USE OF FRUITS AND INFRUCTESCENSE CHARACTERS IN THE IDENTIFICATION OF THE *Acacia* Mill.(Leguminosae) SPECIES IN NIGERIA

Jayeola, A. A. and Folorunso, A.E.[1]
Department of Botany and Microbiology, University of Ibadan, Ibadan
aajayeola@yahoo.com GSM: 08023210656

Received 24th April, 2009; accepted 29th November, 2009

ABSTRACT

Fruits and infructescence characters of 31 *Acacia* Mill. taxa are described in this study. Three species, *Acacia auriculiformis* A.Cum.ex Benth., *A. auricularis* A.Cunn.ex. Benth. and *A. schweinfurthii* Brenan. & Exell., represent new records for Nigeria while three taxa, denoted as *Acacia* species unidentified A, *Acacia* species unidentified B, *Acacia* unidentified C cannot be determined reliably using the available flora and resources of the herbarium. Mophometric variants were observed in *A. gourmaensis* A.Chev., *A. sieberiana* and *A. dudgeoni*, with the morphs identified temporarily as *A. gourmaensis* A. Chev. variant a and *A. gourmaensis* A. Chev.variant c; *A sieberiana* DC. var. *villosa* A. Chev. variant a and *A. dudgeoni* Gaib.ex Hall variant a, respectively. What is not known from this study, however, is if the variation is genecological or not. Presence or absence of trichomes on the fruits and peduncle; fissure, vein and constriction patterns all provided stable characters. Migrations arising from nomadic culture may have accounted for the new additions to the flora. A taxonomic key based on the characters of the fruits and infructenscences is included.

Key words: Acacia., variants, fruits, infructenscences, morphometric.

INTRODUCTION

The genus *Acacia*, commonly called thorntrees or wattle trees, is the second largest genus in the family Leguminosae, with a long and convoluted history, having many genera being split or added to the core *Acacia* during the last 250 years. It is a cosmopolitan genus containing about 161 species of which about 60 species occur in the Americas, 73 species in Africa, 36 species in Asia and 7 species in Australia (Maslin, 1997 and Maslin *et al.*, 2003). They are abundant in the savanna, particularly in the Sudanian zone where they account for about 50% of the plant communities (Mueller and Wittig, 2004). Keay (1989), reported 14 *Acacia* species in Nigeria.

Of taxonomic significance is the status of widely distributed *A. albida* Del, which has continued to engage the attention of botanists employing diverse methods of investigation (e.g Ross, 1979; Elamin, 1977 and Polhill and Raven, 1981), but they differ in their interpretation of the concept of *A. albida*. Ultimately, Polhill and Raven (1981) considered that *A.albida* should be placed in a separate genus *Faidherbia* A.Chev. Based on recent molecular and phylogenetic results (Maslin *et al.*, 2003), previous morphological, biochemical and other evidence (Maslin and Peddley, 1988), it has been suggested that the genus *Acacia* is polyphyletic and should be divided into at least five genera.

The characters used in identifying the *Acacia* species at the moment include, flowers, leaves, bark, thorns and fruits. However, the *Acacia* species are difficult to identify because of the infrequence with which

[1]Obafemi Awolowo University, Ile–Ife.

they are in flower, the annual burning of the savanna which deprives them of mature leaves and modify damage other organs.

However, fruits of *Acacia* are persistent all year round, even when leaves are lost following either burning or senescence. The significance of the fruits in the identification of the *Acacia* is demonstrated in the work of Clarke *et al.* (1989) and Pometti *et al.* (2007).

Ecomically, *Acacia* species are important as fodder for a wide range of animals, both wildlife and domestic. Honey made by bees in using the *Acacia* flower as forage is considered a delicacy, appreciated for its mild flowery taste, soft running texture glass-like appearance and does not crystallize. True gum Arabic is the product of *Acacia senegal*, widespread in tropical West Africa, from Senegal to Northern Nigeria. In Ayurvedic medicine, *A. nilotica* (Linn.) Willd. ex Del. var. *adansonii* (Guill. & Perr.) O. Kuntze is considered a remedy for treating premature ejaculation. Aesthetic characteristics of the *Acacia* species, coupled with their defensive qualities, make them an alternative to walls and wire fences. *Acacia farnesiana* (L.) Willd. is popular in the perfume industry, dating back to the biblical times when burning of *Acacia* wood as a form of incense is mentioned several times in the Bible. Mueller and Wittig (2004) described the importance of the genus *Acacia* as indicator species in characterizing plant communities.

In spite of the broad economic importance of *Acacia*, its identification is often problematic for a number of reasons. The availability of characters used in the identification of *Acacia*, such as the leaves, flowers, bark and thorns are subject to seasonally. Even when available, the structure of these organs may be grossly modified by fire during savanna burning.

It has been observed that fruits of *Acacia* are persistent all season round, even when there are no leaves or flowers on their trees. This study aims to study the characters of the fruits of *Acacia* species which are persistent and therefore present all year round even when other characters in use currently to identify them are either absent or present only in some inadequate form, with a view to using them to identify the species. The findings of this study might prove invaluable for ecologists and foresters who frequently deal with litters in savanna ecosystems, In undertaking this study to use characters of the fruits only, it is understood that taxonomic keys are basically for identification purposes only, they are not designed to reflex evolutionary relationships in any way, and that is, keys are essentially artificial devices.

MATERIALS AND METHODS

Fruits of *Acacia* were observed during several field trips between 1996 and 2004, and several fruits were collected. In all, 312 specimens were collected in the savanna zones of Nigeria: southern Guinea, northern Guinea, Sudan zones, at different times and locations in order to account for possible variability in their characters. In addition, the ecological constraints of widely differing phenological cycles of the species coupled with bush burning, made it impracticable to undertake a single field trip for the research. Hence, data collection spanned over a considerable time, in order to cover the range of distribution of each species. In each case, fresh fruit specimens were collected in the field, labeled, and measured immediately before possible shrinkage to obtain the dimensions of length and breadth. They were later identified in the herbaria (IFE and FHI). Representative specimens were studied to guide in tracking possible variations in morphology. Morrison and Rupp (1995) pointed out that it is important to make observation about the extent of inter-population variation in a widely distributed taxonomic species with a view to finding out if the observed phenotypic differences in the samples are genetically induced or not. Herbarium abbreviations follow the list of Holgren and Kueken (1990). Measurements of fresh and dry fruits were taken and compared. For each specimen, fresh fruit weight was measured at intervals until the value was constant before measuring the dry fruit dimensions. Measurements corresponding to two major levels of discontinuity for each taxon were utilized. Specimens were observed

unders natural condition of light and drawings were made. In total, of 19 morphological characters of the fruits and infructenscenees were selected. In all, the specimens were separated into taxa, consisting of species and subspecies *Trees of Nigeria* (Keay, 1989) and all botanical names are according to these taxonomic text.

RESULTS

The botanical names, dimensions of the fruits and representative specimens examined are contained in Table 1 while Table 2 contains the qualitative characters of the fruits and infrutescences. Figures 1-31 contain the illustrations and botanical names of the fruits and infructescences of the genus *Acacia* in Nigeria. After a thorough observation of the 312 specimens, they were separated into thirty one taxa, consisting of twenty two species out of which eight subspecies (*A. sieberiana var. villisa, A. sieberiana* DC var. *sieberiana, A. niloltica* Willd. subsp. *nilotica, A. nilotica* (Linn.) Willd.ex Del. var. *adansonii* and *A. sieberiana* DC. var. *villosa, A. polyacantha Willd.* subsp. *compylacantha* (Hochst. ex A.Rich.) Brenan, *A. tortilis* (Forsk) Hayne subsp. *radiana*; five morphometric variants (*A. gourmaensis* variant a, *A. gourmaensis* variant b; *A. sieberiana* variant a *A. dudgeoni* variant a and *A. dudgeoni* variant b) and three unresolved cases are simply denoted as *Acacia* species unidentified A. *Acacia* species unidentified B and *Acacia* species unidentified C. Three species, *Acacia auriculiformis* A.Cum.ex Benth., *A. auricularis* A.Cunn.ex Benth. and *A. schweinfurthii* Brenan. & Exell., represent new records, not previously reported in the Trees of Nigeria (Keay 1989). Fruits are persistent on the Acacia trees all year round and in some cases, there are more than one generations of fruits on a tree. Keay (1989) reported the persistence of fruits in *A. polyacantha* var. *campylacantha.*

Quantitative data involving the dimensions of the fruits revealed a great deal of continuity and overlaps as indicated by large deviations in values obtained whereas, the qualitative characters showed clear discontinuity.

Fruits characters

Names of plants bear corresponding illustrations in Figures 1-31. Fruit may curve deeply to form a ring-like loop as is in A. auriculiformis or the curves may be gentle, not forming loops as is in *A.hockii A.hockii, A.albida, A. seyal, A. sieberiana* var. *vilosa, A. gourmaensis, A. gonrmaensis, A senegal, A. sieberiana* DC. var. *sieberiana, A. dudgeoni* while the fruits are straight in all the other species. Structrally, the fruits are either thick or leathery: making it resistant to fire. Sinha (1971) observed that the fruits of *A. nilotica* has a thick coating of thick-walled epidermal cells with an outer wall of thick-walled parenchyma cells which give a leathery texture to the fruit. Constriction patterns of the fruits are different in extent and position. The constriction is deep in A. auriculiformis, leading to invagination of the pod whereas constriction is hardly noticeable in *A. gourmeaensis, A. auricularis, Acacia* species unidentified, *A. erythrocalyx, A. Senegal, A. siberiana* and *A. swenfurthii.* Constriction occurs throughout the fruit in *A. auriculiformis, A. hockii, A. nilotica, A. seyal, A. tortilis, A. kamerunensis, A. nilotica var. nilotica, A. dudgeoni* while in the others constrictions are restricted and not uniformly distributed. Constriction is an important character of the *Acacia* caused by failure of the ovules to form seeds. Fruit may be terete or round as it was observed in *A. tortilis, A. gerrardi, A. sieberiana* but other species possess flat fruits. Presence of puberulose trichome hairs gives *A. gerrardi*; *Acacia* species unidentified A, B, C; A. *nilotica* var. *adstringes*, a distinctive velvety appearance. Fruit may be membranous, for instance, *A. kamerunensis* Gandoga, *A. gourmaensis, A. schweinfurthii*, leathery in *A. auriculiformis, A. ataxacantha*; woody in in *A. albida, A. polyacantha, A. sieberiana* var. *sieberiana* and *A. pentagona.*

Differences observed in the morphology of the seeds are diagnostic, helping to further separate two species that look alike by overall appearance. For example, there is marked overall similarity in the pair of *A. macrothyrsa* and *A. macrostachya*; *A. ataxacantha* and *A. polyacantha* subsp. *compylacantha*; *Acacia* species unidentified A and *Acacia* species unidentified B. However, the seeds have different shapes, surfaces and funicle.

Infructescence characters

All names of plants bear corresponding illustrations in Figures 1-31.The peduncle may be glabrous, for instances in of *A. aculiformis*, *A. polyacantha*, *A. gourmaensis*, *A. senegal*, *A. sieberiana*, *A. pentagona*, *A. dudgeoni* but armed with different trichomes in the others: peduncular glands in *A. hockii*, *A. albida*, *Acacia* species unidentified A, A. *nilotica* subsp. *adstringens*, and *A. schwenfurthii*, to thin hairs in *A. macrostachya* *A. nilotica* var. *adansonii*, *Acacia* species unidentified B, A. *erythrocalyx*; puberulose in *Acacia* species unidentified C. Peduncle may be longer than their fruits in certain cases as observed in *A. pentagoma* and *A. senegal*. Peduncle is compound in *A. macrothyrsa*, *A. macrostacya*, *A. auricularis*, *A.albida*, *Acacia* species unidentified A, A. *polyacantha* subsp. *compylacantha*, *Acacia* species unidentified B, A. *sieberiana* var. *villosa*, *A. pentagon*, *A. dudgeoni* variant *a* but simple in the others. It is segmented in *A.hockii*, *A. nilotica* subsp. *nilotica*, *A. pentagona*. The presence of calyx-like projections on the peduncle which is found in *A. macrothyrsa*, *A. macrostachya*, but absent in the others, is also characteristic. Kazuaru *et al.* (2007), observed that peduncle appears a promising tissue, probably better than leaf, for identifying the species. Occurrence of morphometric variants

Polythetically distinct variants were observed in Acacia *gourmaetisis* (Figures 18, 19 and 20), *A. sieberiana* (Figures 25, 26 and 27), and *A. dudgeoni* (Figures 30 and 31) which are widely distributed species. The morphological boundaries are narrow in length and breadth dimensions, the values dovetail, thereby making taxonomic discrimination unsustainable. These morphs are likely linked with habitat variables in the absence of growth data. It can be seen from Table 1 that the morphometric variants occur in somewhat different savanna zones.

The trend in fruit sizes, texture and shapes are broadly similar in these morphs. In *A. dudgeoni*, the fruits represent different degrees of modification of same characters: curvature, margins and tips while in the separate morphs of *A. sieberiana* and *A. gourmeansis*, the main characters such as fruit apex, curvature, and constriction are retained but expressed to different degrees.

Table 1: Comparative dimensions of fresh and dry fruits of *Acacia* species

No.	Botanical names	Length of fruits [(Mean±SD) cm]*		Breadth of fruits [Mean±SD) cm]*		Representatives specimens
		Fresh	Dry	Fresh	Dry	
1	***Acacia auriculiformis* A. Cum.ex Benth**	15.1±4.1	14.1±5.2	2.4±0.8	2.1±0.4	FHI21380, FHI16380
2	*A. macrothyrsa* Harms	8.1±2.4	6±3.2	4.2±2.3	3.2±0.9	FHI 44075
3	*A. macrostachya* Reichenb.ex Benth.	8.3±3.3	6.6±1.3	4.5±1.8	4.1±0.9	FHI 18090
4	*A gerrandi Benth.* (= *A. hebecladoides* Harms)	**11.2±2.5**	10±3.7	t	t	FHI 26602
5	*A. auricularis* A. Cunn.ex Benth.	7.4±3	6.1±4.2	3.7±0.3	3.5±0.1	
6	*A.hockii* De Willd.	17±4.2	14±2.5	t	t	FHI 28099
7	*A. nilotica* (Linn.) Willd.ex Del. var. *adansonii* (Guill. & Perr.) O. Kuntze	**13.11±2.1**	11±2.2	2.5±0.3	2.4±1.5	FHI 14534
8	*A. albida* Del	16.1±3.2	15±5.1	2.6±0.1	2.4±1.3	FHI 61957
9	*Acacia* species unidentified A	10.7±4.2	8.9±2.1	1.2±1.1	1.0±0.2	Neikle 805
10	*A. ataxacantha* D.C.	9.2±1.3	12.4±2	2.2±0.5	2.2±0.4	FHI 87305
11	*A. polyacantha Willd.* Subsp. *compylacantha* (Hochst ex. A.Rich.) Brenan.	23.1±1.5	22.5±5.1	3.1±2.1	3.0±0.8	FHI 58311
12	*A. seyal* Del.	19.4±5.2	12.1±3.3	1.7±0.3	1.3±0.7	FHI 15633
13	*A. tortilis* (Forsk) Hayne subsp. *radiana* (Savi) Brenan.	17.2±2.0	17.1±5.3	t	t	FHI 69312
14	*Acacia* species unidentified B	9.9±2.4	9.1±3.2	2.2±0.5	2.1±0.8	FHI 69477
15	*A. kamerunensis* Gandoga	14.2±1.6	13.4±3.8	4.2±2.1	3-4±0.8	FHI 15633
16	*Acacia* species unidentified C	9.3±3.6	9.1±2.8	2.5±1.4	2.4±0.8	FHI 43561
17	*A. sieberiana* var. *villosa* A. Chev.	7-16±5.3	15±5.2	1.6±0.3	1.5±1.0	FHI 16136; wide spread in savana
18	*A. gourmaensis* A. Chev.	7.8±1.8	7.0±2.1	2.0±0.7	2.2±0.1	FHI 71445; Northern Guinea savanna
19	*A. gourmaensis* A. Chev. variant a	6.3±0.6	6.0±3.4	2.1±0.2	2.1±0.2	FHI 71485; Southern Guinea savanna
20	*A. gourmaensis* A. Chev variant b	5.9±0.2	5.1±1.1	2.0±0.4	2.1±0.5	FHI 15768; Derived savanna, forests fringes
21	*A. niloltica* Willd. subsp. *nilotica* Keay	9.9±0.1	9.7±0.9	2.1±0.2	2.2±0.6	FHI 44479
22	*A. erythrocalyx* Breman	12.5±0.3	12.3±2.4	2.2±0.1	2.1±0.1	FHI 23451
23	*A. Senegal* (Linn.) Willd.	10±2.2	9.1±3.3	4.2±1.2	2.3±0.4	FHI 16145
24	*A. nilotica* subsp. *adstringens* (Schum & Thnn.) Roberty	12.5±5.1	12.1±2.0	1.0±0.1	1.1±0.1	FHI 13364
25	*A. sieberiana* DC. var. *villosa* A. Chev.	8.5±1.5	8.1±2.1	2.1±0.9	2.0±0.4	FHI 85578; Northern Guinea savanna
26	*A. sieberiana* DC. var. *sieberiana* Keay	12.4±1.2	11±2.2	2.8±1.2	1.7±0.2	FHI 56773; Plateau district
27	*A. sieberiana* DC. variant a.	8.6±-4.2	8.2±1.2	3.0±1.4	2.6±0.8	FHI 21277; wide spread
28	*A. pentagona* (Schum. & Thonn.) Hook. f.	11.7±3.8	11.5±2.1	2.2±0.2	2.1±0.1	FHI 73308
29	*A. schweinfurthii* Brenan. & Exell.	12.4±4.5	12.2±4.1	3.2±0.2	3.0±0.2	FHI 94521
30	*A. dudgeoni* Gaib.ex Hall variant a	7.3±3.7	7.0±3.1	3±0.6	2.8±0.6	FHI 1686 Southern Guinea savanna
31	*A. dudgeoni* Gaib.ex Hall variant b	13.2±2.7	12±1.88	1.5±0.2	1.3±0.5	FHI 16001 Derived

t = terete * Samples = 10

Table 2: Important Characters of the *Acacia* fruits

	Botanical names	Codes of characters of the fruits used																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	*Acacia auriculiformis* A.Cum.ex Benth	-	+	-	+	-	+	-	-	-	-	-	-		-	+	-	+	+
2	*A. macrothyrsa* Harms	-	+	+	-	-	-	-	-	-	-	-	-		-	+	-	+	+
3	*A. macrostachya* Reichenb.ex Benth.	+	+	-	-	-	-	-	-	-	-	-	-		-	-	-	+	+
4	*A.gerrandi Benth* (=*A. hebecladoides* Harms)	+	-	-	+	+	-	-	-	+	-	+	-			-	-		+
5*	*A. auricularis* A.Cunn.ex Benth.	-	+	-	-	+	-	-	-	-	-	-	-		-	+	-	+	+
6	*A.hockii* De Willd. = *A. seyal* Schweinfurt.	-	+	-	-	+	-	-	-	+	+	+	-		+	-	-	-	+
7	*A. nilotica* (Linn.) Willd. ex Del. var. *adansonii* (Guill. & Perr.) O. Kuntze.	-	+	+	+	+	-	-	-	-	-	-	-	+	-	-	+	+	+
8	*A.albida* Del.	-	+	+		+	-	-	-	-	-	-	+	-	-	+	+	-	+
9	*Acacia* species unidentified A	+		+	+	+	-	-	-	-	-	-	-		-	+	-	-	+
10	*A. ataxacantha* D.C.	-	-	-	-	+	-	+	-	-	-	-	-		-	+	-	+	+
11	*A. polyacantha Willd.* Subsp. *compylacantha* (Hochst ex. A.Rich) Brenan	-	-	-	-	+	+	-	-	-	-	-	+	-	-	-	+	-	+
12	*A. seyal* Del.	-	+	-		+	-	-	-	-	-	+	-	+	+	-	-	-	-
13	*A. tortilis* (Forsk) Hayne subsp. *radiana* (Savi) Brenan	-	+	-	-	+	-	-	-	-	-	+	-	-	+	+	-	-	+
14	*Acacia* species unidentified B	+		-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	+
15	*A. kamerunensis* Gandoga		+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+	+
16	*Acacia* species unidentified C	+		+		+							+				+		+
17	*A. sieberiana* var. *villosa* A. Chev	-	-	-	-	-	+	-	-	-	-	+	+	-	-	-	+	-	+
18	*A. gourmaensis* A. Chev	+	-	-	-	+	+	+	-	-	-	-	-	-	-	-	-	-	+
19	*A. gourmaensis* A. Chev. variant a	+	-	-	-	+		+	-	-	-	-	-	-	-	-	-	+	+
20	*A. gourmaensis* A. Chev variant b	+	-	-	-	-	+	+	-	-	-	-	-	-	-			+	+
21	*A. niloltica* Willd. subsp. *nilotica*	-	+	-	-	+	-	+	-	-	-	-	-	+	-	-	-	-	+
22	*A. erythrocalyx* Brenan	-		+		+	+			-	-	-	-	-	-	+	-	-	+
23	*A senegal* (Linn.) Willd.	-	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	-	+
24	*A. nilotica* subsp. *adstringens* (Schum & Thonn.) Roberty.		+	-	+	+	-	-	-	+	-	+	-	+	-	-	-	-	
25	*A. sieberiana* DC. var. *villosa* A. Chev.					+	-	-	-	-	-	-	+	-	-	-	+		
26	*A. sieberiana* DC. var. *sieberiana* A. Chev.	+	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	+

27	*A. sieberiana* DC. variant a	+	-	-	-	+	-	-	-	-	-	+	-	+
28	*A. pentagona* (Schum. & Thonn) Hook. f.	-	-	-	-	+	-	+	-	-	-	+	+	+
29*	*A. schweinfurthii* Brenan. & Exell.	+	-	+	-	+	-	-	-	-	+	-	-	+
30	*A. schweinfurthii* Brenan. & Exell.	+	-	-	-	+	-	-	-	-	+	-	-	+
31	*A. dudgeoni* Gaib.ex Hall. varriant b	-	+	-	-	+	-	-	-	-	+	-	-	+

* Denotes species not previously documented in the flora of Nigeria

Legend to the character codes of the fruits.
1 = fruit constricted only in the middle, 2 = fruit constricted all length, 3 = peduncle glandular/hairy, 4 = fruit pubescent, 5 = fruit acute acuminate, 6 = sessile, 7 = leathery, 8 = membranous, 9 = peduncle a head, 10 = peduncle jointed, 11 = fruit terete, 12 = fruit fissured, 13 = fruit bead-like, 14 = nerves parallel to fruit axis, 15 = nerves reticulate, 16 = fruit woody, 17 = fruit flat, 18 = fruit spirally twisted/curved, 19 = peduncle compound/extended

Table 3: Graphic Key to the identification of *the Acacia* species based on fruits and infructenscences. (*.denotes new record)

1.	Fruit constricted, ...2
-.	Fruit not constricted.....19
2.	Fruit curved, not straight.....3
-.	Fruit straight, not curved.....10
3.	Nerves prominent on fruit.....4
-.	Nerves are absent.....7
4.	Nerves reticulate, not in bundles bundle.....31. *A. dudgeoni* variant b
-.	Nerves not reticulate, horizontal bundles.....5
5.	Fruit coiled, once looped.....13 *A. tortilis* ..
-.	Fruit not coiled, bent slightly.....6
6.	Fruit beaked.....5*. *A. auriculariis* ....
-.	Fruit deflexed.....12 *A. seyal*.....
7.	Fruit coiled, helical.....1*.. *A. aculiformis*
-.	Fruit not coiled, not helical.....8
8.	Fruit loment, puberulose.....21. *A. niloltica*
-.	Fruit not loment.....9
9.	Peduncle glabrous.....18.. *A. gourmaensis* 20. *A. gourmaensis* variant b
-.	Peduncle papillose.....24. *A. nilotica* subsp. *adstringens*.....
10.	Peduncle compound, branching.....11
-.	Peduncle simple, not branching.....14
11.	Pedicel hairy.....6....*A...hockii*
	Pedicel glabrous.....12
12.	Veins sparse, restricted on seeds.....30. *A. dudgeoni.*
-.	Veins dense, directed upward.....13
13.	Veins orthogonal reticulate convergent.....23. *A. dudgeoni*....
	Veins orthogonal reticulate divergent..... ..9. *Acacia* species unidentified A

14. Fruit veined.....15
-. Fruit not veined, fissured or pubescent.....17
15. Veins localized, circular around seeds.....15. *A. kamerunensis*
-. Veins reticulate peduncle pubescent.....16
16. Fruit deflexed beaked, oblong.....22. *A. erythrocalyx*
-. Fruit elliptic.....29*.. *A. schweinfurthii*
17. Fruit velvety, puberulose.....7. *A. nilotica* var. *adansonii*
-. Fruit glabrous, woody.....18
18. Peduncle compound.....25. *A. sieberiana*
-. Peduncle simple.....27. *A. sieberiana*.....
19. Fruit curved.....20
-. Fruit not curved, straight.....24
20. Fruit fissured, lines vertical.....21
-. Fruit not fissured.....23
21. Fissures vertical.....8 *A.albida*
-. Fissures horizontal, concave.....22
22. Pod terete.....17. *A. sieberiana* var. *villosa*
-. Pod flat.....28. *A. pentagotia*
23. Fruit pubescent, velvety.....4. *A.gerrandi*
-. Fruit glabrous.....26. *A. sieberiana* DC. var. *villosa*
24. Prominent seed outline.....25
-. No seed outline visible.....27
25. Seed alternately attached to pod.....10. *A. ataxacantha*
-. Seed not alternately attached.....26.
26. Peduncle compound.....11. *A.potyacantha Willd.* subsp. *compylacantha*
. Peduncle simple.....19. *A. gourmaensis variant* a
27. Veins present, random reticulate.....28
-. Veins absent, vertical fissures present....29
28. Peduncle pubescent.....3. *A.macrostachya*
-. Peduncle glabrus.....2. *A. macrothyrsa*
29. Pecduncle pubescent.....14. *Acacia* species unidentified B
- Peduncle glabrous.....16. *Acacia* species unidentified C

DISCUSSION

The fruits and infrutescences study of *Acacia* has confirmed the morphological diversity of the genus. Indeed, no character of the fruits is generic bound, each species representing a morphological entity, showing clear differences from the other fruits and maintaining predictable variations within its own samples. In this regard, the fruits are sufficiently different morphologically to be readily distinguished and to represent whole plants for purposes of identification. The mechanism of fruit persistence and fire tolerance in *Acacia* fruit has neither been studied nor fully understood. It could be an adaptation against annual burning of the savanna if the fruits were dispersed in the mosaic of dry dead grasses. Therefore, retention of fruits on the parent tree may be for fire avoidance. Nefabas and Gambiza (2007), observed that the frequency of fire has increased in the savannas, yet few studies have assessed how plants persist when subjected to long disturbance by the fire.

The observed inter-population variations can be explained by the ability of *Acacia* to explore a wide variety of habitats in the savanna, including fringing forests or derived savanna, thereby providing favourable ground for the development of ecological variants. What is not known from this study, however, is if the variation is genecological or not. Genecological differentiation of morphological attributes has been observed in other geographically widespread *Acacia* species (e.g. Ross, 1971; McMillan, 1973; Auld and Morrinson, 1992). No single attribute can be used to differentiate the morphometric variants, rather, a combination of characters apply. Constriction of fruits is widespread and variously modified in the *Acacia*, suggesting the ancestral nature of this character. General character states are primitive while specialized states are derived (Goldberg, 1989). Unlike the qualitative characters, the trend in fruit dimensions, are broadly similar, and the differences do not represent any major discontinuities from one species to the other. Of all the attributes of the *Acacia* species studied, dimension is the least useful in delimiting them, showing similarities in both intra-specific and inter-specific values. For the qualitative characters, however, variations are intra-specific and predictable, thereby making them useful in delimiting the species. The apparent constancy of characters in the *Acacia* species suggests that individuals within the species are full rather than half sibs.

The wide distribution of *Acacia gourmaensis* and *A. dudgeoni* may, in part, be explained by the development of relatively few seeds in their fruits which tends to increase dispersal distance. Anguspurger and Hogan (1983) observed that a decrease in seed number per fruit increases both seed weight and dispersal distance, but it decreases the probability that a given dispersal event results in movement of an intact seed. There are three new records of *Acacia* species in Nigeria, namely, *Acacia auriculiformis* A.Cum.ex Benth., *A. auricularis* A.Cunn.ex. Benth. and *A. schweinfurthii* Brenan. & Exell., which probably became introduced through cattle movement in and out of Nigeria since they have not been encountered in home gardens, plantations or agric-mosaic. Three other taxa denoted as *Acacia* species unidentified A, *Acacia* species unidentified B and *Acacia* species unidentified C, have not been determined accurately within the context of available herbarium resources and the flora of this region. It is interesting to note that *Acacia* species unidentified B and *Acacia* species unidentified C are similar in fruit morphology but differ in seed features. Jaskani *et al.* (2007) noted that polyploidy affects fruit characteristics and seed germination in woody plants. Further studies, involving more specimens, growth experiments, ontogeny, cytogenetics are needed to produce more characters in order to draw a stable conclusion in respect of these taxa. A graphic key based on the characters of the fruits and infructescences is included for the identification of the already known species.

REFERENCES

Augspurger, C. K and Hogan, K.P (1983). Wind dispersal of fruits with variable seed number in a tropical tree (*Loncocarpuspentaphyllus*: Leguminosae). *American Journal of Botany*, 70(7): 1031-1037

Auld, T.D and Morrinson, D. A (1992). Genetic determination of erect and prostrate growth habits in five shrubs from windswept headlands in Sydney region. *Australian Journal of Botany*. 40: 1-11.

Clarke, H. David; David S. Siegler and John E. Ebinger (1989). *Acacia farnesiana* (Fabaceae: Mimosoideae) and Related Species from Mexico, the Southern U.S., and the Carribean. *Systematic* Botany. 14 (4):549-564.

Elamin, H.M (1977). Study of *Acacia albida* in relation to other acacias. *Sudan Silva* 3(22): 39-45.

Goldberg.A.(1989). Classification, Evolution and Phytogeny of families of Monocotyledons. *Smithsonia Contribution to Botany*. 71: 1-71.

Holmgren, P.K. and Keuken, W (1990). Index Herbariorum: Part I: The Herbaria of the World. 8th ed. - *Regnum Vegetabile* 120. New York Botanical Garden.

Jaskani, M.J, Kwon S.W, Kim, E. J and Ko B.R (2004). Polyploidy affects fruit characteristics, seed morphology and germination in watermelon (*Citrillus lanatus*). *Journal of the Korean Society for Horticulture Science*, 45:233-7.

Kazuharu O; Abdullah, A. M.; Awang, M and Furukawa, A (2007). Relationship between fruit growth and peduncle cross-sectional area in durian (*Durio zibethinus* Murray). *Ecological modeling*. 200(1-2): 254-254.

Keay, R.W.J. (1989). *Trees of Nigeria*. Clarendon Press Oxford. pp.234-240.

Maslin, B.R; Miller J.T and Siegler, D.S (2003). Overview of the generic status of *Acacia* (Leguminosae: Mimosoidae). *Australian systematic Botany* 16: 1-18

Maslin, B.R. (1997). Australia's golden future. *Landscope* 12 (3): 16-22.

Maslin, B.R. and Peddley, L (1988). Patterns of distribution of Acacia in Australia. *Australian Journal of Botany* 36: 385-393.

McMillan, C. (1973). Prostrateness in *Acacia farnesiana* from Western Mexico under uniform environmental conditions. *Madrono* 22: 140-144.

Morrison, A. D and Rupp, A. J (1995). Patterns of Morphological Variation within *Acacia suaveolens* (Mimosaceae). *Australian Systematic Botany*, 8:1013-1027.

Mueller, J. V. and Wittig, R (2004). The importance of *Acacia* L. (Mimosaceae) for the vegetation in the Sahelian Region of Burkina Faso. *Etudes flore*, 8: 27-38.

Nefabas, L. L and Gambiza, J (2007). Fire-tolerance mechanisms of common woody plant species in a semiarid savanna south west Zimbabwe. *African Journal of Ecology*, Volume 45(4): 55Q-556 *Vegetation Burkina Faso* 8: 27-38.

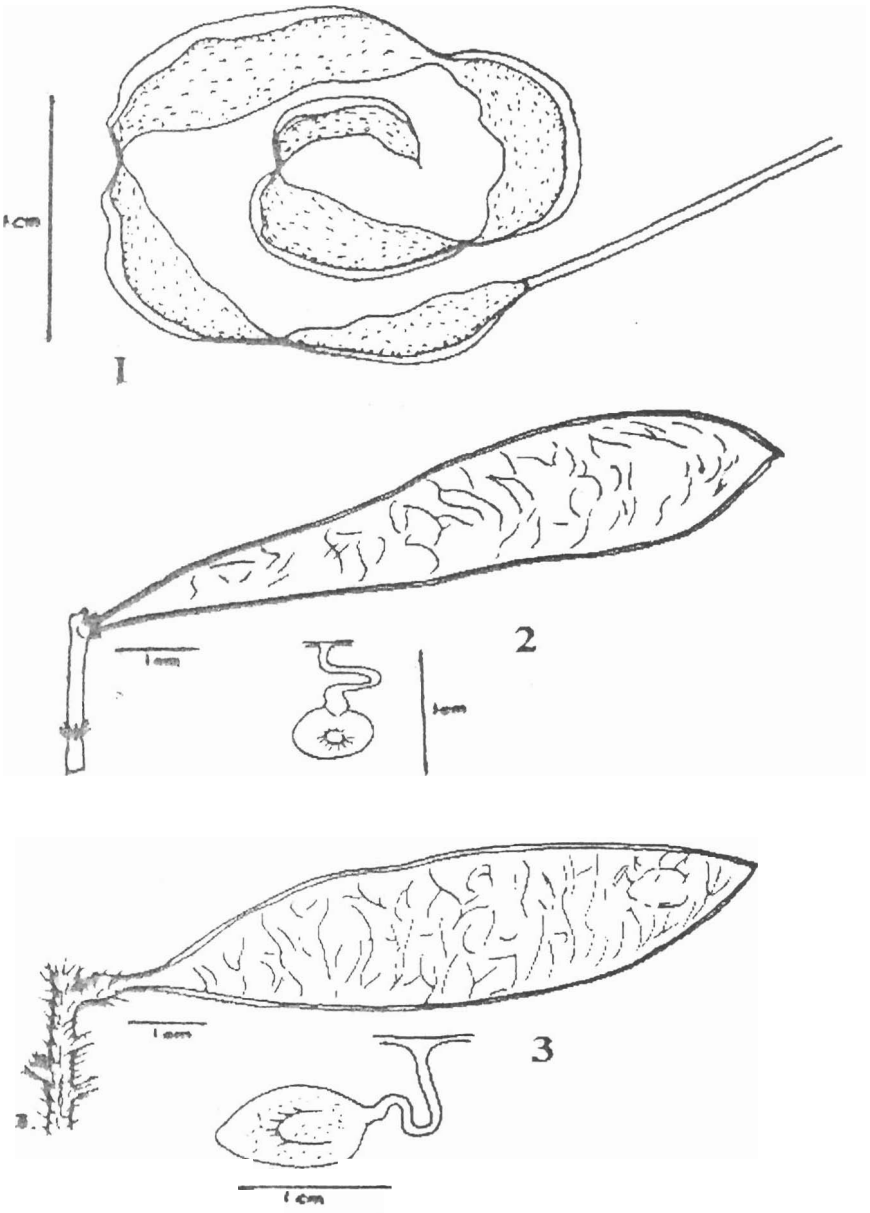
Polhill,R.M ang Raven, P.H. (1981). *Advances in Legume Systematics* I. Royal Botanic Gardens, Kew. Ministry of Agriculture, Fisheries and Food (Great Britain). Ppl70-175.

Pometti, C.L.; Cialdella, A.M; Vilardi, J.C. and Saidman, B.O. (2007). Morphometric analysis of varieties of *Acacia coven*: (Leguminosae-Mimosoideae): Taxonomic inferences from the context of other Argentinean species. Plant Systematic and *Evolution*. 264: 239-249.

Ross, J.H. (1971). *Acacia karoo* in Southern Africa. Rothalia. 10, 385-401

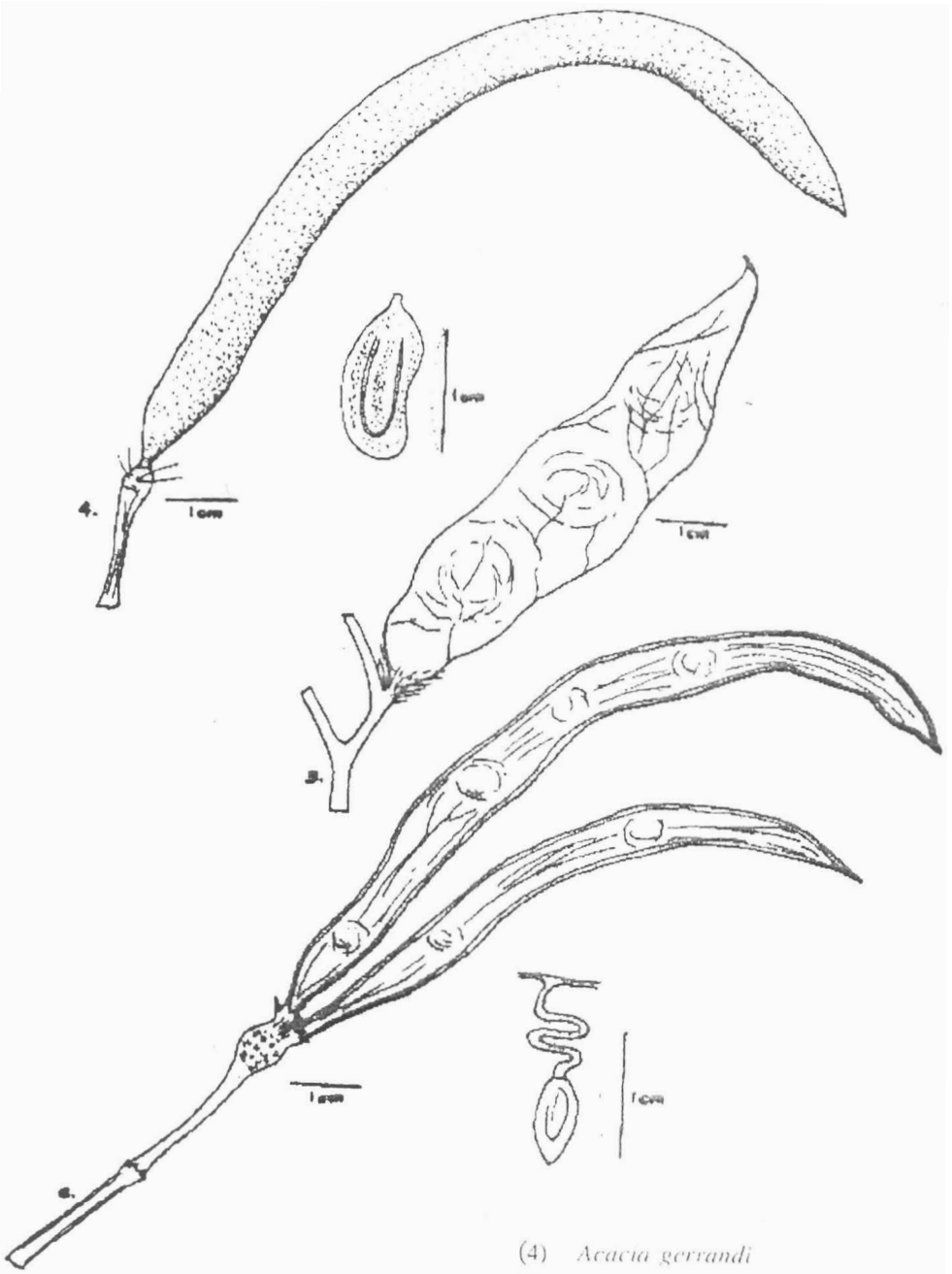
Ross, J.H.(1979). A conspectus of the African *Acacia* species. *Memoirs of Botanical. Survey South Africa*, 44: 83-65.

Sinha, S-C. (1971). Inflorescence morphology of *Acacia nilotica*. *Caribbean Journal of Science*. 11(1-2): 55-6

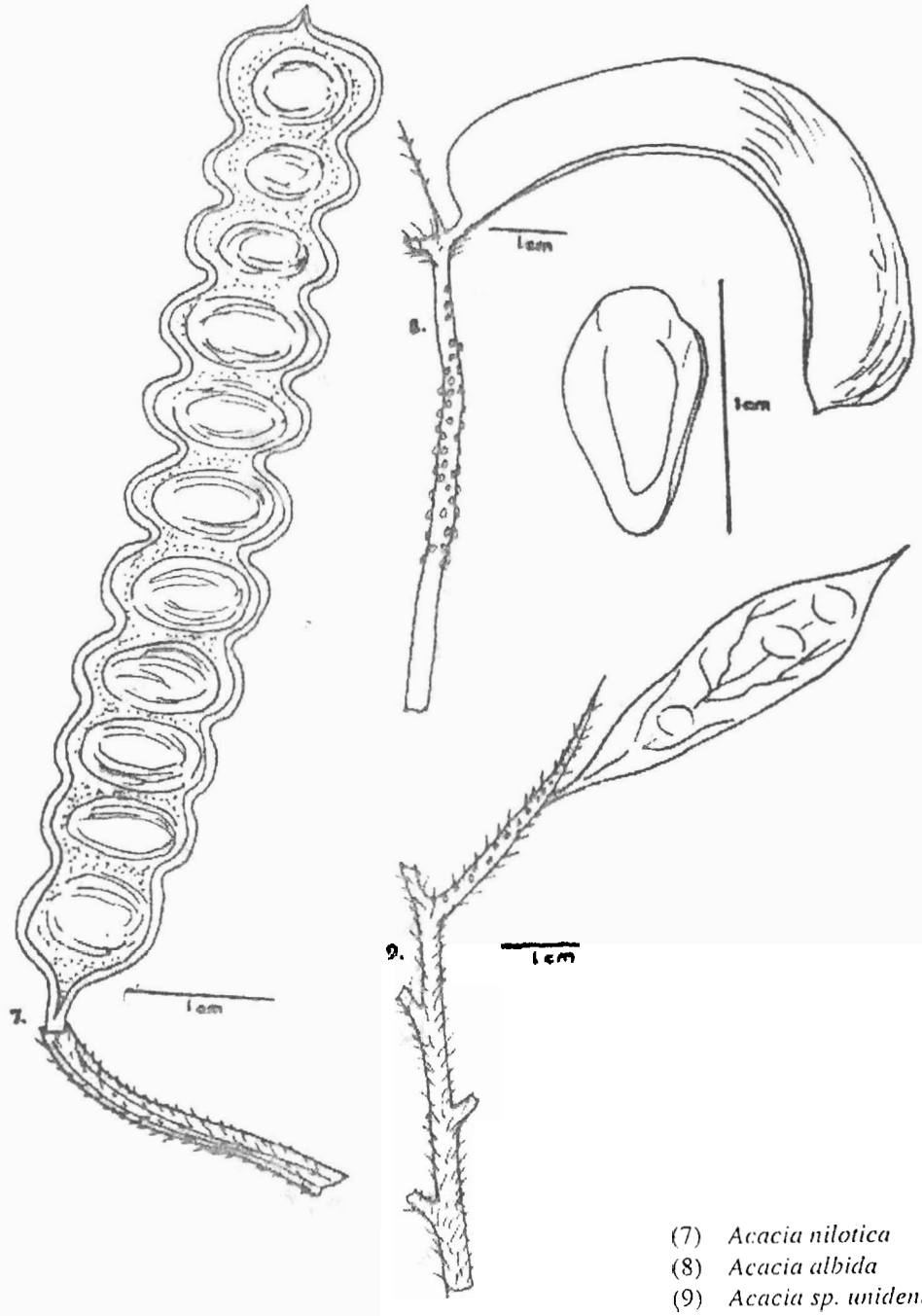


1. *Acacia auriculiformis* **A.Cum. ex Benth.**
2. *A. macrothyrsa* **Harms**
3. *A.macrostachya* **Reichenb. ex Benth.**

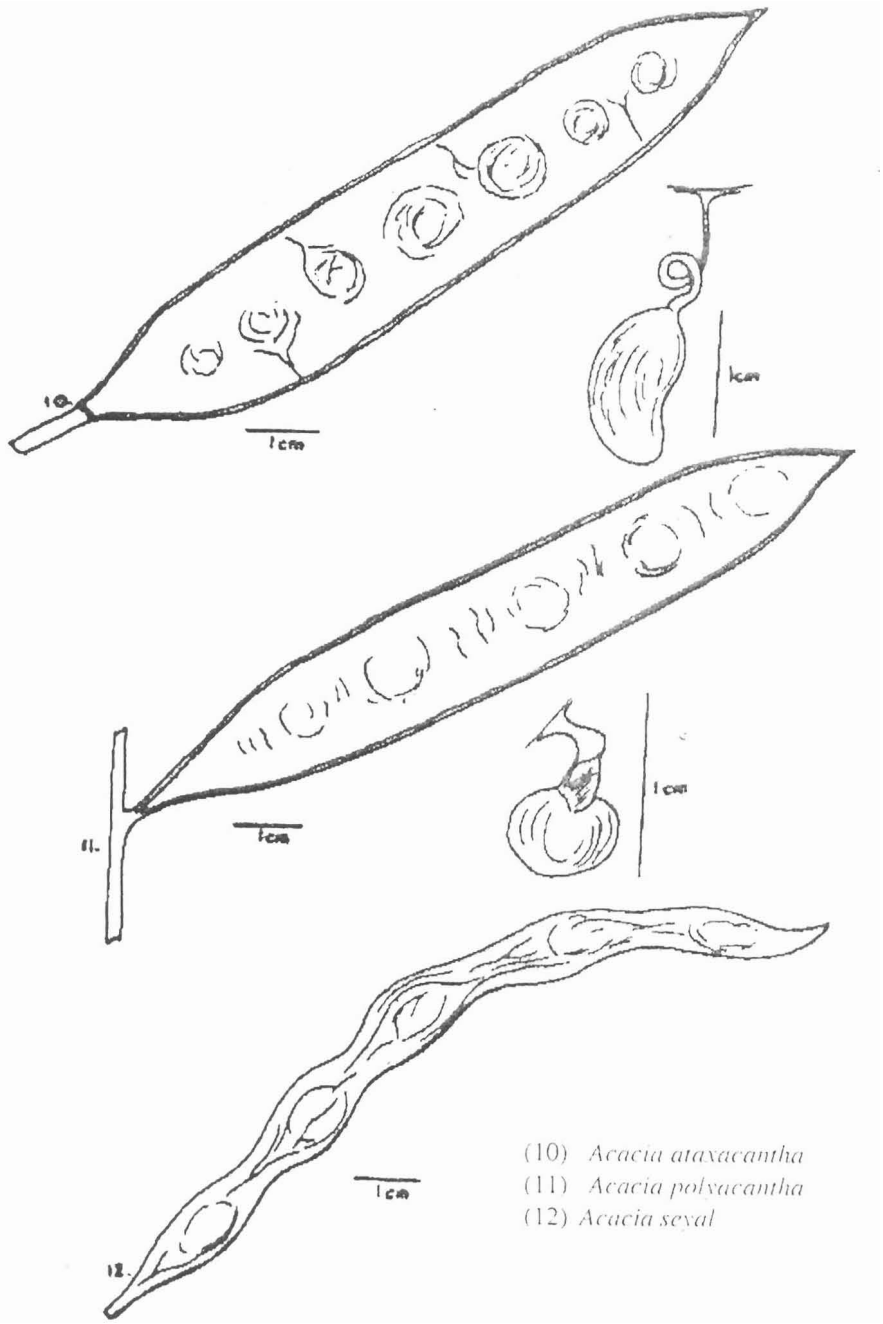
Figures 1-3. Fruits and infructescences of the *Acacia* species of Nigeria.



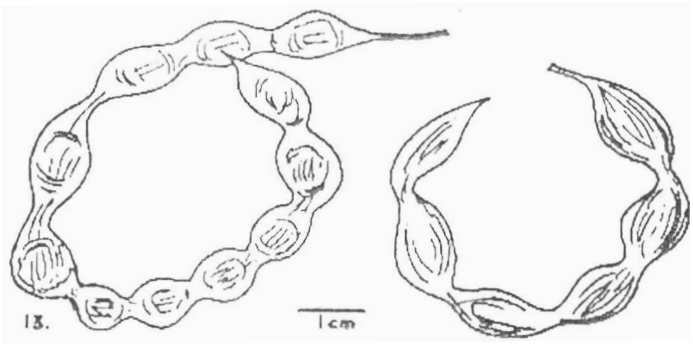
(4) *Acacia gerrandi*
(5) *Acacia auriculariis*
(6) *Acacia hockii*

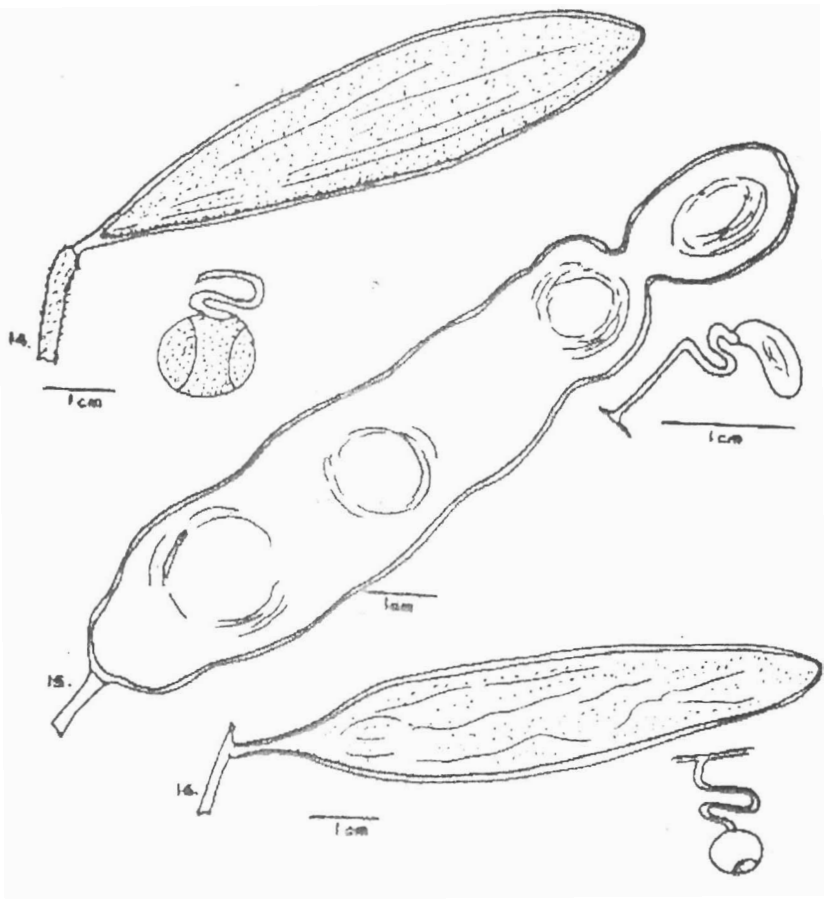


(7) *Acacia nilotica*
(8) *Acacia albida*
(9) *Acacia sp. unidentified A*

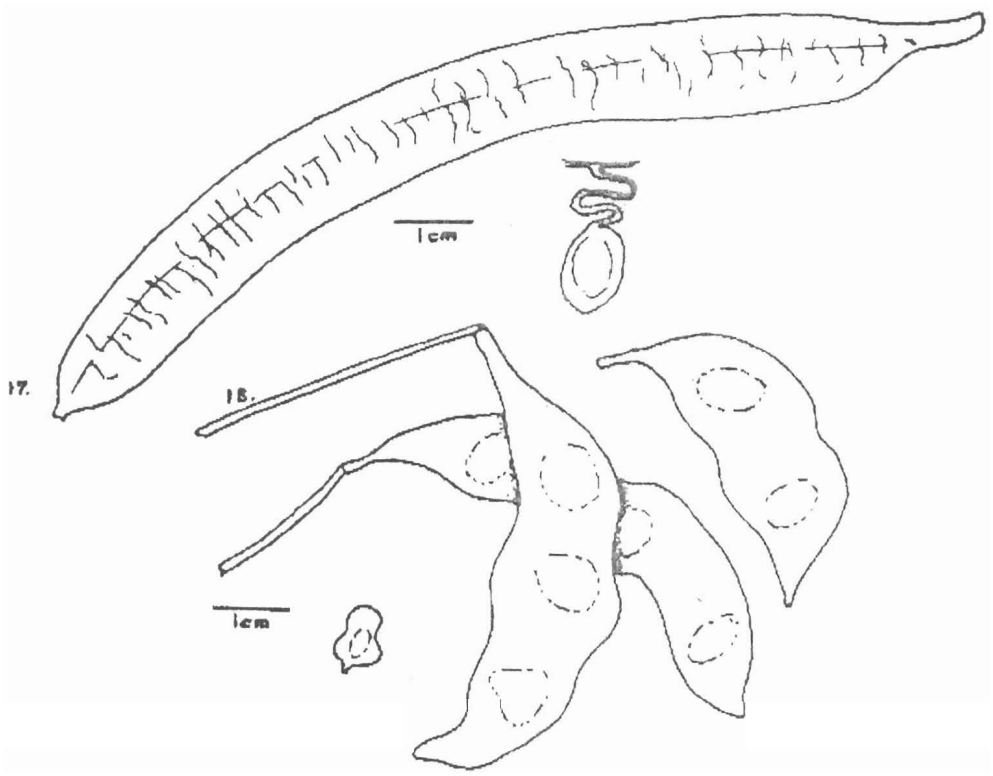


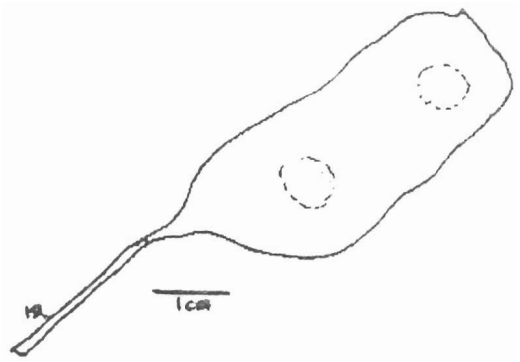
(10) *Acacia ataxacantha*
(11) *Acacia polyacantha*
(12) *Acacia seyal*



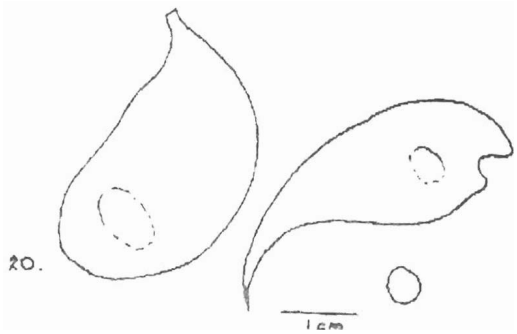


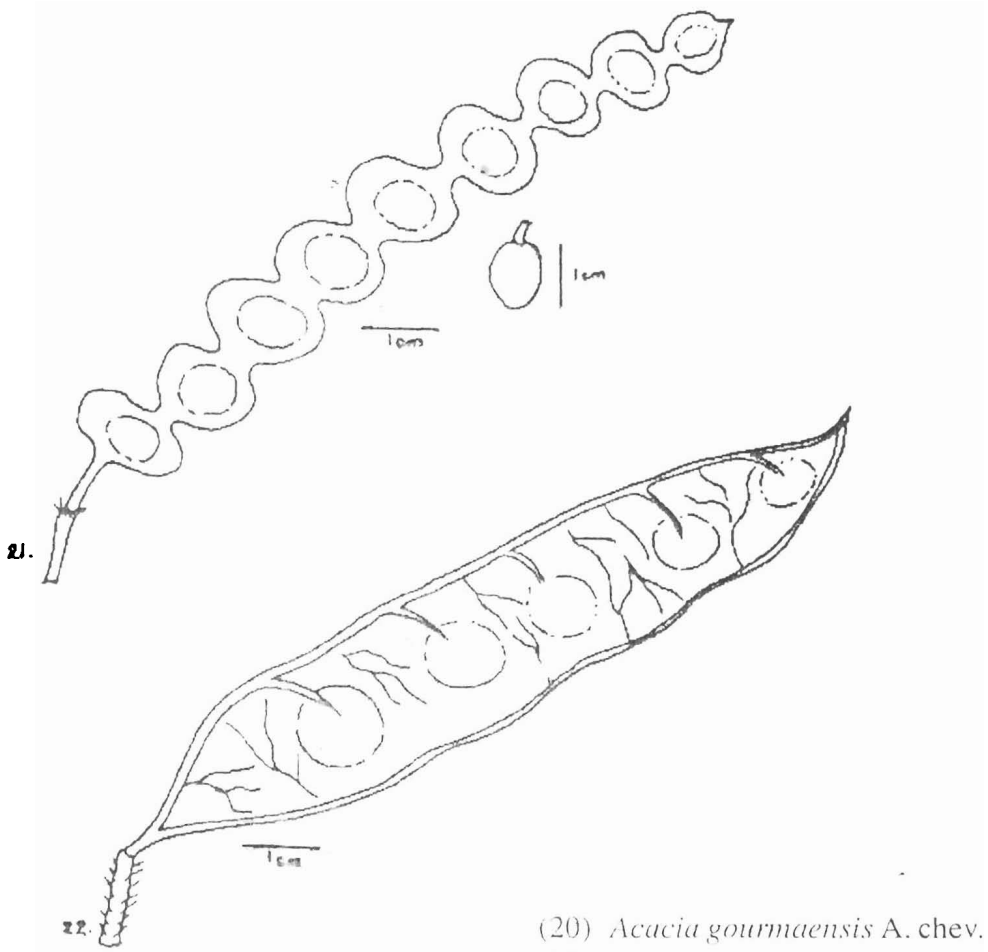
(13) *Acacia tortilis*
(14) *Acacia sp. novum*
(15) *Acacia kamerunensis*
(16) *Acacia sp* (Maiduguri)



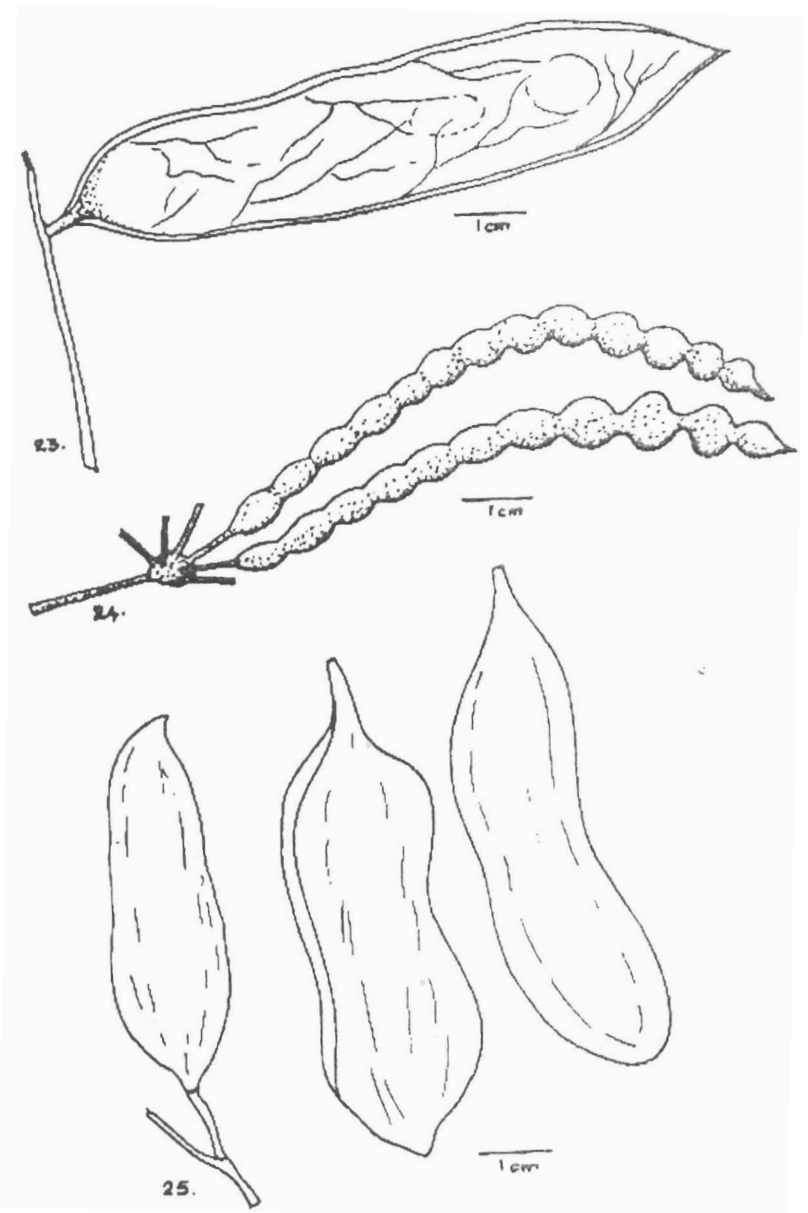


(17) *Acacia sieberiana var. sieberiana*
(18) *Acacia gourmaensis* A. chev.
(19) *Acacia gourmaensis* A. chev.

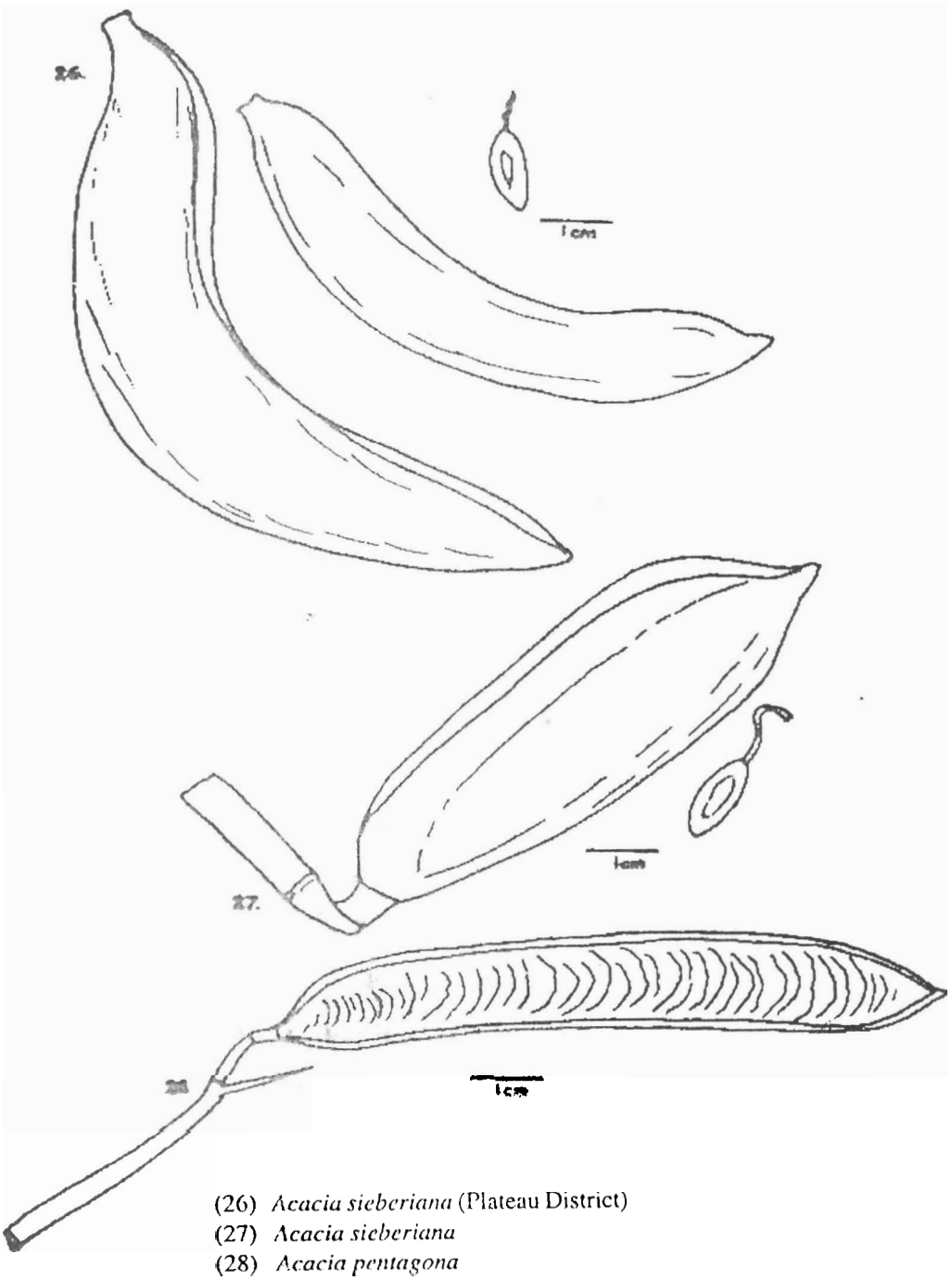




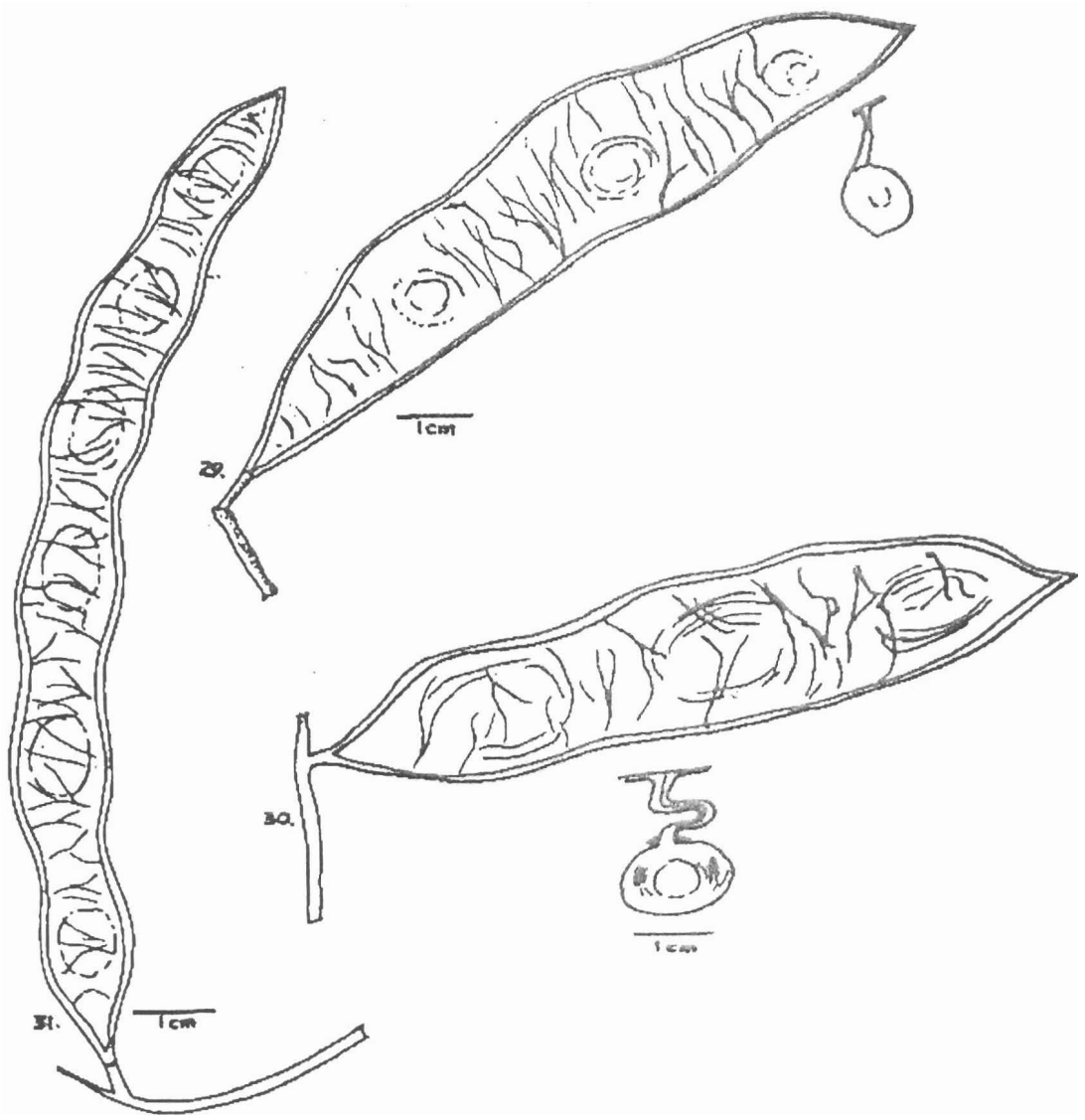
(20) *Acacia gourmaensis* A. chev.
(21) *Acacia nilotica* var. *nilotica*
(22) *Acacia erythrocalyx*



(23) *Acacia senegal*
(24) *Acacia nilotica*
(25) *Acacia sieberiana* var. *villosa*



(26) *Acacia sieberiana* (Plateau District)
(27) *Acacia sieberiana*
(28) *Acacia pentagona*



(29) *Acacia schweinfurthii*
(30) *Acacia dudgeoni*
(31) *Acacia dudgeoni*

Editor's Note:

This article has appeared in Volume 22(No.2) December, 2009 of NJB at pages 317-329 but without illustrations (Figs. 1-31). The error is highly regretted.