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**REVIEW ARTICLE**

***Vernonia amygdalina* Del: A Mini Review**

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**ABSTRACT:**

Phytomedicines are medicinal products of plant origin that have been used since ancient times till date for the prophylaxis and treatment of various ailments. *Vernonia amygdalina* Del (Asteraceae) is a perennial shrub that is widely distributed in tropical parts of Africa. It is popularly known as bitter leaf and consumed as a vegetable and for medicinal purposes. The plant has been used in folkloric medicine for the treatment of several diseases owing to its diverse pharmacological applications. The plant has low toxicity profile; thus, making it a potential drug candidate. Scientific investigations have shown that, *V. amygdalina* Del possesses potent pharmacological activities such as antidiabetic, anthelmintic, antiplasmodial, antimicrobial, antioxidant and antianaemic activities. Moreover, *V. amygdalina* Del contains various phytochemical compounds which may be associated with its potent pharmacological properties. The present study is a review of the therapeutic benefits as well as phytochemicals isolated from *V. amygdalina* Del.

**KEYWORDS:** *Vernonia amygdalina*, phytomedicine, pharmacological-activity, phytochemical.

**INTRODUCTION:**

Herbal medicines, otherwise called phytomedicines, are medicinal products of plants or plant parts such as roots, leaves, flowers, barks, seeds and fruits which are used to treat diseases and to improve health. They are used as complementary or alternative medicines; in the prophylactic treatment and alleviation of diseases and their symptoms.<sup>1</sup> Medicinal plants play a vital role in the treatment of various diseases as evident by their long history of use. They have been used in both ancient and recent times by all culture for curing several diseases<sup>2</sup>

*Vernonia amygdalina* Del is among the medicinal plants used for the treatment of various diseases in different parts of the world. It has been reported that *V. amygdalina* Del plant is used for the treatment of diabetes, yellow fever, dysentery, constipation, malaria and stomach ache in Africa and Asia.<sup>2,3</sup> Moreover, the plant is widely used in Africa as a source of food as vegetable and culinary herb in soup.<sup>4</sup>

*V. amygdalina* Del belongs to the family Asteraceae. It is widely distributed throughout Tropical Africa and cultivated as food supplement in West Africa including Nigeria.<sup>2,5</sup> The common name of *V. amygdalina* Del is 'bitter leaf', locally known as 'Shuwaka' in Hausa Language and 'Ewuro' in Yoruba Language.<sup>6</sup>

In this research various activities as well as phytochemical constituents of *V. amygdalina* Del were reviewed. The data were searched from online sources; Pubmed, googlescholar and science direct. The key word used for searching information was *V. amygdalina* Del.

**Taxonomy:**

*Vernonia amygdalina* Del. is a small tree growing up to 3 m high. The picture of *V. amygdalina* Del in its natural habitat is shown in figure 1.0. It grows throughout the African Tropics<sup>7</sup>.



Figure 1.0: *Vernonia amygdalina* Del plant

*V. amygdalina* commonly called bitter leaf is a perennial shrub belonging to the family *Asteraceae*. It grows throughout Tropical Africa.<sup>8</sup>Its taxonomic classification<sup>6</sup> is presented in Table 1.0.

Table 1.0: Taxonomic classification of *V. amygdalina*Del

Kingdom	Plantae
Class	Angiospermae
Order	Asterales
Family	Asteraceae
Genus	<i>Vernonia</i>
Species	<i>amygdalina</i> Del

**Phytochemistry of *V. amygdalina* Del:**

Qualitative phytochemical screening of *V. amygdalina* Del have detected heavy presence of polyphenols and moderate presence of alkaloids, saponins, flavonoids and steroids<sup>5</sup>. Phytochemical study of the leaves of *V. amygdalina* Del showed that, the plant contains two sesquiterpene lactones; vernolide and vernodalol.<sup>7</sup> Vernoniosides D and Vernoniosides E were isolated from the leaves of *V. amygdalina* Del<sup>9</sup>.

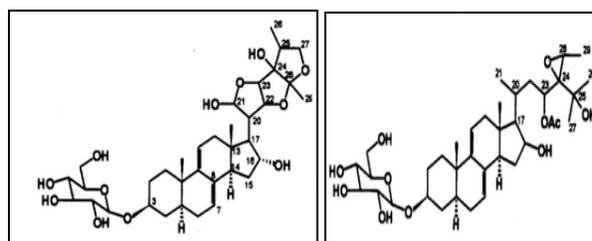
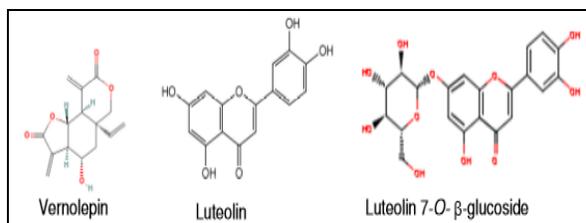
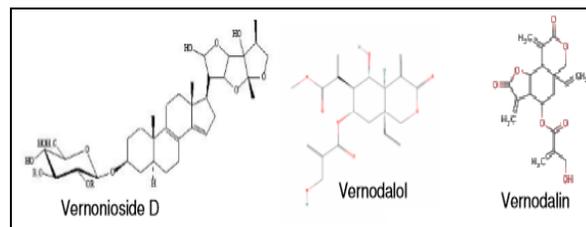
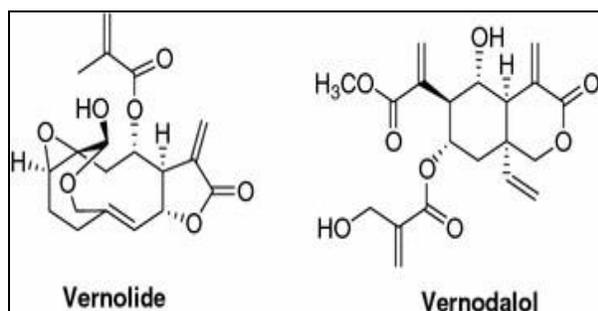


Figure 1: Some compounds isolated from *V. amygdalina*

**Antidiabetic activity:**

*V. amygdalina* Del, demonstrated positive antidiabetic activity when administered through various routes of administration. Intraperitoneal administration of aqueous leaf extract of *V. amygdalina*, Del, produced hypoglycaemic effects which was comparable to tolbutamide. Additionally, when aqueous leaf extract of *V. amygdalina*, was given to normoglycaemic rabbits, the fasting blood sugar reduced from 96 mg% to 48 mg% in 4 h.<sup>10</sup> Similarly, administration of the leaf extract via gastric intubation to alloxan induced rats provided significant reduction of blood and serum glucose.<sup>11</sup> *V. amygdalina* Del has been reported to contain high amount of polyphenols.<sup>11</sup> Accordingly, phenolic extract of *V. amygdalina* Del was found to have significant effect on the key enzymes linked to type-2 diabetes thereby inhibiting the activities of  $\alpha$ -amylase and  $\alpha$ -glucosidase *in vitro* in a concentration-dependent manner.<sup>12</sup> Okolie *et al.* (2008)<sup>13</sup> assessed the antidiabetic effect of *V. amygdalina* Del in human subjects using standard laboratory testing (fasting blood glucose, glucose tolerance test and postprandial blood glucose). It was found that *V. amygdalina* Del caused significant reductions in blood glucose levels almost postprandial time points and for area-under-curve.<sup>13</sup>

The polyherbal combination of *V. amygdalina* Del and *Azadirachta indica* constituents gave a synergistic antidiabetic effect in diabetic rat.<sup>3</sup> In another study,

combination of *V. amygdalina* Del and *Gongronema latifolium* provided significant reduction of serum glucose in streptozotocin (STZ)-induced diabetic Wistar rats. This effect was comparable to that of insulin.<sup>14</sup>

Atangwho *et al.* (2010)<sup>11</sup> suggested that, the mechanism of antidiabetic activity of *V. amygdalina* Del may be due to the regeneration of pancreatic  $\beta$ -cell.

#### **Anthelmintic activity:**

The acetone extract of *V. amygdalina* Del was found to inhibit parasitic larva of *Haemonchus contortus*. It was also reported to inhibit nematode eggs and nematode larvae<sup>15</sup>. In another study, fifty West African dwarf goats were used to compare the anthelmintic activity of some standard drugs namely albendazole, levamisole and ivermectin with that of the aqueous extract of bitter leaf using the Faecal Egg Count Reduction (FECR) assay. The aqueous extract demonstrated highest FECR (100%) compared to the standard drugs (albendazole, 99%; levamisole, 96%; ivermectin, 96%) against the nematodes (*Haemonchus contortus*, *Trichostrongylus* spp., *Ostertagia ostertagi*, *Oesophagostomum* spp., *Chabertia* sp., *Strongyloides*, and *Paramphistomum* spp.) tested.<sup>16</sup>

#### **Antiplasmodial activity:**

The aqueous and ethanolic leaf extracts of *V. amygdalina* Del were analysed *in vivo* (in rats) and *in vitro* (cell lines) using bioassay guided fractionation for the isolation of molecules with antimalarial activity. Both extracts demonstrated antiplasmodial activities at both sexual and asexual blood stages of the parasite.<sup>17</sup> *V. amygdalina* Del leaf was reported to have antiplasmodial activity *in vitro* which was attributed to its phytochemical constituents<sup>18</sup>.

#### **Antimicrobial activity:**

Vernolide and vernodalol; the chemical compounds isolated from the leaves of *V. amygdalina* Del demonstrated a significant bactericidal activity against Gram positive bacteria. However, they failed to show efficacy against the Gram negative strains.<sup>7</sup> Moreover, vernolide and vernodalol showed high and moderate activity respectively against some fungal species. In contrast, they were ineffective against *Fusarium oxysporum*<sup>7</sup>.

#### **Antioxidant activity:**

Methanolic extract of *V. amygdalina* Del prevented lipid peroxidation induced by tert-butyl hydroperoxide.<sup>19</sup> It was also reported that, the methanolic extract of *V. amygdalina* exhibited significant free radical scavenging and antioxidant activities<sup>20</sup>.

#### **Antianaemic activity:**

Methanolic extract of *V. amygdalina* Del lowered erythrocytes lysis induced by tert-butyl hydroperoxide.<sup>19</sup> Therefore, anti-haemolytic effect of *V. amygdalina* Del suggests that the plant can be used as antianaemic agent.

#### **Effect on fertility:**

The reproductive effect of saponin extract of *V. amygdalina* Del studied on male Wistar rats at different doses for 14 days showed that sperm cell motility and concentration were enhanced (at higher doses) without a reduction in the percentage of morphologically abnormal sperm cells<sup>21</sup>.

#### **Immunomodulatory effect:**

*V. amygdalina* Del has been studied for its modulatory effect on the immune system. In one study, the immunomodulatory effect of the leaf extract of the plant, Immunace® and a combination of both were observed in human immunodeficiency virus (HIV) patients on Anti-Retroviral Therapy (ART). A combination of the extract with Immunace® improved the CD<sub>4</sub><sup>+</sup> counts and packed cell volume (PCV) while reducing the development of skin rashes of patients when compared to control (patients on ART only).<sup>22</sup> Similarly, Ezeonu *et al.* (2016)<sup>23</sup> analysed the leaf extract of *V. amygdalina* Del for its immunological effect in rats and reported a remarkable improvement on CD<sub>4</sub><sup>+</sup> counts, haematological parameters and lipid profiles.

#### **Cardiovascular Activity:**

The cardiovascular activity of the aqueous leaf extract of *V. amygdalina* Del was investigated in rabbits fed with atherogenic diet. There was no significant improvement of lipid profile when the bitter leaf-atherogenic diet fed rabbits were compared to control.<sup>24</sup>

#### **Safety and Toxicities Profile:**

Olujimi *et al.* (2017)<sup>25</sup> analyzed concoctions containing ten medicinal plants (including bitter leaf) with potential antidiabetic activity for the presence of toxic elements. They were found to be safe from the risk of the toxic metals and trace elements investigated. There was no death or any physical pathology observed at doses of up to 600 mg/kg when aqueous extract of *V. amygdalina* Del was administered to rats.<sup>26</sup> The histopathology and microscopy of the liver, kidney, small intestine, lung and heart did not show any significant damage except for mild congestion in the kidney after oral administration of *V. amygdalina* Del extract in rats. Biochemical analysis revealed that *V. amygdalina* Del has the potential to elevate some liver enzymes (ALT, AST and ALP) and cholesterol in bitter leaf extract-treated rats.<sup>26</sup> Interestingly, in an *in vitro* study against plasmodium parasite *V. amygdalina* Del leaf extract has been shown to have no sign of toxicity<sup>18</sup>.

## CONCLUSION:

*V. amygdalina* Del is a versatile plant that possesses several prophylactic and therapeutic potentials. This review highlighted many of the pharmacological activities of the plant. Interestingly *V. amygdalina* Del leaf was reported to have low toxicity profile, thus making it a potential drug candidate. However, further researches are required to standardize extracts of the plant and to unravel further medicinal and nutraceutical properties of the plant particularly on the root, stem and bark.

## CONFLICT OF INTEREST:

No conflict of interest.

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