Tree	GulabiSiris	Sirisa	Used as money (coins) while playing
10	<i>Allium cepa</i> L.	Amaryllidaceae	Onion	Pyaz	Leaf	Used as straw to suck juice/water
11	<i>Areca catechu</i> L.	Arecaceae	Areca palm	Supari	Fruits, leaves	Fruit is used as ball and leaf branch used as lorry carrier
12	<i>Aristida</i> spp.	Poaceae			flower	Flowers stalk is used for making toy like snake.
13	<i>Artocarpus heterophyllus</i> Lam.	Moraceae	Jack fruit	Katahal	Leaves & fruits	Leaves are use for making utencils, whistles, tiaras and fruits are used for making toys like cow, horse etc.
14	<i>Azadirachta indica</i> A. Juss.	Meliaceae	Neem	Neem	Fruit, stem	Fruit used as marbles and stem used to make bows and arrows.
16	<i>Barleria prionitis</i> L.	Acanthaceae	Percupine Flower (Daskarenta/	Jhinti (H)	Fruits	Used as crackers by putting it into water
17	<i>Basella alba</i> L.	Chenopodiaceae	Vine spinach	Poi	Fruit	Used for coloration of hand
18	<i>Bauhinia purpurea</i> L.	Caesalpiniaceae	Butterfly tree	Khairwal	Leaf	Used to make container in different games
19	<i>Bixa orellana</i> L.	Bixaceae	Annatto	Latkan/Kumkum	Seeds	Seeds are used as colouration of palm and foots
20	<i>Bombax ceiba</i> L.	Bombacaceae	Red silk cotton	Shalmali	Stem	Used for making wheels and toys
21	<i>Borassus flabellier</i> L.	Araceae	Palm	Taad	Fruit, leaf, stem	fruit used for making wheel, leaves for making watch, stem for making bat
22	<i>Bryophyllum pinnatum</i> (Lam.) Oken	Crassulaceae	Miracle leaf	Zakhm-haiyal	Leaf	Used for cleaning slates

Table 1. Contd.

23	<i>Butea monosperma</i> (Lam.) Taub	Fabaceae	Bastard teak	Palash	Leaves, flower	Leaves used for making utensils (plates, bow) and flowers used for making coloured water (especially in holy)
24	<i>Caesalpinia bonduc</i> L.	Caesalpinaceae	Grey nicker	Kat-karanj	Seed	Used for making necklace and bracelets by girls and boys use it as marbles.
25	<i>Caesalpinia pulcherrima</i> L.	Caesalpinaceae	Peacock flower	Guletura	Flower (petals)	Used for Making artificial nail
26	<i>Calotropis gigantea</i> R. Br.	Asclepiadaceae	Gaint milk weed	Akoa	Fruit, Flower bud	Fruit is used for making parrot and flower is broken to produce sound play
27	<i>Calotropis procera</i> (Aiton) Dry and	Apocynaceae	Rubber bush	Akada	Fruit, stem	Fruit used as ball and stem used as hockey stick.
28	<i>Carica papaya</i> L.	Caricaceae	Papaya	Papaya/Pateeta	Petiole/leaf stalk	Used for making pipe to pass water and to make whistle
29	<i>Cassia fistula</i> L.	Fabaceae	Golden shower	Sundaraj	Fruit	Used as sward to play
30	<i>Citrus reticulata</i> Blanco.	Rutaceae	Orange	Santra	Spine,pulp	Spines used as injection while playing doctor game and pulp used as small bombs by exposing to fire
31	<i>Clerodendrum infortunatum</i> L.	Verbenaceae	Hill glory bower	Bhant	Flower(Stamen)	Stamens are used for playing by doing fight between two stamen to break their anther
32	<i>Cocos nucifera</i> L.	Arecaceae	Coconut	Nariyal	Shells, leaves and fruit	Shells used as utensils in kitchen set, telephone and making play material like tortoise, leaves are used to make watch, necklace, trumpet, hat, mat, baskets. Young coconut used for making cart
33	<i>Codiaeum variegatum</i> (L.) Rumph. Ex A. juss	Euphorbiaceae	Croton		Leaf	Used for making flower bookies
34	<i>Coix lacryma-jobi</i> L.	Poaceae	Adlay	Gurlu	Seed	Used as egg while playing kitchen game
35	<i>Colocasia esculenta</i> (L.) Schott	Araceae	Elephant ear taro	Kachu/Kachlu	Leaf	Used to capture dragonfly and play water bubble game
36	<i>Corchorus capsularis</i> L.	Malvaceae	White jute	Titapat	Stem	Use for making cigarette, straw/pipe as play material
37	<i>Cordia dichotoma</i> G. Forst.	Boraginaceae	Indian cherry	Lasora	fruit	Used as gum to prepare kites
38	<i>Crotalaria pallida</i> Aiton.	Fabaceae	Rattle pods	San	Fruit	Used as crackers
39	<i>Cucumis hardwickii</i> L.	Cucurbitaceae	Wild cucumber		Fruit	Used for making toys like Chickens, horse etc.

Table 1. Contd.

40	<i>Cuscuta reflexa</i> Roxb.	Convolvulaceae	Giant dodder (Nirmuli)	Amar bel	Vines	Used as noodles while playing kitchen game
41	<i>Cynodon dactylon</i> L.	Poaceae	Bermuda grass	Dub	Shoot	Used for sweeping while playing
42	<i>Datura stramonium</i> L.	Solanaceae	Datura	Dhatura	Fruits	Used for punching one another by children to make fun as it contain spines.
43	<i>Delbergia sisoo</i> Roxb.	Fabaceae	Rosewood	Shisham	Wood	Used for making bats
44	<i>Delonix regia</i> (Hook.) Raf.	Fabaceae	Gold mohar	Gulmohar	Seed pods, Stamen	Seed pods are used to prepare fan by children and Stamens are used for playing by doing fight between two stamen to break their anther
15	<i>Dendrocalamus strictus</i> (Roxb.) Nees	Poaceae	Bamboo	Bans	Stem	Used for making glass, pen stand, gun, flute, whistles, pushing car and young stem used as hockey stick
45	<i>Dillenia indica</i> L.	Dilleniaceae	Elephant apple/ouu	Chalta	Fruit	Used as short foot for throw
46	<i>Drypetes roxburghii</i> (Wall.) Hurus.	Euphorbiaceae	Lucky Bean Tree	Putija	Fruit	Used to make 'Natu' for playing
47	<i>Erythrina variegata</i> L.	Fabaceae	Indian coral tree	Pangara	Flower	Used for colouration of palm and decoration as it is deep red in colour
48	<i>Eucalyptus globulus</i> L abill.	Myrtaceae	Blue gum	Nilgiri	Bud	Operculum of stamen is used as tooth(canines) and dried ovary used as top
49	<i>Ficus benghalensis</i> L.	Moraceae	Banyan	Barh	Leaves, prop roots	Leaves are used to make utensils and umbrellas, prop roots are used as the swings.
50	<i>Ficus recemosa</i> L.	Moraceae	Clister fig tree	Goolar	Fruit	Used for making cars
51	<i>Ficus religiosa</i> L.	Moraceae	Peepal tree	Peepal	Leaves	Used to make whistles, decoration, greeting cards and swings on branches
52	<i>Impatiens balsamina</i> L.	Balsaminaceae	Garden Balsam	Gul-mendi	Flower	Used for colouration of palms and decoration purposes.
53	<i>Ipomoea hederifolia</i> L.	Convolvulaceae	scarletcreeper	Lalpungli	Flower	Used for decoration of foreheads, also used as ornaments.
54	<i>Ipomoea parasitica</i> (Kunth) G. Don	Convolvulaceae	Yellow-throated Morning Glory		Leaves	Used for making different ornaments for playing
55	<i>Jasminum arborescense</i> Roxb.	Oleaceae	Royal jasmin	Chameli	Flower	Used for decoration of hair
56	<i>Jatropha gossypifolia</i> L.	Euphorbiaceae	Bellyache bush	Ratanjoti	Petiole, seeds	By breaking the petiole foam bubbles are prepared for playing, seeds are used to play king-queen game

Table 1. Contd.

57	<i>Jatropha integerrima</i> Jacq.	Euphorbiaceae	Spicy jatropa		Stem, flower	Stem used as making baskets and flower for ornamental purpose.
58	<i>Lagenaria siceraria</i> (Molina) Standl.	Cucurbitaceae	Calabash(Lau tumba)	Lauki	Fruit	Epicarp of fruit is used to make utencils and musical instrument
59	<i>Lantana camara</i> L.	Verbenaceae	Wild sage	Raimuniya	Fruits, flower	Bullets
60	<i>Luffa acutangula</i> L. Roxb.	Cucurbitaceae	Angled luffa	Karvitori	Fruits	Used for making Chakri
61	<i>Mangifera indica</i> L.	Anacardiaceae	Mango	Aam	Leaves, seed	Leaves used as currency (notes) and seed used to make whistle
62	<i>Martynia annua</i> L.	Martyniaceae	Tiger's claw	Ulatkanta	Fruits	Used as play material as it Contain spines & looks like1tiger's claw
63	<i>Mimosa pudica</i> L.	Mimosaceae	Shame plant	Lajwanti	Leaves	Children play with the leaf as it is sensitive and become close when they touch it
64	<i>Mimusops elengi</i> L.	Sapotaceae	Bullet-wood tree/Baula	Maulsari	flower	Used for making Ornaments (brasslate, ear rings)
65	<i>Musa paradisiaca</i> L.	Musaceae	Banana	Kela	Stem sheath, Leaf stalk, spathe of inflorescence	Stem sheath used to make boat, Leaf stalk used to make drum stick and Spathe used as slipper in games
66	<i>Neolamarckia cadamba</i> (Roxb.) Bosser.	Rubiaceae	Bur flower	Kadamb	Flower	Used as ball to play cricket/volley
67	<i>Nicandra physalodes</i> (L.) Gaertner	Solanaceae	Shoo-fly plant	Popti	Fruit	Used as crackers
68	<i>Nymphaea pubescens</i> Wild.	Nymphaeaceae	Water lily	Kanval	Flower	Used for decoration as necklace
79	<i>Olax scandens</i> Roxb.	Oleaceae	Olax (Bhadavadalia)	Dheniani	Leaf	Used as money (notes) for playing
70	<i>Oryza sativa</i> L.	Poaceae	Rice	Chaval	Dry stalks	Dry stalk used to make fuel, livestock bedding, fodder and for seating, children mainly used it as straw to drink and to make bubbles from foam.
71	<i>Pandanus fascicularis</i> Lam.	Pandanaceae	Screw pine	Kewra	Flower	Used to keep in bags by children and for decoration of hair as it is very much scented.
72	<i>Peltophorum pterocarpum</i> (DC.) K. Heyne	Fabaceae	Yellow flamebouyant	Peelagulmohtar	Petals, stamens	Petals used to make artificial nails and anthers are crossed with each other and pulled opposite direction by children while playing
73	<i>Phoenix sylvestris</i> (L.) Roxb.	Arecaceae	Date palm	Khajur	Leaves	Used to make different craft items, ornaments and toys.
74	<i>Plumbago zeylanica</i> L.	Plumbaginaceae	wild leadwort	Chitrak	Flower	Used to decorate eyelashes
75	<i>Polyalthia longifolia</i> (Sonn)	Annonaceae	False Asoka (Deb daru)	Ashok	Leaf, branches	Leaves used for decoration and branches used to build small houses for playing

Table 1. Contd.

76	<i>Pseudobombax ellipticum</i> (Kunth) Dugand	Malvaceae	Shaving brush tree		Flower	Used as shaving brush by children
89	<i>Quisqualis indica</i> L.	Combretaceae	Rangoon creeper	Madhumalti	Flower	Used for making Ornaments (necklace, ring)
77	<i>Ricinus communis</i> L.	Euphorbiaceae	Castorbean	Arandi	Fruit	Used as weapon by children
78	<i>Rosa indica</i> L.	Rosaceae	Rose	Gulab	Flower (petals)	Used for nail art or decoration by children
79	<i>Ruellia tuberosa</i> L.	Acanthaceae	Fever root	Ruwel	Pod	Seeds are used as cracker by putting in water
80	<i>Saccharum officinarum</i> L.	Poaceae	Sugarcane	Ganna	Inflorescence stalk	Used for general counting/multiplication/addition etc.
81	<i>Solanum viarum</i> L.	Solanaceae	Tropical soda apple		Fruit	Used as 'gottiyani' to play games like 'guli-bati'.
82	<i>Tagetes erecta</i> L.	Asteraceae	Marigold	Genda	Flower, seed	Flower Used as ball and seed used as microphone.
83	<i>Tamarindus indica</i> L.	Fabaceae	Tamarind	Imli	Seeds, leaves	Seeds are used to make 'gottiyani' for playing ludo, and for learning counting number, addition, subtraction etc. and leaves are used as food while playing kitchen-set.
84	<i>Tectona grandis</i> L.f.	Verbenaceae	Teak	Sagun	Leaf	Used for colouration of palms by rubbing
85	<i>Tinospora cordifolia</i> (Willd.) Miers.	Menispermaceae	Indian tinospora	Gulbel	Stem	Used as telephone cord
86	<i>Trewia nudiflora</i> L.	Euphorbiaceae	False white teak	Pindar	Fruit	Used for making Wheels as play material
87	<i>Tridax procumbens</i> (L.)	Asteraceae	Coat buttons	Khal-muriya	Flower	Used to make tiara
88	<i>Triumfetta rhomboidea</i> Jacq.	Tiliaceae	Burr Bush	Chikti	Fruit	Used for making fun by throwing it to the hair of each other.
90	<i>Xanthium strumarium</i> L.	Asteraceae	Common Cocklebur	Chhotadhatura	Fruit	Used for throwing at each other and sticking it to their hairs and dresses

1996). The herbarium of collected plants is available in the Botany Section (Department of Education in Science and Mathematics) of Regional Institute of Education, Bhubaneswar.

The structured interview included the following open-ended questions, such as: 1) Do you play outside and make fun with plants? 2) What game do you play? 3)

Which plant do you use to make fun? 4) what is the local name of the plant? 5) Where is the plant seen? 6) What kind of plant it is (tree/herb/shrub/climber/creeper)? 7) Which plant part do you use for play or fun? 8) When does the plant flower and bear fruits? 9) Any economic use of the plant you know besides as play material? 10) Can you demonstrate the fun you make with the plant?

RESULTS AND DISCUSSION

Learning occurs in a joyful environment. Teaching should explore the joyful environment in order to promote learning among children through creative activities (NCERT, 2005). As such learning takes

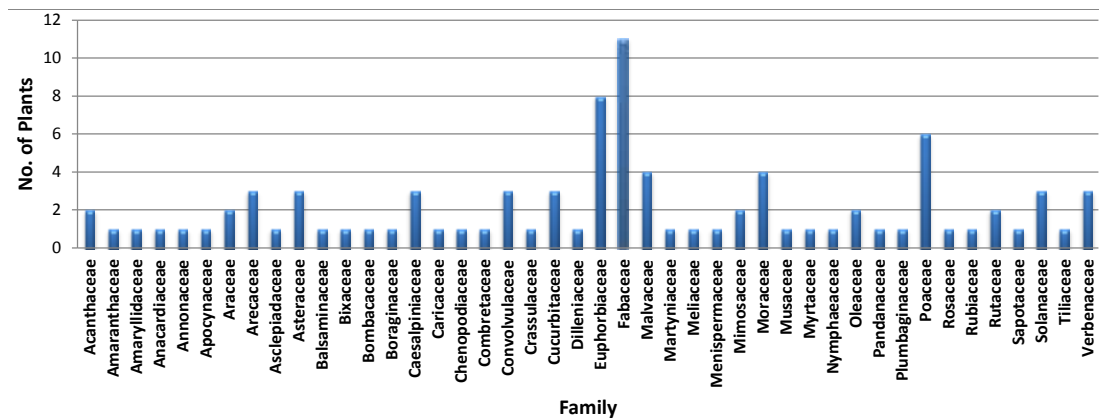


Figure 2. Diversity of Plants used for fun and games according to Family.

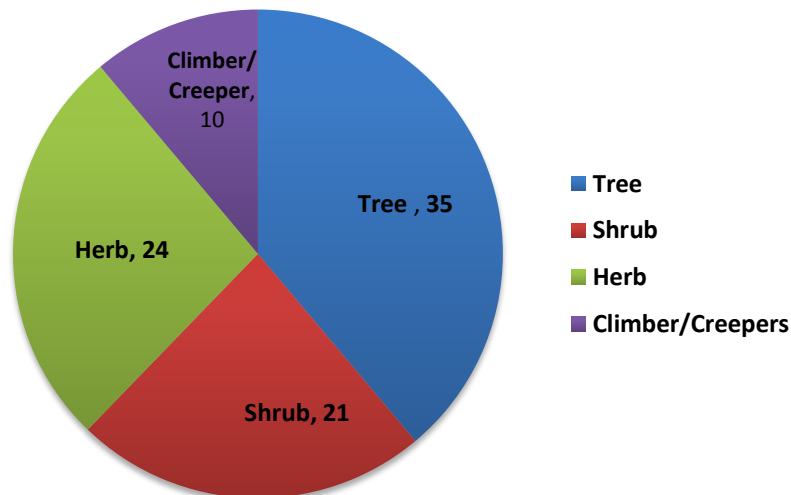


Figure 3. Diversity of plants used for fun and games.

place through child's interactions with the environment, nature, things, and people around them. Discoveries and inventions are based on keen observations and happenings in nature. As such, environment in terms of plants, animals, soil, water etc. not only provides materials for fun and games but also provide opportunities to learn and discover. Children learn language and skills by observing and describing the leaves, flowers, and fruits; and exploring the patterns that they observe in nature around them.

Objective 1

To identify and document plant species used for fun and games from local biodiversity

The reconnaissance survey included some selected

schools and villages of tribal and nontribal regions and some 90 plant species used for fun and play. These are distributed in 85 genera belonging to 44 different families (Table 1).

The largest number of plant species are distributed under family Fabaceae (11), followed by Euphorbiaceae (8) and Poaceae (6) (Figure 2). The plants used for fun and games are distributed in 35 trees, 21 shrubs, 24 herbs and 10 climbers/creepers (Figure 3). Some common plants that are frequently used by the children for making play materials include: *Artocarpus heterophyllus*, *Dendrocalamus strictus*, *Cocos nucifera*, *Calotropis gigantea*, *Cucumis hardwickii*, *Ficus benghalensis*, *Ficus recemosa*, *Ipomoea parasitica*, *Mangifera indica*, *Musa paradisiaca*, *Phoenix sylvestris*, *Polyalthia longifolia*, *Tamarindus indica*, etc (Figure 4).

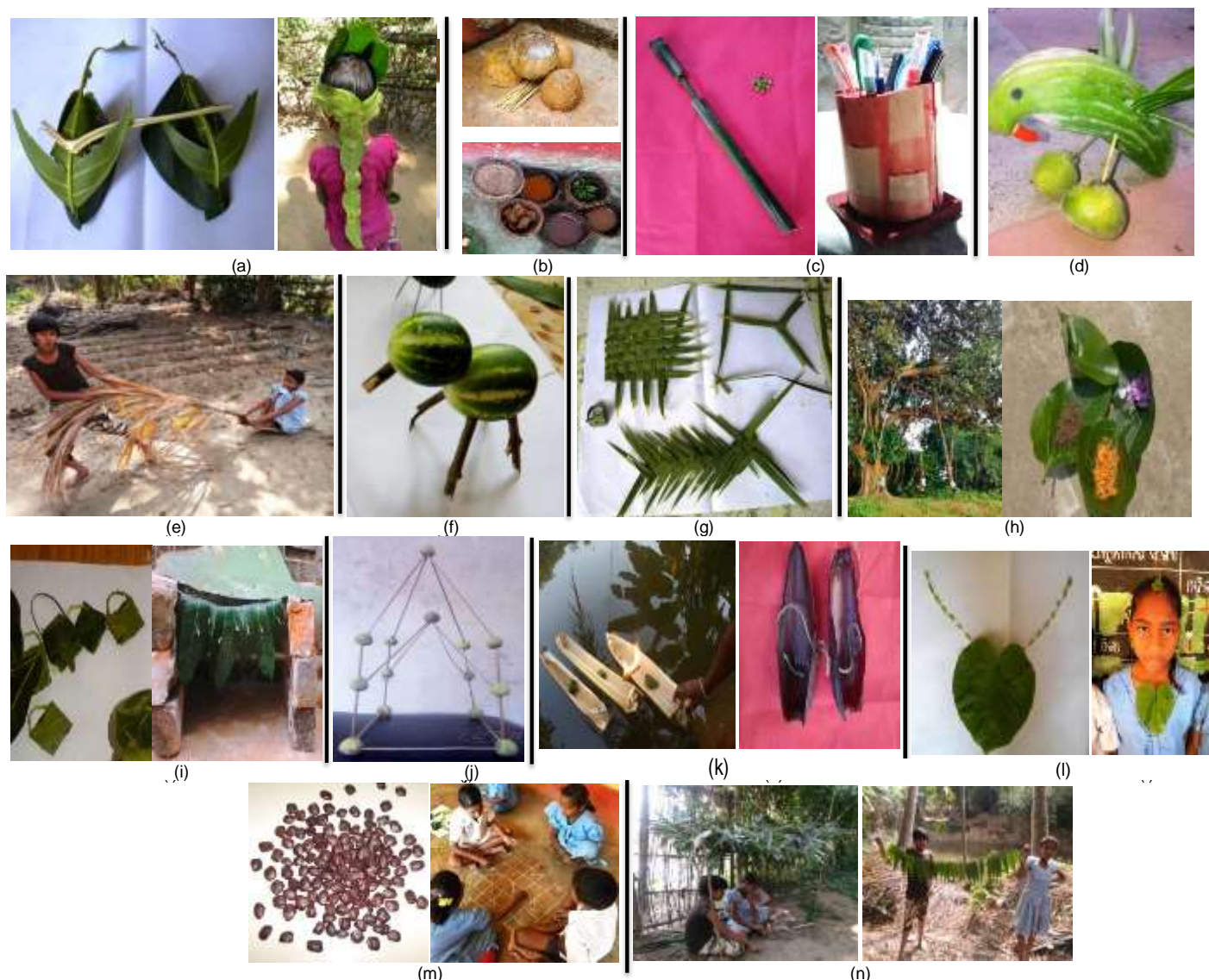


Figure 4. Some common plants and its part used as play material by the children. **(a)** *Artocarpus heterophyllus* Lam. leaves used for making toys, tiaras and fruit used to make toys of horse/cow. **(b)** *Cocos nucifera* L.: Children use the coconut shells as utensils in their kitchen set. **(c)** *Dendrocalamus strictus* (Roxb.): Nees stem is used for making toys like gun, whistle, penstand and carts. **(d)** *Calotropis gigantea* R. Br: Children use the fruits for making artificial parrots for fun making **(e)** *Areca catechu* L. leaf branch used as lorry carrier. **(f)** *Cucumis hardwickii* L.: Children use the fruits to make toys of different shapes like horse, chicks, etc. **(g)** *Phoenix sylvestris* (L.) Roxb: Children use the leaves to make different craft items like hand fans, mats, rings, etc. **(h)** *Ficus benghalensis* L.: Children use these prop roots in order swing one point to other and leaf is used as container. **(i)** *Mangifera indica* L.: Children use leaves to make craft items like small vanity bags, and decoration purpose **(j)** *Ficus recemosa* L.: Children use the fruits as wheels for making Chariots. **(k)** *Musa paradisiaca* L.: Children use stem sheath to make boats and spathe as slipper for walking. **(l)** *Ipomoea parasitica* (Kunth): Children use the leaves for different decoration and ornamental purposes. **(m)** *Tamarindus indica* L. Children use these seeds to make 'gottiyan' for playing different games like 'ludo' or drawing squares on the floor. **(n)** *Polyalthia longifolia* (Sonn) children use the branches with dense leaves for thatching& usually use the leaves for decoration purposes.

Objective 2

To know the plant part being used and the nature of its use

The plant part(s) and mode of their use as play material

were also recorded. It was noted that fruits from most plants species were used for games followed by leaves and flower (Figure 5). The stem is the least used plant part. There are also some plants species in which both flower and fruits, fruits and leaves, leaves and fruits were used for making toys and other play materials. The

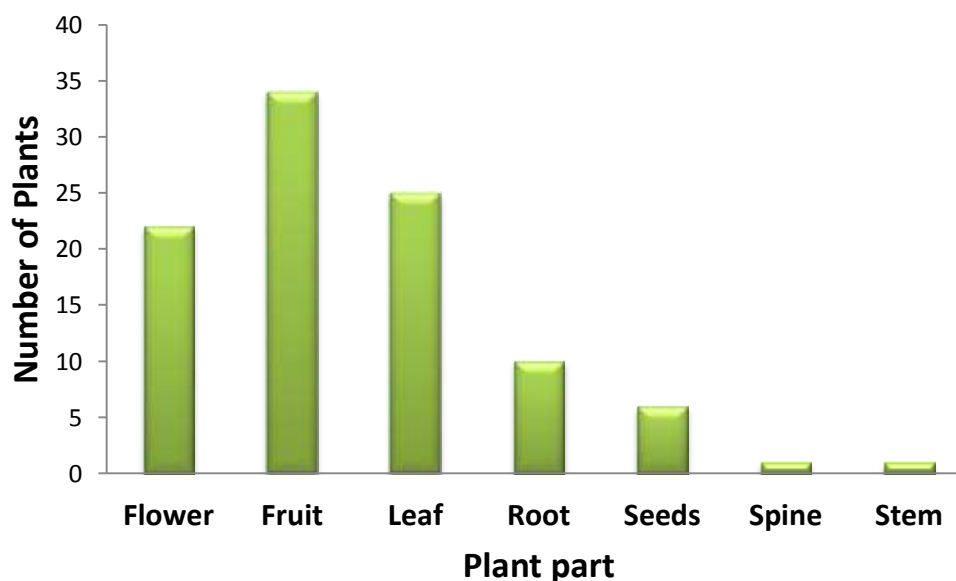


Figure 5. Plant part used as play material.

nature of their use has been explained briefly in Table 1.

Objective 3

To find out the economic value, if any of the plants identified

Among the plants documented for fun and games, some plants were found economically and socially relevant for the local inhabitants. Some plants are used as herbal medicines and others are consumed as food, few are used for building houses, firewood and marketing purposes. The plants like, *Achyranthus aspera*, *Aegle marmelos*, *Azadirachta indica*, *Bryophyllum pinnatum*, *Calotropis gigantea*, *Cynodon dactylon*, *Lantana camara*, *Mimosa pudica*, *Solanum viarum*, *Tridax procumbens*, etc are commonly used as herbal medicine by the local people for their primary treatments such as vomiting, dysentery, toothache piles, itching, wounds, stomach and skin disorders (Bisoi and Panda, 2015). Besides being used as play materials, the plants having food value include *Abelmoschus esculentus*, *Allium cepa*, *Artocarpus heterophyllus*, *Basella alba*, *Carica papaya*, *Citrus reticulata*, *Cocos nucifera*, *Dillenia indica*, *Mangifera indica*, *Lagenaria siceraria*, etc. that are consumed as fruits and vegetables by the local people. *Aegle marmelos*, *Azadirachta indica*, *Ficus benghalensis*, *Ficus racemosa* and *Ficus religiosa* are the major trees species which are having religious importance and worshiped by the local villagers and remain conserved (Choudhury and Pattnaik, 1982). Multiple uses of the

plants observed in the present study have been depicted in Figure 6.

General perspectives

From the present study, it was observed that nature especially plants do provide ample opportunities for children to make fun and games. Creative skills are reflected through activities such as designing of chariots by joining fruits of *Ficus* tree, and from boat preparation by using banana (*Musa*) stem sheaths. These exemplary activities are culturally built up in families. Using plant parts, children design creative games during as well as beyond school hours with the knowledge gained from peers, family and community members.

Teachers use the plant parts (seeds, fruits, leave etc.) in teaching of science and mathematics concepts in the classrooms that is hard to transact. Such activities make learning joyful, effective and durable (Satapathy and Dash, 1994).

In India, the use of trees and their parts such as flowers and fruits have been used in folk songs, folk proverbs, and folk talks has been reported (Agarwala, 1981). However with urbanization, there is degradation of the environment and accelerated loss of biodiversity; consequently, this culturally-established, indigenous knowledge of using plants for various purposes is getting lost over time (Balick, 1996). The cultural knowledge that is available in one locality may not be the same as at other places, because of divergence in the flora and fauna, and people's association with those.

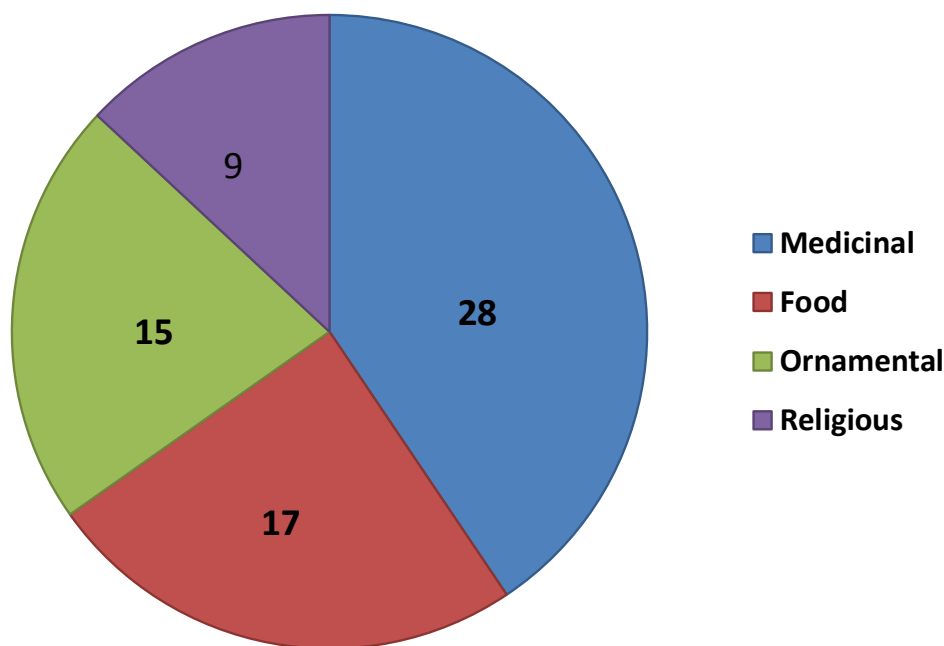


Figure 6. Multiple Economic uses of plants besides being used as play material.

Further, with developments in science and technology, present generation children are more engaged in computers, mobile phones, internets, videogames, rather than with plants in gardens and parks. As such, they are away from nature and have little or no concern for it. The indigenous knowledge gathered over the years is increasingly being eroded. In modern schools and urban pockets, students are completely away from nature and see the plants virtually through computers with support from ICT. As such, it is often noticed that children who are isolated from nature, and spend more time in front of computer screens, face problems such as obesity, irritability, laziness, lack of concentration, aggressive behavior and high frustration levels. Hence there is an urgent need to conserve the plants that are not only economically important but also used as fun and games by children, as well as encouraging them to become more engaged with their natural environment. Further, there is a need for additional studies of more plants that are used as fun and games. Internationally, UNO has declared 2011-2020 as the decade of Bio-diversity conservation in order to create awareness about biodiversity, its importance, and conservation (Kulkarni, 2012). As all genetic resources of living things are useful in one form or the other (Swaminathan, 1989), plants and their parts of interest to children that have educational value in terms of teaching-learning material(s) should be preserved and kept in educational institutions for use as demonstrations and to encourage inquiry learning during teaching of scientific concepts.

CONFLICT OF INTERESTS

The authors declare there is no conflict of interests.

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