CONTRIBUTION TO THE KNOWLEDGE OF NIGERIAN MEDICINAL PLANTS XI. PRELIMINARY PHYTOCHEMICAL SCREENING OF TWO COMMON NIGERIAN PLANTS, MUSA SAPIENTUM (BANANA) AND OXYTHENANTHERA ABYSSINICA MUNRO (BAMBOO)

By

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Musa sapientum (Musaceae) and Oxytenanthera abyssinica Munro (Gramineae), are two very common plants in the humid parts of Nigeria. The banana species have been studied in some other countries in connection with their nutritive value, the bamboo in connection with its utilisation in the paper industry. No attention has been paid to our knowledge to any of these two species of Nigerian origin.

In general Murray et al. (1968) reported on the *Musa cavendishii* present alcohols. Askar et al. (1972) on the amines, Sgarbieri (1966) defined the amino acids in *Musa sapientum* and *M. cavendishii*. Askar et al (1972) reported on two major proteins, Maia et al (1970) on the presence of some tryptophane derivatives. etc.

In the peel are present predominantly phenolic catecholamines, tyrosine, etc. Maia (1970) found also flavonoids and some to the hikimic acid pathway close standing phenols.

During the development stage and ripening, protopectines and pectines are present (Conrad, 1930). Tannins seem to play an important role in ripening of banana (Harris and Poland, 1937).

The colourful bracts of banana flowers are rich in anthocyanins (Simmonds, 1954). Pulp and peel contain small amounts of fatty acids, their aldehydes and some waxes (Groisbois and Mazliak, 1962, etc.). The parts of the peel exposed to the sun produce a series of flavonoids (Tronchet, 1970), etc. From the triterpenoid group, sterols and some triperpenes were reported (Knapp and Nicholas, 1969, 1970, etc.). The nutritive value of the edible banana is based on the presence of large amount of carbohydrates. Physiologically important is the vitamin C present in ripe (not over-riped) fruits. Darkening of the fruits testifies for a strong enzyme activity, especially of the oxidoreductases type.

From the "bamboo" species, mainly those of Asian origine have been investigated. The only one Nigerian species, *Oxytenanthera abyssinica* Munro has been omitted.

It may be very difficult to compare the results published on other species with the Nigerian one. Throughout the world, there are about 50 genera with 1.250 species of bamboo.

The organic acids are very abundant and may be derived from the shikimic acid pathway, some of them being polymerised to the bamboo lignin. Several amino acids and proteins were reported too (Su et al, 1969; Mizuno, 1968, etc.). Saccharides of different type are present, like e.g. pentosanes (Mahanta, 1974). From physiological point of view, the presence or absence of alkaloids may be for us of interest. Only a few reports deal with this point all of them referring to other species than that one growing in Nigerian (Fujii, 1955).

From the triterpenoids, bamboo shoots were found to contain sterols and esters (Beri et al, 1970; Oka et al, 1973), the major being the sitosterol. Ohmoto (1970) isolated some other triterpenes.

Among the papers published on bamboo species, there were also mentioned compounds of other types, e.g. phenols and phenolic compounds (Tozabuero, 1943), aldehydes and ketones (Tarkayoshi, 1956). The bamboo shoots contain complex of lipids (mainly fatty acids). Also vitamin C was reported in the shoots (Kitagawa, 1971).

Experimental part

Amines

extraction: aqueous acid medium and passed into ammoniacal ether (as alkaloids)

PC: ascending solvent system:n-butanol-acetic acid-water (120:30:50)
descending:solvent system: isopropanol-1M ammonium hydroxide-water (200:10:20)

detection: ninhydrine spray reagent
nitroprusside spray reagent
Dragendorff's spray reagent

Indole derivaties

extraction: as for alkaloids
test tube:
detection: in UV light and p-dimethylaminobenzaldehyde reagent used also as spray reagent
TLC: silicagel: solvent system: ethyl acetate-methanol—water (150:26:19)

PC: solvent system: as for TLC
detection: TLC, PC: p-dimethylaminobenzaldehyde spray reagent

Alkaloids

extraction: aqueous acid medium and passed into ammoniacal ether respectively (as usual for alkaloids)

test tube:
precipitating reagents used:
Dragendorff
Meyer
Picric acid
Reineckate salt
Scheibler

colouring reagents used:
Erdmann (Watiez, ternon, 1942)
Marquis
Wasicky

TLC: silicagel: solvent system: ethyl acetate-methanol-water (150:26:19) (Kucera, Marquis, Kucerova, 1927)

PC: paper impregnated with sodium citrate buffer: solvent system:n-butanol-1% aqueous citric acid (90:10)

detection TLC, PC: Munieur-Macheboeuf's spray reagent (Stahl, 1966) Dragendorff's spray reagent

Pigments

Anthocyanins:
test tube:
detection: natural colour
TLC: silicagel: solvent system: ethyl acetate-formic acid—water (80:10:10)

detection: natural colour

PC: solvent system: as above
detection: as above

Carotenoids

test tube:
detection: conc. sulphuric acid
TLC: silicagel:solvent system: n-hexane-benzene (70:30)
detection: antimony (III) chloride spray reagent

Chlorophylls

TLC: silicagel: solvent system: petroleum ether-acetone-n-propanol (90:10:0.45)

detection: natural colour

Flavonoids

test tube:
detection: Wilson-Taubock reaction (Wilson, 1939; Taubock, 1942) Shinoda reaction (Shinoda, 1928)
Pew reaction (Pew 1948)

TLC: solvent system: ethyl acetate-methanol-water (100:20:10) (run 3x) or
n-butanol-acetic acid-water (40:10:50)
detection: exposure to ammonia vapour and spray with bis-diazotised benzidin spray reagent

Phenols

extraction: residue of alcoholic extract taken in alkaline medium, purified with ether, acidified and taken in ether

TLC: silicagel: solvent systems : a) benzene-ethyl acetate (95:5) (Kucera, Kucerova, 1974)
b) hexane-ethyl acetate (95:5)
c) chloroform-ethyl acetate-formic acid (50:40:10)

detection: Barton's spray reagent (Kucera, Kucerova, 1974)

Tannins

extraction: methanolic extract (Luckner, 1966)
test tube:
detection: iron (III) chloride solution:gallotannins vanillin reagent and HCL: catechins bromine water in excess

Fractionation and identification of tannine types according to Watiez, Sternon (1942).

TLC: silicagel: solvent system: benzene-methnol-formic acid (95:25:1)
PC: solvent system: two dimensional: 1st rn: 2% aqueous acetic acid; 2nd run:n-butanol -acetic acid-water (60:15:25)

detection: vanillin spray reagent (Luckner, Bessler, Luckner, 1969)

Triterpenoids

extraction: glycosides and aglycones: methanolic extraction without hydrolysis of material defatted by ether (Kucera, 1976)

test tube
detection: Liebermann-Burchard's reagent (reagent used for detection of steroid skeleton, reacting also with many sterols and triterpenoids (Wichtl, 1971)

triterpenoid saponins:
test tube:
detection: (a) frothing of aqueous extract
(b) haemolysis of erythrocytes
PC: solvent system: n-butanol-acetic acid-water (40:10:50)
detection: on blood agar plate
PC-cholesterol barrier (Kucera, 1976)

CONCLUSIONS

Concerning the amines, the possible detection of tryptamine in all three studied parts of *Musa sapientum* (pink colour by Dragendorff's reagent) is of some interest. In the *Oxytenanthera,* the slow reaction with ninhydrine may indicate the presence of secondary amines, but the detection with nitroprusside reagent failed to be positive. All studied parts of *Musa* and the leaf of *Oxytenanthera* Contain indole derivatives. The reaction with p-dimethylaminobenzaldehyde, positive only in the case of free position 2 of the indole nucleus, may indicate the tryptamine detected in the *Musa.*

A very extensive study showed the absence of alkaloids in Nigerian *Musa* and their presence in the leaf of *Oxytenanthera.*

From the pigments (anthocyanins, carotenoids, chlorophylls and flavonoids) the flavonoids were not detected in fresh leaf of *Musa.* In the flowers, bracts and the peel of *Musa* are apparently present flavons and flavonoles as reported already by Tronchet (1970). In the *Oxytenanthera* the results were not identical.

Mixed catechin tannis and protocatechins are present in the *Musa* leaf, pure and mixed catechins and protocatechin in the peel and gallocatechins in the pulp (according to the sceening method after Waties and Sternon, 1942). In *Oxytenanthera* gallotannins were detected in leaf and stem but were absent in the root, which contained on the contrary catechins.

The reaction of steroid skeleton (Liebermann-Burchard's reagent), positive also with some steroles and triterpenoid saponins, proved the presence of these compounds in the peel of *Musa* (leaf and pulp only traces), while in the *Oxytenanthera* it was positive in leaf and stem. Using haemolysis, saponins were present only in the *Oxytenanthera* root. None of the studied parts of *Musa* caused haemolysis.

RESULTS

Reagent	*Musa*			*Oxythenanthera*		
	leaf	*peel*	*pulp*	*leaf*	*stem*	*root*
AMINES						
Primary (ninhydrine)				+ (slow)	0	+
secondary (nitroprusside)				0	0	0
tertiary (Dragendorff)	+	+	+	+	+	+
tryptamine	+	+	+			
INDOLE DERIVATIVES						
p-aminobenz-aldehyde +	+	+	+	+	0	0
ALKADOIDS precipitating reagents:						
Meyer's	0	0	0	+	0	0
picric acid	0	0	0	+	0	0
Reineckate	0	0	0	+	0	0
Scheibler's	0	0	0 a	+	0	0
			e	+	0	0
colouring reagents:						
Erdmann's	0	0	0	a general change to brown		
				e +	0	0
Marquis'	0	0	0	a +	0	0
				e +	0	0
Wasicky's	0	0	0	a +	0	0
				e +	0	0
Dragendorff's	0	0	0	+	0	0
(a = aqueous extract, e = ethereal extract)						
TLC	0	0	0	+	0	0
PC	0	0	0	+	0	0
PHENOLS TLC	+	+	+	+	+	+
TANNINS test tube						
gallotannins	+	+	+	+	+	0
catechins	++	++	±	0	0	+
TLC*				0	0	+
PC*				0	0	+
* = catechins						
TRITERPENOIDS Liebermann-Burchard's	±	++	±	±	+	0
saponins frothing	slight, non-persistant froth			0	0	0
haemolysis test tube	0	0	0	0	0	±
PC	0	0	0	0	0	+
PC-cholesterol barrier	0	0	0	0	0	+

Table 1 Analytical results on Musa and Oxytenanthera

	Musa						*Oxytenanthera*
	leaf		*flower*	*bract*	*peel*		
	fresh	*dry*	*fresh*	*fresh*	*unripe*	*ripe*	*leaf*
spot tests							
anthocyanins	0		+	+		0	0
carotenoids	+		0	0		0	+
flavonoids:							
Wilson-Taubock	0		+	0			
Shinoda	0		+	+		+	0
Pew	0		+	0		0	0
TLC							
anthycoanins	4*	4	1	4–5	4	1	5
carotenoids	4	1	0	1	0	0	4
chlorophylls	2	2	1	2	2	0	2
flavonoids	0	3	3	4	5	3	3

*==number of spots

Table 2 Analytical results on Musa and Oxytenanthera

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