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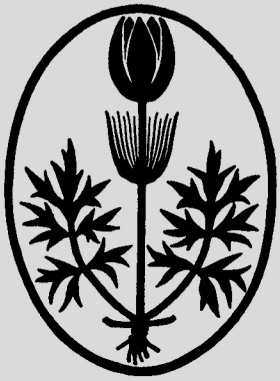

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Dedicated to Dr. Norman K. B. Robson on the occasion of his 87th birthday, with sincere thanks for his kind help and support

Hypericum robsonii spec. nova sect. *Trigynobrathys* (*Hypericaceae*) from the Misiones Province in Argentina

By

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With 7 Figures

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Key words: *Hypericum robsonii* H. A. Keller & S. Crockett spec. nova, *Hypericaceae, Hypericum* sect. *Trigynobrathys*. – New species, taxonomy, ethnobotany, critically endangered species. – Flora of Argentina, Southern Cone.

Summary

Keller H. A. & Crockett S. L. 2015. *Hypericum robsonii* spec. nova sect. *Trigynobrathys* (*Hypericaceae*) from the Misiones Province in Argentina. – Phyton (Horn, Austria) 55 (1): 17–29, with 7 figures.

Plant collections conducted in connection with ethnobotanical studies carried out with the Guaraní peoples of Misiones Province, Argentina, resulted in the discovery of a new species of *Hypericum* L. (*Hypericaceae*), which is characterized by its epigeous herbaceous scions produced seasonally from subterranean stems or roots. This species, *H. robsonii* H. A. Keller & S. Crockett, is described and illustrated for the first time. Information about its ecology, habitat and distribution, phenology and ethnobotany is provided.

Zusammenfassung

Keller H. A. & Crockett S. L. 2015. *Hypericum robsonii* spec. nova sect. *Trigynobrathys* (*Hypericaceae*) from the Misiones Province in Argentina. [*Hypericum*

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robsonii spec. nova sect. *Trigynobrathys* (*Hypericaceae*) aus der Provinz Misiones in Argentinien]. – Phyton (Horn, Austria) 55 (1): 17–29, mit 7 Abbildungen.

Aufsammlungen, die im Zusammenhang mit ethnobotanischen Studien mit den Guaraní-Völkern in der Provinz Misiones, Argentinien, durchgeführt worden sind, führten zur Entdeckung einer neuen Art von *Hypericum* L. (*Hypericaceae*), die sich durch krautige oberirdische Sprosse, die saisonal an holzigen unterirdischen Sprossen und Wurzeln entstehen, auszeichnet. Die Art *H. robsonii* H. A. Keller & S. Crockett, wird hier erstmals beschrieben und illustriert. Informationen über Ökologie, Lebensraum und Verbreitung, Phänologie und Ethnobotanik werden gebracht.

Resumen

Keller H. A. & Crockett S. L. 2015. *Hypericum robsonii* spec. nova sect. *Trigynobrathys* (*Hypericaceae*) from the Misiones Province in Argentina. [*Hypericum robsonii* spec. nova sect. *Trigynobrathys* (*Hypericaceae*) de la Provincia de Misiones en Argentina]. – Phyton (Horn, Austria) 55(1): X–X, con 7 figuras.

Los estudios etnobotánicos efectuados entre guaraníes de Misiones, Argentina, posibilitaron el hallazgo de una nueva especie de *Hypericum* L. (*Hypericaceae*) en la que los brotes herbáceos epígeos se forman temporalmente procedente de las raíces o brotes subterraneos. La especie *H. robsonii* H. A. Keller & S. Crockett es descripta e ilustrada por primera vez. Complementariamente se brinda información acerca de ecología, hábitat y distribución, fenología y etnobotánica de esta especie.

1. Introduction

The flowering plant genus *Hypericum* L. is currently divided into 36 taxonomic sections and encompasses approximately 490 species that are distributed in temperate regions throughout the world (Crockett & Robson 2011; *Hypericum* Online). While the center of species diversity is found in the Old World, the New World is not depauperate in *Hypericum* species and they frequently represent important and abundant floristic elements of the regional flora (e. g., species of *Hypericum* section *Myriandra* in the coastal plain pine flatwoods of northern Florida). According to the results of recent molecular phylogenetic analyses conducted with nuclear rDNA internal transcribed spacer (ITS) and chloroplast sequences (Meseguer & al. 2013, Nürk & al. 2013), the three major sections of *Hypericum* represented in the New World – *Myriandra* (Spach) R. Keller, *Brathys* (Mutis ex L. f.) Choisy and *Trigynobrathys* (Y. Kimura) N. Robson *sensu* Robson 1977, 1981, 1987, 1990, and 2012 – form a monophyletic group. In South America, the genus *Hypericum* is represented by native species belonging to two of these taxonomic sections, *Brathys* and *Trigynobrathys*. Nearly 100 species of *Hypericum* belonging to these sections, which occur as shrubs, sub-shrubs and perennial to annual herbs, occupy both higher (e. g., páramo and sub-páramo grasslands) and lower elevations (e. g., elfin forest, lowlands) (Nürk & al. 2013, Crockett & al. 2010).

From the point of view of its importance to human populations, the species most well-known for its medicinal properties is *H. perforatum* L., which has many therapeutic uses. Other species have been incorporated into traditional medicine systems in several countries around the world, or are sold and planted as ornamentals (Reichardt 1878, Milano 1961, Mazandarani & al. 2007, Crockett & Robson 2011). The southern Guaraní people prepare a great diversity of charms from plant materials, and one of the most widely known in current use is made from material of *H. brasiliense* Choisy (*Hypericum* sect. *Trigynobrathys*). The flowering branches are used as a charm to promote happiness, attract women and support friendships. As a propitiatory device to foster friendships at festive meetings and other events involving interpersonal relationships, young people rub their cheeks with a fragment of the aromatic branches. Decoctions of the branches are also ingested to treat depression. Because of these uses, the species is commonly called *ka'avo tory* (the herb of joy) by these indigenous groups (Cadogan 1957, Keller 2007, Keller & al. 2010).

During an ethnobotanical study conducted in the phytogeographical district of the savannas of the Misiones Province in Argentina, samples of a tiny herb that produces a similar fragrance as *H. brasiliense* were collected and this was referred to by a Guaraní guide as *ka'avo tory pyta'i*, meaning "powerful joy herb". The discovery of flowering specimens of this little herb rapidly allowed its identification to the genus level. However, particular characteristics of the specimens collected did not match those of any of the species of the genus thus far recorded for the Southern Cone in Zuloaga & al. 2008, leading to the conclusion that this could be a species new to science. This hypothesis was confirmed by the world taxonomic specialist for the genus, Norman K. B. Robson (Natural History Museum, London).

The species belongs to *Hypericum* section *Trigynobrathys* that, according to Robson 1987 and 1990, is exemplified by members with shrubby, subshrubby, or perennial to annual herbaceous habits. Characteristics of this section that help differentiate its members from those of section *Brathys* are the possession of dense stem glands, internodes that usually equal or exceed the leaves, leaf pairs that are free or ± united at the base, a leaf lamina that is mostly planar to involute with occasionally elongate glands, an inflorescence with 2-∞ flowers with a dichasial/monochasial to sympodial, or mixed branching pattern, or more rarely 1-flowered with a pseudo-dichotomous branching pattern, and flowers with (5–4–) 3 styles.

2. Material and Methods

Field work in Argentina was conducted intermittently between September 2012 and April 2013. Geolocalization data for the population were collected. Dried herbarium specimens deposited in CTES and BM were examined according to standard procedures. Both vegetative and floral characteristics of the specimens were studied. A high resolution digital camera mounted on a copy stand with an

attached lighting system was used to capture images of features of whole collected specimens (floral, vegetative, and rhizomatous features). A dissecting microscope with an attached lighting system was used to examine and capture images of the characteristics of the leaf, gynoecium (including ovary cross-section), decurrent leaf base, and translucent glands.

Acronyms for herbaria cited in this paper follow Index Herbariorum (Thiers, continuously updated).

3. *Hypericum robsonii* H. A. Keller & S. Crockett, spec. nova (Fig. 1–4)

Holotypus: Argentina: Misiones Province: Department of Candelaria, Loreto. 27° 19' 03,1' S – 55° 32' 42,0" W, 118 m., grasslands with sandy soil. 31-X-2013, fl, fr, H. A. Keller, Ramírez & Franco 11752 (holotype: CTES; Isotype: BM).

Paratypi: Argentina: Misiones Province: Department of Candelaria, Loreto, Ruta Nac. 12. Burnt field, sandy soil on a hill, 06-X-2007, fl, fr, H. A. Keller, Pirelli & Ritter 4569 (CTES). – Ídem, 27° 19' 32,8" S -55° 32' 36,4" W, burned grassland. 01-III-2012, fl, fr, H. A. Keller & Paredes 10849 (CTES). – Ídem, 27° 19' 03,1' S - 55° 32' 42,0" W, 118 m., grasslands with sandy soil. 02-XII-2013, fr, H. A. Keller, Franco & Romero 11874 (CTES, K, SI, MO, NY, BM).

Diagnosis: Herba parva, caules fertiles 2–13 cm longi, radices primores flexuosae, 1–2 mm crassae, horizontales vel adscendentes, caules erecti hypogaei, paulum vel vehementer ramosi, bases ramorum subterraneae. Caules primarii communiter subterranei, erecti, 0.4–8.0 cm longi et 0.8–2.0 mm crassi, gemmis fuscis, dimensiones internodorum cauluum subterranorum 0.2–5.0 mm longae. Folia terna vel quaterna, verticillata, rarissime opposita, laminis 4–5 mm longis, 0.2–2.0 mm latis. Basis foliorum decurrens, glandes laminae pallidae. Flores solitarii, diametro c. 2 cm, ad apices ramorum. Sepala 6–(7)–8, biseriata, petala 6–(7)–8, aurea-lutea, apicibus acuminatis et recurvatis. Stamina copiosa, lutea, filamenta 4–6 mm longa, lutea, antherae usque ad 0.2 mm longae, luteae, granis pollinibus tricolporatis. Ovarium ellipticum, 4–5 carpidiatum, styli 2–5 mm longi, lutei, recurvati per anthesin, tortuosi posteriore. Stigmata clavata, capsulae 3–6 × 1–4 mm, orbiculatae, obovatae vel pyriformae, dehiscentes apud basim. Semina reniformia, testis foveolatis scalariformibus.

Eponymy: The specific epithet is dedicated to Dr. Norman K. B. Robson (British Museum, London) who has devoted over sixty years to the study of this genus.

Description: Small herb, 2–13 cm tall (Fig 1A). Primary roots up to 2 mm diameter, dark brown, horizontal to ascending, capable of generating stems from vegetative buds. Primary stems usually completely subterranean, erect, 0.4–8.0 cm long × 0.8–2.0 mm in diameter, with buds brown-reddish and densely covered by squamiform, narrowly triangular bracts.

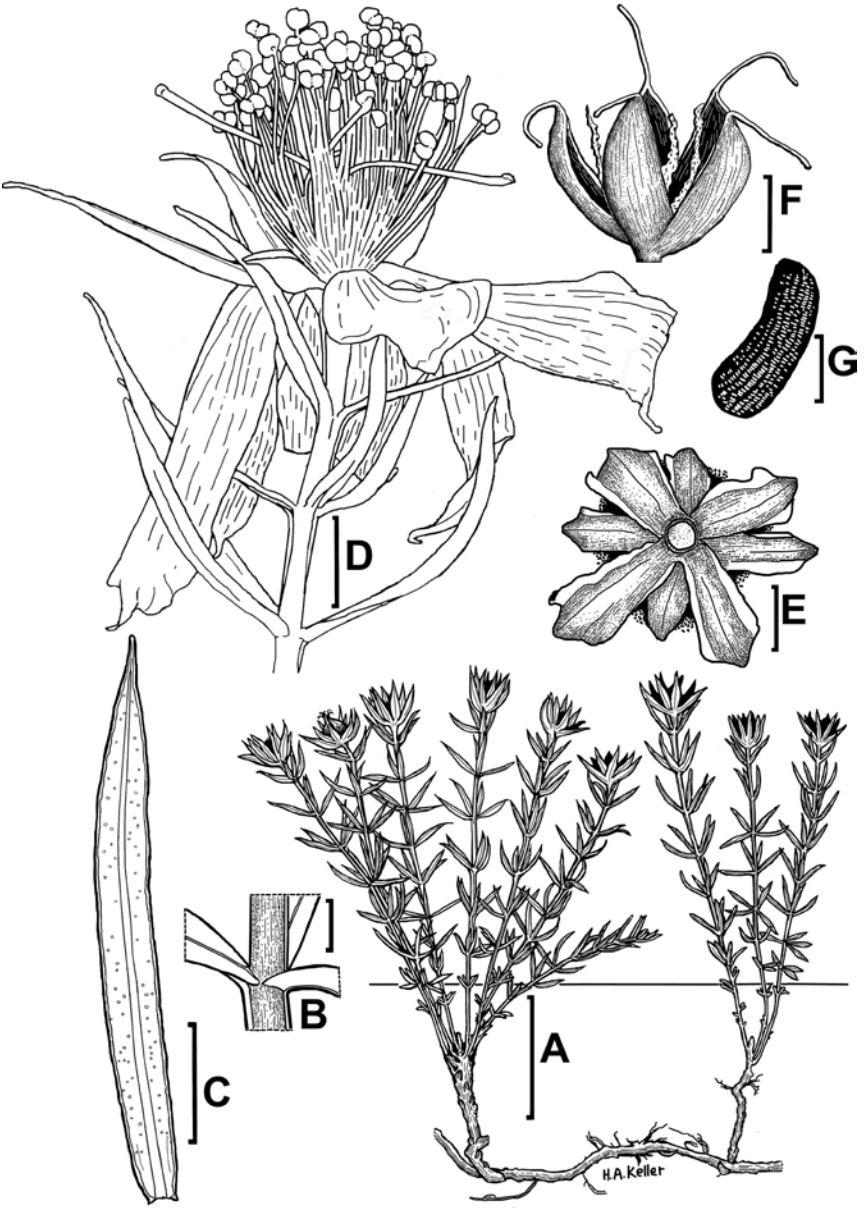

Fig. 1. *Hypericum robsonii* H. A. Keller & S. Crockett. – A aerial and subterranean parts; the line indicates soil level (scale = 3 cm). – B leaf node, illustrating decurrent leaf bases (scale = 2 mm). – C leaf (scale = 2 mm). – D flower with hexapetalous corolla (scale = 2.5 mm). – E base of calyx in fruit (scale = 2 mm). – F dehiscing capsule (scale = 2.5 mm). – G seed (scale = 0.5 mm). [A H. A. Keller & al., 4569. – B, C & D H. A. Keller & al., 11752. – E & F H. A. Keller & al. 11874.] Drawn by H. A. Keller.

Fig. 2. Dr. Norman K. B. Robson and Sara L. Crockett at the British Museum for Natural History (London) with a specimen of *Hypericum robsonii* H. A. Keller & S. Crockett.

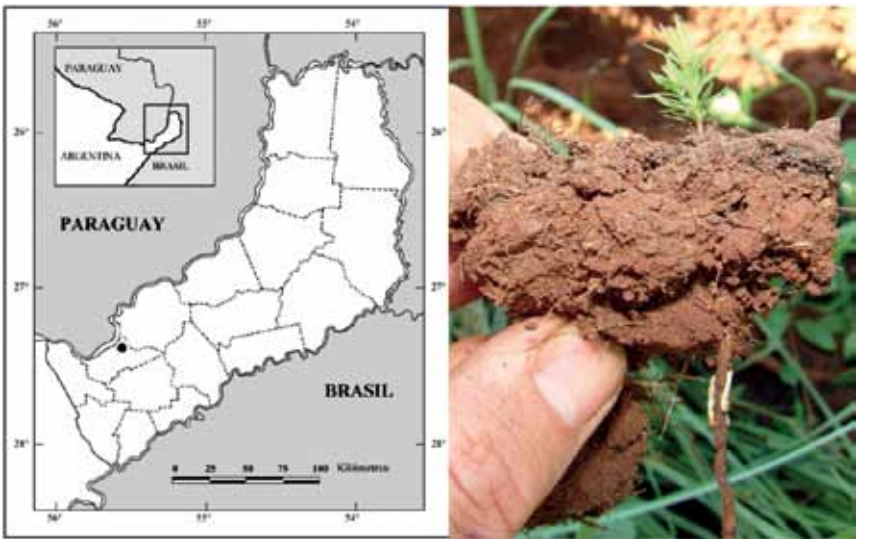

Fig. 3–4. *Hypericum robsonii* H. A. Keller & S. Crockett. Distribution and characteristic features. – Fig. 3. (left) Distribution map of the species (black dot). – Fig 4. Young shoots sprouting from a primary underground stem.

Branches ascending from the apical segment of subterranean stems; the upper portion 0.5–2.0 cm long, golden yellowish; internodes 0.2–5.0 mm long; leaves from these segments brown and shiny 1–4 × 0.2–1 mm, ovate to oblong, apex acute to obtuse; epigeous parts of the plant are only the apical portion of branches, which are 2–13 cm tall, with internodes 3–13 mm long, and nodes with (2) 3–4 leaves (Fig. 1B). Lamina of fully developed leaves 4–15 × 0.2–2 mm, incurved, ascendant, narrowly elliptic, narrowly lanceolate to oblong, frequently scarcely falcate, plane to revolute; margin hyaline; apex strongly acute to acuminate; base decurrent with a narrow wing running along the length of internode; laminar gland dots pale (Fig. 1C). Flowers about 2 cm in diameter, solitary, borne at the end of branches (Fig. 1D, 6). Sepals 6–(7)–8, in two opposing series, frequently unequal in form and shape; sepals 5–13 × 1–3 mm, narrowly lanceolate to oblong-lanceolate; horizontal in open flowers, persistent and erect in fruit; punctuate translucent glands pale yellow or red (Fig. 1E). Petals 6–(7)–8, golden yellow, 10–14 × 3–5 mm, narrowly oblanceolate, apex acuminate, reflexed. Stamens numerous, completely yellow; filaments 4-6 mm long, yellow, very shortly united or apparently free; anthers yellow and up to 0.2 mm long; pollen grains approximately 16 × 20 µm, tricolporate. Ovary elliptic with 4–5 parietal placentae; styles 2–5 mm long, yellow and recurved in flower, brownish and tortuous in fruit; stigma clavate, ventrally whitish. Capsules 3–6 × 1–4 mm, orbicular, broadly obovoid, pyriform to ellipsoid, dehiscing to near the base via 4–5 valves that are elliptic to obovate, with 4–5 placentae (Fig. 1F, 7). Seeds (6) 16–35, reniform, 1–1.5 × 0.4–0.6 mm; testa foveolate in several scalariform lines (Fig. 1G).

Distribution and ecological observations: This species is only known from the type area in the Department of Candelaria near Loreto in the southern Misiones Province of Argentina (Fig. 3). This area is part of the Botucatu Formation (Teruggi 1970) of Misiones, consisting of eolian sandstone outcrops. In a provincial context, this is a remarkable feature, since most of the surfaces of Misiones are covered by laterite soils derived from basalt (Ligier & al. 1990). Plants of *H. robsonii* grow under other plants within a savanna community (Fig. 4, 5) on sandy soil. Sporadic fires that eliminate the grassy cover encourage the growth and flowering of these minute plants, as is the case with other species of herbs and suffrutescent plants. Within the community, the grass *Axonopus suffultus* (J. C. Mikan ex Trin.) Parodi (*Poaceae*) is the dominant species in this location along with two species of small palms, *Allagoptera campestris* (Mart.) Kuntze and *Butia paraguayensis* (Barb. Rodr.) L. H. Bailey (*Arecaceae*), which are abundant.

Phenology: Observations from several sessions of fieldwork made in the type locality throughout the year revealed that the plant is hidden under grasses or lies dormant underground. Depending on the density of grass cover, or the occurrence of intentional or accidental fires, regenerating branches can sprout from the subterranean stems (Fig. 4) during the last

days of September. Anthesis (Fig. 6) can occur from September onwards, when early burning occurs, but can be delayed up until early March when later burns generally occur. The dehiscence of the capsules (Fig. 7) takes place from October until the end of March. From the beginning of April until the time that the plants sprout in spring, they are completely hidden underground.

Taxonomic notes: Species with leaves that are 4-whorled have not previously been mentioned from sections *Brathys* or *Trigynobrathys*, although within section *Trigynobrathys* subsection *Connatum* (R. Keller) N. Robson, specimens with 3-whorled leaves have been reported (rarely) for *H. ternum* A. St. Hil. and (usually) for *H. legrandii* Lyman B. Smith. Morphologically, *H. robsonii* appears to be most closely affiliated with *H. ternum*, which occurs in eastern Brazil (Minas Geraes, Sâo Paulo, Paraná, northern Santa Catarina), and *H. cavernicola* Lyman B. Smith, which has only been recorded from the type location in Tacuarembo, Uruguay. These distributions are located to the east and south, respectively, of the collection location of *H. robsonii*. It can be distinguished, however, from *H. ternum* by the 3–11 flowered inflorescences, as well as smaller flowers and fruits. *H. cavernicola* usually has 1-flowered inflorescences, but only paired leaves and again much smaller flowers and fruits. Other species within this subsection that have extensive distributions, such as *H. cordatum* (Vell.) N. Robson, display high levels of variability in leaf and flower size, as well as trends toward more or less numerous inflorescence branches, across the geographic range. Given the large number of species of *Hypericum* reported for this region of South America, and the rapid rate of diversification demonstrated by this group, genetic diversity analyses including nuclear (amplified fragment length polymorphism, AFLP) and highly variable plastid markers (such as *trnL-trnF*) could help elucidate the relationships among these species (Koch & al. 2013, Nürk & al. 2013).

Hypericum robsonii can be also differentiated from all other South American species of the genus by its possession of subterranean primary stems and higher number of members in the calyx and corolla (up to 8). According to Robson 1981, the numbers of members in these two whorls in species of *Hypericum* are almost always 4–5; only very exceptionally has an extra member been recorded. With respect to a hexamerous perianth, in the exemplifying calyx of *H. empetrifolium* Willd. var. *oliganthum* K. H. Rech., Robson explained that the influence of 3-whorled phyllotaxis had been carried over to the perianth. Therefore, it is highly probable that the octamerous whorls of the perianth seen in *H. robsonii* are due to 4-whorled phyllotaxis present in the majority of branches.

Conservation status and threats: Due to its apparently highly restricted distribution with an extent of occurrence that is estimated to be less than 10 km^2, the conservation status of *H. robsonii* should at this time be considered as critically endangered. It is, therefore, recommended to include

Fig. 5. *Hypericum robsonii* H. A. Keller & S. Crockett. Habitat at the type locality in the Misiones Province (Argentina).

this species in the Critically Endangered species list (CR: A2, B2a(iii), Cai, D, E) according to the criteria established by the IUCN 2001.

The abundant regeneration of adventitious species of the genus *Pinus* L. (*Pinaceae*), and the fact that the landowners have attempted to produce maize and sorghum in this locality since last year, without success, represent serious threats to *H. robsonii*. It is not insignificant to note that the establishment of non-native timber trees (e. g., *Pinus radiata*) and intensification of agriculture (resulting in contamination of soil and water with agrochemicals) are human impacts that have been shown to negatively affect other plant species as well as other species of *Hypericum* occurring in the páramo regions of Central and South America (Crockett & al 2010). Individuals of several other endemic species, including *Borreria loretiana* E. L. Cabral (*Rubiaceae*), *Sida rhizomatosa* Krapov., *S. loretana* krapov. (*Malvaceae*), and *Tephrosia fertilis* R. T. Queiroz & A. M. G. Azevedo (*Fabaceae*) occur in this fragile ecosystem along with *H. robsonii* (Cabral 1986, Krapovickas 2012, 2014, Queiroz & Tozzi 2013) and are also subject to these threats.

The conservation of critically endangered species distributed in the grasslands of the Misiones Province is an initiative fraught with diverse complications. One of the most challenging is the prevailing opinion that such "treeless ecosystems" are unworthy of conservation. Another difficulty, with reference to management policies, is the reluctance to consider the use of fire as a valid conservation practice in these ecosystems (Fontana 2005). In the neotropical grasslands, periodic burns encourage the regeneration and

Fig. 6–7. *Hypericum robsonii* H. A. Keller & S. Crockett. Habit and characteristic features. – Fig. 6. Bud and flower. – Fig 7. Dehiscing capsules.

growth of plants that have evolved certain resistant traits, such a xylopodium (subterranean woody rootstock) and gemmiferous roots, radicular structures characterized by the production of buds (Fariñas & Silva 2007). Many plants occurring in the dry savannas and cerrados of South America possess a these features. However, as pointed out by Muniz Silva & al. (2013), other variables that affect species structure and composition must be taken into

account, including soil conditions such as fertility and structure. In the case of *H. robsonii*, due to the limited known geographical distribution and occurrence on private land, it is necessary to pursue both in situ (habitat conservation) and ex situ conservation strategies.

Ethnobotanical notes: Among the Guaraní peoples, most aromatic herbs are believed to bear magical properties; moreover, a strong aroma is a highly valued and useful quality in a plant, because it is considered the remains of the spiritual essence of the ancient cultivator of the plant that created it (Keller 2011). The Guaraní expression *ka'avo-tory-pyta'i* can be interpreted as "potent joy herb"; this is probably a recent name because, according to Lange 1966, polynomial plant names are usually not as old as mononomial or binomial names. Among the southern Guaraní, the word *pyta'i*, means "red", "infant", or "newborn child" (Cadogan 1957, 1992; Guasch & Ortíz 1995; Ruiz de Montoya 1639), but in the context of their traditional medicine, the termination *pyta'i* applies to herbs that – by virtue of being small and/or rubicund – have greater curative powers than other plants that are called by the same generic Guaraní name (Keller 2011). The uses are the same as those that have been mentioned in the introduction for *H. brasiliense*, but a comparatively high number of magical and medicinal virtues are credited to *H. robsonii*. This is because of the small size of the plants and also because the species grows in unshaded areas of the grasslands. In Guaraní cosmology, higher exposure to solar radiation means that the "creative contemplation of the sun" (*kuara'y jechaka*) is more intense. The sun is considered by Guaraní peoples to be "the first ancestor" and "the living creator" (Keller 2013).

4. Acknowledgments

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