

PART II THE SULCOREBUTIA - WEINGARTIA PROBLEM

The reclassification of *Weingartia* Werd. is impossible without resolving the vexing question as to whether one genus or two are necessary to contain all the species described under these two genera. This part of the review is an 'up-dating' of the Paper I read at the 12th IOS Congress in Reading, September 1973 and forms the basis of the lecture I delivered to the Deutsche Kakteen Gesellschaft Jahreshauptversammlung at Nuremberg in May 1979 (omitting some of the history already given in Part 1 above). Part of the argument has already been covered in the previous Part 1 of this Review and will be given only passing reference here.

This is not a new problem but one that has been with us since Curt Backeberg created the genus *Sulcorebutia* in 1951. Perhaps the problem might even go back as far as 1931 when Erich Werdermann first described the species *Rebutia steinbachii*. However, whether this puzzle occurred in 1931 or 1951 is a matter of hindsight and the judgements made by Backeberg and Werdermann at the time were reasonable. The peculiarities of *Rebutia steinbachii* were not so noticeable in 1931 than they would be today, so the superficial resemblance to *Rebutias* then grown seemed to be a sufficient reason to place the new plant in that genus. No one could have been expected to observe that the plant was actually closer to *Lobivia* than *Rebutia* in its less obvious morphology. The small multiheaded bodies producing small naked funnel form flowers, small papery fruits and black seeds all seemed to fit *Rebutia*. Yet a more detailed examination and comparison with the other *Rebutias* then known could have shown that it is quite different. It stems from a different line of development, i.e. from *Lobivia* whereas the true *Rebutias* stem from *Echinopsis*. *Rebutia* and *Sulcorebutia* are convergent but only distantly related. Backeberg chose to create *Sulcorebutia* on two counts- a characteristic long thin areole buried in a groove on an obliquely aligned tubercle and flowers with thick tubes carrying broad naked scales, no other *Rebutia* had these characters then. *Sulcorebutia steinbachii* is a distinctive, easily recognised plant.

Our story now goes back in time again to 1934 when Backeberg created the new genus *Spegazzinia* to accommodate two new discoveries from the borders of Argentina and Bolivia, described then as *Echinocactus fidaianus* Back. from Bolivia and *Echinocactus neummannianus* Back. from Argentina. Distinctive plants again with globular to short cylindrical bodies, short tubed funnel form flowers with broad naked scales; large rounded raised areoles with porrect stiff spines; small papery fruits; and large tuberous roots separated from the body by a narrow neck. The key to a new genus? The name regrettably was a later homonym of a genus of fungi proposed in 1886 by Saccardo. In 1937 Erich Werdermann correctly and properly provided the required nomen novum *Weingartia* Werd. and effected the transfer of these two species with *E.fidaianus* remaining as the type species, i.e. *Weingartia fidiانا* (Back.) Werd. An easily recognised plant and no one would confuse it with any other plant, and certainly not readily associate it with that other plant now known as *Sulcorebutia steinbachii*. However today we are more critical and we look far more closely at alleged differences. The images created by *Weingartia fidaiana* on the one hand and *Sulcorebutia steinbachii* on the other were imprinted upon our minds - the differences stood out - the similarities were not noticed and so remained hidden or ignored until today.

Taxonomy - the art of classification is seemingly an easy innocent occupation that Homo sapiens engages in constantly as an everyday pastime quite unconsciously. This is the art of recognition and interpretation of one's surroundings and the objects therein.

Familiarity is built up and so strangeness becomes a quality which is noticed immediately. The strangeness is assessed, compared and classified unconsciously. Yet this unconscious intelligence which rarely lets us down, often fails to assert itself when we consciously try to regulate and systematise the living world about us. An artificiality is built into the developed system of nomenclature and the code derived for its application and interpretation so that it is possible for a name or binomial to become more important than the object named. This is part of the *Weingartia-Sulcorebutia* problem - it is the names that one can use rather than the plants that need elucidation. If we can solve the name problem then I believe the actual problems presented by the plants themselves will be quickly resolved. Taxonomy and the interpretation of the International Code of Botanical Nomenclature is not the facile process mentioned above - it is not recommended as a pastime for amateur plant enthusiasts. The Cactus literature is littered with their misguided efforts - let Editors beware of taxonomic revisions and reclassifications offered to them. One should remember that the name is more important than the plant - binomial combinations are easy to put together but impossible to lose - they are there to haunt you for all time. The rules governing the valid publication of a binomial or polynomial are simple and anyone can do it - but once done it is there forever, even if quite inappropriate, the combination is sacred.

After the War many new *Weingartias* and *Sulcorebutias* were discovered. The separation that clearly existed between *S.steinbachii* and *W.fidaiana* becomes blurred so much so that it becomes difficult to decide if say *Weingartia purpurea* Don. ought to have been a *Sulcorebutia* (i.e. *S.latiflora* Rausch nom.nud.) or whether *Sulcorebutia glomeriseta* Ritt. ought to have been a *Weingartia*. There are many other parallel cases.

The easily observed morphological differences no longer allow an easy decision. The question now arises - are two genera actually needed - may they in fact really be a single genus - the two original genera representing only the terminal species at either end of the distribution zone? *Weingartia* and *Sulcorebutia* are virtually sympatric almost throughout their entire range. If only one genus was in fact, botanically speaking, justified, then the name without doubt must be *Weingartia* and *Sulcorebutia* would be lost in synonymy. But don't let us be too hasty - do not rush into print and transfer all *Sulcorebutias* and *Weingartias*. The investigation is not yet over. Let us look closer at what is *Sulcorebutia* and what is *Weingartia*. Nol Brederoo and I have looked long and hard at this - so have others. We believe that on the present understanding while *Weingartia* and *Sulcorebutia* are closely related and probably both derived from *Lobivia* lines, they can still be justified as separate genera of the *Cactaceae* and are evolving still. Some transfers from *Weingartia* to *Sulcorebutia* might be justified. It might also be desirable to subdivide the genera into sections and if one does this, again one must remember the rules. Every subgeneric division, i.e. subgenus or section, must retain the name of the parent genus for that which contains the original type species. Thus *Weingartia* would have a subgenus *Weingartia* and a section *Weingartia* to include *Weingartia fidaiana* (Back.) Werd. It cannot be *Spegazzinia* as suggested by Brandt on this account, also it cannot be *Spegazzinia* because the latter is an illegitimate homonym of *Spegazzinia* Saccardo which in its own turn reserves this name for its type subgenus and section.

The pollen grain studies at Heidelberg by Dr. Beat Lauenberger at this stage show that *Weingartia* and *Sulcorebutia* are closer to each other than to *Rebutia* or *Lobivia* but again seem to be derived from *Lobivia* rather than *Rebutia* confirming the observations from stem morphology.

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The seed structures are more helpful. A brief report by Nol Brederoo and myself has already appeared in *Succulenta* 58:11; January 1979 and in *Kakt. u.a. Sukk.* 30:8; 198-202, August 1979.

Observations at low power on a whole series of species from *Weingartia* and *Sulcorebutia* suggested to me that there was a remarkable general similarity and that even some *Lobivias* from the *acanthoplegma* group might also be included. Comparison with *Gymnocalycium* and *Neowerdermannia* was also made but here no close similarity was observed suggesting that *Weingartia* and *Sulcorebutia* were not closely related to these genera despite the ideas of Paul Hutchison and Curt Backeberg.

Nol Brederoo decided to take a deeper look as did our friends at Heidelberg with their facilities for S.E.M. studies. At higher magnification we can observe differences between our two problem genera and also within the genera themselves. These differences can be correlated with other morphological differences in the flower and body, areoles and spines as well as with the geographical distribution. The taxonomic position of a plant is determined by correlation of several characteristics, very rarely is a single character of sufficient weight to decide a classification. Similarly it is not expected that every species in a single genus will show 100 per cent of the determining generic characters but only a substantial portion of them.

A total study of all the species of *Weingartia* and *Sulcorebutia* known today is in progress. It would appear that there are three main combinations of characters that could be used to contain all the species so far known.

Group 1: The Southern *Weingartias* based upon the type species *W.fidaiana* and includes:

W.neumanniana (Back.) Werd.

W.kargliana Rausch

W.cintiensis Card.

W.westii (Hutch.) Don.

W.lecoriensis Card.

W.vilcayensis Card.

W.cintiensis is probably a phenotypic variant of *W.fidaiana* and *W.lecoriensis* is almost certainly an ecotype of *W. westii*.

Group 2: The Northern *Weingartias* based upon *W.neocumingii* to include:

W.brachygraphisa Brandt

W.erinacea Back.

W.hediniana Ritt.

W.knizei Brandt

phenotypes of

W.lanata Ritt.

W.neocumingii

W.multispina Ritt.

W.sucrensis Ritt.

W.pulquinensis Card.

W.trollii Oeser.

W.pilcomayensis Card.

W.riograndensis Ritt.

W.longigibba Ritt.

phenotypes of

W.platygonia Card.

W.lanata

W.corroana Card.

W.chuquichuquiensis Card.nom.nud.

Sulcorebutia glomeriseta Ritt.

W. Sp. Ritter 816

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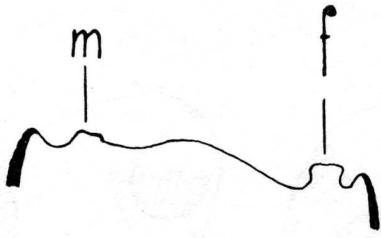
Group 3: The *Sulcorebutia* group based upon *Rebutia steinbachii* Werd. and including:

| | |
|---|---|
| <i>W.aglaia</i> Brandt. | = <i>S.bicolorispina</i> Knize n.n. |
| <i>W.purpurea</i> Donald | = <i>S.latiflora</i> Rausch n.n. |
| <i>W.torotorensis</i> Card. | = <i>S. vizcarrae</i> Ca rd. |
| <i>W.nigrofusca</i> Brandt. | = <i>S.tiraquensis</i> v. <i>spinosior</i> Ritt. n.n. |
| <i>W.backebergiana</i> Brandt | = <i>S.steinbachii</i> v. <i>horrida</i> |
| <i>W.ritteri</i> Brandt | = <i>S.sucrensis</i> n.n. Ritt |
| <i>W.aureiflora</i> Brandt | = <i>S.frankiana</i> v. <i>aureiflora</i> Rausch |
| plus all other published <i>Sulcorebutias</i> . | |

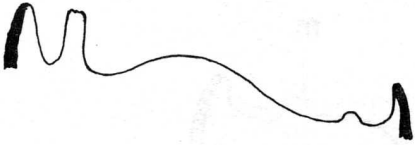
The seed of Group 1 *Weingartia* is cap-shaped, rounded nearly as broad as high while that of Group 2 *Weingartia* is more elongated, ovoid higher than broad. The testa of Group 1 is papillate, covered with minute papillae, whilst that of Group 2 is tessellate covered by a mosaic of somewhat flattened larger papillae. The hilum of Group 1 shows a micropyle and funiculus protruding through the strophiola whilst in Group 2 they are buried. The micropyle in Group 2 is surrounded by a mound of tissue but if this is removed the micropyle is observed to be pedunculate. A pedunculate micropyle is a characteristic of both groups of *Weingartia* and of *Sulcorebutia*. The difference between *Sulcorebutia* and Group 2 *Weingartia* lies in the testa cells which are not flattened but truly papillate. Thus the seeds of the two genera are remarkably similar and clearly have a common phylogenetic origin. I would suggest that we might find this in *Lobivia*. At first sight the seeds of the *Lobivia acanthoplegma* group are easily differentiated from those of *Weingartia* and *Sulcorebutia* by virtue of the deeply sunken, almost saucer-like hilum but the same elements are there in the same proportions.

Based upon seed characters alone, one would say that *Weingartia* and *Sulcorebutia* belong to the same genus. Taking into account the other characters of the flower, areole and spine clusters we can see they become further apart.

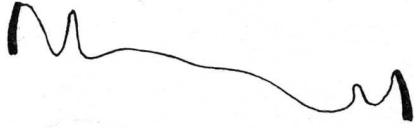
| | |
|----------------------------|---|
| <i>Weingartia</i> Group 1: | Rounded raised areole, long narrow tubed flower, strongly porrect subulate spines, monoflorous areole, terminal flower zone. |
| <i>Weingartia</i> Group 2: | Oval areole, slightly depressed with a fan shaped woolly pad beyond the porrect acicular spine cluster out of which the short-tubed wide funnel-form flowers appear - multi-florous areoles, lateral flower zone. |
| <i>Sulcorebutia</i> : | Narrow to oval depressed areoles, with pectinate to porrect acicular spines, long or short tubed flowers from usually monoflorous areoles, lateral flower zone. The latter group is still evolving rapidly. |
| <i>Acanthoplegma</i> : | Narrow to oval areoles slightly depressed, acicular porrect spines, woolly to naked narrow scales on tube, medium to short tubed wide funnel-form flowers, lateral flower zone. |



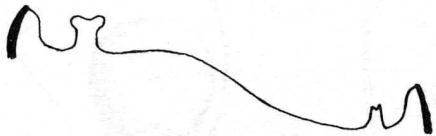
W. FIDAIANA



W. CINTIENSIS



W. NEUMANNIANA



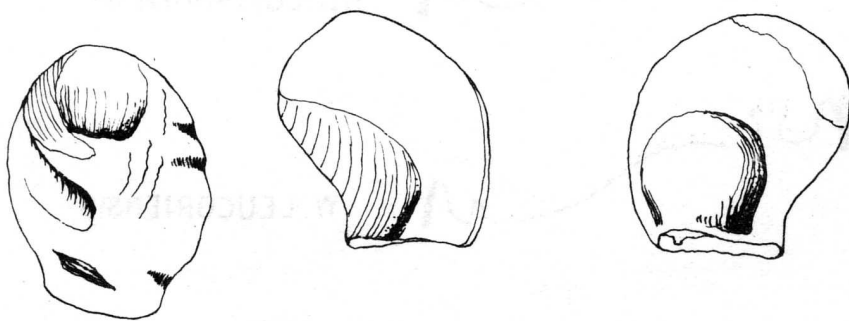
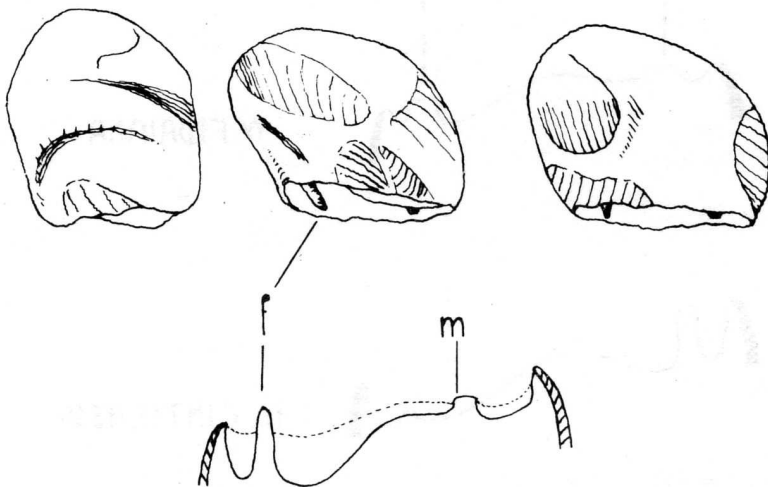
W. LEUCORIENSIS



S. STEINBACHII

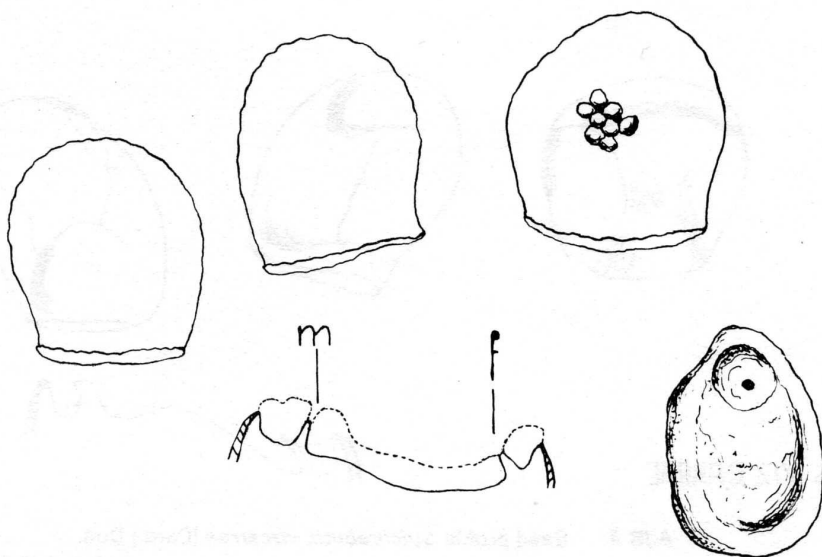
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W. PURPUREA

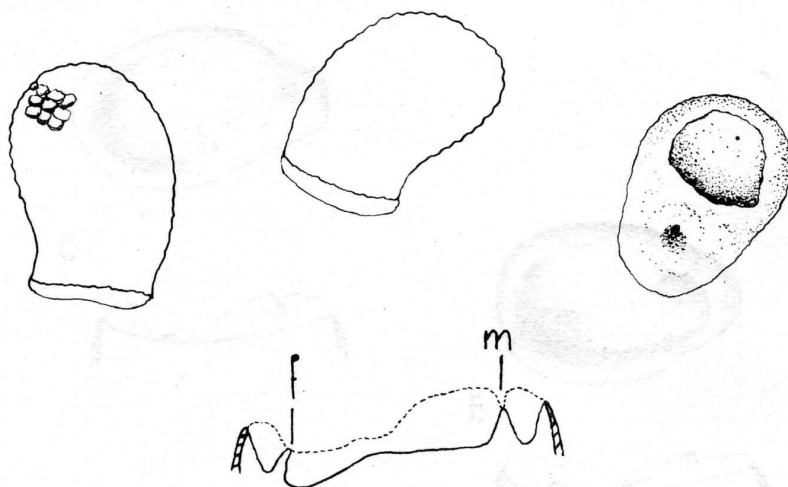


W. TOROTORENSIS

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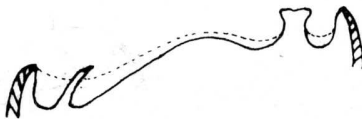
W. CORROANA 0.9-1mm L



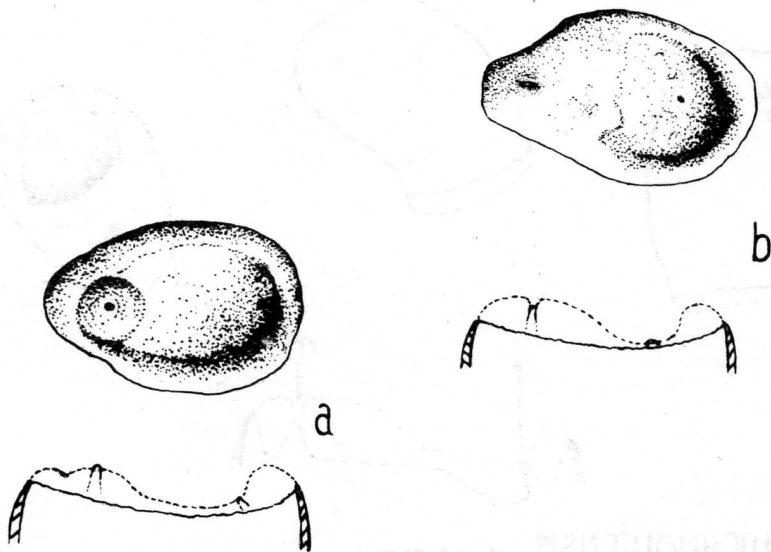
W. CHUQUICHUQUIENSIS 1-1.2mm L



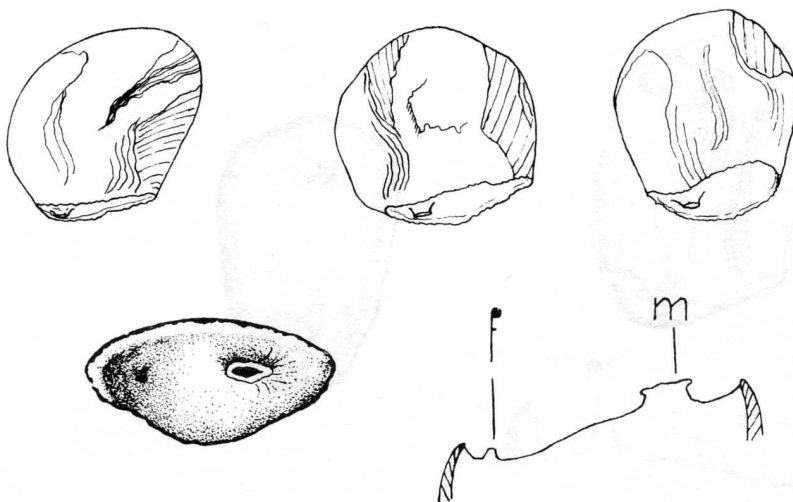
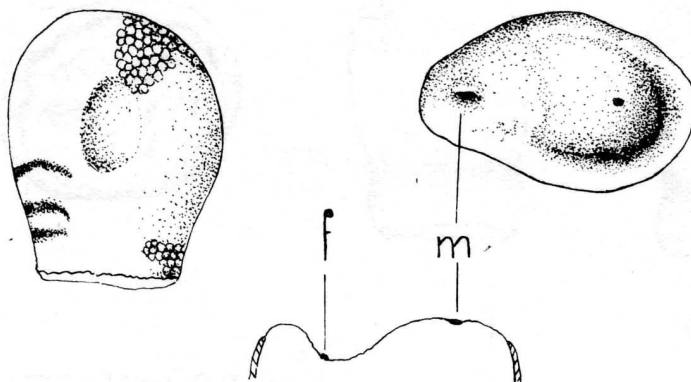
S. VIZ CARRAE



AJB 4 Seed profile *Sulcorebutia vizcarrae* (Card.) Don.

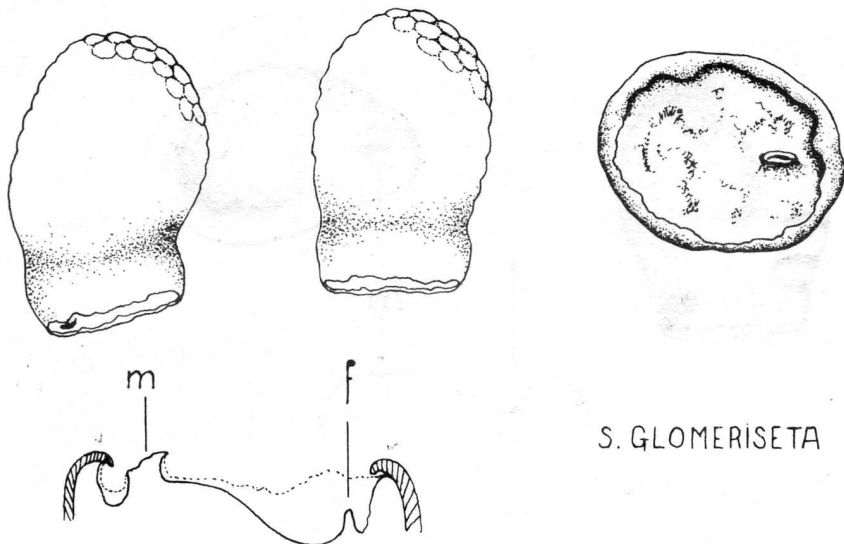


AJB 5 Hilum studies

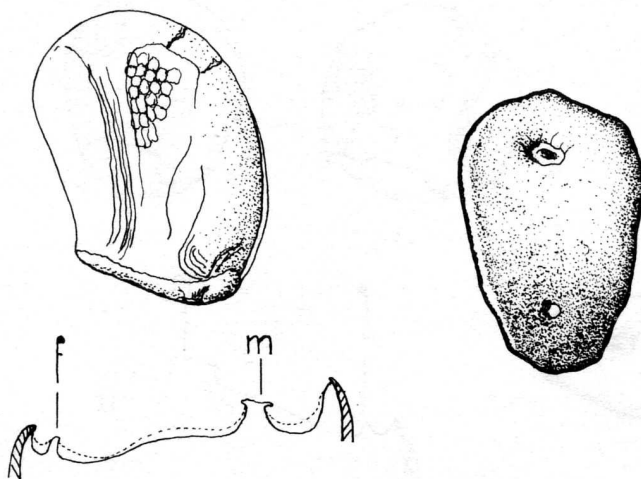


S. CYLINDRICA

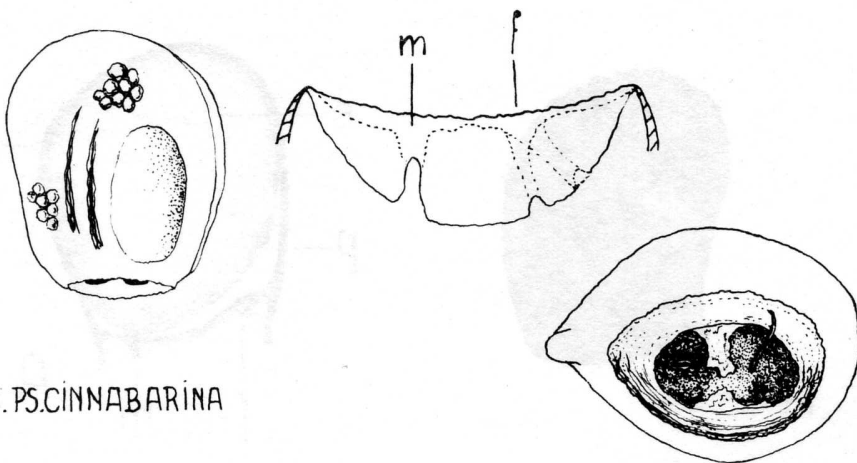
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S. GLOMERISETA

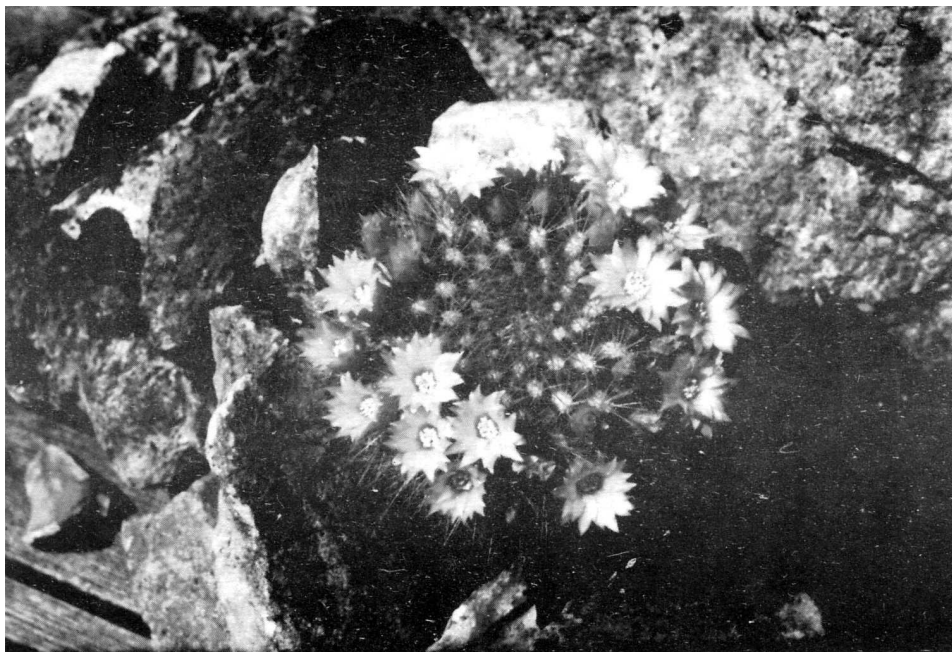


S. KRAHNII



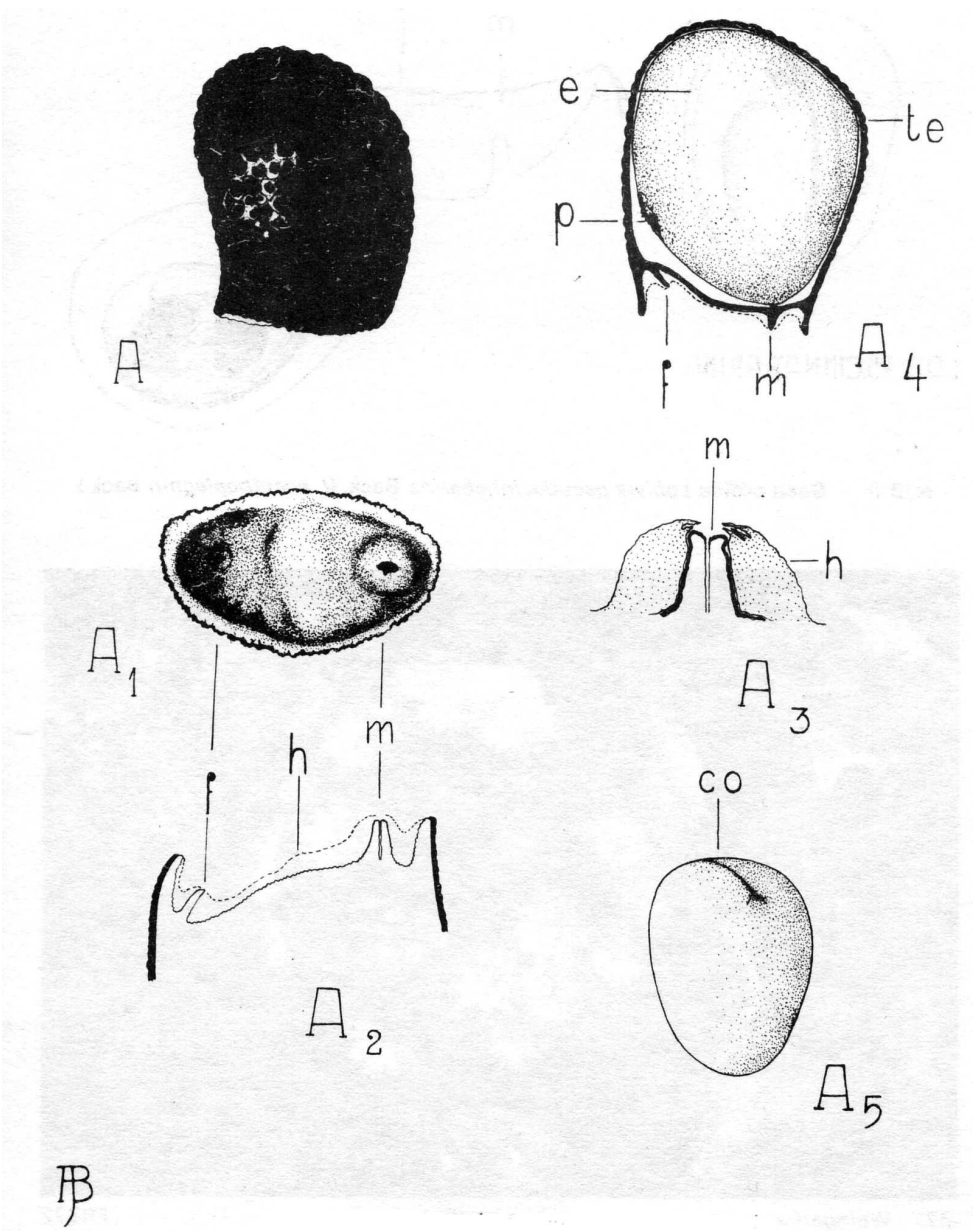
LOB. PSCINNABARINA

AJB 8 Seed profile *Lobivia pseudocinnabarina* Back. (*L. ancanthoplegma* Back.)

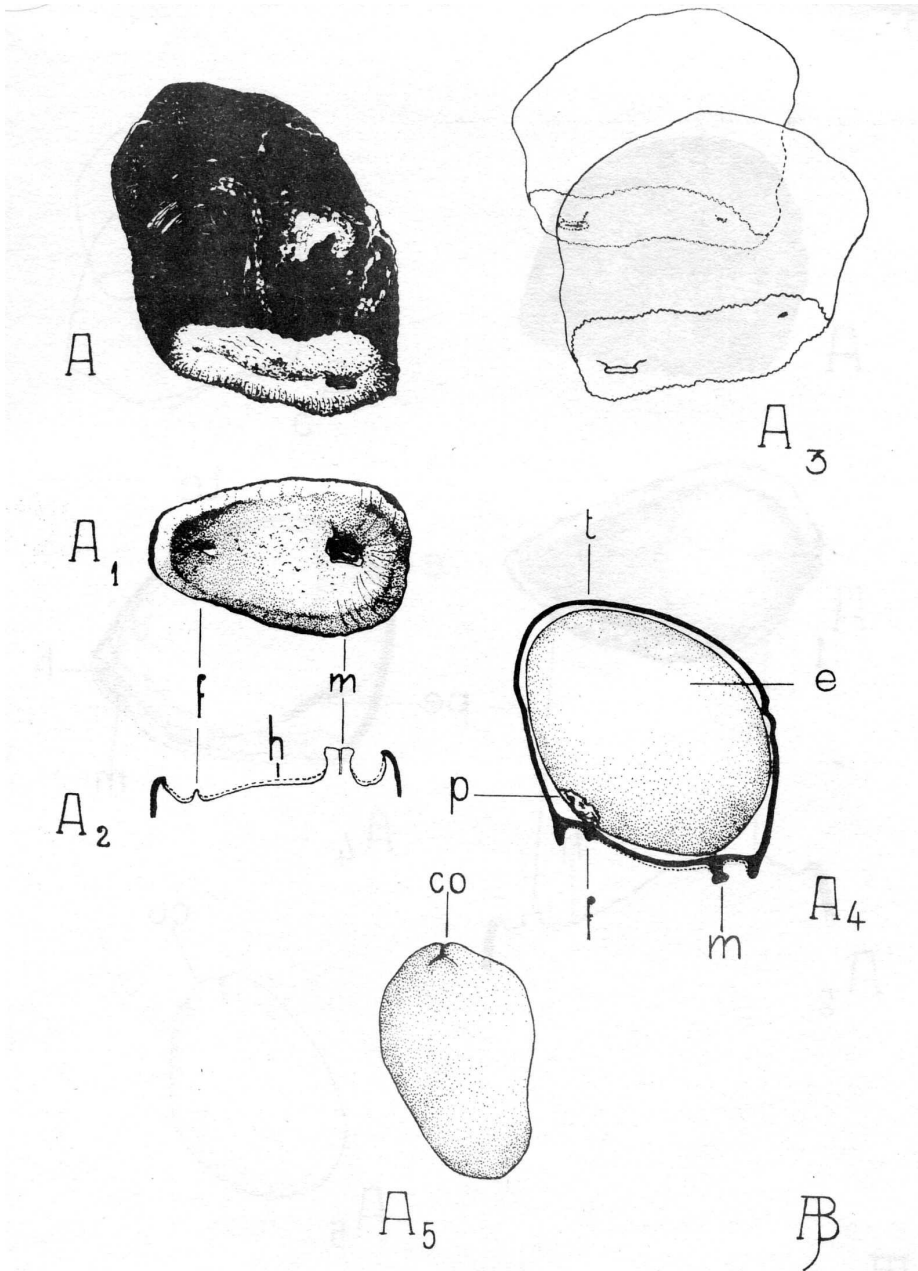


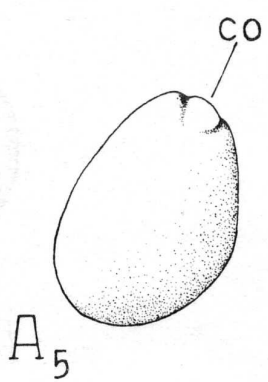
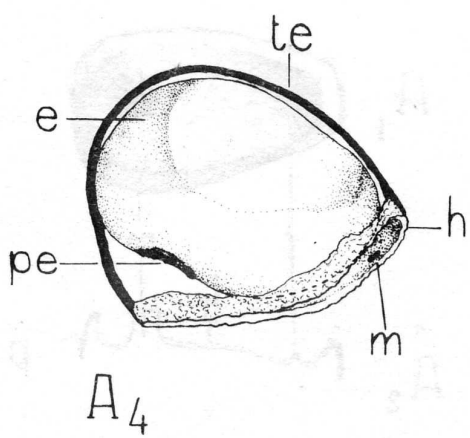
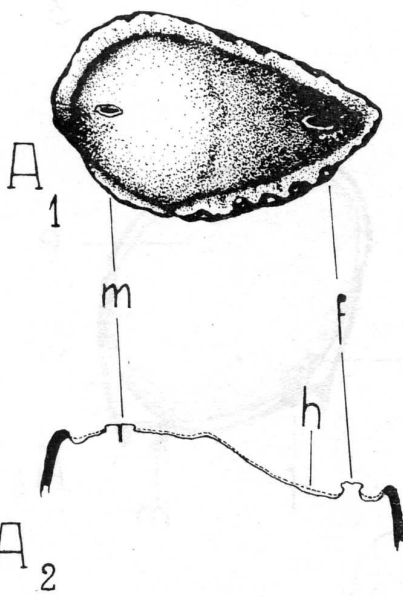
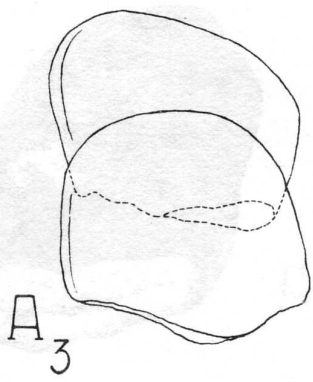
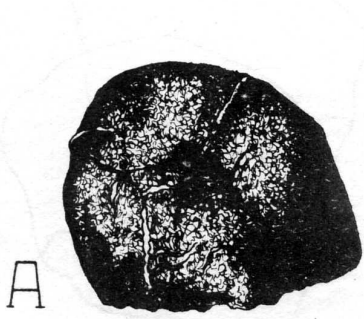
37. *Weingartia neocumingii* var. *multispina* (Ritt.) Don.

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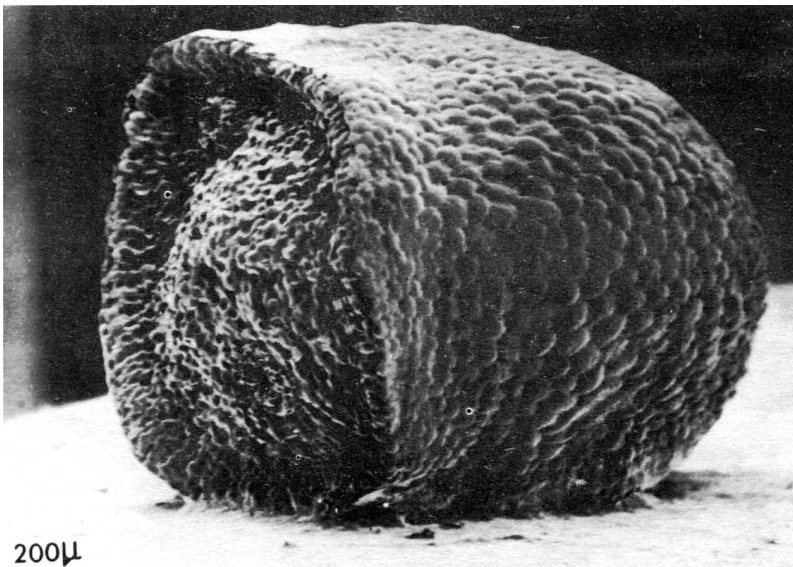


AJB 9 *Weingartia neocumingii* Back. Seed

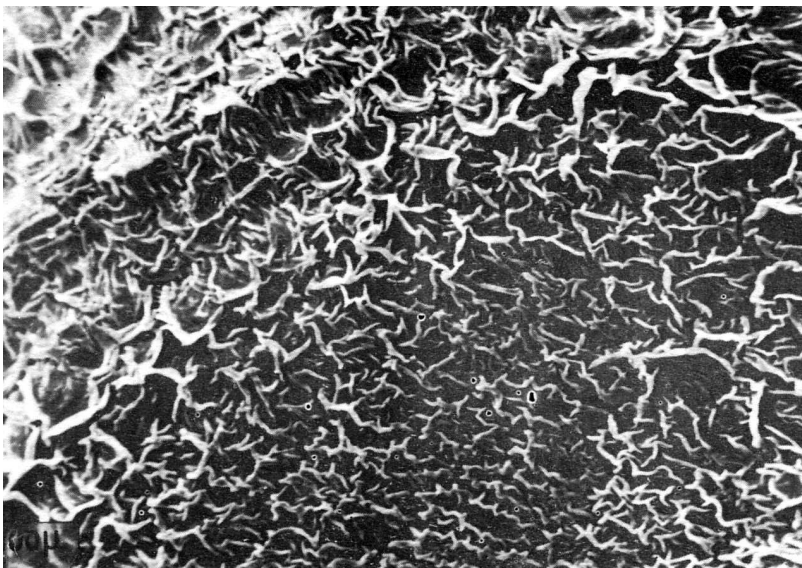




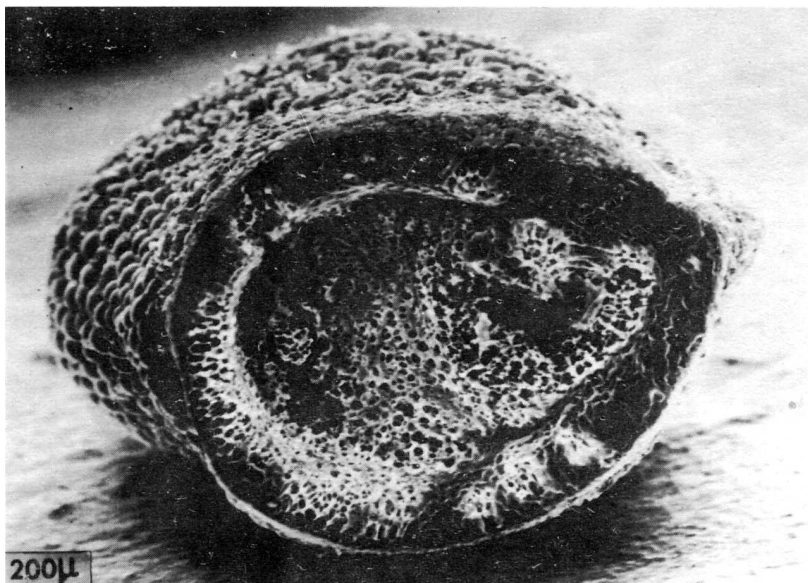
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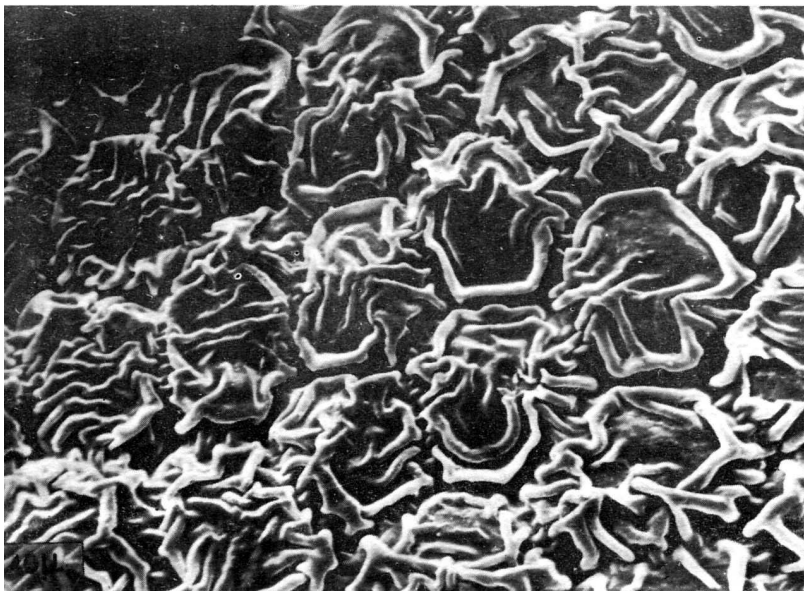
48. SEM Seed study x 100 *Weingartia fidaiana* (Back.) Werd.
(Cutical removed) W. Barthlott & G. Voit.
Inst. syst. Bot. u. Pflanzengeog. Heidelberg.



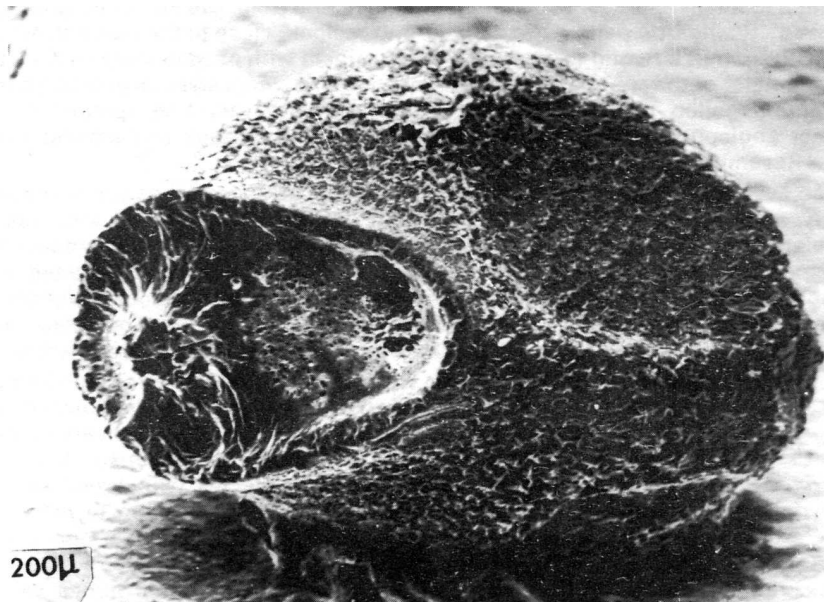
49. SEM Seed study x 200 *Weingartia fidaiana* (Back.) Werd.
by W. Barthlott & G. Voit.



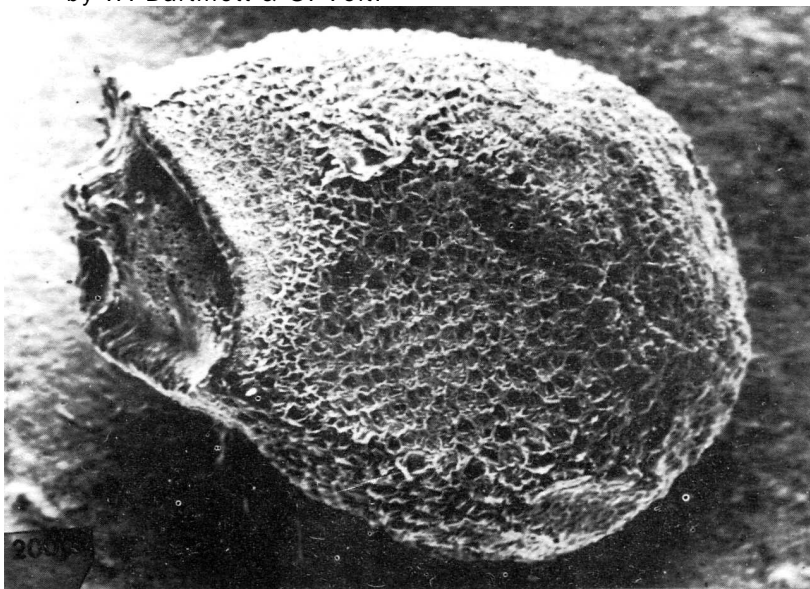
50. SEM Seed study x 100 *Weingartia neocumingii* Back.
by W. Barthlott & G. Voit.



51. SEM Seed study x 500 *Weingartia neocumingii* Back.
by W. Barthlott & G. Voit.



52. SEM Seed study x 100 *Sulcorebutia steinbachii* (Werd.) Back.
by W. Barthlott & G. Voit.



53. SEM Seed study x 100 *Sulcorebutia steinbachii* (Werd.) Back.
by W. Barthlott & G. Voit.

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The pollen studies from Beat Lauenberger to quote him from "Die Pollenmorphologia der Cactaceae". *Weingartia* pollen, tricolpate or hexacolpate close to the exine structure for *Gymnocalycium* in size and form. However the puncta with padded margins are as large as the diameter of the spinula; intermediate between *Gymnocalycium* and *Sulcorebutia*. *Sulcorebutia* pollen mostly subprolate, tricolpate with very fine spinula and large indistinct anulopunctate perforations. Spinulae very numerous and smaller than the puncta. Resemblance to *Weingartia* and *Rebutia*.'

Here the evidence is more conflicting suggesting that *Weingartia* has some relationship with *Gymnocalycium* as well as *Sulcorebutia* and that *Sulcorebutia* also has some resemblance with *Rebutia*. Similar pollen form and similar seed morphology does suggest to me some common genetic inheritance. The puzzle is why it is not reflected in other morphologies? Only the Southern group of *Weingartia* show any body resemblance to *Gymnocalycium* but the flowers and seeds do not, except in the naked receptacle and the broad but different scales of the latter. The fruit is nothing like *Gymnocalycium*.

The similarity of the pollen of *Sulcorebutia* to that of some *Rebutias* is again interesting and again not unexpected in view of their distribution, especially at the Southern end of the *Sulcorebutia* distribution and its overlap with *Aylostera*. There is a very interesting group of plants found by Rausch and Lau - *Rebutia padcayensis* and *Rebutia margarethae* which have narrow areoles, naked receptacles with broad scales but *Aylostera* type seeds and body morphology. This would seem again to reflect some genetic exchange. *R. margarethae* is the most variable of all the *Rebutias*- no two plants are ever exactly alike. Flower colours vary from a greenish-yellow to deep purple through yellow, orange, scarlet, crimson, with bicolor and tricolor forms. Spines vary from pectinate to porrect, short to long, while to yellow, orange, red, brown to black in all combinations. A hybrid swarm perhaps - a still evolving species - what are its parents - an *Aylostera* and a *Sulcorebutia*? - of which the nearest geographically are *Sulcorebutia tarijensis* from Tarija to Villazon and *Rebutias pseudodeminuta*, *fiebrigii* and *tarijensis* from Tarija to Santa Victoria.

We still have the problem and it is not yet finally resolved. We can say that the present genus *Weingartia* is a mixture of two distinct evolutionary lines - the true *Weingartias* close to the type species *W.fidaiana* and another group based on *W.neocumingii* which has many characters shared with *Sulcorebutia* but not all. We must still retain the two genera:

Weingartia Werd.

Subgenus *Weingartia* Werd.

Subgenus '*Cumingia*'

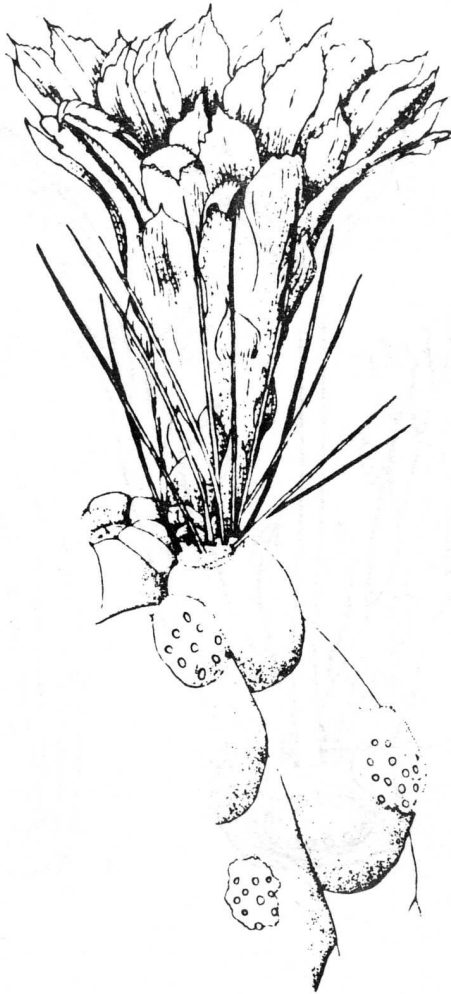
Sulcorebutia Back.

Typ. *W.fidaiana*

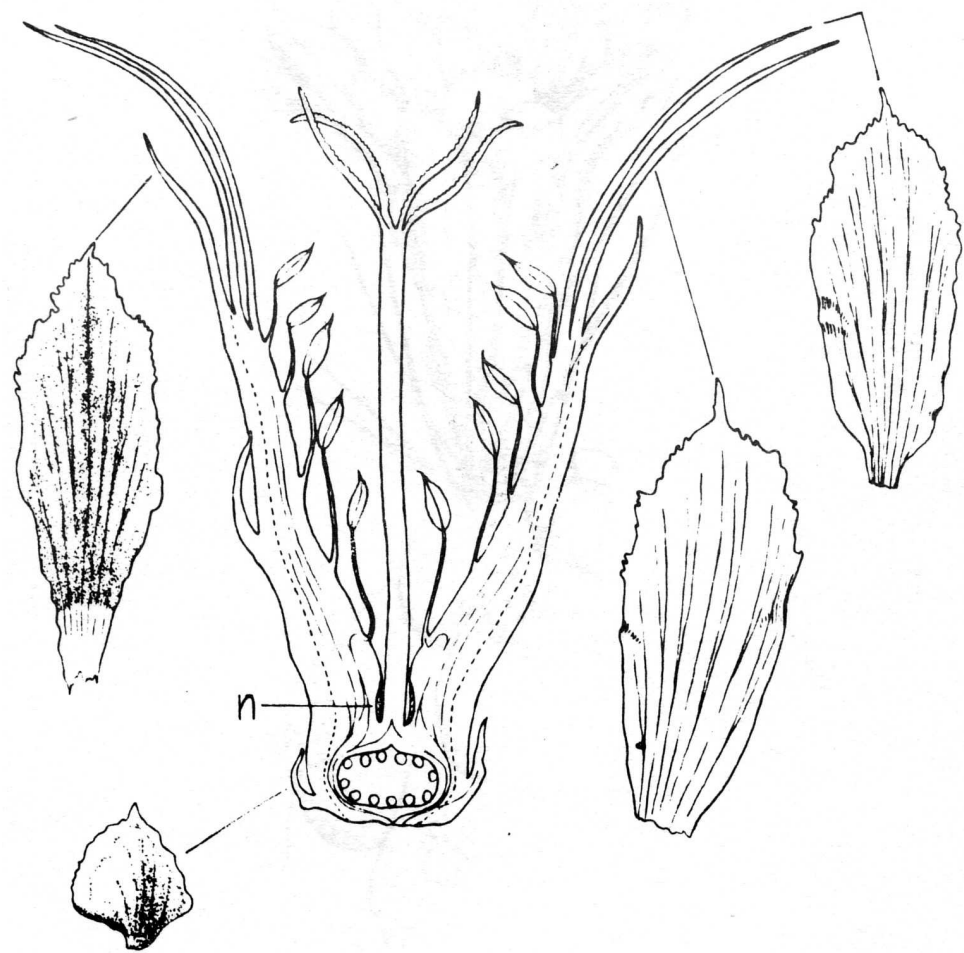
Typ. *W.neocumingii*

Typ. *S.steinbachii*

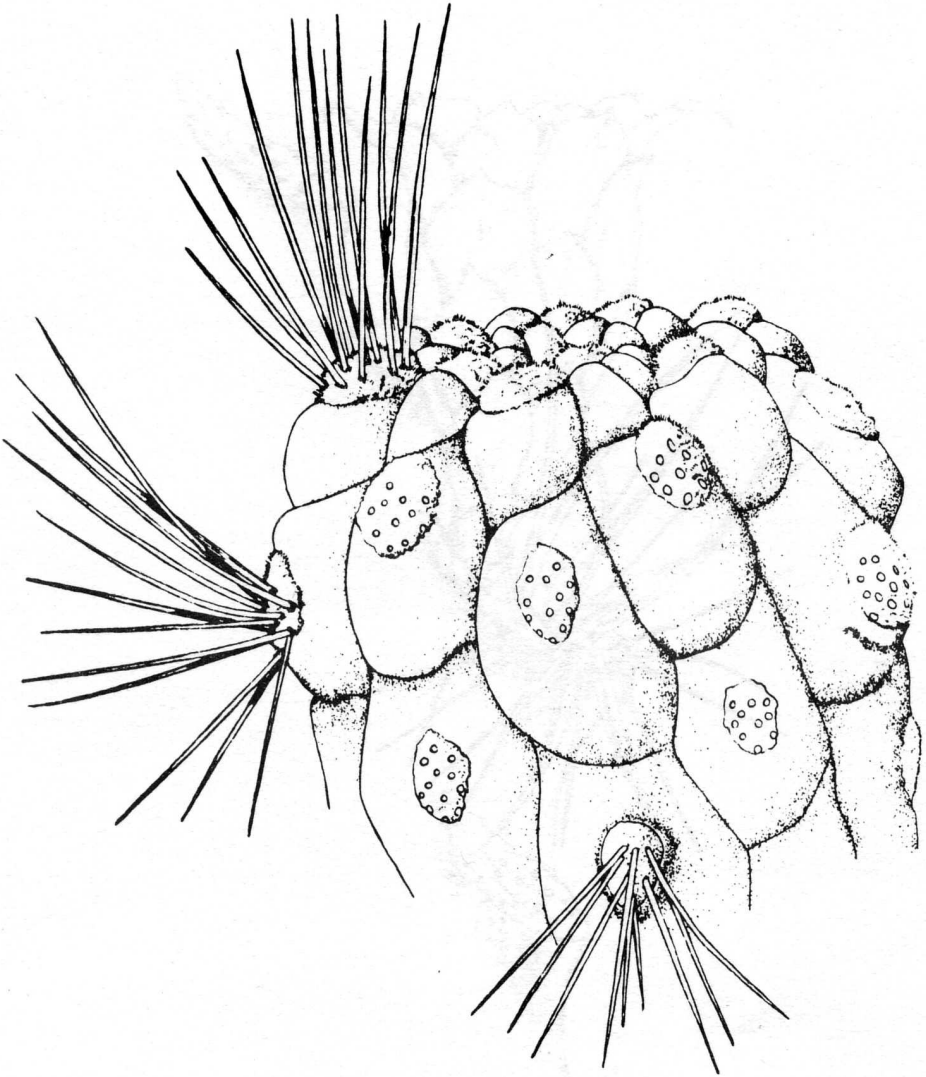
The species problem is another matter - there is room for plenty of rationalisation - for fewer species are needed - there are too many at the moment.



AJB 12 *Weingartia fidaiana* (Back.) Werd. Flower

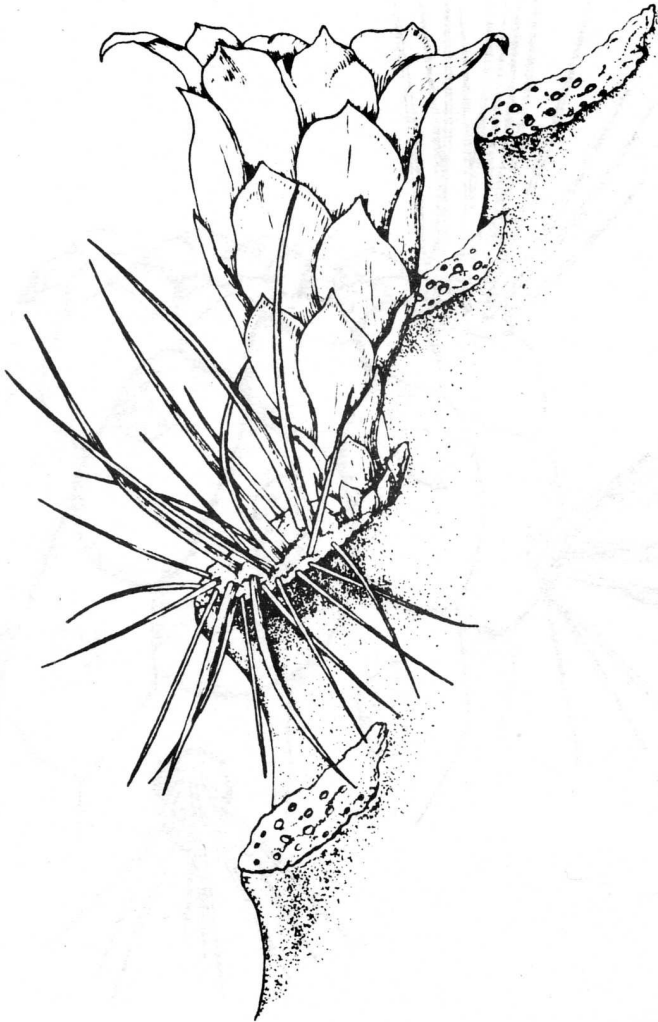


AJB 13 *Weingartia fidaiana* (Back.) Werd. Flower section

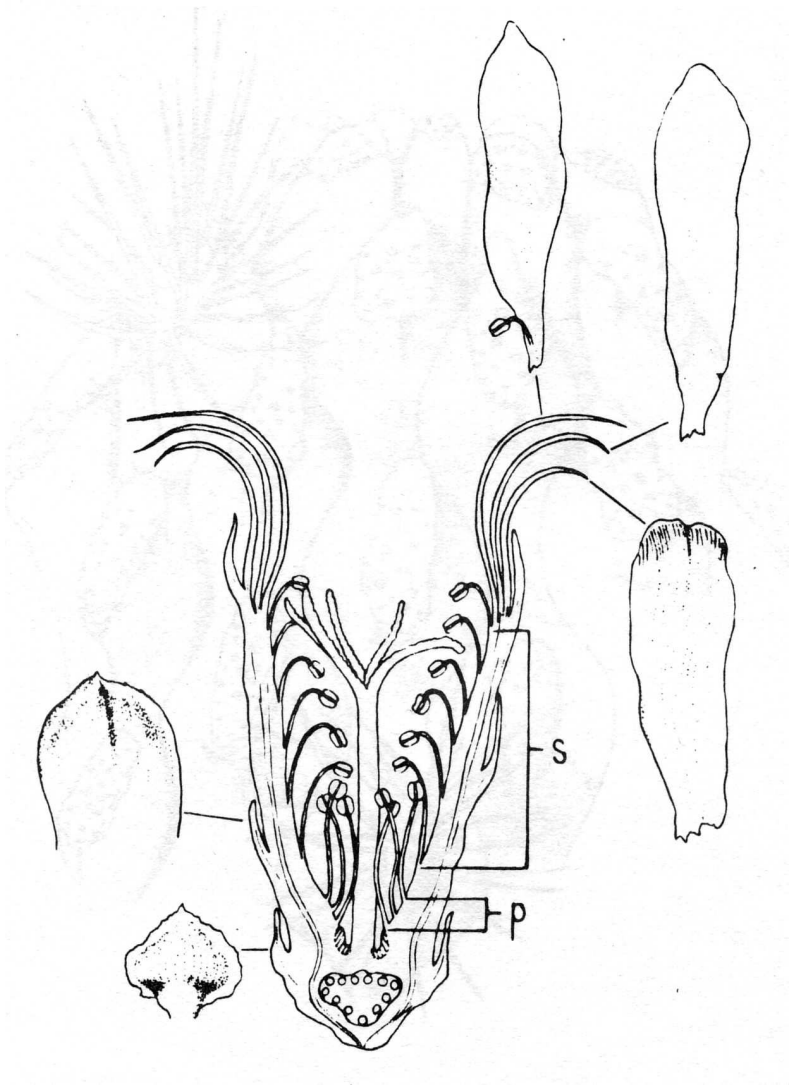


AJB 14 *Weingartia fidaiana* (Back.) Werd. Body form

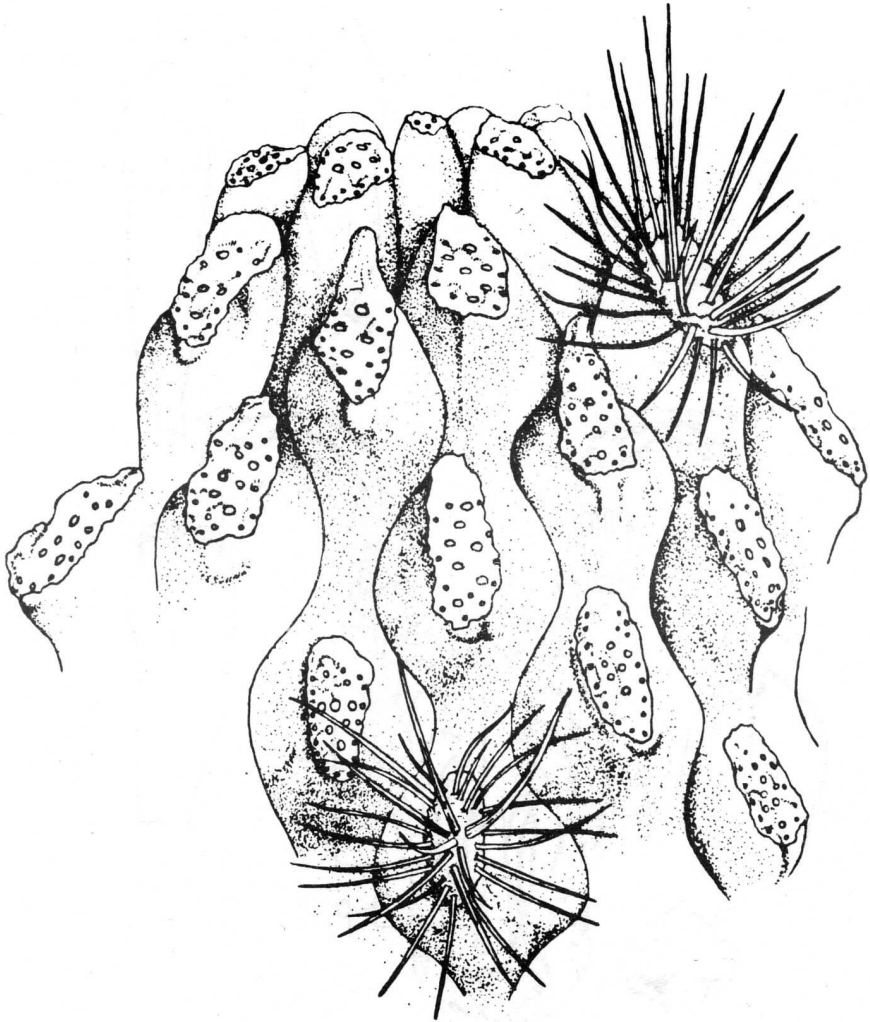
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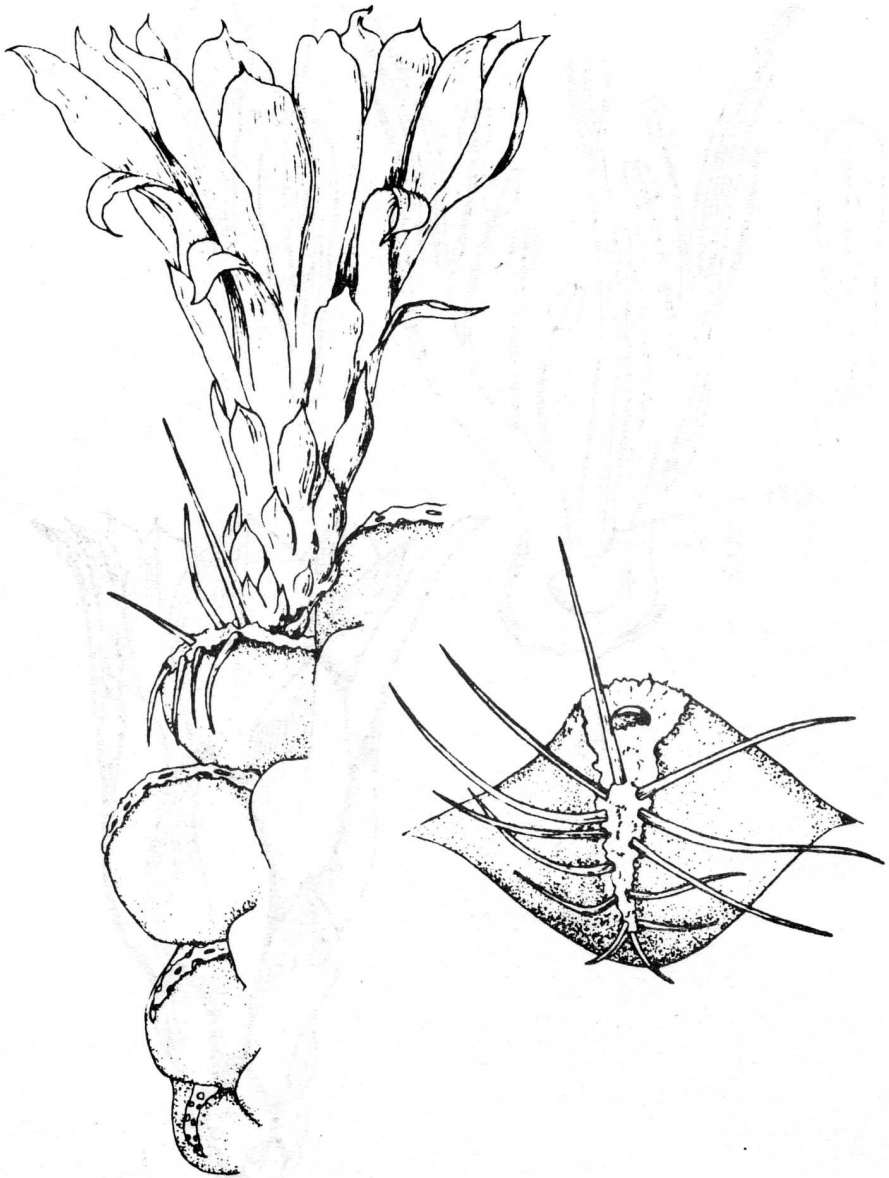
AJB 15 *Weingartia neocumingii* Back. Flower



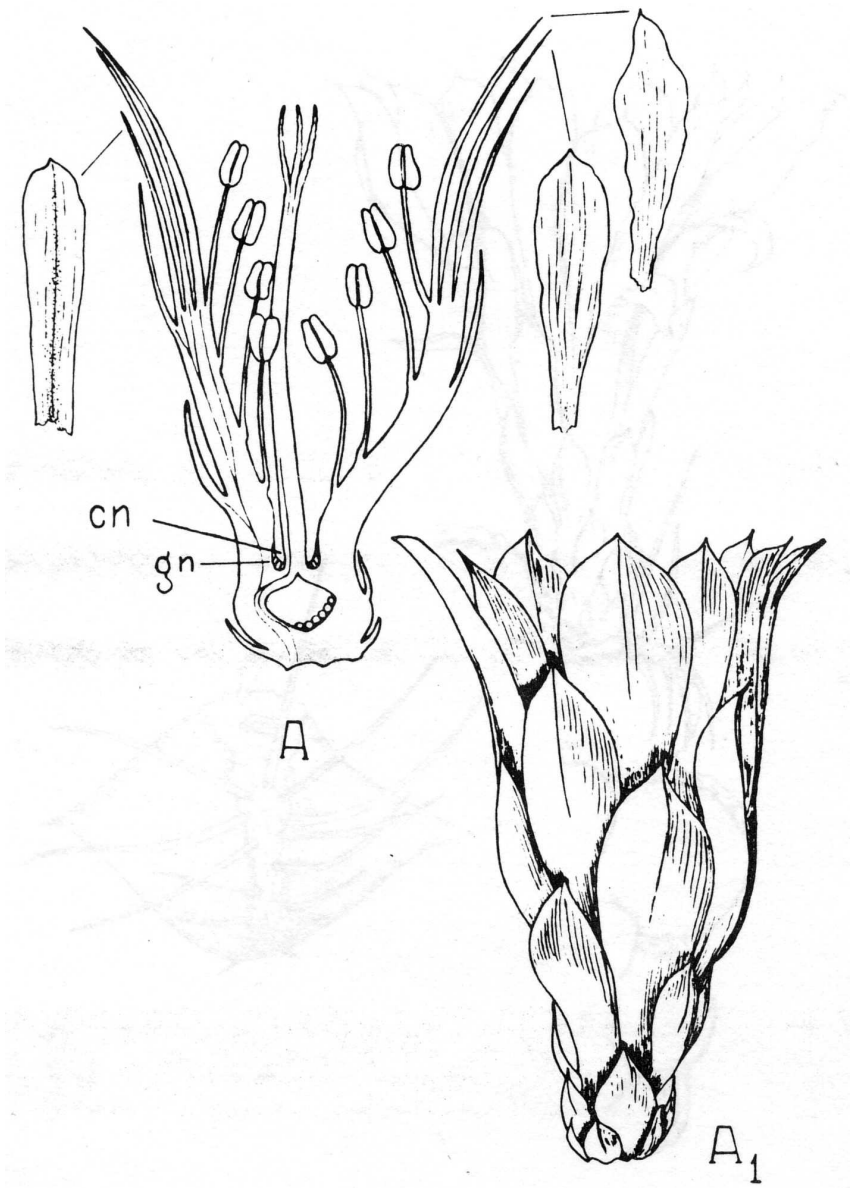
AJB 16 *Weingartia neocumingii* Back. Flower section



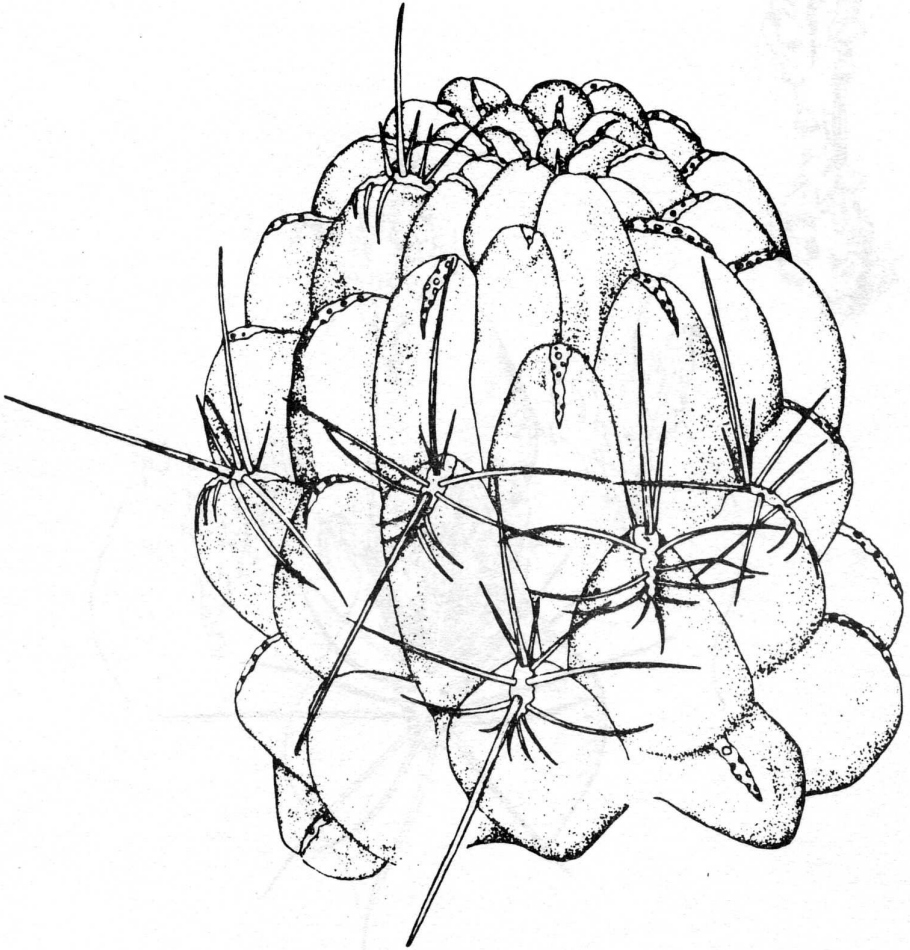
AJB 17 *Weingartia neocumingii* Back. Body form



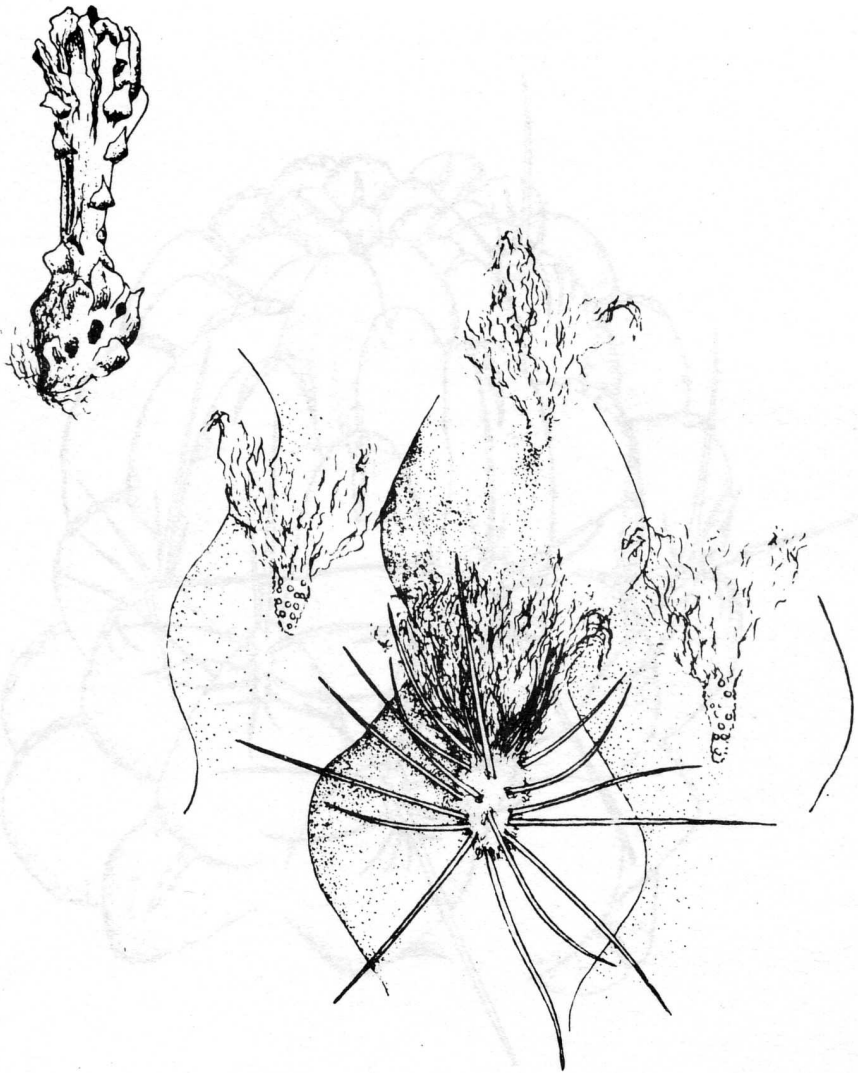
AJB 18 *Sulcorebutia steinbachii* (Werd.) Back. Flower



AJB 19 *Sulcorebutia steinbachii* (Werd.) Back. Flower



AJB 20 *Sulcorebutia steinbachii* (Werd.) Back. Body form



AJB 21 *Weingartia neocumingii* var. *hediniana* (Back.) Don. Areole and spine cushion

ASHINGTONIA

Credits

Half tone studies

37. Weingartia multispina FR372 J. D. Donald

48./49. Weingartia fidaiana SEM Seed Studies

50./51. Weingartia neocumingii SEM

52./53. Sulcorebutia steinbachii SEM

W. Barthlott and G. Voit at
Institut. Syst. Bot. Heidelberg

Drawings

AJB1-AJB21 A. J. Brederoo

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