

VANATROP Workshop

Taxonomy and biology of the tropical plant *Jatropha curcas* L.

Claudine Campa, IRD
Damien Kuhn, AgroParis Tech
Diegane Diouf, UCAD
Christian Valentin, IRD
Raphaël Manlay, AgroParis Tech

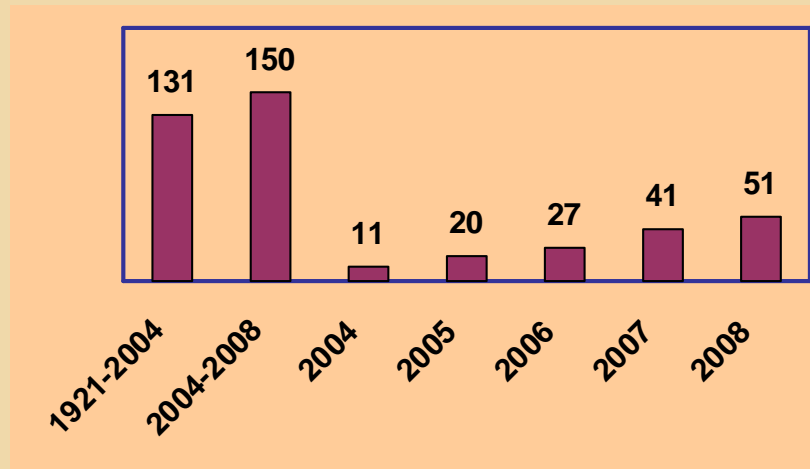


Jatropha curcas

A little known plant

Scientific
publications:

280 in 86 years



A plant in question

Or vert du désert
Green gold from the desert

- ▶ Non-edible plant
- ▶ Able to grow in arid zones
- ▶ Oily seeds → Biofuel

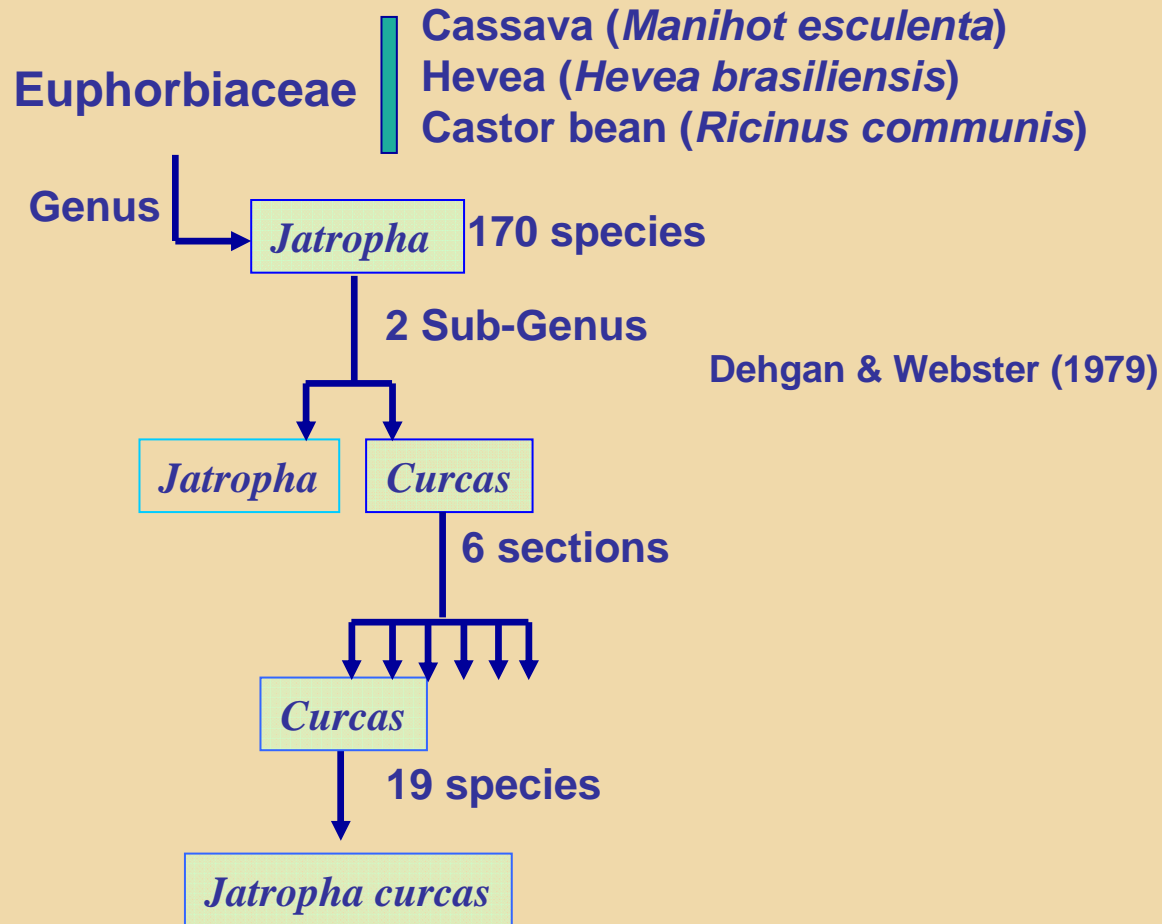
A plant that creates the debate

Jatropha curcas

Jatropha curcas L.: Linnaeus (1753)
(*iatros*: doctor; *trophé*: food)



Medicinal uses

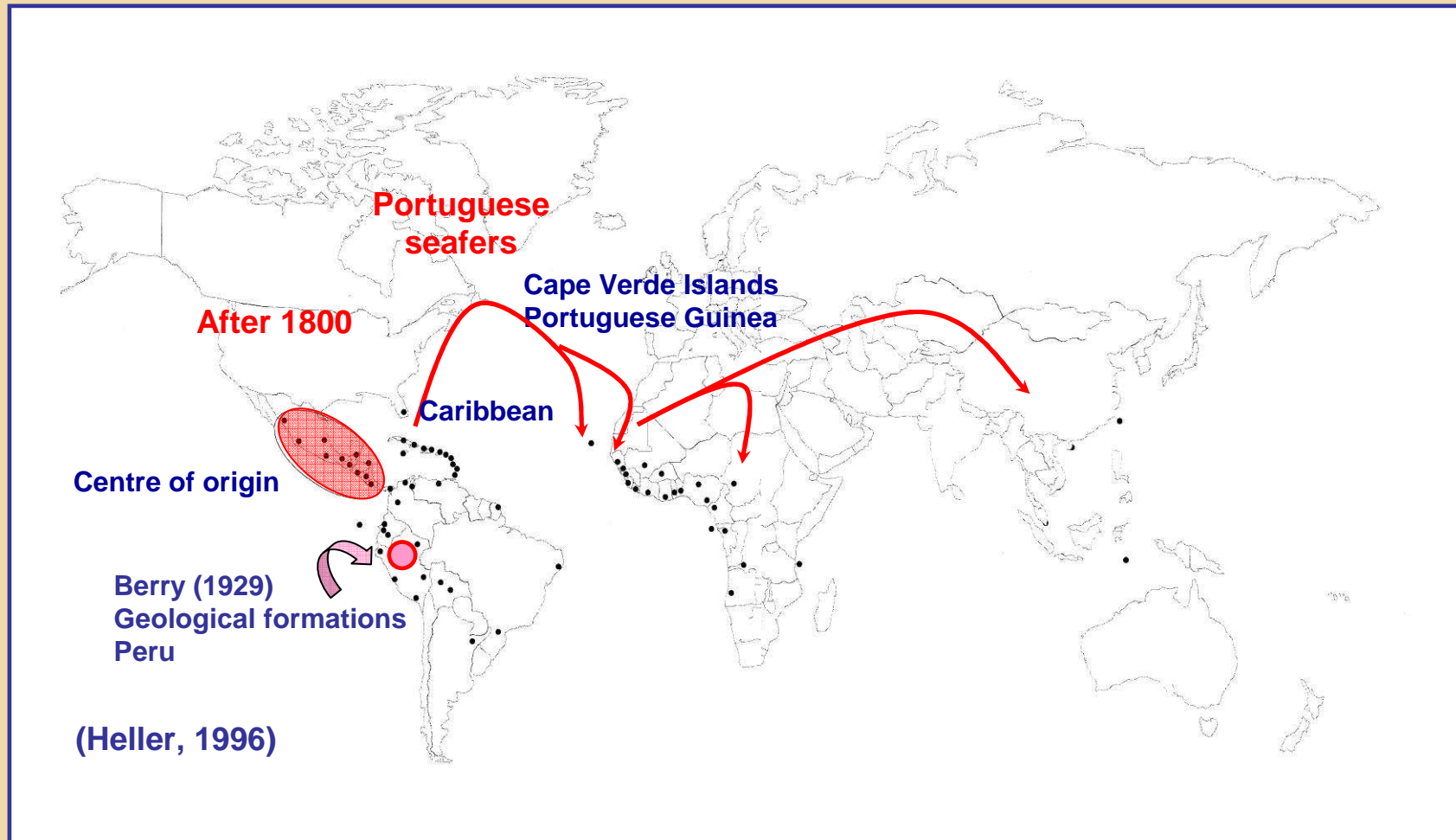


Jatropha curcas L. [sect. *Curcas* (Adans.) Griseb., subg. *Curcas* (Adans.) Pax]

Jatropha curcas

Pantropic tree

Indigenous to Mexico and Central America



Jatropha curcas

Shrub or small tree (6 m)
(3 to 10 m)

Deciduous (dry season)

Very high habitat plasticity

Very dry tropical zones



Wet Tropical Forest



Altitude	0– 500 m
Annual T° (mean)	18–28 °C (40°C)
Annual rainfall	300–1000 mm (3000 mm)
Soil type	Well-drained

Jatropha curcas

High degree of phenological plasticity

► Heller, 1992

11 provenances

W Africa

E Africa

India

4 sites (Senegal, Cape Verde)

► 12 provenances (ICRISAT, Niger)

W Africa

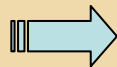
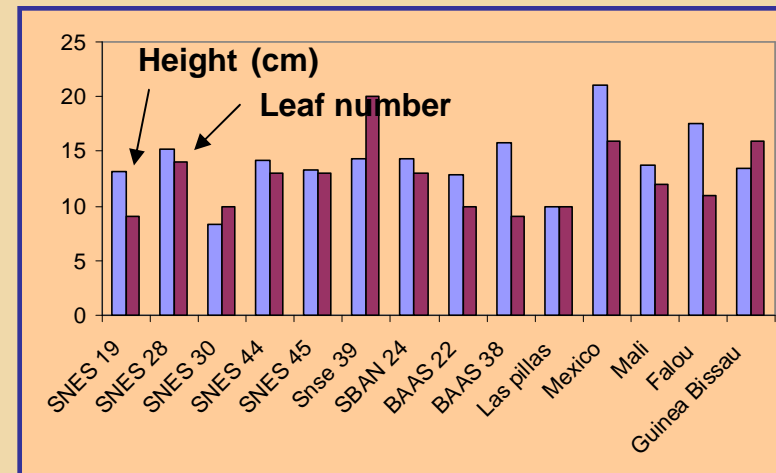
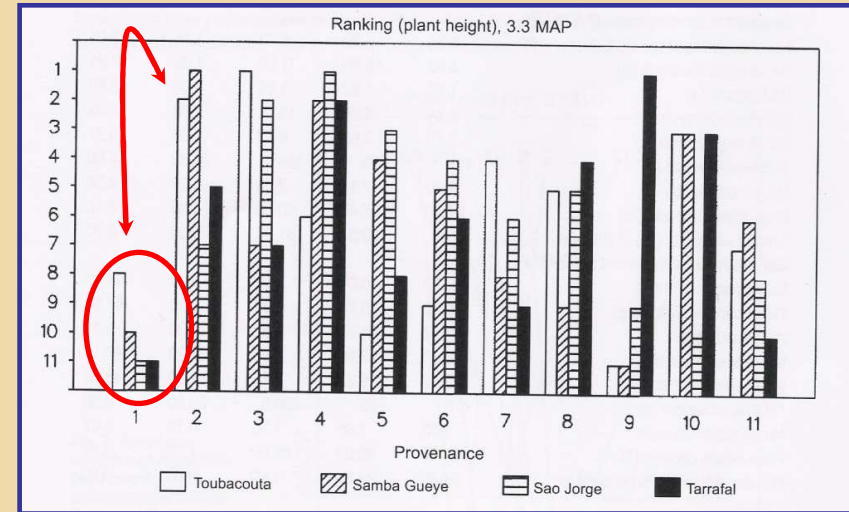
E Africa

India

America



Same culture conditions
Tropical greenhouse
Montpellier



Very sensitive to environmental conditions

Jatropha curcas

Leaves Arranged alternately

Flowers Wet season (2 peaks)

Yellow-green
Inflorescence in the leaf axil

Male and female flowers

13:1 to 29:1

Pollination by insects (bees)

↳ **Limit for seed production**

Fruit: on 1-3 year plants

Green capsule



Yellow



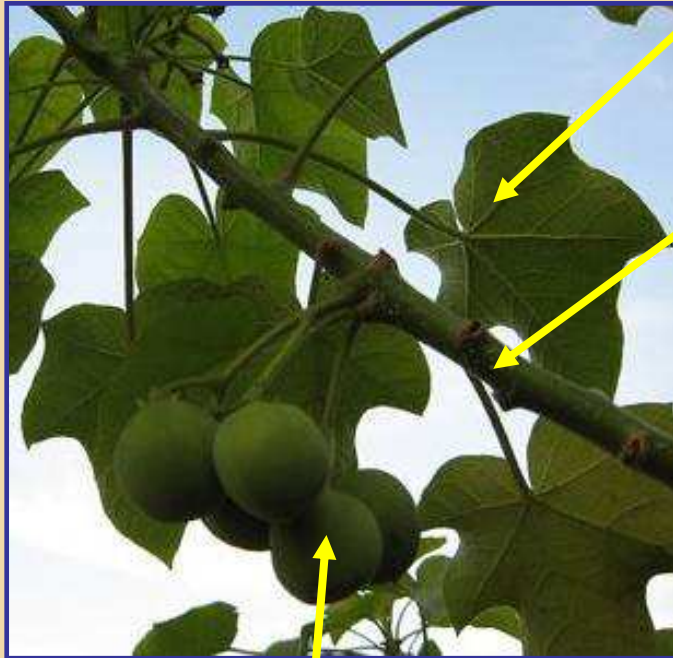
Mature seeds
(2- 4 months)

2 or 3 large black, oily seeds



Jatropha curcas

Biochemical composition



Leaves

Flavonoids (apigenin)
Glycosyl-flavonoids (vitexin, isovitexin)
Sterols
Steroid saponenins (terpenes)

Stem

Bark : Tannins (37%) blue colour
curcine : toxalbumine
cyanogenic compounds

Latex : Tannins (10%)
Hydrocyanic acid (HCN)
Curcine : toxalbumine
Alkaloid (jatrophine)

Antileukemic activity

Anti-cancerous properties

Fruit

Shell (30 %)

Kernell (= seed)

Trypsin inhibitors
Phytic acid (12%)
Saponins
Curcine

~~Phorbol esters (3%)~~

Non toxic varieties

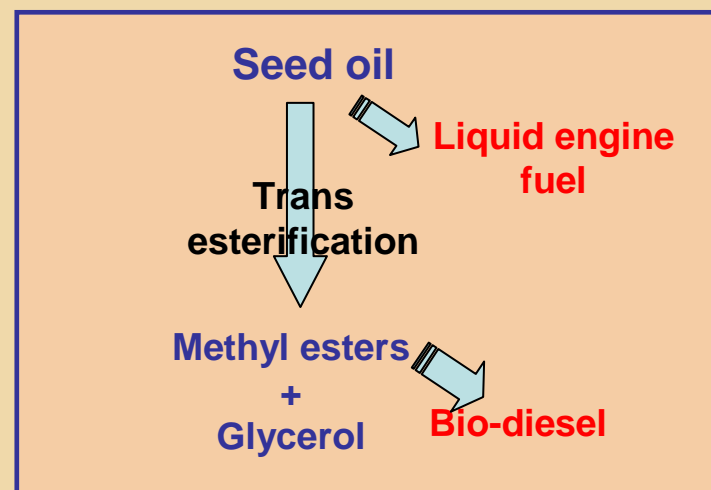
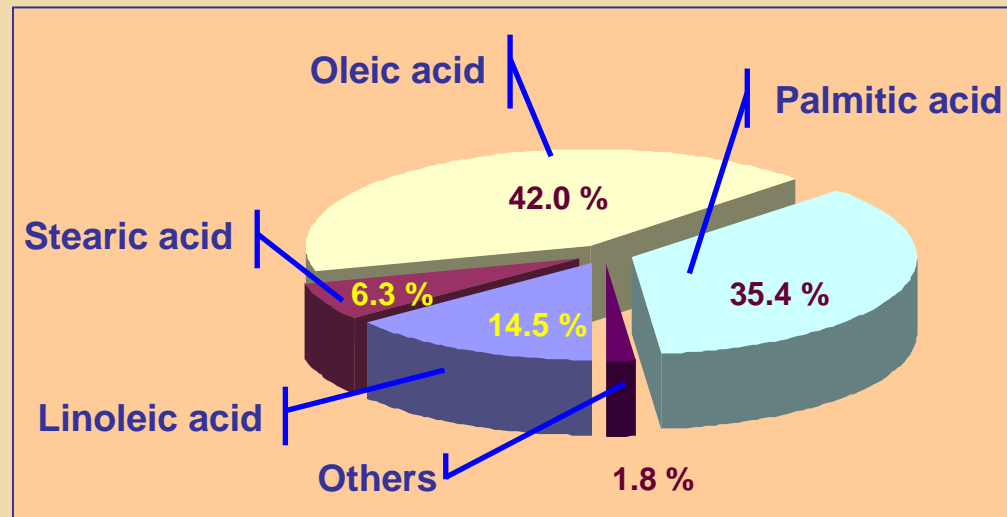
Fat	38.0 %	Oil Biofuel
Total carbohydrate	33.5	
Proteins	18.2	
Fiber	15.5	
H2O	6.6	
Ash	4.5	

(Duke and Atchley, 1983)

Jatropha curcas

Seeds

► Lipid composition



Jatropha curcas

Seeds

► Other compounds

Trypsin inhibitors	Inhibitors of digestion and growth
Curcine	~Abrin & Ricin toxicity Agglutination of erythrocytes
Phytic acid	Metal-chelating (Ca, Fe)
Phorbol esters	Tumor promoters (protein kinase C activation)

Heating



Inactivated



Inactivated



Heat-stable factor



Stable factor



Toxicity during harvest?

Non edible
Oil
Seed cake



Biofuel toxicity?

Jatropha curcas

Some questions

➡ Secondary metabolism

1 - Industrial use vs traditional?

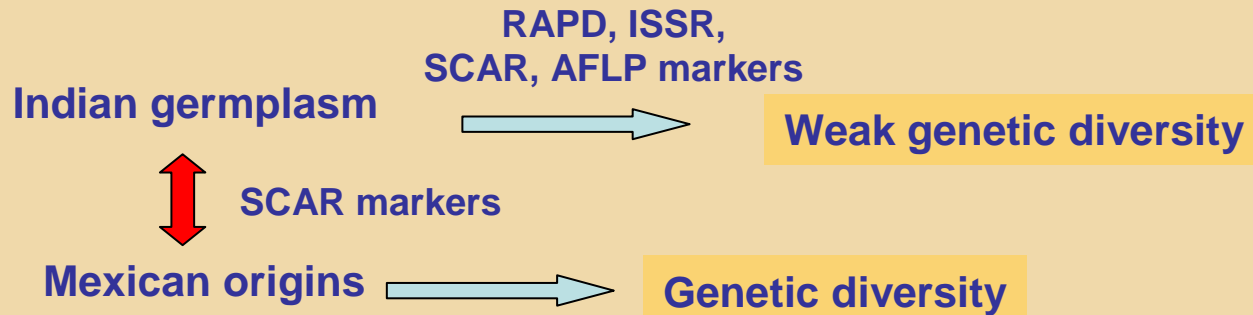
▶ **Medecine**

Part of the plant	Treatment
Seed oil	Purgative action Skin diseases
Leaf decoction	Cough Antiseptic after birth
Stem sap flowing	To stop bleedings
Latex	Antimicrobial properties

2 - Real toxicity in seeds?

Jatropha curcas

➔ Genetic diversity



- ▶ A very recent dispersal (1800)
- ▶ Propagation by cuttings

➔ No genetic diversity



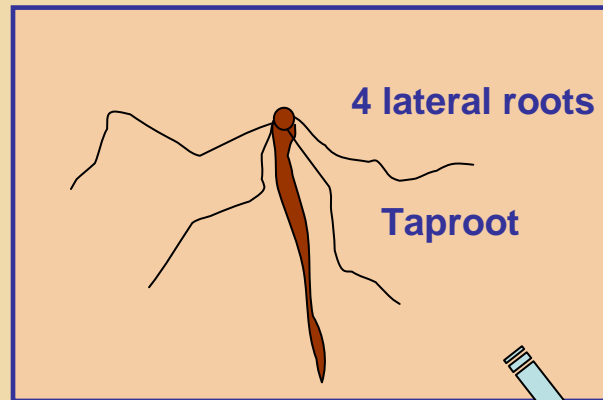
- Selection ?
- Improvement for:
production or oil quality?
resistance?

➔ **GMO!**

Jatropha curcas

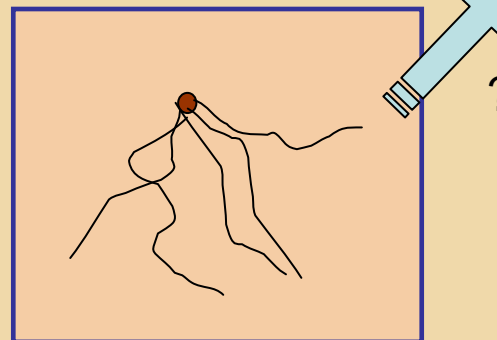
→ Effect on soil erosion

▶ Propagation by seedlings



→ Limiting soil erosion

▶ Propagation by cuttings



Jatropha curcas

Conclusions

Plant with high potentialities:

A great plasticity: able to develop in arid zones

A great diversity in the biochemical composition

But potentially:

Toxic

Negative for soil erosion

Difficult to improve because of its low genetic diversity

Jatropha curcas

tabanani

pinoncillo

jangliarandi

yu-lu-tzu

poungière

valavelona

sabudam

pignon d'Inde

mundubi-assu

Merci!

purgig nut

habel meluk

physic nut

physic nut

bagani

pinhão de Purga

pinol