Comparative Chromatographic Analysis of Ethanolic Extracts of Leaves and Stem-Bark of *Piptadeniastrum africanum* (Hook.f.) Brenan and *Cathormion altissimum* (Hook.f.) Hutch. & Dandy

*1YOUKPARIGHA, FO; 2NYANANYO, BL

1Department of Biological Sciences, Faculty of Science, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria
2Department of Plant Science and Biotechnology, Faculty of Science, University of Port Harcourt, Port Harcourt, Rivers State, Nigeria

*Corresponding Author Email: felix.1968.youkparigha@gmail.com; Tel: 08037093371

**ABSTRACT:** This study investigated the flavonoid compounds present in the ethanolic extracts of leaves and stem-bark of *Piptadeniastrum africanum* and *Cathormion altissimum* using Chromatographic technique with a view to assessing their degree of relatedness. The upper phase of Butanol Acetic Acid Water (BAW) solvent in the ratio of 4:1:5 was used. Results showed that the plants have several flavonoid compounds in common such as Chalcone, Flavone, Flavonol, Anthocyanin, Aurone and Isoflavonol. It was however discovered that Flavanone was present only in the leaves and stem-bark of *P. africanaum* but was absent in *C. altissimum*. This discovery, which has never been previously demonstrated, may be taxonomically significant and may be justifying the placement of these plants in different genera; and by implication the monotypic status of genus *Piptadeniastrum* Brenan. There is need for further studies to determine the specific flavonoid compounds in these plants and especially the flavanone compounds that seem to be one of the chemical bases for the delimitation of the genera to which these plants belong.

**DOI:** [https://dx.doi.org/10.4314/jasem.v26i3.23](https://dx.doi.org/10.4314/jasem.v26i3.23)

**Open Access Article:** [https://pkp.sfu.ca/ojs/](https://pkp.sfu.ca/ojs/) This an open access article distributed under the Creative Commons Attribution License (CCL), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.


**Google Analytics:** [https://www.ajol.info/stats/bdf07303d34706088ffffffbc8a92c9c1491b12470](https://www.ajol.info/stats/bdf07303d34706088ffffffbc8a92c9c1491b12470)

**Copyright:** © 2022 Youkparigha and Nyananyo

**Dates:** Received: 10 January 2022; Revised: 22 February 2022; Accepted: 15 March 2022

**Keywords:** *Piptadeniastrum africanum*, *Cathormion altissimum*, flavonoids, Chromatography

*P. africanum* is an important medicinal forest tree endemic to tropical Africa. This tree which also occurs in the Niger Delta especially on river banks in the riverine areas of the rain forest is validly published as the only species in the genus *Piptadeniastrum* (Brenan, 1955; Hutchinson & Dalziel, 1958; Willis, 1985; Nyananyo, 2006). It is about 45-50 m high and 3-5 m in girth with conspicuous plank-like buttresses, straight bole, with fine fern-like foliage. It has copious flowers in panicles of spikes at the end of the shoots with conspicuous, lanceolate fruits ((Hutchinson & Dalziel, 1958; Bukhill, 1995; Nyananyo, 2006). It is however considered by some indigenous people in Bayelsa State as very closely related to *C. altissimum* which is also a forest shrub or tee of about 50 ft in family Fabaceae. It is the only species of the genus *Cathormion* represented in Nigeria (Keay, 1958). The plant occurs in all of tropical Africa including Nigeria, where it is commonly found in fresh water swamp forests and secondary forests. The leaves of the plant are alternate and bipinnately compound with 4-8 pairs of pinnae. Flowers are bisexual and the fruits are often spirally twisted or curved (Lemmens, 2006). The identification and classification of plants based on chemical characters is well known, especially in the establishment of consanguinity (Davies & Heywood, 1973; Stace, 1980; Wink & Waterman, 1999). It has been acknowledged to be better than traditional morphological and anatomical methods due to the ease and flexibility of the methodology (Erdtman, 1963; Datta, 1988; Singh, 2016). One group of phytochemicals that is useful in this direction is the secondary metabolites such as flavonoids, alkaloids, terpenes, glycosides and saponins which play essential roles that enable plants to survive in their environments and reproduce successfully (Wink, 2003; Singh, 2016). The taxonomic value of phytochemicals stems partly from the fact that their
Comparative Chromatographic Analysis of Ethanolic Extracts of Leaves…..

The composition is very distinctive and varies widely amongst plants (Dias, 2012; Carlos & Imai, 2017). Flavonoids form one of the largest and most widespread groups of secondary metabolites and are of taxonomic significance (Wink & Waterman, 1999). The presence or absence of flavonoids compounds, for example, brought about the removal of Caryophyllaceae and Molluginaceae from ten other families of the order Centrospermae to a different order which does not correspond to existing anatomical evidence (Erdtman, 1963). Most works on *P. africanum* have concentrated on the phytochemical analysis of its leaves and stem-bark extracts with a view to assessing their antimicrobial, anti-candidosic, anti-arthritis, analgesic and anti-inflammatory properties (Brusotti *et al*., 2013; Dawe *et al*., 2016; Jiofack, 2008) with no known studies on its taxonomy in the public domain. The importance and effectiveness of paper chromatographic method in systematics is well established (Alston & Turner, 1959). This work is therefore aimed at assessing the degree of relationship between *P. africanum* and *C. altissimum* based on their phytochemical composition using the tool of paper chromatography.

**MATERIALS AND METHODS**

**Study Area:** The study was carried out in Bayelsa State which is made up of eight Local Government Areas. The state is located within latitudes 04º15' North and 05º23' south and longitudes 05º22' West and 06º45' East. It is bounded by Delta State on the North, Rivers State on the East and on the west and south by the Atlantic Ocean (Figure 1).

![Figure 1: Bayelsa State, showing the Local Government Areas (Inset: Map of Nigeria showing Study Area).](image)

The state has both tropical monsoon and tropical rainforest climates characterized with high humidity, dense vegetation and abundant precipitation. The wet season is not less than 340 days. The mean monthly temperature ranges from 25 ºC - 31 ºC. The vegetation of the State is composed of four ecological zones - coastal barrier Island forests, mangrove forests, fresh water swamps and lowland rain forests. Ecological issues facing the study area (Bayelsa State) include soil and coastal erosion, oil pollution and flooding (Johnson, 2017). Some of the common tree species are *Raphia* spp, *Cleistopholis patens*, *Alstonia boonei*, *Elais guineensis*, * Irvingia gabonensis*, *Anthoceista* spp, *Vitex grandifolia*, *Cathomion altissimum*, *Treculia africana*, *Uapaca* spp, *Symphonia globulifera*, *Taminalia* spp, *Harungana madagascariensis*, and *Alchornea cordifolia* (Ihinmikaiye & Unanowo, 2018). PH of surface soils in parts of the state has been reported to be generally acidic with moderate 4.7 to high 6.4. (Ezekiel *et al*., 2017) There are several surface waters such as creeks, creeklets, streams and rivers. Most of these surface water bodies have their origin from the Nun River which is a distributary of river Niger (Kigigha *et al*., 2017).

**Collection and Identification of Plant Materials:** Samples of *P. africanum* and *C. altissimum* were collected from sites within the area of study. The plant specimens were morphologically identified in the Forest Herbarium Ibadan of the Forestry Research Institute of Nigeria (FRIN) and the Herbarium of the Department of Plant Science and Biotechnology, University of Port Harcourt, Rivers State. Voucher specimens of the plants were deposited in these herbaria for reference and further studies.

**Extraction Method:** A 10 g portion of the sample was extracted with 30 ml of 95% ethanol by boiling. This was decanted into a clean beaker and further vaporized on water bath to about 5-10 ml volume. The sample was picked up by capillary tubing and loaded into a...
Comparative Chromatographic Analysis of Ethanolic Extracts of Leaves...

Both plants under visible light and ultraviolet light after the chromatogram was sprayed with Ammonia solution (Table 2). The results, in Table 1, further showed that only the bark of *C. altissimum* lacked Anthocyanin, while Aurone was not found in the leaves of *C. altissimum* but these compounds were present in the bark and leaves of *P. africanum* respectively. These occurrences may not be of any taxonomic significance because it has been observed that different specimens of a plant may differ largely in chemical composition. This could be attributed to soil conditions, seasonal factors or infection-induced change in metabolism (Erdtman, 1963). This shows the importance of employing other sources of evidence to strengthen conclusions. Furthermore, results in Table 2 revealed a striking chemical difference between *P. africanum* and *C. altissimum* – the flavonoid compound Flavanone was detected both in the bark and leaf extracts of *P. africanum* but was not seen in *C. altissimum*. This restricted or unique occurrence of flavanone in *P. africanum* could be of taxonomic significance (Davies & Heywood, 1973; Wink & Waterman, 1999). The common presence of six flavonoid compounds may also be a chemical systematic evidence of their common ancestry; while the absence of flavanone in one of the plants i.e. *Cathormion altissimum* could be a clear evidence of the fact that the two plants do not belong to the same genus *Piptadeniastrum*.

### RESULTS AND DISCUSSION

The flavonoid compounds that were detected in the leaves and stem-bark extracts of *P. africanum* and *C. altissimum* under visible light and under ultra-violet light are presented in Table 1. Both plants contained Chalcone, Flavone, Flavonol, Anthocyanin, Aurone and Isoflavonol. Isoflavonol was detected only in the barks of the plants but was detected in the leaves of both plants under visible light and ultraviolet light after the chromatogram was sprayed with Ammonia solution (Table 2). The results, in Table 1, further showed that only the bark of *C. altissimum* lacked Anthocyanin, while Aurone was not found in the leaves of *C. altissimum* but these compounds were present in the bark and leaves of *P. africanum* respectively. These occurrences may not be of any taxonomic significance because it has been observed that different specimens of a plant may differ largely in chemical composition. This could be attributed to soil conditions, seasonal factors or infection-induced change in metabolism (Erdtman, 1963). This shows the importance of employing other sources of evidence to strengthen conclusions. Furthermore, results in Table 2 revealed a striking chemical difference between *P. africanum* and *C. altissimum* – the flavonoid compound Flavanone was detected both in the bark and leaf extracts of *P. africanum* but was not seen in *C. altissimum*. This restricted or unique occurrence of flavanone in *P. africanum* could be of taxonomic significance (Davies & Heywood, 1973; Wink & Waterman, 1999). The common presence of six flavonoid compounds may also be a chemical systematic evidence of their common ancestry; while the absence of flavanone in one of the plants i.e. *Cathormion altissimum* could be a clear evidence of the fact that the two plants do not belong to the same genus *Piptadeniastrum*.

### Table 1: Results of paper chromatography of samples using BAW (4:1:5)

<table>
<thead>
<tr>
<th>Sample</th>
<th>Flavonoids under visible light</th>
<th>Flavonoids under ultraviolet light</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaf of <em>C. altissimum</em></td>
<td>Chalcone, Flavone, Flavonol</td>
<td>Anthocyanin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chalcone, Flavone, Flavonol</td>
</tr>
<tr>
<td>Leaf of <em>P. africanum</em></td>
<td>Anthocyanin</td>
<td>Aurone</td>
</tr>
<tr>
<td></td>
<td>Chalcone, Flavone, Flavonol</td>
<td>Flavone, Chalcone</td>
</tr>
<tr>
<td>Bark of <em>C. altissimum</em></td>
<td>Aurone</td>
<td>Flavonol</td>
</tr>
<tr>
<td></td>
<td>Flavone, Flavonol, Chalcone</td>
<td></td>
</tr>
<tr>
<td>Bark of <em>P. africanum</em></td>
<td>Anthocyanin</td>
<td>Anthocyanin</td>
</tr>
<tr>
<td></td>
<td>Chalcone, Flavone, Flavonol</td>
<td>Flavonol, Chalcone</td>
</tr>
<tr>
<td></td>
<td>Flavonol, Chalcone, Aurone</td>
<td>Isoflavonol</td>
</tr>
</tbody>
</table>

### Table 2: Results of paper chromatography of samples using BAW (4:1:5) after chromatogram was sprayed with Ammonia solution

<table>
<thead>
<tr>
<th>Sample</th>
<th>Flavonoids under visible light</th>
<th>Flavonoids under ultraviolet light</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaf of <em>C. altissimum</em></td>
<td>Not detected</td>
<td>Chalcone, Flavone, Isoflavonol</td>
</tr>
<tr>
<td>Leaf of <em>P. africanum</em></td>
<td>Chalcone, Flavone, Flavonol</td>
<td>Isolavonol, Flavonol, Chalcone</td>
</tr>
<tr>
<td>Bark of <em>C. altissimum</em></td>
<td>Chalcone, Flavonol</td>
<td>Flavonol, Isoflavonol</td>
</tr>
<tr>
<td>Bark of <em>P. africanum</em></td>
<td>Chalcone</td>
<td>Flavone, Chalcone, Flavonol, Aurone</td>
</tr>
</tbody>
</table>
**Conclusion:** The comparative chromatographic analysis of ethanolic extracts of leaves and stem-bark of *P. africanaum* (Hook.f.) Brenan and *C. altissimum* (Hook.f.) Hutch. & Dandy showed that the plants were largely similar in their chemical composition with respect to flavonoid compounds. However, flavanone occurred only in the leaves and stem-bark of *P. africanaum*. This unique occurrence may be of taxonomic significance. Further studies to identify the specific flavanone compounds in *P. africanaum* is recommended.

**REFERENCES**


Dawe, A; Mbiatcha, M; Fongang, Y; Nana, WY; Yakai, F; Atuefack, G; Shaig, MA; Lubna, I; Ngadjui, BT (2016). Piptadenin, a Novel 3, 4-Secoooleane Triterpene and Piptadenamide, a New Ceramide from the stem bark of *Piptadeniastrum africanaum* (Hook.f.) Brenan. *Chem. Biodivers*, 14, 2


Ihinmikaiye, S; Unananaoni, OE (2018). Tree species structure and diversity in the lowland-rain forest zone of Bayelsa State. *JSNR*, 2(2), 126


