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Plant Profile, Phytochemistry and Pharmacology of *Costus speciosus* Koeing Sm. (*Kebuka*): A Review

Author: Priyanka Hajare¹

Co Authors: K Bharathi² and B Pushpalatha³

^{1,2}Dept. of Prasuti tantra & Stri Roga, National Institute of Ayurveda, Jaipur, Rajasthan, India

³Dept. of PTSR, National Institute of Ayurveda, Jaipur, Rajasthan, India

ABSTRACT

Costus speciosus belongs to Zingiberaceae family and is commonly called as *Kebuka* and *Kemuka*. *Kebuka* is found throughout India and in the moist tropical evergreen forests. In obstetrics, dystocia if not diagnosed at right time and treated, can lead to maternal as well as fetal morbidity and mortality. Aim of intrapartum care is achieving healthy mother and child using the least possible number of interventions. In order to prevent from all these life threatening situations, Ayurveda single drug i.e. *Kebuka* can be used easily, safely, cost-effective and comfortably to pregnant women for the progress of labour. It has long been medicinally used in traditional system of medicine. The plant has been found to possess diverse number of pharmacological activities, which might be helpful in preventing from dystocia i.e. *Kashta prasava*. Present article gives collection of updated information on *Kebuka* pharmacological properties. The reports are very encouraging and indicate that the plant should be studied more extensively for its therapeutic effects mainly in regard of *Prasuti tantra*.

Key Words: *Saponin, Estrogenic, Kashta prasava, Vata strengthening*

INTRODUCTION

Medicinal herbs are moving from fringe to mainstream use with greater number of people seeking remedies and health approaches free from side effects caused by synthetic chemical¹. As the incidence of Elderly primigravida is increasing, there are increased incidences of operative/invasive deliveries also. Thus there is a high prevalence of labour abnormalities. Diet, behavior and environment of the mother directly affect the health of mother and child. To combat all these problems and to reduce complications during and after delivery Ayurveda drug can be used safely. Due to *Kebuka garbhashaya sankochaka*

prabhava, it helps in easy delivery because one of the most common causes of *garbhasanga* is inadequate uterine contraction. *Kebuka* is a potent uterine stimulant by its *prabhava* and *tikta-kshaya* properties. In this way *Kebuka* increases uterine contractions which cause dilatation of cervix. That's why there is a scope of Ayurveda drug as they can be always used easily, safely, comfortably and economical also.

AIMS AND OBJECTIVES

To study the effect of *Costus speciosus* Koeing sm (*Kebuka*) on *prasava*.



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METHODOLOGY

Literary references were collected from Ayurveda classics, commentaries, modern literatures, research journals available in institute library, online portals like Pubmed central, Ayush research portal, Google scholar, E-books and analyzed to frame conceptual work.

Plant profile

Scientific classification-

Kingdom - Plantae

Subkingdom - Tracheobionta

Superdivision - Spermatophyta

Division - Magnoliophyta

Class - Liliopsida

Subclass - Zingiberidae

Order - Zingiberales

Family - Costaceae

Genus - Costus L.

Species - Costus speciosus (J. Koenig) Sm.

Classical names: *Kebuka, Kembuka, Kemuka, Kembu.*

Vernacular names:

Bengali - Kevu

English - Wild ginger, Crepe ginger, Canereed, Spiral flag

Hindi - Kebu, Kemuk, Kemuaa, Keu, Vanajardraka

Kannada - Chenglavaa-Koshtu, Changalvakoshtu

Malayalam - Channakkilannu, Channakkuvva

Marathi - Pevaa

Tamil - Koshtam

Telugu - Chenglavaa-Koshtu

Kebuka comes under *Aphala* and *Pushpini*. *Kebuka* is a herb of height 1-3 m, resembling ginger plant. The leaves are 6-12 inch long, slightly oval and 3-4 inch wide. The flowers are found in clusters, white in colour with reddish end and 2-4 inch long. They are seen during rainy season (*Kharifa*). The rhizomes are slightly slimy².

Botanical distribution: Found throughout country in moist tropical evergreen, forests at altitude of 1200 m and widely distributed in Assam, Madhya Pradesh, Meghalaya, Bihar, Uttaranchal, Orissa, North Bengal, Khasi and Jaintia Hills. Commonly found in Sub-Himalayan tract extending between Kangra to Arunachal Pradesh and also in Western Ghats.

Parts used: Root and Rhizome (tuber)

Historical review of *Kebuka* - Classical classification:

Charaka samhita - *Krimighna mahakashaya, Tikta skandha*

Susrutha samhita - *Shaka varga*

Astanga hridaya - *Shaka varga*

Besides Ayurveda texts, *Costus speciosus* is among the most effective Islamic traditional medicinal plants. It has been proven in authentic Hadith present in Sunan Abi Dawud, the Book of Medicine (*Kitab Al-Tibb*). In prophetic medicine, use of *Costus speciosus* was specifically recommended as remedy for pharyngitis and tonsillitis in children, pleurisy, and as snake venom antidote³.

Table 1 Properties of *Kebuka* in chronological order

Text	Rasa	Guna	Veerya	Vipaka	Action	Reference
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Kaidev nighantu (1425)	Tikta	Laghu	Sheeta	Katu	Kapha pitta shamaka, vata vardhaka	Kaidev nighantu, Aushadhi varga 1/1607-1609, Pg.643.
Bhava prakasha nighantu (16th AD)	Tikta Katu	Laghu Grahi	Sheeta	Katu	Kapha pitta shamaka, vata vardhaka	Bhavprakasha nighantu, Shaka varga 10/90, Pg.687.
Raj vallabha nighantu (18th AD)	-	-	-	-	Kapha pitta shamaka	Rajvallabha nighantu 3/117.
Priya nighantu (1983)	Katu Tikta	-	Sheeta	-	Vata vardhaka, Garbha patanam	Priya nighantu, Shatpushpadi varga 210.
Dravyaguna vigyana (2005)	Tikta Kashaya	Laghu Ruksha	Sheeta	Katu	Gharbhashaya sankochaka, Kapha pitta shamaka, Vata vardhaka	Part 2, Pg 605-606.

Phytochemistry: Identity, Purity and Strength⁴ as mentioned in Table 2.

Table 2

Foreign matter	Not more than 2 percent, Appendix 2.2.2.
Total ash	Not more than 20 percent, Appendix 2.2.3.
Acid-insoluble ash	Not more than 5 percent, Appendix 2.2.4.
Alcohol-soluble extractive	Not less than 3 percent, Appendix 2.2.6.
Water-soluble extractive	Not less than 12 percent, Appendix 2.2.7.

Assay- TLC

T.L.C. of the alcoholic extract on silica gel 'G' plate using chloroform: Glacial acid: Methanol: Water (5:2:2:1) shows under UV light (365 nm) a fluorescent zone at R_f 0.95 (greenish yellow). On sparing with Anisaldehyde-sulphuric acid reagent and heating the plate for ten minutes at 105°C, nine spots appear at R_f. 0.11, 0.22, 0.33, 0.49, 0.59, 0.72, 0.79, 0.87 (all green) and 0.95 (blue).

Properties of Kebuka

Kebuka (*Costus speciosus* Koenig Sm.); it is *tikta-kashaya*⁵ in property, aggravates *vata* and acts through its *garbhashaya sankochak prabhava*⁶, as mentioned in Table 1 and 3. On Pharmacological screening the Rhizome of *Kebuka* is found to have Diosgenin⁷, Costusosides, Saponins-dioscin, gracillin and

beta-sitosterol-beta-D-glucoside. Diosgenin starch is of hygroscopic nature, due to which it absorbs water and softens the cervix. Diosgenin also has oestrogenic activity⁸.

Table 3: Properties and action of Kebuka-

Properties and action	<i>Rasa</i>	<i>Tikta</i>
	<i>Guna</i>	<i>Laghu, Ruksha</i>
	<i>Veerya</i>	<i>Sheeta</i>
	<i>Vipaka</i>	<i>Katu</i>
	<i>Prabhava</i>	<i>Garbhashaya sankochaka</i> ⁹
	<i>Karma</i>	<i>Garbhashaya sankochaka, Garbha patanam, Pittahara, Kaphahara, Deepana, Pachana, Grahi, Krimighana, Hridya, Raktashodhaka, Vrishya.</i>
	<i>Doshagnata</i>	<i>Kapha-pitta shamaka, Vata vardhaka</i>

Use on reproductive system: In dystocia (*Kasta prasava*), it act as *garbhashaya sankochaka* and helps in normal labour.



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Chemical constituents: Steroidal saponins such as (Tigogenin and diosgenin), gracillin and beta-sitosterol, beta-D-glucoside.

Pharmacological activities: Estrogenic activity, Anticholinesterase activity, Hepatoprotective activity, Antifertility activity, Antioxidant activity, Antipyretic, Adaptogenic activity, Astringent, purgative, depurative, anti-inflammatory, anthelmintic, antivermin, maggoticide, antifungal.

Other therapeutic uses: *Kaphapittaja vikara*, *Agnimandya*, *Grahani*, *Krimi-roga*, *Raktavikara*, *slipada*, *Prameha*, *switra*, *Kustha*, *Jvara*, *Kasa*, *Kamala*, *Arsa*, *Mutrakrcchra*.

Pharmacology of *Kebuka*:

1. *Krimighna* effect of *Kebuka*: In *gana*, *Acharya Charaka* mentioned *Kebuka* in *krimighna mahakashaya*. As it is also anthelmintic, antifungal¹⁰, antivermin, maggoticide in property. The high antibacterial activity may be due to presence of diosgenin¹¹. Application of *Kebuka taila* in vaginal tract might help in prevention from infection during labor and in puerperium also. One research study by Duraipandiyan, Al-Harbi, and Muthukumar (2012) carried out on isolation of sesquiterpene lactones, designated as eremanthin and costunolide from hexane extract from *Costus speciosus* rhizomes using column chromatography and characterized by GC-MS and X-ray crystallography techniques. Further, Antibacterial and antifungal activities of ethyl acetate, hexane, chloroform, methanol extracts and isolated compounds were evaluated against some bacterial strains (*S. epidermidis*, *S. aureus*, *B. subtilis*) and

some fungal strains (*T. mentagrophytes*, *E. floccosum*, *T. rubrum* and *M. grisea*). The experimental finding of the study suggested that *Costus speciosus* was found to have promising antimicrobial activity.

Acharya Susrutha and *Bhavaprakasha* mentioned *Kebuka* under *Shaka varga* and this *varga* act on normalcy of *Apana vayu*, which is important for smooth labour i.e. *Sukhprasava*.

2. Saponin: Chemical structure of steroidal saponin is similar to that of many of body's hormones, for example cortisol and estrogen¹². Diosgenin, alkaloid which is precursor for synthesis of steroidal hormone. Recently *Kebuka* is used in drug industry as natural source of diosgenin which is steroidal sapogenin used for the synthesis of sex hormones, cortisone and oral contraceptives. Diosgenin content up to 3.37% has been reported in *Costus speciosus* rhizome.

3. Estrogenic activity: Research study by S. Singh et al. (1972) explained that saponin showed estrogenic activity in sprayed rats, increased uterine weight and uterine glycogen concentration and produced proliferative changes in uterus¹³ statistically significantly. One more research study by P. V. Tewari et al. (1973) reported estrogenic activity of 1600 µg diosgenin isolated from *Costus speciosus* was approximate equal to that of 150 µg neoclinestrol. These show that it helps in the priming of cervix and proliferation of estrogen receptors in the endometrium.

Kebuka due to its *tikta-kashaya* property, aggravate *vata*. But, according to *Acharya Charaka*, some drugs act by *rasa*, some by *guna*,



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veerya, vipaka and some by *prabhava*. *Kebuka* act through its *prabhava*. Due to its *garbhashaya sankochaka prabhava*, *Kebuka* helps in easy delivery because one of the most common causes of *garbhasanga* is inadequate uterine contraction. *Kebuka* is a potent uterine stimulant by its *prabhava* and *tikta-kshaya* properties. In this way *kebuka* increases uterine contraction which cause dilatation of cervix. One of the main causes of cervical dystocia is inadequate uterine contraction¹⁴. Research work by Lijuan, W., Kupittayanant, P., Chudapongse, N. *et al.* reported that the effect of wild ginger of *Kebuka* rhizome extract and diosgenin on rat uterine contractions- *Costus speciosus* rhizomes were ethanolic extracted and analyzed. Isometric force was measured in the strips of longitudinal myometrium. Extract (10 mg/100 mL) increased the spontaneous contractions. Amplitude and frequency of phasic contraction were significantly increased along with the basal tension. Force produced in presence of extract was abolished by the inhibition of L-type calcium channels. Actions of the extract were not blocked by estrogen receptor blocker, fulvestrant. Although significant amounts of diosgenin were present in extract, found that, depending upon concentration, diosgenin had either no effect or was inhibitory on force. Interestingly, extract induced significant amounts of force in absence of extracellular calcium, which could be blocked by inhibition of sarcoplasmic reticulum calcium-ATPase, but not fulvestrant. These conclude that wild ginger rhizome extract stimulates phasic activity in rat

uterus. Data suggest that uterotonic effect is due to non-estrogenic effect and not those of diosgenin. Wild ginger was able to increase contraction via calcium entry on L-type calcium channels and sarcoplasmic reticulum calcium release. These suggest that wild ginger rhizome extract may be useful uterine stimulant¹⁵. Thus application of *kebuka* can prevent from - Myometrial lactic acidosis and small decrease in oxygen saturation may be contributing factors to dysfunctional labour¹⁶.

Diosgenin (precursor of estrogen) present in *Kebuka* might be acting through enhancing the 20 α HSD enzymes to inactivate progesterone and thereby helping in shortening of cervix as well as cervical ripening.

Costus speciosus Koen., is also used as *Kalihaari*¹⁷ or this plant is also being used as a substitute of *Langali*. Acharya P.V Sharma in *Priya nighantu*, explained *Kebuka* with *Garbha patanam* property. So, its action may be similar to Misoprostol (Synthetic PGE1), as it is used as abortifacient and also for induction of labour. In the same manner, *Kebuka* may act as uterotonic and helpful in cervical remodelling. It may appear to have an action on collagen, encouraging its disintegration and dissolution (Same as mode of action of misoprostol)¹⁸. This all over effect results in to *Sukhprasava* as described by *Chakradutta*.

Kebuka rhizomes are rich in diosgenin starch which is hygroscopic in nature. Due to this hygroscopic nature it absorbs water and soften the cervix. By virtue of these qualities, drug



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medicated *taila* shows good results in facilitating smooth vaginal delivery¹⁹.

4. Anticholinesterase activity: Research study by Bhattacharya *et al.*, 1972 has reported that total alkaloids isolated from rhizome of *Costus speciosus* enhanced pharmacological action of acetylcholine. Anticholinesterase activity was shown by observation on frog rectus muscle and dog blood pressure.

5. Antioxidant activity: Application of *Kebuka* can prevent from - Myometrial lactic acidosis and small decrease in oxygen saturation may be contributing factors to dysfunctional labour²⁰. So, uncontrolled production of reactive oxygen species and concomitant lipid peroxidation, protein damage, and DNA strand breaking may be prevented by its antioxidant activity. Research study by Nehete *et al.*, 2010 has tried to assess *in vitro* antioxidant activity of different extracts of this plant by DPPH radical scavenging activity, total antioxidant capacity, ion chelating activity, nitric oxide scavenging activity, hydroxyl radical scavenging activity and its correlation with total phenolic content. *C. speciosus* has antioxidant activity which may be due to plant-derived antioxidants such as tannins, lignans, phenolic acids, flavones, flavonols, catechins, anthocyanins, proanthocyanins, stilbenes, coumarins, quinones and xanthenes that could delay and provide protection for living organisms from damage caused by uncontrolled production of reactive oxygen species and concomitant lipid peroxidation, protein damage, and DNA strand breaking.

6. Hepatoprotective activity of *Kebuka*:

Application of *Kebuka taila* may work on coagulation factors of liver and thus keeps in balance the biochemical entities of liver like SGOT, SGPT and Prothrombin time. Thus it may help in prevention from post-partum hemorrhage. As Acharya Bhavapraksha mentioned *kebuka* as 'astra nashanam' and Kaideva *nighantu* as 'Asrika harete'. Research study by Verma and Khosa (2009a) reported hepatoprotective activity of ethanolic extract of rhizome of *Kebuka* in carbon tetrachloride treated rats. Various parameters like Serum glutamic oxaloacetic transaminase, Serum glutamic pyruvic transaminase, Alkaline phosphatase and liver inflammation, were studied. Other research study by Srivastava S. *et al.* (2012) evaluated the anti-arthritis activity of methanolic extract of aerial parts of *Kebuka* in male Albino rats employing Freund's adjuvant induced arthritic model. Diclofenac sodium (15 mg/kg) was employed as reference drug. Biochemical examination was done by assessment of SGPT, SGOT, ALP and bilirubin levels. The results revealed that the methanolic extract of CS reduced the levels of such biochemical entities. The study indicated that CS had significant anti-arthritis properties.

7. Anti-nociceptive activity of *Kebuka*:

Application of *Kebuka taila* in vaginal canal may blocks the detection of a painful or injurious stimulus by sensory neurons of perineum, thus helps in easy labor. It may help in subsiding the pain during and after the labor. Research study by Bhattacharya and Nagaich (2010) showed anti-



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nociceptive activity of aqueous and ethanolic extracts of rhizomes of *Kebuka* on Swiss albino mice. Anti-nociceptive screening revealed peripheral actions of both the extracts statistically significant.

8. Anti-inflammatory and Antipyretic activity

of *Kebuka*: Application of *Kebuka taila* in vaginal canal may prevent the cervical tissues, vaginal tissues and perineum from inflammation during labor, by its anti-inflammatory activity. It might also be helpful in reducing swelling after delivery, which affects urination. And by use of it, puerperal fever can also be prevented. Research study by Binny, Sunil, and Dennis (2010) reported anti-inflammatory and antipyretic properties of ethanolic extract of rhizome of *Kebuka* using carrageenan induced paw edema and cotton pellet induced granuloma formation in rats. Conclusively, antipyretic effect was found to be minimal with 800 mg/kg dose. Other research study by Pandey et al. (1972) evaluated the anti-inflammatory activity of mixture obtained from dried rhizomes of *C. speciosus*. The total saponin mixture had significant anti-inflammatory activity. Results were compared with β -methasone. Saponin was found to significantly increase the uterus weight of spayed rats.

9. Diuretic activity of *Kebuka*: Application of *Kebuka* might help in prevention from post-partum difficulty in passing urine and urinary retention. Drug induced increased urine flow is diuretics which is used to adjust volume and the composition of body fluid in variety of disorder including hypertension, cirrhosis, nephritic

syndrome, renal failure, heart failure, and pregnancy toxemia. Administration of diuretic drugs has many adverse side-effects. Hence there is necessity for the new diuretic agent with therapeutic efficacy²¹. Research study by Dubey S *et al.*, 2010 evaluated the effect of aqueous and alcoholic extract of the rhizomes of *Kebuka* in albino rats of and outcome was compared with furosemide as the standard drug in diuretic activity. Found that both extracts remarkably increased urine output as well as urinary electrolyte concentration, which concluded *Kebuka* having diuretic activity. Other research study by Rahmatullah, Jahan, & Khatun, (2010) – *Costus speciosus* acts as a diuretic by significantly increasing the urine output and urinary electrolyte concentration.

10. Anti-hyperglycemic activity of *Kebuka*:

Research study by Rajesh, Harish, Sathyaprakash, Shetty, and Shivananda (2009) evaluated anti-hyperglycemic activity of the petroleum ether, methanolic, chloroform and aqueous extracts of *Kebuka* rhizomes which prompted reduction of blood glucose level significantly except that with petroleum ether extract observed in rats.

11. *Kebuka* as ingredients of *Samvardhana*

***Ghrita*:** Administration of *Kebuka* in pregnant women may be beneficial for her fetus also. *Samvardhana Ghrita*, described by *Acharya Kashyapa* in *Kashyapa samhita Lehadhyaya*. It is specified for growth of the healthy child and treatment of *Pangu* (Debilitate), *Muka* (Dumb), *Ashruti* (Deaf) and *Jada* (Mentally deficient) state²².



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12. Antifertility activity of *Kebuka*:

Research study by P. V. Tewari et al. (1973) proved that saponin mixture exhibits the antifertility effect in rats. Mixture of the saponin isolated from rhizomes of *Kebuka* effectively protected against pregnancy in rats, when fed at 5-500 µg/100 g of body wt. for 15 days. Administration of *Kebuka* rhizome extract at dose of 1000 mg/kg of body weight decreased the number of implantation site. Anti-implantation effect of these extracts could be due to disturbance of the endocrine-endometrial synchrony which is dependent on estrogen and progesterone balance.

CONCLUSION

Kebuka might be a wonderful drug as it has numerous therapeutic application viz. Hepatoprotective, Anticholinesterase, Anti hyperglycemic, Diuretic, Antidepressant, Antioxidant, Anti nociceptive, Anti-inflammatory, Anti-bacterial, Anti pyretic property. The major research studies reported on its multiple properties. From the thorough study of available literature on *Costus speciosus*, it is clearly shown that the plant serves chief source of many therapeutically efficient chemicals, among which mainly diosgenin, used for synthesise of sex hormone, cortisone and oral contraceptives. This plant should be studied more extensively for its therapeutic effects mainly in regard of *Prasuti tantra*.



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