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DISTRIBUTION, USES AND SEED CHARACTERISTICS OF *Jatropha curcas* L. ACCESSIONS FROM VERACRUZ MEXICO

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ABSTRACT

Jatropha curcas is a native oily plant from Mexico and Central America. *J. curcas* produces seeds rich in oil (≈40 %) easily convertible into biodiesel meeting international standards. Specimens of *J. curcas* were collected in several regions across the State of Veracruz Mexico to determine its geographical distribution and characteristics of seed, oil content and phorbol ester according to its growing place. Most of the accessions were located less than 300 meters above sea level (m.a.s.l.), in sandy soil and light slope. In the Nautla and Totonaca regions, the human consumption of seeds of *J. curcas* is part of food tradition. Analysis of seeds from these regions showed absence of phorbol esters. In contrast, seeds from Capital, Montañas, Sotavento, Papaloapan, Tuxtlas and Olmeca regions, presented phorbol ester in a range from 0,05 to 0,66 mg/gr. Great variability in the number of seeds per fruit, size and weight of the seeds were found. The results suggest that the presence or absence of phorbol ester in seeds has influenced the use of this plant as food in some regions of Veracruz.
Key words: Biodiesel, distribution, phorbol ester, *Jatropha curcas*.

INTRODUCTION

Jatropha curcas or "*piñón*", is a shrub belonging to the Family of *Euphorbiaceae*, plant widely distributed in Mexico. Besides, nowadays, the production of renewable energies is an issue that has acquired high relevance at worldwide level. Therefore, the biodiesel production through, the grown of this plant is seen a viable option as a raw material, based on the high oil content in their seed (≈40 %) (ACHTEN *et al.,* 2008). In consequences in several states of Mexico, the establishment of *J. curcas* plantation has been promoted. However, there are, some obstacles like the presence of pests, variability in the fruit, seed yield and oil content and heterogeneity in the fruit ripeness that have been related to the fact to characterize local genetic materials in order to start a programme and to process the genetic selection.

Veracruz is a narrow land strip, slightly curved of 72,815 km^2. It extends from the northwest to southeast coast of Gulf of Mexico. Due its orography, this state presents diverse edafoclimatic conditions and types of vegetation. The presence of *J. curcas* has been previously reported in several regions of Veracruz. In the Totonaca region *J. curcas'* seeds are very appreciated due to their taste, and are consumed in several traditional dishes despite of its widely documented toxicity, that might cause diarrhea, vomit, abdominal pain and irritation on the skin, due to the presence of toxic compounds and antimetabolites identified in leaves and seeds (MARTÍNEZ *et al*.,

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2006). The aim of this work was to have a better understanding of the geographical distribution of *J. curcas* in the Veracruz state, Mexico its uses and seed characteristics.

MATERIALS AND METHODS

A search of "*piñón*" shrub in all regions that conform the state of Veracruz was carried out from July to 2009 to September 2010. The regions searched were: Huasteca Alta, Huasteca Baja, Totonaca, Nautla, Capital, Sotavento, Montañas, Papaloapan, Tuxtlas y Olmeca. Once that *J. curc*as shrubs were located, samples from ground (1 kg) were taken and the coordinates registered; as well as altitude (m.a.s.l.), the ground slope and the phenological state of the plants. An interview, to the owner of the plants was carrie out to know the traditional uses of each part of the plant. To determine the quantity of seeds, 40 mature fruits were used for each accession. To determine weight, length, width and thickness 50 seeds were used for each accession. Oil content in the seeds was done by extraction with hexane and the result was expressed in percentage. Finally, content of phorbol ester in the oil was quantified by means of High Performance Liquid Chromatography (HPLC) using as a standard phorbol-12-myristate 13-acetate.

RESULTS AND DISCUSSION

Eighty-five specimens of *J. curcas* were collected during 2009 and 2010 from different localities of the state of Veracruz. 89 percent of these accessions were found in altitudes below the 300 m.a.s.l, established in sandy soil and with light grounds slope.

The *J. curcas* accessions found in places with altitudes above 600 m.a.s.l., presented less vigor as compared with plants found at lower altitudes. Since, in the state of Veracruz exist a great variety of climates. It was common to observe an asynchrony in the phenological states of the plants. Of the total eighty-five accessions identified, only 38 (45%) were found in active fructification (Table 1).

According to the interviews, the traditional uses varied in relationship to the geographic location. In the north and center regions of the state (Huasteca Alta, Huasteca Baja, Totonaca y Nautla) the main use of *J. curcas* was as food. Roasted seeds are used in sauces and as an ingredient in several regional dishes. These results are according with the ones obtained by other authors (MAKKAR *et al*., 1998; MARTÍNEZ *et al.,* 2006).

The accessions from the Papaloapan, Tuxtlas and Olmeca regions in the south of the Veracruz state, are mainly used as medicinal and live fence as reported by AVENDAÑO and ACOSTA (2000).

It was found a relationship between the use of the plant and the presence or absence of phorbol ester a toxic compound. All accessions with phorbol ester are from regions were *J. curcas* is used as live fence. Meanwhile, those accessions without phorbol ester correspond to regions where the seeds are used as food.

An explanation of the presence and absence of phorbol ester, could be due a process of empirical selection (*trial and error*), carried out from the inhabitants of the localities of the north of Veracruz, to obtain a non-toxic plants due to the flavor of the *J. curcas* seeds.

The oil content in the analyzed accessions ranged from 26% (VER-JC11 and VER-JC22) to 55% (VER-JC21 and VER-JC28). Twenty-five of the analyzed accessions from Veracruz showed higher oil content than reported by KAUSHIK *et al* (2007), were specimens from India had 38% oil by weight.

Table 1. Accession number, location, main use, and oil and phorbol ester content from 38 seed sources of *J. curcas* accessions, from Veracruz, Mexico.

Accession No.	Region	Latitude (N)	Longitude (E)	Altitude (m.a.s.l.)	Uses	Oil content (%)	Phorbol ester (mg/gr)
VER-JC1	Huasteca Alta	21°18'	98°20'	130	Food	30	ND
VER-JC2	Huasteca Baja	21°11'	97°59'	228	Food	36	ND
VER-JC3	Totonaca	20°27'	97°19'	173	Food	47	ND
VER-JC4	Totonaca	20°27'	97°19'	170	Food	33	ND
VER-JC5	Totonaca	20°11'	97°15'	119	Food	37	ND
VER-JC6	Totonaca	20°28'	97°15'	43	Food	45	ND
VER-JC7	Totonaca	20°15'	96°48'	5	Food	35	ND
VER-JC8	Totonaca	20º15’	97º15’	78	Food	39	ND
VER-JC9	Totonaca	20º23’	97º12’	114	Food	43	ND
VER-JC10	Nautla	20°10'	96°53'	9	Food	39	ND
VER-JC11	Nautla	20º10’	96º53’	14	Food	26	ND
VER-JC12	Nautla	20°06'	96°00'	70	Food	47	ND
VER-JC13	Nautla	19°53'	96°48'	631	Food	42	ND
VER-JC14	Nautla	19°50'	96°48'	1054	Live fence	50	ND
VER-JC15	Nautla	19º56’	96º50’	321	Food	40	ND
VER-JC16	Capital	19°35'	96°23'	4	Live fence	41	0.43
VER-JC17	Capital	19°24'	96°52'	892	Live fence	34	ND
VER-JC18	Sotavento	19°10'	96°8'	10	Ornamental	48	0.23
VER-JC19	Sotavento	18°55'	96°12'	12	Live fence	39	0.16
VER-JC20	Sotavento	19°11'	96°20'	16	Ornamental	52	ND
VER-JC21	Sotavento	19°11'	96°20'	15	Ornamental	55	ND
VER-JC22	Montañas	18°49'	96°49'	523	Live fence	26	0.65
VER-JC23	Montañas	18°53'	97°01'	1006	Food	50	ND
VER-JC24	Papaloapan	18°47'	95°47'	21	Live fence	29	0.42
VER-JC25	Papaloapan	18°47'	95°45'	22	Live fence	41	ND
VER-JC26	Papaloapan	18°38'	95°31'	5	Live fence	46	0.45
VER-JC27	Papaloapan	17°44'	95°48'	77	Live fence	46	0.23
VER-JC28	Tuxtlas	18°31'	95°05'	520	Live fence	55	0.12
VER-JC29	Tuxtlas	18°38'	95°06'	8	Live fence	37	ND
VER-JC30	Tuxtlas	18°40'	96°09'	30	Live fence	43	0.28
VER-JC31	Tuxtlas	18°41'	95°14'	16	Live fence	39	0.44
VER-JC32	Tuxtlas	18°26'	95°10'	258	Medicinal	34	0.43
VER-JC33	Tuxtlas	18°18'	96°06'	490	Medicinal	41	0.48
VER-JC34	Tuxtlas	18º31’	95º03’	68	Live fence	44	0.33
VER-JC35	Tuxtlas	18º18’	95º06’	493	Medicinal	45	0.59
VER-JC36	Tuxtlas	18º04’	94º53’	75	Live fence	45	0.28
VER-JC37	Olmeca	17°45'	94°06'	50	Live fence	31	ND
VER-JC38	Olmeca	17°57'	94°13'	42	Live fence	31	ND

ND: No detected

The number of seeds per fruit, ranged from one to four. Nevertheless the majority of the fruits had three seeds per fruit (Figure 1), except of the accessions: VER-JC1, VER-JC3, VER-JC8, VER-JC22, VER-JC32, VER-JC36, VER-JC36, VER-JC37 and VER-JC38 where the mode for the number of seeds was two and one for accession VER-JC6.

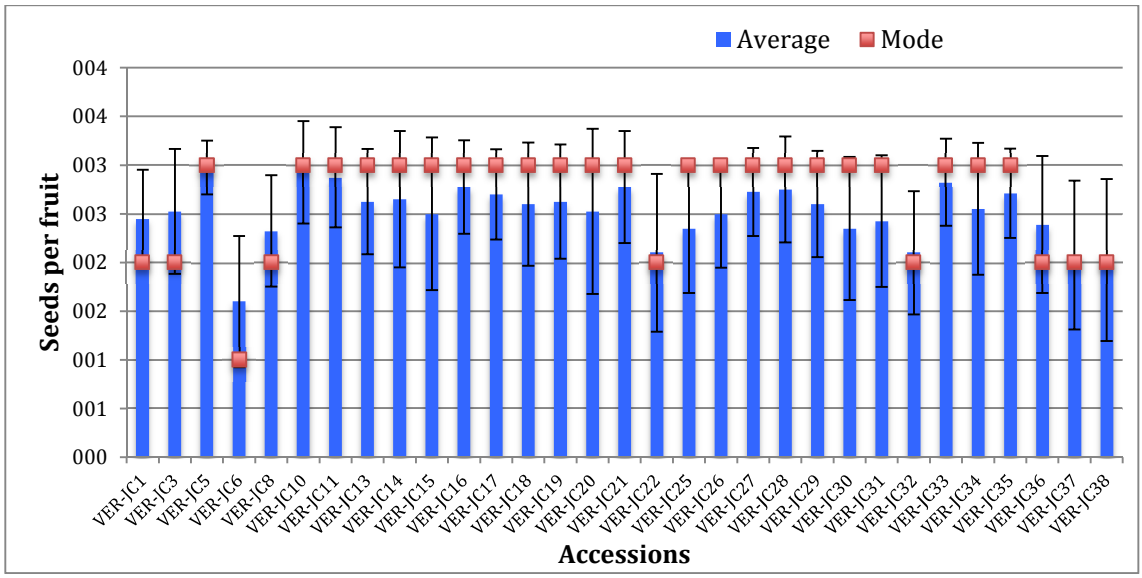

Figure 1. Average and mode for seeds per fruit on *J. curcas* accessions

The accessions from Totonaca region showed great variability in the number of seeds per fruit, this might be due to pollination, since it is known that the absence of pollinizer agents can affect the number of seeds per fruit. Besides, the drought stress.

It was observed that fruits with few seeds produced larger and heavier seeds (Figure 2), which might be due to the assimilation of photosynthates, that could be more efficient due to a lower competition among seeds.

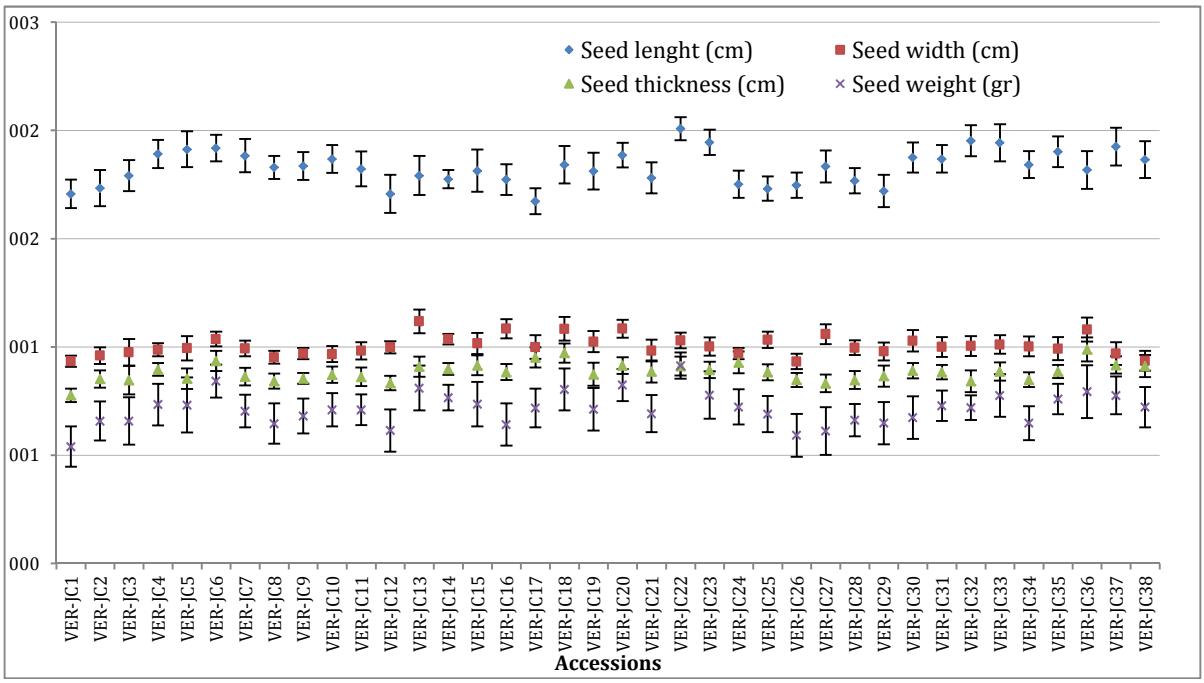

Figure 2. Values of length, width, thick and weight of seeds from different accessions of *J. curcas* collected in Veracruz, México.

Accessions VER-JC22 and VER-JC23, both located in the Montaña region, had the greatest seed length, while accessions VER-JC13, VER-JC16, VER-JC18, VER-JC20 and VER-JC36, located at different regions, had the greatest seed width.

CONCLUSIONS

J. curcas has a wide distribution in the state of Veracruz and due to the different agroecological conditions, it is possible to observe an effect in the morphology of the seeds. Besides, the nutritional use that it has is due to occurred to the seeds in some regions of the state, has a strong relation with its content of phorbol ester.

In this research, 23 accessions with no phorbol esters were detected by HPLC. These plant materials could become good candidates to start a breeding programme to obtain commercial varieties, using the oil for biodiesel production and the remaining seed cake for animal feed.

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