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Chinese onion: An under-utilized medicinal plant of Karbi Anglong, Assam

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Abstract

Allium chinense is a perennial species native to China, cultivated and naturalized in the Himalayas. Regarding the habitat, it thrives primarily in the Tropical and Sub-tropical areas of Japan, China and widely cultured in many other parts of eastern Asia. *A. Chinese* is an immunity-boosting food rich in fructans and its essential oil can be used as fumigant against pest control programs. The leaves and the bulb of this crop can be eaten raw or cooked. Geographically it is a vital, yet underutilized, medicinal, and culinary plant, traditionally used by ethnic communities in Karbi Anglong, Assam. Known for its bulbs and leaves, it serves as a nutritious ingredient rich in sulfur compounds and antioxidants, providing anti-inflammatory, antimicrobial, and blood-pressure-regulating benefits. Despite its potential, it remains largely underexploited commercially in the region. Though this crop is economically significant throughout eastern Asia as a valuable, yet sometimes considered as a threatened species due to its reliance on localized traditional cultivation and wild harvesting in the region. Through this paper it is attempted to create awareness on the importance of this crop and popularise for large scale commercial cultivation among the farmers of Hill regions of Assam.

Keywords: Alliumchinense, karbianglong, underutilized medicinal plants, traditional medicine, pharmacological properties

Introduction

Chinese onion is renowned as a versatile plant, prized for both its culinary and medicinal applications. Chinese onion (*Allium chinense* G. Don) which is native to China (Yan *et al.*, 2009; Wang *et al.*, 2019) ^[29] is a perennial species of the *Allium* genus in the Amaryllidaceae family, and widely cultured in East Asia (He *et al.*, 2018) ^[10]. Allium Chinese also known as oriental onion is native to China. The plant is identified by its crisp, white bulbs, tall green stems, and small, purple blooms. The tillers of this crop grows vigorously and each shoot forms a small-ovoid bulb at the base (Tanaka *et al.*, 2019) ^[26]. A thin, papery skin covers the bulbs, which are characterized by their purplish or off-white color. It is a close relative of other spice crops such as onion, shallot, leek, chive and garlic. This crop is commonly known as Chinese onion, chinese scallion, Japanese scallion, Oriental onion, Kiangsi scallion, Rakkyo but in Karbi it is known by the names *Jirlang* / *Arleng harsun*. It is a popular crop and recognized not only for its high nutritional but for its medicinal value also.

Allium chinense is a perennial, evergreen herb that produces 15-35 cm long leaves and 20-40 cm tall flower stalks from an underground bulb. Unlike traditional onions, its bulbs are formed solely by thickened leaf sheaths, lacking dry, bladeless scales. The plant, which produces purplish flowers and has cylindrical, hollow leaves, thrives in full sun, requiring moist, well-drained soil. It is primarily cultivated in tropical and subtropical East Asia.

Allium chinense is a widely cultivated edible bulb, likely native to China, with no major threats to its survival. Known as Chinese onion or rakkyo, it is commonly grown for food, though its, long-term domestication makes its precise original ecological distribution difficult to determine. It is generally considered a species of least concern.

Both the foliage and the underground bulb are edible, whether consumed raw or cooked. The bulb boasts a high-quality crisp texture and a pungent onion taste, measuring roughly 4 to 5 cm in diameter; however, its maturity is not reached until the second or third year.

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According to Teshika *et al.* (2018) [27], it contains approximately 3.10% protein, 0.12% fat, 18.30% soluble carbohydrates, and 0.70% ash.

Since Chinese onion is a valuable food crop and has an important economic value in east Asia, there is a need to know the extent to which this plant is important, especially on nutritional and medicinal basis. Therefore, the aim of this paper is to provide the information on its importance to create an awareness and an opportunity to cultivate *A. chinense* in marginal lands using sustainable methods. Through this paper increased commercial interest is expected to spread cultivation to non-traditional areas, promoting its use as a sustainable, low-input crop.

Distribution

According to Zhu *et al.* (2017) [36], Central Asian mountain ranges serve as the native home for most edible *Allium* species. Originally *Allium chinense* is native to China but cultivated and naturalized in the Himalayas. It is economically significant throughout the Tropical and Sub-tropical areas of eastern Asia, particularly in China, Japan, Korea. Geographically, the domestication and cultivation of Chinese onion have been in Eastern Asia as described previously (Fereol *et al.*, 2005; Mukhopadhyay *et al.*, 2005) [7, 18]. This crop is predominantly grown in select, hilly areas across North-Eastern India of India more particularly in Arunachal Pradesh, Nagaland, Manipur, Assam (Karbi Anglong and Dima Hasao Districts), Meghalaya etc. It is widely grown for its edible bulbs and leaves. *Allium chinense* is a valuable, yet sometimes threatened, species due to its reliance on localized traditional cultivation and wild harvesting in the region.

Utilization (culinary and medicinal)

It is widely cultivated in Asian countries for its edible bulbs and leaves, which may be eaten raw or cooked. According to Rabinowitch and Currah (2002) [24], the flowers are edible and ideal for garnishing salads. *Allium chinense* is primarily utilized in East Asian cuisine as a chutney, pickled side dish or pungent condiment, prized for its crunchy texture. The use of *Allium chinense* bulbs for making pickles has been documented by Gohil and Koul (1981) [8]. Chinese onion bulbs, commonly known as *Jiaotou* or *Rakkyo*, are often prepared as sweet or sour pickles, having been steeped in sugar and brine, cooked with other ingredients, and featured highly in varied Chinese cuisine (He *et al.*, 2018). Almost all of the herbaceous parts of Chinese onion *viz.* bulb, leaves, flowers and young seed pods can be consumed (Yamaguchi, 1993; Xu *et al.*, 2008) [31, 32].

Medicinally, it acts as a tonic for intestinal health, aiding digestion (stomachic), and is used to treat cardiovascular issues like stenocardia, high blood pressure, and high cholesterol due to its rich sulfur-containing compounds and saponins (Shahrajabian *et al.*, 2020) [17]. The pungent smell of Chinese onions is often used to deter moles and vermin. Research indicates that *Allium* species constitute some of the most ancient vegetable crops cultivated by humans. Recent chemical analysis reveals that the primary components responsible for the bioactivity of *Allium chinense* essential oil are dimethyl disulfide, methyl propyl disulfide, allyl isothiocyanate, and dimethyl trisulfide. The nutritional profile of the Chinese onion, including essential compounds and their respective contents, is presented in Table 1 (Li *et al.*, 1989) [12].

Table 1: Content of nutritionally important compounds in Chinese onion (Li *et al.*, 1989) [12]

Nutrient component	Content [%]
Water content	73.52
Protein	1.71
Sugar	11.51
Water soluble sugar	4.20
Vitamin B1	8.66
Vitamin C	0.16
Lysine	0.160
Asparaginase	0.191
Aspartyl acid threonine	0.132
Arginine	0.127
B acid serine	0.130
Glutamate	0.071
Alanine	0.094
Methionine	0.027
γ -aminobutyric acid	0.124
Leucine isoleucine	0.104

According to Wang *et al.*, (2016) [28], *allium chinense* contains many chemical components with medicinal value, such as steroidal saponins, sulphur. A phytochemical compounds which are responsible for its onion-like flavour were reported by (Augusti, 1996; Pino *et al.*, 2001) [3, 22], polysaccharides, nitrogen-containing compounds etc. (Okuyama *et al.*, 1989; Yao *et al.*, 2016) [20, 34]. Beyond its culinary consumption as a common vegetable, this plant is traditionally utilized in Chinese medicine for the prevention and treatment of cardiovascular disorders (Lin *et al.*, 2016) [13].

The plant-derived phytochemical flavonols include quercetins and quercetin glycosides (Xiao *et al.*, 2015;

Kothari *et al.*, 2019; Pan *et al.*, 2018) [11, 21, 30]. Quercetins, a natural, anti-oxidant rich plant pigment which exhibit anti-cancer and anti-inflammatory activities have been reported in Chinese onion (Zielinska *et al.*, 2003; Rohn *et al.*, 2007) [25, 38].

Research indicates that secondary metabolites in the *Allium* genus, specifically flavonoids and organosulfur compounds, are key contributors to its various health benefits (El Hadidy *et al.*, 2014; Zeng *et al.*, 2017). For instance, *Allium chinense* has been identified as a potent antimicrobial agent, showing particular effectiveness against *Candida* (Naibaho *et al.*, 2015) [19]. Furthermore, a study of 16 *Allium* species highlighted their anticancer

potential, attributed to the presence of bioactive substances such as quercetin, ajoene, and S-allyl mercaptocysteine (Asemani *et al.*, 2019) ^[12]. Beyond these compounds, the polysaccharides in Chinese onion have gained scientific attention for their diverse therapeutic roles, including antioxidant, anti-diabetic, and immunomodulatory activities (Zhu *et al.*, 2018) ^[37]. These medicinal properties align with long-standing practices in Traditional Chinese Medicine, where the bulbs are used to produce "Xiebai." This crude drug remains a staple in classical prescriptions for managing cardiovascular conditions such as chest pain, stenocardia, and cardiac asthma reported in Chinese Pharmacopeia Commission, 2015.

The dried bulbs of Chinese onion (*A. chinense*) are also used in the traditional Chinese medicine "Xie Bai", which is used for treatment of thoracic pain, stenocardia, heart asthma and diarrhea (Liu *et al.*, 2014) ^[15]. From the perspective of Traditional Chinese Medicine (TCM), Chinese onions are highly valued for their warm and hot properties, which are used to treat conditions such as asthma and diarrhea (Liu *et al.*, 2014) ^[15]. According to Yang *et al.* (2018) ^[33], these onions possess medicinal properties that align with TCM principles, including warming the lungs to reduce phlegm, warming the stomach to aid digestion, acting as a detoxifier to destroy intestinal worms, reducing swelling and soreness, and decreasing blood pressure and blood lipids. Asemani (2019) ^[12] reported that the active constituents of *Allium* species target multiple stages of cancer development, ranging from initiation to metastasis, by modulating signaling pathways, inducing apoptosis, hindering the cell cycle, and providing antioxidant effects.

A diet rich in *Allium* vegetables has been associated with a lower incidence of various malignancies (Zhou *et al.*, 2011) ^[35]. Furthermore, *Allium*-derived oils have been identified as potent antioxidants possessing superior antibacterial properties (Mnayer *et al.*, 2014) ^[16].

Research indicates that *Allium chinense* (Chinese onion) bulb extract exhibits anti-MRSA activity, effectively curbing the growth of this drug-resistant bacterium, a skin infection that may look like a pimple, boil, or abscess causing serious, hard-to-treat infections this was reported by (Aretha and Jusuf, 2019) ^[1].

Research by Prasanna Kumar *et al.* (2015) ^[23] identifies *Allium chinense* as a nutritious, fructan-rich option for strengthening the immune system.

Liu *et al.* (2014) ^[15] found that the essential oil of *A. chinense* can be used as fumigant against booklice; and suggested that the essential oil maybe recommended as effective in pest control programs. This aligns with the findings of Brewster (2008) ^[4], who reported that its repellent characteristics help to combat insects and moles.

Ecology, biology and cultivation

Chinese onion grows on wide range of soil types but well drained, loamy and slightly acidic/alkaline soils are most satisfactory. It prefers moist soil, and does not grow well in the shade. It grows in temperate as well as in tropical zones. There are few reports on the effects of environmental requirements on the commercial yields of *A. chinense*. Differences in the environmental conditions greatly affected the yield reported by (Takeuchi *et al.*, 1983). Environmental factors that affect the yield are air and soil temperatures, relative humidity and light intensity. Toyama *et al.*, (1985)

also examined the effects of light intensity and temperature on photosynthesis and transpiration of Chinese onion in controlled environment. Photosynthesis decreases as the temperature increases from 15 to 35°C, but transpiration increases. Due to its robust growth and efficient nutrient uptake, the Chinese onion thrives even in poor soil, producing high-quality, small bulbs.

However, it performs very well on light well-drained soil and in sunny position (Li *et al.*, 1989) ^[12]. Jiaotou seedlings usually die-back in hot summer and recover growth in late summer, and flowers set in the autumn examined by (Havey, 1995) ^[9]. In China, mother bulbs are generally grown in September and thus cooled during the winter and offspring bulbs are usually harvested during the smonth of June (Liu *et al.*, 2005) ^[14].

According to Baba *et al.* (2000), *Allium chinense* G. Don known as Rakkyo in Japan has a long history of cultivation and is commonly utilized as a spice and in pickles.

Allium chinense (Chinese onion) is widely distributed and cultivated in North East India, serving as an essential, popular, and traditional cash crop, particularly in Nagaland, Arunachal Pradesh, and the surrounding Hilly regions. It is commonly grown in kitchen gardens, backyards, and agricultural fields in tribal-dominated tracts, where it plays a significant role in the local economy and diet. It is primarily grown as a backyard cultigen or minor crop, highly adapted to various mountain environments. Thrives in the warm, humid climate of the region, specifically in terrace gardens and kitchen gardens. The plant thrives in the region's varied elevations and is integral to the food habits of many indigenous communities.

Market potential and industrial promise

Allium chinense it is often grown locally by indigenous communities rather than on a massive commercial scale, and is highly valued in local markets. The crop holds significant potential as a valuable food in India, particularly in North-Eastern India in the context of emerging high-value, niche food market but yet remains as an untapped market and industrial promise. *A. chinense* is having tremendous medicinal value and culinary advantages as a high value indigenous herb. The crop is already a significant cash crop in North-Eastern States lie Nagaland, Manipur, Arunachal, Meghalaya and Assam where it exist locally as a staple food more particularly in Karbi Anglong District & Dima Hasao District,.

Cultivation of this crop offers a profitable income source for marginal and small famers in the North eastern region. There is niche market opportunity in the gourmet cuisine and health food markets. In Japan, it is significant cash crop, so there is much scope for export in the international market provided cultivation can be carried in a standardized and scientific manner.

Allium chinense (also known as Chinese onion, Rakkyo, or Xiebai) exhibits high market potential due to its dual use as a popular culinary ingredient (particularly in pickles) and a traditional medicinal herb with significant antioxidant and anticancer properties. It is a commercially significant cash crop in East Asia, with an annual production of 30,000 tonnes in Japan and China (Brewster, 2008) ^[4].

High commercial demand in East Asia

It is a highly valued and widely consumed product In Japan, China, and Korea.

Versatile consumption

It is used as raw or fresh for its unique, mild garlic-like flavor and crisp texture in North Eastern region of India. While primary consumption is through pickled, salted, or canned products in other countries.

Nutraceutical & pharmaceutical value

The bulbs contain high amounts of fructans, which are considered healthy food additives. Compounds isolated from *A. chinense* have shown potential in treating heart failure, lowering cholesterol, treating bronchitis, and providing anti-tumor benefits. Thus, this crop provides a great potential and scope with driving interest in the pharmaceutical industry.

Scope for expanding global market

Due to its exceptional culinary and medicinal properties, its usage is expanding beyond East Asia into the USA, Canada, and New Zealand.

High profitability

Studies indicate that the crop is highly profitable, with a 43% ROI (Return on Investment) for producers in certain regions.

Conclusions

Allium chinense (often called Chinese onion, Rakkyo, or Xiebai) possesses significant industrial potential, primarily driven by its application in the food processing, pharmaceutical, and agricultural sectors. It is a highly valued, pungent bulb crop in East Asia (China, Japan, Korea) with expanding interest globally. From the above it is concluded that:

- As an underutilized plant, focusing on post-harvest technology and commercialization in the farmers' field can convert this important crop into a valuable product, moving beyond its subsistence use.
- Further research into the phytochemicals, including antimicrobial and anti-inflammatory properties, can lead to the development of new plant-based, natural medicines.
- Chinese onion as a key, underutilized ethnomedicinal plant in Karbi Anglong, holds significant potential for both traditional healthcare and livelihood enhancement by promoting large scale commercial cultivation.
- Scientific validation and value addition are crucial to transforming this traditional herb into a high-value, sustainable crop, ensuring its preservation and economic benefits for local communities in the district and for the State as a whole.
- Further, systematic research on genetic enhancement to develop high yielding genotypes, efficient production technologies to harvest the plants in mass, post-harvest management to minimize marketing loss and medicinal/pharmaceutical investigations to promote industrial uses are needed to harness the potential of Chinese onion.
- There is growing potential for Chinese onion to be marketed as a functional health food or supplement, given its role in reducing cholesterol and managing obesity. Increased commercial interest is expected to spread its cultivation to non-traditional areas, promoting its use as a sustainable, low-input crop.

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