

A Comprehensive Review on *Cucurbita colocyntha***Vikhe Rohini Bhausaheb¹, Abhishek Sharma²****^{1,2}Department of Botany, Sabarmati University Ahmedabad****Corresponding author: Vikhe Rohini Bhausaheb****Conflict of interest: Nil****Abstract:**

Cucurbita colocyntha (L.) Schrad., commonly known as bitter apple or colocynth, is a medicinal plant belonging to the family Cucurbitaceae and is widely recognized for its traditional therapeutic applications. The plant has attracted considerable scientific interest because of its diverse phytochemical constituents and potential pharmacological properties. This review provides a comprehensive overview of the morphology, phenology, reproductive biology, seed germination, phytochemical composition, and medicinal importance of *C. colocyntha*. The plant exhibits characteristic adaptations to arid and semi-arid environments, while its flowering, fruiting, and seed germination are influenced by environmental factors such as temperature, rainfall, light, and seed dormancy. Phytochemical investigations have identified several bioactive constituents, including cucurbitacins, cucurbitacin glycosides, flavonoids, flavonoid glycosides, phenolic compounds, fatty acids, and other secondary metabolites. Among these, cucurbitacins are particularly important due to their diverse biological activities. Experimental studies have explored the plant's potential antioxidant, anti-inflammatory, analgesic, anti-ulcer, hepatoprotective, antihyperlipidemic, and other pharmacological effects. Furthermore, its traditional use in indigenous systems of medicine highlights its ethnobotanical significance. However, the presence of potent and potentially toxic constituents, particularly in the fruit, necessitates careful evaluation of its safety, dosage, and therapeutic efficacy. This review emphasizes the importance of integrating traditional knowledge with systematic phytochemical, pharmacological, toxicological, and clinical investigations to establish the medicinal potential of *C. colocyntha* and support its safe and evidence-based utilization.

Keywords: *Cucurbita colocyntha*, Cucurbitaceae, colocynth, cucurbitacins, phytochemicals, medicinal plants, pharmacological activities, seed germination.

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Introduction**Morphology:**

The cucurbits are morphologically studied by Baily (1929, 1930, 1943, 1948), Braun (1876), Cogniaux (1881, 1916), Cogniaux and Harms (1916), Hageup (1930), Heimlick (1927), Judson (1929 & 1929), Muller and Pax (1889), Naudin (1855), Whitker (1947) Whitkar and Carter (1946),

Mercy et al. (2013), Zhang et al. (2006), Kocyan et al. (2007), Schaefer et al. (2009), Schaefer and Renner (2011a, b)

Phenology:

The phenology has been studied in tropical latitudes by various workers. To mention a few significant contribution are those of Gibbs and Leston (1970), Nevling (1971), Rees (1964),

Frankie et al. (1974), Krishnaswami and Mathuda (1954), Njoku (1958), Boaler (1966), Gupta (1961), Hopkins (1966, 1970), Bhatnagar (1968), Janzen (1967), Croat (1969), Daubenmire (1972), Medway (1972), Huxley and VonEck (1974), Kaul and Raina (1980), Opler et al. (1976, 1980), Dar and Kachroo (1983), Fleming et al. (1985) Heithaus (1979), Rathor (1970), Kater et al. (2001), De Boer et al. (2012) and Mitchell et al. (2015). In tropical environments, pattern of flowering and fruiting have been clearly correlated with annual variation in temperature and rainfall (Janzen, 1967; Smythe, 1970; Frankie, Baker and Opler, 1974; Raemaekers; Aldrich-Blake and Payne, 1980, Foster, 1982, 1985, Sebastian et al. 2010, Chomicki and Renner, 2015). Bhatnagar (1968) studied defoliation phenomenon in Central Indian forest tree species. He recognized two types of tree species: those shedding their leaves in winter and in summer seasons. On the basis of periodicities of foliation and flowering he recognized three patterns in tree species: (i) species in which flowers appeared preceding the new foliage, (ii) in which flowers appeared with new foliage and (iii) in which flowers appearance of mature foliage.

Waser and Real (1979), Thomson (1981), Ratheke (1983) and Waser (1983) are of the opinion that natural selection may acts as a brake upon divergence. When antagonistic selective pressures have become balanced, the species will have reached, optimal, flowering times, Various studies of plant communities seem to have provided evidence for the degree of separation and sequencing of flowering time, predicted by the competition hypothesis (Mosquin, 1971; Heithaus, 1974; Stiles, 1975: Schenske et al. 1978; Waser, 1978a, 1978b, 1983; Gross and Wermer 1983). However, pattern of flowering date in many natural communities do not fulfil predictions of the competition hypothesis.

In some cases flowering times are aggregated (Thomson, 1980; Ratheke, 1983) or statistically indistinguishable from randomly generated patterns (Robinowitz, 1981; Aarssen, 1985). After extensive studies, Kochmer and Handel (1986) made a suggestion that phylogenetic constraints may be more important than competition in determining community level patterns of phenology.

The degree to which the periodical are controlled by climate factors. has been advocated by a number of authors and reviewed by Richards (1952), Alvim (1964) and Longman (1969), Fischer and Turner (1978) and Opler et al. (1976) are of the opinion that in a seasonal tropical forests, flowering is often induced by rainfall. Heavier rains increase synchrony of flowering within populations of some tropical trees (Augspurger, 1982). However, Brochert (1983) considered that flowering in some tropical trees occurs in response to decreased water stress which may be stimulated by either leafloss or rainfall.

Flowering duration within population can last from a single day to the entire year for different species (Frankel and Galun, 1977).

Gentry (1974) categorized flowering patterns for species based upon duration. Species with short durations produce masses of flowers in a synchronous display (mass flowering) whereas species with extended duration commonly produce a few flowers a day over long periods (Steady-State flowering).

Zanzen (1967), Frankie et al. (1974). Augspurger (1980) and Opler et al. (1980) have postulated that in tropical forests, mass flowering is common among trees, that flowers during the dry season.

Whereas steady-state flowering is found in most understory species. However, variations

exist between these two extremes. Janzen (1967) pointed out the biological significance of the synchronization of flowering of trees with dry season. Some of the recent contributions on phenological investigations are highlighted as under.

Newton (1988) studied structure and phenology of a most deciduous forest in central Indian highlights. He made phenological observations on 61 species in Kanha Tiger Reserve, M.P. dominated by Shorearobusta.

Heidman (1989) studied forest tree species of a rain forest in Central Philippines. Ansan et al. (1989) recorded Phenological observations of 37 woody angiosperms in Garhwal region. Spence (1989) carried out phenological observations in selected alpine species. Childes (1989) observation the phenological patterns of nine woody species, which are common components of Kalahari sand communities. Leslier (1989) has given a brief description of tree phenology of Somalia where as in other harsh arid and semi-arid countries, the patterns of leafing, flowering and fruiting are linked to rainfall. Werger and Ellienbrock (1982) reported and unusual phenological rhythms in Sudano-Zambezian tree *Acacia albida* which its leaves with the start of rainy season. Novchoo et al. (1986) reported broad phenological aspects of vegetation of Pulwama in Kashmir. Ansari (1989) furnished the phenological calendar during the solar year i.e. number of plants, flowering in each month to compare with the phenology of woody and herbaceous species against the changing weather and season.

Malik and Bhosale (1990) studied flowering of 12 mangrove species in west coast of Maharashtra. Duke (1990) reported leaf fall and reproductive phenology of mangrove tree *Avicennia marina*.

Hegarty (1990) studied the production and retention of leaves by trees and lianas in a

predominantly evergreen Australian subtropical rain forest. Blatter (1906-1907), Dar and Kachroo (1983), Kaul and Raina (1980), Singh (1982),

Kulkarani (1987), Mishra (1980), Kuruvilla (1989) have attempted phenological investigations of Indian forest trees. Singh (1992) reported on the phenology of *Madhuca indica* an economically poor man's bread earning tree species of Central Indian forests.

Reproductive Biology :

In the evolution of the land plants one find a progressive specialization of the reproductive structure until, in the flowering plants these reproductive structure are found to be borne in a modified shoot called the flower. The flower is the most conspicuous structure in the angiosperms. The importance of the flower lies in its connection with reproduction which is a very manifest property of life. The floral biological studies date back to the work of Camerarius (1994). Later, Dobbs (1750), Sprengel (1793) and Knight (1799), contributed some valuable information's in the field of reproductive biology. The 18th century abounded mostly in philosophical thoughts regarding the floral biology. Consequently, the concepts of pollination proved to be just vain glory. The floral biological studies acquired new dimensions after the publication of theory of Natural selection by Darwin (1959). During this period the natural adaptations between flowers and their pollinating agents were considered to be a biological phenomenon. Many important trends and concepts of present day floral biology are derived from the work of Muller (1883) Rosa (1924) and Vivilov (1926). List of other earlier students of such a study includes the names of Sagaret (1926), Edmond (1930), Currey (1932), Gustaffson (1936) and Gardner and Marth (1937).

The pollination ecological studies have been done by a number of workers in India and abroad. some of the recent noteworthy contributors to pollination ecology and fruit and seed-set study of economically important crops are Champman (1964), Free (1970), Pijl (1971), Macior (1971), Proctor and Yeo (1973), Colwell (1973), Wilson and Rathcke (1974), Price (1975), Bhatnagar (1975), Shrivastava (1975), Nair (1976), Uppal et al., (1977), Shrivastava (1978), Singh (1979), Shrivastava and Shrivastava (1981), Reddi and Reddi (1982), Nigam (1983), Dwivedi (1986), Bhatnagar and Mishra (1987), Dwivedi et al., (1989), Yadav (1991) and Tripathi (1992). Pijl (1966), Baker and Hard (1968) and Leepik (1977) have suggested that primitive angiosperms were pollinated by insects rather than by the wind action. Muller (1871) was also of the opinion that evolution of dicotyledonous flower is a product of entomophily. Arber (1950) has also discussed the possible role insects in the origin of flowers.

Seed germination :

Morphological characteristics of many seeds have been studied in various autecological investigations including those of Thakur (1992), Pandey (1993), Rais (1993), Arnold (1994), Pandey (1997), Bais (2000), Khan (2002) and Agrawal (2004) also studied the morphology of seeds in their respective autecological investigations.

The principal physical difference found in seeds, are seed size, density, shape, surface, texture, colour and seed conductivity.

Dwivedi et. al. (1990) studied variability in shape, size and weight of seed produced as a result of different crosses on different occasions.

Seed weight too has been reported to be the most important factor effecting the size of one

year old eastern white pine (*Pinus strobus* L.) seedling by Pandey et al. 1985). He suggested that seed weight should always be taken into account before the growth rates of seedlings are determined. They found that heavy seeds germinated faster and survived in larger proportions than the light seeds. Relationship among seed weight and several growth parameters in *Pinus oocarpa* have been investigated by Kandya et al. (1978). It was found that the seed weight plays an important role in the early phase of growth of the seedlings.

Singh et al. (1990) reported the effect of weight of seed of *Picea smithiana* on seed germination and early seedling growth under laboratory conditions. Seed germination, growth of seedlings and their dry weight increased with an increase in the seed weight.

Gautam (1990) observed that the hardness of seeds of *Melilotus indica* is due to the impermeability of their seed coat.

Different seeds show variable periods of viability. The duration of viability of seeds depends on the genetic constitution of the species and their storage conditions. Weise and Wentz (1937) reported that life span of the Maize grains is associated with certain genes. But the seeds of similar genetic constitution can have their life span greatly modified by varying storage condition (Crocker, 1938, Mayer and Poljakoff-Mayber, 1963), such as moisture content, Oxygen supply, temperature and seed storage. They also observed that seed viability is best retained under conditions in which the metabolic activity of seed is greatly reduced, i.e. low temperature and high CO₂ concentration. Crocker and Barton (1953) and Owen (1952) observed that moisture contents of the seed and temperature are the principal factors influencing the viability of seeds in storage.

Viability period is generally shortened under moist conditions, but Went (1974) noted that *Amaranthes* seeds retain their viability for many years after submergence in water. Lotus seeds are reported to retain viability even after being buried for thousands of years in bays. These seeds remain alive while fully saturated with water. Many seeds when maintained under vacuums retain viability for a long time. But outside vacuum, lose the viability within 10 years (Went, 1974).

Some seeds are reported to lose their viability in a very short time. Crocker (1938) reported that seeds of most species of Rubiaceae, Myrtaceae, and Lauraceae lose their germination capacity soon after being detached from the mother plant.

It is reported that seed of wild plants retains their viability well. Crocker (1938) observed that dormant seeds can retain viability in moist soil for 50 years or more. Dormant seeds of many cultivated plants like celery, clover and blue grass can retain viability for nearly 20 years. Viability is generally retained for long periods in seeds having a hard seed coat (Mayer and Poljakoff-Mayber 1963). Becquerel (1934) has also emphasized the significance of hard seed coats in retaining viability of seeds. Several well documented records of old seeds are available. In Beal's records of old seeds as quoted by Darlington (1951), seeds of *Varbasculum blattaria*, *Rumex crispus*, *Oenothera biennis* etc. were found germinating even after 71 years. These seeds, mixed with sand, were stored in bottles buried 18" below the surface of the ground. Crocker (1938) has recorded that the seeds of *Cassia multiuga*, *Nelumbonucifera* showed 85% germination after 150 years. In Becquerel's record of old seeds, determined longevity of *Mimosa glomerata* was found to be 81 year and probable longevity was calculated to be 221 years. Likewise

determined longevity of *Cassia bicapsularis* seeds was calculated to be 119 years.

Tests carried under United States Department of Agriculture, Buried seed Project (U.S.D.A.B.S.P.) revealed that members of the family Gramineae, after a period of 30 years, Poa seeds showed a germination of 18.15%.

Babeley and Kandya (1986) used excised embryo test for the determination of viability of the seeds of six tropical dry forest tree species viz. *Acacia catechu*, *Albizia lebeck*, *Bauhinia variegata*, *Cassia fistula*, *Leucaena leucocephala* and *Wrightia tinctoria*. They observed that the excised embryo test proved to be a quick method for determining seed viability in these species as compared to laboratory/field germination test.

The use of X-ray contrast method of viability was developed by Simak (1957). Seeds were soaked in a heavy metal solution (usually Barium Chloride) then X-rayed with soft X-rays. Seeds, which damaged or have lost their membrane integrity take up salt, and exhibit a shadow on the radiograph. Sussman and Halvorson (1966) have defined dormancy as rest period of reversible interruption of the phenotypic development of an organism. According to Amen, (1963) and Vegis (1964), dormancy may be constitutive, where development is delayed to the penetration of nutrients, a metallic block or production of inhibitor. This type of dormant condition originate automatically within the plant. According to Vegis (1964) dormancy is a highly useful adaptation to the environmental condition which prevail where the species or variety originates. It is found that to Flasper (1957) in cultivated soil dormancy ensured survival of plants. Wareing (1965) observed that dormancy is a safeguard against any factor of the environment which effect the subsequent growth adversely. Several workers (Nikolaeva, 1958; Mall and Manilal 1962;

Amen, 1963) stressed that dormancy of seed is an adaptive property and it is correlated with the distribution of plant in nature. But according to Amen (1968), in addition to inductive mechanism for onset of dormancy cryptobiotic central mechanism also operate for the maintenance of metabolic blocks.

Physical dormancy is due to impermeability of seed coat or pericarp to water. Many workers including Crocker (1948, 1961), Toole (1962), Stotzky, et al. (1962), Koller (1962) Poljakoff-Mayber et al. (1963), Dwivedi (1988), Bano, and Singh (2016) have encountered dormancy due to the presence of mechanically resistant and hard seed coats, impervious to the entry of either water or oxygen in plants belonging to diverse plant families such as Malvaceae, Leguminosae, Convolvulaceae, Solanaceae, Chenopodiaceae, Cannaceae and Graminae etc.

Chemical dormancy is found due to presence of inhibitors in pericarp or seed coat. A number of workers (Barton, 1948; Evanary, 1949; Black, 1956; Miyamoto et al., 1961; Asakawa 1963; Wareing, 1965 and Kentzer, 1966 etc.) have stated that dormant condition brought about by the presence of growth inhibitors in testa, embryo, endosperm or pericarp. This has been reported by them in a number of plants including tomato, mustard, cocklebur, apple, cherry and ash etc.

The freshly harvested mature seeds of *Datura innoxia* exhibit a period of dormancy during which no germination occurs even under favourable external conditions of moisture, temperature and aeration. However, dormancy is slowly lost after a period of about 45 days from harvest of seeds (Rais 1992).

The effect of different light conditions on seed germination has been studied by many workers (Evenari et al., 1957; Sen, 1969; Mishra, 1985; Rais, 1992; Kasera and Sen, 1995).

The significance of light on germination of seeds was reviewed by Evenari (1949). He observed the influence of light on germination and dispersal units has been termed as photoblastism.

It is observed by several workers that effect of continuous light in different species including *Mullugonudicaulis* (Bakshi and Kapil 1952), *Gesekiapharnaccoides* (Joshi and Kamboj, 1959) and *Tribulusterrestris* (Joshi et al. 1967 and Kashyap, 2009). In the seeds of *Alternantherasessilis* minimum germination was noticed in complete darkness.

Agrawal and Vyas (1970) observed maximum inhibition in white light, while maximum germination in white and red, but yellow, blue and green spectra has inhibitory effect on seed germination of *Indigoferastragalina*. It has been well known that the temperature is one of most important factors for seed germination. Under unsuitable temperature the seed of many species either fail to germinate or they show poor germination.

Mayer and Poljakoff-Mayer (1963) observed that different temperature range, within which they germinate. Gupta and Kumar (1977) in *Dendrocalamusstrictus* has observed that 30°C temperature is an ideal temperature for its germination. *Zea mays* has a temperature range of 8-44°C, *Oryza sativa* can germinate within a range of 10-42°C. *Triticum sativum* is active between 3-43°C and *Avena sativa* can germinate between 3-40°C. Temperature ranges for the seed of *Desmodiumpulcherum* (Tripathi and Shrivastava, 1970) and *Dichanthiummannulatum* (Maurya, 1972) have been reported to lie between 20-50°C and 15-40°C respectively. Santra et al. (1981), Kasera and Sen (1987), and Pandeya and Reddy (1991) found that continuous light and low temperature favourable for germination of

Bidenspilosa, *Borreiaarticularis* and *Asphodelustenuifolius* respectively.

Radiant energy stimulates the germination percentage. It has been reviewed by many workers (Dimitrov 1956, Spencer 1955, 1959; Woodstock and Justice, 1967; Singh 1972; Torne and Rant Desai 1975; Baqar Ahmed et al. (1975). X-ray sensitivity of seeds had been pointed out by John (1936), Maxwell and Kempton (1936).

According to Kutacek et al. (1966) irradiation may lead to an increased formation of indole auxins or their precursors, thus stimulating subsequent growth. The radiant energy stimulates the respiratory enzymes which are associated with mitochondria (Woodstock and Comb, 1965).

A wide range of chemicals has been tested to investigate their effect on percentage of seed germination by a number of workers. Ribeiro (1944), Koller et al. (1962), Farooq et al. (1991), Karadge and Sawant (1991), Rais (1992), Pandey (1996), Tripathi (1998) and Bais (2000), Bano and Singh (2016) mentioned that various chemicals like, colchicine, ascorbic acid, CuSO_4 , sulphadiazine, sulphaguanidine, vitamin B complex, NH_4OH , NaOH , acids, micronutrients, different detergent powders, herbicides etc. have been known to effect on germination of many seeds. Pandeya and Baghela (1973), working on seeds of *Celosia argentea* reported inhibitory as well as promotive effect of colchicine depending on its concentration. Freshly harvested seeds of certain plants do not germinate, it shows dormancy and start germination after storage of 1 to 6 months. In certain seeds the cause of dormancy has been enumerated as low auxin level which fails to trigger the germination process. Auxin level in such seeds controls dormancy (Donaho and Walker, 1957, Monroy, 1967, Scarano and Augusti-Tocco, 1967, Paleg and Cohen, 1967).

Wareing and Saunders (1971) also review the effect of hormones on dormancy. Amen (1968) observed that over all control of seeds dormancy, particularly in albuminous seeds, seems to involve a reduction in the growth promoting hormones content during maturation. Amen (1968) further observed that endogenous hormones control the hydrolytic system of dormant seeds. Wiley and Ashton (1967) suggested that embryo axis may send hormonal signals for transcription of different enzyme systems. IAA is reported to stimulate germination of certain dormant seeds like Lettuce and Pea (Solding and Wagner, 1955), but how this is effective is not entirely clear (Poljakoff-Mayber 1958).

Certain growth promoters are known as the agents which release dormancy in some cases (Haemberg, 1949, Evenari, 1961, Vegis, 1964, Wareing, 1965, 1969 and Wareing and Saunders, 1971). Stimulative effect of exogenously applied GA on seed germination was conclusively proved for the first time by Lona (1956) and Khan et al. (1956), on the seeds of *Lactuca sativa* and *L. scariola*, Naylor and Simpson (1961) reported its promotive effect on *Hordeum*. Similar results have been reported for a number of plant species including *Thlaspi arvense*, *Avena fatua*, *Drabacina* and *Gentiana vialis* (Corns, 1960, Paleg, 1965, Evenari, 1965 and Simpson, 1965).

In several plant species dormancy has been overcome by the application of Gibberellic acid including barley (Khan and Waters, 1969). The role of Gibberellic acid in breaking dormancy and promoting seed germination is not very clear. It may act on elongation of embryo axis (Ikuma and Thimann, 1960) as it may enhance α -amylase activity (Wurzbarger et al. 1974) or the synthesis of it (Chrispeels and Varner, 1967). Gibberellic Acid can promote the release of rapidly soluble food materials from food reserve (Naylor and Simpson, 1961),

protein, amino acids and auxin contents are reported to be changed by Gibberelic Acid activity (Paleg, 1961, Koller et al., 1962, Kuraishi and Muir 1962). Gibberelic acid may also effect nucleic acid synthesis (Naylor, 1966) Paleg and Cohen (1967) observed that GA is associated with enzyme system.

Phytochemical study and Medicinal uses :

Various important chemical constituents are elucidated from entire plant (root, stem, leaves, fruit and seeds) are documented in literature imparting medicinal value to the genus are carbohydrates, proteins, separated, amino acids, alkaloids, flavonoids, terpenoids. Fruits are the main source of drugs. Cucurbita colocyntha have proved to have several active chemical constituents like colocynthin, colocynthetin, cucurbitacins, á-elaterin (Adam et al. 2001), cucurbitacines (Sturm et al. 2009), cucurbitacin glycosides (Hatam et al. 1989, Seger et al. 2005 and Abbas et al. 2006), flavonoids and flavone glycosides (Maatooq et al. 1997 and Abbas et al. 2006). The well-known bioactive compounds of fruit are cucurbitacins; cucurbitacins E (richly found from pulp), Phenolics, Flavonoids, Fatty Acids, Alcoholic and Ketonic alkyl chains (Priyavardhini et al. 2009, Najafi et al. 2010, Uma & Sekar, 2014, Kapoor et al. 2020, Rubalakshmi, et al. 2021, Soni et al. 2022a and Sanket, et al. 2022). Ash values are helpful in determining the quality and purity of crude drugs in powdered form. The total ash method is designed to measure the total amount of material remaining after ignition. The different ash values like total ash, acid insoluble ash, water soluble ash was carried out. Extractive values are useful for evaluation of crude drugs and give an idea about the nature of chemical constituents present in them. Petroleum ether extract at 600-800C, 95% ethanol soluble extractive, chloroform soluble extractive and water soluble extractive values were determined. Solubility and pH values were also

determined using standard procedures (Anonymous, 1998 and Venkateshwarlu et al. 2010).

Ancient Indian and world literature medicin suggests that primitive people used several kinds of medicinal plants for combating diseases. The cultivation of medicinal and aromatic plants were studied by certain members, Scope of cultivation of importnat medicinal plants in Chhatisgarh plains (Oudhia and Tripathi 1999), Prospects of cultivation of medicinal plants under controlled phyto-environmental conditions (Sharma et al. 1999) and Influence of nutriants on the growth, yield and active principle content in Kalmegh (AndrographispeniculataNees) (Ramesh et al. 1999).

Inspite of the influx of the modern civilization and modern medical facilities, the rural folk hold on to their traditional faith in benefits of indigenous medicines and depend on the medicinal efficiency of plants for treatment of their ailments

Some of the knowledge on different medicobotanical aspects as produced by different workers in India and abroad are as such. Native medicine in Sudan (Ahmed 1970), medicinal plants of Somoa (George, 1974), medicinal plants of Bhagirathi valley (De, 1962), Euphorbia in medicine (Khan and Chagtai 1979), medicinal plants from Baghelkhand (Dwivedi and Pandey 1990), medicinal plants of Rubiaceae at Bhopal (Khan et al. 1984), Indian medicinal plants (Kirtikar and Basu 1935), observation on certain plants used in various disease by the tribals of Shahdol district Madhya Pradesh (Khan and Khan 1997), Ethnobotanical notes on some herbs from Chhatisgarh region of Madhya Pradesh (Gupta et al. 1999), Traditional phytotherapy of maikal range and plateau of Pendra district Bilaspur (Shukla et al. 2001), weeds of Soybeen in Rewa division (Khan et

al. 2003), weeds of Pigeon pea (Khan et al. 2003), Significance of wild poisonous plants of Amarkantak (Khan and Khan 2004), wild medicinal plants of Vindhya region (Khan et al. 2004), use of plants in various ailments of Umaria district (Khan et al. 2004), Herbal treatment curing children disease (Khan et al. 2005), Enumeration of certain members of family Euphorbiaceae and their medicinal use(s) among the tribals of Bandhavgarh National Park (Khan et al. 2006), Observation of certain plants used in skin diseases by Baiga tribes of Mandla district (Khan et al. 2008), Ethno botanical importance of *Cucurbita colocyntha* L. (Soni et al. 2022b).

Both plants are phytochemically analysed by various researchers time to time viz. Hatam et al. (1989), Maatooq et al. (1997), Seger et al. (2005), Kumar et al. (2008), Najafi et al. (2010), Rahimi et al. (2012), Rodge and Biradar (2013), Vadnere et al. (2013), Pravin et al. (2013), Kadam and Bodhankar (2013), Uma and Sekar (2014), Venkateshwarlu et al. (2014), Hussain et al. (2014), Gupta and Bagh (2014), Attar and Ghane (2017), Dhakad et al. (2017), Patel (2018), Kapoor, et al. (2020), Soni et al. (2022a&b).

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