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Lac, Plant Resins and Gums Statistics 2015 : At a Glance

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Cover page photographs
Up to down : **Row 1 -** *Accasia nilotia* (Rajasthan) **Row 2 -** *Sterculia urens* (Jharkhand)
Row 3 - *Commiphora wightii* (Gujarat) **Watermark -** Production and EXIM trend of *guar* gum.

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FOREWORD

Non-Wood Forest Products (NWFPs) have for many years been seen as providing fertile ground for community development initiatives, especially those focused on rural, remote, indigenous, and/or economically marginalized communities. Production of such natural products is greatly influenced by weather vagaries and prices. Therefore, statistics of these commodities are sought by the traders, processors, exporters, importers, government officials, policy makers, researchers and others. The present publication, 'Lac, Plant Resins and Gums Statistics 2015: At a Glance' contains statistics on geographical distribution, production, price, processing, export and import of natural resins and gums including lac, pine resins, *guar* gum, gum *karaya*, *dhawda* gum, Olibanum, *etc*. The production of gums in important States, *viz*, Chhattisgarh, Madhya Pradesh, Gujarat, Rajasthan and Andhra Pradesh; production of pine resins in Uttarakhand and Himachal Pradesh; export and import of natural resins and gums is included to give a clear and comprehensive overview of the most important information in as little time as possible.

Reliable and timely availability of data and information on natural resins and gums production may be helpful to the stakeholders. Documentation of updated major production and market areas will be helpful in relation to plan their operation in time for collection and disposal of the produces. This publication is the comprehensive treatment of Natural Resins and Gums (NRGs) in India. It had a strong focus on the markets and potential markets for these products. It will be useful to private sectors who are interested in increasing their income and widening its base.

In this issue, content is presented in five major headings covering introduction; methodology; production, processing and trade; policy implications and conclusions. Information on market trend is essential for better organization of Indian producing states to meet increasing demand through better organization of their local/regional/national commercial channels from production to export, stabilization of the market with appropriate stocks, quality control of exported products and adequate support and application of price at production level. While it applies to a wide range of situations, marketing research gives decision-makers the information they need to find solutions to business problems such as how consumer satisfaction, decision, *etc.* Simply put, the solution to most business problems can be found through marketing research.

We believe it will contribute to the development of a sector that has huge untapped potential in an assortment of directions. I am sure that the information and data contained in this bulletin would be useful to all the stakeholders of NRG sector. Authors made every effort to distill and condence a very large and diverse topic into and approachable volume. I exalt the authors for their efforts in bringing out this bulletin. Suggestions and inputs are sought from stakeholders for improvement of this publication in future. The information used in the publication will be duly acknowledged.

Ranchi

(KK Sharma)

Director

Acknowledgement

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INTRODUCTION

Along with the remarkable economic growth and industry development, India has become one of the largest producer, consumer and trader of Non-Wood Forest Products (NWFPs) in the world. This rapid development has led to substantial changes in the global picture of NWFPs trade and has drawn attention to the future demand and supply on a global scale. India is a diverse tropical (dry and wet) country of approximately 1252 million people. Forest cover is about 21.34% (FSI, 2015) of the total geographical area. Forest is an important sector having a significant contribution to the Indian economy. Forest industries contribute to 1.2% of India's Gross Domestic Product (Economic Survey, Ministry of Finance, 2011). It is estimated that of the 6.2 billion people on the planet, 25 % depend to varying degrees on the forest resources for their livelihood with 350 million people living in or near dense forest areas and depend highly on them for their subsistence or livelihood (Killman, 2003). About 80% of the people living in developing countries depend on Non-Wood Forest Products (NWFPs), such as fruits and herbs, for their primary health and nutritional needs (FAO, 2008).

India houses 30% of the global poor, 24% of global population without access to electricity, and 92 million people without access to safe drinking water. Coupled with its vulnerability in terms of the impact of climate change, this entails that India faces formidable and complex challenges in terms of balancing the sustainable development agenda. Given the challenges it faces, it has prepared an ambitious plan in terms of clean energy, energy efficiency and lower emission intensity while addressing the critical issue of poverty and food security. The world also witnessed the adoption of the Sustainable Development Goals (SDGs) in September 2015 which replace the State of the Economy: An overview 29 Millennium Development Goals (MDGs) and set the development agenda for the next 15 years with the aim of guiding the international community and national governments on a path of sustainable development. Domestically, many initiatives have been taken by India on climate change and sustainable development. India has submitted ambitious targets in its Intended Nationally Determined Contribution (INDC) in the renewable energy sector, mainly from solar and wind energy. India's INDC has been welcomed as fair and ambitious specifically on renewable energy and forestry sector. Out of the eight National Missions on Climate Change in India, five focus on adaptation in sectors like agriculture, water and forestry. In the June 2012 RIO+20 United Nations Conference on Sustainable Development, the UN General Assembly's Open Working Group proposed SDGs covering a broad range of sustainable development issues, including ending poverty and hunger, improving health and education, making cities more sustainable, combating climate change and protecting oceans and forests, and were adopted by the General Assembly as part of the broader post-2015 development agenda in September 2015. The SDGs are effective from January 2016 and will end in 2030.

Indian subcontinent is a major hub of biodiversity of fauna and flora. Several forest products have significant importance in social and economic life in tropical areas. These forest products are classified into wood and Non-Wood Forest Products (NWFPs). NWFPs according to definition of FAO (1999) are 'products of biological origin other than wood, derived from forests, shrublands and tree plantations'. These products are produced from trees, understory plants, fungi or animals and collected from forests or cultivated. Many of the NWFPs have commercial value and important contribution to the economy on local and national level. The non-wood plant species of commercial

importance worldwide are estimated to be 4000 to 6000 (FAO, 2001). NWFPs include natural resins, gums and exudates, leaves (*tendu*), turpentine from pines and perfumery oils from roots, stumps and fruits of various tree species. These are also natural source of spices, medicines, dyes and tannins. Most NWFPs are export currency earners and many are well suited for local small scale industries. In tribal and disadvantaged district areas of the India, NWFPs such as natural resins, gums and tamarind seeds are more profitable than timber. Despite the importance of NWFPs, the sustainable management of forests has been traditionally focused on timber production. However, in the recent decades the interest for NWFPs have been increased, as a result of the international shift to multifunctional sustainable forest management, which aims at optimizing the provision of multiple goods and services, while maintaining the equilibrium of forest ecosystems. Within this framework the promotion and utilization of NWFPs is identified as a priority area by the FAO. However, the particularities in harvesting these products distinguish their management from that of timber. For example, some NWFP have short harvesting period and products perish soon after this period. Additionally, their frequent, uncontrollable and illegal harvest may have negative effects on the forest ecosystem.

The contribution of agriculture and allied sectors to the Gross Value Added (GVA) at 2011-12 prices of the country has been declining. In national accounts, GVA is output minus intermediate consumption. It is a balancing item of the national accounts' production account. The growth rates in agriculture have been fluctuating at 1.5% in 2012-13, 4.2% in 2013-14, (-) 0.2% in 2014-15 and a likely growth of 1.1% in 2015-16. Among the agriculture and allied sectors, crops including fruits and vegetables account for about 61.0% of the GVA; the rest by the allied sectors consisting of livestock products, forestry and fisheries. The share of forestry and loggings to the GVA (at 2011-12 prices) of the country has also been declining and it is fluctuating at 1.5 % in 2012-13, 1.5 % in 2013-14, 1.4 % in 2014-15 and a likely growth of 1.2 % in 2015-16.

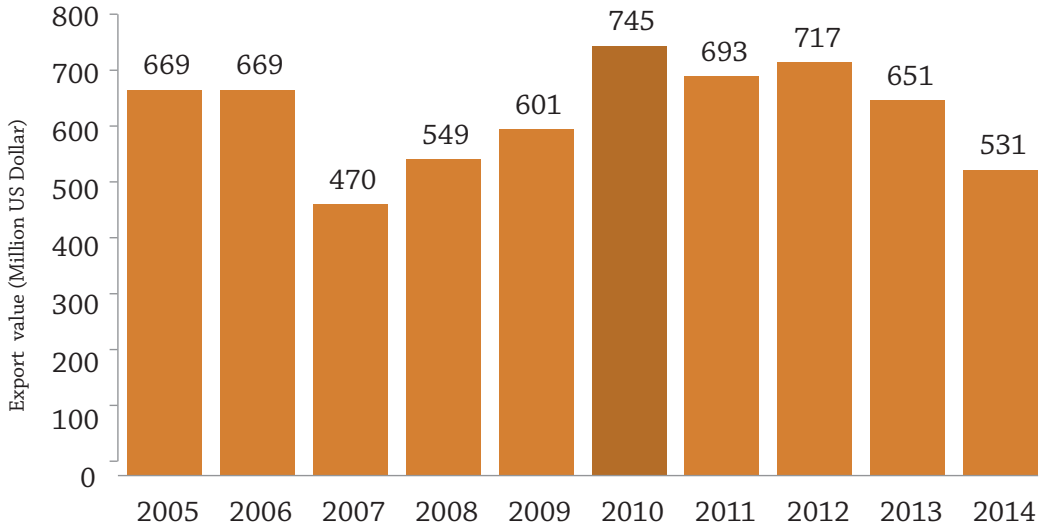

Figure 1. *World export flow of lac, natural gums, resins, gum-resins and balsams during the decade*

According ITC calculations based on UN COMTRADE statistics, the world trade aggregation of lac, natural gums, resins, gum-resins and balsams during 2014 was about 1358.44 million US dollars.

Out of this, the world export aggregation of lac, natural gums, resins, gum-resins and balsams during 2014 was about 530.78 million US dollars. A decadal data (2005-2014) on world EXIM aggregation of lac, natural gums, resins, gum-resins and balsams were analyzed and presented in Figure 1 and Figure 2. Since 2012, deceleration in the value of world export aggregation was observed and stagnation was found in the value of world import aggregation during the similar period.

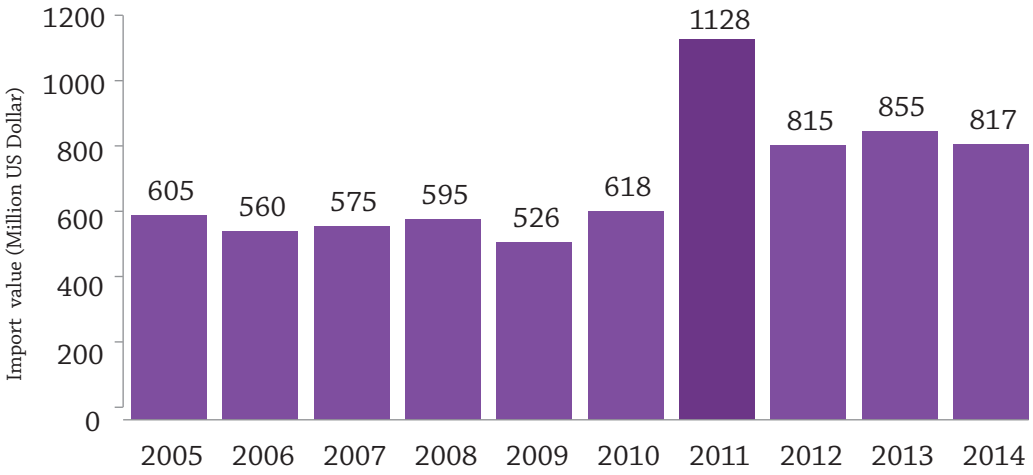

Figure 2. *World import flow of lac, natural gums, resins, gum-resins and balsams during the decade*

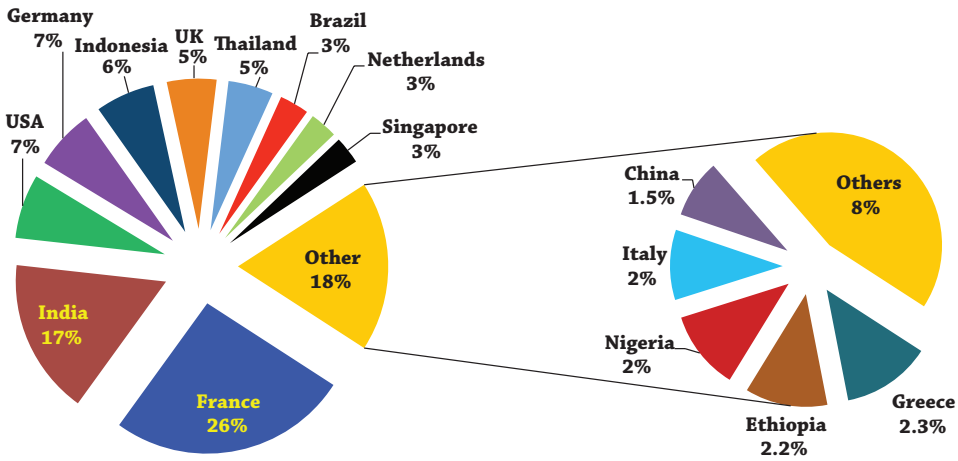

Figure 3.Break up of the World export aggregation of NRGs during 2014 (Destination wise share in %)

Major suppliers of NRGs contributing about 92 % share in international market are France (25.8%), India (16.8%), USA (6.9%), Germany (6.5%), Indonesia (6.4%), UK (5.3%), Thailand (4.8%), Brazil (3.2%), Netherlands (3.0%), Singapore (3.0%), Greece (2.3%), Ethiopia (2.2%), Nigeria (2.1%), Italy (1.8%) and China (1.5%). Rests of the 8% NRGs are supplied from 87 countries across the world (Figure 3). Similarly, the world import aggregation of lac, natural gums, resins, gum-resins and balsams during 2014 was about 816.86 million US dollars.

Major importers of NRGs contributing about 80% share in the international market are India (14.8 %), United States of America (11.7 %), France (11.2 %), Germany (6.0 %), Netherlands (5.0 %), China (4.0 %), Italy (3.7 %), United Kingdom (3.4 %), Russian Federation (3.0%), Saudi Arabia (2.5%), Singapore (2.5%), Portugal (2.3%), Spain (2.2%), Japan (2.1%), Ireland (1.9%), Switzerland (1.4%), Brazil (1.3%) and Thailand (1.2%). Rests of the 20% demand of NRGs aroused from the 127 countries across the world (Figure 4).

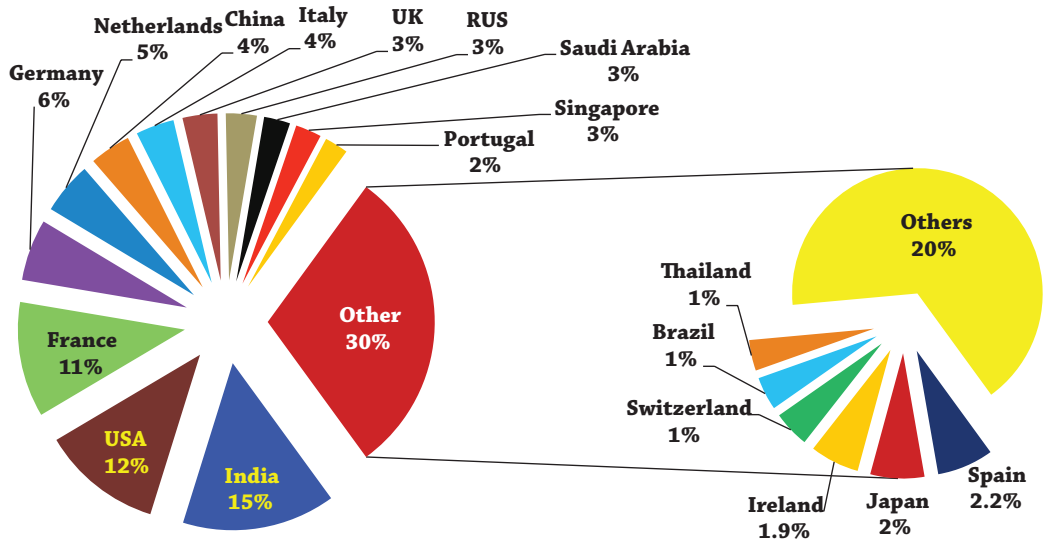

Figure 4. *Breakup of the World import aggregation of NRGs during 2014 (Source wise share in %)*

FAO has estimated that NWFPs are capable of generating 4 million person-years of employment annually (FAO, 2002; FAO, 2005). Out of a total of 16,000 recorded plant species in India, 3000 yield NTFPs who contribute about 40 % of total forest revenue and 55% of forest based employment. According to the World Resource Institute (WRI), the more than 1 billion people depend on forests for their livelihoods at global level. In 1996, Hegde and coworkers also reported that over 50 million people are dependent on NWFPs for their subsistence and cash income in India. About 70% of the NWFP collection in India takes place in the tribal belt of the country (Mitchell *et al.,* 2003). Around 55% of employment in forestry sector is attributed to this sector alone (Joshi, 2003).

There are a large number of lac host and gum producing trees in India which exude resins and gums. Natural resins and gums (NRGs) originated from the plants/insects may be classified in three categories namely natural resins, natural gums and gum resins. Natural resins are solid or semi-solid materials, usually a complex mixture of organic compounds called terpenoides, which are insoluble in water but soluble in certain organic solvents. Resin is a hydrocarbon secretion of several plants, particularly coniferous trees. NRGs of commercial importance like lac (*Kerria lacca* Kerr), Pine resin, *guar* gum (*Cyamopsis tetragonoloba L.*), gum *karaya* (*S. urens*), *dhawada* gum (*Anogeissus latifolia*), Tamarind gum (*Tamarindus indica), char /piyar* gum (*Buchanania lanzan Spreng.*) and *babool* gum (*Acacia nilotica*) are produced in India. India holds monopoly in world trade over some of the NRGs such as lac, gum *karaya* and *guar* gum.

Resins are valued for their chemical properties and associated uses such as the production of varnishes, adhesives and food glazing agents. These are also prized as an important source of raw material for organic synthesis and as constituents of incense and perfume. This group of natural resins includes lac secreted by an insect *K. lacca* (Kerr) and plant originated products like rosin, copal and dammer. Solidified resin from which the volatile terpene components have been removed by distillation is known as rosin.

Natural gums are polysaccharides of natural origin, capable of causing a large viscosity increase in solution. Most often these gums are found as exudates from woody elements of plants or in seed coatings. In the food industry these are used as thickening, gelling and emulsifying agents and stabilizers. These are also used as adhesives, binding agents, crystal inhibitors, clarifying agents, encapsulating agents, flocculating, foam stabilizers, swelling agents, *etc.* Natural gums can be classified according to their origin. Firstly, originated from non-marine botanical resources *e.g.* gum *arabic*, gum *ghatti*, gum *tragacanth*, gum *karaya*, *guar* gum, locust bean gum, *chicle* gum, *dammar* gum, *mastic* gum, psyllium seed husks and spruce gum. Secondly, originated from seaweeds *e.g.* agar and *carrageenan* and thirdly, produced by bacterial fermentation *e.g. gellan* gum and *xanthun* gum. They can also be classified as uncharged or ionic polymers (polyelectrolyte).

Gum-resins are the natural mixtures of gums and resins in variable proportions therefore possess properties of both the groups. They contain traces of essential oils and are partly soluble in water. They have a penetrating and characteristic odour and taste and obtained from the plants. Olibanum/*salai* gum (*Boswellia serrata*), Guggal *(Commiphora wightii),* Myrrh, Asafoetida, *etc*. are the major gum resins of national importance.

Table 1. World EXIM trade aggregation of lac, natural gums, resins, gum-resins and balsams *(Value in Million US$)*

Year	Export	Import	Re-Export	Re-Import
2005	669.12	605.44	9.57	1.10
2006	669.12	559.72	11.77	0.75
2007	470.47	575.00	11.82	1.50
2008	548.82	594.65	13.26	0.12
2009	601.20	526.39	19.94	0.24
2010	745.48	617.75	15.46	0.20
2011	693.28	1127.70	15.12	0.55
2012	716.89	814.98	17.88	0.24
2013	650.94	854.70	17.06	0.31
2014	530.78	816.86	10.43	0.37

Source: ITC calculations based on UN COMTRADE statistics.

The reminder of the Bulletin is structured in four chapters. A brief methodology is given in Chapter 2 and Chapter 3 discusses the relevant information about the production, processing and trade. Chapter 4 deals with policy implications. Finally, Chapter 5 presents the summary and broad conclusions emerged out.

METHODOLOGY

Reliable and periodical assessments of quantities and values of production and market outlook studies at the national level of Non-Wood Forest Products (NWFPs) are essential to decision-makers for policy formulation and governing the sustainable development of the sector. Appropriate and biometrically valid inventories of NWFPs are an essential prerequisite for their sustainable management and harvesting. However, methodologies for the precise assessment of forest resources yielding NWFPs are not yet sufficiently elaborated, neither can they be easily implemented by resource managers in the field. Timely and accurate estimation of production may be helpful for the stakeholders to plan their operations in time. Accuracy in production estimate would be useful in precision planning by all concerned. Besides knowing the present status, it would be helpful in regulating imports, planning for enhanced exports, reasonable prices and reliability in supply of lac based products. However, such statistics do not yet exist for many countries, neither is the already available data comparable among countries. In most countries, the current coverage and quality of existing information is inadequate for policy analysis and decision making at national level.

FAO currently assists national governments and institutions to improve the availability of national qualitative and quantitative data related to NWFPs. These efforts include: the development of a standard framework that describes the key information required for the evaluation of NWFPs utilization at the country level; the improvement and elaboration of methodologies for the collection and validation of the required information including more precise product nomenclature and corresponding product classification; and the compilation of standardized national reporting formats on NWFPs. From the lessons learned by implementing this national survey, specific case studies to improve NRGs data gathering methodologies are being carried out in selected states (Jharkhand, West Bengal, Chhattisgarh and Madhya Pradesh). Hence, under the research project "Market research for production and marketing of natural resins and gums" a standard reporting format has been developed to assist in recording statistics on the production and trade of major NRGs. This approach was used in order to compile NRGs state profiles for all states of India. A brief summary of the assessment is also being published annually as a separate chapter in the Agricultural Research Data Book, ICAR-IASRI, New Delhi.

The objectives of present methodology are to estimate and update the production, processing and value addition of NRGs at national level and to compile the latest EXIM data. The approach used in the present methodology was through survey of local traders and processors, as all NRGs produced in India are collected/procured through the local traders/societies/forest departments.

Big traders/federations are limited in number but they have close contact with the primary purchaser who have knowledge of present crop condition and expected output. Survey of all big traders was helpful in estimation. Further, all the produced products pass through the processing units. Processors use the current harvested or stocked or imported crop/produce. Survey of processing units was helpful in estimating quantity of processed products at national level and validation of production data. Information on market arrival during seasons at important markets in India was collected through survey of identified major markets. Regular contacts were also made with the persons/ organizations related to NRGs in India through correspondence, phone

and personal visit for collection and updating of data. Production estimation was made by the survey of selected processors, exporters, importers and markets (traders). Export and import NRGs related products were obtained from Directorate General of Commercial Intelligence and Statistics (DGCI&S), Kolkata. Five schedules / questionnaire were framed for collection of data and information during the field surveys *i.e.* survey of markets, survey of processing centers, crop-wise arrival in the market, survey of importers and processing at processing centers. Production year was considered from April to March (Financial year) and final production assessment completed by the month of April. Data and other related information for estimation of production and processing was collected throughout the year. Tabular analysis and pictorial presentation has been used to analyze the survey data. Validation of production data at national level was made by secondary data on quantity processed at national level, export and import figures.

Sampling design and survey area

It's been said that information is power. This simple cliché underscores the market control and business success that information yields. Marketing research is about collecting information. While it applies to a wide range of situations, marketing research gives decision-makers the information they need to find solutions to business problems such as consumer satisfaction, decision, representation and response to completion, *etc.* Simply put, the solution to most business problems can be found through marketing research. National level information and data on NRGs were collected from primary and secondary sources. Survey was made in various NRG producing areas of the country for collection of data throughout the year during 2014-15. The requisite data has been collected from respondents at various NRGs markets and processing centers. For updating the information and data, regular telephonic contacts were also made with the respondents.

Table 2. States and districts surveyed

States/Country	Districts
Andhra Pradesh	Vishakhapatnam and East Godavari
Assam	Kamrup and Karbi-Anglong
Bihar	Patna
Chhattisgarh	Balarampur, Bilaspur, Dhamtari, Korba, Korea and Raipur
Delhi	Chandni Chauk
Gujarat	Vadodara
Jharkhand	Bokaro, Dhanbad, Giridih, Khunti, Ranchi, Simdega and West Singhbhum
Karnataka	Bangaluru and Uttara Kannada
Madhya Pradesh	Balaghat and Seoni
Maharashtra	Bhandara and Gondia
Nepal	Kathmandu
NE region	Garo hills, Imphal, East Kameng, Barapani and Kohima
Odisha	Balasore and Sundergarh
Rajasthan	Jaipur, Ajmer and Jodhpur
Uttar Pradesh	Allahabad
Uttarakhand	Bilaspur
Telangana	Hyderabad
West Bengal	Kolkata and Purulia

Surveys were conducted in 42 districts of 13 states of India and Nepal covering 952 stakeholders including 90 institutions, 628 farmers, 40 traders, 64 processors/wholesalers/exporters and 130 resource persons were interacted through visits and telephonic conversations during 2014-15. These respondents were directly/indirectly concerned with NRG production, processing and value addition across the country. Name of the states and districts which were covered for survey and sample size surveyed during the year have been presented in Table 2 and Table 3, respectively. Category wise and state-wise composition of selected stakeholders is presented in Figure 5 and Figure 6.

Table 3. Sample size during the survey

States/Country	No. of districts	Farmer	Market functionary	Processor/ Manufacturer	Govt. Official/ NGOs/ Other key informant	Total
Andhra Pradesh	2	0	3	0	1	4
Assam	2	51	1	0	6	58
Bihar	1	10	0	0	12	22
Chhattisgarh	6	123	4	6	15	148
Delhi	1	0	0	0	21	21
Gujarat	1	0	2	0	1	3
Jharkhand	7	83	11	6	22	122
Karnataka	2	10	0	0	5	15
Madhya Pradesh	2	0	1	0	0	1
Maharashtra	2	0	1	0	1	2
NE region	5	0	0	0	75	75
Nepal	1	0	6	0	0	6
Odisha	2	1	1	1	0	3
Rajasthan	3	20	5	14	8	47
Telangana	1	0	0	0	6	6
Uttar Pradesh	1	20	2	13	6	41
Uttarakhand	1	0	0	2	1	3
West Bengal	2	6	3	7	8	24
Others	NA	304	NA	NA	47	351
Total	42	628	40	49	235	952

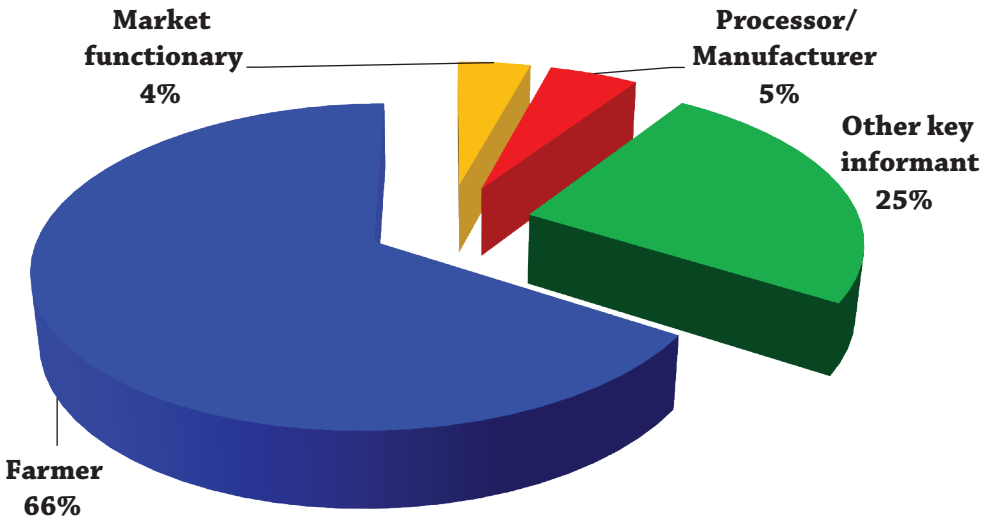

Figure 5. Composition of stakeholders under survey programme (Category wise)

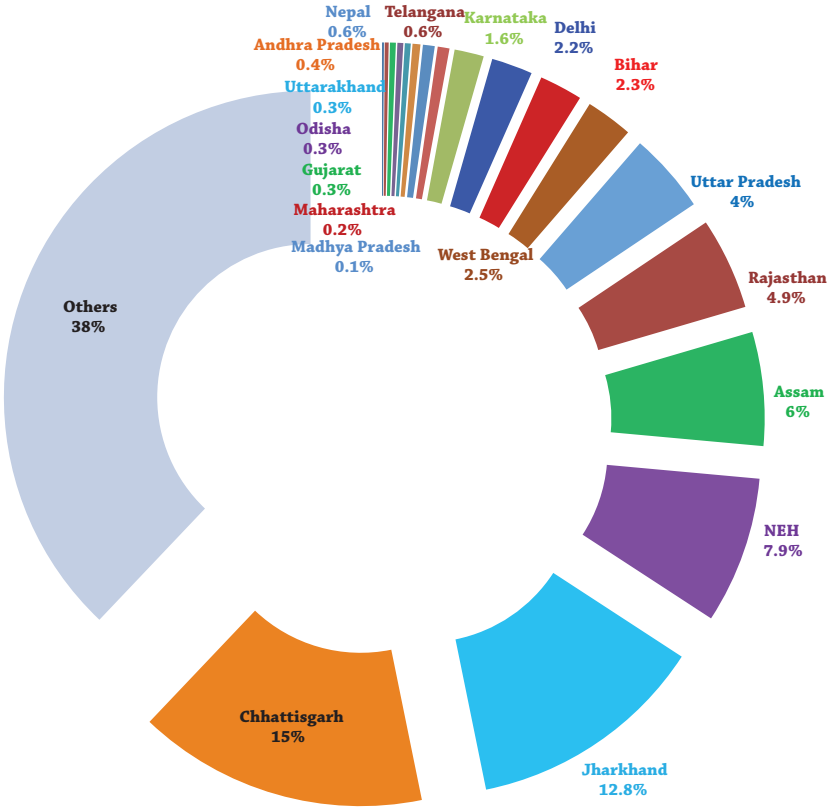

Figure 6. Composition of stakeholders under survey programme (State-wise)

PRODUCTION, PROCESSING AND TRADE IN NRGs

NRG production level during 2014-15 was estimated comparatively higher (1160314.1 tons) than previous year (837582.8 tons). Other resins and gum production declined during the current year. Production and trade of NRGs including *guar* gum, lac, pine resin, gum *karaya*, *dhawda* gum and other natural resins and gums is depicted in Table 4 and Figure 7.

Table 4. Total NRG production and trade during 2014-15 (quantity in tons)

Name of product	Production	% share	Export	% share	Import	% share
Guar gum*	1094546.50	97.09	521175.90	95.87	125.55	0.15
Lac	16978.00	1.84	6569.17	1.21	0.00	0.00
Pine resin	6699.30	0.85	374.89	0.07	36117.76	41.90
Gum *karaya*	83.23	0.02	198.02	0.04	586.28	0.68
Other NRGs	1817.47	0.20	15302.53	2.81	49360.22	57.27
Total	1120124.50	100.00	543620.51	100.00	86189.81	100.00

**Estimation of guar gum is based on the conversion of total guar seed production*

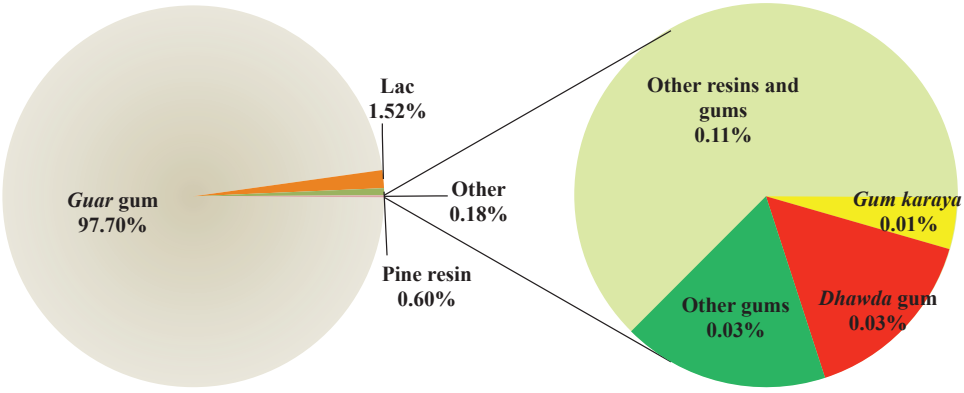

Figure 7. *Product/major group-wise production share of NRGs*

It is evident from the Table 4 that *guar* gum has a lion's share in total NRG production and consequently in export also. For *guar* gum, India is the leading producer, processor and exporter country in the world. Hence, a negligible quantity has been imported for research and other purposes. Similarly, India is the largest producer, processor and exporter of the lac. Export quantity of lac has been increased by 87% in comparison to previous year export. However, the increase in value of exported lac was only 18%. About 1.5% production of the total NRGs is contributed by pine resins, gum *karaya* and other natural resins and gums. Export under these commodities/groups has exceeded the production data. There may be two reasons, first the exported quantity supplied from the carry over stock and secondly, raw material imported and exported after processing in India. Overall, there was about 42% increase in total quantity of NRGs exported and quantity in

import basket was almost stable. But, price fall of *guar* gum in international market resulted with a decline in total foreign exchange earnings as comparison to 2012-13 and 2013-14. The detailed information about state-wise production processing and trade of natural resins (Lac, pine resin), natural gums (Gum *karaya*, *guar* gum, gum *ghatti, gum arabic*) and natural gum resins (Olibanum, myrrh, asafoetida) is presented below.

A) Natural resins

Lac – a fauna based natural resin

Photo 1. *Lac and its value added products*

Lac is a natural resin secreted by an insect *Kerria lacca* (Kerr) which thrives on the tender twigs of specific host trees *viz.*, *palas* (*Butea monosperma*), *ber* (*Ziziphus mauritiana*), *kusum* (*Schleichera oleosa*), *Flemingia semialata*, *Ficus spp*. *etc.* Raw lac is the source of three valuable, natural and renewable products *i.e.* resin, dye and wax. *Rangeeni* and *kusmi* are the two strains of lac insect which are classified based on preference of the insect for specific host plants. Lac cultivation is an important source of income for livelihood of the forest and sub-forest dwellers in different states. Besides, it has high potential for generating employment for both men and women in forest and subforest areas of Jharkhand, Chhattisgarh, Madhya Pradesh, West Bengal, Maharashtra, Odisha and parts of Uttar Pradesh, Telengana, Andhra Pradesh, Gujarat and NEH region. It is a highly remunerative crop, paying high economic returns to the farmers and also foreign exchange to the country through its export. Lac is mainly produced in India, Thailand, Indonesia, parts of China, Myanmar, Philippines, Vietnam, Cambodia, *etc.* and India is the largest producer of lac in the world.

Lac production in India

In 1950s, the average production of lac in India was about 42320 tons and onward decline trend in lac production during 1970s (52 %), in 1980s (19 %) and 1990s (4 %) was observed. However, in revival period of 2000s, 24% increase was recorded. During this decade the efforts in terms of policy, research and development regarding the lac sector percolated at grass root level and interest of stakeholders had got the vital support. At present only less than 5% lac host trees are under the lac cultivation. It is assumed that there are some bottlenecks hampering the growth of the sector.

Estimation of lac production is required by the Government, lac-based industries, lac traders, entrepreneurs and exporters. The lac growers, processors, traders, exporters and policy makers can plan their operations in time by using timely and accurate estimations. The cultivation of lac on a large number of hosts of different kinds, its collection by numerous small growers, variations in the yield depending on the type and size of the host, cultivation practices and climatic conditions are the major factors influencing the estimation of lac production. Accuracy in production estimate would be helpful in precision planning by all concerned. Besides knowing the present status, it would be helpful in regulating imports, planning for enhanced exports, reasonable prices and reliability in supply of lac based products.

On the basis of survey in the markets of different lac producing districts and states, the estimated national production of sticklac during 2014-15 was approximately 16,978 tons. Jharkhand state ranks 1st followed by Madhya Pradesh, Chhattisgarh, Maharashtra and Odisha. These five states contribute around 93 % of the national lac production (Figure 8). Contribution of Jharkhand in national lac production is about 51 % followed by Madhya Pradesh (15%), Chhattisgarh (14 %), Maharashtra (9 %) and Odisha (4 %). *Aghani* crop ranked 1st with the contribution of 32 % followed by *Jethwi* (26 %), *baisakhi* (24 %) and *katki* (18 %) in total lac production. In the year 2014-15, production of all the crops in comparison to previous year production has decreased and the decline was 41 %, 23 % and 6 % for *jethwi, baisakhi* and *katki* crops, respectively. However, an increase of 9 % was observed in case of *aghani* crop .Overall, the total production has declined by 19 % in comparison of the lac production during 2013-14.

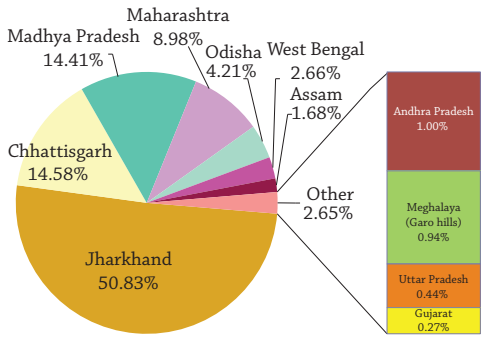

Figure 8. *States-wise share in lac production during 2013-14*

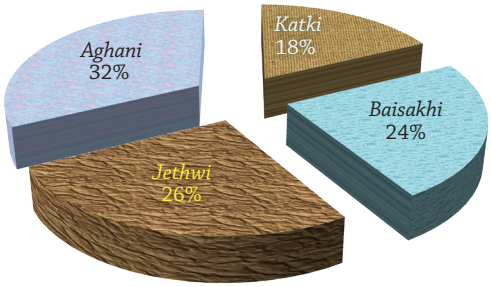

Figure 9. *Crop-wise share in total lac production*

Table 5. Lac production in India during 2014-15 (in tons)*

Name of states / Districts	Name of lac crop@				Total
	Baisakhi	*Jethwi*	*Katki*	*Aghani*	
Jharkhand	385	3895	625	3725	8630
Madhya Pradesh	1990	58	495	43	2586
Chhattisgarh	445	373	378	1140	2336
Maharashtra	765	0	760	0	1525
Odisha	40	95	105	475	715
West Bengal	91	30	240	90	451
Assam	45	0	240	0	285
Andhra Pradesh	55	5	105	5	170
Meghalaya (Garo hills)	150	0	10	0	160
Uttar Pradesh	20	0	55	0	75
Gujarat	15	20	2	8	45
Total	4001	4476	3015	5486	16978

*@**Baisakhi:** - Summer crop of rangeeni; **Jethwi:** - Summer crop of kusmi; **Katki:** - Rainy crop of rangeeni; **Aghani:** - Winter crop of kusmi; $ Andhra Pradesh including Telengana;* See Annexure I for details.*

At national level, the production of lac was around one per cent more than the average lac production. Lac production scenario in India and districts producing over 1000 tons of lac during 2014-15 are presented in Table 5 and Table 6, respectively. Share of different crops at national level is presented in Figure 9. Lac production in India during previous five years is depicted in Figure 10.

Table 6. Top ten lac producing districts in the country (in tons)

District (States)	2013-14	Rank	2014-15	Rank
Ranchi (Jharkhand)	3475	1	2530	1
Simdega (Jharkhand)	2445	2	1910	2
Khunti (Jharkhand)	1790	4	1380	3
Gumla (Jharkhand)	2380	3	1330	4
Seoni (Madhya Pradesh)	1185	5	1165	5
Gondia (Maharashtra)	1010	6	1100	6
Balaghat(Madhya Pradesh)	890	9	882	7
West Singhbhum (Jharkhand)	985	8	860	8
Korba (Chhattisgarh)	1000	7	750	9
Kanker	735	10	510	10

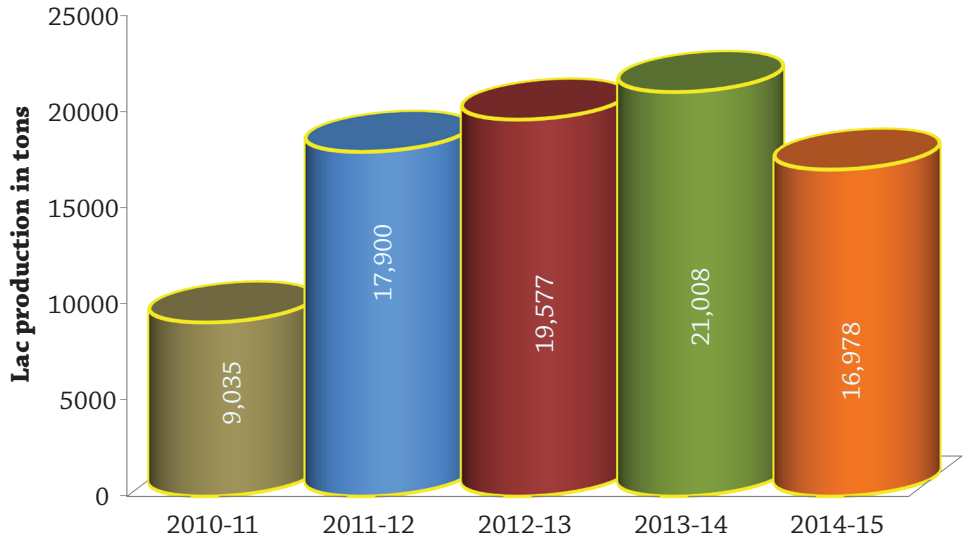

Figure 10. *Lac production in India during previous five years*

The overall, production of the lac in the country has been estimated to be 16,978 tons which is lower than the previous year production (21,008 tons). The production was under-estimated in Jharkhand, Chhattisgarh, Maharashtra, West Bengal, Uttar Pradesh and Gujarat. During, current year 2014-15, the lac production tends to the lowest level during last five years excluding 2010-11 figures. It is interesting to mention that the production level of lac had increased from the lowest level of 9,035 tons during 2010-11 to 17,900 tons (about 100 % increase) during 2011-12 and reached up to the highest level of 21,008 tons during the second year of XII plan period. But, during 2014-15, it has declined due to various biotic and abiotic stresses. District wise lac

production statistics and major lac producing areas in the country are presented in Annexure I and Annexure II, respectively.

Lac processing and value addition in India

Sticklac in small quantity or lots is generally sold in the rural markets (*haats)* by the lac growers. Rural markets (*haat*) in remote lac growing areas operate once or twice in a week. Lac growers, after harvesting sticklac sell to *paikars* (primary purchasers). Lac growers, nearer to lac processing units, also sell their produce directly to processing units. The *paikars* after collecting, whatever quantity they get in the course of the market day, sell it to the wholesaler in the same market or nearby manufacturing centers in bigger lots. Simultaneously, the wholesalers sell the produce to manufacturers at different lac processing centers. After processing, lac is sold for internal consumption within the country or exported by lac exporters.

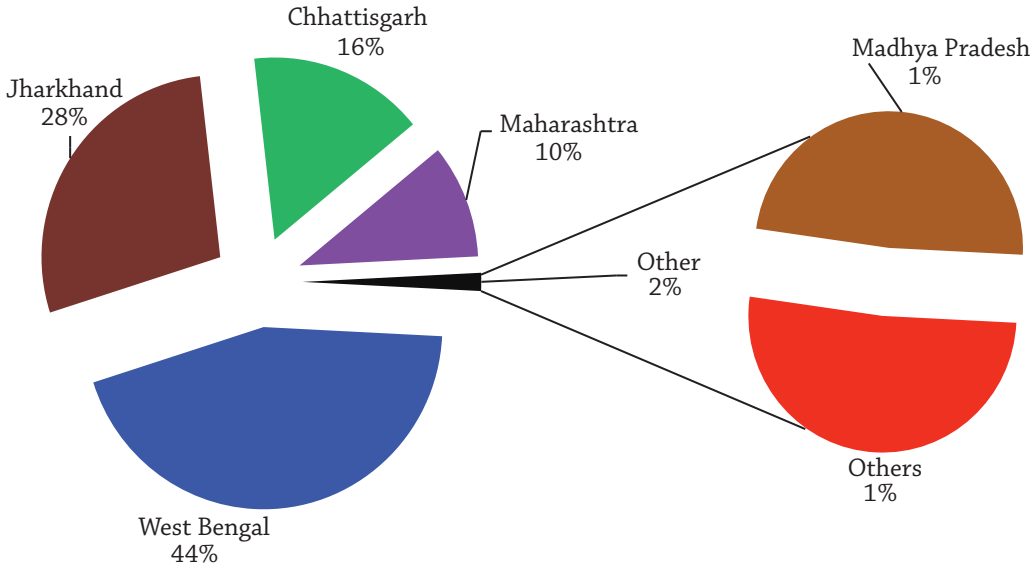

Figure 11. States-wise share in lac processing during 2014-15

On the basis of surveys conducted at different lac processing centers in the country, the total quantity of sticklac processed during 2014-15 was 19292 tons which also included the imported lac and previous carry over stock in India. Information about share of different states in lac processing is presented in Figure 11 and amount of lac processed in India during previous five years is depicted in Figure 12. Lac processing centers in India and amount of sticklac processed at different lac processing centers in the country during 2014-15 are presented in Table 7 and Table 8, respectively.

A total 155 lac processing units were functional in West Bengal (102), Chhattisgarh (29), Jharkhand (16), Maharashtra (6) and Madhya Pradesh (2) during the year 2014-15. In the processing of lac across the country, Chhattisgarh (31 %), West Bengal (31 %) and Jharkhand (31 %) shared equally

about 93 % followed by Maharashtra (6.7 %) and Madhya Pradesh (0.3 %). There were 8 primary and 6 secondary markets existing at national level, in which annual arrival of sticklac was more than 500 tons.

Table 7. Major lac processing centers in India during 2014-15

States	Districts /Centres	No. of processing units	Products made
Chhattisgarh	Dhamtari	15	Seedlac, Button lac, Bleached lac, Aleuritic acid
	Janjgir-Champa	5	Seedlac, Shellac, Bleached lac, Dewaxed Shellac, Lac dye
	Kanker	2	Seedlac
	Korba	7	Seedlac, Shellac, Bleached lac, Button lac
	Rajnandgaon	1	Seedlac, Shellac
	Raipur	1	Bleached lac, Aleuritic acid
Jharkhand	Daltonganj	2	Seedlac
	Ranchi and Khunti	10	Seedlac, Button lac, Shellac, Lac dye, Bleached lac
	Simdega	2	Seedlac
	Saraikela-Kharsawan	1	Bleached lac
	West Singhbhum	1	Black Shellac
Madhya Pradesh	Indore	1	Seedlac, Bleached lac, Varnish
	Balaghat	2	Seedlac
	Seoni	2	Seedlac
	Hosangabad	1	Seedlac
Maharashtra	Gondia	6	Seedlac, Shellac, Gasket Shellac Compound, Bleached lac
West Bengal	Purulia	93	Seedlac, Shellac, Button lac, Bleached lac, Aleuritic acid, lac wax, Dewaxed Decolourised lac
	North 24 Paragana	1	Aleuritic acid
	Others	20	Lac based value added products
Others		10	Lac based value added products
Total		183	

Table 8. Quantity of sticklac processed in India during 2014-15

States	Districts/ Centres	Quantity processed (tons)	% change over last year
Chhattisgarh	Dhamtari	2100	-19.2
	Janjgir-Champa	1150	43.8
	Kanker	110	-81.7
	Korba	1330	-52.5
	Rajnandgaon	80	-20.0
	Sub total	4770	-30.9
Jharkhand	Daltonganj	20	-95.0
	Ranchi and Khunti	4340	-14.9
	Saraikela-Kharsawan	30	-71.4
	Simdega	500	-58.3
	West Singhbhum	30	-50.0
	Sub total	4920	-28.3
Maharashtra	Gondia	1950	30.0
Madhya Pradesh	Indore	40	-28.6
	Balaghat	30	NA
	Seoni	50	NA
	Hoshangabad	30	66.7
	Sub total	150	102.7
West Bengal	Purulia	6593	-3.2
	North 24 Paragana	40	NA
	Others	710	NA
	Sub total	7343	7.8
Others	Karnataka, Uttar Pradesh, Delhi, Tamil Nadu	159	NA
Total		19292	-12.9

Name of the primary and secondary markets with annual arrival of over 500 tons and district wise distribution of lac processing centres across major lac producing districts of India are presented in Table 9 and Table 10, respectively.

Table 9. Markets with annual arrival of over 500 tons

States	Primary markets	Secondary markets
Chhattisgarh	Bhaisama Bazar	Dhamtari, Kathgora and Sakti
Jharkhand	Bandgaon, Jaldega and Kolebira	Khunti
Maharashtra	Barghat region	Gondia
West Bengal	Balarampur, Jhalda and Tulin	Balarampur

Table 10. Lac processing centers in the major lac producing districts of India

Classifications (Qty. in tons)	No. of districts*	Name of the districts
> 1,000	06 (20)	Gumla, Khunti, Ranchi & Simdega (Jharkhand); Seoni (Madhya Pradesh) and Gondia (Maharashtra)
500-1000	04 (12)	West Singhbhum (Jharkhand); Balaghat (Madhya Pradesh); Korba and Kanker (Chhattisgarh)
100-500	17 (100)	Palamau, (Jharkhand); Bastar, Janjgir-Champa Bilaspur, Raipur and Rajnandgaon (Chhattisgarh); Purulia, Midnapur (West Bengal); Nabarangpur, Sundergarh (Odisha) and Mandla (Madhya Pradesh); Garhchiroli and Chandrapur (Maharashtra) and Meghalaya (Garo hills)
1- 100	22 (16)	Balasore, Keonjhar, Koraput and Mayurbhanj (Odisha); Bhandara (Maharashtra); Mahasamund, Ambikapur, Surguja, Raigarh, Dhamtari, Durg & Raigarh (Chhattisgarh); Garhwa and Latehar (Jharkhand); Annuppur, Chhindwada, Dindori, Hosangabad, Narshinghpur & Shahdol (Madhya Pradesh) and Bankura (West Bengal).
< 1	24 (35)	Rest of the districts in Assam, Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Jharkhand, Madhya Pradesh, Meghalaya, Odisha, Uttar Pradesh, Telangana and West Bengal.
Total	73 (183)	

** Figure in parentheses are number of processing centers*

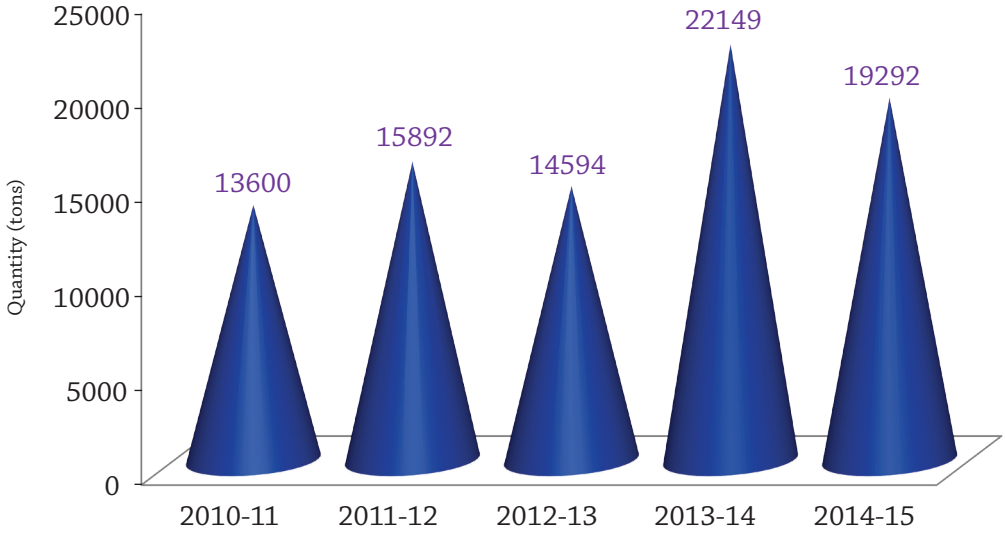

Figure 12. Lac processing in India during last five years

Movement in price of lac over the period

The data on prices of *rangeeni* and *kusmi* sticklac and seedlac was collected from the lac markets of Jharkhand (Khunti, Ranchi and Simdega), West Bengal (Balarampur, Purulia), Chhattisgarh (Dhamtari, Kanker and Korba), Maharashtra (Gondia) and Madhya Pradesh (Seoni and Balaghat) on quarterly basis. The trend in movement of lac prices have been presented in Figure 13. The prices of *rangeeni* and *kusmi* sticklac as well as seedlac has shown increasing trend from December, 2010 to December, 2012, respectively. Prices rose sharply during the period, due to less production of lac in other lac producing countries during that period. Consequently, poor import was observed during previous two years. Regular export demand of lac and low carryover stocks from previous years dragged up the price level. Subsequently, harvesting of good lac crop was observed during the previous three years 2011-12 to 2013-14 and crop was supplied to the market. It was observed that prices of *sticklac* and seedlac started to decline onwards of December, 2012. Here, at this stage of dip in price level, TRIFED, Ministry of Tribal Affairs, Government of India, New Delhi appeared with a policy for price stability and ICAR-Indian Institute of Natural Resins and Gums, Ranchi provided the technical guidance to the pricing cell of TRIFED for estimation of the cost of lac cultivation. Government announced Minimum Support Price (MSP) for both *kusmi* and *rangeeni* crop of lac, so that lac growers can get remunerative price during poor market demand or bumper production period. Pricing Cell had recommended the MSP of ₹ 230 and ₹ 320/kg for *rangeeni* and *kusmi* lac, respectively for 2015-16 crop.

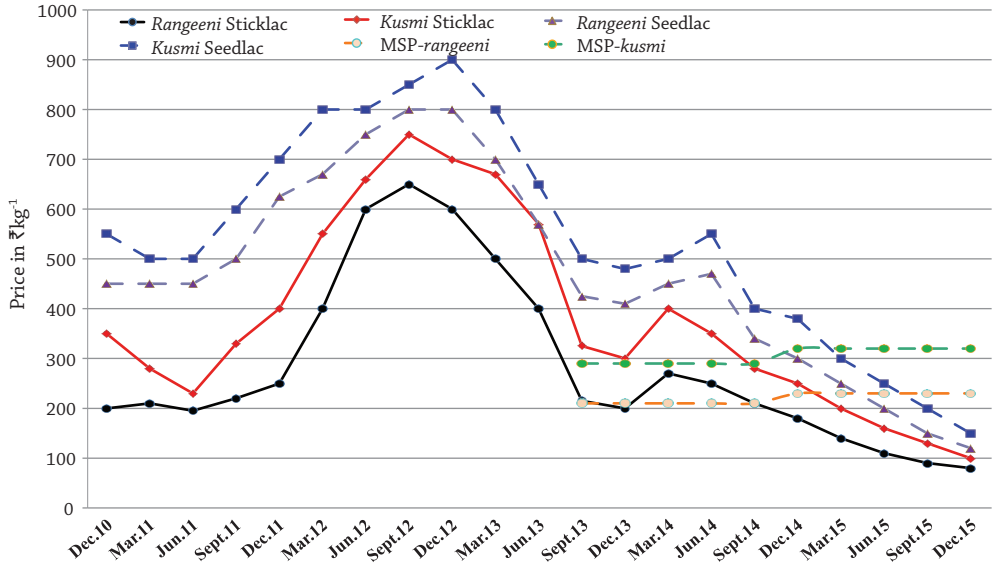

Figure 13. Movement in prices of sticklac and seedlac

International trade of lac and its value added products

Data on export of lac and its value added products from India were collected from Shellac and Forest Products Export Promotion Council (SHEFEXIL), Kolkata. The total export of lac and its value added products during the year 2014-15 was 6569.17 tons which was valued ₹ 322.50 crores. Details of export in quantity and value, list of top 15 countries importing Indian lac and export of

lac has been presented in the Table 11 and Table 12 while direction of the trade, the trend in export of lac in quantity and value during last seven years and share of different items of lac export from India are shown in Figure 14, Figure 15 and Figure 16, respectively.

Table 11. Export of lac and its value added products from India during 2013-15

Products	Export in 2013-14		Export in 2014-15	
	Quantity (tons)	Value (₹ lakh)	Quantity (tons)	Value (₹ lakh)
Shellac	3738.61	22556.46	3261.44	14650.36
Aleuritic acid	162.01	10054.42	181.12	5909.11
Seedlac	3709.35	19803.33	2690.29	8770.25
Dewaxed shellac	211.04	1930.74	183.02	1250.94
Bleached lac	258.29	2311.04	142.89	1048.13
Shellac wax	17.80	183.61	15.20	116.28
Kiri lac	0.00	0.00	0.00	0.00
Hydrolysed lac	56.00	14.03	0.00	0.00
Gasket lac	0.00	0.00	0.00	0.00
Lac dye	0.00	0.00	0.00	0.00
Dewaxed bleached shellac	0.00	0.00	31.07	273.48
Garnet shellac	0.00	0.00	52.05	214.87
Shellac(kiri)	0.00	0.00	12.00	15.57
Stick lac	0.00	0.00	0.10	0.60
Total	8153.10	56853.63	6569.17	32249.58

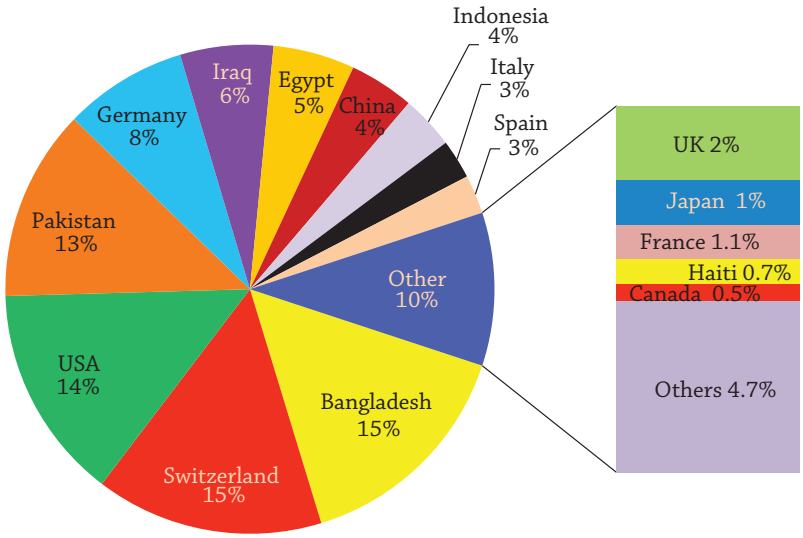

Figure 14. Direction of the trade of lac and its value added products

Table 12. Top 15 importing countries of Indian lac during 2014-15

Country	Quantity (tons)	Value (₹ lakh)	% Share
Bangladesh	1239.30	4909.60	15.2
Switzerland	158.00	4857.87	15.1
USA	1343.81	4581.39	14.2
Pakistan	1102.02	4087.45	12.7
Germany	595.65	2630.89	8.2
Iraq	426.50	1985.65	6.2
Egypt	410.68	1741.73	5.4
China	112.73	1387.06	4.3
Indonesia	255.88	1139.65	3.5
Italy	183.13	837.92	2.6
Spain	148.00	825.13	2.6
U.K.	103.00	665.24	2.1
Japan	95.60	399.96	1.2
France	38.60	297.95	0.9
Haiti	50.50	229.80	0.7
Canada	48.00	145.98	0.5
Others	257.79	1526.30	4.7
Total	6569.17	32249.58	100.00

Export destinations of sticklac, seedlac and shellac during 2014-15 depicted in Table 14. Sticklac was exported only to Switzerland. Seedlac export was dominated by Pakistan (45%), USA (34%) and Germany (12%). Bangladesh (33%), Iraq (14%) and Egypt (10%) were the major destination for Indian shellac. In high value products of lac like aleuritic acid a lions share of Switzerland (82%) and China (18%) have observed during the current year. USA (84%) and UK (14%) found as the major importer for bleached lac from India (Table 15). Export destinations of by-products of lac during 2014-15 depicted in Table 16.

Table 13. Export of lac during previous seven years

Year	Quantity (tons)	Value (₹ lakh)
2008-09	6968.42	12414.50
2009-10	6422.61	11002.33
2010-11	6339.05	21112.92
2011-12	6858.21	36461.30
2012-13	4361.30	48027.58
2013-14	8158.10	56853.63
2014-15	6569.17	32249.58

Table 14. Export destinations of sticklac, seedlac and shellac during 2014-15

Country	Quantity (tons)	Value (₹ lakh)	% Share
Stick lac			
Switzerland	0.10	0.60	100.00
Total	0.10	0.60	100.00
Seedlac			
Pakistan	1073.07	3950.28	45.04
USA	1097.39	2978.89	33.97
Germany	289.55	1042.17	11.88
Egypt	61.55	220.50	2.51
Japan, Canada, China and Bangladesh	113.15	366.89	4.18
Total	2690.29	8770.25	100.00
Shellac			
Bangladesh	1214.20	4811.31	32.84
Iraq	426.50	1985.65	13.55
Egypt	349.13	1521.23	10.38
Germany	257.55	1312.56	8.96
Indonesia	253.88	1107.27	7.56
Italy	144.23	573.55	3.91
Spain	84.85	526.75	3.60
USA	78.95	479.04	3.27
Haiti	50.50	229.80	1.57
China	44.63	217.34	1.48
U.K.	45.10	200.04	1.37
Japan	40.02	188.45	1.29
Austria	18.00	142.73	0.97
Others	253.92	1354.65	9.25
Total	3261.44	14650.36	100.00

Table 15. Export destinations of high value products of lac during 2014-15

Country/Product	Quantity (tons)	Value (₹ lakh)	% Share
Aleuritic acid			
Switzerland	152.50	4820.99	81.59
China	28.00	1046.57	17.71
France & USA	0.62	41.55	0.70
Total	181.12	5909.11	100.00

Country/Product	Quantity (tons)	Value (₹ lakh)	% Share
Bleached lac			
USA	123.74	877.73	83.74
U.K.	17.00	148.87	14.20
Australia	1.33	11.06	1.06
U.A.E., Korea (S) & Saudi Arabia	0.83	10.46	1.00
Total	142.89	1048.13	100.00
Dewaxed bleached shellac			
U.K.	20.50	156.09	57.08
Korea (s)	4.02	48.22	17.63
USA	3.00	30.96	11.32
Indonesia	1.00	16.44	6.01
Australia	1.95	15.10	5.52
Chile & Sri Lanka	0.60	6.67	2.44
Total	31.07	273.48	100.00
Dewaxed shellac			
Italy	34.40	251.54	20.11
USA	40.56	210.95	16.86
France	28.00	180.78	14.45
U.K.	18.40	152.98	12.23
Germany	24.45	152.86	12.22
Spain	14.75	96.70	7.73
Ecuador	6.10	65.80	5.26
Australia	3.10	30.47	2.44
Korea (s)	2.40	30.16	2.41
Pakistan, Indonesia, Malaysia, Taiwan, U.A.E., Switzerland, Iran, Turkey, Korea and China	10.86	78.71	6.29
Total	183.02	1250.94	100.00
Garnet shellac			
Spain	48.40	201.68	93.86
U.K.	2.00	7.26	3.38
Italy	1.50	5.07	2.36
USA	0.15	0.87	0.40
Total	52.05	214.87	100.00

Table 16. Export destinations of by-products of lac during 2014-15

Country/Product	Quantity (tons)	Value (₹ lakh)	% Share
Shellac wax			
Germany	12.10	107.73	92.65
Italy	3.00	7.77	6.68
Australia	0.10	0.78	0.67
Total	15.20	116.28	100.00
Shellac(kiri)			
Germany	12.00	15.57	100.00
Total	12.00	15.57	100.00

Lac is an important natural resins exported by and also imported (from Indonesia, Thailand, *etc.*) in India. During last 10 years exported value showed that 99.81 % contribution in natural resins export was from lac (90.47 %), other resins (5.59 %) and gum rosin (3.75 %).

Average annual export quantity of lac during last 10 years (2002-03 to 2011-12) was 9156.75 tons worth ₹12,334.86 lakh. Similarly, the average annual export quantity of lac was 8,249.85 tons valued ₹17419.91 lakh during the period 1998-99 to 2012-13. However, during last 15 years growth in exported quantity was negative for lac and total natural resins group. But, in value terms the same figure has got a momentum of the significant growth rate of about 11 % with a high stability coefficient during the period 1998-99 to 2012-13.

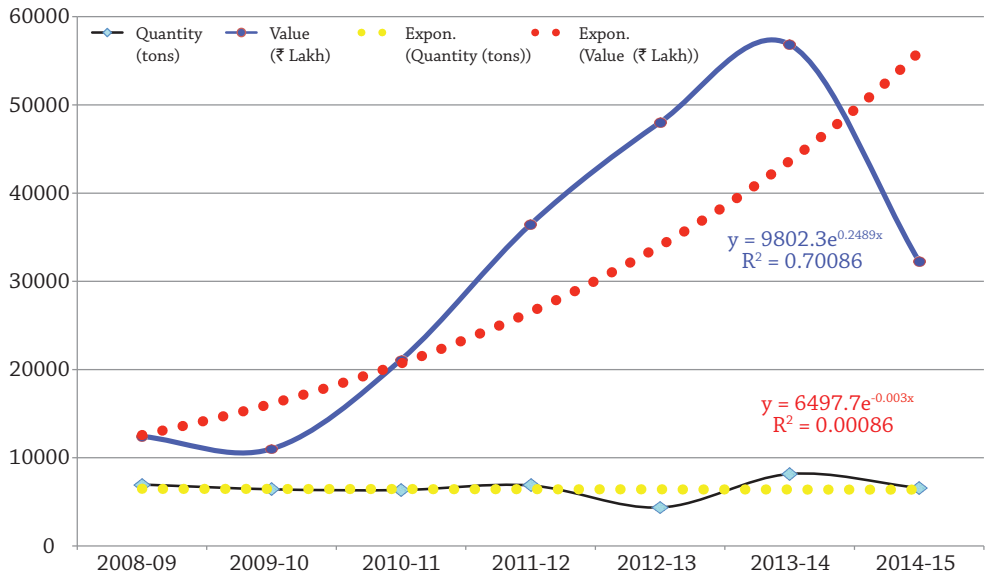

Figure 15. Trends in export of lac based products from India

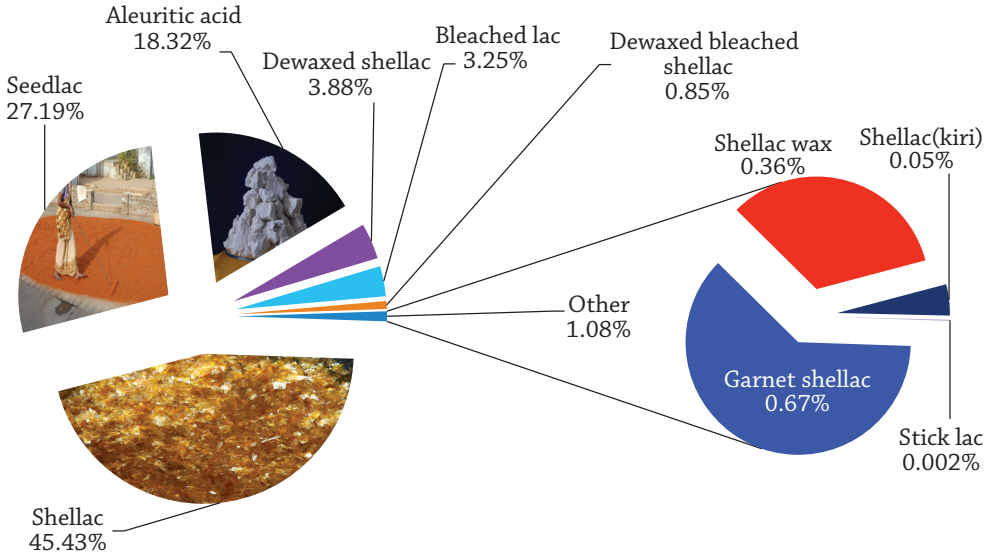

Figure 16. Product-wise export share of various lac based products (in value)

Pine resin –a flora based resin

Rosin is a natural product of pine resins (*Pinus roxburghii* Sarg.). The production of rosin has crossed one million metric tons per year. Rosin is an abundant and inexpensive hydrocarbon biomass. Rosin and its derivatives have been used as paper-sizing agents, emulsifiers, surface coatings, chewing gums, tackifiers in adhesives, insulating materials, and additives for printing inks. Recently, it is also evaluated for application in the pharmaceutical field as microencapsulating materials (Lee & Hong, 2002; Mandaogade, Satturwar, Fulzele, Gogte, & Dorle, 2002; Wilbon, Chu, & Tang, 2013). The surface functionalization of Cellulose Nano Crystals (CNCs) by a family of natural compounds (rosin) was successful, and the resulting modified materials showed strong antibacterial activity against Gram-negative bacteria and weak activity against Gram-positive bacteria. It opens an avenue for the rational utilization of rosin in the field of functional surfaces (Castroa *et al* 2016). These may be useful to develop antibacterial cellulose-based nano-materials under sustainable and green conditions.

Photo 2. *Pine resin collection using borehole method*

Pine resins are secretion of plants, particularly coniferous trees. These are valued for their chemical properties and associated uses like production of varnishes, adhesives, and food glazing agents. Extensive *chir* pine forests are found in the Himalayas between an elevation of 1000 to 1900

m. *Chir* pine yields commercially important oleo-resin which forms the raw material for rosin and turpentine oil industry in India. *Chir* pine is widely tapped for resin on commercial basis, particularly in the hills of Himachal Pradesh, Uttarakhand, Jammu & Kashmir and north-eastern states. The northern hill states annually produces around 8,000 to 9,000 tonnes of raw rosin extracted from pine trees.

Major share of resin production comes from Himachal Pradesh and Uttarakhand. Commercially tapped sources of pine resin are depicted in Table 17. The production of resin in the states during the year 2013-14 was about 8000 tons and about 85 % of this raw material is processed in the Rosin and Turpentine oil Factories (RTFs). Indonesia is also supplying rosin to Indian industries but China was the major supplier of imported product. Indonesian rosin costs around the same as the Chinese product. Both China and Indonesia have captured more than 50% of the Indian market. After the global recession, China had dropped its prices in the Indian market. The annual requirement of rosin in the country was 40,000-50,000 tons.

Table 17. Commercially tapped sources of pine resin: species and country of production

Sl. No.	Species	Producing country
1.	*Pinus caribaea* Morelet	Venezuela, South Africa, Kenya
2.	*P. halepensis* Miller	Greece
3.	*P. kesiya* Royale ex Gordon	People's Republic of China
4.	*P. massoniana* D. Don	People's Republic of China
5.	*P. merkusii* Jungh. & Vriese	Indonesia, Viet Nam
6.	*P. oocarpa* Schiede	Mexico, Honduras
7.	*P. pinaster* Aiton	Portugal
8.	*P. radiata* D. Don	Kenya
9.	*P. roxburghii* Sarg.	India, Pakistan
10.	*P. sylvestris* L.	Russia
11.	*P. elliottii* Engelm.	Brazil, Argentina, South Africa, USA, Kenya

Source: FAO, Rome, Italy

Pine resin production

World production of turpentine is approximately 3.3 lakh tons from all sources; an almost 1.0 lakh tons (30%) is estimated to be gum turpentine, and the bulk of the remainder is sulphate turpentine. In India resin production and its value during 2007-08 to 2014-15 is depicted in Figure 17.

Resin production policy

In 2010-11, the cheap Chinese rosin, a solid form of resin obtained from pines and conifers, has flooded the Indian market and is threatening the profit margins of the rosin business in India. China had supplied the solid or semi-solid viscous substance at much lower rates as compared to the domestic product. When the global demand for rosin nosedived following the recession in Europe, China started dumping its surplus stock in India. Imported rosin, especially from China,

was badly affecting the Indian industry. Himachal Pradesh Forest Development Corp (HPFDC), one of the major players in rosin business in the country, is facing tough competition as the buyers are opting for the imported product. China is marketing rosin at much lower rates in the Indian market due to global recession. It has dumped its surplus stocks in India.

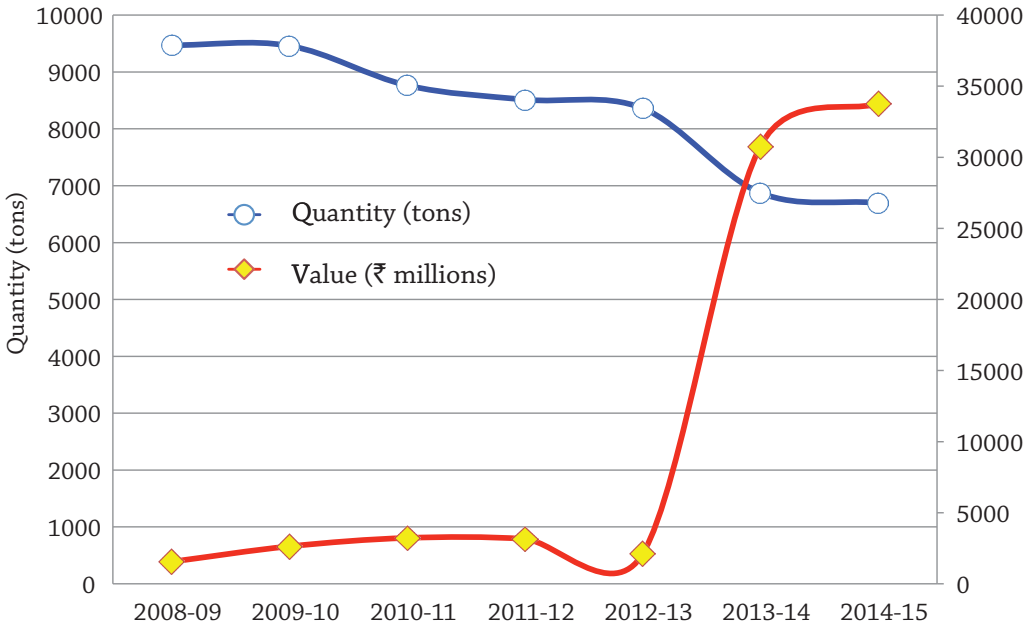

Figure 17. Pine resin production and its value in Himachal Pradesh and Uttarakhand

Total annual production of rosin is about 1.0 million tons world-wide. Of this, it is estimated that almost 60 %, is gum rosin; most of the remainder, about 35 % is tall oil rosin and the rest is wood rosin. State wise annual pine resin production and their contribution in the total production is given in Table 18 and graphical illustration presented in Figure 18.

Uttarakhand: To ensure transparency in allotment of resin to different agencies, resin policy has been formulated and issued in 2003. A total of 50% may be sold by open auction to units registered in Uttarakhand according to their processing capacity and 25% of the resin may be sold by open auction on all India basis. Balance 25% may be sold by open auction amongst the units of Khadi-Gramodyog, Co-operatives, Kumaon Mandal Vikas Nigam and Garhwal Mandal Vikas Nigam according to their processing capacity. If some quantity of resin is left unsold as per the above arrangements it can also be sold by all India open auction.

Himachal Pradesh: The hill state annually produces around 6,000 tonnes of raw rosin extracted from pine trees, grown mainly in lower hills of Hamirpur, Una, Mandi, Solan and Sirmaur districts. After processing the raw rosin, the HPFDC markets it and its extract tarpaulin oil is used in the paint industry. Trade representatives said the HPFDC was marketing rosin at ₹118-135/kg depending upon its quality. To clear its stocks, the HPFDC has plan to conduct an auction of rosin at plant in Nahan and Bilaspur. In 2010, HPFDC got good rates due to low supply from China which was hit by floods. Due to floods, China had failed to supply the rosin in India and corporation managed to

sell 6,000 tons and earning a revenue of ₹70 crore. While in 2009 the HPFDC's revenue from rosin sale was ₹43 crore and it was ₹32 crore in 2008. The HPFDC was marketing rosin at ₹118-135/kg depending upon its quality. The Chinese companies were supplying it at ₹25-30 less than the HPFDC rate. In 2010-11 China was supplying rosin at $3,300/t (around ₹161, 000/t), but these days its price is around $1,800/t. China is the main player that regulates global prices. Top quality rosin produced by the HPFDC was made available at ₹137/kg, excluding taxes and freight, while the Chinese product was priced at ₹105/kg, which included import duty. Since the HPFDC is not following the global trend, it is ending up in accumulating losses.

Table 18. State wise annual pine resin production and their contribution in the total production (in tons)

Year	Uttarakhand	Himachal Pradesh	Total
2008-09	1875 (19.8)	7596 (80.2)	9471.2 (100.0)
2009-10	1961 (20.7)	7500 (79.3)	9460.8 (100.0)
2010-11	1764 (20.1)	7000 (79.9)	8764.1 (100.0)
2011-12	1614 (19.0)	6900 (81.0)	8514.2 (100.0)
2012-13	1467 (17.5)	6894 (82.5)	8361.3 (100.0)
2013-14	1486 (21.6)	5389 (78.4)	6875.3 (100.0)
2014-15	1442 (21.5)	5258 (78.5)	6699.3 (100.0)
Average	1658 (20.0)	6648 (80.0)	8306.6 (100.0)

Figures in parentheses are the percentage of the total

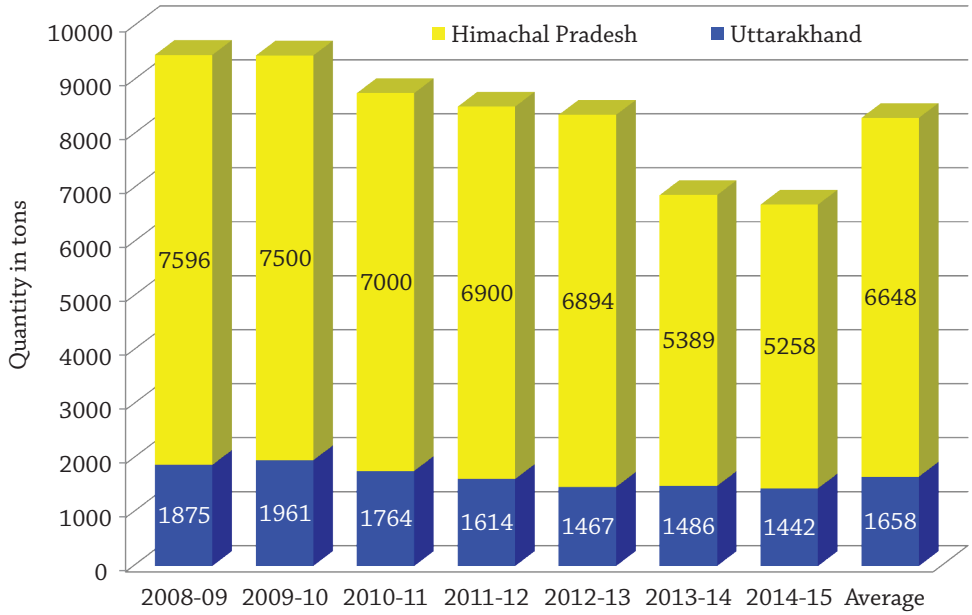

Figure 18. *Pine resin production in Himachal Pradesh and Uttarakhand*

Pine resin processing in India

Himachal Pradesh State Forest Development Corporation Limited, an Undertaking of the Himachal Pradesh government, came into existence on 25th of March 1974. This Corporation deals mainly with marketing of timber, fuel wood, pulpwood, bamboo, *khair* and resin. The entire government resin tapping work is being done by the Corporation, through modern techniques (Rill method as of now). It is graded and sold on the basis of colour, the palest shades of yellow-brown being the better quality. Quality criteria and specifications are described in Table 19.

The two Resin & Turpentine Oil Factories, located at Bilaspur and Nahan operational since four decades, have both skilled and unskilled workers to undertake resin processing and other diversification activities. Rosin and turpentine oil and other subsidiary products like phenyl, varnish, black japan *etc*. are produced from the collected resin. Rosin is the major product obtained from pine resin. It remains behind as the residue after distillation of the turpentine oil. It is a brittle, transparent, glassy solid. It is insoluble in water but soluble in many organic solvents.

Table 19. Quality criteria for different grades of the rosin

Rosin	Grade	Full Name
Pale	X	Extra White
	WW	Water White
	WG	Window Glass
	N	Nancy
Medium	M	Mary
	K	Kitty
	H	Harry
Dark	D	Dark
	B	Black

Pine resin market and price

In any analysis of world production and trade in gum naval stores, the volume of trade taking place in crude resin needs to be estimated. Until recently, this did not need to be considered as all resin was processed at origin and rosin and turpentine were the primary products of trade. However, trade in crude resin has developed over years as the capacity for tapping has fallen in some of the traditional producing countries, notably Portugal and India. These countries have excess processing capacity which can be brought back into production if an economic, external source of crude resin is found. The absence of capital costs therefore enables the processors of imported resin to sell the outputs (gum rosin and turpentine) at a price which only need covers raw material and processing costs, freight, drums and profit.

The sale of crude resin also allows producing countries with a surplus to earn extra revenue without investing in additional capacity for processing. Price of turpentine oil (vegetable) per litre (naked) ex-factory on cash basis ranged from ₹ 87 to ₹ 88. The price of per kg rosin is given in Table 20 and graphically shown in Figure 19. This price is an ex-factory price including packing charges excluding taxes and duties, *etc*.

Table 20. Grade-wise price of rosin during 2014-15

Rosin Category	Grade	Full name	Rate (₹/Kg) @	Rate (₹/Kg) #
Pale	X	Extra White	120.0	121.5
	WW	Water White	118.0	119.5
	WG	Window Glass	116.0	117.5
	N	Nancy	115.0	116.5
Medium	M	Mary	114.0	115.5
	K	Kitty	113.0	114.5
	H	Harry	112.0	113.5
Dark	D	Dark	109.0	110.5
	B	Black	92.0	93.5

@Packing in TP Barrels #Packing in PGI Barrels

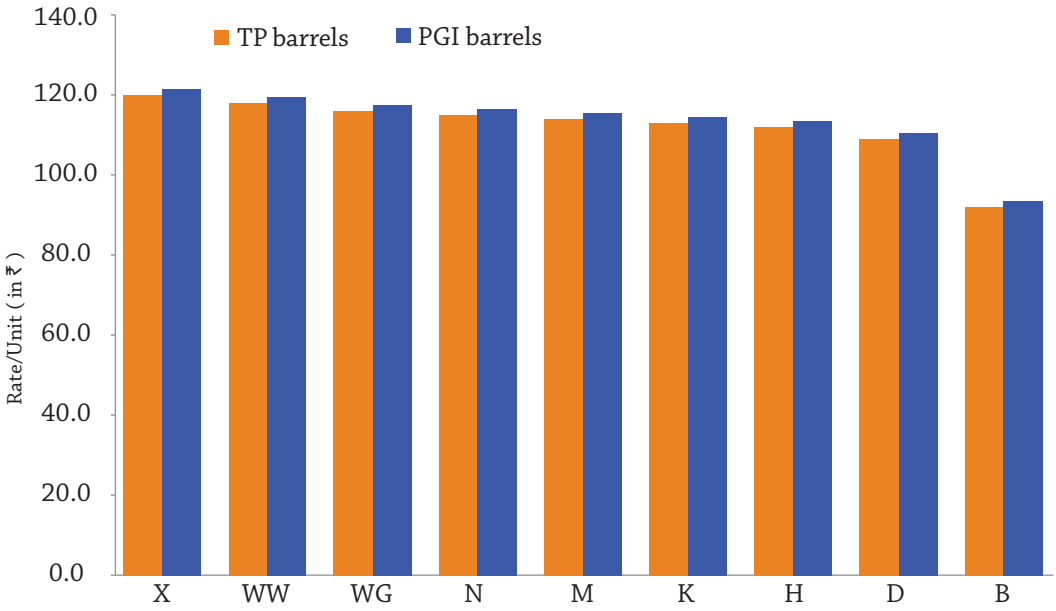

Figure 19. *Price pattern of various grades of Pine resin based products*

International trade of pine resin

Details of export in quantity and value, list of the countries importing resin from India and details of resin supply from various countries during 2014-15 is presented in the Table- 21. The total export of rosin during the year 2014-15 was 374.89 tons which was valued ₹520.80 lakh. Similarly, total import of rosin during the year 2014-15 was 36117.76 tons which was valued ₹45038.61 lakh. The analysis of EXIM data revealed that the exported quantity of rosin increased 192.1 tons in 2013-14 to 374.89 tons in 2014-15 and imported quantity of rosin was decreased slightly from 36859.4 tons in 2013-14 to 36117.76 tons in 2014-15.

During this year in international market, export price of rosin increased by 1.6 %, while import price rose by 22.5 %. Demand of resin was higher than the quantity processed in India. Hence, India depends on China, Indonesia, Vietnam and Nepal to meet its domestic demand. About 95 % gum rosin was supplied from these four neighboring countries of Asia and rest of this came from Europe and America. Similarly, about 91 % gum rosin was demanded by the major buyers like China P Rp, Nigeria, Kenya and Nepal.

Table 21. EXIM scenario of rosin during 2014-15

Country	Quantity (tons)	Value (₹ lakh)	Value (000 US $)	% Share
Export				
China P Rp	186.53	228.80	380.94	44.40
Nigeria	90.00	137.80	223.14	26.01
Kenya	38.72	62.70	101.54	11.84
Nepal	23.15	44.70	75.16	8.76
Uganda	19.76	17.70	28.99	3.38
U Arab Emts	7.92	15.70	25.72	3.00
U S A	4.00	7.50	12.71	1.48
Ethiopia	2.50	2.50	4.13	0.48
Mauritius	1.40	1.90	3.05	0.36
Zambia	0.48	1.00	1.65	0.19
Congo D. Rep.	0.20	0.30	0.45	0.05
Burundi	0.08	0.10	0.24	0.03
Others	0.17	0.10	0.22	0.03
Total	374.89	520.80	857.92	100.00
Import				
China P Rp	11459.03	16742.67	27668.08	37.43
Indonesia	9960.09	13173.76	21563.88	29.17
Nepal	8536.02	6883.53	11218.98	15.18
Vietnam SOC Rep	4534.27	5964.08	9791.08	13.25
Brazil	1515.60	1992.68	3220.00	4.36
Japan	48.00	122.22	199.91	0.27
Belgium	30.63	91.43	148.13	0.20
Singapore	3.80	32.41	53.96	0.07
Portugal	9.30	19.38	31.51	0.04
France	4.00	10.17	16.71	0.02
U S A, Netherland, Argentina and Spain	17.04	6.29	10.29	0.01
Total	36117.76	45038.62	73922.50	100.00

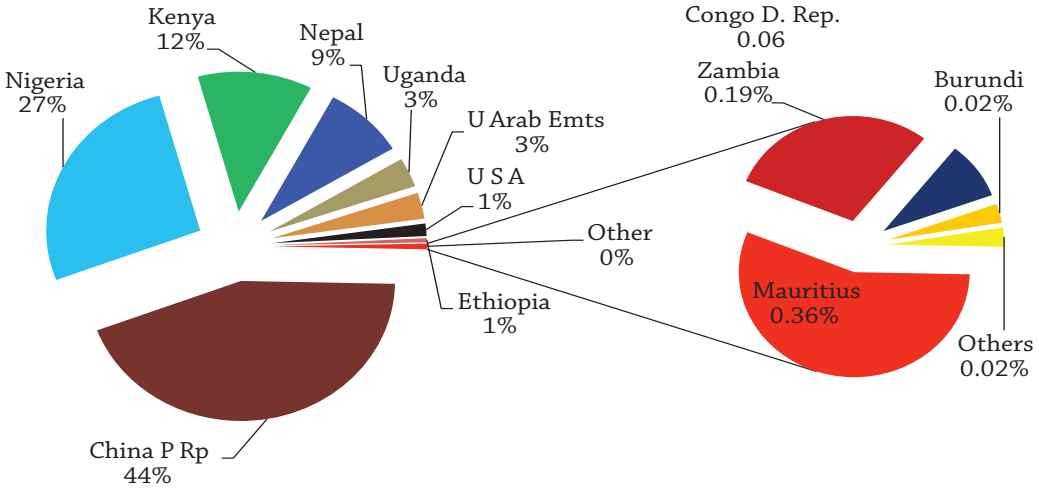

Figure 20. *Destination wise scenario of rosin during 2014-15*

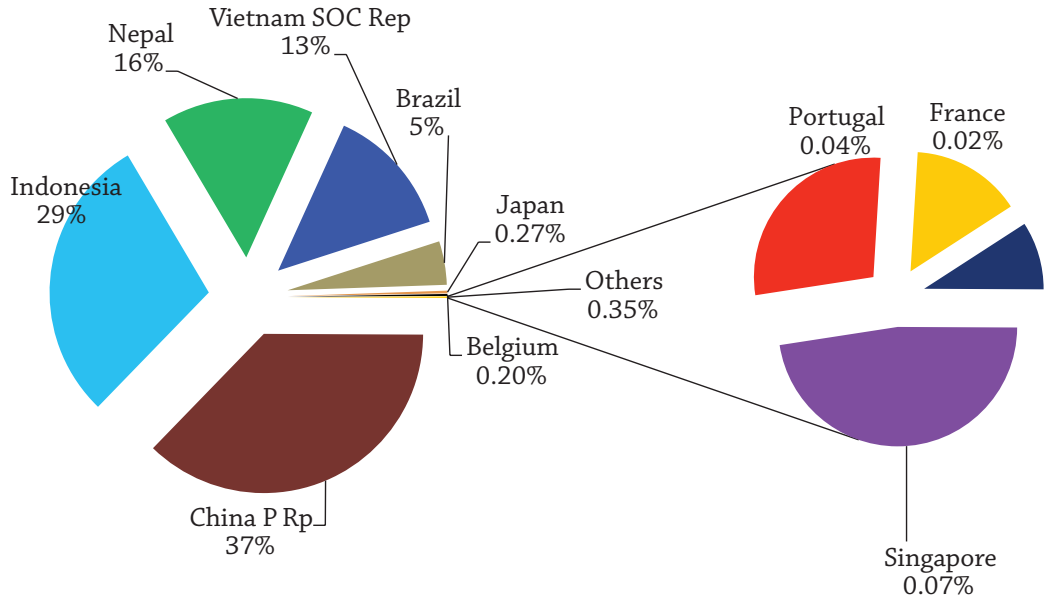

Figure 21. Source wise scenario of rosin during 2014-15

The destination and source wise demand and supply of the rosin is depicted in the Figure 20 and Figure 21. Rosin is an important natural resin in the basket of import items. During last 10 years exported value showed that 3.75 % contribution in natural resins export were from gum rosin. The average annual export quantity of rosin was 542.78 tons valued ₹ 343.62 lakh during the period 1998-99 to 2012-13. However, during last 15 years growth rates in exported quantity as well as value were estimated as negative and these were calculated about 25 % and 21 %, respectively. Similarly, the average annual import quantity of rosin was 22292.71 tons worth ₹ 12454.34 lakh

during the period 1998-99 to 2012-13. Its import had a very high stability with growth rates in import quantity (10.65 %) as well as value (26.41 %).

Copal

Copals are derived from species of *Bursera*, *Protium* (*Burseraceae*), and *Hymenaea*. The adhesive property of copal makes it as a potential coating material. It is evident from Table 22 that more than 95% of the copal in India has supplied from Indonesia (94.75%) and Philippines (4.42%). A very little portion of the total imported quantity was exported to Thailand (90.21%) and Canada (9.79%).

Table 22. EXIM scenario of copal during 2014-15

Country	Quantity (tons)	Value (₹ lakh)	Value (000' US dollars)	% share
Export				
Thailand	0.50	0.09	1.48	90.21
Canada	0.08	0.01	0.16	9.79
Total	0.58	0.10	1.64	100.00
Import				
Indonesia	1958.29	89.43	1466.71	94.75
Philippines	95.42	4.14	68.36	4.42
Singapore	19.34	0.80	12.95	0.84
Total	2073.05	94.36	1548.02	100.00

Dammar batu

Damar is tapped from the sal tree *(Shorea robusta)*, although some is still collected from the ground in fossilized form. Annual production of Dammer batu in India is about 80-100 tons. It is used as painting and incense material. Destination wise EXIM scenario of dammar batu during 2014-15 is given in Table 23. During 2014-15, more than 95 % of this resin in India has supplied from Indonesia (54.54%) and Thailand (43.91%). Less than one percent of total import quantity was exported to Jordan (81.34%), Vietnam SOC Rep (10.61%) and Germany (5.29%).

Table 23. EXIM scenario of dammar batu during 2014-15

Country	Quantity (tons)	Value (₹ lakh)	Value (000' US dollars)	% share
Export				
Jordan	8.00	1.28	21.56	81.34
Vietnam SOC Rep	0.50	0.17	2.81	10.61
Germany	0.26	0.09	1.40	5.29
Maldives	0.10	0.03	0.47	1.77
Sri Lanka DSR	0.10	0.02	0.26	0.98
Total	8.96	1.58	26.50	100.00

Country	Quantity (tons)	Value (₹ lakh)	Value (000' US dollars)	% share
Import				
Indonesia	9916.49	243.70	3992.84	54.54
Thailand	3593.35	197.61	3214.55	43.91
Vietnam SOC REP	122.47	4.61	75.61	1.03
Lao PD RP	31.00	2.36	37.61	0.51
Total	13663.31	448.28	7320.61	100.00

Mastic gum

The traditional Greek product Chios Mastic Gum or Mastiha, primarily known for its distinctive flavor. This is the dried exudate of the shrub-like tree *Pistacia lentiscus L. var. chia* of the *Anacardiaceae* family, cultivated exclusively in the south of the Greek island Chios. The preparation of traditional food products based on mastic gum or essential oil, such as chewing gum, confectionery, bakery products as well as alcoholic and nonalcoholic beverages, is also reported. Mastic Gum shown to exert beneficial effects on a wide range of human disorders. The most comprehensive data so far have indicated that mastic gum provides protection against gastrointestinal malfunctions and bacterial infections. Substantial evidence has also suggested that mastic gum exhibits hepatoprotective and cardioprotective, antiinflammatory/antioxidant, and antiatherogenic properties. In the last decade, an increasing number of studies further evaluated the potential antiproliferative properties of mastic gum against several types of human neoplasia. In India, it is imported from Greece (99.11%) and Morocco (0.89%).

B) Natural Gums : Plant exudate based natural gums

Exudate gums possess a unique combination of functionalities and properties that can never be matched by any other alternative synthetic polymers, which makes their complete substitution impossible. Importantly, these biopolymers are eco-friendly as they are biodegradable.

Photo 3. *Karaya* Tree (*S. urens*) : Source of gum *karaya*

The data and information have been collected from the major collection centers like Nagpur, Bilaspur, Surat, Ajmer and Delhi. Procurement data available with Odisha Forest Development Corporation Ltd, Rajasthan Tribal Areas Development Cooperative Federation Ltd, Maharashtra State Cooperative Tribal Development Corporation Ltd, Jharkhand State Minor Forest Produce Cooperative Development Marketing Federation Ltd, Ranchi, Jharkhand, Girijan Co-operative Corporation Limited, Visakhapatnam, Andhra Pradesh, Chhattisgarh Minor Forest Produce (T&D) Fed. Ltd., Raipur, Chhattisgarh, Gujarat State Forest Development Corporation Limited (GSFDCL), Vadodara was also compiled. The gum tapping is mainly done in the schedule areas where tribal populations exist. The collection charges to the

collectors at collection centres are paid by the purchaser at the rate fixed by the Government. After making the payment of the collection charges to the collectors and the difference amount of sale rate and collection rate in the District Union, the purchasers are allowed to transport the collected gums wherever they desire. In India, mainly gum *karaya* (*S. urens*), *dhawada* gum (*A. latifolia*), *babool/babul* gum (*A. nilotica*), *prosopis* gum (*P. juliflora*), *khair* gum (*Acasia catechu*), *Jhingan* (*Lannea coromandelica*), *palas* (*Butea monosperma*), *char* (*B. lanzan Spreng*) and *guggul* gum (*C. wightii*) are produced. The state wise gum production during 2008-09 to 2014-15 is shown in Table 24 and graphical illustration is shown in Figure 22.

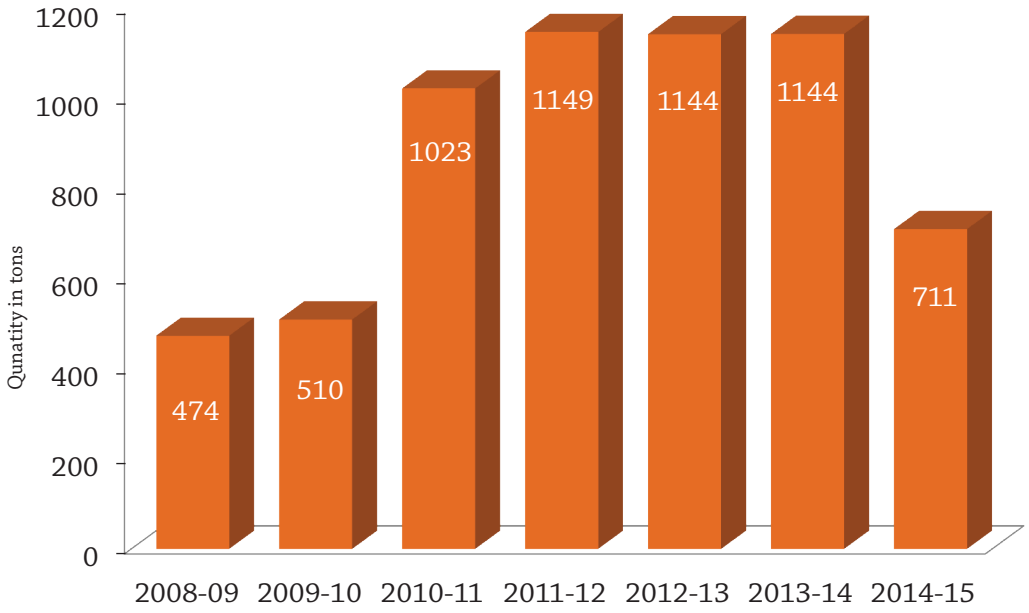

Figure 22. Year wise production scenario of natural gums in India

About 83 % of gum production in the country is contributed by Madhya Pradesh (22.0 %), Andhra Pradesh (20.3 %), Chhattisgarh (8.8 %), Jharkhand (16.2 %) and Maharashtra (15.4 %). Rest of the 17 % comes from Gujarat (5.4 %) and other minor gum producing states (11.9%). District wise gum producing areas in the country are presented in Annexure III. In parts of the Jaipur, Ajmer and Jodhpur districts *Acacia senegal* is common. On the upper slopes, the main species are replaced by *Sterculia urens* Roxb. *Boswellia serrata* Roxb. and *Lannea coromandelica* (Houtt.) Herrill and along the foothills by *Butea monosperma* (Lam.) Taub (Roy and Kumar, 1987). *Acacia catechu* forests are common in the south-eastern regions. *e.g.* Baran, Jhalawar, Kota, Tonk , Chittorgarh and Alwar.

Gum *karaya* (*Sterculia urens*)

Vernacular names:-Kullu, Kadaya, Kadu, Galgala, Genduli, Tapsi, Panerukh, Kandol, Salad Gum *karaya* is the dry exudate of *S. urens* and *S. villosa*. It is also collected from *S. urceolata* and *S. foetida* in Indonesia, *S. setigera* in Africa and from *S. caudata* in Australia (Gautami and Bhat 1992). It is also known by the name Indian tragacanth, as it resembles gum tragacanth produced by *Astragalus spp.* Gum *karaya* is one of the least soluble gums used for many industries as given below:-

i. Pharmaceutical, food, paper, textiles, cosmetic industry
ii. Superior grades in ice-creams
iii. Inks, rubber, linoleum, oil clothes, paper coatings, polishes, lower grades in varnishes, *etc.*
iv. Engraving processes and in oil drilling operations
v. In dental compounds and colostomy rings.
vi. Acting as mucilage it is also used as a bulk laxative
vii. As a binder, emulsifier and stabilizer in food industry.

Table 24. Gum production in major gum producing states of India (in tons)

State /Year	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	Average
Andhra Pradesh	75.07	35.05	23.97	34.49	29.87	42.53	26.17	38.17
Chhattisgarh	142.42	236.94	41.64	20.30	23.61	2.54	4.03	67.35
Gujarat	28.00	47.20	27.85	33.57	42.62	54.72	51.50	40.78
Jharkhand	0.00	0.00	240.60	270.40	207.30	90.00	56.00	123.47
Madhya Pradesh	23.20	8.74	286.48	292.28	232.39	207.50	120.00	167.23
Maharashtra	0.00	0.00	200.00	203.40	350.77	539.11	323.79	231.01
Telangana	200.31	175.59	99.67	159.55	102.19	65.02	42.46	120.68
Others	5.00	6.40	103.00	134.60	155.20	143.00	87.00	90.60
Total	474.00	509.92	1023.22	1148.59	1143.95	1144.43	710.94	879.29

Note: These are the revised dataset and may differ with previous estimates due to validation and updates

Table 25. Gum *karaya* production in major gum producing states of India (in tons)

State /Year	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	Average
Andhra Pradesh	44.65	22.94	16.59	24.76	16.33	27.94	16.05	24.18
Chhattisgarh	86.42	175.01	38.97	13.85	19.09	1.84	4.03	48.46
Gujarat	0.10	0.10	0.06	0.20	0.20	0.10	0.20	0.14
Jharkhand	0.00	0.00	0.00	49.40	51.50	4.40	4.00	15.61
Madhya Pradesh	23.20	8.74	6.48	12.18	8.19	12.10	10.00	11.56
Maharashtra	0.00	0.00	0.00	23.20	10.00	13.00	5.00	7.31
Telangana	194.58	173.59	98.51	157.31	101.59	64.38	38.95	118.42
Others	5.00	6.40	3.00	4.00	5.00	5.00	5.00	4.77
Total	353.95	386.79	163.61	284.90	211.90	128.76	83.23	230.45

Gum *karaya* production in India

Overall production has decreased from 6838 tons in 1975–1976 to 130.2 tons in 2014-15. During this period the price increased from ₹7.4/kg to ₹110/kg. The gum production across various states has been presented in Table 25 and Figure 23. The gum producing forest divisions in the Chhattisgarh

are Bilaspur (Mugeli, Dindori, Ratanpur, Takhatpur, Lormi), Raipur, E. Surguja (Balarampur), Marvahi (Kota), S. Surguja, Raigarh (Khamariya,), Dharmajaygarh, Rajnandgaon, Mahasamund, Dhamtari, Korea, Sukma, Bijapur, Dantewada and W. Bhanupratapur. In Jharkhand, the *karaya* gum is produced in the Latehar (Garu, Mahuadar, Herhanj, Balumath, Barwadih, Lesliganj, Chhipadohar and Richughutu), Chatra (Lawalang, Pratappur and Kanti), Garhwa (Ramkanda and Bhandaria), Daltonganj (Panki and Chhatarpur) and West Singhbhum (Chakradharpur). Annual average production of *karaya* gum during last seven years in India is illustrated in Figure 24.

Collection and grading of gum *karaya*

During 2014-15, a Minimum Support Price (MSP) of ₹10800 per qt for gum *karaya* was declared by Pricing Cell, TRIFED, Ministry of tribal affairs, Govt. of India. The scheme is initially being implemented in the states having scheduled areas and scheduled tribes in the fifth schedule of the Constitution of India (except Himachal Pradesh) namely Odisha, Jharkhand, Chhattisgarh, Maharashtra, Madhya Pradesh, Gujarat, Andhra Pradesh and Rajasthan.

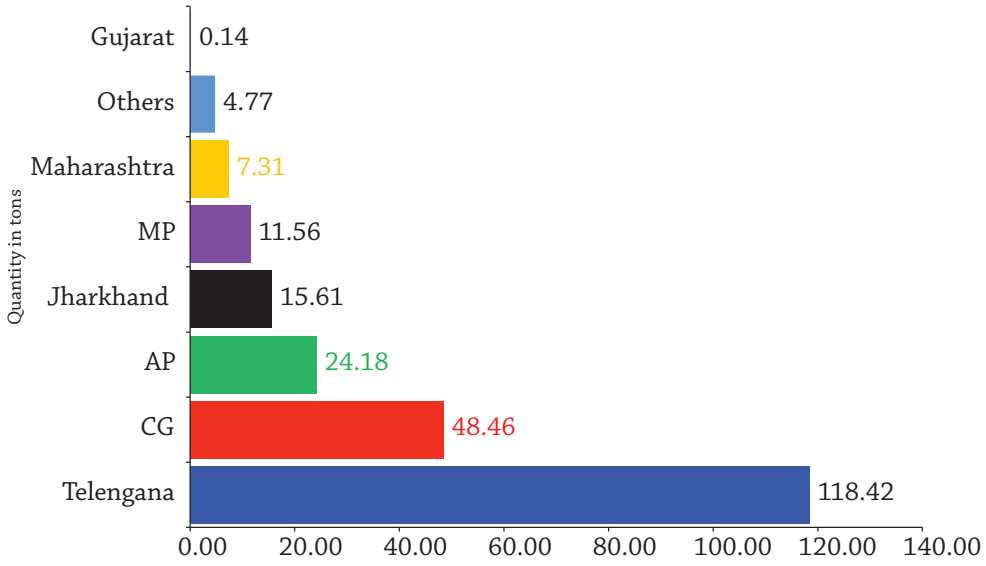

Figure 23. State-wise average production of karaya gum

International trade of gum *karaya*

Export of gum *karaya* from India during previous years is depicted in Figure 25 while domestic demand from and overseas supply in India is given in Table 26. During 2014-15, gum *karaya* was exported across the globe in 26 countries. There is high demand of gum *karaya* from India. Japan (52.96 %), France (13.68 %), Pakistan (8.57 %), Switzerland (7.05%), Taiwan (2.23%), Spain (1.82%), Thailand (1.76%), Syria (1.42%), U K (1.25%) and United State (0.93 %) remained as major export destinations during 2014-15 and about 97 % gum *karaya* supplied to these top 12 destinations. Brazil, Indonesia, Tunisia, Egypt A RP, Jamaica and Singapore were the other destinations (Figure 26). Ghana and Mali has supplied 80 % raw gum *karaya* and about 20 % supply of good quality gum *karaya* was from USA. Source wise import figures are presented in Figure 27.

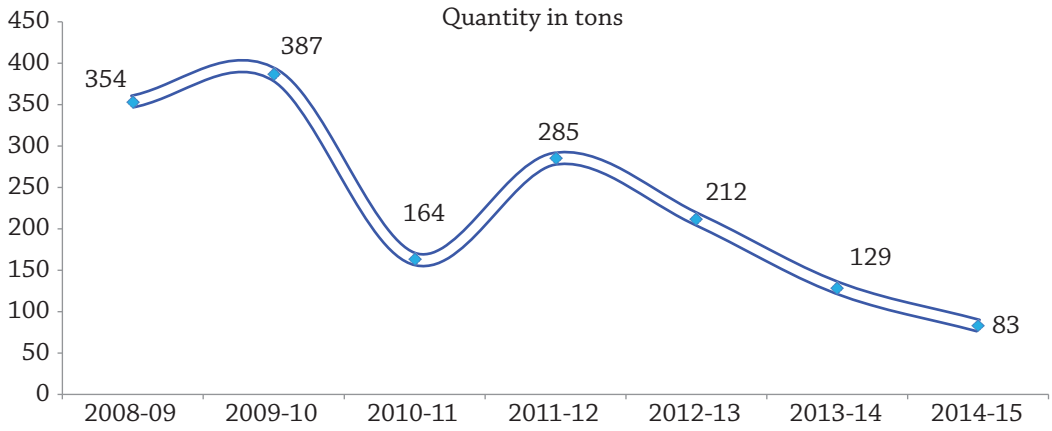

Figure 24. Gum karaya production in India

Table 26. Export and import of gum *karaya* during 2014-15

Country	Quantity (tons)	Value (₹ lakh)	Value (000' US dollars)	% share
Export				
Japan	79.50	409.41	670.10	52.96
France	41.03	103.17	173.08	13.68
Pakistan IR	25.66	65.76	108.48	8.57
Switzerland	22.20	55.04	89.25	7.05
Malaysia	5.00	23.01	37.30	2.95
Germany	5.00	19.56	32.11	2.54
Taiwan	2.00	17.71	28.23	2.23
Spain	3.00	13.65	23.01	1.82
Thailand	1.80	13.68	22.24	1.76
Syria	3.00	10.64	17.94	1.42
U K	1.38	9.69	15.87	1.25
U S A	1.50	7.17	11.76	0.93
Brazil	1.00	3.91	6.26	0.49
Indonesia	0.50	3.72	6.08	0.48
Tunisia	0.90	3.40	5.48	0.43
Egypt A RP	2.00	3.03	4.85	0.38
Jamaica	1.00	2.59	4.17	0.33
Singapore	0.25	1.60	2.67	0.21
Others	1.32	3.90	6.35	0.51
Total	198.02	770.63	1265.22	100.00
Import				
Ghana	544.00	276.78	462.52	70.41
U S A	5.58	78.59	128.46	19.55
Mali	36.70	39.31	65.99	10.04
Total	586.28	394.67	656.96	100.00

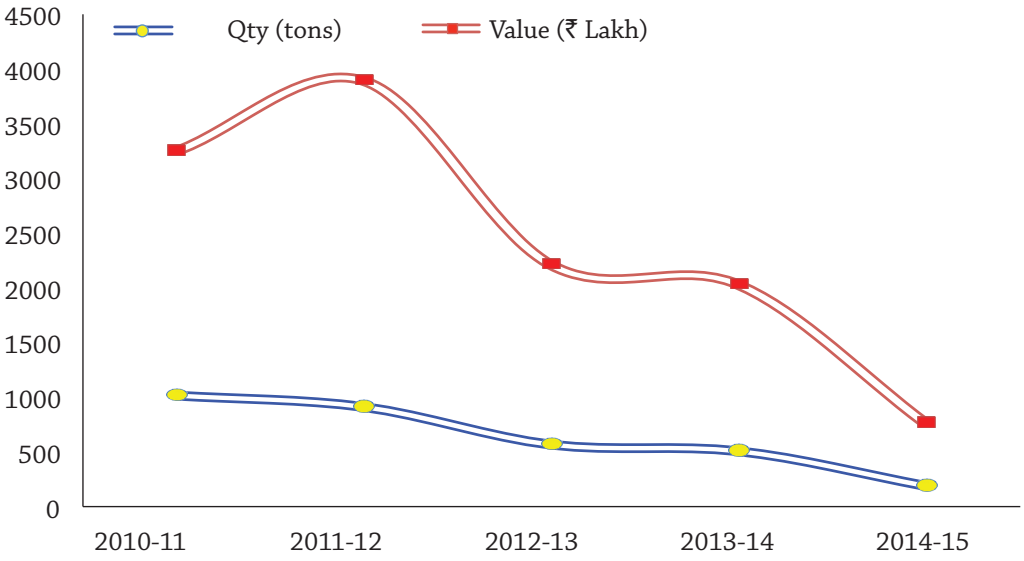

Figure 25. Export of gum karaya from India

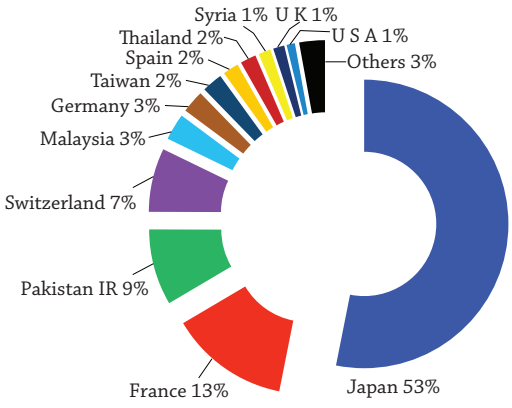

Figure 26. Destination wise scenario of gum karaya during 2014-15

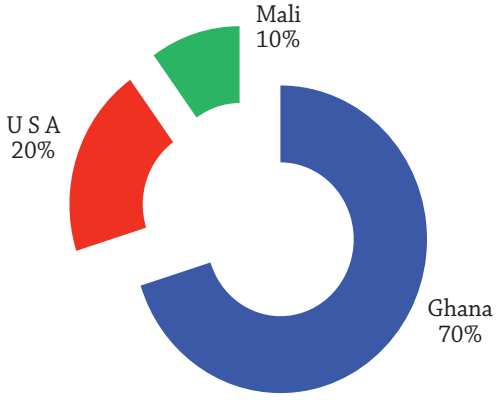

Figure 27. Source wise scenario of gum karaya during 2014-15

Dhawda gum/*Gum Ghatti* (*A. latifolia*)

Vernacular names :- Gum Ghatti, Dhauda, Dhaura, Bakli, Tirman, Vekkali, Dhanda, Damado

Dhawda gum is the dry exudate of *A. latifolia*. It has a glassy fracture and occurs in rounded tears which are normally less than 1 cm in diameter. It often occurs in larger vermiform masses. The colour of the exudate varies from light to dark brown; the lighter the colour the better the quality. *Dhawda* gum is used by many industries. It is used as an emulsifier and stabilizer in beverages and butter containing table syrups; flavour fixative for specific applications; to prepare powdered, stable, oil-soluble vitamins; as a binder in long-fibered light weight papers; as an emulsifier of petroleum and non petroleum waxes to form liquid and wax paste emulsions; to prepare uniform and discrete prills of cross-linked polystyrene; used as drilling mud conditioner and the acidizing of oil wells and also used in powdered explosives to improve resistance to water damage.

Dhawda gum production in India

Dhawda gum is produced in the states of Chhattisgarh, Gujarat, Jharkhand, Madhya Pradesh, Maharashtra and Andhra Pradesh. State-wise production data are shown in Table 27. It is evident from the Figure 28 that total collection of *Dhawda* gum increased from 2.7 tons in 2011-12 to 448.41 tons in 2014-15.

Table 27. *Dhawda* gum production in major gum producing states of India (in tons)

State /Year	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	Average
Andhra Pradesh	0.60	0.30	0.80	0.50	0.60	0.80	1.00	0.66
Chhattisgarh	39.30	42.50	1.60	3.01	2.62	0.20	0.00	12.75
Gujarat	0.20	0.50	0.30	2.33	1.30	1.40	1.30	1.05
Jharkhand	0.00	0.00	0.00	20.50	30.20	25.40	12.00	12.59
Madhya Pradesh	0.00	0.00	0.00	30.10	24.20	20.80	10.00	12.16
Maharashtra	0.00	0.00	0.00	40.20	240.77	334.11	230.79	120.84
Others	0.00	0.00	0.00	50.60	80.20	65.70	40.00	33.79
Total	40.10	43.30	2.70	147.24	379.89	448.41	295.09	193.82

Collection and grading of *dhawda* gum

The collection rate for *dhawada* gum for the year 2014-15 is around ₹500/kg for Grade-I, ₹200/kg for Grade-II, ₹100/kg for Grade-III.

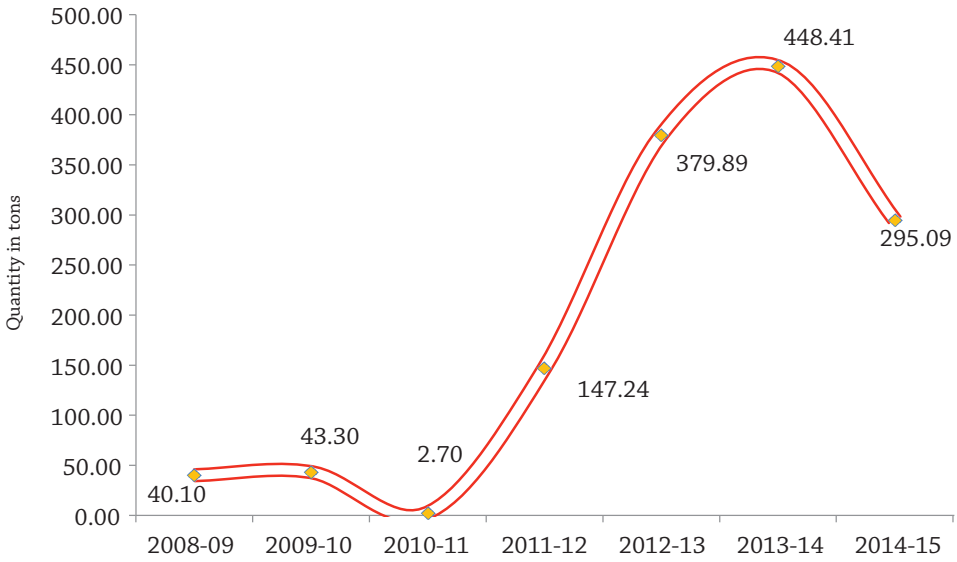

Figure 28. Year wise production scenario of gum ghatti in India

Gum Arabic (*Acacia senegal*)

Gum arabic, also known as Acacia gum, is a natural gum made of the hardened sap of various species of the Acacia tree. Gum acacia is a deciduous shrub, growing upto 15 m tall and usually

branching out from the ground. Gum arabic is predominantly collected from two related species, namely *Acacia senegal* and *Vachellia (Acacia) seyal*. Producers harvest about 80% of the gum commercially from wild trees, mostly in Sudan. Gum exudes from the duct of the inner bark and is tapped in the hot season when the trees are under stress and annual gum production in India is about 5-10 tons. It is tapped in the hot season (May-June) when the trees are stressed. Tapping begins when trees are 4-5 years old. It commences after leaf fall and ceases during the colder months of the dry season. Annual yields stand at 188-2856 g for young trees and 379-6754 g for older trees (7-15 years). Gum production is excellent on poor soils and higher in stressed trees.

The uses of gum arabic are linked to its two main characteristics: its high solubility in water and its low viscosity comparatively. This gives gum arabic eminent qualities as an emulsifier, stabilizer, thickener or adhesive of a non-toxic nature and its low calorific value and high soluble fibre, which are of major importance in nutrition and dietary applications. Pharmaceutical drugs and cosmetics also use the gum as a binder, emulsifying agent, and a suspending or viscosity increasing agent. There are two main types of gum arabic used as hydrocolloids: *Acacia senegal* and *Acacia seyal*. Senegal grade is an emulsifier, much used in beverage emulsions. Seyal grade is used in confectionery, coatings and as a soluble dietary fiber.

International trade of gum Arabic

The three main producing countries are Sudan, Chad and Nigeria, which cover about 95% of the global gum Arabic export market (Network for Natural Gums and Resins in Africa, 2004).

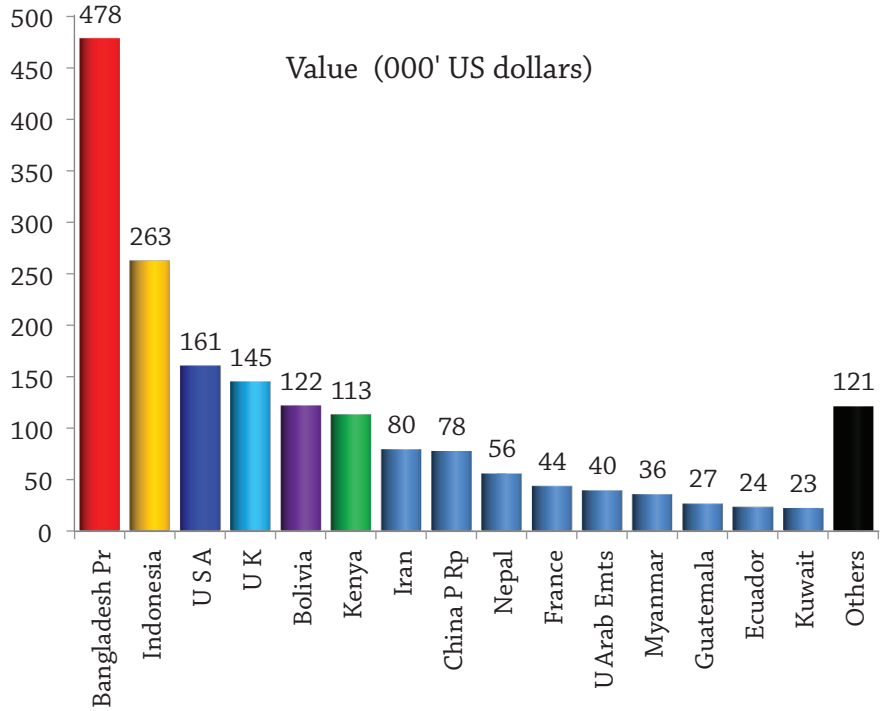

Figure 29. Destination wise scenario of gum Arabic during 2014-15

Destination wise export and source wise import share is depicted in Table 28. There is high demand of gum *Arabic* from and in India also. About 400 tons of gum Arabic exported to Bangladesh Pr (26.46 %), Indonesia (14.53 %), and USA (8.88 %), UK (8.03%), Bolivia (6.73%), and Kenya (6.25 %) during 2014-15. About 71 % gum Arabic supplied to these top 6 destinations (Figure 29).

Table 28. Export and import of gum Arabic during 2014-15

Country	Quantity (tons)	Value (₹ lakh)	Value (000' US dollars)	% share
Export				
Bangladesh Pr	81.73	28.81	478.34	26.46
Indonesia	31.20	15.77	262.64	14.53
U S A	38.22	9.64	160.51	8.88
U K	1.65	8.86	145.14	8.03
Bolivia	15.00	7.55	121.65	6.73
Kenya	37.25	6.94	112.95	6.25
Iran	13.00	4.83	79.50	4.40
China P Rp	24.00	4.84	77.96	4.31
Nepal	98.36	3.48	55.92	3.09
France	1.04	2.67	43.94	2.43
U Arab Emts	8.11	2.44	39.69	2.20
Myanmar	5.30	2.21	35.63	1.97
Guatemala	8.00	1.65	26.79	1.48
Ecuador	1.20	1.41	23.54	1.30
Kuwait	6.71	1.40	22.50	1.24
Others	27.87	7.42	121.06	6.70
Total	398.65	109.93	1807.76	100.00
Import				
Sudan	11919.04	469.65	7671.22	36.30
Nigeria	9668.77	330.58	5481.34	25.94
Cameroon	4109.30	164.79	2701.42	12.78
Chad	1912.00	116.16	1894.49	8.97
France	224.05	46.87	763.32	3.61
Ghana	1133.38	36.43	602.14	2.85
U K	102.38	35.79	590.32	2.79
Ethiopia	438.00	20.23	331.64	1.57
Senegal	740.43	19.28	317.89	1.50
Tanzania Rep	296.45	13.40	216.45	1.02
Others	463.94	34.07	559.90	2.65
Total	31007.75	1287.23	21130.14	100.00

The international market for gum *Arabic* is subject to different trends and fluctuations, determined by an increasing demand, variable capacity of African producer countries to stabilize the supply, variability of quality and prices and use of substitutes by importing countries, which can negatively affect the gum Arabic market demand. During 2014-15, gum *arabic* is exported across the globe in 49 countries. Sudan, Nigeria, Cameroon and Chad have supplied 84 % raw gum Arabic and rest 16 % was supplied from France, Ghana, UK, Ethiopia, Senegal, Tanzania Rep and others (Figure 30).

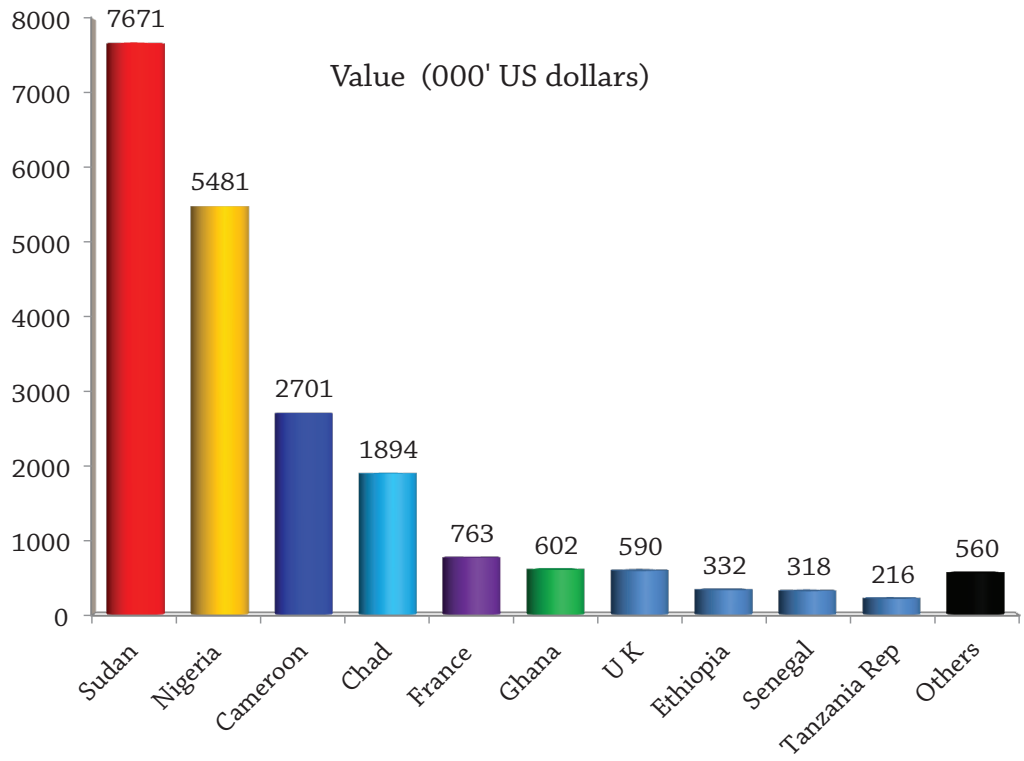

Figure 30. Source wise scenario of gum Arabic during 2014-15

International trade of Asian gum

There is high demand of Asian gum from and in India also. Destination wise export and source wise import share of Asian gum is depicted in Table 29 and graphical presentation of direction of trade is illustrated in Figure 31.

During 2014-15, about 400 tons of Asian gum was exported from the country. Germany (30.38 %), Belgium (22.40 %), Japan (15.16 %), South Africa (5.91%), and Malaysia (5.01 %) remained as major export destinations. About 79 % gum Asian supplied to these top 5 destinations. During 2014-15, Asian gum was exported across the globe in 34 countries. Indonesia and Singapore have supplied 100 % raw Asian gum in Indian Market.

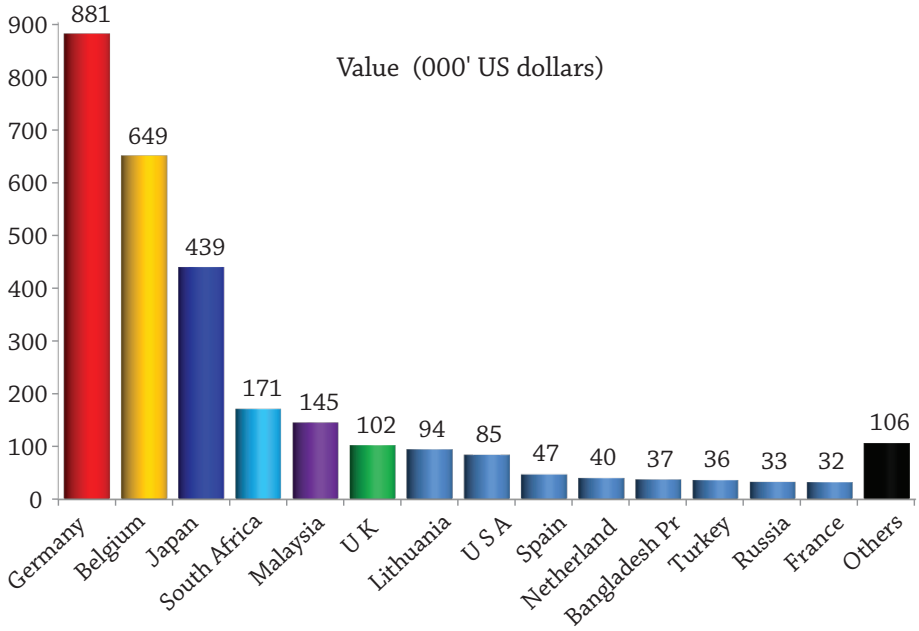

Figure 31. Destination wise scenario of Asian gum during 2014-15

Table 29. Export and import of Asian gum during 2014-15

Country	Quantity (tons)	Value (₹ lakh)	Value (000' US dollars)	% share
Export				
Germany	118.00	54.10	880.52	30.38
Belgium	84.41	39.81	649.42	22.40
Japan	34.20	26.71	439.31	15.16
South Africa	26.28	10.44	171.19	5.91
Malaysia	20.50	8.87	145.10	5.01
U K	26.14	6.34	102.06	3.52
Lithuania	18.00	5.81	94.16	3.25
U S A	13.34	5.20	84.71	2.92
Spain	4.40	2.92	47.26	1.63
Netherland	6.18	2.41	40.07	1.38
Bangladesh Pr	13.78	2.27	37.13	1.28
Turkey	4.00	2.21	36.27	1.25
Russia	3.00	2.00	32.90	1.13
France	10.00	1.94	32.47	1.12
Others	23.37	6.49	106.16	3.66
Total	405.60	177.53	2898.72	100.00

Country	Quantity (tons)	Value (₹ lakh)	Value (000' US dollars)	% share
Import				
Indonesia	25.00	1.98	32.58	63.10
Singapore	21.97	1.17	19.05	36.90
Total	46.97	3.15	51.63	100.00

International trade of African gum

In India, African gum is supplied from Chad (63.66%) and Senegal (36.34%). It is evident from the Table 30 that Kenya (98.38%) and Uganda (1.62%) are the major export destination of African gum.

Table 30. Export and import of African gum during 2014-15

Country	Quantity (tons)	Value (₹ lakh)	Value (000' US dollars)	% share
Export				
Kenya	0.49	0.08	1.28	98.38
Uganda	0.01	0.00	0.02	1.62
Total	0.50	0.08	1.30	100.00
Import				
Chad	205.00	5.90	97.98	63.66
Senegal	110.00	3.39	55.92	36.34
Total	315.00	9.29	153.91	100.00

Jhingan gum (Lannea coromandelica)

Lannea coromandelica (*Jhingan*, Indian Ash Tree, Moi tree) is a deciduous tree which grows upto 14 m height. Jhingan gum is mostly obtained from natural exudation and sometimes by tapping and annual gum production is about 60-80 tons in India. It is used as an alternative to gum arabic in food and other purposes. It was found that the emulsion containing *jhingan gum* produced more stable emulsion at a much lower amount as compared to the emulsion stabilized by gum acacia.

Production and export performance of *agarbathi* industry depends on availability of forest based raw materials. Indiscriminate collection is leading to overexploitation and shortage of raw materials particularly, the basic binding material which is the bark (*Jigat*) of slow growing evergreen tree *Machilus macrantha*. Amongst the various plant materials screened, *Lannea coromandelica* syn. *Odina wodier (Moyna or Jinghan)* gum in combination with Jigat in 1:1 ratio was found to be a good partial substitute and agarbathis rolled using this mixture cost 20% less than those rolled with pure *jigat*.

Saja (Terminalia tomentosa)

Terminalia tomentosa (*Saja, Saj*) is a tree growing upto 30 m tall, with a trunk upto diameter of 1 m. A copious transparent gum exudes in large globular tears from the trunk. In India, the annual gum production is about 30-40 tons. It is used as incense and cosmetic. *Terminalia tomentosa* has a remarkable attribute as some members of the species store water in the dry season.

Tragacanth (Adracanth) (Astragalus gummifer)

Tragacanth gum (TG) is a natural and acidic polysaccharide that secretes spontaneously or with a scratch on the different species of *Astragalus* plant. *Astragalus gummifer* is the most famous species of this plant. TG obtained in two different forms: ribbon and flake. The name tragacanth is originated from two Greek words of tragos (goat) and akantha (thorn) showing its curved shape. TG is almost insoluble in water, but swells to form a stiff gel due to its structure. TG has been accepted since 1961 as generally recognized as safe (GRAS) at the level of 0.2–1.3% and in Europe has E-number E413 on the list of additives approved by the Scientific Committee for Food of the European Community. TG is widely used in various fields such as food, pharmaceuticals and cosmetics industries acting as the stabilizer, emulsifier, thickener, fat replacer and cross-linking agent. In recent years, several works are reported on the application of TG in the wound and burn dressing, synthesis of silver nanoparticles, hydrogel membranes, superabsorbent hydrogel, matrix of verapamil hydrochloride tablets, matrix for cell immobilization and drug encapsulation. Encapsulation is a technique of preparing the tiny package materials such as pharmaceuticals, enzymes, dyes and flavorsto protect from the external environment. EXIM scenario of Tragacanth (Adracanth) during 2014-15 is given in Table 31.

Table 31. Export and import of Tragacanth (Adracanth) during 2014-15

Country	Quantity (tons)	Value (₹ lakh)	Value (000' US dollars)	% share
Export				
Tanzania Rep	0.10	0.01	0.24	60.05
U S A	0.02	0.01	0.15	37.40
Israel	0.00	0.00	0.01	2.54
Total	0.12	0.02	0.39	100.00
Import				
U A E	2.32	0.16	2.74	53.66
Germany	0.02	0.15	2.37	46.34
Total	2.35	0.31	5.11	100.00

Xanthun gum

Xanthan gum is a polysaccharide secreted by the bacterium *Xanthomonas campestris*, used as a food additive and rheology modifier, commonly used as a food thickening agent. Xanthan gum was discovered by Allene Rosalind Jeanes. It was brought into commercial production under the

trade name Kelzan in the early 1960s. It was approved for use in foods after animal testing in 1968. It is accepted as a safe food additive with E number E415. Xanthan gum derives its name from the strain of bacteria used during the fermentation process, *Xanthomonas campestris*. *X. campestris* is the same bacterium responsible for causing black rot to form on broccoli, cauliflower, and other leafy vegetables. The bacterium forms a slimy substance that acts as a natural stabilizer or thickener. In foods, xanthan gum is most often found in salad dressings and sauces. It helps to prevent oil separation by stabilizing the emulsion, although it is not an emulsifier. Xanthan gum also helps suspend solid particles, such as spices. Also used in frozen foods and beverages, xanthan gum helps create the pleasant texture in many ice creams, along with guar gum and locust bean gum. Toothpaste often contains xanthan gum, wherein it serves as a binder to keep the product uniform. EXIM scenario of *Xanthum* gum during 2014-15 is given in Table 32.

Table 32. Export and import of *Xanthun* gum during 2014-15

Country	Quantity (tons)	Value (₹ lakh)	Value (000' US dollars)	% share
Export				
Ethiopia	0.58	0.48	7.83	61.61
Congo D. Rep.	0.30	0.19	3.10	24.40
U A E	0.03	0.06	0.89	6.96
Nepal	0.05	0.03	0.46	3.59
Ghana	0.05	0.03	0.44	3.43
Italy	0.00	0.00	0.00	0.01
Total	1.00	0.77	12.72	100.00
Import				
China P Rp	79.75	15.75	257.03	95.36
Poland	0.53	0.51	8.37	3.10
U S A	0.20	0.25	4.11	1.53
U A E	0.00	0.00	0.02	0.01
Total	80.48	16.52	269.52	100.00

Plant Exudate: Other gums

The other important gums are Gum arabic (*Acacia senegal),* Gum kondagogu (*Cochlospermum gossypium), saja* (*Terminalia tomentosa*), *Jhingan* (*L. coromandelica), babool* (*A. nilotica*), *palas* (*B. monosperma*), *khair* (*A. catechu*) and *char* (*B. lanzan* Spreng). Gujarat is major *guggal* gum and *prosopis* gum/*babool* gum producing state. Gum kondagogu is a naturally occurring nontoxic polysaccharide derived as an exudate from the bark of *Cochlospermum gossypium* (*Bixaceae* family), a native tree of India. The total production of other gums across various states was around 352.0 tons during 2014-2015 (Table 33).Graphically demonstrated in Figure 32.

Table 33. Production of other gums in India (in tons)

State /Year	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	Average
Andhra Pradesh	29.83	11.81	6.59	9.23	12.94	13.79	9.12	13.33
Chhattisgarh	16.70	19.43	1.07	3.44	1.90	0.50	0.00	6.15
Gujarat	27.70	46.60	27.49	31.04	41.12	53.22	50.00	39.60
Jharkhand	0.00	0.00	240.60	200.50	125.60	60.20	40.00	95.27
Madhya Pradesh	0.00	0.00	280.00	250.00	200.00	174.60	100.00	143.51
Maharashtra	0.00	0.00	200.00	140.00	100.00	192.00	88.00	102.86
Telengana	5.73	2.00	1.16	2.24	0.60	0.65	3.50	2.27
Others	0.00	0.00	100.00	80.00	70.00	72.30	42.00	52.04
Total	79.95	79.83	856.91	716.45	552.16	567.26	332.62	455.03

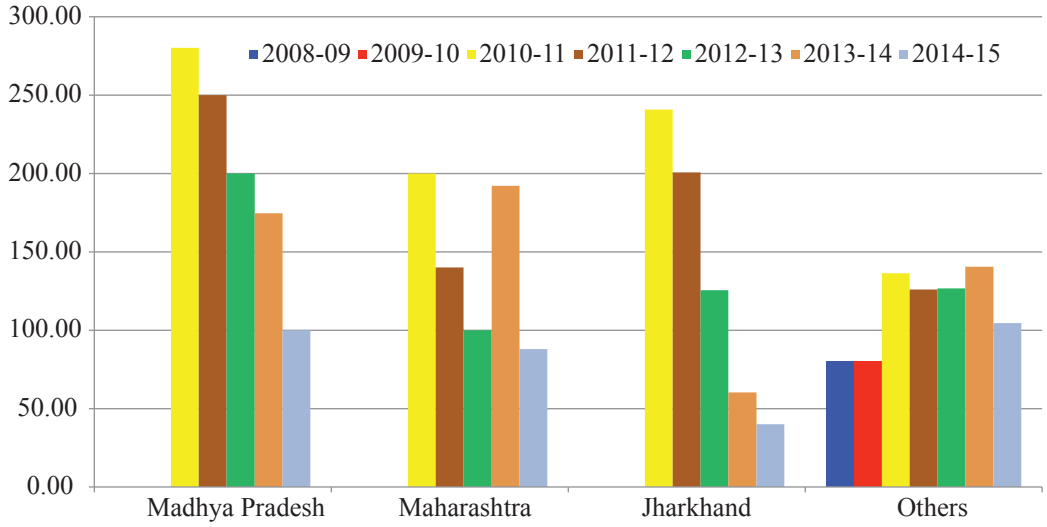

Figure 32. Total production of other gums across various states in India

Collection price and grading

The collection rate of *jhingan*, *khair* and *babool* gum ranged from ₹ 2000 to 5000/qt. Retail packing price of the *babul* gum and *salai dhoop* in Gujarat increased from ₹170/kg to ₹200/kg and ₹ 250/kg to ₹400/kg, respectively. While acacia gum has been harvested in Arabia, Sudan, and West Asia since antiquity, sub-Saharan acacia gum has a long history as a prized export. The gum exported came from the band of acacia trees that once covered much of the Sahel region: the southern littoral of the Sahara Desert that runs from the Atlantic to the Red Sea. Today, the main populations of gum-producing *Acacia* species are harvested in Mauritania, Senegal, Mali, Burkina Faso, Niger, Nigeria, Chad, Cameroon, Sudan, Eritrea, Somalia, Ethiopia, Kenya and Tanzania.

Table 34. Collection price of other gums in India (grade wise)

Natural gum	*Scientific name*	*Grade*	*Price/Kg (in ₹)*
Guggul gum	***C. wightii***	***I***	***600***
Guggul gum	***C. wightii***	***II***	***250***
Guggul gum	***C. wightii***	***III***	***150***
Salai gum	***B. serrata***	***I***	***125***
Khiar gum	***A. catechu***	***I***	***50***
Babool gum	***A. nilotica***	***I***	***40***
Babool gum	***A. nilotica***	***II***	***30***
Babool gum	***A. nilotica***	***III***	***27***
Other			***30-40***

Acacia senegal is tapped for gum by cutting holes in the bark, from which a product called kordofan or Senegal gum is exuded. Seyal gum, from *Acacia seyal*, the species more prevalent in East Africa, is collected from naturally occurring exudations on the bark. Traditionally harvested by semi nomadic desert pastoralists in the course of their transhumance cycle, acacia gum remains a main export of several African nations, including Mauritania, Niger, Chad, and Sudan. The hardened exudations are collected in the middle of the rainy season (usually in July), and exported at the start of the dry season (November). Grade-wise collection price of other gums in India is depicted in Table 34.

Regulations and governance

On the basis of regulations and governance issues for trading of NTFPs including natural resins and gums, the Government has classified as nationalized items, monopoly items and non-nationalized items. State Government classifies NTFPs as nationalized items, which can only be traded / marketed by Forest Department and it may vary from state to state. Four major gums namely *karaya/kullu* gum (*S. urens*), gum ghatti/ *dhawada* gum (*A. latifolia*), *babool* gum (*A. nilotica*) and *khair* gum (*A. catechu*) are categorized under nationalized gums in the some states. A trade wing of the Forest Department's trade division deals with its marketing. The forest Department gives the monopoly rights for value added processes and marketing of NTFPs to some agency under lease agreement, based on sustainable harvesting and economic value. Apart from nationalized and monopoly items, remaining NTFPs are open to all. Primary collectors or their associations must get permits from the Divisional Forest Officer (DFO) to transport and market the produce. The state-wise list of gums producing trees and respective categories is presented in Annexure IV.

Seed based natural gum-*Guar* gum

India is native of *guar* or cluster bean. It is used as vegetable by households, as cattle food (whole green plant), as cattle feed (*churi* and *korma)* and as a green manure crop in agriculture. *Guar* gum comes from the endosperm (30 %) of the seed of the legume plant *Cyamopsis tetragonoloba*; an annual plant, grown in dry regions of India. There are various grades of *guar* gums pure or derivative. *Guar* gum is a white to creamy coloured, free flowing powder without any extraneous matter. Its ability to suspend solids, bind water by hydrogen bonding, control the viscosity of aqueous

solutions, form strong tough films have accounted for its rapid growth. The growing season of *guar* is 14 to 16 weeks and requires reasonably warm weather and moderate flashing rainfall with plenty of sunshine. Too much rain can cause the plant to become more 'leafy' resulting thereby reducing the number of pods or the number of seeds per pod which affects the size and yield of seeds. The crop is generally sown after the monsoon rainfall in the second half of July to early August and is harvested in late October to early November. The *guar* is a naturally rain fed crop. Depending on the monsoon rainfall the total size of *guar* crop varies from year to year. After harvesting, when the pods become dry through sunlight, they are beaten off and during this process, the seeds come out of the pods. Peak arrival of the crop in the market is seen in October to December while lean arrival in the months January to May.

Photo 4. *Guar* plant (*C. tetragonoloba*) with pods

Guar seed production in India

India contributes about 80 % to the world *guar* production and Pakistan is the second largest producer. The all India area, production and yield of *guar* seed has been presented in Table 35. State wise area, production and yield of *guar* seed has been presented in Table 36. In major guar producing area like Rajasthan, Haryana and Gujarat *guar* crop is grown after the first shower of *monsoon* in July to early August and is harvested in late October early November. It grown as the rain fed crop and its production is totally depends on the performance of *monsoon*. The decline in production due to deficient rainfall during 2009-10 also confirmed this fact. The price hit all time high in the spot and futures market during this period.

Table 35. All India area, production and yield of *guar* seed and potential *of guar* gum production

(Area- thousand ha, Production- thousand tons, Yield- kg/ha,)

Year	*Guar* seed			*Guar* gum
	Area	Production	Yield	Potential production
2008-09	3862.5	1935.8	501	645.3
2009-10	2995.2	594.7	199	198.2
2010-11	3382.2	1965.3	581	655.1
2011-12	3444.2	2217.6	644	744.3
2012-13	5151.7	2460.7	478	819.0
2013-14	5887.7	3388.4	576	1129.1
2014-15	5359.8	3284.0	613	1094.6

Source: Directorate of Economics and Statistics, MoA, GoI; www.rsamb.rajasthan.gov.in

Table 36. State wise area, production and yield of *guar* seed during previous seven years

State	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	Average
State wise area of *guar* seed during previous seven years (thousand ha)								
Gujarat	150.4	132.7	124.6	128.3	207.1	308.1	278.0	189.9
Haryana	370.0	252.0	256.0	215.0	388.0	481.0	406.0	338.3
Punjab	27.8	21.8	24.0	25.0	26.0	28.2	48.6	28.8
Rajasthan	3318.1	2586.8	2980.9	3094.2	4533.3	5070.9	4625.2	3744.2
Uttar Pradesh	2.5	2.5	2.4	2.5	2.5	2.5	2.0	2.4
All India	3868.8	2995.8	3387.9	3465.0	5156.9	5890.7	5359.8	4303.6
State wise production of *guar* seed during previous seven years (thousand tons)								
Gujarat	52.7	44.7	73.0	74.5	128.5	133.6	167.0	96.3
Haryana	602.0	329.0	333.0	290.0	278.0	369.0	338.0	362.7
Punjab	22.1	16.8	18.0	20.0	22.0	21.2	33.4	21.9
Rajasthan	1261.0	201.0	1540.5	1846.6	2026.7	2861.9	2744.0	1783.1
Uttar Pradesh	2.1	2.1	2.0	2.0	2.0	2.0	1.6	2.0
All India	1939.9	593.6	1966.5	2233.1	2457.2	3387.7	3284.0	2266.0
State wise yield of *guar* seed during previous seven years (Kg/ ha)								
Gujarat	350	337	586	581	620	434	601	507
Haryana	1627	1306	1301	1349	716	767	833	1072
Punjab	795	771	750	800	846	752	687	762
Rajasthan	380	78	517	597	447	564	593	476
Uttar Pradesh	854	827	833	800	800	800	800	817
All India	501	198	580	644	476	575	613	527

Source: Directorate of Economics and Statistics, MoA, GoI

Rajasthan has been a leading state in production as well as processing of *guar* seed in India followed by Haryana and Gujarat. In Rajasthan, the districts where *guar* crop cultivated are Churu, Bikaner, Jaisalmer, Barmer, Nagaur, Hanumangarh, Jodhpur, Sri Ganganagar, Jaipur, Sirohi, Dausa, Jhunjhunu and Sikar. The districts in Haryana indulged in the production of *guar* are Bhiwani, Gurgaon, Mahendragrh and Rewari and the districts in Gujarat are Kutch, Banaskantha, Mehsana, Sabarkantha, Vadodara and Ahmadabad. Cultivation of *guar* crop has been started in newer areas like Andhra Pradesh including Telengana and other southern states also.

Guar seed processing and value addition in India

India is leading in *guar* gum production due to its well established *guar* gum industry in Jodhpur, Rajasthan. Other states like Gujarat, Haryana and Maharashtra has *guar* seed collection centers and

guar gum processing units. Recently, more units are also being established in Bikaner, Rajasthan with high capacity. Sri Ganganagar, Hissar, Alwar, Sirsa, Jodhpur, Bikaner, Jaipur are the major markets for *guar* seed. Major *guar* gum is used in paper, textile, oil drilling, mining, explosives, ore flotation and other various industrial applications. Out of the decadal average potential production of guar gum around 6.5 lakh tons in the country, around 3.0 lakh tons is consumed in the domestic market as raw as well as processed and around 3.5 lakh tons is exported.

During processing, modifications in *guar* gum are intended to impart desired chemical properties in the galactomannan like increased solubility in water, clarity of solution, increased shelf life, ionic character according to the needs of the particular final application. By these modifications lot of opportunities are opened, where chemically modified *guar* derivatives can be used (Table 37).

Table 37. Various varieties of processed products of *guar* gum for industrial applications

Varieties	Applications	Varieties	Applications
Hydroxy alkylated *guar* gum	Oil well drilling	Sulphated *guar* gum	Mining
Carboxy methylated guar gum	Textile printing, Tobacco industry, water based paints	*Guar* gum formate	Food-Human and animal, Miscellaneous
Oxidised *guar* gum	Paper industry Food, textile printing applications	*Guar* gum acryl amide	Pharmaceutical industry
Acetates of *guar* gum	Food-Human and animal	Borate cross linked *guar* gum	Photography, Oil well drilling, carpet printing
Cationic derivatives of *guar* gum	cosmetic and paper industries	Reticulated *guar* gum	Stick explosives, blasting slurries

Movement in price of *guar* gum

The seasonal demand for *guar* gum is at its peak during the months of Nov-March around the world.

As the reason being quite simple, the majority of the drilling activities of crude oils take place during these months. Going forward we expect *guar* seed and *guar* gum prices to stable further due to normal carry forward stocks, good export demand and seasonal demand for *guar* gum. *Guar* seed prices in near future in domestic market may remain stable as the normal production during 2014-15. The international price scenario of different grades of *guar* gum during 2005-06 to 2014-15 is shown in Figure 33.

International trade of *guar* gum

India's top agricultural export commodities in terms of quantity and value for three years are given in the Table 38. Agricultural exports decreased from ₹1349.4 billions in 2013-14 to ₹1304.6 billions in 2014-15. Decrease in value of agricultural exports during 2012-13 was primarily on

account of lower exports of *guar* gum, basmati rice, wheat and other cereals. *Guar* gum has been the topmost export commodity in agri-export during previous years like in 2012-13, but in 2013-14 it ranked on 4th position after *basmati* & non-*basmati* rice, and buffalo meat. Subsequently, in 2014-15, it ranked on 4th position after buffalo meat, *basmati* and non-*basmati* rice.

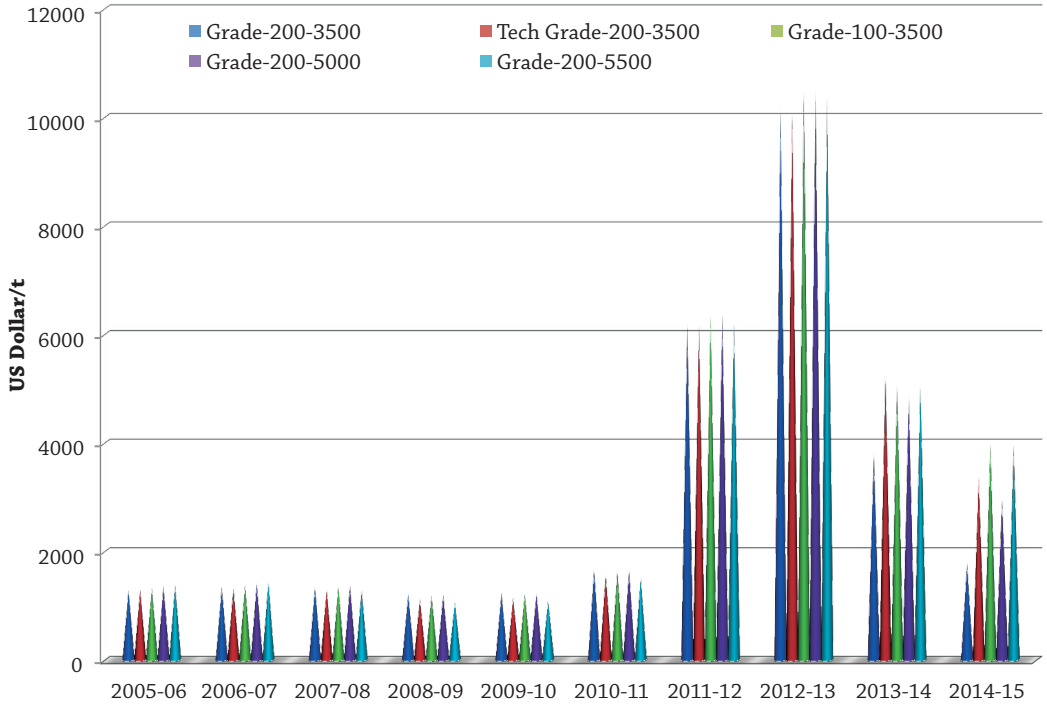

Figure 33. International price level of different grades of guar gum

Table 38. Top agri-export commodities during previous three years

Particulars	Export Value (₹ in billions)			% share in total agri- export		
	2012-13	2013-14	2014-15	2012-13	2013-14	2014-15
Guar gum	196.2	117.3	94.80	18.2	8.7	7.3
Basmati rice	168.6	293	275.99	15.7	21.7	21.2
Buffalo meat	156.6	272.5	292.83	14.6	20.2	22.4
Non-basmati rice	130.9	174.9	203.36	12.2	13	15.6
Other cereals	-	71.3	52.58	-	5.3	4.0
Wheat	91.9	92.6	49.75	8.5	6.9	3.8
Total (S.No.1-6)	744.3	1021.6	969.30	69.2	75.7	74.3
Total agri-export (All items)	1076.4	1349.4	1304.6	100.0	100.0	100.0

Source: DGCIS & APEDA Annual Report.

Export of *guar* gum during X and XI plan period, export and production capacity during 2007-08 to 2014-15 is given in Table 39 and Figure 34. India is the major exporter of *guar* gum to the world. It exports various forms of *guar* products to a large number of countries. The country has exported 6, 65,097.71 MT of *guar* gum to the world for the worth of ₹ 947.82 crores during the year 2014-15. India is also the leading net exporter of *guar* seeds. The country exports over 6.65 lakh tons of *guar* and its derivatives, which is comprised by 84,744 tons of refined split *guar* gum (12.7 %), 4.36 lakh tons of treated and pulverized *guar* gum(65.7 %), 1.44 lakh tons of *guar* meal (21.6 %) and traces of *guar* seed. Composition of *guar* gum export from India is given in Figure 35. Destination wise overseas demand from and source wise supply in India of *guar* meal, *guar* gum refined split (GGRS) and *guar* gum treated and pulverized (GGTP) are illustrated through pie charts in Figure 36, Figure 37, Figure 38 and Figure 39 respectively,

Table 39. Export of *guar* gum during XI and XII plan period

Year	Quantity (in tons)	Quantity (in '000 tons)	Value (in ₹ lakh)	Value (in US million dollar)
2007-08	123675.30	123.68	61,126.35	151.75*
2008-09	257810.30	257.81	133406.57	286.52*
2009-10	217938.29	217.94	113013.56	236.92*
2010-11	440659.60	440.66	293198.85	638.88*
2011-12	707326.44	707.33	1652386.68	3,446.36
2012-13	406149.90	406.15	2128130.52	3,919.18
2013-14	601945.42	601.95	1173452.50	1,979.56
2014-15	665097.71	665.10	94782.61	1551.87

*Source: Directorate of Economics and Statistics, MoA, GoI; *Yearly average exchange rates (ask) for corresponding time horizon has been used for calculation.*

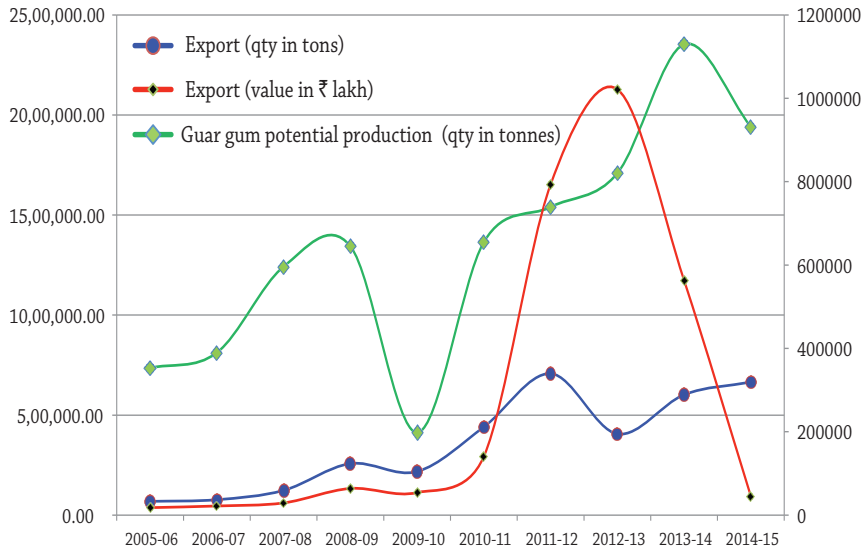

Figure 34. Trends in production potential and export of guar gum from India

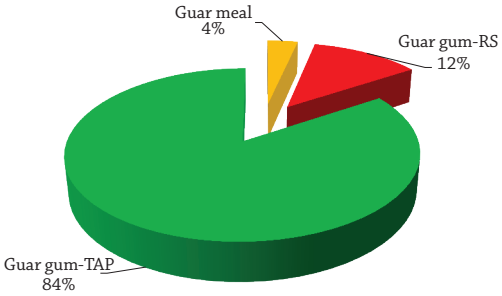

Figure 35. Composition of guar gum export from India

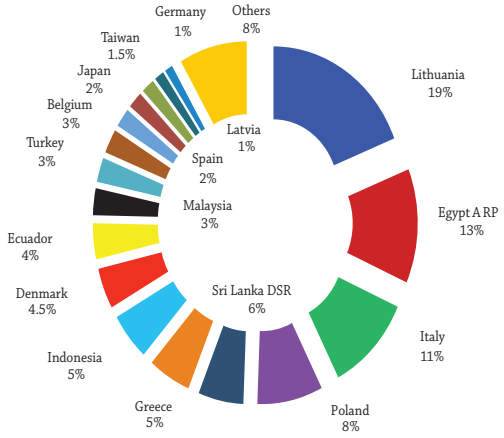

Figure 36. Destination wise scenario of guar meal during 2014-15

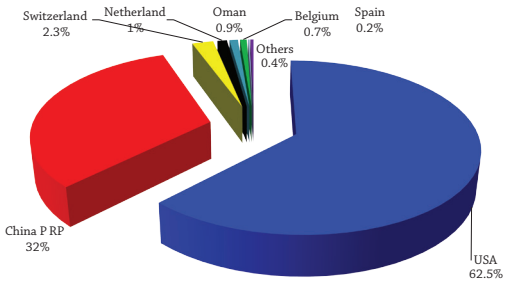

Figure 37. Destination wise scenario of guar gum refined split during 2014-15

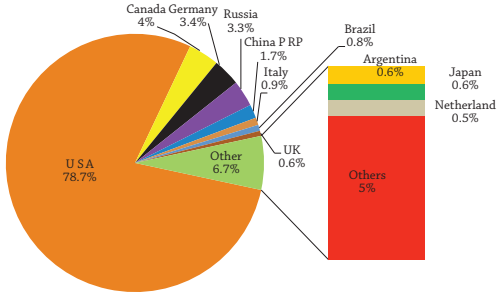

Figure 38. Destination wise scenario of guar gum treated and pulverized during 2014-15

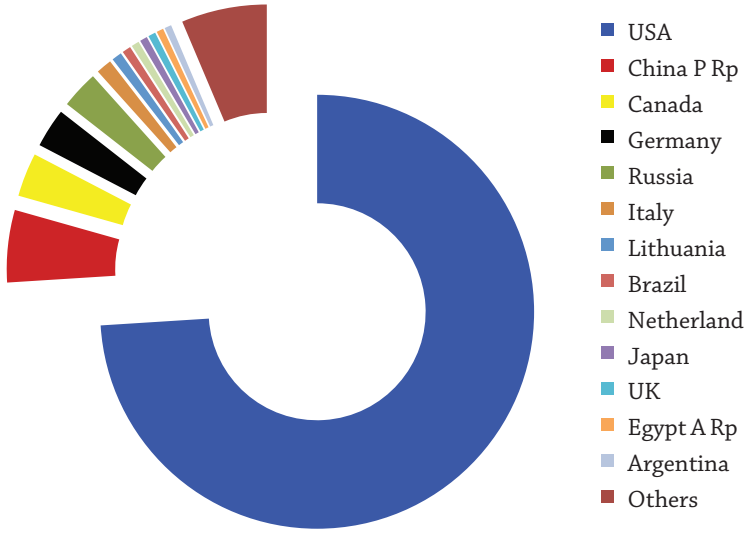

Figure 39. Destination-wise quantitative share of the guar gum exported from India (Overall)

United States, China, Canada, Germany, Russia, Italy, Lithuania, Brazil, Netherland, Japan and UK remained as major export destinations in 2014-15. Canada, Lithuania, Egypt and Argentina were the new entrants in top export destinations during 2014-15. During 2014-15, *guar* gum was exported across the globe to 103 countries. About 94 % was exported to top 13 countries and rest 6 % was exported to 90 countries around the world. Other countries are Poland, Korea, Netherland, Lithuania, U.K., Brazil, Philippines, Japan, Thailand, Argentina, U.A.E., Belgium, Australia, Switzerland, South Africa, Bulgaria, Mexico, Denmark, Ecuador, Iran, France, Cyprus, Chile, Bangladesh, Spain, Singapore, Vietnam, Saudi Arabia, Colombia, Nigeria, Pakistan, *etc*. Destination wise export share is depicted in Figure 20.

C) Natural gum resins

Under this category, *asafoetida*, *salai* gum and *myrrh* are the major gum resins. About 11000 tons of the gum resins exported from the country and ₹630 million earned as a foreign exchange.

Salai gum

Salai gum (*Boswellia serrata*) *Frankincense*, also known as *Olibanum*, is an aromatic oleogum resin obtained as pale yellow to red tears from the bark of trees belonging to the genera *Boswellia* of the *Burseraceae* family thriving in arid regions in the horn of Africa and southern Arabia. There are 43 different reported species in India, Arabian Peninsula and North Africa. Olibanum is produced in a restricted geographical area from uncultivated trees, and usually collected by small nomadic groups; the name is derived from the Arab word "al Luban", which means milk and is references to the milky sap that, exudes from the tree upon incision. Appreciated by ancient civilizations, *Boswellia* resins ranked along with gold and ivory, spices and textiles as valuables for trading and barter. It is generally composed of 5–9% essential oil, 65–85% alcohol-soluble resin and the remaining water-soluble gums. The essential oil of frankincense is produced by steam distillation of the tree resin.

Extracts from *B. serrata* resin are currently used in India for the treatment of rheumatic diseases and ulcerative colitis. Furthermore, the extracts and essential oils of frankincense have been used as antiseptic agents in mouthwash, in the treatment of cough and asthma and as a fixative in perfumes, soaps, creams, lotions and detergents. Today frankincense is widely employed in aromatherapy, Catholic Christian ceremonies as well as other religious and secular traditions (Camarda at al 2016). Recently, increasing interest in natural dietary and therapeutic preparations used as dietary supplements has been observed. One of them is frankincense. This traditional medicine of the East is believed to have anti-inflammatory, expectorant, antiseptic, and even anxiolytic and anti-neurotic effects. The main component of frankincense is oil (60%). It contains mono- (13%) and diterpenes (40%) as well as ethyl acetate (21.4%), octyl acetate (13.4%) and methylanisole (7.6%).

Production

Boswellia serrata (Family: Burseraceae) is a deciduous middle sized tree, which is mostly concentrated in tropical; parts of Asia and Africa. In India it occurs in dry hilly forests of Rajasthan, Madhya Pradesh, Gujarat, Bihar, Assam, Orrisa as well as central penisular regions of Andhra

Pradesh, Assam, *etc.* The gum is tapped from the incision made on the trunk of the tree which is then stored in specially made bamboo basket and converted into different grades of material according to flavor, color, shape and size. The fresh gum obtained from the tree is hot dry with a pleasant flavor and slightly bitter in taste. Harvesting Frankincense is a time consuming process that begins in December, reaching a peak from March to May (Marshall 2003). The trees start producing resin when they are about 8 to 10 years old (Michie et al, 1991). In India, *Shorea robusta*, *Anogeissus latifolia*, *Terminalia tomentosa*, *Boswellia serrata, Buchanania lanzan, Acacia catechu*, *etc.* are reported as the important tree species by Champion and Seth (1968) and these species exhibit local dominance. According Sagar *et al* (2003) half of these species changed dispersion behaviour as a result of disturbance. Species changing from clumped distribution to uniform distribution included *B. serrata, H. antidysenterica and L. coromandelica.*

International trade of olibanum

In India, olibanum is supplied from Yemen Republic (85.77%) and Ethiopia (13.07%). Trinidad (26.88%) Mexico (19.31%) and Malaysia (10.53%) are the major export destination (Table 40).

Table 40. Export and import of olibanum during 2014-15

Country	Quantity (tons)	Value (₹ lakh)	Value (000' US dollars)	% share
Export				
Trinidad	34.20	29.08	47.36	26.88
Mexico	26.00	20.62	34.03	19.31
Malaysia	3.38	11.64	18.56	10.53
U S A	5.00	9.40	15.43	8.76
Mauritius	5.89	7.01	11.52	6.54
France	2.00	5.05	8.19	4.65
U Arab Emts	1.20	4.24	6.95	3.95
Russia	1.50	4.17	6.92	3.92
Oman	0.85	3.60	5.99	3.40
Sri Lanka DSR	2.00	2.70	4.45	2.52
Jamaica	1.00	2.26	3.82	2.17
Australia	0.11	2.24	3.61	2.05
Others	3.87	5.80	9.40	5.33
Total	87.00	107.82	176.20	100.00
Import				
Yemen Republic	22.13	98.35	159.82	85.77
Ethiopia	32.00	14.73	24.36	13.07
Thailand	0.60	1.04	1.65	0.89
Germany	0.05	0.31	0.50	0.27
Total	54.78	114.43	186.33	100.00

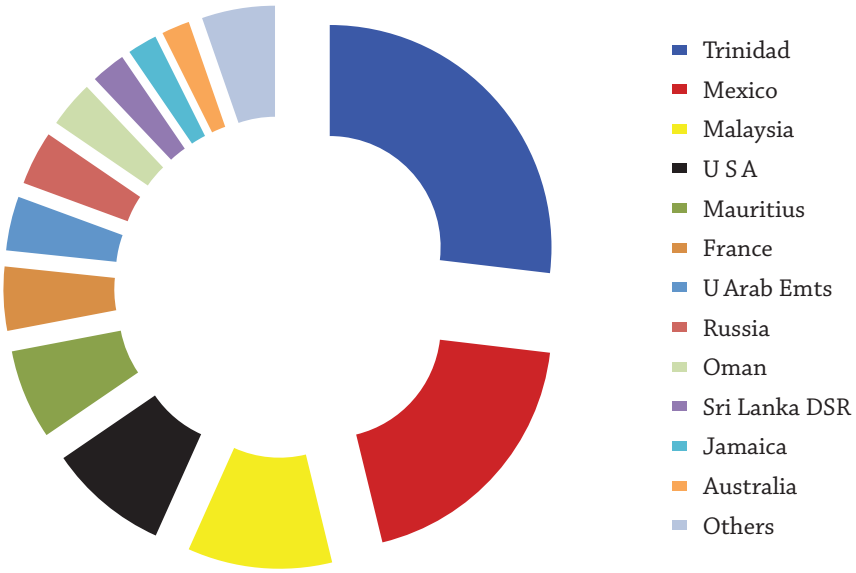

Figure 40. Destination-wise quantitative share of the olibanum exported from India

Myrrh

Myrrh comes from a small, thorny tree. Commiphora myrrha is the most species-rich genus of flowering plants in the frankincense and myrrh family, Burseraceae, which was cultivated in ancient times in the Arabian Peninsula. The grower made a small cut in the bark, where the resin would leak out. It was then collected and stored for about three months until it hardened into fragrant globules. Myrrh was used raw or crushed and mixed with oil to make perfume. Myrrh oil, which is steam distilled directly from the myrrh resin, has an aroma that is woody, earthy and a bit balsamic. Also, myrrh is occasionally used as a flavoring agent. Somalia and Ethiopia are major producers of the substance.

International trade of myrrh

In India, myrrh is supplied from Yemen Republic (94.07%) and Kenya (4.16%). Korea RP (81.74%), UK (4.85%) and Lebanon (4.36%) are the major export destination of myrrh (Table 41).

Asafoetida (*Hing*)

Asafoetida or asafetida (*Ferula anthrax* and *F. foetida*) also know as "Food of the Gods", "Stinking Gum", "Devil's Dung" is the dried latex prepared from the rhizome of several *Ferula* species occurring in Asia and North Africa. It is popular spice used in daily food by Indians. It was found to contain mainly ferulic acid, umbellic acid and ketonic substance known as umbelliferone. Powder of Asafoetida is used as carminative, it is also used in fainting, flatulent colic and chronic bronchitis as well as it is used to treat asthma in adults (Kokate *et al* 2002). The drug is used as herbal remedy or spice especially in oriental countries since ancient times. In Germany the drug is known in mediaeval times. The spectrum of ingredients is characterized by a complex mixture

of sesquiterpene coumarins, diterpenes, esters of ferulic acid and sulphur-containing organic compounds. The drug is traditionally used for the treatment of diseases of the digestive and respiratory tract. New pharmacological investigations indicate possible anti-inflammatory, anti-diabetic and anti-bacterial effects (Kandziora *et al* 2015).

Table 41. Export and import of myrrh during 2014-15

Country	Quantity (tons)	Value (₹ lakh)	Value (000' US dollars)	% share
Export				
Korea RP	12.00	1.68	27.23	81.74
U K	0.13	0.10	1.62	4.85
Lebanon	0.10	0.09	1.45	4.36
Austria	0.05	0.06	1.01	3.02
U S A	0.03	0.04	0.62	1.86
New Caledonia	0.02	0.04	0.59	1.77
Maldives	0.03	0.03	0.50	1.50
Canada	0.03	0.01	0.20	0.61
Hungary	0.00	0.01	0.10	0.29
Total	12.39	2.05	33.31	100.00
Import				
Yemen Republic	41.93	23.63	386.87	94.07
Kenya	10.95	1.05	17.11	4.16
Somalia	3.00	0.23	3.78	0.92
Italy	0.10	0.16	2.66	0.65
Morocco	1.05	0.05	0.85	0.21
Total	57.03	25.12	411.27	100.00

International trade of Asafoetida

In India, Asafoetida is supplied from Afghanistan (89.50%) and UAE (7.92%). On other hand, UAE (28.11%), USA (19.80%) and Singapore (7.48%) are the major export destination of Asafoetida (Table 42).

Dikamali (Gardenia gummiferra)

Gardenia gummiferra (*Dikamali*) family Rubiaceae is the gum resin obtained from the leaf buds of a shrubby plant by making a cut on the stem or branches. It is geographically distributed in all districts of south India, Burma, Bangladesh, Konkan region, North Kanara, and Malabar Coast. Other names are Dikamali, *Gandharaj, Hingunadika, Nadihingu, pindava, etc*. A number of flavonoids such as gardenin A, B, C, D, and E were isolated from Dikamali in the past. It contains 89.9% resin and 0.1% oil and gardenin, a coloring agent and annual production is 10-15 tons.

Table 42. Export and import of asafoetida during 2014-15

Country	Quantity (tons)	Value (₹ lakh)	Value (000' US dollars)	% share
Export				
U A E	229.64	115.53	1888.62	28.11
U S A	183.54	81.16	1329.98	19.80
Singapore	57.48	30.74	502.70	7.48
U K	52.89	24.10	395.27	5.88
Saudi Arab	36.69	14.88	243.31	3.62
Malaysia	10031.33	14.58	238.43	3.55
Kuwait	22.39	14.50	236.37	3.52
Thailand	30.20	13.35	218.92	3.26
Myanmar	39.00	12.93	211.33	3.15
Oman	27.22	12.50	204.57	3.04
Canada	19.15	10.68	175.34	2.61
Australia	18.72	9.51	156.08	2.32
Baharain IS	13.62	6.48	106.02	1.58
Qatar	10.71	5.80	94.94	1.41
South Africa	13.17	5.18	84.63	1.26
Others	97.31	38.58	631.92	9.41
Total	10883.07	410.49	6718.42	100.00
Import				
Afghanistan	733.918	3568.035	58246.45	89.50
U A E	1.56	0.660114	5152.65	7.92
Uzbekistan	140.511	317.2055	1672.99	2.57
Iran	153.282	103.2811	10.84	0.02
Total	1029.271	3989.182	65082.94	100.00

In color and odor it resembles asafoetida. It possesses certain alkaloids and minerals. *Dikamali* is well-known antiseptic and carminative. It also used as an antithelmintic, antispasmodic, carminative, diaphoretic, expectorant, potentiation of pentobarbitone induced sleep, antiepileptic, peripheral and central analgesic, cardiotonic, antioxidant and antihyperlipidemic. It is also claimed

to be useful in dyspepsia, flatulence for cleaning foul ulcers and wounds, and to keep off flies from wounds in veterinary practice. The gum powder mixed with honey is used to massage the gums in teething troubles. It is also an effective painkiller, antiseptic as well as a wound healer, used in the dental aches and infections. The paste of gum has salutary effect on swellings, allocated with pain. Producers' price in the market is ₹100-120 and retail price of processed product is about ₹1200-1400.

D) Natural Resins and Gums (NRGs)

NRG production level during 2013-14 was estimated to be comparatively higher (~1160314.1 tons) than previous year (Table 43). Other resins and gum production have declined during the current year. Production and trade of NRGs including *guar* gum, lac, pine resin, gum *karaya*, *dhawda* gum and other natural resins and total production figure of all the NRGs is tabulated as under.

Table 43. Total NRG production (quantity in tons)

Crops	2010-11	2011-12	2012-13	2013-14	2014-15	Average	%
Guar gum*	655449.10	744295.20	818975.10	1129134.40	1094546.50	888480.06	97.09
Lac	9035.00	17900.00	19577.00	21008.00	16978.00	16899.60	1.85
Pine resin	8764.10	8514.20	8361.30	6875.30	6699.30	7842.84	0.86
Karaya gum	163.61	284.90	211.90	128.76	83.23	174.48	0.02
Dhawda gum	2.70	147.24	379.89	448.41	295.09	254.67	0.03
Other gums	856.91	716.45	552.16	567.26	332.62	605.08	0.07
Others	430.30	691.10	1082.50	975.10	1189.76	873.75	0.10
Grand total	674701.72	772549.09	849139.85	1159137.23	1120124.50	915130.48	100.00

**Estimation of guar gum is based on the conversion of total guar seed production with a coefficient of conversion*

Export and import of Natural Resins and Gums during 2014-15

Data on export and import of natural resins, gums and gum-resins were collected from Directorate General of Commercial Intelligence and Statistics, Kolkata. The total export of natural resins, gums and gum-resins during the year 2014-15 was 543620.51 tons valued ₹9237.70 crores and total import was 32474.02 tons valued ₹147.50 crores. A comparative decrease in the volume of total NRG export was observed during 2014-15 and due to deceleration in price, particularly for *guar* gum, the total value of NRG export was less than previous year 2013-14. Details of export and import of natural resins, gums and gum-resins is presented in the Table 44.

NRGs are important natural products in the export basket for foreign exchange reserve in India. The average annual export quantity of NRGs was 218971.29 tons valued ₹ 357155.57 lakh during the period 1998-99 to 2012-13. However, during last 15 years exported quantity has registered increasing trend with an annual compound growth rates of 10.69 %. Consequently, export value of NRGs has also shown increasing trend with an annual compound growth rates of 22.04 %. Similarly, the average annual import quantity of rosin was 50523.48 tons valued ₹ 29896.12 lakh during the period 1998-99 to 2012-13. Its import had a very high stability with growth rates in

import quantity (13.64 %) as well as value (24.95 %). Trend in export of natural resins and gums from India and import in India during last five years is presented in Figure 41 and Figure 42, respectively.

Table-44: Export and import of natural resins, gums and gum-resins during 2014-15

Sl. No.	Name of product	Export		Import	
		Quantity (tons)	Value (₹ Lakh)	Quantity (tons)	Value (₹ Lakh)
A. Natural resins					
1.	Copal	0.58	0.99	2073.05	943.65
2.	Dammar batu	8.96	15.84	13663.31	4482.79
3.	Gum rosin	374.89	520.87	36117.76	45038.61
4.	Lac	6569.17	32249.58	NA	NA
5.	Mastic gum	0.50	2.22	2.16	10.29
6.	Other resins	235.47	409.55	172.05	772.47
	Total	7189.56	33199.04	52028.33	51247.82
B. Gums					
7.	African gum	0.50	0.81	315.00	92.90
8.	Asian gum	405.60	1775.30	46.97	31.52
9.	Gum arabic	398.65	1099.32	31007.75	12872.35
10.	*Guar* gum refined split	84744.27	116171.44	65.15	296.49
11.	*Guar* gum treated and pulverized	436431.64	799103.48	60.41	255.03
12.	*Karaya* gum (Indian tragacanth)	198.02	770.63	586.28	394.67
13.	Tragacanth (Adracanth)	0.12	0.24	2.35	3.10
14.	Xanthum gum	1.00	7.72	80.48	165.24
15.	Other natural gums	3062.81	4841.57	309.64	639.35
	Total	525242.60	923770.50	32474.02	14750.65
C. Gum resins					
16.	Asafoetida	10883.07	4104.90	1029.27	39891.82
17.	Myrrh	12.39	20.50	57.03	251.22
18.	Olibanum or frankincence	87.00	107.82	54.78	114.43
19.	Other gum resins	205.89	2068.19	546.39	1157.24
	Total	11188.35	6301.40	1687.47	41414.71
	Grand total	543620.51	963270.94	86189.81	107413.18

Source: DGCIS, SHEFEXIL & APEDA Annual Reports.

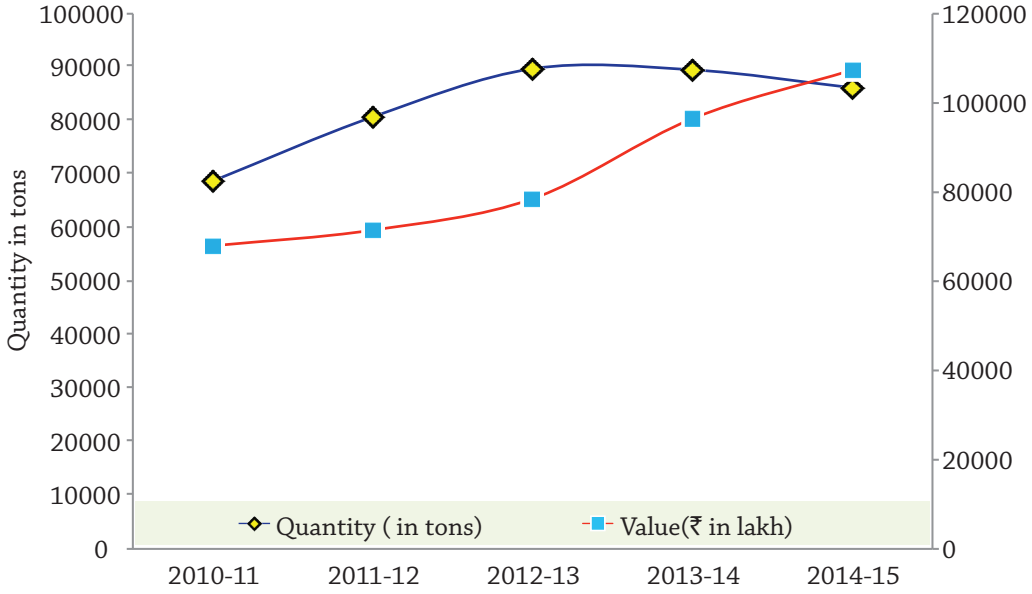

Figure 41. Trend in export of natural resins and gums from India during last five years

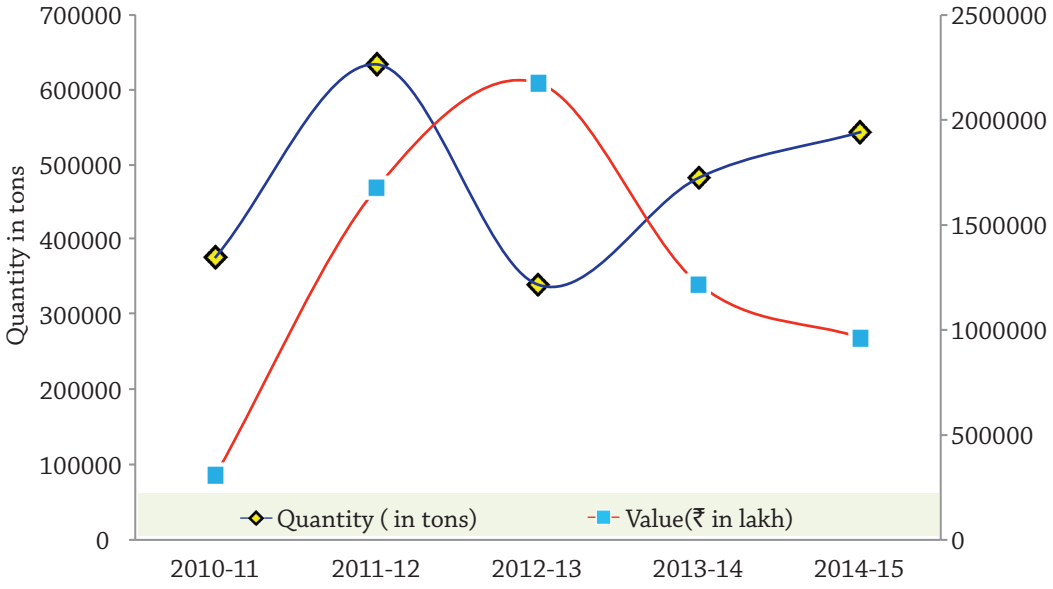

Figure 42. Trend in import of natural resins and gums in India during last five years

POLICY INTERVENTIONS

The present practices adopted by different States for fixation of price for different MFPs were on the basis of market prices by reducing all the overheads and the second methodology for arriving at procurement price is to follow cost plus method in which cost of collection can be calculated for MFPs in different States. Therefore, government has taken the initiatives under the scheme for MFPs.

Mechanism for marketing of Minor Forest Produce through Minimum Support Price and development of Value Chain for MFP

A Pricing Cell was constituted pursuant to the Ministry of Tribal Affairs, Government of India and notified vide TRIFED's to recommend Minimum Support Price for Minor Forest Produce under the scheme "Mechanism for marketing of Minor Forest Produce through Minimum Support Price and development of Value Chain for MFP" To determination fair and remunerative MSP for lac and gum *karaya* the deliberations of the Pricing Cell with State Procurement Agencies (SPAs) and federations were conducted. Computation of cost of production of gum *karaya* and lac for MSP was furnished by ICAR-Indian Institute of Natural Resins & Gums (ICAR-IINRG). The Pricing Cell analysed the above information furnished by the SPAs and observed the wide variation in the data on the related parameters from State to State. Following decisions were made in the context of price stabilizing policy for MFPs.

A. Recommendations of Minimum Support Price of gum *karaya* for the 2014 crop

It was noted that major quantity of gum *karaya* is procured in Andhra Pradesh, Madhya Pradesh, Jharkhand, Chhattisgarh and Maharashtra. Gum *karaya* is procured from gum pickers in three grades and procurement prices are also announced grade wise. However, Gum *karaya* of grade III accounts for approximately 70 % of the total quantity purchased by GCC in Andhra Pradesh. Similar status was confirmed by other states regarding grade wise procurement. It was also noted that gum *karaya* is a nationalized item or is under monopoly system of procurement in most of the states except Gujarat, Jharkhand & Maharashtra. Despite announcement of procurement price in Gujarat hardly any quantity of gum *karaya* was procured. Similarly in Jharkhand and Maharashtra also, the quantity procured was very low. The Pricing Cell also considered the computation of the cost of production of gum *karaya* as calculated and furnished by ICAR-IINRG, Ranchi. Representative explained the details of the cost worked out by for gum *karaya*, which is calculated on the basis of collection of gum *karya* in a scientific manner. The method used by them is to calculate the direct cost associated in collecting gum *karaya* independent of the minimum wage method. At the same time, members observed that IINRG, an institution engaged in research and training for NRGs, has calculated the cost that appears to be more reliable as they have arrived at this cost after studying various aspects of collection over a period. Finally, the Pricing Cell felt it appropriate to determine MSP on the basis of the cost of production as calculated by ICAR-IINRG plus 10 % increase thereon. Accordingly, the Pricing Cell recommended MSP of ₹ 108/- per kg. for gum *karaya* Grade-III for the current procurement season. However, the Pricing Cell underlined the need of initiating a study to collect relevant data to calculate cost of collection so that the MSP

is fixed in pursuance of the spirit of the scheme. It requires field visits, primary data collection and hands-on work to study various factors affecting cost of collection for MFPs. However, this may take a long time as the survey can be conducted only during the harvesting season. The Pricing Cell recommended that a study be immediately initiated so that relevant data to calculate cost of collection for 12 MFPs in 8 States can be collected.

B. Recommendations of Minimum Support Price of lac for the 2014 crop

The two varieties of lac *rangeeni* variety (harvesting season is May-June & October-November) and *kusumi* variety (harvesting season is January-February & July-Aug) cultivated mainly by tribals. Its production is mainly dependent upon inoculation of broodlac by tribals on the lac host trees in time. Major quantity of lac is available in the State of Jharkhand followed by Chhattisgarh, M.P. & Odisha. Accordingly, based on the inputs provided by IINRG, Pricing Cell had recommended a Minimum Support Price (MSP) of ₹210 and ₹290/ kg for *rangeeni* and *kusumi* lac, respectively for 2014 crop (applicable up to November 2014 as the cost of the production may vary depending upon the cost of broodlac during the next season).

C. Recommendations of Minimum Support Price of lac for the 2015 crop

Normally the lac price is dominated by processors but farmers / primary collectors should get the price based on the cost of the production which may vary depending upon the cost of broodlac for the season. During the current year, the Lac Cultivators have used brood Lac of July 2014 crop in their cultivation when the prices were ranging between ₹300-350/kg, hence cost of production of lac will be higher during harvesting season in December and January. IINRG submitted a detailed cost sheet for determining the cost of production for each variety of lac. The Pricing Cell recommended enhancing the current MSP by 10 %. Pricing Cell had recommended a Minimum Support Price (MSP) of ₹230 and ₹320/kg for *rangeeni* and *kusumi* lac, respectively for 2015 crop.

CONCLUSIONS

Value addition in lac based products has an encouraging market scenario as the export of Aleuritic acid is increasing since last two years. New and young entrepreneurs have entered in lac sector with big investments for production of high value products like Aleuritic acid and isoambrettolide. To meet the domestic demand Pine resin processing infrastructure is needed to be revamped. Both the units are functional at under capacity level. Production and procurement of some gums is declining during last two years. MSPs for NWFP may be key intervention for procurement, marketing and value chain establishment. It will be helpful to stabilize the price fluctuation particularly in case of lac. Copal, damar batu, mastic gum, gum rosin, lac and others are natural resins exported and imported in India. Gum arabic, asian gum, african gum, *karaya* gum, tragacanth, *guar* gum (refined split and treated pulverized), xanthun gum and others are natural gums exported and imported in India. Asafoetida, myrrh, oilbanum and others are gum-resins exported and imported in India. The exported quantity of natural resins and gums during 2014-15 was 543620.51 tons valued ₹ 963270.94 lakh while imported quantity was 86189.81tons valued ₹ 107413.18lakh.These figures are on higher side of the normal EXIM scenario of NRGs.

Although resins discussed have proved to be popular alternative or complementary medicine used in the treatment of many diseases, clinical trial evaluation of these claims using currently accepted protocols is needed. The reported resins offer huge potential as a possible pharmacological application but its necessary a further investigation to verify whether purified compounds isolated may have better therapeutic potential as compared to crude extracts. These new chemicals will serve to enhance the continued usefulness of higher plants and their products as renewable resources of chemicals.

This report presents an overview of quantity and values for selected forest products and services from Indian forests. Results highlight a strong concentration of value in guar gum production. The economic value of NWFPs however is only partly reflected on the market and recorded by official statistics. Underestimation by existing statistics might be due to several reasons, including: (i) the public-good nature of many products/services and consequent difficulties in estimating them; (ii) the fact that data recorded for official statistics are not always complete (for example they do not always cover all the region as in the case of NWFPs); and (iii) the fact that a certain proportion of the NRGs is not mirrored by official data because some products are traded through informal channels and markets. Enhancing the offer of Indian market products and increasing their role in the rural economy could help to reduce the costs of forest protection: a well-structured forest economy able to provide stable flows of incomes can provide a fundamental set of public non-market services and social values to both local people and the whole community. Understanding the true value of natural resources, for both land users and policymakers, is an essential step for promoting their protection and sustainable use. Since markets do not reflect all values flowing from NWFPs, further research is needed to better understand the link between ecosystem functioning and the delivery of services, as well as their appropriate economic evaluation. As a final point, we are aware that synergies and trade-offs exist between market products and nonmarket services,

as well as among different ecosystem services. Estimations would significantly contribute to the identification of management conditions and choices, as well as the setting of priorities that allow a social optimum to be achieved.

The constraints related to export of natural resins and gums were small and scattered quantity of produce, fluctuation in domestic production and prices, adulteration in raw material, limited export promotional measures, improper international market information, lack of future trading and prior agreement as expressed by the exporter. India has a great potential in production and export of natural resins and gums because of availability of resins and gums yielding trees, manpower, favorable climate and R&D support. The proper attention and action for intensification of effort for increasing natural resins and gums production will definitely improve the export earning of the country. Major gums and resins of international commerce produced and traded in and from India include Guar gum, lac, gum karaya, gum Arabic from *Acacia* species, and myrrh, asafoetida, Rosin and olibanum from *Commiphora* species. Scientific inoculation and gum tapping methods would produce more NRGs than traditional method because they have been practiced successfully by innovative/progressive farmers during last few years. It would be preferable to consider scientific inoculation and gum tapping methods to get better quality and yield, and to change the economic standards of cultivators of India.

Annexure I. Sticklac lac production scenario in India during 2014-15 (in tons)

Name of states / districts	Baisakhi	Jethwi	Katki	Aghani	Total
Andhra Pradesh & Telengana	55	5	105	5	170
Assam	45	0	240	0	285
Chhattisgarh					
Bastar	5	10	10	120	145
Bilaspur	30	10	25	80	145
Dhamtari	10	10	10	35	65
Durg	5	0	2	0	7
Janjgir-Champa	40	10	10	45	105
Kanker	30	155	15	310	510
Korba	165	125	165	295	750
Mahasamund	20	1	25	10	56
Raipur	10	25	1	90	126
Rajnandgaon	35	5	30	50	120
Surguja	45	0	35	0	80
Ambikapur	0	2	10	0	12
Raigarh	25	10	10	25	70
Others	25	10	30	80	145
Total	445	373	378	1140	2336
Gujarat	15	20	2	8	45
Jharkhand					
Garhwa	10	0	15	0	25
Gumla	15	460	45	810	1330
Latehar	5	5	10	10	30
Palamau	40	0	125	20	185
Ranchi	100	1470	140	820	2530
Khunti	100	800	120	360	1380
Simdega	15	750	55	1090	1910
West Singhbhum	50	310	15	485	860
Others	50	100	100	130	380
Total	385	3895	625	3725	8630
Madhya Pradesh					
Annuppur & Shahdol	10	5	0	5	20
Balaghat	720	10	150	2	882
Chhindwada	20	8	10	5	43
Dindori	80	5	10	2	97
Hosangabad	45	5	15	2	67
Mandla	60	5	45	5	115

Name of states / districts	*Baisakhi*	*Jethwi*	*Katki*	*Aghani*	Total
Narshinghpur	10	0	5	2	17
Seoni	950	15	195	5	1165
Others	95	5	65	15	180
Total	1990	58	495	43	2586
Maharashtra					
Bhandara	50	0	40	0	90
Chandrapur	60	0	40	0	100
Garhchiroli	135	0	100	0	235
Gondia	520	0	580	0	1100
Total	765	0	760	0	1525
Meghalaya (Garo hills)	150	0	10	0	160
Odisha					
Balasore	5	0	15	20	40
Koraput	5	5	10	25	45
Mayurbhanj	5	5	15	165	190
Nabarangpur	5	15	30	105	155
Sundergarh	5	50	0	125	180
Keonjhar	0	10	0	10	20
Others	15	10	35	25	85
Total	40	95	105	475	715
Uttar Pradesh	20	0	55	0	75
West Bengal					
Bankura	20	6	25	5	56
Midnapur	40	5	135	5	185
Purulia	20	14	45	55	134
Others	11	5	35	25	76
Total	91	30	240	90	451
Grand total	4001	4476	3015	5486	16978

Annexure II. Lac producing areas in the country

Sl. No.	State/ district	Major lac producing areas
I.	***Andhra Pradesh & Telengana***	
1.	Adilabad	Utnoor
2.	Vishakhapatnam	Paderu
II.	***Assam***	
3.	Kamrup	Boko
4.	Karbi-Anglong	Amtreng, Baithalangsu
5.	Marigaon	Nellei
6.	Nagaon	Amsoi, Hojai

Sl. No.	State/ district	Major lac producing areas
III.	***Bihar***	
7.	Gaya	Raniganj
8.	Jehanabad	Malichak
IV.	***Chhattisgarh***	
9.	Balrampur	Chando, Dharmi, Wandrafnagar
10.	Bastar	Keshkal
11.	Bilaspur	Gaurella, Kota, Lorami, Pendra
12.	Dhamtari	Gatta Silli, Nagri, Sihawa
13.	Durg	Balod, Daudi, Dondi-Lohara, Kusumkasa
14.	Gariyaband	Amlipadar, Chhaila, Chhura Gariyaband, Indagaon, Mainpur, Udanti
15.	Janjgir-Champa	Sakti, Saragaon
16.	Kanker	Antagarh, Bhanupratapur, Biragaon, Kondagaon, Korar, Narharpur, Sambalpur
17.	Korba	Bhaisama Bazar, Chaitama, Chhuri, Haldi Bazar, Kartala, Katghora, Korbi, Madanpur, Pali, Pasan, Pasarkhet
18.	Korea	Bhartarpur, Kusmi
19.	Mahasamund	Bagbahara, Basana, Khalari, Mahasamund, Pithora, Tendukona
20.	Narayanpur	Narainpur
21.	Raigarh	Dharmjaigarh, Lailunga, Pathalgaon,Tamnar
22.	Raipur	Abhanpur
23.	Rajnandgaon	Aawadhi, Bharitola, Khardi, Manpur, Mohala-chowki
24.	Sarguja	Chalgi, Mainpat, Pasta, Pratappur, Premnagar, Raghunathnagar, Ramanujganj,
V.	***Gujarat***	
25.	Panchamahal	Dakor, Godhara, Ghoghamba, Nadiad and Santrampur
26.	Vadodara	Chhota Udepur, Devhant, Jambaguda, Jatpurpavi, Jhonjh, Kawant, Keori, Kundal Ghata, Tejgadh and Zoz
VI.	***Jharkhand***	
27.	Chatra	Tandwa
28.	Garhwa	Bargarh, Garhwa, Godarmana, Rakshi, Ramganga, Ramkonda, Ranka
29.	Gumla	Chainpur, Dumari, Kanshir, Palkot, Patratoli, Raidih
30.	Khunti	Murhu, Soeko Torpa, Karra, Rania,Tapkara
31.	Latehar	Balumath, Barwadih Brahmani, Chandwa, Garu Latehar, Manika, Sarju, Satbarwa
32.	Palamu	Matalong, Panki, Raj Chaipur,
33.	Ranchi	Angara, Banta, Birbanki, Bundu, Jonha, Namkum, Ormanjhi, Silli, Maranghada, Sonahatu, Tamar
34.	Simdega	Bano, Hating hode, Jaldega, Kolebira, Lachragarh
35.	West Singhbhum	Anandpur, Bandgaon, Baskata, Chaibasa, Chakradharpur, Goelkera, Lodai, Manoharpur, Sonuwa, Toklo
VII.	***Madhya Pradesh***	
36.	Anuppur	Jaitahari, Keshwahi, Kotma, Venkatnagar
37.	Balaghat	Baihar, Katangi, Lalbarra, Lamta, Langi, Parashwada, Waraseoni
38.	Chhindawada	Damoa
39.	Dindori	Bazak, Bhanupur, Karanjia, Ramnagar, Rampur
40.	Hosangabad	Bankhedi, Babai, Daggrai, Darawpadaw, Hapa, Jonahata, Kekra, Lokamti, Pipariya
41.	Mandla	Bichhia, Chabbi, Ghughari, Kalpi, Mahegaon, Mavai, Nainpur, Narainganj, Navas-Bablia

Sl. No.	State/ district	Major lac producing areas
42.	Narshinghpur	Chichli, Godarwara, Kalakhar, Kalyanpur, Nayakheda, Salechauka
43.	Seoni	Barghat, Ghansore, Kahani, Kanewara, Keolari, Khamaria, Khari
44.	Shahdol	Burhar, Jaitpur, Sohagpur
VIII.	***Maharashtra***	
45.	Bhandara	Gobarwahi, Nakadongri
46.	Chandrapur	Bandh, Navargaon
47.	Garhchiroli	Allapalli, Bamragarh
48.	Gondia	Amgaon, Chopa, Goregaon, Hirapur, Kampta, Kati, Kotjamura, Kurodhi, Salekasa, Tiroda
IX.	***Meghalaya***	
49.	Garo Hills	Damra, Dodno, Nongpoh, Tura
X.	***Odisha***	
50.	Balasore	Haldipada, Jaleshwar, Nilagiri
51.	Keonjhar	Telkoi
52.	Koraput	Ramgiri
53.	Mayurbhanj	Jashipur, Kaptipada, Karanjia, Kusumi, Padampokhari, Sarat, Thakurmunda, Udala,
54.	Nabarangpur	Chandahandi, Raighar
55.	Sundergarh	Gurundia, Khandadhar, Kutra, Rajgangpur
XI.	***Uttar Pradesh***	
56.	Sonbhadra	Doodhi
57.	Allahabad	Koraon, Meja
XII.	***West Bengal***	
58.	Bankura	Idpur, Khatra, Raipur, Ranibandh,
59.	Midnapur	Katai, Kuti, Moyna, Panskurah, Ramnagar, Tamluk
60.	Purulia	Ayodhya Pahar, Bagh Mandi, Balarampur, Jhalda, Kashipur, Kutidih, Raghunathpur, Tulin

Annexure III. Gums producing districts and areas

Sl. No.	Name of State/ District	Major gum producing areas
I.	***Andhra Pradesh & Telengana***	
1.	Adilabad	Jannaram, Kamma Reddy, SK Nagar and Utnoor
2.	Chittur	Chittur, Kaddapa and Nellore
3.	East Godavari	Addategella, Maredumilli, Rajavomma Kangi and Rampachodavaram
4.	Khammam	Bhadrachalam, Chintoor, Dammapeta and Kukunaru
5.	Mahboobnagar	Mannanoele, Nanjaria and Pedadornala
6.	Srikakulam	Pathpattanam and Setampeda
7.	Visakhapatnam	Arku, Chintapalli, GKVidhi, G.Murugala, Kashipatnam, Koyuru, Munchingput, Paderu and Petabayallu
8.	Vizianagram	Gummalaxmipuram, Parvatipuram and Salur
9.	Warangal	Etrunagram, Mulug and Narshimhpeda
10.	West Godavari	AR Puram
II.	***Chhattisgarh***	
11.	Balrampur	Chando, Dharmi
12.	Bastar	Jagdalpur, Keshkal

Sl. No.	Name of State/ District	Major gum producing areas
13.	Bilaspur	Dindori, Lormi, Mugeli, Ratanpur and Takhtpur
14.	Dhamtari	Gatta Silli, Nagri, Sihawa
15.	Gariyaband	Amlipadar, Chhaila, Chhura Gariyaband, Indagaon, Mainpur, Udanti
16.	Janjgir-Champa	Sakti, Saragaon
17.	Kanker	Antagarh, Bhanupratapur, Biragaon, Kondagaon, Korar, Narharpur, Sambalpur
18.	Korba	Bhaisama Bazar, Chaitama, Chhuri, Haldi Bazar, Kartala, Pali, Pasan, Pasarkhet
19.	Korea	Bhartarpur
20.	Mahasamund	Bagbahara, Basana, Khalari, Pithora
21.	Narayanpur	Narainpur
22.	Raigarh	Khamariya, Dharmjaigarh, Manendragarh Milupara, Pathalgaon
23.	Raipur	Abhanpur
24.	Rajnandgaon	Khardi, Manpur, Mohala-chowki
25.	Sarguja	East Sarguja, South Sarguja
26.	Sukma	Sukma
27.	Bijapur	Bijapur, Bairamgarh, Bhopalpatnam, Usoo
28.	Dantewada	Dantewada,Geedam,Kuwakonda, Katekalyan
III.	***Gujarat***	
29.	Balsar	Dharampur, Malanpada and Pangarbari
30.	Banskantha	Ambaji, Pata and Virampur
31.	Bharuch	Jaghadiya and Jankhawav
32.	Dahod	Baria and Sagtala
33.	Dang	Ahwa and Waghai
34.	Kuchachh	Bhachau, Bhirandiyara, Bhuj, Dwarika, Mandvi, Nakhatrana and Rapar
35.	Narmada	Dediapada, Mandvi and Rajpipla
36.	Navsari	Ankalachh, Bansda and Chikhali
37.	Panchamahal	Dakor, Ghoghamba, Nadiad and Santrampur
38.	Sabarkantha	Bhiloda, Choriwada Modasa and Posina
39.	Vadodara	Chhota Udepur, Devhant, Jambaguda, Jatpurpavi, Kawant, Tejgadh and Zoz
IV.	***Jharkhand***	
40.	Chatra	Lawalang, Pratappur and Kanti
41.	Garhwa	Ramkanda and Bhandaria
42.	Gumla	Dumari, Kanshir, Palkot, Patratoli, Raidih
43.	Khunti	Murhu, Soeko Rania,Tapkara
44.	Latehar	Garu, Mahuadar, Herhanj, Balumath, Barwadih, Lesliganj, Chhipadohar and Richughutu
45.	Palamu	Daltonganj,Panki, Chhatarpur
46.	Ranchi	Angara, Bundu, Jonha, Sonahatu, Tamar
47.	West Singhbhum	Chakradharpur

Sl. No.	Name of State/ District	Major gum producing areas
V.	***Madhya Pradesh***	
48.	Balaghat	Kochewahi, Baihar, Lamta, Langi, Paraswada
49.	Betul	Savani
50.	Chhindawada	Amarwada, Damua, Patalkot
51.	Hosangabad	Pipariya
52.	Mandla	Pindarai, Bamhani, Mohgaon, Lingapondi, Bichhia, Chabbi
53.	Narshinghpur	Chichli, Godarwara, Kalakhar, Kalyanpur, Nayakheda, Salechauka
54.	Seoni	Bhimgarh, Chhopara, Dhuma
VI.	***Maharashtra***	
55.	Bhandara	Gobarwahi, Nakadongri
56.	Chandrapur	Mul
57.	Garhchiroli	Armon, Wadsa, Desai ganj
58.	Gondia	Salekasha, Amgaon, Goregaon, Dhapewada, Tiroda, Navegaon Bandh
59.	Wardha	Dhagabhawan, Navargaon, Hingni, Bordhara , Karanja range
VII.	***Odisha***	
60.	Balasore	Haldipada, Jaleshwar, Nilagiri
61.	Keonjhar	Telkoi
62.	Koraput	Ramgiri
63.	Mayurbhanj	Jashipur, Kaptipada, Karanjia, Kusumi, Padampokhari, Sarat, Thakurmunda, Udala,
64.	Nabarangpur	Chandahandi, Raighar
65.	Sundergarh	Gurundia, Khandadhar, Kutra, Rajgangpur
VIII.	***Rajasthan***	
66.	Ajmer	Beawar, Kekeri, Kisangarh, Nasserabad, Puskar
67.	Alwar	Bansur, Rajgarh, Ramgarh,Thanagazi
68.	Churu	Sardarsahar, Sujangarh,Taranagar
69.	Jaipur	Amer, Bassi, Chomu, Chaksu, Jamwa Ramgarh, Kotputli, Phagi, Phulera
70.	Jhunjhunu	Chirawa, Khetri, Navalgarh
71.	Jodhpur	Bilara, Luni, Phalodi, Shergarh
72.	Nagour	Ladnu, Merta, Parbatsar
73.	Pali	Bali, Sojat, Sumerpur
74.	Sikar	Fatehpur, Neem-ka-Thana, Ringus, Sri Madhopur
75.	Tonk	Niwai, Malpura, Uniara
76.	Udaipur	Gogunda, Kotra

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

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