

Full length Research paper

Taxonomic evaluation of the medicinal and economic values of some species of *Indigofera* L. (Leguminosae-Papilionoideae)

*¹Nwachukwu CU, ²Mbagwu FN, ¹Ukpai KU and ¹Omugo JE

¹Department of Biology, Alvan Ikoku University of Education, Owerri, Imo State, Nigeria.

²Department of Plant Science and Biotechnology, Imo State University, Owerri, Imo State, Nigeria.

Accepted 29 July, 2015

Investigations on the medicinal and economic values of eight species of *Indigofera* from Eastern Nigeria were carried out. This is with a view of documenting the outcome which will serve as a data base that will provide basic phytochemical, pharmaceutical and industrial information on which further researches could be based. Results from this investigation revealed that various vegetative and reproductive organs of these taxa are important medicinally and economically. To this end the significance of these plant organs in traditional medicine as well as their potential as foreign exchange earner were documented. Emphasis on these plants stemmed from their popular usage in alternative medicine in Nigeria particularly by the people of Eastern Nigeria.

Key words: *Indigofera*, ethnomedicine, evaluation, habits, taxonomy, economic values.

INTRODUCTION

Indigofera L. is a member of the family Leguminosae – Papilionoideae, a family of largely herbs, shrubs and trees with a great variety of habits. They include hydrophytes, xerophytes and climbers found in both temperate and tropical areas (Dallwitz and Watson 1980). They make up one of the largest families of flowering plants numbering some 700 genera and 17,000,00 species (Heywood and David, 1978). The leaves are usually stipulate, nearly always alternate and range from pinnately or plamately compound to simple and the petiole is commonly enlarged into pulvinus (Dallwitz and Watson, 1980). Racemes of flowers grow in leaf axils. Most species have flowers in shades of red, but there are a few white and yellow-flowered species. The fruit is a legume pod of varying size and shape. Bentham and Hooker (1883) considered the order leguminales as a whole to constitute one family laguminosae among the dicotyledons with nine tribes. The genus *Indigofera* belongs to the tribe Galegeae and has well over 700 species that are found in warm tropical

and sub-tropical regions of the world (Willis, 1985).

The genus *Indigofera* is subdivided into five subgenera by Hutchinson and Dalziel (1968). *Acanthonoitus*, *Amecarpus*, *Indigofera*, *Indigastrum* and *Microcharis*. The subgenus *Indigofera* was further divided into three sections. In West Africa different number of *Indigofera* species have been reported by different authors. Burkill (1994) reported 60 species while Hutshinson and Dalziel (1958) reported 78 species. In Nigeria, Burkill (1994) identified 45 species while Hutchinson and Dalziel (1958) reported 55 species.

Nigerian is rich in rare and useful plants from which important drugs could be prepared, some of these are exported to industrially advanced countries while essential drugs in raw or finished forms are extracted from them. Thus Nigeria is loosing by selling plant materials cheaply while importing expensive essential drugs. To this end there is a need for the medicinal and economic values of these taxa to be properly investigated and documented to serve as a database that can provide basic phytochemical, pharmaceutical and industrial information on which further pure and applied research could be based. The present study is aimed therefore at contributing to the emerging pool of knowledge in ethnobotanical studies. Characteristically, the *Indigofera* species are creeping, prostrate or erect annual, biennial or per-

ennial herb or semi woody undershrub and trees (Dallwitz and Watson, 1980). Stem may be slender, erect and conspicuously branched with bright green or tinged with red colour. The leaves are alternate, openly spaced on the stems around 10cm long and may be rough and velvety smooth to the touch. The leaves are also simple and prematurely trifoliolate. The fruit is a pod usually smooth, reddish, brown and cylindrical with 2-15 seeds in most species.

Some of the plants selected for investigation and documentation in Eastern Nigeria are *I. hirsuta* L., *I. paniculata* Pers., *I. pulchra* Vahl, *I. prioureana* Guill., et Perr., *I. senegalensis* Lam, *I. stenophylla* Guill. And Perr., *I. terminalis* and *I. tinctoria* L. These plants were chosen for investigation and documentation because they are the most commonly – occurring of *Indigofera* species in Eastern Nigeria and they are also medicinally and economically important.

MATERIALS AND METHOD

Several trips were undertaken to both the University of Ibadan Herbarium (UIH) and the forestry Herbarium Ibadan (FHI) Nigeria to obtain the necessary literature materials as well as to examine some herbarium specimens or a compilation of the important medicinal and economic characters for the eight species of *Indigofera* and these eight plants selected for the present study are *Indigoferahirsuta*, *I. paniculata*, *I. prioureana* and *I. pulchra*, others are *I. senegalensis*, *I. stenophylla*, *I. terminalis* and *I. tinctoria*: Furthermore, field trips were undertaken to collect living (fresh) and mature materials from some parts of South Eastern and South South Nigeria such as Imo, Rivers, Enugu, Abia, Anambra, Ebonyi, Bayelsa, Akwa-Ibom and Cross River States. The medicinal and economic values of these taxa were then documented.

RESULTS

The taxonomic investigation of the medicinal and economic values of the eight *Indigofera* species were documented and summarized below and illustrated in Figure 1 and 2 (a-d).

Indigofera hirsuta L. is an erect, annual or biennial herb measuring 80cm tall and variable with two varieties namely var. *hirsuta* and var. *pumila* Welw. ex Bak. The species is a small plant found only in Plateau in Nigeria and also in Angola. The stipules are setaceous (small & brittle) while the leaves are 4.75cm – 7.5cm long. The leaflets are usually 5-7 pairs, rarely 9 and obovate, 9-15 lines long and blunt with a faint mucro or grey thinly silky above and more densely silky beneath. A root decoction is applied to counteract various poisons and is given for kidney and spleen enlargement and for severe cough

(Daniel, 1960; Hutchinson and Dalziel, 1968; Burkill, 1994, Dorfling, 2001). *I. hirsuta* produces blue dye, which is sold commercially. Agriculturally, the plant as a legume fixes nitrogen and equally kills nematodes. It could equally serve as a green manure and as cover crops. Furthermore, the leaves are grazed by cattles thereby contributing to available forage. The crushed leaves are used in some Eastern States against skin itching.

Indigoferapaniculata Perris is described as an erect much-branched annual herb or under-shrub. The stem is slender with twiggy branches. The petioles are shorter than the leaves, which are simple, linear, oblong or sub-glabrous, the flowers are in elongated terminals. The pods are terete, deflexed, glabrous and four-seeded. This species is grown as a green manure on some coffee plantation in Tanzania (Daniel, 1960; Hutchinson and Dalziel; 1968, Simon et al, 1984). This species is used in hair dye and dressing oil as well as for body decoction.

Indigoferaprioureana Gillet Perr. is a herbaceous annual stem 20-45cm high, erect and sparingly branched, wide spread mainly in the tropics and sub-tropics. The stipulates are linear-subulate and 0.63cm long. The petiole is erect measuring 0.63cm-1.25cm while the leaflets are oblanceolate and 2-3 lines broad. The apex is rounded and mucronate and the lateral ones are opposite, 0.63-1.88cm apart with both sides thinly silky. Flowers are nearly sessile with axillary racemes and ultimately equal to the leaves. This plant serves as forage for livestock (Daniel, 1960; Hutchinson and Dalziel, 1968; Dorfling, 2001). The leaves are further used as chest pain reliever and the bark when grounded could be used against backache. The root decoction could be used for constipation and pile. It is also a source of dye production Burkill (1994).

Indigoferapulchra Vahl. Is a herb or semi-woody erect stem 5-12cm highly copious and form angular branches. The petiole varies from 0.63cm long to nearly 1.0cm. The leaflets are 3-7 opposite and oblanceolate, 0.95cm – 0.25cm long apex is rounded on both sides especially the under ones being grey-green. The flowers are in copious panicle and crowded towards the end of the branchlets and separated 1-3 free from each node. This plant is cut and mixed with grass for thatching (Daniel, 1960; Burkill, 1994).

Sap from the whole plant of *I. pulchra* is used in the case of injury to the eyeball, inflammation of the eyelids, or to kill filarial in the conjunctive tissue. A root-decoction is applied in most parts of Nigeria to counteract various poisons (Burkill 1994). The root is infused in palm wine to drive away or destroy lice Dallwitz and Watson (1980). Some species of *Indigofera* have other medicinal uses such as helping with infertility and menstrual cramps (Dorfling, 2001; Daniel, 1960).

Indigofera senegalensis Lam. Is an annual herb. The stem is erect and 2.5cm more or less long and diffusely branched; the branchlets being slender or angular. The

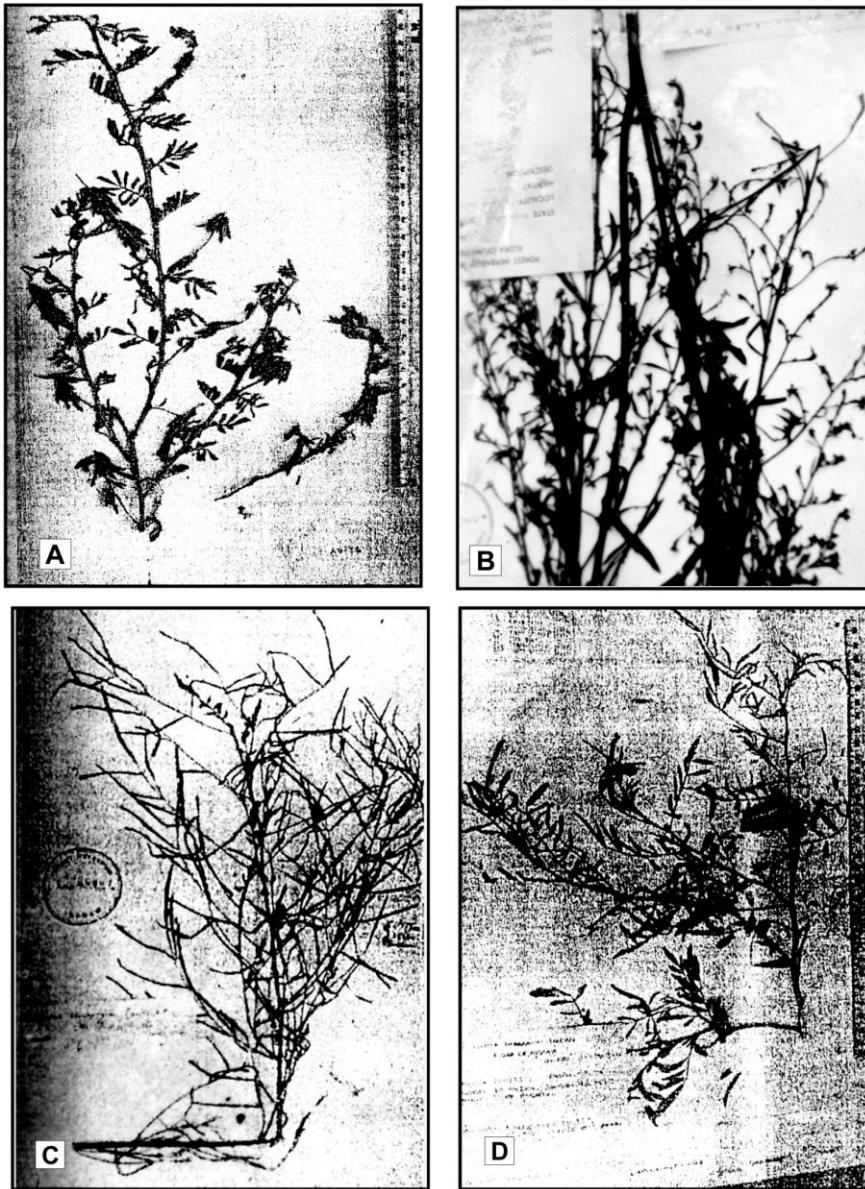


Figure 1.1. Morphology (a) *I. Terminalis* (b) *I. Paniculata* © *I. stenophylla* (d) *I. priureana* note: The difference shapes of leaves of these taxa.

stipules are setaceous while the petiole is slender 0.63-1.25cm long. The leaflets are 1-3 pairs, linear 2-5cm – 3.75cm long and 2-3 lines broad, pointed or mucronate and nearly sessile with both sides glaucous and permanently coated with strong and pressed silvery hairs. This species serves as food for cattle in most Eastern States (Daniel, 1960; Hutchinson and Dalziel, 1968; Burkill, 1995). It is also used as manure residue rich nitrogen to form manure. It also forms a good cover crop for an eroded soil.

Indigoferastenophylla Guill. is an annual herb, erect semi-or more or less woody stem and sparingly branched or subglabrous below while thinly silky

upwards. The stipules are setaceous and petioles are erect patent measuring 1.25-2.5cm long. The leaflets are linear narrowed to both ends 2.5cm – 3.75cm long and 1.3 lines broad, the lateral ones opposite or sessile measuring 1.25-1.88cm apart and both sides with short grey hairs. The pod is linear to mucronate 3.75cm long and 0.6cm broad with about 12-15 seeds and used topically for swellings of the body and also for treatment of cold and cough (Daniel, 1960). This species could be grown commercially for export and domestic use hence serve as a source of foreign exchange earner.

Indigoferaterminalis Baker. is a semi-woody undershrub with dark shining purplish brown bark, and

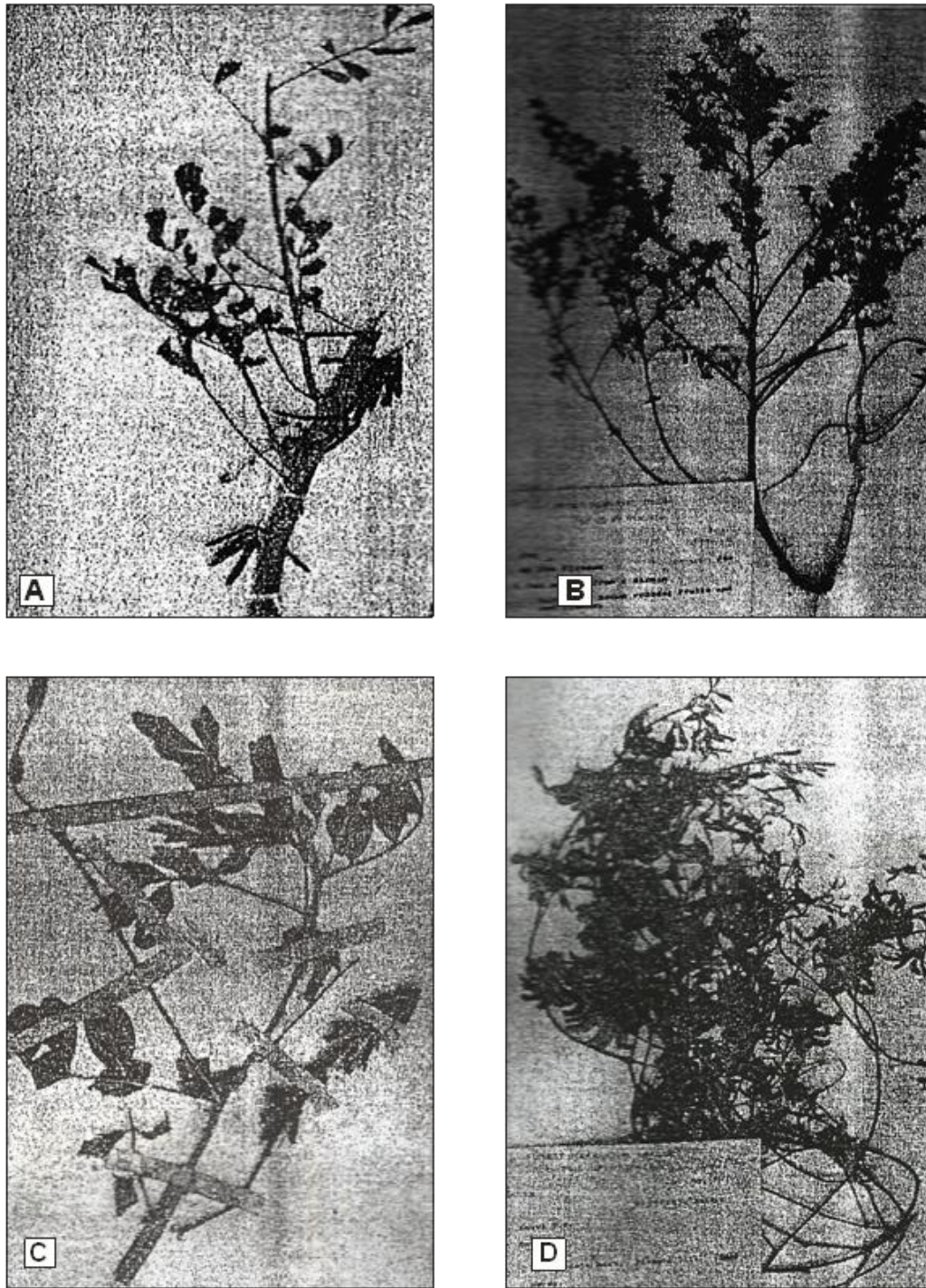


Figure 1.2. Morphology (a) *I. tinctoria* (b) *I. pulchra* (c) *I. hirsuta* (d) *I. senegalensis* Note: The different shapes of leaves of these taxa.

the branches being copious, slender and again branched. The ultimate branchlets are slender, terete and not at all silvery. The stipules are linear. Petiole is 0.63-1.25cm long and spreading. The leaflets are 3-5, obovate or oblong, 0.63cm long, spreading and 1.5 lines broad, apex

is rounded and mucronate the lateral ones opposite on short stalk. The corolla has the same colour with the calyx as the pod is ovoid, mucronate 0.06cm long and single seeded and is used as a perennial bush cover crop especially for contour hedge planting (Daniel, 1960;

Burkill, 1994; Dorfling, 2001 and Stern, 2000). The leaves when pounded to a pulp are applied topically against swellings of the body. This species produces dye, which is used commercially by the southwestern part of Nigeria.

Indigofera tinctoria L. is a soft woody shrub 50cm high of waste places in savanna and copiously branched. The branches are straight or flexous. The stipules are small and setaceous while the petiole is firm and 1.25-2.5cm long. The leaves are 1.25cm-1.88cm long with leaflets of 4-6 pairs, oblong or obovate. Racemes are axillary and about 20-flowered, ultimately equaling or a little exceeding the leaves. This plant was at one time a major source of supply of indigo dye for which it was universally cultivated (Daniel, 1960; and Dorfling, 2001). The powdered root of *I. tinctoria* is used in most part of Eastern Nigeria to alleviate toothache.

DISCUSSION

The medicinal and economic values of the *Indigofera* species studied which serve both as complimentary medicare and source of foreign exchange earner in a developing country as Nigeria cannot be over emphasized. This is because the history of medicinal and economic importance of *Indigofera* goes far back into the past. This genus has been used since Neolithic times (Burkill, 1994). *Indigofera* is one of the oldest colouring agents known to man and is among the most widely used natural dye in the world (Howard, 1988; Burkill, 1994).

The adaptive nature of this research has brought out the potentials and viabilities of these species, which could be utilized by industrialists, pharmacists, agriculturalists traditional medicine practitioners and agronomists, which is one way of saving the species from extinction. In the light of the above there is urgent need to preserve these endangered taxa because of their economic and medicinal importance. This could be done through cultivation and conservation of available gene pool of these *Indigofera* species.

Based on the findings of this work, an artificial key for the identification of the *Indigofera* species studied was prepared.

REFERENCES

- Bentham G, Hooker JD (1883). General Plantarium 3:143-145.
- Burkill HM (1994). The Useful Plants of West Tropical Africa. Vol. 2 (2nd Ed). Royal Botanic Gardens, Kew. 2 p.636.
- Dallwitz MJ, Watson CB (1980). A General System for Coding Taxonomic Description *Taxon*, 29: 41-164.
- Dalziel JM (1958). The Useful Plants of West Tropical Africa. Crown Agents, London, U.K. p.602.
- Daniel O (1960). Flora of Tropical Africa, Vol. 2, Reeve and Co. Covent Garden, London, p.613.
- Dorfling C (2001). Growing Native Plants.,Hepper and Row Publisher New York, p.791.
- Heywood VH, Davis PH (1973). Principles of Angiosperm Taxonomy, Oliver and Boyd, London, Pp121-183.
- Howard RA. (1988). Flora of the Lesser Antilles, Leeward and Windward Islands Dicotyledons, Vol. 4, Part 1. Harvard University Press Town, p.673.
- Hutchinson J, Dalziel MJ (1958). Flora of West Tropical Africa Vol. 1 Part 1 2nd Ed. Crown Agents for Oversees Government and Administration, Mill Bank, London, 533-543.
- Hutchinson J, Dalziel MJ (1968). Flora of West Tropical Africa Vol. 1. Part 2, Crown Agents for Oversees Government and Administration, London, p.294.
- Simon JE, Chadwick AF, Craker GB (1984). Scientific Literature on Selected Herbs, Aromatic and Medicinal Plants of the Temperate Zone., Archon Book, Hauden, p.770.
- Stern KR (2000). Introductory Plant Biology. MacGraw-Hill Company Inc. United States of America, p.630.
- Willis JC (1985). A Dictionary of the Flowering Plants and Ferns. Cambridge University Press, p.1245.

ARTIFICIAL KEY

- 1a. Calyx shape linear.....*I. terminalis*
- 1b. Calyx shape elliptic:
 - 2a Leaf type simple.....*I. paniculata*
 - 2b. Leaf type compound:
 - 3a. Corolla colour pubescent.....*I. stenophylla*
 - 3b. Corolla colour rose:
 - 4a. Fruit type terete..... *I. prioureana*
 - 4b. Fruit type pod:
 - 5a. Peduncle arrangement opposite.....*I. tinctoria*
 - 5b. Peduncle arrangement sessile:
 - 6a. Corolla freedom or fused solitary....*I. pulchra*
 - 6b. Corolla freedom or fused imbricate:
 - 7a. Pedicel cernous.....*I hirsuta*
 - 7b. Pedicel very short and silky:

EXPLANATION OF FIGURES

Fig. 1 (a-d) Morphology of *Indigofera* species

- (a) *I. hirsuta*. An annual erect herb
- (b) *I. paniculata*. Annual much branched herb or under shrub.
- (c) *I. prioureana*. Herbaceous annual and sparingly branched.
- (d) *I. pulchra* – semi woody under shrub.

Fig. 2 (a-d) Morphology of *Indigofera* species

- (a) *I. senegalensis*. Annual herb
- (b) *I. stenophylla*. Annual herb
- (c) *I. terminalis*. A semi woody under shrub.
- (d) *I. tinctoria*. A soft woody shrub.