

FACTORS INVOLVED IN THE PRODUCTION OF HOMOEOPATHIC DRUGS

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Introduction

During the past two decades, the Homoeopathic Pharmaceutical Industry has provided a vast range of drugs for human use and has an increasing sophistication in the production of medicaments. The primary responsibility for assuring quality of medicine lies with the manufacturer. The production of homoeopathic drugs depends on the crude drug which has reached for pharmaceutical manufacturing. The therapeutic value of the drug is due to its particular active constituent and, the nature and amount of this constituent varies with number of factors such as climate, collection, drying, storage and certain plants which are cultivated and grow in a wild state.

Factors Influencing Production

Climate

Plant growth and development, and often the nature and quantity of secondary metabolites, are affected by temperature, rainfall, length of day (including the quality of light). Such effects have been studied by growing particular plants in different climatic areas and observing variations; however, it is impossible to control all the variables in such experiments and special laboratories (phytotrons) have been constructed in which all the factors are independently controllable.

(i) *Temperature*: Temperature is the major factor controlling the development and metabolism of plants. Normally the plants can withstand considerable range of temperature and have become adapted to its own natural environment. Many tropical and subtropical plants grow in temperate regions during summer months, but they lack frost resistance to withstand the winter. Night and day temperature must also be considered, for e.g. the

variation in night and day temperature influence the growth in *Hyoscyamus muticus*. The plant is tall and has narrow leaves at day temperature of 24° C and night temperature of 17° C as compared to plant which when grown at constant temperature of 27° C is short and has broad leaves. The mean optimum temperature for production of nicotine in *Nicotiana rustica* is 20° C (lower at 11-12° C and at 30° C).

In general, the formation of volatile oils appears to be enhanced at higher temperature although very hot days may lead to an excess physical loss of oil. Several authors have indicated that fixed oil produced at low temperature contains fatty acids with higher content of double bonds than those formed at higher temperature.

(ii) *Rainfall*: Continuous rain can lead to loss of water-soluble substances from leaves and roots by leaching, and this is known to apply to some alkaloids (particularly solanaceae), glycosides and even volatile oil producing plants. This could account for low yields of some active constituents in wet season from plants whose general condition appears to be good. Variable results have been reported for the production of volatile oils under different conditions of rainfall and in some instances coupled with the development of glandular hairs.

(iii) *Day Length and Radiation Characteristics*: In certain cases research has shown that light is a factor which helps to determine the amount of glycosides or alkaloids produced. Full sunshine brought about sharp increase in hyoscyamine content in *Datura stramonium* var *tatula* and higher alkaloid content in *Belladonna*, *Stramonium* and *Cinchona ledgeriana*. It has been shown that under long day conditions peppermint leaves contain menthone, menthol and traces of menthofuran; plants grown under short day conditions contain menthofuran as a major component of volatile oil. Type of radiation has been studied in respect of morphological development of the plant, but little information appears to have been reported concerning medicinal metabolites.

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(iv) *Altitude* : Medicinal plants like rhubarb (*Rheum*), tragacanth (*Astragalus*) Cinchona, Cocoa and Tea require elevation. In case of *Cinchona succirubra* the plant grows well at low levels but produces practically no alkaloid. The constituents of *Gentiana lutea* increase with altitude whereas of *Lobelia inflata* and oil content of thyme and peppermint decrease. Other oil producing plants may reach a maximum at certain altitudes. Pyrethrum gives the best yield of flower heads and pyrethrins at high altitude on, or near Equator. It is therefore produced in East Africa and North-west South America. However, vegetative growth is more lush under irrigated conditions at lower altitude, so therefore the propagation form (for the vegetative multiplication of plants) are, in Ecuador, situated at lower levels than the final commercial forms.

Cultivated and Wild Plants

Some plants have been cultivated from time immemorial (e.g. flax, opium, poppy and coca). Others are grown because supplies of wild plants are insufficient to meet the demand or owing to sparse distribution or inaccessibility, collection is difficult. For success in cultivation it is necessary to study the conditions under which the plant flourishes in the wild state and reproduce these conditions or improve on them. Small changes in ecology can affect plant products.

Certain plants lose their medicinal value when they are cultivated e.g. *Cephalandra indica*. Certain morphological and microscopical characteristics have also been reported to be different in roots of *Withania somnifera*.

Collection

The season and age at which the drug is collected is usually a matter of considerable importance, since the amount and sometimes the nature of active constituents is not constant throughout the year. For example it has been found out that rhubarb (*Rheum*) contains no anthraquinone derivatives in winters but contains anthranols which on the arrival of warmer weather are converted by oxidation into anthraquinones. This applies for example, to collection of *Podophyllum*, and *Ephedra* also.

The age of the plant is also of considerable importance and governs not only the total quantity but

also the proportion of components of active mixture e.g. in young shoots of *Mentha piperita* the volatile oils shows relatively high proportion of pulegone while mature leaves show menthone and menthole.

Cardioactive glycosides content varies with age in *Digitalis purpurea*, therefore leaves of second year's growth are collected for preparation of medicine.

The specific season and time of collection for few homoeopathic drugs of plant origin are mentioned below :

1. *Artemisia vulgaris* : Collected in dry season and take care not to wash them.
2. *Aegle marmelos* : Unripe fruit.
3. *Carica papaya* : Green unripe fruits excluding seeds.
4. *Cubeba officinalis* : Unripe fruits.
5. *Digitalis purpurea* : Leaves of second year's growth.
6. *Ficus religiosa* : Tender leaves.
7. *Filix mas* : Rhizome collection in summer.
8. *Juglans regia* : Leaf and green unripe fruit.
9. *Piper nigrum* : Dried unripe fruits.
10. *Populus candicans* : Buds collected in winter.
11. *Terminalia chebula* : Semi-mature fruits.

Drying

Drying largely depends on weather. In suitable climates open air drying is done while artificial heat is necessary for drying in tropical countries where humidity is very high. Drying should take place as soon as possible after collection. Drugs containing volatile oils are liable to lose aroma if not dried and all moist drugs are liable to develop moulds. Fairly rapid drying helps flowers and leaves to retain their aroma, but the temperature used in each case must be governed by constituents and physical nature of the drug. As a general rule, leaves, herbs and flowers may be dried between 20°C and 40°C and, barks and roots at 30°C and 65°C.

Exactly how far drying is to be carried is a matter of practical experience. If leaves and other delicate structures are overdried they become very brittle and tend to break in transit.

Storage

Long storage is not recommended. Drugs such as Indian hemp and Sarsaparilla deteriorate even when carefully stored. Drugs should be stored in sacks, bales, wooden cases, cardboard boxes and paper bags. Odourous substances should be kept in separate vessels in cool and dry place. Drugs such as Digitalis and Indian hemp should never be allowed to become air dry or they lose a considerable part of their activity.

Factors which deteriorate the drugs are moisture content, light and presence of oxygen. When these conditions are suitable living organisms like bacteria, moulds, mites and insects multiply. Material should be examined during storage and drug showing any sign of contamination should be rejected. No preservative of any kind is permissible during storage.

Looking at the above factors Homoeopathic Pharmacopoeia of India, Vol.I p.12 under the heading- "Method of Procuring Medicinal Substances" has laid down few generalisations which every manufacturer should take care before preparation.

To add to all the above factors few general facts which should be taken into consideration are : leaves

should be collected as the flowers are beginning to open, flowers just before they are fully expanded, underground organs as the aerial parts die down and stems should be collected after development of leaves. Barks of resinous trees should be collected in early spring i.e. at about the time of the development of leaves and blossoms, and non - resinous barks should be collected late in autumn from young vigorous trees. Different directions are followed for collection of roots. Roots of biennials should be collected in the spring and of annuals should be dug out early in the autumn because they die after ripening of the seeds. Roots of perennials should be collected in the second and third year before they develop woody fiber. The roots should be cleaned without the use of much water. Leaves, flowers and fruits should not be collected when covered with dew or rain. Any part which is discoloured or attacked by slugs should be rejected. Any product of foreign countries are to be obtained from reputed and reliable druggists, preferably, in their natural, normal state and proper identification should be carried out before use.

Thus, a careful collection gives the product of best quality and therapeutic value, and success to a medical practitioner.

"Something cannot come out of nothing, creation is nothing, but a process of manifestation of what is latent, a process of evolution of what is already involved".

*Indian Sankhya Philosophy
Essays on Homoeopathy (p.584)
Dr. B.K. Sarkar*
