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## A review on antibacterial activity of alkaloids from *Sida acuta*

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**Abstract**

*Sida acuta* is a shrub indigenous to pantropical regions. The plant is widely used for its various pharmacological properties. Among compounds of pharmacological interest occurring in the plant, are indoloquinoline alkaloids. The aim of the present study was to investigate the antibacterial activity of alkaloids of *S. acuta*. The alkaloids had a good antibacterial activity against the test microorganisms. In the agar-well diffusion assay, highest inhibition zone diameters were recorded with Gram-positive bacteria.

**Keywords:** quindoline, indoloquinolines, antibacterial, *Sida acuta*

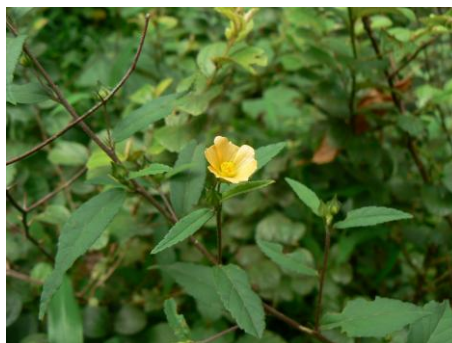
**1. Introduction**

This traditional medicine uses numerous plants, among them, *Sida acuta* Burm f. (Malvaceae). *S. Acuta* is a shrub indigenous to pantropical areas, widely distributed in these regions and widely used in traditional medicine. The aerial part of the plant is the most frequently used part. In central America, the plant is used to treat asthma, renal inflammation, colds, fever, headache, ulcers and worms. In Colombia the plant is known to treat snake bites. Otero *et al.* demonstrated that the ethanolic extract of the plant had an effective moderate activity against the venom of *Bothrox atrox*. The plant is traditionally used in the treatment of malaria, diarrhoea and many other diseases. Research focussed on malaria led to the identification of alkaloids, principally cryptolepine the major alkaloid of the plant, as its antimalarial agent. More recently, we found that polyphenol extract of the plant had a weak antioxidant activity through *in vitro* free radicals scavenging assays, on the other hand the extract was very active on pathogenic bacteria and this activity may be influenced by the polymerisation size of the phenolic compounds. Phytochemical screening on *S. acuta* resulted in the isolation of several alkaloids and steroidal compounds.

Among the compounds isolated from *S. acuta*, its alkaloids appeared to be of great interest in pharmacological studies. These alkaloids belong to the family of indoloquinolines. The purpose of the present review is focused on the antibacterial activity of alkaloids from *S. acuta* against Gram-positive and Gram-negative bacteria.

**Synonym**

*Sida carpinifolia*



**Scientific Classification**

- Kingdom Plantae
- Subkingdom Tracheobionta

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- Phylum Magnoliophyta
- Class Magnoliopsida
- Subclass Dilleniidae
- Order Malvales
- Family Malvaceae
- Genus Sida L.

### Chemical Constituents

It contains Ephedrine, hypaphorine, vasicinone, choline, betaine, phytosterol etc.

The roots are a very well-known source of Beta sitosteols and well known for its Immuno-modulatory effects.

### Antibacterial Activity

The antimicrobial screening of *S. acuta* revealed that many compounds might be responsible for the activity of the plant. The first antimicrobial screening of the plant was conducted by Anani *et al.* (2000) using the disk diffusion assay. The authors found that the methanolic extract of the plant had a significant activity on *Staphylococcus aureus*, *Escherichia coli*, *Bacillus subtilis* and *Mycobacterium phlei*, however the extract was not active on *Streptococcus faecalis*, *Klebsiella pneumoniae*, *Salmonella thymurium*, *Pseudomonas aeruginosa* and *Candida albicans*. The same findings were confirmed in another study using methanolic extract and similar microorganisms. Polyphenols and alkaloids of the plant were tested separately on several pathogenic bacteria including clinical strains and reference strains of Enterobacteriaceae and Staphylococcaceae families. The tests were performed by agar well diffusion (Perez *et al.*, 1990) and the NCCLS (2000) broth microdilution assays. The results revealed that the phenolic compounds had a good *in vitro* antimicrobial activity and this activity was much influenced by the storage of the extract probably because of the phenolic compounds oxidization. The inhibition zone diameters varied from 11 to 25 mm for 250 µg polyphenols and MBC values ranged from 20 to 2000 µg/mL. Alkaloids of *Sida acuta* also displayed a good antibacterial activity. The recorded inhibition zone diameters varied from 16 to 38 mm for 100 µg alkaloids and the MBC values from 80 to 400 µg/mL. In another study, leaf/flower combination was evaluated for antimicrobial activity using hexane, chloroform, methanol and aqueous extraction methods. The antibacterial activities were exhibited by the four extract on *E. coli*, *S. pyogenes*, *Pasterella multocida* and *S. typhimurium* as there was no activity exhibited on *S. typhi*, *S. pneumoniae* and *K. pneumoniae*. As many other plants with antibacterial properties, *S. acuta* contains phenolic compounds that are responsible for the activity of the plant. The current problem with phenolic compounds is the fact that they are vulnerable to polymerization in air through oxidation reactions. This oxidization may first affect the extractability of the phenolic compounds that is crucial in drug preparation; in this topic some authors suggested extracting the compounds directly on fresh material in order to enhance the yield. However, in our enquiries many traditional healers always dry their plant materials before the use, particularly when the plant does not grow around habitations. Secondly, an important factor governing the activity of phenolic compounds is their polymerization size. Oxidized condensation of phenols may result in the toxification of microorganisms, while the adverse effects can be observed in some cases. Recently in the case of *S. acuta* we observed that the tested microorganisms were particularly susceptible to the stored extract. Therefore, it is

now the time to think about how to prepare phenolicsbased drugs with traditional healers. Other *in vitro* activities Since *S. acuta* has several usages in folk medicine it has been involved in many other pharmacological screenings. The plant has been screened for its cancer chemopreventive properties by Jang *et al.* (2003). The study resulted in the isolation of several compounds, among them quindolinone, cryptolepinone and 11- methoxyquindoline was found to induce quinone reductase activity, while cryptolepinone, Ntransferuloyltyramine exhibited a significant inhibition of 7, 12-dimethylbenz-[a]anthracene-induce preneoplastic lesions in mouse mammary organ culture model. These observations suggested that cryptolepinone was a potential chemopreventive agent. The polyphenol extract of the plant was tested together with polyphenol extract of other medicinal plants for antioxidant activity through free radical scavenging. The tests were performed using the phosphomolybdenum reduction and the ABTS radical cation decolorization assays with trolox as standard antioxidant. The results showed that there was a good correlation between the two methods ( $r = 0.9$ ) and *S. acuta* had a weak free radical scavenging according to values recorded with bark extracts of *K. Senegalensis*, *P. erinaceus* and *C. micranthum* in the same study. The activities were highly correlated with the total phenolic content determined by the Folin-Ciocalteu reagent with gallic acid as standard ( $r = 0.94$  and  $r = 0.91$  with the two assays respectively). In another study, showed that the ethanolic extract of the plant had a moderate activity against the lethal effect of *Bothrops atrox* venom. In Western Kenya where the plant is consumed as legume, a study using Brine shrimp lethality tests revealed that the plant was toxic (LC50 = 99.4 g/ml). The author concluded that the plant can cause acute or chronic toxicities when consumed in large quantities or over a long period of time.

### Conclusion

The *Sida acuta* was reported to have antibacterial activity.

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