

PHARMACOGNOSTICAL STUDIES OF *ANGELICA GLAUCA* EDGEW.

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ABSTRACT

Pharmacognostic studies of the root and rhizome of *Angelica glauca* Edgew., a plant of promising drug value is presented. The present study deals with the distribution, uses, collection and commerce, macroscopical and microscopical characters of the root and rhizome, microchemical tests, study of the pondered drug and physical constants.

INTRODUCTION

Angelica is a well reputed genus for its medicinal species, well distributed in the old & new worlds and in the orient. It has a *pagan* of tradition and was used in connection with ceremonies before the Christians adopted and used it at spring time festival of Annunciation. *Angelica archangelica* is found in Europe and Asia and every part of the plant is used in medicine. The whole plant is cordial and sudorific; it has been always famous against pestineutical and contagious diseases. The stems are candied in sugar syrup and candied angelica stalks are a popular sweetmeat in France & Spain. The candy is valued for its tonic properties, Leyer (1957). *Angelica* oil is distilled from seeds. It is used in confectioneries, preparation of liquers, perfumery and medicinals in Europe, Edlin (1951), Schery (1952) and Levy (1966). The stem, leaves and roots are edible and used as vegetable. The other species of *Angelica* are equally well reputed for their medicinal properties. In China & Japan *A. acutiloba* is supposed to be an important remedy for female diseases and is believed to have sedative, emmenagogue and tonic properties.

According to Monachino (1956), in China, the roots of *A. sinensis* have been used as a sedative in dysmenorrhoea. *A. kuisiana* was cultivated as a vegetable and it was lost because of its gradual replacement by other crops. The seeds are still used as condi-

ment with garlic, Hui-Lin-Li (1970). Hartwell (1971) reported the following species which have been used in different types of cancers mostly in China. *A. anomala* Ave. Lall (Breast cancer), *A. archangelica* (stomach and internal cancers), *A. glabra* Makino (Cervical cancer), *A. polymorpha* Maxim. (Naso-pharangeal thyroid and lymph node), *A. sinensis* Diels (cancer), *A. sylvestris* L. (Lip, tongue and inflammatory cancer). According to Core (1967) the fresh roots of *A. arthropurpurea* L. are poisonous and were used by Applichian aborgines for suicidal purposes. Bailey (1950), reported 60 species but according to Monachino (1956), the genus in broad sense comprises about 50 species of herbs. In India, two species i.e. *A. archangelica* L. [*Archangelica officinalis* (Moench) Hoffm.] and *A. glauca* Edgew. are found in the sub-alpine & alpine region. *A. glauca* is an important ayurvedic drug, well known for curing various ailments and diseases and is commonly known as 'Choraka'. Chemical examination of *A. glauca* fruit and root was done by Chaudhary *et al.* (1960) and Kapoor *et al.* (1972). It is a promising drug which may find its use in various formulations. It was, therefore, thought worth while to make the pharmacognostic studies of the root and rhizome of the plant that the adulteration of this drug could be checked. The present study deals with the distribution, uses, collection & commerce, macroscopical & microscopical

characters of the root & rhizome, micro-chemical tests, study of the powdered drug and physical constants.

DISTRIBUTION

In earlier records of Hooker (1879), Watt (1889), Kirtikar & Basu (1933) and Ann. (1948), the distribution of this plant was mentioned from Kashmir to Simla. But, its distribution actually extends from Kashmir to East of Kumaon. In Kashmir, it has been reported from Pushwari, in Bapand valley, Kapoor *et al.* (1953) and in Kishen Ganga valley, Handa *et al.* (1957). In Himachal Pradesh, Hattu, Dhaura Dhar range above Kangra valley, Stewart (1869); in Narkunda, Collet (1921) and in Palchak and Pani Hartu, Uniyal and Chauhan (1971); in Chamba Dist., Kapoor (1953); in Goragot, Gupta (1961).

In Uttar Pradesh, Ralam valley, Strachey (1906); in Dwali, Rao (1960); Rajkharak, Dey *et al.* (1968) and in Pindari, Laspa & Milam, Shah & Joshi (1970).

In Kedarnath, at a distance of about 3 miles in the north-west, there is a small lake known as 'Chorabari Tal'. According to local people, the surrounding slopes of this lake were full of 'Chora', and hence, the name was 'Chorabari Tal'. But, one of the authors (Shah) visited the place in 1969 and found that there was no trace of the species. Due to indiscriminate collection by the local inhabitants the species has been wiped out. The name of the place has recently been changed from Chorabari Tal to 'Gandhi Sarovar'.

MEDICINAL USES AND FOLKLORES

Kirtikar & Basu (1933) mention it as diuretic, diaphoretic, carminative, stimulant and emmenagogue; Pandey (1969) in leprosy, eczema, cough, gout, fever and as a blood purifier.

The drug is not only used in ayurveda

but also in folklore medicines. According to Bapalal (1972) *Angelica glauca* is the 'Choraka' of ayurveda and is well mentioned by Charaka, Vagbhatta and Bhavaprakash for its good appetising, carminative and aromatic properties. Stewart (1869) reported that in Punjab (Himachal Pradesh) its aromatic root is added to food to give it "celery flavour". Jain *et al.* (1971) reported that the Santals use this plant in ulcer of palate, infantile atrophy, dysentery and menorrhagia. Uniyal & Chauhan (1971) reported that in Himachal Pradesh, the roots are used as condiment in cookery and are said to be stimulant and used in dyspepsia and stomach-ache. According to Shah & Joshi (1971) in Kumaon, the roots are used in stomach troubles and the powder of the root is given to check vomiting and the food seasoned by the root is supposed to give strength and vigour to women after delivery.

COLLECTION AND COMMERCE

The root and rhizomes of *A. glauca* are sold in the markets of Kumaon & Garhwal by the name of 'Gandherain' or 'Chora'. The inhabitants of montane region collect the roots and rhizome before it starts snowing and dry them in shade where they become hard. These are cut into small pieces 4 to 7 cm and marketed at nearest towns. In Himachal Pradesh, according to Gupta (1964), Uniyal & Chauhan (1971) the drug has a moderate demand.

PLANT

The plant is 1-1.5 m tall, stem stout, erect, grooved and fistular. Leaves pinnately divided, the basal ones are ternate pinnate; leaflets oval to ovate and irregularly mucronulate-serrate; upper surface dark green, lower glaucous. Umbel compound and long stalked. Flowers white or purple. Fruits glabrous, flattened, oblong 12 by 7 mm. In young plants, the main

root comes out from the lower terminal of the root stock and goes deep in the soil and by the time, the main root, may wither away. The root and root stock become thick and increase with the age. Flowering season is from July to September.

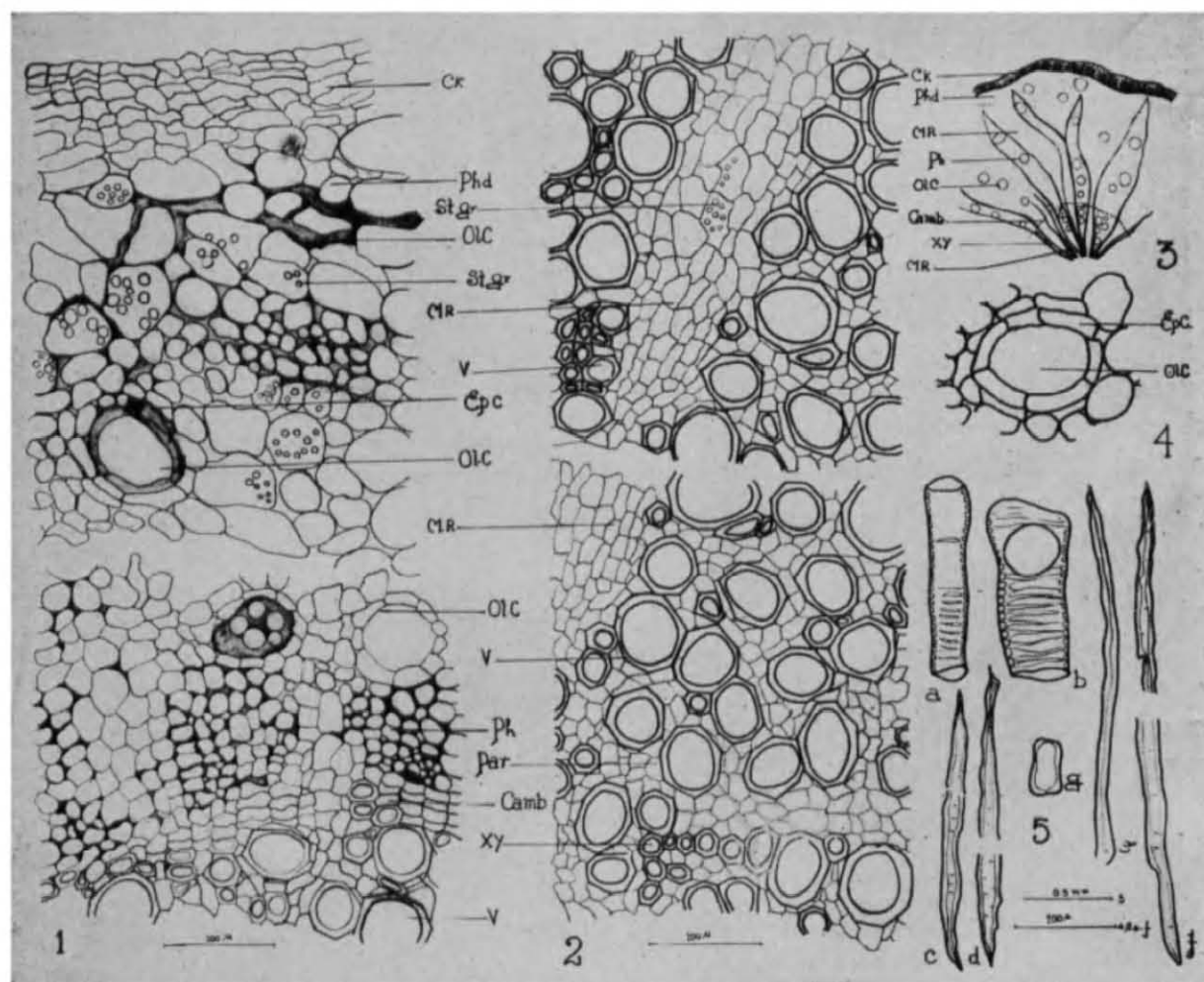
MATERIAL AND METHOD

Roots and root stocks of *Angelica glauca* which are commonly used were procured from different places of the country namely, Kumaon, Garhwal and Himachal Pradesh and after confirming the authenticity, the macro- and microscopical structures were studied. The microchemical tests for the

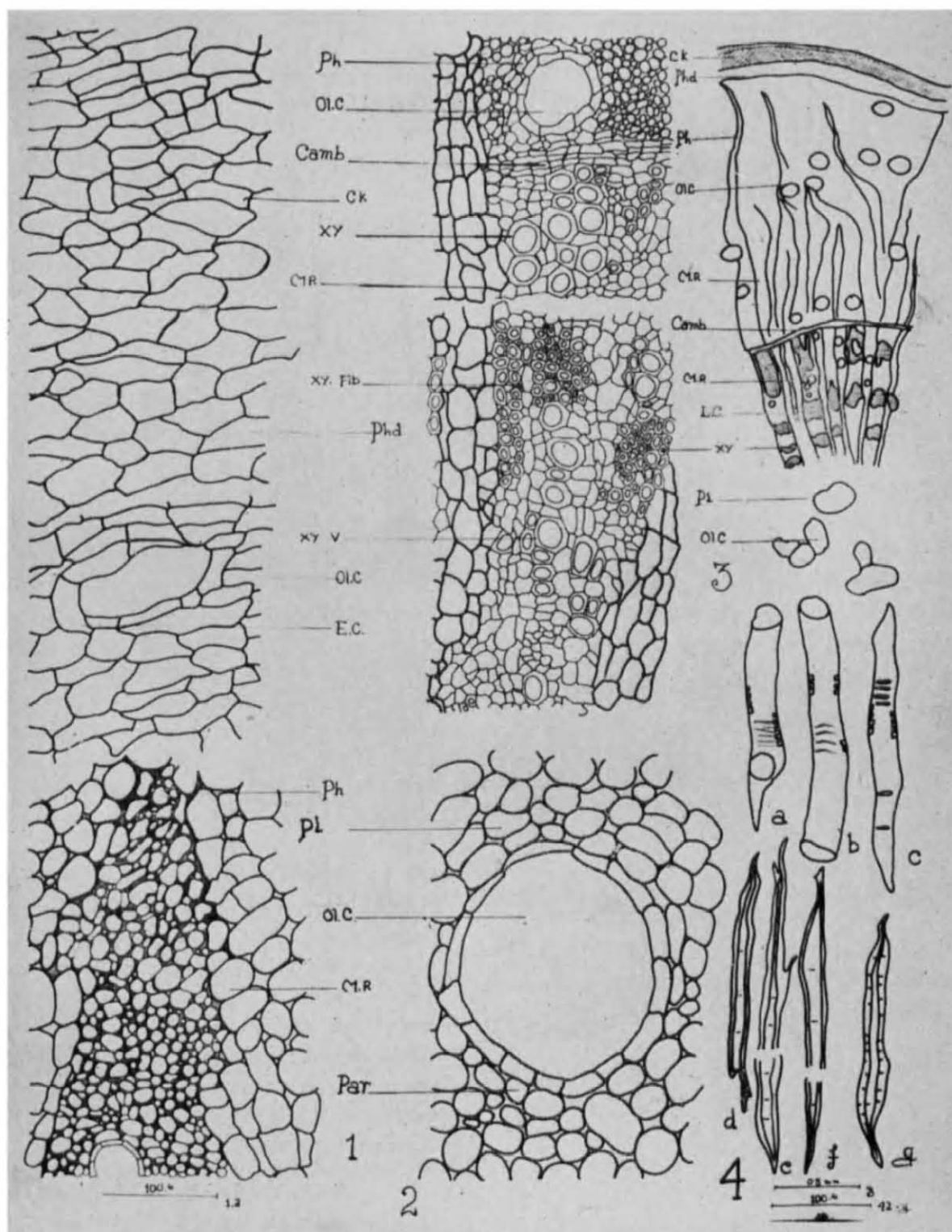
cell contents were performed by the method given by Johansen (1940) and Kay (1938). The ash and extractive values of the powdered drug were determined according to the method given in I. P. (Ann. 1966). The powdered drug was studied microscopically and the behaviour of the powder on treatment with different chemical reagents were also noted. Preliminary phyto-chemical work of the powdered drug was done.

MACROSCOPICAL CHARACTER

Root: The root occurs in small pieces, 2-18 mm in diameter, externally greyish brown, surface is rough due to longitudinal



Figs. 1-5g: Microscopical structure of the root: 1-2. Transverse section of the root showing details. 3. Diagrammatic representation of T. S. of root. 4. Oleo-resin cavity. 5 a-g. Isolated elements: 5a-b. Vessels. 5c-f. Fibres. 5g. Parenchyma.



Figs. 1-4g: Microscopical structure of the root stock: 1-2. Transverse section of the root-stock showing details. 3. Diagrammatic representation of T. S. of root stock. 4a-g. Isolated elements. a-b. Vessels. c. Tracheid. d-g. Fibres.

Camb., Cambium; Ck., Cork; E. C., Epithelial Cell; L. C., Lignified Cells; M. R., Medullary Ray; Ol. C., Oleo-resin Cavity; Par., Parenchyma; Ph., Phloem; Ph.d., Phelloderm; Pi., Pith; St. Gr; Starch Grains; V., Vessels; Xy., Xylem; Xy. Fib., Xylem Fibres.

wrinkles, deep furrow, transverse cracks and remnants of roots and root scars and, texture is spongy. Internally it shows, a yellow porous radiating wood with brown bark. Fracture is short and smooth and the fractured surface shows bark with numerous radially arranged schizogenous oleo-resin cavities with brown or yellow content. The odour is characteristically aromatic; the taste is sweet, pungent and bitter.

Root stock: The root stock appears in small vertical and thick pieces, 5-20 cm long and 1.00 to 3.5 cm in diameter. Externally yellowish to greyish brown in colour, rough due to the presence of deep furrows, longitudinal wrinkles and transverse cracks, roots and remnants of roots and root-scars. It is frequently crowned with leaf or stem base. Fracture is hard and fibrous. The fractured surface shows the similar structure as that of root except that the pith is present in the centre.

MICROSCOPICAL CHARACTER

Root (Figs. 1-5g): The transverse section of root shows periderm consisting of 5-8 layers of thin walled yellowish-brown cork, a layer of phellogen and phelloderm. The latter is composed of thin walled parenchyma, the cells of which are irregular in shape with inter-cellular space and contain abundant starch grains. Some of these cells disintegrate in the mature root forming irregular cavities. Schizogenous type of oleo-resin cavities are present in this region containing oil globules and resin. Phloem is a wide zone, cone shaped and consists of sieve tubes, companion cells, phloem parenchyma transversed by medullary rays. Numerous schizogenous oleo-resin cavities (lined by epithelial cells) are radially arranged in the phloem parenchyma, containing yellowish or yellowish brown contents. The cells are cellulosic in nature, parenchymatous and filled with abundant starch grains. Cambium is 4-6 layered. The stele is diarch and the

radiating wood is transversed by medullary rays. The ray cells are parenchymatous, multi-seriate and filled with starch grains. Sometimes these cells disintegrate and form cavities. Wood consists of vessels, tracheids, wood parenchyma and wood fibres, and occupies the 2/3rd of the section. The vessels are large, drum-shaped or elongated, reticulately thickened, the perforations being in the centre. The fibres are long, thick walled, lignified, pitted with their tapering ends pointed, chisel like or blunt.

Root stock (Figs. 1-4g): Root stock shows 6-10 layered cork cells, followed by 3-4 layers of phellogen and a wide zone of phelloderm. The cork consists of tangentially elongated cells with suberized walls. Phelloderm consists of thin walled parenchyma in which schizogenous cavities are present. Phloem is cone shaped consisting of usual tissues but the cells are cellulosic in nature, traversed by parenchymatous medullary rays, which is wedge shaped and filled with starch grains. Numerous schizogenous oleo-resin cavities lined by epithelial cells are present. These cavities are radially arranged and filled with yellowish contents. Cambium is 3-5 layered and the xylem is arranged in concentric layers and consists of vessels, tracheids, fibres and xylem parenchyma and traversed by medullary rays. Numerous tiers of wood fibres of varying lignification and vessels and tracheids are imbedded. The wood fibres vary greatly in extent of lignification and thickness of their walls. Pith is present in the centre consisting of thin walled parenchymatous tissue, in which schizogenous oleo-resin cavities, filled with yellowish contents of resin are present.

MICRO-CHEMICAL TEST

The transverse section of the root and root-stock when treated with H_2SO_4 and iodine become black showing the presence of starch. When treated with Sudan III and IV, the yellowish contents change to red

colour showing the presence of oil and resin. Prismatic crystals of calcium oxalate are present in the parenchymatous cells.

Measurements of individual cells and tissues of *Angelica glauca*

Plant Tissues	Microns
<i>Rhizome</i>	
Cork	20-50-63 by 8-13-20
Phelloderm	13-25-30 by 10-20-25
Phloem	15-25 by 15-25
Secretory cavity	100-200-300-350 to 70-150-200-250
Ray cells	13-25 by 5-8
Starch grains	5-10-13-18 in diameter
<i>Isolated elements</i>	
Fibre	300-450-650-1100 by 10-20
Vessels	100-200-300-400 by 30-40-70-120
Tracheids	200-300-350-400 by 10-30-40-50
Fibre-tracheid	300-350-400 by 10-20-30
<i>Root</i>	
Cork	18-38-50-63 by 10-13-25-33
Cortex	30-60-80-100 by 30-60-80-100
Phelloderm	30-38-50 by 15-20-25
Phloem	13-25-38 by 13-20-30
Phloem ray	20-38-63-88 by 15-25-38
Wood ray	15-30-38-75 by 10-20-25-30
Secretory cavity	70-150-250-300 by 50-100-200-250
Cambium	18-20-25 by 5-8-13
<i>Isolated elements</i>	
Vessels	150-350-400-550 by 30-50-80-100
Fibres	300-350-400-600 by 10-20-30-40
Tracheid	250-350 by 30-40
Thick walled parenchyma	80-180-250 by 10-20-30
Starch grains	5-8-13-15 in diam.
Crystals of calcium oxalate	30-70-100 by 20-30-60

POWDER DRUG

Powder is yellowish-brown in colour, aromatic with sweetish and later bitter taste. Parenchymatous cells are first filled with yellow or reddish-brown colouring matter, also contain oil globules. Numerous schizogenous cavities with epithelial linings are present, vessels are fairly abundant and are mostly reticulately thickened.

Starch grains are simple, oval to circular with hilum in the centre.

BEHAVIOUR OF POWDERED DRUG ON TREATMENT WITH DIFFERENT CHEMICAL REAGENTS

The powdered drug on treatment with different chemical reagents *viz.* Iodine, Ferric chloride, Hydrochloric acid, Nitric acid, shows a characteristic colour which have been recorded in the Table-I.

TABLE I

Behaviour of powdered drug on treatment with different Chemical reagents

Reagents	Behaviour of powder
Iodine (aq. sol.)	Turns brown
5% Ferric chloride	Turns Black
HCl (sp. gr. 1.16)	Dirty yellow
Conc. HNO ₃ (sp. gr. 1.42)	Light reddish brown

PHYSICAL CONSTANTS

The total and acid insoluble ashes, the water soluble and alcohol soluble extractive values of *Angelica glauca* were determined by the method given in I.P. (Ann. 1966) and the data are recorded in the Table-II.

TABLE II

Determination of Physical constants

	Percentage*
Total ash	7.083
Acid insoluble ash	0.042
Water insoluble extractive	23.2
Alcohol soluble extractive	26.7

*Each value is an average of three determinations.

PRELIMINARY PHYTOCHEMICAL INVESTIGATION

50 gm. of the drug powder was taken for the experiment and extractives were prepared in different solvents *viz.* petroleum ether, chloroform, alcohol and water. Each extract was tested for its constituents and the result is tabulated below: (Table III).

TABLE III
Preliminary Phytochemical Tests of *Angelica glauca*

Extractive	Colour	Reducing sugar	Resin	Alkaloid	Sterol	Tannin	Flavonoid
Dried petroleum ether extractive	Light yellow	—	—	+	+	—	—
Dried chloroform sol. extractive	Light yellow	—	+	+	+	—	—
Dried alcohol sol. extractive	Light yellow	+	—	+	+	—	—
Dried water sol. extractive	Light brown	+	—	+	+	—	—

DISCUSSION

In India two different species viz. *Angelica glauca* and *A. archangelica* go under the same vernacular name 'Choraka'. However, roots and root stocks of both the species are indiscriminately sold in the drug market. Most of the uses and the properties of these two species are similar. Youngken (1950) has reported some salient pharmacognostic characters of the *Angelica archangelica*. There are certain characters which are common in both the species and also a few salient differences by which *Angelica glauca* can easily be distinguished from *A. archangelica*. These are enumerated in Table IV.

TABLE IV

Distinguishing characters of *Angelica glauca* & *A. archangelica*

Rhizome	
<i>A. glauca</i>	<i>A. archangelica</i>
1. External surface yellowish to greyish brown in colour with transverse annulations	External surface dark gray-brown to reddish and purplish brown
2. 2.5 to 5.0 cm thick	5.0 to 10.0 cm thick
3. Fracture hard and fibrous ; surface yellowish to greyish brown	Fracture short and smooth ; surface dark grey-brown to reddish and purplish brown
4. 2.0 cm to 15 mm thick	5-7 mm thick

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REFERENCES

- Anonymous. *Pharmacopoeia of India*. Manager of Publications, New Delhi, 1966.
- *The Wealth of India : Raw Materials* Vol. I. CSIR, New Delhi, 1948.
- BAILEY, L. H. *The Standard cyclopedia of Horticulture* Vol. I. McMillan & Co., New York, 1950.
- BAPALAL, G. VAIDYA. Some controversial drugs of Indian Medicine. *J. Res. Ind. Med.* 7(1) : 77-78. 1972.
- CHAUDHARY, S. S., YOGINDER NATH AND K. L. HANDA. Chemical examination of *Angelica glauca* fruit. *Proc. Nat. Acad. Sci. India* 29 : 283. 1960.
- COLLET, H. *Flora Simlensis*. Thacker, Spink & Co., 1921.
- CORE, E. L. Ethnobotany of the Southern Appalachian Aborigines. *Econ. Bot.* 21(3) : 210. 1967.
- DEY, A. C., M. R. UNIYAL AND D. V. SHANKAR. Flora of the Bhilangana valley of the Erstwhile Tehri Garhwal State. *J. Bombay Nat. Hist. Soc.* 65(2) : 384. 1968.
- EDLIN, H. L. *British Plants*. B. T. Bats Ford Ltd., London, 1951.
- GUPTA, R. Flora of Lam Dal. *Indian For.* 87(5) : 321. 1961.
- Survey Record of Medicinal & Aromatic Plants of Chamba Forest Division. *Ibid.* 90(7) : 460. 1964.
- HANDA, K. L., I. C. CHOPRA AND S. N. SOBTI. Aromatic Plant Resources of Jammu & Kashmir. *J. Sci. & Ind. Res.* 16 A(5) : 6. 1957.
- HARTWELL, J. Plants used for against Cancer. *Lloydia* 24(3) : 312. 1971.
- HOOKE, J. D. *Flora of British India*. Vol. II. L. Reeve & Co., London, 1879.
- HUI-LIN-LI. The origin of cultivated plants in South East Asia. *Econ. Bot.* 24(1) : 9, 16. 1970.
- The vegetables of Ancient China. *Econ. Bot.* 24(1) : 258. 1970.
- JAIN, S. K. AND C. R. TARAFDAR. Medicinal Plant lore of the Santals. *Econ. Bot.* 24(3) : 244. 1970.
- JOHANSEN, D. A. *Plant Microtechnique* (1st edn.). McGraw Hill Book Co., Inc. New York & London, 1940.
- KAPOOR, L. D. A note on the minor forest products of Chamba (H.P.) and scope for their development. *Indian For.* 79(4) : 238. 1953.
- , R. N. CHOPRA AND I. C. CHOPRA. Survey of Economic vegetable products of Jammu & Kashmir. *J. Bombay Nat. Hist. Soc.* 50(1) : 116. 1951.
- KAPOOR, S. K., Y. N. SHARMA AND ASIF ZAMAN. Extractions of *Angelica glauca*. *Phyto Chemistry* 11(1) : 475-476. 1972.
- KAY, L. A. *Microscopical studies of Drugs* (1st edn.). Bailliere, Tindall & Cox, London, 1938.
- KIRTIKAR, K. R. AND B. D. BASU. *Indian Medicinal Plants*. Vol. II. Allahabad, 1933.
- LEVY, J. DE BAIRACLI. *Herbal Handbook for Everyone*. Faber & Faber Ltd., London, 1966.
- LEYEL, C. F. *Green Medicine*. Faber & Faber Ltd., London, 1957.
- MONACHINO, JOSEPH. Chinese Herbal Medicines Recent Studies. *Econ. Bot.* 10(1) : 43. 1956.
- PANDEY, G. S. *Bhav Prakash Nighantu*. Chowkhamba Vidya Bhawan, 1969.
- RAO, T. A. A Botanical Tour to Pindari Glacier and Kumaon Hill Stations. *Bull. bot. Surv. India* 2 (1 & 2) : 76. 1960.
- SCHERY, R. W. *Plants for Man*. Prentice-Hall, Inc., New York, 1952.

- SHAH, N. C. AND M. C. JOSHI. Folklore Aromatic Plants of Kumaon Hills. *The Flavour Industry* 1(12) : 853. 1970.
- An Ethnobotanical Study of the Kumaon Region of India. *Econ. Bot.* 25(4) : 416, 417. 1971.
- STRACHEY, R. *Catalogue of the plants of Kumaon and of the adjacent portion of Garhwal & Tibet*. Revised and supplemented by J. F. Duthie. Lorell Reeve & Co., London, 1906.
- STEWART, J. L. *Punjab Plants*. Govt. Press, Lahore, 1869.
- UNIYAL, M. R. AND N. S. CHAUHAN. Medicinal Plants of Uhal Valley in Kangra Forest. *J. Res. Ind. Med.* 6(3) : 289. 1971.
- WATT, G. *A Dictionary of Economic Products of India*. Vol. I. Calcutta, 1889.
- YOUNGKEN, H. W. *Text Book of Pharmacognosy* (6th edn.). The Blakiston Company, 1950.