Coryphantha spp. proximate composition and phytochemical profile

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Abstract

Mexico has an important diversity of cacti. *Coryphantha* species are abundant in Lagos de Moreno, located in the highlands of Mexico, in the state of Jalisco. However, little is known about their chemical composition. In this research work, three *Coryphantha* species (*Coryphantha bumamma*, *C. clavata* and *C. cornifera*) were studied to determine their chemical composition of primary metabolites (proximate analysis) and to identify the presence or absence of some secondary metabolites (phytochemical profile). Results showed a higher concentration for moist, ash, fat and fiber in *C. bumamma* and *C. clavata*. *Coryphantha clavata* and *C. cornifera* presented higher content of protein and carbohydrates. Alkaloids, saponins, flavonoids and sterols (triterpenes) were detected in all three species; while tannins and quinones were absent in all samples. The results were compared to chemical information reported for other Cactaceae. The information here presented is valuable in order to establish a database for the potential use of these species as phytochemical source.

***Keywords*:** *Coryphantha bumamma*, *C. clavata*, *C. cornifera*, proximate analysis, phytochemical profile.

Introduction

Mexico is known for being home of the largest number of endemic genera and species of cacti in America (Dicht and Lüthy, 2005; Guzman *et al*., 2003; Robles del Valle, 1998). Some of them play important roles as source of food, feed and herbal medicine, especially for the inhabitants of the arid and semi−arid areas of Mexico (Benitez and Davila, 2002); other species have ornamental uses.

Lagos de Moreno, located in the highlands of Mexico in the state of Jalisco, has a diversity of species of Cactaceae, among them *Coryphantha* is one of the most notable (Arreola−Nava, 1996). The name *Coryphantha* originates from Greek *koryphe* = apex and *anthos* = flower and means "flowering from the apex". They are small to medium−sized globose to short columnar and tubercled; the plant bodies are not partitioned into ribs. Their flowers are yellow, white or pink; 3−10 cm of diameter and arise from the new growth, which is the center of the plant. Tubercles of *Coryphantha* have a groove in their upper surface, which usually reaches from the areole to the axil. Different types of areole exist; they are often used in systematics (Dicht and Lüthy, 2005). However, only a small portion of the Jalisco's cacti has been studied as mentioned in 'The vegetation of New Galicia', in which Rzedowski and McVaugh (1966) described the major plant associations in the region of the Altos de Jalisco, and refer to its components, including: the pasture lands in which they emphasize the presence of *Opuntia robusta* and several species of *Mammillaria*

(Arreola−Nava, 1996). Recently, Gallegos and Medina (2008) described anatomical features of *Coryphantha bumamma*, *C. clavata*, *C. cornifera*, and *Mammillaria uncinata,* contributing to the knowledge of these species of cacti. Botanical and chemical studies about *Coryphantha* are scarce; and changes in land use and expansion of industrial and residential areas are threatening the existence of some of these endemic cacti. As an example, *Coryphantha elephantidens*, present in the municipality of Lagos de Moreno, is included in a risk category (NOM−059−ECOL−2001).

Only a few published studies on the chemical characterization of components in *Coryphantha* species exist (Below *et al*., 2006; Bruhn and Agurell, 2006; Hornemann *et al*., 2006; Meyer *et al*., 1983). In order to contribute to the understanding and conservation of the cacti species, endemic to the region of Lagos de Moreno, this study was conducted to evaluate the proximate analysis (moisture, ash, protein, fat, and fiber) and the phytochemical profile [alkaloids, sterols (triterpene), flavonoids, quinones, tannins, and saponins] of the stem and root of three *Coryphantha* species: *C. bumamma*, *C. clavata* and *C. cornifera*.

Materials and methods

Plant Material

Adult plants of *Coryphantha clavata* (Scheidweiler) Backeberg and *C. cornifera* (de Candolle) Lemaire were collected at the area of the dam "El Cuarenta" located on the road from Lagos de Moreno, Jalisco to San Luis Potosi, México; meanwhile, *C. bumamma* (Ehrenberg) Dicht and Lüthy was collected on the slopes of "Cerro de la Mesa", located within the municipality of Lagos de Moreno, Jalisco, México (21° 53' North, 21° 10' South, 101°34' East, 102°10' West). All the samples were collected during the months of May to July, 2008. Plant specimens were transported to the laboratory. Once there, the areoles with spines and trichomes were removed as well as any foreign material. Stem from each cleaned−plant was separated from root and divided into three portions: apical, middle and basal (Figure 1). All sections were cut into 1 cm cubes and processed according to the method to use.

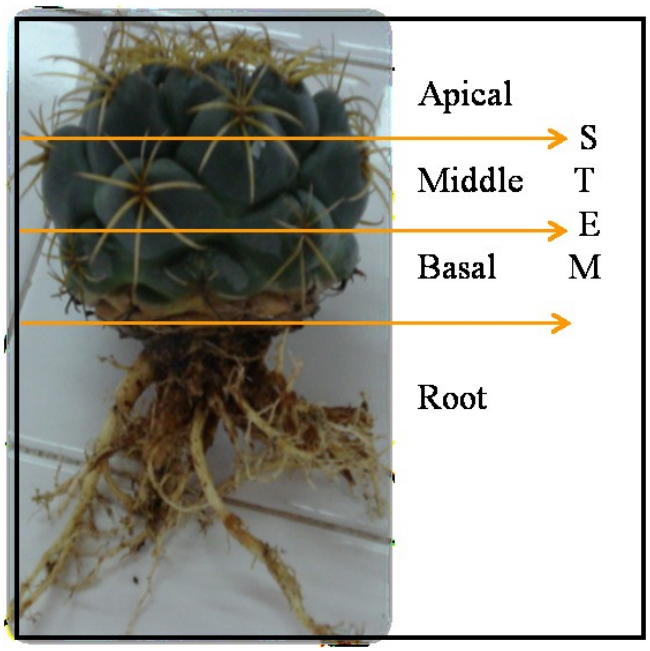

Figure1. Stem and root portions of cactus plant were separated for analysis.

Proximate analysis

Proximate analysis was carried out according to the procedures of Association of Official Analytical Chemists (AOAC, 1990). This constitutes the main chemical components in plant tissue such as moisture, ash, fat, protein, fiber and free nitrogen extract (which corresponds to an approximation of the carbohydrate content). Three individuals (plants) per species were analyzed and each analysis was performed by triplicate. Results are showed on dry basis, except for moisture.

Phytochemical profile (Qualitative analysis of secondary metabolites)

The secondary metabolites (alkaloids, sterols (triterpene), flavonoids, tannins, quinones and saponins) were determined in a qualitative way, according to Dominguez (1973) and Tecanhuey (2005). Analysis were carried out on three different polarity extracts prepared from air dried apical, middle, basal (stem) and root of *Coryphantha* cactus. Prior to extracts preparation, all cacti portions were dehydrated to constant weight under environmental conditions (14−28 °C; 44−58 % RH) during 8 days until loss of 85 to 95 % of moisture. Dry samples were ground in a mortar and the obtained powder was used for the preparation of extracts according to del Castillo−Ochoa *et al*. (2004). Five to nine g of plant material were mixed with n−hexane (70 mL) and the mixture was refluxed during 30 min. After cooling at room temperature, n−hexane extract was decanted and plant material was mixed with 70 mL of 80% aqueous ethanol and refluxed during 30 min to give the ethanol extract. Finally, the aqueous extract was obtained from plant material previously extracted with n−hexane and aqueous ethanol, by the same procedure.

All extracts were placed into plastic bottles, which were covered with foil and stored under refrigeration until analysis. Chemical reactions with change of color or precipitates formation indicated the presence of secondary metabolites. The presence of alkaloids was determined according to Domínguez (1973). Ten mL of each extract were evaporated; the residue was mixed with 5.0 mL of 10% HCl. After 10 min of warming on a hot plate, each mixture was filtered at room temperature and divided into four test tubes. The extracts in the tubes were treated with 0.25 mL of Dragendorff's, Mayer's, Warner's and Hager's reagents. Turbidity or precipitation in at least three of the four reagents was taken as evidence of the presence of alkaloids. The presence of sterols (triterpens) was determined following the method described by Tecanhuey (2005), using Libermann−Burchard's and Salkowski's reagents added to each plant extracts dissolved in chloroform. The test was considered positive when presenting blue, purple, red or green color on the Libermann−Burchard reaction; and brown or reddish on the Salkowski's. Flavonoids identification was done using two methodologies reported by Domínguez (1973) y Tecanhuey (2005). In the first test, flavonoids were detected by the presence of reddish to brown color in the extract following the addition of zinc powder and 0.25 mL of 5*N* HCl. In the second reaction, 0.25 mL of aqueous NaOH were added to 5.0 mL of each extract in a test tube, the appearance of yellow to orange−ocher color was considered indicative of the presence of flavonoids.

For tannins detection, 10.0 mL of the extract were evaporated to dryness, and taken up in water, filtered and divided into four test tubes; 0.25 mL of 10% $FeCl_3$ solution was added to one tube, a blue−black or green color was taken as evidence of tannins presence (Tecanhuey, 2005). The presence of tannins was confirmed by the formation of precipitate in the extract when tubes two and three were treated with 1% gelatin solution, and 1% gelatin solution in 1% NaCl, but not precipitate was formed in tube four when 1% NaCl solution was added. For quinone identification, 5.0 mL of each extract were mixed with 1.0 mL 20% H_2O_2, and 1.0 mL 50% H_2SO_4, and heated for 15 min. After cooling at room temperature, 5.0 mL toluene were added and mixed thoroughly. Two mL of toluene phase were mixed with 1.0 mL 5% NaOH and 2% NH_3. The mixture was stirred and observed: A reaction was considered positive when the aqueous phase turned pink to red (Domínguez, 1973). The saponins were determined by two tests (Domínguez, 1973; Tecanhuey,

2005). The extracts were evaporated to dryness and made up with hot water. The appearance of foam that remained consistent for 20 min. after manual agitation of the aqueous extract was taken as evidence of saponins presence. For Rosenthaler's reaction; 5.0 mL of each extract were evaporated to dryness, and 0.1 mL of Rosenthaler's reagent and 0.1 mL of H_2SO_4 were added. The appearance of violet color was considered as an indicative of the presence of saponins.

Statistical analysis

A completely random experimental design was used by considering three plants per species with three replicates each. For the quantitative analysis (moisture, ash, protein, fat and fiber) variance analysis and the Tukey comparison of means ($\alpha \leq 0.05$) were performed with the Statistical Analysis System, version 9.1 (SAS Institute, 1989).

Results

Proximate analysis

Proximate composition of the analyzed *Coryphantha* species is given in Table 1. Moisture content in *Coryphantha* species studied was in the range from 78.56% to 93.97%. Root samples presented the lower values for moisture; while in aerial parts, middle portions presented the highest values for this parameter. In general, *C. cornifera* showed the lowest moisture values. The ash content was 8.63% (dry matter basis) for the root of *C. clavata* and 18.24% for the middle portion of *C. bumamma*. In general, root samples of the three species presented the lowest values for ash content; while middle portions the highest values. *Coryphantha clavata* presented the lowest values for ash. Content of fat was relatively high in *C. clavata* compared to *C. bumamma* and *C. cornifera*. The lowest content of fat was present in *C. cornifera* (1.08%, in middle and basal stem portions), whereas the highest content of fat was determined in the stem middle portion of *C. clavata* (6.99%).

Fiber determination values were in the range of 11.21% to 29.40%. The highest values for fiber content were present in the root samples of all plants of *Coryphantha* analyzed; while the lowest values were for the stem apical portions. In general, *C. bumamma* presented the highest fiber content and *C. cornifera* the lowest values for this parameter. Protein content of *Coryphantha* species analyzed was low, it ranged from 0.63% to 1.56%; middle portions presented the lowest protein values; and the highest protein quantities were determined in root and apical portions. *Coryphantha bumamma* presented the lowest protein content, whereas *C. clavata* had the highest values. Free nitrogen extract (FNE), which corresponds to an approximation of the carbohydrate content in sample material, was calculated by subtracting to 100% the percentages determined for ash, fat, fiber and protein. FNE values ranged from 54.58% to 72.85%. The lowest content was for C. *bumamma* middle stem portion and the highest value was found in basal portion of *C. clavata.*

Phytochemical profile (Qualitative analysis of secondary metabolites)

Table 2 shows the results of secondary metabolites detected in three different polarity extracts from the three stem portions and root of *C. bumamma*, *C. clavata* and *C. cornifera*. Alkaloids were present in the three *Coryphantha* species studied and in all plant fractions analyzed. Reaction to alkaloid identification reagents was abundant in aqueous extracts, moderate in 80% ethanol extracts, and absent in hexane extracts. The results indicate that alkaloids in *Coryphantha* species studied are in the form of organic acid salts (Arango, 2002). *Coryphantha cornifera* showed the highest amounts of alkaloids, while *C. clavata* presented the lower quantities of these secondary metabolites. Alkaloids were present in higher quantities in aerial parts of plants, whereas *C. cornifera* and *C. clavata* roots presented the lowest contents of these compounds. Sterols occurred in low quantities in all three species analyzed. The presence of these phytochemicals was evident in

80% ethanol extracts. *Coryphantha bumamma* presented, relatively, the highest amounts of sterols in all stem portions compared to *C. cornifera* and *C. clavata*.

Flavonoids were present in the three *Coryphantha* species studied; *C. cornifera* protrude between *C. bumamma* and *C. clavata* for its high content of flavonoids; meanwhile *C. clavata* showed the lowest contents. Because of their solubility, flavonoids were present in aqueous and ethanol (80%) extracts, and absent in hexane extracts. The medium and basal portions presented more abundant flavonoids than the apical portions of the three species. Saponins were abundant in all portions of the three *Coryphantha* species analyzed. *Coryphantha clavata* showed the highest amount of saponins in all three extracts of the four different portions, whereas *C. bumamma* presented the lowest amounts in the aqueous and hexane extracts, and in the 80% ethanol extracts of these species saponins were absent. The results suggest that different kinds of saponins are extracted according to solvent polarity and depending on the presence or absence of saccharides residues and other polar groups. Notably, tannins and quinones, widely distributed in plants, were no detected in the *Coryphantha* species studied.

Table 1. Proximate analysis of different stem portions and root of *Coryphantha bumamma*, *C. clavata* and *C. cornifera.*

	Moisture			
Species	Apical	Middle	Basal	Root
C. bumamma	91.46 ± 0.001a	93.97 ± 0.005a	91.93 ± 0.018a	86.39 ± 0.005bc
C. clavata	93.42 ± 0.007a	93.12 ± 0.008a	92.77 ± 0.021a	85.32 ± 0.058cd
C. cornifera	92.60 ± 0.123a	90.90 ± 0.032ab	81.07 ± 0.044de	78.56 ± 0.021e
	Ash			
C. bumamma	12.49 ± 0.004b	18.24 ± 0.017a	14.15 ± 0.024ab	13.22 ± 0.14ab
C. clavata	14.23 ± 0.003ab	13.91 ± 0.006ab	13.12 ± 0.013ab	8.63 ± 0.000c
C. cornifera	16.00 ± 0.150a	17.42 ± 0.018a	15.02 ± 0.021ab	12.92 ± 0.003b
	Fat			
C. bumamma	4.43 ± 0.005ab	3.60 ± 0.005ab	4.55 ± 0.004ab	3.53 ± 0.005ab
C. clavata	6.22 ± 0.003a	6.99 ±0.009a	6.33 ± 0.010a	3.28 ± 0.000ab
C. cornifera	2.56 ± 0.006b	1.08 ± 0.002b	1.08 ± 0.006b	1.19 ± 0.003b
	Fiber			
C. bumamma	20.97 ± 0.017b	23.16 ± 0.009b	21.26 ± 0.017b	22.08 ± 0.001b
C. clavata	11.70 ± 0.025c	21.00 ± 0.006b	15.19 ± 0.023bc	29.40 ± 0.001a
C. cornifera	11.21 ± 0.005c	15.56 ± 0.009bc	15.85 ± 0.012bc	24.12 ± 0.015b
	Protein			
C. bumamma	0.84 ± 0.003bc	0.63 ± 0.000c	0.74 ± 0.002c	0.81 ± 0.001bc
C. clavata	1.14 ± 0.001b	0.92 ± 0.000bc	0.88 ± 0.001bc	1.56 ± 0.001a
C. cornifera	1.12 ± 0.001b	0.70 ± 0.001c	1.34 ± 0.001ab	1.02 ± 0.002b
	Free nitrogen extract			
C. bumamma	61.56 ± 0.024a	54.58 ± 0.027ab	65.85 ± 0.104a	60.15 ± 0.021a
C. clavata	66.04 ± 0.030a	57.20 ± 0.003ab	72.85 ± 0.075a	57.14 ± 0.001ab
C. cornifera	70.59 ± 0.013a	65.36 ± 0.019a	67.52 ± 0.030a	61.85 ± 0.018a

Results are the mean of three determinations ± SD, expressed on dry basis (except for moisture). Different letter on the same variable indicate statistically significant difference (P≤0.05).

Table 2. Phytochemical analysis data of different polarity extracts from four portions of *Coryphantha bumamma*, *C. clavata* and *C. cornifera*.

Species	Portion	Secondary metabolites											
		Alkaloids			Sterols			Flavonoids			Saponins		
		W	E	H	W	E	H	W	E	H	W	E	H
C. bumamma	Apical	+++	++	−	−	++	−	++	+	−	++	−	++
	Middle	++	+	−	−	++	+	+++	+	−	++	−	++
	Basal	++	+	−	−	+	−	+++	++	−	+++	−	++
	Root	++	++	−	−	++	−	+	++	−	++	−	+
C. cornifera	Apical	+++	++	−	−	++	−	++	+	−	+++	+	++
	Middle	+++	++	−	−	+	−	+++	++	−	+++	+	++
	Basal	+++	++	−	−	+	−	+++	++	−	+++	+	++
	Root	+++	+	−	−	+	−	++	++	−	+++	+	++
C. clavata	Apical	++	+	−	−	+	−	+	+	−	+++	++	++
	Middle	+	++	−	−	+	−	+	++	−	+++	++	++
	Basal	++	++	−	−	+	−	++	++	−	+++	++	++
	Root	+	+	−	−	+	−	+	+	−	+++	++	++

Presence: (+), (+slight; ++moderate, +++ abundant). Absence: (−); W: aqueous extract; E: 80% ethanol extract; H: hexane extract.

Discussion

To our knowledge, this is the first study where chemical composition of *Coryphantha* species has been reported. Chemical composition of species analyzed in general was similar to other Cactaceae species information published, except for protein values, which were below all data reported previously. It is interesting to verify that soil, environmental factors, and life stage of plant tissue have an important influence in chemical composition of macro−components of *Coryphantha*.

Moisture content (78.56−93.97%) results were similar to those reported for other cacti. For example, Hoffman and Walker (1912), Retamal *et al*. (1987), and Gregory and Felker (1992) mentioned moisture contents of 85, 92.5, and 94.3%, respectively for *Opuntia* cladodes; and Padrón−Pereira *et al*. (2008) reported moisture contents of 85.6% for *Epiphyllum phyllanthus*. Moisture in plants is important because it contributes to tissue structure and flexibility and acts as solvent and transporter of nutrients; its content can vary depending on the effect of many factors such as soil and season; higher moisture content could be present during the rainy season.

Ash content (8.63−18.24% dry matter basis) determined for *Coryphantha* species was in the interval reported for other cacti as for *Opuntia*. Stintzing and Carle (2005) reported values between 19− 23%, and Flachowsky and Yami (1985) mentioned 20% of ash for *Opuntia*. Our results for ash content were greater than those reported by Padrón−Pereira *et al*. (2008) and Portillo and Vigueras (2002) for *Epyphyllum phyllanthus* phyllocladodes and *Acanthocereus occidentalis* young stems (7.23% and 9.76% of ash). Ash content could vary depending on the quantity of minerals dissolved and moisture of soil.

Results for fat content (1.08−6.99% dry basis) were in the range of values reported for other cacti. Portillo and Vigueras (2002) mentioned 2.39% of fat in young stems of *Acanthocereus occidentalis* and Padrón−Pereira *et al*. (2008) found 2.95% of fat in *Epiphyllum phyllanthus* phyllocladodes. Similar results (1.55−3.60% of fat) have been reported in *Opuntia* species (Hoffman and Walker, 1912; López *et al*., 1997; Moreno−Alvarez *et al*., 2008; Sáenz, 1997). It has been observed that fat

content in the Cactaceae can be influenced by seasonality; for example Retamal *et al*. (1987) mentioned a higher fat content in *Opuntia* cladodes collected during spring. Nobel (2002) described plant requirements at different stages of life could be a determinant factor for fat content as plants get older fat content increases. Moreover, part of the fat storage is used to develop barriers to prevent moist evaporation, which contributes to plants survival in the harsh environments where they inhabit. Fiber contents (11.21 to 29.4% dry basis) in *Coryphantha* species were low compared with 35.34% of fiber in *Epiphyllum pyllanthus* phyllocladodes (Padrón−Pereira *et al*., 2008) and 36% in young *Opuntia* cladodes (Retamal *et al*., 1987); but higher than those pointed out for *Acanthocereus occidentalis* stems (2.37% of fiber) (Portillo and Vigueras, 2002) and different *Opuntia* species [8.67% (Nefzaoui and Ben−Salem, 2001); 5.14−9.53% (Tegegne, 2003); 4.15% (Moreno−Alvarez *et al*., 2008)]. Life stage of plant determines the content of fiber; as vegetal tissue goes older, the content of fiber increases (Nobel, 2002; Saenz, 1997; Van, 1982).

In our results, the youngest tissue, which corresponds to the apical portion, presents lower contents of fiber compared with basal portion and root (see Table 1). The morphology of inner structure of plants, especially the accumulation of secondary growth (fibers in wood and phloem) could be the cause of fiber content differences related to lignin, cellulose, and hemicellulose proportions as reported by Padrón−Pereira *et al*. (2008). Protein contents (0.63−1.56%, dry basis) of the three *Coryphantha* species were lower than the 7.86% reported for *Epiphyllum phyllanthum* (Padrón−Pereira *et al*., 2008). Protein content in plants could vary with different factors such as plant's life stages. Nobel (2002) mentioned that in older plants, fiber contents increases while protein diminishes, a behavior seen in the species of *Coryphantha* studied. Plant species and environmental conditions could affect the content of protein in plants too. The results for FNE (54.58−72.85%, dry basis) were similar to those reported by Flachowsky and Yami (1985), who registered 70 to 75% in *Opuntia ficus−indica*; and Nefzaoui and Ben−Salem (2001), who reported high soluble carbohydrate content in *Opuntia* species. Differences in carbohydrates content depends on soil and environmental factors, plant's life stage and plant's species (Nefzaoui and Ben−Salem, 2001).

In order to identify the presence of most secondary metabolites in the analyzed species, different polarity extract were prepared. Alkaloids, flavonoids, sterols, and saponins were detected in the three *Coryphanta* species analyzed. Alkaloids were abundant in all samples. These compounds have been also quantified in other *Coryphantha* species (Below *et al*., 2006; Bruhn and Agurell, 2006; Hornemann *et al*., 2006; Meyer *et al*., 1983; Pummangura *et al*., 1981; Sato *et al*., 1972; Smith, 1997). These phytochemicals are considered to protect plants from predators because of their effect on the insects and other herbivores nerve system (Bailey and Bailey, 1997; Brown, 2003), and its presence makes *C. bumamma*, *C. clavata* and *C. cornifera* possible sources of these bioactive compounds. The presence of triterpens was moderate in *C. bumamma* and slight in the other two species of *Coryphantha* studied. These compounds have been also reported in *Peniocereus fosterianus* and *Stenocereus thurberi* (Gibson and Nobel, 1986).

Results of this research suggest that sterols are common metabolites in different tribes of Cactoideae subfamily. A number of factors, such as genotype (species and variety), environmental conditions (sun radiation, water availability), growth rate, life stage of plant, nutrient concentration, diseases, and predators of each individual plant (Romero *et al*., 2000) influence sterols synthesis in plants. This is why their presence and concentration may vary among species, and even among individuals. Flavonoid concentrations were moderate in the three studied *Coryphantha* species; flavonoids have been found in stem, fruits and other plant portions of cacti. For example, Chuquimia *et al*. (2008) reported the presence of flavonoids with antioxidant capacity in *Neowerdermannia vorwerckii*; Vázquez−Cruz *et al*. (2008) studied phenolic compounds in fruits of

Myrtillocactus geometrizans, and Almaraz−Abarca *et al.* (2007) identified some flavonoids in pollen of *Stenocactus multicostatus*. Thus, *Coryphantha* species could be an important source of antioxidants.

Saponins are common secondary metabolites of plants because they can act as a defense mechanism against bacteria and viruses. The occurrence of saponins has been described widely in several cacti, such as *Cereus deficiens* (Zapata *et al*., 2003) and *Epiphyllum phyllantus* (Padrón−Pereira *et al*., 2008). Tannins and quinones were absent in the analyzed *Coryphantha* species. Tannins have been found in other Cactaceae such as *Cereus deficiens* (Zapata *et al*., 2003), but their absence in other Cactaceae has been reported too (Padrón−Pereira *et al*., 2008). It has been related the presence of tannins with astringency present in early stages of vegetative development. In this research work, tannins were not detected in *Coryphantha* species probably because adult plants were analyzed (Aerts *et al*., 1999). Presence of quinones in *Coryphantha* species was not evidenced by the assay developed, agreeing with Zapata *et al*. (2003), who reported absence of quinones in *Cereus deficiens*. The absence or the presence on extremely low quantities of quinones in extracts of *Coryphantha* species could be associated to the low sensibility of the test.

Chemical attributes have been used to support grouping taxa in the family Cactaceae (Gibson 1982; Gibson *et al*., 1986; Gibson and Horak, 1978; Leuck and Miller, 1982; Unger *et al*., 1980). However, there is a need for more studies to confirm the presence of phytochemicals that could be used as taxonomic markers in *Coryphantha* species.

Conclusions

Even when chemical composition of *Coryphantha bumamma*, *C. clavata* and *C. cornifera* are similar, agronomic practices, environmental and soil factors, species, variety and the anatomical characteristics of *Coryphantha* species have great influence on their chemical composition. Slight significant differences were found between *C. bumamma* and C. *clavata*, which presented high contents of moist, fat and fiber. The highest values of moist, ash, fat and NFE were present in stem portions, whereas protein and fiber were more concentrated in roots. In relation to secondary metabolites, *Coryphantha* species presented saponins, alkaloids and flavonoids in abundance; slight presence of sterols (triterpens); whereas tannins and quinones were absent. The results here presented contribute to the knowledge of *Coryphantha* species. Further research should be directed to isolate and identify secondary metabolites in order to investigate their potential biological activity, to promote their use in drugs, and to evaluate their contribution to understand their taxonomic relationships.

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