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A study on properties of geographically (Desha) W.S.R. to *Sterculia urens* Roxb

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Abstract

Sterculia urens Roxb gums are used traditionally in India. It has to have a deep relationship with the health and disease of an individual. At present time, all people showed their interest in the traditional system of medicine. Ayurveda is one of them, attracting the global society towards it. India has a rich repository of medicinal plants. Proper care is needed to conserve, domesticate, and use medicinal plants. Gum is generally used as pharmaceutical innovation and convenience. It offers a unique avenue for drug delivery, allowing medications to be administered. Beyond these, gums play essential roles in industrial settings. Adhesive gums are crucial in manufacturing, acting as binders in paper, textiles, and certain foods. Polyuronides, i.e. alginic acid, pectin), gums and mucilage's are the other pharmaceutically important polysaccharide derivatives. Gums are pathological products of calcium, potassium and magnesium salts of complex substances known as 'polyuronides'. According to Ayurveda, India geographical distributed in three types dry land (Jangala Desha), marshy land (Anupa Desha) and Mishra Desha (Anupa and Jangala Desha).

Keywords: *Sterculia urens*, *Sterculia*, gum, Desha, geographically, traditionally

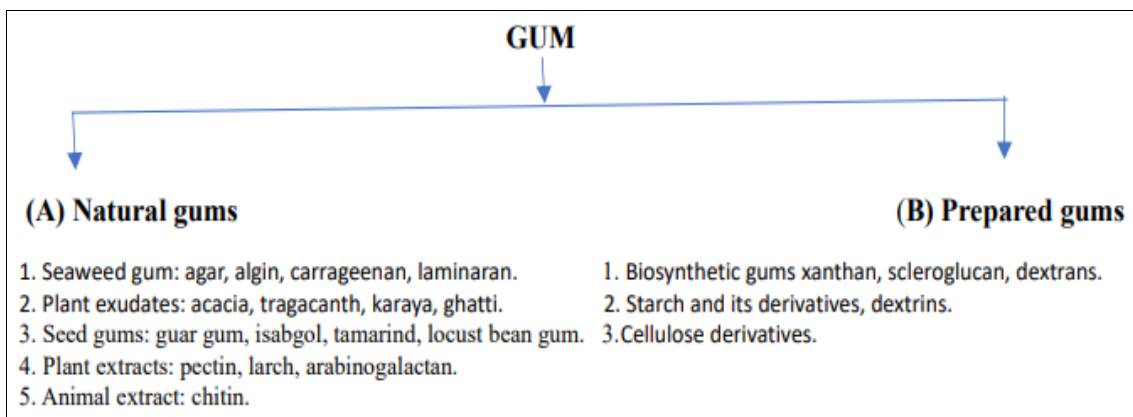
1. Introduction

Desha is one of the importance concepts of *Ayurveda*. It is considered as *Karana Dravya* (causal factors) as well as environmental factors, which are also responsible for the maintenance of health and management of disease because the characters of both patient and *Ausadhi* (drug) are very much affected by their respective *Desha* (place of origin). (Dwivedy *et. al.* 2008) ^[1-2] Indian *Katira* gum is natural gum and plant exudates occurred from north central parts of India. Gums are either hydrophobic or hydrophilic high molecular weight molecules with colloidal properties, usually in an appropriate solvent or swelling agent. They produce gels, highly viscous suspensions or solution. (Kokate *et al.*, 2019) ^[29, 35] Description of *Sterculia urens* roxb occurs in *Bhavprakash Samhita*. *Sterculia urens* rob gum is native to India having a wide distribution. It is in abundance found in the arid deciduous forests in the adjoining areas of Chambal Madhya Pradesh, Chhattisgarh, Andhra Pradesh, which contributed to more than 50% of gum production in India remaining came from other states of India. (Vikaspedia, 2018) ^[28].

2. *Sterculia urens* Roxb

Sterculia urens is a species of plant in the family *Sterculiaceae*. It is native to India and has been introduced into Burma. A small to medium-sized tree with a pale-coloured trunk, it is commonly known as the *bhutya* in Marathi (meaning "ghost tree"), kulu, Indian tragacanth, gum karaya, katira, *sterculia* gum or kateera gum (India Biodiversity Portal 2015). The specific name *urens* refers to the stinging hairs on the flowers (Flowers of India 2015). *Sterculia urens* var. *thorelii* (Pierre) C. Phengklai is an accepted name according to the Catalogue of Life and found in Vietnam, known as *bâythua Thorel*. Synonyms of *S.U. thorelii* are *Sterculia thorelii* (Pierre 1888) and *Clompanusthorellii* (Roskov, 2014) ^[33].

2.1 Classification of Gum- (Kokate *et al.*, 2019) ^[29, 35]



2.1.1 Biological Source: Gum karaya is a dried gummy exudate obtained from the tree *Sterculia urens* (Roxburgh); *Sterculia villosa* (Roxburgh), *Sterculia tragacanth* (Lindley) or other species of *Sterculia* (Sterculiaceae)

2.1.2 Geographical Source: *Sterculia urens* is widespread in

India, especially in north-central parts.

3. Types of Desha

The term "Desha" describes a person as their natural occupant presented in the Fig. 1.

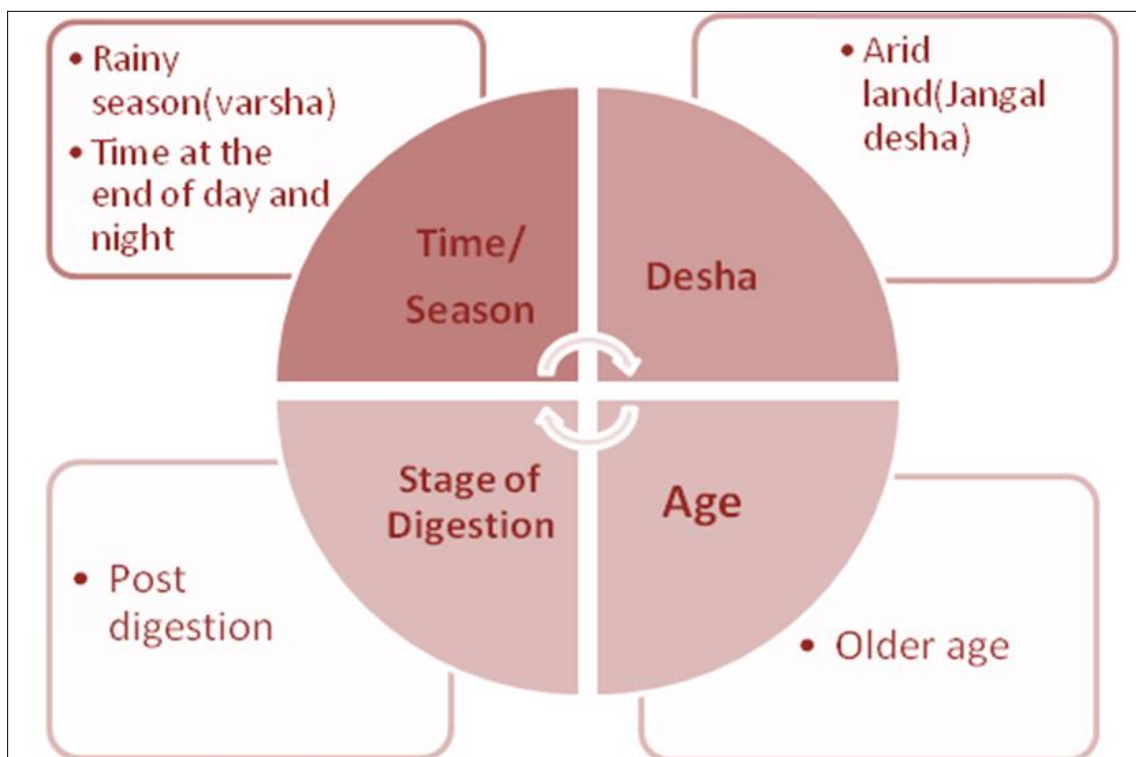


Fig 1: Show describes a person as their natural occupant

3.1 Dry land (Jangala Desha)

Those residing in dry forests are known as *Jangala*. (Sharma *et al.* 2008) [15, 16, 20]. The *Jangala Desha* (desert land) is characterized by *Acharya Charaka* as follows it abounds in the open sky. It has deep forests of trees like Kadar, Khadira (*Acacia catechu*), Asana (*Pterocarpus marsupium*), Asvakarna (*Dipterocarpus turbinatus*), Dhava (*Anogeissus latifolia*), Tinisha (*Ougeiniadal bergioides* Benth), Shallaki (*Boswellia serrate*), Sala (*Shorearo busta*), Soma-valka (*Acasiasuma* Buch.Ham), Badari, Tinduka (*Diospyros peregrine*), Aswatha (*Ficus Religosa*), Vata (*Ficus benghalinses*), and Amalaka (*Emblika officinalis*). It is mostly surrounded by trees of Sami (*Prosopis cineraria*), Kakubha (*Terminalia Arjuna*) and Simsapa (*Delbergia sissoo*) in larger numbers. The tender branches of these trees dance, swaying by continuous dry winds. It abounds in thin, dry, rough sands

and gravels, giving rise to mirages. This area is inhabited by lava (dusky gull), *Sterculia urens* grow in the arid, stony hills and plateaus of central and northern India. *Sterculia urens* gums known as Gum karaya is an acetylated polysaccharide exudate of *Sterculia urens* trees. Gum, collected in April to June and again in September after the monsoons. Trees are tapped by removing bark and later collecting the dried exudates. (James, 2019) [27] Tittiri (Partridge) and Chakora (partridge) and the people habituating this type of land are dominated by Vayu and Pitta; most are sturdy and hardy. (Pandey *et al.* 2008) [11, 13, 14]. The region with little water, a few trees, strong winds, and intense sun is known as *Jangala* (arid). There occurs least number of diseases (Sharma *et al.* 2008) [15, 16, 20]. In the context of *Jangala Desha*, *Acharya Sushruta* has given the same opinion except that the area is even or flat. This area is full of thorn trees; the people are

emaciated, stable, and prone to *Vata*, *Pitta* disease. (Sharma *et al.* 1999) [12, 17, 18]. *Vagbhatta* said that the region of land (country) which has less water (resources), vegetation and mountains is known as *Jangala* (arid); it produces few diseases in man. *Vata dosa* is predominant in *Jangala Desha*.

3.2 Marshy land (*Anupa Desha*)

Those residing in marshy land are *Anupa*. (Sharma *et al.*, 2008) [15, 16, 20]. *Acharya Charaka* described in *kalpasthana* the *Anupa Desha* (*Marshy land*) is characterized as follows; the *Anupa Desha* contains deep forests of trees like *Hintal* (*Phoenix Paludosa* Roxb), *Tamala* (*Nicotiana tabacum* Linn), *Narikel* (*Cocos nucifera*), *kadali* (*Banana tree*) etc. This area is generally located at the banks of rivers and seas, mostly cold *Vayu* blow here; the banks are beautified by plants like *vanjula* (*Salix tetrasperma*) and *vantra*. The area is surrounded by thick forests, beautiful blossoming trees, and mountains covered with creepers. The branches of trees located here echo with the sound produced by birds like *Hamsa* (*Swan*), *Chakravaka* (*Anas casarca*), *Balaka* (sort of cranes), *Nandi-mukha* (*Falahari popcorn*), *Pundarika* (*lotus flower*), *Kadamba* (*Anthocephalus indicus*), *Madgu*, *Bhringraja* (*Ecliptaalba*), *Satapatra* (*Nelumbo nucifera*) and inebriated *kokila*. The people inhabiting this type are of tender body, and generally they are *Dom* (*Cocosnucifera*) cinated by *Vayu* and *Kapha* (Pandey *et al.*, 2008) [11, 13, 14]. *Acharya Charaka* described *Anupa Desha* in *Vimana sthana*, as the

region which has abundant water and numerous trees, mild air and scarce sunshine and gives rise to many diseases (Sharma *et al.* 2008) [15, 16, 20]. *Acharya Sushruta* has described *Anupa Desha* as the area where water is more in quantity, the surface is uneven, rainfall is more, and rivers are more, cold air blows continuously. The area has dense forests and big trees, the persons have tender body and are more prone to *kapha Vatika* disorders (Sharma *et al.*, 1999) [12, 17, 18]. According *Acharya Vagbhatta Anupa* (*Marshy, wet*) *Desha* is opposite in characters to *Jangala* (*arid*) *Desha*. In *Anupa Desha kapha* is the predominant *Dosha*. (Murthy *et al.*, 2005) [10].

3.3 Sadharana Desha

The *Sadharana Desha* is characterized as it has creepers, *Vanaspata* (*Tall tree*), *Vanaspata* (*Medium tree*), birds and beasts described above in respect to *Jangala* and *Anupa Desha*; and the persons inhabiting this land are sturdy, tender, endowed with strength, complexion and compactness, as well as other attributes of people inhabiting in the land of general nature. (Pandey *et al.*, 2008) [11, 13, 14]. *Acharya Sushruta* has described *Sadharana Desha* as the land with mixed features of *Anupa* and *Jangala Desha* (Sharma *et al.*, 1999) [12, 17, 18]. According *Acharya Vagbhatta Sadharana* (*moderate*) *Desha* is that which is sum, neither too less nor too much of these features. In *Sadharana Desha* all the *Dosas* are in normal condition (Sharma *et al.*, 1999) [12, 17, 18].

Table 1: Ecological features of *Bhumi Desha* (Meena *et al.*, 2015; Goswami *et al.*, 1993) [5, 3]

	<i>Jangala Desha</i>	<i>Anupa Desha</i>	<i>Sadharana Desha</i>
Ecological features	Dry land is even distinguished by its stony, sandy, stone-filled surface, summertime mirages, small ponds, open areas, scorching climate, and thorny vegetation. Shrubs, little rain, desert and dry winds predominate. Humidity range (around 35-65%). There's less than 500 mm of rain.	Marshy, damp, and wet. The surface of the land is uneven. Numerous hills, lakes, wells, and rivers can be found, although the subsurface water level is not very deep in coastal areas. The approximate humidity range is 70-95%. The region receives between 2,000 and 3,000 mm of rain annually, including rivers, lakes, mountains, deltas, and lush forests.	The characteristics of <i>Jangala</i> and <i>Anupa Desha</i> are found. Through a proper balance of dry land and moist season, open spaces & forests. Humidity (approx.50-70), Rainfall is in the range of 1,000-2,000 mm.
Commonly available flora and fauna.	Typically, one can see camels, spotted deer, sheep, donkeys, and bears. The majority of plants are prickly, including trees like <i>Aswakarana</i> (<i>Dipterocarpus alatus</i>), <i>Khadira</i> (<i>Acacia farnesiana</i>), <i>Sallaki</i> (<i>Boswellia serrate</i>), <i>Vata</i> (<i>Ficus benghalensis</i>), <i>Amalaka</i> (<i>Emblika officinalis</i>), and <i>Aswatha</i> (<i>Ficus Religosa</i>). Trees such as the <i>Jujubee</i> , <i>Pello</i> (<i>Salvadora persica</i>), and <i>Sami Arka</i> (<i>Calotropis procera</i>). Rich crops: <i>Bajra</i> , <i>groundnuts</i> , <i>cotton</i> , etc.	The variety of fruits and vegetables: <i>Hintal</i> (<i>Phoenix Paludosa</i> Roxb), <i>Tamala</i> (<i>Nicotianatabacum</i> Linn), <i>Narikel</i> (<i>Cocosnucifera</i>), <i>kadali</i> (<i>Banana tree</i>), etc. Swans, Cranes, Geese, Hare, Pigs, Buffaloes, Deer, and other wild animals? Trees abound along riverbanks and seacoasts. There are a lot of flowering climbers located between woodlands. plantain tree, sugarcane, rice, etc.	The animals and crops Have the combined characters of <i>Jangala</i> and <i>Anupa Desha</i> .
Predominance of <i>Doshas</i> & its impact on health	People in <i>Desha</i> have a constitution that primarily consists of <i>Vata</i> and <i>Pitta</i> . They are more vulnerable to diseases dominated by <i>Vata</i> and <i>Pitta</i> and are harsh, forceful, and coarse by nature.	<i>Anupa Desha</i> people tend to have more of a <i>Kapha</i> and <i>Vata</i> -dominated constitution. They are more susceptible to <i>Kapha</i> and <i>Vata</i> illnesses and are typically delicate, lovely, and gentle in temperament.	The people have the combined characters of <i>Jangala</i> and <i>Anupa Desha</i> .
Distribution	Western Rajasthan e.g. <i>Barmer</i> , <i>Jaisalmer</i> <i>Saurashtra</i> and <i>Kutch</i> and <i>Ladakh</i> region of <i>Jammu</i> and <i>Kashmir</i> .	Assam and other adjoining northeastern states, northern parts of <i>West Bengal</i> and western coastal Plains in the peninsular India extend from <i>Maharashtra</i> to <i>Kerala</i> .	East <i>Uttar Pradesh</i> , <i>Bihar</i> , <i>Gangetic West Bengal</i> , <i>Madhya Pradesh</i> , <i>Vidarbha</i> , <i>Jharkhand</i> and a few coastal areas in <i>Andhra Pradesh</i> and <i>Tamil Nadu</i> , and the rest of the <i>Himalayan</i> regions in <i>Himachal Pradesh</i> , <i>Uttaranchal</i> and <i>Jammu</i> and <i>Kashmir</i> .

4. Collection and Purification

Sterculia trees exude after taping of the trunks. Harvest is done during the dry season. Before selection, big lumps are broken down into smaller pieces to remove the biggest bark

impurities. Raw gum is graded upon colour (pale yellow to brown) and impurities (BFOM content), (Hamburg, 2014) [34]. The trees with a circumference of 1 metre are selected and blazes are made. The number of blazes per tree should not

exceed two. Immediately after tapping, the exudation oozes out the maximum exudation during the first 24 hours. The large irregular tears which weigh in pounds are picked and sent to the collecting centres. Tapping is done during March-April up to June or till the commencement of monsoon.

During rainy season, the yield of gum is reduced. The plants are tapped again in September. The yield per tree is about 1-5 kg per year, and on average, the tree is tapped about five times during its lifetime. The large tears are broken into small pieces, enhancing the drying process. The pieces of bark, sand particles and foreign organic matter are removed. The size reduction and air flotation of loose bark ensure purification to a certain extent. Sand particles are removed by gravity. Granulated or crystal gum karaya has a particle size between 6 and 30 mesh. Finely powdered variety usually passes through 150 mesh screens (Kokate *et al.*, 2019) [29, 35].

4.1 Description

It is found in irregular tears or vermiform pieces from white to brown. It has slight acetous odour and bland mucilaginous taste. Wood fibres and small sand particles may be present in the drug. It is insoluble in water, but forms a translucent colloidal solution. Powdered gum swells in water (Kokate *et al.*, 2019) [29, 35].

4.2 Standards of Quality

Foreign organic matter: Not more than 3.0 per cent.

Acid insoluble ash: Not more than 1.0 per cent

4.3 Chemical Constituents

Karaya gum contains about 8.0 per cent of acetyl group and more than 37% of uronic acid residues. On acid hydrolysis, it gives D-galactose, L-rhamnose, D-galacturonic acid, aldobiuronic acid and an acid trisaccharides. Gum karaya gives pink colour with solution of ruthenium red not observed in tragacanth, (Kokate *et al.*, 2019) [29, 35].

5. Properties of *Sterculia urens* Roxb gum

Sterculia urens gum is a white or extremely crimson polysaccharide partly acetylated and acidic. It solidifies as huge, spherical tears. It expands into a jelly-like mass in water but is not soluble. It is the least soluble among exudates gums, although it is one of low concentrations that absorbs water extremely quickly to form thick mucilage's. *Sterculia urens* gum is a calcium and magnesium salt that contains D-glucuronic acid in some of its side chains and D-galactose, L-rhamnose, and D-galacturonic acid units in its central chain. *Sterculia urens* gum dispersions become more soluble when heated, although their viscosities are permanently reduced. Because *Sterculia urens* gum can yield finished products, it is permitted for use in food and listed as GRAS (Generally Recognized Act Safe) under the Food and Drug Act. (Vikaspedia, 2018) [28].

6. Uses of *Sterculia urens*

It swells about 60-100 times in water. It is neither digested nor absorbed by the body; hence, it is a good bulk laxative. It is also used as denture adhesive in dental treatment and in pharmaceuticals as emulsifier, thickener and stabilizer. Karaya gum is listed in the food chemical codex and hence, used on large scale in foods such as ice pops, cheese spread, sherbets, and ground meat products. It is also used in paper and textile industries. During 1995-96 and 1996-97, India has exported Karaya gum of worth ₹ 675 lac and 894 lac respectively (Kokate *et al.*, 2019) [29, 35]. In *Ayurveda* is used in different ailments due to its *Gunakarma*. *Sterculia*

gum has anti-heat properties, hence calms the burning, sweating and thirst caused by heat. Due to this tactile quality, it has a soothing effect on the mind in case of mental touch. Coating means to form a layer on the metals present in the body by applying liquids with backward properties or to cover the metals. When two different ingredients get coated due to the backward properties, both the ingredients combine and get combined. This is why its symptoms have been called '*Sandhankar*'. To understand this, the example of glue can be taken. It is a liquid substance. When two objects are coated and combined, they become combined or joined. Its thinness is the reason behind its coating. *Sterculia urens* gums act as *Raktasthambhaka* (~hemostatic) Substances that prevent bleeding are called haemostatic. Gums act also as these substances are cold and alkaline they increase blood clotting (coagulant) and constrict blood vessels (vasoconstrictor). A substance that soothes external and internal burning is called 'burning relief' such as lotus, sandalwood etc. Burning is a symptom of bile so these substances are cold semen and choleric. They are used in pathological disorders and inflammation (Chunekar and Pandey 2010) [36].

7. Samgraha Desha (land suitable for drug collection)

Acharya Sushruta states that a plant's potency (or origin) depends on its cultivation location, harvesting period, and appropriate storage. Its place of origin directly influenced any plant's characteristics with the caveat that the plant to be collected must be resistant to insects, poison, weapons, sun, wind, fire, water, oppression, thoroughfares, and have excellent Rasas. It should also not be fragile or unfertile, and have distant water sources. (Shastri, 2004) [22]. Himalayan region is the ideal home for medicinal plants. (Shastri, 1969) [21]. These are the excellent among the mountains, named Himalaya, which is the best habituate of medicinal plants. Hence one should obtain the fruits grown there is proper time, mature with, taste and potency, replenished with the sun, air, shade and water in respective seasons according to need, and which are uneaten, unpurified, uninjured and nontoxic (Tripathi, 1988) [23, 24, 25]. *Charaka* saying that *divvyausadhis* (celestial drugs) normally grown in places appropriate to them i.e. in sacred places. They do not grow in other places. If such a celestial plant is accidentally found in ordinary sinful places, it does not possess the *Virya* (~potency) attributed to it (Tripathi B 1988) [23, 24, 25]. These herbs exert milder effect in case of different habitat, subject and mode of administration through the intake method is the same for all. The persons with luxurious living who cannot search or use them should resort to other methods of Rasayana described hereunder. These celestial drugs produce moderate effects because of improper administration or by *adrasta* (unseen forces) (Tripathi, 1988) [23, 24, 25].

8. Bhumi Pariksha

While examining *Desha* (*Bhumi*), the following points are considered about patient.

- Birthplace of the individual.
- The place where he has been brought up.
- The place where he became diseased.
- The food habits, customs etc., of the particular region.
- Physical strength, mental condition, prakriti, incidence of specific disease in particular regions. (Dwivedy *et al.* 2008) [1-2].

8.1 Bhumi Desha and Nidana (cause) of disease

Determining the causes of an illness is a crucial task for

BhumiDesha. In contrast to *Anupa Desha* (marshy land), where the humor prominent *Dosha* is *kapha*, *Jangala Desha* (dry land) has a predominance of *Vata*, making its inhabitants more susceptible to diseases related to *Vatadosa*. People there are therefore more vulnerable to *kapha* *Dosa*-related illnesses. Thus, knowledge of *BhumiDesha* in *Pareekshyabhavas* (Tenfold of investigation) aids in addressing the potential *Nidanas* (cause) of a sickness, its prognosis, and ultimately helps with elements of treatment. Certain diseases have been discussed based on *Desha*, such as *Kasyapa Samhita Amlapitta*, described according to *Desha* and said to be treated with *Jangala Desha* medicine. According to Madhavakar, the *Slipada* is based on *Desha*, and he has mentioned that the biggest risk factor of *Slipada*, i.e. *Anupa Desha*.

8.2 *Bhumi Desha* and Swastha (health)

According to *Ayurvedic* classics, the body's predominant *dosa* regions are as follows the first region extends from *Hridayas* to the entire upper portion and is the place of *Kapha*; the second region extends between *Hridaya* and *Nabhi* and is the place of *Pitta dosha* the third region extends from *Nabhi* to the very bottom and is the place of *Vata*. The investigation of geo-pathologic aspects are thought to be crucial for understanding the body's pathophysiological processes. *Vata dosha* will predominate in *Jangala Desha* (arid area), and the inhabitants are often strong-built. Herbs, birds, animals, and humans are all impacted by the predominance of *Vata dosa*, which is seen in their *prakriti*. In the Marry *Anupa Desha*

9. Discussion

Bhumi Desha- Bhumi Desha is applied for a particular area that is very important from a health and disease perspective. It plays an important role in determining the causative factors of a disease. As dry land is having the predominance of *Vata*, this made the people more prone to disease about *Vata Dosha* where as in marshy land the humors predominant *dosa* is *kapha*, thereby people are more prone to diseases related to *kapha Dosha*. There by the understanding of *Bhumi Desha* in *Pareekshyabhavas* (Tenfold of investigation) helps to tackle the possible *Nidanas* (cause) of a disease, its prognosis and in turn aids in treatment aspects. If *Jangala Desha* inhabitants are resorted to *Vata* enhancing *Ahara* and *Viharas* leads them to the manifestation of *Vata* Vicars (disease due to *Vata*). The *Vata* predominant Vicars manifestation in this particular *Desha* because of equivalent nature of *Dushya*, *Desha* and *Prakarti*. Therefore the treatment protocol adapted to such diseases should be of opposite nature of the qualities of *Desha* (*Desha-vipareeta*). That is why it said that “*Yasya desasya Yojan tutadjanya tasya Ausadham hitam*” (Pandey and Chuneekar, 2009) [26].

10. Conclusion

Drugs growing in *Himalaya* are cold very efficacious and those found in *Vindhya* region are hot & light. This indicates the importance of *Desha* and *Disha* both. Movement of substances in a particular locality. Animals which graze light food, those inhabiting deserts, or those who are very active are light; otherwise, they are heavy. Their acclimatization to that region can be acclimatized to different types of localities by using substances with opposite qualities, e.g. use of hot and non-unctuous substances in marshy land and cold and unctuous substances in deserts. The quality of drugs is also described according to *Desha*, and the collection of the drugs is described, keeping the view of different *Dishas* also. Some drugs are described for collection from *Himalaya*, some from *Vidhya Pradesh*, some from *Sadharana*, etc., because specific

Desha influenced the potency of drugs.

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