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Salicornia- "A Versatile Genus"

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Abstract

The genus Salicornia contains "halophytes," or plants that can survive in salty environments. As a sustainable crop, this plant has a wide range of additional industrial and ecological uses. It is a crucial source for the bio energy, ecological, medicine, and food industries. To better our understanding of these components with relation to scaled production, aspects including morphology, microstructure composition, and salt-adaptation mechanisms are examined. Commercial exploitation of these components depends on a better understanding of their structure and composition. The yields of its biomass, seeds, oil, and ethanol are then listed in order to demonstrate how profitable it is as a sustainable crop. Applications in the food, pharmacy, ecology, chemical, and cosmetic sectors are also covered, as well as ecological applications in aquaculture and phyto remediation. In this review, Salicornia stands out in the areas of food and pharmacy due to its bioactive compounds, which have been reported to have anti oxidative, anti-inflammatory, and immunomodulatory health benefits. They can also be used as secondary metabolites in pharmaceutics or as nutraceuticals in food, with high commercial and culinary value as salt substitutes due to its protective effect on vascular dysfunction and hypertension. The second feature that is highlighted is the seed oil content, which is 30% edible oil that is high in linoleic, oleic, palmitic, and stearic acids as well as protein. Salicornia seed oil and biomass are also considered as potential sources of biofuel and bioethanol.

Keywords-halophytes, bioethanol

Introduction

Salicornia is a halophyte and a member of the Amaranthaceae family. It is also known by a number of other names, including pickleweed, glasswort, sea beans, sea asparagus, crow's foot greens, and samphire . The Latin term for "salt" is actually where the name Salicornia came from. Studies claim that some species, such *Salicornia europaea*, are tolerant of salinities as high as 3% NaCl . The borders of wetlands, marshes, seashores, and mudflats

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are where you can find this fleshy plant in fact, most alkaline flats have it . Four continents, including North America, Asia, Africa, and Europe, make up its geographic spread. Small, scale-like leaves, spongy stalks, tiny flowers, and unnoticeable fruits are the features of this plant. Due to the extensive usage of plants as a source of food, home remedies, and medications, the study of plants has long been of significant importance. For instance, many medications are based on the bioactive substances that are found naturally in plants. Additionally, a lot of plants are crucial for human nutrition since they contain a lot of vitamins and minerals, which are vital traits that offer some species a lot of economic worth. Salinization caused by a decline in freshwater and groundwater has been deteriorating agricultural land over the past 50 years. Integrated seawater agriculture can make use of it. The first step is to dig a canal from the sea. The system's canal supplies water to several phases. In the beginning, the scientists pump saltwater into ponds or run it past cages used to grow shrimp or fish. Typically, this type of aquaculture is "environmentally disastrous." A significant portion of the excrement in the runoff is used as fertiliser for salicornia downstream. Salicornia is cultivated in fields that receive saltwater irrigation and can be harvested similarly to other crops like rice or wheat. The runoff from that irrigation, which is now saltier and still contains some fish and shrimp waste, is then supplied to a stretch of mangrove trees, which may flourish in that saltier water, along with more water from the canal. The mangrove forest acts as a barrier, preventing any contaminated fish farm water from entering the ocean. The leaves can be fed to the fish as well.

Food uses

It's utilized as a green salad because of how salty and crunchy it is.

It is regarded as a delicacy even in some cultures. It is advised to only eat the green, sensitive parts because the reddish ones include an excessive amount of silica and salt. The shoots are used in some communities to make beverages including vinegar, makgeolli (a Korean rice wine), and nuruk (a type of fermentation starter. According to a study, Salicornia increases the vinegar's quality while also promoting the growth of fermenting microbes. These plants have been deemed suitable as a food source in addition to direct eating.

Apart from direct consumption, these plants have been found fitting as asource of dietary salt. *S. herbacea* powder was transformed into spherical granules, which showed potential to be used like NaCl. According to a study, 1.5% of Salicornia salt can be used to

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improve the texture of hot dogs without causing any noticeable negative effects. The fortification had a good impact on emulsion stability and cooking yield, which were both improved. Salicornia bigelovii salt was found to inhibit the hypertensive impact typically linked with NaCl in a different fascinating investigation.

Lower serum creatinine levels were found to be associated with an ameliorative effect on the kidney and liver. Additionally, malondialdehyde (MDA) concentration reduced while superoxide dismutase (SOD) and Na(+)-K(+)-ATPase activity rose, suggesting a positive impact on the body's antioxidant profile. s *Descurainaia sophia, Helianthus annuus, and Salicornia bigelovii* had the greatest oil contents of all the halophytes, with 44, 35, and 30%, respectively. Unsaturated oil levels in *S. bigelovii* are comparable to those found in standard soy-bean oil (Glenn et al., 1991). However, *S. brachiata* seeds have a high level of saponins (547.52 mg/g), and S. bigellovii has a high level of saponification , making the oil unfit for large doses of human ingestion. However, it has been claimed that heating the oil at a high temperature and washing it under running water will drain the saponins from it. Because saponins break down at high temperatures, the seeds are more suitable for use as food.

Pharmaceutical uses

It has been used for generations as a medicinal herb and in the production of soap due to its high ash content . An excellent source of vitamin A, minerals, and fatty acids, as well as a vegetable, according to the Oriental Pharmacopeia, are just a few of the purported medical benefits for this plant .

Furthermore, investigations on Salicornia's nutritional qualities have demonstrated the advantages of the plant as an edible crop. For example, Guil et al. (1997) showed significant amounts of ascorbic and dehydroascorbic acids (100 mg 100 g1) as well as carotenoids (5 mg 100 g1). The *S. bigelovii* species has a high concentration of -carotene (15.9 mg 100 g1 of fresh weight) and polyphenols (1.2 GAE g1 of fresh weight), Salicornia culture in seawater might produce a high phenolic and flavonoid content. In *S. ramosissima* growing at low salinity, Lima et al. (2020) reported a high content of the soluble fat vitamin -Tocopherol (241 g 100 g 1 fresh weight), whereas carotenoids like -carotene (a good source of vitamin A and lutein, which aids in the prevention of age-related macular degenerative diseases. The scientists also discussed the species' mineral makeup, particularly Fe++ and Na+, which have high concentrations of 17.4 mg per kilogramme and 1113 mg per kilogramme of fresh

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weight, respectively, at 465 mM of sodium. Because of its protective effect against vascular dysfunction and hypertension due to the presence of trans-ferulic acid, some studies (Lopes et al., 2017; Panth et al., 2016; Zhang et al., 2015) have increased the use of *S. bigelovii* and *S. europaea* as salt substitutes. These studies demonstrated that high intakes of purified salt increased blood pressure in rats, whereas intakes of Salicornia, with the same.

Bio fuel uses

Salicornia can be utilised to make diesel alternatives in addition to having a high edible oil value. The Salicornia lignocellulosic biomass's composition has been linked to potential ethanol generation and biofuel production. Salicornia is one of the most promising genera in this area .. For instance, *S. bigelovii* can efficiently produce biofuels from both seed oil and lignocellulosic biomass . Similar to other oil seed crops like sunflowers, the salicornia's oil-rich seeds can be processed in a similar way to press them. Once that oil has been altered, a secret UOP Honeywell procedure can be used to make it appropriate for mixing with jet fuel. The remainder of the plant can then be burned to create steam for electricity generation or utilised to make liquid fuels.

The Sustainable Bioenergy Research Consortium (SBRC), a non-profit entity established by Masdar Institute that is part of Khalifa University of Science and Technology, announced the world's first commercial flight using locally produced sustainable fuel on an Etihad Airways Boeing 787 powered by GE's GEnx-1B engines.

Salicornia biofuel "substantially reduces life-cycle carbon dioxide emissions compared to fossil fuel," according to Etihad Airways. By integrating the Salicornia crop with a fish and shrimp farm in Masdar City, directly near to the Abu Dhabi International Airport, SBRC created the biofuel that was used on the Etihad Airways flight. Salicornia is a genus of succulents that thrives in saltwater, so it doesn't use up precious desert drinkable water.

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