Haoma: unveiling the mysteries of Iran's sacred Zoroastrian botanical wonder

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Ethnobotany Research and Applications 31:22 (2025) - http://dx.doi.org/10.32859/era.31.22.1-15
Manuscript received: 20/02/2025 – Revised manuscript received: 13/07/2025 - Published: 15/07/2025

Review

Abstract

Background: The Zoroastrian plant haoma has sparked extensive scholarly debate within history, botany, and religious studies. Its identity and cultural significance remain pivotal in discussions surrounding Indo-Iranian religious traditions. This review synthesizes historical, botanical, and religious perspectives to enhance understanding of Haoma's role in Indo-Iranian traditions.

Methods: This study adopts a systematic review approach, synthesizing information from historical texts, archaeological findings, and ethnobotanical research. Key sources include the Avesta, Vedic literature, and comparative Indo-Iranian mythology. The study also incorporates modern phytochemical analyses of proposed botanical candidates to assess their plausibility in historical religious use. By comparing linguistic similarities and cross-cultural applications of sacred plants, the review evaluates the likelihood of various species representing the historical Haoma.

Results: Haoma serves as a vital symbol of immortality, purity, and divine connection in Zoroastrian rituals. While various identifications exist, the research endorses Ephedra due to its historical importance and psychotropic properties, highlighting parallels with the Vedic Soma and emphasizing the broader religious implications of sacred plant compounds. Furthermore, the role of haoma has evolved, maintaining relevance in contemporary Zoroastrian practices and academic discourse.

Conclusions: This study addresses knowledge gaps by reexamining haoma's botanical and religious significance. Although Ephedra remains a strong candidate, further interdisciplinary exploration is essential to address uncertainties. By employing modern methodologies, this review enhances our understanding of haoma's enduring impact on religious and cultural history.

Keywords: **Haoma**, Cultural heritage, Ethnobotany, Zoroastrianism, Sacred drink

Background

Haoma, a plant of enormous historical and cultural value (Clark 2019), traces its origins back to ancient Persia, when it played a key part in religious rites and therapeutic activities (Caneva et al. 2023, Elgood 2010). Known by numerous names in different civilizations, such as "Soma" in ancient Indian traditions and "Homa" in the Avestan tradition (Grether 2007, Pourlak 2018), Haoma has long been regarded as a holy plant endowed with divine properties. Archaeological evidence from

Anatolia's Oluz Höyük shows how much Achaemenid culture—including Haoma-related customs—influenced regional customs in the Late Iron Age (Soba 2018). The Avesta, Zoroastrianism's sacred text, identifies Haoma as a key ingredient in rites and religious ceremonies, representing knowledge, immortality, and spiritual enlightenment (Harter 2016).

Haoma, a plant of immense historical and cultural value, has its origins in ancient Persia and has been regarded as a holy plant with divine properties. It is often personified as a deity in Zoroastrianism's rituals, which were deeply intertwined with the spiritual and moral framework of the religion (Figure 1). The Yasna, one of the most important Zoroastrian liturgical texts, describes the preparation and consecration of Haoma juice as an offering to the divine (Skjærvø 2012, Malandra 1983, Mills 1907). Haoma was often personified as a deity, reinforcing its sacred status. The Haoma ceremony was performed by priests, who would chant sacred hymns while extracting and consuming its juice, signifying purification, divine wisdom, and strengthening of spiritual consciousness. These ceremonies played a crucial role in reinforcing social and religious cohesion among Zoroastrian communities (Stausberg 2004, Zargaran *et al.* 2012, Bowman 1970). The concept of Haoma as a bridge between the mortal world and the divine aligns with Zoroastrian dualism, emphasizing the perpetual struggle between good (Ahura Mazda) and evil (Angra Mainyu). It was believed to possess potent healing properties, facilitating communication with the divine realm, indubiting spiritual ecstasy, and promoting physical and mental well-being (Zaehner 2021, Nietzsche 2019, Russell 2022). Scholars have debated the specific plant species referred to as Haoma, but it is commonly thought to be a wild or cultivated plant, possibly belonging to the Ephedra genus or a similar group of plants. Studies on ethnobotanical practices indicate that similar sacred plants have been utilized in various religious traditions, including the Vedic Soma and the shamanic use of psychoactive plants in Central Asia (Houben 2003, Shah 2015, Mahdihassan 1989). Haoma's significance extends beyond ancient Persia and has influenced neighboring cultures, particularly in the Indian subcontinent. In the ancient Indian Vedas, the plant Soma is described as possessing attributes similar to Haoma, and was also utilized in religious rituals and associated with divinity, immortality, and rejuvenation. Today, while the exact identity of the Haoma plant remains uncertain, the cultural and religious traditions associated with it continue to be practiced by Zoroastrians and other communities (Wohlberg 1990, Ahirrao 2022, Staal 2001, Falk 1989).

In order to compare the significance of Haoma in Persian and Indian traditions, this review will critically examine the historical, linguistic, and scientific facts surrounding it. By combining knowledge from botany, archeology, and philology, this work offers a thorough analysis of Haoma's identity and ongoing relevance in Zoroastrian rituals. Important research gaps still exist in this field, nevertheless. There is currently insufficient direct evidence from ancient writings and archeological discoveries to definitively identify Haoma botanically. The pharmacological characteristics and possible contemporary uses of haoma have gotten relatively less attention than the religious and cultural components of the plant, which have been thoroughly studied in the past. For a comparative study of Haoma and other Indo-Iranian holy plants, further interdisciplinary research integrating botanical, historical, and linguistic approaches is required. Addressing these gaps can contribute to broader discussions on sacred plant traditions and their enduring impact on cultural heritage.

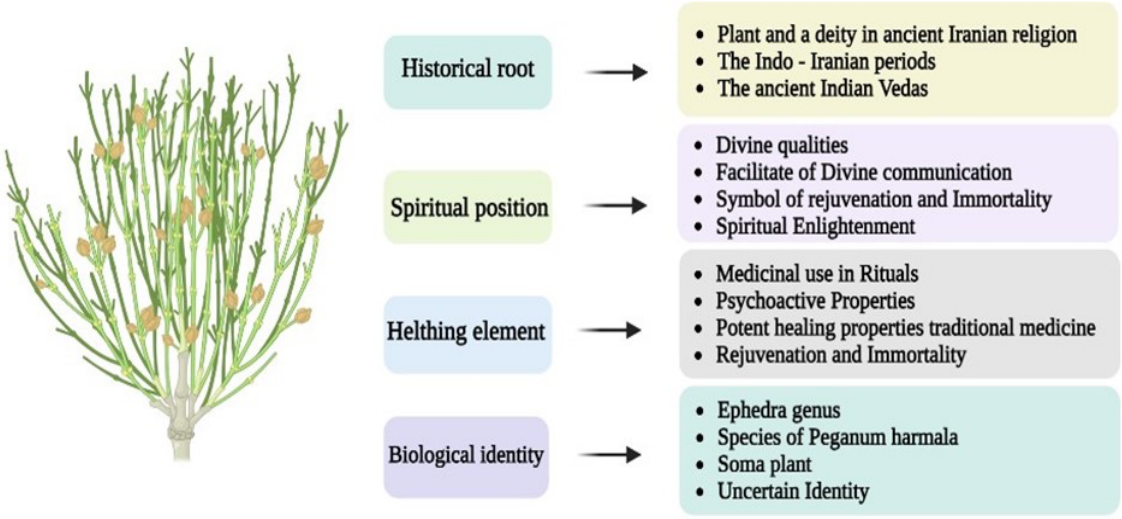

Figure.1. Exploring the Sacred Plant: Historical Roots, Spiritual Significance, Healing Properties, and Botanical Identity.

Materials and Methods

By combining current research from several fields, this study takes a methodical way to examining the pharmacological, ethnobotanical, and historical facets of Haoma. The following are the main components that make up the methodology:

Literature Search and Selection Criteria

Using keywords like "Haoma," "Ephedra," "Zoroastrian botany," "sacred plants," and "ethnopharmacology," relevant literature was found by searching academic databases such as PubMed, Scopus, Web of Science, and Google Scholar. Studies were chosen based on their relevance, credibility, and contribution to the discussion of the botanical, pharmacological, and religious significance of Haoma. Peer-reviewed journal articles, ethnobotanical field studies, historical texts, and pharmacological research were prioritized.

Historical and Textual Analysis

The Avesta, Pahlavi writings, and Zoroastrian commentaries were among the main and secondary historical materials analyzed to investigate Haoma's place in Zoroastrian tradition. Patterns in descriptions of Haoma and its potential botanical identification were found through comparative literary analysis. To see if there could be any similarities in their botanical and ceremonial functions, references to Haoma in Indo-Iranian traditions were also compared to accounts of the Vedic Soma.

To establish contextual comparisons, ethnobotanical studies of sacred plants with comparable purposes were studied, with particular focus on research on *Ephedra* species, *Peganum harmala*, and other medicinal or psychedelic plants that have been suggested as Haoma possibilities. This study attempts to give a thorough and multidisciplinary picture on Haoma, point out current research gaps, and suggest future avenues of inquiry for ethnobotanical and pharmacological studies by combining data from several disciplines.

Historical and Religious Perspectives on Haoma

Haoma in the Avesta and Zoroastrian Rituals

Haoma is a plant and a deity in ancient Iranian religion, particularly in Zoroastrianism, which was one of the world's oldest known monotheistic religions. The historical context of Haoma can be understood by examining the religious, cultural, and historical developments of the ancient Iranian civilizations. The origins of Haoma can be traced back to the Indo-Iranian period, which dates back to around 2000 BCE. During this time, the Indo-Iranian people shared a common cultural and linguistic heritage (Abdullaev 2010, Kuz'mina 2007). They worshipped a pantheon of gods and practiced rituals centered around a sacred plant known as soma in the Rigveda (the ancient Indian religious texts) and later as haoma in the Avesta (the ancient Iranian religious texts). With the division of the Indo-Iranian people, their religious practices also diverged (Shenkar 2017). The Indo-Aryans in the Indian subcontinent continued to venerate soma, while the Iranians developed their own distinct religious beliefs and practices, including the worship of haoma. Haoma became a central figure in the religious rituals of the ancient Iranians, particularly in Zoroastrianism (Ali & Sa'eed 2022, Sarianidi 2003). In Zoroastrianism, Haoma is considered a divine entity associated with healing, immortality, and spiritual enlightenment. Haoma is both a plant and a deity, symbolizing the divine essence and the physical substance derived from the plant. The plant itself is believed to have intoxicating and medicinal properties (Abdullaev 2010, Clark 2019, Sarianidi 2003). The Magi, a priestly class, were responsible for conducting the rituals associated with haoma. These rituals involved extracting the juice from the haoma plant and consuming it in a ceremonial fashion, often accompanied by prayers and invocations. Throughout different cultures, the utilization of psychoactive plants, including haoma, in religious ceremonies has been a prevalent tradition. The purpose behind this practice is to facilitate altered states of consciousness and foster spiritual encounters. Ingesting haoma was regarded as a pathway to connecting with the divine, purifying the soul, and achieving spiritual enlightenment (Abdullaev 2010, Aymankuy & İpkoparan 2022, Sayin 2016). The historical context of Haoma is intertwined with the broader cultural and religious developments in ancient Iran. Zoroastrianism, which was founded by the prophet Zoroaster (also known as Zarathustra) in the Sixth century Before Common Era, became the dominant religion of the Persian Empire and influenced the religious and philosophical traditions of the region (Akbar 2020). Zoroastrianism's impact extended beyond its own followers, with its ideas, such as the dualism of good and evil, influencing the spirituality of neighboring peoples and the religions of Judaism, Christianity, and Islam (Sundermann 2008). However, with the Arab conquest of Persia in the Seventh century Common Era, Zoroastrianism gradually declined, and the rituals involving haoma became less prominent. The Islamic religion, which was brought by the Arabs, supplanted the indigenous religious practices of Iran. Today, Zoroastrianism survives as a small minority religion, primarily practiced by the Parsi community in India. The historical context of Haoma is rooted in the ancient Iranian civilizations and their religious traditions. Haoma played a significant role in the rituals and beliefs of Zoroastrianism, symbolizing divine essence, healing, and spiritual enlightenment (BeDuhn 2020,

Boyce 1970, Green 2000, MacKenzie 1964). While its prominence diminished over time, Haoma remains an important aspect of the cultural and religious heritage of ancient Iran.

Haoma and Vedic Soma: A Linguistic and Cultural Comparison

Linguistic studies suggest that Haoma and Soma share a common Indo-Iranian origin. Both were considered sacred elixirs, consumed in rituals for divine communion. However, their botanical identities remain uncertain. Ancient India: In ancient Indian texts, particularly the Rigveda, the plant known as Soma holds profound significance. Soma is revered as a divine plant associated with gods and plays a pivotal role in Vedic rituals, believed to possess mystical properties bestowing immortality, healing, and spiritual enlightenment (Brough 1971, McDonald 2004, Wasson 1971). Linguistically, there is a notable similarity between "Haoma" in Avestan and "Soma" in Sanskrit, hinting at a linguistic link between these terms (Jalali- Naeeini 1986). While the exact botanical identity of Haoma and Soma remains uncertain, scholars propose that both refer to a similar plant or group of plants with psychoactive and ritual significance. Various potential candidates have been suggested, including *Ephedra*, *Sarcostemma* R.Br., *Periploca* Tourn. ex L., *Cannabis*, and *Rheum* L. (Brough 1971, Clark 2019, Staal 2001). In ancient Indian Vedic texts, particularly the Rigveda, Soma is portrayed as a sacred plant from which an elixir is derived. Soma was revered as a divine substance believed to possess transformative and mystical properties (Padhy & Dash 2004, Wasson 1971). Soma held a central role in Vedic rituals and ceremonies. It was offered as a libation to the gods and consumed by priests and participants during religious rites. The consumption of Soma was thought to facilitate communion with the divine and induce spiritual experiences (Padhy & Dash 2004, Trabazo 2020). In Hindu mythology, the concept of Soma is associated with gods like Indra, Agni, and Soma itself. This notion is believed to have been influenced by Haoma, a similar divine drink in Zoroastrianism. The consumption of Soma is linked to the granting of immortality and divine wisdom (Hromada 2014). Although Haoma is not directly used in contemporary Hindu rituals, the ancient Soma rituals described in Hindu texts have significantly influenced practices such as Yajnas (fire rituals) and certain forms of worship in Hinduism. The importance of Soma in Vedic rituals is evident in hymns, invocations, and chants preserved within Vedic literature (Houben 2003, Shackelford & Houben 2003, Shackelford & Weekes-Shackelford 2021, Wright 1960). Haoma or Soma symbolizes spiritual enlightenment, divine knowledge, and the awakening of consciousness. It embodies the pursuit of wisdom, divine insight, and the realization of higher truths (Mahdihassan 1987, Mills 1907, Ostovari *et al*. 2013, Wohlberg 1990). Haoma/Soma is viewed as a conduit to connect with the gods and establish a spiritual link between the human and divine realms. It serves as a metaphorical bridge bridging the mortal and immortal worlds (Abdullaev 2010).

Haoma in Pre-Islamic Iran and its Decline

Zoroastrianism's impact extended beyond its own followers, with its ideas, such as the dualism of good and evil, influencing the spirituality of neighboring peoples and the religions of Judaism, Christianity, and Islam (Sundermann 2008). However, with the Arab conquest of Persia in the Seventh century Common Era, Zoroastrianism gradually declined, and the rituals involving haoma became less prominent. The Islamic religion, which was brought by the Arabs, supplanted the indigenous religious practices of Iran. Today, Zoroastrianism survives as a small minority religion, primarily practiced by the Parsi community in India. The historical context of Haoma is rooted in the ancient Iranian civilizations and their religious traditions. Haoma played a significant role in the rituals and beliefs of Zoroastrianism, symbolizing divine essence, healing, and spiritual enlightenment (BeDuhn 2020, Boyce 1970, Green 2000, MacKenzie 1964). While its prominence diminished over time, Haoma remains an important aspect of the cultural and religious heritage of ancient Iran (Figure 2)

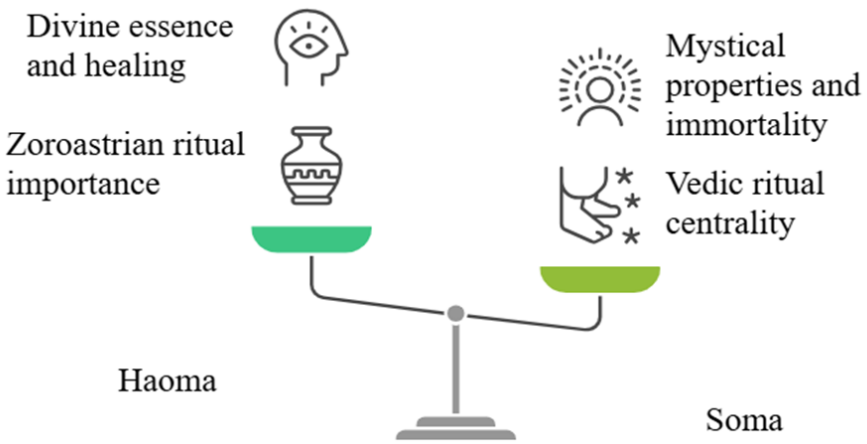

Figure. 2. Comparing Haoma and Soma in Ritual Contexts

Unraveling the Botanical Identity of Haoma: Debates and Speculations

The identification of Haoma has been a subject of scholarly debate, with multiple candidates proposed based on textual analysis and phytochemical properties.(Figure 3)(Table 1) While there is no consensus on the exact plant species that Haoma refers to, several theories and candidates have been proposed based on textual references, linguistic analysis, and comparative studies of ancient Indo-Iranian cultures (Clark 2019, Prasad 2010, Wohlberg 1990). One prevailing theory suggests that Haoma may be associated with the plant known as Ephedra scientifically, which is a genus belonging to gymnosperms found in various parts of the world. These plants have long, thin branches and produce small, seed-bearing cones. They contain alkaloids, including ephedrine, which have stimulant and medicinal properties (Liu & Wang 2016, Meyer 1995, Stapf 1889). Support for the identification of Ephedra as Haoma comes from linguistic and textual analysis. The term "haoma" itself is linguistically related to the Sanskrit word "soma" and the ancient Indian Rigvedic plant known as Soma, which is widely believed to be a species of Ephedra (Ickert & Wojciechowski 2004, O'Dowd et al. 1998). Since the Indo-Iranian peoples shared a common cultural and linguistic heritage, it is plausible that Haoma and Soma were related. Another proposed candidate for Haoma is a plant called *Peganum harmala* L., commonly known as Syrian rue or wild rue. *Peganum harmala* is a flowering plant native to the Middle East and Central Asia (Mamedov et al. 2018). It has a long history of religious and medicinal use in the region, including associations with ritual practices and visionary experiences. Some scholars argue that *Peganum harmala* fits the descriptions of Haoma found in the ancient Iranian texts. The seeds of *Peganum harmala* contain alkaloids such as harmine and harmaline, which have psychoactive properties and are known to induce altered states of consciousness (Herraiz et al. 2010, Merlin 2003p, Naranjo 1967). Other suggestions for the botanical identity of Haoma include plants like *Cannabis* L., *Asclepias acida* Roxb., and *Vitis vinifera* L. (grapevine) (Abdullaev 2010). However, these proposals have received less scholarly consensus and are based on more speculative interpretations. It is important to note that the exact identity of Haoma may never be definitively determined. The lack of specific botanical descriptions in ancient texts and the changes in plant species availability over time make it challenging to pinpoint the exact plant that was originally associated with Haoma. Nonetheless, the significance of Haoma in ancient Iranian religions, particularly Zoroastrianism, remains significant, regardless of its botanical identity. Haoma symbolizes the divine essence, healing, and spiritual enlightenment in the religious rituals and beliefs of the ancient Iranians.

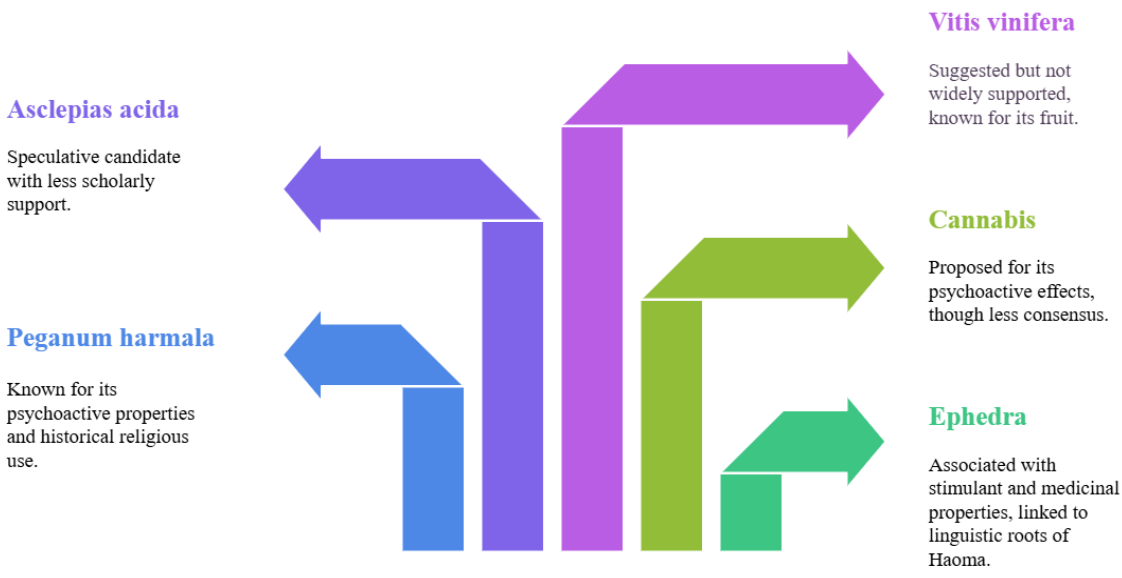

Figure.3. Botanical Candidates for Haoma

Table 1. The Botanical Identity of Haoma

Candidate Plant	Botanical Characteristics	Psychoactive Compounds	Cultural and Ritual Significance
Ephedra *spp.*	Gymnosperm, needle-like leaves	Ephedrine (stimulant)	Strongly linked to Zoroastrian rituals and Vedic **Soma**
Peganum harmala (Syrian Rue)	Herbaceous plant, seeds contain alkaloids	Harmine, harmaline (hallucinogenic)	Used in Middle Eastern and Central Asian spiritual ceremonies
Cannabis sativa	Flowering plant, psychoactive resin	THC, CBD	Used ritually in various cultures but with weaker textual links to **Haoma**

Candidate Plant	Botanical Characteristics	Psychoactive Compounds	Cultural and Ritual Significance
Asclepias acida	Vining plant, possible Vedic connection	Unknown	Suggested as an alternative Vedic **Soma** candidate
Vitis vinifera (Grapevine)	Woody vine, produces grapes	Ethanol (fermentation)	Speculatively linked to **Haoma** due to ritualistic wine use

Scientific, Environmental, and Pharmacological Perspectives on Haoma

Scientific Perspectives on Haoma's Botanical Identity

The identity of Haoma is still up for question among historians, ethnobotanists, and botanists. Textual evidence from the Avesta and Indo-Iranian sources has led to the proposal of a number of possibilities, including Ephedra spp., *Peganum harmala*, and even psychotropic fungi (Dalby 2024, Houben 2016). Haoma may have been chosen for its physiological benefits, ability to withstand dry weather, and symbolic qualities, according to comparative studies of ceremonial plants like Soma in Vedic cultures. Its exact identification is made more difficult by the absence of clear botanical descriptions in ancient sources. To answer this topic, further multidisciplinary studies combining languages, phytochemistry, and archeological data are required (Soba 2018, Clark 2019).

Environmental Factors and Ethnobotanical Relevance

Ecological value is typically associated with sacred plants, and Haoma is no exception. If *Ephedra* is the ancient Haoma, then its distribution over arid and mountainous areas of Central Asia and Iran indicates that its adaptability and scarcity added to its ceremonial significance. *Ephedra* species may have been chosen as holy plants because of their propensity to produce alkaloids and withstand drought (González-Juárez *et al*. 2020, Elhadef *et al*. 2020). Cultural views of the utility and holiness of plants are shaped by environmental limitations, as demonstrated by ethnobotanical comparisons with other ceremonial plants, such as the peyote cactus (*Lophophora williamsii*) in Native American cultures. The necessity for more ecological research on the range, state of conservation, and customary harvesting methods of aoma-like species is highlighted by this viewpoint (Ermakova *et al*. 2020, Terry *et al*. 2012, Terry and Trout 2013).

Pharmacological and Medicinal Properties

Research on Ephedra species suggests that they contain ephedrine alkaloids, which are known to have effects on respiratory function, cardiovascular activity, and energy enhancement. Traditional uses of *Peganum harmala*, another candidate for Haoma, suggest additional antioxidant, neuroprotective, and psychoactive properties due to the presence of β-carboline alkaloids. Further ethnopharmacological studies could explore Haoma's potential contributions to modern herbal medicine, neuropsychopharmacology, and natural product drug discovery. The pharmacological significance of Haoma is gaining attention, especially in relation to its potential stimulant, adaptogenic, and medicinal properties (Abourashed et al. 2003, Aslam et al. 2014, li et al. 2017, Gökkaya et al. 2023).

Cross-Cultural Parallels of Sacred Plants

Tracing the Origins of Haoma in Ancient Civilizations: Unveiling its Sacred Significance and Reverence Across Cultures

The sacred significance of Haoma in ancient civilizations reflects a profound reverence for natural elements as conduits of divine essence. From Zoroastrian and Vedic rituals to broader cultural mythologies, Haoma represents a universal archetype of the sacred plant, embodying health, vitality, and the divine spirit. The enduring legacy of Haoma in religious traditions underscores the timeless human aspiration for transcendence and communion with the divine, woven through the natural world's sacred fabric (Table2).

Table 2. Native plants with origin and convergence of Haoma plant

Culture	Haoma Plant	Use and Significance	Reference
Ancient Persia	*Peganum harmala*	The Haoma plant was considered sacred and used in Zoroastrian religious rituals. Its juice as consumed as a sacrament, symbolizing immortality and divine wisdom.	(Ostovari *et al*. 2013)
Vedic India	*Sarcostemma acidum*	Haoma played a vital role in ancient Indian rituals and was associated with Indra, the king of gods. Its juice	(Abdullaev 2010, Padhy & Dash 2004)

Culture	Haoma Plant	Use and Significance	Reference
		was believed to grant strength, vitality, and divine inspiration.	
Avestan Iran	*Ephedra spp.*	Haoma was a central element in the Avestan religion. Its extract, called haoma, was consumed during rituals to promote spiritual awareness, healing, and protection against evil forces.	(Ostovari *et al*. 2013, Sarianidi 2003)
Central Asia	*Rhazya stricta*	The Haoma plant was used in traditional Central Asian medicine for its medicinal properties. It was believed to possess healing abilities and was used to treat various ailments.	(Sharopov & Setzer 2020)
Ancient Greece	*Cannabis sativa*	The Haoma plant was not directly present in ancient Greek culture, but some scholars believe that the plant mentioned in the Avesta as Haoma was cannabis, which was known and used in Greece for various purposes.	(Wohlberg 1990)
Mexico and Central America	*Salvia divinorum*	It is ingested in shamanic rituals to induce visionary experiences, facilitate spiritual journeys, and promote healing and divination.	(Metzner 2005, Valdes *et al.* 1987, Valdés 1994)
African	*Tabernanthe iboga*	It is ingested in ceremonies for healing, divination, and spiritual growth. Iboga is believed to enable contact with ancestors, provide profound insights, and address spiritual imbalances.	(Gallo *et al*. 2009, Strubelt & Maas 2008)
	Echinopsis pachanoi	It is consumed in rituals to induce altered states of consciousness, establish connections with the spiritual realm, and acquire wisdom and healing. This cactus, containing mescaline, plays a pivotal role in inducing altered states of consciousness.	(Carod Artal 2006, Uthaug *et al*. 2022)
North America	*Lophophora williamsii*	It is regarded as a sacrament used in religious ceremonies to induce spiritual experiences, establish connections with the divine, and seek healing and guidance.	(Doesburg-van Kleffens *et al*. 2023, Feeney 2018)

Pre-Columbian Americas

Fascinating parallels exist between Haoma/Soma and the rituals involving plant-based practices of indigenous civilizations in the Americas (Carod-Artal 2015, Metzner 2013). Plants such as Ayahuasca, Peyote, and Psilocybin mushrooms were utilized in spiritual and shamanic rituals, sharing mystical and transformative qualities reminiscent of Haoma and Soma (Abdullaev 2010, Kellenberger 1978).

Native American Traditions

Peyote (*Lophophora williamsii* (Lem. ex J.F.Cels) J.M.Coult.) is a small cactus native to North America, cherished by indigenous communities like the Huichol, Navajo, and Native American Church. It is regarded as a sacrament used in religious ceremonies to induce spiritual experiences, establish connections with the divine, and seek healing and guidance (Jones 2007, Knab 1977). Ayahuasca (*Banisteriopsis caapi* (Spruce ex Griseb.) C.V.Morton) is a plant mixture employed in indigenous traditions of the Amazon rainforest. It is prepared by combining the *Banisteriopsis caapi* vine with other plants. Ayahuasca is ingested in rituals to induce altered states of consciousness, facilitate spiritual journeys, and gain profound insights into oneself and the universe. Beyond its spiritual use, Ayahuasca is explored for potential therapeutic benefits in treating substance use disorders, anxiety, depression, and enhancing self-acceptance and mindfulness (Domínguez-Clavé *et al*. 2016, Simão *et al*. 2019).

African Traditions

Iboga (*Tabernanthe iboga* Baill.) is a plant native to West-Central Africa, utilized in spiritual and shamanic practices by indigenous communities like the Bwiti. It is ingested in ceremonies for healing, divination, and spiritual growth. Iboga is believed to enable contact with ancestors, provide profound insights, and address spiritual imbalances (Nyongo Ndoua & Vaghar 2018, Paškulin 2009). The roots of the iboga plant contain ibogaine, known for its anti-addictive and detoxifying properties, particularly concerning nicotine, alcohol, opiates, and stimulant drugs (Paškulin 2009). Ibogaine has been employed to break the cycle of opioid use disorder (C. Mash 2018). Its use in initiation rites and secret societies has been a significant aspect of local religion in Gabon, with its effects impacting the acceptance of Christianity in the region (Pope 1969). The San Pedro cactus (*Echinopsis pachanoi* (Britton and Rose) H.Friedrich and G.D.Rowley) is integral to indigenous traditions in the Andean region, notably among the indigenous peoples of Peru and Ecuador (Carod-Artal & Vazquez-Cabrera 2006) It is consumed in rituals to induce altered states of consciousness, establish connections with the spiritual realm, and acquire wisdom and healing (Carod-Artal & Vazquez-Cabrera 2006, Glass-Coffin 2010). This cactus, containing mescaline, plays a pivotal role in inducing altered states of consciousness. The tradition of using San Pedro cactus persists in Andean shamanism to the present day (Carod-Artal & Vazquez-Cabrera 2006).

Haoma's Influence Beyond Iran

Haoma in Ancient Persia

Haoma holds deep roots in Persian culture and occupies a central role in Zoroastrianism, the ancient religion of Persia documented in the Avesta, its sacred texts. It stands as a symbol of divine wisdom, immortality, and spiritual enlightenment (Houben 2003, Sarianidi 2003). In Zoroastrianism, founded by the prophet Zoroaster (also known as Zarathustra), Haoma is revered as a sacred plant, often called the "King of Plants" or the "Plant of Immortality" (Adelazadeh & Fakhri 2015, Ostovari *et al*. 2013), believed to have been created by the supreme deity, Ahura Mazda, for the preservation and well-being of humanity.

Haoma plays a significant role in Zoroastrian rituals and ceremonies, symbolizing purity and providing a means of divine connection (Hienz 2008). It is used as an offering to the divine and consumed as a sacrament by priests and participants (Cantera 2014, Sarianidi 2003), serving to transcend ordinary consciousness and connect with higher realms of reality (Abdullaev 2010). The preparation and consumption of Haoma juice or extract are central to various Zoroastrian ceremonies, including the Yasna, a primary liturgical rite, associated with symbolic and divine attributes (Mills 1907, Ostovari *et al*. 2013). Within Zoroastrianism, Haoma signifies cleanliness, eternal life, and the merging of human and divine essence, analogous to the significance of Hajj in Islam (Fauzan 2022). Haoma is considered a bridge between earthly and spiritual realms, embodying divine wisdom, immortality, and spiritual enlightenment, believed to possess physical and spiritual healing properties (Abdullaev 2010, Ostovari *et al.*2013). Its consumption during religious rituals is thought to facilitate communication with the divine and foster spiritual ecstasy, enlightenment, and union with Ahura Mazda (Sayin 2016,2014). Moreover, Haoma embodies the concept of righteousness and ethical living in Zoroastrianism, reminding adherents of the importance of purity, truth, and moral conduct (Mills 1907, Sarianidi 2003). Overall, Haoma's role in Zoroastrianism underscores its profound significance as a sacred and transformative element within the religious and spiritual traditions of ancient Persia.

Yasna Ritual

The central ritual involving Haoma is the Yasna ceremony, where invocations, prayers, and hymns are recited by the priestly class known as the Magi. Haoma is consumed during the Yasna, symbolizing communion with the divine and facilitating spiritual connection (Caicedo Fernández 2010). Participation in the Yasna ceremony includes consuming Haoma as a sacrificial act, echoing the food sacrificial rituals observed in the Hakka community of China. Moreover, the spiritual significance of Haoma in the Yasna ceremony shares similarities with the role of haka, a Māori performance art, in revitalizing daily practices through indigenous spirituality (Smith 2017).

Haoma in Central Asia: Exploring its Presence in Shamanic and Nomadic Cultures

Haoma/Soma holds significance in the ancient cultures of Central Asia, including among the Scythians and Bactrians. These cultures adopted the use of this plant for religious rituals and medicinal purposes, likely influenced by neighboring Persian and Indian civilizations (Abdullaev 2010, Ostovari *et al.* 2013). Regarded for its transcendent properties, Haoma/Soma was considered sacred and employed to connect with supernatural realms (Abdullaev 2010). Shamanism has deep historical +-roots in Central Asia and has been practiced by various indigenous and nomadic communities in the region (Aigle 2014, Seaman & Day 1994). Shamanic traditions involve beliefs in spirits, the shaman's ability to communicate with the spirit world, and their role as mediators between humans and spiritual realms (Mithen 2022). Despite challenges in interpreting these

religious phenomena, shamanism has endured in Central Asia, often blending with other belief systems such as Sufi Islam (Aigle 2014) . The enduring appeal of shamanism lies in its ability to provide a symbolic connection to the earth and offer coping mechanisms for uncertainty (Seaman & Day 1994). Shamanic rituals frequently incorporate plant-based substances for healing, divination, and spiritual purposes. Haoma, or a similar plant with psychoactive properties, may have been utilized by shamans in their rituals and ceremonies (Sayin 2016). These substances, which induce altered states of consciousness, have been integral to religious rituals in various cultures, including shamanic and pagan practices, African native religions, and Greek and Hellenistic traditions. The consumption of psychoactive plants has been associated with the genesis of religious and mythological figures and symbols (Sayin 2014). Haoma, or a similar plant, could have been utilized by shamans in Central Asia due to its perceived medicinal properties. These plants were believed to possess healing qualities capable of addressing physical, mental, and spiritual ailments (Abdullaev 2010). The potential psychoactive attributes of haoma are also explored, suggesting it may have been used for its mind-altering effects (Clark 2019). The use of plants in hawan rituals in Odisha, India, further underscores the notion of plants being employed for their perceived healing attributes in religious and spiritual contexts (Mishra *et al*. 2020). Shamans may have consumed Haoma or its extracts as part of their healing rituals (Sayin 2014, 2016). Ingesting the plant could have been perceived as a means to access its healing powers, commune with the spirit world, and facilitate both spiritual and physical healing (Montalvo 2022, Sayin 2014, 2016). Shamans in Central Asia often hold beliefs in a spiritual hierarchy and the presence of benevolent and malevolent spirits (DeWeese 2014). The consumption of haoma could have been viewed as a method for shamans to establish a connection with the spirit world, seeking spiritual guidance and protection (Aigle 2014, Ja 1998). Shamanic practices frequently involve altered states of consciousness achieved through various methods, including the ingestion of psychoactive substances (Thomason 2010). Consumption of Haoma might have been utilized by shamans to induce trance-like states, enabling them to embark on visionary journeys and receive divine insights (VanPool 2019).

Other Indigenous Traditions

Salvia divinorum Epling and Játiva is a plant native to Mexico, utilized by indigenous Mazatec communities for its psychoactive properties. It is ingested in shamanic rituals to induce visionary experiences, facilitate spiritual journeys, and promote healing and divination (Whitcomb 1998) . The plant contains salvinorin A, a chemical responsible for its visionary effects (Marushia *et al*. 2002). *Salvia divinorum* shows potential for clinical and research applications, particularly in the treatment of specific ailments (KR 2003). Further research has validated its hallucinogenic properties and identified its flowering patterns (Valdes *et al*. 1987). The Dream Herb (*Calea zacatechichi* Schltdl.) is utilized by indigenous cultures in Mexico and Central America, including the Chontal and Mixe peoples (Mata *et al*. 2022). It is believed to enhance dreams, promote lucid dreaming, and aid in spiritual communication through dreams. This belief aligns with the broader cultural significance of dreams in indigenous cultures, where they are often regarded as a source of knowledge and insight (Islas Salinas *et al*. 2006, Santo 2009). The use of the Dream Herb and the importance attributed to dreams in these cultures highlight the role of dreams in shaping spiritual beliefs and practices (Shulman & Stroumsa 1999).

Ancient Greece

Although Haoma/Soma was not directly present in ancient Greek culture, historical and linguistic connections exist between the ancient Persian and Greek civilizations. The Greek deity Dionysus, associated with wine, ecstasy, and spiritual liberation, shares similarities with Haoma/Soma, suggesting possible cultural exchanges or influences (O'Flaherty 1980, Wohlberg 1990). The interpretation of Dionysus by Greek vase painters also implies a deeper significance beyond mere wine consumption (Isler-Kerényi 2007). The origins of the Haoma/Soma cult are explored, with suggestions that knowledge of its psychoactive properties spread through migrants from Central Asia to Persia and India (Clark 2019). This diffusion of cultural and religious practices may have contributed to the broader understanding of similar themes across ancient civilizations. (Figure 4)

Conclusion and future prospective

This review article has comprehensively examined the historical, cultural, botanical, scientific, environmental, and pharmacological significance of Haoma, the sacred plant of Zoroastrian tradition.This study has shown how Haoma serves as a mythical, ceremonial, and medicinal entity that connects spirituality, ethnobotany, and plant-based therapeutic practices by synthesizing a broad range of literature. Haoma's wider significance in pharmaceutical research, environmental preservation, and cross-cultural studies has also been brought to light by the investigation.

Although historical and linguistic studies have clarified the theological and symbolic connotations of Haoma, its exact botanical identification is still up for question. This persistent ambiguity calls for more scientific research, especially in the fields of ethnopharmacology, genetic analysis, and phytochemistry. It may be possible to identify Haoma and its

characteristics more conclusively by combining contemporary analytical methods with historical writings and ethnobotanical traditions. Exploring the pharmacological potential of plants linked to Haoma may also provide information on their psychotropic qualities, therapeutic impacts, and medical uses.

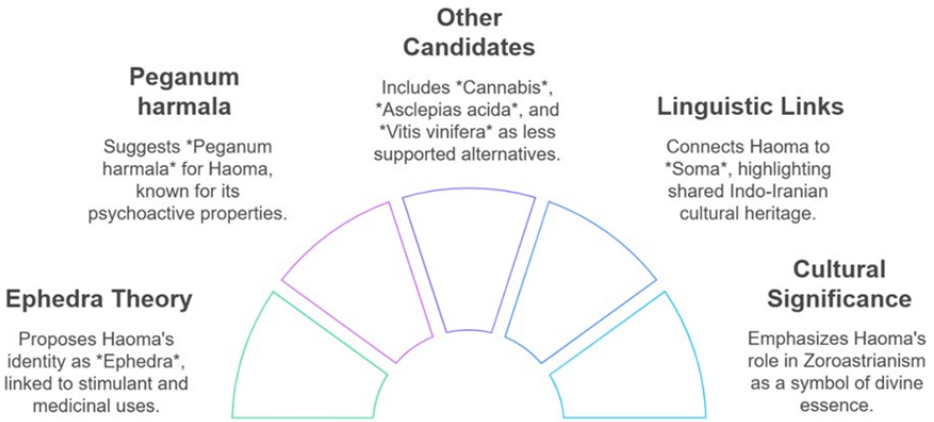

Figure 4. Exploring Haoma's Botanical Identity: Ephedra Theory, Peganum harmala, Other Candidates, Linguistic Links, Cultural Significance

Environmentally speaking, it is necessary to evaluate the ecological state and conservation requirements of any plant species linked to Haoma. Climate change, habitat loss, and overharvesting are major dangers to many ceremonial and therapeutic plants. To ensure the long-term preservation of Haoma-related biodiversity, sustainable conservation techniques that incorporate traditional ecological knowledge and community-based activities should be established.

Cross-cultural comparisons also indicate that Haoma is related to other holy and psychedelic plants utilized in indigenous, Mesopotamian, and Vedic cultures across the world. By exploring these links, we may be able to learn more about common ancient knowledge systems and ceremonial plant usage, which may help us better understand how many cultures have used plants for spiritual and therapeutic purposes.

Future study should use an interdisciplinary strategy that incorporates ecological, historical, genetic, and phytochemical investigations in order to better understand Haoma. The identification of active chemicals in prospective Haoma species by chemical profiling is a top priority. This is followed by an analysis of the physiological and psychotropic effects of these compounds in ceremonial and therapeutic contexts. Their pharmacological relevance may be better understood by looking at their possible uses in neurology, respiratory health, and psychedelic therapy. In addition to research on Haoma's biogeographical range and historical existence in ancient Persia, comparative genomics and DNA barcoding should be used to ascertain the plant's most likely botanical identification.

Declarations

List of Abbreviations: Not applicable

Ethics approval and consent to participate: Not applicable

Availability of data and materials: Not applicable

Competing interests: The authors declare no competing interests.

Funding: This study received no external funding.

Author contributions: All authors contributed equally to the manuscript.

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