Ethnobotany of the genus Physalis L. (Solanaceae) in the South American Gran Chaco

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Abstract

ARENAS, P. & N. M. KAMIENKOWSKI (2013). Ethnobotany of the genus Physalis L. (Solanaceae) in the South American Gran Chaco. *Candollea* 68: 251-266. In English, English and French abstracts.

The species of the genus *Physalis* L. *(Solanaceae)* are grasses or shrubs, practically all of which are native to America. They are known for their application as foods and medicines in several different countries of the continent. The genus is represented in the Gran Chaco by 6 taxa, of which *Physalis viscosa* L. is the most widespread and of greatest local use. This paper presents ethnobotanical, floristic and ecological data recorded for the *Physalis* that live in the region. Likewise, bibliographical sources were examined for references to the genus in the Gran Chaco and other parts of America. During field work original data were recorded and the reference plant material was collected. The research study included nine indigenous groups as well as the rural population of the region. The vernacular names of the different species collected, their uses and forms of use are provided. These results are compared with the references from other human groups in America, and the role of these plants in the context of each culture is discussed.

Key-words

SOLANACEAE – Physalis – Gran Chaco – Economic botany – Qualitative ethnobotany – Chaco Indians – Edible Plants – Medicinal Plants

Résumé

ARENAS, P. & N. M. KAMIENKOWSKI (2013). Ethnobotanique du genre Physalis L. (Solanaceae) du Gran Chaco sudaméricain. *Candollea* 68: 251-266. En anglais, résumés anglais et français.

Les espèces du genre *Physalis* L. *(Solanaceae)* sont des herbes ou des arbustes qui sont presque entièrement originaires d'Amérique. Ils sont connus pour leurs utilisations alimentaires et comme médicaments dans les différents pays du continent. Le genre est représenté dans le Gran Chaco par 6 taxons, dont *Physalis viscosa* L. est le plus répandu et utilisé. Dans cet article, nous présentons des données ethnobotaniques, floristiques et écologiques sur les *Physalis* vivant dans la région. De même, des sources bibliographiques ont été examinées pour les références au genre dans le Gran Chaco et d'autres régions d'Amérique. Les données et les échantillons ont été recueillis au cours des travaux de terrain. L'enquête a porté sur neuf groupes autochtones et la population rurale de la région. Les noms vernaculaires sont fournis pour les différentes espèces collectées, ainsi que leurs usages et leurs formes d'emploi. Ces résultats sont comparés avec des références provenant d'autres groupes ethniques en Amérique. Le rôle de ces plantes est discuté dans le contexte culturel régional.

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Introduction

This report summarises a set of ethnobotanical data that were obtained during field work in the Gran Chaco. It is also the result of a thorough review of the various bibliographical sources that refer to this region and to others where plants of the genus *Physalis* L. live. The original data came from field work carried out with nine indigenous ethnic groups of the Gran Chaco, as well as with non-indigenous settlers.

The Gran Chaco (Fig. 1) is a geographical area situated in the centre of South America. It comprises two extended zones delimited mainly by their respective rainfall patterns: the dry or semi-arid Chaco to the West, and the wet or lower Chaco to the East (Cabrera & Willink, 1973; Morello & Hortt, 1985). The indigenous inhabitants of this region are used to obtain food by hunting, fishing, gathering edible plants and honey, catching insects, and by means of a very incipient agriculture (Nordenskiöld, 1912; Métraux, 1946; Zerries, 1968; Susnik, 1982). The diversity of plant products they were able to gather has drawn the attention of several authors (Baldus, 1931; Martínez Crovetto, 1964, 1965; Arenas, 1981, 1982; Schmeda-Hirschmann, 1998; Arenas, 2003).

In the past, the landscape of this region was a typical savanna where woodlands alternated with extended grasslands. This landscape was sustained by the fires set by the indigenous inhabitants for the practice of hunting. After a fire the fresh grass cover and the shoots on the bushes would attract various herbivores, particularly the greater rhea *(Rhea americana)* and the red brocket *(Mazama americana)*, and this is where the natives would lie in wait for hunting them (Morello & Saravia Toledo, 1959; Saravia Toledo & Del Castillo, 1988). The indigenous peoples recall that the *Physalis* grew in great abundance in burnt terrain and they used to gather large quantities of their fruits. At the end of the nineteenth century and the first part of the twentieth century the region underwent a process by which shrub and tree formations encroached upon grasslands, and the original landscape thus suffered a complete alteration (Scarpa & Arenas, 2004: 136).

This contribution is part of the ethnobotanical investigations conducted among several human groups of the Gran Chaco, starting in the 1970s, which aimed to compile traditional knowledge on the environment. The proposed objective is to safeguard the cultural and linguistic heritage, and contribute with data that may be useful to highlight the importance of the natural components of the region, seriously threatened by external pressures alien to the interests of its ancestral inhabitants.

Materials and methods

Ethnobotanical data were gathered by the first author Pastor Arenas in the course of several interviews carried out between 1974 and 2011 with qualified informants belonging to different aboriginal groups of the Gran Chaco, as well as from "in situ" observations. The information was obtained through general interviews that were designed to learn more about how these people use a set of different plants, including *Physalis*. In each indigenous group, a variable number of people were interviewed, depending on a range of circumstances such as time of permanence "in situ", degree of transculturation in the village, and specificity of the research work carried out with the different indigenous peoples. Informants were selected from people referred to by other members of the community as having the most accurate traditional knowledge. Informants were generally elderly people who lived at a time before their cultures were significantly transformed by Western society. Ethnobotanical data were selected based on the reliability and depth of knowledge of these informants.

All the interviews were performed using a semi-structured form, each lasting approximately 2-3 hours. In many cases, when the informant did not speak Spanish or Guarani, it was necessary to ask for the assistance of a translator. Data were obtained from the informant's spontaneous speech and/or from the guided conversations, which were assisted by a previously prepared set of questions (Arenas, 1995). All the informants were paid for the time they dedicated to the interview and for field guidance.

Data were recorded on tapes and in field books. Plant material was collected in the company of informants and was used to prepare voucher specimens. Herbarium specimens and samples have been incorporated into the Herbarium from the Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" from Buenos Aires (BA). The data for each taxon are presented in the Appendix 1.

Results

Physalis L.: taxonomy, biogeography, ecology

The genus *Physalis* comprises about 90 species, most of them native to America, excepting *P. alkekengi* L. which is native to the Old World (Hunziker, 2001; Toledo & Barboza, 2005: 69). *Physalis* is a clearly defined genus, in the tribe *Solaneae*, and has a distinctive fruit. This is a globose two-carpelate berry, small or large (4-7 / 10-20 mm diameter) with an either juicy or rather dry pericarp. The berry is loosely enclosed by the accrescent bladdery inflated calyx. The seeds are usually numerous (around 50, 100 or 180 per fruit) but this number tends to diminish as the flowering season advances, often to 5-6 seeds (Martínez, 1998: 76; Hunziker, 2001: 204).

The species are low annual or perennials herbs and shrubby or arborescent perennials (Martínez, 1998: 73; Hunziker, 2001: 202-204). The centre of diversity of *Physalis* is Mexico with over 70 species, most of which are

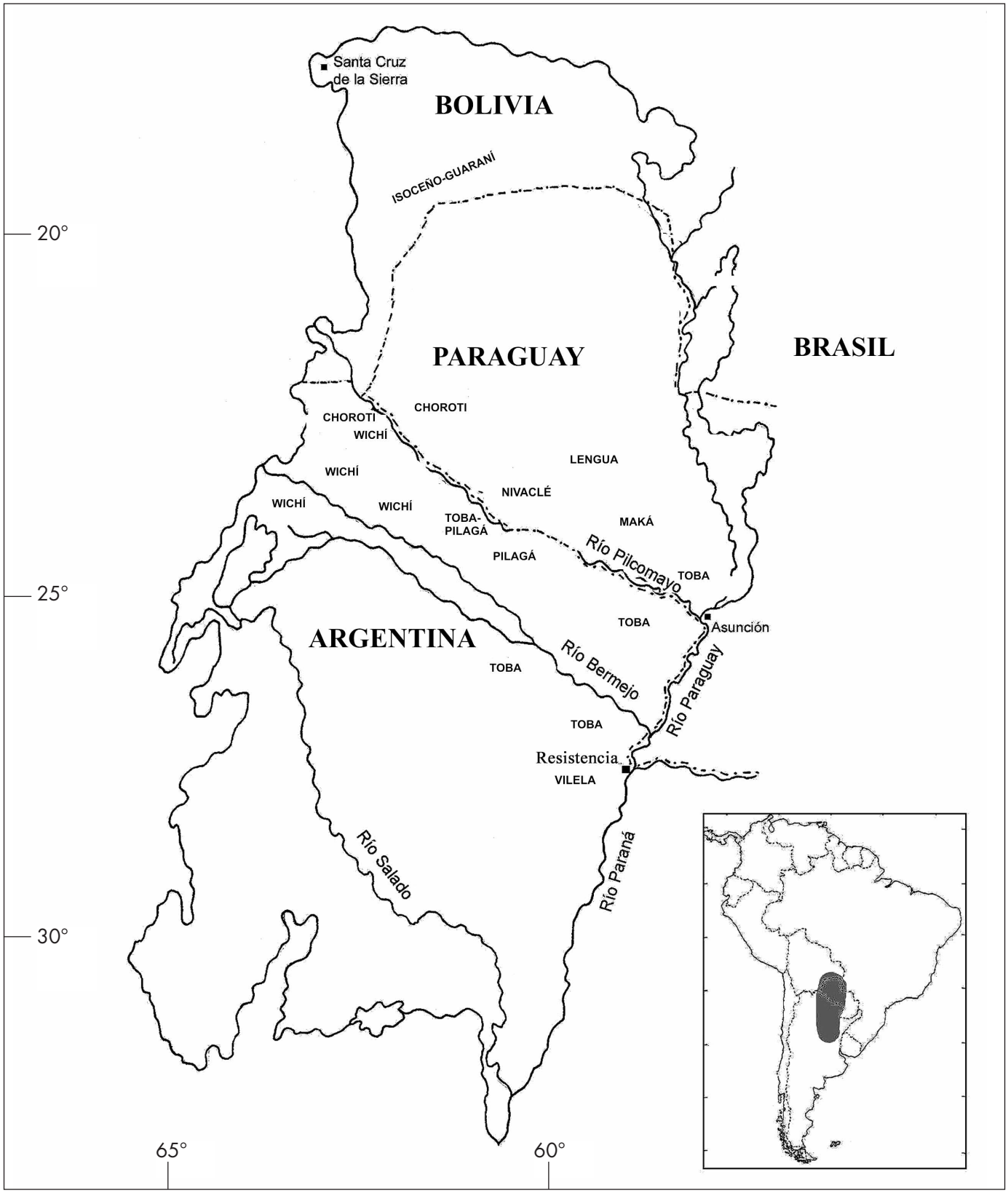


Fig. 1. – Geographical location of the indigenous peoples of the Gran Chaco mentioned in this study.

endemic; two other centres of diversity are United States and Central America, also with endemic species (Martínez, 1998: 72; Hunziker, 2001: 207). In South America barely 12 species live, some of them are also endemic (Martínez, 1998: 72; Hunziker, 2001: 207).

A few species are cultivated in the temperate and tropical Old World and in Australia, while others (mainly *P. peruviana* L. and *P. angulata* L.) are ruderal plants or weeds (National Research Council, 1989: 240-251; Hunziker, 2001: 207). These plants were introduced into warm areas of the world in post-Columbian times, with the voyages of exploration, discovery and commercial exploitation that began in the 16th century (Hedrick, 1919).

On the basis of voucher specimens available from the Gran Chaco and bibliographical data, the genus *Physalis* is represented by 6 taxa in this region (Toledo & Barboza, 2005). In the Gran Chaco, *Physalis* flowers in spring and summer, and its fructification extends simultaneously until autumn. Occasionally, the fruits are also available in winter, when wild foods are scarce, particularly in the xerophytic parts of the region, where there is a limited amount of fresh food available for both people and animals. The different species of *Physalis* of the Gran Chaco grow in a diversity of environments and conditions, such as clearings and the edges of forests, xerophytic scrubland, and thus tend to invade crops, roadside verges, natural grasslands, sandy beaches along streams and rivers, land which is prone to flooding and the herbaceous stratum of gallery forests (Fiebrig & Rojas, 1933: 51).

Ethnobotany of *Physalis*

The ethnobotanical information is presented in two sections: the first contains a basic review of the literature on the species that live in other geographical regions, particularly in America, while the second section brings together specific data on the Gran Chaco and its neighbouring zones of influence. They will thus provide comparative elements to highlight the role of this genus of plants for the people of the Chaco. The bibliographic review does not seek to be exhaustive but aims to provide a prospective vision that allows general comparisons and conclusions.

Physalis: a general review

In works of a general nature that deal with the subject of useful plants, several authors have mentioned the nutritional use of the fruits of various species in different regions, indicating their area of origin, and whether they are consumed raw, or in sauces, compotes, pies, jams or relishes (Hedrick, 1919: 431-433; Bois, 1928: 367-369; Bailey, 1938: 657-658; Künkel, 1984: 275; Facciola, 1990: 206-207). They also mention the consumption of the leaves of *P. angulata* in salads (Hedrick, 1919: 431; Künkel, 1984: 275).

Herbarium labels usually provide additional data recorded by collectors which are of ethnobotanical interest. Reviews of specimens of the Harvard University Herbarium and the NYBG collections provide information on plants collected in the Neotropics, recording vernacular names, uses and other curiosities. In the case of *Physalis*, the edible and medicinal uses prevailed (Reis Altschul, 1973: 269; Reis & Lipp, 1982: 270).

The Eurasian species *P. alkekengi* is used as an ornamental plant and is also mentioned as medicinal and edible, although it has been mentioned that its taste is rather unpleasant and it may be toxic when unripe (Bois, 1928: 366; Bailey, 1938: 657; Uphof, 1959: 277; Romo, 1996: 67). This plant is now domesticated and sold all around Europe in fruit markets.

In North America, several edible species are mentioned. Their fruits are consumed raw or boiled in various culinary preparations among indigenous groups in the region (Yanovsky, 1936: 56; Uphof, 1959: 277; Moerman, 1998: 395-396). Moerman (1998: 395, 396; 2010: 180, 181) reports several medicinal qualities attributed to 6 species and the edible use of 10 species. In Mexico various representatives of the genus with edible fruits and medicinal applications among the indigenous peoples and the "mestizo" population are also mentioned (Caballero & al., 1978: 123; Caballero & Mapes, 1985: 35, 45-46; Williams, 1985: 95-127; Casas & al., 1987: 331; Martínez Alfaro & al., 1995: 238-240; Gispert Cruells & Rodríguez González, 1998: 50-51).

In Mexico and in the Andean region, some species of the genus have been cultivated for their edible fruits since ancient times (Heiser, 1984: 50). The original species of Mesoamerica *P. philadelphica* Lam. has been cultivated in Mexico and Guatemala from immemorial time, to which archaeological deposits bear witness. Domesticated in Mexico, it was taken to Spain and other parts of the world (Montes Hernández & Aguirre Rivera, 1992). The fruits of *P. peruviana* were in use in Ancient Peru, in pre-Columbian times. This plant spread through the Old World after the Conquest of America as well as to other warm regions of America, extending southwards to the River Plate region, as well as to Africa and Australia (Bois, 1928: 367-368; León, 1964: 109-110; Mathon, 1981: 103; Balbin Ordaya, 1982: 6; Heiser, 1984: 50; Montes Hernández & Aguirre Rivera, 1992: 115; Hurrell & al., 2010: 236). Other species cultivated, albeit in a more restricted form, are *P. grisea* (Waterf.) M. Martínez from the eastern United States, well appreciated for its juicy fruits (Martínez, 1998: 72), and *P. ixocarpa* Hornem., considered of excellent nutritional quality and grown in orchards in Mexico and Central America (León, 1964: 110; Mangelsdorf & al., 1964: 435; Mathon, 1981: 96; Katz, 1990: 265).

There are numerous reports on around ten South American species, as well as others which have spread throughout America. For many of them, edible and medicinal uses are reported as well as several other applications (Uphof, 1959: 277). In several countries (Bolivia, Chile, Peru, Colombia, Nicaragua and Venezuela) mention is made of species of *Physalis* with edible fruits while other parts of the plant are used as medicines (Soukup, 1970: 261; García Barriga, 1975: 81-84; SECAB, 1983: 186; Cárdenas, 1989: 133; Mösbach, 1991: 104; Coe & Anderson, 1996: 105). Information on medicinal and food uses are also reported in the Amazonia (Brazil, Ecuador and Colombia) (Glenboski, 1983: 56; Vickers & Plowman, 1984: 31; Albert & Milliken, 2009: 56, 180). Similar records can be found in other regions in Brazil (Corrêa, 1926: 408-409; Di Stasi & al., 1989: 45-46; Souza & al., 2003: 100). Similarly, there are references concerning the edible and medicinal use of various species by different human groups in Bolivia (Girault, 1987: 382; Cárdenas, 1989: 13; Mostacedo & Uslar, 1999: 22; Bourdy, 2002: 147-149). The nutritional and medicinal use of *P. viscosa* L. in eastern Paraguay is also widespread (Michalowski, 1955: 12; Gatti, 1985: 58, 59; Pavetti & al., 1985: c.33; Pin & al., 2009: 152). Similar data are repeated in the north of Argentina, particularly in the provinces bordering on the Gran Chaco, where *P. viscosa* is mentioned as a food and medicine, with limited mentions of other representatives of the genus (Hieronymus, 1929: 203-204; Ragonese & Martínez Crovetto, 1947: 204; Parodi, 1886: 34; Schulz, 1963: 61-62; Martínez Crovetto, 1981: 99). *Physalis pruinosa* L. is a weed in the north of Chile and was used in past decades as a medicine (Möbasch, 1991: 104).

There is a body of information on the phytochemical components and the pharmacological activity of various species, which in some way would appear to validate the medicinal uses assigned to them. Several authors provide references on this subject, and also include other references to provide greater depth in the matter (Di Stasi & al., 1989; Schultes & Raffauf, 1990: 436; Hunziker, 2001: 207, 208; Pin & al., 2009: 152). Given the characteristics of its clearly ethnobotanical approach, this paper will offer no further information on this phytopharmaceutical point.

Physalis in the Gran Chaco

All the original information gathered, as well as that taken from the bibliography, is organized and detailed below with the taxa arranged in alphabetical order:

Physalis angulata L.

An annual herbaceous plant that can reach 1 m in height, apparently glabrous, lightly pubescent; it lives in warm and temperate America; a frequent weed in cropland and in modified soils (Cabrera, 1983: 446). The Toba-Pilagá report that the ripe fruits are tasty and are gathered to be eaten raw (Fig. 2 B, D).

Physalis pruinosa var. *argentina* J. M. Toledo & Barboza

Annual, robust herbaceous plant which can reach up to 1.5 m in height; lives in Bolivia, Paraguay and Argentina, with the Gran Chaco and its adjoining areas being places where its presence has been well documented (Toledo & Barbosa, 2005: 73-76). It lives in clearings and the edges of forests, invading crops, roadsides and disturbed terrain. The Pilagá report that the ripe fruit is a source of food.

Physalis pubescens L.

Annual herbaceous plant that reaches up to 1.50 m in height. It is usually branchy and is covered in glandulous hairs. In America it is a pan-tropical species which can be found from the south of the United States, extending through warm zones of the Neotropics to the north of Argentina (Cabrera, 1983: 446; Martínez, 1998: 110). A weed in disturbed and worked terrain, it grows in preferably damp soils. In their games, Toba-Pilagá children burst the fruits and hollow stalks of the plants. They do this with the ripe or unripe fruits of this species, when they are still covered by the inflated and globose calyx. The child places it on the palm of the hand and strikes it with the other hand, producing a loud noise as it bursts.

Physalis pubescens var. *hygrophila* (Mart.) Dunal

Annual herbaceous plant that reaches 1 m in height. Found in low-lying warm zones of South America, from Colombia to the north of Argentina, with the Gran Chaco being one of its areas of distribution. The name *P. neesiana* Sendtn. was usually used for identifications of this taxon, which has recently been reinterpreted (Toledo & Barboza, 2005: 77). The Toba-Pilagá consume the ripe fruits raw. In the past, wherever it was abundant, the women would pick a good quantity and bring them home for family consumption. They report that in years past, the English missionaries belonging to the Anglican Church, who performed evangelical work with this ethnic group, used to make jams with these fruits.

Physalis subilsiana J. M. Toledo

Annual herbaceous plant of around half a metre in height. A typical species of the Chaco (Bolivia, Paraguay and Argentina) that lives in clearings and the edges of forests and on roadsides; recently published as a new species (Toledo & Barboza, 2005: 70-72). During this investigation no samples corresponding to this species were collected. However, it should be stressed that it grows in the traditional habitats of numerous ethnic groups of the Gran



Fig. 2. - *Physalis viscosa* L. **A.** A Maká Indian offers information about the plant; **C.** Ripe fruit with remains of the accrescent calyx; **E.** A Choroti Indian shows a branch of the plant. *Physalis angulata* L.; **B, D.** Branch with fruit.

[Photos. **A, E:** P. Arenas; **B-D:** V. Friesen]

Chaco: ayoreo, chamacoco, lengua, chulupí, wichí and choroti (see exsiccata and map of distribution from Toledo & Barboza, 2005: 72, Fig. 2); perhaps it is given some of the uses mentioned for the other species of *Physalis* in the area.

Physalis viscosa L.

Species from warm America, which has been naturalized in different countries; blooms in spring and summer and fructifies simultaneously until autumn (Fig. 2 A, C, E). A perennial herbaceous plant, with horizontal, thin rhizomes, which send out erect, branchy stalks of 10-40 cm in height (Marzocca, 1957: 338; Cabrera, 1983: 445; Hurrell & al., 2010: 236). Grows in fertile, soft, humus-rich or sandy soils, and propagates by seeds and rhizomes. Frequently found in modified terrain (roads, ditches, fences, etc.) where more or less compact colonies may form, which make abundant gathering easier when they are ripe. It grows as a weed among crops, but it is also found in natural grasslands. It has been mentioned as a species that is "suspected" of causing food poisoning in animals (Marzocca, 1957: 338-340).

The Lengua-Maskoy bake the fruits in embers or boil them before eating. There is an old saying among this ethnic group that claims that the fruit can turn those who eat it into liars, which is seen as being rather humorous today (Arenas, 1981: 302). This same human group also uses a liquid prepared from crushed leaves placed in water to treat conjunctivitis and other eye ailments; the liquid is dropped into the eyes (Arenas, 1981: 301, 302). The Nivaclé and the Maká eat the ripe fruits raw. The Maká report that they are the favourite of children, who gather them in their outings into the forest. Maká hunters also comment that it is a fruit much prized by the greater rhea or "ñandú" *(Rhea americana)*. In the past, the Toba-Pilagá used to pick large quantities of the fruits, when they grew in abundance after the burning of fields. They claim that it is still eaten today despite the fact that it is not as common as it was in the past. They are eaten raw or mashed into a purée and seasoned by sprinkling ash over them (Arenas, 2003: 286). The natives of western Chaco recall that the Anglican missionaries from England who conducted evangelising work among the Toba-Pilagá and the Wichí for much of the 20th century used to prepare preserves with those fruits, and they tell that those of this species exceeded in quality those of other plants of the same genus. Both the Pilagá and the Toba from the East eat the ripe fruits raw, as we were able to observe *in situ* and as is mentioned by various other authors (Franzé, 1925: 14; Martínez Crovetto, 1964: 321; Vuoto, 1981: 22). Vuoto (1981: 22) adds that older Toba from the East would use it as a sweetener. Among the Wichí, this is the species of greatest use but specimens of other species of the genus (*P. angulata*, *P. pruinosa* var. *argentina* and *P. pubescens* var *hygrophila*) to which the same use is attributed were also gathered. The ripe fruits are eaten raw. This information was also recorded by other authors (Maranta, 1987: 186, 219; Arenas, 2003; Torres & al., 2007: 163, 166, 180). The last Vilela of Argentina's Central Chaco, who have now disappeared, told Martínez Crovetto (1965: 22) that they used to eat the fruits, but they gave no further information.

For the Toba of the East and Criollos (members of a folk society from the Argentine provinces of Formosa and Chaco), Father Franzé (1925: 14) says that the fruits also have a medicinal use as a diuretic, a febrifuge, they help prevent the formation of gallstones, and are useful for intestinal and pulmonary fevers. He adds that the leaves are frequently used in external poultices as a painkiller. Information of Franzé (1925) is completely atypical in the context of the ethnobotany of the Toba of the East. One may wonder if the information was perhaps taken from the academic bibliography, since the catalogue was prepared by the priest for an exhibition held in the Vatican in 1925. In the Criollo environment of the eastern Chaco it is known by the name "camambú". Its fruits are of a slightly acid taste and are eaten raw because they are thought to be refreshing, it also has medicinal applications (Franzé, 1925: 14; Ragonese & Martínez Crovetto, 1947: 204; Schulz, 1963: 61-62). The Criollo of the west of Formosa name it "pocote" or "pocote 'e perro". Its ripe fruits are eaten raw by children, while the aerial parts are sought out by dogs that eat them as an emetic when they suffer from indigestion (Scarpa, 2000: 265; Arenas, 2003: 286).

The Mennonite settlers are another representative human group in the region, who have a clear influence in social, political and economic affairs at the heart of the Paraguayan Chaco. They began to arrive from central Europe and the former USSR in the 1930s, escaping from persecution. In an inhospitable environment they had to make the most of the natural space and the local plants available. Among other fruits, the species of *Physalis* were well used by housewives. The use of *P. viscosa* has been confirmed, but perhaps they make use of other plants of the same genus commonly found in the area. In their dialect - "Plautdietsch" - they are known as "Junitjoasche" (= June cherries) and they are used to prepare jams, compotes and several kinds of pies ("pee"), especially "Riebelplautz", a Sunday pie which is similar to crumble.

Physalis sp.

Martínez Crovetto (1964: 22) reports that the Toba of the East call one *Physalis*, whose species the author does not identify, "tapañi". It is doubtful whether the name belongs to this genus since, to our knowledge, the name "tapañi" is usually applied by diverse Toba and Pilagá communities to representatives of the genus *Solanum* L. (*S. aridum* Morong, *S. elaeagnifolium* Cav. and *S. hieronymi* Kuntze), which when have no flower or fruit can easily be mistaken by *Physalis*

(Arenas, 1992-1993: 98; Filipov, 1992-1993: 118). Likewise, Chase Sardi (1977) claims that different species of *Solanaceae* are used by the Nivaclé for magical and medicinal purposes. They are applied by shamans in their initiation ceremonies, and are consumed in potions or are smoked. He includes *Physalis* among them, but the author provided no reliable identification. Finally, importance should be given to information coming from the Izoceño-Guarani people from the east of the Bolivian Chaco, who mention the fruits of several species of *Physalis, P. viscosa* among them, as animal feed and as a remedy (Bourdy, 2002: 147-149).

Vernacular names

There are lists of vernacular names assigned to species of *Physalis* in works of a floristic nature, or in works on the subject of useful plants, However, they have compiled names that in many cases give no specification as to where they are applied or by whom, nor to which species they refer (Corrêa, 1926: 408-409). This frequently happens in the literature of the Southern Cone of America, although the names are usually restricted to *P. viscosa*, the most common species in the region (Bondenbender, 1941: 18; Marzocca, 1957: 338; Xifreda, 1992: 44; Hurrell & al., 2010: 236). Martínez (1998) condenses a long, very detailed list of names with indications as to the places where they are applied, giving special importance to those used in Mexico and Central America. Similar care has been taken to present the vernacular nomenclature of *P. peruviana* by the compilers of the work that deals with the lost crops of the Incas (National Research Council, 1989: 249-250). Indigenous names from the Gran Chaco are given in Appendix 2, which includes data from published works on ethnic groups that were not studied by the authors.

In order to give the Criollo names or those given by the rural population greater precision we organized the vernacular nomenclature according to these human and regional groups. These generic vernacular names are also applied to various species of *Physalis* with no distinction. Among the Spanish-speaking population in Argentina the plants receive different names: "uvilla", "uvilla del campo", "uvilla camambú", "pocote", "pocote de víbora", "pocote de perro" and "meloncillo" (Hieronymus, 1929: 203; Bodenbender, 1941: 18; Acuña, 1945: 23; Schulz, 1976: 42; Scarpa, 2000: 265; Biurrun & al., 2007: 126; Torres & al., 2007: 163, 166, 180). In Paraguay, where the population is bilingual in Spanish and Guarani, the name generally applied to the different species is the Guarani term "kamambu" (Fiebrig-Gertz, 1923:119; Cadogan, 1957: 31). This designation is also applied in the Argentine regions bordering on Paraguay (such as the provinces of Misiones, Corrientes, Formosa, Chaco and Salta) as well as in the east of Bolivia (Franzé, 1925: 14; Ragonese & Martínez Crovetto, 1947: 204; Schulz, 1963: 61-62; Bourdy, 2002: 147-149). Bertoni (1980: 22, 43) offers it as a generic word for *Physalis* and gives in addition the phonetic variant "kamapú," possibly more linked to the Tupi language, since it is the word that is habitually reported for Brazil (Tastevin, 1923: 16; Corrêa, 1926: 408; González Torres, 1981: 226; Di Stasi & al., 1989: 45; Da Matta, 2003: 87). "Kamambu" means "blister, bladder formed by elevation of the epidermis, bubble"; by extension, or similarity, it is applied to those inflated fruits such as the species of *Physalis* and those of some *Sapindaceae* (Gatti & al., 1947: 37; Guasch, 1981: 569; Gatti, 1985: 58-59). It should once again be stressed that the Tupi Guarani-speaking peoples are refined observers of nature and the vernacular generic name coincides with the generic name given by academic science. In fact, *Physalis* comes from the Greek *physa* which means bladder (Bailey, 1938: 657; Soukup, 1970: 261; Parodi, 1980: 945). The name "kamambu'i" (the particle "i" is a diminutive that means "small") is usually given to *P. viscosa*, because of its smaller size (Hassler, 1909: 145; Bodenbender, 1941: 18; Schulz, 1976: 42; Pin & al., 2009: 152).

The vernacular nomenclature and the classification systems of the hunter-gatherer peoples are of great interest because they contain an invaluable body of observations on nature and culture. Very little has been investigated on this topic among the indigenous peoples of the Gran Chaco. Regarding *Physalis* it can be seen that there are primary names and also compound names. The primary names probably suggest certain meanings, although we have little information in that respect. Such is the case of the "qotoñí" (Toba-Pilagá) or "makani" (Maká) names given to *Physalis*. As for the compound and descriptive names we resort to the phytonymy of the Wichí people, who give *Physalis* the following names: "wahat te'lhui" (= sábalo eyes; sábalo, a fish), "wuq'ute lhui" (= owl eyes), "wi'yes te'lhui" (= cavy eyes; cavy, a small rodent). With such descriptive names they compare the fruits surrounded by the calyx with the morphology of the eyes of the animals mentioned. The name "p'oh p'oh" is an onomatopoeic, primary name, and alludes to the explosion of the closed accrescent calyx produced when it is crushed or struck (Maranta, 1987: 186; Arenas, 2003: 286).

Discussion and conclusions

The Gran Chaco is home to representatives of nearly one half of the 12 species mentioned for South America (Hunziker, 2001; Toledo & Barboza, 2005). This shows that the region is a suitable environment for the plant's reproduction. In the vast anthropological literature existing on the Gran Chaco we have found practically no references to species of *Physalis*. This occurs very often due to the lack of real attachment of the specialists in social sciences to documentation on plants in their research papers, in which systematic botanical references are often missing, or if they are present they may not be reliable.

The categories of use recorded for the *Physalis* of the Gran Chaco largely correspond to the label "food" and only exceptionally has the plant been documented under "medicinal", with just one use as a remedy among the Lengua-Maskoy. The largest amount of information gathered corresponds to whose presence and use could be observed among most of the ethnic groups of the Gran Chaco studied. Its form of reproduction by rhizomes probably facilitates the formation of colonies where gatherers can collect a certain amount of the product and transport it to their homes. This species is possibly very resistant to competition with other organisms as well as being resistant to adverse conditions, since it may be found in a great diversity of environments. The other species that inhabit the region are less commonly present. On this point, Martínez (1998: 72) stresses that most of the species have restricted habitats, and many are only known from the type material or from a few additional collections.

The main use of the different species of *Physalis* is for food, being the ripe fruits the part used. The forms of preparation involved are very simple and come down to eating them raw, boiled or roasted among the ashes of the fire. They form part of no dish in particular and only a few ethnic groups report that they usually season them with a little ash. This is explained by two features that characterize the cooking of the natives of the Gran Chaco: the almost total absence of mixtures of several ingredients to make dishes or recipes, and their little enthusiasm for strong flavours, to the extent that their preparations tend to be bland and are only identified by their flavour "per se" (Arenas, 2004).

In the Gran Chaco, the period of abundance, either of fruits or of other products from the forest, is from the end of spring to the beginning of autumn (December to March). In the past the indigenous groups that inhabited the arid lands used to collect large quantities of food products and dry them to keep for the time of scarcity, which was usually from autumn until well into spring (April to the start of December). Various papers give a long list of wild fruits of the flora from the Chaco region that were dried for keeping (Métraux, 1946; Arenas, 1981, 1982, 2003; Arenas & Scarpa, 2007; Scarpa, 2009b). However, we have no information that species of *Physalis* were processed for this purpose. In this respect the ethnic groups of the Gran Chaco differ from those of North America who were reported to conserve dried fruits of this genus to prepare sauces or other types of foods in times of shortage (Facciola, 1990: 206-207; Moerman, 1998: 395-396; 2010: 180-181).

As mentioned above, Toba-Pilagá children use the unripe fruits of *P. pubescens*, covered by the globose calyx, in their games to produce a little explosion. In North America something similar occurs among indigenous children, as reported by Duke (1992: 146), who does not specify the ethnic group to which they belong, while another author assigns that ludic practice to Dakota children (Moerman, 1998: 396).

Among the Lengua-Maskoy and the Nivaclé some *Solanaceae* form part of the potion consumed during the shaman's initiation ceremonies, or they are used to be smoked during their ceremonial rites (Chase Sardi, 1977; Arenas, 1981; Pagés Larraya & Tomasini, 1987). Chase Sardi (1977) explicitly mentions representatives of *Physalis* that were applied for magical and therapeutic purposes. There is very little information in the literature to indicate or suggest psychoactive effects among the species of *Physalis*. This genus was not cited by Schultes (1979) in the stock of hallucinogenic *Solanaceae*. However, in a later work it is reported that *P. angulata* is slightly narcotic (Schultes & Raffauf, 1990: 436). The consumption of its fruits as a soporific among the Kallawayas of Bolivia is suggestive (Girault, 1987: 382). The information on the Omaha of North America is also striking: they smoke the root of *P. lanceolata* for unspecified ailments (Moerman, 1998: 396). This information also lends credence to our questions since the plants used for smoking in therapeutic contexts are often used to induce altered states or as psychoactives. Such disperse information indicates the need to deepen the studies on this aspect of the genus *Physalis*.

The edible species of *Physalis* are an important resource for the hunter-gatherers and for the peasants of the Chaco region. Their role becomes more relevant in both the more arid sectors, especially during periods of prolonged drought, and in emergency situations during their excursions away from the settlements and in the forests. In these cases, the inhabitants of the region know perfectly well a group of plants that can provide them with food, salty or fresh aqueous substances, or elements that provoke salivation and comfort them in cases of thirst. These products are characterized in certain ethnobiological papers as "famine foods", "starvation foods", "emergency foods" or "queer foods" (Minnis, 1991: 232). Without the dramatism of the picture presented above, each ethnic group knows different small fruits that are used as sweets by children in their adventures and games, including those of *Physalis*.

Physalis fruits, along with others of an even smaller size, are an important source of food for certain birds, reptiles or small mammals, and an invaluable contribution in the food chain, apart from being viewed as occasional foods for the different human groups. The local indigenous peoples are very well aware of the foods consumed by animals and, as regards *Physalis*, we have indicated above that the Maká attribute its consumption to the *Rhea americana* and the Guarani of the Bolivian Izozog report that it is food for the *Columbina picui* dove (Bourdy, 2002: 149).

As mentioned throughout this paper, the *Physaslis* are widely used as medication in various regions of America. Nevertheless, in the material gathered during this investigation the only information obtained comes from the Lengua-Maskoy of the Paraguayan Chaco (Arenas, 1981: 301-302). Recent

contributions on the pharmacopoeias of various indigenous groups of the region shed no new information on medicinal *Physalis* (Arenas, 1987; Filipov, 1994; Scarpa, 2004; Martínez, 2008; Scarpa, 2009a; Pirondo & al., 2009), and likewise in rural communities (Schulz, 1997; Scarpa, 2000; Chifa & Ricciardi, 2001). In the case of indigenous groups we can find a possible explanation in the fundamentals of their traditional ethnomedicine, in which curing illnesses was based fundamentally on shamanic therapy, which in this region does not resort to the application of medicines (Métraux, 1967; Susnik, 1973; Regehr, 1993; Arenas, 2009). Of course, these native peoples also had a reduced stock of natural remedies which served to relieve simple ailments but, save for the Lengua-Maskoy exception mentioned, does not include species of *Physalis*. By contrast, the settlers who arrived in the region from other neighbouring areas brought their respective pharmacopeoias as part of their cultural heritage, and this gradually introduced different medicinal plants to the indigenous people with whom they came into close contact; however, in the catalogues collected so far there is no reference to *Physalis* (Martínez Crovetto, 1964; Arenas, 1987; Schmeda-Hirschmann, 1993; Filipov, 1994; Martínez, 2008; Scarpa, 2009a). As regards the ophthalmological use the Lengua-Maskoy give to *P. viscosa*, we found no reference in the almost one hundred bibliographic sources from America reviewed. It is even more striking that the records of medicinal plants in neighbouring folk areas of Bolivia, Paraguay and Argentina do not mention its properties for treating ocular ailments, and the only information we found is for *P. philadelphica*, the fruits of which the Diegueño Indians of North America mash and use the juice as an eyewash (Moerman, 1998: 396).

A large volume of papers dealing with useful plants in different parts of America was examined, and in almost one hundred works the use of *Physalis* as a medicine was found. On the basis of these data certain distinctive features on this kind of use can be gathered: all parts of the plants (fruits, leaves, flowers, stems and roots) are used. They are prepared in different forms (decoction, infusion, soaked) and applied in different ways, internal or external. In most cases, the indicated species of *Physalis* is applied alone, in other cases it is applied with other plants in the form of prescriptions or compounds. In this review two aspects attracted particular attention. First of all, that the stock of ailments for which they are applied is moderate, that is, they are not reported as panaceas indicated for countless ailments, as frequently happens in folk medicine. Secondly a marked repetition of medicinal qualities or attributes could be observed. Perhaps they were coincidences or due to a shared situation in works with these characteristics, in which they are copied from each other without mentioning sources. On the other hand, ethnobotanists and ethnopharmacologists believe that when a species or a group of species are used to the same end by different human groups, this may be an indication of efficacy and biological activity. Nevertheless, we insist on the important role of dissemination played by informative publications on the subject of medicinal plants and the rather irresponsible reproduction of such data.

The ethnobotanical data relative to the species of *Physalis* recorded in the bibliography consulted and mentioned in this paper bring together a large number of species whose belonging and identification were taken with caution. Since the creation of the genus by Linnaeus in 1753, it grew noticeably, and in successive taxonomic revisions nomenclatural variations occurred, taxa were reconsidered and new species were described. Putting the taxonomy of the genus in order was no easy task for those who studied it. On this difficulty, Martínez (1998: 72) stressed that estimations of the number of species within the genus vary enormously, between 75 and 120 taxa, probably because the species are similar morphologically, and collections, field notes and other different study elements are scarce or confusing. In order to interpret the cultural role of the *Physalis* in the countries of America, during this investigation a long list was prepared with the scientific names of species of the continent for which ethnobotanical data have been recorded. This material was compared with the current valid names according to the data bases of Kew Gardens, Tropicos and IPNI. After this comparison between former and current data, more doubts than certainties arose regarding the validity of the identifications given in the bibliography on useful plants. This task proved that achieving a correct interpretation of *Physalis*, for the purpose of clarifying its ethnobotany, will still demand considerable work based on floristic and taxonomic studies and a detailed analysis of ethnobotanical and botanical records.

In the Gran Chaco, the consumption of the different species of *Physalis* for food has slowly been abandoned over recent decades due to the sociocultural and environmental change that took place throughout the region. Since the end of the 19th century, and in particular in the first part of the 20th century, the Gran Chaco was invaded and colonized by national societies, and the natives lost their ancestral territories. Our informants frequently stress that forestry exploitation and the advance of the agricultural frontier are responsible for the scarcity of traditional foods, while pointing out that the occupation and expropriation of their territories prevent the displacement and seasonal migration that formed their way of life in the past. The arrival of the livestock settlers brought as a consequence the introduction of animals of great voracity such as sheep, goats, pigs and cows, which destroyed natural pastures and caused the disappearance of species and a reduction in biodiversity. The Toba-Pilagá claim that *P. viscosa* is no longer as abundant as in the past, and they suggest that perhaps this is a consequence of stockbreeding.

The specific review of this group of plants revealed the need to investigate and deepen field work while the traditional customs and knowledge are still alive in the memory of fewer and fewer persons. To conclude, we again underline the opinion presented in the introduction: documenting these facts in order to safeguard even a small part of the natural history of humankind is the main objective of our ethnobotanical research.

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Appendix 1. – Exsiccata of *Physalis* L. from the Gran Chaco kept as taxonomic vouchers.

Physalis angulata L.

Argentina. Prov. Formosa. Dpto. Matacos: Ing. Juárez, Barrio Mataco, 23°54 S 61°51 W, 24.II.1983, *Maranta 54* (BA) [Wichí indians]. **Prov. Salta. Dpto Rivadavia:** Alto de la Sierra, 22°44 S 62°30 W, 5.XI.1984, *Maranta 671* (BA) [Wichí indians].

Paraguay. Dpto Presidente Hayes: Colonia Menno, Paratodo, 22°35 S 60°20 W, 28.I.1976, *Arenas 1442* (BA) [Lengua indians]; Qemkuket, desvío a Puerto Falcón de la Ruta No. 9, 25°11 S 57°38 W, 26.XII.2009, *Arenas 3735* (FCQ) [Maká indians].

Physalis pruinosa var. *argentina* J. M. Toledo & Barboza

Argentina. Prov. Formosa. Dpto Patiño: Colonia Muñiz, a 8 km de Las Lomitas, 24º46 S 60º29 W, 3.VI.1985, *Dell Arciprete 25* (BA) [Pilagá indians]. **Dpto Matacos:** Ing. Juárez, Toldería Toba, 1 km al N del pueblo, 23°53 S 61°51 W, 20.II.1983, *Arenas 2191* (BA) [Toba-pilagá indians]. **Dpto Bermejo:** Pozo de Maza, 23°34 S 61°42 W, 4.II.1989, *Arenas 3399* (BA) [Wichí indians]; Pozo de Maza, 23°34 S 61°42 W, 15.VII.1996, *Scarpa 84* (BA) [Criollo]; Vaca Perdida, 23º29 S 61º38 W, 13.III.1986, *Arenas 3214* (BA) [Toba-pilagá indians]. **Prov. Salta. Dpto Rivadavia:** Misión La Paz, 22º24 S 62º30 W, 23.I.1984, *Arenas 2683* (BA) [Choroti indians].

Paraguay. Dpto Presidente Hayes: Misión San Leonardo de Escalante, 61º00 S 24º45 W, VI.1981, *Sturzenegger s.n.* (BACP 2524, BA) [Nivaclé indians].

Physalis pubescens L.

Argentina. Prov. Formosa. Dpto Patiño: El Descanso, 24º08 S 60º27 W, 28.XI.1991, *Filipov & Arenas 61* (BA) [Pilagá indians].

Physalis pubescens var. *hygrophila* (Mart.) Dunal

Argentina. Prov. Salta. Dpto Gral. San Martín: Misión Chaqueña "El Algarrobal", 23º15 S 63º44 W, 25.II.1984, *Maranta & Arenas 561* (BA) [Wichí indians]. **Dpto Rivadavia:** Misión La Paz, 22º24 S 62º30 W, 24.I.1984, *Arenas 2694* (BA) [Choroti indians]; Misión San Patricio, 23º53 S 62º33 W, 3.I.1983, *Maranta & Arenas 339* (BA) [Wichí indians]. **Prov. Formosa. Dpto Bermejo:** Dr. G. Sayago, La Rinconada, 23º29S 61º34W, 7.VIII.1985, *Arenas 2978* (BA) [Toba-pilagá indians].

Physalis viscosa L.

Argentina. Prov. Formosa. Dpto Bermejo: El Churcal, 23º22 S 61º49 W, 15.XI.1985, *Arenas 3040* (BA) [Toba-pilagá indians]; La Rinconada, 23º29 S 61º34 W, 6.XII.1985, *Arenas 3114* (BA) [Toba-pilagá indians]; La Rinconada, 23º29 S 61º34 W, 10.XII.1996, *Scarpa 182* (BA) [Criollo], La Rinconada, 23º29 S 61º34 W, 14.XII.1996, *Scarpa 222* (BA) [Criollo]; Pozo de Maza, 23°34 S 61°42 W, 30.III. 1999, *Scarpa 382* (BA) [Criollo]; Pozo de Maza, 23°34 S 61°42 W, 10.XI.1989, *Arenas 3428* (BA) [Wichí indians]. **Dpto Matacos:** Ing. Juárez, Toldería Toba, 1 km al N del pueblo, 23°53 S 61°51 W, 20.II.1983, *Arenas 2229* (BA) [Toba-pilagá indians]. **Dpto Patiño:** Pozo Navagán, reducción de indígenas pilagás, 24º15 S 60º00 W, 25.I.1982, *Arenas 2023* (BA) [Pilagá indians]. **Dpto Pilagás:** Misión Tacaaglé, 24°58 S 58°49 W, 27.IX.1979, *Vuoto 1978* (BACP, BA) [Toba from the East indians]; Misión Tacaaglé, 24°58 S 58°49 W, 12.X.1979, *Vuoto 2056* (BACP, BA) [Toba from the East indians]. **Prov. Salta. Dpto Rivadavia**: Alto de la Sierra, 22°44 S 62°30 W, 5.II.1984, *Maranta 670* (BA) [Wichí indians]; Misión La Paz, 22º24 S 62º30 W, 15.I.1982, *Arenas 2107* (BA) [Nivaclé indians]; Misión La Paz, 22º24 S 62º30 W, 12.I.1984, *Arenas 2609* (BA) [Choroti indians]; Misión La Paz, 22º24 S 62º30 W, 15.I.1982, *Arenas 2107* (BA) [Wichí indians]; J. Solá, Morillo, 23°28 S 62°53 W, 12.I.1983, *Maranta & Arenas 102* (BA) [Wichí indians]; J. Solá, Morillo, 23°28 S 62°53 W, 3.XII.2005, *Suárez & Arenas 28* (BA) [Wichí indians].

Paraguay. Dpto Presidente Hayes: Colonia Menno, Paratodo, 22°35 S 60°20 W, 30.I.1976, *Arenas 1473* (BA) [Lengua indians]; Colonia Menno, Paratodo, 22°35 S 60°20 W, XII.1974, *Arenas 1088* (BA) [Lengua indians]; Qemkuket, desvío a Puerto Falcón de la Ruta No. 9, 25°11 S 57°38 W, 30.XII.2009, *Arenas 3735* (FCQ) [Maká indians]; Gral. Bruguez, margen del río Pilcomayo, 24°45 S 58°50 W, 4.I.1980, *Arenas s.n.* (BACP 1553, BA) [Maká indians]; Estancia Loma Pyta, 23°40 S 59°35 W, 4.IV.1974, *Arenas 566* (BA) [Nivaclé indians]; Estancia Loma Pyta, 23°40 S 59°35 W, 9.XII.1978, *Arenas s.n.* (BACP 676, BA) [Nivaclé & Maká indians]. **Capital Asunción:** 25°16 S 57°38 W, 4.IX.1976, *Schinini 13538* (BA) [Criollo].

Appendix 2. – Vernacular names for *Physalis* from the Gran Chaco. The group (Amerindian or Criollo) from which the names are presented is shown between square brackets at the end of each name.

Physalis angulata L.

"yateepé yaamit", "yam yateepé yaamit" [Lengua indians];
"maqane" [Maká indians];
"kyes'tax teeh'lhuy", "wo'ko te'lhoy", "amlhox te'lhoy" [Wichí indians].

Physalis pruinosa var. *argentina* J. M. Toledo & Barboza

"xucinxasché lhakos" [Nivaclé indians];
"maqane" [Pilagá indians];
"kuchi'maGañik", "kochi'maGañi" [Toba-pilagá indians];
"kaaní" [Choroti indians];
"wahat te'lhui", "wuq'ute lhui" [Wichí indians];
"pocote" [Argentinian Criollo].

Physalis pubescens L.

"qoto'ñi" [Pilagá indians].

Physalis pubescens var. *hygrophila* (Mart.) Dunal

"kaaní hi'toi" [Choroti indians];
"qochi'maGañik" [Toba-pilagá indians];
"yesteh'lhuy", "wi'yes te'lhui", "p'oh p'oh" [Wichí indians].

Physalis viscosa L.

"yateepé yaamit" [Lengua indians];
"maqane" [Maká indians];
"makaanni", "makane", "qa'ni" [Nivaclé indians];
"camambú" [Criollo; Paraguayan Chaco];
"pocote", "pocote e'comer", "pocote e'perro" [Argentinian Criollo];
"si'khyuste'lhoi", "wo'ote'lhoi", "sik'yus telhoy", "wahat te'lhui", "wuq'ute lhui" [Wichí indians];
"katoñi" [Toba from the East indians];
"qoto'ñi", "qotoñi" [Toba-pilagá indians];
"qoto'ñi" [Pilagá indians];
"ka ni'i" [Choroti indians];
"bons(l)í" [Vilela Indians, Argentina, Prov. Chaco, Resistencia] (Cf. Martínez Crovetto, 1965: 22).