Plant Archives Vol. 18 No. 1, 2018 pp. 301-319 *ISSN 0972-5210*

POTENTIAL SOAP, SHAMPOO AND DETERGENT PLANT RESOURCES OF INDIA AND THEIR ASSOCIATED TRADITIONAL KNOWLEDGE

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Abstract

The present paper deals with 108 species of potential soap, shampoo and detergent plants belonging to 87 genera and 52 families of vascular plants of India. These include indigenous cultivated plants with wild-forms. Botanical names of plants are listed in alphabetic order. Correct names, important synonyms, name of the family; vernacular names; mode of use of plant parts; chemical constituents; geographical distribution of each plant are presented in tabular form. Data sources for every recorded use of the listed plants are indicated. Cleaning property of plant parts, healing actions, bioprospective potentials, scope for value addition, promotion of cosmaceutical uses, trade of natural cleaning agent are discussed.

Key words : Soap, shampoo, detergent, medicine, cosmaceuticals, traditional knowledge.

Introduction

The soaps and detergents are essential materials for primary health care and hygiene. They are used for the purpose of cleaning body, washing clothes and maintaining good health and freshness. These are either natural or synthetic in origin. The natural soaps and detergents are derived from plants, which are rich in saponins, a class of glycosides with cleaning properties. The fruit, seed, bark and sometimes the whole plant are directly used as soaps or detergents. Acid contents of some plants and alkalinity of plant ashes in water are also harnessed for washing and cleaning. In the traditional process of washing, the plant parts (fresh or dried) are usually crushed or chopped into small pieces, infused in hot water and then used for washing clothes, cleaning body and hair. The dirty clothes immersed in this mixture or filtrate of the mixture are left for one or two hours, followed by beating the clothes with a wooden hammer and washing with clean water. In another method, the plant ash is mixed in water, filtered and dirty clothes are immersed in the filtrate followed by boiling for one or two hours, allowed to cool and then beaten on wooden planks are washed in clean water. These natural products provide vitality to fabrics, hair and skin and are also biodegradable in nature. These are safe to wash pet animals, cleaning utensils floor of houses, toilets and woven driving away insects and pests from the garden plants. Most of the plants that have been traditionally used for washing and cleaning also possess medicinal properties. The plant shampoos are most suitable for the people allergenic to synthetic soaps and shampoos and work effectively to fight dandruff.

The aboriginals of India had good knowledge of using plant parts as soap, shampoo and detergent long before the invention of artificial/chemical cleaning products. Predominant use of natural soaps, shampoos and detergents starts from the pre-historic times till the synthetic soaps and detergents almost completely replaced them from modern urban civilization in the 20th century. Use of industrial soaps, shampoos and detergents in India may be linked with the entry of HLL Company of England (presently Hindustan Liver Limited) into India. HLL company exported its laundry soap, 'Sunlight' in 1888; in 1895 'Lifebuoy' soap was launched in India followed by 'Perars' in 1902. 'Lux' in 1905. Vim powder in 1913, Sunsilk shampoo in 1964, Rin detergent bar in 1965, Clinic shampoo in 1971 and Lirilbathing soap in 1974 (http://icmr.icfai.org/cases-tudies/catalogue/Marketing1/MKTA000.htm). Replacement of the biodegradable soft detergents by hard detergents and their

widespread use led to some environmental problems, rendering water bodies unfit for aquatic life due to persistence of detergents and rapid growth of algae as well as depletion of oxygen level in water due to addition of phosphate radicals of detergents (Singh *et al.,* 2001)

Natural soaps are still used by people in rural / tribal areas for bathing and washing clothes. These are also sued for cleaning some special category of dresses, fine fabrics and for special hair care. A large fraction of rural people of India living in or around forest areas use natural soaps, shampoos and detergents of plant origin. The tribals of the Himalayas and North East India use natural plant materials from *Sapindus*, *Aesculus*, *Acacia*, etc. for cleaning their warm clothes they wear to protect themselves from cold. Even the urban elites scared off the negative effects of synthetic cleaners are inclined towards eco-friendly herbal soaps and shampoos based on their traditional knowledge system. The stray ethnobotanical publications dealing with traditional uses of natural soaps and detergents by the tribes of India prove that a vast treasure of such knowledge is still held among the traditional communities. However, there is no comprehensive account of such natural soap, shampoo and detergent yielding plants. Documentation of all the innovative traditional knowledge (TK) about soap plants was felt essential in the face of depletion of indigenous biodiversity, gradual loss of traditional knowledge as well as the newly generated traditional knowledge on introduced plants. Documentation of plant diversity and associated traditional knowledge is also a prerequisite to meet the objectives and targets of Global Strategy of Plant Conservation (based on COP VI to the CBD, on 19th April 2002 in the Hague) which inter alia calls for "preventing decline of plant resources and associated indigenous and local knowledge, innovations and practices that support sustainable livelihood, local food security and health care". The present chapter is an attempt to provide a comprehensive account of the potential soap, shampoo and detergent plants of India with their associated traditional knowledge, bioprospectingpotentials, scope for value-addition and promotion of cosmaceutical industry.

Methodology

Several Floras, ethnobotanical works and journals on economic plants were screened to list the plants used as soaps, detergents and shampoos in India. Cleaning property of the listed plants was confirmed through study of literature on chemistry of the concerned plant parts. Taxonomic identity of each plant species was confirmed through herbarium & field studies. Names of plants are listed in alphabetic order. Correct names of the plants with important synonyms and name of the family, vernacular names, mode of use of plant parts, PGR status, reported saponin and medicinal property and distribution of the plants are given in table 1. Data sources for every use of the listed plants are also given. Therapeutic and cosmaceutical potentials and trade values are discussed.

Results and Discussion

Soap, shampoo and detergent use of Indian plants

A few reports on soap, shampoo and detergent use of plants are available from India. Agarwal (1986) recorded 28 species of plants used for washing clothes and cleaning body and hair in India; Jain (1991) noted the uses of 13 plant species of India as detergent and shampoo; Mal & Joshi (1991) reported three less-known plants with cleaning property; Banerjee and Pal (1996) noted 4 species used as soap and shampoo by the tribes of North India; Pande and Pokharia (1999) reported 12 species of plants traditionally used as detergent by Himalayan people; Sing *et al*. (2001) listed 16 plant species used as soap and detergent by the Meitei community of Manipur, Menon (in http://www.mtnforum.org/resouces/library/menop02a.htm) listed 4 species used as shampoo by the people of PepparaWildlifeSancturary in Kerala; Khanna (2002) recorded 2 plant species used for cleaning purpose in terai region of Uttar Pradesh; Saklani and Rao (2002) recorded 2 species used as soap and shampoo by people of NE India. Manadhar (2001) tabulated 31 species of traditional soap, shampoo and detergent plants of Nepal, all of which are found in India (except Orneocnide) and possibly used by Nepalis in the adjoining Sikkim and mountainous West Bengal. Besides, a few stray reports on such use of plants from India (given with the mode of use of the species) are available in literature. Present search reveals that there are about 108 species of plants with potential cleaning properties belonging to 87 genera and 52 families of vascular plants in India. These include 25 species of indigenous cultivated plants with available wild forms, 31 species of introduced plants and exotic weeds and 51 species of exclusively wild plants, including 10 species of wild relatives of cultivated plants (fig. 1). Ten dominant families of soap plant resources traditionally used for washing and cleaning in India (fig. 2) are: Leguminousae (15 spp.), Sapindaceae (6 spp.), Rubiaceae (5 spp.), Euphorbiaceae (5 spp.), Sapotaceae (3 spp.) and Asteraceae (3 spp.). These ten dominant families contribute 53 species (50 %) of total soap plant resources of India. The growth form of the soap plant resources (fig. 3) include herbs (37 spp.), climbers (13 spp.), shrubs (24 spp.) and trees (33 spp.). of the 107 species of soap

plant resources of India, those exclusively used as soap for cleaning body parts, as shampoo for cleaning hai and as detergent for washing clothes include 20, 33 and 41 species, respectively. 3 species used both as soap & detergent, 4 species as both shampoo & detergent. Plant parts used as soap, shampoo and detergent (fig. 3) include : extracts of roots, rhizomes and tubers (12 spp.); leves (11 spp.), barks (15 spp.), whole plant (19 spp.), flowers and inflorescence (4 spp.), fruits & seeds (32 spp.), plant ash (14 spp.). Although, not exhaustive, the list of species presented in table 7 provides good representation of plant species, which may be taken up for further research on their cleaning, healing and cosmaceutical properties.

Besides this, Checklist of Medicinal Plant of South East Asia developed by Asian Regional Centre for biodiversity includes 21 species of vascular plants used for washing hair (htt://www.arcbc.org.ph/arcbcweb/medicinal_plants_page5. htm–accessed on 16.9.2013). of these 9 species viz., *Aervalanata* (L.) A.L. Juss ex Schult., *Aspleniumnidus* L., *Klenoviahospita*:, *Morindacitrifolia* L., *Ophioglossum pendulum*, *Archidendronel lipticum* (Blume) I.C. Nielsen, *Plantago major* L., *Sterculia foetida* L. and *Vitistri folia* L. occur in India are not included here due to lack of confirmation.

Cleaning properties of plant parts

About 20 out of a total 108 species of vascular plants traditionally used household soaps; shampoos and detergents contain saponin in their natural products (Sprag *et al*., 2004; Kapoor *et al*., 1969-1975; Rastogi, 1998-2002) a group of glycoside with surface-active properties. These are the sugar-attached steroid molecules with fat-soluble and water-soluble ends, which act as surfactants like soap molecules. Saponins form foamy colloidal dispersion when dissolved in water and the saponin molecules get arranged racially with the hydrophobic end directed towards centre and hydrophilic end to outwards. The surfactant micelles wet the dirt and greese paticles and help in dispersing these water insoluble molecules into and aqous environment, which are then easily removed from the clothes by the mechanical process of washing. Some other plants bear acid useful for cleaning stains and dirt. The plant ashes producing alkaline solution in water are traditionally used as detergent. The cleaning efficiency of these natural products is usually improved through heating and mechanical agitation. The south Indian natural shampoo powder, popularly called 'Thali' in Kerala, is generally a mixture of 12 species. Viz., *Hibiscus rosasinenis* L., *Sida cordifolia* L., *S. rhombifolia* L., *Elephantopus scaber* L., *Indigofera tinctoria* L., *Aloe vera* (L.) Burm. F., *Eclipta prostrate* (L.) L., *Phyllanthus fraternus* Webster, *Piper nigrum* L., *Smithia conferta* Sm., *Biopohytum sensitivum* DC. and *Electaria cardamomum* (L.) Maton. Sometimes powder of a few plants like *Vernonia cineraria* Less., *Ocimum tenuiflorum* L., *Asparagus racemosus* Wild., *Cardiospermum helicacabum* L. and *Curcuma caesia* Roxb. are also added to 'thali' to improve its medicinal property. This natural shampoo powder is popular in South India for its better cleaning effect on hairs with additional medical benefits.

Healing effects of natural soap, shampoo & detergent

About 69 out of 108 species (64% of these plants are reported to have medicinal properties (Rastogi *et al*., 1998-2002; Jain, 1991; The Wealth of India, 1952 – 1985), and are traditionally used against various ailments including rheumatism, skin and hair problems. Although, soaps and shampoos are applied externally at the time of bathing a fraction of material gets absorbed by skin and provides some medicinal effects. Thus, most of these plants serve double purpose, cleaning and healing. About 20 species out of the total 108 species have saponins. Saponins are insecticidal, antibiotic and have other pharmacological properties (Sprag, 2004). They are used in phytotherapy and in cosmetic industry (Estrada *et al*., 2000). Saponins are extremely toxic to cold-blooded animals but their oral toxicity to the mammals is low (Dini *et al*., 2004). Thus, the pharmacological properties of saponins are traditionally extracted for the benefit of human being, a warm blooded animal.

Saponin of the fruits of *Sapindus mukorossi* is germicidal and has deodorizing properties. When used as soap or shampoo, it removes freckles and beautifies skin and the remnants of saponin on the body serve as insect repellent (htt://www.solsticesoap.com/herbal-soap.html). The seeds of *Aesculus hippocastanum* are decongestant, expectorant and tonic and used in treatment of rheumatism, neuralgia and haemorrhoids. The leaf of *Agava Americana* being a good poultice against bruses and rheumatism can also be used as a shampoo. The whole plant of *Anagalis arvensis* is used against cerebral affection, gout, hydrophobia and leprosy (Ambasta *et al*., 1986). Thus use of *A. arvensis* as soap may also provide good medicinal effects to the users. Leaf extract of *Senna alata* effective against skin diseases and eczema. Effectiveness of the plant parts used as soap and shampoo may be enhanced by addition of more effective natural probducts like *Azadirachta indica* (lf), *Hydnocarpu skurzii* (sd-oil), *Senna alata* (lf), *Bacopa monnieri* (lf), etc. for skin care. Seeds of *Trigonella foenumgraecum*

Table 1 : Potential soap, shampoo and detergent plants of India.

S.no.	Name [Basionym & synonym] (Family)	Vernacular name	Plant parts & Mode of use	Soap in Nepal	Medicinal	Status	Distribution
1	*Acacia concinna* (Willd.) DC. [=Mimosa concinna Willd.; Acacia sinuate (Lour.) Merr.; A. ruguta (Lam.) Voigt](Leguminosae-Mimosoideae	Shikakai (Guj.);Kochi, Hikakai(Hind.); Sikokai(Tam.); Soap pod (Eng.)	Pod used as detergent in terairegion of Uttar Pradesh (Khanna, 2002). Indians use decoction of pod power for washing hair & paste of pod in skin diseases (D'amelio, 1999)	-	+	W	India: ANP, AP, AS, BH, DL, G, GR, KT, Kr, MP, ML, MNP, MZ, NL, OR, PC, RS, SK, TN, UP, WB; Bangladesh, Bhutan, Myanmar, Nepal, China, Malesia & Australia.
2	*Acacia instsia* (L.) Wild.[Mimosa intsia L.](Leguminosae-Mimosoideae)	Aila (Hind.); Korinta (Tel.); Kariyundu (Tam.)	Bark used as substitute of soap for washing hair (Agarwal, 1986)	-	+	W	India: ANP, GR, HP MR, MP, PJ, TN, WB; Bangladesh, Nepal, Sri Lanka & Myanmar.
3	*Acacia pennata* (L.) Wild.[=Mimosa pennata L.](Leguminosae-Mimosoideae)	Biswal, Iktonda(Hind.); Potadontari(Ori.); Kuchui(Beng.); Rustymimosa (Eng.)	Bark used as detergent (shampoo?) in Madhya Pradesh, Maharashtra & Andhra Pradesh (Jain, 1991).	-	-	W	India: ANP, AP, AS, BH, G, GR, KT, KR, MP, ML, MZ, OR, NL, PC, PJ, RS, SK, TN, UP, WB; Nepal, Bangladesh, Bhutan & Myanmar.BH, G, GR, HP, JK, KT, KR, MP, MR, OR, PC, PJ, RS, SK, TN, UP, WB; Pakistan, Thailand & Sri Lanka.
4	*Acacia torta* (Roxb.) Craib.[=Mimosa torta Roxb.](Leguminosae-Mimosoideae)	Chilar, Alay, Ktnar(Hind.); Anthochini,Attu (Mal.); Dentari(Ori.)	Bark used as detergent in Punjab, Haryana, Rajasthan & Gujarat(Jain, 1991)	-	-	W	India: ANP, AP, BH, G, GR, HP, JK, KT, KR, MP, MR, OR, PC, PJ, RS, SK, TN, UP, WB; Pakistan, Thailand & Sri Lanka.
5	*Aesculus hippocastanum* L.(Hippocastanaceae)	Pu (Punj.); Horsechestnut (Eng.)	Seeds rich in saponin & latherwell in cold (Wealth of India, 1985).	-	+	E	South Europe; occasionally grown as an ornamental tree in India.
6	*Aesculus indica* Hook. [=Pavia indica Wall ex Cambess.] (Hippocastanaceae)	Bankhor, Kandar(Hin.); Han (Kash.); Himalayan Chestnut (Eng.)	Crushed fruit used for washing clothes (Wealth of India, 1985); Kernel is a detergent for woolen clothes (Jain, 1991)	-	+	W	Distributed in India, Pakistan, Nepal, Bhutan, Myanmar, North Thailand, Laos, South West Yunnan, Afghanistan & Iran.
7	*Agave Americana* L. (Agavaceae)	Rambans (Hind.); Bilatipat (Beng.); Century plant (Eng.)	Plant-ash used by Himalayan people for washing clothes (Pande & Pokharia, 1999)	+	-	E	Mexico; introduced in Punjab and Bombay Presidency as a hedge plant.
8	*Albizia lebbeck* (L.) Willd. [=Mimosa lebbeck L.] (Leguminosae-Mimosoideae)	Siris (Hind., Beng., Ori.); Kattuvaka (Mal.); Sirisha (Sans.); East Indian walnut (Eng.)	Bark used as detergent in Karnataka, Tamil Nadu, Goa, Kerala & Lakhadeev (Jain, 1991)	+	+	W	India: ANP, AP, AS, BH, DL. G, GR, HP, JK, KT, KR, MP, MR, MNP, ML, MZ, NL, OR, PC, PJ, RJ, SK,, TN, TP, UP, WB; Bangladesh, Bhutan, Myanmar, Nepal, Pakistan, Sri Lanka, Maldives.

Table 1 continued...

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9	*Albizia lucidior* (Steud.) I.C. Nielsen [Inga lucidior Steud.; Albizia lucida Benth.] (Leguminosae- Mimosoideae)	Sil (Beng.); Padaka (Nep.)	Bark used for bathing in Nepal (Manandhar, 2001)	-	-	W	India: AP, AS, BH, HP, MR, MNP, ML, NL, PJ, SK, TN, TP, UP, WB; Bangladesh, Bhutan, Myanmar, Nepal, Pakistan, China & Indo-China.
10	*Albizia procera* (Roxb.) Benth. [=Mimosa procera Roxb.] (Leguminosae- Mimosoideae)	Safed siris (Hind.); Koroi (Beng.); karunthagara (Mal.); Sirisa (Sans.)	Pod and stem bark used as shampoo by tribals in NE India (Saklani & Rao, 2002)	+	+	I	India; sub-Himalayan tracts from Yamuna eastwards to West Bengal, Satpura ange, Gujarat, S.India & Andamans; Sri Lanka, S.China, SE Asia & N. Australia.
11	*Aloe vera* (L.) Burnm.f.] [=A. barbadensis Mill. (Aloaceae)	Ghrit kumara (Hindi.); Ghee kuanri (Ori.); Ghrita kumara(Sans.); Barbados/ Indian aloe (Eng.)	Leaf juice used to wash hair in Punjab, Haryana, Rajasthan & Gujarat (Jain, 1991).	-	+	E	American tropics; widely cultivated & sometimes naturalized many parts of India.
12	*Anagallis arvensis* L. (Primulaceae)	Jainghani (Hind.); Dhabbar (Punj.); Sabune jhar (Nep.); Scarlet pimpernel (Eng.)	Plants used for bathing in Nepal (Manandhar, 2001).	+	+	W	North Africa, temperate Asia, Indian subcontinent and Europe
13	*Ananas comosus* (L.) Merr. [=Bromelia comosa L.] (Bromeliaceae)	Ananas (Hind.);Sapuri Panas (Ori.);\ Kazhudha-chakka (Mal.); Pine apple (Eng.)	Fresh fruit juice used for washing dirty hands and removing stains on clothes by Meitei community of Manipur (Singh, *et al.,* 2001)	-	+	E	S. America; Brazil; cultivated throughout India.
14	*Archidendron clypearia*(Jacq.) I.C.Nielsen [=Inga clypearia Jack.; Pithecelocium clypearia (Jacq.) Benth.] (Leguminosae-Mimoideae)	Takpier (Lep.); Grass hopper tree (Eng.)	Bark used for washing hairs in India (Agarwal, 1986)	-	-	E	India: AS, AP, ML, TP, KR, TN; Bangladesh, Nepal, Sri Lanka, China, Thailand, Borneo, Java, Sumatra, Philippines, Myanmar.
15	*Asparagus racemosus* Willd. (Asparagaceae)	Satawar (Hind.);Satamuli (Beng.); Shatavali (Mal.);Shimaishadavari (Tam.)	Roots used for washing clothes in Nepal (Manandhar, 2001)	+	+	I	India: tropical & subtropical parts, common in Upper Gangetic plains, Bihar plateau, Andamans & ascending to 1500 m in Himalayas; Sri Lanka, Indonesia, Australia & tropical Africa.
16	*Averrhoa carambola* L. (Averrhoaceae)	Kamarakh (Hind.); Kamranga (Beng.); Karamanga (Ori.); Heinoujom (Mani.); Star fruit (Eng.)	Fruit juice used for washing hands and stained clothes by Meitei community of Manipur (Singh, *et al.,* 2001)	-	+	E	Malesia; cultivated throughout India & other tropical countries.

Table 1 continued...

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17	*Avicennia officinalis* L. (Avicenniaceae)	Bean, Bina (Hind., Beng.); Tivar (Mar.); hite mangrove (Eng.)	Wood ash used by Mundas of Sundarbans in West Bengal as hair wash (Benerjee & Pal, 1996; Jain, 1991).	-	+	W	India: Along coasts of peninsular India & Andamans; Sri Lanka, Malayan peninsula, shores of Indian & Pacific ocean.
18	*Balanites aegyptiaca* (L.)Del. [=Xymenia aegyptiacaL.] (Balanitaceae)	Hingan (hind., Beng.); Ingudihala (Mal.); Nanjunda (Tam.); Angavriksha (Sans.)	Fruit juice used in cleaning silk and cloth due to mild acid in it (Agarwal, 1986, Jain, 1991)	+	+	W	India: throughout drier parts of peninsular India particularly in Karnataka & Tamil nadu, W.Rajasthan & from Punjab to West Bengal & Sikkim; NE Africa & Arabia.
19	*Balanites roxburghii* Planch. (Balanitaceae)	Hingan (Beng.,Hind.); Angario(Guj.); Nanjunda (Tam.)	Pulp of fruit used for cleaning silk & cotton (Singh & Singh, 1998)	+	+	W	India: drier parts of peninsular India, Rajasthan and from SE Punjab to West Bengal & Sikkim; Pakistan and Myanmar.
20	*Bignonia capreolata* L. [=B.catalpa L.] Bignoniaceae	Cross-Vine, Quarter-Vine (Eng.)	UPI		+	E	Native to North America and extensively grown for Ornament in the tropics of the old world (Wealth of India 2: 151.1988)
21	*Boehmeria rugulosa* Wedd. (Urticaceae)	Sedang (Beng., (Lep.); Dar (Nep.)	Bark used for bathing in Neapal (Manandhar, 2001)	-	-	W	Throughout Himalayas from Garhwal to Bhutan, up to 1200 m.
22	*Borago officinalis* L. (Boraginaceae)	Bee plant, Borage (Eng.)	Flowering tops used in cleaning of skins and helps remove impurities from clogged pores (D'Amelio, 1999)	+	+	E	N. Africa, W. Asia and Europe; cultivated in India, N. America and Chile.
23	*Brassica rapa* L.ssp.campestris (l.)A.R. Clapham [=B.campestris L.] (Brassicaceae)	Sarsoo, Lahi (Hind.); Sarisa (Beng.);Sorisha (Ori.); Katusneha (Sans.); Mustard (Eng.)	Plant ash used for washing clothes in Nepal (Manandhar, 2001). Ass of Brassica spp. Used as detergent by the Himalayan people (Pande & Pokhariya, 1999)	-	+	I	India : cultivated throughout; Central Asia, Europe & Africa; exact native range obscure; originated most likely in Eruasian region.
24	*Byttneria andamensis* Kurz (Sterculiaceae)	Adbaubol (Andamani)	Mucilage of bark used for washing hair ((Malik, 1993; Agarwal, 1986)	-	-	W	India, often found near coasts and along creeks, Andaman & Nicobar Islands.
25	*Byttneria aspera* Colebr. (Sterculiaceae)	Tikoni borua (Asm.); Risut-riubi (Miri,Abor); Mei-slah (Khasi)	Macerated young parts and bark used by Mikiris and Khasi women to wash hair (Kanjilal, *et al*., 1934)	-	-	W	India: Mixed evergreen forests in Arunachal Pradesh, Assam, Meghalaya, Nagaland, Sikkim; Bhutan, China, Nepal.
26	*Carica papaya* L (Caricaceae)	Papita (hind.) Pepe (Beng.); Papayi (Guj.); Awathabi (Mani.); Papaya (Eng.)	Latex used for washing reddish-stained clothes by the Meitei community of Manipur (Singh, *etal.* 2001). Fruit pulp removes blemishes (Kapoor, 2005). Leaf extracts used in facemask & shamppos; pulp of ripe fruit used as face wash in northern India.	-	+	I	Southern Mexico, C. America; America; cosmopolitan under cultivation.

Table 1 continued...

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27	*Carissa carandas* L.[=Carissa congesta Wight] (Apocynaceae)	Karaunda (hind.); Karancha (beng.); Karakka (mal.); Kalaka (Tam.); Karamla (S); Karanda (Eng.)	Bark used for bathing in Nepal (Manandhar, 2001)	-	+	I	India: in dry forests & frequently cultivated especially in northern and north-western plains; China, E. Asia, Indo-China & Malesia.
28	*Citrus limon* (L.) Burm. F. [*C.medica* L. var. limon L. (Rutaceae)	Gulgul, Paharikaghzi (Hind.); Goralebu(beng.); Champra (Mani.); Limon (Eng.)	Fruit juice used for cleaning turmeric and chlorophyll stains by Meitei community of Manipur (Singh, *et al.,* 2001)	-	+	E	S.E. Asia; cultivated throughout India and other tropical & subtropical countries.
29	*Colubrina asiatica* (L.) Brongn.]=Ceanothus Asiaticus L.] (Rhammanaceae)	Guti (Mar.); Indian snakewood,Lather leaf, Asian snake root (Eng.)	Bark contains saponin and is reported to be used in Samoa for clearing mats (Bhandari & Bhansali, 2000).	-	+	W	India: near coasts; China, Myanmar, Sri Lanka, Indonesia, Australia and S. Africa.
30	*Convolvulus arvensis* L (Convolvulaceae)	Birilhara (hind.); Bhadrabala (Sans.); Field bindweed (Eng.)	Whole plant used as detergent in Jammu & Kashmir & Himachal Pradesh (Jain 1991)	-	+	E	Macaronesia, N. Africa, temperate Asia and Europe.
31	*Curcuma longa* L.[=Curcuma domestica Val.] (Zingiberaceae)	Haldi (Hindi., Ori.);Halud (Beng.); Yaingang (Mani.); Turmeric (Eng.)	Filtrate of the mixture of ash of dry leves in water used for washing silk clothes and threads by Meitei community of Manipur (Singh, *et al*., 2001)	-	+	I	Extensively cultivated throughout India and other tropical countries; Probably arose with C. aromatic Salisb. A native of India, from E. Himal to Sri Lanka.
32	*Cyathula capitata* Moq. (Amaranthaceae)	Kuro (Nep.)	Roots used for washing clothes in Nepal (Manandhar, 2001)	-	+	W	India: Himalayas, North East India; Sri Lanka, Java.
33	*Cyclea peltata* (Lam.) Hook.f. & Thoms. [=Menispermum peltatum Lam.] (Menispermaceae)	Kanipet, Kalepat (Guj.); Para (Tam.); Padathaly, patavalli (Mal.)	Rhizome & leaf used as shampoo in Peppara WLS in Kerala (Menon)	-	+	W	India: Gujarat, Maharashtra, Tamil Nadu & Kerala in moist deciduous forests; Sri Lanka.
34	*Dioclea hexandra* (Ralph) Mabb. [=Mucuna hexandra Ralph; *Dioclea reflexa* (Hook.f.) C. Wright (Leguminosae-Faboideae)	Sea purse (Eng.)	Sees used in hair wash for killing lice in India (Agarwal, 1986).	-	-	E	India, Bangladesh, Sri Lanka, Myanmar, Malesia, Australia & Islands of Pacific ocean.
35	*Dioscorea alata* L.[D. globosa Roxb.](Dioscoreaceae)	Chupri alu (hind.,Beng.); Greater yam,Asiatic yam (Eng.)	Dried tuber powder used for hair wash to remove dirt by the tribes of north India (Banerjee & Pal, 1996)	-	-	I	India: Western & Eastern Himalayas & NE India; Myanmar, Malaysia, Indonesia & Eastern SE Asia; cultivated throughout the tropics.
36	*Dioscorea deltoidea* Wall. ex Griseb. (Dioscoreaceae)	Kniss, Kriss, Tar, Ritra (Punj.); Kildri, Kithi, Krish (Kash.)	Tuber used as soap for body wash to kill lice (Singh & Kachroo, 1976); also used in washing silken clothes in Western Himalayan region	+	+	I	India; Kashmir & Punjab eastward to Nepal & Khasi hills; Afghanistan, China, Bhutan, Nepal & Pakistan.

Table 1 continued...

Table 1 continued...

37	*Diplocyclos palmatus* (L.) Jeffrey [=*Bryonia palmatus* L.] (Cucurbitaceae)	Gargumaru (Hind.); Sanoghuru (Nep.); Shivalingani (Beng.); Lingini (Sans.); Lollipop-climber (Eng.)	Fruits used for washing hair in Nepal (Manadhar, 2001)	-	+	W	Indian subcontinent, Africa, China, Malesia & Australia.
38	*Diploknema butyracea*(Roxb.) H.J.Lam. [=Bassia butyracea Roxb.; Madhuca butyracea (Roxb.) J.F.Macbr.; Aesandra butyracea (Roxb.) Baehni] (Sapotaceae)	Phulwara (Hind.);Chyura (Kum.);Indian butter tree,Hill mahua (Eng.)	Seed meals used for washing clothes by Himalayan people (Nigam & Misra, 1996; Wealth of India, 1952; Negi *et al*., 1988;Pande & Pokhariya, 1999)	+	+	W	India: sub-Himalayan tract from Kumaon east wards to Sikkim & Bhutan, Andaman island.
39	*Elatostema sessile* J.R. & G. Forst. (Urticaceae)	—	Plant paste in water used by local inhabitants of Tons valley in Uttarkashi district as substitute of soap (Rana, *et al.,* 2003).	-	-	W	India: Himalayas, Assam hills, Nilgiris; Africa, Bhutan, China, Nepal, Malaysia & Myanmar.
40	*Entada rheedii* Spreng. [=E. pursaetha DC.](Leguminosae-Mimosoideae)	Gardul (Hind.); Chui (Arc.)	Seeds used in washing hair in Manipur (Saklani & Rao, 2002); saponins in bark & seeds used as soap (Nielsen, 1992).	+	-	W	India: ANP, AP, BH, G, KT, KR, MP, MR, MNP, ML, NL, OR, SK, TN, TP, WB, AN; Bangladesh, Bhutan, Myammar, Nepal, Sri Lanka; China, Indo-China, Malesia & Africa.
41	*Erioglossum rubiginosum* (Roxb.) Bl. [= *E. edule* Roxb.; *Lepisanthesru biginosa* (Roxb.) Leenth.] (Sapindaceae)	Abigran (Asa.);Ritha (Hind.); Mahanga koli (ori.);Soap nut tree (Eng.)	Fruits used as shampoo in hair wash (Agarwal, 1986)	-*	-	W	India: Eastern Himalayas & North ?East India southwards to peninsular India & Andaman & Nicobar Islands.
42	*Euphorbia hypericifolia* L.[=E. parviflora L.](Euphorbiaceae)	Hakshardana(hind.); Hazardana(Punj.); Musinodudhi (Nep.)	Plants used as soap in Nepal (Manandhar, 2001)	-	+	W	Throughout hotter parts of India, from Punjab, ascending to 4000 feet in the Himalayas to the southern deccan; Malaysia & Sri Lanka.
43	*Euphorbia thomsoniana* Boiss. (Euphorbiaceae)	Hirtiz, Hirer (Kash.)	Roots & leaves used as detergent (Mal & Joshi, 1991). Crushed rootstock used for washing hair, after boling used as purgative(Wealth of India, 1952)	-	+	W	India: Kashmir at elevations above 7,000 fet.
44	*Flacourtia jangomas*(Lour.) Raeusch.[=Stigmarota jangomas Lour.] (Flacourtiaceae)	Paniala (beng.); Heitroi (Mani.); Baincha (Ori.); *Puneala plum* (Eng.)	Filtrate of the mixture of plant ash & water used as detergent by Meitei community of Manipur (Singh, *et al*., 2001)	-	+	I	Semi-wild in Brahamaputra & adjoining areas in the North-East India; cultivated elsewhere.

Table 1 continued...

Table 1 continued...

45	*Ganophyllum falcatum* Blume (Sapindaceae)	—	Bark powder used as hair wash in India (Agarwal, 1986)	-	-	W	India: coastal forests, Andaman & Nicolbar Islands; tropical Western Africa, Philippines, Malaya, Sumatra, Java, New Guinea & Northeast Autrailai.
46	*Garchinia xanthochymus* Hook. f. (Clusiaeae)	Heibung (Mani.); Tamal (Beng., Hind., Ori.); Tamala (Tam.); Egg tree (Eng.)	Ornamentals cleaned with fruit extract for extra glistening by Meitei community of Manipur; fruit is a constituent of local hair lotion (Singh, *et al*., 2001)	-	+	I	India: Eastern Himalayas, AS, BH, OR, MR, TN, KR, ANP, AN; Bangladesh, China, Myanmar, Thlailand & Malaya peninsula; sometimes cultivated.
47	*Gardenia campanulata* Roxb. (Rubiaceae)	Lam beibi (Mani.); Dhubhi khola,Rukhawak (Hind.)	Extract of green fruits stirred in water to foam & used to clean clothes by Meitei community of Manipur (Singh, *et al*. 2001) Fruits used for removing spots on silk fabrics (Agarwal, 1986)	+	+	W	India: Sikkim Himalaya, North East India, Bihar; Bangladesh, Myanmar & Java.
48	*Gardenia turgid* Roxb. (Rubiaceae)	Karhar (Hind.);Gulgal (Guj.); Bhuru(Kandh, Kohl);Bharangi (Sans.)	Pulp of fruit used as hair wash for removing sebum from the scalp by the tribes in North India (Banerjee & Pal, 1996); as detergent in Sikkim, Bengal, Bihar & Orissa (Jain, 1991).	-	+	W	India – tropical Himalaya: from Garhwal to Bhutan and peninsular India: from Bihar & Madhya Pradesh southwards to Tamil Nadu.
49	*Ginkgo biloba* L. (Ginkgoaceae)	Maidenhair-tree (Eng.)	Seeds used for washing clothes (Agarwal, 1986)	-	+	E	China; occasionally grown in gardens of India, particularly on hills.
50	*Glycine max* (L.) Merr. [=*Phaseolus max* L.] (Fabaceae)	Bhatwar, Ramkurthi (Hind.); Soya bean (Eng.)	Boiled extract of mature seeds used as a detergent by Meitei community of Manipur (Singh, *et al*., 2001)	-	+	E	Cultigen believed to be domesticated in N.China; introduced and cultivated throughout India.
51	*Gonostegia hirta* (Blume) Miq. [Pouzolzia hirta (Blume) Hassk. (Urticaceae)	Pathura harjora(beng.); Chiple(lep.)	Seeds used as shampoo in Nepal (Manandhar, 2001)	-	+	W	India: Assam, Meghalaya, tropical Himalaya; Australia, China & Malaysia.
52	*Grevillea robusta* A.Cunn.ex R.Br. (Proteaceae)	Koubiliya (Mani.);Silky-oak (Eng.)	Filtrate of the mixture of plant ash & water used as a detergent for washing clothes by Meitei community of Manipur (Singh *et al*., 2001)	-	+	E	Australia; cultivated in gardens of Ina.
53	*Grewia flavecens* A.L. Juss. [=*G.carpinifolia* sensu Masters] (Tiliaceae)	Chaperandhavi (Hind.); Chikka-garakele (Kan.); Semparan dai (Tam.)	Juice of the plant used in washing hair to remove dandruff & prevent lice by tribal women of India (Agarwal, 1986)	-	+	W	India: in scrub & dry deciduous forests of peninsular India; tropical Africa.
54	*Grewia optiva* J.R. Drumn.ex	Bhimal, Biul, Bitung	Extract of bark used as shampooby the	-	-	W	Moist deciduous and evergreen forests of

Table 1 continued...

Table 1 continued...

	Burette (Tiliaceae)	(Hind.); Taglar (Lep.)	women of Kumaon hills (Lata, 1996; Jain, 1991). Plant ash used as detergent by Himalayan people (Pande & Pokhariya, 1999)				Indian Himalayas; also grown by villagers along boundaries of terraced agricultural fields in Uttaranchal); Pakistan, Nepal & Bhutan.
55	*Gymnocladus assamicus* P.C. Kanjilal (Leguminosae-Caesalpinioideae)	—	Pods used as detergent in Arunachal Pradesh (Sharma, et al. 2002) and as soap for washing bairs by Khasi (Agarwal, 1986)	-	-	W	India: meghalaya, Arunachal Pradesh, Nagaland; China.
56	*Harpullia arborea* (Blanco) Radlk. [=*Ptrlea arborea* Blanco] (Sapindaceae)	Phutika (Ori.); Bidasale (Kan.); Nei-Kottei (Tam.); Chittilamadakku (Mal.)	Fruits used in washing clothes and for washing hair (Pant 2000)	-	+	W	India: evergreen forests; malesia, Australia & SW pacific.
57	*Hibiscus cannabinus* L. (Malvaceae)	Ambari, patsan (Hind.); Meitei Sougree (Mani.); Kanuriya (Ori.); Deccan hemp (Eng.)	Acidic juice of leaves used for washing dirty hands by the Meitei community of Manipur (Singh *et al.*, 2001)	-	-	I	India: throughout; tropical & subtropical Africa; cultivated in most tropical countries for its bast fibre.
58	*Hibiscus rosasinensis* L. (Malvaceae)	Joba (Asm., Beng.,) Mandar (Or.), Java, pushpam (Sans.)	Flowers & leaves used as shampoo by tribes of PepparaWLS, Kerala (Menon)	-	-	E	Cultivated in gardens throughout India &other tropical & subtropical countries;Origin uncertain (FI)
59	*Ipomoea turbinate* Lag. [*I. muricata* (L.) Jacq.; *Convolvulus muricatus* L.] (Convolvulaceae)	Parkamkuthe (Majhi); Purplemoon flower, Lilacbell (Eng.)	Seed paste used for washing hair, removing lice & sometimes for cleaning utensils in Mayurbhanj, Orissa (Saxena & Brahmam, 1989)	-	-	E	Pantropical weed; probably originated in Mexico.
60	*Jatropha curcas* L. (Euphorbiaceae)	Dhala jahaji (Ori.); Barbados nut (Eng.)	Cotyledons used for washing hair in Nepal (Manandhar, 2001)	-	-	E	Mexico and S.America; cultivated & naturalized in India & other tropical countries.
61	*Luffa cylindrical* (L.) M.J.Roem. [=*L. aegyptiaca* P. Mill. (Cucurbitaceae)	Jhinga (Beng.);Jahni (Ori.); Ridgegoud (Eng.)	Widely used as bathe-sponge in India	-	+	I	Cultivated as well as wild in India & other tropical countries.
62	*Lychnis indica* Benth. (Caryophyllaceae)	—	Root and leaves used as a substitute of soap (Agarwal, 1986; Mal & Joshi, 1991; WI)	-	-	E	India: temperate Himalayas at altitudes of 1,650 – 3,000 m.
63	*Madhuca longifolia* (L.) J.F.Macbr. [=Bassia longifoliaL.] (Sapotaceae)	Mahua (Hind.);Ilupai (Tam); Mowrabutter tree (Eng.)	Oil-cake used for washing clothes in Nepal (Manandhar, 2001)	-	+	I	Indian subcontinent & Indo-China; common in mixed deciduous forests of peninsular India; also cultivated.

Table 1 continued...

Table 1 continued...

64	*Madhuca malabarica*(Bedd.) Parker [=Bassia malabarica Bedd.](Sapotaceae)	Attiripa (Tam.?)	Seed paste in water used as hair wash in India (Agarwal, 1986)			I	India: Deccan & western peninsular India.
65	*Matricaria chamomilla* L. [*M. recutita* L.; *Tripleurosperumum perforatum* (Merat) Lainz] (Asteraceae)	Babuna (Gun., Punj.); Babunah (Urd.); Chamobile (Eng.)	Flower heads used as hair wash and cleaning wounds (Agarwal, 1986)	-	+	E	India: JK, HP, PJ, UT; Pakistan, Iraq, Japan, N.Asia & westwards to Atlantic.
66	*Moringa oleifera* Lam. (Moringaceae)	Sohajna (Hind.); Sujuna (Ori.); Mungra (Tel.); Moringa (mal.); Drum stick (Eng.)	Paste of flower used as shampoo and applied on head before bathing for better hair growth by tribals of Nilgiris, Tamil Nadu (Rajendran & Aswal, 2003)	-	+	I	India, Bangladesh, Myanmar, Vietnam, Philippines and Pakistan.
67	*Musa* spp. (Musaceae)	Kela (hind.); Laphu (Mani.); Kadali (Ori.); Banana, Plantain (Eng.)	Ash of petiole/fruit used for washing clothes by Meitei tribes of Manipur (Singh, et al., 2001). Banana ash used in making soap (P.J.Bryant in URL; htt://Darwin.bio.uci.edu:80/susta in/protected/chap7slides.ppt)	-	-	I	India and Malaysia; widely cultivated all over world.
68	*Mussaenda frondosa* L.(rubiaceae)	Bedina (Hind.); Nagballi (Beng.); Velliam (Mal.); White lady (Eng.)	Leaves used as shampoo in Peppara WLS, Kerala (Menon)	-	+	I	Tropical Himalayas from Dehra Dun eastwards, Khasi hills, Deccan peninsula & Andaman & Nicobar Islands; commonly cultivated in gardens.
69	*Neolitsea cassia* (L.) Kostermans [=*N. zeylanica* (Nees) merr.; *Litseazey lanica* Needs] (Lauraceae)	Bellary leaf (Eng)	Plants used as detergent (Shiva *et al.*, 2002)	-	+	I	India: Eastern Himalaya, hills of Assam & Deccan peninsula; also cultivated.
70	*Noltea africana* (L.) Endl. [=*Ceanophys africanaus* L.] (Rhamnaceae)	Dogwood (Eng.)	Plants used as soap and detergent in India (Ambasta *et al.*, 1986)	-	-	E	Africa; cultivated in India.
71	*Oldenlandia corymbosa* L.(Rubiaceae)	Daman papar (Hind.); Khet-papra (beng.); Gharpodia (Ori.); Parpadagam (Tam.); Parapata (Sans.)	Whole plant used as shampoo in Peppara WLS, Kerala (Menon)	-	+	W	India & other tropical countries.
72	*Oryza sativa* L. (Poaceae)	Dhan (Hind, Beng.); Dhana (Ori.); Phou (Mani.); Dhanya (Sans.)	Straw ash used as a detergent for washing clothes and sometimes used as soap for bathing by Meitei community	-	+	I	Primary centre NE Himalayan region; cultivated throughout tropics, subtropics & warm temperate regions.

Table 1 continued...

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			of Manipur (Singh *et al*., 2001); used as detergent by Himalayan people (Pande & Pokhariya, 1999).				
73	*Pegolettia senegalensis* Cass. (Asteraceae)	—	Herbs useful in washing ornaments in India (Agarwal, 1986)	-	+	E	India: NW Rajasthan; Pakistan, Arbia & Cape Verde islands; global weed.
74	*Persicaria lapathifolia* (L.)Gray [=Ploygonumlapathi folium L.] (Polygonaceae)	Phelwa makundo(Nep.); PalePersicaria (Eng.)	Whole plant used for washing clothes in Nepal (Manandhar, 2001)	-	-	E	N.Africa, temperate Asia & Europe; widely naturalized.
75	*Phlogacanthus thyrsiflorus* Nees (Acanthaceae)	Tita phool (Hind.); Bankeka (Asa.); Rheeom (Lep.)	Leaves used for washing purpose in India (Agarwal, 1986)	-	-	W	Subtropical Himalayas from Garhwal to Bhutan; also common in Khasia mountains and Assam.
76	*Phlogacanthus tubiflorus*Nees (Acanthaceae)	Bhataitia (Asa.); Chakbam (Hind.); Banchha, (Mikir); Vatezuk (Lusai)	Lather produced on rubbing leaves with water used for washing purposes in North East India (Kanjilal 1934; Wealth ofIndia, 1969; Jain, 1991)	-	+	W	India: Assam plains, Khasi & Garo hills.
77	*Phyllanthus emblica* L. [*Emblica officianlis* Gaertn.] (Euphorbiaceae)	Amla (Hind.);Amalaki (beng.);Myrobalan (Eng.)	Plant ash used as detergent by the people of the Himalayas (Pande & Pokhariya, 1999)	-	+	I	India, Sri Lanka, China & Malaysia; also cultivated in home-gardens.
78	*Phyllanthus parvifolius*Ham. (Euphorbiaceae)	Khareto (Nep.)	Whole plant used for bathing in Nepal (Manandhar, 2001)	-	-	W	Temperate Himalayas: from Jammu & Kumaon to Bhutan
79	*Pilea anisophylla* Wedd.) Urticaceae)		Roots used for cleaning hair & removing dandruff (Manandhar, 2001)	-	-	W	Eastern subtropical Himalayas & Naga hills; Nepal, Sikkim & Bhutan.
80	*Pouzolzia zeylanica* (L.)Benn. [=*Parietaria zeylanica* L.; *Pouzolzia indica* (L.) Gaud.] (Urticaceae)	Eddu (Tel.); Kallurki (Tam., Mal.);Maslahari (Nep.)	Whole plant used for washing hair in Neapal (Manandhar, 2001)	-	-	E	Throughout India up to an altitude of 2100 m and often occur as weed.
81	*Prangos pabularia* Lindl. [= *Koelzella pabularia* (Lindl.) Hiroe] (Apiaceae)	Komal (Hind.);Kurungas (Kash.)	Fruits and seeds used as hair wash to clean skin root in animals (Agarwal, 1986)	-	-	W	India – Western Himalayas: Kashmir, 1000 – 3500 m; Tibet, Afghanistan & central Aisa.
82	*Pteridium aquilinum* (L.) Kuhn [=*Pteris aqilina* L. (Denstaedtiaceae)	Tavi (Mal.); Parnai(Tam.); Bracken(Eng.)	Rhizome used for cleaning clothes in India (Wealth of India, 1969; Ambasta, *et al*., 1986)	-	-	W	Worldwide weed; weed in grassy lands in the hills of India.
83	*Quillaja saponaria* Molina (Quillajaceae)	Sabunper (Tam.?); Soap-bark tree, Soapbush (Eng.)	Powdered bark gives foams for washing fine fabrics & cleaning hairs (Agarwal, 1986); also used to make a dandruff	+	+	E	Peru & Chile in South America; introduced in Nilgiris and south India (Samraj, 1981).

Table 1 continued...

Table 1 continued...

			shampoo (D'Amelio, 1999).				
84	*Randia spinosa* Poir. [=Xeromphis spinosa Keay] (Rubiaceae)	Mainphal (Hind.);Main (Nep.); Emeticnut (Eng.)	Unripe fruits used for washing clothes (Manandhar, 2001; Agarwal, 1986)	-	-	W	India: common in Sal forests of the sub-Himalayan tract & in many parts of peninsular India.
85	*Saccharum officinarum* L. (Poaceae)	Eekh, Ganna (Hind.); Akhu (Ori.); Chu (Mani.); Sugarcane (Eng.)	Warm fresh juice used as detergent for washing clothes, especially white dresses (Singh *et al.*, 2001)	-	+	I	Cultivated in India & warmer parts of world.
86	*Sapindus emarginatus* Vahl. (Sapindaceae)	Ritha (Hind.); Aratula (Kan.); Berugukay (Mal.); Soap nut (Eng.)	Fruits used for washing clothes and cleaning body (Agarwal, 1986; Pant, 2000)	+	-	I	India: gangetic plain, Western Ghats, Deccan Plateau, in deciduous & dry evergreen forests, occasionally planted on roadsides & gardens; Pakistan, Sri Lanka & Myanmar.
87	*Sapindus mukorossi* Gaertn. (Sapindaceae)	Ritha (Hind.); Kekru (Mani.); Urvangikaya, Urulingi (Mal.); Pungan kottai (Tam.); Chinese soapberry (Eng.)	Fruit pulp or dried fruit skin soaked in warm water used for washing hair, silk & woolen garments for extra gloss by the tribes of north India, Himalayas, Manipur & other places of India (Negi & Pant, 1994; Banerjee & Pal, 1996; Pande & Pokhariya, 1999; Singh, *et al.*, 2001; Agarwal, 1986).	+	+	I	India: Himalayas, Gangetic Plains, Assam plains up to 1660 m, also frequently planted along roadsides; China, Japan, Pakistan, Nepal, Bangladesh.
88	*Sapindus trifoliatus* L. [=*S. laurifolius* Vahl.] (Sapindaceae)	Ritha, Bara reetha (Hind..); Pasamota (Mal.); Soap nut tree (Eng.)	Fruit extract used especially for washing clothes; kernel oil used in soap industry (Agarwal, 1986; D'Amelio, 1999; Pant, 2000)	+	+	I	India: plains of Northrn Western & Central India, Western Ghats, common in evergreen forests, sometimes planted; Pakistan and Sri Lanka.
89	*Saponaria officinalis* L (Caryophyllaceae)	Soap wort, Soaproot Crow soap, Bouncing bet (Eng.)	Extract of root & leaf used for washing delicate fabrics (Majumdar, 1972; Agarwal, 1986; (htt;://altnature.com/gallery/s oapwort.htm) and as shampoo (D'Amelio, 1999)	+	+	E	Macaronesia, Caucasus, Siberia, W.Asia, Europe; wildly naturlised elsewhere; planted in Indian gardens.
90	*Saussurea costus* (Falc.)Lipsch. [=*S. lappa* (Deccne.) C.B.Clarke] (Asteraceae)	Kut, Kutha (Hind.); Brahma kamal (Beng.); Kottam (Mal.); costus (Eng.)	Dried root powder useful as a hair wash & astringent stimulant (D'Amelio, 1999)	-	-	W	India-NW Himalayas: Jammu & Kashmir, Himachal Pradesh, Uttaranchal; Pakistan.
91	*Scrophularia urticaefolia* Benth. (Scrophulariaceae)	Mokhi ghasns (nep.)	Whole plant used for washing hair in Nepal (Manandhar, 2001)	-	-	W	India: Central and Eastern Himalayas; Nepal.
92	*Senna alata* (L.) Roxb. [=*Cassia*	Dadmurdan (Hind.);	Decoction of flowers and leaves used	-	+	E	South America; Introduced in India & other

Table 1 continued...

Table 1 continued...

	alata L.] (Leguminosae-Caesalpinioideae)	Jadumari (Ori); Dadhrugna (Sans.); Ringworm cassia (Eng.)	for washing enzymatous patches (Agarwal, 1986)				tropical counties.
93	*Seasmum orientale* L. [= *S. indicum* L.] (Pedaliaceae)	Til (Hind.); Tila(Sans., Ori.);Gingelly (Eng.)	Plant-ash used for cleaning clothes by people of Himalayas (Pande & Pokharia, 1999)	-	+	E	Africa, India: cultivated & naturalized throughout plains.
94	*Shorea robusta* Roxb. ex Gaertn.f. (Dipterocarpaceae)	Sal (hind., Beng., Ori., Punj.); Salah (Sans.)	Wood Ash used for washing clothes in Nepal (Manandhar, 2001); seed-oil used in soap industry (Agarwal, 1986)	-	+	W	India: sub-Himalayan tract from Punjab to Assam, southwards through WB, BH & OR in to Andhra Pradesh & Madhya Pradesh; other tropical coutries.
95	*Sida acuta* Burm.f. (Malvaceae)	Bariara (Hind.); Sunakhadika (Ori.)	Roots used in Nepal as shampoo (Manandhar, 2001)	-	+	W	India & all other tropical countries as a weed.
96	*Sida rhombifolia* L.(Malvaceae)	Bhiunli (Hind.); Lalberala (Beng.); Anakurunthotti (Mal.)	Whole plant used as detergent (shampoo?) in Karnataka, Tamil Nadu, Goa, Kerala & Lakhyadeep (Jain, 1991)	-	-	W	Throughout India & other tropical countries.
97	*Silene griffithii* Boiss. (Caryophyllaceae)	—	Roots and leaves used as substitute of soap (Mal & Joshi, 1991; Wealth of India, 1972)	-	-	E	India: Western Himalayas- from Kashmir to Garhwal; Afghanistan.
98	*Solanum aculeatissimum* Jacq. (Solanaceae)	Kantakari (Nep.); Love apple (Eng.)	Fruits used for washing clothes in Nepal (Manandhar, 2001)	-	+	E	Brazil; naturalized in tropics including South India.
99	*Suaeda maritime* (L.) Dumort. (Chenopodiaceae)	Khari lani (hind.); Ilakoora (Tel.); Vellakeerai (Tam.); Indian saltwort (Eng.)	Whole plant used as detergent (soap?) in Sikkim, Bengal, Bihar & Orissa (Jain, 1991)	-	-	W	India: Upper Gangetic plains, Delhi, Sea coast of Bengal, Mumbai, Decan; Sri Lanka, Myanmar, Europe, N. Africa, N & W Asia, N. America.
100	*Tamarindus indica* L. (Leguminosae-Caesalpinioideae)	Imli (Hind.); Tetul (Beng.); Tentuli (Ori.); Kanggoon (Mani.); Tamarind (Eng.)	Crushed green/mature fruits used as a detergent especially for cleaning white clothes; also used as a soap for washing hair (Singh *et al.*, 2001)	-	+	W	Indian subcontinent, Indo-China.
101	*Terminalia myriocarpa* Heurck & Muell.-Arg. (Combretaceae)	Tolhao, Murdh (Mani.); Panisaj (beng.); Hollock (Eng.)	Plant ash used for cleaning teeth; filtrate of the mixture of ash & water used for washing clothes by Meitei community of hills in Manipur (Singh *et al.,* 2001).	-	+	W	India: Eastern Himalayas from North Bengal eastwards to Assam & Arunachal Pradesh; China, Indo-China & Malesia.
102	*Toona ciliata* M. Roem. (Meliaceae)	Tun (Hind.); Tuni (Beng.); Tunna, Apina (Sans.); Redcedar (Eng.)	Ash of bark used as detergent by the people of the Himalayas (Pande & Pokharia, 1999)	-	+	W	India: sub-Himalayan forest from Indus eastwards to Assam & southwards to Tamil Nadu; Pakistan, Nepal, China, Bangladesh,

Table 1 continued...

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							Myanmar, Thailand, Malesia to Australia.
103	*Trigonella foenum-Graecum* L. (Leguminosae-Favodeae)	Methi (Hind., Beng., ori.); Methika (Sans.); Fenugreek (Eng.)	Seed extract used as a hair cleanser (Kapoor, 2005)	+	+	E	India: cultivated throughout, naturalized in Jammu & Kashmir, Punjab & Upper Gangetic plains; Pakistan, Orient, Arabia, S.Europe & Ethiopia.
104	*Triumfetta rhomboidea*Jacq. (Tiliaceae)	Akra (Asa.); Bajramuli (Ori.); Bonghas (Nep.); Burweed (Eng.)	Whole plant used for washing hair in Nepal (Manandhar, 2001)	-	+	W	Weed in India & other tropical countries.
105	*Vaccaria hispanica* P.Mill.) Rauschert [=*Saponaria vaccaria* L.] (Caryophyllaceae)	Sabuni (Beng.); Musna (Hind.); Soap-wort, Cow-Herb (Eng.)	Plant sap used by Indian natives for washing garments, hairs, etc. & as remedy for itch (Majumdar, 1972; Agarwal, 1986)	+	+	E	N.Africa, Asia temperate, Europe; sometimes cultivated in gardents of India & Tibet as an ornamental.
106	*Yucca filamentosa* L. (Agavaceae) Adam's needle,	Needle opalm (Eng.)	Leaves & roots contain steroidal saponis and used to make soap & shampoos; also medicinal (http:// garden.lovetoknow.com/wi ki/Adam's Needle)	+	-	E	Arid areas of southern N. America; planted in gardents of India.
107	*Zingiber zerumbet* (L.) Sm. [=Amoomum zerumbet L.] (Zingiberaceae)	Banadrak (Hind.); Shampoo ginger (Eng.)	Watery juice of flowering heads used as natural shampoo in Polynesia (http:// the.Honolulu advertiser.com/article/ 2005/Jun/2 4/il/ill0a.htm)	-	+	I	Sub-Himalayan tract to peninsular region and also in Andaman & Nicobar; cultivated in tropics.

(Abbreviations used: Arc.=Arunachali; Asa=Asamese; Beng= Bengali; Gar=Garhwali; Guj= Gujarati; Him.=Himachali; Hind.=Hindi; Kan.=Kannad; Kash;=Kashmiri; Kum.=Kumaoni; Lep.=Lepcha; Mal.=Malyali; Mani.=Manipuri; Mar.=Marathi; Nep.=Nepali; Ori.=Oriya; Punj.=Punj.; Sant.=Santhali; Sans.=Sanskrit; Tam=Tamil; Tel.=Telgu; AN=Andaman & Nicobar; ANP=Andhra Pradesh; AP=Arunachal Pradesh; AS=Assam; BH=Bihar; CG=Chhatish garh; DL=Delhi; G=Gora; GR=Gujatrat; HP=Himachal Pradesh; HY=Haryana; JH=Jharkhand; JK=Jammu & Kashmir; KR=Kerala; KT=Karnataka; ML=Meghalaya; MNP=Manipur; MP=Madhya Pradesh; MR=Maharashtra; MZ=Mizorum; NL=Nagaland; OR=Orissa; PC=Pondichery; PJ=Punjab; RS=Rajasthan; SK=Sikkim; TN=Tamil Nadu; TP=Tripura; UP=Uttar Pradesh; UT=Uttaranchal; WB=West Bengal; I=Indigenous cultivated with wild form; W=exclusively wild; E=Introduced cultivated plant or exotic weed; '+' = Present; '-' = absent}.

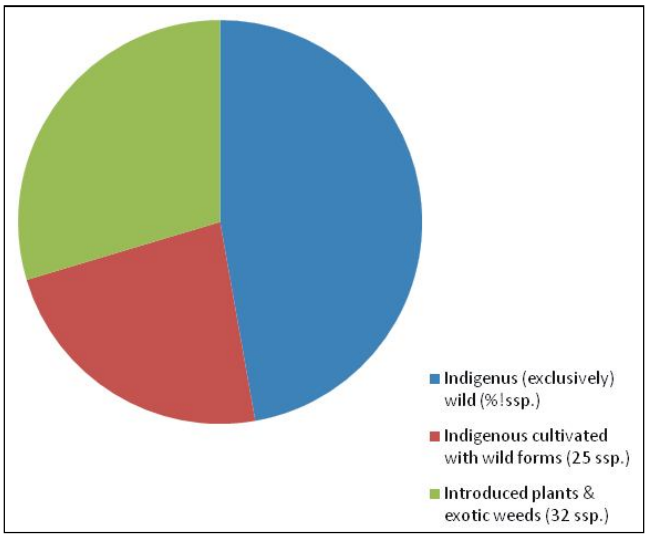

Fig. 1 : Soap, shampoo & detergent yielding plant species of India.

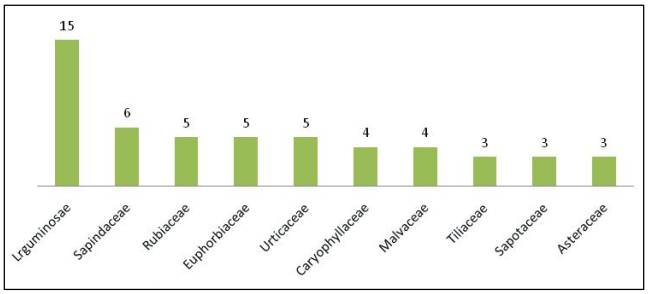

Fig. 2 : Dominant families of soap plants in India.

and fruits of *Tribulus terrestris* reported to have rich saponin content may also be tested for cleaning. Bark of *Salix alba* is an astringent used for cuts and sores and as analgesic, antiseptic, anti-inflammatory, anti-rheumatic and anti-pyretic. This can be used in hair conditioners, shampoos, rinses, etc. (D' Amelio, 1999). *Aloe vera* (lf) usually employed in skin creams, lotions, hair treatments, cuts and irritated skins, has positive medical benefits when used directly as shampoo or as its ingredient. *Betula alba* (brk, lf, fl) is generally used to treat skin diseases, *viz*, acne, psoriasis and eczema and frequently available in market with value added soaps and shampoos. *Matricaria chamomilla* is yet another soap plant with anti-inflamatory, carminative and healing properties, and is used as an ingredient of shampoo and cosmetics. Leaf extract of *Matricaria chamomilla* is applied in anti-acne cream; fruit extract of *Acacia concinna* used for control of dandruff; root extract of *Saussurea costus* in skin ointments for chronic skin diseases; seed extract of *Sesamum orientale* for skin protection and rejuvenation; fruit extract of *Phyllanthus indica* (with oil) for promotion of hair growth (Kapoor, 2005). Leaves and roots of *Yucca filamentosa* used as soap and shampoo also possess antinflamatory and pain-releaving abilities and used as

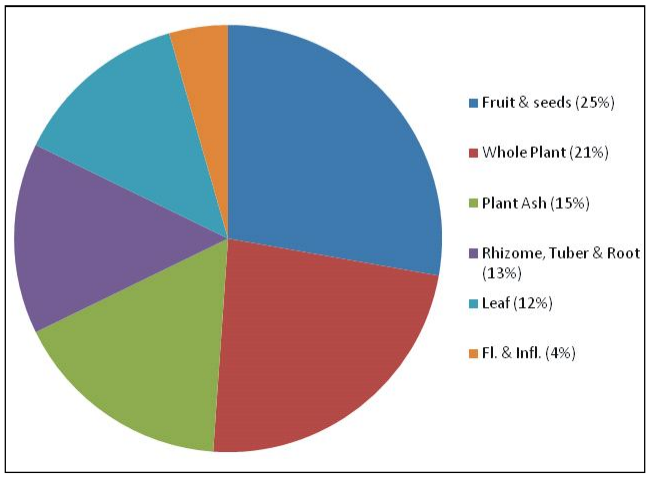

Fig. 3 : Break up of plant parts used as Soap, Shampoo & Detergent.

medicine for inflammation, rheumatism and migraines (http://garden,lovetoknow.com/wiki/adam'sneedle & http:// www.lyraesherbpages. homestead.com/ medicinalherbsQ-Z.html). A number of herbal shampoos in market contain extracts of *Phyllanthus emblica, Acacia concinna, Yucca filamentosa, Zingiber zerumbet* and many others.

Cosmaceuticals

Milky juice of ripe fruits of *Carica papaya* is a good ingredient for facial cream due to presence of protein digesting enzyme 'papein'; *Citrus limon* oil is used in various preparations to reduce skin itching and skin nourishment, pulp left after extraction of juice is useful as facial ingredients; rhizome powder of *Curcuma longa* possesses anti-inflammatory and anti-oxidant properties; used extensively in facial cream and ointments; *Aloe vera* leaf juce, its pulp or extracted material applied on skin for smoothness, healing controlling skin burn, sun burn and injury (Kapoor, 2005).

Plants used in preparation and value addition of Industrial cleaning products

Besides direct use of plant parts for the purpose of cleaning the extracts of various plant parts are also used in preparation of industrial soap, shampoo and detergents and and their value addition. In contrast to natural soaps, shampoos and detergents the industrial cleaning products contain additional inorganic chemicals for increased efficiency in cleaning actions. Some plants such as *Aesculus hippocastanum* L., *Arachis hypogaea* L., *Bactris major* Jacq., *Calpphyllumino phyllum* L., *Corylu savellana* L., *Garcinia cambogia* Desr., *Gossypium* spp., *Maduca longifolia* (L.) Macbr., *Cocos nucifera* L., *Olea europaea* L., *Pongamia pinnata* (L.) Pierr. *Brassica ceruna* (Thunb.) Forbes & Hems.,

Circium arvense (L.) Scop., *Xanthium strumarium* L., *Fortunella japonica* Thunb., *Garcinia echinocarpa* Thwaites, *Garcinia mangostana* L., *Guizotia abyssinica* Cass. And *Impatiens sultcata* Wall. Yield seed oil and used for preparation of industrial soaps. Costly soaps are prepared by using good quality seed oils in soap industries. Essential oils and other biochemical extracts derived from various parts of many species are used for value addition and fragrance of soaps and shampoos. Some of them are: *Aloe vera* L., *Citrus sinenssis* Osbeck., *Matricaria chamomilla* L., *Cymbopogon flexuous* (Steud.) Wats, *Betula alba* L., *Cinamomum glanduliferum* Meisn., *Eucalyptus citriodora* Hook, *Jasminum* spp., *Larusnobilis* L., *Lavendula angustifolia* Mill., *Phyllanthus emblica* L., *Rosmarinus officinalis* L., *Santalum alum* L., *Bursera delpechiana* Boiss., *Cinamomum tamala*, *Ximenia Americana* L., etc. other species useful for preparing industrial soaps are: *Actinodaphne hookeri* Meisn. *Azadirachta indica* A.Juss., *Dipterocarpus macrocarpus* Vesq., *Dipterocarpus pilosus* Roxb., *Haloxy longrecurvum* Bunge, *Hevea brasiliensis* (HBK) Muell., etc.

Trade of natural plant parts used as soap, shampoo and detergent

Many species used as soap substitute are medicinal and usually are usually commercially exploited. These are either sold in India by the herbalists or exported to other countries. A bulk of c. 49% of this resource is exploited from wild source (fig. 1) as non-wood forest produce. Some potential cleaning agents like *Acacia concinna, Albizia lebbeck, Aloe vera*, *Dioscorea deltoidea, Phyllanthus emblica, Hibiscus rosasinensis, Saussurea costus. Tamariandus indica* and *Zingiber zerumbet* are exported from India and *Sapindus mukorossi* (fr.) and *Asparagus racemosus* (rt.) are imported to India from other countries in the form of raw drugs (Rawal, 2003). *Dioscorea deltoidea* and *Aloe vera* have listed in CITES Appendix II. A threatened species, *Sausurea costus* and *Aesculus indica* are also known under trade in Himalayan region (Samant *et al.*, 1998).

Lucrative commerce of some natural cleaning products in India are: *Sapindus mukorossi*, *S. emarginata*, *S. trifoliatus*, *Senna alata* (lf, pod), *Acacia intsia*, *A. concinna*, *Dioscorea deltoidea*, *Asparagus racemous*, *Aesculus indica* and *Saponaria officinalis* (http://www.infobanc.com/selling /2013/2013_ql/503312.htm).

Chemical investigation of Indian plants for saponins

Kapoor *et al*. (1969, 1971, 1972, 1976) investigated about 583 species (incl. vars.) of vascular plants of India and found 79 species positive for saponin. Of these only 3 species (*Dioscorea deltoidea* Wall ex Griseb., *Musa* sp. and *Gardenia turgid* Roxb.) have reported traditional use as soap or shampoo, 7 species (*Agava* sp., *Asparagus acerosus* Roxb., *Cyathula tomentosa* Miq., *Dioscorea bulbifera* L., *Grewia glabra* Bl., *Asparagus curillus* Ham. & *Dioscorea pentaphylla* L.) are relative of earlier reported plants with soap use and the remaining 69 species have no such report of traditional use as soap. Saxena investigated plants of 103 species of phanerogams from Orissa and reported 12 species positive for saponins, none of which have any report of traditional use as soap or shampoo.

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