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Characterization and Marmelade processing potential of quince cultivars cultivated in tropical regions

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Abstract - With the purpose of adding value to the final product and aiming to identify which cultivars implanted in tropical regions are more appropriate for the processing of marmelade, the objective of this study was to characterize and evaluate the influence of different cultivars of quince (‘Fuller’, ‘Smyrna’, ‘Portugal’, ‘Provence’, ‘Mendonza Inta-37’, ‘Alaranjado’, ‘Lajeado’, ‘CTS 207’, ‘D’Angers’ and ‘Bereczy’) grown in tropical Brazilian regions, on the physical-chemical characteristics, rheological properties and the consumer acceptance of the obtained marmelade. The different quince cultivars presented great variability among themselves in relation to physical and physicochemical characteristics. However, the cultivars studied gave rise to marmelades that were similar to each other, which had a high sensory acceptance, except for the cultivar Mendonza Inta-37, which resulted in a less accepted marmelade.

Index Terms: *Cydonia oblonga*, quince cultivars, marmelade, processing.

Caracterização e potencial de processamento na forma de marmeladas de cultivares de Marmeleiro de regiões tropicais

Resumo- Com o intuito de agregar valor ao produto final, e visando a identificar quais cultivares implantadas em regiões tropicais são mais apropriadas para o processamento de marmeladas, o objetivo deste estudo foi caracterizar e avaliar a influência de diferentes cultivares de marmeleiro (‘Fuller’, ‘Smyrna’, ‘Portugal’, ‘Provence’, ‘Mendonza Inta-37’, ‘Alaranjado’, ‘Lajeado’, ‘CTS 207’, ‘D’Angers’ e ‘Bereczy’), cultivados em regiões tropicais do Brasil, sobre as características físico-químicas, propriedades reológicas e aceitação sensorial da marmelada obtida. As diferentes cultivares de marmelo apresentaram grande variabilidade entre si em relação às características físicas e físico-químicas. Entretanto, as cultivares estudadas deram origem a marmeladas muito semelhantes entre si que apresentaram alta aceitação sensorial, com exceção da cultivar Mendonza Inta-37, que deu origem a uma marmelada menos aceita.

Termos para Indexação: *Cydonia oblonga*, cultivares de marmelo, marmelada, processamento.

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Introduction

The quince tree (*Cydonia oblonga* Mill.) is an important cultivation option for many growers (ZAMBON et al. 2014), mainly because of its rusticity compared to other temperate fruit trees and the probability of cultivation in practically all areas that offer mild winters. The quinces present great processing viability, mainly in the elaboration of marmalades, jellies and jams (ALVARENGA et al. 2008; PEREIRA et al. 2011) since this fruit is practically not consumed in fresh form.

Despite the efforts to grow quince in tropical and subtropical regions (BETTIOL NETO et al. 2011), only the Portugal cultivar has been commercially exploited in these regions (PIO et al. 2008). However, there are other cultivars with similar productive potential to 'Portugal', such as 'Smyrna', 'Mendoza INTA-37', 'Fuller' and 'Provence', in subtropical regions (BETTIOL NETO et al. 2011) and even in colder regions, such as 'Lageado' (FIORAVANÇO et al. 2006).

According to Alvarenga et al. (2008), despite the productive capacity of the cultivars, the quality of the products produced from different quince cultivar fruits is quite variable. Due to the availability of several quince cultivars, it is necessary to carry out a study to verify which cultivar or cultivars are most suitable for processing, that is, which give rise to better quality marmelades (KAPOOR; RANOTE, 2016).

In this context, the objective of this study was to characterize and evaluate the influence of different quince cultivars ('Fuller', 'Smyrna', 'Portugal', 'Provence', 'Mendonza Inta-37', 'Alaranjado', 'Lageado' 207 ', 'D'Angers' and 'Bereczy') cultivated in tropical regions of Brazil on the physical-chemical characteristics, rheological properties and sensory acceptance of the resulting marmelade in order to identify the cultivars with the greatest potential for industrial use.

Materials and methods

Ten cultivars of quince were used ('Fuller', 'Smyrna', 'Portugal', 'Provence', 'Mendonza Inta-37', 'Alaranjado', 'Lageado', 'CTS 207', 'D'Angers' and 'Bereczy'). When the fruits reached physiological maturity they were collected in the city of Lavras - MG (Brazil). This municipality is located at 21°14'south latitude and 45°00' west longitude, at an average altitude of 918 meters. The climate is tropical climate of altitude, with dry winter and rainy summer, according to Köppen classification (MARO et al. 2013). After harvesting, the fruits were separated according to maturity, caliber and equality. Subsequently the fruits that presented physical or microbiological damage were rejected and then the sanitization with chlorinated water was done. After this procedure the fruits were kept cold (-15^{o}C) until the marmelade processing.

In addition to fruits, sucrose, high methoxylation pectin (Danisco, SP, Brazil) and citric acid were used for the marmelade preparation.

Ten marmelade formulations were prepared and the quince cultivars were the only variations among them. The sanitized fruit were ground by adding 50% water for about 5 minutes in a Poly industrial model mixer LS-4 with a capacity of 4.0 L and a speed of 3500 rpm to obtain the pulp. After this procedure the obtained pulp was passed through a fine mesh sieve to obtain a clear juice.

For the marmelades preparation, 65% quince juice, 35% sugar, 1% high methoxyl pectin and 0.25% citric acid were used. For the processing, the juice and sugar were initially mixed and heated in an open pan with gas flame (Macanuda, SC, Brazil). When this mixture began to boil, powdered pectin was added. At the end of cooking, when the soluble solids reached 65°Brix, the heating was stopped and the citric acid was added. A portable refractometer model RT-82 was used for the measurement of total soluble solids. The marmelades were then poured into 250 ml capacity sterilized glass jars, cooled to room temperature and stored at 7^{o}C until the analysis.

Analyzes of quince fruit and marmelade were carried out in three replicates. In the fruits the analyses performed were: length, diameter, unit mass, total soluble solids (SS), total titratable acidity (TA), pH and color (Chroma and Hue). From the values found for soluble solids and total titratable acidity, the ratio (SS / TA) was calculated. On the marmelades elaborated from the different quince cultivars the total titratable acidity, pH, color (Chroma and Hue), texture profile analysis and sensorial analysis were performed.

The length and diameter of the fruit were measured with the aid of a 150 mm digital caliper, and average fruit weight was determined by individual weighing of each fruit on an AUX220 semi - analytical scale (PENONI et al. 2011).

The total acidity, soluble solids and pH values were determined according to the Adolfo Lutz Institute- IAL. The color was determined according to the method method previous described by Curi et al. (2017).

The texture profile analyses (TPA) of the marmelades were performed in penetration mode under the conditions described by Souza et al. (2014): "a pre-test speed of 1.0 mm/s, a test speed of 1.0 mm/s, a post-test speed of 1.0 mm/s, a time interval between penetration cycles of 10 s, a distance of 40.0 mm and compression with a 6.0 mm diameter cylindrical aluminum probe using a Stable Micro Systems TA-XT2i texturometer (Goldaming, England)". The marmelade samples were compressed by 30%. The parameters analyzed were hardness, adhesiveness, springiness, cohesiveness, gumminess and chewiness.

For the sensorial evaluation of the samples, an acceptance test was carried out with 95 consumers. Each taster evaluated the 10 quince formulations (5 formulations per day) and was instructed to give an acceptance note to each sample according to the 9-point hedonic scale (1 = extreme dislike and 9 = extremely liked) to the attributes color, taste, consistency and overall liking. Each consumer evaluated, on average, 5 grams of each of the ten quince marmelade formulations, which were served in 50 mL plastic cups with 3-digit codes in a balanced order (CURI et al. 2016). Sensory analysis was performed according to the local Ethics Committee, approval number 1.091.594.

In order to compare the different quince cultivars in relation to the physical and physico-chemical characteristics and the different quince marmelade obtained in relation to physical-chemical, rheological and sensorial characteristics, a univariate statistical analysis (ANOVA) and Tukey test were performed to verify if there was a significant difference between the samples at a 5% significance level ($p \leq 0.05$).

In order to better visualize the sensorial acceptance of the consumer a three-way internal preference map obtained by PARAFAC was generated (NUNES et al. 2011). The PARAFAC model was optimized using the value of Core Consistency Diagnostic (CORCONDIA) to choose the number of factors (NUNES et al. 2011). Data analysis was performed using the software SensoMaker version 1.8 (PINHEIRO et al. 2013).

Results and discussion

Physical and physicochemical analysis of quince cultivars

Table 1 shows the mean values and the mean test of the physical and physico-chemical parameters of the different quince cultivars. It can be verified that there was significant difference ($p \leq 0.05$) for all evaluated attributes.

As for the size and weight parameters of the different quince cultivars, through Table 1, it is possible to verify that the Mendonza Inta-37 cultivar stood out from the others presenting the largest dimensions - 76.45 mm in length, 81.62 mm in diameter, and consequently presented the higher unit mass, reaching 239.33 g per fruit. Generally for fresh consumption larger fruits are more accepted by consumers.

The soluble solids varied from 1.33 to 10.33 °Brix, the acidity ranged from 0.81 to 1.00 g of malic acid/100 g, the pH varied from 3.67 to 4.46 and the ratio ranged from 1.37 to 12.34. It is through these parameters that the fruits are indicated for consumption in fresh form or for industrialization in the form of products like jams and marmelades.

The degrees brix is related to the presence of organic acids and the amount of sugars present in the fruit. In general, the fruits with the highest brix content are the sweetest and consequently most appreciated by consumers (CURI et al. 2016). The soluble solids is one of the factors that lead to the indication of quince maturity, since 80% of this content represents the sugars (CURI et al. 2017). Both sugars and soluble solids are affected by the location of the fruit on the tree, by the amount of fruit on the branch, by the type of pruning that was carried out and mainly by the climate of the region.

The fruits can be classified as mild in flavor and generally more appreciated by the consumer as fresh when the acidity ranges from 0.08 to 1.95%. All studied cultivars fit within this group (Table 1), but for commercialization in the form of products such as jams and marmelades, a higher acidity is desirable to aid in gel formation. According to Curi et al. (2016), the ideal pH for the processing is in the range of 3.5, only the cultivar Alaranjado presents values close to this range, that is, in general the quince is a fruit that has an acidity below that recommended for preparation products that undergo gelling, therefore, for the preparation of these products it is necessary to use citric acid in the formulation.

The ratio is also a very important parameter for fruit classification; it reflects the sweet and acidity balance. It was verified that the Portugal, Provence, Alaranjado and Bereckzy cultivars stood out for providing higher ratio values (SST/ATT) (Table 1). Thus, these cultivars have high sweetness and low acidity which reflects in an optimal sweet-acid balance which is desirable for fresh fruit consumption.

As for the coloration of the fruits of the different quince cultivars, the color parameter L* ranged from 38.82 to 56.19, the range of variation for Chroma was from 13.00 to 27.59 and Hue from 51.93 to 74.64 (Table 1). The hue indicates the shade of color, that is, in general the quince cultivars have a yellowish tone, and the chromaticity indicates the color intensity, suggesting that the fruits of the D'Angers cultivar have a more intense yellow coloration.

Physicochemical and rheological properties of quince marmelade formulations

Table 2 shows the mean values and the mean test of the physical-chemical parameters of the marmelades obtained from the different quince cultivars. It can be verified that the marmelades obtained are very similar to each other, since there was a significant difference ($p \leq 0.05$) only for the °Hue parameter.

Soluble solids of different marmelades obtained from the quince cultivars ranged from 67.30 to 76.34 Brix ('Fuller' and 'Lageado', respectively) (Table 2). It was expected that the soluble solids content would not differ significantly, because although quince cultivars presented different soluble solids contents, during the preparation of the marmelade the final Brix degree was fixed.

The pH ranged from 3.16 to 3.40 (Fuller and CTS 207 cultivars, respectively) (Table 2). The lower pH of marmelades compared to fresh fruit is due to the addition of citric acid during processing. In relation to the acidity of the marmelade, it varied from 0.02 to 0.03 g malic acid/100g.

Table 1 - Average length (AL), average diameter (AD), unit weight (UW), total soluble solids (SS), total acidity (TA), solids/acidity (ratio), pH, ratio, color (L*, Chroma and °Hue) in different quince cultivars.

Cultivars	AL (mm)	AD(mm)	UW(g)	SS (ºBrix)	TA	pH	Ratio	L*	Chroma	°Hue
Fuller	63.32^{abc}	72.91^{ab}	180.00^{abc}	7.00^{bc}	0.81^{e}	4.46^{a}	8.64^{bc}	56.19^{a}	26.62^{ab}	73.37^{a}
Smyrna	68.53^{abc}	74.90^{ab}	158.66^{abc}	1.33^{d}	0.97^{ab}	3.77^{bc}	1.37^{e}	48.60^{b}	24.47^{bc}	72.88^{a}
Portugal	61.60^{abc}	72.60^{ab}	163.00^{abc}	9.66^{ab}	0.94^{bc}	3.75^{bc}	10.27^{ab}	52.81^{ab}	20.13^{de}	73.02^{a}
Provence	53.23^{c}	60.78^{b}	93.32^{c}	10.33^{a}	0.90^{cde}	4.10^{abc}	11.47^{ab}	48.22^{b}	22.99^{cd}	68.27^{a}
Mendonza	76.45^{a}	81.62^{a}	239.33^{a}	3.00^{cd}	0.86^{cde}	4.09^{abc}	3.48^{cd}	50.66^{ab}	18.04^{e}	70.32^{a}
Alaranjado	74.12^{ab}	72.30^{ab}	156.66^{abc}	10.33^{a}	1.00^{a}	3.67^{c}	10.33^{ab}	47.60^{b}	18.63^{e}	68.77^{a}
Lageado	61.54^{abc}	59.03^{b}	100.00^{bc}	3.66^{cd}	0.91^{c}	3.97^{abc}	4.02^{cd}	48.60^{b}	24.47^{bc}	72.88^{a}
CTS 207	60.47^{abc}	62.96^{b}	121.66^{abc}	5.00^{cd}	0.90^{cd}	4.09^{abc}	5.55^{cd}	52.99^{ab}	20.84^{de}	69.95^{a}
D'Angers	57.66^{bc}	61.83^{b}	111.66^{bc}	7.00^{bc}	0.85^{de}	4.02^{abc}	8.23^{bc}	50.95^{ab}	27.57^{a}	74.64^{a}
Bereczy	72.81^{ab}	75.26^{ab}	216.66^{ab}	10.00^{ab}	0.81^{e}	4.34^{ab}	12.34^{a}	38.82^{c}	13.00^{f}	51.93^{b}
CV(%)	9.84	8.73	26.88	15.68	2.19	1.18	15.25	4.39	4.58	6.75

*Mean values with common letters in the same column indicate that there is no significant difference among samples ($p \leq 0.05$) from Tukey's mean test.
** Total acidity: g malic acid/100 g f.w.

Table 2 - Soluble Solids (SS), pH, total acidity (TA) and color (L*, Chroma and °hue) in quince marmelades.

Cultivars	SS	pH	TA	L*	Chroma	°Hue
Fuller	67.30^{a}	3.36^{a}	0.03^{a}	37.27^{a}	22.98^{a}	72.40^{b}
Smyrna	73.61^{a}	3.16^{b}	0.03^{a}	35.58^{a}	16.46^{a}	73.72^{b}
Portugal	72.02^{a}	3.30^{a}	0.03^{a}	24.17^{a}	23.61^{a}	68.92^{c}
Provence	75.32^{a}	3.30^{a}	0.03^{a}	35.71^{a}	23.74^{a}	67.47^{cd}
Mendonza Inta-37	71.62^{a}	3.36^{a}	0.03^{a}	38.44^{a}	20.45^{a}	76.97^{a}
Alaranjado	72.02^{a}	3.33^{a}	0.02^{a}	30.46^{a}	21.82^{a}	68.18^{c}
Lageado	76.34^{a}	3.33^{a}	0.04^{a}	37.07^{a}	18.72^{a}	64.94^{d}
CTS 207	69.64^{a}	3.40^{a}	0.02^{a}	35.07^{a}	22.40^{a}	64.93^{d}
D'Angers	74.09^{a}	3.30^{a}	0.03^{a}	34.60^{a}	23.26^{a}	68.50^{c}
Bereczy	73.69^{a}	3.30^{a}	0.03^{a}	33.97^{a}	24.00^{a}	71.72^{b}
CV(%)	4.33	1.28	21.94	19.43	12.39	1.32

*Mean values with common letters in the same column indicate that there is no significant difference between samples ($p \leq 0.05$) by Tukey's mean test.
** Total acidity: g malic acid/100 g f.w.

Regarding color, the parameter L* ranged from 24.17 to 38.44, Chroma ranged from 16.46 to 24.00 and Hue ranged from 64.94 to 76.97 (Table 2). According to the mean table (Table 2), it can be verified that the cultivar Mendonza Inta-37 stood out from the others presenting the highest Hue values, indicating that it is a more yellow-green marmelade than the others.

Table 3 shows the mean values and the mean test of the rheological parameters of the marmelades obtained from the different quince cultivars. It can be observed that there was a significant difference ($p \leq 0.05$) for the parameters of hardness, adhesiveness and gumminess.

In relation to the texture, it can be seen from the average table (Table 3) that the marmelade obtained with the Provence cultivar was characterized by the highest values of hardness (1.29 N) and gumminess (0.44 N). The marmelade obtained from the cultivar D'Angers' characterized by having the highest adhesiveness (2.31 N/s). As the hardness measures the force required to reach a particular deformation and the gumminess reflects the energy required to disintegrate a semisolid food to the point of being swallowed, the Provence cultivar gives rise to a more rigid and firm marmelade. Since the adhesiveness reflects the amount of force to simulate the work required to overcome the forces of attraction between the surface and the surface of food in contact with it.

Several factors may explain the texture change among the marmelades made from different quince cultivars. The amount of sugar present in each cultivar, pH, acidity and soluble pectin content, are factors that can influence the gelling and, later, the texture of the final product (SOUZA et al. 2014).

Sensory analysis of the quince marmelade formulations

Through analysis of variance, a significant difference was observed among all the marmelades obtained from the different quince cultivars ($p \leq 0.05$). The mean values and the mean test of the sensorial characteristics evaluated are expressed in Table 4. To facilitate the visualization, Figure 1 represents the three-way internal preference map obtained by PARAFAC, where we have the representation of consumers, samples and evaluated attributes.

Regarding color, there were significant differences between the different samples. For this attribute, the highest averages were obtained for the marmalades obtained by Provence cultivar, formulation that was accepted by 98% of the tasters (note greater than 6). The marmalade elaborated with the cultivar Mendonza Inta-37 obtained the lowest averages of acceptance by the group of tasters, and more than 40% of them did not approve the color of this marmalade (note less than 6). For Matsuura et al. (2002), the color is of fundamental importance, since it is linked to the attractiveness to the consumer.

For the taste attribute, all the samples showed a significant difference between them, and the marmalade samples elaborated with the cultivars Lageado and CTS 207 showed a higher average, in which 90% of the tasters accepted the taste of these formulations (note greater than 6). Mendonza Inta-37 showed the lowest average, and 20% of the tasters did not approve the taste of this formulation (note less than 6).

The marmalades elaborated with Fuller cultivar showed greater acceptance in relation to consistency, and more than 90% of the testers accepted the consistency of this formulation (note greater than 6). On the other hand the marmalades elaborated by the cultivars Smyrna, Portugal, Provence, Mendoza Inta-37 and D'Angers were less accepted. According to Pereira et al. (2011), the consistency of the marmalade is influenced by the acidity and the pectin and sugar concentrations.

In relation to overall liking, the tasters demonstrated a greater acceptability for the marmalades elaborated with the cultivars Fuller, Lageado and CTS 207. Already the marmalade obtained with the cultivar Mendonza Inta-37 was the least accepted in this study, in which 27% of the consumers didn`t like (note less than 6).

In general, the marmelade formulations presented an excellent sensory acceptance for all sensory attributes evaluated, with average scores varying between the hedonic terms "slightly liked" and "liked very much" (Table 4). According to Table 4 and the PARAFAC shown in Figure 1, it can be clearly seen that the marmelade obtained from the cultivar Mendonza Inta-37 presented a lower consumer preference, with average scores varying between the hedonic terms "indifferent" and "slightly liked". All other cultivars gave rise to a marmelade with similar sensorial acceptance.

Only the Mendonza Inta-37 cultivar does not seem to be very suitable for processing in the marmelade form, however, because it is the cultivar of larger size and weight, it is often more suitable for fresh consumption, while the smaller and unattractive fruits are more suitable for processing. According to Bettiol Neto et al. (2011), the Mendoza Inta-37 cultivar generally presents quality attributes that are more adequate for fresh consumption, with higher soluble solids content, lower titratable acidity, higher ratio and adequate pulp firmness.

In relation to the other cultivars studied, as all originated a marmelade of similar sensory acceptance, factors such as adaptation, susceptibility to pests, production cost and yield should be taken into account to indicate which the most interesting cultivars are for industrialization.

According to Pio et al. (2007), although there are several quince cultivars in the state research units (EPAMIG and IAC), the only commercial cultivar is 'Portugal' possibly because there is a lack of diffusion of technology by the technicians.

Table 3 - Hardness (Hard N), adhesiveness (Adhe N/s), springiness (Sprin), cohesiveness (Cohe), gumminess (Gummi N) and chewiness (Chew) in quinces marmelade.

Cultivars	Hard	Adhe	Spr	Cohe	Gum	Chew
Fuller	0.66^{b}	0.92^{bc}	0.96^{a}	0.38^{a}	0.25^{b}	0.24^{a}
Smyrna	0.92^{ab}	1.04^{bc}	0.99^{a}	0.36^{a}	0.33^{ab}	0.32^{a}
Portugal	0.82^{b}	1.01^{bc}	0.98^{a}	0.42^{a}	0.34^{ab}	0.34^{a}
Provence	1.29^{a}	0.76^{c}	0.84^{a}	0.33^{a}	0.44^{a}	0.36^{a}
Mendonza Inta-37	0.90^{ab}	1.79^{abc}	0.93^{a}	0.35^{a}	0.31^{ab}	0.29^{a}
Alaranjado	0.83^{b}	1.34^{abc}	0.98^{a}	0.37^{a}	0.31^{ab}	0.30^{a}
Lageado	0.80^{b}	1.40^{abc}	0.97^{a}	0.41^{a}	0.33^{ab}	0.32^{a}
CTS 207	1.01^{ab}	2.04^{ab}	0.95^{a}	0.36^{a}	0.37^{ab}	0.354^{a}
D'Angers	0.94^{ab}	2.31^{a}	0.99^{a}	0.38^{a}	0.35^{ab}	0.35^{a}
Bereczy	0.85^{b}	0.92^{bc}	0.94^{a}	0.36^{a}	0.30^{ab}	0.28^{a}
CV(%)	14.78	30.31	6.09	11.37	17.11	11.60

*Mean values with common letters in the same column indicate there is no significant difference between samples ($p \leq 0.05$) by Tukey's mean test.

The Portugal cultivar is the most planted quince in subtropical regions of Brazil, and has an average yield of 8.5 tons.ha^{-1}, being considered one of the most productive in these climatic conditions and is thus a more used cultivar. However, due to the high and similar sensory acceptance of the marmelade obtained by other quince cultivars and due to the high productive performance (6.9 to 10.5 ton.ha^{-1}) of some cultivars such as Fuller, Smyrna and Provence it can be verified that Portugal should not be the only option of the producers (BETTIOL NETO et al 2011). Thus, although Portugal is the most cultivated, other quince cultivars also have great potential for being cultivated and processed, since they are little explored quince options, but with great potential.

Table 4 - Sensory characteristics of the quince marmelades obtained from different cultivars

Formulations	Color	Taste	Consistency	Overall Liking
Fuller	7.21^{ab}	7.13^{ab}	7.29^{a}	7.31^{a}
Smyrna	7.37^{ab}	6.86^{ab}	6.20^{b}	6.77^{ab}
Portugal	7.30^{ab}	7.04^{ab}	6.38^{b}	6.95^{ab}
Provence	7.61^{a}	7.17^{ab}	6.08^{b}	6.88^{ab}
Mendonza Inta-37	5.78^{c}	6.59^{b}	6.32^{b}	6.41^{b}
Alaranjado	6.84^{b}	6.95^{ab}	6.63^{ab}	6.98^{ab}
Lageado	7.04^{ab}	7.27^{a}	5.57^{ab}	7.12^{a}
CTS 207	6.90^{b}	7.29^{a}	6.61^{ab}	7.07^{a}
D'Angers	6.79^{b}	6.86^{ab}	6.38^{b}	6.77^{ab}
Bereczy	6.91^{b}	7.16^{ab}	6.49^{ab}	6.91^{ab}

* Mean values with common letters in the same column indicate there is no significant difference among samples ($p \leq 0.05$) by Tukey's mean test.

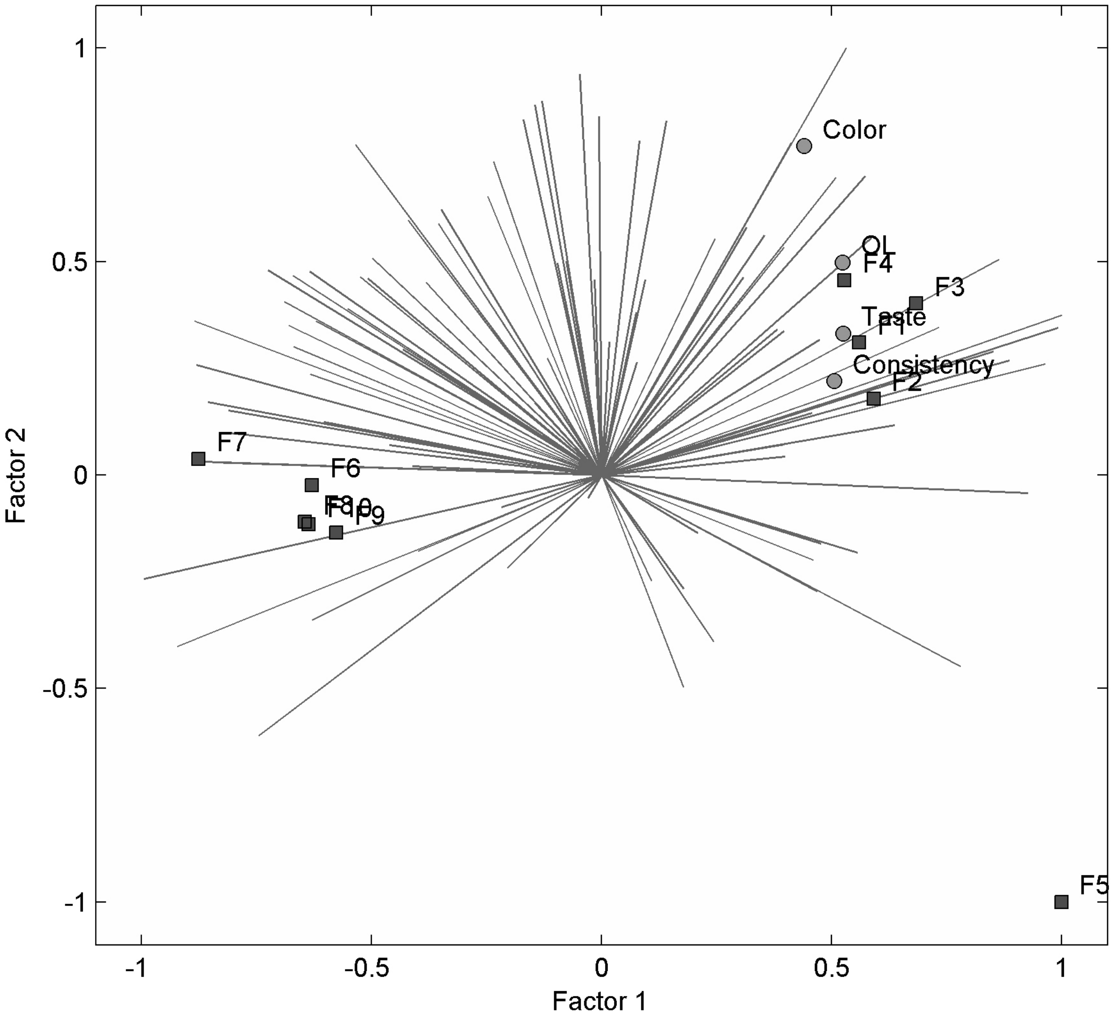

Figure 1 - Three-way internal preference map for sensory attributes (color, taste, consistency and overall liking [OL]) for the quince marmelade formulations. Fuller (F1); Smyrna (F2); Portugal (F3); Provence (F4); Mendonza Inta-37 (F5); Alaranjado (F6); Lageado (F7); CTS 207 (F8); D'Angers (F9) and Berecy (F10).

Conclusion

It was verified in this study that the different quince cultivars present great variability among themselves in relation to physical and physico-chemical characteristics. However, the cultivars studied gave rise to many marmelades that were similar to each other, which had a high sensory acceptance, except for the cultivar Mendonza Inta-37, which resulted in a less accepted marmelade. It can be concluded that quince cultivars cultivated in tropical regions present great processing potential in the form of marmelade.

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