

## REVIEW ARTICLE

**Influence of Harvesting and Processing Methods on the Active Principles of Medicinal Plants**Reshmi Pushpan<sup>\*1</sup>, Harshita Kumari<sup>1</sup>, and K Nishteswar<sup>2</sup>

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**ABSTRACT**

The indigenous systems of medicine practiced in India are based mainly on the use of medicinal plants. The knowledge of plant gained so far is still meager considering the huge number species available in the world. In the modern of 3, 00,000 species of higher plants, only a small number yield well-defined drugs. Approximately only 10% of the organic constituents of plants are reported to be known and remaining 90% are yet to be explored. In the medicinal plants, the organic constituents or active principle are made available through properly executed harvesting techniques. The scientificity behind ancient Ayurvedic harvesting techniques is proven by modern scientific methods. *Acharya Susruta* and *Charaka* advocated the collection of medicinal plants keeping in view part used, soil in which the herb grows and the desired pharmacological actions or therapeutic benefits. The scientific data produced by modern methods clearly advocate applying proper harvesting techniques for preserving the required quantity of active principles.

**Key words:** Ayurveda, harvesting, lunar cycle, chemical constituents.

**INTRODUCTION**

The knowledge about the use of medicinal plants has been acquired through centuries and deposited in Ayurvedic classics. The Herbal glory of Ayurveda has attracted the attention of the modern scientists who started isolating the active principles for a better therapeutic action of phyto medicines. The attempts are being made to increase the quantity of secondary metabolites by adopting better harvesting techniques of medicinal plant parts. Research studies confirmed that the plant parts collected according to lunar cycles can influence the final yield of active principles of herbs. Some of the studies carried out also proved the influence of chanting mantra while collecting the useful parts of the medicinal plants with the design of double blind technique.

So far one herb namely *Arogyapacha* (*Trichopus zeylanicus*) of Tribal origin is proved to be a good anti-fatigue agent. Dr Mayaram Uniyal has identified the Sanjivani plant of Ramayana as *Saussurea gossipiphora* which contains Beta-sitosterol and other host of active principles which may prove to be useful to combat the dreadful disease like cancer by research studies<sup>[1]</sup>.

The growing pressure of population and vast expansion of urban area lead to development of roads to remote areas which have become a major cause for rapid deforestation and loss of natural plant resource. Keeping in view of deforestation attempts are being made to conserve and cultivate the important medicinal plant which is in demand. According to the analysis done by National Medicinal Plant Board it is clear that roots/rhizomes and the whole plant based raw drugs make for more than half of the total raw drugs in trade<sup>[2]</sup>. This analysis also brings up the issue of 'destructive harvesting' (harvesting of whole plants, roots, wood and bark) involved in respect of botanicals in trade. Two third of the species are subjected to destructive harvesting for obtaining the traded botanicals. Availability of many of the medicinal plant species in the country has rapidly declined over the recent past.

**HARVESTING:**

The information about harvesting techniques delineated in the Ayurvedic classics as well as available in the modern literature is consulted to document the information which may be useful to

preserve the active principles among medicinal plants.

### Harvesting and Collection practices: Hints from Ayurvedic Literature:

The ancient knowledge about medicinal plants is valued even today, although chemical synthetic drugs like antibiotics etc have attained greater importance in modern medicine. But most of the plants are entering into Red-list of medicinal plants such as endangered, threatened, very severely threatened etc due to mal-adaptation of harvesting methods. Ayurveda advocates that drugs are required to be collected keeping in view the appropriate habitat (*desha-sampat*), appropriate season (*kala-sampat*) and their effective attributes (*Guna sampat*). The dos and don'ts which can be considered as the Good collection practices have been envisaged by the seers of Ayurveda.

**Table 1: Time of collection according to part used** [3,4,5]

Useful part	Sushruta Samhita	Charaka Samhita	Raja Nighantu
1.Mula	Pravrit	Grishma/Shishira	Shishira
2.Patra	Varsha	Varsha/Vasanta	Shishira
3.Shaka	-	Varsha/Vasanta	-
4.Pushpa	-	Yatha ritu	Vasanta
5.Phala	Grishma	Yatha Ritu	Vasanta
6.Sara	Vasanta	Hemanta	-
7.Twak	Sharat	Sharat	-
8.Kanda	-	Sharat	Hemanta
9.Ksheera	Hemanta	Sharat	-
10.Panchanga	-	-	Sharat

Ayurvedic classics delineated the principles of collection of medicinal plants according to their part used. *Susrutha* is not agreeing with *Charaka's* concept of seasonal collection of medicinal plants. He has quoted the contemporary principles of drug collection and has finally concluded that these principles are not relevant and suggested that drugs of *Shita virya* should be collected in *Soumya ritu* and those of *Ushna virya* in *agneya kala*. *Susrutha* suggests to collect the drug basing on virya instead of part used of the plant.

### Specific Useful parts Harvesting mentioned in Ayurvedi Literature [6]:

1. Charaka advocates to collect mature fruits of *Madanaphala* (*Randia dumetorum*), commonly known as emetic nut in between *Vasanta*(spring) and *Grishma*(summer) season on *Pushya*, *Ashwini* or *Mrigashira Nakshatra* [4].
2. The tender leaves of *Ikshvaku* (*Lagenaria cicerea*) (*Katukalabu*) should be collected before the flowers appear on the climber.
3. *Thrivrut*(*Operculina turpethum*) should be collected for purgative therapy during the lunar cycle of full moon phase.

4. Latex of *Snuhi* (*Euphorbia* species) should be collected at the end of *Shishira ritu*( winter season) from the plant which is two or three years old.

### Current Harvesting Practices of some important medicinal plants used in Ayurveda [7]

Recent researches confirmed that the total active principle content varies depending upon of period of collection and processing methods of herbs. Some of the observation made are enumerated below:

**Aswagandha-** *Withania somnifera* (Linn.) Dunal: Harvesting starts from January and continues till March. The maturity of the crop is judged by the drying out of the leaves and berries turning red.

**Kumari** - *Aloe vera* (Linn.) Burm.f.: The exudates called aloe, aloes or bitter aloes is contained in the pericycle cells of the vascular bundles in the leaf and is used either fresh or dry. *Aloe vera* plant takes about 3 years to attain harvestable size and then leaves can be harvested for 7 years. For gel production leaves are cut at intervals of about 3 months. The youngest leaves(<25 cm) are not suitable because of their low gel content, but the leaves should not be too old because gel quantity and quality may decline.

**Kebuka-** *Costus* species: Diosgenin content is maximum when the crop is in an active stage of vegetative growth, and when it is about 16-17 months old. After harvesting aerial shoots, the most satisfactory and economical method to dig out the rhizomes is to run the tractor drawn cultivator cross-wise twice or thrice over the field and simultaneously collect the uprooted rhizomes manually.

**Dhattura-Datura metel** : the plant attain optimum vegetative growth as well as the highest percentage of alkaloids by July (5 months after sowing), when the first harvest is taken. It is recommended to harvest the leaves in the early morning or late afternoon. In studies in India it was found that mature leaves of about the middle of the stem of *D.metel* had the maximum alkaloid content and that very young fruits possessed a higher content of alkaloid than older fruits. In *Datura metel* grown experimentally in Iran , the highest scopolamine content were found in the stem (0.3%) and young leaves(0.25%) of six weeks old plant and in the roots(0.2%) of 16-weeks old plant.

**Vidanga** *Embelia ribes*: Embelin is a phenolic compound found in the fruits of *Embelia tsjeriamcottam* ,responsible for the medicinal properties of the plant. The fruits are usually harvested at a large scale before maturity but a recent study

showed that the immature fruits collected in October contain an average of 1.67% embelin whereas mature fruits collected in December on an average contain 4.64% embelin which clearly points out that the fruits should be harvested after attaining maturity to get better quality produce.

**Yashtimadhu-** *Glycyrrhiza glabra* Linn: the crop is ready for uprooting about 3-4 years after planting and just before the plants have borne fruit. The plants are lifted in autumn (Nov-Dec) after the rains.

**Pippali** - *Piper longum* Linn : the spikes are picked from the vines 6 months after planting. The spikes will be ready for harvest 2 months after their formation on the plants. The spikes should be picked when they are blackish-green and most pungent. The thick parts of the stem and roots which have medicinal value may be harvested from 18 months after planting.

**Nimba-** *Azadirachta indica* A.Juss : the trees shed their leaves during February-March and a full-grown tree produces an estimated 350 kg of leaves. The fruits mature in June-July.

**Ahiphena-** *Papaver somniferum* Linn : the lancing operation is performed by skilled labour, usually on bright sunny days between noon and 4pm. The hottest part of the day is chosen, since the pellicle is said to form on the surface of the freshly exuded latex due to the hot sun, resulting in a greater degree of evaporation and quicker thickening.

**Sarpagandha-** *Rauwolfia serpentina* (Linn.) Benth. ex Kurz : It is reported that roots dug out in winter (December), when plants have shed their leaves, are richer in total content of alkaloids than the roots harvested in August.

**Markandika-** *Cassia angustifolia*: young senna leaves and pods contain a high sennoside content. It is also found that senna plants produce foliage containing higher sennosides between 50-90 days of sowing.

**Vacha-** *Acorus calamus*: after about a year, the crop is ready for harvesting. The leaves start turning yellow and dry, indicative of maturity.

**Tagara-** *Valeriana wallichii* DC : It is advisable to harvest 2-year old plants, since the yield of the underground parts would be higher and so also their essential oil content. The plants can be harvested when they become dormant during November, exhibiting yellowing of leaves and withering of plants.

**Ajamoda-** *Apium graveolens* : The crop is harvested when about 80% of the buds begin to turn light-brown. In cooler climates plant produces seeds only in the second year. In the

plains, the crop matures within about 3 months of transplanting.

**Tulasi** - *Ocimum sanctum*: harvesting done on bright sunny days yield oil of good quality and higher quantity. The oil and eugenol content is maximum at the flower initiation and seed-setting stages.

**Usheera-** *Vetiveria zizanioides*: the plants planted in July should be harvested after 18 months to get the maximum oil-yield. The yields of root and oil percentage vary with changes in environmental conditions.

While planting, collecting and harvesting, farmers and traditional healers are carefully observing the phases of the moon which is popularly known today as "Lunar gardening". Many studies have shown seasonal variations, effects of harvest dates, and circadian effects on chemical constituents of some plant species that could help develop improved protocols for production practices. Research on St. John's wort (*Hypericum perforatum*) herb, one of the top ten herbal products in retail sales in the United States,<sup>8</sup> has shown seasonal variation and differences due to cultivation location. Level of hypericin and pseudohypericin, the compounds to which commercial products are usually standardized, were found to vary from 100 ppm to 5000 ppm from winter to summer.<sup>9</sup> Although environmental, genetic and physiological factors contribute to the overall Phytochemical profile of plants, the harvest time could be one of the more important aspects. This is an exceedingly valuable finding if useful parts are being grown for individual compounds or if manufactured products are harvested at different times and standardized to a specific compound that varies from month to month, week to week or even day to day.

Apart from seasonal variation, daily changes have also been reported. Daily fluctuation is seen in the essential oil of *Ocimum gratissimum* (Lamiaceae), where levels of eugenol in the essential oil were observed to drop from 98% at 12 a.m. to 11% at 5 p.m.<sup>10</sup>

## CONCLUSION

Through many generations, traditional cultures have learned the harvest practices, specifically the time of harvest which can greatly influence the characteristics and qualities of plant products. With modern chemical tools and guidance from ancient wisdom, the activity of the medicinal plant is subject to the availability of secondary metabolites. If a proper care is not taken while applying proper harvesting techniques may result in loss of therapeutic activity. The data analysed

in this communication highlights the necessity of application of scientific harvesting techniques to make phytomedicines as potent as any other modern agent. The herbs without potentiality become useless weapon of physician's armamentarium in combating the disease condition.

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