Cultural importance of wild edible plants in three sympatric communities: Agni, Akyé and Gwa in the Department of Alépé (Southeast of Côte d’Ivoire)

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Research Abstract

Background: Wild plants are plants that are neither cultivated nor domesticated by humans. This study aimed to assess the knowledge level about wild edible plants used in the communities living in the same area.

Methods: An ethnobotanical survey was carried out in ten different villages which are parts of three studied communities. Two sets of surveys were used. The first type was a house-to-house based survey on free lists interviews. The second type of survey was a walk-in-the woods with some key informants identified by the communities. Frequency of quotation, Smith’s index and cultural importance index were used to estimate the knowledge level of the communities. Venn diagram, Jaccard similarity index and the hierarchical clustering were used to compare the distribution of the knowledge in the communities. Whereas the Kruskal-Wallis test and the Mann-Whitney test were used to assess the significance of difference in plants used by the communities.

Results: Through the studied communities, 43 wild edible plants were collected. Myrianthus arboreus, Dacryodes klaineana, Elaeis guineensis, Piper guineense and Spondias mombin were the most salient. Twenty-two plants are shared by these communities. There is a significant difference concerning wild edible plants shared simultaneously by the three studied communities whereas there is no significant difference about the usage-category. Wild edible plants are used mainly as fruits and vegetables in the studied communities.

Conclusion: The three communities have a high knowledge of wild edible plants. Moreover, fruits and vegetables are the most important usage categories. Finally, the interactions between the three communities bring about the sharing of the knowledge.

Keywords: Alépé, Côte d’Ivoire, Dacryodes klaineana, fruit, Myrianthus arboreus, quantitative ethnobotany, vegetables
Background

Throughout the world, each community has developed its own culture which are expressed through the usage of plants (Bédiakon et al. 2018). In order to survive, humans consume plants and animals which contain energy, protein and vitamins (Atungbou 2020). Among those plants, wild edible plants play the main role in many cultures (Coé & Gaoue 2020). In most African countries, for instance in Benin (Goudégnon et al. 2017), in Uganda (Ojelel et al. 2019) and in Cameroon (Billong Fils et al. 2020), people in rural areas rely basically on wild edible plants for their daily’s food.

In Côte d’Ivoire, wild edible plants are associated with exotic plants in the diet of people (Gauthier-Béguin 1992). Before the introduction of exotic species, wild edible plants are parts of traditional culture (Ambé 2001). Unfortunately, the diet of rural people, is gradually changing due to the deforestation and its multiple consequences. For instance, the loss of some plant species, the over-exploitation of natural resources, pollution, and the anthropogenic climate change (Corlett 2016). This situation is becoming worse by the erosion of local wild edible plants and its knowledge (Ojelel et al. 2019). In Côte d’Ivoire the investigations on wild edible plants were based on listing (Kouamé et al. 2008, Nguessan et al. 2015), the nutritional values of local plants (Ehilé et al. 2018), the domestication of wild plants (Bédiakon et al. 2018) and the socio-economic value of wild edible plants (Kouamé et al. 2016), through different regions. These investigations had an intracultural background. Despite these investigations, a little attention is given to sympatric ethnobotanical studies on wild edible plants. We can point out that such studies contribute to the understanding of the reasons why people consume one wild edible plant than other. It also gives the reason of the fall into disuse of a given plant, for instance with changing eating habits (Pardo-de-Santayana et al. 2007). Cognitive salience is an approach which allows the knowledge holders to state the plant name that comes to his/her mind, until they are exhausted in a given domain (Ojelel et al. 2019). This approach assesses the knowledge level of the informants in a given cultural domain. In addition, culture is a shared system of knowledge and competence among a group of people (Tardio & Pardo de Santayana 2008). The cultural importance of a plant in a given usage category can be defined as the preference of a plant used by the members of a community in a given usage category.

The communities of the study area have been living in close contact for many centuries. The Agni and the Akyé communities belong to the great Akan ethnic group (Kossonou & Assanvo 2016). Whereas the Gwa communities were adopted in the great Akan ethnic group later on (Goly 2010, Aka 2011). In this context, these communities have the same natural resources. Based on the principle that any usage of a plant is a cultural expression, we assume that the communities of different origins, who live in the same geographical area, could have different food habits. We also assume that their long proximity allows them to share their knowledge in a given domain.

This study aimed (i) to assess the diversity of wild edible plants used by the studied communities and knowledge level of the people and (ii) to determine the cultural importance of the usage category of wild edible plants.

Material and Methods

Study area

The study area is located in the Southeastern part of Côte d’Ivoire between 5°13’04.49”-5°55’22.06” N and 3°25’25.25”-3°57’46.64” W (Fig. 1). The climate of this area is equatorial and humid, characterized by four alternative seasons (two rainy seasons and two dry seasons). The annual rainfall ranges from 1,200 to 1,600 mm. The annual temperature is 26.4°C. The vegetation is a Guinean rainforest characterized by Eremospatha macrocarpa (Mann. & Wendl.) Wendel and Diospyros mannii Hiern (Guillaumet & Adjanohoun 1971).

The study area harbors three sympatric communities the Agni, the Akyé and the Gwa. All of them are unequally spread within five sub-prefectures (Aboisso-Comœo, Alépé, Allosso, Danguira and Oghlwapo). These communities have been settled in their current territory since the beginning of the 18th century. The Agni and the Akyé communities came from the actual Ghana (Diabaté 2013, Adjéliou 2016). Whereas the Gwa community came from Liberia (Goly 2010, Aka 2011). At their arrival, these communities were in conflict for their curr.

Ethnobotanical survey

Ten (10) villages were surveyed (three villages in the Agni community, four villages in the Akyé community and three villages in the Gwa community). The ten villages were visited in 13 trips from September 2017 to August 2019. The survey was carried out in two steps.
Step 1. During house-to-house approach, men and women have been interviewed randomly, individually, or collectively. Questions were asked to collect information about the parts of wild edible plants used, their local names, and how they were used (fruit, vegetables, beverages, seasoning). At the end of the interview, we asked for demographic information including marital status and ethnic group of spouses.

Step 2. From the previous list of interviewees, 10 key knowledge holders were selected (three in the Agni community, four in the Akyé and three in the Gwa community), based on the high number of wild edible plants they mentioned. For this step, knowledge holders were interviewed during a walk-in-the-wood approach in the surrounding bushes. During these walks, herbarium vouchers of listed plants were collected. Then, the lists collected during the first step added to those collected in the walk-in-the-wood was associated. All herbarium vouchers were identified in the laboratory of Botany of NANGUI ABROGOUA University.

Data analysis
Abundance and intercultural relationship of wild edible plants
All knowledge holder’s data were grouped per community. The specific richness of wild edible plants exclusive to one community was determined. Then, wild edible plants shared by two communities and simultaneously shared in the three communities, were determined. The result of the survey was obtained with Venn diagram using the VennDiagram package (Chen & Boutros 2011). Venn diagram shows the overlap of wild edible plants in the studied communities.
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In addition, the Jaccard similarity index (Jaccard 1908), was performed to determine the similarity usage on wild edible plants used by the studied communities. It ranges from 0% (low similarity) to 100% (maximum similarity).

Knowledge level of wild edible plants

In order to obtain the knowledge level of each wild edible plant, the Smith’s index (Sutrop 2001, Borgatti 2015), was performed using Anthropac 4.0. It is based on the cognitive salience (Sa) and the frequency of quotation (Fq). The cognitive salience ranges from 0 (low cognitive salience) to 1 (high cognitive salience). Whereas the frequency of quotation ranges from 0% to 100%. Thus, the cognitive salience and the frequency of quotation are subdivided in three knowledge levels:

- 0.32 < Sa < 0.72 and Fq > 50% mean that wild edible plants are well known.
- 0.11 < Sa < 0.33 and 25% < Fq < 50% means that wild edible plants are moderately known.
- 0.01 < Sa < 0.12 and Fq < 25% mean that wild edible plants are little known.

Kruskal-Wallis test has used to compare wild edible plants shared by the three communities. This test determines the intercultural convergence about wild edible plants, simultaneously shared by these communities. All statistical analyses were performed with R software (version 4.0.5).

Cultural importance of the usage category

The cultural importance index (CI) defined by Tardio & Pardo-de-Santayana (2008), was assessed in order to determine the spreading of the usage (number of informants) of wild edible plants, but also the diversity of their usages (number of usage categories). The cultural importance of a given plant ranges from 0 (low usage of plants) to 1 (high usage of plants).

In addition, the Mann-Whitney test was used to compare the usage category of wild edible plants between the studied communities.

Distribution of the knowledge

Hierarchical clustering was performed using different packages (Weller 2005) including FactoMineR to perform the analysis and Factoextra for visualization of the analysis. Hierarchical clustering shows the distribution of wild edible plants through the communities. This hierarchical clustering is based on the preference of each wild edible plant in each community. This preference takes in account the frequency of quotation of each plant.

Results

Demographic profile of informants

A total of 445 knowledge holders were surveyed (Table 1). They are distributed among 112 knowledge holders in the Agni community (45 men and 67 women), 111 in the Akyé community (52 men and 59 women) and finally 222 knowledge holders in the Gwa community (100 men and 122 women). Of the knowledge holders surveyed, 113 (25.39%) were between 18 and 39 years. Two hundred and thirty-five (52.81%) knowledge holders were between 40 and 62 years. Finally, 97 (21.80%) knowledge holders were between 63 and 87 years.

Abundance and intercultural relationship of wild edible plants

Forty-three (43) wild edible plants were collected. They are distributed in 39 genera and 25 families of which Malvaceae contained. nine species (18.60%), Annonaceae, Arecaceae and Phyllanthaceae with three species per family (6.98%), are the most represented. 79% of the species collected are trees and shrubs, 12% lianas 9% herbaceous.

A total of 31 wild edible plants were mentioned by the Agni community, 32 plants by the Akyé community and finally 34 wild edible plants were mentioned by the Gwa community. Among these collected plants, 22 (55.16%) were common to the three communities. Six wild edible plants are exclusively consumed by the Gwa community. In addition, three species are only consumed by the Agni community. Finally, two species are consumed by the Akyé community. Fig. 2 shows the abundance of wild edible plants which are distributed among these communities. Jaccard similarity index is assessed. It ranges from 58.54% to 70.27%. These values indicate that there is a high similarity between wild edible plants used in the studied communities (Table 2).
Table 1. Demographic profile of informants (N=445)

| Ethnic group | Age group | No. of informant | No. of informant [n (%)] |
|--------------|-----------|------------------|--------------------------|
|              | [18;39]   | [40;62]          | [63;87]                  |
| Agni men     | 10        | 31               | 4                        |
| Agni women   | 18        | 41               | 8                        |
| Akyé men     | 14        | 27               | 11                       |
| Akyé women   | 21        | 26               | 12                       |
| Gwa men      | 19        | 45               | 36                       |
| Gwa women    | 31        | 65               | 26                       |

| Ethnic group | Age group | No. of informant | No. of informant [n (%)] |
|--------------|-----------|------------------|--------------------------|
|              |           |                  |                          |

| Ethnic group | Age group | No. of informant | No. of informant [n (%)] |
|--------------|-----------|------------------|--------------------------|
|              |           |                  |                          |

| Ethnic group | Age group | No. of informant | No. of informant [n (%)] |
|--------------|-----------|------------------|--------------------------|
|              |           |                  |                          |

| Ethnic group | Age group | No. of informant | No. of informant [n (%)] |
|--------------|-----------|------------------|--------------------------|
|              |           |                  |                          |

| Ethnic group | Age group | No. of informant | No. of informant [n (%)] |
|--------------|-----------|------------------|--------------------------|
|              |           |                  |                          |

| Ethnic group | Age group | No. of informant | No. of informant [n (%)] |
|--------------|-----------|------------------|--------------------------|
|              |           |                  |                          |

| Ethnic group | Age group | No. of informant | No. of informant [n (%)] |
|--------------|-----------|------------------|--------------------------|
|              |           |                  |                          |

| Ethnic group | Age group | No. of informant | No. of informant [n (%)] |
|--------------|-----------|------------------|--------------------------|
|              |           |                  |                          |

| Ethnic group | Age group | No. of informant | No. of informant [n (%)] |
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|              |           |                  |                          |

| Ethnic group | Age group | No. of informant | No. of informant [n (%)] |
|--------------|-----------|------------------|--------------------------|
|              |           |                  |                          |

| Ethnic group | Age group | No. of informant | No. of informant [n (%)] |
|--------------|-----------|------------------|--------------------------|
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| Ethnic group | Age group | No. of informant | No. of informant [n (%)] |
|--------------|-----------|------------------|--------------------------|
|              |           |                  |                          |

| Ethnic group | Age group | No. of informant | No. of informant [n (%)] |
|--------------|-----------|------------------|--------------------------|
|              |           |                  |                          |

| Ethnic group | Age group | No. of informant | No. of informant [n (%)] |
|--------------|-----------|------------------|--------------------------|
|              |           |                  |                          |

| Ethnic group | Age group | No. of informant | No. of informant [n (%)] |
|--------------|-----------|------------------|--------------------------|
|              |           |                  |                          |

| Ethnic group | Matrimonial status | No. of informant [n (%)] |
|--------------|--------------------|--------------------------|
| Single Agni  |                    | 82(73.21)                |
| Agni married to Agni | 25(22.32)            |
| Agni married to Akyé  | 4(3.57)               |
| Agni married to Gwa  | 1(0.89)               |
| Single Akyé   |                    | 42(37.84)                |
| Akyé married to Akyé | 59(53.15)            |
| Akyé married to Gwa | 2(1.8)                |
| Single Gwa    |                    | 89(40.09)                |
| Gwa married to Akyé  | 100(45.05)           |
| Gwa married to Agni | 31(13.96)            |
| Gwa married to Gwa  | 2(0.9)               |

Table 2. Matrix of the similarity of wild edible plants used in the studied communities

|        | Agni | Akyé |
|--------|------|------|
| Agni   | 70.27|
| Akyé   | 58.54|
| Gwa    | 65.00|

Figure 2. Venn diagram comparing the abundance of wild edible plants used in the studied communities

Knowledge level of wild edible plants in each community

Knowledge levels differ from one community to another. From the 43 wild edible plants, only five (11.63%), have high cognitive salience and high frequency of quotation values, including *Myrianthus arboreus* P.Beauv [Akyé (Sa=0.72; Fq=89.19%)] Fig. 3a, *Dacryodes klaineana* (Pierre) H.J.Lam [Agni (Sa=0.58; Fq=80.18%)] Fig. 3b, *Elaeis guineensis* Jacq [Agy (Sa=0.54; Fq=87.39%); Akyé (Sa=0.5; Fq=57.66%)], *Piper guineense* Schumach & Thonn [Akyé (Sa=0.29; Fq=43.24%)] and *Spondias mombin* L [Agni (Sa=0.33; Fq=49.55%)]. Table 3 shows the knowledge level of wild edible plants consumed by the studied communities.

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Table 3. Knowledge level of wild edible plants in each community

|        | Agni      | Akyé      |
|--------|-----------|-----------|
|        | 70.27     | 58.54     |

Figure 3. Two wild edible plants with high knowledge level: a) Young leaves of *Myrianthus arboreus*; b) Cutting down of the tree of *Elaeis guineensis* for the extraction of the sap as local beverage called ‘bandji’
Table 3. Knowledge level of wild edible plants consumed by the studied communities

| Family           | Species                                      | Agni  | Akyé | Gwa  | Part used | Use     | Agni local name | Akyé local name | Gwa local name |
|------------------|----------------------------------------------|-------|------|------|-----------|---------|----------------|-----------------|----------------|
|                  | Fq (%) | Sa    | Fq (%) | Sa    |           |         |                |                 |                |
| Anacardiaceae    | Spondias mombin L.                           | 49.55 | 0.33 | 18.92 | 0.05      | 29.73   | 0.2            | fruit           | raw            |
|                  | Trichoscypha arborea (A. Chev.) A. Chev.    | 34.23 | 0.20 | 66.67 | 0.32      | 29.28   | 0.16           | fruit           | raw            |
| Annonaceae       | Monodora myristica (Gaertn.) Dunal.          | 14.41 | 0.05 | 3.6   | 0.01      | 7.66    | 0.02           | seed            | roasted        |
|                  | Uvaria afzelii G.F. Scott-Elliott            | -     | -    | -     | -         | 0.45    | 0.00           | fruit           | raw            |
|                  | Xylopia aethiopica (Dunal) A. Rich.         | -     | -    | 0.9   | 0.00      | 0.9     | 0.00           | fruit           | roasted        |
| Apocynaceae      | Landolphia hirsuta (Pichon) Pichon           | 4.5   | 0.04 | -     | -         | -       | -              | fruit           | raw            |
| Areceae          | Elaeis guineensis Jacq.                     | 66.67 | 0.44 | 57.66 | 0.50      | 87.39   | 0.54           | seed, pulp, fermented sap | cooked beverage |
|                  | Raphia hookeri G. Mann & H. Wendl.          | -     | -    | 3.6   | 0.01      | -       | -              | fruit           | raw            |
| Burseraceae      | Dacyodes klaineana (Pierre) H.J. Lam         | 80.18 | 0.58 | 76.58 | 0.44      | 54.95   | 0.43           | raw, beverage   | raw            |
| Celastraceae     | Salacia nitida (Benth.) N.E. Br.             | -     | -    | -     | -         | 3.60    | 0.02           | fruit           | raw            |
| Chrysobalanaceae | Parinari congris Didd.                      | -     | -    | -     | -         | 3.15    | 0.01           | fruit           | raw            |
| Clusiaceae       | Garcinia kola Heckel                        | 20.72 | 0.1  | 8.11  | 0.04      | 9.91    | 0.07           | seed            | raw            |
|                  | Ricinodendron heudelotti (Baill.) Heckel     | 19.82 | 0.1  | 24.32 | 0.09      | 14.86   | 0.05           | seed, pulp, roasted sap | cooked roasted   |
| Irvingiaceae     | Irvingia gabonensis (Aubry-Lecomte ex O’Rorke) Baill. | 23.42 | 0.08 | 22.52 | 0.2       | 8.56    | 0.03           | seed            | cooked         |
| Lauraceae        | Beilschmiedia manni (Meisn.) Benth. & Hook. f. ex B.D.Jacks | 0.9   | 0.01 | 19.82 | 0.12      | 5.41    | 0.03           | seed            | cooked         |
| Lecithidaceae    | Napoleonaea vogelli Hook. & Planch.          | 3.6   | 0.01 | -     | -         | -       | -              | fruit           | raw            |
| Malvaceae        | Ceiba pentandra (L.) Gaertn.                 | 18.02 | 0.08 | 30.63 | 0.18      | 11.26   | 0.04           | leave           | cooked         |
|                  | Cola gigantea A. Chev. var. glabrescens      | -     | -    | 21.62 | 0.09      | 24.77   | 0.17           | fruit, leave    | cooked         |
|                  | Cola heterophylla (P. Beauv.) Schott & Endl. | -     | -    | -     | -         | 11.26   | 0.07           | fruit           | raw            |
|                  | Cola nitida (Vent.) Schott & Endl.          | 2.7   | 0.02 | 9.01  | 0.04      | 4.95    | 0.03           | fruit           | raw            |
|                  | Glyphaea brevis (Spreng.) Monach.            | -     | -    | 0.9   | 0.01      | -       | -              | inflorescences   | cooked         |

- troma, mgba, maga
- alékouli, ndabo, ndrakou
- èfouan, mkpo, mmin
- doudouglon
- èfouan, mkpo, mmin
- akpi, akpi
- kaklou, bé, gbabou
- bilé, moukouzo, poupouizo
- blé moulou, ah égna, won
- éwalé, awah, tongbaplé
- essorè, leuh, opo
- atofin
| Family       | Species                                                                 | Fq | Sa  | Urticaceae | Solanaceae | Sapindaceae | Zingiberaceae | Marantaceae | Melastomataceae | Olacaceae | Polygalaceae | Sapotaceae | Urticaceae | Zingiberaceae |
|--------------|-------------------------------------------------------------------------|----|-----|------------|------------|-------------|--------------|-------------|----------------|-----------|--------------|------------|------------|--------------|
|              | Leptonychia pubescens Keay                                            | 10.81 | 0.09 | -          | -          | -           | -            | -           | -              | -         | -            | -          | -          | -            |
|              | Sterculia tragacantha Lindl.                                            | -   | -   | 13.51      | 0.08       | 8.56        | 0.04         | leave       | cooked         | -         | mgboto       | -          | ddrédréboué | -            |
|              | Tarrietia utilis (Sprague) Sprague                                      | 25.23 | 0.11 | 16.22      | 0.09       | -           | -            | leave       | cooked         | niano     | kpanda       | -          | -          | -            |
|              | Hypselodelphys violacea (Ridl.) Milne-Redh.                           | 12.61 | 0.07 | -          | -          | 2.7         | 0.02         | fruit       | raw            | -         | -            | amachi     | -          | -            |
|              | Thaumatococcus danielli (Benn.) Benth.                                 | 7.21  | 0.04 | 2.7        | 0.01       | -           | -            | fruit       | raw            | -         | -            | ndété      | -          | -            |
|              | Dicellandra barteri Hook. f.                                            | -   | -   | -          | 0.45       | 0.00        | -            | fruit       | raw            | -         | -            | ndougo     | obiablon    | -            |
|              | Poula edulis Baill.                                                    | 50.35 | 0.34 | 37.84      | 0.17       | 4.5         | 0.03         | fruit       | raw            | roasted   | bodjè        | -          | -          | -            |
|              | Heisteria parvifolia Sm.                                               | 3.6  | 0.00 | -          | 0.45       | 0.00        | -            | fruit       | raw            | komou-aliè | -            | -          | -          | -            |
|              | Maesobotrya barteri (Bai.) Hitch.                                      | 19.82 | 0.09 | 9.91       | 0.04       | 8.56        | 0.05         | fruit       | raw            | kouati-kouali            | abizakouè | gogobin     | -          | -          | -            |
|              | Uapaca esculenta A. Chev. ex Aubrév. & Leandri                         | 7.21  | 0.04 | 3.6        | 0.02       | 22.97       | 0.14         | fruit       | raw            | kouati-kouali            | nanh       | ndabinyé    | -          | -          | -            |
|              | Uapaca heudelotii Baill.                                               | -   | -   | 0.9        | 0.00       | 0.45        | 0.00         | fruit       | raw            | -         | nombi        | pakobié     | gblè        | -            |
|              | Piper guineense Schumach. & Thonn.                                     | 24.32 | 0.12 | 43.24      | 0.29       | 21.17       | 0.11         | leave, fruit | raw            | roasted   | assissian-sian | gblé        | gblé         | -            |
|              | Carpolobia lutea G. Don                                                | 9.01  | 0.05 | 8.11       | 0.04       | 11.71       | 0.07         | raw         | sekénouwa      | -         | -            | abamia     | -          | -            |
|              | Bignonia simplex K.D. Koenig                                            | 0.9  | 0.00 | 0.9        | 0.00       | -           | -            | fruit       | raw            | -         | -            | -          | -          | -            |
|              | Synepleatum brevipes (Baker) T.D. Penn.                                | 8.41  | 0.02 | 0.9        | 0.00       | -           | -            | fruit       | cooked         | -         | -            | -          | -          | -            |
|              | Tieghelemela heckelii (A. Chev.) Pierre ex D.Abard                     | -   | -   | -          | 0.9        | 0.00        | -            | fruit       | cooked         | -         | -            | -          | -          | -            |
|              | Solanum indicum L.                                                     | 4.5  | 0.03 | 2.7        | 0.02       | 2.25        | 0.01         | fruit       | cooked         | -         | -            | -          | -          | -            |
|              | Solanum torvum Sw.                                                     | 4.5  | 0.03 | 2.7        | 0.01       | 0.9         | 0.01         | fruit       | cooked         | -         | -            | -          | -          | -            |
|              | Talinum triangulare (Jacq.) Wild.                                      | 6.31  | 0.04 | 18.02      | 0.1        | 56.31       | 0.32         | leave       | cooked         | dahomey-gna     | achiapa    | -            | ajammon      | nmynnong    | -            |
|              | Musanga cecropioides R. Br. ex Tedlie                                   | 10.81 | 0.08 | 2.7        | 0.01       | 4.5         | 0.02         | leave       | cooked         | raw         | agradjan       | mjokotéh   | -          | -            |
|              | Myrianthus arboreus P. Beauv.                                          | 66.67 | 0.37 | 89.19      | 0.72       | 76.58       | 0.46         | leave, fruit | cooked         | niamangan-tillé   | agnan      | -            | -          | -          | -            |
|              | Aframomum escapum (Sims) Hepper                                        | 1.8  | 0.01 | 7.21       | 0.04       | 4.5         | 0.01         | leave       | cooked         | raw         | -            | moukoulé    | -          | -            |

Fq: frequency of quotation; Sa: cognitive salience; -: species not mentioned by the community.
The Kruskal-Wallis test revealed a significant difference ($\chi^2=339.94; P\text{-value}=2.2 \times 10^{-16}$), of wild edible plants shared by the three communities. Indeed, the studied communities do not appreciate wild edible plants at the same level.

**Parts of wild edible plants used and cultural importance of the usage category**

Fruits, leaves, seeds, bark, inflorescence, pulp, and fermented sap are the different parts of wild edible plants consumed. Fruits (55.1%) and leaves (24.49%) are mainly the parts used in the study area (Fig. 4).

![Proportion of organs (%)](image)

**Figure 4.** Proportion of wild edible plants used in the studied communities

Concerning the cultural importance of the usage category, the distribution of knowledge is heterogeneous. Indeed, the value of this index changes from one usage category to another. *M. arboreus* (CI=0.77) and *D. klaineana* (CI=0.67) are culturally significant as fruit. Then, *M. arboreus* (CI=0.77) and *E. guineensis* (CI=0.75) are significant as vegetables. Finally, *E. guineensis* (CI=0.76) culturally significant as beverage (Table 4).

| Use category | species                                      | IC   |
|--------------|----------------------------------------------|------|
| Fruit        | *Myrianthus arboreus* P. Beauv.              | 0.77 |
|              | *Dacryodes klaineana* (Pierre) H.J. Lam.     | 0.67 |
| Vegetables   | *Myrianthus arboreus* P. Beauv.              | 0.77 |
|              | *Elaeis guineensis* Jacq.                    | 0.75 |
| Beverage     | *Elaeis guineensis* Jacq.                    | 0.76 |
| Seasoning    | *Piper guineense* Schumach. & Thonn.         | 0.27 |
|              | *Ricinodendron heudelotii* (Baill.) Heckel   | 0.18 |

IC: cultural significance index

The Mann-Whitney test revealed that there is no significant difference within the studied communities according to the usage category ($W=0; p\text{-value}=1$). Thus, there is a sharing of knowledge within the studied communities about the usage category. Fig. 5 shows some wild edible plants significant in different usage categories.

The most common usage category is fruit (1470 usage reports) followed by vegetables (1158 usage reports). In contrast, the lowest usage categories are beverages (336 usage reports) and seasoning (231 usage reports). Table 5 shows the usage categories of wild edible plants.

| Study area, all vegetables are served as sauce with various dishes such as rice (*Oryza* spp.), "foutou" a pounded plantain (*Musa paradisiaca*) and cassava (*Manihot esculenta*), or a dish based on fermented cassava called "placali" or "béchiké" or semouлина of cassava "attiéké" or "atoupkou" and brown pounded of cassava called "cocondé". |
Figure 5. Significance of wild edible plants according to the usages category in the studied communities: a) Fruits of *Dacryodes klaineana*; b) Buds of *Myrianthus arboreus* used as vegetables; c) Young lianas of *Piper guineense* used in seasoning; d) Extraction of the sap of *Elaeis guineensis* used as beverage

| Usage category | Number of using report |
|---------------|------------------------|
| Fruit         | 1470                   |
| Vegetables    | 1158                   |
| Beverage      | 336                    |
| Seasoning     | 231                    |

In this study, the same plant obtained different local names. In the Gwa communities, *P. guineense* young shoot of the liana is called “gblè”. Then the mature liana is known as “gblègo”. Finally, the fruit of clusters of the same plant is “mpouhé”. While as for the Akyé community, the same *P. guineense* younger shoots of the liana is called “pako”. The fruit clusters are “pakobié” and the mature creeper is called “bédi-bédja”. That name means “if you ate it, you would marry the cook”. Indeed, in African custom, the woman rule is to cook very good meals and to do housework. When that woman makes a delicious sauce with the mature liana of *P. guineense*, she is likely to be taken in marriage by the man who would taste her meal. This is the reason why this plant is called by the Akyé community, “bédi-bédja”.

**Distribution of the knowledge**

The distribution of the knowledge about wild edible plants in the studied communities, gathers them in two groups, according to the preference. The first group (G1) is characterized by wild edible plants mentioned in the Gwa communities. Whereas the second group (G2) is formed by wild edible plants known in the Agni and the Akyé communities (Fig. 6). Thus, the interactions between the studied communities bring about a sharing of their knowledge.
Discussion

Diversity of wild edible plants and distribution of knowledge

From our study, the similarity index showed that the co-presence of wild edible plants mentioned in these communities, is greater than 50%. This result could be explained by the same eating habits of the studied communities. In their studies, Gaoue et al. (2017) indicated that the high similarity on the sharing of knowledge, is due to a long residence of the communities, their interactions as interethnic weddings and the communication through the roads in the same geographical area. Furthermore, Voudouhê et al. (2009) demonstrated in Benin that these high values are widely explained by the interaction of ethnic groups. In fact, these authors indicated that the geographical proximity of communities who live relatively close, share generally many plants. In addition, the high similarity reflects a high interaction within the communities (Amjad et al. 2020). From this point of view, we can conclude that the interaction between communities increases the sharing of knowledge.

From this study, different interactions were recorded. This variation is due to the fact that the studied communities married each other. It has been shown that the preference of a given plant used by a community is influenced by different aspects. Indeed, as demonstrated by Vodouhê et al. (2009) and Salako et al. (2018), the preference depends on the gender and the ethnic group. The variation of wild edible plants would come from the diversity of ethno-species. Indeed, several plants could have the same local name, or several local names could point out the same plants (Ta Bi et al. 2015, Ouattara et al. 2016). These different local names may point out the state of growth of plants or the growth of their fruits or something else. That wild edible plants have a high significance in the local culture as well as in the food domain as in the medicinal domain. Thus, this ethno-species could be one of the key species in the local culture (Coe & Gaoue 2020).

Knowledge level of wild edible plants

Plants which have a high knowledge level were D. klaineana, E. guineensis, M. arboreus and P. guineense. There are several reasons which could explain the cultural significance of wild edible plants. In fact, the fruits of D. klaineana and the fresh young shoots of M. arboreus, are sold in quantities in the local market. This great sale is due to the
sweet taste of fruits, appreciated by communities. In addition, the cultural significance of wild edible plants, in particular D. klaíneana was revealed by Kouamé et al. (2008) and Nguessan et al. (2015), respectively in the Bété community in the central west and in the Krobo community in the southern part of Côte d’Ivoire. Moreover, the high knowledge level and the great consumption of the parts used, made wild edible plants important. Thus, P. guineense have been used by various organs. The fruits of this plant are used as spices. Its young shoots are used to flavour sauces. Lastly, the bark of the mature liana is scraped and then used to cook a pasty and laxative sauce in the Akyé community. Gnagbo et al. (2017) pointed out that the alcohol mixture with the fruits of P. guineense are used as an aperitif in association with the mature creeper of the same plant, cut freshly. In Togo, Atato et al. (2012) demonstrated that the fruits of P. guineense are consumed as food and sold in the local market. The high knowledge and the great consumption of the parts of E. guineensis give it also a cultural significance. In fact, the pulp of the fruits cooked with water, is used to make a very appreciated sauce in the study area. For instance, in Nigeria the heart of E. guineensis tree is used as vegetables (Caliman et al. 2005). In addition, in Nigerian rural communities, people produce a traditional wine from this plant. This traditional wine is highly appreciated as a beverage. It also sold in our study area, as well as other Ivorian communities (Kouakou 2019).

Cultural importance of the usage categories
The significance of fruits and vegetables could be explained by two reasons. One reason is the means of supply. The studied communities supply easily fruits and vegetables in the vegetation. Similar observations were revealed by Aké et al. (2015). According to these authors, fruits and vegetables are harvested by the people, especially children who appreciate a lot the fruits. The other reason is the availability of organs during the year. According to the studied communities, fruits and vegetables are available during the year and are easily accessible. The investigations of Yao et al. (2015) are confirmed our observations. Indeed, according to these authors in different regions of Côte d’Ivoire, there are different factors that influence the consumption of plants including their availability. The stickiness of leaves guides the studied communities in the choice of vegetables. That is the case of leaves of M. arboreus which are sticky and widely consumed as vegetables by communities. This wide consumption of leaves, mainly as vegetables, could be justified by the taste and the ease of cooking. In contrast, according to Atchibiri et al. (2012) and Yao et al. (2015) leaves consumed as vegetables do not occupy a prominent place in the eating habits of Ivorians’ population. Those observations confirm the low presence of leaves in the diet of the studied communities. In addition, the target communities use the beverage of the sap of E. guineensis in their eating habits, but also for the economic and socio-cultural value. According to Kouakou (2019), in communities living near the Haut-Sassandra classified forest, the pulp and sap are used respectively in the cooking of sauces and local beverages. However, the beverage usage category obtained a low usage report value in our study. This result could be explained by three different reasons. First, a high effort is required to cut down a palm tree. After cutting down of palm trees, there is a daily cutting of the apical bud to maintain the flow of sap. Finally, the daily gathering and heating of the apical bud to facilitate the flow of the sap, are exhausting for the collector. These different steps and techniques make that few people are interested by this practice. Kouchade et al. (2017) in Benin revealed similar observations. According to these authors, the Beninese communities extract the sap of E. guineensis from various steps and techniques which are very exhausting. However, few wild edible plants are used in seasoning by the studied communities. This result could be explained by the fact that the seasoning based on plants becomes obsolete in the eating habits of these communities. Indeed, communities substitute meal seasoning plants with stock cubes. Mananga et al. (2020) in Congo showed that the Komono communities consume Tiliacora funifera (Miers) Oliv, leaves as a spice well as seasoning. In fact, according to these authors that plant is very well known and enhances the taste of the dish by making it tender and appetising during consumption. This difference in results could be explained by the disuse of traditional seasoning plants. However, the usage categories contain the most versatile and well-known wild edible plants with no significant difference between communities. This result could be explained by the usage of wild edible plants in the same way. In sudanian zone of Benin, there was a significant difference between 11 communities, concerning food and medicine, the usage categories of Lannea microcarpa Engl. & K.Krause. For Goudégnon et al. (2017) indicated that this plant was more significance as food for the Otamari, the Dendi and the Natimba communities. In reverse, the same plant, has been ranked by the Bial, the Waama, the Mokolé, the Dendi and the Natimba communities as medicine. This difference could be explained by the different cultural context, but also by the different origins of the communities. The fruits may be consumed alone, raw or roasted. As for the leaves, there are used as vegetables. Therefore, there are cooked and consumed with a food rich in starch. These wild plants are consumed so much in our study. Thus, there contribute greatly in helping rural communities to reach their food security. According to Gauthier-Béguin (1992) in West Africa, rural communities which are living in rainforest areas benefit from a balanced diet, with a very high intake of vitamins, proteins and carbohydrate from the harvest of wild edible plants. In the same way, Acho et al. (2014), revealed that wild edible plants remain significance in the diet of the rural communities.
Conclusion
This study showed the differences and the similarities between the studied communities, on 43 wild edible plants. These communities have a good knowledge of wild edible plants. They use it as fruits and vegetables. Finally, the interactions as weddings led to the sharing of knowledge between the studied communities.

Declarations
Ethics approval and consent to participate: Before starting study, the chief of each investigated village was informed on the study project. Then, an agreement was needed to residents prior to start questions. Local inhabitants of the study area gratefully acknowledged for sharing valuable information.
Availability of data and materials: Data are available from the first author.
Competing interests: The authors declare that they have no competing interest.
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Author contributions: AL Diop led the field data collection and has performed the data analysis. AL Diop and DF Malan designed the subject and the methodological approach. For the writing DF Malan, YB Kouakou, AL Litta and KG Kouassi, critically revised this manuscript. All authors read and approved it as the final manuscript.

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