



A REVIEW ON SURANJANA (*COLCHICUM LUTEUM* BAKER): CLASSICAL AND CONTEMPORARY PERSPECTIVES

Rama Babasaheb Ganakwar*¹, B. Ram², Diksha Sharma³

1. Junior Resident, Department of Dravyaguna, Faculty of Ayurveda, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India 221005.

2. Professor, Department of Dravyaguna, Faculty of Ayurveda, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India 221005

3. Junior Resident, Department of Dravyaguna, Faculty of Ayurveda, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India 221005.

ABSTRACT

Suranjana (*Colchicum luteum* Baker), commonly known as Meadow Saffron, is an important medicinal plant extensively used in Ayurvedic and Unani systems of medicine. In the Unani system of medicine, Suranjana Talkh is considered therapeutically more potent and is commonly used to manage gout and inflammatory joint diseases. Although the drug is not described in the Ayurveda classics, it was later incorporated by scholars such as Yadavji Trikamji, K. C. Chuneekar, and Ram Sushil Singh, who recognised its therapeutic significance. In Ayurveda, Suranjana is described as possessing Tikta-Katu rasa, Laghu-Ruksha guna, Ushna virya, and Katu vipaka, making it particularly useful in Kapha-Vata disorders. The present review highlights the botanical description, classical references, geographical distribution, cultivation practices, chemical composition, pharmacological properties, therapeutic uses, precautions, and recent research updates of Suranjana. The plant contains important bioactive alkaloids such as colchicine and demecolcine, along with several phenolic compounds responsible for its anti-inflammatory, analgesic, antioxidant, antimicrobial, enzyme inhibitory, and anticancer activities. Various parts of the plant, including the corms, seeds, and flowers, are traditionally used to manage joint disorders, urinary ailments, skin diseases, and blood-related conditions. Modern pharmacological studies strongly support many of the traditional claims regarding Suranjana; however, due to the toxic nature of colchicine, careful dosage regulation and medical supervision are essential. Thus, Suranjana represents a valuable medicinal herb with promising therapeutic potential in both traditional and modern medicine.

KEYWORDS

Suranjana, Suranjana Talkh, *Colchicum luteum* Baker., colchicine, gout, anti-inflammatory.

INTRODUCTION

The genus comprises nearly seventy species, of which two are native to India. Plants belonging to this genus are corm-bearing herbs characterized by a short scape. *Colchicum luteum* Baker is a perennial herb belonging to the species *luteum*, family *Liliaceae* (Ayurvedic: Rason Kul), genus *Colchicum*, division *Magnoliophyta*,

and class *Magnoliopsida*. It grows wild in the western Himalayan region and is also widely cultivated in India, Afghanistan, Pakistan, and Nepal.^[1]

The term “Suranjana” is believed to have originated from the Unani tradition. Descriptions of the drug Suranjana and its Ayurvedic properties are not mentioned. Sankar Dutt Gond first included Suranjan (*Colchicum luteum* Baker) in *Sankar Nighantu* in 1935 A.D. It is commonly referred to as “Suranjaan-e-Talkh” in Urdu, “Hiranya-Tuttha” and “Tuthanjana” in Sanskrit, “Virikum” in Kannada, “Hiran Tutiya” in Hindi, “Suranja” in Marathi, and “Suranjan-e-Lakh” in Persian.^[2]

In English, *Colchicum luteum* is known by several common names. It is called “Meadow Saffron” because of its solitary, long, violet, tubular flowers that resemble those of crocus plants and possess six bright red style branches. However, it differs from crocuses in having six stamens, three styles, and a superior ovary. In contrast, crocuses possess only three stamens, a single style divided into three parts, and an inferior ovary. The name “Hermodactyl” is attributed to its finger-shaped flowers. It is also referred to as “Golden Collyrium” due to its funnel-shaped, golden-yellow perianth. The term “Colchicum” is believed to have originated from Colchis, a region historically associated with Italy, where the plant was said to grow abundantly.^[3]

AIM

The present review aims to compile and critically analyze the classical references, pharmacological properties, therapeutic applications, and recent scientific advances related to Suranjana

BOTANICAL DESCRIPTION

Macroscopic

Suranjana Talkh is a small perennial herb that grows to a height of about 2–10 inches.^[4] The leaves are alternate or less often opposite or whorled, broad linear shape with a dimension of 12-18cm x 0.8-2cm. The flowers are nearly always bisexual and actinomorphic.^[5] Corms are light brown in color and opaque with a bitter taste.^[6]

Microscopic

In transverse section, the corm appears reniform (kidney-shaped) with a depression along the grooved region. The epidermis is composed of rectangular cells, some of which contain a few starch grains.^[7] Beneath the epidermis lies a thin-walled hypodermis composed of cells similar in structure to the epidermal cells but lacking cellular contents. The ground tissue consists of thin-walled parenchymatous cells densely packed with starch grains. On the grooved side near the periphery, some cells appear laterally compressed, forming 2–4 fine streak-like structures. Numerous scattered vascular bundles are present, predominantly in the central region of the corm near the basal bud. The peripheral vascular bundles are comparatively less developed and more sparsely distributed. Most vascular bundles are collateral, although occasional bicollateral bundles may also be observed. The xylem is composed of annular and spiral vessels. The starch grains present in the parenchymatous ground tissue are simple and may be ovoid, spherical, or polyhedral in shape. Their size ranges from 2–21 µm, and they characteristically possess a 2–6 angled stellate hilum.^[8]



Figure 1: Suranjana plant with flower



Figure 2: Fresh Suranjana corm

CLASSICAL REFERENCES

Suranjana (*Colchicum luteum* Baker) is not described in the early classical Ayurvedic Samhitas, and its detailed description appeared in later Ayurvedic literature. Subsequently, several twentieth-century Ayurvedic scholars, including Yadavji Trikamji, K. C. Chuneekar, and Ram Sushil Singh, recognized Suranjana as an important medicinal drug for the management of gout and rheumatoid arthritis. In Ayurveda, Suranjana is categorized into three types on the basis of its taste and colour:^[9]

Sr no	Type	Taste/Colour/Properties
1	Shweta	Madhura
2	Peeta	Small in size and Tikta taste
3	Krishna	Poisonous, applied externally to reduce pain and swelling.

GEOGRAPHIC DISTRIBUTION

The plant is commonly found along forest margins, open grassy slopes, and temperate regions of the Western Himalayas, particularly from Kashmir to Chamba, at elevations ranging between 700–2800 meters in India. Its geographical distribution extends to Afghanistan, Pakistan, the Hind Kush Mountains, Punjab, Himachal Pradesh, Nepal, and Sikkim. Generally, the plant thrives in cool climatic conditions and is predominantly found in regions where the temperature remains below 15°C.^[10]

The natural habitat of Suranjana is characterized by temperate climatic conditions, including severe winters, snowfall, and low humidity. The plant is commonly propagated through corms, which are collected from their natural habitat after the melting of snow during April–May. Healthy corms free from injury and infection are preferred for cultivation. Approximately 0.5 million corms are required for planting in one hectare of land.^[11]

PLANTING OPERATIONS

a. Land Preparation and Application of Fertilizers

The land should be ploughed two to three times to make the soil loose and porous, which facilitates proper planting and sprouting of the corms. Since the corms are susceptible to rotting under waterlogged conditions, the field must be well-drained and preferably have a gentle slope. Suranjana grows best in sandy loam soil; therefore, sand may be added to improve soil texture if necessary. During the pre-planting stage, farmyard manure (FYM) at the rate of 6 tonnes per hectare should be evenly spread and thoroughly mixed with the soil during ploughing.

b. Transplanting and Optimum Spacing

The corms are directly planted in rows on small beds prepared in the field. Cultivation is generally carried out during the Rabi season, particularly in October in temperate regions. For optimum growth and development, the corms should be planted at a spacing of 10–20 cm. Under suitable conditions, the corms germinate and develop roots within one month.

c. Crop Maturity and Harvesting

The crop attains maturity within approximately 16–18 months. Seeds should be collected immediately after the fruits ripen in April. The corms are harvested after an interval of about one month, usually in May, once the leaves have completely withered. This interval allows adequate hardening of the protective outer layer of the corm.^[12]

CHEMICAL COMPOSITION

Both the seeds and roots of the bitter variety of *Colchicum luteum* Baker contain considerable amounts of the alkaloid colchicine, which is readily soluble in water and alcohol. They also contain constituents such as tannic acid, gallic acid, starch, sugar, and gum. The sweet variety contains only trace amounts of an alkaloid that is considered physiologically inactive. Chemical analysis of the seeds and roots of Suranjana further reveals the presence of a large quantity of starch, a small amount of oily resinous matter, and the bitter alkaloid phenethylisoquinoline.^[13]

The colchicine content in the air-dried corms of *Colchicum luteum* Baker has been reported to range between 0.21–0.25%, whereas the seeds contain approximately 0.41–0.43% of the alkaloid. Since colchicine is sensitive to high temperatures, the corms should be collected during early summer and dried at temperatures not exceeding 65°C to preserve their chemical constituents. In addition to colchicine, Suranjana contains several colchicine analogues, including deacetylthiocolchicine (DTC), deacetylmethylcolchicine (DMC), and trimethylcolchicic acid (TMCA), which are considered beneficial in the management of gout. The major phenolic compounds identified in *Colchicum* include 4-hydroxy-3-methoxybenzaldehyde (vanillin), 4-hydroxybenzoic acid (vanillic acid), 3-(3-hydroxyphenyl)-2-propanoic acid (coumaric acid), caffeic acid, and 3,4,5,7-tetrahydroxyflavone (luteolin).^[14]

PROPERTIES AND PHARMACOLOGICAL ACTION

Ayurvedic Attribute	Description	Sanskrit Term
Rasa (Taste)	Bitter, Pungent	Tikta, Katu
Guna (Properties)	Light, Dry	Laghu, Ruksha
Virya (Potency)	Hot	Ushna
Vipaka (Post Digestive effect)	Pungent	Katu

Due to these properties, Suranjana exhibits several important pharmacological actions. It is considered Kapha-Vatahara (alleviates Kapha and Vata doshas), Cakshushya (beneficial for the eyes), and Rakta-Prasadana (blood purifier). It also possesses analgesic properties and promotes wound cleansing (Vrana Shodhaka) and wound healing (Vrana Ropaka). Additionally, it acts as Sara, Sukrala, Deepana-Pachana (enhances digestion and metabolism), Rechaka (laxative), Vamaka (emetic), Ama-Visha Nashaka (detoxifying agent), and Vidahikara.^[15]

Suranjana possesses stimulant, laxative, expectorant, diuretic, anti-inflammatory, and anticancer properties. It is also known to produce an irritant effect on the skin, leading to hyperemia. Owing to these actions, it is externally applied in certain skin disorders, including leprosy, while internally it is primarily used in the management of gouty arthritis.

THERAPEUTIC USES

The medicinally useful parts of Suranjana include the dried corms (*Colchici Tuber*), dried seeds (*Colchici Semen*), Hiranya Tuttha (a dark brown dried extract obtained from *Colchicum luteum* Baker), and the fresh flowers.^[16]

The dried corm of Suranjana possesses a bitter and pungent taste, hot potency, and Kapha–Vata alleviating properties. Owing to these medicinal attributes, it is widely used in the management of inflammation, swelling, joint disorders, gout, sciatica, osteoarthritis, rheumatoid arthritis, indigestion, and wound healing.

Suranjana also exhibits diuretic action, making it useful in urinary tract ailments such as urinary calculi, dysuria, and urinary tract infections.

Furthermore, it acts as a mild laxative and aids in relieving constipation. Traditionally, the corm is also employed in disorders affecting the liver and spleen. Due to its blood-purifying action, it is considered beneficial in various skin and blood-related diseases, including leprosy. When used in suitable therapeutic doses, Suranjana is also regarded to have antidepressant properties.^[17]

Hiranya-Tuttha, a dried extract of *Colchicum luteum* Baker, is commonly used in medicinal formulations prescribed for the management of acute attacks of gout and rheumatism. Similarly, tinctures prepared from meadow saffron are utilized in homoeopathic practice for comparable conditions.

The seeds possess acrid and bitter properties and are known for their anodyne, astringent, anti-inflammatory, analgesic, sedative, aphrodisiac, carminative, alterative, aperient, laxative, and blood-purifying actions. They are traditionally used in the treatment of neuralgia, gout, leukaemia, pruritus, liver disorders, splenic enlargement, sexual debility, sciatica, lumbago, and familial Mediterranean fever.

The flowers contain alkaloids such as colchicine and demecolcine, which are therapeutically important in the treatment of solid tumours and certain forms of leukaemia, particularly chronic myelocytic leukaemia.

MEDICINAL USES

Majoon Suranjana is a polyherbal formulation used in Unani system of medicine for the treatment of rheumatic arthritis.^[18]

According to the Unani Pharmacopoeia, the formulation Ilaj ul Amraz contains the following ingredients:

1. Dried rhizome of *Zingiber officinale* Linn. (Ginger) – 3.5 g
2. Dried corm of *Colchicum luteum* Baker (Suranjana) – 3.5 g
3. Dried extract of *Aloe vera* Linn. – 7 g

This formulation is traditionally used in the Unani system of medicine for the treatment of dysuria, constipation, inflammation, and arthritis.^[19]

A paste of Suranjana, saffron and egg can be applied beneficially to rheumatic and other forms of swelling.^[20]

Dried and powdered corms of the plant is very useful in healing the wounds, it should be sprinkled on the affected areas. It promotes cicatrization.

‘Tutthanjana’ refers to a collyrium prepared from copper sulphate and the root of *Colchicum luteum* Baker, traditionally used as an ocular cleanser.^[21]

Application of a cloth coated with cow ghee and a paste prepared from the corm of Suranjana over the piles mass is believed to induce necrosis, causing the mass to gradually slough off over time.^[22]

The colchicine extracted from this plant is administered orally in tablet form and is commonly used in the management of acute gout, benign enlargement of the prostate, gonorrhoea, dropsy, and familial Mediterranean fever. It is also considered beneficial in painful rheumatic conditions affecting the fingers, wrists, and abdomen, as well as in rheumatoid headaches, rheumatic iritis, swollen joints with or without effusion, muscular pain, and subacute or chronic sciatica.

In addition, colchicine is widely utilized in plant genetics and breeding research to induce chromosomal doubling, thereby altering the genetic makeup of plants in order to develop new and improved varieties.^[23]

It is primarily used in the treatment of rheumatic disorders, especially gout, and is also prescribed for its cathartic and antiemetic properties. Additionally, it is employed in the initial management of pericarditis.

Colchicum exerts its action by inhibiting mitosis through suppression of cellular motility, particularly that of phagocytic lymphocytes. This mechanism is therapeutically significant, as it helps prevent the migration and autolysis of phagocytes during inflammatory processes, thereby producing an anti-inflammatory (antiphlogistic) effect.

PRECAUTION

Prolonged or excessive use of colchicine may produce severe irritation of the intestines. To minimize these adverse effects, the drug is traditionally administered along with Suchi (*Atropa belladonna* Linn.) and Khurasani Ajwain (*Hyoscyamus niger* Linn.).^[24]

When administered in large doses, colchicine may produce toxic effects such as diarrhoea, excessive salivation, vomiting, abdominal cramps, convulsions, and generalized paralysis. These symptoms usually appear several hours after administration, even with high doses, possibly due to its conversion into oxycolchicine.

Toxic doses of colchicine may lower body temperature, potentiate the action of central nervous system depressants, and enhance the effects of sympathomimetic agents. It also depresses the respiratory centre and stimulates the chemoreceptor trigger zone and vasomotor centre, resulting in vasoconstriction and elevated

blood pressure. Severe toxicity may lead to muscular weakness, ascending paralysis, and even death due to respiratory failure. Therefore, the drug is contraindicated during pregnancy and lactation.

At therapeutic doses, however, colchicine acts as a highly effective anti-inflammatory and analgesic agent. It prevents the migration of macrophages to inflamed joints during acute attacks of gout, which occur due to the deposition of urate crystals.

Prolonged use of *colchicum* may result in liver and kidney damage. Suranjan is also considered toxic to animals, particularly when consumed through dry fodder. The alkaloids may pass into milk and accumulate to toxic levels.^[25] The toxic dose in humans is about 10 mg, while 40 mg would always be fatal (leads respiratory and cardiovascular disruption within a few days).^[26]

RESEARCH UPDATES

Activity	Extract Used	Findings
Antioxidant Activity ^[27]	The ethanolic extract of the corms of <i>Colchicum luteum</i> Baker was phytochemically investigated and demonstrated significant antioxidant potential.	The chloroform fraction showed the highest antioxidant activity (91%), while the overall activity ranged between 56–91%.
Antifungal Activity ^[28]	The methanolic extract of the corms and its various fractions were evaluated for antifungal effects against different pathogens.	The extracts exhibited moderate to excellent antifungal activity, particularly against <i>Trichophyton longifusus</i> (up to 75%) and <i>Microsporum canis</i> (up to 85%).
Antibacterial Activity ^[28]	The crude methanolic extract and its fractions were screened for antibacterial activity.	Mild to moderate antibacterial activity was observed, with the highest activity (58%) against <i>Bacillus subtilis</i> .
Enzyme Inhibition Activity ^[29]	The crude methanolic extract and different fractions (chloroform, ethyl acetate, n-butanol, and aqueous) were tested against various enzymes.	Significant inhibition (89%) was observed against lipoxygenase, while mild to moderate inhibition was noted against butyrylcholinesterase (32%) and acetylcholinesterase (29–61%). No activity was found against urease.
Anticancer Activity	<i>Colchicum luteum</i> contains tropolone alkaloids such as colchicine, which possess antimitotic properties. Cancer cells divide rapidly; therefore, compounds that inhibit cell division can aid in cancer management.	Colchicine helps inhibit cell division and is used in the treatment of tumors and various neoplastic disorders. ^[30] Alkaloids such as colchicine and demecolcine have shown usefulness in cancer treatment. ^[31]

DISCUSSION

Suranjana (*Colchicum luteum* Baker), though absent in the Ayurveda classics, later was recognized by Ayurvedic scholars for its importance in the treatment of gout, rheumatoid arthritis, and inflammatory disorders. Its traditional properties such as Tikta-Katu rasa, Ushna virya, and Kapha–Vata shamaka support its use in joint diseases and swelling. Modern pharmacological studies validate these traditional claims by demonstrating anti-inflammatory, analgesic, antioxidant, antimicrobial, and anticancer activities, mainly due to alkaloids like colchicine and demecolcine. However, despite its significant therapeutic potential, the plant requires careful dosage regulation because of its toxic effects in excessive use. Thus, modern scientific findings strongly support the traditional medicinal value of Suranjana.

CONCLUSION

Colchicum luteum Baker (Suranjana), the drug is particularly valued for its blood-purifying action and its effectiveness in reducing uric acid levels, due to the presence of the potent alkaloid colchicine, which makes it highly beneficial in the management of gout and other inflammatory joint disorders. In addition to its traditional uses, several scientific studies conducted worldwide have validated its several pharmacological properties. Further clinical and pharmacological studies are required to establish the safety, efficacy, and standardization of Suranjana formulations. Therefore with proper dosage and medical supervision, the safe and rational use of Suranjana can contribute significantly to human health and wellbeing.

REFERENCES

- 1) Wink, M., & Van Wyk, B.-E. (2004). *Medicinal plants of the world* (Vol. 1). South Africa: Briza Publications.
- 2) Sharma, P. V. (2006). *Dravyaguna vigyan* (Vol. 2, pp. 809–811). Varanasi, India: Chaukhambha Bharati Academy.
- 3) Singh, M. P., & Panda, H. (2005). *Medicinal herbs with their formulation* (Vol. 1, pp. 278–280). Delhi, India: Daya Publishing House.
- 4) Ahmed, S. N., Ahmad, M., Shinwari, Z. K., & Shinwari, S. H. (2016). Taxonomic, pharmacognostic and physicochemical authentication of *Colchicum luteum* Baker (Suranjan Talkh) from its commercial adulterant. *Pakistan Journal of Botany*, 48(5), 2039–2045.
- 5) Ahmad, B., Khan, H., Bashir, S., Nisar, M., & Hassan, M. (2006). Inhibition activities of *Colchicum luteum* Baker on lipoxxygenase and other enzymes. *Journal of Enzyme Inhibition and Medicinal Chemistry*, 21(4), 449–452.
- 6) Nair, V., Singh, S., & Gupta, Y. K. (2011). Evaluation of the disease modifying activity of *Colchicum luteum* Baker in experimental arthritis. *Journal of Ethnopharmacology*, 133(2), 303–307.
- 7) Anonymous. (2008). *Reviews on Indian medicinal plants* (Vol. 7, pp. 340–341). New Delhi, India: Indian Council for Medical Research.
- 8) Siddiqui, M. Z., & Akhtar, S. (2019). Suranjan Talkh (*Colchicum luteum*): A review of an anti-arthritis Unani drug. *International Journal of Research and Analytical Reviews*, 6(1), 328–332. <https://doi.org/10.22040/ATCAM.2019.108140>
- 9) Trikamji, Y. (1997). *Dravyaguna-vigyan* (Vol. 2, p. 366). Nagpur, India: Vedhnath Ayurved Bhavan.
- 10) Sheth, A. K. (2005). *The herbs of Ayurveda* (Vol. 2, p. 108). Gujarat, India: K. Sheth Publishers.
- 11) Bhattachar, S. K. (1998). *Handbook of medicinal plants* (p. 110). Jaipur, India: Pointer Publishers.
- 12) Diversity and conservation status of vascular plants of Dir Kohistan valley, Khyber Pakhtunkhwa Province. (2014). *Journal of Biodiversity and Environmental Sciences (JBES)*, 5(1), 164–172.
- 13) Singh, M. P., & Panda, H. (2005). *Medicinal herbs with their formulation* (Vol. 1, p. 280). Delhi, India: Daya Publishing House.
- 14) Tomas, G. J. (2008). *Encyclopaedia of domestic medicine* (Vol. 1). Delhi, India: Sri Satguru Publications.

- 15) Sharma, P. V. (2006). *Dravyaguna-vigyan* (Vol. 2, p. 809). Varanasi, India: Chaukhambha Bharati Academy.
- 16) Wink, M., & Van Wyk, B.-E. (2004). *Medicinal plants of the world* (Vol. 1). South Africa: Briza Publications.
- 17) Trikamji, Y. (1997). *Dravyaguna-vigyan* (Vol. 2, p. 366). Nagpur, India: Vedhnath Ayurved Bhavan.
- 18) Antiarthritic activity of Majoon Suranjan polyherbal Unani formulation in rat. (2011). *Indian Journal of Medical Research*, 134(3), 384–388.
- 19) Therapeutic effects of eight Unani (herbal) drugs in the patients of Waj-ul-Mafasil (Rheumatoid Arthritis) in the development of Nuzj (Purgation) and maintenance of pH of urine – A randomized open controlled study. (2015). *International Journal of Herbal Medicine*, 3(1), 28–32.
- 20) Bhattachar, S. K. (1998). *Handbook of medicinal plants* (p. 112). Jaipur, India: Pointer Publishers.
- 21) Saroya, A. S. (2005). *Herbalism, phytochemistry and ethnopharmacology* (p. 390). New Hampshire, USA: Science Publishers.
- 22) Trikamji, Y. (1997). *Dravyaguna-vigyan* (Vol. 2, p. 366). Nagpur, India: Vedhnath Ayurved Bhavan.
- 23) Singh, M. P., & Panda, H. (2005). *Medicinal herbs with their formulation* (Vol. 1, p. 280). Delhi, India: Daya Publishing House.
- 24) Trikamji, Y. (1997). *Dravyaguna-vigyan* (Vol. 2, p. 366). Nagpur, India: Vedhnath Ayurved Bhavan.
- 25) Singh, M. P., & Panda, H. (2005). *Medicinal herbs with their formulation* (Vol. 1, p. 280). Delhi, India: Daya Publishing House.
- 26) Wink, M., & Van Wyk, B.-E. (2004). *Medicinal plants of the world* (Vol. 1). South Africa: Briza Publications.
- 27) Antioxidant activity and phenolic compounds from *Colchicum luteum* Baker (Liliaceae). (2010). *African Journal of Biotechnology*, 9(35), 5762–5766.
- 28) Ahmad, B., Khan, H., Bashir, S., & Ali, M. (2006). Antimicrobial bioassay of *Colchicum luteum* Baker. *Journal of Enzyme Inhibition and Medicinal Chemistry*, 21(6), 765–769.
- 29) Ahmad, B., Khan, H., Bashir, S., Nisar, M., & Hassan, M. (2006). Inhibition activities of *Colchicum luteum* Baker on lipxygenase and other enzymes. *Journal of Enzyme Inhibition and Medicinal Chemistry*, 21(4), 449–452.
- 30) Deshmukh, V. N., et al. (2011). Ethnopharmacological review of traditional medicinal plants for anticancer activity. *International Journal of PharmTech Research*, 3(1), 298–308.
- 31) Wink, M., & Van Wyk, B.-E. (2004). *Medicinal plants of the world* (Vol. 1). South Africa: Briza Publications.