

## The Taxonomy, Systematic and the Description of the Species *Parkia biglobosa* (Jacq.) Benth

ONL, P.L

Forestry Research Institute of Nigeria, P.M.B 5054, Jericho, Ibadan. Nigeria

(Accepted 19 November 2001)

**ABSTRACT:** *Parkia biglobosa* had attracted interests of early botanists from time immemorial due to its traditional roles in rural economy sustenance and prominence in several agroforestry practices. The foundation of the current taxonomy originated in 1826 with Robert Brown who was responsible for describing the plants of the Denham-Oudney-Clapperton-Expedition-1822-4, among which was Clapperton's specimen of *Parkia biglobosa* from Bornu, Nigeria. Thereafter various attempts had been made by several subsequent taxonomist to properly classify the species into the specific taxonomic nomenclature (genus and epithet), however several misapplication errors were made in the process and the problem persisted for several centuries.

Within the last two decades the species had received further substantial taxonomic research attention. However despite these, certain taxonomic aspects of the species requires further clarification in order to reduce the frequency of misapplications of the specific synonyms and the genus. At both genus and specific epithet levels the problem persists probably due to the broad ecological amplitude of the species which often results in slight morphological variations. The present study attempts to systematically summarise the historical nomenclature dating back to 1775 when the species was first mentioned in 1757 and the genus in 1763 by Jacquin. This information were streamlined in a chronological manner using both tables and figure where appropriate. Major differences separating the three African mainland species were also illustrated to further put to rest these problems and assist effective identifications and description by subsequent workers.

**Key words:** Bio-systematic, *Parkia biglobosa*, taxonomy.

### INTRODUCTION

*Parkia biglobosa* (Jacq.) Benth, named after Mungo Park by Robert Brown (1826), has long been widely recognised as an important indigenous fruit tree in several parts of its range in West African, extending from Senegal eastwards to Uganda. As a result of an age-long association with traditional agriculture and diverse usage, it has attained protective status in many traditional agricultural systems (Keay, 1955; Hagos, 1962; Hopkins, 1983). *Parkia biglobosa* is a deciduous tree with a large spreading crown, which produces indehiscent pods, containing edible seeds (Keay, 1955; Hopkins, 1983).

The seed is the most valuable product of the species topping the list of acceptable indigenous multipurpose trees in Nigeria (Awodola, 1989) and ranked highest of a list of eighteen traded edible forest products in Mali (Gakou *et al.*, 1995). FAO (1989) reported arrays of multipurpose use, including food, medicine, manure, gum, tannin shade wind-break, bee food, stabilisation of degraded environmental, livestock feed, fuel, fibre, fish poison and several other domestic uses. Within the context of taxonomic classification several misapplications

had been made by past collectors leading to catalogues of misrepresentations and classification especially with other species types prevalent in the West African range of the species including *Parkia bicolor* and *Parkia filicoidea*. Although the work of Hopkins (1983), Hopkins and White (1984a) and (1984b) attempted to finally resolve the confusions to a very greater extent, however gaps in information were still observed thereafter which necessitate the present study. The present study therefore adopted a monographic style in synthesising the information together in a chronological order to further understand the bio-systematic as prerequisite for further study of the species.

### THE SPECIES

#### Nomenclatural history; synonyms and misapplications.

The specific epithet, *biglobosa*, is the correct name for the important and widely distributed African savanna species of *Parkia*. The oldest written record of this species can be traced back to the account of Adanson

(1757) and (Busson, 1965). Caillié (1819-1828) also described the fruits as very nourishing and of great use to the travellers (Jacques Félix, 1963; Busson, 1965).

The botanical history of the genus *Parkia* dates back to the illustration of a specimen by Jacquin (1763) supporting a circumscription of what is called *Mimosa biglobosa*. It is based on a plant cultivated in Martinique, West Indies, but presumed to have been introduced from West Africa (Bentham, 1875; Hagos, 1962; Hopkins, 1983) (Table 1). Unfortunately there is no record of that specimen being preserved. Twenty years later Persoon (1783) applied the name *Mimosa taxifolia*, to a specimen since destroyed or lost in the herbarium of Antoine Laurent de Jussieu, but a formal description was only published after another 24 years (1807).

In 1799, Mungo Park included a brief reference to the species in his journal, under the vernacular name "nitta" from what is now the Guinea/Mali border area. In the next stage, attention returned to Jacquin's plant and its generic placement in 1806. Willdenow made the transfer from *Mimosa* to *Inga*, as *Inga biglobosa*. Soon after, in 1816 Palisot de Beauvois extended the use of the Jacquin epithet to Nigerian plants, but unfortunately a specimen of a different species, today's as *P. bicolor*, and confused later workers by publishing a poor description and an illustration mixing features from both species (Beauvois, 1816). Further independent development took place in the West Indies. In 1824, Hamilton drew up a brief description of a plant which he referred to as a new species of *Inga*, *Inga faeculifera*, utilising a name originally attributable to Nicaise-Auguste Desvaux (Hopkins, 1983). In parallel, *Inga* was also the generic placement favoured for West African plants. De Candolle cites the name *Inga senegalensis* (Candolle, 1825) as a revised name for the material Persoon called *Mimosa taxifolia*. Another change in generic name followed when Desvaux (1826) transferred the plants he had called *Inga faeculifera* to *Prosopis*, as *Prosopis faeculifera*.

The foundation of the current taxonomy originated in 1826 with Robert Brown. Brown was responsible for describing the plants of the Denham-Oudeney-Clapperton-Expedition 1822-4, among which was Clapperton's specimen of *Parkia biglobosa* from Bornu, Nigeria. Brown realised the likelihood of several older names being applied to a single species and that a new generic placement would be appropriate. He suggested that *Inga biglobosa*, *Inga senegalensis* and *Inga taxifolia* were all the same, and that reference to "nitta" trees in the dairies of Mungo Park written in 1797 (Park 1797) were to this species too. Accordingly he named the genus *Parkia* after Mungo Park, but introduced a new species epithet 'africana', later to fuel much nomenclatural debate (Keay, 1955; Hagos, 1962; Hopkins, 1983). At the time, however, the name

adopted was *Parkia biglobosa* formally published by George Don in Bentham, 1875.

The next developments were of further collections of *Parkia* and reduction of further old names to synonyms. Confusion still continued, however. Four years later, George Don (London, 1830) described an additional species as *P. uniglobosa*, only for it to be sunk into *P. biglobosa* by Bentham in 1875. Earlier in 1842, Bentham had introduced the combination *Parkia biglobosa* for Asian as well as African plants (Bentham, 1842). Oliver (1871) applies the name *P. biglobosa* to West African plants explicitly giving *P. africana* as a synonym, but, like Bentham (1842), extends the circumscription to Asian material. In addition, Oliver introduced *intermedia* as an epithet in *Parkia* to refer to a specimen (Mann 1099, K) collected by Gustav Mann on Saô Tomé.

In 1875, Bentham finally separated the Asian and African material, using the name *P. africana* for the latter and reducing *Inga faeculifera*, *Prosopis faeculifera* and *P. uniglobosa* to synonyms under this name. He divided the Asian material among two species: *P. biglandulosa* and *P. roxburghii*. Entering the present century, Chevalier (1910) reported the occurrence of Oliver's *P. intermedia* on the mainland as well as Saô Tomé, also recognising *P. biglobosa*. Like his predecessors, Chevalier had overlooked the view of a western *P. biglobosa* and a separate eastern species of West African savanna and *Parkia intermedia* was adopted. But in 1919 Macbride replaced the name *P. intermedia* with *P. oliveri*, retaining Mann 1099K as the type specimen (Macbride, 1919). One further name was to be introduced when Baker (1930), established s.n (BM) from Kete Krachi in Ghana as the type of a new sub-species of *P. filicoidea* (subsp. *glauca*).

After the second World War, in-depth studies of African *Parkia* were undertaken as the regional West African flora was revised. In this process, for the easternmost species, Keay (1955) introduced the name *P. clappertoniana* to replace *P. africana*, arguing that Brown's use of *africana* contravened the code for botanical nomenclature because valid epithets already existed and some of the descriptions derived from material explicitly associated with these (Keay, 1955). Exell (1956) kept *P. oliveri* as a distinct species, but unlike Chevalier (1910), regarded it as strictly endemic to Saô Tomé. Keay (1958) in the standard regional flora recognised *P. biglobosa*, *P. clappertoniana* and (by implication) *P. oliveri* as separate species but reduced Baker's *P. filicoidea* subsp. *glauca* to synonymy under *P. clappertoniana* (Hutchinson & Dalziel, 1954). Justus Hasskarl's use of *intermedia* for another species in 1844 (Oliver, 1871). Hagos (1962) rejects Keay's case for replacing the epithet *africana* with *clappertoniana* and restores the former, at the same time extending the range west to the coast of Senegal.

Hagos still recognised *P. biglobosa* as a separate species. Finally Hopkins (1983) united *P. africana/clappertoniana* and *P. biglobosa* as one

species under *P. biglobosa*, the older name. Hopkins views were followed here. The complex nomenclatural chronology is summarised in Table 1.

Table 1: *Parkia biglobosa*: chronology of nomenclature, synonyms and other combinations involving the specific epithet *biglobosa*

Year	Authority	Remarks
1763	Jacquin	<i>Mimosa biglobosa</i> , described in (Martinique), West Indies. Original description not associated with any known herbarium specimen.
1797	Mungo Park	Records species as "nitta", a local name. □
1806	Willdenow	<i>Inga biglobosa</i> , new generic placement.
1807	Persoon	<i>Mimosa taxifolia</i> , described further still, a Senegal plant. No link with Jacquin or Willdenow names perceived.
1806	Palisot-de Beauvois	Applied <i>Inga biglobosa</i> , for illustration based on specimen of <i>P bicolor</i> and the Jacquin description.
1824	Desvaux	name <i>Inga faeculifera</i> coined. No link with Jacquins or Persoon material perceived
1825	Hamilton	<i>Inga faeculifera</i> , formerly described, under Desvaux's epithet.
1825	De Candolle	<i>Inga senegalensis</i> :new generic placement and a new specific epithet for Persoon material
1826	Desvaux	<i>Prosopis faeculifera</i> : a new generic placement for the Desvaux specimen.
1826	Robert Brown	Genus <i>Parkia</i> established, and specific epithet <i>africana</i> introduced. Suggested that <i>Inga biglobosa</i> <i>I senegalensis</i> and <i>Mimosa taxifolia</i> were synonyms
1830	G. Don	<i>Parkia uniglobosa</i> , combination <i>Parkia biglobosa</i> formally published; described.
1842	G. Bentham	<i>Parkia biglobosa</i> , circumscribed broadly as African and Asian.
1783	Persoon	Coined name <i>Mimosa taxifolia</i> for a specimen since lost. Not aware of similarity with Jacquin plant.
1871	Oliver	Describes <i>P. intermedia</i> , as Sao Tomé endemic, treats <i>P biglobosa</i> as synonyms.
1875	Bentham	Revises circumscription of African plants <i>Parkia</i> material with <i>P biglobosa</i> , <i>P uniglobosa</i> and <i>Prosopis faeculifera</i> as synonyms
1910	Chevalier	Revises use of the name <i>P biglobosa</i> , extends range of <i>P. intermedia</i> to mainland Africa.
1919	Macbride	Points out use of <i>P intermedia</i> for African plants is invalid, introduces <i>P oliveri</i> as valid alternative.
1930	Baker	Describes <i>P filicoidea</i> subsp. <i>glauca</i> from Ghana.
1955	Keay	Argues that the name <i>P africana</i> is invalid and published <i>P. clappertoniana</i> as replacement.
1958	Keay	Reduces <i>P filicoidea</i> subsp <i>glauca</i> to synonym under <i>P clappertoniana</i> .
1962	Hagos	Replaces name <i>P clappertoniana</i> with <i>P africana</i> retaining <i>P biglobosa</i> as a separate species; reduces <i>P oliveri</i> to synonym under the <i>P africana</i>
1983	Hopkins	Unites <i>P biglobosa</i> and <i>P africana/clappertoniana</i> as one species with <i>P. africana</i> and <i>P. clappertoniana</i> treated as synonyms.

#### Systematic position

##### The Tribe *Parkieae*

When Brown first described *Parkia*, he concluded that it was a legume in the tribe Mimosoideae displaying a character (imbricate calyx aestivation) suggesting affinity with the Caesalpinioideae (Hopkins, 1986). A few years later the tribe *Parkia* was created by Robert Wright & George Arnott (1834) to separate it from all other genera of tribe Mimoseae, which Wright & Arnott

referred to as sub-tribe *Acaciae*. As more mimosoid legumes were described, a more complex systematy was developed with *Parkieae* raised to tribal rank, reorganised to accommodate *Parkia* and *Pentaclethra*. In the past, *Erythroleum* and *Dinizia* have been included at times. Modern thinking is reflected by the view of Elias (1981). There are five tribes of the legumes (Figure 1).

*Parkieae* is distinguished from the other tribes by imbricate sepals which are united. It consists of only two genera: *Pentaclethra* with (two species) and *Parkia* with about 35 species. According to Elias (1981), the principal character linking the two genera is the imbricate aestivation of the sepals; otherwise the two have little in common and Hopkins (1986) questions whether the two genera are closely related.

The two genera are separated from each other by *Pentaclethra* having monomorphic bisexual flowers in

elongated, often paniculate spikes, 5 stamens with equal or greater number of staminodal and pollen shed in monads, while *Parkia* has heteromorphic flowers organised in capitate, claviform inflorescence, those flowers in the upper parts of the inflorescences being bisexual while the lower are staminate or neuter. There are 10 fertile stamens, no staminoda, and the pollen is shed in either 32-or sometimes 16-celled polyads (Elias, 1981).

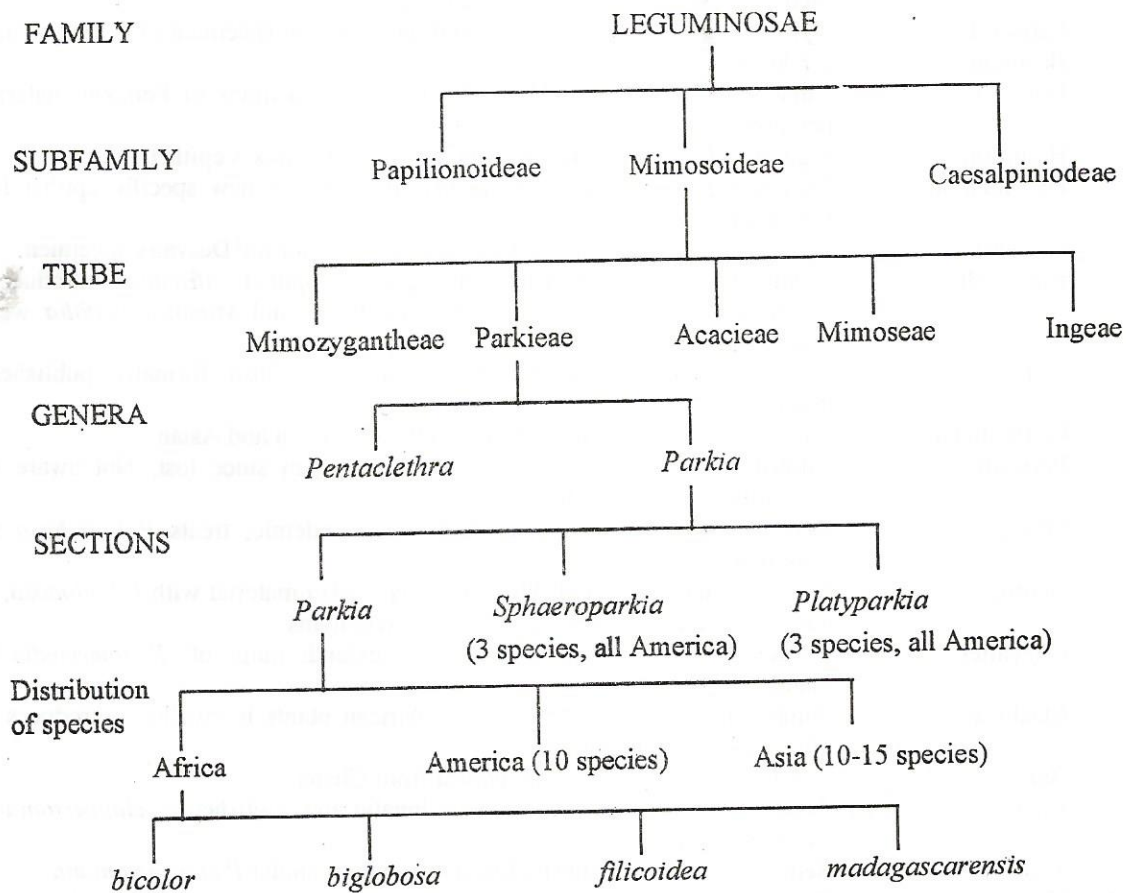


Figure 1. *Parkia biglobosa* in the taxonomic hierarchy based on Leguminosae (Elias, 1981; Hopkins 1983).

Table 2: Summary of the differences which separate the African species.

Characters	<i>bicolor</i>	<i>biglobosa</i>	<i>Filicoidea</i>	<i>Madagascarensis</i>
Pairs of pinnae	10-25	up to 17	4-12	7-22
Disposition and pairs of leaflets per pinna	opposite 20-25□	Usually subopposite 13-70□	Opposite to subopposite 13-32	Opposite to alternate; number of pairs not reported
Leaflets□	5-15 mm long, 1-2.5 mm wide; main nerve usually sigmoid	8-30 mm long, 1.5-10 mm wide; straight main nerve	14-35 mm long, 3.5-13 mm wide; straight or sigmoid main nerve	5-11 mm long, 2-2.5 mm wide; sigmoid main nerve.
Primary rhachis□	pubescence, ferruginous; no awn	Pubescence greyish; caducous awn□	Pubescence ferruginous or absent; no awn	not reported□
Petiolar gland	Single, elliptical, slightly above petiole base	Single orbicula at petiole base	double or 2 lobed between petiole base and first pair of pinnae	Single, elliptical between petiole base and first pair of pinnae
Fertile flowers □	corolla 8-12.5 mm long; corolla lobes > 0.5 total corolla length	Corolla lobes 10-17 mm long corolla lobes <0.3 total corolla length	corolla 12-20 mm long; corolla lobes >0.5 total length	Corolla 10-14 long; corolla lobes <0.3 total corolla length
Basal flowers□	filaments of basal flowers far exerted □	Filaments of basal flowers not or only slightly exerted	Filaments of basal flowers not or only slightly exerted	Character uncertain
Basal part of capitulum, with exerted filaments	ca 40 mm diameter□	ca 15-20 cm diameter□	constricted, ca 15 mm diameter	Apparently constricted, ca 15 mm diameter
Capitulum colour□	Pinkish red to yellow	Deep bright red □	bright red to creamy white	Unknown□
Pods □	growing to 250-450 mm long including stipe, 115-35 mm broad; flattened usually not constricted between seeds surface over seeds shallowly corrugated	Growing to 150-300 mm long including stipe, s15-25 mm broad terete, not constricted between seeds; surface over seeds ± smooth	growing to 250-800 mm long including stipe 15-35 mm broad; flattened constricted or not between seeds flat and smooth or shallowly corrugated	50-90 mm broad flattened; surface reticulate
Seeds form and maturity□	ovoid, 11-15 mm x 7-10 mm □	Somewhat flattened 12 mm x 8-10 mm x 4-5 mm	Somewhat flattened 16-25 mm x 7-9 mm	not reported
Testa □	smooth and without pleurogram; detached from cotyledons	with ovate pleurogram, otherwise smooth; tightly enclosing cotyledons □	wrinkled and without pleurogram; detached from cotyledons	not reported □
Cotyledons	smooth or wrinkled, olive-green	Smooth, whitish or yellowish	smooth or wrinkled olive-green	not reported

Source: Hopkins, 1983; Oni, 1997.

### The genus *Parkia*

The genus *Parkia* is pantropical, distributed in tropical Africa (four species), the Neotropics (10 species) Asia (10-15 species) and the East Indies (four to five species) Hopkins, 1983, 1986). It consists of

about 35 species (Hopkins, 1983) divided among three sections. Separation of section within the genus has been revised by Hopkins (1986). Section *Parkia* is distinguished from the other sections by the presence of neuter staminodal flowers at the base (proximal end) of

the inflorescence: such flowers are lacking in *Platyparkia* and *Sphaeroparkia*. The last two sections are separated from each other on the basis of whether the inflorescence are pendent in *Platyparkia* but not in *Sphaeroparkia* and whether the flowers within an inflorescence display similar sexuality (basal fertile flowers and apical modified nectar-secreting flowers in *Platyparkia*) but all flowers are fertile in *Sphaeroparkia*. Chevalier (1910) stated that in reality, a chain of species occur, the separation of which is difficult on the shared border of their ranges.

Chevalier (1910) suggested division of what today is section *Parkia* (then calling this "section *Euparkia*") into subgenera, but only three of the species are accepted today. *Parkia biglobosa* and *P. filicoidea* are referable to subgenus *Euparkia* because the endocarp completely fills the gap between the seeds within each pod. In *P. bicolor*, however, gaps are not completely filled by the endocarp until the seeds mature and reappear as they ripen. This feature was the criterion for assignment in a separate subgenus, *Parkopsis*. As the seeds of *P. madagascarensis* are unknown, the placement of this species according to Chavlier's subgenera is not possible and Hopkins (1983) concludes that there is no justification for referring the African species to subgenera.

## CONCLUSION

*Parkia biglobosa* had attracted taxonomic interests from time immemorial dating back to 1763 to 1983 and even beyond by various early botanists, taxonomists and different other workers by virtue of its economic potentials and its roles in the rural economy sustenance. At various times different collectors attempted to place the species in the appropriate taxonomic grouping using perceived knowledge of understanding. However several misapplication errors were made either due to the existence of other species types or as a result of the broad ecological amplitude of the genus, spreading across eighteen West African countries (Oni, 1997). This ecological spread introduced step cline problem which led to some of the encountered confusion of members of the family due to similar morphological traits. The adoption of synonyms at the genus and specific species levels by various subsequent workers further confused many recent workers with many still using synonyms in place of the correct nomenclature *P. biglobosa*

Within the context of the family and sub-family of which *P. biglobosa* belongs several members display very similar morphological attributes and if collectors were not disposed to have access to all plant parts (the leaves, flowers and fruits) along with careful examination of the bark of the specific species during taxonomic studies several misapplications and errors may likely arise.

Attempts were made in the present study to unify and update all these misapplications problems to reduce further possible complications in the accurate positioning of the species. The historical perspective as summarised and the systematic positioning with clear distinguishing characters of the various components parts of the species within the test would lend more credence to the proper understanding of the specific genus and epithet review in the present study.

## Acknowledgements:

This work was undertaken as part of the support to FRIN *Parkia* project by the Commission of European Communities. Contract TS3\* CT92-0072. The support is gratefully acknowledged by the author.

## REFERENCES.

- AWODOLA, A.M. (1989): Potential farm trees in Sokoto Local Government. In proceeding of the 19<sup>th</sup> Annual Conference of Forestry Association of Nigeria (Ed. Oguntala A.B. 423-468)
- BENTHAM, G. (1875): Revision of the Suborder *Mimoseae*. *The Transactions of the Linnean Society of London*, 30: 335-364.
- BENTHAM, G. (1842): Notes on Mimoseae with a short synopsis of species. *Journal of Botany*, 4: 323-418.
- BROWN, R. (1826). *Narrative of travels and discoveries in northern and central Africa*. (Ed. by D. Denham & H. Clapperton).
- BUSSON, F. (1965): *Plantes alimentaires de l'Ouest Africain; etude botanique, biologique et chimique*. Leconte, Marseilles. 568 pp.
- CAILLIÉ, R. (1830):. *Travels through Central Africa to Timbuctoo: and across the Great Desert to Morocco, performed in the years 1824-28. Vol. 1*. Henry Colburn and Richard Bentley, London. New Impression 1992, DARF Publishers, London. 475 pp.
- CANDOLLE, A.P. DE (1825): Leguminosae. In: *Prodromus Systematis Naturalis Regni Vegetabilis, Part 2*. Treuttel & Würtz, Paris. 644 pp.
- CHEVALIER, A. (1910): Mission scientifique de l'Afrique occidentale française. Dahomey. Les *Parkia* de l'Afrique occidentale. *Bulletin du Museum National d'Histoire Naturelle, Paris*, 16: 169-174.
- ELIAS, T.S. (1981): Mimosoideae. In: *Advances in legume systematics, Part 1*. (Ed. by R.M. Pophill & P.H. Raven). Royal Botanic Gardens, Kew. 425 pp.
- EXELL, A.W. (1956): *Catalogue of the vascular plants of S. Tomé*. British Museum (Natural History) London, 428 pp.
- FAO. (1989): Utilisation of tropical foods: tropical beans. *Food and Nutrition Paper 47*: 1-74.

- GAKOU, M., FORCE, J.E. & MCLAUGHLIN, W.J. (1995): Non-timber forest products in rural Mali: a study of villager use. *Agroforestry Systems*, 28: 213-226.
- HAGOS, T.H. (1962): A revision of the genus *Parkia* R. Br. (Mim.) in Africa. *Acta Botanica Neerlandica*, 11: 231-265.
- HOPKINS, H.C. & WHITE, F. (1984a): *Parkia biglobosa* (Jacq.) R. Br. Ex. G. Don. (1830). *Distributiones Plantarum Africanarum*, 27. *Bulletin Botanique National de Belgique*, 54: 245.
- HOPKINS, H.C. & WHITE, F. (1984b): The ecology and chorology of *Parkia* in Africa. *Bulletin du Jardin Botanique National de Belgique*, 54: 235-266.
- HOPKINS, H.C. (1983): The taxonomy, reproductive biology and economic potential of *Parkia* (Leguminosae: Mimosoideae) in Africa and Madagascar. *Botanical Journal of the Linnean Society*, 87: 135-167
- HOPKINS, H.C. (1984): Floral biology and pollination ecology of the neotropical species of *Parkia*. *Journal of Ecology*, 72: 1-23.
- HOPKINS, H. C. (1986): *Parkia* (Leguminosae Mimosoideae). *Flora Neotropica, Monograph*, 43. 117 pp.
- HOPKINS, H.C. (1989): Patterns of diversity, distribution and speciation in *Parkia*. *Bul. I.G.S.M.*:17: 61-77
- HUTCHINSON, J. & DALZIEL, J.M. (1954). *Flora of West Tropical Africa. Vol. 1. Second Edition. Crown Agents, London. 828 pp.*
- IRVINE, F.R. (1961): *Woody plants of Ghana: with special reference to their uses*. Revised edition. Oxford University Press, London. 868 pp.
- JACQUES-FELIX, F. (1963): Contribution de René Caillié à l'ethnobotanique africaine au cours de ses voyages en Mauritanie et à Tombouctou (1819-1828). *Journal d'Agriculture Traditionnelle et Botanique Appliquée*, 10: 551-582.
- KATER, L.J.M., KANTE, S. & BUDELMAN, A. (1992): Karité (*Vitellaria paradoxa*) and néré (*Parkia biglobosa*) associated with crops in South Mali. *Agroforestry Systems*, 18: 89-105.
- KEAY, R.W.J. (1955): A new species of *Parkia* R. Br. (Leguminosae-Mimosaceae). *Bulletin du Jardin Botanique de l'Etat à Bruxelles*, 25: 209-212.
- KESSLER, J.J. (1992): The influence of karité (*Vitellaria paradoxa*) and néré (*Parkia biglobosa*) trees on sorghum production in Burkina Faso. *Agroforestry Systems*, 17: 97-118.
- OLIVER, D. (1871): *Flora of Tropical Africa. Vol. II. Leguminosae to Ficoideae*. Reeve & Co., London. 613 pp.
- ONI, P. I. (1997): *Parkia biglobosa* (Jacq.) Benth in Nigeria : a resource assessment . An unpublished Ph. D Thesis , University of Wales Bangor, U.K.