



## Comparative study of hydroethanolic extract of *Terminalia mantaly* on *Staphylococcus aureus* ATCC and *Salmonella typhi*

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### Abstract

In the present work, antibacterial activity of a hydroethanolic extract of *Terminalia mantaly* was verified on two bacteriam strains *Staphylococcus aureus* American Type Culture Collection (ATCC) and *Salmonella typhi* in petri dishes by comparing the diameters of the different inhibition zones. The hydroethanolic extract of *Terminalia mantaly* was prepared with a solvent containing 70% ethanol and 30% distilled water. The Mueller-Hinton medium was poured into petri dishes and then the bacterial strains (*Staphylococcus aureus* ATCC and *Salmonella typhi*) were separately plated. Using the wells, the extract was introduced to record the diameters of the inhibition zone in order to assess the antibacterial activity. Oxacillin was used as a standard antibacterial. The results showed that the antibacterial activity is pronounced on *Staphylococcus aureus* ATCC compared to *Salmonella typhi*. These tests support the use of *Terminalia mantaly* against various bacterial diseases.

**Keywords:** *Terminalia mantaly*; *Staphylococcus aureus* ATCC; *Salmonella typhi*; Oxacillin; Hydroethanolic extract.

### 1. Introduction

Infectious diseases are caused by different types of pathogenic microorganisms, such as bacteria, viruses, parasites or fungi WHO, 2015 [1]. Infections of bacterial origin are responsible for 70% of deaths Gangoue, 2007 [2]. Bacteria-related diseases are on the rise despite the presence of modern drugs. This observation is due to the resistance of bacteria to antibacterials. Among these resistance methods we can mention impermeability, enzymatic inactivation, modification of the target of the antibiotic and active efflux Ben *et al.*, 2005 [3]. Faced with this resistance, it was imperative to search for new molecules. Several studies have been conducted with plant extracts in order to find new molecules that can eradicate bacterial infections effectively, at lower cost and accessible to a large majority of the population Benoit-Vical, 2005 [4], Benoit-Vical, *et al.*, 2006 [5], Mada *et al.*, 2013 [6]. Some medicinal plants are pharmacologically active and others possess antimicrobial properties Press, 1996 [7]; Willcox *et al.*, 2004 [8]; Ginalin and Rahman, 2005 [9]. Scientists in this vein have been working on medicinal plants to develop antibacterial compounds that can meet the needs of the population. According to the WHO, nearly 80% of the population in developing countries use medicinal plants and this has increased worldwide Wood-sheldon *et al.*, 1997 [10]; WHO, 2003 [11]; Elujoba *et al.*, 2005 [12].

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This is the case of *Terminalia mantaly*, which belongs to the combretacea family and is used in the traditional environment to treat several ailments such as gastroenteritis, diarrhea, dysentery Orwa *et al.*, 2009 [13], anti-infectious diseases Riviere *et al.*, 2005 [14]. It is also used for post-partum care (hypertension) and diabetes Riviere *et al.*, 2005 [14]. The bark is used in the treatment of infections. The plant is used in the treatment of athletes' feet Yaye, 2013 [15]. In the present work, the antibacterial activity of a hydroethanolic extract of *Terminalia mantaly* was tested on two bacterial strains in petri dishes by comparing the diameters of the different inhibition zones.

## 2. Material and methods

### 2.1. Plant material

*Terminalia mantaly* barks were collected in July 2021 on the campus of the University Felix HOUPHOUET-BOIGNY Cocody (Abidjan; Ivory Coast). The plant was identified at the National Center of Floristics of the said university.

### 2.2. Germs used

*Staphylococcus aureus* (*S. aureus*) ATCC and *Salmonella typhi* (*S. typhi*) are two bacteria provided by the Pasteur Institute of Ivory Coast located in Cocody.

### 2.3. Extraction

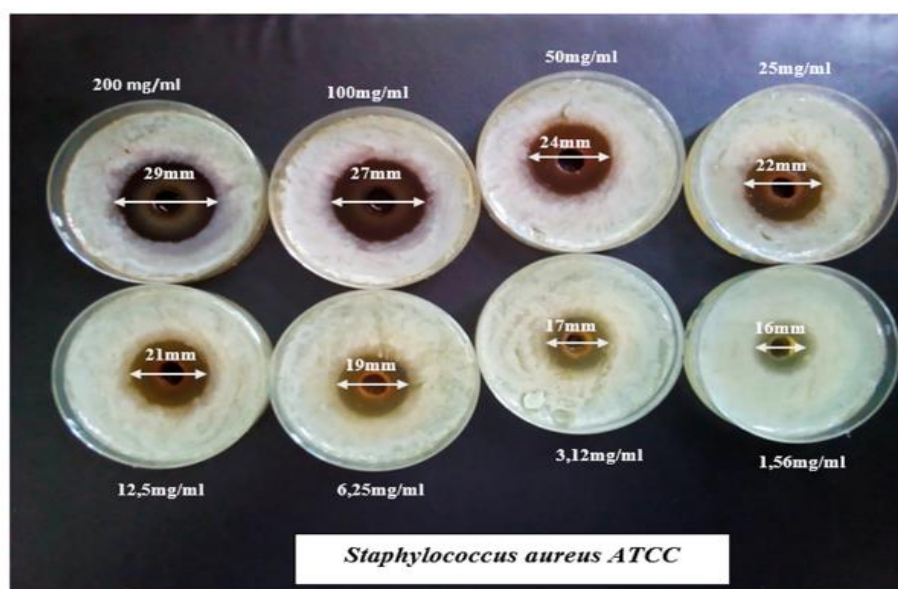
*Terminalia mantaly* stem bark was harvested, cut into small pieces and dried in the sun at a temperature of 25°C. After grinding and rendered into fine powder, the hydroalcoholic extract was prepared. For this purpose, 1L of solvent comprising 70% ethanol and 30% distilled water was added to 100g of the fine plant powder. The whole was homogenized in a blender. After six (6) cycles of homogenization, the homogenate was wrung out in a square of white cloth then filtered successively twice on absorbent cotton and once on Whatman 3mm paper. The filtrate was concentrated with a Büchi type rotary evaporator.

#### 2.3.1. Antibacterial tests

Concentration ranges from 200 mg/mL to 1.56 mg/mL of reason ½ were prepared for the hydroethanol extract and oxacillin. On petri dishes on which beforehand, were seeded separately the two bacterial strains. A quantity of 1mL of each extract was introduced in a well. The observation was done 48h for each germ.

## 3. Results

The inhibition diameters were recorded in each petri dish. The results are recorded in the two tables 1 & 2 and the different culture figures 1 & 2.



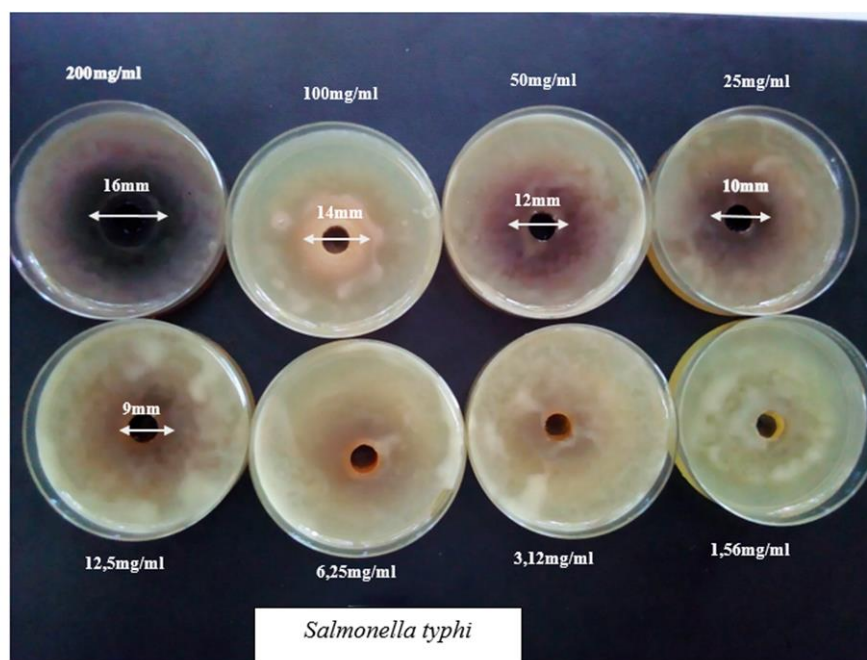
**Figure 1** *Staphylococcus aureus* ATCC culture against ethanolic extract of *Terminalia mantaly*

**Table 1** *Staphylococcus aureus* ATCC

Concentrations (in mg/mL)	200	100	50	25	12.5	6.25	3.12	1.56
Diameters of inhibition with hydroethanol extract of <i>Terminalia mantaly</i> (in mm)	29	27	24	22	21	19	17	16
Diameters of inhibition with oxacillin (in mm)	35	34.66	32.33	30.00	28.66	27.33	26.66	25.33

**Table 2** *Salmonella typhi*

Concentrations (in mg/mL)	200	100	50	25	12.5	6.25	3.12	1.56
Diameters of inhibition with hydroethanol extract of <i>Terminalia mantaly</i> (in mm)	16	14	12	9	0	0	0	0
Diameters of inhibition with oxacillin (in mm)	22.33	19.66	17.33	17.33	14.66	14.00	13.00	11.33

**Figure 2** *Salmonella typhi* culture against ethanolic extract of *Terminalia mantaly*

#### 4. Discussion

Herbal in developing countries commonly used for the traditional treatment of health problems Boukef, 1986 [16]. In the present study *Terminalia mantaly* barks extracted with hydroalcohol were investigated for its antibacterial potentiality against two kinds of bacterium: *Staphylococcus aureus* ATCC and *Salmonella typhi*. *S. Typhi* causes typhoid fever in humans but does not infect mice Tsolis *et al.*, 1999 [17]. Within the concentration range, zones of inhibition were observed around the wells in all petri dishes. For each bacterial species and for a given concentration, oxacillin gave a larger zone of inhibition on both types of bacteria than the crude hydroethanol extract from *Terminalia mantaly*. For each individual germ and in comparison to the diameter of the zone of inhibition, the crude hydroethanolic extract was more active on *Staphylococcus aureus* ATCC than on *Salmonella typhi*. These observations can be explained by a difference in composition or concentration of active substances in the plant, which may be related to differences in the time of harvest or place of collection. In addition, Oxacillin also showed strong activity on *Staphylococcus aureus* ATCC. The reference antibiotic showed higher antibacterial activity than *Terminalia mantaly* tested, with significantly larger inhibition zone diameters. This is explained by the fact that oxacillin contains isolated, pure molecules of known

concentrations Sourabie *et al.* (2010) [18], while *Terminalia mantaly* is an unpurified mixture of active substances that are compounds of secondary metabolism. The results of our values are lower than the values found with the stem extract of *Ximenia americana* compared to Cefoxitin (FOX, 30µg), which was more active on the strains of *S. aureus* 735UB/18CNRA and *S. aureus* 566 UB/18CNRA with respective inhibition zones of  $18 \pm 1$ mm and  $14 \pm 0.58$  mm, against that of Cefoxitin which was  $11 \pm 0$  mm and  $10 \pm 0$  mm. The results are in the same order as Zeinab *et al.* (2016) [19] who obtained zones of inhibition of 17 mm to 16 mm for the hydromethanolic extract of Sudanese species on *S. aureus*, a value close to that observed with *S. aureus* 735 UB/CNR A (18 mm).

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## 5. Conclusion

This study has shown that *Terminalia mantaly* bark has a real antibacterial property *in vitro* against these two strains. A further study to extract the active principle from the extract of *Terminalia mantaly* could have a better effect than the synthetic product oxacillin. Through this study the validity of the use of *Terminalia mantaly* to treat various bacterial diseases in the traditional environment is proven.

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## Compliance with ethical standards

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### Disclosure of conflict of interest

All author and co-authors of this article, attest to being accountable for the content and existence of our full names and position. We will not imply any conflict of interest. In witness whereof, this email serves as consent and approval.

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