



## MONOGRAPH OF DIGITALIS

### DIGITALIS PURPUREA LINN

### DIGITALIS LANATA LINN

#### INTRODUCTION

#### HISTORY

The genus *digitalis* is from the Latin *digitus* (finger), perhaps referencing the shape of the flowers, which accommodate a finger when fully formed

**Botanical name :** *Digitalis purpurea* Linn

**Family:** Scrophulariaceae

**Part Used :** Leaves

**Synonym :** Purple Foxglove



#### Geographical source:

European countries, England, France, Germany. In India, it is cultivated in Kashmir and Nilgiri Hill.

#### CULTIVATION AND COLLECTION:

It is a biennial or perennial herb. It is about 1 to 2 metres in height. The seed of digitalis are small in size, so they are mixed with sand for sowing. Leaves are collected when 2/3 of flowers are fully developed. Generally the leaves are collected in the early afternoon, with a belief that maximum cardio-active glycosides are present at that time.

The leaves are immediately dried after collection below 60°C and dried leaves are stored in airtight containers. The dried leaves should not contain more than 5% moisture, since it promotes hydrolysis of cardiac glycosides resulting in loss of cardiac activity.



## DESCRIPTION:

### MORPHOLOGY

- **LEAVES:** General appearance: Usually broken and crimped.
- Shape: Ovate-lanceolate.
- Wide Margin: Crenate or dentate
- Apex: obtuse or rounded
- Base: Tapering, decurrent
- Surface: Upper - Slight pubescent, dark green, little wrinkled, Lower surface: Grayish-green, very pubescent. Network of veins seen on the underside
- Odour: Characteristic. Taste: Bitter
- **FLOWERS** : Purple corolla has bright red spots with a white rim



### MICROSCOPY

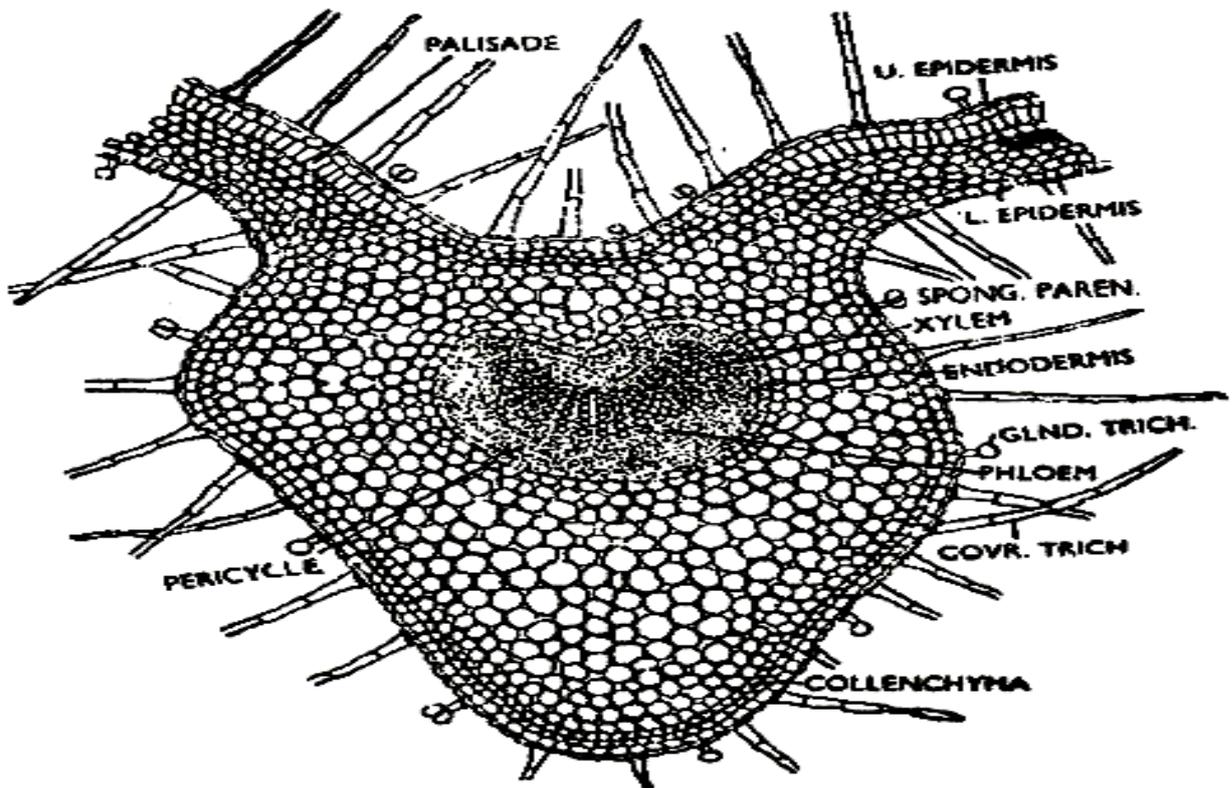
#### Lamina:

- **Upper epidermis:** Single layered with more or less rectangular cells having a distinct cuticle. Abundant covering and glandular trichomes.
- **Covering trichomes** are uniseriate, multicellular (3-6 Celled), Certain cells of the covering trichomes are collapsed, thus forming a diagnostic feature for the identification. Glandular trichomes are with either unicellular or bi-cellular terminal (through rare) stalk having unicellular or bi-cellular terminal gland. Few stomata are also seen on the upper epidermis.
- **Mesophyll:** It is differentiated into palisade and spongy parenchyma.
- **Palisade:** One layered, compact with radially elongated cells
- **Spongy parenchyma:** 4-6 layered and many distinct obliquely cut out veinlet are seen.
- **Lower epidermis:** Similar to upper epidermis and has many stomata (Anomocytic) and more trichomes compared to those of upper epidermis.

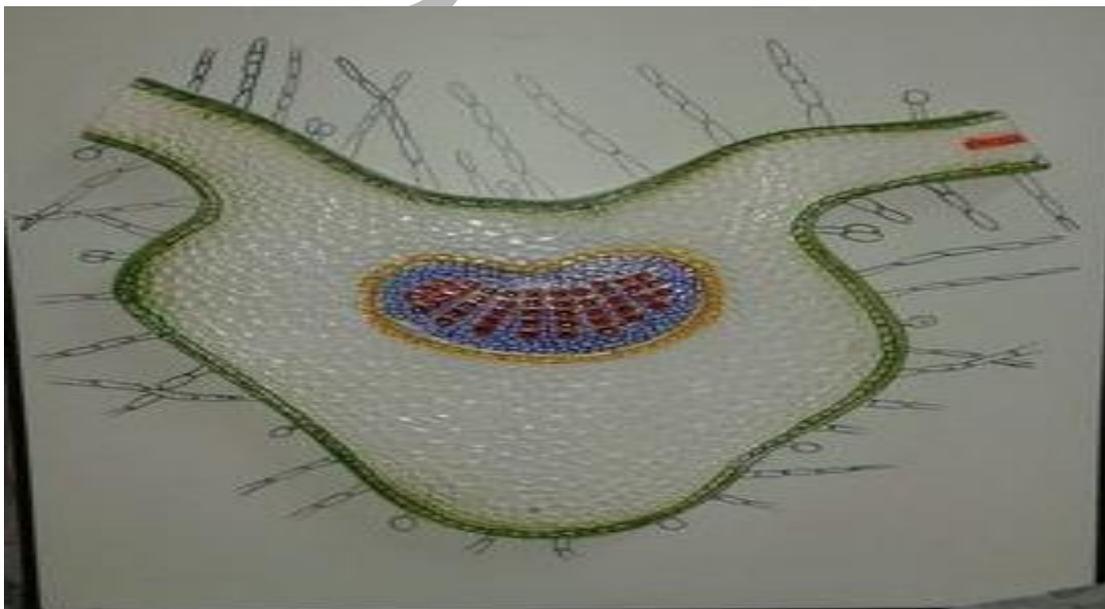


**Midrib:**

- The dorsal surface of the midrib is strongly convex . Below the upper epidermis and above the lower epidermis are seen thin strips of collenchymas. The vascular bundles (phloem and xylem) are surrounded by a distinct endodermal layer, the cells of which contain abundant starch. Distinct tissue can be seen on the dorsal surface and well developed tissue towards the ventral surface of the midrib



**Fig. 3: T. S. of *Digitalis purpurea* leaf**





## INTRODUCTION

**Biological Source:** *Digitalis lanata* Linn

**Part used :** Dried leaves

**Family:** Scrophulariaceae

**Synonyms:** Woolly fox glove, Grecian Fox glove



## GEOGRAPHICAL SOURCE:

The plant is a biennial herb. It grows wild throughout Europe. It is cultivated in Holland, North America and India.

## DESCRIPTION

### MACROSCOPY

- **LEAVES :** Shape: sessile, linear, and lanceolate.
- Size: About 30 cm in length, 4 cm broad
- Apex: Acute.
- Margin: Entire.
- Vein leave: Midrib at a very acute angle.
- **FLOWERS :** are grouped in a long and dense raceme. Calyx is pubescent. Corolla is creamy white with brown veins. Deeply bilabiate,

### MICROSCOPY :

- **Upper epidermis :** Single layered, covered with a thick cuticle, cells have wavy and thick walls; multicellular, uniseriate covering trichomes and glandular trichomes with unicellular stalk. Stomata are also seen occasionally on the upper epidermis.



- **Mesophyll:** It is differentiated into palisade and spongy parenchyma.
- **Palisade:** Two layered, loosely arranged and does not form a continuous band throughout as it is absent above the vascular bundles of lamina.
- **Spongy parenchyma:** Many layered and shows distinct transversely cut vascular bundles as in the midrib.
- **Lower epidermis:** Identical to upper epidermis but numerous stomata

#### Midrib:

- The dorsal surface of the midrib is strongly convex. Below the upper epidermis and above the lower epidermis are seen thin strips of collenchymas. Rest of the midrib is filled with cortical parenchyma.
- An arc shaped vascular bundle is present more towards the ventral surface (upper epidermis) of the midrib. The vascular bundle is surrounded by distinct endodermal layer, the cells of which contain abundant starch

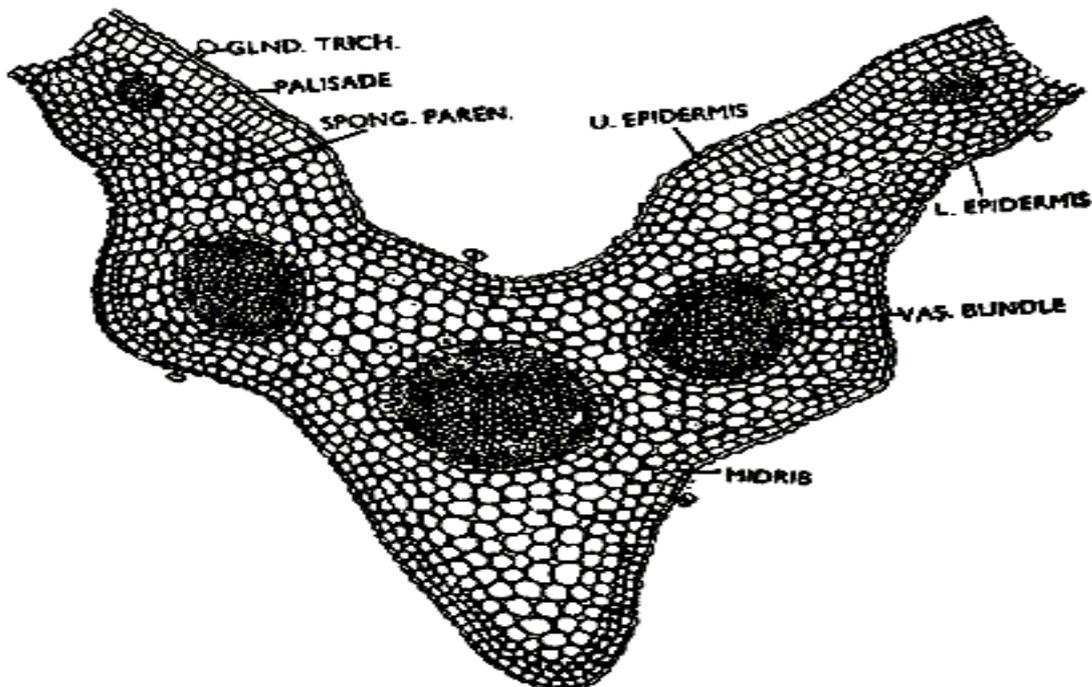


Fig-5: T.S. of *Digitalis lanata* leaf

**CHEMICAL COMPOSITION*****Digitalis purpurea***

- The major constituents are the cardenolide glycosides (0.1 to 0.4%) , Purpurea Glycoside A and Purpurea Glycoside B . 30 glycosides are characterised. Series A predominates with more than 50% concentration

Series	Primary Glycoside	Secondary Glycoside	Aglycone	Substitution in the main structure
A	Purpurea Glycoside A	Digitoxin, Digitalin	Digitoxigenin	3 $\beta$ ,14 $\beta$ di OH
B	Purpurea Glycoside B	Gitoxin,	Gitoxigenin	3 $\beta$ ,14 $\beta$ , 16 $\beta$ tri OH
E	Purpurea Glycoside E	Gitaloxin,	Gitaloxigenin	3 $\beta$ ,14 $\beta$ , di OH 16 OCHO

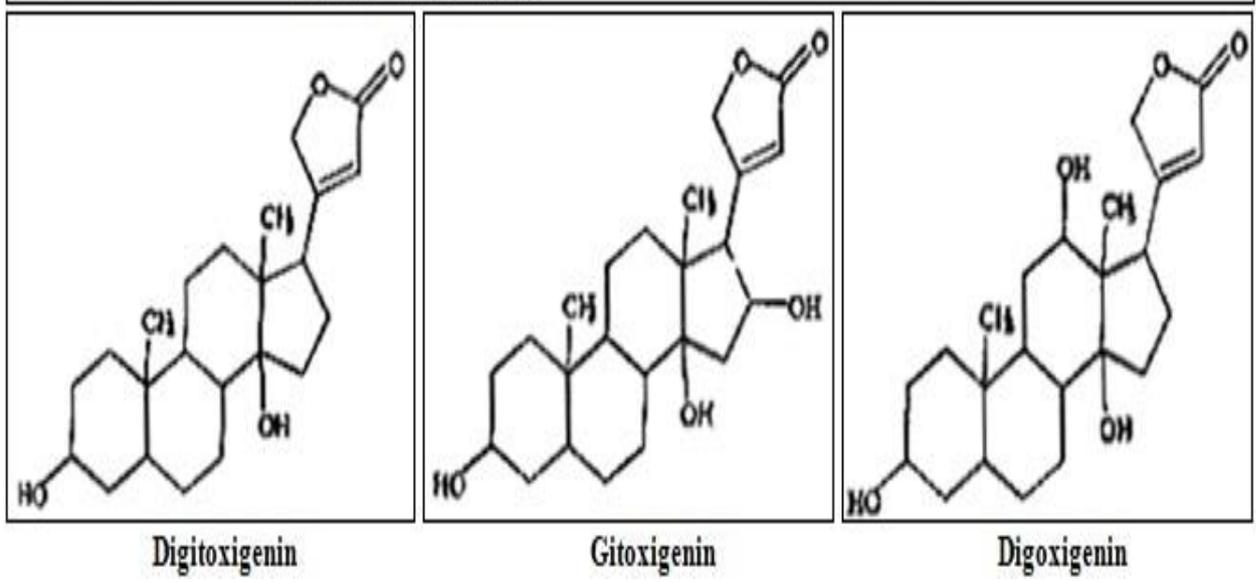
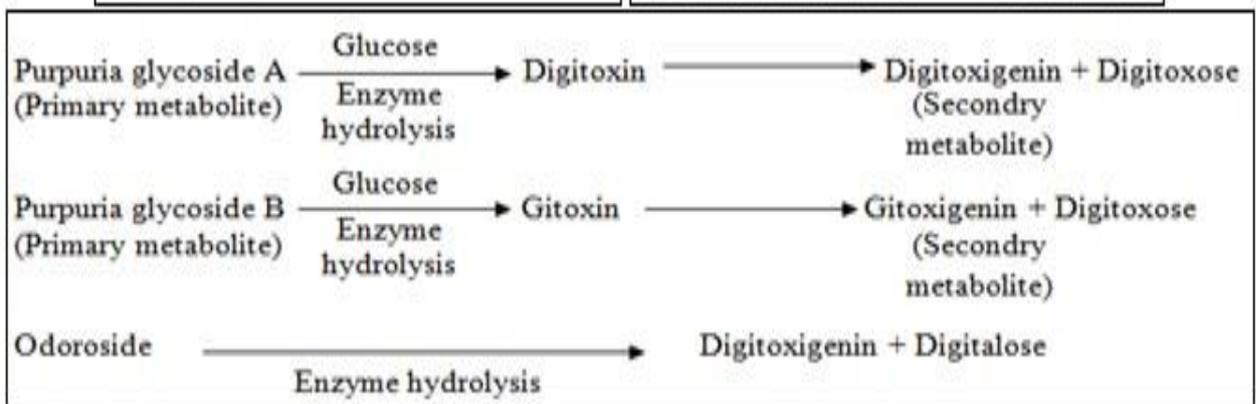
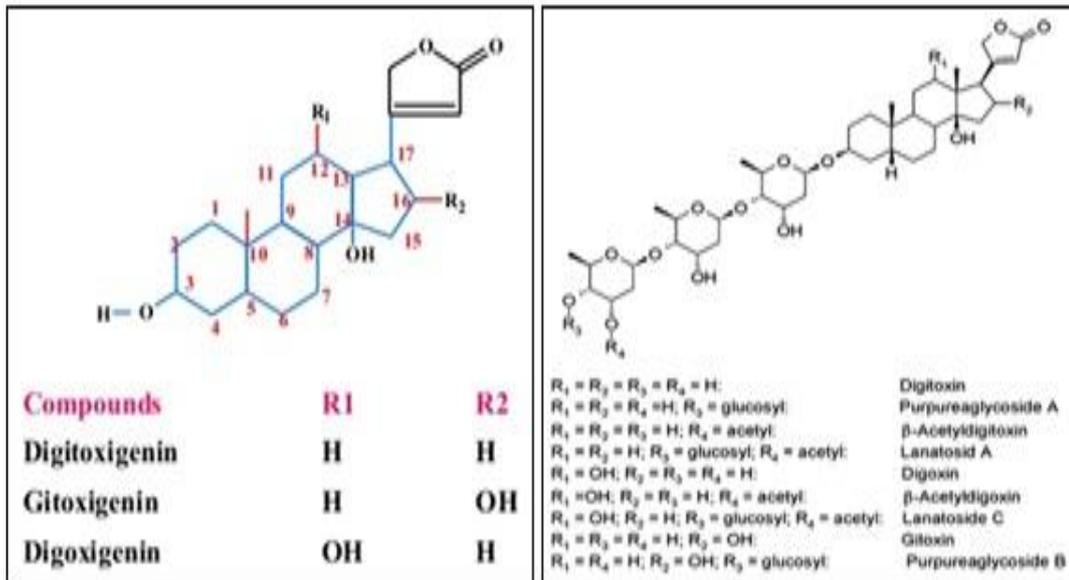
The sugar molecule is attached to the 3<sup>rd</sup> position and it comprises of three molecules of D – digitoxose and one molecule of glucose

- Minor cardiac glycoside - Strosposide : Gitoxigenin D-digitaloside ,  
Digiproside : digitoxigeninD-fucoside
- Flavonoids – Flavones and Flavone glycosides
- Anthraquinones – Methoxylated derivatives of 2- methyl anthraquinone and alizarin derivative
- Saponins – Digitonin and tigonin.
- Digitanol Glycosides: Digitalonin

***Digitalis lanata* Linn**

The major constituents are the cardenolide glycosides (1%) , Lanatoside A and Lanatoside C Series C predominates with more than 50% concentration

Series	Primary Glycoside	Secondary Glycoside	Aglycone	Substitution in the main structure
A	Lanotosides A	Acetyl Digitoxin,	Digitoxigenin	3 $\beta$ ,14 $\beta$ di OH
B	Lanotosides B	Acetyl Gitoxin,	Gitoxigenin	3 $\beta$ ,14 $\beta$ , 16 $\beta$ tri OH
C	Lanotosides C	Acetyl Digoxin	Digoxigenin	3 $\beta$ ,14 $\beta$ , 12 $\beta$ tri OH
D	Lanotosides D	Acetyl Diginatin	Diginatigenin	3 $\beta$ ,14 $\beta$ , 12 $\beta$ , 16 $\beta$ tetra OH
E	Lanotosides C	Acetyl Gitaloxin,	Gitaloxigenin	3 $\beta$ ,14 $\beta$ , di OH 16 OCHO





### CHEMICAL TEST :

- **Raymond's Test:** To the drug, add a few ml of 50% ethanol and 0.1 ml of 1% solution of m- dinitrobenzene in ethanol. To this solution, add 2-3 drops of 20% sodium hydroxide solution. Violet color appears, this is due to the presence of an active methylene group.
- **Legal Test:** To the drug, add a few ml of pyridine and 2 drops of nitroprusside and a drop of 20% sodium hydroxide solution. A deep red color is produced.
- **Killer Killiani Test:** Glycoside is dissolved in a mixture of 1% ferric sulfate solution in (5%) glacial acetic acid. Add one or two drops of concentrated sulphuric acid. A blue color develops due to the presence of deoxy sugar.
- **Xanthydroxol Test:** The crude is heated with 0.1 to 5% solution of xanthydroxol in glacial acetic acid containing 1% hydrochloric acid. Red color is produced due to the presence of 2-deoxysugar.
- **Keddes Test:** The use of an aromatic nitro derivative (3,5 dinitrobenzoic acid) which in alkaline medium forms a colored product with the lactone – purple red colour. Negative for bufadienolides
- **Fluorescence reaction :** Under acidic condition – Cardiac glycoside forms fluorescent dehydrated derivatives 14- dehydroderivative. A trienone is formed which has three double bond conjugated with C=O.

### ADULTERANTS

- *Verbascum thapsus* also known as Mullein leaves. These leaves are covered with large woolly branched candelabra trichomes
- *Primula vulgaris* (Primrose leaves) can be detected by the presence of long eight to nine celled covering trichomes in them
- *Symphytum officinale* (Comfrey leaves) , this leaves contains multicellular trichomes forming hook at the top
- *Inula conyza* ( Ploughman`s Spikenard), may be distinguished by their greater roughness, the less divided margins.

### THERAPEUTIC USES :

**Cardiovascular Effects:** Cardiac glycosides are often called digitalis or digitalis glycosides, in particular, digoxin and digitoxin, The cardiac glycosides are with low therapeutic index. They are cardiotonic, having positive inotropic effect. Like other cardiac glycosides, they exert their effects by inhibiting the ATPase activity of a complex of transmembrane proteins that form the sodium-potassium ATPase pump, ( $\text{Na}^+/\text{K}^+$ -ATPase). Inhibition of the  $\text{Na}^+/\text{K}^+$ -ATPase, in turn, causes a rise not only in intracellular  $\text{Na}^+$  but also in calcium, which in turn results in increased force of myocardial muscle contractions.



**Antitumor Activity:** *D. purpurea* were identified as having cytotoxic properties, showing that apoptosis induction is a major effect of digitalis on several types of tumor cells

**Antidiabetic Effect:** Digitonin, a saponin from the seeds of *Digitalis purpurea*, improved glucose tolerance and possessed beneficial effects on serum lipids by improve antioxidant activity in rats

**Adverse Effects and Toxicity:** Digitalis is a toxic plant. At low serum drug concentrations, digitalis was well tolerated. However, it characterized by a very narrow therapeutic index, and digitalis toxicity include a low pulse rate, nausea, vomiting, and uncoordinated contractions of different parts of the heart, leading to cardiac arrest and finally death

## REFERENCES

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