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CULTIVATION CONDITIONS AND PHYSICO-CHEMICAL PROPERTIES OF *LUFFA ACUTANGULA* VAR. *ACUTANGULA* SEED OIL

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Luffa acutangula var. *acutangula,* known as ribbed gourd (N.O. Cucurbitaceae), is a cultivated climber and used as a vegetable and medicine for haemorrhoids and leprosy. A study regarding its cultivation conditions and characteristic of the seed oil was made with a view to determining its possibility as an oilseed crop. It has been observed that the amount of oil in the *Luffa acutangula* seeds is 25.8% and the fatty acid composition (amount by weight) of this oil is linoleic (33.56%), oleic (24.42%), palmitic (23.09%), stearic (9.84%), myristic (1.48%), lauric (1.78%) and other unidentified acids (3.32%).

INTRODUCTION

Luffa acutangula var. *acutangula* (syn. *Cucumis acutangula* L., N.O. Cucurbitaceae) locally known as *Kali Tori* is also known as ribbed gourd due to its characteristic fruit with acutely ten-angled darker skin [1]. At present the plant is being cultivated commonly in all parts of Pakistan. It is grown in hot weather and its young fruits are eaten as a green vegetable [2].

Fig. 1. *Luffa acutangula* var. *acutangule* (Kali Tori). Mature fruit on the vine in the experimental field of PCSIR Labs, Lahore.

The plant is a climber and its leaves are 15-20 cm. long and palmately angled. The fruit is 15-30 cm. long tapering towards the base, longitudinally ribbed with ten sharp angles (Fig. 1). The seeds are 13 cm. long and 6.8 cm. broad, ovoid and black in colour [3](Fig. 2). A unique characteristic of the genus *Luffa* of the family Cucurbitaceae is that of the seeds inside the fibrous bag of the fruit. The black coloured seeds have a hard covering enclosing the two oil-rich cotyledons. The average weight of a single seed is 1.099 g. In the local materia medica emetic and purgative properties have been ascribed to the seeds, while pounded leaves are applied locally in diseases such as splenitis, haemorrhoids and leprosy [4].

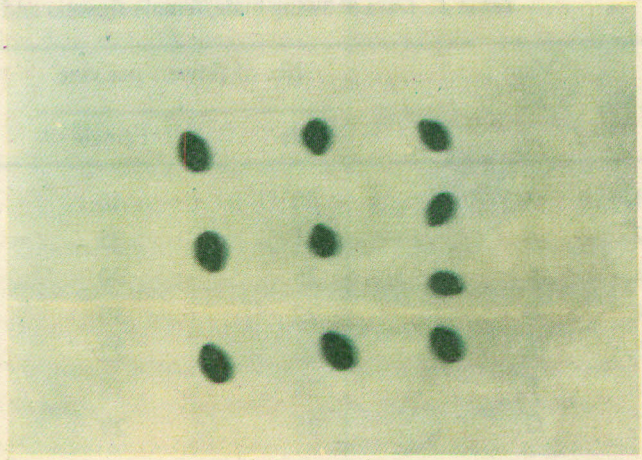

Fig. 2. *Luffa acutangula* var. *acutangula* (Kali Tori). Ripe seeds.

The present work on the cultivation conditions and studies of the characteristic of the seed oil was carried out with a view to exploring the possibility of exploiting this and other members of Cucurbitaceae family as oil-seed crops.

Large-scale annual cultivation of *L. acutangula* var. *acutangula* as a source of vegetable presents itself as an attractive source of an oilseed crop as well. The present paper, therefore, describes the cultivation of the plant as undertaken at the experimental fields of the PCSIR Laboratories, Lahore. The chemical composition of the seed oil (28.5%) has also been determined and it is reported that the oil is composed of lauric (1.78%), myristic (1.48%), palmitic (23.09%), stearic (9.84%), oleic (24.42%), and linoleic (33.56%) acids.This composition of the oil from *Luffa acutangula* can find use both as edible oil and also for soap making.

MATERIALS AND METHODS

1. *Soil preparation.* The soil, free from pebbles and stones, was thoroughly ploughed, made loose-mixed with cow dung manure and then levelled.

2. *Seed source.* Healthy seeds were obtained from the ripe fruits by hand picking and also from the local market.

3. *Seed sowing.* Clean seeds were sown singly 3 cm. deep at a distance of about 45 cm. from each other in early April. (temp. max. 31.7°C, min. 18.3°C; humidity, max, 65%, min. 28%) on the ridges of 150 cm. wide and 15 cm. high furrows.

4. *Germination.* Almost 12 days after sowing the seeds germinated in mid-April (temp. max. 34.3°C, min.22.8°C, humidity, max. 62%, min. 36%). On an average 80% seeds germinated.

5. *Irrigation.* The freshly sown seeds were watered immediately and once in a week till flowering and then fortnightly till fruiting. The eco-metereological data of *Luffa acutangula* cultivation are given in Table 1.

6. *Flowering and fruiting.* Flowering occurred at the end of May (temp. max. 46.4°C; min. 26.7°C; humidity, max. 38%, min. 17%) and continued till June (temp. max. 38.6°C; min. 30°C; humidity, max. 54%; min. 43%). Fruiting started in the last week of June (temp. max.

Table 1. Eco-meteoological data of *Luffa acutangula* var *Acutangula cultivation*

S. No.	Cultivation state	Dates	Temperature°C		Humidity		Soil type	Irrigation
			Min.	Max.	Min.	Max.		
1.	Sowing	07.04.1984	18.3	31.7	28.0	65.0	Loamy	Weekly
2.	Germination	19.04.1984	22.8	34.3	36;0	62.0		”
3.	Flowering	27.05.1984	26.7	46.4	17.0	38.0		Fortnightly
4.	Fruiting	27.06.1984	30.0	38.6	43.0	54.0		”

Table 2. Data showing male/female flowers and ripe/un-ripe fruits per vine and yield of seed per fruit

S.No.	Vine No.	No. of flowers per vine		No. of fruits per vine		Average yield of seeds per ripe fruit
		Male	Female	ripe	unripe	
1.	A	30	40	17	13	75
2.	B	21	25	11	9	65
3.	C	25	30	14	6	80
4.	D	22	30	15	11	90
5.	E	16	22	10	8	55
6.	F	28	38	16	12	70
7.	G	25	29	13	9	50

* Fruit size variation was noted from 18 to 30 cm. and the number of seeds varied from 25 to 140.

39.5°C; min. 29.4°C; humidity, max. 70%; min. 45%) and continued till the end of August (temp. max. 34°C; min. 26.1°C; humidity, max. 87%; min. 75%). The data concerning the ratio of male and female flowers and ripe and un-ripe fruits are supplied in Table 2.

7. *Harvesting.* The fruits started maturing at the end of August and the process continued till early October. Brown coloured ripe fruits were harvested by hand picking and stored under ordinary room temperature.

8. *Oil extraction.* Dry and clean seeds, obtained by splitting the fibrous bag, were crushed in a pestle and mortar and then extracted with hexane (b.p. 65–70°) in a Soxhlet. The solvent was removed under tap water pressure to yield a clean, dark brown coloured oil (25.8%).

9. *Oil characteristics.* The seed oil was evaluated by determining its various physico-chemical characteristics. These data and those reported by Choptra [4] are given in Table 4 for comparison.

10. *Fatty acid composition.* The seed oil was saponfied as usual and the methyl esters of the liberated fatty acids were analysed by gas chromatographic procedure as described previously. The determined fatty acid composition of the oil is compared with the fatty acid composition reported by Hilditch [5] in Table 4.

Table 3. Physico-chemical properties of the oil of *Luffa acutangula* var *acutangula*

S. No.	Present work		Present work	Chopra [4]
1.	Oil yield	=	25.8%	23%
2.	Colour	=	Dark brown	–
3.	Appearance	=	Liquid	Liquid
4.	Sp.gravity	=	0.9312	0.0212
5.	Iodine value	=	4.9	5.1
6.	Acid value	=	2.7	2.5
7.	Saponification value	=	195.4 to 196.7	196.5 to 197.5
8.	Unsaponificable matter	=	1.47%	1.7%

Table 4. Fatty acid composition of *Luffa acutangula* var. *acutangula* seed oil

S.No.	Component acid	Present work % age composition	Hilditch [6]
1.	Lauric	1.78	–
2.	Myristic	1.41	–
3.	Palmitic	23.09	–
4.	Stearic	9.84	30
5.	Palmitoleic	0.56	–
6.	Oleic	26.42	28.0
7.	Linoleic	33.56	42.0
8.	Other acids	3.32	–

RESULTS AND DISCUSSION

Cultivation of *Luffa acutangula* vines, as a source of green vegetables is a common practice in the provinces of Sind and the Pubjab. Usually the seeds are sown in the early days of April and fruiting occurs almost five months later. This common observation is also strengthened by the results of the present study.

It has been observed that better seed germination occurs when they are sown in the month of April. The flowering and fruiting times are also the same as observed commonly. It is, therefore, observed that the common cultivation practices for *Luffa acutangula* are optimum and well suited to the climatic conditions of Pakistan (Table 1).

The ratio of male and female flowers on the vines of *Luffa acutangula* was found to be almost equal (Table 2). However, the number of fruits has been observed to be varying from vine to vine. Those vines which were spread on the ground, although having the same number of flowers bore less fruits than those which were hanging from the supports. On an average the ratio of the fruits on the supported to unsupported vines was calculated to be 1.5:1 (average of seven vines). Considerable variation in fruit sizes was also observed both on the supported as well as the unsupported vines. The differences in seed yield per fruit are thus directly attributable to the fruit size (Table 2).

The fatty acid composition of the varieties of Cucurbitaceae has recently been published [7] and this oilseed composition is also similar to the general pattern. The fatty acid composition of *Luffa acutangula* seed oil as reported in the literature from other sources is compared in Table 4. It is seen from this comparison that there are only minor variations in the percentages of the component fatty acids but the overall composition is similar and comparable to the composition of any other edible oil. The variations however, can be attributed to the places of origin and the environments in which the plants grow.

In view of the above a large-scale cultivation of the plants is under study and actual per hactare yield of the mature fruits as well as seeds will be reported later when the economics of its cultivation will also be fully worked out. In the meantime, however, it is reported that the members of the plant family Cucurbitaceae present themselves as an attractive and potential source of oilseeds

because of their oil content, fatty acid composition and cultivation/ripening times as they do not interfere with other agricultural crops. The multiplicity of their use will perhaps provide another advantage in their acceptance as an oilseed-cum vegetable/fruit crop of the summer.

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