Traditional oil yielding plants of Mayurbhanj district (Odisha), a region of eastern India: a quantitative ethnobotanical investigation on diversity, medicinal utility, cultural significance and sustainable usage

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Research

Abstract

Background: Oil yielding plants plays a major in welfare of human society as possess dietetic, medicinal, cultural, ritualistic and other important values. In this context, this study underscores the need to conserve biocultural heritage and support community-led stewardship of oil producing species. Documenting oil yielding plants genetic resource associated with sustainable utilization and empowering livelihood, is necessary for improving socioeconomic circumstances and conservation of natural resources.

Methods: Data collection was conducted through semi-structured interviews with 47 informants to gather ethnobotanical information from Mayurbhanj district of Odisha. Quantitative indices such as Use Value (UV), Relative Frequency of Citation (RFC), Direct Matrix Ranking (DMR), and Family Use Value (FUV) were employed to analyze the ethnobotanical usage of oil and ethnomedicinal utility of plant.

Results: The present study documents 27 oil yielding plant species from 19 families. The family Fabaceae recorded the dominant family with 4 species, and trees (48.14%) were the most prevalent plant habit. Seeds emerged as the primary source of oil extraction, while leaves were commonly used in traditional remedies. Dermal application (51.85%) was the most frequent mode of consumption. The oil of ×.*Brassarda juncea* had the highest UV (0.83) and Relative RFC (0.43) whereas

Azadirachta indica had the highest UV (0.83) and RFC (0.49) for medicinal purposes. The Arecaceae family recorded the highest FUV and *Ricinus communis* ranked highest DMR value with a score of 22, reflecting its wide applications.
Conclusion: Traditional extraction methods ecologically sound harvesting practices and role of oil in empowering livelihoods reflect a strong sense of environmental stewardship. Hence further study regarding phytochemical validation and clinical manifestation is necessary for more interdisciplinary research.

Keywords: Conservation, India, livelihood, oil extraction, quantitative Ethnobotany, sustainable use

Background

Plants represent the primary foundation of life on earth. They are integral to the stability of ecosystems by preserving biodiversity and providing the fundamental resources essential for the survival of humans and other organisms. From oxygen to nourishment, plants are the silent architects of survival. They are life-giving, healing, nurturing and deeply intertwined with human progress and well-being. A multifaceted relationship between human culture and plant kingdom is explored by a dynamic, interdisciplinary field known as Ethnobotany, which particularly emphasizes on how societies perceive, utilize and steward botanical resources. In simple, it is defined as the study of interactions between people and plants, with special emphasis on usage, management and cultural significance (Jan *et al.* 2017, Mohanty *et al.* 2025a), revealing how such communities sustainably manage biodiversity through orally transmitted knowledge. Oil-yielding plants, often known as nature's liquid gold, have long been cherished as a vital legacy of the natural world, enriching human life from the cradle of ancient civilizations to the innovations of the modern age. Plant oils account for over 80% of the world's vegetable oil supply, underlining their fundamental role in human nutrition and industrial applications (Gunstone 2011). These plants occupy a significant niche within ethnobotanical research due to their extensive traditional uses and socio-economic value across diverse cultures. From sizzling kitchens to sacred rituals, from healing balms to high-performance biofuel, the oils extracted from seeds, fruits and nuts energize our bodies and enrich our cultures which reflect a profound co evolution of human ingenuity and botanical diversity (Sharma & Kumari 2015). Among all parts, seed is the fundamental and effective contribution for optimal yield generations (Nial *et al.* 2019).

From the golden elixirs pressed from sesame to the versatile oil extracted from castor, these species illuminate the ways in which traditional societies have harnessed botanical oils for myriad purposes. It is believed that the cultivation of plants for oil extraction dates back to ancient times. These oils serve a wide array of purposes across traditional cultures, encompassing culinary use, medicinal applications as well as cosmetic formulations. Moreover, they have held a significant place in classical systems of medicine, including Ayurveda, where their therapeutic properties have been extensively valued and employed (Jagtap & Jagtap 2023). Edible oil sources like coconut, groundnut and mustard are central to nutrition and domestic use, whereas non-edible oils from species such as Castor, Neem and Karanja have gained prominence in biofuel research and industrial applications (Thirumala *et al.* 2021). The plants like canola, sunflower and soybean oil are effectively utilised as biofuel worldwide (Athar & Nasir 2005). Economically, oil-bearing crops such as Palm, Soybean and Rapeseed support livelihoods. In industry, oil yielding plants serve as renewable sources for biofuel (Vijayakumar 2016), lubricants and plastics, offering environmental benefits over fossil fuels (Demirbas 2009). Not only industrial values but also these oils have diverse applications due to their antimicrobial, antioxidant and anti-inflammatory properties, with essential oils like Eucalyptus and Tea tree showing bioactivity against pathogens (Bakkali *et al.* 2008).

Apart from this, these oils simmer in cooking pots, nourish skin and hair, soothe aching muscles and cradle infants during gentle massages. Passed down through generations, these natural extracts are trusted remedies for wounds, skin infections, joint pain and even respiratory and menstrual discomfort. They also guard homes and livestock from pests serve as natural preservatives, fuel lamps and engines and form the base for soaps and cosmetics (Seker & Esen 2021). In a time increasingly defined by the quest for green alternatives and cultural preservation, these plants stand not only as resources, but as legacies living bridges between the wisdom of the past and the promise of the future. Sustainable utilization of oil-yielding plants is vital for ecological stability, biodiversity conservation and rural livelihood security. Oil crops not only provide a natural and renewable source of raw materials, but they also improve rural livelihoods through decentralized processing and organic farming practices, making them essential for resilient and sustainable agriculture (Carrubba & Catalano 2009). Furthermore, community-based resource management and the inclusion of traditional ecological knowledge play a vital role in promoting sustainability. As the world turns once more to the power of plant-based oils, Ethnobotany emerges as a vital compass guiding us through the rich intersection of ancestral wisdom and modern innovation. The Mayurbhanj, which is a tribal dominate district is famous for its own traditional culture and indigenous knowledge. In the heart of this district, such living tradition endures, deeply entwined with the rhythms of its forests, fields and communities. Although several studies on oil yielding plants were previously conducted in different regions of India (Banik & Paul 2015, Nial & Mahalik 2020, Ramesh

2024) as well as some ethnobotanical studies conducted in Mayurbhanj and its adjoining area of Odisha (Behera 2006, Behera *et al.* 2008, Panda *et al.* 2011, Dikshit *et al.* 2016, Routray & Nayak 2017, Noor & Satpathy 2022, Mohanty *et al.* 2025a,b, Mohanta 2025), specific studies on the diversity and Ethnobotany of oil yielding plants remain unexplored. This study aimed to explore the diversity of oil-yielding flora, quantitative ethnobotanical assessment like RFC, UV, FUV, and DMR of obtained oil and medicinal usage of different parts of oil yielding plants as well as traditional oil extraction process followed by livelihood linkage in Mayurbhanj district of Odisha.

Materials and Methods

Study area

This study was conducted in Mayurbhanj district, which is largest district of Indian state Odisha based on geographical area. This district is situated between 21°17' to 22°34'N latitude and 85°40' to 87°10'E longitude covering an area of about 10, 418 km^2, which share its boundary with neighboring state West Bengal and Jharkhand (Figure 1). The district experiences a subtropical monsoon climate with average annual precipitation ranges from 150 to 164 cm, with peak humidity reaching 98% during the rainy season (Ray *et al.* 2016). A dendritic river system including the Budha Balanga, Deo, Sone, and Subarnarekha rivers supports diverse vegetation types. The district is characterized by diverse and dense vegetation including Similipal Biosphere Reserve. According to 2011 census, the district has a total population of 2,519,738 with tribal population 1,479,576 (2011 census) with different tribal communities including Kolha, Santala, Munda, Bhumija, Bthudi, Gond, Saunti, Bhumiyan, Ho etc. Our study area mainly consisted of Baisinga, Betanati, Udala, Kaptipada, Sharata, Mhulidhia, Thakurmunda, Karanjia, Barsahi, Khunta, Baripada, Suliapada, Muruda, Chandua, Jasipur, Koliana and Bangiriposi. These regions possess rich cultural identities and traditional practices.

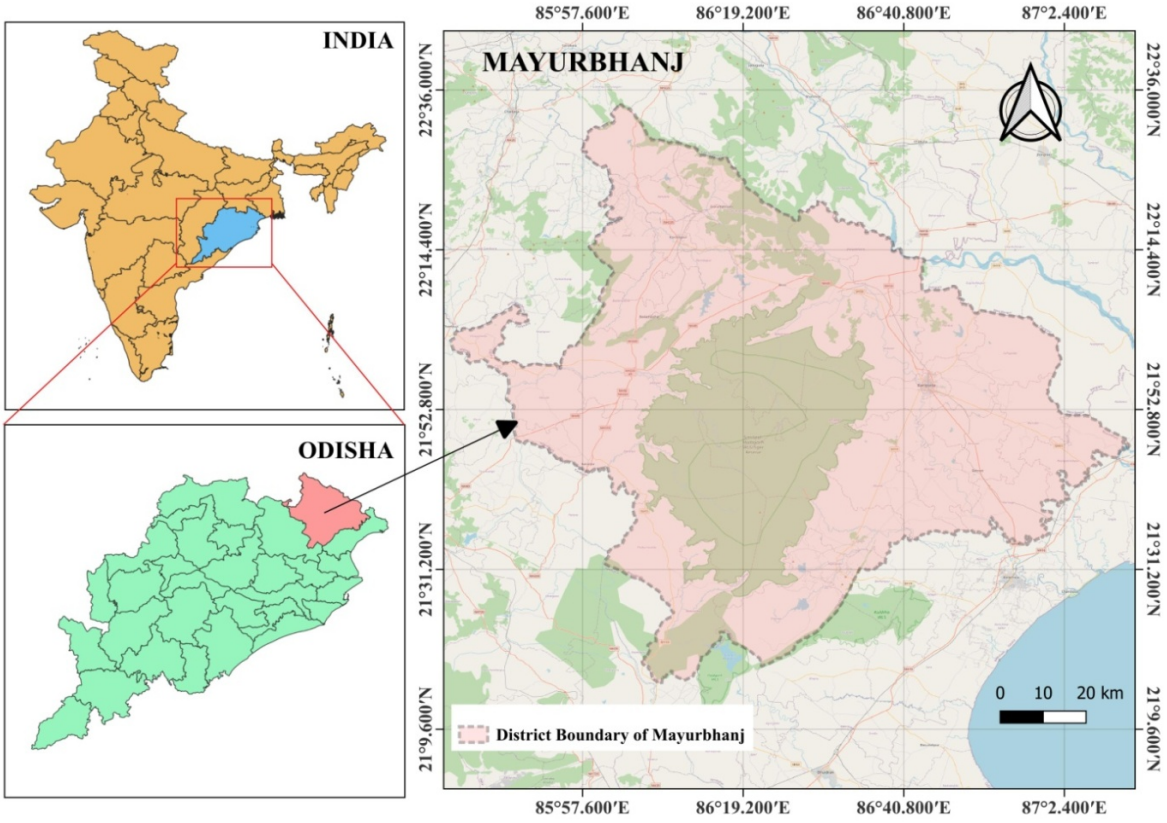

Figure 1. Map of study area

Demographic features of informants

A total of 47 individuals were investigated, consisting of 28 male and 19 females of different age groups ranged from 24 to 77 years (Table 1). Snowball method described by Jan *et al.* (2022) was used to identify the potential informant. The informants were selected according to their experience and standing with the local community. To verify the accuracy and authenticity of collected ethnobotanical knowledge, a consistent relation was kept with the local communities. The maximum informants were uneducated whereas only few of them received education up to graduation level. Special interviews were arranged with oil processors, healers and elders to validate the obtained ethnobotanical information. The

informants belonged to different religions, i.e. Hindu, Islamic and Christian among which Hinduism is the dominant religion. The interview was conducted in the local vernacular language Odia.

Table 1. Demographic features of informants

Variable	Category	Total	Percentage
Gender	Male	28	59.57
	Female	19	40.43
Age Group	24-34	08	17.02
	35-45	11	23.40
	46-55	09	19.15
	56-65	13	27.66
	66-77	06	12.77
Qualification	Illiterate	07	14.89
	Primary	08	17.02
	Secondary	12	25.53
	Higher Secondary	15	31.91
	Graduation	05	10.64

Ethnobotanical survey and data collection

Field study was carried out in multiple rural and forest fringe villages of the study area from September 2023 - April 2025. Ethnobotanical data were collected by semi-structured interview as well as standard questionnaires in group discussion (Martin 1995), while group discussion was conducted in the area where villagers are gathered for social interaction. At first the aim and objectives of the study were explained with the informants and then they agree and provides their consent to disclose their traditional knowledge and expertise. Data collection focused on local names and identification of oil-yielding plants, plant parts used and methods of oil extraction, cultural, ritual, or medicinal usage, and preparation and application techniques (Figure 2). The information that was collected in local language later translated to English language. Multiple investigations were carried out to maintain the uniformity.

Figure 2. Photo plate representing field study to collect ethnobotanical information

Plant specimen collection and identification

Plant specimens were collected in the field during their flowering or fruiting stages to ensure accurate identification. The collected specimens were assigned to a specific field number for preparation of herbarium specimen. Taxonomic identification was carried out with the help of botanical keys, taxonomic literatures as well as the enumeration available in the literature (Saxena & Brahmam 1994-1996, Haines 1921-1925), Herbarium of Indian Institute of Science, Bangalore (JCB), India Biodiversity portal and Tropicos. The updated nomenclature of the taxon was validated through the available online

database like Plants of the World Online (POWO) and International Plant Names Index (IPNI). Collected seed samples from locals were identified by consulting experts. The prepared herbarium specimens were deposited to the herbarium of P.G Department of Botany, Mayurbhanj College of Accountancy and Management, Baripada, Odisha.

Data Analysis

Relative Frequency Citation (RFC)

This index is used to indicate the local importance of each species, which is calculated by dividing the number of informants who reported the plant's use (FC) by the total number of informants investigated (N), without considering the different categories of use (Kayani *et al.* 2014). The RFC is calculated by using the formula described by Barkatullah *et al.* (2018). The value of RFC ranges from 0 to 1.

$$RFC = FC/N$$

Use Value (UV)

This index aimed to evaluate the significance of each oil yielding plant species used by local community. The UV value of an oil yielding plant species increases when it possesses multiple uses. In this study the UV was determined by referring to Phillips and Gentry (1993).

$$UV = \Sigma Ui / N$$

Ui: Total number of usage reports provided by each informant
N: Total number of informants involved in the inquiry

Family Use Value (FUV)

This FUV index is used for the determination of the use value that associated with a particular family. This is evaluated by referring the formula of Phillips and Gentry (1993).

$$FUV= \Sigma UV/N$$

Where, 'ΣUV' represents the summation of the total use value from all species of a particular family and 'N' represents the overall count of species belongs to that family.

Direct Matrix Ranking (DMR)

DMR is a method used to calculate the diversified use of a particular plant species, utilizing the data collected from the informants (Martin 1995). A group of 15 selected informants selected were based on their expertise on traditional knowledge on the plants that possess ethnobotanical importance. The informants were instructed to marking the use value to each species with a scale ranging from 0-5, where '0' has no value and '5' represents best. The score secured by each plant were then aggregated to obtain total score, which were later ranked.

In the present study the quantitative data analysis like UV, RFC, FUV were calculated for both ethnobotanical usage of oils and ethno-medicinal importance of oil yielding plant species. The DMR value was calculated only for the ethnobotanical usage of oil instead of ethno-medicinal importance of plant as it is restricted to only medicinal use.

Results

Diversity

The comprehensive ethnobotanical survey in the Mayurbhanj district of Odisha with special reference to oil yielding plants documented 27 oil-yielding plant species across 19 distinct families (Table 2), showcasing significant taxonomic and morphological diversity. These species vary notably in their habit; parts used for oil extraction and traditional ethnobotanical applications (Table 2). Among the families, Fabaceae was most dominant, represented by four species (14.81) followed by Euphorbiaceae and Brassicaceae with 3 species each (11.11%), while 15 families had only a single representative, except Myrtaceae (7.4%) which had two (Figure 3).

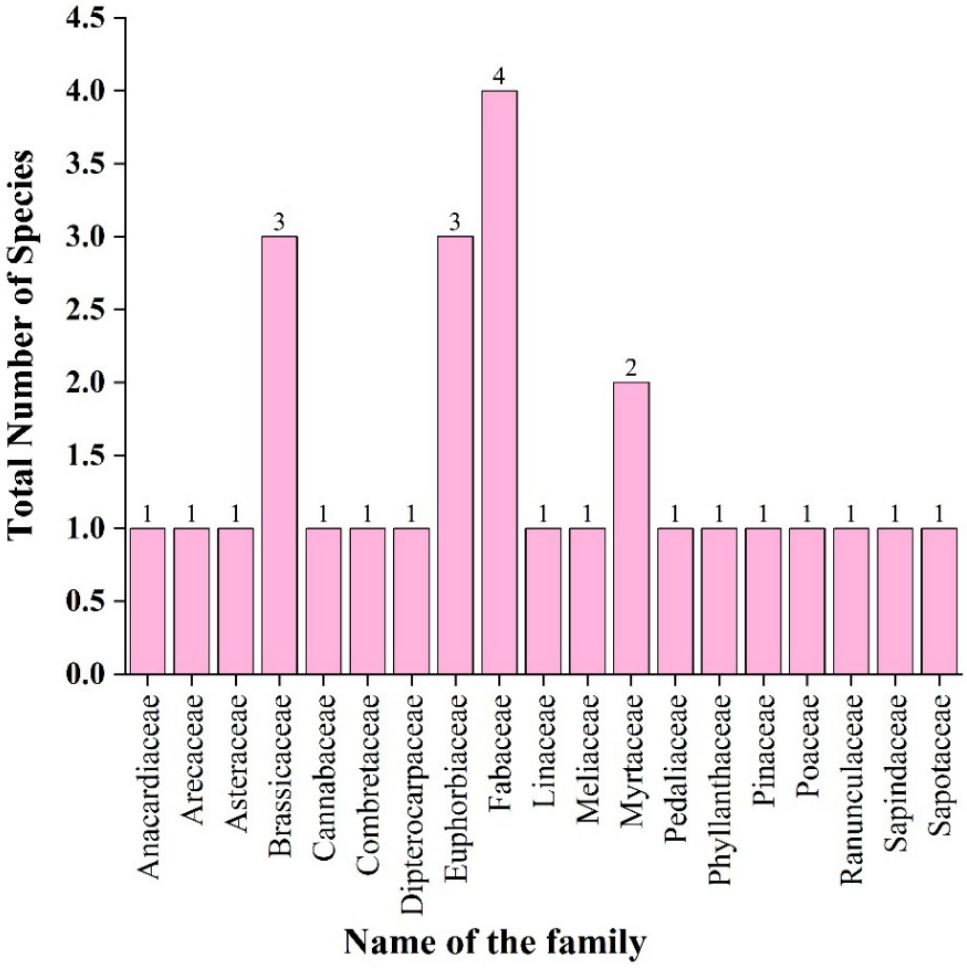

Figure 3. Representation of species diversity of different families

Growth habit

Out of the 27 species documented, 13 species (48.14%) were classified as trees, herbs, shrubs and climbers representing 9 species (33.33%), 4 species (14.81%) and 1 species (3.7%) respectively (Table 2).

Part used and mode of consumption

Seeds were the primary plant part used for oil extraction (Table 2; Figure 4), documented in 24 out of the 27 species (88.89%). Exceptions included *Syzygium aromaticum* (Myrtaceae), yielding clove oil from flower buds, *Cymbopogon citratus* (Poaceae) from leaves and *Pinus roxburghii* (Pinaceae), from resin, highlighting a clear regional preference for seed-based oil sources. The reliance on seed oils also aligns with traditional extraction methods and practical efficiency.

Ethnomedicinal importance of these oil yielding plant species (Table 3) resulted that, leaves were the most commonly used part recorded in 10 species (37.04%), indicating their dominance in traditional medicinal practices. This was followed by seeds (25.93%), barks (14.81%), flowers and fruits (7.40% each), and latex & roots (3.70% each) with 7 species, 4 species, 2 species in each and 1 species in each respectively (Table 3; Figure 5). In terms of mode of consumption, the dermal route was most prevalent, being employed in 14 species (51.85%). The oral route was reported in 10 species (37.03%), while 3 species (11.11%) were consumed in the form of smoking.

Figure 4. Plant part used for extraction of oil (a: Seed powder of *Azadirachta indica* A. Juss., b: Seed of *Sesamum indicum* L., c: Seed of *Arachis hypogaea* L., d: Fruit of *Ricinus communis* L., e: Fruit of *Madhuca longifolia* (L.) J.F. Macbr., f: Seed of *Schleichera oleosa* (Lour.) Oken, g: Seed of *Azadirachta indica* A. Juss., h: Dried seed of *Ricinus communis* L.

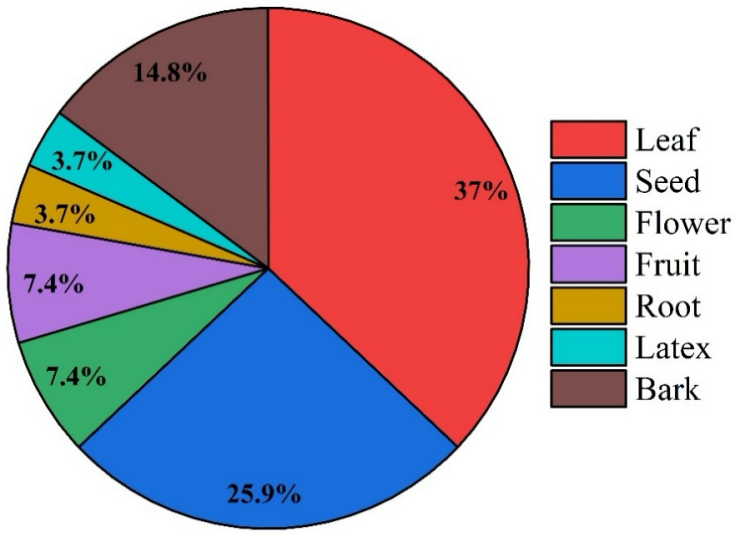

Figure 5. Pie chart showing percentage distribution of plant part used in ethnomedicinal purposes

Ethnobotanical Usage

The ethnobotanical usage of the oil and medicinal utility of the plant species are described in Table 2 and 3 respectively, which indicates that the diversified use of oil and curative properties of plants respectively. The different oils are generally used for cooking, skin care, hair nourishment, joint pain, bone fractures as well as ritual purposes. In other ways the plant species were used for the treatment of diseases like Common cold, skin diseases, gastrointestinal problem, and body ache as well as treatment of livestock.

Table 2. Ethnobotanical uses, RFC and UV of Oil obtained from oil yielding plants

Name of The Plant	Family	Habit	Part Used	Major Ethnobotanical Usage of Oil	FC	RFC	ΣUi	UV
Anacardium occidentale L.	Anacardiaceae	Tree	Seed	Used for skin moisturization in winter, hair nourishment	4	0.09	9	0.19
Arachis hypogaea L.	Fabaceae	Herb	Seed	Cooking, massage to new born, treatment of dry skin, and minor burn relief	7	0.15	17	0.36
Azadirachta indica A. Juss.	Meliaceae	Tree	Seed	Prophylaxis against lice, mosquito and leech. Sprayed in field to control insect, veterinary disease treatment.	10	0.21	24	0.51
×.*Brassarda juncea* (L.) Su Liu & Z.H Feng	Brassicaceae	Herb	Seed	Cooking oil, preservative in pickles, makes hair shiny, ritual use, removal of facial product	20	0.43	39	0.83
Cannabis sativa L.	Cannabaceae	Herb	Seed	Pain and cramp relief	2	0.04	3	0.06
Cocos nucifera L.	Arecaceae	Tree	Seed	Moisturizer of skin and hair, oral hygiene, burn wound healing, cooking	16	0.34	34	0.72
Cymbopogon citratus (DC). Stapf	Poaceae	Herb	Leaf	Mosquito repellant, incense sticks (agarbatti) preparation	3	0.06	8	0.17
Eucalyptus globulus Labill.	Myrtaceae	Tree	Seed	Acne treatment and joint pain relief	3	0.06	7	0.14
Glycine max (L.) Merr.	Fabaceae	Climber	Seed	Cooking, marination, natural facial product remover	4	0.09	15	0.32
Helianthus annuus L.	Asteraceae	Shrub	Seed	Cooking, facial moisturizing, and cosmetic cleansing	9	0.19	22	0.47
Jatropha curcas L.	Euphorbiaceae	Shrub	Seed	Soap making, and as an illuminant in oil lamps	5	0.11	14	0.30
Jatropha gossypiifolia L.	Euphorbiaceae	Shrub	Seed	Illuminant in oil lamps, bone fracture treatment	6	0.13	17	0.36
Linum usitatissimum L.	Linaceae	Herb	Seed	Used for skin and hair care, ritual uses and wood finishing	4	0.09	11	0.23
Madhuca longifolia (L.) J.F. Macbr.	Sapotaceae	Tree	Seed	Treatment of dry skin and cracked feet, reducing swelling, make hair shiny	17	0.36	31	0.66
Mutarda nigra (L.) Bernh.	Brassicaceae	Herb	Seed	Cooking oil, preservative in pickles, treatment against joint pain and earache, hair nourishment	5	0.11	11	0.23
Nigella sativa L.	Ranunculaceae	Herb	Seed	Treatment of asthma and headache	2	0.04	5	0.11
Phyllanthus emblica L.	Phyllanthaceae	Tree	Seed	Make hair dense, improve skin tone and treatment of cheilitis	4	0.09	9	0.19
Pinus roxburghii Sarg.	Pinaceae	Tree	Resin	Treatment of rheumatologic disorder and arthritis	3	0.06	5	0.11
Pongamia pinnata (L.) Pierre	Fabaceae	Tree	Seed	Treatment of eczema and dandruff, Prophylaxis against leech and insect, treatment of veterinary diseases	13	0.28	27	0.57
Ricinus communis L.	Euphorbiaceae	Shrub	Seed	Used as lamp fuel, preparation of Kajal, joint pain relief, labor induction, ritual usage	11	0.23	23	0.49
Schleichera oleosa (Lour.) Oken	Sapindaceae	Tree	Seed	Thermoregulation in winter, glowing skin, treatment of baldness and cracked feet.	13	0.28	24	0.51
Senna tora (L.) Roxb.	Fabaceae	Tree	Seed	Treatment of bone fracture, muscle cramps and nail infection	5	0.11	9	0.19
Sesamum indicum L.	Pedaliaceae	Herb	Seed	Ritual uses, lamp oil and used as emollient	7	0.15	13	0.28

Shorea robusta C.F. Gaertn.	Dipterocarpaceae	Tree	Seed	Lubricant in weapon, polish of wood, treatment of spondylitis	10	0.21	17	0.36
Sinapis alba L.	Brassicaceae	Herb	Seed	Used as preservative to remove pungent smell, applied topically to cure backbone pain	6	0.13	14	0.30
Syzygium aromaticum (L.) Merr. & L.M Perry	Myrtaceae	Tree	Flower	Mouth fresher, cure toothache, treatment of migraine	4	0.09	8	0.17
Terminalia catappa L.	Combretaceae	Tree	Seed	Treatment of leprosy, reduce dark spot and prevent stretch mark	4	0.09	10	0.21

Quantitative Data Analysis

RFC

The study revealed that the Relative Frequency of Citation (RFC) of ethnobotanical usage of oil ranged from 0.04 to 0.43 (Table 2; Figure 6), with ×.*Brassarda juncea* having the highest RFC (0.43), followed by *Madhuca longifolia* (0.36) and *Cocos nucifera* (0.34). The oil of *Cannabis sativa* and *Nigella sativa* had the lowest RFC value (0.04).

The RFC value calculated based on medicinal importance of oil yielding plants varies from 0.04 to 0.49 (Table 3; Figure 6). Highest RFC (0.49) were recorded for *Azadirachta indica* followed by *Madhuca longifolia* (0.45), *Pongamia pinnata* (0.38), and *Jatrophacurcas* (0.30). While the lowest RFC value of 0.04 was reported for *Arachis hypogaea*, *Cymbopogon citratus*, and *Syzygium aromaticum*.

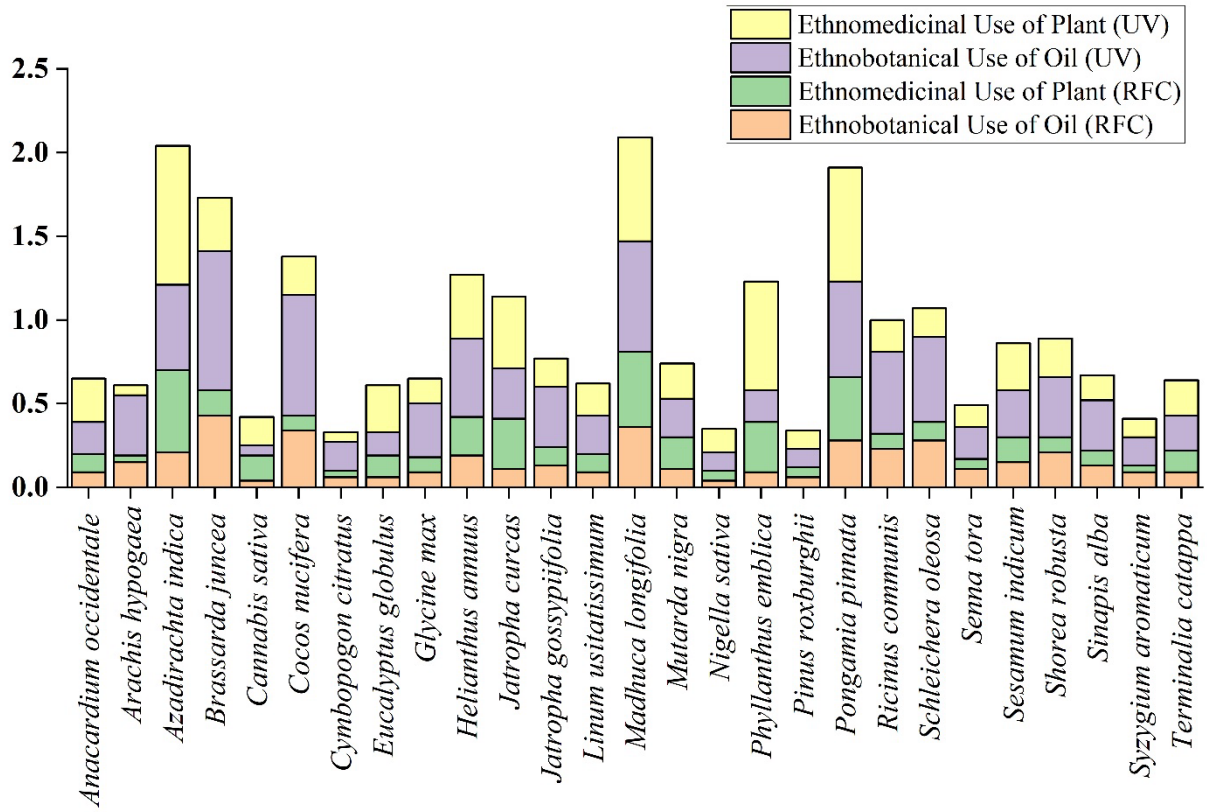

Figure 6. Stacked bar graph showing comparison of RFC and UV value of ethnobotanical usage of oil and medicinal utility of plant species

UV

Similarly, Use Value (UV) of oil scores ranged from 0.06 to 0.83. ×.*Brassarda juncea* again ranked highest use value (0.83) indicating multipurpose uses, followed by *Cocos nucifera* (0.72), *Madhuca longifolia* (0.66) and *Pongamia pinnata* (0.57). The lowest UV (0.06) was recorded for *Cannabis sativa*. Likewise, the highest medicinal Use Value of plant species is also 0.83, resulted in *Azadirachta indica*, while lowest was 0.06 in *Arachis hypogaea* and *Cymbopogon citratus*.

Table 3. Ethnomedicinal use, RFC and UV of Oil yielding plant

Name of The Plant	Vernacular Name	Part Used	Mode of Use	Major Ethnomedicinal value	FC	RFC	ΣUi	UV
Anacardium occidentale L. MCAMB-241	Kaju badam	Leaf	Oral	Gum problem, toothaches, mouth ulcer	5	0.11	12	0.26
Arachis hypogaea L. MCAMB-307	Chini badam	Seed	Oral	Blood deficiency in body	2	0.04	3	0.06
Azadirachta indica A. Juss. MCAMB-154	Nimba, limba	Leaf	Dermal	Eczema, ring worm, scabies	23	0.49	39	0.83
×.*Brassarda juncea* (L.) Su Liu & Z.H Feng MCAMB-242	Rai sorisa	Seed	Oral	Common cold in livestock	7	0.15	15	0.32
Cannabis sativa L. MCAM-BOT-247	Bhang, Ganjei	Flower	Smoking	Hallucination, stress relief	7	0.15	8	0.17
Cocos nucifera L. MCAMB-267	Nadia	Fruit	Dermal	Coconut water used to remove spot caused by chicken pox, skin care	4	0.09	11	0.23
Cymbopogon citratus (DC). Stapf MCAMB-248	Dhawantari	Leaf	Oral	Indigestion problem in livestock, mouth fresher	2	0.04	3	0.06
Eucalyptus globulus Labill. MCAMB-305	Eucalyptus	Leaf	Dermal	Control vitiligo and dark patches on neck	6	0.13	13	0.28
Glycine max (L.) Merr. MCAMB-245	Soyabadi	Leaf	Dermal	Burn wound and scald	4	0.09	7	0.15
Helianthus annuus L. MCAMB-262	Suryamukhi	Root	Dermal	Used as poultices against insect bite	11	0.23	18	0.38
Jatropha curcas L. MCAMB-158	Dhala baigaba	Latex	Dermal	Toothache, crack feet, nail pain	14	0.30	20	0.43
Jatropha gossypiifolia L. MCAMB-152	Kala baigaba,	Leaf	Dermal	Ash of leaf is used against itches and eczema	5	0.11	8	0.17
Linum usitatissimum L. MCAMB-282	Pesi, Alasi	Seed	Oral	Indigestion, constipation, diarrhea	5	0.11	9	0.19
Madhuca longifolia (L.) J.F. Macbr. MCAMB-153	Mahula, Mahua	Bark	Oral	Decoction of bark consumed against Rheumatism, joint pain and diabetes	21	0.45	29	0.62
Mutarda nigra (L.) Bernh. MCAMB-273	Sorisa	Seed	Oral	Paste is consumed to reduce mouth ulcer due to common cold	9	0.19	10	0.21

Nigella sativa L. MCAMB-278	Kala-jeera	Seed	Smoking	Crush seed are smoked to control sneezing and insomnia	3	0.06	7	0.14
Phyllanthus emblica L. MCAMB-274	Aonla	Fruit	Oral	Indigestion, constipation, irregular menstrual cycle	14	0.30	31	0.65
Pinus roxburghii Sarg. MCAMB-279	Sarala	Bark	Dermal	Paste applied to cure ulcer and wound as antiseptic	3	0.06	5	0.11
Pongamia pinnata (L.) Pierre MCAMB-234	Karanja	Bark	Dermal	Fungal infection in inguinal region and ulcer in external genital area	18	0.38	32	0.68
Ricinus communis L. MCAMB-235	Jada, Goba	Leaf	Dermal	Treatment of Arthritis, bone fracture	4	0.09	9	0.19
Schleichera oleosa (Lour.) Oken MCAMB-237	Kusuma	Seed	Dermal	Powder seed are mixed with saliva to prepare paste against migraine	5	0.11	8	0.17
Senna tora (L.) Roxb. MCAMB-169	Chakunda	Leaf	Dermal	Smeared on the head of restless person against insomnia	3	0.06	6	0.13
Sesamum indicum L. MCAMB-225	Rasi	Leaf	Smoking	Fresh leaves are crushed and smoked against whooping cough	7	0.15	13	0.28
Shorea robusta C.F. Gaertn. MCAMB-221	Sala	Bark	Dermal	Decoction of bark is used to wash head against dandruff and hair loss	4	0.09	11	0.23
Sinapis alba L. MCAMB-156	Sweta Sorisa	Seed	Oral	Paste is consumed in empty stomach to prevent worm infection	4	0.09	7	0.15
Syzygium aromaticum (L.) Merr. & L.M Perry MCAMB-311	Labanga	Flower	Oral	Consumed as mouth freshener, digestion	2	0.04	5	0.11
Terminalia catappa L. MCAMB-157	Katha badam	Leaf	Dermal	Used as poultices to treat leprosy, wound	6	0.13	10	0.21

FUV

Among the 19 plant families documented the FUV (Table 4; Figure 7) represents that, the ethnobotanical usage of oil obtained from the species of Arecaceae family recorded the highest FUV (0.72). It attributes to the multifunctional applications of *Cocos nucifera* in cooking, skin and hair care, and wound healing. Other prominent families included Sapotaceae (0.66), Meliaceae (0.51), and Sapindaceae (0.51), which also showed diverse oil-based uses such as skincare, ritual applications, and insect repellency. The lowest FUV was reported in the oil of family Cannabaceae. Ethnomedicinal utility of the documented species indicates that, Meliaceae family (represented by single species, i.e. *Azadirachta indica*) exhibited the highest FUV (0.83) for ethnomedicinal usage, which was frequently used to treat skin disorders like eczema and scabies. This was followed by Phyllanthaceae (0.65) and Sapotaceae (0.62), indicating their significant roles in traditional medicine, especially in treating digestive issues and joint pain.

Table 4. Family Use value of the recorded family (FUV)

Name of the family	Total Number of Species	FUV (Ethnobotanical Usage of Oil)	FUV (Ethnomedicinal Usage of Plant)
Anacardiaceae	1	0.19	0.26
Arecaceae	1	0.72	0.23
Asteraceae	1	0.47	0.38
Brassicaceae	3	0.45	0.23
Cannabaceae	1	0.06	0.17
Combretaceae	1	0.21	0.21
Dipterocarpaceae	1	0.36	0.23
Euphorbiaceae	3	0.38	0.26
Fabaceae	4	0.36	0.26
Linaceae	1	0.23	0.19
Meliaceae	1	0.51	0.83
Myrtaceae	2	0.16	0.20
Pedaliaceae	1	0.28	0.28
Phyllanthaceae	1	0.19	0.65
Pinaceae	1	0.11	0.11
Poaceae	1	0.17	0.06
Ranunculaceae	1	0.11	0.14
Sapindaceae	1	0.51	0.17
Sapotaceae	1	0.66	0.62

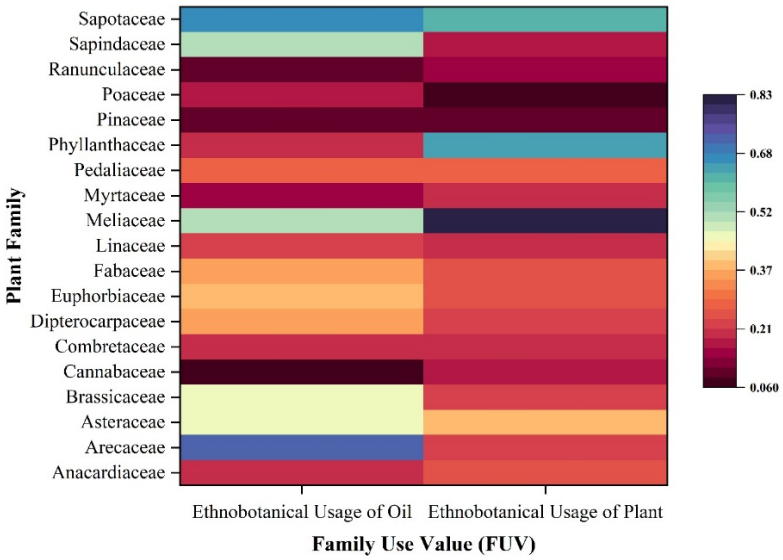

Figure 7. Heatmap representing FUV of recorded families on basis of uses of oil and medicinal utility of plant

DMR

The Direct Matrix Ranking (DMR) analysis highlighted the multipurpose ethnobotanical value of selected oil-yielding plants (on the basis of Use value of oil) across ten use categories from cooking to ritual uses (Table 5; Figure 8). *Ricinus communis* (castor) ranked highest with a score of 22, reflecting its wide applications in fuel, joint pain, bone fractures, and rituals. ×.*Brassarda juncea* (mustard) followed with 16, valued for culinary and ritual uses. *Cocos nucifera* (coconut) and *Azadirachta indica* (neem) each scored 15 for their roles in skin care, hair care, and insect control. "Skin disease control and care" emerged as the most common traditional use, emphasizing the cultural and medicinal importance of these plants in local healthcare practices.

Table 5. DMR value of selected oil yielding plant species

Plant Name	Ethnobotanical Usage										Total score	Rank
	A	B	C	D	E	F	G	H	I	J		
×.*Brassarda juncea* (L.) Su Liu & Z.H Feng	5	5	0	3	1	0	0	0	0	2	16	2
Cocos nucifera L.	1	0	4	5	0	5	0	0	0	0	15	3
Madhuca longifolia (L.) J.F. Macbr.	0	0	4	4	0	1	3	0	1	0	13	5
Pongamia pinnata (L.) Pierre	0	0	5	2	0	0	0	5	2	0	14	4
Schleichera oleosa (Lour.) Oken	0	0	4	5	1	0	1	0	0	0	11	7
Azadirachta indica A. Juss.	0	0	5	3	0	0	0	5	2	0	15	3
Ricinus communis L.	0	0	0	1	4	2	4	1	5	5	22	1
Helianthus annuus L.	5	3	4	0	0	0	0	0	0	0	12	6
Arachis hypogaea L.	3	2	5	2	0	2	0	0	0	0	14	4
Jatropha gossypiifolia L.	0	0	0	0	2	0	4	0	4	0	10	8
Shorea robusta C.F.	0	0	0	0	4	0	4	0	0	1	9	9
Total score	14	10	31	25	12	10	16	11	14	8		
Rank	4	7	1	2	5	7	3	6	4	8		

A: Cooking, B: Preservative, C: Skin disease control and care, D: Hair maintenance, E: Body and joint pain, F: Burn and scald treatment, G: Bone fracture and swelling, H: Biocontrol, I: Fuel, J: Ritual use

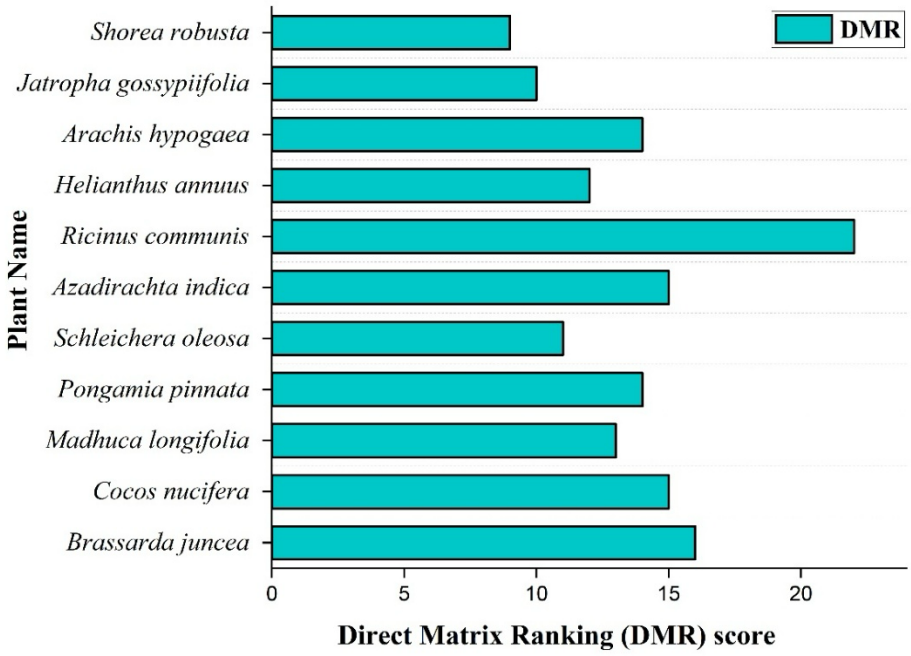

Figure 8. Bar graph showing DMR value of ethnobotanical usage of oil of selected plants

Common methods of oil extraction used by local people

The different oil extraction techniques (Figure 9) used by local people are categorized to 5 methods described as follows:

Grinding and boiling method

This traditional oil extraction technique involves three sequential steps known as grinding, squeezing, and boiling. First, oil-rich plant materials such as seeds or kernels are cleaned and finely ground into a paste. This paste is mixed with warm water and squeezed through a clean cloth to obtain a milky emulsion. The liquid is then gently boiled, during which water evaporates, and oil naturally separates and floats to the top. The oil is then skimmed off or strained for collection. This method is commonly used in the preparation of oils from coconut (*Cocos nucifera*) and similar sources.

Dry seed crushing and filtering method

In this mechanical extraction process, dry seeds are first thoroughly cleaned and fed into a traditional wooden or metal oil expeller, locally called a 'ghani'. These are generally operated by hand or by animals, crush the seeds under pressure to release oil. The crude oil flows out and is collected in containers placed below the outlet. To remove solid impurities, the oil is then filtered through cloth. This method is widely practiced for oil extraction from Groundnut, Soybean, Linseed, Sal and Sunflower seeds.

Resin Tapping and Steam Distillation

This method is specifically used for extracting essential oils from resinous trees. Shallow incisions are made in the bark of the tree to allow resin to ooze out. The collected resin is then subjected to steam distillation, where it is heated, vaporized, and condensed. Upon cooling, the essential oil is separated from water and collected. This technique is commonly applied to trees like Chir Pine (*Pinus roxburghii*).

Manual Pressing and Cloth Filtration

This process begins by grinding seeds into a paste with the help of mortar and pestle. The paste is then tightly wrapped in a cotton cloth and manually pressed to squeeze out the oil. To improve clarity, the extracted oil may be slightly heated to help any remaining impurities settle. This method is particularly useful for oil extraction from seeds like Neem (*Azadirachta indica*) and Mahua (*Madhuca longifolia*).

Indirect Steam-Assisted Extraction

This semi-mechanical method uses a two-chamber setup. The lower vessel is filled with boiling water, while the upper perforated chamber holds the seed paste. As steam rises, it softens and heats the paste without direct contact with water. The softened material is then pressed to extract oil. This steam-assisted approach is commonly used for extracting oil from mustard (*Brassica juncea*) and karanja (*Pongamia pinnata*) seeds.

Figure 9. Photographs showing Oil extraction method and obtained oil (a, b: Machine used for oil extraction, c: Oil of *Cocos nucifera* L., d: Oil of *Pongamia pinnata* (L.) Pierre, e: Oil of *Ricinus communis* L. store in container, f: Indirect steam-assisted extraction method, g: Oil of *Azadirachta indica* A. Juss., h: Oil of *Schleichera oleosa* (Lour.) Oken, i: Oil of *Sesamum indicum* L.

Empowering livelihood and sustainable use

The production and commercialization of plant-derived oils have emerged as a crucial livelihood strategy among tribal communities, with women at the forefront of this transformative sector. The intersection of livelihood enhancement and ecological conservation is vividly reflected in the sustainable use of oil-yielding plants among local communities and forest inhabitants. These plant-derived oils not only support biodiversity and forest preservation but also serve as vital sources of income. Women, in particular (from communities like Gonda, Santhal, Ho, Bhumij, Munda etc.) play a central role in this transformation, acting as key agents in the informal oil economy. They extract and process oils which are marketed through weekly markets (Known as "Hata" in local language), village fairs (Makar festival, Magha festival, Chaitra/chaiti festival and Sarhul) and through direct doorstep marketing turning traditional knowledge into economic empowerment. Sometimes district administration of Mayurbhanj district organize different events like Pallishree Mela, Zilla Mohostav and other regional festival like Jagadhatri mela and Ratha Mela in which Coconut oil, Kusuma oil, Mahua oil, Karanja oil, Sunflower oil and Neem oils are sold widely along with other natural plant products. Among tribal communities, there is a deep-rooted belief that worshipping plants is equivalent to worshipping God. Plants like *Shorea robusta*, *Madhuca longifolia*, *Azadirachta indica*, *Phyllanthus emblica, Sinapis alba, Linum usitatissimum*, are revered as sacred, symbolizing nature's divine blessings. The tribal communities worship this plant in different festivals. Similarly, the Sal plant is worshiped in a particular region known as Jahira (Sacred groves), a region which is considered as a sacred area to preserve biodiversity. These plants are not only worshipped but they also play a vital role in daily life providing food, medicine and oil. This spiritual and practical relationship reflects a profound respect for nature and a desire to preserve it for future generations.

To amplify their impact, many women organize themselves into Self Help Groups (SHGs) to collectively extract and sell oils, enhancing bargaining power and ensuring fair profit distribution. The sector supports multiple rural income streams from seed collection and processing to packaging and transportation, thereby sustaining entire households. A comparative analysis of oilseed cultivation like cultivation of *Sesamum indicum*, *Arachis hypogaea*, and *Brassarda juncea*, reveals distinct economic profiles and profitability margins. *Sesamum indicum* and ×.*Brassarda juncea* demonstrate operational efficiency with a low seed rate requirement (2.0-2.5 kg/acre for both). The total expenditure for these crops is relatively modest, typically ranging from Rs 11,500 to Rs 14,000, with labour costs estimated to be a significant component, often between Rs 4,000-6,000 per acre depending on mechanization. *Sesamum indicum* yields typically range from 3 to 5 Quintals, generating a net income of Rs 22,000-25,000 per acre based on a market realization approximately rate of Rs 8,200 per quintal. *Brassarda juncea*, with a higher average output of 5 to 8 Quintals and a selling price of Rs 5,500-6,000 per Quintal, achieving a net profit of Rs 20,000-25,000 per acre.

In contrast, *Arachis hypogaea* (groundnut), cultivation necessitates a substantially higher seed rate (75-90 kg/acre) and a greater total expenditure (Rs 20,000-28,000). Labor costs for groundnut are generally higher, estimated between Rs 8,000-12,000 per acre, mainly due to harvesting and shelling. However, this crop yields a far superior average output (8 to 10 Quintals) and commands a strong selling price (Rs 60-75/kg). Consequently, groundnut cultivation generates the highest returns, providing farmers with a significant net profit of Rs 35,000-40,000 or higher per acre. While all three oilseeds offer favourable returns, groundnut production provides the most substantial financial realization, although profitability for all crops remains contingent upon market price fluctuations.

Sustainability ensures the long-term availability of plant resources like seeds, leaves, flowers, and fruits, allowing communities to benefit from year after year. For instance, the responsible harvesting of wild species such as *Madhuca longifolia* and *Schleichera oleosa* promote natural regeneration and seasonal livelihoods. Practices like decentralized processing, value addition, and organic farming reduce external dependence while expanding rural employment opportunities, especially for women.

In this context, the sustainable utilization of oil-yielding plants becomes more than just a livelihood strategy, it becomes a cultural and spiritual commitment. By using these plants responsibly, tribal communities aim to ensure that the resources continue to thrive, supporting both ecological balance and economic well-being. This sacred approach to sustainability strengthens the livelihood connection, where oil extraction and use are carried out with reverence, ensuring that traditional knowledge and practices are preserved and passed on, and that the harmony between people and nature is maintained for generations to come.

To strengthen these grassroots economies, the government has implemented policies like the Pradhan Mantri Van Dhan Yojana (PMVDY) aimed at uplifting tribal economies through value addition, fair pricing, and entrepreneurship. The Krushak Assistance for Livelihood and Income Augmentation (KALIA) scheme provides financial support to small and marginal farmers

and landless agricultural labourers to boost their livelihoods and income. Legal frameworks such as the Forest Rights Act (FRA), 2006, further empower indigenous communities with rights to access, collect, and manage forest resources from the transition zone of Similipal Biosphere Reserve and other forest regions, ensuring both social justice and environmental stewardship.

This is particularly crucial for wild and semi-domesticated oil-yielding species like *Schleichera oleosa* (kusuma), *Madhuca longifolia* (mahua), *Shorea robusta* (sal), and *Azadirachta indica* (neem) which are traditionally harvested for oil. Sustainable practices such as community-led governance and responsible collection are essential to maintain their regenerative capacity while improving livelihoods. Supported by institutions like TRIFED (Tribal Cooperative Marketing Development Federation of India), various NGOs (Non-governmental Organization) and enriched by traditional ecological knowledge, these integrated approaches secure tribal income while conserving biodiversity and promoting ecological resilience.

Discussion

The present study offers a comprehensive ethnobotanical documentation of 27 oil yielding plant species traditionally utilized by the local communities of Mayurbhanj district, Odisha. This highlights the rich reservoir of indigenous knowledge surrounding plant-based oil extraction and usage, which has been preserved and passed down through generations. Notably, the Fabaceae family emerged as the most dominant in our findings, aligning with the observations of Nial and Mahalik (2020), who also reported Fabaceae as a leading family in their study in Nabarangpur district of Odisha, which indicates the use of leguminous plants in different regions of Odisha as a major source of oil yielding plant. This study highlighted the quantitative evaluation of ethnobotanical data and recorded 27 species of oil plants under 19 plant families and their research represents qualitative data of 24 species from 17 families. Interestingly, 20 plant species are common in both studies, indicates a comparable level of plant diversity in both regions. Furthermore, seeds were the most commonly utilized plant part in both investigations, reinforcing their central role in traditional oil extraction practices.

A comparative assessment of present study with previous studies in Shivamogga taluk of Karnataka reveals that, 8 species recorded in the present study overlap with the findings of Ramesh (2024). However, a clear distinction emerges in the dominant plant families. Fabaceae is most represented in the current study, while Arecaceae was dominant in Ramesh's findings. Similarly, 15 oil yielding species were documented by Banik and Paul (2015) in Bastar region of Chhattisgarh among which 7 plant species were found to be common with those recorded in present investigation. This contrast reflects the influence of local ecological conditions, cultural practices and resource availability, underscoring how traditional plant use is shaped by regional knowledge systems and environmental diversity.

The culinary and cosmetic uses of sunflower oil observed in the study strongly align with the work of Khan *et al.* (2015), who highlighted its nutritional richness and therapeutic potential. Similarly, the traditional use of sesame oil as a natural skin emollient echoes the observations made by Wara (2011), reaffirming the continued relevance of indigenous knowledge systems in promoting skin health.

The findings of the current study align closely with those of Vala and Kapadiya (2014), who documented the diverse medicinal applications of *Cocos nucifera* oil in the Bhavnagar district of Gujarat. Their study highlighted the oil's use as a natural skin moisturizer, hair conditioner and remedy for dermatological conditions such as eczema and fungal infections. These reported uses strongly parallel the ethno medicinal practices observed in the current study area, thereby reinforcing the widespread traditional knowledge surrounding the therapeutic value of coconut oil across different cultural and geographical contexts.

In this study, *Schleichera oleosa* (Kusuma) oil was frequently reported for its application in treating a variety of dermatological conditions, rheumatic pain and promoting hair health. These observations are consistent with the review of Meshram *et al.* (2015), within the framework of Indian ethnomedicine. The alignment between the present data and prior literature not only supports the continued ethnobotanical relevance of the oil, but also reinforces the validity of traditional knowledge systems that have preserved and transmitted these therapeutic practices over generations.

A comparison between the present studies with the result of Mohanty *et al.* (2025b) in ritualistic and medicinal plant usage in Jajpur district reveals shared ethnomedicinal practices and plant usage patterns. In both studies, leaves are the most frequently used plant parts, particularly in traditional medicine. While the oil obtained from seeds of *Linum usitatissimum* possesses ritual use in this study deviates from their findings as they described the seeds were used in preparation of Prasad offer to God instead of oil-based practice, but both the studies agree with the ritualistic use of the plant. Similarly, three main modes of applications i.e. oral, dermal and smoking are reported in both studies. In their study, the oral consumption

is predominant, whereas dermal application is more common in the present findings. This variation likely reflects regional differences in cultural practices, disease treatment methods and selection of two distinct plant categories.

The research of Singh *et al.* (2023) explored the effectiveness of commonly used oils in strengthening the skin's barrier function in Bangladesh, spotlighted mustard oil as a widely used and highly beneficial option. Notably, this study revealed that similar product is well-tolerated, even by delicate skin and is routinely applied post-bathing to lock in moisture, combat dryness and prevent skin-related ailments. These insights closely align with the focus and findings of our own study.

Information on medicinal use of oil crops showed that dermal application of the oils to cure ailments are major in traditional uses. However, detailed information on ethnomedicinal aspects of the plants indicate that different plant parts (leaves, seeds, flowers and bark) also have significant medicinal applications. This would indicate that oil plants have multiple benefits on human health, not only by their oil but also by the medicinal activity of other plant parts. Unseen of these is, to conserve their germplasm and its sustainable cultivation as means for the conservation of a valuable traditional knowledge and continued availability of these multipurpose species.

While discussing the quantitative data analysis results of our ethnomedicinal investigation with result of Jena *et al.* (2025) in Mayurbhanj, the RFC value of *Jatropha gossypiifolia* (0.32) and UV of *Schleichera oleosa* (0.63) is highest and their UV and RFC were 0.3 and 0.14 respectively, that deviates from our result. Interestingly, both the studies explain the similar extraction part and ethnobotanical utility of *Schleichera oleosa* oil as well as skin diseases curative properties of both plants. Hence findings of the both studies act as a source of evidence for clinical trial of plant material against skin disease. However, the deviation in the quantitative data may be due to the variation in the number, age group as well as community of informants.

The comparison of our findings with Mohanty *et al.* (2025a) in the Northeastern coastal region of Odisha, a mutual prominence of leaf-based remedies is observed, highlighting the widespread reliance on foliage in traditional healing practices. While their study was exclusively focused on ethnoveterinary applications, it is noteworthy that *Pongamia pinnata* emerged with the highest Use Value (UV) followed by *Azadirachta indica*, signifying its central role in livestock healthcare. In contrast, our broader ethnobotanical investigation also identified it as having comparatively high UV values of these species. This overlap underscores the species' multipurpose significance and suggests a cross-contextual relevance in traditional medicine systems.

Standing out for its exceptional ethnomedicinal importance, *Azadirachta indica* (Neem) recorded the highest Use Value (UV) and Relative Frequency of Citation (RFC) and recognized for treating skin-related ailments such as eczema, ringworm and scabies. This observation aligns with the findings of Moin *et al.* (2021), who also emphasized Neem's central role in Unani and other traditional systems of medicine, particularly for its potent leaf-based remedies against common skin infections.

In present study, the RFC and UV of ×.*Brassarda juncea* ranked highest among others. The multipurpose uses of the oil including their application on cooking, preservative, nourishment of hair, ritual use, removal of facial product and massage, may be the reasons behind the highest use value and relative frequency of citation. This result suggests that the people of the Mayurbhanj district of Odisha used this oil in their daily life in comparison to other oils. The family use value is highest in Arecaceae family suggests that, although the single member of the family is used as a source of oil plant, but comparatively this family contribute to full fill the basic requirements of the local people. This finding plays a crucial role for promoting Coconut cultivation in the study area. *Ricinus communis* (castor) ranked highest DMR than others, which is due to its wide medicinal application, and multiple household utility as fuel and ritual purposes. The approach highlights the potential plant that leads to be culturally significant and ecologically susceptible which supporting the need for sustainable management practices.

In this study the ethnobotanical information was collected on the basis of usage of oil and medicinal value of plant, but the documented plants can also possess cultural significance. Some plants like *Azadirachta indica*, *Cannabis sativa*, *Cocos nucifera*, *Linum usitatissimum*, *Phyllanthus emblica*, *Sesamum indicum* and *Sinapis alba* contain ritual values in Odisha (Mohanty *et al*. 2025b) as well as some are worshiped by Hindu religion in Assam (Sarma & Devi 2015) and some other by Tharu tribe in Uttarakhand (Lata *et al*. 2022). cultural usage of plant aligns with our finding as some oil yielding plants are worshiped by tribal communities in different festivals.

Oil obtained from *Azadirachta indica* and *Pongamia pinnata* are also used for the treatment of veterinary disease repotted in present study agree with the findings of (Mohanty *et al*. 2025a) in adjoin region of our study area. Beside this other study conducted by Selvaraju *et al.* (2011) also confirm the usage of these two plants in treatment of live stocks. From their study Bhat *et al.* (2023) resulted that the *Cannabis sativa*, *Phyllanthus emblica* and *Ricinus communis* possess the ethno-veterinary utility in Meghalaya. Interestingly although these plants are common in our study but evidences regarding their ethno-veterinary usage are not recorded. This deviation may be due to the difference in study area, mode of investigation or variation in selection of informants.

Overall, this study not only validates existing literature but also expands the understanding of plant-based oil extraction traditions among indigenous communities. The observed overlaps, divergences and multifunctional uses of oil-yielding species underscore the need for continued interdisciplinary research to preserve, validate and potentially integrate these practices into broader healthcare and livelihood frameworks.

Conclusion

This study reveals the vibrant tapestry of traditional knowledge surrounding 27 oil yielding plant species from 19 families in Mayurbhanj district of Odisha, where seeds, flowers, leaves and resins are transformed into powerful agents of healing, nutrition and cultural expression. From kitchen staples like Coconut and Mustard to therapeutic oils from Neem, Castor and Flaxseed, these plants are deeply woven into the everyday lives and rituals of local communities. Yet, this rich heritage remains largely undocumented and underutilized in modern science. Despite its valuable insights, the study highlights key gaps including limited sample size, lack of phytochemical validation and unexplored clinical manifestation pointing to the need for more interdisciplinary research. Future studies must expand geographically, integrate pharmacological testing, explore seasonal influences on oil yield and assess commercial potential. With rising global interest in plant-based remedies and sustainable alternatives, these ethnobotanical treasures hold immense promises, not only as sources of traditional healing, but as catalysts for community empowerment, green innovation and biodiversity conservation.

Declarations

Ethics approval and consent to participate: Prior to the survey for collection of ethnobotanical information, we obtained oral informed consent from each participant.

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