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PGR NOTE

Introduction of Heeng Germplasm by NBPGR Leads to its Successful Cultivation in India

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ICAR-NBPGR facilitated the introduction of heeng (*Ferula assa-foetida* L.) from Iran in 2018 following stringent pest risk analysis. By the end of 2020, CSIR-Institute of Himalayan Bioresource Technology, Palampur has successfully established 800 saplings in the cold desert region of Lahaul valley. Successful cultivation of heeng is expected to save crores of rupees in foreign exchange as well as increase the income of small and marginal farmers of Jammu and Kashmir, Uttarakhand and Himachal Pradesh. Heeng introduction is an example of cooperation between CSIR and ICAR institutes.

Ferula assa-foetida L. commonly known as Asafoetida or *Heeng*/*Hing* is prized as a condiment in India and other parts of the world. Asafoetida is native to central Asia, eastern Iran to Afghanistan, and today it is grown chiefly in Iran and Afghanistan, from where it is exported to the rest of the world. Though asafoetida is not native to India, it has been used in Indian medicine and cuisine since long. The economic product from asafoetida plants is the oleo-gum resin exudate from roots. The butyl propenyl disulphide is responsible for the typical aroma of asafoetida. It is known to be beneficial in asthma, whooping cough, chronic bronchitis and digestive disorders. It is considered to have anthelmintic, antiseptic, antispasmodic, digestive, analgesic, carminative, diuretic, expectorant, laxative and sedative properties (Yaqoob and Nawchoo, 2016) and is used in developing green pesticides due to its antimicrobial and insecticidal properties (Salehi *et al*., 2019). It is an important ingredient of several Indian cuisines as a flavouring agent particularly in Indian curries, dal, sambhar and pickles. The whole plant is used as a fresh vegetable. The herb is also used as an antidote of opium. In Persia, this herb is highly esteemed as a condiment and called as the "food of the Gods". This herb is the major component in the famous Ayurvedic herbal formula *Hingashtak*.

The demand for quality asafoetida in the domestic, as well as in international markets, is high. The UK, Yemen, Belgium, Kenya, Malaysia, Oman, Switzerland, United Arab Emirates are the major importing countries. India consumes nearly 40% of the world's total production of asafoetida. The price of quality asafoetida in the domestic market varies between Rs. 10,000 to 15,000/- per kg (Anonymous, 2020a). The basic raw material is imported mainly from Iran and Afghanistan and processed into powder and tablet form for domestic market. During 2019-20, India has imported heeng worth INR 942.44 crore (Anonymous, 2020b).

Ferula is the third largest genus of family Apiaceae (Yaqoob and Nawchoo, 2015) comprising 180-185 species (Pimenov and Leonov, 2004). Some species of the genus are commonly used as spices while some are used in the preparation of local drugs. Three species viz. *Ferula narthex*, *Ferula thomsoni* and *Ferula jaeschkeana* occur in India (Yaqoob and Nawchoo, 2016; Hooker, 1872). However, commercial asafoetida is obtained mainly from *F. assa-foetida* known as Red asafoetida (*Hing Lal*) and *F. narthex* known as milky white asafoetida (*Hing Kabuli Sufaid*) (Pandey, 2008). The white or pale variety is water soluble, whereas the dark or black variety is oil soluble. While *F. assa-foetida* is grown extensively in Iran and Afghanistan (Sultana *et al*., 2015), *F. narthex* is found in the dry valleys of the Ladakh region in Kashmir, at an altitude of 4000 m (George, 2006). The oleogum of *F. narthex* is used as a substitute for *asafoetida* in India. A reddish coloured species, *F. alliacea* Boiss, popularly known as *Multani Hing*, which grows in Eastern Persia, Khorasan and Kirman (Dutt, 1928) has reddish exudate and used for cooking.

Ferula assa-foetida is a perennial herbaceous plant. It grows to the height of 2-2.5 meters with a circular

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mass of leaves having a diameter of 30-40cm. Flowering stems are 10 cm thick and hollow inside with a number of schizogenous ducts in the cortex containing the resinous gum. It has large, compound, bipinnate, pubescent radical leaves with sheathing petioles. Flowers are pale greenish-yellow in colour borne in large compound umbels. Carrot shaped roots are thick, massive, and pulpy which are covered with bristly fibres, with one or more forks. The plant is ready to harvest after five years of planting when the fusiform taproots attain a diameter of 12 to 15 cm at the crown (George, 2012). Roots yield a resin similar to that of the stems. All parts of the plant have a distinctive putrid smell. Tapping is usually done before flowering, when the plant sprouts from the taproot. After a month, the green foliage turns yellow, the stem is cut near the crown and milky juice exudes coagulates on exposure to air. After a few days, the exudate gum resin is scraped off (George, 2012; Giri *et al*., 2008). The yield of resin is around 900g per plant (Sood, 2020).

The history of introduction of asafoetida to the Indian subcontinent is very old. It is said that the army of Alexander the Great carried this plant with them when they came to India in the 4th century BCE. For Alexander's army, it was a case of mistaken identity: they thought it was silphium, a rare plant that was used to tenderise meat. The army came across it while crossing over the Hindu Kush mountains into India and the Hindu Kush, Afghanistan and Iran has been the cradle of this remarkable spice that is full of sulphur compounds (Anonymous, 2020c).

ICAR-NBPGR has been instrumental in introducing several new germplasm to the Indian soil including that of asafoetida. Though the efforts were initiated way back in 1963 when *Ferula assa-foetida* was introduced from Hungary, the plants could not be established. Subsequently several efforts were made during 1964-1976 to introduce this species from countries like Germany, France, Italy and the USA. After the Division of Plant Introduction was rechristened as NBPGR, further efforts were made to introduce this species from Italy in 1976 (EC115668) and planted at NBPGR Regional Station, Shimla. In 1977, EC119507 was introduced from USSR and EC119786 from Italy. Dr RK Arora collected EC129285 personally from USSR through Indian Embassy, Moscow in 1979 and planted the seeds at NBPGR, Shimla. In 1982, two accessions viz., EC145134 and EC145135 were received through USSR Embassy, New Delhi by Dr R Gupta, NBPGR. However, none of them could be established. During that period several related species of *Ferula,* namely *F. communis, F. gracilis, F. jacksiana, F. kosschinskyi, F. longifoliafiseh, F. penninervis, F. pseudooreoselinum, F. tennuisecta, F. stylosa, F. pennineris* were imported from countries like USA, Italy and Germany. In 1989, *F. hispanica* was imported from Japan. However, there is no record of maintenance of these species. *Ferula* has very specific climatic requirements and need to be planted at typically high altitude. This could be one of the reasons for failure in establishing the accessions introduced.

It was during 2018, the CSIR-Institute of Himalayan Bioresource Technology, Palampur proposed to import this species from Iran. NBPGR carried out elaborate Pest Risk Analysis (PRA) and six accessions (EC966538, EC968466-70) were imported from the University of Medical Sciences and Research Institute for Biotechnology and Bioengineering, Iran. This was for the first time when the *heeng* germplasm introduced from Iran could be successfully established and by the end of 2020, CSIR-IHBT has planted as many as 800 saplings in the cold desert region of Lahaul and Spiti under the aegis of the State Department of Agriculture, Himachal Pradesh. Since the cold deserts of Himachal Pradesh have the same climatic conditions that are found in Iran, Turkey and Afghanistan, with refinement in cultural practices, asafoetida is expected to be grown in these regions. The Gulmarg region of Kashmir in India also has small tracts of cultivation (Anonymous, 2020a). Commercial cultivation of this emerging crop under Indian conditions will certainly open new avenues to the small and marginal farmers of hill states like Jammu & Kashmir, Uttarakhand and Himachal Pradesh. Today, a kilogram of pure asafoetida can fetch approximately Rs. 35,000 to Rs. 40,000 in the international market, which shows plantation of this crop can certainly increase farmer's income. Moreover, production of asafoetida in the country would reduce the dependence on other countries saving valuable foreign exchange. ICAR-NBPGR has a continuous program to import more germplasm from other countries like Afghanistan to evaluate them under Indian conditions for high quality produce.

Heeng cultivation is an example of cooperation between CSIR and ICAR institutes. The successful introduction is expected to be followed by efforts in

Fig. 1. Seeds of asafoetida accessions imported from Iran. Photo courtesy: CSIR-IHBT, Palampur

agronomy and crop improvement to adapt this emerging crop to Indian conditions.

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