

ANALYTICAL STUDIES IN THE EVIDENCES REGARDING CHEMICO-CULTURE IN THE HISTORY OF INDIAN MEDICINE IN ANCIENT PERIOD—ALLIUM SERIES

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Undoubtedly smiling is an indication of good health, happiness and prosperity (i. e. *Mens sana in corpore sana*, i. e. a sign of sound mind in a sound body).

The reference to Buddhist's canons, the *piṭaka* (basket) of *Vinaya* (law of ethical principles), *Sutte* (rules of monastic life and *abhidhamma* (metaphysical principles and other allied non-medical texts having influences from diverse sources, contributing to the flowering chemico culture of Indian genius in multiple fields cannot be ignored for this purpose. The vitality of Indian chemico-culture is evidenced by the fact that healthy physicochemical ideas and institutions were easily assimilated without disturbing the organic unity of the original views in the field of history of Indian medicines and that too in Indian medicinal plants described in the non-medical texts. With the knowledge in the aetiological field the treatment was prescribed for attaining health through extracts from flowers, roots, fruits regulated in terms of consumption and non-consumption techniques by physicians who were granted special privilege and prestige with the follow of certain ethics in the society. They were quite conversant with the decoctions of various plants for studies in the ailments. Not only this, hunger suppression preparations were used in case of scarcity of foodstuffs. The support of establishments of shops for sale of green herbs, medicinal roots and experiments of various drugs in relation to the symptoms carried over in Divyananda including references of Lord Buddha critically appraise the knowledge of chemico-culture established those days. The efficacy not established by *Piper nigrum* (*marica*) *Piper longum* (*pippali*) *Zingibre officinale* (*sunthi*) in intestinal obstructions is explained on the basis of physico-chemical principle involved in the ingredients of Palandu series. The digestive tract in relation to reaction with *Allium sativum* has been incorporated in this paper and a clue regarding chemico culture has been suggested for the *modus operandi* for Allium used those days.

Undoubtedly smiling is supposed to be an indication of good health, happiness and prosperity, i. e. a sign of sound mind in a sound body. This *modus operandi's* reference to the Buddhist's canons, the *piṭaka* (basket) of *vinaya* (law of ethical principles),³ *sūtra* (rules of monastic life³) *abhidhamma* (metaphysical principles)⁴ and other allied non-medical texts⁵ which have influences from diverse sources and contribute towards the flowering chemico-environment of Indian genius in multiple fields cannot be ignored for the studies in this series. The vitality of Indian chemico-culture in the history of Indian medicines is evidenced by the fact that mostly physico-chemical ideas^{6,7} assimilated those days combine the aetiological conditions in terms of the organic unity of the original thoughts especially established in the medicinal plants⁸ described⁹ in the non-medical texts. The *tripiṭaka* (500 B. C. —86 A. D.), *Buddhacarita* and *Saundarānanda* of Aśvaghōṣa (1st cent. A. D.) and Bhadrabāhu's *Kalpasūtra*, I. 42 mention 43, 57 and 40 medicinal plants respectively in this series of investigation. The unearthing of five rods⁶ (in Altekars's *Kumrahan excavations*-two of them broken, both the ends of one of the rods clubbed but not pointed) made of copper for smearing the eyes and several collyriums prepared from various techniques with the help of antimony rods⁷ (*Kalasyi añjani śalākā*), i. e. the use of five types of *añjana* (antimony), i. e. *kāla*, *rasa*, *sola*, *geruka* and *kapall* gives the indication for procurement of various metals and minerals in this chemico-culture series.

Regarding attainment of health in case of diseased person the four^{11,12} *ārya* truths are equated as disease, its cause, health (*ārogya*) and medicine (*bhaiṣajya*) and *Saundarānanda* XIV, 40¹⁰ stresses the importance on proper understanding of the cause cum treatment of the ailment in this respect.

The geography of Strabo (B. C. 54—A. D. 24) throws important light on the positions of the medicines in India those days, through knowledge in bio-chemical antidotes and their actions caused by a plant like that of laurel in the form of epileptic side effects alongwith symptoms like that of foaming mouth. The damage to the eyes through a prickly plant like cucumber, throat choking by consumption of unripe dates was also known those days. It is said that among the oriets, the arrows which were made of wood and hardened in fire were besmeared in deadly poisons. At the time when Ptolemus was wounded and was in danger of losing his life, (although Alexander was found asleep) someone stood beside him and showed him a root and branch, which he bade Alexander to crush and apply to the wound. After awakening from sleep Alexander remembered the vision, sought and found the root, which grew in abundance there and simultaneously made use of it, both for himself and for others. When the barbarians saw that the antidote had been discovered they surrendered to the King.¹⁴

The *Manusmṛiti*¹⁵ mentioning edible preparations envisages the extracts from pure flowers, roots and fruits for consumable items. Saundarānanda visualises medicines possessing very rarely both the properties, i. e. taste and disease pacifying actions. Soft (*bhojaniya*), hard (*khādiya*), relishable or likeable (*lehya*) foods were used for this purpose. The syrups prepared from the fruits were used in addition to the intoxicating drinks. Five kinds of beverages alongwith *surā*, *varuni*, *prasanna*, and *sidhu* with adherence to certain rules are mentioned in the series.¹⁵

Although the physicians those days were granted special privilege and prestige in the society (i. e. the envoy (*pranidhi*) on mission, in disguise of of physician, the Prince apprehending imprisonment or death or exile with allotment of land free from taxes and other burdens (including provision of royal rations for them) they were not authorised to sell or mortgage these items and were also restricted not to monopolise their business secretly, i. e. they had to report the cases approaching them secretly for treatments of patients suffering from ulcer or symptoms exhibited by consumption of excess of unwholesome food or drinks. Otherwise both the patients and physicians were proved guilty and were liable for heavy¹⁶ punishments. The physicians were supposed to be the true followers of the old sages and ancient traditions. They were supposed to be practical men, skilled in diagnosis, master of efficacious treatment, collector of medicinal herbs and capable of curing every disease. The use of *ghṛta*, butter, oil, honey and mollasses was considered to be of medicinal efficacy in this respect.

Milindapanho's IV.7.20. (*sabbe pi acariya roguppattim ca nidānam ca sabhavam samutthanam ca kiriyam ca siddhasiddham ca*) can be traced for the knowledge in interpreting aggravation, prognosis, cure, management and mutual coordination in interpreting knowledge of other systems for the betterment of the patients. *Caraka saṃhitā*¹⁶ mentions of the celebrated physician Bahlika (Balakha) to have participated in various seminars organised by Punarvasu Ātreya¹⁶ in this regard. A person aspiring to become a surgeon, was supposed to acquaint himself with the application of ointments (*bheṣajjanulimpana*) which is definitely noteworthy from the point of chemico-culture. The *Mahāvagga* of *Vinayapīṭaka* (VIII, *civarakkhaṇḍaka*, *Jivakavatthu*) lauds the medico-surgical achievements of Jivaka in this respect. Jivaka on his way to Rājgrha from Taxila University had cured a case of chronic headache through a medicated oil which was used as errhine (*Natthukamma-Skt-nasṭahkarma*) at Saket (modern Ayodhya). Fistula in anus of king Bimbisāra of Rājgrha was cured by the application of one ointment only by him. He had also given a very mild purgative to Lord Buddha through a lotus flower soaked in the

medicines. The use of collyrium in ocular disorders¹⁶ is also note-worthy. The eight causes¹⁷ of ailments include super abundance of *vāta*, *pitta*, *śleṣman* (*semha*), the union of the aforesaid *doṣas*, variations in seasons (*utu-parinamaja*), the avoidance of dissimilarities (*visamahāra*), the external agency (*opakkama*) and deeds (*kamma-vipaka*). Regarding medico-terminological instincts Kātyāyana on *Aṣṭādhyāya* affixes 'nas' and 'ul' respectively after the words 'pārsu' and 'vāta,' thus forming the words 'pārsva' and 'vātula' in this series of ailments. The affix 'la' comes after the word *Klinna* for denoting indication to the eyes and 'cilla' and 'pilla' are substitutes of 'klinna' (bleared) for bleared eyes, which is called 'cilla' or 'pilla'. The term 'culla' is also another substitute. A person having the disease 'kaccu' (scabies) is denoted as 'kacoura.' The affix 'vini' is added diversely to the terms 'marma' (vital part) and *amaya* (disease) in the sense of possession. Besides these affixes, the vowel is also lengthened optionally. In the *vedas* the above substitution (*pūrya-savarṇa*) takes place in the case of 'skanda,' preceded by 'ud' as 'agreduram utkandah' (meaning a disease 'utkandako rogah'). Alternatively this form may have been derived from the root 'kanda' and not 'skandir.' Milindapanho discusses technical differences between matured (*kālamarana*) and pre-matured (*akālamarana*) situations alongwith eight causative factors of the later origins. The *Caraka Saṃhitā* mentions these facts aphoristically. The exponential vividity mentioned in various texts¹⁷ for four *bhūtas* (*pāthavi*, *apo*, *teja* and *vāyu*) except *ākāśa* cannot be ignored for these explanations. The term 'dhātu' has been incorporated in Buddhist's literatures from the medical innovations. ...

Buddhacarita in describing the sickness or disease (*roga*) explains it as an effect of the provocation of the *dhātus* three in number, namely, *vāta*, *pitta* and *śleṣman* (*tri-dhātuprakopa-prabhāvaḥ*) charactered by a swollen belly with shaking frame as if one paints with arms hanging loosely and shoulders having the thin and pale body juxtaposed by embracing the stranger.¹⁷ Diseases arisen from *rajas*, *tamas*, physical factors, were especially treated by the psychiatrists known as *ādhyātmavid*. As the *doṣas* (*vāta*, *pitta* and *śleṣman*) are brought forth (*uṅkleśa*) before *saṃśodhan* (eliminatory) treatment likewise the diseases are also aggravated before their treatments.

In the *Saddharmapūṇḍarīka*,¹⁷ diseases (*vyādhyayāḥ*) are classified as *vāttika*, *paittika*, *ślaiṣmika* and *sannipātika*. The *Lalitavistara* also mentions persons suffering from diseases coming under the classification of *vāta*, *pitta*, *śleṣman* and *sannipāta*. Patañjali, the celebrated scholiast on Pāṇini's *Aṣṭādhyāyī* refers to the course of form *jvaraḥ* as curd or *dadhi* and fig or musk melon (*trapusa*) and says that a bed of reeds with water (*navalodaka*) tends to increase the diseases of foot (*pada-roga*). Buddhist's canons mention 'tikiccha' instead of *Āyurveda*. The 21 principal professions mentioned in *Jātaka* II,

include medical science as one of the major professions to earn livelihood. (*vejjakamma* Skt. *vaidyakarma*).

Kautilya *Arthaśāstra* mentions the remedial decoction mixtures prepared from various substrates to be consumed for a month or fortnight (also produced from vivid sources) carry the symptoms as follows :²⁸.

<i>Symptoms</i>	<i>Causing factor</i>	<i>Preparations</i>
Destruction of eyes and madness	Smoke	Burning mixture of powder of <i>krikana</i> (a kind of partridge) <i>kṛkalāsa</i> (lizard), <i>gṛhagodhika</i> (a small house lizard) and <i>andhahika</i> (a blind snake)
Leprosy	Smoke	Burning of mixture of (<i>Kṛkalāsa</i> and <i>gṛhagodhika</i>)
Diabetes	Smoke	Burning of mixture of <i>kṛkalāsa</i> and entrails of <i>citrabehka</i> (a kind of variegated colour) and <i>madhu</i> (<i>celtis orientalis</i> of honey).
Consumption	Mixture	Same mixture mixed with human blood
Destruction of tongue Atrophic fever (paralysis of tongue)	Powder	Powder of <i>duṣviṣa</i> (drugs having the property of slow poisoning), <i>madana</i> (<i>Randia dumenorum</i> Linn) and <i>koḍrava</i> (<i>Paspalum scuobiculatum</i>)
<i>Viśucikā</i> Cholera	Mixture	Of the powder of <i>matruvahaka</i> , <i>jalloka</i> (leech) the tail mixture of a peacock, the eyes of a frog and <i>pituk</i> (<i>salvadra perisca</i>)
Fever	Mixture	Mixture of <i>pañcakauṣṭha kandinnyaka</i> , <i>rājvrkṣa</i> (<i>Cassia fistula</i>) <i>madhupuṣpa</i> (<i>Bassia latifolia</i>) and <i>madhu</i> (honey)
Dumbness and deafness	Mixture	Mixture from the powder of the knot of the tongue of <i>bhasa</i> (the bearded vulture), <i>nakula</i> (mongoose) reduced to a paste with the milk of a she donkey

Leprosy	Paste (<i>Kalka</i>) rubbed over any part of body for a month	Prepared from <i>ṭiṇḍuka</i> (<i>Diospyrus paniculata</i>) and <i>arṣṣa</i> (<i>Sapindus trifoliatu</i> s) and cowdung, smeared over the joint of <i>bhallataka</i> (<i>Semecarpus anacardium</i>)
Leprosy	Paste	Prepared from <i>guñja</i> (<i>Abrus precatorium</i>) kept for seven nights in the mouth of a white cobra or a house lizard
Leprosy	External liquid	Of essence of the eggs of a parrot and a cuckoo
White in colour	Mixture eating	Of the powders of the roots of the <i>kukkūṭa</i> (<i>Marisittalaentata</i>), <i>koṣataki</i> (<i>Dausapentandra</i>) and <i>śatavarī</i> (<i>Asparagus racemosa</i>) for a month
Black colours	Decoctions	Of <i>vaṭa</i> (<i>Ficus bengalensis</i>) and rubhis body with the paste prepared from <i>sahacara</i> (<i>Berlenia perionitis</i>)
Dark blueness	Mixture	<i>Haritāla</i> (orpiment or sulphate of arsenic) and <i>manaḥśilā</i> (realgar or red arsenic) mixed with the oil extracted from <i>śakuna</i> (a kind of bird) and <i>kaṅka</i> (a vulture).

In addition to these observations Kautilya^{1*} *Arthaśāstra* mentions various recipes for the diseases which are experimentally produced. The decoctions of the roots of *śṛgāla vranta* (*Bigonia indica*) or *madana* (*Rondia dumetorum*) or *varuna* (*Cratava roxburghii*) or *valli* (a creeper or a group of drugs), *vidarī* (*Pueraria tuberosa*), *sariva*, *rajani-haridrā* (*Curcuma langa*), *guduci* (*Sida cardifolia*) and *ajarsāṅgi* (*Pistocia integerrima*) or *ṭagara* (*Valeriana wallichii*) or all of these mixed with the milk, and drunk, removes the effects of the mixtures of *madana*. The stinking oil extracted from *Kaiarya* (*Vanguria spinosa*) removes madness. The mixtures prepared from *priyāṅgu* (*Agalaria roxburghiana*) and *naktamala* (*Pongamia pinnaia*) when applied through the nose removes leprosy. The mixture prepared from the *kuṣṭha* (*Sausurea lapp*) and *lodhra* (*Symplocos racemosa*) pacifies the consumption. Likewise the

mixture prepared from *kāṭphala* (*Myrica nagi*), *dravanti* (*Anthericum tuberosum*) and *vidaṅga* (*Embellia ribs*) removes the headache, and other disorders of the head when applied through the nose.

The prominent achievement¹⁹ in the field of military medicines during the Mauryan age was the knowledge of the application of the drugs along with hunger-suppressive characteristics, which had the quality of inducing capabilities in the soldiers to work even for 15 days or a month, in case of scarcity of food stuffs. Kauṭilya mentions four such compounds in the sequence as follows :

A dose of powder of *śiriṣa* (*Albizzia lebeck*), *udumber* (*Ficus racemosa*) and *sami* (*Prosopis spicigera*) mixed with *ghṛta* (clarified butter) render fasting possible for half a month.

The scum prepared from the mixture of the roots of *kaserulia* (*Scripus grossus*), *utpalakāṇḍa* (root of *Nelumbium speciosum*), *ikṣumūla* (root of *Saccharum officinarum*), *durvā* (*Cymadon dactylon*) milk and *ghṛta* enables the man to fast for a month.

The powder of *mās* (*Phaseolus mungo*), *yava* (*Hordeum vulgare*), *kulattha* (*Dolichus biflavous*), *darbha* (*Desmostachyabipinnata*) mixed with milk and *ghṛta* : the milk of *vallī* (*Phaseolus aconitifolius*) and clarified butter derived from it and mixed in equal proportions, combined with the paste prepared from the root of *śālaparṇī* (*Desmodium gangeticum*) and *praśniparṇī* (*Uraria picta*) when drunk with the milk, or a dose of milk mixed with clarified butter and honey, both prepared from the above substrates enable one to fast for a month.

Ghṛta, butter, oil, honey, mollasses compensate these views. These food and drinks (beverages etc.) had been safeguarded by the female nurses in this regard. The green herbs and medicinal plants (roots needed for this purpose) were sold at the shops at *Śrāvastī* (identified with Sahet Mahet on the bank of Rapti river in the district of Gonda of Uttar Pradesh).²⁰

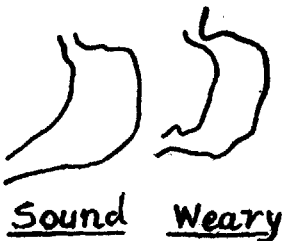


FIG. 1.

In the *Divyānanda*²⁴ there is a mention of one experiment of various drugs on human being with symptoms resembling on advanced type of intestinal obstruction caused by roundworms. Once Emperor Aśoka suffered from a severe disease. Faecal odour from mouth was the main symptom. The queen consort of Aśoka, Tiṣyarakṣitā, asked the physicians to bring the patients of either sex with the same symptoms. Accordingly a cowherd suffering from

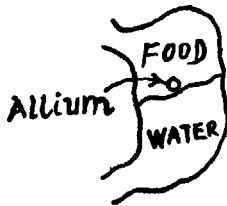


FIG. 2.

these symptoms was shifted to a hidden and lonely place and after making him unconscious (*jīvitad vyāparopitah*), she opened his abdomen and observed that a long roundworm went upwards which caused vomiting with disagreeable odour (probably faecal odour) so that when it moved downwards it caused purging with the same odour. The role²⁷ played by the stomach in the digestive system cannot be ignored for this purpose. Although the stomach works energetically when one is young, repeated stretches and contractions in rubber-like muscles and muscular layers of the same, loses the flexibility and strength (necessary to perform this vital digestive action) as one gets advanced in age. Successful pregnancy and childbirth responds actively to digestion upto 40 years of age. A sound stomach actively performs mechanical churning of food which is accomplished by the waves of muscular contraction only mixed with sufficient but not excessive gastric secretions. Some drugs partially stimulate the upper portion of the stomach for the digestive action. Over 40 years, the upper portion generally loses the digestive power and the digestion is limited to lower half only. The remaining half is left unemployed during the digestion. This can eventually cause ulceration and even carcinogenous growth in that region after these years.

The remedial drugs used in this series should atleast possess the properties of disinfecting the stomach walls, stimulating the digestive action and gastric secrets, intensifying the stomach's rhythmic churning of food and increasing the movement of musculature contractions, thus reducing undesired burden on the intestine with simultaneous stimulation to supply pure oxygen-rich blood to the capillaries of the stomach walls by the liver.

The gastritis or the ulcer originated in this consecutive patterns can be divided into exogenous and endogenous varieties. The exogenous mode is caused by overeating or drinking, or by eating spoiled food, drinking too much or taking excessive amount of stimulants. The endogenous characteristics is originated by the toxins released by bacteria of typhoid, diphtheria, dysentery, T. B., syphilis, side-tracks and mismanaged liver, kidney, heart and other allied internal organs. The overall symptoms exhibited are—pain in stomach,

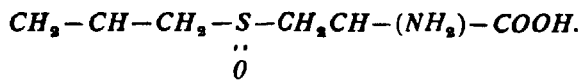
dullness, headache, lack of appetite, belching, nausea, bad breathing, vomiting sensations, slight rise of temperature. peritonitis in advanced stages, whereas endogenous envisages lack of appetite, poor digestion, considerable stomach pain. This series can be compared with the symptoms mentioned in the Buddhist's texts.²⁴

1. Faecal odour comes out from the mouth (*mukhad uccāro nirgacchati*), i. e. vomiting, copious and projectile, first of all food, then bile, and later materials alkaline to litmus and finally the faecal.
2. Presence of worms in the intestine. (*pakwasāyasthane antarayam krimiprādurbhutih*).
3. When a worm goes upwards the faecal odour sprinkles out from the mouth (*krimau urdhvam gacchati mukhatosuchipt pradharanti*).
4. When a worm comes downwards the faecal material sprinkles out from the anus (*adhō gacchati kramau aśuchint adhaḥ pradharanti*) comprising stereoraceous in intestine, abdominal distention, flanks with obstruction in colon centred more with obstruction to small intestine.

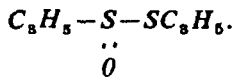
For these observations Lord Buddha²⁵ once consumed mild purgative through snuffing the lotus flower already soaked in purgative medicines. This process is testified in the *Caraka Saṃhitā*. VII. I. 19. The *marica* (*Piper nigrum*), *pippali* (*Piper longum*) and *sunthi* (*Zingibre officinale*) although tried in intestinal obstructions could not prove effective although drug-ingredients belong to the *Palandu* series. The properties such as aphrodisiac, diuretic, vermifuge, external rubefacient in action, stimulant to the skin, antipyretic, stimulant to gastro-intestinal tract, carminative flavouring agent, used in dyspepsia, flatulant colic, adjunct to many tonics, stomachic, sialagogue, digestive stimulant, has been supplemented by the studies of the physico chemical ingredients in the *Palandu* series with the use of pulvis, decoctum, confection, pleoresina, syrups, tincturae, tabellae preparations as such with special reference to *Allium sativum* in this series of investigation (28,24,25,26,27).

Russian Botanist, Pavlov, reported that *Allium sativum* grew wilder in Central Asia exhibited the properties such as (i) invigoration and used in seasoning for foods, maintenance and stimulation of the health, mystic religion to protect the person from the evils, and as stimulant cum elixir of life. Although many physico-chemical ingredients for their actions in the intestinal obstructions with the fungi *Erysiphe taurica* Lev., *Alternaria palaundi* and *Rhizopus sp.* have been recognised in this series of investigation, the stimulation and vermifugicity cannot be ignored here because the garlic oil

from the bulb is supposed to be allin with the composition :



The membrane originated aminase gives smell to the allin. The combination of allin and aminase gives rise to allicine :



which surpasses manifold activities of antibacteria as compared to penicilline. The allicine possesses oxidising action with composite action on vitamins, proteins, stimulation towards digestive ingredients and ferment, bacteria thereby are destroyed. When combined with oxygen it converts into volatile diallyl disulphide and therefore is used immediately after its slicing. The glucoside from the *Allium sativum* possesses the scorginine or *Allium scoroboprasum* which fetches properties equivalent to consumption of 65% water, 16% albumin, 5% Ca, 14% fat and is associated with small amounts of sugar in liver, blood and tissues. Hence it is beneficial for use as nutrient and health harmonising agents.

The SH radical in a deoxidising process combines readily with noxious elements introduced from the outside to neutralise and excrete them easily. The scorginine and a portion of this ingredient is metabolised inside the body and the sugar of the glucoside is hydrolysed and turned into scorgin, having fructulose acid and SH radical at both the ends. It ventilates the cells, various systems and organs and removes the detrimental products. The breath which delivers the smell of anything taken inside the mouth, circulates only through the mouth and lungs and never enters the stomach. As a result the smell of the *Allium sativum* is kept away from the teethlips, tongue and rest of the mouth's surface. For this reason the oblate is supposed to be most effective in the series. The essential oil absorbed into the circulation, is consumed, excreted through the lungs and bronchial mucosa, it acts as a good antiseptic and hence antispasmodic membranes are thus removed in many of the ailments. The juice is rich in organic bound S (organic sulphide), iodine, salicylic acid, vitamins etc. and therefore used as stimulant, carminative, vermifuge expelling roundworms, antiseptic and a tonic dyspeptic agent.

In addition to these physico-chemical observations the findings in the following chart clarifies the action of the allicin in the destruction of the worms which was not established through the rest of the *Palandu* series mentioned in the ancient texts.

TABLE 1

	Garlic	Chive Allium Schone prasum	Welshe Onion	Moly	Onion Allium cepa	Stone Leck Allium perrum	Leck Allium Rieto riolis	Allium Wild Rocam baie	Allium Bakery Allium grayi
Methyl allicin	+	+	+	+++	(+)	(+)	+++	++	+++
Methyl Allyl allicin	++	(-)	+	++	(-)	(-)	++	+	++
Methyl propyl- allicin	+	+	+	(-)	(+)	(+)	(-)	+	+
Allicin	++++	(-)	(+)	+++	(-)	(-)	++	+	+
Allyl propyl allicin	+	(-)	(+)	(-)	(-)	(-)	(-)	+	+
Propyl allicin	+	+	++	(-)	+	+	(-)	+	+
Total amount of allicin	500	120	30	(-)	60	80	280	110	300

increases in the order (+), +, ++, +++, +++++
(-) not found.

REFERENCES

- 1 Jyotir Mitra, *History of Indian Medicines from Pre-Mauryan to Kushan period*, Varanasi, 1974, Chapt. I. p. 3.
- 2 Bhikku Jagdisa Kasyapa : (i) *Mahāvagga*, Pali Publication Board, Bihar Govt. 1956.
(ii) *Cullāvagga*, 1956.
(iii) *Pacittiya*, 1958.
(iv) *Parajikar*, 1958.
(v) *Vinaya Pitaka* (The book of the discipline), Vols. I-IV. PTS.
- Homer, I. B. *Mahāvagga*, Vol. iv. 1951, Rep. 1962. *Cullāvagga*, Vol. v. 1963. *Suttavihaṅga*. Vol. 1, 1949 : *Suttavihaṅga*, Vol. II. 1940.
- 3 Bhikku Jagdisa Kasyapa : (i) *Dighanikāya*, Pali Publication Board, Bihar Govt. Vols. I, II, III, 1958.
(ii) *Majjhimānikaya*, (I, II, III-1958)
(iii) *Samyuttanikaya*, I, II, III, 1959.
(iv) *Khuddanikaya*, I to VII. 1959.
(v) *Anguttaramikaya*, I, II, III, IV, 1960.
- Vedekar, R D., *Millindapanho*, Univ. of Bombay, 1940.
- Law, B. C. 'Buddhavansha' (The minor anthologies of the Pali canon.) Pt. III, PTS, London, 1938.
- Davids, Rhys (Mrs.) 'Dhammapada' (The minor anthologies of the Pali canon,) Pt. I. SBB, London, 1931.

- Law, B. C. '*Cariyapitaka*'. (The minor anthologies of the Pali canon, Pt. III), PTS. London, 1938.
- Cowell, E. B. '*Jātaka*'. (the stories of the Buddha's former births), vols. I to IV and VII (Index) PTS, 1907. First edn. and reprint in 1969.
- Davids, Rhys (Mrs). '*Khuddakapatha*' (The minor anthologies of the Pali Canon, Pt. I.) SBB. London, and also by the name the minor reading—translated by Bhikku Nanamati PTS, London, 1957.
- Faushall, V. '*Suttanipata*' SBE (X) 1898 and also by R. Chalmers, Harvard Oriental Series, Cambridge, 1932 and also by name of Woven cadences of Early Buddhists, EM. Hare SBB, London, 1944.
- Davids, Rhys (Mrs). '*Therigatha*' (Psalms of the early Buddhists, Psalms the sisters). PTS, London, 1964.
- Woodwards, F. L. '*Udana*' (Verses of Uplifts), SBB. London, 1935 & also by D. M. Strong, London, 1902.
- ⁴ Bhikku Jagdisa Kasyapa. '*Abhidhammapitakar*' Pali Pub. Board. Govt. of Bihar, 1960, 1961, 1951.
- Law, B. C. '*Puggalpannati*' Designation of Human types, PTS, London, 1915
- ⁵ Warren Henery Clarke, '*Viśuddhimagga*' by Buddhaghosa' (A. D. 380-440) revised by Dharmananda Kausambhi, Harvard Oriental Series, Harvard University Press, Harvard.
- Bhikku Nanamali. '*Viśuddhimagga*' (The Path of Purification), Colombo, Ceylon, 1956.
- Shastri, Ramchandradas. '*Buddhacarita of Aśwaghosa*' Chaukhambha, Varanasi, 1972.
- Vaidya, P. L. '*Divyavadana*' Mithila Institute, Darbhanga, 1959.
- Jacobi, H. '*Kalpasūtra of Bhadrabahu*', SBE, XXII, Motilal Banarasidas, Delhi, 1964.
- Vaidya P. L. '*Lalitavistara*', 1958. '*Saddharmapuṇḍarika*', 1960.
- Chaudhari, Suryanarayan. '*Saundarānanda*', Motilal Banarasidas, Delhi; 2026, V. E. X.
- ⁶ Altekar, A. S. '*Report on Kumraher excavations*'. Patna, 1959, p. 125. 136.
- ⁷ Pandey, Ramteja, Shastri. '*Arthaśāstra of Kauṭilya*', Pandit Pustakalaya, Kasbi, 1964.
- Shastri, R. Sharma. '*Arthaśāstra of Kauṭilya*', Mysore, 1919, XIV. I 3.
- ⁸ Lallanji Gopal. '*History of Indian medicine from Premauryan to Kushan Period*', Foreword, IX-XII. B. H. U. Varanasi 1974.
- Sharma, P. V. '*History of Indian medicine from Premauryan to Kushan Period*', Introduction. XIII-XVII. B. H. U. Varanasi, 1974.
- Ibid.
- ⁹ Jyotir Mitra. Appendix No. 1 (a), 434. '*Medicinal plants referred to in Tripiṭaka*' (500 B. C.-56 A. D.) pp. 73-129.
- Appendix No. 3 (A)-57 '*Medicinal plants referred to in Buddhacarita of Saundarananda of Aśwaghosa*' (1st. Cent. A. D. pp. 136-139.)
- 49 '*Medicinal plants in Bhadrabahu's Kalpasūtra*', I, 42.
- Saundarananda. XIV. 40. ibid, XVI. 41.
- ^{10 11 12} Sharma, P. V. '*Caraka cintan, Chaukhambha, Varanasi, 1970*', pp. 43-45.

- ¹³ Gopal Shastri Nene. *Manusmṛiti*, Chaukhambha, Varanasi, 1970, V. 10
Buhler, G. *Manusmṛiti* (The laws of Manu); SBE, XXV. Motilal Banarasidas, Delhi 1964.
- ¹⁴ Majumdar, R. C. *The Classical accounts of India*, Firma K. L. Mukhopadhyay, Calcutta, Biography of Strabo, (B.C. 54—A.D. 24) p. 96.
- ¹⁵ ¹⁶ ¹⁷ ¹⁸ ¹⁹ ²⁰ ²¹ ²² Details as mentioned in above cited references.
- ²³ Mukerjee, B. *The Indian Pharmaceutical Codex*, Vol. I, *Indigenous drugs*, CSIR, New Delhi, 1953, pp 204-206, 266, 331.
- Nadkarni, K. M. *Indian Materia Medica*, Vol. I, pp. 970-72. pp. 203-204 345, 274, 255-56, 332, 357, 381, 358. pp. 1309, 1308-1315, 964. Bombay-7, 1954.
- Capalāsuna-Allium ascalomicum* Linn., a species of garlic. Nadiya, —*Allium sativum* Linn, synonym of *Lasuna*, garlic, *Magdhaka*, *Allium sativum*, Linn., Name of *Lasuna*.
- ²⁴ Nadkarni, K. M. *Indian Materia Medica*, pp. 63. 64. 65—71. 350. 352. 359.
Chopra, I. D. Bombay Govt. Agri. Deptt. Bulletin. pp. 459. 563
- ²⁵ Watt, G. *The Wealth of India*. Vol. I., *Raw Materials*, CSIR. New Delhi, 1948, P. 56.
- A Dictionary of Economic Product of India*, 6 vols. 1889-99. (i. 168, I. 171, I 1741-169, I. 172).
- ²⁶ Watt, G. *Commercial Products of India*, 1908, 58.
Hooker, J. D. *Flora of British India*, 7. Vols. 1878-97 (VI. 337-338).
Kirtikar, K. R. and Basu, B. D. *Indian Medicinal Plants*, 1935, 4 vols.
- ²⁷ Knott, J. E. *Vegetable Growing*, 1941. Fig. 56.
Bentley. R. and Trimen. H. *Medicinal plants*, 4 vols. 1880.
Ramsushil Singh. *Vanaushadhi Nirdeshika*, Ayurvedic Pharmacopoea. 1969, Hindi Samit, UP, Lucknow. P. 305-306.
- Health Bulletin*, Delhi, No. 23, 1941, 31. 33
Journal of Agriculture Research, Washington Platitudes, 1935. 5, 857.
Chemical Abstracts, New York, 1941. 35, 2627 & 2552. *Die pflanzenstaffa*-2 vols. (Wehmer, C I. 1929-31. 1935 Supplement. 153.
The Extra Pharmacopœa, 22nd edn. 2. vols. 1941-43. (Martinadale) I. 167.
Indigenous Drugs of India (Chopra R. H.) 1933, 273-274. *The Chemistry of essential oils, and artificial perfumes* 2 vols 1921-22 (Parry E. J.) 92.
Yoshio Kato, *Garlic. A Miraculous Bulb*, Oyama Garlic Laboratory. Japan, 1973.