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CEPHALARIA SYRIACA – AN OILSEED CROP FOR THE ARID AND SEMI ARID AREAS OF PAKISTAN

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Cephalaria syriaca Linn (N.O. Dipsacaceae), imported from Turkey, has successfully been grown in Pakistan. With 23 % oil content, the seed yield/hectare has been calculated to be 1600 Kg. The fatty acid composition of the locally grown seed oil has been found to be $C_{12:0}$, 1.20 %; $C_{14:0}$, 18.10 %; $C_{16:0}$, 9.40 %; $C_{18:0}$, 2.80 %; $C_{18:1}$, 24.20 %; $C_{18:2}$, 35.8 %; and epoxy oleic acid 7.30 %.

Key words: Cephalaria syriaca arid, Saponification.

INTRODUCTION

Cephalaria syriaca (Linn N.O. Dipsacaceae) has recently been identified growing as a weed in the waste places in wheat fields of Peshawar, Quetta and Kashmir regions of Pakistan [1]. The plant is a perennial 1 m. tall herb, and bears flowers/fruits alongwith the wheat crop.

In Turkey, however, the plant grows as a perennial weed in the wheat fields, predominantly in the Southern regions. It has also been reported that the seeds of the plant are specifically grown for adding them to wheat seeds the flour of the mixed seeds emiliorates its baking value and delays staling [2].

A number of studies have been carried out on different aspects of *Cephalaria syriaca* by various workers [3-9]. Its seeds contain about 25 % oil, 15 % protein, 12 % crude fibre and 40.6 % of the nitrogen free extract on dry weight basis. Other physical and chemical properties of the seed and its oil are also well recorded [10].

The present study was initiated to test the possiblity of growing *C. syriaca* commercially Pakistani environment as an oil seed crop, particularly in the Barani/Arid areas. Results obtained from field trials and chemical composition of the oil obtained from locally grown crop are discussed in this paper.

MATERIALS AND METHODS

A. *Agricultural data*

(i) *Source of seeds and their viability tests.* Seeds were imported from Turkey and one hundred seeds were germinated on moist blotting papers in the last week of January. The viability was observed to be 90 % in the second week of February.

(ii) *Preparation of field beds and sowing.* Field beds, covering an area of one acre, at the PCSIR Laboratories Lahore, were ploughed thoroughly and then levelled. Parallel ridges, 15-20 cm. high and 40 cm. apart, were made in the levelled field. On the ridges, at a distance of 30 cm., two to three seeds were sown. After sowing in the last week of January, the field was irrigated and the germination started in the second week of February. The plants showed healthy growth and the seedlings attained a height of 30 cm. by the first week of March when the second irrigation was done.

(iii) *Flowering and seed formation.* In the first week of April the plants attained a height of 60 cm. and started flowering and the field was irrigated the third time. The whole flowering was complete in the first week of May when the plants attained a height of 75 cm – 100 cm. The flowers were bluish purple in colour. The field was irrigated the fourth time in the first week of May. Seed formation was observed in the second week of May and was complete in the first week of June.

(iv) *Harvesting and yield per acre.* The harvesting was done manually in the last week of June when there was full ripening of seeds. The crop thus took 150 days to mature.

The data showing ecometeorological conditions for *C. syriaca* are given in Table 1.

B. *Oil content and fatty acid composition*

(i) *Oil extraction.* The soxhlet extraction using hexane as the solvent (b.p.67-90^{O}) was used to determine the oil content.

(ii) *Physico-chemical evaluation and fatty acid composition.* The physical and chemical properties and the fatty acid composition of the oil, as determined by the standard methods [10], are given in Tables 2 and 3 respectively.

Table 1. Eco-meteorological data of *Cephalaria syriaca.*

Stage	Time	Temperature Min.°C	Temperature Max.°C	Humidity % Min. °C	Humidity % Max. °C	Soil type
Sowing	25.01.1986	4.7	2.8	48	91	Clayey
Germination	11.02.1986	11.1	14.6	94	100	"
Flowering	15.04.1986	17.8	33.5	36	75	"
Fruiting	20.05.1986	17.2	32.4	59	60	"
Harvesting	25.06.1986	26.1	37.7	56	91	"

RESULTS AND DISCUSSION

Cephalaria syriaca, that usually grows as a weed in the wheat fields, is difficult to separate from the wheat grains because of its similarity in the shape and length. However, there are certain obvious differences in the width and colour of the two seeds. The wheat grains are lighter in colour and more wide than the *C. syriaca* seeds.

It will be seen from Table-4 that the seeds are a rather rich source of oil when compared to oil yield per hectare of other oil seeds [11]. The oil in the *C. syriaca* is about 1 % more than in soybean but fairly less than in other oilseeds such as castor, rape and mustard, safflower and sunflower. However, the oil yield per hectare of *C. syriaca* comes second only after the groundnut and is thus an attractive oilseed crop particularly for the rain fed areas. This crop, if planted in rich and productive soils used for other oilseed crops, will hold a much higher potential.

The properties and fatty acid composition of *C. syriaca* are compared with other oils such as castor feed linseed, sunflower and rapeseed (*B. campastris*) (Tables 2 & 3). It will be seen that this composition compares favourably with sunflower and therefore, *C. syriaca* oil can be used for edible purposes if grown as a crop.

Physico chemical evaluations of the oil of *C.syriaca* are shown in Tables 2 and 3. The seed oil, with an iodine number of 88, can be classified as non-drying. The high specific gravity and viscosity of the oil indicate the presence of an oxygenated fatty acid in the triglycerides. The fatty acid composition as determined by GLC and shown in Table 3, indicates that the oil contains appreciable amounts of myristic acid (18.1 %) and palmitic acid (9.4 %) which are characteristics of plant families myristicaceae and palmacae. The oils with similar compositions are usually valued for commercial considerations.

The presence of an epoxy acid (7.30 %) suggests that this oil can be advantageously used in the paint industry. The additional commercial application of the oil can be in the leather industry and in fact this oil has been used for this purpose in Turkey [12-13].

The cultivation/agricultural data indicates that *C. syriaca* can be successfully grown in the "Barani"/Arid areas of Pakistan. The fatty acid composition of the seed oil, comparable with that reported elsewhere [12], further suggests that the oil can find applications both in the paint as well as the soap industries.

It is, therefore, suggested that trial cultivation of *C. syriaca* not only in the rain fed but also in the irri-

Table 2. Physico-Chemical properties of *C. syriaca* oil and Castor seed(*), linseed(*), sunflower(*) and *B. canpestris*(†) oils.

Properties	*C. syriaca* Pakistan	*C. syriaca* Turkish	Castor seed	Linseed	Sunflower	*B. canpestris*
Oil content %	23.14	25	45.50	35.50	22.32	39.44
Colour	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
Appearance	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid
Ref. index at 25°C	1.4542	1.4702	1.473-7	1.477-1.4820	1.472-1.474	1.4740
Specific gravity at 25°C.	0.9211	0.9241	0.9450	0.935	09160.919	0.9060
Iodine value	88.7	89.0	81.91	165.204	125-136	95-106
Saponification value	192.6	190.0	176-187	188-196	188-194	176-178
Unsaponifiable %	1.20	1.28	1.0	1.7 max	1.5 max	1.10-1.40

(*) Baily's Industrial Oil and Fat Products, Vol. 1, Fourth Ed. (John Wiley and Sons, New York, 1979).

(†) S.A. Khan, P. Aziz, K.H. Khan, S.I. Khan, A.W. Sabir and A.A. Malik Pakistan J. Sci. Ind. Res., 27, 146, (1984).

Table 3. Fatty acid composition of *C. syriaca* oil and castor oil and castor seed,(*) linseed,(*) sunflower seed(*) and *B. canpestris*(†) seed oils.

Fatty acids	*C. syriaca*		Castor seed	Linseed	Sunflower seed	*B. canpestris*
	Pakistan	Turkish				
Lauric acid ($C_{12:0}$)	1.20	1.40	–	–	–	0.24
Myristic acid ($C_{14:0}$)	18.10	18.40	–	–	–	1.17
Palmitic acid ($C_{16:0}$)	9.40	8.80	0.9-1.60	4.0-7.0	3.0-6.0	3.55
Stearic acid ($C_{18:0}$)	2.80	1.90	1.0-1.80	3.0-5.0	1.0-3.0	5.20
Oleic acid ($C_{18:1}$)	24.20	25.50	3.20-5.70	12.0-34.0	14.0-43.0	16.87
Epoxy acid as Epoxy oleic	7.30	7.80	–	–	–	–
Recinoleic or hydroxy oleic acid	–	–	83.60-89.0	–	–	–
Linoleic acid ($C_{18:2}$)	35.80	36.30	3.70-6.70	17.0-24.0	44.0-75.0	19.16
Linolenic acid ($C_{18:3}$)	–	–	0.20-0.60	35.0-60.0	–	18.45
Erucia acid ($C_{22:0}$)	–	–	–	–	–	37.30

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Table 4. Comparison of oil yield per hectare of various oilseed crops grown in Pakistan.

Oil seed crop	Area grown (hectare)	Production (000 tonnes)	seed yield/ hectare (kg.)	Oil content (%)	Oil yield per hectare (kg.)
Castor	25545	21938	826	37	306
Groundnut	591	691	1170	32	374
Linseed	9419	5170	549	35	192
Rape and Mustard	3169	2348	677	43	291
Safflower	2882	3140	1090	28	305
Sesamum	342	135	397	22	87
Soybean	4537	1799	397	22	87
Sunflower	2592	7789	812	32	260
Cephalaria syriaca	–	–	1600	23	368

gated areas of Pakistan be tried as an oil seed crop. Because of the higher per hectare seed and oil yields this crop may prove useful in the Pakistani environment. The oil from the crop can meet the industrial requirements whereas its seed meal can be eaten in admixture with other flours or used in animal feed preparations.

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