PHARMACOGNOSY

Different Systems of Classification of Crude Drugs

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Keywords
Crude drug, Systems of Classification, Chemical Classification, Pharmacological classification, Morphological Classification, Chemotaxonomical classification
Crude drugs of vegetable, animal and mineral sources form the subject matter of pharmacognosy. Although pharmacognosy is concerned mainly with naturally occurring substance of medicinal importance, it is not entirely limited to such substances. Thus, surgical dressings prepared from natural fibres, flavouring and suspending agents, disintegrants, filtering and support media etc. are included within the subject along with poisonous and hallucinogenic plants and raw materials for oral contraceptives.

The term *crude drug* generally applies to the products from plant and animal origin found in a raw form. However, the term is also applied to include pharmaceutical products from mineral kingdom in original form and not necessarily only of organic origin such as kaolin, bentonite etc. Crude drugs can thus be defined as to the natural products that has not been advanced in value or improved in condition by any process or treatment beyond that which is essential for its proper packing and prevention from deterioration.

**Classification of Crude Drugs**

The most important natural sources of drugs are higher plant, microbes and animals and marine organisms. Some useful products are obtained from minerals that are both organic and inorganic in nature. In order to pursue (or to follow) the study of the individual drugs, one must adopt some particular sequence of arrangement and this is referred to a system of classification of drugs. A method of classification should be

(a) Simple
(b) Easy to use
(c) Free from confusion and ambiguities.

Because of their wide distribution, each arrangement of classification has its own merits and demerits, but for the purpose of study the drugs are classified in the following different ways:

1. Alphabetical classification
2. Morphological classification
3. Taxonomic classification
4. Pharmacological classification
5. Chemical classification
6. Chemotaxonomical classification

**Alphabetical Classification**

Alphabetical classification is the simplest way of classification of any disconnected items. Crude drugs are arranged in alphabetical order of their Latin and English names (common names) or sometimes local language names (vernacular names).

Some of the pharmacopoeias, dictionaries and reference books which classify crude drugs according to this system are as follows.

1. Indian Pharmacopoeia
2. British Pharmacopoeia
3. British Herbal Pharmacopoeia
4. United States Pharmacopoeia and National Formulary
6. European Pharmacopoeia

In European Pharmacopoeia these are arranged according to their names in Latin where in U.S.P. and B.P.C., these are arranged in English.

**Merits:**
- It is easy and quick to use
- There is no repetition of entries and is devoid of confusion.
- In this system, location, tracing, and addition of drug entries is easy.

**Demerits:** There is no relationship between previous and successive drug entries.

**Examples:** Acacia, Benzoin, Cinchona, Dill, Ergot, Fennel, Gentian, Hyoscyamus, Ipecacuanha, Jalap, Kurchi, Liquorice, Mints, Nuxvomica, Opium, Podophyllum, Quassia, Rauwolfia, Senna, Vasaka, Wool fat, Yellow bees wax, Zeodary.

**Morphological Classification**

In this system, the drugs are arranged according to the morphological or external characters of the plant parts or animal parts i.e., which part of the plant is used as a drug e.g., leaves, roots, stem etc. The drugs obtained from the direct parts of the plants and containing cellular tissues are called as *organized* drugs e.g., Rhizomes, barks, leaves, fruits, entire plants, hairs and fibres. The drugs which are prepared from plants by some intermediate physical processes such as incision, drying or extraction with a solvent and not containing any cellular plant tissues are called as *unorganized* drugs. Aloe juice, opium latex, agar, gambir, gelatin, tragacanth, benzoin, honey, beeswax, lemon grass oil etc. are examples of unorganized drugs.

**Organised Drugs**

**Woods**– Quassia, Sandalwood, Red Sandalwood.

**Leaves**– Digitalis, Eucalyptus, Gymnema, Mint, Senna, Spearmint, Squill, Tulsi, Vasaka, Coca, Buchu, Hamamelis, Hyoscyamus, Belladonna, Tea.

**Barks**– Arjuna, Ashoka, Cascara, Cassia, Cinchona, Cinnamon, Kurchi, Quillia, Wild cherry.

**Flowering parts**– Clove, Pyrethrum, Saffron, Santonica, Chamomile.

**Fruits**– Amla, Anise, Bael, Bahera, Bitter Orange peel, Capsicum, Caraway, Cardamom, Colocynth, Coriander, Cumin, Dill, Fennel, Gokhru, Hirda, Lemon peel, Senna pod, Star anise, Tamarind, Vidang.

**Seeds**– Bitter almond, Black Mustard, Cardamom, Colchicum, Ispaghula, Kaladana, Linseed, Nutmeg, Nux vomi ca, Physostigma, Psyllium, Strophanthus, White mustard.

**Roots and Rhizomes**– Aconite, Ashwagandha, Calamus, Calumba, Colchicum corn, Dioscorea, Galanga, Garlic, Gention, Ginger, Ginseng, Glycyr rhiza, Podophyllum, Ipecac, Ipomoea, Jalap, Jatamansi, Rauwolfia, Rhubarb, Cassurea, Senega, Shatavari, Turmeric, Valerian, Squill.

**Plants and Herbs**– Ergot, Ephedra, Bacopa, Andrographis, Kalmegh, Yeast, Vinca, Datura, Centella.

**Hair and Fibres**– Cotton, Hemp, Jute, Silk, Flax.
Unorganised Drugs.

Dried latex— Opium, Papain

Dried Juice— Aloe, Kino

Dried extracts— Agar, Alginate, Black catechu, Pale catechu, Pectin

Waxes - Beeswax, Spermaceti, Carnauba wax

Gums – Acacia, Guar Gum, Indian Gum, Sterculia, Tragacanth.

Resins– Asafoetida, Benzoin, Copaiba Guaiacum, Guggul, Mastic, Coal tar, Tar, Tolu balsam, Storax, Sandarac.


Fixed oils and Fats– Arachis, Castor, Chalmoogra, Coconut, Cotton seed, Linseed, Olive, Sesame, Almond, Theobroma, Cod-liver, Halibut liver, Kokum butter.

Animal Products – Bees wax, Cantharides, Cod-liver oil, Gelatin, Halibut liver oil, Honey, Shark liver oil, shellac, Spermaceti wax, wool fat, musk, Lactose.

Fossil organism and Minerals– Bentonite, Kaolin, Kiesslguhr, Talc.

<table>
<thead>
<tr>
<th>Organized Drugs</th>
<th>Unorganized Drugs</th>
</tr>
</thead>
<tbody>
<tr>
<td>These may be of plant or animal origin.</td>
<td>These may be of plant, animal or mineral origin.</td>
</tr>
<tr>
<td>These are direct part of plant or animal.</td>
<td>These are the product of plant or animals.</td>
</tr>
<tr>
<td>These have cellular structure.</td>
<td>These do not have well defined cellular structure.</td>
</tr>
<tr>
<td>Generally identified by morphological character.</td>
<td>Generally identified by organoleptic properties.</td>
</tr>
<tr>
<td>Examples: Digitalis leaf, cinchona bark and ephedra stem.</td>
<td>Examples: Agar, gelatin, honey.</td>
</tr>
</tbody>
</table>

Merits: Morphological classification is more helpful to identify and detect adulteration. This system of classification is more convenient for practical study especially when the chemical nature of the drug is not clearly understood.

Demerits:
- The main drawback of morphological classification is that there is no co-relation of chemical constituents with the therapeutic actions.
- Repetition of drugs or plants occurs.

Taxonomical Classification
Taxonomical classification is purely a botanical classification and is based on principles of natural relationship and evolutionary developments. They are grouped in Kingdom, phylum, order, family genus and species. As all the entire plants are not used as drugs, part of the plant is used as a drug, for example, cinnamon bark. Thus it is of no significance from identification
point of view to put plants in a taxonomic order. Table 1 give the account of main characters of various taxon that contribute crude drugs while as Table 2 gives the taxonomical classification of some drugs.

Table 1: Main Characters of Various Taxon that Contribute Crude Drugs

<table>
<thead>
<tr>
<th>Plant Kingdom</th>
<th>Thallophyta</th>
<th>Pteridophyta</th>
<th>Gymnosperm</th>
<th>Angiosperm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>● Alage and fungi are considered together</td>
<td>● This group of plant derives its name from the fern, <em>Pteris</em> which also represent salient features of group (<em>Pteridopteris</em>, <em>Phyton-plant</em>)</td>
<td>● The gymnosperm (<em>Gymnos-naked</em> and <em>sperma-seed</em> i.e. plant with a naked seeds) are comparatively more ancient than the angiosperm in evolutionary terms</td>
<td>● The term angiosperm means enclosed seed because the ovules or potential seed are enclosed within a hallow ovary.</td>
</tr>
<tr>
<td></td>
<td>● They differ in mode of nutrition</td>
<td>● They occur is humid and tropical climates and usually ground on soil, rocks, in ponds etc.</td>
<td>● The living gymnosperms are widely distributed in the cold climates</td>
<td>● The angiosperms constitute the most dominant and ubiquitous vascular plants of present day flora</td>
</tr>
<tr>
<td></td>
<td>● Alage exhibit autotrophic and fungi exhibit heterotrophic nutrition. Example: Rhodophyta (Red algae) agar</td>
<td>● These plant are also raised in pots as ornamentals Example: Male fern</td>
<td>● The plant body is sporophyte and differentiated into roots, stem and leaves.</td>
<td>● Dicots and monocots are its sub divisions.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dicot</th>
<th>Monocot</th>
</tr>
</thead>
<tbody>
<tr>
<td>They have two cotyledons Example: Coriander, Capsicum</td>
<td>They have one cotyledons Example: Vanilla, Colchicum</td>
</tr>
</tbody>
</table>

Table 2: Taxonomical Classification of Some Crude Drugs

<table>
<thead>
<tr>
<th>Phylum</th>
<th>Order</th>
<th>Family</th>
<th>Drugs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thallophyta (Bacteria, fungi, Lichens)</td>
<td>Gelidiales</td>
<td>Gelidiaceae</td>
<td>Agar</td>
</tr>
<tr>
<td>Pteridophyta (Liverhorts, Mosses and Ferns)</td>
<td>Filicales</td>
<td>Polypodiaceae</td>
<td>Male fern</td>
</tr>
<tr>
<td>Gymnosperms</td>
<td>Genetales Coniferae</td>
<td>Ephedraceae Pinaceae</td>
<td>Ephedra Colophony</td>
</tr>
<tr>
<td>Angiosperms (Moncotyledons)</td>
<td>Liliiflorae Microsporae</td>
<td>Liliaceae Dioscoreaceae Orchidaceae</td>
<td>Colchicum Dioscorea Vanilla</td>
</tr>
</tbody>
</table>
Merits: Taxonomical classification is helpful for studying evolutionary developments.

Drawback: This system also does not co-relate in between the chemical constituents and biological activity of the drugs.

Pharmacological Classification
Grouping of drug according to their pharmacological action or of most important constituent or their therapeutic use is termed as pharmacological or therapeutic classification of drug. This classification is more relevant and is mostly followed method. Drugs like digitalis, squill and strophanthus having cardiotonic action are grouped together irrespective of their parts used or phylogenetic relationship or the nature of phytoconstituents they contain. Table 3 gives an outline of pharmacological classification of drugs.

Table 3: Classification of Drugs based on Pharmacological action.

<table>
<thead>
<tr>
<th>Pharmacological Action</th>
<th>Drugs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticancer</td>
<td>Vinca, Podophyllum, Taxus</td>
</tr>
<tr>
<td>Anti-inflammatory</td>
<td>Colchicum, Turmeric</td>
</tr>
<tr>
<td>Antiamoebic</td>
<td>Ipecac root, Kurchi bark</td>
</tr>
<tr>
<td>Antiasthmatic</td>
<td>Ephedra, Lobelia</td>
</tr>
<tr>
<td>Anthelminthic</td>
<td>Male fern, Quassia wood</td>
</tr>
<tr>
<td>Antispasmodic</td>
<td>Datura, Hyoscyamus</td>
</tr>
<tr>
<td>Astringent</td>
<td>Catechu</td>
</tr>
<tr>
<td>Analgesic</td>
<td>Opium, poppy</td>
</tr>
<tr>
<td>Bitter tonic</td>
<td>Quassia wood, Nux-vomica, Gentian</td>
</tr>
<tr>
<td>Carminatives</td>
<td>Coriander, fennel, clove, peppermint</td>
</tr>
<tr>
<td>Purgatives</td>
<td>Senna, Rhubarb</td>
</tr>
<tr>
<td>Expectorant</td>
<td>Tulsi, Balsam of Tolu, Vasaka</td>
</tr>
<tr>
<td>Cardiotonic</td>
<td>Digitalis, Squill, Strophanthus</td>
</tr>
<tr>
<td>Tranquilizers</td>
<td>Rauwolfia Roots</td>
</tr>
</tbody>
</table>

Merits: This system of classification can be used for suggesting substitutes of drugs if they are not available at a particular place or point of time.

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Demerits: Drugs having different action on the body gets classified separately in more than one group that causes ambiguity and confusion. Cinchona is antimalarial drug because of presence of
quinine but can be put under the group of drug affecting heart because of antiarrythymic action of quinidine.

Chemical Classification

The crude drugs are divided into different groups according to the chemical nature of their most important constituent. Since the pharmacological activity and therapeutic significance of crude drugs are based on the nature of their chemical constituents. The chemical classification of drugs is dependent upon the grouping of drugs with identical constituents. An out of this classification is as follows:

1. Carbohydrates– Carbohydrates are polyhydroxy aldehydes or ketones containing an unbroken chain of carbon atoms.
   - **Gums**
     - Acacia, Tragacanth, Guargum
   - **Mucilages**
     - Plantago seed
   - **Others**
     - Starch, Honey, Agar, Pectin, Cotton

2. Glycosides – Glycosides are compounds which upon hydrolysis give rise to one or more sugars (glycone) and non-sugar (aglycone).
   - **Anthraquinone Glycosides**
     - Aloe, Cascara, Rhubarb, Senna
   - **Saponins Glycosides**
     - Quillaia, Arjuna, Glycyrrhiza
   - **Cyanophore Glycosides**
     - Wild cherry bark
   - **Isothiocyanate Glycosides**
     - Mustard
   - **Cardiac Glycosides**
     - Digitalis, Strophantus
   - **Bitter Glycosides**
     - Gentian, Calumba, Quassia, Chirata, Kalmegh

3. Tannins– Tannins are complex organic, non-nitrogenous derivatives of polyhydroxy benzoic acids. Examples- Pale catechu, Black catechu, Ashoka bark, Galls, Myrobalan, Bahera, Amla

4. Volatile oils– Monoterpenes and sesquiterpenes obtained from plants
   - Examples- Cinnamon, Fennel, Dill, Caraway, Coriander, Cardamom, Orange peel, Mint, Clove, valerian

5. Lipids
   - **Fixed oils** – Castor, Olive, Almond, Shark liver oil
   - **Fats** – Theobroma, Lanolin
   - **Waxes** – Beeswax, Spermaceti

6. Resins– Complex mixture of compounds like resinols, resin acids, resinotannols, resenes. Examples Colophony, Podophyllum, Cannabis, Jalap, Capsicum, Turmeric, Balsam of Tolu and Peru, Asafoetida, Myrrh, Ginger

7. Alkaloids – Nitrogenous substance of plant origin
   - **Pyridine and Piperidine** – Lobelia, Nicotiana
   - **Tropane** - Coca, Belladonna, Datura, Stramonium, Hyoscyamus, Henbane
   - **Quinoline** – Cinchona
   - **Isoquinoline** – Opium, Ipecac, Calumba
   - **Indole** – Ergot, Rauwolfia
   - **Amines** – Ephedra
   - **Purina** – Tea, coffee
8. **Protein** – Gelatin, Ficin, Papain

9. **Vitamins** - Yeast

10. **Triterpenes** – Rasna, Colocynth

**Merits**: It is a popular approach for phytochemical studies

**Demerits**: Ambiguities arise when particular drugs possess a number of compounds belonging to different groups of compounds.

**Chemotaxonomic Classification**

This system of classification relies on the chemical similarity of a taxon i.e. it is based on the existence of relationship between constituents in various plants. There are certain types of chemical constituents that characterize certain classes of plants. This gives birth to entirely new concept of chemotaxonomy that utilizes chemical facts/characters for understanding the taxonomical status, relationships and the evolution of the plants. For example, tropane alkaloids generally occur among the members of Solanaceae thereby, serving as a chemotaxonomic marker. Similarly other secondary plant metabolites can serve as the basis of classification of crude drugs. The berberine alkaloid in Berberis and Argemone; Rutin in Rutaceae members, ranunculaceous alkaloids among its members etc are other examples.

It is the latest system of classification and gives more scope for understanding the relationship between chemical constituents, their biosynthesis and their possible action.

**References**