

Taramira [*Eruca Sativa* Mill.]: A Review on Its Biology, Genetics, Breeding and Cultivation

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ABSTRACT: *Eruca* is a genus of flowering plants in the family Brassicaceae, native to the Mediterranean region, which includes the leaf vegetable known as arugula or rocket.

The number of species is disputed, with some authorities only accepting a single species, while others accept up to five species. The following species are accepted by the Med-Checklist:^{[1][2]}

- *Eruca loncholoma* (Pomel) O.E.Schulz
- *Eruca pinnatifida* (Desf.) Pomel (syn. *E. sativa* subsp. *pinnatifida* (Desf.) Batt.; *E. vesicaria* subsp. *pinnatifida* (Desf.) Emberger & Maire)
- *Eruca sativa* Mill. (syn. *E. vesicaria* subsp. *sativa* (Mill.) Thell.)
- *Eruca setulosa* Boiss. & Reuter
- *Eruca vesicaria* (L.) Cav.

When treated as a monospecific genus, all are included within *E. vesicaria*.^{[3][4]}

Varieties can be either annual or biennial, growing to 20–100 cm tall. The leaves are deeply pinnately lobed with four to ten small lateral lobes and a large terminal lobe. The flowers are 2–4 cm diameter, arranged in a corymb, with the typical 4-petal, 4-sepal Brassicaceae flower structure; the petals are creamy white with purple veins, and the stamens yellow. The fruit is a silique (pod) 12–25 mm long with an apical beak, and containing several seeds.^{[5][6][7]}

KEYWORDS: *Eruca*, *sativa*, brassicaceae, biology, genetics, breeding, cultivation, monospecific

I. INTRODUCTION

Taramira oil, commonly known as Jamba oil comes from the seeds of Rocket Salad or Arugula. The Latin name for this plant is *Eruca vesicaria* (Blamey and Grey-Wilson, 1989). The *Eruca vesicaria* is an edible annual plant that is very resistant to adverse weather conditions such as droughts. This makes Taramira oil popular in locations that experience poor rainfall, especially in Pakistan, Northern India, and other parts of West Asia (Sindhu and Kantaraj, 1989).

Eruca sativa is a species of *Eruca* that is native to Mediterranean regions, such as Morocco, Portugal, Egypt, Turkey, and Lebanon (The MED-CHECKLIST, 2015). It belongs to the Brassicaceae family which also includes other commonly flowering plants such as the cruciferous vegetables i.e. cabbage, cauliflower, mustards and horseradish. [11,12,13]

Visually, the *Eruca* grows between 20-100 centimetres in height. The leaves are pinnated which means they are, “a compound leaf that has leaflets arranged in 2 rows either side of a midrib like a feather.” The flowers are between 2-4 cm, creamy white, and arranged in a corymb and is common in the brassicaceae family (Hickey and King, 2000). The silique pod is between 12 and 25 mm long and contains several edible seeds. (Huxley, Griffiths and Levy, 1999).

The plant is a popular herb that has been grown and consumed since Roman times. The Ancient Egyptians and Romans both considered the leaves of the Taramira to be an aphrodisiac (Sastry, 2003; Padulosi and Pignone, 1997). This plant has been used over time for a wide variety of reasons. The tender fresh parts of the plant have been traditionally used in salads and as an herb or spice. [1,17,18]



It has been used for various medicinal purposes; as a tonic, rubefacient, astringent, digestive, laxative, emollient, stimulant, stomachic, and aphrodisiac (S JAAFAR and S JAAFAR, 2015). In addition, within traditional medicine, Rocket has been used for the management of cardiovascular-related issues, especially hypertension (Salma, Khan and Shah, 2015) It also has a positive effect on male fertility. The oil can be used for cooking as an addition to salads, for massage, to soothe the skin, during soap production and as an adulterant for mustard oil to impart a spicy taste. [12,1,18]

Eruca is highly rich in potassium and Vitamin C. Vitamin C (ascorbic acid) is an essential vitamin that supports metabolism and aids in the absorption of other vitamins, micronutrients, and minerals. It also aids in maintaining a healthy immune system, contributes to the formation of essential hormones such as adrenaline and noradrenaline and helps cells within the body communicate with each other. Potassium helps the body regulate fluid balance, regulates muscular contraction and helps the nervous system to relay messages between the brain and body. (McCormick, 2013).

E.sativa seed extract contains a significant amount of metabolites such as alkaloids, tannins, phenols, flavonoids, saponins and ascorbic acid. Rocket salad types are very rich in antioxidant complexes as they are a source of vitamins such as ascorbic acid, carotenoids, and polyphenols. It also contains a large amount of Erucic acid a monosaturated omega-9 fatty acid commonly found in the brassica family. Erucic acid is also known as cis-13-docosenoic acid and the trans isomer is known as brassidic acid (WIKI). While Erucic acid has many shared uses with mineral oils, it is comparatively more biodegradable. It can be also converted to use as a precursor for biodiesel fuel as well as lubricants or surfactants ((Bao, Pollard and Ohlrogge, 1998)

E. Sativa oil and extract was tested for its antimicrobial properties against gram positive and gram negative bacteria and it was found that the, "Seed oil showed maximum inhibition of growth against all the antibiotic-resistant bacteria. MIC values for the Eruca seed oil showed that this oil had almost equal activity with respect of the broad-spectrum antibiotic Gentamicine."(Sadiq, A et al, 2011).[18,19,20]

II.DISCUSSION

Hair growth occurs during three separate stages: the long growing phase (anagen phase), the brief transitional apoptotic phase (catagen) and the resting phase (telogen) (Safaeian, Shatalebi, Baradaran and Alamdarian, 2016). It is thought that when added to hair it increases the length and weight of hairs and the hair follicle levels in the anagen phase. This can be attributed to Eruca sativa containing a large number of polyphenols and flavanoids which promote hair growth; they are able to stimulate hair growth via the combined effect of nourishing hair follicles and increase blood flow to the area (Safaeian, Shatalebi, Baradaran and Alamdarian, 2016). Taramira oil also is considered pharmaceutically stable and non sensitising. Due to indole-3-carbiol content it is considered a soothing oil and can be very useful for individuals who suffer from skin inflammation such as eczema, psoriasis and even for chronic conditions such as rheumatoid arthritis. In addition, Taramira oil contains a pungent compound known as allyl isothiocyanate which also exhibits anti-inflammatory properties.

Kim B, et al, 2014 studied the use of erucic sativa on patients with atopic dermatitis and conclude that it has anti inflammatory benefits and promotes the skin barrier function. They put this down to E.Sativa flavanoids: quercetin and isorhamnetin. It has been shown to inhibit elastase (enzyme that degrades elastine) and can therefore may prevent sagging skin (Eid AM, et al, 2015). Adding it to skincare products could help stability in terms of harmful microbes as it has been found to have, "partial bioactivity against the growth of microbes" - though it has no antifungal activity. It also has a sun protection factor of 5.57 so may be a useful addition to sun care products. This slightly green oil has a pungent, lingering scent, similar to horseradish and wasabi. This is from the allyl isothiocyanate present in the oil. I used it neat on my scalp and it stung for around 30-40 minutes. I have also used it neat on dandruff and I was amazed at how it worked; the following day there was no dandruff present.[15,18,19]

Taramira or Arugula or garden rocket or Safed Sarson (Eruca sativa syn: E. vasicaria sub sp. Sativa (Miller) Thell., Brassica eruca L. syn: Brassica eruroides Roxb.) is an important oilseed crop belongs to family



Brassicaceae which is cultivated in arid and semi-arid regions of the world. The losses in oilseed crops due to biotic stresses is about 19.9% worldwide, out of which diseases cause severe yield reduction at different growth stages. Taramira or Arugula or garden rocket or Safed Sarson (*Eruca sativa*) is affected by many diseases. These diseases as well as pathogen either alone or in combination causes substantial damage to crop resulting in heavy economic losses every year. First of all farmers should preferably use the disease resistant or tolerant or disease escaping cultivars if available.[22,21,23]

III.RESULTS

Genetic diversity is a key to identify elite genotypes for any crop improvement programme. In a study, diverse Taramira (*Eruca sativa* Mill.) genotypes were characterized using molecular markers in order to assess the inherited patterns of these genotypes for identification of elite and genetically diverse genotypes. Sixty (60) genotypes were provided by Bioresources Conservation Institute (BCI), National Agricultural Research Center (NARC). Simple Sequence Repeats (SSR) analysis revealed that 54 polymorphic bands were generated using 40 primer pairs. Polymorphism Information Content (PIC) value calculated for 10 SSR selected primers determined allele variations at each locus. These values varied from 0.234 for primer PBCGSSRBo36 to 0.720 for primer Na10-G10 with an average PIC value of 0.495 per locus. Each primer produced an average of 1.4 polymorphic bands. All the selected primers produced polymorphism among studied genotypes. The allele's size varied from 90bp-700bp is the evolution of proposed molecular approach. These results inferred that the accessions studied in present research have low variation revealing narrow genetic background of these accessions. Present investigation concerning molecular analyses, illustrated the highest level of inter-species and middle level of intra-species diversity amongst evaluated genotypes.

Genetic divergence of 99 lines of taramira (*Eruca sativa* Mill.) was assessed using Mahalanobis' D^2 statistic. These lines could be grouped in 13 clusters. Grouping of lines in different clusters was not related to their geographic origin. Pods/plant, seed yield/plot, seed yield/plant and test weight contributed maximum towards total genetic divergence. Based on mean performance, genetic distance and clustering pattern, hybridization involving parents KIM-136, 176, 91, 345 and 465 belong to clusters III, VIII, X and XII may give higher yielding varieties.

Taramira is an important oilseed crop of drier regions of north-western India. The oil is not directly eaten, although it is mixed with mustard oil to increase the pungency of the latter. It originated in Mediterranean region. It has 2n=22 chromosomes which are very small. Genetic improvement is limited in this crop, although some varieties are available. Very recently a variety RTM-314 has been released for the general cultivation. Taramira has good traits particularly conferring disease resistance which can be transferred to *Brassica campestris* and *B. juncea* both are important crops. Some efforts are underway in this regard with limited success.[27,25,23]

IV.CONCLUSIONS

Taramira is raised on very poor sandy soils with low rainfall. Mustard and sarson group of plants however are grown both on sandy and heavy soils under irrigated and rainfed conditions. These crops are commonly cultivated in areas of marginal and sub marginal productivity, either mixed or intercropped with wheat, barley, gram, pea, sugarcane, lentil etc. In areas of advanced Agronomy, they are chiefly grown as pure crops. In recent years though there has been an increase in area and production of rapeseed and mustard, the average productivity (800 kg/ha) of the country is quite low in comparison of the developed countries of the west. The cause for low production is diverse and often complex, but major ones have been nonavailability of improved varieties of seeds and fertilizers, susceptibility to various insect pests, disease and frost. Coupled with these is unawareness on the part of farmers about the crop management practices. If efficient crop management practices are adopted at appropriate time, the production and productivity levels can easily be enhanced[28,29,30]

Generally the rape and mustard thrives best in medium or heavy loam soils except taramira which is raised on lighter soils but heavy soils subjected to water logging should be avoided as the crop can not tolerate such conditions. Very light soils usually cause a serious moisture stress and a poor crop growth is observed. Saline and alkaline soils are often not fit for the crop though it has good tolerance to such conditions. Plants can tolerate moderate salinity reasonably well but a soil having neutral pH is ideal for their proper growth and development. The rapeseed and mustard requires fine, firm and moist seedbed so that a reliable moisture supply is assured for germinating seeds and young seedlings. For achieving this type of tillage the field should be given pre-sowing irrigation, if there is less moisture in the field. The field



should be given a deep ploughing soon after the kharif crop is harvested in the middle of September. Thereafter it may be ploughed for 3-4 times with country plough and planking after such ploughing. Care should be taken to see that weeds and stubbles are well removed from the field and the field and the soil contains adequate moisture to ensure good germination.[35,37,38]

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