



REVIEW ARTICLE

AKARKARA: A VERSATILE MEDICINAL PLANT – A REVIEW

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The actual purpose of Ayurveda is to live the life with physical, mental, social and spiritual wellbeing. In Ayurveda numerous plants are described for fulfilling its purpose. One of those plants is *Akarkara* (*Anacyclus pyrethrum L.*). Basically, *Akarkara* is described in Unani system of medicine as an amazing drug used in various ailments. Later on, due to its multidimensional uses, it also has been included in the Ayurvedic text written in & after the medieval era. Shodhal Nighantu has described firstly *Akarkara* as one of the potent aphrodisiac drug. Here, an attempt is made to review its scattered multi-dimensional health benefits quoted in Ayurvedic and Unani treatises and validated through scientific researches in laboratories.

KEYWORDS: *Akarkara*, *Anacyclus pyrethrum*, Aphrodisiac drug

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INTRODUCTION:

Ayurveda, the ancient Indian traditional system of medicine, aimed with prevention and cure of diseases as well as promotion of quality of life [1, 2]. Thousands of therapeutics have been described in various classical texts of Ayurveda for the prevention and management of different maladies using numerous plants either single or in combinations. The great scholars of Ayurveda always tried to validate Ayurveda according to that era. Therefore they also used to include new treatment principles, formulations and plants from other system of medicine. This was the generosity of the great *Acharyas* of Ayurveda for the service of humanity.

Akarkara (*Anacyclus pyrethrum DC*) is a plant used single or in various combinations for multiple purposes in Ayurveda. In *Brihatrayee*, this plant has not been described. It has been described for the first time in *Shodhala Nighantu* (Gada Nigraha) by *Vaidya Shodhala* as *Akallaka* in 12AD^[3,4]. Later on, *Akarkara* has been described in most of the Ayurvedic treatises [5-14]. This drug has been used by Unani physicians since ancient time. *Dioscorides* (1st century AD), *Jalinus* (131-210 AD), *Ibne Sina*, *Ishaque bin Imran*, *Abu Marwan bin Zohar* (*Avenzoar*), mentioned this herb in their books [16, 17].

PLANT PROFILE:

Akarkara is native to North Africa, cultivated in Mediterranean and Arabian countries. It is also cultivated in few regions of India and has

been grown at elevation of 900m at Jammu and Kashmir [18, 19].

Botanical classification^[20]:-

Kingdom: Plantae
Division : Spermatophyta,
Class : Dicotyledons,
Order : Comanulatae,
Family : Compositae or Asteraceae,
Genus : *Anacyclus*,
Species : *Pyrethrum D.C.*

DESCRIPTION:

a) Macroscopic^[21, 30, 31]:-

Akarkara is a perennial, procumbent herb. Stem lies on the ground, before rising erect. The leaves are smooth, alternate, pinnate, pale green, with deeply cut segments. Fruit obovate achene. The root is almost cylindrical crowned with a tuft of grey hairs. Externally it is brown and wrinkled, with bright black spots.

b) Microscopic^[21, 30, 31]:-

Mature root shows cork, sclerenchyma, parenchymatous cells, secondary phloem, cambium 2-5 layered and secondary xylem consisting of xylem vessels, tracheids and xylem parenchyma. Inulin, oleo-resinous schizogenous glands and calcium oxalate crystals in rosette form present in secondary cortex, secondary phloem, secondary xylem and medullary rays cells.

PHARMACOLOGICAL PROPERTIES:

In Ayurveda – Rasa- Katu

Guna- Ruksha, Teekshna

Veerya- Ushna

Vipaka- Katu

Karma- Vatahara, Pittahara, Kaphahara, Sukrala, Vajikara, Svedakara, Dipana, Buddhivardhaka, Balakaraka^[10, 21].

Organoleptic properties:-

Akarkara has an aromatic odour and pungent, very acrid taste. It causes tingling sensation and increases salivation^[22-24].

Chemical Composition:-

Akarkara contains an alkaloid, namely “pellitorin” called as *pyrethrin*. Root contains alkyl amides, which active constituent is *pyrethrin*. Alkyl amide fraction of roots of *Akarkara* is made up of the following isobutylamides and tyramine amides. *Akarkara* arial parts contain active constituents are *Anacyclin*, *N-methylanacyclin*, *Nmethyl-N-(2-methyl propyl) 2, 8-decadiene 4, 6-diyamide*. The root contains *Anacyclin*, *Pellitorine* enetriyne alcohol, *hydrocarolin*, *inulin* (50%), traces of volatile oil and (+)-*sesamin*. They also contain *N-(2-P-hydroxy phenylethyl) deca*, *dodeca*, and *tetradeca-trans-2*, a new series of tyramine amides corresponding to the isobutylamides^[22, 23, 25, 26, 33, 44].

THERAPEUTIC USES:

In Ayurveda, *Akarkara* is generally used for *Vajeeekarana* (Aphrodisiac) purpose specially as *Shukrastambhaka* (restore premature ejaculation) drug^[10]. Since Gada Nigraha to recent Ayurvedic Pharmacopoeia, most of them *Akarkara* has generally described in *Vajeeekarana* formulations. But other indications of *Akarkara*, rather than *Vajeeekarana* are also found in Ayurveda. In

Unani system of medicine, *Akarkara* is used for multiple purposes. The useful part of *Akarkara* is its root^[16, 17, 71, 74].

Modern researchers have also validated the efficacy of this drug not only in sexual disorders but also in other ailments.

The multiple uses of *Akarkara* has been summarized in the following paragraphs.

1. Anaphrodisiac agent :

The most important use of *Akarkara* in Ayurveda is as *Vajeeekarana*^[15]. It is classified as *Shukrastambhaka* drug^[10]. It increases the time of ejaculation and quality of semen. From Gada Nigraha to Siddha Prayoga Sangraha, everywhere *Akarkara* has used mostly in *Shukrastambhaka* Formulations^[5, 7, 8, 11, 13, 14]. In Unani System of Medicine it is used in various aphrodisiac formulations both internally and local application^[16, 26, 27, 28]. Recent researches have also revealed the *Vajeeekarana* effect of this drug^[43]. The Petroleum ether extract of root showed significant improvement in penile erection index with 4 fold increase in mount and 3 fold increases in intromission frequency in treated rats^[34]. Penile erection index indicates enhanced vascular function in penile tissue^[36]. Unlike testosterone, Petroleum ether extract of *Akarkara* showed sustained effect after the lapse of 7 and 15 days of discontinuation of

treatment^[34]. Therefore it may conclude that the effect of *Akarkara* in erectile dysfunction is long lasting. It has also proved that the effect of *Akarkara* in erectile dysfunction and premature ejaculation is safe i.e. no untoward effects appeared^[39, 40, 45]. This drug significantly increases body weight, sperm count, motility and viability along with serum testosterone, Luteinizing Hormone and Follicle Stimulating Hormone concentration^[38, 41]. So this drug shows androgenic activity^[37]. It also increases spermatogenic activities and therefore may improve male sexual behaviour and fertility^[42]. Another study showed that aqueous root extract of *Akarkara* increases the weights of body and sex organs along with increase in sperm count of epididymis and vas deferens and reduces the percentages of abnormal spermatozooids^[35].

2. Anticonvulsant and muscle relaxant effect :

The anticonvulsant and myorelaxation activity of ethanolic extract of roots of *Akarkara* was assessed using albino mice against maximum electroshock seizure (MES) test and rotarod test respectively. The ethanolic extract of *Akarkara* inhibits MES-induced convulsions^[22, 46]. Other studies also have showed

anticonvulsant property of *Akarkara*^[45, 47, 48].

3. Antidiabetic-effect:

The aqueous root extract of *Akarkara* significantly reduced elevated blood glucose level in *alloxan* diabetic rats. But in normal rats it did not show any hypoglycaemic effect. Simultaneously serum triglyceride levels also reduced in *alloxan* diabetic rats, indicates its long term use not only better for control of elevated blood glucose level but also for normalization of disturbed lipid metabolism. Which may prevent further predisposition of the patients to cardiovascular complications^[45, 49]. It decreases the dose of insulin in patients of type I diabetes mellitus^[77].

4. Antimicrobial effect :

Akarkara extract produced little antibacterial effect against *Staphylococcus aureus* and *Streptococcus sanguis*. The plant did not have any antibacterial effect against *Sreptococcus mutans* and *Pseudomonas aeruginosa*^[45, 50, 51, 52].

5. Antioxidant effect :

Recent studies show the antioxidant property of *Akarkara*. In a study, ethanolic extract of root of *Akarkara* taken for in vitro and invivo to find out antioxidant activity by using different experimental models. The extract exhibited marked free radicals

like DPPH, hydroxyl, hydrogen peroxide, nitric oxide scavenging activity in in-vitro scavenging models. The reducing power of the extract increased in dose dependent manner. The extract also showed significant protection in lipid per oxidation^[45,62].

6. Antipyretic effect :

The ethanolic extract of *Akarkara* was prepared and screened for antipyretic activity in yeast induced pyrexia in rats at a dose of 100mg/kg i.p. possessed significant anti-pyretic activity. The activity was very comparable to standard drug Paracetamol 150mg/kg i.p..The maximum non lethal dose was found to be 2g/kg. Hence it may be an effective alternative medicine as antipyretic agents to synthetic drugs^[45, 54]. It also acts as anti inflammatory agent.

7. Diuretic effect :

Akarkara has so many medicinal properties that some of those have revealed and many properties still remain unknown on scientific parameters although ancient scholars have described about those virtues. As the science is advancing more facts are unveiling. In same way a study revealed the diuretic effect of this drug. It may become much beneficial to hypertensive patients who use this drug as aphrodisiac agent^[26, 55].

8. Immunomodulatory effect :

In Ayurveda, the drugs which are described for *Vajeekarana* effect, also having *Jeevniya*, *Balya*, *Brihana* and *Rasayana* properties^[56]. *Rasayanadrug* is the drug which have rejuvenationary, immunomodulatory antioxidant and anti aging properties^[57]. *Akarkara* also having *Rasayana* property not only through concept of Ayurvedabut proved by many scientific studies too.

Hot water soluble polysaccharide extracts from root of *Akarkara* exerted a strong enhancement of blood elimination of carbon particles and increased number of spleen cells^[58]. It may contain active principles with immune-enhancing effects on both phagocytic and lymphocytic system.*Akarkara* also works as an adaptogen and immunomodulator by increasing IgG antibodies^[44,59].

9. Inhibition of tobacco-induced mutagenesis :

Akarkara which has been traditionally used in India during the preparation of chewable tobacco, on tobacco induced mutagenesis were evaluated using Ames Salmonella/microsome assay. *Akarkara* extract (1 mg/plate) produced 74.33% inhibition of tobacco-induced mutagenesis. The extract also inhibited

the nitrosation of methylurea in a dose-dependent manner [22, 60].

10. Insecticidal activity:

Insecticidal ability of *Akarkara* is well known from many years. It is able to kill wide range of insects that include whiteflies, thrips, aphids, cabbageworms, beetles, ants (excluding fire ant), candelles, centipeds, crickets, fungus gnat, hornworms, Indian meal moths, leafhoppers, mealy bugs, Mediterranean flourmoths, rose aphid, rose chafers, rose slugs, spiders, trogoderma etc. *Akarkara* is generally considered to be the safest insecticide as “nontoxic to humans and pets^[22].” It is also effective in head lice eradication [60].

11. Local anaesthetic activity :

The aqueous and alcoholic (2%) extracts of roots of *Akarkara* exhibited in animals local anaesthetic activity of a longer duration than xylocaine(0.2%). In guinea pig demis and rabbit cornea, the herbal root preparation induced anaesthesia in 5 min. and lasted-12hours longer than xylocaine^[23, 26, 44, 62, 63].

12. Memory enhancing effect :

Akarkara also has memory boosting effect. A study was done in Wister rats in which memory impairment was induced by scopolamine. Ethanolic extract of *Akarkara* treated rats showed

an improvement in cognitive deficits. The study suggested that ethanolic extract of *Akarkara* increased brain cholinesterase level and hence it possess memory enhancing activity in scopolamine induced amnesia models by enhancing central cholinergic neurotransmission^[44,64]. *Akarkara* is regarded as a tonic to the nervous system^[58].

13. Neuropharmacological effect :

Akarkara has potential neuropharmacological activity as nootropic and also having antidepressant property. Further neurochemical investigations can unravel the mechanism of action of this drug with respect to nootropic and antidepressant activity. Preliminary investigations showed that ethanolic extract of *Akarkara* has significant neuropharmacological actions^[44, 65, 66].

14. Protective effect for male reproductive organs :

Akarkara is a drug having vast qualities. One of them is the protection of male sexual organs against some specific metal toxicity. *Lanthenum chloride* affects Sertoli cells adversely that leads to reduced sperm count and reduces viability which resulted into anti fertility. In this condition, *Akarkara* is one of the plant which can treat male infertility caused by

Lanthenumchloride.It alsoimproves testosterone and LH level^[67]. In another study, it has been revealed that aqueous extract of *Akarkara* root can be used effectively in the protection against male sexual disorders resulted from herbicide *Atrazine* exposure^[68].

15. Toxicity :

Akarkara is very safe drug even taken in high doses. A study per OECD guidelines^[69] showed that different root extracts of *Akarkara* did not cause any apparent toxicity in animal models. No death or signs of toxicity were observed in rats treated with extracts at dose 2000 mg/kg, establishing its safety. LD₅₀ value of *Akarkara* root extracts was found to be more than 2000 mg/kg of body weight. However, detailed experimental analysis of its chronic toxicity is essential for further support of this drug^[44,70]. Although In large dose the powdered root is an irritant to the mucous membrane of the intestine

causing blood stools, tetanus-like spasms and profound stupor^[18, 71], contact dermatitis if handled incorrectly^[72].

16. Uses in *Unani* System of Medicine :

Plant root has been used as expectorant^[17, 73]; diaphoretic, diuretic, bemmenagogue, galactogogue, rubefacient, calorific, aphrodisiac, general tonic, appetizer^[16, 26, 27, 74]; analgesic, anti-arthritis, anti-catarhal, carminative, digestive, vermifuge, sialagogue^[22]; in facial paralysis^[26, 76]; migraineetc. It is also used in dental problems like pyorrhoea, dental carries, loosening of teeth and toothache^[26].

It is also mentioned that *Akarkara* is an individual plant which may have its potency up to 7years^[71].

DOSAGE FORMS: *Akarkara* is used in various dosages forms- *Churna*/power, *Vati*/tablet, *Avaleha*, *Asava*and *Rasa*/herbomineral preparation etc.

Table no.1: Different formulations of Akalkara

S. N.	Dosage Form	Examples	References
1.	<i>Churna</i>	<i>Aakarkarabhadi churna</i> ,	<i>Sh. S.: M.Kh.-3/163-64^[5]</i>
2.	<i>Vati</i>	<i>Madanmanjari vati</i>	<i>R.T.S.-S.P.S: Part II Page-614^[17]</i>
3.	<i>Avaleha</i>	<i>Muslipak</i>	<i>A.S.S.:Avalehaprakaran, Page No.-554^[14]</i>
4.	<i>Aasava</i>	<i>Kaumaryasava</i>	<i>Sh.S.: M.Kh.-10/23^[5]</i>
5.	<i>Rasa</i>	<i>Kamini Vidravana rasa</i>	<i>Bh.R.:75/22, PageNo.-1160^[9]</i>

DISCUSSION:

Akarkara is a wonderful drug having various ailments treating properties. It was used in Ayurveda as well as Unani System of Medicine since ancient time by eminent *Vaidyas* and *Haqims*. The scholars of that time used to observe nature and its various components whether they are beneficial for health or not. So the most of the principles of Ayurveda or other ancient medicine systems are generally based on fine observations. But in modern era it is compulsory to validate these therapeutic values on scientific parameters. Although most of the observations based on therapeutic properties are validated. So in the light of new scientific researches, *Akarkara* is proved as good aphrodisiac^[29], anti diabetic, anticonvulsant, nootropic, diuretic, immune modulator, antioxidant, antipyretic, antibacterial, memory enhancing, insecticidal, dental protecting agent etc.

Akarkara is an amazing aphrodisiac^[15, 43] agent because it has pellitorine, an alkylamide which may be responsible for improved sexual functions^[34, 37]. Alkylamide either mimic or increases secretion of testosterone^[41] because all androgenic effects were seen in experimental models^[42] which validated its *Vajeekarana* effect, described in *Ayurveda*.

‘Eugenol’ has been detected in *Akarkara*^[44], which delayed onset of seizures induced by PTZ. Probably *Akarkara* produces anticonvulsant effect by enhancing GABAergic

neurotransmission^[46]. The anxiolytic action of *Akarkara* also detected^[47]. The ethanolic root extract can inhibit voltage dependent Na⁺ channels in MES induced tonic seizures^[48].

The mode of action of *Akarkara* might involve action other than pancreatic beta cells insulin release. This effect could be due to increase utilization of glucose by peripheral tissues, improved sensitivity of target tissues for insulin or may be due to improved metabolic regulation of blood glucose. Along with this effect, it also lowered down serum triglycerides level in *alloxan* rats. Which indicates long term use will be better not only for blood glucose control but also for lipid metabolism^[49].

Akarkara produced little antibacterial effect against *Staphylococcus aureus* and *Streptococcus sanguis*^[50, 51]. So it may be used as supportive agent to main antibacterial therapy. *Akarkara* showed good antioxidant property due to having OH⁻ radicals, H₂O₂ and NO₂ scavenging capability in dose dependent manner. It also inhibited lipid peroxidation. High antioxidant property of *Akarkara* is due to presence of eugenol, phenols, flavonoid, ascorbic acid compounds, alkaloids and tannins^[52, 53, 74].

Most of the antipyretic drugs inhibit COX-2 expression to reduce the elevated body temperature by inhibiting PGE-2 biosynthesis. Moreover, these synthetic agents irreversibly inhibit COX-2 with high selectivity but are

toxic to the hepatic cells, glomeruli, cortex of brain and heart muscles, whereas natural COX-2 inhibitors like *Akarkara* have lower selectivity with fewer side effects. Hence it may serve as an effective alternative medicine as antipyretic agents to synthetic drugs^[54].

The presence of flavonoids, saponins and organic acids are responsible for diuretic property of *Akarkara*. However further work is required to isolate and evaluate the active principles for the diuretic action^[55].

The immunomodulatory action of *Akarakara* suggests that its extract stimulates the immune response by acting on macrophages. This effect was due to its mitogenic effect on the lymphocytes. It appeared that the polysaccharide fractions from *Akarkara* may contain active principles with immune enhancing effects on both phagocytic and lymphocytic systems^[58]. Alkylamide, present in *Akarkara* has been reported to possess potent immune-stimulating activity.. Alkylamides have been described as producing a strong stimulation of phagocyte function as well as lipoxygenase inhibiting activity^[59].

The chemical compound eugenol found in *Akarakara* is responsible for inhibition of tobacco induced mutagenesis in tobacco chewers^[60].

The insecticidal property of *Akarkara* is due to pyrethrin. It is considered as safe insecticidal chemical because harmless to human being^[61].

Akarkara also produce local anaesthesia probably due to its irritating property causes local nerve endings reversible desensetised^[62]. *Akarkara* increases production and secretion of saliva. So used in dry mouth and is frequently used for toothache too^[63].

Akarkara inhibites acetylcholinestrase enzyme therefore elevates acetylcholine concentration in the brain and ultimately improves memory. *Akarkara* has neuro-protective role, therefore it may prove to be useful anti Alzheimer agent in view of its memory enhancing property^[64].

The neuro-pharmaceutical effect of *Akarkara* probably may be due to the involvement of neurotransmitters since the building of memory is augmented only when the levels of neurotransmitters are attenuated. This is demonstrated that the central cholinergic system, serotonergic transmission and nor adrenaline play a vital role in the cognitive function of the brain. Therefore *Akarkara* is regarded as nervine tonic^[58, 78].

Akarkara has also found effective in lanthenum chloride induced male infertility^[67]. However further study is required to reveal mechanism. It can protect against *Atrazine* induced reproductive disorders in adult male rats via attenuation of the oxidative stress, inhibition of apoptosis and increase of antioxidants, which ultimately led to improve the testicular function^[68].

Akarkara has wide therapeutic index as it has founded safe at 2000mg/kg body weight in

experimental models. So it can be used fearlessly^[70].

CONCLUSION:

Finally it can be concluded that *Akarkara* is an amazing medicinal plant which possesses multiple beneficial properties regarding to prevention as well as curing of health problems not only quoted by ancient scholars but also proved in experimental researches.

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