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Physico-chemical Composition of *Grewia coriacea* Mast. (Malvaceae) Fruit during ripening

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Abstract

The physico-chemical juice change composition of Grewia coriacea Mast. fruits during development and ripening were determined. The results of proximate analysis have showed that, the percent in water content and titratable acidity decreased with ripening. Tartaric acid level is high more than malic acid whatever the stage of development and ripening. The physical and minerals elements composition increase with development and ripening.

Keywords: Physico-chemical, composition, fruit, ripening.

Introduction

Congolese forests are rich in plant species. Some of them are used in traditional medicine, as food resources[1]. These forests are still incompletely studied, and are become now subject to uncontrolled exploitation, which may in the long term lead to the extinction of many plant species. Among food resources, there are fruits whose play an important role in human nutrition, especially as sources of vitamins and mineral elements[2]. Despite their importance, studies devoted to them are limited only on general information about their consumption, morphology, dispersion mode. Knowledge about the mode and conditions of development are lacking as pointed in some studies[3-5].

The chemical composition of such comestible fruits like *Dacryodes edulis*, *Garcinia kola Heckel* have been studied[6,7]. Nutritional value and physico-chemical composition of apple, pear, grape and cherry are well known. However, those of *G. coriacea* Mast. (Malvaceae) called "ntsui-Teke" abundly sold and consumed in the large portion of Congolese populations still unknown. Others studies have demonstrated the evolution of photosynthetic pigments[8], the presence of ascorbic acid, sugar and proteins[1] in *G. coriaceae*. It was also reported in the kernel the presence of arachidic, stearic and palmitic acids[9].

The aims of this study are to determine some physico-chemical parameters of the fruit during ripening, in order to meet the socio-economic requirements of nutritional quality and sensory consumer.

Material and Methods

Plant material: The Fruits of *G. coriacea* was collected manually in Mpoumako forest (south of Congo-Brazzaville), at differents stages as shown in figure-1.

Physical characteristics: The parameters pH (Hydrogen ion concentration), EC (electrical conductivity) and TDS (total dissolved solids) were measured using portable multi-parameters Consort C 933.

Figure-1
Ripening stages of *Grewia coriacea* Mast. Fruits

Free acidity: Free acidity was determined by titration[10] of 10 ml fresh juice from fruit mesocarp during ripening by following equation:

$$\text{Total acidity} = 0.49 \times V \quad (1)$$

With, V: volume of added NaOH in mL

Water content: 50g of fresh mesocarp of fruit at different stages were heated at 60°C in an over dry during 2 days. After that, the sample was weighted again. The water percent was calculated following the relation (2):

$$\% W = \frac{Wf - Wd}{Wf} \times 100 \quad (2)$$

With, Wf: weight of fresh mesocarp (g), Wd: weight of dry mesocarp (g).

Mineral elements: The concentration of calcium (Ca), magnesium (Mg), potassium (K) and sodium (Na) were determined by atomic absorption spectrophotometer (AAS-Buck 205 model). Iron (Fe) contents were determined using colorimetric method.

The ash contents were also determined[11]. Total protein has been determined after the mineralization of organic matter by concentrated sulfuric acid[12]. The percent nitrogen and proteins content (%) was calculated by the following relations, respectively:

$$\% N = \frac{[V(H2SO4) \times 0.07]}{\text{Sample weight}} \quad (3)$$

$$\% \text{ protein} = \% N \times 6.25 \quad (4)$$

All determinations were done in triplicate and statistical analyses have been performed using Statistica 7.1.

Results and Discussion

The results revealed that the water content of *G. coriacea* juice (Table-1) decreased with ripening: 93.40 ± 0.31%, 66.87 ± 1.99% and 60.20 ± 4.89 % at unripe, veraison and ripe stages, respectively. This is explained by the synthesis of organic compounds. The water content of juice of *G. coriacea* (60.20 ± 4.89 %) at ripeness (Figure-2) is in agreement with other study related to apple Cayor at ripe stage[13].

The acidity of the fruit is an important contributor to its flavor. In *G. coriacea* fruit examined (Figure-3), total titrable acidity was maximum in the juice of unripe fruit (69.97± 3.92 m.eq. $H_2SO_4.L^{-1}$) then decreased as the fruit reached the veraison (58.99 ± 4.58 m.eq. $H_2SO_4.L^{-1}$) and continued to decrease at ripeness (49.10 ± 7.55 m.eq. $H_2SO_4.L^{-1}$). Tartric and malic acids (Figure 4) were found to be the major organic acids and they have been shown to decrease during ripening: 107.10±5.99 to 75.15±7.01 m.eq.$H_2SO_4.L^{-1}$ and 95.67±5.35 to 67.13±2.32 m.eq.$H_2SO_4.L^{-1}$, respectively. Whatever in the stage of ripeness, tartaric acid was found to be in the greatest content compared to malic acid. These results show that the two acids determine the total titrable acidity. Decrease of the total titrable acidity during ripening of the fruit is attributed to an increased synthesis of soluble sugars[1, 14]. The result is similar to those obtained with grape juice[15].

Juice pH depend on acid content. The mean value of pH was 2.25 ± 0.04 in the juice of unripe fruits of *G. coriacea*, and then rises gradually from 2.51 ± 0.06 to 2.74 ± 0.01, respectively at veraison and ripeness. These results are similar to those obtained with *Punica granatum* L. which shown that ripe fruit has low titrable acidity and high pH compared to immature fruit[16]. The results are also in agreement with those obtained in the juice of the fruit of *Garcinia kola* Heckel[7].

In Table-1, the result revealed that conductivity and total dissolved solids (TDS) increase during ripening. The mean values of TDS at unripe, veraison and ripeness stages were 874 ± 9.73, 958 ± 6.94 and 1380 ± 5.12 mg/ml, respectively. The mean values of conductivity were 1638 ± 8.10, 1858 ± 4.00 and 2578 ± 5.28 µS/cm during development and ripening, respectively. The ash values increases gradually during ripening with the maximum at ripe stage of fruit (5.85 ± 0.01 %), which confirm the richness of mineral salts in the juice of *G. coriacea*.

The mineral analysis (Table-1) shows the presence of magnesium, potassium, calcium, sodium and iron. Potassium, magnesium, calcium and sodium mean values contents were respectively 1740 ± 0.05, 340 ± 2.00, 230 ± 2.00 and 10 ± 0.01 mg/100g of matter, respectively. Potassium was found to be the most important mineral in the juice followed by magnesium, calcium, sodium and iron. However the sodium content remains constant throughout ripening.

The content of mineral elements is higher than those reported about *Garcinia kola* fruit[7]. Iron content increased during ripening of *G. coriacea* fruit with a maximum in the ripeness stage: 2.40 ± 0.01 mg/100 g. This value is lower than those reported for *Garcinia kola* and *Gardena aqualla* [7, 17]. During fruit development and ripening of *G. coriaceae*, the gradual increase in nitrogen gives information for the value of protein content (9.18 ± 0,02 %) of the fruits of *G. coriaceae*. At ripeness, the proteins content are higher.

Conclusion

The results of this study showed that *G. coriacea* is an acidic fruit. The decreasing in tartric and malic acids content is responsible for the loss of acidity and total titrable acidity. At any ripening stage (unripe, veraison or ripe) of *G.coriecea* fruit, the increasing of pH was observed. The data also revealed that *G. coriacea* fruit is an excellent source of nutritional supplement in diet for humans.

Table-1
Physico-chemical parameters of *Grewia coriacea* Mast. during ripening

S	Physico-chemical parameters									
	pH	Con.	TDS	Ash	Mg	K	Na	Ca	Fe	Proteins
		(µS/cm)	mg/ml	(%)	(mg/100 g)					(%)
I	2.25±0.04	1658±8.10	874±9.73	3.84±0.01	160±1.00	124±2.00	10±0.01	120±2.00	2.00±0.01	6.69±0.01
V	2.51±0.06	1829±4.00	958±6.94	4.77±0.02	210±2.00	138±2.00	10±0.01	130±1.00	2.20±0.01	7.25±0.01
M	2.74±0.01	2578±15.28	1380±35.12	5.85±0.01	340±2.00	170±1.00	10±0.01	230±2.00	2.40±0.01	9.18±0.01

S: stage; I: Immature; M: Maturity; Con.: Conductivity.

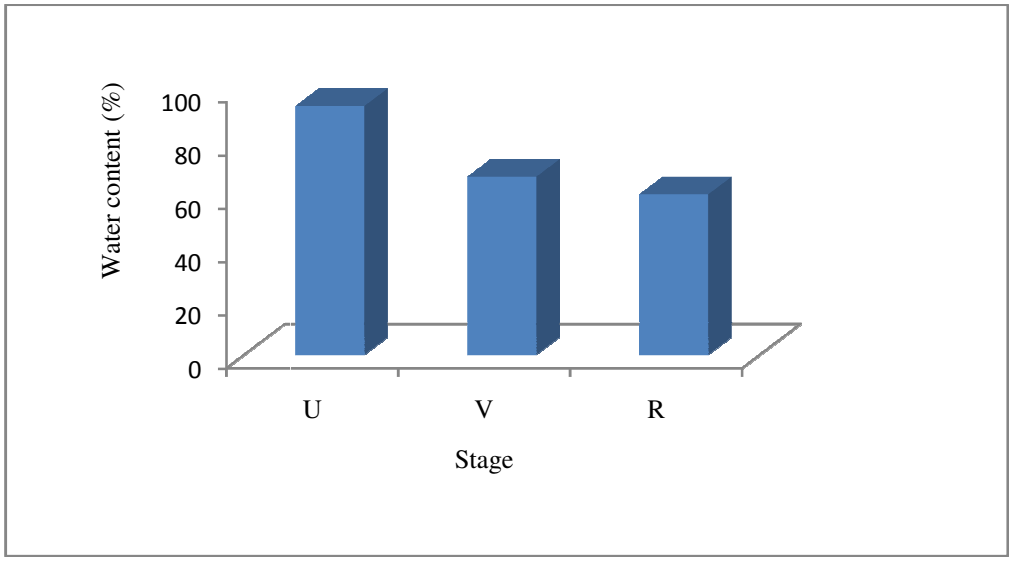

Figure-2
Water content of *G. coriacea* Mast. juice during ripening (U: unripe, V: veraison, R: ripeness)

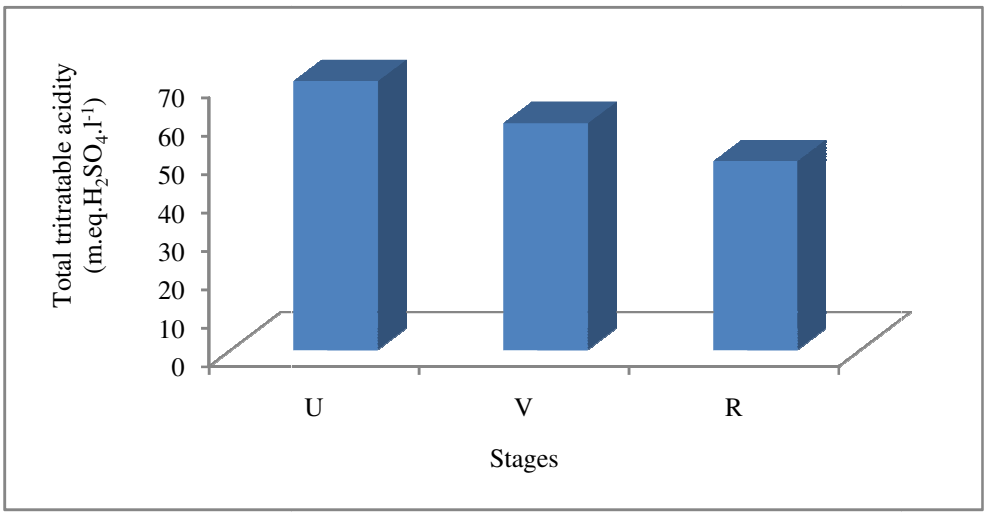

Figure-2
Water content of *G. coriacea* Mast. juice during ripening (U: unripe, V: veraison, R: ripeness)

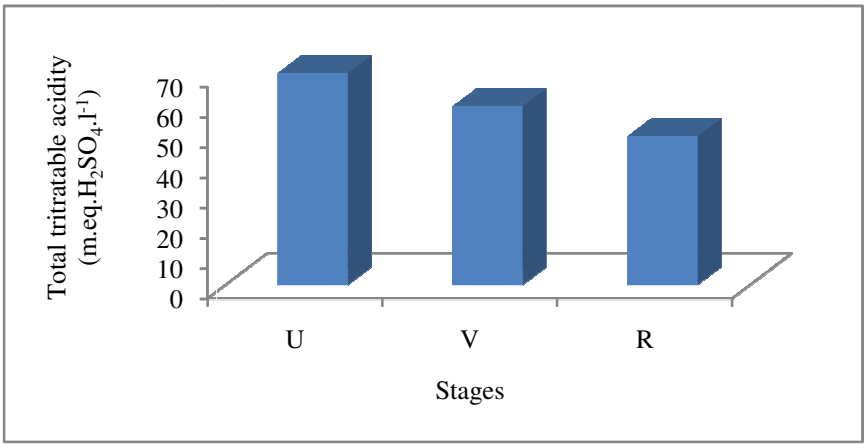

Figure-3
Total titratable acidity of *G. coriacea* juice during ripening (U: unripe, V: veraison, R: ripeness)

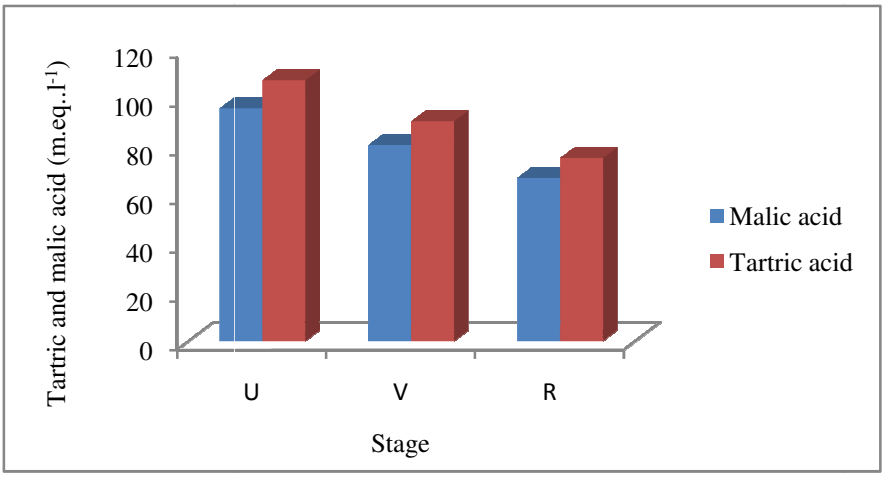

Figure-4
Tartric and malic acids contents of *G. coriacea* juice during ripening (U: unripe, V: veraison, R: ripeness)

References

1. Attibayeba, Ngantsoue L., Essamambo F., Nkourissa A.C. (2007). #Changes in the chemical composition of the fruits of *Grewia coriacea* Mast.# falling on development and ripening, *Fruit* 62 369-375.
2. Nahar N., Rahman S. and Mosiihuzzaman M. (1990).# Analysis of carbohydrates in seven edible fruits of Bangladesh.# *Journal of Science and Food Agricultura*, 5 185-192.
3. Motom M. (1981).# Study of some tropical fruits: concept and classification.# Ph.D. Thesis 3rd cycle, University of Strasbourg, 76.
4. Makita Madzou J.P. (1978).# List of edible plants in the village of Makabana.# Copying, 2.
5. Makita-Madzou J.P. (1985).#Morphological study of plants and phytogeographical regions of edible fruits and Niari Lékoumou.# Thesis 3rd Cycle, University of Orleans, 159.
6. Youmbi E., Clair-Maczulajtys D. and Bory G. (1989).#Variation de la composition chimique des fruits de Dacryodes edulis (Don) Lam.# *Fruits*, 44, 149-154.
7. Morabandza C.J., Ongoka R.P., Matini L., Epa C., Nkounkou L.C. and Abena A.A. (2013).# Chemical composition of the mesocarp of Garcinia kola Heckel (Clusiaceae).# *Fruit Research Journal of Recent Science,s* 2 (1) 1-8.
8. Goma Malanda L. and Malonga Moundimba A.J. (2002).# Study of the evolution of photosynthetic pigments during the fruit ripening on the tree: the case of Grewia coriacea.# Memory CAPES Natural Sciences, University Marien Ngouabi, 54.

9. Attibayeba, Ngantsoue L., Massamba D. and Makoundou B. (2010). #Variation of lipids in almond during growth and ripening of the fruit of Grewia coriacea Mast.# (Tiliaceae), Delle Rivista Italiana Sostanze Grasse, Vol. LXXXVI, 63-67.

10. Anon., Flore du Congo, du Rwanda et du Burundi (1963). #Spermaphytes, Institut National des Etudes Agronomiques (INEAC), Bruxelles, Belgique.

11. Montana C.M., Carmen D., Esperanza T.M. and Pilar C.M. (1994).#HPLC determination of organic acids in pineapple juice and nectars.# Z. Lebensm. Unters Forsch, 198, 52-56.

12. Motegaonkar Manorama B. and Salunke Shridar D. (2012). #The ash and calcium content of common fruit grown in Latur district, MS, India.# *Res.J.Recent Sci,* 1(5), 66-68.

13. Jackson M.L. (1958). #Soil chemical analysis, Prentice Hall Inc.# Englewood Cliffs, New Jersey, U.S.A.

14. Balla A. and Barage M. (2008).# Physico-chemical pulp and characterization of the lipid fraction of the fruit of the almond apple Cayor (Neocarya macrophylla Sabine).# *Bulletin of Agricultural Research of Benin,* 61, 1-6.

15. EF See, W Abdullah, W Nadiah, NA Abdul Aziz (2007).# Physico-chemical and sensory evaluation of breads supplemented with pumpkin flour.# *Tropicultura*, 25(2), 119-125.

16. Bourzeix M., Guitraud J. and Champagnol F. (1970).# Identification of the organic acids and evaluation of their respective amounts in musts and wines by chromatography and photodensitometry..# *Journal of Chromatography,* 50 83-91.

17. Zarei M., Azizi M., Bashir-Sadr Z. (2011). #Evaluation of physicochemical characteristics of pomegranate (*Punica granatum* L.) fruit falling on ripening.# *Fruit*, 66, 121-129.

18. Muhammad A., Dangoggo S.M., Tsate A.I., Itodo A.U., Atiku F.A. (2011). #Proximate, minerals and anti-nutritionals factors of *Gardenia aqualla (Gauden dutse)* fruit pulp.# *Pakistan Journal of nutrition,* 10(6) 577-581.