بسم الله الرحمن الرحيم

شبكة المعلومـــــات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

﴿ قـــسـم ﴾

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد اعدت دون آية تغيرات

يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of
15 – 25c and relative humidity 20-40 %

بعض الوثائق الأصلية تالفة

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لم ترد بالأصـــل

Population Genetic Analysis of A Neotropical Tree Species: *Tapirira guianensis*

Master Thesis in Biotechnology

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Declaration

I hereby declare that the research work described in this thesis entitled "**Population genetic analysis of A Neotropical tree species: *Tapirira guianensis***" has not been, and is not actually submitted to obtain any other university degree, and that all experiments and results indicated are of my own realization under the direction of my scientific supervisors. Sources of any other data, methods or results included have been clearly mentioned in the text and in the reference list.

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Arwa Shahin

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Abstract:

Ecological devastation is widespread in the tropics where forests continue to disappear at an increasing and alarming rate. To maintain forests as evolutionary viable units able to adapt to changing conditions in the long term, genetic variation must exist. To date, genetic diversity in tropical trees species has only been investigated for a limited number of species.

This study is a part of GENEO-TROPECO project; it is a collaboration between six international organizations which are: INPA (Brazil), UFRJ (Brazil), CATIE (Costa Rica), INRA (France) IPBO (Belgium) and CEH (Scotland UK). The aim of this project is to evaluate the level and dynamics of genetic diversity in natural forest populations. An important criterion already identified for genetic diversity is conservation of the processes that maintain genetic variation, for which four indicators have been identified: i) levels of genetic variation. ii) Mating system processes. iii) Directional change in gene or genotype frequencies and iv) Gene migration between populations.

To rapidly and efficiently measure and evaluate the genetic diversity within and between different populations of a given species, DNA fingerprinting techniques have proven to be very useful. In this study, we determined the genetic diversity of a tropical tree species (*Tapirira guianensis)* in natural forest populations. The fast growing and dominant tree *Tapirira guianensis*, is one of the most frequent tree species in the Atlantic rainforest fragments. *Tapirira guianensis* (Anacardiaceae) populations were sampled in the Neotropical region (Middle and South America) from four populations, one in French Guiana (Paracou), one in Brazil (Manaus) and two in Costa Rica (Corinto, Tirimbina).

Six primer pairs resulted in a total of 198 scored bands with 93.43% of them being polymorphic. Based on analysis of molecular variance within and between populations (AMOVA), *T.guianensis* appears to have most of its genetic diversity (89.21%) within populations and little variation between populations (10.79%, $P< 0.001$). This result is similar to those observed in other woody, widely distributed, outcrossed, long lived perennial species using different molecular markers.

Analysis of population structure with allele- frequency based F-statistics revealed a global F_{ST} of 0.0724 ($P< 0.001$). The lowest genetic distance and F_{ST} were found between Corinto and Tirimbina (Both in Costa Rica) 0.0201 and 0.0290 respectively. The highest genetic distance values and the highest F_{ST} values were found between Manaus (Brazil) and Tirimbina (French Guiana) 0.0728 and 0.1042 respectively.

The genetic variability within the four populations calculated as Nei's gene diversity (H) ranged from 0.35 in Paracou to 0.42 in Corinto. The partitioning of genetic variation observed in natural populations of *T.guianensis,* obtained by Lynch & Milligan method was 0.3817 within populations and 0.0299 among populations, these results were statistically significant. Isolation by distance test revealed that there was a positive but not significant correlation (r= 0. 146) between geographical distance and genetic dissimilarity in the north region (Tirimbina and Corinto).

More direct analyses of *Tapirira guianensis* reproductive biology and anatomic features of its flowers must be carried out in order to determine how breeding, as well as pollen and seed dispersal occurs in this species. In addition, a more direct estimation of gene flow by using codominant molecular systems could provide more informative data concerning *T.guianensis* reproductive biology.

1. Theoretical Background

1.1 *Tapirira guianensis*

The pioneer and dominant tree *Tapirira guianensis* is a frequent tree species in the Neotropical region. *Tapirira guianensis* is a tree of 20-35m heights and 30-70cm in diameter; it has a straight, cylindrical trunk, sometimes with tabulary roots. *Tapirira guianensis* presents a large period of fruit production, simultaneous ripening and short intervals between reproductive periods (Antunes and Ribeiro, 1999). Little is known about *T. guianensis*, but it has the distinction of being a shade-tolerant, wet-forest indicator species. It is evergreen but displays some seasonal shifts in leaf turnover (Phillips *et al.*, 2001).

1.1.1 Taxonomy:

- Kingdom: *Plantae.*
- Division: *Magnoliophyta.*
- Class: *Magnoliopsida.*
- Sub-class: *Dicotyledoneae.*
- Order: *Sapindales.*
- Family: *Anacardiaceae.*
- Genus: *Tapirira.*
- Species: *guianensis.*

(E:\Internet files\Classification\print.htm)

1.1.2 The family: Anacardiaceae

Members of the Anacardiaceae are an important component of the dioecious and evergreen tropical forest. The family has a pantropical distribution, with some species found in temperate regions (Cronquist, 1981).

Anacardiaceae consists of 850 species, including fruit crops of great economic importance throughout the tropical and subtropical regions of the world (Popenoe, 1979). This family includes 73 genera growing worldwide in tropical, subtropical, Mediterranean, and temperate regions (Most important genera are given in table 1, appendix II). Generally this family is characterized by much of the plant tending to be aromatic with an odour of mango or plum; the resinous sap found in several genera

(*Mangifera, Rhus, Toxicodendron*) can be very caustic, so that these should be handled carefully (Zamora, 2004).

1.1.3 The genus: *Tapirira*

The genus *Tapirira* is composed of approximately 15 species found primarily from Mexico throughout South America (Braga, 1976).

1.1.4 The species: *Tapirira guianensis Aubl.*

- **Terminology:**

This plant is commonly known as "pau-pombo" in addition to many other local and trade names which are: tatapiririca, cedro-í, cupiúva, peito de pomba, jobo; duka, waramia; weti-oedoe, ook doka; isaparitsi (Richter and Dallwitz, 2000). Its appearance (Fig 1), trunk colour and its internal bark resemble a species of *Trichilia* (Meliaceae), which is the source of some of its common names.

Fig 1: *Tapirira guianensis*: Flower-bud plant

- **Characterization:**

a. <u>Leaves:</u>

This species is characterized by its compound leaves, leaflets with entire margin, base asymmetric, and secondary veins weakly forming a submarginal vein, and the young leaves with silky pubescence beneath. Leaves imparipinnate- compound, alternate (ca. 10x 3.5 cm), leaflets 5–13, 7.5–23 × 2.5–11.2 cm, elliptic to oblong-elliptic, opposite, apex short-acuminate, glabrous or sparsely pubescent beneath near the midvein, margin entire, venation pinnate; petioles 4–20cm long (Zamora, 2004; Fig 2).

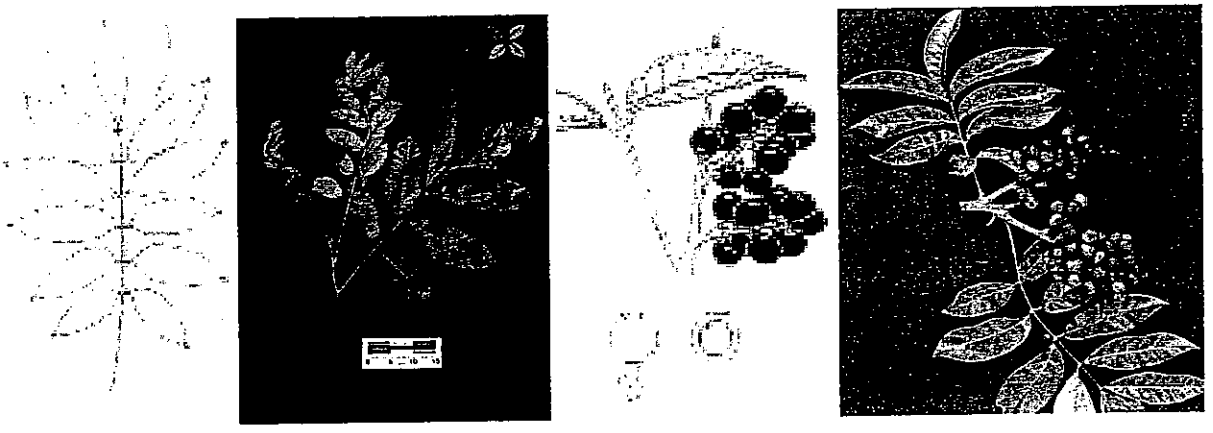

Fig 2: Leaves and fruits of *Tapirira guianensis*

http://kourou.cirad.fr/silvolab/implantations/campus/sentier/tapiriraguianensis.html

b. <u>Flowers, fruits and seeds:</u>

The flowers are small green-yellowish, visited by bees and other insects. Flowering and fruit formation occurs from March till September. Inflorescence is a broad panicle, subterminal, with numerous flowers, 10–35 cm long. Flowers unisexual, with an intra-staminal disk, white to yellowish green or cream; sepals 5, 0.4–0.9 mm long; petals 5, 1.4–2.2 mm long, free, imbricate; stamens (8–) 10, unequal, staminodes present in pistillate flowers.

Fruit is a drupe, 1–1.8 × 0.8–1.3 cm, ovoid, oblong or obovoid, when mature dark purple to black (Fig 3). Fruit production has been observed to be high. Seeds are dispersed by birds and animals (Zamora, 2004).

Fig 3: *Tapirira guianensis* flower, fruit cluster and seed.

➢ **Geographical Distribution:**

Tapirira guianensis grows at low and medium elevations, in humid or very humid climates on both slopes; 10–1300 m. *Tapirira* is found in the forests of the central part of the Caribbean Sea and the Panama Canal, but it is rare or absent in the dry