NOTES ON THE CACTACEAE

THE TYPIFICATION OF « ECHINOCACTUS »

By LEON CROIZAT

RESUMEN

Notas sobre Cactáceas : Determinación del tipo de « Echinocactus ». — En este trabajo el autor comenta detalladamente la publicación original de *Echinocactus* Link et Otto y *Malacocarpus* Salm-Dyck. Se demuestra que el género *Echinocactus* como fuera originariamente concebido por Link et Otto, es un grupo confuso que incluye especies norte y sudamericanas que no tienen relación entre sí. Se presenta la determinación del tipo de *Echinocactus*, y se conserva el criterio de Schumann y Britton y Rose con el fin de no perturbar la nomenclatura existente. Como resultado de ésto, se excluye *Echinocactus* de la flora de Sudamérica. *Echinocactus platyacanthus* Link et Otto, considerado por Britton y Rose como lectotipo de *Echinocactus* y admitido por ellos como especie dudosa, viene a ser sinónimo de *E. latispina* (Haw.) Hemsl., y como un resultado de esta identificación *Ferocactus* Britt. et Rose pasa a la sinonimia de *Echinocactus*. En oposición al *Index Kewensis* se niega que Berger haya publicado nunca *Notocactus* como género.

It became known about fifteen years ago that the writer of these notes had a mild and somewhat amateurish interest in the *Cactaceae*. This interest has been persistingly recalled by friends and correspondents, who have asked this writer for opinions on this or that phase of the classification of this difficult family.

To meet these questions, this writer found two ways open, either to cull out as much information each time as the answer required, or to lay bare once for ever the core of the subject by a searching investigation. In the long run this writer learned that it was easier to study something once than to nibble

at it many times. Having been recently asked what are the limits of *Echinocactus*, and why it so happens that this genus seems to have left the flora of South America, this writer has gone at last into the subject of *Echinocactus* at some length. This article is written to give an account of his findings, and is one of a series to deal with the fundamentals of the classification of the *Cactaceae*.

Since the truth must be served, it is appropriate to begin a study of the *Cactaceae* with the statement that the classification of this family is in a state of absolute chaos. When, using if not abusing the authority of Engler's *Natürlichen Pflanzenfamilien*, and imposing to some extent up on the good will of his readers, Vaupel states (in *op. cit.*, 2nd. edit., 21: 613. 1925): « Zur Nomenklatur mag hier vorweg bemerkt sein, dass ich mich trotzt der Priorität and die herkömnlichen Namen gehalten habe, um verständlich zu bleiben. Bei den Kakteen, die mehr wie jede andere Pflanzenfamilien Gemeingut weitester Laienkreise geworden sind, muss die Ueberlieferung dem starren Prinzip vorangehen », Vaupel bares one of the principal reasons why the *Cactaceae* are today found in an exceedingly disordered condition. As the « Gemeingut weitester Laienkreise », this family is overrun with hosts of amateurs and with sundry kinds of dealers who work at cross purpose with a minority of serious botanists, the ultimate result of so much activity being that nobody can understand anything at all. It is peculiar that the editors of the *Natürlichen Pflanzenfamilien,* if not Vaupel himself, should overlook the truth that science can be vulgarized after it has been carefully and intelligently systematized, *not before.* Principles cannot be bartered away, and the lovers of succulent plants, together with their dealers and agents, are in the long run very poorly served by an untidy stream of meaningless names. The common denominator of popular as well as of scientific botany is common sense, and on the ground of common sense it should be possible to achieve some unity of results and of purposes.

The original publication of *Echinocactus* is available in very few libraries, and much of the confusion about the use of the name is due to the fact that the botanists who have read it are

a small minority. This genus was published in a contribution written along customary lines and titled *XLIII. Ueber die Gattungen « Melocactus » und « Echinocactus », nebst Beschreibung und Abbildung der im Königl. botanischen Garten bei Berlin befindlichen Arten* by H. F. Link and F. Otto. This contribution consists of pp. 412-429, Pls. XI-XXVII, of the Dritter Band of the *Verhandlungen des Vereins zur Beförderung des Gartenbaues in den Königlich Preussischen Staaten*, Berlín 1827. All the plates are labelled with reference to *Melocactus*, which conflicts with much of the text, and is apparently due to the fact that Link & Otto meant to treat as *Melocactus* the species which they decided to segregate eventually as *Echinocactus.* Following the paper just cited is another, pp. 430-432, unsigned but to all appearances to be credited to Link, titled *Cacti Lin. Index specierum horti botanici Berolinensis.* The mention of *Echinocactus* in this index is followed by the abbreviation *Clus.* which should be a reference to the author of the genus. Such an abbreviation, however, may refer only to Clusius (*Exotic. Libri Decem :* 92. 1605), who illustrates an *Echinomelocactus* introduced into Holland in 1601, and is cited (*op. cit.*, 412) by Link & Otto in their paper. Since this *Echinomelocactus* has a manifest cephalium, and is certainly not a species of *Echinocactus*, it is patent that the abbreviation *Clus.* is an error, and must be treated as such. The genus is to be credited beyond doubt to Link & Otto.

Some of the introductory remarks of Link & Otto read as follows (*op. cit.*, 414): « Haworth vermuthete schon, dass einige Arten von *Melocatus* eine eigene Gattung bilden möchten. Diese Vermuthung hat sich völlig bestätigt. Ein *Echinocactus tenuispinus*, aus dem hiesigen Garten dem Fürsten zu Salm-Dyck geschickt, blüthe zu Dyck, und der Fürst hatte die Güte, uns eine genaue Beschreibung und Abbildung der Bluthe zu schickten. Es ist die Blüthe eines *Cereus*, keinesweges eines *Melocactus*, wie sie Haworth beschreibt. Auch fehlt der Schopf ganz und gar. An dem grossen Exemplare von *Echinocactus platyacanthus*, welches Herr Deppe aus Mexico schickte, waren trockene Blüthen befindlich, an denen man die Gestalt einer Cereusblüthe bestimmt. Diese schopflosen Cacti müssen von

Melocactus getrennt und als eine besondere Gattung aufgefürth werden, die wir *Echinocactus* nenne wollen. Wir kennen zwar nur die Blüthen jener beiden Arten, aber wir mögen vorläufig die schopflosen Arten damit vereinigen, und so zwei Gattungen *Melocactus* und *Echinocactus* annehmen. Aber wie sollen wir nun *Echinocactus* von *Cereus* unterscheiden ?... Wir können also nur auf die Form des Stammes und auf die Stellung der Blüthen sehen, um *Cereus* von *Echinocereus* zu trennen; dieser trägt die Blüthen nur auf der Spitze oder dem Scheitel, jener an den Seiten ».

The description of the genus *(op. cit.,* p. 420) in the Latin diagnosis is: « Caulis aphyllus, simplex, globosus, ovalis, aut oblongus, sulcis profundis et costis alternantibus. Costae e tuberculis (ramis) confluentibus, in apice spinarum fasciculo insignitae, saepe lanugine cinctae. Cephalium nullum. Flores e vertice caulis. Involucrum tubulosum, e bracteis imbricatis concretum, cum germine et calyce connatum. Calyx superus, interiorem paginam involucri sistens. Corolla polypetala, calyci inserta. Stamina numerosa, calyci inserta. Stylus 1. Stigma 10 et multipartitum. Fructus ignotus. » The following species are listed under the genus: *E. tenuispinus,* p. 421, Pl. XIX, 1: «in Brasiliae provincia Rio Grande. Sellow»; *E. tephracanthus,* p. 422, Pl. XIV, 2: « in Brasiliae provincia Rio Grande. Sellow »; *E. poliacanthus,* p. 422, Pl. XVI, 1: « in Brasiliae provincia Rio Grande, Sellow »; *E. Salmianus,* p. 423, Pl. XIII: « in Curaçao. Sereniss. Pr. a Salm Dyck »; *E. platycanthus,* p. 423, Pl. XIV: « in Mexico unde Dn. Deppe specimen misit 200 librarum pondere » [1]; *E. acuatus,* p. 424, Pl. XXIII:

[1] This large plant was lost almost immediately after it had been received. Say Link & Otto (*op. cit.,* 415): « Das Exemplar war with mehreren Cactus-arten über 6 Monat unterweges gewesen, und kam gegen das Ende des Dezembers schetnbar gesund wie die übrigen and. Aber es zeigte sich bald, dass sie durch die Kälte gelitten hatten, und nach einiger Zeit gingen sie in Fäulniss über. » The figure, as stated by the twe authors (*op. cit.,* 224) is only: « Icon juniorifs plantae, 7 poll. altae, 9 1/2 p. crassae», which immature specimen may, or may not have been conspecific with the adult plant weighing 200 pounds. As it is well known, considerable changes in the ribs and the spines take place when plants in this group of Cacti reach maturity.

« In Montevideo. Sellow »; *E. Sellowii,* p. 425, Pl. XXII: « In Montevideo. Sellow. »; *E. tuberculatus,* p. 425, Pl. XXVI: « In Mexico. Dn. Deppe »; *E. recurvus,* p. 426, Pl. XX [Syn.: *Cactus nobilis* Willd., Ait.; *Cactus recurvus* Haw.]: « Habitat in Peru »; *E. gladiatus,* p. 426, Pl. XVII: « In Mexico. Deppe »; *E. orthacanthus,* p. 427, Pl. XVIII: « In Montevideo. Sellow»; *E. subuliferus,* p. 427, Pl. XXII: « In Mexico. Deppe »; *E. intricatus,* p. 428, Pl. XXIV: « In Montevideo. Sellow »; *E. meonacanthus,* p. 428, Pl. XV; « in Jamaica ».

At the closing of their paper, Link & Otto state (*op. cit.,* 429): « Hisce Echinocacti speciebus, saepius observatis, sequentio addere licet. Verus Echinocactis character tam in floribus, qui Cerei sunt, quam in vértice depresso, lanugine obsito, floresque continente, positus est. Si haec ita sunt, sequentes species genuinae erunt: *E. poliacanthus, tuberculatus, Sellowii, platycanthus, acuatus, orthacanthus, gladiatus, tephracanthus.* Sequentes vero species a Cereis vix diversae videntur: *E. meonacanthus, recurvus, tenuispinus, subuliferus, intricatus.* De sequenti dubii haeremus, an in Melocactos fortassis transeat scilicet: *E. Salmianus* ».

These notes, descriptions and comments make it abundantly clear that: 1) Otto & Link lacked a clear morphological concept of *Echinocactus.* They understood it negatively, that is, they saw in it a group of Cacti which had the flowers of *Cereus,* but bore these flowers at the apex, or towards the apex of the stems rather than on the side; likewise, the two authors separated *Echinocactus* from *Melocactus* because the former had an inconspicuous cephalium or no cephalium at all; 2) The two authours had no idea of the possible geographic limits of their genus: they treated as *Echinocactus,* seven species from Rio Grande do Sul and Uruguay, one alleged to be from Peru, four from Mexico and two from the West Indies; 3) Considered as a systematic and taxonomic unit, *Echinocactus* proves untenable. Of its fourteen species Britton & Rose *(Cact.,* 3. 1922) identify five certainly under *Malacocarpus;* one, doubtfully, under the same genus: two under *Ferocactus;* two under *Cactus;* one under *Echinofossulocactus.* Three species: *E. platyacanthus, E. orthacanthus* and *E. tuberculatus* they cannot safely place at all.

The year after the publication of *Echinocactus*, A. P. De Candolle (in DC. *Prodr.* 3: 461-463. 1828) took up the genus, this being one of the earliest record of its use in current taxonomic work. As one may expect, De Candolle's treatment is confuse. He lists thirteen species as doubtful, but retains *E. tenuispinus*, *E. gibbosus*, *E. cornigerus*, *E. crispatus*, *E. obvallatus* and *E. melocactiformis*. Of these species only the first belongs to Link & Otto, and it should be possible to interpret it today as the standard-species of *Echinocactus*. The six binomials accepted by De Candolle era identified by Britton & Rose *(Cact.*, 3. 1922) as *Malacocarpus Ottonis*, *Gymnocalycium gibbosum*, *Ferocatus latispinus*, *Echinofossulocactus crispatus*, *Echinofossulocactus obvallatus* and *Ferocactus melocactiformis*.

This paper is not primarily devoted to bibliographic amenities, and this writer sees no reason why he should introduce here the full evidence of what Pfeiffer, Lemaire, Labouret, Salm-Dyck and other more or less illustrious cactologists thought of *Echinocactus*. They all thought about the same, that is, they accepted as *Echinocactus* plants that were not *Cereus* because they were usually too short; not *Mammillaria*, because as a whole they had low tubercules or ridges instead of podaria; not *Cactus* and *Melocactus*, because they lacked a cephalium; not *Echinopsis* because they did not carry long tubular flowers. Accordingly, a negative concept of the genus was maintained throughout, although much work was done to break up its body, bloated by continuos new discoveries, into minor units. Lemaire, Salm-Dyck and Labouret worked in this direction with a measure of success.

Schumann's treatment of *Echinocereus* stands out as a classic of the immediate pre-Brittorosean era. Schumann recognizes (*Gesamtb. Kakt.*, 290-452, 1899) not less than 138 species under the genus. He distributes them into eleven subgenera, as follows (*op. cit.*, 291-292): *Discocactus*, *Malacocarpus*, *Cephalocactus*, *Lophophora*, *Astrophytum*, *Euechinocactus*, *Ancistrocactus*, *Stenocactus*, *Nonocactus*, *Hybocactus*, and *Trelocactus*. Even more inclusive is the classification of Vaupel (in Engl. *Nat. Pflanzenf.*, 2nd. edit., 21: 621-628. 1925), an author of the post-Brittorosean epoch, who finds it expedient to include

under *Echinocactus* even the « Gruppe » of *Coryphanta*, which Schumann allots to *Mammillaria (op. cit.*, 474). Berger, too *(Kakt.*, VII, 198-258. 1929) credits to *Echinocactus* not less than 25 subgenera, indulging in so doing in various nomenclatural sins to be reviewed later in this paper. Berger, however, retains *Coryphanta* as a separate genus.

It is clear to any critically minded student that the concept of Schumann, Vaupel and Berger ist untenable even only in the systematic sense. There is a limit to breaking genera apart or throwing them together, and the essential function of classification is not that of writing formal papers according to rote or of telling an orange apart from an onion. Plants must be put together under units which macke sense under the traditional, phylogenetic and morphological approach to taxonomy. A classification that associates *Astrophytum*, *Ferocactus* and *Frailea* as *Echinocactus* may be moved by profound cogitations, but is certainly not one inch ahead of that of Link & Otto: these forms do not agree, as visual evidence immediately reveals, and no amount of will to believe can make them one.

Britton & Rose had ample justification for the breakings down of a concept of *Echinocactus* that between 1827 and 1922 had grown from a muddy trickle to a turbid and fast stream. The two authors may not always have acted with good judgemend, segregating oligotypes or monotypes in swarms, but nothing should be said against their having used a ram to reduce *Echinocactus*. As this writer sees it, the issue today can be only *how Britton & Rose did it*.

This is the manner in which they dit it, to quote their own words *(Cact.* 3: 166. 1922): « In their introduction Link and Otto state that *Echinocactus tenuispinus* and *E. platyacanthus* have the flowers of a *Cereus*, and for this reason, as well as the absence of a cephalium, were separated as *Echinocactus*. The other 12 species referred there, whose flowers they did not know, were evidently thus referred from the supposed lack of a cephalium. It seems, therefore, the type of the genus *Echinocactus* should either be *E. tenuispinus* or *E. platyacanthus*. In the last paragraph of their paper they state that *E. tenuispinus* should probably be referred to *Cereus* and that *E. platyacanthus*

and 7 other species belong to *Echinocactus*. We therefore designate *E. platyacantus* Link and Otto as the type of the genus. »

Great as is this writer's respect ford Britton & Rose's ability, he cannot refraining from noticing that these authors cherish a peculiar concept of typification and its purposes. In a text which deserves to be widely publicized, Bentham states (in *Jour. Linn. Soc., Bot.*, 17 : 190. 1887) : « The object of the Linnean nomenclature is the ready identification of species, genera, or other groups for study or reference, not the glorification of botanist..... changing and established name is very different from giving a name to a new plant. « Acting in this very spirit, a well informed and critical botanist will refrain from choosing as the type of a difficult and controversial unit an entity which cannot be safely identified, so long as he may choose a better type or avoid rejecting a name well known. The contentions leading to the choice of *E. platyacanthus* as the standard-species of *Echinocactus* are plausible, *on paper*, but they have results, *in fact*, which are unwelcome. *Echinocactus platyacantus* is a doubtful species, as Britton & Rose themselves (*opt. cit.*, 172) admit : « Unfortunately, the type of the genus *Echinocactus* is now known only from the early descriptions and a single illustration. It seems to be quite distinct from the other species of the genus. The large giant cacti are very common in Eastern Mexico, but it will require some careful field work to disentangle this species. » Having read the original description of *E. platyacanthus* not one but several times, and duly meditated upon the exceedingly crude illustration of young, sterile plant which Link & Otto believed to be this species, this writer is convinced that no amount of « careful field work » can « disentangle » a stillborn species, even as no amount of artificial respiration can restore life to a putrescent corpse. This writer, moreover, does not believe that *E. platyacanthus,* « seems to be quite distinct from the other especies of the genus » for the very same reason that he cannot accept a wholly spoiled negative as a good portrait. Of course, *E. platyacanthus* may be « identified » by strenuous appeals to a self-assertive imagination, but exercises of the kind are not the primary purpose of botany, and usually

prove trying to others, if not to the identifiers themselves.

Considering that *E. platyacanthus* is a binomial of uncertain application, that is, a classic *nomen dubium*, it should be desirable to reject it, and to shift the typication of the genus away from the technicalities and quibbles of Britton & Rose. By every canon of reason, *Echinocactus* should be a South American genus, typified by *E. Sellowii,* which is represented by three binomials (*E. Sellowii*, commoly misspelled *Sellowianus* in the literature, *E. tephracanthus* and *E. acuatus*) in the original publication, or by *E. tenuispinus (E. Ottonis)*, one of the species which Link & Otto saw in flower. So typified, *Echinocactus* would include *Malacocarpus* of Salm-Dyck as a full synonym, because this genus, too, rests in a large measure upon *E. Sellowii*. Nothing in the current Rules of Nomenclature, as a matter of fact forbids to reserve the decision of Britton & Rose, and to reintroduce *Echinocactus* into the flora of South America, where the majority of its historic synonymy belongs. As his personal reward ford wrecking what Britton & Rose have built, this writer could look forward to several interesting new combinations, perhaps to a new generic name, the anticipation of such a nomenclatural prize having probably inspired the authors just mentioned to be exceedingly punctilious in their deductions about *E. platyacanthus*.

This writer, however, stands ready to yield a part of his immortality, and to make the supreme sacrifice of letting a few good combinations go, because this writer does not believe that he has the right of disturbing existing nomenclature without necessity. This writer believes, in addition, that not everybody will be ready to appreciate the depth and beauty of the solutions he can offer and that grumblings may be heard about such white rabbits as can be pulled out of the nomenclatural hat. Accordingly, this writer believes that it is better to condone — in part, as it will be seen — the abuses of Britton & Rose, *seeing that such abuses do not directly fall under the veto of the Rules*, rather than to try to heal their effects by a liberal application of new names to this writer's own credit.

Since Britton & Rose have deliberately chosen to typify an important and controversial genus by a *nomen dubium*, and by

so doing have forced nomenclature and taxonomy into channels which have been worn deep by twenty year of use, this writer will follow them to the end, and will certify the *nomen dubium* which they use, in strict accordance with Art. 63 and Rec. XXXVII of the current International Rules of Botanical Nomenclature.

De Candolle lists under *E. cornigerus* (in DC. *Prodr.* 3 : 461. 1828) two synonyms with question mark, *Cactus latispinus* Haw. in *Phil. Mag.* 63: 41. 1824, and *Echinocactus platyacanthus* Link & Otto in *Verh. Ver. Beförd. Gartenb.* 3 : 414, 415, 423, Pl. XIV. 1827. Of these two synonyms, Britton & Rose elect the first as the source of a new combination under their own genus *Ferocactus*, as *F. latispinus* (Haw.) Britt. & Rose, and use the second as the standard-species of *Echinocactus*, as it has been shown. The use of this double standard is perhaps the result of an oversight, for Britton & Rose cite in the synonymy of *F. latispinus* only De Candolle in *Mém. Mus. Hist. Nat. Paris* 17 : 36. 1828. There is not the slightest reason, however, why this oversight should not be repaired here, and the following should be witheld :

Echinocactus latispinus (Haw.) Hemsley *Biol. Centr. Amer. Bot.* 1 : 533. 1880

Syn. : *Cactus latispinus* Haw., *Phil. Mag.* 63 : 41. 1824.
Echinocactus platyacanthus Link & Otto, *Verh. Ver. Beförd. Gartenb.* 3 : 414. 415, 423, Pl. xiv. 1827.
Echinocactus cornigerus A. P. DC. in DC. *Prodr.* 3 : 461. 1828 ; in *Mém. Mus. Hist. Nat. Paris* 17 : 36, Pl. 7. 1828.
Ferocactus latispinus (Haw.) Britt. & Rose, *Cact.* 3 : 143. 1922.

In this listing and under this synonymy, *E. platyacanthus* Link & Otto, 1827, *Cert. A. P. DC. 1828*, is used in the Candollean sense, and the certification stands. No objection may be offered on the ground that De Candolle listed *E. platyacanthus* in the synonymy of *E. cornigerus* only with a question mark. De Candolle listed *Cactus latispinus* Haw., too, in the synonymy of *E. cornigerus* with a question mark, but this did not deter Britton & Rose from accepting the hint and effectting the combination *Ferocactus latispinus* (Haw.) Britt. & Rose, putting *E. cornigerus* in synonymy. Lastly, no serious objection may be based upon the fact that Link & Otto's crude figure of *E. platyacanthus* fails to exhibit the flattened out spines which De Candolle illustrates in his plate of *E. cornigerus*. This crude figure is meaningless, and it is not even certain that it was derived from a plant conspecific with the large specimen, weighing 200 pound and dead almost immediately upon its arrival in Berlin, which Link & Otto evidently used for the diagnostic notes of *E. platyacanthus*. What species these authors try to sow in their illustration, nobody can say : everybody may notice, however, that by chosing the specific epithet *platyacanthus* they have alluded to character which is not apparent in the illustration itself. Accordingly, only two alternatives are open, *a*) Either to reject *E. platyacanthus* as a *nomen confusum* under Art. 64 of the Rules of Nomenclature ; *b*) Or to certify it in a manner which conforms with historic synonymy and use. This vriter chooses the latter alternative for reasons that have been detailed in the preceding pages. The variability of the spines of plants of this group was already well known to Miquel (in *Linnaea* 12 : 7 Pl. 4 Fig. 4. 1838, and there should not be justification for quibbling about it here.

Aside from other considerations, the typification of *Echinocactus* in a manner that automatically reduces *Ferocactus* to synonymy, is advised for the following reasons :

1) Under *Echinocactus* subg. *Euechinocactus* Schumann brings (*op. cit.*, 326) the following binomials, *E. robustus*, *E. Pottsii*, *E. Pfeifferi*, *E. flavovirens*, *E. electracanthus*, *E. Echidna*. Five of these species, either as legitimate entities or synonyms, are treated by Britton & Rose as *Ferocactus* (*op. cit.*, 3 : 123-147), only *E. Pottsii* being considered by them as a species of *Thelocactus* (*op. cit.*, 4 : 12. 1923). Schumann's erection of *Euechinocactus* is unassailable, and this is the subgenus which is the first nomenclatural type of *Echinocactus*. It is fortunate that De Condolle's certification of *E. platyacanthus*, Schumann's understanding of *Euechinocactus*, and Britton & Rose's use of *Cactus latispinus* all point to the same solution. No difficulty is to be looked for on account of the fact that Schuman treats *E.*

cornigerus under subg. *Ancistrocactus* (*op. cit.*, 334, 352) rather than under subg. *E. Euechinocactus* for the simple reason that he puts under subg. *Ancistrocactus* also *E. Wislizenii* (*op. cit.*, 357), which has been chosen by Britton & Rose, as the type-species of *Ferocactus* (*op. cit.*, 3 : 127).

2) *Echinocactus, Ferocactus* and *Homalocephala*, as broadly defined by Britton & Rose, form a recognizable phylogenetic unit, which is closely connected with *Melocactus* and *Cactus* by such forms as *E. horizonthalonius*. The range of this unit is in the main from California, through Northern Mexico and Texas, to the shores of the Caribean. In its spread and nature, this cactoid perfectly matches an euphorbiaceous unit represented by the species of *Croton* sect. *Drepadenium* Muell.-Arg. *Croton maritimus* Jacq. suggested to be the ancestor of *Drepadenium*, is an element of the seashore, wich ranges throughout the West Indies to Venezuela and to Virginia in the United States. From Texas to California *Drepadenium* is represented by such species as *C. texensis*, *C. neo-mexicanus* and *C. californicus*. The speciation of the *Croton* aggregate and that of the *Cactus* group would seem to be due to the same order of causes: all these plants evolved in the main, under conditions of progressive aridity from the early Tertiary on. The belief that the Cactaceae are a «recent family» is hardly tenable for several reasons which this writer may not disscuss here. The range and nature of the *Echinocactus-Melocactus* group may serve as a reminder-however, of the flimsiness of the grounds upon which it is be, lieved that the *Cactaceae* are a new creation in plant-life. It is worthy of notice that a tendency towards forming cephalium-like structures is noticeable in the species close to *E. ingens* and *E. horizonthalonius*. While it may not be denied that *Echinocactus* as here understood has some point of contacts with certain forms of South America, witness the striking similarities between seedling plants of *Malacocarpus Tephracanthus* and *E.* (*Homalocephala*) *texensis*, it may be affirmed that no cogent reason exist why the North and South American groups in this broad affinity should be treated as congeneric, unduly extending the concept of *Echinocactus* to take in plants of the two Americas.

3) A rational concept of *Echinocactus* makes it possible to deal efficiently with a host of minor segregates in its vicinity, such as *Echinofossulocactus*, and even more with such troublesome groups as *Sclerocactus*, *Coryphanta*, *Echinomastus*, *Utahia* and the like. Aggregates that are sound in point of phytogeography and phylogeny can be classified without the uncertainties that now surround practically all the major cactoid units.

4) A merging of *Ferocactus* and *Echinocactus* or, at least, a correct appreciation of the value of their differences, when and if any, is in line with the requirements of a moderately conservative taxonomy, such as, for instance, is that of Benson, Thornber & Nichol in the recent *The Cacti of Arizona* (*Biol. Sc. Bull. Univ. Arizona*, n° 5: 98-114. 1940). Sound taxonomic opinion in North as well in South America is alarmed and embarassed by the multiplication of genera under the *Cactaceae*, while recognizing at the same time that it is not possible to go back to the concepts of Schumann, of Vaupel and of Berger.

5) The *Cactaceae* subf. *Cereoideae* of Schumann, 1899, are antedated by the *Echinocactoideae* and the *Melocactoideae* of Salm Dyck, 1840, which are being discussed by this writer in an article now in the hands of an editor. The necessity of interpreting Salm-Dyck's units in a clean-cut manner is patent, as is patent the impossibility of so doing without having a preliminary clear concept of the limits of *Echinocactus* and *Melocactus*.

6) The least possible disturbance to existing nomenclature follows when *Echinocactus* is typified by *E. latispinus* (Haw.) Hemsl. and is thus radically removed from ist South American previous affinities and cognations. It is lamentable that the historic synonymy of the genus should be bound in great part to species now treated as *Gymnocalycium* and *Malacocarpus*, but this is a minor evil compared with the changes in actual nomenclature that would be required by a return of *Echinocactus* to South America.

7) Britton & Rose, as well as other authors, have never questioned the association of forms like *E. Grusonii* and *E. horizonthalonius* under the same genus, despite the obvious differences that distinguish these two biotypes. This writer is not blind to

the necessity of effecting a careful revision of *Echinocactus* and allied groups on the strength of the typification proposed here, which automatically merges this genus with *Ferocactus*, and he admits that it may be found expedient to keep ultimately aggregate distinct in two or more genera rather than merge it under one. Such a revision cannot be lightly undertaken, however, and must be a critical and efficient work, not a matter of snappy judgement. There is no penury of generic and subgeneric legitimate names for the plants of this group, and it remains to be seen how best they can be used.

Malacocarpus is published by Salm-Dyck (in *Cact. Hort. Dyck.* 1849: 24-25. 1850) with the following diagnosis: « *Perigonii* tubus ultra germen productus, brevissimus, inferne lana longa instructus; phylla numerosa, sepaloidea acuta axillis lani-setigerisque; petaloidea erecto-patula, corollam crateriformem aemulantia. *Stamina* numerosa, tubo adnata, limbo breviora. *Stylus* stamina vix superans, columnaris, sulcatus, fistulosus. *Stigma* 8-10 radiatum, radiis abbreviatis, erecto-confertis, coccineis, *Bacca* perigonio marcescente coronata, sublaevis, oblonga, succosa, mollis, penicillis quibusdam lanuginosis instructa. *Cotyledones* minutae, connatae, acutae. *Caullis* carnosus depressus, globosus, vel obovatus, costis verticalibus numerosis, acutatis, crenato-obrepandis instructus. Pulvilli aculeiferi immersi, juniores lana copiosa in vertice caulis cephalium simulante, instructi, dein velutini. *Flores* numerosi ex axillis pulvillorum juniorum, phyllis petaloideis luteis, obtusis, fimbriato-erosulis, per aliquot dies mane aperti noctuque clausi. *Bacca* matura rosea aut violacea, vix e lana in vertice caulis emergens ». This diagnosis is generally accepted as the whole statement made by Salm-Dyck on *Malacocarpus*, but this is not the case, because (*op. cit.*, 141) this is added: (Malacocarpus *Nob.*) Plantae omnes quae ad Sectionem *Gymnocarporum* in genere *Echinocacto* relatae erant habitu peculiari, inflorescentiae modo, et praesertim bacca sublaevi colorata molli, a caeteris speciebus, et a charactere generis *(Echinocacti)* valde recedunt. Ex iis genus novum constituendum esse existimavi, intermedium inter *Discocactum* et *Echinocactum*, et transitionem ab uno ad alterum efficiente ».

On the strength of Salm-Dyck's description and notes it may be confidently stated that the limits of *Malacocarpus* are essentially those of *Echinocactus,* insofar as this genus was applied to the plants collected by Sellow in Southern Brazil and Uruguay. Has Schumann and Britton & Rose so willed, they could have reduced *Malacocarpus* to *Echinocactus* by the simple expedient of typifying both Link & Otto's and Salm-Dyck's genera with the same species, *E. Sellowii*. This would have been legitimate and taxonomically sound. However, these authors decided that *Echinocactus* should be typified by plants of North America, and modern taxonomists are bound to follow them for the sake of avoiding unnecessary disturbances in current nomenclature.

Botanists in South America should take careful notice of the fact that *Echinocactus* is for them practically a dead genus, which in their floras survives as an historic synonym *only. They should not try to use this generic name when publishing new species, but they should retain Malacocarpus in its stead, or other generic allied units (Gymnocalycium, for instance). To publish now new species in the flora of South America under Echinocactus, unless it be for the most weighty phylogenetic, morphologic and taxonomic reasons, can lead only to a renewal and a deepening of confusion.*

One of the minor segregates out of *Malacocarpus* is supposed to be *Notocactus,* which the *Index Kewensis* lists under the authorship of A. Berger. This listing calls for some comment.

In one and the same publication, *Kakteen* 1929, Berger refers to *Notocactus* as a Subgenus of *Echinocactus* (*op cit.*, VII), as a Section of the same genus (*op. cit.*, 208, *in not. E. formosus*) and, perhaps and only by implication, as a separate genus (*op. cit.*, 343). By a series of devious entries and other subterfuges, Berger tries — as it seems — to secure for himself the authorship of combinations which he does not openly effect. This brand of nomenclature is unbecoming gentlemen botanists, and all the users of the *Kakteen* and of the *Index Kewensis* should be warned against it.

To illustrate the deceit practiced by Berger, this writer refers to p. v. of Berges's cited work. In a *Spezeiller Teil,* Berger pre-

sent a conspectus of the classification of the Cactaceae which in a foot-note (*op. cit.*, V) is described as: « Gleichzeitig Uebersicht über das System der Kakteen, wie es hier angewendet werden musste ». In this Uebersicht, *Astrophytum*, for instance (*op. cit.*, VII) is clearly designated as a subgenus (Untergattung) of *Echinocactus*. Turning to p. 233 of Berger's opus, it is found that *Echinocactus capricornis*, illustrated Fig. 64, p. 234, is precisely listed as follows: « *Echinocactus capricornis* Dietr. (1851). *Astrophytum* Br. u. R. *Maierocactus* Rost (1926). » Leaving aside *Maierocactus*, a minor synonym, the reader may soon learn that this synonomy means that *Echinocactus capricornis* published by Dietrich in 1851 (in *Allg. Gartenz.* 19: 274 is treated as *Astrophytum capricorne* (Diet.) by Britton & Rose, Cact. 3: 184. 1922. This synonomy, of course, is true and correct.

Echinocactus apricus (*op. cit.*, 211) is listed by Berger exactly in the same manner as *Echinocactus capricornis*, that is, as « *Echinocactus apricus* Arech. (1905). *Notocactus* Berger ». This synonymy is false, because *Notocactus apricus* was never published by Berger in a work anterior to or even contemporaneously issued with the *Kakteen*, 1929.

Turning to the *Sachregister* (Index) of the *Kakteen*, pp. 337-346, the user of Berger's work may notice that a line under the heading states (*op. cit.*, 337): « Die mit * versehen Namen werden hier zum ersten Mal genannt ». In the *Sachregister*, *Astrophytum capricorne* is entered, p. 337, and *Echinocactus capricornis*, p. 339, both these names bearing no *. Likewise, *Echinocactus apricus* is entered, p. 339, without *, but *Notocactus apricus* appears, p. 343, with *, as follows: « *Notocactus apricus** 211 ».

The user of Berger work, then, is supposed to know that *Notocactus apricus* is « zum ersten Mal gennant » somewhere in the *Kakteen*, 1929, the adverb « hier » referring just as well to p. 211 as to p. 343. In this manner, *Notocactus*, very clearly called a subgenus and spoken of less clearly as a section by Berger, is ultimately supposed to be turned into a genus. Many are the cases in which authors have tried to secure for themselves the authorship of two or more names publishing them at

the same time under different genera, but nothing so deceiving and so cunning was ever devised as Berger's treatment.

The *Index Kewensis* accepts the publication of *Notocactus* as a genus by Berger, referring this publication to p. 207 of the *Kakteen*, 1929. This is *certainly* not correct because *Notocactus* appears in the *Sachregister*, p. 343, only as follows: « Notocactus 307 », without the indication of the name of an author or the sign *, which is needed to understand that this name is « hier zum ersten Mal gennant ». Accordingly, *Notocactus was never published by Berger as a genus:* it appears p. 207, as given by Berger in the *Sachregister*, in a printing type which fully matches the type used throughout the *Kakteen* for subgenera, not in the type used for genera (see, for a comparison, the type used by Berger, p. 281, to announce a new genus *Roseocactus*).

Since Berger *never* published *Notocactus* as a genus, could he publish species under it, like *Notocactus apricus*? The *Index Kewensis* answers yes, accepting *Notocactus* as a change of rank by Berger, who is supposed by the editors of the *Index Kewensis* to have turned Schumann's subg. *Notocactus* into a full fledged genus. This writer, the authority of the *Index Kewensis* notwithstanding, is inclined to believe that Berger never published anything at all, in the literal sense. At the very best, he published *nomina provisoria* or synonyms (Art. 37 *ter*, Art. 40 Amsterdam *Code*) which are invalid. But, once again, did he publish anything at all? If *Notocactus* was never published, validly or invalidly, how could Berger propose new combinations under it?

Berger's « publication » of *Notocactus* is a sample of much that is current in the classification of the Cactaceae. Some botanists will accept the listing of the *Index Kewensis* as a publication, deeming that this listing « legitimizes » Berger's tricks and deceits. This writer is firmly of the opinion that the *Index Kewensis is an index*, purely and simply, in which errors and mistakes occur, which errors and mistake do not involve the substance of things. The name of this writer is *Leon Croizat*, and he may happen to be mentioned by an indexer as *Ludwig Crozet*, which does not change this writer's name or person,

after all. A certification, legitimation or publication involves a *deliberate will* to certify, to legitimate or to publish *something*, this will being liable to be expressed more or less emphatically but being recognizable after all. The compilers and editors of the *Index Kewensis* have no will other than that of submitting *the facts* — as they find them — to the users of the *Index*. If they are deceived by Berger, or if they clerical agents make mistakes, the authors of the Index *certify nothing at all*, nevertheless.

This writer has not gone over the history of *Notocactus* to ascertain who is the first author who may be said to have published *Notocactus* in the generic rank. The nomenclatural issue involved in such an investigation is a finely spun one, because it is required that this author *also* publishes the genus, which Berger certainly did not, not even as a *nomen provisorium*. It may be possible, after all, that the authors of such a publication are two amateurs, Marshall and Bock, who in their amateurish, *Cactaceae*, 1941 state (*op. cit.*, 157-158): « Genus 30. *Notocactus* Schumann, 1898... Britton & Rose included most of the species now found in *Notocactus* in their genus *Malacocarpus* but plants in this latter genus have soft, naked, red fruits resembling those of *Melocactus* or *Mammillaria* while the species referred here have dry, woolly fruits. Lack of living material for study was doubtless the cause of this obvious error. We follow all recent writers in placing the following species in *Notocactus* because of their fruit characters. ». This account errs in crediting *Notocactus* to Schumann, 1898, while Schumann published in 1899 *Echinocactus* subg. *Notocactus* (*Gesamtb. Kakt.*, 292, 1899), but contains the following interesting list of species, *Notocactus Schumannianus, N. Grossei. N. apricus, N. concinnus, N. tabularis, N. Scopa, N. maricatus, N. Ottonis, N. mammulosus, N. Haselbergii, N. Leninghausii, N. Graessneri*, all said to have been « combined » by Berger. Barring proof to the contrary, this writer is inclined to credit all these combinations to the cited amateurs, and to credit them also with the publication of *Notocactus*.

This writer does not know at this hour whether it is true or not that *Notocactus* can be generically separated from *Malacocarpus* by fruit characters. Authors, botanists and amateurs alike, who refer to « soft » and « dry » fruits, are not always well informed as to what makes a fruit « dry » rather than « soft ». In certain Cacti, for instance, the berry at maturity is practically pulpless, the epicarp being fleshy, no doubt, but cartilaginous rather than absolutely carnose. In other plants of this group, the berry is very pulpy, the epicarp [including the entire wall of the fruit] being comparatively thin. Both these fruits, although different in their anatomy and phylogeny, can be spoken of as « soft », but it is prevailingly the former kind which by degrees becomes « dry ». Schumann, who uses both *Malacocarpus* and *Notocactus* as subgenera of *Echinocactus*, states (*Gesambt. Kakt.* 291, 1899) that the fruit of the former is: « Frucht weich, beerenarting, rosa oder rötlich », while that of the latter (*op. cit.*, 292) is; « Fruchtknoten fast stets beschuppt und wollig, oft borstig ». The definition given by Schumann of several fruits of species under *Notocactus* is interesting, as follows: *Echinocactus Schumannianus* (*op. cit.*, 383-384): « Beere hellgelb, ins Hellrötliche, mit einigen Borsten bekleidet, fleischig »; *E. concinnus* (*op. cit.*, 385) : « Beere ziemlich trocken, wollig behaart »; *E. submammulosus* (*op. cit.*, 387): « Beere weich, gelblich »; *E. Ottonis* (*op. cit.*, 391): « Frucht ziemlich trocken, wollig ». Little in these notes suggests that it is possible to use the characters of the fruit to effect a separation between *Malacocarpus* and *Notocactus*.

Summary. — 1) The original publication of *Echinocactus* Link et Otto, and *Malacocarpus* Salm-Dyck is quoted in full and commented upon.

2) It is shown that *Echinocactus*, as originally conceived by Link et Otto, is a confuse group, including North and South American unrelated species.

3) The typification of *Echinocactus* is carefully discussed and the understanding of Schumann and Britton et Rose upheld in order not to disturb existing nomenclature. As a result, *Echinocactus* is factually excluded from the flora of South America.

4) *Echinocactus platyacantus* Link et Otto, chosen by Britton et Rose, as the standard-species of *Echinocactus* and admitted by them to be a doubtful species is identified as *E. latispinus* (Haw.) Hemsl.,

Ferocactus Britt. et Rose automatically falling in the synonymy of *Echinocactus* as the result of this identification.

5) In opposition with the listings of the *Index Kewensis,* it is denied that Berger ever published *Notocactus* as a genus and Berger's deceptive use of this entity is bared.

Arnold Arboretum, Harvard University,
Jamaica Plain, Mass, U. S. A.