APPENDIX

idy are given below. Slides are deposited at the
the Botanical Research Institute, Pretoria.

Marlier s.n., *Keraudren-Aymonin & Aymonin* 2606,
binson 5292.
-Humbert 6147
31, *Loveridge* A44.

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was done while I was stationed at the Royal
am grateful for having had access to the superb

A revision of *Gibasis* Rafin.

American *Commelinaceae* XII*

D. R. HUNT

Summary. Gibasis Rafin. (*Commelinaceae – Tradescantieae*) is a predominantly Mexican genus whose segregation from *Tradescantia* L. is justified by inflorescence characters. In this revision, 11 species (3 divided into subspecies) are recognized and one is regarded as insufficiently known. A new combination *G. triflora* (Martens & Galeotti) D. R. Hunt is proposed and this name used for specimens hitherto referred to *G. aguensis* (Standl. & Steyerm.) Rohw.; a new subspecies is proposed in *G. karwinskyana* (Schult.f.) Rohw., namely subsp. *palmeri* D. R. Hunt; *G. heterophylla* (Brandegee) Reveal & Hess is reduced to subspecific rank as *G. venustula* subsp. *peninsulae* D. R. Hunt, and *G. rhodantha* (Torrey) Reveal & Hess is reduced to subspecific rank as *G. linearis* subsp. *rhodantha* (Torrey) D. R. Hunt.

TAXONOMIC HISTORY

In 1837, the maverick North American botanist Constantine Samuel Rafinesque-Schmaltz (1783–1840) divided *Tradescantia* into ten genera: *Tradescantia* itself, *Sarcoperis* (=*Campelia* L. C. Rich.), *Siphostima* (=*Cyanotis* D. Don), *Gibasis*, *Etheosanthes* (probably = *Tradescantia* sensu stricto), *Tripogandra*, *Phyodina*, *Leiandra*, *Heminema* (= *Tripogandra*), and *Aploleia*. A century and more later (thanks more to nomenclatural priority than to the taxonomic insight of their author!) several of the names have re-entered the vocabulary of the family, notably *Tripogandra*, monographed by Handlos (1975), and *Gibasis*, whose species have figured prominently in cytological and genetical studies at Kew over the past two decades.

Tradescantia pulchella Kunth, the type species of *Gibasis*, is one of a group of species long included in *Tradescantia* which were transferred by Woodson (1942) to the predominantly Old World genus *Aneilema* because the cymes (cincinni) are simple, not fused in pairs as they have to be under Woodson's definition of *Tradescantia* and the tribe *Tradescantieae*. The Woodson classification was adopted in several floristic treatments thereafter, including those for Panama (Woodson & Schery 1944), Guatemala (Standley & Steyermark 1952), Mexico (Matuda 1956), Venezuela (Aristeguieta 1965) and Texas (Correll & Johnston 1970).

A detailed study of the inflorescence of the *Tradescantieae* led Rohweder (1956) to conclude, however, that Woodson's definition of the tribe had been over-simple and insufficiently precise. Rohweder noted several similarities between the *T. pulchella* group and the *Tradescantieae* sensu Woodson which Woodson had overlooked: the closely grouped cymes, standing at the end of a common axis and often in pairs (though not fused together); the abbreviated nature of the cyme-axis; the parallel series of bracteoles differentiated from the bracts; and most significant in Rohweder's opinion, the way in which the cyme-axis is more or less sharply angled at its base in relation to the stipe or stalk. In some of the species, the cyme-axis is reflexed to such a degree that the oldest flowers are uppermost, just as in the typical *Tradescantieae* inflorescence.

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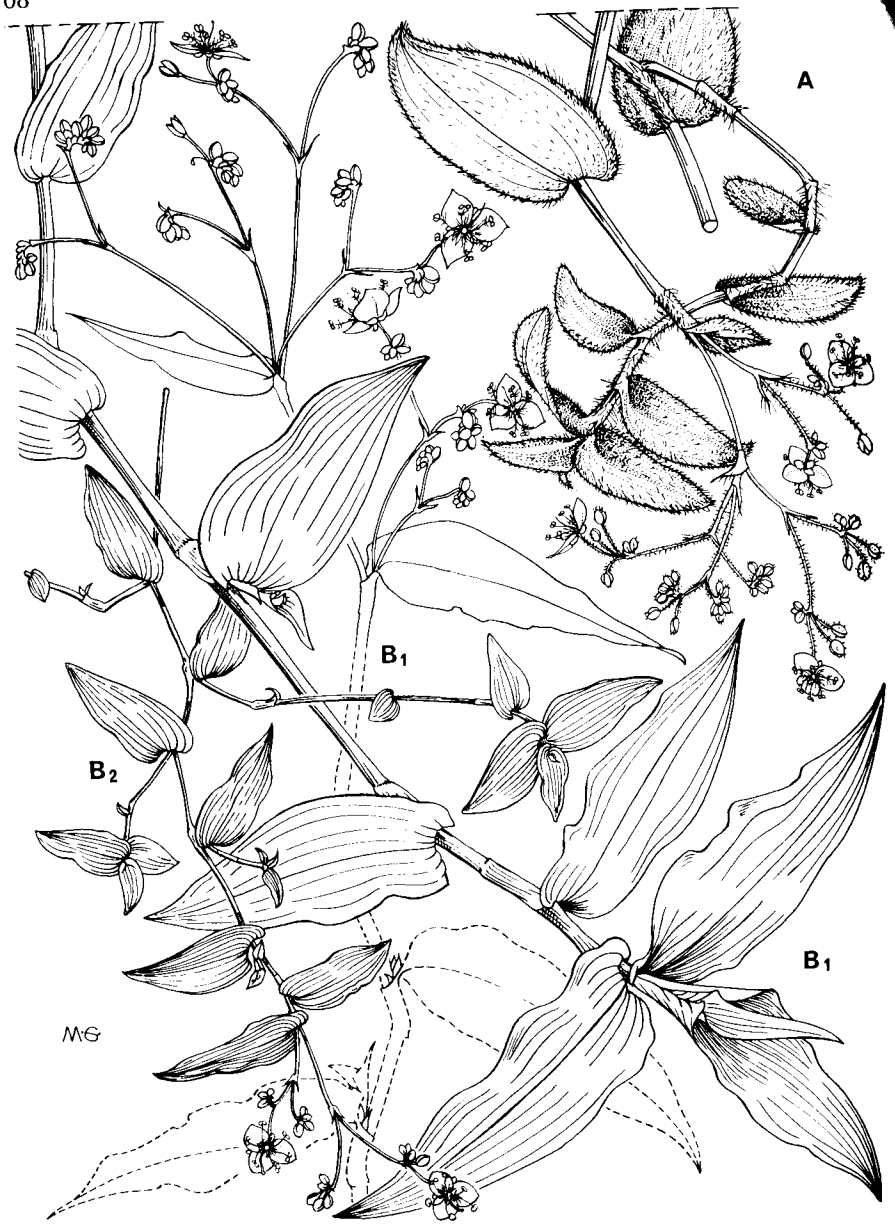

FIG. 1. **A** *Gibasis geniculata*, from Kew accn. no. 153–62.15301; **B**$_1$ *G. pellucida*, from Kew accn. no. 000–69.11673; **B**$_2$ smaller-leaved clone of *G. pellucida*, from Kew accn. no. 673–63.67301. All × 0·9. Drawn by Mary Grierson.

In *T. pulchella* the reflexed fertile axis of the cyme is actually fused with the stipe.* Rohweder suggested that in the typical *Tradescantieae* it is the fusion of the cyme with its own stipe which is the primary feature, and that the cymes only seem to lie directly on the common axis due to the reduction of the stipes.

*The term *stipe* is here used to denote the basal internode of the cyme above the subtending bract.

In support of these inflorescence characters, Rohweder noted Brückner's earlier observation that the stomata of *T. geniculata* are of the *Tradescantieae* type, with one pair of lateral subsidiary cells only.

Rohweder re-established *Gibasis* for *Tradescantia pulchella* and its immediate allies, six species in all, and made it a monotypic subtribe (*Gibasinae* Rohw.) within the *Tradescantieae*. Later (Rohweder 1969), taking into account Tomlinson's anatomical data (see below), he thought the similarity between *Gibasis* and *Tripogandra* greater than between *Tripogandra* and *Rhoeo*, for instance, and doubted whether the subtribe *Gibasinae* could be upheld.

After initial reservations (see Jones *et al.* 1969), the present writer accepted *Gibasis* at generic rank and added seven further species (Hunt 1972, 1973, 1976, 1978). Three species were also added by Reveal & Hess (1972), who suggested a division of the genus into two sections based on habit and leaf-characters. This was rejected by the present author (Hunt 1976), who proposed an alternative arrangement in two sections based on several characters, including chromosome number and size.

The net total of species recognized in the present revision is 11, of which three are divided into subspecies. There is also one species of doubtful status (see under no. 3).

General Morphology

The diagnostic characters of *Gibasis* are those of the inflorescence, as already noted. The cymes are separate, not fused in pairs, but grouped in pairs or umbelliform clusters (Fig. 1). Individually, the cymes are stipitate, usually conspicuously so, but in *G. linearis* the stipes are sometimes so short as to be scarcely apparent, a feature which has caused confusion with the superficially similar *Tradescantia pinetorum* Greene. The fertile axis of the cyme is abbreviated and bears small imbricate bracteoles in two parallel series subtending the flowers. The axis is more or less sharply angled at the junction with the stipe (Fig. 2A). The degree of reflection varies from species to species, being most marked in *G. pulchella* and *G. matudae*, where it is virtually 180° and the fertile axis is largely fused with the stipe (Fig. 2B).

Each stipe is subtended by a more or less vestigial subulate bract, the lowermost being typically somewhat larger and occasionally, as in *G. matudae*, foliaceous. In species with umbelliform clusters of cymes, the derivation of the umbel from a thyrse by condensation of the internodes of the main axis is suggested by the presence and arrangement of the bracts.

The flowers of *Gibasis* are regular and of the typical *Tradescantia* plan, i.e. three free equal cymbiform sepals, three free equal petals (violet-blue, purple-pink or white), six free subequal stamens, the filaments variously barbate, the anther-connectives versatile and relatively broad and the anthers opening by longitudinal slits. The ovary is three-celled with two superposed ovules in each cell, the style equalling or exceeding the stamens, with minutely capitellate stigma. The fruit is a small, loculicidally dehiscent capsule, and the seeds have a linear or rarely elongate-punctiform hilum and dorsal embryotega.

Vegetatively, the genus is composed mainly of tufted, tuberous-rooted perennials (6 spp.), with several creeping or ascending chamaephytes (4 spp.) and one annual or short-lived species (*G. triflora*, including *G. aguensis*). The tuberous species are relatively narrowly-leaved and xeromorphic, the non-tuberous broader-leaved and more mesomorphic.

Distribution

In its geographical distribution, the tuberous group of *Gibasis* spp. is largely confined to the uplands of Mexico, descending to lower elevations in two western taxa (*G. chihuahuensis* and *G. venustula* subsp. *peninsulae*) and with one remarkable disjunction: the occurrence of the type species, *G. pulchella*, in Colombia as well as central Mexico. Of the non-tuberous species, *G. pellucida* (*G. schiedeana*) is found at intermediate elevations principally on the Atlantic side of Mexico, but has also been collected a few times on the Pacific side. The little-known *G. pauciflora*, described from Cuba, may be synonymous. *G. geniculata* is strictly tropical, with a very wide distribution from the West Indies and SE Mexico to Brazil and N Argentina. *G. oaxacana* and *G. matudae* are currently known from their Mexican type-localities only. The annual or short-lived *G. triflora*, as here understood, is known from the SW Mexican states of Michoacan, Guerrero and Oaxaca, and from Guatemala, where it occurs on Volcan de Agua (*G. aguensis*).

Pollen and Seed

The pollen of *Gibasis* has been studied by Poole & Hunt (1980). All the recognized species except *G. triflora* and *G. chihuahuensis* were examined, and a total of 23 samples. Variation in ornamentation was found, in one case within a single species (*G. pellucida*), but thought to be of little taxonomic significance. In general, however, the pollen was closely of the type widespread in the *Tradescantieae* and very unlike that of *Aneilema*, tending to confirm Rohweder's interpretation of the affinities of the genus and arguing against Woodson's.

Seeds of 7 species were examined and described by Lee (1980). All exhibited the linear hilum/dorsal embryotega syndrome also found in *Tradescantia*. Such variation in size, colour, surface-ornamentation, etc. as was observed may be diagnostic at the specific level, but has yet to be studied in detail.

Anatomy

Tomlinson (1966) confirmed the earlier observation of Brückner (1926) that the stomata of *Gibasis* are 4-celled, like those of *Tradescantia*, and noted the presence of silica in the epidermis, a feature also found in the New World genera *Callisia*, *Hadrodemas* and *Tripogandra* and in the Old World genera *Amischotolype* (*Forrestia*) and *Coleotrype*.

Rohweder (1969) examined the shiny inner epidermis of the ovary of *G. geniculata* and found it to be of a widespread type in which the anticlinal cell-wall thickening is uniform. He also listed the presence of silica in the outer ovary epidermis, a feature only otherwise recorded in *Tripogandra serrulata* (*T. cumanensis*).

Stant (1973) studied the leaf epidermis in *G. geniculata*, *G. matudae* and *G. pellucida* (*G. schiedeana*). She observed trichomes of several distinct categories and silica cells in all three species. Differences between the species may be of sectional significance but the survey was too limited to permit taxonomic inferences to be drawn.

Cytology

The cytology of *Gibasis* has been the subject of intensive study at Kew since the nineteen-sixties, and data have been published for nearly all species (Jones, Colden & Hunt 1969; Jones & Jopling 1972; Jones 1974; Jones, Papes & Hunt 1975; Brandham & Bhattarai 1977; Kenton 1978; Jones, Bhattarai & Hunt 1981; Kenton 1981, 1983, 1984a, 1984b). The progress and conclusions of this published research may be summarized as follows:

Initial observations were made on a range of material, mainly of unknown wild origin, identified as '*Tradescantia geniculata*', and of *T. karwinskyana* (Jones, Colden & Hunt 1969). *T. karwinskyana* was found to be an autotetraploid with an asymmetric complement of 2n = 20 large (for the family) chomosomes and a basic number of x = 5. The material of '*T. geniculata*' displayed very wide cytological and morphological diversity, resolving into three distinct elements: 'A' (*T. geniculata* sensu stricto) a possible allotetraploid with 2n = 32 small chromosomes which form only bivalents at meiosis (x = 8); 'B' (compared with *T. geniculata* var. *botterii*) a tetraploid with 2n = 16 comparatively large chromosomes forming quadrivalents at meiosis (x = 4); and 'C' (no information on identity) a diploid with 2n = 16 small chromosomes forming bivalents at meiosis (x = 8). All the complements observed were 'asymmetric', i.e. consisting at least in part of submedian and acrocentric chromosomes.

The basic numbers of x = 5 and x = 4 were, in 1969, and remain today, the lowest known in the family. It was argued that these low numbers would be derived rather than primitive, and if so, that unequal interchange followed by the loss of the smaller product might be the mechanism of the numerical reduction.

In its bearing on the systematic position of the species examined, the initial chromosome evidence was somewhat equivocal. *Aneilema* sensu stricto contains only species with relatively small chromosomes with basic numbers ranging from x = 7 upwards (Lewis 1964 and later references; cf. also Faden 1975). The large chromosome elements described by Jones *et al.* would clearly not fit well into such a background, but there was nothing in the cytology of the small chromosome elements to preclude them from *Aneilema*.

Tradescantia contains, at one extreme, the species with large symmetric complements based on x = 6 such as *T. virginiana*, and at the other extreme, those of the *T. fluminensis* complex which have asymmetric complements of numerous small chromosomes of indeterminate basic number. Species with x = 4 or 5 are unknown, and those with higher basic numbers than 6 have been transferred to other proposed genera. The removal of *T. geniculata* and *T. karwinskyana* from *Tradescantia* (in the pre-Woodson sense) could thus be justified on cytological grounds.

Further material of 'C' was collected by the writer in Mexico in 1971 (*Hunt* 8175) and described as *Gibasis oaxacana* (Hunt 1972). The identity of 'B' as *T. geniculata* var. *botterii* was confirmed from material collected in Mexico in 1969 (*Hunt* 7171, etc.) and the taxon established as a distinct species under the name *G. schiedeana*, based on *T. schiedeana* Kunth (Hunt 1973). Unfortunately, this name must be replaced by *G. pellucida* (Martens & Galeotti) D. R. Hunt (Hunt 1983).

Material of various Mexican *Commelinaceae* was meanwhile examined by Handlos (1970), who described the chromosomes of the type species of *Gibasis*, *G. pulchella* (2n = 10) and 2n = 10 cytotypes of *G. karwinskyana* and *G. pellucida* (reported as *G.* cf. *geniculata*). The present author also collected *G. pulchella* in 1969, which provided preliminary confirmation of Handlos's count (Jones & Jopling 1972), and a diploid cytotype of *G. pellucida* in 1971. The two cytotypes of *G. pellucida* were then used by Jones to explore the earlier suggestion that the

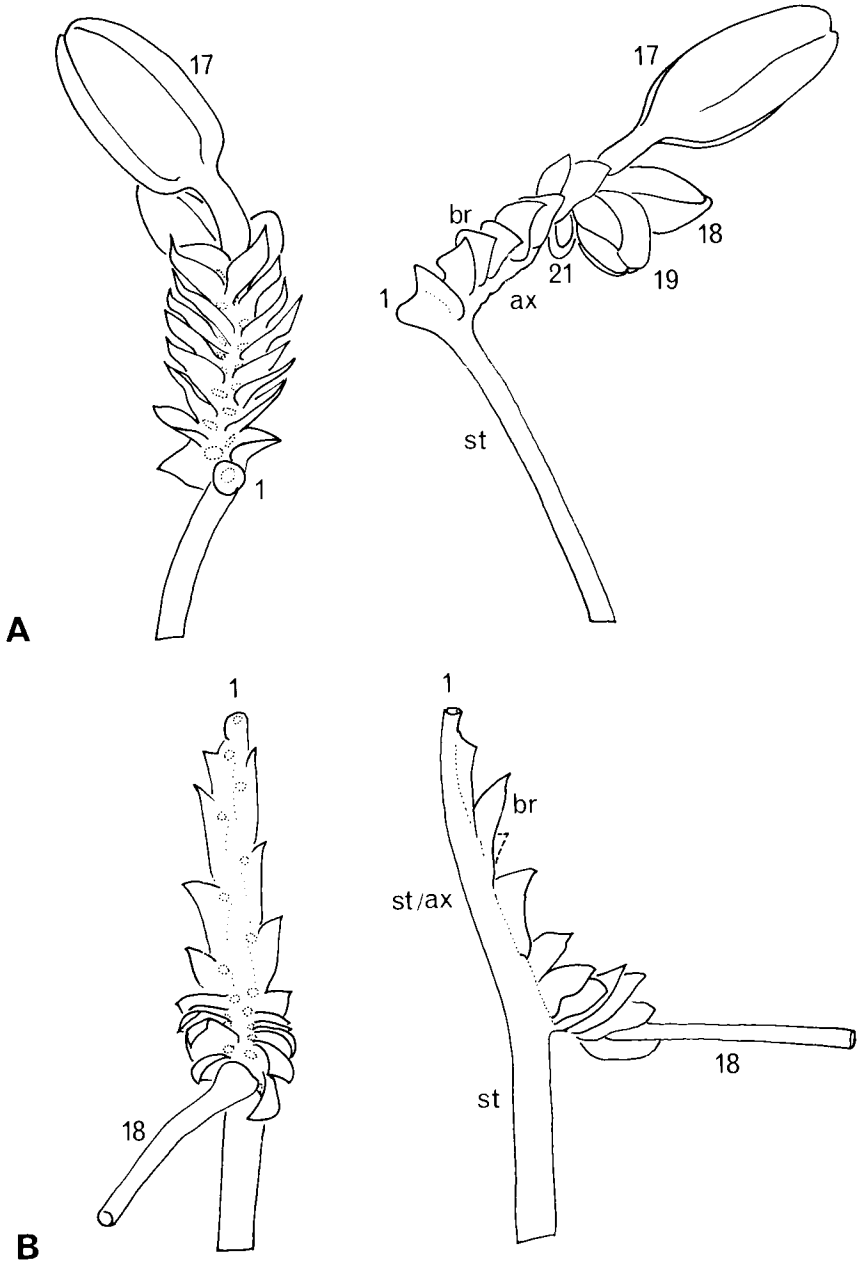

FIG. 2. **A** cyme of *Gibasis karwinskyana* subsp. *palmeri*. The cyme-axis (ax), with imbricate bracteoles (br) in two rows, is sharply angled at its junction with the stipe (st); the pedicel-scar of the oldest flower (1) is at the base of the cyme; flowers 2–16 (all unpollinated) have abscissed; several buds (17–21) remain to open or abort. From *Hunt* 8041 (Kew accn. no. 311–71.2729). **B** an older cyme of *G. pulchella* (Kunth) Rafin. Through the fusion of much of the cyme-axis with its own stipe, the pedicel-scar of the oldest flower (1) appears to be apical; flowers 2–17 (unpollinated) have also abscissed; the pedicel of flower 18 (pollinated) remains (cut); the youngest bud in the cyme has aborted. From *Kenton et al.* 62–438 (Kew accn. no. 372–83. 03873). All × 6. Drawn by the author.

x = 4 complement could have been derived from x = 5 by the process of 'Robertsonian translocation' followed by the loss of the smaller product.

Further observations on the species of *Gibasis* hitherto examined were presented by Jones, Papes & Hunt (1975). The existence of hexaploid (2n = 48) *G. geniculata* in Trinidad previously reported by Simmonds (1954) was confirmed and the tetraploid nature of other *G. geniculata* material deduced. Diploids (2n = 10) in *G. karwinskyana* were reported amongst material collected by Hunt in 1971. The cytology of several additional species was also described in varying detail: *G. pulchella*, *G. triflora* (as *G. aguensis*), *G. linearis* and two species newly described, *G. consobrina* D. R. Hunt and *G. matudae* D. R. Hunt. All these are large-chromosome elements, tending to support the exclusion of the group from *Aneilema*. A new basic number for the genus of x = 6 was found in the *G. linearis* group, further extending the range of chromosome variation in the genus.

In view of the morphological and chromosomal diversity now displayed in the genus, it was divided into two sections and several groups by Hunt (1976). The species with small chromosomes were assigned to sect. *Heterobasis* D. R. Hunt, those with large chromosomes to sect. *Gibasis*. Chromosomally, three informal groups were recognized within sect. *Gibasis* by Jones, Papes & Hunt (1975): The *G. linearis* group (x = 6), the *G. schiedeana* group (x = 4 or 5, chromosomes asymmetric) and the *G. pulchella* group (x = 5, chromosomes symmetric).

The effect of B-chromosome number on chiasma frequency within and between individuals of *G. linearis* was studied by Brandham & Bhattarai (1977), using material collected by Hunt & Owens in 1976. The effect of increasing numbers of B chromosomes was found to be an overall rise in chiasma frequency, as in the majority of previous reports for other species.

Giemsa C-banding in *G. karwinskyana* and *G. consobrina* was described by Kenton (1978). The two species, regarded as an allopatric or vicariant pair, have a similar karyotype when the chromosomes are stained by the normal Feulgen method. However, C-banding has revealed extensive intraspecific polymorphism in *G. karwinskyana*, involving presence or absence of centric and interstitial bands, while in *G. consobrina* bands are almost exclusively confined to the telomeres. The cytological differentiation is further emphasized by distinctive meiotic behaviour including differences in chiasma position at the diploid level and interchange heterozygosity only in tetraploid *G. consobrina* (Jones & Kenton 1984). Interspecific hybrids show a marked lack of chromosome homology and low pollen fertility at the diploid level, while in tetraploid hybrids, fertility is maintained by autosyndetic (within-genome) pairing.

More detailed cytological information on *G. linearis* and its allies was provided by Jones, Bhattarai & Hunt (1981) using material mainly collected by Hunt in 1974 and by Hunt & Owens in 1976. The new basic number for this group of x = 5 was reported in *G. rhodantha* and *G. speciosa*, both close allies of, and here regarded as conspecific with, *G. linearis* itself. Plants of *G. rhodantha* with x = 6 were also found and an implicit Robertsonian relationship between the x = 6 and x = 5 chromosome sets noted. This relationship was the subject of a separate paper by Kenton (1981) in which it was shown, in F_1 hybrids between *G. venustula* and *G. speciosa*, that Robertsonian change is fundamental to the karyotypic rearrangement. Meiotic analysis of F_1 hybrids and their reduced fertility has also revealed cytological differentiation between experimental material of the erstwhile species *G. graminifolia*, *G. rhodantha* and *G.*

TABLE 1. A biochemical classification of *Gibasis* (from Del Pero de Martinez, 1981, fig. 4.8, updated)

Group	Character	Section/species
A	Sulphated phenolic acids present	Sect. Heterobasis *G. geniculata*, *G. oaxacana*
	Sulphated phenolic acids absent	Sect. Gibasis
B	Syringic acid present	*G. linearis* subsp. *rhodantha*, (*G. graminifolia*), *G. venustula* (incl. *G. heterophylla*)
	Syringic acid absent	
C	Quercetin 3-glycoside present	*G. pulchella*, *G. matudae*
	Quercetin 3-glycoside absent	
D	8-C-glycosides present	*G. karwinskyana*, *G. consobrina*
E	Only 6-C-glycosides present	*G. pellucida* (*G. schiedeana*)

speciosa (Kenton 1984a) and of *G. venustula* and *G. heterophylla* (Kenton 1984b). Morphologically, however, it does not seem practicable to recognize more than two species (*G. linearis* and *G. venustula*) in this group.

Stigma Morphology and Breeding System

In their extensive survey of stigma surfaces in the angiosperms, J. Heslop-Harrison & Shivanna (1977) classified *Gibasis*, *Thyrsanthemum* and *Weldenia* as having 'wet' stigmas (i.e. with surface secretions present at maturity) and a receptive surface of low to medium-sized papillae. Later, after surveying more species of *Commelinaceae*, Owens & Kimmins (1981) found that the majority of *Gibasis* species have stigmas of the 'dry' type (i.e. without copious secretions). Some support for the sectional division of the genus was inferred from the occurrence of one type of stigmatic papilla and the cellular composition of the papillae.

The breeding system of various species of *Gibasis* has been investigated by Owens (1977, 1981). *G. geniculata* is self-compatible, as are some individuals of *G. pellucida* and *G. pulchella*. The remainder of the genus, so far as known, is self-incompatible. The incompatibility system in *G. karwinskyana* and *G. oaxacana* is under the control of a single multi-allelic gene acting gametophytically in the pollen.

Chemistry

A survey of flavonoids, phenolic acids and their sulphated derivatives has been made in a wide range of *Commelinaceae* by Del Pero de Martinez (1981). Her experimental material, largely from the Kew collections, included 10 taxa of *Gibasis*, now regarded as belonging to 9 species, and she was able to group these, according to the presence or absence of various compounds, into the five groups suggested on morphological and cytological grounds by Hunt (1976) (Table 1).

Elsewhere in the family, Del Pero de Martinez found sulphated phenolic acids in *Coleotrype*, *Commelina*, *Tradescantia* and *Tripogandra*, and suggested that their distribution in *Tradescantia* might be of taxonomic significance. Syringic acid is common and widespread in the family and appears to be of taxonomic interest in *Gibasis* only. Quercetin 3-glycoside, though much less common, is also widespread in other genera, chiefly but not exclusively in the tribe *Commelineae* (sensu Rohweder).

A survey of leaf and flower anthocyanins in some 28 species of *Commelinaceae* by Zantovska Stirton & Harborne (1980), using Kew material, included four species of *Gibasis*. Of two distinctive anthocyanin patterns in the family, the *Gibasis* spp. were found to possess the widespread 'Tradescantia' type involving 3, 7, 3′-triglucoside as a major constituent. The related delphinidin triglucoside was also detected in *G. consobrina*.

Enzyme multiple form variation in *G. pellucida* (*G. schiedeana*) has been the subject of analyses by Reynolds (1979) (peroxidase) and Reynolds & Gilbert (1981) (acid-phosphatase).

Materials studied

Living material of all the Mexican taxa of the genus, with the exception of *G. chihuahuensis*, has been collected by the writer in the course of several short periods of fieldwork. All the taxa have been successfully grown in the Science Support glasshouses at Kew, apart from *G. triflora* (*G. aguensis*) which is an annual or short-lived plant and has proved difficult to establish from cuttings or raise from seed. Live material of the dubious species *G. pauciflora*, native to Cuba, has not been available.

The systematic treatment which follows is based on examination of the above-mentioned live material, especially in respect of floral characters, which are difficult to study in dried material, and on herbarium specimens, including nomenclatural types, representing some 500 field collections, in 30 herbaria. A list of these specimens, including voucher material from experimental plants, is available from the author.

Gibasis *Rafinesque*, Fl. Tell. 2: 16 (1837); Rohweder in Abh. Geb. Auslandsk. 61 (C. 18): 143 (1956). Type: *Tradescantia pulchella* Kunth, based on *Humboldt & Bonpland* s.n. (holotype P; isotype B).

Annual or perennial herbs, habit various, mostly with root tubers. Cymes individually stipitate (rarely the stipes nearly obsolete), grouped in pseudo-terminal pairs or umbels; subtending bracts leaf-like or inconspicuous; axis more or less sharply angled or reflexed at the junction of the congested fertile part and the sterile stipe, and in some species fused with it; bracteoles very small, closely imbricate in two parallel rows. Flowers actinomorphic, bisexual; sepals and petals 3, free; stamens 6, equal, anther-connectives broadly triangular, versatile; ovary 3-locular with two ovules per loculus; stigma capitellate. Fruit a capsule; seeds with elongate-punctiform to linear hilum and dorsal embryotega.

Key to Sections of Gibasis

Non-tuberous; leaves oblong-lanceolate to broadly ovate; usually densely villous-pubescent; flowers white; chromosomes small (x = 8); humid tropical zone throughout tropical America, including S Mexico . . . . . sect. **Heterobasis** (spp. 1, 2)

Tuberous or non-tuberous; leaves narrowly linear to lanceolate, rarely ovate; glabrous or sparsely indumented species, mostly with coloured flowers and self-sterile; chromosomes large (x = 4, 5 or 6); mesophytic to semi-arid habitats in the subtropical to cool temperate zone throughout Mexico, and in Guatemala, Cuba and Colombia . . . . . sect. **Gibasis** (spp. 3–11)

Key to species and subspecies of Gibasis

1. Flowers white; leaves oblong-lanceolate to broadly ovate; tubers absent:
2. Cymes (2–)3–8-nate; leaves spirally arranged, equal sided, 'petiolate'. Mexico (Oaxaca) . . . . . **1. G. oaxacana**
2. Cymes strictly binate; leaves more or less 2-ranked, the base oblique, sessile, rounded to cordate:
3. Leaves densely villous-pubescent especially the sheath and margins, lanceolate to broadly ovate; stipes usually glandular-pubescent. Humid neotropics . . . . . **2. G. geniculata**
3. Leaves almost glabrous (except for ciliae on sheaths) to pubescent, narrowly oblong-lanceolate to ovate; stipes eglandular. Mexico, subtropical zone . . . . . **3. G. pellucida**
1. Flowers usually purple, pink or violet-blue; leaves linear to ovate-lanceolate; tubers present or absent:
4. Leaves narrowly oblong-lanceolate to ovate-lanceolate, glabrous or pubescent:
5. Cymes strictly binate, fertile axes reflexed and completely fused with stipe; leaves lanceolate to ovate-lanceolate; tubers present or absent:
6. Perennials; leaves ovate-lanceolate, at least the lower 1–2 cm broad, rounded and more or less amplexicaul at base:
7. Plants erect or ascending from tuberous rootstock; leaves glabrous, the uppermost reduced. Temperate C Mexico, Colombia **4. G. pulchella**
7. Plant decumbent or creeping, lacking tubers but rooting at the nodes; leaves hairy beneath, the uppermost (outer bract of inflorescence) not reduced. Mexico (Veracruz) . . . . . **5. G. matudae**
6. Annuals; leaves lanceolate, 'subpetiolate', not amplexicaul, 5–10(–18) mm broad, often villose pubescent. (W Mexico, Guatemala: Volcan de Agua) . . . . . **6. G. triflora**
5. Cymes 3–13-nate; leaves narrowly oblong to lanceolate, tubers present. (Mexico)– 4 choices follow:
8. Stem and leaves pubescent; leaves narrowly oblong tapering relatively abruptly to the tip, 8–11 × 1·5–2·5 cm; cymes of main umbel numerous (c. 12) (Chihuahua, Michoacan). . . . **7. G. chihuahuensis**
8. Stem, leaves and inflorescences glabrous to pubescent; leaves lanceolate, slightly to markedly cordate at base, 2·5–5·5 × 0·7–1·5 cm; cymes of main umbel 3(–7). (Morelos and Guerrero to Puebla and Oaxaca) . . . . . **8. G. consobrina**
8. Stem and leaves glabrous; leaves lanceolate-acuminate, cordate-amplexicaul at base, 4–9 × 1·5–2·5 cm; cymes of main umbel (2–)4–5(–10). (Hidalgo and San Luis Potosí to Coahuila) . . . . . **9b. G. karwinskyana** subsp. **palmeri**
8. Stem and leaves glabrous; leaves narrowly lanceolate, usually not cordate at base, gradually tapering to the tip, 8–14 × c. 1·2–2 cm; cymes of main umbel numerous, 5–12. (Hidalgo to San Luis Potosí and Tamaulipas). . . . **9a. G. karwinskyana** subsp. **karwinksyana**
4. Leaves linear, glabrous; tubers present:
9. Flowers usually blue or pale pink, not purple-pink; plants glaucescent, glabrous; leaves 4–15 mm broad, subsucculent and rather flaccid, attenuate-acuminate:
10. Plant relatively weak, often decumbent, leaves 4–6 mm broad; cymes 2–4-nate. (Coahuila to Hidalgo). . . . . **10a. G. venustula** subsp. **venustula**
10. Plants relatively robust, often erect, at least the lower leaves 8–15 mm broad; cymes 2–8-nate. (W Mexico, Baja California):
11. Plant green to glaucous, flowers usually blue. (Mainland W Mexico, from Chihuahua to the state of Mexico) . **10b. G. venustula** subsp. **robusta**
11. Plant strongly glaucous, flowers pink (Baja California) . . . . . **10c. G. venustula** subsp. **peninsulae**
9. Flowers purple-pink; plants not glaucescent, calyces and pedicels glabrous or glandular pubescent; leaves narrowly linear, 1–6 mm broad, stiffish, channelled to the hooded tip:
12. Plants dwarf, flowering stems less than 15 cm tall, sometimes with only one internode beneath the inflorescence; stipes often very short or obsolete, less than 1 cm long. (State of Mexico, Guanajuato, above 2500 m) . . . . . **11a. G. linearis** subsp. **linearis**
12. Plants usually larger, flowering stems 12–30 cm or more tall, with 2 or more internodes below the inflorescence; stipes usually clearly developed, 1·2–3 cm long. (Sierra Madre Occidental: Michoacan to Chihuahua) . . . . **11b. G. linearis** subsp. **rhodantha**

Section Heterobasis

Gibasis sect. **Heterobasis** *D. R. Hunt* in Kew Bull. 30(4): 714 ('1975', publ. 7 Apr. 1976). Type: *G. geniculata* (Jacq.) Rohw.

Perennial herbs without tubers; leaves oblong-lanceolate to broadly ovate; cincinni 2–8-nate; flowers white; chromosomes small (x = 8).

Two species, one widespread in tropical America, the other of restricted distribution in Mexico.

1. Gibasis oaxacana *D. R. Hunt* in Curtis's Bot. Mag. 179: N.S., t. 624 (1972); Jones, Papes & Hunt in Bot. J. Linn. Soc. 71: 147 (1975). Type: Mexico, Oaxaca, road from Oaxaca to Tuxtepec, about 11 km before Valle Nacional, 680 m, 18 Sept. 1971, *Hunt* 8175, cult. Hort. Kew. no. 337-71.03053 (holotype K; isotypes MEXU, US).

Erect or decumbent perennial (short-lived?) to 40 cm, freely branched, stems, leaves and inflorescences glandular-villous. Leaves ovate-lanceolate to ovate-elliptic, acuminate, rounded and petiolate or subpetiolate above the sheath, blade to 9 × 3·5 cm, thin, green or deep purplish, sticky above with gland-tipped hairs, less hairy below. Cymes 3–8-nate; cyme-bracts 1–2 mm; stipes 9–18 mm; pedicels slender, 3–5 mm at anthesis. Sepals c. 3 × 1–2 mm; petals very broadly ovate, c. 4 × 4–5 mm, white or with pale purplish midstripe; stamens 3–4 mm, tufted with hairs at base and above middle. Seeds c. 0·8 mm. 2n = 16. Self-incompatible.

Mexico (Oaxaca). Moist places in evergreen forest, 680–1600 m. Recorded from a few localities near Tuxtepec only (*Moore* 8955, cult., K; *Martinez Calderon* 368, MEXU; *Rzedowski* 34065, ENCB).

2. Gibasis geniculata (*Jacq.*) *Rohw.* in Abh. Geb. Auslandsk. 61 (C. 18): 143 (1956); Jones, Papes & Hunt in Bot. J. Linn. Soc. 71: 145 et seq. (1975). Type:

West Indies, Martinique, *Jacquin* (isotypes BM, M).

Tradescantia geniculata Jacq., Select. Stirp. Amer., 94, t. 64 (1763); Clarke in DC., Monogr. Phan. 3: 300 (1881) pro parte, excl. vars. *schiedeana* & *botterii*; Jones, Colden & Hunt in Bot. J. Linn. Soc. 62: 207 (1969), pro parte (clones A_1, A_2).

Aneilema geniculata (Jacq.) Woodson in Ann. Missouri Bot. Gard. 29: 147 (1942); Standley & Steyermark, Fl. Guatemala in Fieldiana Bot. 24(3): 4 (1952).

Tradescantia effusa Mart. ex Schultes f. in Roemer & Schultes, Syst. Veg. 7: 1159 (1830); Seub. in Mart., Fl. Bras. 3(1): 251, tab. 34 (1855). Type: Brazil, Minas Gerais, in sylvis primaevis ad Mariana, April [1818], *Martius* (M).

Aneilema filipes Mart. in Flora 24, Beibl. 2: 59 (1841). Type: Brazil, in nemoribus ad Ilheos, Dec. [1818] *Martius* (B, K).

Tradescantia floribunda Kunth, Enum. Pl. 4: 89 (1843). Syntypes: var. α, Brazil 'inter Vittoria et Bahia' *Sellow* (B, K); var. β 'prope Rio de Janeiro' *Gaudichaud* (B); Surinam [cites: *Callisia umbellulata* Weigelt. herb. Surinam] (not seen); Martinique *Sieber* 258 (B, BR, M, W).

Tradescantia kunthiana Seub. in Mart., Fl. Bras. 3(1): 252 (1855). Type: S Brazil, *Sellow* (B).

Tradescantia geniculata var. *kunthiana* (Seub.) Clarke in DC., Monogr. Phan. 3: 301 (1881).

Tradescantia decumbens Klotzsch in Allg. Gartenz. 21: 118 (1853). Type: Central America, *Warszewicz* (holotype B).

Tradescantia hypophaea C. Koch & Bouché, Index Sem. Hort. Berol. 1855: 9 (1855). Type: 'e regionibus tropicis Americae', *Warszewicz* (holotype B?; not seen).

Decumbent perennial to 60 cm, freely branched, rooting at nodes, stem and leaves villous, inflorescence often glandular-villous. Leaves ovate to oblong-elliptic, often somewhat unequal-sided, acute, subcordate, sessile or nearly so on the sheath, 3–5(−11) × 1·5–2·5 cm, dark glossy green or purplish. Cymes strictly 2-nate; cyme-bracts 1–4 mm; stipes 12–16 mm; pedicels c. 4 mm. Sepals 2·5–3 × 1 mm; petals ovate, 3–3·5 × 2–2·5 mm, white; stamens 2·5–3 mm, filaments bearded at base only. Fruiting pedicels to 12 mm; seeds 1 mm, hilum elongate-punctiform. 2n = 32, 48. Self-compatible. Fig. 1A.

DISTRIBUTION. Tropical America, from S Mexico and the West Indies to Paraguay and N Argentina. Moist places in evergreen forest, 0–650 (−1600) m.

MEXICO: Veracruz (*Santos* 2832, MICH; *Hunt* 7160, cult., K); 'Yucatan & Tabasco' (*Johnson* 93, K); Campeche (*Rovirosa* 603, K). BELIZE: (*Schipp* 1087, K). GUATEMALA: (*Tuerckheim* 8327, K). HONDURAS: (*Molina* 10391, US). COSTA RICA: (*Skutch* 2923, K). PANAMA: (*Burch* 1048, K). HAITI: (*Nash* 178, K). DOMINICAN REPUBLIC: (*Ekman* H. 14893, C, K, S). PUERTO RICO: (*Sintenis* 524, K). VIRGIN Is: St Thomas (*Friedrichsthal* 392, W). ANTIGUA: (*Wullschlaegel* 547, M). GUADELOUPE: (*Duss* 3292, S). DOMINICA: (*Lloyd* 423, K). MARTINIQUE: (*Sieber* 258, B, BR, M, W). BARBADOS: (*Warming* 32, C). GRENADA: (*Broadway*, s.n., BR, K). TRINIDAD: (*Sastre* 346, K). GUYANA: (*Schomburgk* 14, K). SURINAM: (*Hostmann* 944, K). BRAZIL: Bahia (*Harley* 17240, K); Minas Gerais (*Martius* 1099, M); Rio de Janeiro (*Gardner* 702, K); Guanabara (?) (*Glaziou* 13287, K); São Paulo (*Pedersen* 10706, C); Paraná (*Jönsson* 781a, K); Rio Grande do Sul (*Rambo* 42797, B, K). PARAGUAY: (*Woolston* 634, C, K, S). COLOMBIA: Magdalena (*Smith* 2283, BR, K, S, WIS). VENEZUELA: Bolivar (*Steyermark* 88648, K). ECUADOR: Manabi (*Eggers* 15215, LD); Guayas (*Schimpff* 1017, M). PERU: San Martin (*Spruce* 4099, BR, K). BOLIVIA: Santa Cruz (*Steinbach* 7483, K, S). ARGENTINA: Corrientes (*Pedersen* 2680, C, K).

3. Gibasis pellucida (*Martens & Galeotti*) *D. R. Hunt* in Kew Bull. 38(1): 132 (1983). Type: Mexico, *Galeotti* 4965 (holotype BR).

Tradescantia pellucida Martens & Galeotti in Bull. Acad. Brux. 2: 376 (1842).

Tradescantia schiedeana Kunth, Enum. Pl. 4: 90 (1843). Type: Mexico, Veracruz, Jalapa, *Schiede* 975 (holotype B).

T. geniculata var. *schiedeana* (Kunth) C. B. Clarke in DC., Monogr. Phan. 3: 301 (1881).

Gibasis schiedeana (Kunth) D. R. Hunt in Curtis's Bot. Mag. 179: N.s., t. 636 (1973); Jones, Papes & Hunt in Bot. J. Linn. Soc. 71: 148 (1975).

T. geniculata var. *botterii* C. B. Clarke, l.c. Syntypes: Mexico, Veracruz, Orizaba, Dec. 1854, *Botteri* 960, the same, Jan. 1855, *Botteri* 962 (K).

[*T. consanguinea* Klotzsch, ms; *T. sp.*, Klotzsch in Linnaea 6: 43 (1831). Based on *Schiede* 975].

Tradescantia lundellii Standley in Publ. Field. Mus. Nat. Hist. Chicago, Bot. ser. 22: 5 (1940). Type: Mexico, San Luis Potosí, Tamazunchale, in second growth on wet hillside, 300 m, July 1937, *C. L. & A. A. Lundell* 7098 (holotype F 901086).

Tripogandra lundellii (Standley) Woodson in Ann Missouri Bot. Gard. 29: 153 (1942).

[*Aneilema geniculata* sensu Matuda in An. Inst. Biol. Mex. 26: 321, fig. 5 (1956), non *T. geniculata* Jacq. (All specimens cited are *G. pellucida*; petal colour erroneously stated to be blue or purple)].

Decumbent or creeping perennial to 1 m or more, branching and rooting at the nodes, glabrous or sparsely hairy. Leaves lanceolate, unequal-sided, acute or acuminate, usually cordate, sessile on the sheath, 1–10 × 0·3—3 cm, thin, green, sometimes tinged purple below. Cymes strictly binate; cyme-bracts small, subulate; stipes 8–22 mm; pedicels slender, 3–10 mm at anthesis, often purplish. Sepals 2–3 × 1 mm; petals very broadly ovate, 3·5–7 × 2·5–6 mm, white; stamens 3–4 mm, tufted with hairs at base and above middle. Fruiting pedicels 12–15 mm; seeds 1 mm. 2n = 10, 16. Usually self-incompatible, but some 2n = 16 individuals self-compatible. Fig. 1B.

Mexico. Stream banks, wet rocks and gullies, moist shady places, in forest and woodland, principally on the Atlantic side, 300–2200 m.

MEXICO: Sinaloa (*Breedlove* 18259, ENCB); Nayarit (*McVaugh* 18959, MICH); Jalisco (*Mexia* 1253, US); Tamaulipas (*Hunt* 8055, K); San Luis Potosí (*Palmer* 254, US); Hidalgo (*Pringle* 8875, ENCB, K, M, MEXU, US); Puebla (*Bravo* 110, MEXU); Veracruz (*Hunt* 8563, K); Oaxaca (*Gonzalez Quintero* 1845, ENCB); Chiapas (*Hunt* 7171, K). EL SALVADOR (introduced?) (*Harmon & Fuentes* 4946, UMO).

Frequently cultivated as an ornamental in Mexico and the U.S.A. ('bridal veil'), and often confused with *G. geniculata* or superficially similar species in

other genera. A specimen at BM vouches for the cultivation of the species at Kew as early as 1784.

Perhaps conspecific with *G. pellucida* is:

Gibasis pauciflora (*Urban & Ekman*) *D. R. Hunt* in Kew Bull. 33: 146 (1978). Type: Hispaniola, Santo Domingo, Cordillera Central, prov. Azua, 'ad Rio del Medio in montibus saxosis, ubi Arroyo Yaquecillo influit', c. 700 m, 11 Oct. 1929, *Ekman* 13734 (holotype S).

Tradescantia pauciflora Urban & Ekman in Arkiv Bot. Stockh. 23 no. 11: 7 (1931).

GREATER ANTILLES. Hispaniola, Santo Domingo, prov. Azua, Sierra de Ocoa, San José de Ocoa, dry hills W of town, c. 700 m, 25 Feb. 1929, *Ekman* 11666 (paratypes C, K, S). CUBA. E Cuba, 1859–64, *C. Wright* 1714 (K), 3225 (K, S).

Wright's specimens were determined as *Tradescantia geniculata* Jacq. (*Gibasis geniculata* (Jacq.) Rohw.) by C. B. Clarke but seem to me closer to *G. pellucida*. The elliptic leaves and long-peduncled inflorescence are distinctive. If referable to sect. *Gibasis*, it would be a plausible range-extension for the section.

4. Gibasis pulchella (*Kunth*) *Rafinesque*, Fl. Tell. 2: 16 (1837); Rohweder in Abh. Geb. Auslandsk. 61 (C. 18): 144 (1956); Jones, Papes & Hunt in Bot. J. Linn. Soc. 71: 156 (1975). Type: Mexico, Guanajuato, between Guanajuato [Guanaxuato] and Santa Rosa de la Rosa de la Sierra, alt. 2330 m, Humboldt & Bonpland (holotype P, not seen; photo. at K; isotype B).

Tradescantia pulchella Kunth in Humboldt, Bonpland & Kunth, Nov. Gen. Sp. 1: 262 (1816), ibid. 7: t. 673 (1825); Clarke in DC. Monogr. Phan. 3: 297 (1881).

Aneilema pulchella (Kunth) Woodson in Ann. Missouri Bot. Gard. 29: 148 (1942); Matuda in An. Inst. Biol. Mex. 26: 320 (1956), pro parte.

Erect or ascending glabrous perennial 10–30 cm with slender hairy tubers. Leaves ovate-lanceolate, acute, rounded to cordate at base, sessile on the sheath, blades 3–6 × 1–2·5 cm, thin to subsucculent, green or glaucescent, usually reduced towards the inflorescence. Cymes strictly 2-nate, c. 4–7-flowered, axis reflexed and fused with stipe-apex; cyme-bracts small, or the lower leaf-like; stipes accrescent during anthesis, eventually 20–55 mm; pedicels slender, 5–7 mm at anthesis. Sepals 3 × 1 mm; petals broadly ovate-trullate, 6–12 × 5–9·5 mm, pink, purplish or violet-blue; stamens 4–8 mm, bearded. Fruiting pedicels stiffly deflexed; seeds c. 1·4 × 1 mm. 2n = 10, 15. Usually self-incompatible, but some individuals (2n = 10) self-compatible. Fig. 2B.

Mexico, Colombia. Shade in temperate oak-pine woods, silver fir forest, and grassy banks, 2300–3400 m.

MEXICO: San Luis Potosí (*Rzedowski* 4157, ENCB); Michoacan (*Bautista* s.n., ENCB); Guanajuato (*Hunt* 8067, K); Hidalgo (*Rose & Painter* 6736, US); Mexico (*Balls* 5053, K); Distrito Federal (*Pringle* 6489, K, M, MEXU); Morelos (*Hunt* 8099, K); Puebla (*Kral* 25094, ENCB). COLOMBIA: Cundinamarca (*Balls* 5724, K).

5. Gibasis matudae *D. R. Hunt* in Bot. J. Linn. Soc. 66(3): 234 (1973) and in Kew Bull. 30(4): 710 (1975); Stant in Bot. J. Linn. Soc. 66(3): 234 et seq. (1973); Jones, Papes & Hunt in Bot. J. Linn. Soc. 71: 156 (1975). Type: Mexico, Veracruz, Los Cumbres de Acultzingo, 2 km from Peña del Aire, 2150 m, roadside banks in temperate zone, 18 Sept. 1971, *Hunt* 8176, cult. Hort. Kew no. 337-71.03054 (holotype K!; isotypes ENCB, MEXU, MICH, US).

Decumbent or sprawling subglabrous perennial to 40 cm or more, without tubers, rooting at the nodes. Leaves ovate-lanceolate, acute, rounded to subcordate at base, sessile on the sheath, blades 6–8 × 2–2·5 cm, thin, green, pubescent both sides or glabrous above. Cymes strictly 2-nate, axis reflexed and fused with stipe-apex; lower cyme-bract leaf-like, upper reduced; stipes accrescent during anthesis, eventually c. 30–45 mm; pedicels c. 5 mm. Sepals c. 3·5 × 1 mm; petals broadly ovate-trullate, c. 5 × 4·5 mm, violet-blue or purplish pink; stamens c. 4–5 mm, filaments bearded. Capsule, seeds, not recorded. 2n = 10. Self-incompatible.

Mexico (Veracruz). Moist banks at margin of temperate woodland, 2150–2400 m. The earliest collection seen is from 'Orizaba' and dated 1854 (*Botteri* 532, BM). All more recent collections have been from the neighbourhood of the type locality.

6. Gibasis triflora (*Martens & Galeotti*) *D. R. Hunt* comb. nov.

Tradescantia triflora Martens & Galeotti in Bull. Acad. Brux. 2: 376 (1842). Type: Mexico, Oaxaca, Juquila, woods, 5000 ft [1500 m], Sept.–Nov. 1840, *Galeotti* 4954 (lectotype BR, chosen here; see note below).

?T. aguensis Standley & Steyermark in Field Mus. Publ. Bot. 23: 36 (1944). Type: Guatemala, dept. Sacatepequez, slopes of Volcan de Agua north of Santa Maria de Jesus, 1800–2100 m, 10 Dec. 1938, *Standley* 59358 (holotype F).

?G. aguensis (Standl. & Steyerm.) Rohw. in Abh. Geb. Auslandsk. 61 (C. 18): 143 (1956); Hunt in Kew Bull. 30: 712 (1976).

[*Aneilema pulchella* sensu Matuda in An. Inst. Biol. Mex. 26: 321 (1956) quoad spec. *Hinton* 13259].

Erect or decumbent glabrous to villous annual or short-lived perennial to 50 cm. Leaves lanceolate, acuminate, cuneate or rounded and subpetiolate above the sheath, blades 4–6·5 × 0·5–1·5 cm, thin, green, usually sparsely villous. Cymes strictly 2-nate, few-flowered, axis short, sometimes reflexed and fused with stipe; both cyme-bracts, or the lower only, leaflike; stipes 10–30 mm; pedicels 4–11 mm. Sepals 2–3 × 1 mm; petals broadly ovate, 2·5–6 × 2–4 mm, pale pink, pale blue or white; stamens 1·5–4 mm, bearded. Seeds 1·25 × 1 mm. 2n = 10. (Self-compatible?).

W Mexico and NW Guatemala. Moist shady banks and woods, 150–2100 m.

MEXICO: Nayarit (*McVaugh* 16462, MICH); Jalisco (*Gonzalez Tamayo* 379 (MICH); Michoacan (*Hinton* 13259, K, NY); Guerrero (*Hinton* 10764, K); Oaxaca (*Rzedowski* 19548, ENCB, MEXU, TEX, UMO). GUATEMALA: Sacatepequez (*Standley* 59358, F).

Martens & Galeotti (l.c.) cite Juquila, in the state of Oaxaca, as the prov-

enance of *Tradescantia triflora*, but of the two *Galeotti* collections (syntypes) referred to it, one (no. 4948) was collected in Veracruz, according to the label, and is *G. pellucida*. I therefore choose the other, no. 4954, as the lectotype.

It seems likely that *G. aguensis*, which is known to me only from the type, is conspecific with *G. triflora*, and that the Mexican plant from the states of Guerrero, Michoacan, etc., which I have previously referred to *G. aguensis* belongs here also. The chromosome count of 2n = 10 (Jones, Papes & Hunt 1975) is from a specimen collected in Michoacan (*Hunt* 8130, K).

7. Gibasis chihuahuensis (*Standley*) *Rohw.* in Abh. Geb. Auslandsk. 61 (C. 18): 143 (1956). Type: Mexico, Chihuahua, Rio Mayo, Guasaremos, shaded canyon bottom, 10 Aug. 1936, *Gentry* 2365 (holotype MO, not seen; isotypes K, MEXU, S).

Tradescantia chihuahuensis Standley in Field Mus. Publ. Bot. 17: 227 (1937).
Aneilema chihuahuensis (Standley) Woodson in An. Missouri Bot. Gard. 29: 148 (1942); Matuda in An. Inst. Biol. Mex. 26: 316 fig. 3 (1956).

Erect or ascending pubescent perennial to 40 cm with tuberous roots. Leaves narrowly oblong or oblong-elliptic, acute to acuminate, somewhat narrowed into the sheath, blade 5–12·5 × 1·7–2·5 cm. Cymes numerous, 11–18-nate; cyme-bracts small; stipes c. 20–30 mm; pedicels 7–8 mm. Sepals ovate-cymbiform, 2·5–4 mm, hyaline with green keel; petals 3·5–8 mm, pale blue or white. Seeds 1·4 × 1·2 mm.

W Mexico. Definitely known from the type collection only, but a smaller-flowered plant from Michoacan (distr. Coalcoman, Sierra Naranjillo, 14 July 1939, *Hinton* 13944, W) may belong here, and I have amplified the description to cover it. No live material has been available to me.

8. Gibasis consobrina *D. R. Hunt* in Kew Bull. 30(4): 709 (1975); Jones, Papes & Hunt in Bot. J. Linn. Soc. 71: 153 (1975). Type: Mexico, Oaxaca, gravelly bluffs above Tomellin Canyon, 4000 ft [1220 m], 9 July 1897, *Pringle* 6723 holotype K; isotypes BR, ENCB, M, MEXU, US 316933, S, WU, Z).

Decumbent sparsely pubescent perennial to 40 cm with slender tubers. Leaves lanceolate, acute, rounded to cordate at base, blade 3–5(−8) × 1–1·5 cm, subsucculent, green or slightly glaucous. Cymes 3(−7)-nate; cyme-bracts small, or the lower leaf-like; stipes 15–20 mm; pedicels c. 8 mm. Sepals c. 5 × 1·5–2·5 mm; petals very broadly ovate, 9–10 × 7–8·5 mm, dark violet-blue or purplish pink; stamens 5·5–6·5 mm, filaments coloured like the petals, bearded; ovary glandular-hairy. Seeds 1·7–2 × 1·3–1·6 mm. 2n = 20. Self-incompatible.

S Mexico. Grassy calcareous slopes and bluffs in spiny shrubland (matorral), 1000–2000 m.

Mexico: Guerrero (*Richards & Rowell* 3334, MICH); Mexico (*Hinton* 4177, K); Morelos (*Hunt* 9001, K); Puebla (*Hunt* 9013, K); Veracruz (*Bourgeau* 2667, K); Oaxaca (*Hunt, Jones & Owens* 9193, K).

9. Gibasis karwinskyana (*Schultes f.*) *Rohw.* in Abh. Geb. Auslandsk. 61(C. 18): 144 (1956); Jones, Papes & Hunt in Bot. J. Linn. Soc. 71: 152 (1975).

Type: Mexico, Hidalgo, Toliman Canyon [W of Zimapan], *Karwinsky* (isotype M).

Tradescantia karwinskyana Schultes f. in Roemer & Schultes, Syst. Veg. 7: 1165 (1830); Clarke in DC. Monogr. Phan. 3: 299 (1881); Jones, Colden & Hunt in Bot. J. Linn. Soc. 62: 216 (1969).
Aneilema karwinskyana (Schultes f.) Woodson in Ann. Missouri Bot. Gard. 29: 148 (1942); Matuda in An. Inst. Biol. Mex. 26: 318 (1956).
Tradescantia urbinana Greenman in Proc. Amer. Acad. 39(5): 70 (1909). Type: *Pringle* 9250 (isotype MEXU 2833); see note below.
Aneilema urbinana (Greenman) Matuda in An. Inst. Biol. Mex. 26: 320 (1956).
Tradescantia collina Brandegee in Univ. Calif. Publ. 4: 269 (1912). Type: Mexico, San Luis Potosí, Minas de San Rafael, July 1910, *Purpus* 5400 (lectotype UC 155199; see note below).
Aneilema collina (Brandegee) Matuda in An. Inst. Biol. Mex. 26: 317 (1956).

Suberect sparsely branched glabrous perennial with tuberous roots. Leaves lanceolate, acute, rounded or subcordate above the sheath, blade to 14 × 2·5 cm, subsucculent, pale glaucous green. Cymes 4–12-nate; cyme-bracts small; stipes to 35 mm; pedicels 10–15 mm at anthesis. Sepals to 5 × 2·5 mm; petals broadly ovate, 10 × 8 mm, purplish pink or paler, very rarely white; stamens 8 mm, bearded; ovary glandular-hairy. Seeds 1·9 × 1·7 mm. 2n = 10, 20, 30. Self-incompatible.

G. karwinskyana (now understood to exclude its southern Mexican relative *G. consobrina* D. R. Hunt) is widespread in eastern Mexico north of the transverse volcanic belt. Two races are clearly discernible by virtue of the leaf and inflorescence characters noted in the key, supported by cytological evidence from chromosome banding patterns (Kenton 1978), and these appear to be largely allopatric, one 'eastern' and the other 'western'. Karwinsky's type of the name *Tradescantia karwinskyana* is identifiable, morphologically, as the 'eastern' plant. The 'western' is recognized below as *G. karwinskyana* subsp. *palmeri* D. R. Hunt.

The typification of two names included above in the synonymy of *G. karwinskyana* is problematical. *Tradescantia urbinana* Greenman was based on *Pringle* 9250, for which the label data are 'Morelos, Sierra de Tepoxtlan, near Cuernavaca, altitude 2300 m, 11 Sept. 1900' (not '1902' as cited by Matuda, 1956). The rather poor specimen seen by me (MEXU 2833) seems identifiable as *G. karwinskyana*, rather than *G. consobrina* which does occur in Morelos. Pringle's well-known habit of making repeated collections on different occasions to complete 'sets' of specimens, coupled with the anomalous collection number (he was in the 8800's in 1900), lead one to suspect an error somewhere, and to suggest that the specimen in question is mislabelled; it seems more likely to have been obtained much further north. If, however, it can be matched by a new collection from Tepoxtlan, its identification might have to be revised, and possibly the synonymy.

The type sheet of the name *Tradescantia collina* Brandegee bears two specimens of *Gibasis karwinskyana* allegedly collected at Minas de San Rafael in San Luis Potosí in June 1910 by C. A. Purpus (*Purpus* 5400 in UC 155199). The left-hand specimen is subsp. *palmeri*, the right-hand subsp. *karwinskyana*. Of several places called San Rafael in that state, the one in question is identified by Sousa Sanchez (1969) as the one situated at 22°13′N/100°15′W, i.e. between

Cerritos and Rio Verde due east of the city of San Luis Potosí. Distributionally, it is possible that both subspecies would occur there but there is no other record of subsp. *palmeri* at relatively low elevation so far east of San Luis Potosí. Provisionally, therefore, the right-hand specimen, representing subsp. *karwinskyana* seems the better choice as a potential lectotype, and the epithet *collina* has been discounted in the choice of a subspecific epithet for the new subspecies.

subsp. **karwinskyana**

Leaves narrowly lanceolate, usually not cordate at base, gradually tapering to tip, 8–14 × c. 1·2–2 cm; cymes of main umbel 5–12-nate. 2n = 10, 20, 30.

E Mexico. Grassy calcareous flats, slopes and bluffs in spiny matorral, 1360–2000 m.

Mexico: Nuevo Leon (*Owens, Kenton et al.* 10117A, cult., K); Tamaulipas (*Hunt* 8035, cult., K); San Luis Potosí (*Purpus* 5400, in part, UC); Hidalgo (*Coulter* 1604, K).

subsp. **palmeri** *D. R. Hunt* subsp. nov.; a subspeciei typica differt foliis lanceolato-acuminatis, basi cordato-amplexicaulibus, 4–9 cm longis, 1·5–2·5 cm latis, umbellae principalis cymis 4–5-natis. Typus: Mexico, Coahuila, Carneros pass area [fide I. M. Johnston in J. Arn. Arb. 25: 52 (1944)], 1880, *Palmer* 1325 (holotypus K).

Leaves lanceolate-acuminate, cordate-amplexicaul at base, 4–9 × 1·5–2·5 cm; cymes of main umbel 4–5-nate. 2n = 10. Fig. 2A.

E Mexico. Grassy calcareous flats, slopes and bluffs in spiny matorral, 1600–2300 m.

Mexico: Coahuila (*Pennell* 17359, MEXU); Tamaulipas (*Stanford et al.* 778, MEXU); San Luis Potosí, *Hunt* 8014, cult., K); Hidalgo (*Hunt* 8545, cult., K). A specimen from Nuevo Leon (*Thurm, Dunn et al.* 112a, K, UMO) may also be this subspecies. Johnston (1944) cites a specimen from Zacatecas (*Stanford et al.* 499) under *Tradescantia karwinskyana* which might be this subspecies, but has not been seen by me.

10. Gibasis venustula (*Kunth*) *D. R. Hunt* in Kew Bull. 33: 145 (1978); Stephenson & Owens in Bot. J. Linn. Soc. 77: 157–175 (1978).

Tradescantia venustula Kunth, Enum. Pl. 4: 87 (1843); Clarke in DC., Monogr. Phan. 3: 298 (1881); I. M. Johnston in J. Arn. Arb. 25: 52 (1944). Based on *T. karwinskyana* Hort. Berol., 1834, not Schultes f.

Erect or sprawling sparsely to diffusely branched glabrous perennial with tuberous roots. Leaves linear, usually attenuate-acuminate, scarcely broadened at base, 5–30 × 0·4–1·5 cm, subsucculent but flaccid, glaucous green. Cymes 2–8-nate; cyme-bracts small; stipes to 35 mm; pedicels c. 10 mm at anthesis, glabrous or sparsely glandular. Sepals 4–6 × 2·5–3 mm, margins hyaline; petals broadly ovate, 6–12 × 5–8 mm, clear blue, rarely pale pink or white; stamens 5–9 mm, bearded; ovary glabrous. Seeds 1·8–2·5 × 1·7–2 mm. 2n = 12. Self-incompatible.

N Mexico. Non-calcareous grassy slopes and ravines in spiny matorral, 1600–2350 m; also on bluffs near sea level (subsp. *peninsulae*).

The distinct identity of *Tradescantia venustula* was recognised by I. M. Johnston (1944) and the species transferred to *Gibasis* by the present author in 1978.

Intraspecifically, *G. venustula* is divisible into a number of geographical vicariants, of which one has hitherto been treated as a distinct species, namely that from Baja California, *G. heterophylla*, here treated as *G. venustula* subsp. *peninsulae* D. R. Hunt. Although hybrids between this very glaucous-looking race and typical *G. venustula* are almost sterile (pollen fertility less than 5%; Kenton 1983, 1984b), morphological discrimination is difficult, and Brandegee's name-giving characteristic of heterophylly seems neither marked nor constant.

Another named form is subsp. *robusta* D. R. Hunt (native to Durango), where low fertility in F_1 hybrids with subsp. *venustula* is also reported (Jones, Bhattarai & Hunt 1981) and there are minor morphological differences. In size and habit, typical subsp. *venustula* (from the state of Hidalgo) is intermediate between subsp. *robusta* and forms of the species from the state of San Luis Potosí.

subsp. **venustula**

Relatively weak, often decumbent. Leaves 4–6 mm broad. Cymes of main umbel 2–4-nate. Flowers 10–15 mm diameter.

Mexico: Coahuila (*Marsh* 485, TEX); San Luis Potosí (*Parry & Palmer* 901, K); Guanajuato (*Rivera* 254, ENCB); Hidalgo (*Moore* 5446, MEXU).

subsp. **robusta** *D. R. Hunt* in Bot. J. Linn. Soc. 83: 137 (1981). Type: Mexico, Durango, beside highway Mex 45 about 40 km SE of city of Durango, 1900 m, 18 Aug. 1976, *Hunt & Owens* 9423 (holotype K).

Relatively robust with erect inflorescence-shoots. Leaves 8–15 mm broad. Cymes 4–8-nate. Flowers 15–20 mm diameter.

Mexico: Durango (*Hunt* 8800, cult., K). Possibly referable here also are collections from Chihuahua (*Gentry* 1504, K, MEXU) and the state of Mexico (*Hinton* 1021, 4216, 4384, all K).

subsp. **peninsulae** *D. R. Hunt* stat. et nom. nov. Type: As for *Tradescantia heterophylla* Brandegee.

Tradescantia heterophylla T. S. Brandegee in Univ. Calif. Publ. Bot. 10: 181 (1922). Type: Mexico, Baja California, Cape Region, Sierra Taste, 1 Nov. 1902, *Brandegee* s.n. (holotype UC 142035; photos. at K, MEXU 91797).
Aneilema heterophylla (Brandegee) Matuda in An. Inst. Biol. Mex. 26: 312 ('1955', publ. 1956).
Gibasis heterophylla (Brandegee) Reveal & Hess in Bull. Torrey Bot. Club 99: 245 (1972).

Relatively robust. Leaves, at least the lower, 8–15 mm broad. Cymes of main umbel 2–3-nate. Flowers 10–15 mm diameter.

Mexico: Baja California (*Martinez* s.n., MEXU, *Chambers* 906, MEXU, *Moran* 7001, SD, *Hunt* 8742, cult., K).

11. Gibasis linearis (*Bentham*) *Rohw.* in Abh. Geb. Auslandsk. 61(C. 18): 144 (1956); Hunt in Kew Bull. 30(4): 711 (1975); Jones, Papes & Hunt in Bot. J. Linn. Soc. 71: 159 (1975); Jones, Bhattarai & Hunt in Bot. J. Linn. Soc. 83:

142 (1981). Lectotype: Mexico, 1830, *Graham* 356 (K).

Tradescantia linearis Bentham, Pl. Hartw., 27 (1840); Clarke in DC. Monogr. Phan. 3: 298 (1881).

Aneilema linearis (Bentham) Woodson in Ann. Missouri Bot. Gard. 29: 148 (1942); Matuda in An. Inst. Biol. Mex. 26: 310 (1956).

For further synonymy, see under the two subspecies.

Slender, usually unbranched perennial 5–30 cm with tuberous roots, glabrous except the often glandular-pubescent stipes, pedicels and sepals. Leaves narrowly linear, channelled to the hooded tip, to 30 × 0·1–1·6 cm, stiffish, green, not glaucous. Inflorescence-shoot 5–30 cm, scapiform or with 1–several leaves; cymes typically 2-nate but often 3–several; cyme-bracts small; stipes developed or nearly obsolete, 2–30 mm; pedicels c. 10 mm. Sepals 4–5 × 2–2·5 mm, keeled; petals broadly ovate, 6–10 × 5–8 mm, pinkish purple; stamens 5–8 mm, bearded; ovary glabrous. Seeds c. 1·4 × 1·4 mm. 2n = 12, 20, 22. Self-incompatible.

Mexico. Mountains of W Mexico, north of the transverse volcanic belt, in oak-pine woods, (1300–)2300–3200 m.

Like *G. venustula*, of which it may be regarded as the western counterpart and with which it intergrades at the northern and southern ends of the ranges, *G. linearis* contains several forms and the taxonomy is not yet fully elucidated. The more complete and dwarfish specimen of the two *Graham* collections cited by Bentham is here treated as lectotype and is identifiable with a relatively localized form which occurs in the states of Mexico and Guanajuato at higher altitudes. This, therefore, is subsp. *linearis*. The larger and commoner plant at lower elevations throughout the Sierra Madre Occidental is identifiable as *Tradescantia rhodantha* Torrey, or *T. graminifolia* Martens & Galeotti non Rafin., and this probably merits recognition as a subspecies, i.e. subsp. *rhodantha*. Although distinctive cytologically, *G. speciosa* Reveal & Hess does not seem distinguishable morphologically.

subsp. **linearis**

Dwarf. Inflorescence-shoots less than 15 cm, often scapiform. Stipes often short or obsolete, 2–10 mm. 2n = 12.

Mexico: Guanajuato (*Hunt & Owens* 9505, K); Mexico (*Rzedowski* 22876, ENCB, UMO).

subsp. **rhodantha** (*Torrey*) *D. R. Hunt* stat. nov.

Tradescantia rhodantha Torrey, Rep. United States & Mexico Boundary Survey 2(1): 225 (1859). Type: Mexico, Chihuahua, Corallitos, *Thurber* s.n. (US?, not seen).

T. graminifolia Martens & Galeotti, Bull. Acad. Sci. Brux. 9: 378 (1842), non Rafin., Atl. Journ. 1: 148 (1832) (= *T. rosea* Vent.). Type: Mexico, Michoacan, near Morelia, Jesus del Monte, 6900 ft, 1840, *Galeotti* 4941 (holotype BR; isotype K).

T. linearis var. *graminifolia* (Martens & Gal.) C. B. Clarke in DC., Monogr., Phan. 3: 299 (1881).

G. rhodantha (Torrey) Reveal & Hess in Bull. Torrey Bot. Club 99: 245 (1972).

G. speciosa Reveal & Hess in Bull. Torey Bot. Club 99: 243 (1972). Type: Mexico, Durango. La Campaña, 22 km W of El Salto, 8 Aug. 1971, *Reveal, Hess & Kiger* 2696 (holotype US; isotypes GH, K, MEXU, NY).

G. graminifolia D. R. Hunt in Kew Bull. 30: 712 (1975); ibid., 33: 146 (1978).

Larger than subsp. *linearis*. Inflorescence-shoots 12–30 cm with 1 or more leaves. Stipes 12–30 mm. 2n = 10, 12, 20, 22.

Mexico: Sonora (*White* 3217 etc., MICH); Chihuahua (*Pringle* 698, K); Coahuila (*Lyle Wynd & Mueller* 618, K, MEXU); Durango (*Palmer* 385, K); Zacatecas (*Knobloch* 1047, MICH); Jalisco (*Iltis* 550, WIS); Michoacan (*Hinton* 13875, MICH, UC); Guerrero (*Abbott* 158, ENCB); Mexico (*Reiche* 729, M).

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