

# PLANT RESOURCES USED BY THE AYOREO OF THE PARAGUAYAN CHACO<sup>1</sup>

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Schmeda-Hirschmann, Guillermo (*Departamento de Ciencias Biológicas, Universidad de Talca, Casilla 747, Talca, Chile*). PLANT RESOURCES USED BY THE AYOREO OF THE PARAGUAYAN CHACO. *Economic Botany* 48(3):252–258. 1994. An ethnobotanical study was carried out among the Ayoreo of the Paraguayan Chaco to document their use of food plants. Scientific and Ayoreo names as well as uses have been provided for 33 gathered and 12 cultivated food plants. The agricultural and gathering practices are presented and discussed.

Plantas alimenticias de los Ayoreo del Chaco Paraguayo. Se realizó un estudio etnobotánico entre los Ayoreo del Chaco Paraguayo para documentar su empleo de plantas alimenticias. Se presentan los nombres científicos y Ayoreo, así como el uso de 33 plantas alimenticias objeto de recolección y de 12 especies cultivadas.

**Key Words:** Ayoreo; Paraguayan Chaco; gathering; agriculture; edible plants.

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Little is known of the natural resources used by the ethnic groups living in the Paraguayan Chaco. Except for the ethnobotanical studies of the Maká and Lengua-Maskoy cultures (Arenas 1981, 1982), the information available is sparse and not properly documented with voucher herbarium specimens.

The Ayoreo are a hunter-gatherer people traditionally occupying an area of some 330,000 square kilometers in Paraguay and Bolivia, delimited by 16°–22° S and 58°–64° W (Bormida and Califano 1978). A few decades ago, they lived in an environment with restricted natural resources in an economy of relative abundance. The population included some 1500 individuals settled in the Central Chaco at Gesudi and Campo Loro, as well as at the Mission Maria Auxiliadora by the Paraguay River, in the settlements of Isla Alta and Cucarani. Two families lived at Chovoreca (see map). The Ayoreo language belongs to the linguistic family, Zamuco, as does that of their neighbours, the Chamacoco. Seven Ayoreo clans are recognized and are distinguished by different signs used for the identification of small forest paths, or differences in textile handicrafts. The seven clans are the Chikenoi,

Etacore, Pikanerai, Dosapei, Kutamurajá, Posorajá and Juuminí.

The objective of the present work is to document the use of plants as food by the Ayoreo, including both the cultivated and gathered species.

## STUDY AREA

The surveyed area is part of the Chaco vegetation zone, a vast alluvial plain located in the central part of South America (Fig. 1). In the central Paraguayan Chaco, where the settlements of Gesudi and Campo Loro are located, the vegetation is a xeromorphic forest with trees 15–20 m tall, and a continuous stratum of trees some 8–10 m high. The dominants are *Aspidosperma quebracho-blanco*, *Chorisia insignis*, *Schinopsis quebracho-colorado*, *Castela coccinea*, *Prosopis kuntzei*, *Bulnesia sarmientoi*, *Capparis tweediana*, *C. retusa*, *C. speciosa*, *Zyziphus mistol*, *Caesalpinia paraguariensis*, *Sideroxylon obtusifolium* and several species of Cactaceae and Bromeliaceae. Maria Auxiliadora is located in the wet Chaco and is now divided into Isla Alta, near Colonia Peralta, and Cucarani, some 12–15 km south by the Paraguay River. The dominant vegetation is a *Copernicia alba* (Palmae) savanna associated with a xerohygrophilic forest with trees 10–12 m tall: *Prosopis alba*; *Geoffroea spinosa*;

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*Maytenus vitis-idaea*; *Zyziphus mistol*; *Capparis* spp. and *Acacia caven*. Bromeliads are richly represented in this forest. Chovoreca is an almost inaccessible settlement. The vegetation at Chovoreca resembles the Brazilian "cerrado" formation, with *Acrocomia aculeata*, *Anadenanthera macrocarpa*, Bignoniaceae, Leguminosae, Vochysiaceae, several Arecaceae and legumes.

The mean annual rainfall ranges between 400 and 1300 mm according to the zone. Rains are irregular both in season and location, but usually coincide with the spring and summer. There is a dry season from May to September. In the humid eastern part of the Chaco, rain is common throughout the year. Temperatures vary from more than 45°–48°C in the central and northern part of the Chaco in the summer months, to 1°–2°C or less during the night in winter. Mean annual temperatures are 20°–25°C (Ramella and Spichiger 1989; Spichiger et al. 1991).

## METHODS

Information was obtained by interviews with adults recognized as having a high level of knowledge of their culture. In most cases, interviewees had spent a significant part of their lives in the forest before contacting "civilization."

Field work was carried out at the following settlements: Campo Loro (April 1987, November 1988); Gesudi (November 1990); Chovoreca (February 1991); and María Auxiliadora, comprising both the Isla Alta and Cucarani (November–December 1991). Plant specimens were either collected in the forests or from the Ayoreo gardens with the help of Ayoreo informants. Ayoreo names and uses of edible plants were documented for each specimen. The data were cross-checked with informants in other settlements. Most of the work was carried out with the help of the following informants whose ages are shown in parentheses: Gabriel Gajakai (50–60), belonging to the clan Chikenoi and from Gesudi; Luis Ijaoi (28) from the clan Dosapei and also from Gesudi; and José Ikevi (approximately 50) and Cachui Gajakai (55) both from the clan Posorajá, living at Chovoreca. In the Misión María Auxiliadora, most work was carried out with the help of Abujei Jurumi (70–75), from the clan Juumini and living at Isla Alta; Ingoi Ari (70–75), from the clan Pikanerai and also residing at Isla Alta; and Seei Dosapek (70) from Cucarani. In Campo Loro, Mateo Sobode

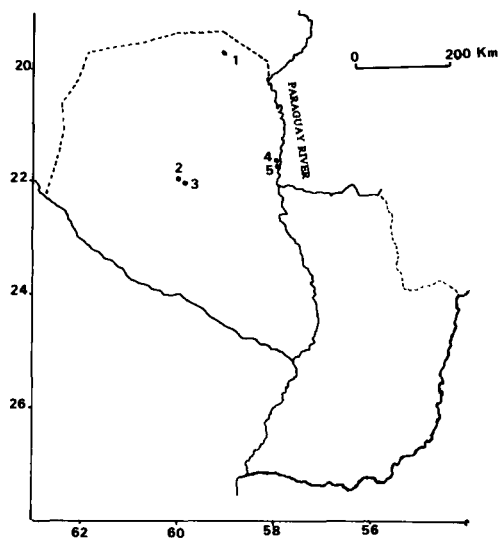


Fig. 1. Paraguay and location of the Ayoreo settlements in the Paraguayan Chaco. 1: Chovoreca; 2: Gesudi; 3: Campo Loro; 4: Isla Alta; 5: Cucarani.

(35–40) of the clan Chikenoi assisted by contacting other older informants in the settlement.

Mythic narrations, songs and invocations were recorded and translated by Spanish speaking Ayoreo. The Ayoreo names were written in Spanish, as developed by the Summer Academy of Language (New Tribes Missions). The grammar was verified in some cases by the Ayoreo teachers at María Auxiliadora.

Voucher herbarium specimens were identified at the United States National Herbarium, Smithsonian Institution, Washington, D.C. (US) by Stephen F. Smith, Dan Nicholson, Lyman B. Smith, R. W. Read and W. J. Hahn, and specimens have been deposited at the Smithsonian Institution, Washington (US) and at the Herbarium of the University of Talca (Chile).

## PLANTS GATHERED BY THE AYOREO

The plants are listed in alphabetical order. Entries consist of botanical name, voucher, specimen number (Schmeda collection), common name as recorded by us and additional data on their uses. Table 1 summarizes the plants most commonly cultivated by the Ayoreo.

### ACHATOCARPACEAE

*Achatocarpus praecox* Griseb., S 1479, *Eso-kenéjna*, shrub. The ripe fruit is similar in form to *esó* (*Sideroxylon obtusifolium*). Of limited consumption.

TABLE 1. PLANTS CULTIVATED BY THE AYOREO.

Plant family	Ayoreo name	Scientific name	Voucher
Caricaceae	Namona	<i>Carica papaya</i> L.	1500
Convolvulaceae	Batata*	<i>Ipomoea batatas</i> (L.) Lam.	1517
Cucurbitaceae	Mimiojó	<i>Citrullus lanatus</i> (Thunb.) Mats. & Nakai	1495
Cucurbitaceae	Dutué	<i>Cucurbita maxima</i> Duchesne	1522
Cucurbitaceae	Purudie	<i>Cucurbita pepo</i> L.	1585
Cucurbitaceae	Duchubíre	<i>Lagenaria siceraria</i> (Mol.) Standl	1582
Euphorbiaceae	Pejek	<i>Manihot esculenta</i> Krantz	1497, 1498
Gramineae	Guejna	<i>Zea mays</i> L.	1579
Myrtaceae	Guayaba*	<i>Psidium guajava</i> L.	1520
Papilionaceae	Cugué	<i>Phaseolus lunatus</i> L.	1518, 1524
Solanaceae	Sidí	<i>Nicotiana tabacum</i> L.	1586
Musaceae	Banana*	<i>Musa paradisiaca</i> L.	1496

\* Spanish names.

### ANNONACEAE

*Annona nutans* R. E. Fries, S 1353, *gaguajape*, shrub 2–3 m. Found in wet soils of the central Chaco, frequent near Gesudí. The ripe fruits are eaten raw, but according to some informants, were not consumed when the natives lived in the forest.

### ARACEAE

*Taccarum weddellianum* Brongn. ex Schott., S 1406, *dóinejná*, herb 0.80–1.50 m, forming groups. Collected at Chovoreca. The tuber, some 20 cm in diameter, is cooked in ashes. If not properly prepared, "it causes mouth pains."

*Spathicarpa hastifolia* W. Hooker, S 1385, 1504, *ymose*, herb 20–30 cm. Frequent in well-drained soils near the Paraguay River and on clay soils in Chovoreca. Tubers, the size of small potatoes, are cooked in ashes. Eaten in winter, in spring it is said to cause a burning sensation in the mouth.

### ARECACEAE

*Acrocomia aculeata* (Jacq.) Loddiges ex Mart., S 1411, 1480, *pikáde*. The different parts of the fruit *adie* have specific names: *ajnunie*, the seed and *anione*, the yellow, edible pulp, which are both eaten raw. The trunk yields starchy fibers which are processed to obtain *edaui* or *fariña*, a kind of flour. The palm heart (*carodí*) is also highly prized, either raw or cooked in ashes. *Pikáde* can be found in the cerrado formations of Chovoreca or near the Paraguay River at María Auxiliadora, but not in the Central Chaco.

*Copernicia alba* Morong S 1317, 1366, 1531, *ijnáque*, *ijná*. Common in the wet Chaco. The

palm heart, *carodí*, is eaten raw, cooked in water or in ashes. The palm ashes were used as a salt substitute.

*Trithrinax schizophylla* Drude S 1326, 1573. "Nujna." Frequent in the borders of xerophytic forests. The palm heart, *carodí* is eaten either raw, cooked in ashes or boiled in water.

### ASCLEPIADACEAE

*Marsdenia paraguariensis* Morillo, S 1306, *adó*, vine. Frequent in the Central Chaco. The roots are edible, and the fruit valves are used as spoons. The plant is not eaten by rodents which usually destroy the mandioca (*Manihot esculenta*) plots. The roots are cooked in ashes, but it is said that care has to be taken since the roots cause vomiting if not well cooked. The roots are preferred in the dry season, when their water content is low. More than 3 kg of roots can be obtained from a single vine. The fruit can also be eaten, but it does not have a pleasant taste.

*Morrenia odorata* (Hook et Arn.) Lindl., S 856, 1488, 1576, *pongorapitá*, herb, vine. Common in sunny exposures. The unripe fruits are cooked in ashes for some 10–15 minutes, and the fleshy portion eaten. A second species, *Morrenia stormiana* (Morong) Malme, known as *pongorá* (S 872, 1157 and 1308), is regarded as tasteless.

### BROMELIACEAE

*Bromelia balansae* Mez. S 862, 1182, 1482, *dore*, herb. Common in the underforest forming dense associations. The gathering of *dore* is women's activity. The plants are placed directly in the fire, and the base of the leaves eaten.

## CACTACEAE

*Cereus spegazzinii* F. A. C. Weber, S 1154, 1578, *nujnangá*. Cactus 1–1.5 m with a variegated, whitish-lilac pseudostem. Frequent in the understory of the forest. The ripe fruit is red inside and is eaten raw.

*Cereus* sp. S 1184, *naujná*, arborescent 4–5 m, common in the xerophytic forest. The fruits which ripen in summer are externally yellow with white flesh and are eaten raw. Taste is similar to *chirimoya* (*Annona* spp.).

*Harrisia bonplandii* (Parmentier) Britton et Rose, S 1185, 1489, *datura* (the fruit), *ajnia* (the white flower). Frequent, 3–4 m long, white flowers. The fruits are eaten raw. The young flowers are boiled in water with salt and *jnopita* (*Capsicum chacoense*), or are cooked in ashes.

*Praecereus* (= *Cereus*) *rhodoleucanthus* (K. Schum.) N. P. Taylor, S 1183, *tococ*. Common, forming aggregations in the understory of the forest and xerophytic forests. The fruits are eaten raw.

*Monvillea spegazzinii* (Weber) Britton et Rose, S 1491, *naujá*. Frequent in the understory of the forest. Fruits are edible.

## CANNACEAE

*Canna glauca* L., S 1483, *bacao*, herb. Forming aggregations in humid places, the rhizome is baked in ashes, done in 20 minutes. Rhizomes said to lose their flavour if a woman sings when gathering *bacao*. Rhizomes are said to taste better in autumn and winter.

## CAPPARACEAE

*Capparis retusa* Grieseb., S 875, 1174, 1528, *cuyá*, *juyá*, shrub 3–4 m. Abundant in the xerophytic forest. The unripe fruits are boiled in water for several hours with at least three changes of water. If these precautions are not taken, the fruits taste "like aspirin."

*Capparis salicifolia* Griseb., S 854, 1178, *guiatú*, shrub 3–4 m. The plant is regarded as poisonous, but the fruits can be eaten after adequate treatment. The unripe fruits are boiled in water for several hours, with 3–4 changes of water. If eaten after a single boiling, the fruit induces a drunken sensation. Some informants consider the plant to be very dangerous. The treatment for the intoxication caused by this plant is honey from a native bee.

*Capparis tweediana* Eichl., S 868, 1173, *guiatúá*, shrub 2–3 m. Very common in the xerophytic forest. The fruits were commonly eaten by the Ayoreo when they lived as nomads. The unripe fruits are boiled in water for several hours with 3–4 changes of water.

## CONVOLVULACEAE

*Merremia dissecta* (Jacq.) H. Hallier, S 1595, *pujukuode*, voluble. Common in Chovoreca. The tuber is cooked in ashes.

## ERYTHROXYLACEAE

*Erythroxylum myrsinites* Mart., S 1372, *garamejná*, small tree 3–4 m. Frequent in the cerrado formation in Chovoreca. The small, red fruits are eaten raw.

## FABACEAE

*Geoffroea spinosa* Jacq., S 1168, 1348, 1478, *jó*, tree 4–5 m. Frequent; the unripe fruits are boiled in water, while the ripe ones are placed directly in the fire or cooked in ashes. The taste is like coconut.

## MIMOSACEAE

*Prosopis alba* Griseb., S 1180; *Prosopis fiebrigii* Harms, S 1552, *najnuña*, tree 5–6 m. Frequent, the ripe pods are eaten either raw, or the flour is processed into *fariña* or fruits can be cooked in an earth oven.

## PASSIFLORACEAE

*Passiflora cincinnata* Mast., S 1381; *Passiflora mooreana* Hook, S 1167, 1365, *ohjá*, vine. Common; the orange-sized fruits are red-orange in color when ripe and are eaten raw by some Ayoreo groups. The taste of *P. cincinnata* fruits is like grapefruit.

## RHAMNACEAE

*Zizyphus mistol* Griseb., S 1177, 1312, 1587, *nujná*, tree 4–6 m. Common in the xerophytic forest, the ripe fruits are eaten raw, or pounded and consumed with water.

## RUBIACEAE

*Guettarda uruguensis* Cham. & Schlecht, S 1384, *esokenejnami*, shrub 1.4 m. Frequent at Chovoreca, children eat the fruits.

## SANTALACEAE

*Acanthosyris falcata* Griseb., S 1333, 1541, *gajá*, tree 3–4 m. Frequent in humid soils, the yellow fruits are eaten raw.

## SAPOTACEAE

*Sideroxylon obtusifolium* (Roem. & Schult.) Pennington ssp. *obtusifolium*, S 1181, 1332, 1475, *esó*, tree 3–4 m. Frequent in the Central Chaco, the small grape-sized fruits are highly prized and are considered the most delicious of the Chaco—eaten raw.

## SOLANACEAE

*Capsicum chacoense* A. T. Hunz., S 863, 1301, 1407, 1493, 1584, *jnopitá* or *nurujná*, herb 0.4–1.0 m. The ripe fruits are used raw, or are dried and stored. It is the most widespread spice of the Ayoreo. Occasionally cultivated in the settlements.

*Solanum aridum* Morong, S 1150; *Solanum hieronymi* O. Kuntze S 1309, *najnenó*, herb. Frequent, the small tubers are cooked in ashes. Both species were major food sources but are no longer important. They form colonies in sandy soils.

## AGRICULTURE

The agriculture developed by the Ayoreo was rudimentary. They grew their crops in temporary plots cleared by slash and burn. Once a site had been selected, trees and shrubs were cut down to near ground level; when the vegetation was dry, it was burnt. The soil was selected according to the desired crops, and a few seeds placed in each of a series of holes dug with a wooden shovel. There was no specific order in the disposition of the crops on the plots. After sowing, little care was given to plants, except some weeding. Plants were not irrigated. The preparation and planting of the vegetable gardens, *gesnai*, was men's activity, while harvesting was carried out by women. The plots were frequently located near the settlements; however, since the Ayoreo were fully nomadic, they sometimes returned to the plots for harvesting. Seeds were obtained in the past by stealing the crops from their neighbours. For keeping the seeds, a receptacle made of the dry fruit of *duchubire* (*Lagenaria siceraria*) was used; a bunch of *daju* (*Bromelia hieronymi*) threads served as a stopper.

The Ayoreo recognize a dry, frequently cold

season from May to September, and a rainy hot season corresponding approximately to the months of September to April. The change of one season to another was indicated by the *Asojná* rites. The Ayoreo usually sow in September–November and harvest in December–April.

Before contact, Ayoreo bands foraged and cultivated *gvejnai* (*Zea mays*), *cugueode* (*Phaseolus* spp.), *dutué* (*Cucurbita maxima*), *duchubire* (*Lagenaria siceraria*), *sidí* (*Nicotiana tabacum*), *jnopita* (*Capsicum chacoense*) and *mimie* (*Citrullus lanatus*).

After becoming settled at agricultural and cattle raising mission stations, several new crops were introduced, including *Manihot esculenta*, *Ipomoea batatas* and *Carica papaya*. In each annual cycle, only one harvest was obtained, except for tobacco. There are differences in the relative importance of agriculture as a food source according to the geographical position of the settlements. Campo Loro and Gesudi, which are located relatively near the Mennonite colonies of the Central Chaco, offer the Ayoreo the opportunity to obtain work at the colonies or farms and to purchase carbohydrate-rich food for cash. At Gesudi the situation is influenced by the INDI (National Institute of Aborigine Development) policy which distributes foodstocks at no cost, thus discouraging self-maintenance.

Gesudi is a new settlement where the traditional practices are not influenced by missionaries, but are to some extent by the temporary work available at the Colonias. At Chovoreca, the traditional foraging patterns are the least influenced. Beans, corn, watermelon ("mimie"), *Capsicum chacoense*, and *Manihot esculenta* are cultivated.

María Auxiliadora has by far the most developed agriculture of the Ayoreo villages because of the higher rainfall of the area and the relative geographical isolation. Both settlements of María Auxiliadora (Isla Alta and Cucarani) are self-sufficient in agricultural products and many new crops have been successfully introduced: these include guayaba (*Psidium guajava*), papaya (*Carica papaya*), chirimoya (*Annona cherimoia*), pineapple (*Ananas* spp.), banana (*Musa paradisiaca*), mango (*Mangifera indica*) and citrus fruits. The vegetable gardens are planted mainly with their traditional crops and "mandioca" (*Manihot esculenta*), as well as batatas (*Ipomoea batatas*). Seeds of high-yielding varieties and of selected crops are purchased at the Brazilian border or

obtained from Asunción. Surplus production is sold to the Paraguayans of Colonia Peralta and the Brazilians at Porto Murtinho.

#### GATHERING

During the dry, cold period of May to September, gathering wild plants was a major activity for the Ayoreo. When the cultivated crops were exhausted, they depended increasingly on the plant resources of the xerophytic forest. Tuberos species, which played an important role as carbohydrate sources are collected for food mainly during the dry season, and less commonly eaten in the hot, rainy months when the availability of other food sources is greater.

The flowering and fruiting of the native Chaco plants is dependent on the rainfall. Most fruits ripen between November–January, although availability periods vary between species. *Prosopis alba* legumes ripen in November–December, while Capparaceae fruits are available in December–February; *Ziziphus mistol* fruits ripen in the Central Chaco in December and the sweet *Sideroxylon obtusifolium* fruits are consumed in January–February. Cactus fruits ripen in the summer months.

The María Auxiliadora area falls outside the traditional Ayoreo territory and many of the plants formerly gathered are not available near the settlements. The women must therefore undertake long trips for collecting *dore* (*Bromelia balansae*). When old people become ill, they request the “old” meals, and often refuse the introduced ones.

#### RESULTS AND DISCUSSION

Thirty-three gathered and 12 cultivated food plants were documented. The gathered species belong to 19 botanical families and are collected as food for their edible roots and tubers (7 spp.), for their fruits (24 spp.) or leaf bases (1 sp.). The information presented here concerning crop plants is in agreement with the data of Regehr (1979:55) and Bórmida and Califano (1978:13–16, 35–41).

Regehr (1979) reported the cultivation of corn, beans, calabash, zapallo, tobacco and watermelon by the Paraguayan Ayoreo. The present situation is quite different from that during their nomadic way of life. The Ayoreo diversified their agriculture by introducing several new crops.

The information on the plants gathered includes some marked differences from our study.

Bórmida and Califano (1978) report the consumption of the tubers of *adoi*, *doridesna*, *doriá* and *kusí*; the fruits of *kuyá*, *esó*, and the cactaceae *tokoi*, *pigaroi* and *datuá*; the palm heart of *pikade*, *isnai* and *pikadekesnai*; the fungus *kukangone* and the spice *durusná*. Of the plants cited by Bórmida and Califano (1978) only *kusí*, *pigaroi* and *kukangone* could not be collected. However, a species closely related to *kusí* corresponds to *Manihot guaranitica* Chod. et Hassler (S 1486, deposited at US). *Kusí* is most probably a species of *Manihot*. *Pigaroi* seems to be more common north of the surveyed area. *Pikadekesnai* (*Bactris glaucescens* Drude; S 1574), a palm whose name means “similar to *pikadé*” = *Acrocomia aculeata* is not eaten by the Paraguayan Ayoreo because of its sharp thorns. *Marsdenia castillonii* Lillo ex Meyer has been reported as an edible plant of Chaco Amerindians by Arenas and Giberti (1987). Our collection shows that other *Marsdenia* species are eaten by the Chaco Indians. Lindl (1974:105–108) cited several plants gathered by the Ayoreo by their native names. However, as with Bórmida and Califano (1978), none of the plants were properly documented or botanically identified.

Perhaps as a result of cultural prejudices, the native species have never been the subject of cultivation trials, and the refined carbohydrate-rich products have replaced the more varied natural foods. Some considerations are necessary at this point. Western-style food requires a shorter processing time and much less fuel than some of the traditional ones. For example, the consumption of Capparaceae fruits has almost disappeared: it needs too much time and fuel to process the native fruits, and it requires prolonged boiling with several water changes. It is remarkable how the aborigines lowered or eliminated the toxicity of food sources by appropriate cooking. The younger generation eat the wild fruits of Cactaceae, *esó* (*Sideroxylon obtusifolium*) and *nujná* (*Zizyphus mistol*), but gathering of edible roots has been abandoned in favour of the introduced crops.

For most of the edible Ayoreo plants, there is no data on toxicity or nutritional value. Some trials carried out by our group showed that *pukuode* and *nurujna* (*Capsicum chacoense*) can easily be propagated from seeds, while *ymose* (*Spathicarpa hastifolia*) tubers grow in normally drained soils. As the native plants are well adapted to the climatic conditions at the Chaco, their

cultivation might benefit the Ayoreo and other groups living in ecologically similar areas.

The overall pattern of gathering and cultivating food plants is similar to that of other Chaco Indians (Arenas 1981, 1982) showing cultural continuity with their native ancestors.

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### BOOK REVIEW

**Phytochemical Dictionary: A Handbook of Bioactive Compounds from Plants.** Jefferey B. Harborne and Herbert Baxter. 1993. Taylor and Francis Ltd, 1900 Frost Road, Suite 101, Bristol, PA 19007-1598. 791 pp. (hardcover). \$350.00. ISBN 0-85066-736-4.

A number of books have been written over the years dealing with natural organic compounds which are products of primary and secondary metabolism. There are also comprehensive dictionaries available on specific classes of compounds such as terpenoids and alkaloids. The *Phytochemical Dictionary* is a pioneer handbook in that it provides vital information on the most widely encountered plant constituents, with emphasis on those which are biologically active and/or of economic value.

The handbook includes 60 chapters under five main parts dealing with carbohydrates and lipids, nitrogen-containing compounds (excluding alkaloids), alkaloids, phenolics and terpenoids. In each part, compounds are grouped together in alphabetical order, according to class and subclass. The data given for each entry in the dictionary are: dictionary registry number, trivial or systematic name and synonyms, natural occurrence indicating the major sources (plant genus, species and family), chemical structure (with stereochemistry), mo-

lecular weight, molecular formula, biological activity and commercial or other use. Each part of the book starts with a general introduction followed by a general list of references. In addition, an introduction and references to individual classes of compounds are given in their respective sections. The handbook ends with an index containing the names of the main entries with their entry numbers, their synonyms and the names of significant similar compounds referred to in the texts of some entries.

The handbook is a major contribution to phytochemical literature and will obviously be of immense use to a wide audience of natural product chemists, phytochemists, pharmacists, pharmacognosists, food scientists, etc. The book would have been even more useful, if it had included a botanical index for readers who are primarily botanists and agronomists. We hope the editors will take this lack into consideration for future editions.

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