



## **An Overview on the Importance of *Acacia nilotica* (L.) Willd. Ex Del.: A Review**

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### **Authors' contributions**

This work was carried out in collaboration among all authors. Author IA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author MS managed the analyses of the study. Author AS managed the literature searches. All authors read and approved the final manuscript.

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### **ABSTRACT**

Egyptian mimosa or *Acacia nilotica* or *Vachellia nilotica* is a leguminous and complex species tree of great socio-economic and ecological significance in the world. It is called as Bagaruwa in Hausa and is a great source of livelihood. *A. nilotica* is an agroforestry and urban forestry tree species, which provide fruits, timber, fodder, gums and other services such shade, beauty, soil improvement. It is used for climate change mitigation, adaptation and phytomediation. Every part of the plant is medicinal. This paper reviews the perception and usage on taxonomy, socio-economic and ecological importance of *Acacia nilotica*. This attempted to compile and document information on different aspects of this important plant species and its potential uses from the literature. The study provides a base line information about the societal and ecological benefit derived from Egyptian mimosa, which is constitutes a management tool for the conservation of the species. This study recommends the use of *Acacia nilotica* trees in planting programmes.

**Keywords:** *Acacia nilotica*; climate change; ecosystem services; multipurpose tree.

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## 1. INTRODUCTION

*Acacia nilotica* (L.) Willd. ex Del. or Egyptian mimosa formerly belongs to the *Mimosaceae* [1]. *A. nilotica* or *Vachellia nilotica* which belongs to the sub family of *caesalpinioideae* and family of *Fabaceae* according to the new subfamily classification of the *Leguminosae* based on a taxonomically comprehensive phylogeny [2] which includes the genera of the mimosoid clade in *Caesalpinioideae*. *A. nilotica* has nine subsp but six in Africa Tropics and three in Indian Subcontinent [3]. In West Africa Sahel region, *A. nilotica* has three subsp that are subsp. *nilotica*; subsp. *tomentosa* and subsp. *adstringens* [1]. *A. nilotica* is socially, economically and ecologically important *leguminosae* tree species. *A. nilotica* is a multipurpose *leguminosae* species across the world [4,5]. For example, in West Africa Drylands *A. nilotica* is for several uses such traditional pharmacopoeia for animal and human, agricultural, pastoral, industrial and food [1,6,7]. Further, the fruits of *A. nilotica* are sold in Kumasi central market, in Ghana as illustrated in Photo (A). Furthermore, [8] pointed out that *A. nilotica* bark is of the major sources of natural antioxidant. Apart from medical property, *A. nilotica* is able for phytomediation of CD from metal contaminated saline and nonsaline soils [9]. In addition, *A. nilotica* is used a green manure in Saudi Arabia [10]. *A. nilotica* is also largely used for tannin production world-wide [5,11]. Added to that, it is an ornamental tree species [12], *Acacia nilotica* is a multipurpose tree widely distributed, as well as cultivated, in the Indian Subcontinent [13], the Middle East, and Africa [6,13,14;Table 1].This paper examines the currently available studies in the literature by using several search engines, which have assessed the distribution of *A. nilotica*, its ecosystem services provided in terms of socio-economic and ecological contributions to the society worldwide.



**Photo A. Showing the fruits of *A. nilotica* in the market in Kumasi/Ghana (Source Moussa Soulé, 2019)**

## 2. TAXONOMY AND DISTRIBUTION

*Acacia nilotica* or Egyptian mimosa formerly belongs to the *Mimosaceae* [1]. *Acacia nilotica* is now known as *Vachellia nilotica* according to the new subfamily classification of the *Leguminosae* based on a taxonomically comprehensive phylogeny [2] that includes the genera of the mimosoid clade in *Caesalpinioideae*. *A. nilotica* is a leguminous tree which can reach 20 m of height, 60 cm of trunk diameter and with dense canopy [1]. It is a complex species with nine subspecies, of which six are native to the African tropics [15]. *A. nilotica* has three subsp that are subsp. *nilotica*; subsp. *tomentosa* and subsp. *adstringens* [1] native to West Africa Sahel region. *Acacia nilotica* or prickly *acacia* in English or gommier rouge in French is an evergreen and spiny legume tree which support an altitude of 0-1 to 340 m, a mean yearly temperature range from 4 to 470, average annual rainfall range from 200-1270 mm and with tolerance to wide type of soils [5]. The specie is native to some countries and it has been massively introduced to many countries due to its several values to the humanity and environment as illustrated in Fig. 1. In West Africa drylands, *A. nilotica* has Sahelo-Sudanian distribution [1]. The *A. nilotica* moved from Senegal to Sudan, Arabia, India, Gregarius often planted. In Niger, the *A. nilotica* is located around water places and shallows almost all over the country [16]. *A. nilotica* was found to be used as urban forestry species in Togo [17], in Niger [18], in Nigeria [19] and in India area [20,21]. Apart from that *A. nilotica* is used as agroforestry system tree species [10,22]. But *A. nilotica* was found to be an invasive alien plant in Australia [23].

## 3. ECOLOGICAL BENEFITS OF *Acacia nilotica*

*Acacia nilotica* is a multipurpose tree species. It is used as green fertilizer, timber tree, and fodder tree in agroforestry systems across the world [5,24,25]. Used as urban forestry tree species in Niger [17;Photo B] for shading purpose. Climate change affects agricultural production and leads to the reduction in household incomes. In this context, the use of *Acacia nilotica* in agroforestry systems can help farmers to climate change adaptation. For instance, *Acacia nilotica* was found to have significant effects on amending soil, improving crops growth and yield performance in Saudi Arabia [10]. In addition to that, *Acacia nilotica* is leguminous plant, which is nitrogen-fixing species and found to enhance

biomass production of a given ecosystem therefore carbon dioxide sequestration [26]. Leguminous species are the provider of nitrogen to the non-nitrogen fixing species, which is vital for the productivity of ecosystems therefore more carbon storage. Approximately the lifespan of *Acacia nilotica* is 40-year periods [23]. In terms of tree species, choice, multipurpose trees are likely to be preferred in a given ecosystem due to the diversity of services that users are likely to get from them while from the climate action perspectives, Therefore, if tree species that combine these characteristics can be used and valued in agroforestry systems or urban forestry

so that the effects of climate change may be reduced. One tree species that seems as a possible candidate in meeting that is *Acacia nilotica*. [20,21] reported that *Acacia nilotica* store considerable amount of carbon in their respective studies areas. There is paucity of information in the literature about the effects of climate change on the *Acacia nilotica*' biology. This study calls for more research on the impacts of climate change on *Acacia nilotica*' biology and the role of *Acacia nilotica* in climate change effects mitigation such as flooding, high temperature, wind and water erosion in order to have the holistic role of this plant in a changing climate for

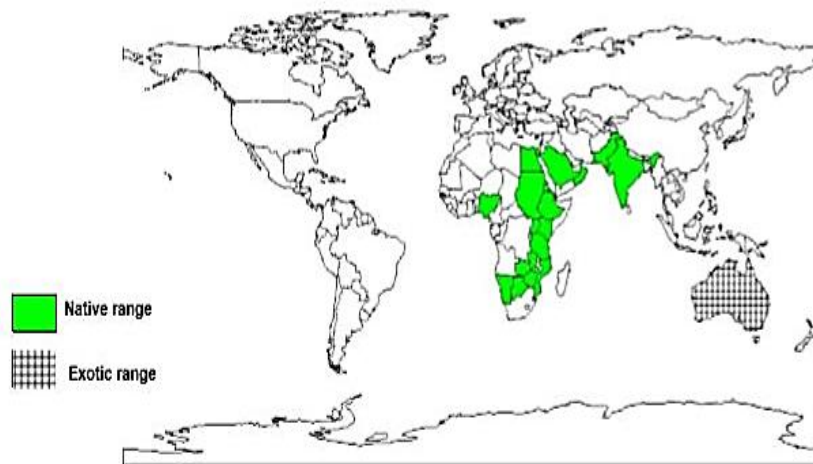


Fig. 1. *A. nilotica* distribution map source [5]



Photo B. *Acacia nilotica* (L.) Willd. ex Del. in the Sékou Touré green space in Maradi city, Niger (Source, Moussa Soulé, 2017)

sustainable future. [27] reported that *Acacia nilotica* improves soil fertility and crop yield. This suggests in the context of restoration of agricultural lands that, *Acacia nilotica* can be used for the land restoration such as to reclaim sodic soils as reported by [28], wasteland reclamations [29] in removing toxic elements from solution. *A nilotica* is leguminous tree, which is used for the production of biofuel as it has a potential to provide a source of renewable energy as reported by [30-32]. In addition, *A. nilotica* contribute the population livelihood [7,33] which may enhance the resilience of the society to adapt to the climate change. In this sense, *A nilotica* is a good candidate for mitigating and adapting climate change.

#### 4. A RESILIENCE RELIEVE PLANT

Woody plants, which provide leaves, flowers, fruits, seeds or other parts, are used for human consumption. *Acacia nilotica* belongs to the economically and ecologically important family *Leguminosae* or *Fabaceae*. *Acacia nilotica* is an imperative multipurpose tree diverse societal benefit. For instance, the products derived from *Acacia nilotica* such as gum, fuel, fodder and drugs can be used to fight societal poverty and adapt to climate change in the rural areas. For example, *Acacia nilotica* is used as green manure in order to improve soil fertility, which could be a climate change adaptation option. This presents an opportunity for food security and poverty reduction. This goes with the sustainable development's goals [34]. It is known

that during the lean season, farmers have to search for food in the wild to survive. These food products are vegetable and animal obtained in nature [35]. For instance, the fruits of *A. nilotica* are of good source of income for the population with the transformation of seeds into condiments; process that generates a lot of by-product used for leather tanning, dyeing and the pharmacopoeia in sub-Saharan countries such as Nigeria [7] and Sudan [36]. This procures substantial benefits to the population in the chain of leather production including others products from the tree. This could enhance the resilience of the population in the context of change climate.

#### 5. OPPORTUNITIES AND HEALTH ENHANCER PLANT

Many studies reported that *Acacia nilotica* is a great source of many active secondary metabolites, which may serve as potential candidates for drug business in future [8,12,15]. All parts of the *Acacia nilotica* have medicinal properties as described in Table 1. Apart from that, *Acacia nilotica* presents a great source of gum production which may serve also as potential candidates for gum industry [15].

Acquah and Oduro [39] reported in their work how opportune could be *Acacia nilotica* tree. Furthermore, [12] reported that *Acacia nilotica* is a tree species with paramount socio-economic importance such as the variety of the chemical components found in any part of the species.

**Table 1. Medicinal properties and chemical compounds extracted from *Acacia nilotica***

Part of <i>Acacia nilotica</i> used medicinal purpose	Medicinal properties and chemical compounds	Source
Stem bark	Sexually transmitted diseases, bark is reported to have antibacterial, antioxidant, antimutagenic, and cytotoxic activity	[4,37]
Fruits	The fruits are sold for medicinal purposes some West African countries such as Niger, Nigeria and Ghana.	(Moussa Soulé, 2018 Personal communication)
Leaves	The leaves are used as antibacterial, chemo preventive, astringent, anti-inflammatory and as anti-Alzheimer.	[12]
Flower	53 Phytoconstituents present in Petroleum ether extract of <i>Acacia nilotica</i> flower, flowers are used in gastrointestinal disorders	[4,38]
Roots	The root is used against tuberculosis and tumors of ear, eye, and testicles	[12]
All part of the plants	All parts of the <i>Acacia nilotica</i> have medicinal properties	[4,37]

Rather et al. [12] reported also that *Acacia nilotica* is a safe, biodegradable and renewable source of drugs with high therapeutic index. Added to that, [40] demonstrated that *Acacia nilotica* is a great source antibacterial drug. In addition, every part of the plant has medicinal values [12] and it is used for the treatment of many diseases [41,42].

## 6. CONCLUSION

*Acacia nilotica* is a multipurpose tree species, which is widely distributed and used in agroforestry and urban forestry for various services. This tree is part of an economic dynamic and in the strategies of resilience in the face of different threats from the population and provides a considerable opportunity for climate adaptation. Therefore, we recommend that *Acacia nilotica* should be included in planting programmes for socio-economic and ecological benefits, which can be a climate change response.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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