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Pharmacognostical and preliminary phytochemical evaluation of Jati patra (Jasminum grandiflorum Linn.)

Research article

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Abstract

The *Jati* patra (*Jasminum grandiflorum Linn.)* belongs to the *Oleaceae* family. It is a widely grown plant throughout India. It has *tikta, kashaya* (bitter, astringent) rasa, *ushna veerya (hot in potency), katu vipaka (pungent) and laghu (light), snigdha (unctuous), mridu (smooth) guna (properties).* It is used for the management of *Vrana* (wounds), *Mukha roga* (oral cavity diseases), *Netra roga* (eye diseases), *kustha* (all types of skin diseases) etc. In spite of extensive utility, such study was not carried out. Hence, an attempt has been made to analyze it for its pharmacognostical and preliminary phyto-chemical screening by using different analytical tests. Transverse section of leaf shows, single layer of epidermal cells with unicellular trichomes, starch grains, 10 to 14 stomatal cells, 16.5m stomatal index, 10 to 16 per sq. mm Vein islet and vein termination number an average of 15 to 16 per sq. mm palisade cells. Its leaf indicates maximum solubility in 90% Ethyl alcohol. Preliminary phyto-chemical analysis shows the presence of carbohydrates, tannins, sterols, flavanoids, saponins, alkaloids, etc.

Key words: *Jati , Jasminum grandiflorum Linn, Pharmacognostical, Phytochemical.*

Introduction:

Now a day, single drug therapy is becoming popular and many plants were screened to understand their pharmacognostical, phytochemical and pharmacological actions. *Jati* (*Jasminum grandiflorum Linn*) is one of the plant origin drug, which has been mentioned for its varied benefits in the classical literature of Ayurveda. It is using for different ailments like *shiroroga* (diseases of head), *vrana* (wounds), *kustha* (skin diseases), *netra roga* (eye diseases), *mukha roga* (diseases of oral cavity) and *danta roga* (dental disorders) etc. produced by both *nija* (internal) and *agantuja* (external) *karanas* (causes) [1]. It possesses *tikta kashaya rasa* (bitter and astringent taste), *laghu, snigdha mridhu* (light, unctuous, mild properties) *guna*, *usha veerya (hot in potency)* and katu vipaka (becomes pungent after digestion) [2]. On scientific background the present drug *Jati* (*Jasminum grandiflorum Linn*) was subjected for different studies to know its pharmacognostical characters, chemical constitution present in the selected part of plant.

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Materials and Methods:

(A) Pharmacognostical Study.

Materials: The materials collected for the studies were.

Drug: *Jasminum grandiflorum* Linn. leaf.

Collection of Materials: The leaves of *Jasminum grandiflorum* Linn., were collected freshly from herbal garden of B.N.M. Rural Ayurvedic medical college and PG centre Bijapur.

Equipments: Sense organs

Methods: Organoleptic method.

(i) Organoleptic characteristics: In this method nature of the leaves, colours, taste, size, shape, odour, arrangement of leaves, etc characters were studied with the help of sense organs.

(2) Microscopical study [3]:

Materials: The materials collected for the studies were.

Drug: Fresh leaves of *Jasminum grandiflorum* Linn. (*Jati*).

Equipments: Compound microscope, eye piece, camera lucida, glass slides, cover slips, watch glass, camel brush, mountain brush, filter paper, blades, spirit lamp, pipettes.

Chemicals: Phloroglucinol, Chloral hydrate, conc. HCl. Glycerin, Iodine.

Methods:

1) Section Method.
2) Staining Process Method.

1) Section Method:

A fresh healthy, non-infected leaf of *Jati* was selected. It was cut at its mid rib and taken the sample into small square section of potato, then hold the sample vertically in between the thumb and fore finger, with the help of new blade, 10 to15 sufficient thin transverse sections were taken; thick and oblique sections were rejected. Then with the help of mountain hairbrush, the thin selected sections were transferred to the watch glass containing water.

2) Staining process method:

Selected thin transverse section of the sample was taken and transferred it on a slide with the help of mountain hairbrush. Add a drop of water. Added few drops of chloral hydrate solution and allowed to heat for two to three minutes. Added equal proportions of phloroglucinol and conc. HCl, warm gently on a flame and cool it. Finally added a drop of glycerin and covered the section avoiding air bubble carefully with cover slip. Focused the section under microscope and the arrangements of cells were studied.

3) Physical (Microscopical) evaluation [4]**:**

Methods: Stomatal number, stomatal index, vein islet number, vein termination number, palisade ratio.

Methodology:

3-4 pieces of the fresh leaf are cut from the middle portion of the lamina avoiding midrib and margin. These sections were taken in a test tube and boiled with chloral hydrate solution in a water bath, until they were clean enough for observation. The leaf sections were taken in watch glass and one of them was mounted on a glass slide with lower surface of the leaf facing up wards. The stage micrometer was focused (1mm) and the camera lucida was fixed in such a way that the aperture of it is in the same line with that of the eyepiece. Black drawing sheet was placed on the same side of the microscope where camera lucida was fixed. Using a white pencil draw a square of 10×10 cm length.

Then the stage micrometer was removed & the slide was mounted with the leaf specimen & focus in the same way. The square drawn on the paper was adjusted in such a way that it lies exactly in the middle of the field of vision and image of the leaf piece mounted appears to be superimposed on the square of the drawing sheet. Starting from one side all the vein islets inside the square as well as on the boundary was traced. The vein let termination within the square only was taken into account.

Stomatal number:

Methodology: For determining the Stomatal index. Clear the pierce of the leaf by boiling in chloral hydrate solution. Peel

out the upper & lower epidermis by using forceps. Keep it on slide and mount in glycerin water. Draw a square of 1 mm by means of stage micrometer, fixed the camera Lucida and placed the slide with clear leaf on the stage, trace the epidermal cell & stomata. Counted the numbers of stomata present in the area of 1sq. mm. Included the cell of at least half of its area lies within the square. Record the result for each of the ten fields and calculated the average number of stomata per sq.mm.

Stomatal index:

For determining the stomatal index, the fragment of leaf of 5x5 mm^2 in size was taken in a test tube containing 5 ml of chloral hydrate solution. It was heated in a water bath until the fragment become transparent. Upper and lower epidermis peeled out. The clear one is mounted on the glass slide by adding few drop of chloral hydrate solution. Draw a square of 10x10 cm on a black drawing sheet. The camera lucida was fixed, placed the mounted slide on stage of microscope. Number of stomata & epidermal cells were counted in each field. Calculation of stomatal index by using following formula;

$$I = \frac{S}{E+S} \times 100$$

I - Stomatal index
S – Stomatal Number
E – No. of Epidermal cells

Palisade ratio:

Methodology: Take healthy leaf, cut the lamina of the leaf avoiding the midrib. Sections of were boiled in test tube containing chloral hydrate. The upper & lower epidermis was peeled. Clear fragment of leaf was mounted on glass slide in such a way that the upper surface should face up ward. The camera lucida and drawing board were arranged. The outline of four cells of epidermis traced off. Then by using high power objective focused down to palisade layer and traced off sufficient cells to cover epidermal cells. Palisade cells under the four epidermal cells were counted. Included the palisade cells in the count when more than half is within the area of epidermal cell and exclude it when less than half was within the area of epidermal cells. Palisade ratio was calculated by dividing the total number of palisade cell by 4.

Vein islet Number:

Methodology: 3-4 piece of fresh leaf was cut from the middle portion avoiding the mid-rib. These pieces of leaf were taken in a test tube containing chloral hydrate and heated in a water bath for 30 min. The upper and lower epidermis was peeled out by using forceps. Mount a piece of leaf fragment on glass slide. For this study, 6x eyepiece and low power objective were used. Camera lucida was fixed and 10 x 10 cm square was drawn. Number of vein islet starting from one side of the square as well as on the boundary was counted.

Vein let termination:

Methodology: The number of vein-let termination present within the square was counted.

4) Determination of p^H:

Materials:

Drug: *Jati* patra extract.

Equipment: Digital calibrates P^H.

Method: 50 ml of distilled water was taken in beaker; digital P^H meter was immersed up to the maximum immersion level. Allowed the reading to stabilize and using a screwdriver turned the p^H calibration trimmer to read 7.0. 5 gms of *Jasminum grandiflorum* Linn., leaf extract was added to 50 ml of distilled water in a beaker, stirred well with glass rod gently. At uniform suspension, digital p^H meter was immersed, observed for maximum immersion and reading was recorded [5].

B) MATERIALS FOR PRELIMINARY PHYTOCHEMICAL STUDY:

Materials for Preliminary Phytochemical Test:

Solubility of *Jasminum grandiflorum* Linn.

Materials: Funnels, beaker, filter paper, test tube, fine powder of *Jasminum grandiflorum* Linn.

Solvents: 1) Ethyl alcohol 2) Ethyl acetate 3) Petroleum Ether 4) Chloroform 5) Methane 6) Distilled water 7) Solvent ether 8) Acetone 9) Benzene 10) Toluene 11) Xylene 12) Carbon tetrachloride.

Methodology:

5 gms fine powder of *Jasminum grandiflorum* Linn. was added to the different solvent taken in a test tube and mixed well and allowed to stand for certain period. Then the mixture was filtered through filter paper kept in different funnels. The filter paper which contains fewer residues considered as more soluble in that solvent.

I. Extraction:

Materials:

Drug: Coarse powder of *Jasminum grandiflorum* Linn.

Equipments required: Soxhlet apparatus of 1000ml, round bottom flask, water condenser with distillation apparatus. Beaker's of 500ml, measuring cylinder, weighing machine, filter paper, magnetic stirrer, porcelain glass chips. (Boiling chips).

Chemical: 90% Ethyl alcohol.

Methods: The air dried leaves of *Jasminum grandiflorum* Linn., was subjected to exhaustive extraction by soxhlet apparatus around 18 hrs with 90 % ethyl alcohol [6]. After the extraction the solvents were distilled off to obtain semisolid extract, concentrated on magnetic stirrer [7].

2) Preliminary phytochemical test:

Materials:

Drug: Extractive sample of *Jasminum grandiflorum* Linn.

Equipments: Test tube, test tube holder, test tube stand, spirit lamp, pipette, glass rods, beakers 50ml -250ml,conical flash, water bath, burner.

Chemicals : 10 % conc. H_2SO_4, Chloroform solution, Acetic anhydride, Sulphar powder, Soda lime, Million's reagent, Mercuric sulphate, 10 % Sulphuric acid, 1 % Sodium nitrate, 5 % Sodium hydroxide, 1 % Copper sulphate, 10 % Tannic acid, Acetic anhydride, Acetyl chloride. Zinc chloride, Mayer's reagent, Wagner's reagent, Hager's reagent, Dragendorff's reagent (potassium bismuth iodide) ,Ammonium Renikate, Molish's reagent, Barford's reagent, Benedict reagent, Saponin, Ferric chloride, fragments pieces of Magnesium ribbon and conc. Hydrochloric acid, Zinc dust, Sodium hydroxide, 10 % Lead acetate, Bromine water, Ferric chloride, Lead acetate.

Methods:

i) Test for sterols:

a) Salkowski's test: To 2ml extract added 2ml chloroform and 2 ml conc H_2So_4, shaked well.

b) Liebermann – Burchard reaction: To 2ml extract few drops of chloroform + 2ml acetic anhydride + 2 drops conc. H_2So_4 from side of test tube.

c) Sulphar test: Added a pinch of Sulphar powder to the solution of extract.

ii) Test for proteins: Preparation of test solution: 0.5 gm of sample extract was added to 100ml of water and heated. This solution was used for following tests.

a) Biuret test (General test): To 3 ml of test solution added 4 % sodium hydrate and few drops of copper sulphate solution.

b) Million's test: To 3 ml of test solution added 5 ml of Million's reagent.

c) Xanthoprotein test: To 3 ml of test solution added 1 ml conc. H_2So_4 and boiled the precipitate and added few drops of ammonium hydroxide.

iii) Test for Triterpenoids:

a) Tschugajew test: To 2ml extract in a test tube, added 2 ml acetyl chloride and

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pinch of zinc chloride, boiled in water bath.

iv) Test for Alkaloids: Preparation of test solution: Evaporated the alcoholic extract, to residue added dilute HCl, shaked well and filtered by using the filtrate the following test are performed.

a) Mayer's test: To 2ml of filtrate in a test tube added few drops of Mayer's reagent

b) Wagner's reagent test: To 2 ml of filtrate in a test tube added few drops of Wagner's reagent.

c) Hager's test: To 2ml of filtrate in a test tube added few drops of Hager's reagent

d) Dragendorff's test: To 2ml filtrate in a test tube added few drops of Dragendorff's reagent.

v) Test for carbohydrate:

a) Molish's test (General): To 2ml extract in a test tube added few drops of Molish's reagent, shaked well and added few drops of H2So4 from the side of test tube.

b) Barfoed's test (Monosaccharides): Added equal volume of test solution and Barfoed's reagent in a test tube and heated for 2 min in water bath.

c) Benedict's test: (Reducing Sugar): Mixed equal volume of test solution and Benedict reagent in a test tube and heated for 5 min in water bath.

vi) Test for Saponin's:

a) Foam test: The drug extract was mixed with water and shaked vigorously.

b) Hemolytic test: To one drop of blood taken on the glass slide and added drug extract.

vii) Test for Tannins:

a) Ferric chloride test: To 2ml extract added few drops of 5 % $Fecl_3$ solution in a test tube

b) Lead acetate test: To 2ml extract in a test tube added few drops of lead acetate.

c) Bromine water test: To 2ml extract in a test tube added few drops of Bromine water.

viii) Test for Flavonoid's:

a) Shinoda test: To 2ml extract in a test tube added 5ml of 95 % ethanol and few drops of conc. HCl and 0.5gm magnesium turnings.

b) Lead acetate test: To 2ml of extract in a test tube added few drops of lead acetate solution.

c) Alkaline reagent test: To 2ml of extract in a test tube added increasing amount of sodium hydroxide, yellow ppt disappears after addition of acid.

d) **Zinc –HCl-reduction:** To 2ml extract in a test tube added a pinch of zinc dust & few drops of conc. HCl and allowed to stand [8].

Observations and results:

A) Observation of Pharmacognostical study:

The pharmacognostical study includes:

1) Morphological observation, 2) Microscopical observation, 3) Microscopical evaluation (Leaf constituents), 4) Determination of p^H.

1) Morphological observation:

Table No. 1. Showing morphological observation of *Jati* patra:

Colour	Brownish green
Taste	Astringent, bitter
Size	Length-7.5cms, Width-2.5cms
Shape	Ovate-Lanceolate, rhomboid-oblong
Odour	Bitter
Nature of leaf	Glabrous
Touch	Smooth ,Unctuous

a) Shape of leaf:

Table No. 2. Showing shape of *Jati* patra:

Shape	Ovate –Lanceolate Oblong-Rhomboid
Length and width	Length-7.5cms, Width-2.5cms.
Midrib	Prominent on ventral surface, divided in to vein,

	Vein lets.
Phyllotaxy	Opposite.
Apex	Acuminate.
Base	Petiolate, leaflets are sessile, oblique.
Venation	Midrib, vein, vein lets.
Dorsi-Ventral leaf	Dorsally glabrous, veins are prominent on ventral surface. Deep greenish in colour.
Margin	Wavy.

1) Microscopical observations:

a) Epidermis: It is the outer most layer of leaf. It is single layered on both side, covered by thick striated cuticle hairs. It is polygonal in shape. The epidermal cells of the leaf are having two surfaces. A different type of stomata based on the arrangement of epidermal cells has been seen. Trachoma's are variable outgrowth of epidermal cells. It is observed that the epidermis of *Jati* having unicellular trachoma cells.

b) Upper cuticle: It is thick, mostly unicellular with pointed apex, glandular. It has cylindrical compact cells, which continue as collenchymas around the midrib.

c) Lower cuticles: It has rounded clustered cells.

d) Parenchyma: It occurs as general tissue in this plant. 4-6 layers of parenchyma present towards lower epidermis. It is acidimetric, thin walled and the simplest type of cells and they have intracellular spaces.

e) Sclerenchyma: It is hard supporting tissue with heavy secondary thickenings. They are roundly isodiametric, it found in bundles covering the vascular bundles on either side.

f) Collenchyma: It is composed of cellulose. It is 2-5 layered, pericycle represented by slightly lignified small fiber group. These are found towards lower surface that is around the circumference of the midrib.

g) Xylem: They are arranged in vertical series and separated by phloem. The cell of xylem shows pink colouration after staining. The structural elements observed in xylem are as follows: **I) Tracheids**: It has lignified thickened and pitted cell wall.

II) Vessels: It consists of a vertical series of trachied like segments. Whereas the type of vessels shows complete dissolution of the end wall to give slit like opening.

h) Phloem: It shows reddish brown colouration after staining. They are arranged in a vertical series. The cell phloem is oval and small. The xylem and sclerenchymal sheath surrounds them.

i) Starch: The small granules of starch are seen in chloroplast by the condensation of sugar. It looks like bluish black colour after staining with N/50 Iodine solution.

3) Microscopical evaluation (Leaf constituents):

i) Observation of Stomatal number and stomatal index: Each stomata consists of two guard cells and the spore was counted as a single unit. Stomatal index was the percentage proportion of stomata on one side and epidermal cells plus stomata on other side. Stomatal number is 12-18/ mm^2 and stomatal index is 16.5m.

ii) Vein islet:

The number of vein islet per square mm was termed as vein islet number. This number per unit area of leaf was constant and it is 20/ mm^2.

iii) Vein let termination:

Starting from one side all the vein islets inside the square as well as on the boundary is to be traced. The vein-let termination within the square only was taken into account. To get exact values it is necessary to take reading from four such squares and trace the vein islet within it.

The value obtained from vein islet and vein let termination was calculated as an average 12/ mm^2.

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i) Observation of Palisade ratio: The average number of palisade cells present beneath each upper epidermal cells are 20-25/ mm^2.

4) DETERMINATION OF p^H:

Table No.3. Showing p^H value of *Jati* patra extract.

Distill water normal p^H	7.0
Acidic media p^H	0 -7
Alkaline media P^H	7-14
***Jasminum grandiflorum* Linn. extract p^H**	**5.4**

B) Phytochemical Observations:

1) Observation of solubility test:v The residue was very minimal in ethyl alcohol compare to other solvents.

i) Solubility tests:

Table No. 4. Showing solubility of *Jati* patra.

Solvent	**Soluble**	**Sparingly soluble**	**Insoluble**
Distilled water	-	+	-
Solvent ether	-	-	+
Petroleum ether	-	+	-
Acetone	-	-	+
Benzene	-	+	-
Toluene	-	-	+
Chloroform	-	+	-
Ethyl alcohol	+	+	-
Xylene	-	-	-
Carbon tetra chloride	-	-	-

ii) Extraction:

Table No. 5. Showing extraction of *Jati* patra.

Leaves of *Jasminum grandiflorum* Linn	**Solvent**	**Extract**
Coarse leaves powder 60gms	650ml ethyl alcohol	40gms

2) Observations of preliminary phytochemical test:

Table No. 6. Showing observations of preliminary phytochemical test:

Tests	**Observations**	**Results:**
i)Test for sterols:		
i) Salkowski's test	Turns into red colour	**+ ve**
iii)Sulphar test	Sulphar powder sinks and settled at the bottom of test tube	**+ ve**
ii) Test for proteins:		
i)Biuret test	Violet and pink colour observed.	**+ ve**
ii) Million's Test:	First white precipitate by warming turns into brokered and dissolves giving red colour solution.	**+ ve**
iii)Xanthoprotein Test:	White precipitate observed, it turns into yellow by boiling.	**+ ve**
iii) Test for Triterpenoids		
ii) Tschugajew Test:	Zinc chloride powder sinks and settled at the bottom of test tube.	**+ ve**
iv)Test forAlkaloids:		
i) Mayer's Test:	White coloured precipitate observed.	**+ ve**

ii) Wagner's Test:	Reddish brown ppt observed.	+ **ve**
iii) Hager's Test:	Yellow ppt seen.	+ **ve**
iv)Dragendorff's Test:	Orange brown ppt observed.	+ **ve**
v)Test for carbohydrates:		
i) Molish's Test:	Violet ring formed at the junction of two liquids.	+ **ve**
iii) Benedict's Test:	First appears green colour and after heating, it turns to yellow.	+ **ve**
vi)Test for Saponins:		
i) Foam Test:	Persistence foam observed.	+ **ve**
ii)Hemolytic Test	Hemolytic zone appears.	+ **ve**
vii) Test for tannins:		
i) Ferric chloride test:	Deep blue-black colour was seen.	+ **ve**
ii) Lead acetate test:	White ppt was seen after adding lead acetate.	+ **ve**
viii)Test for Flavonoids:		
i) Shinoda Test:	Pink colour observed.	+ **ve**
ii) Lead acetate:	Yellow coloured ppt observed.	+ **ve**
iii) Alkaline reagent test:	Yellow coloured ppt observed.	+ **ve**
iv) Ferric chloride test:	Deep blue-black colouration was observed.	+ **ve**
vi)Zinc HCl reduction test:	Zinc dust sink and settled at the bottom of test tube.	+ **ve**

DISCUSSION:

The pharmacognostical study suggests the procedures of organoleptic study, which comprises the morphological, microscopical and physical evaluation of the present undertaken part of *Jati* (*Jasminum grandiflorum* Linn.). Organoleptic method expresses the appearance, texture, odour, taste. This plays an important role in identification and establishes a standard protocol of drug. The leaf is bitter, astringent in taste, glabrous, ovate, acute tip and imparapinnatelly compound leaf, plant has opposite phyllotaxy.

The microscopical study of *Jati* patra, showed 1-2 layers of epidermal cells, with trachoma on both upper and lower epidermis. It is thick, unicellular and pointed apex. Below the upper epidermis single layer of columnar palisade cells arranged compactly and at regular in travels present an air cavity formed by the stomatal cells. Parenchymal cells of 4 layers present towards the lower epidermis. Sclerenchyma is an isodiametric cell. It continues as pericycle around the mid rib. Inside this, compact cells of collenchyma which separates vascular bundles i.e. xylem and phloem. Presence of starch granules of bluish black colour are seen in section leaf.

The guard cells as single unit of stomata and final proportion of stomata with the epidermal cells are taken in percentage ratio giving the resultant value of 10 to 14 stomatal cells and stomatal index 16.5m and having 10 to 16 per sq.

mm. vein islet and vein termination number. The palisade cells are observed at upper epidermal cells at an average of 15 to 16 per sq. mm.

Discussion on phytochemical study:

The medicinal value of drug is attributed to the presence of both active and non-active principles of drug, such as alkaloids, glycosides, sterols, tannins, saponins, flavanoids, triterpinoids, starch, proteins, carbohydrates etc. respectively. In the present study, all the active components of *Jasminum grandiflorum* Linn., was tested quantitatively by employing specific chemical tests.

Before carrying out the phytochemical tests, the drug was subjected for its solubility in different solvents like ethyl alcohol, chloroform, distill water etc. and maximum solubility was observed in 90% ethyl alcohol. Then the drug was subjected for exhaustive extraction with ethyl alcohol in Soxhlet apparatus, and extract was subjected for distillation. The distilled sample was again subjected for magnetic stirrer to evaporate the ethyl alcohol residue present in the extract. Then the extractive sample was subjected for its phytochemical investigations by using specific methods. It shows presence of tannins, sterols, alkaloids, saponins, triterpinoids, starch, proteins, carbohydrates, and flavanoids. The acidic and alkaline nature of extract was determined by using the Caliberate p^H meter. It was found that, the p^H of *Jasminum grandiflorum* Linn., was 5.4. It indicates the acidic nature, hence it act as antimicrobial and antiseptic.

Conclusions:

1. *Jati* patra (*Jasminum grandiflorum Linn*) is one of the easily available and more economical drug.
2. It shows presence of tannins, sterols, alkaloids, saponins, triterpinoids, starch, proteins, carbohydrates, flavanoids and acid p^H i.e. 5.4.

Recommendations:

It is recommended to evaluate the effect *Jati* (*Jasminum grandiflorum* Linn) on patients, to estimate *ekmoolika dravya prayoga* (single drug therapy) by using *patra kalka* (leaf paste) and extract on the basis of chemical constituents seen in phytochemical analysis in classically indicated diseases.

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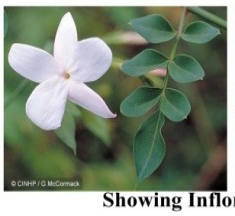
Figure 1

Photo plate showing natural habitat of Jati.

Natural Habitat of Jati. (*Jasminum grandiflorum* Linn)



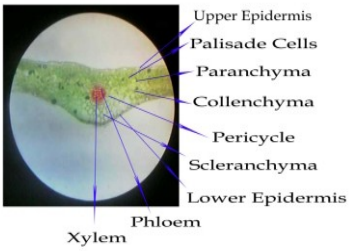
Showing Inflorescencs of Jati.

Dried leaf of Jati.

Coarse powder of Jati Patra

Figure 2

Photo plate showing Microscopical study of Jati.(*Jasminum grandiflorum* Linn)



Stomatal number | Vein Islet& Vein terminstion | Stomatal Index

Figure 3

Photo plate showing extraction of Jati patra

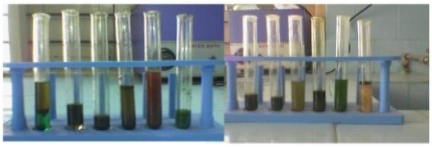
Distillation

Extraction by using Soxhlet app.

Magnetic stirrer →

Preliminary phytochemical analysis

Water Bath



Test tube showing phytochemical analysis