Hoya Pollinaria

A PHOTOGRAPHIC STUDY

Hoya

Pollinaria

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Dedication

This works is dedicated to the serious student and researcher who wishes to learn more of the Genus Hoya. It is hopped it may lend additional data for pollen researchers in other Asclepiad genera and species. Mostly it is in appreciation of the intricacies of any study and the realization that no subject is simple once an in-depth inquiry is started. I wish to again thank all who have contributed of material and time to further my work in this field, their concern and helpful criticism is always appreciated.

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"The pollen masses present great variations in size, form, and length of pedicels and probably afford excellent characters".

J. D. Hooker 1838 in Flora of British India.

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Introduction

As with previous publications of mine, I hope the material and data herein contained will form the basis for a better appreciation of the Hoya pollinaria as a taxonomic tool. My first motivation in the direction came from Hooker's profound observation of the stability of pollen masses while working with dried material (herbarium sheets). Secondarily, adverse criticism of Dr. Rintz's emphasis on the past neglect of "twin-pollinia" as a taxonomic character, spurred me on to further critical in-depth study.

Dr. Schlechter drew floral parts on most of his Hoya herbarium sheets. Drawings of the pollinarium were also included. Although these representations are small and lacking in many details, they are none-the-less valuable in re-identifying his species as their relative proportions are still of value. Even in his descriptions, such comments as "retinaculum very small" are significant in a taxonomic sense. The most detailed drawings of Hoya pollinarium have been those of David Kleijn of the Netherlands. David Liddle in Australian publications has also made detailed drawings of Pollinarium. I have one objection to the positioning of the Retinaculum above the two pollinia by these two authors and by Dr. Rintz. To me it is like not using the top of a map to represent north. The pollinarium in Hoya is upright, i.e. the retinaculum is secreted by the fused stigmas and the pollinia are inward toward the center of the flower. For me, Schlechter had it correct !

I have discussed under "Materials and Methods" some of the difficulties in photographing these very small structures. There is a loss of resolution and detail at every step of the process in bringing this work to publication. I suppose we all wish for more money, better equipment, and above all more time. The expenses and time of all this work is borne by me personally. Many thousands of negatives and pictures have been filed and labeled. These form the data base for this and further studies. I feel a photographic record is invaluable, since at any time I can refer back to the actual photo. I continually re-photograph species so I am able to study any variations occurring over time. In addition, clones bloomed in many locations are added to the photographic and data record on a continuing basis, along with drawings and critical measurements. With the advent of computers it is easy to make necessary corrections and additions to a data base and to then from time to time release updated publications.

Acknowledgments

The development and writing of this book required the help of a large number of people. Probably the most important are all those who took time to send me flowers and cuttings. In addition constructive comments have been invaluable in furthering this work. Flowers have been used in my photographic data base of hoya species. For flowers I thank Ann Wayman (AW) Oregon, Ted Green (TG) Hawaii, Chanin Thorut (CT) Thailand, Michael Miyashiro (MW) and Jerry Williams, Vista Ca.. The above have also provided innumerable cuttings. In addition cuttings have been supplied by Dexter Heuschkel (DH), Professor Juan Pancho (JP), Maximo Wayet (MW), Blass Hernaez from the Philippines, the late Peter Tsang of Australia, Ruurd van Donklaar of the Netherlands, Iris and David Liddle of Australia, and Geoff Dennis of the Solomon Islands. I have also been helped by Chuck Everson, Vista CA and John Scoville San Jose CA and many others.

I also wish to recognize Dr. Domingo Madulid of the National Herbarium in Manila, Philippines, Dr. Johanis Mogea of the Herbarium at Bogor, Indonesia, and to the entire herbarium staff at the University of California Berkeley, California, USA. Indirectly thanks also to the staff of the Herbarium at University of the Philippines and to the Forestry Herbarium both at Los Banos, Laguna, Philippines. I do not forget the directive help supplied by Dr. Veldkamp of the Rijksherbarium at Leiden, The Netherlands. I will always be indebted to the late Dr. Benjamin Stone for his unselfish devotion to education and help whenever called upon.

Dale Kloppenburg

Materials and Methods

Pollinaria of the Hoya flower are very small but the five dark brown colored retinacula are readily visible in the crown without the aid of magnification. In working to remove the pollinarium I use a "Swift" binocular microscope with 10X magnification. With the sharp end of a fine sewing needle inserted under the outer end of the retinaculum, a gentle lift will usually release the entire structure intact. Those removed are placed on a slide with a 1 mm. imbedded graduated scale, as a measuring device, divided into microns (100 parts). The slide is wetted with a drop of Kew solution (glycerin, water, and formaldehyde). The removed pollinaria are easily transfer to the wetted area. Most pollinarium can be examined at thirty power or above. At around 30-40 magnifications the pollinarium are easy to focus since the field depth is relatively small. An overall view is good at these magnifications.

I have found that a magnification of 100 power is best for detailed study of most hoya pollinarium. For this I use a Bausch & Lomb monocular scope. It is provided with a EW 10 XD/20.50 -14.5 mm. eyepiece. The 10x lens is 0.25. By the time the pollinarium is in good general focus in a SLR camera the magnification with this lens combination is approximately 160X (actually it is slightly more than 162). The camera is provided with a microscope adapter which allows me to switch from the Swift binocular scope (for extraction) to the monocular for measurements and photography. The camera mounts on the eyepiece, and the SLR feature allows visual focusing through the microscopes.

Problems encountered: At near 100X magnification even though the pollinarium is a small object (we are dealing with fractions of a millimeter) the depth through which you must focus becomes greater (the depth of field is shallower). This requires a number of photos at various focal planes to record all the features. Thus presentations must be of a number of photos or composites. The retinaculum is especially deep i.e. three dimensional and thick, especially at the head and central portion. The photos (copies) in the data pages are a best average photo depiction of the structure or a composite in a few cases. At 160 magnifications some pollinarium are too large to fit within the view area and thus must be a composite of at least two photographs.

Problem areas in addition to the above are:

(1) When removing pollinarium, both pollinia do not always stay adhered to the caudicle. In some instances neither of the two pollinia may remain attached. The longer the flower is open the more this becomes true.

(2) Occasionally, especially from herbarium material, the pollinia may be withered (not the general situation). Preserved dry flowers must be thoroughly soaked in Kew solution (or boiled) before removal is practical.

(3) Destruction of the pollinia (since it represents high protein) by bupestids or other insects is occasionally encountered.

(4) Upon extraction from the anthers the pollinia and retinaculum often twist and turn. This is especially true of translators located well down the retinacular column. It becomes a real challenge to get them to lie in their original configuration, and flat on the slide. Long retinaculum with the translators attached well down on the column tend to raise their head (the inner apex) above the scale surface, adding to the depth of the focal plane. This adds to the difficulty of getting a single clear photo of the structure. In some cases the twisting is almost impossible to undo. Drying the slide is an aid and using two needles for manipulation helps. The pollinarium of course can be studied from the top (normal positioning) or turned on its back and studied from the bottom.

I have been using 100 ASA color film or recently 200 ASA speed color film. The faster speed film cuts down on the exposure time (and thus camera battery renewal). I at first used the auto exposure meter of the camera but learned that most photos were overexposed (more true for floral parts than of the pollinarium through the monocular scope). With a tensor lamp directly below the stage, directed up through the field it takes only a fraction of a second for full exposure, possibly 1 second. I now use the bulb camera setting. Photos show more and clearer detail then the photocopies or scanned images presented here but are too expensive to use in this presentation.

Pollinarium Formation

The pollen of the hoya species I have examined are coalesced into gelatinous masses. (It is not powdery). Each mass is covered with a continuous clear, rather tough membrane. The containing receptacle is a pocket (at first an closed envelope) in the side of the triangular membranaceous anther. This anther is fused in its central basal region above to the lower surface of the inner coronal lobes basal portion and below to the edge of the stylar table between the fused stigmas. The (anther) apical triangular and lateral edges being free. The anther points inward toward (and often covers the stylar region) the center of the flower. There are two pockets in each anther apical region arranged in a fashion, so as the upper (inner) ends are nearly touching, forming a triangle which thus follows the outline of the anther edge. The edges of the envelope are thickened and buttery yellow in color. These pockets are somewhat linear as are most pollinia. It is in these pockets that the pollinia form at a very early stage of flower development even prior to the development of the corona. The sepals are still covering the whole floral bud and the corolla has not begun to enlarge beyond the calyx. At this stage the sepals are the most visible structure of the developing flower bud. At this early period the pollen masses are gelatinous, turgid, undifferentiated, uncolored masses; shortly developing a pale yellow color.

The pollen masses early on are completely covered by the anther envelope and sealed within it. As development continues the pollen mass deepens in color (yellow) and differentiates into characteristic parts. Eventually the envelope separates along the outer edge freeing the enclosed pollinium, which however remain in place unless disturbed. A sterile edge of varying length differentiates along the edge of the pollinium adjacent to the inner envelope edge (its narrow side). This is the thinnest portion of the pollinium as seen in cross section. This pellucid, sterile edge differs in structure and length among the various hoya species. It is absent in the *Section Eriostemma* Schlechter species; very rudimentary in the *Section Rudimentalia* Kloppenburg (as exemplified by *Hoya darwinii* Loher). In most species it is well defined and readily visible under a microscope even at low power. This has been called the "germinal mouth". In many cases there is a linear vacuole separating this edge and the gelatinous pollen, either partially or nearly completely. Upon germination the pollen tubes burst forth (usually) first at the inner end, the end nearest the retinaculum, of the sterile edge where a pore is present allowing honeydew to enter. Almost immediately, however the whole side splits with emerging pollen tubes.

If germination occurs near the stigmatic receptive area the whole bundle of individual elongating, translucent, colorless, pollen tubes are directed to the small stigmatic receptive area. What starts as a flat linear formation of pollen tubes emerging along the entire length of the sterile edge (germinal mouth), becomes a coalesced tubular

shaped grouping all entering the stigmatic cavity. From here they proceed to elongate through the moist loosely differentiated tissue which leads from the receptive area to the top of the ovaries enveloped in the stylar material.

There are ten stigmas (decagynous) in hoya fused into pentamerous pairs. At the outer corners (edge) of the pentagonal stylar table the fused stigmas form a short barely discernible groove. This is on the upper side of the receptive area. Secretions from this grove give rise to the retinaculum. The surface of the stigma upon which the retinaculum is formed belays a raised spongy, although structurally coherent, template of the retinaculum. At a very early stage of flower development, just after the pollinia are visible as gelatinous masses, the stigma begins to secrete the retinacular structure. I have arbitrarily termed this (Stage 2). At this time the upper surface of the retinaculum begins to form. The inner apical (head) portion is continuous from secretion of the inner end (proximal) of the stigmatic grove. The two sides of the retinaculum are at first free and bisymmetrical, forming from lateral secretions of the stigmatic groove. This upper surface eventually fuses as maturation continues. The outer ends remain free and curve slightly outward from the median line. They also curve over the edge of the fused stigmas toward the underlying receptive area. The whole structure at first pale brown and somewhat soft then becomes horny and dark brown, being very rigid. Gelatinous material in a semi-structured condition at the end of the twin extensions remains unsolidified.

As the corolla formation is completed and the flower is just ready to open (anthesis) the formation of the retinaculum is complete, and the pollinia are released from the anther envelopes (stage 4). At this stage the retinaculum is a three dimensional structure with a tubular cavity in from the outer (distal) apex, the lower surface of this channel (the under side of the retinaculum) is shorter than the upper (dorsal) surface with its projected extensions. This surface may be flat or slightly rounded. This lower surface thins as it reached its rounded outer extremities. Through the top view on a microscope it appears as a rounded end of the retinaculum (the lower surface; end furthermost from the head). In addition to this central tube there are two side tubes, one on either side. Usually these side tubes are 45 degrees to the main axis and the central tube, but not connected to it. It is in these side tubes that the translator arms and caudicle are attached at the inner end. This allows for twisting and turning of the attached structures when the pollinarium is removed from its housing.

The translators and caudicles are secreted at about the time the corolla begins to emerge from the surrounding calyx (Stage 3). They develop along the groove formed by the fused lower side of the anther, thus connecting the retinaculum to the pollinia. Each retinaculum has two translator arms and associated caudicles which connect to two pollinia each housed in (different) adjacent anthers. The clear sticky caudicle is supported by the translator. The translator is wedge shaped, conforming to the space between the anther and style, with its wider concave top supporting the caudicle. It is more structurally sound than the more fluid sticky caudicle. The latter in many cases is in the shape of a comma with the bulbous end into which the basal end of the

pollinium adheres. Both of these parts of the pollinarium show individuality and differ widely among the various hoya species. In the Section Eriostemma Schlechter they are linear and fused tightly together , in other species the caudicle is rudimentary, but I have never found it lacking. In some species the caudicle itself shows differentiation of its surface similar to that found in the translators, and also with some structural differentiation. The diversity presented in the following photomicrographs shows what a critical and important tool for taxonomic identity the pollinarium is. In herbaria material it is the one floral part that may remain intact without distortion or change. Upon soaking of the flower in the Kew solution (or boiling it up) it can many times be removed for study intact.

At flower opening the pollinia are usually tightly affixed to the caudicle. As the flower ages this bond becomes less. In older flowers, while removing the retinaculum from a open flower, the pollinia may separate easily from the caudicle. On the following pages I have tried to break the pollinarium development into stages and show photomicrographs related to each stage.

Dr. Rintz (The Peninsular Malaysian Species of Hoya) The Malayan Nature Journal 30:1978, 10 divided pollinarium into four groupings. (1) both caudicles and pollinia winged. (2) only pollinia winged. (3) neither caudicle or pollinia winged, caudicles long. (4) Neither caudicles nor pollinia winged, caudicles short. By winged he is referring to the sterile edge of the pollinia or the translator supporting the caudicle. I have found caudicles and translators on all the species I have photographed in his grouping (2). In addition there is a rudimentary (very short) sterile edge on the species *Hoya mitrata* Kerr (and also *Hoya darwinii* Loher), his grouping (4). Of the pollinarium I have so far examined I have yet to find any without both a translator or caudicle as I define them. On close examination the long twisted connectors in the Section Eriostemma Schlechter species show that there is the typical opaque translator closely associated with the clear (although linear) caudicle. The pollinia do not appear to have a sterile edge (germinal mouth) typical of all other Hoya species. It appears as far as the sterile edge is concerned the Section Rudimantallia Kloppenburg species represent a near loss (or beginning) of this structure among Hoya species.

In discerning the caudicle, since in most cases it is a clear almost transparent structure, it may be necessary to check closely at different focal planes in order to detect its presence. It is in some cases below the more opaque translator and thus hidden. I have found the use of dye helpful in differentiating these complex structures and especially useful in photographing parts that are all of the same color.

Corona of a Hoya Flower

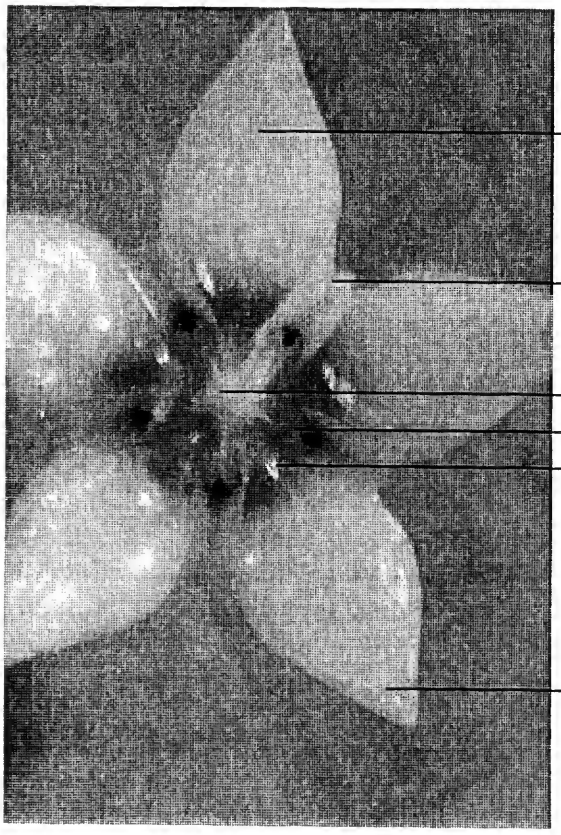


Photo of hoya flower crown (corona), a top view magnified approximately 15 times.

Stylar Table of Hoya Flower

Coronal Scale (outer lobe).

Apical area of stylar column.

Anther below inner coronal lobe.

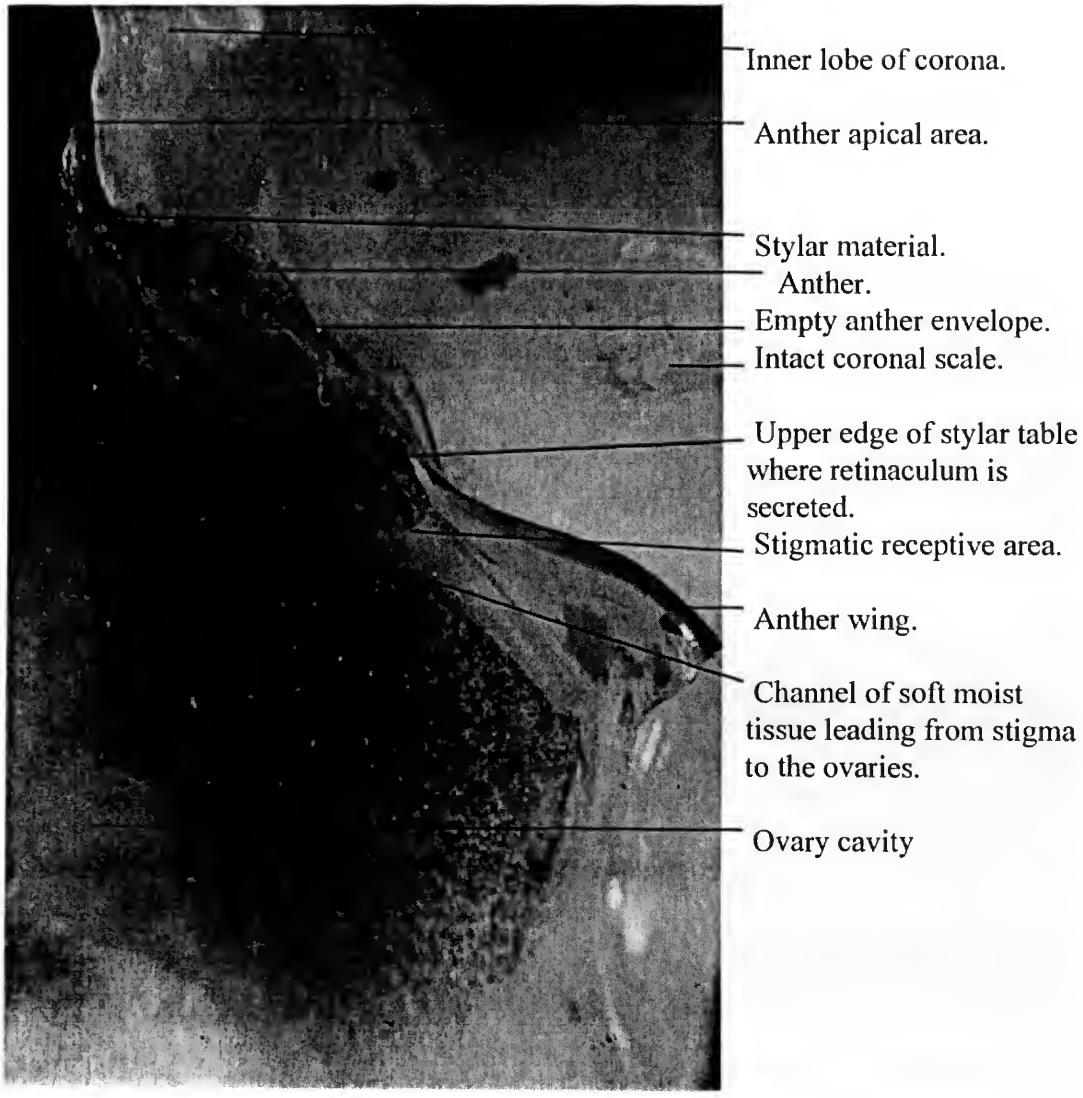
Inner coronal lobe.

Dark amber retinaculum with translators and caudicles attached to two pollinia. This is situated at one point of the pentagonal stylar table.

Anther wings with channel leading to the stigmatic receptive area directly under the retinaculum.

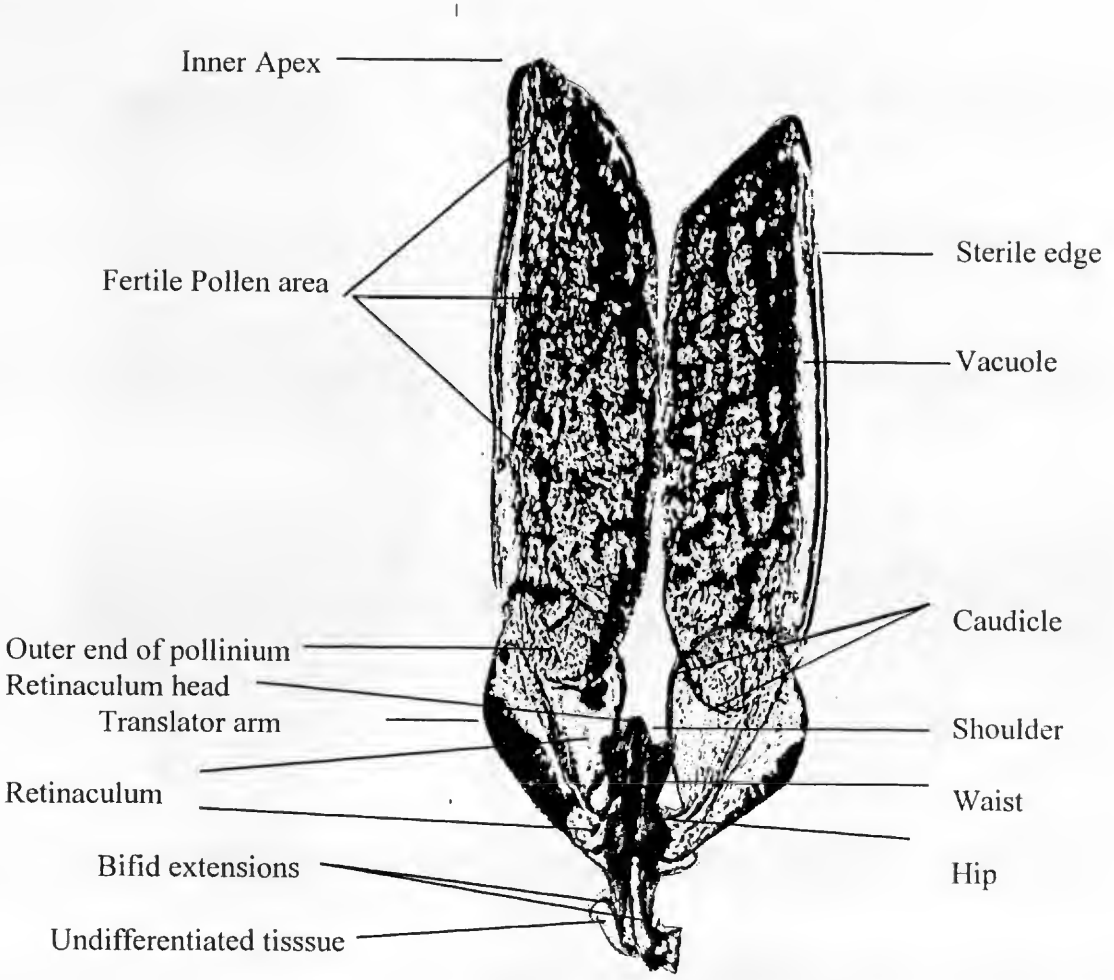
Picture of a hoya pentagonal stylar table. Three coronal scales and the underlying anthers have been removed to show the relative position of the pollinarium. Two scales remain, one at the right side and one above. Magnified approximately 45 times.

Coronal Section



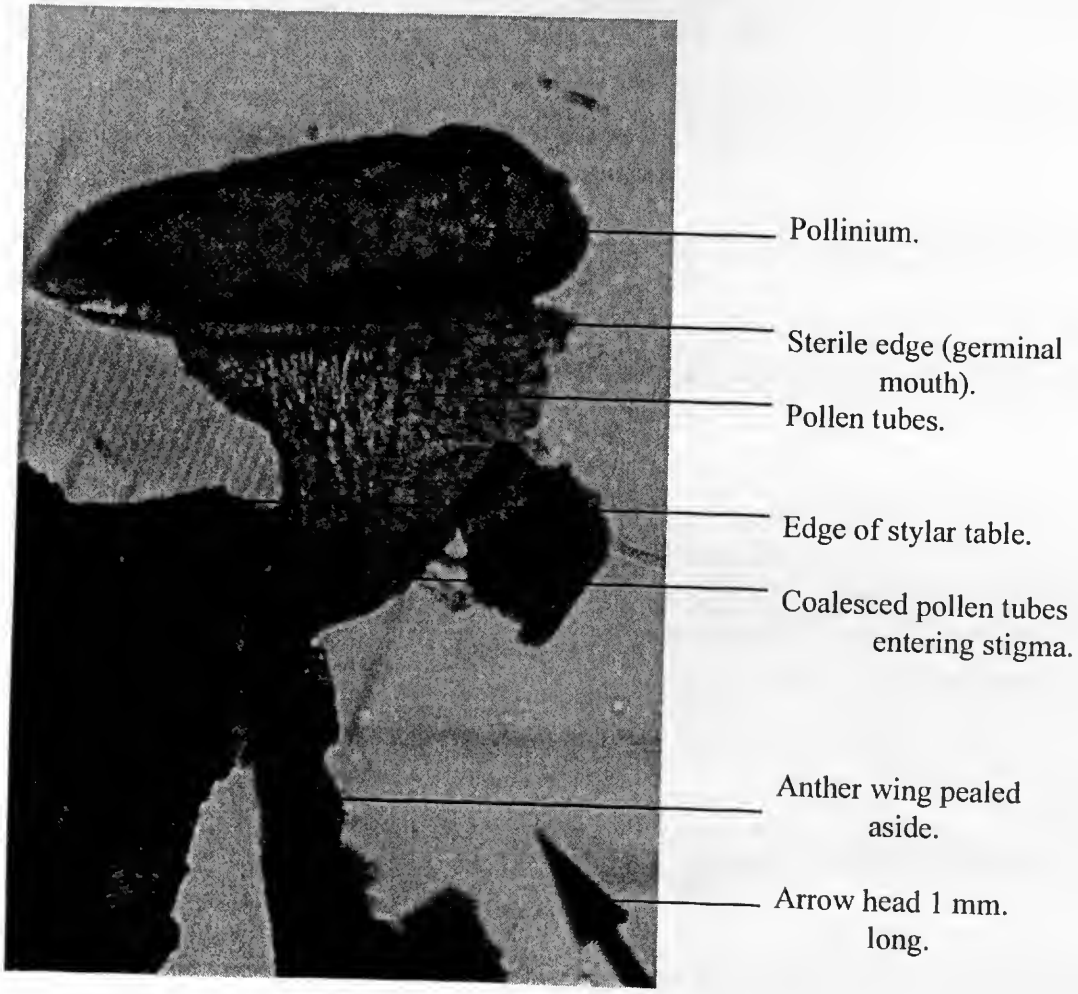
Section between the anther wings of a flower of *Hoya obtusifolia* Wight, magnified approximately 16X. Section stained to bring out structural detail. Showing anther with one empty anther envelope, above which is one intact coronal scale. Below the anther the stylar material has been sectioned cutting through the fused stigma, with the stigma receptive cavity visible at the end of the groove flanked on the right side by one rigid anther wing. Leading from the stigma the channel of spongy material is visible through which pollen tubes would travel if fertilization were to occur. Hollow ovary cavity is visible and labeled above.

The Hoya Pollinarium



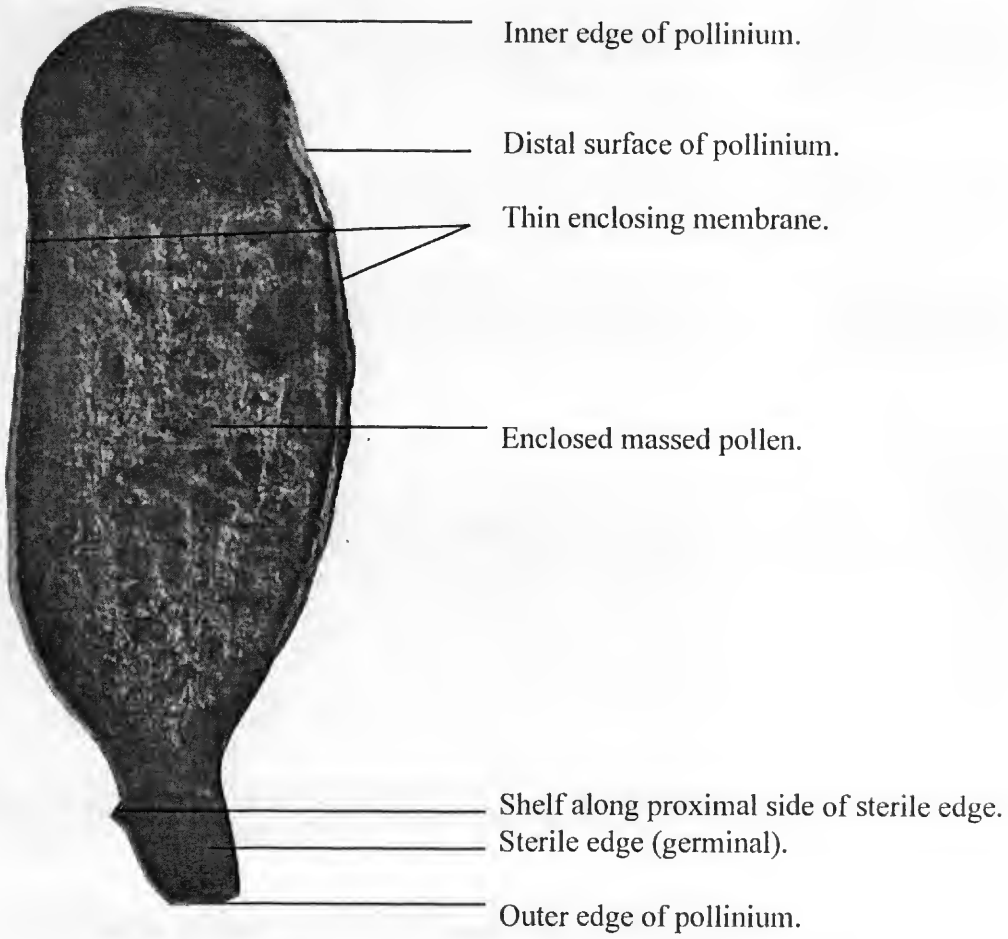
This is an immiage of a hoya pollinarium enlagred approximately 160 times.

Pollinium Germination



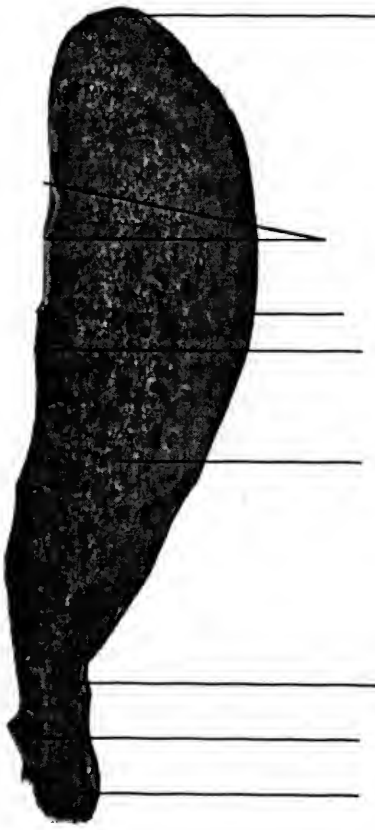
Pollinia magnified approximately 160X showing pollen tubes emerging from sterile pellucid edge (germinal mouth). Tubes coalesce into a tube entering the receptive stigmatic area under where the retinaculum is secreted. Scales and sections removed to photograph this germination.

Cross Sections of Pollinia



Magnified approximately 160X.

Pollinia from flower of *Hoya obtusifolia* Wight, clone with white corona via CT. Thailand.



Inner edge of pollinium

Thin membrane enclosing massed pollinia.

Upper edge of pollinium, distal side.

Proximal side of pollinium, side adjacent to the stylar table and central flower axis.

Enclosed pollen masses.

Vacuole area of pollinium adjacent and inward from sterile edge.

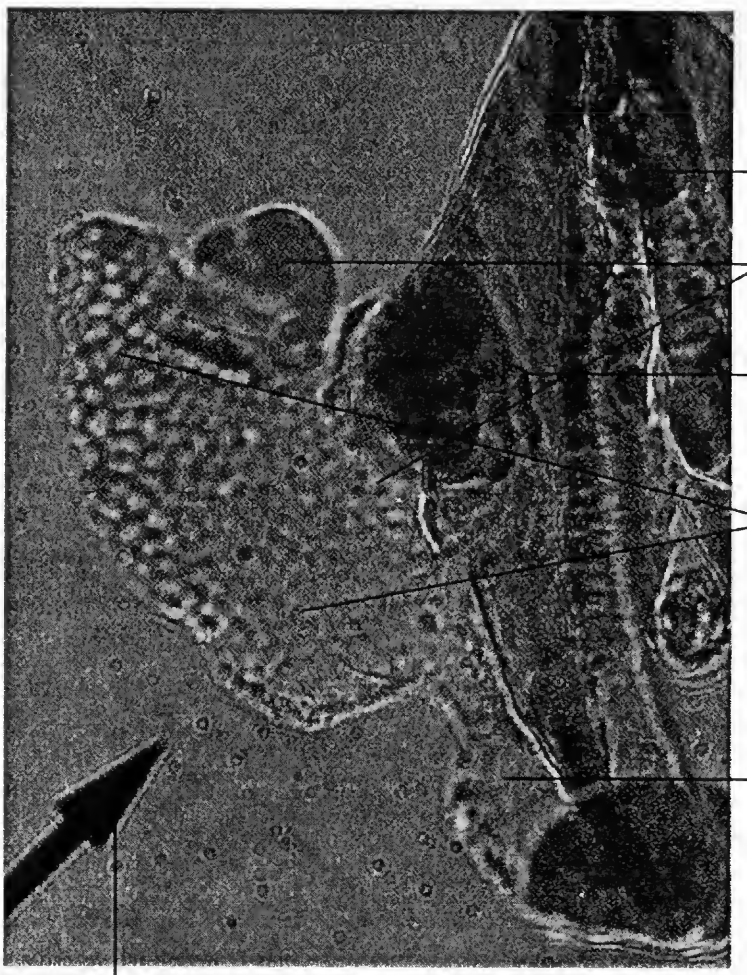
Shelf along proximal side of sterile edge.

Sterile edge of pollinium,(edge of germinal mouth).

Magnified approximately 160X.

Pollinium from flower of *Hoya imperialis* Lindley, clone via TG from Palawan, Philippines. Cross section.

Translator and Caudicle Development

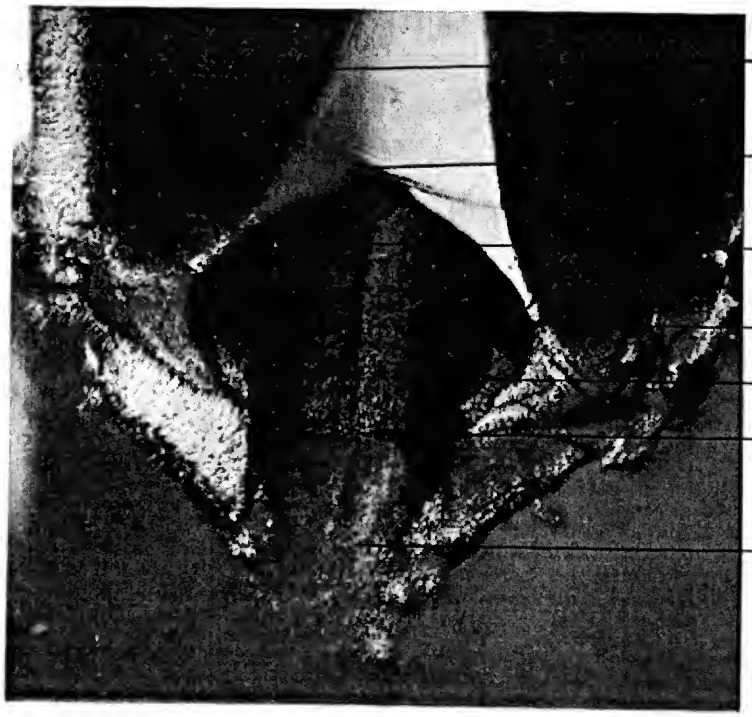


Magnified over 600X. At this stage of development on the pollinarium,the bud of the Hoya flower is covered over 1/2 by the calyx. The translator is more completely developed at this time than is the caudicle, which at this early stage is not yet in contact with the pollinium. The pollinium are still enclosed in the anther envelope. The caudicle and translator are attached inside the retinaculum in a tunnel entering the side at approximately a 45 degree angle extending upward under the broadened shoulder of the retinaculum.

Upper and Lower surfaces of the Retinaculum

from *Hoya imperialis* Lindley, clone from Palawan, Philippines via TG.

Lower Surface View ↓



Pollinia.

Inner apex.

Head area, hollow in central portion.

Shoulder.

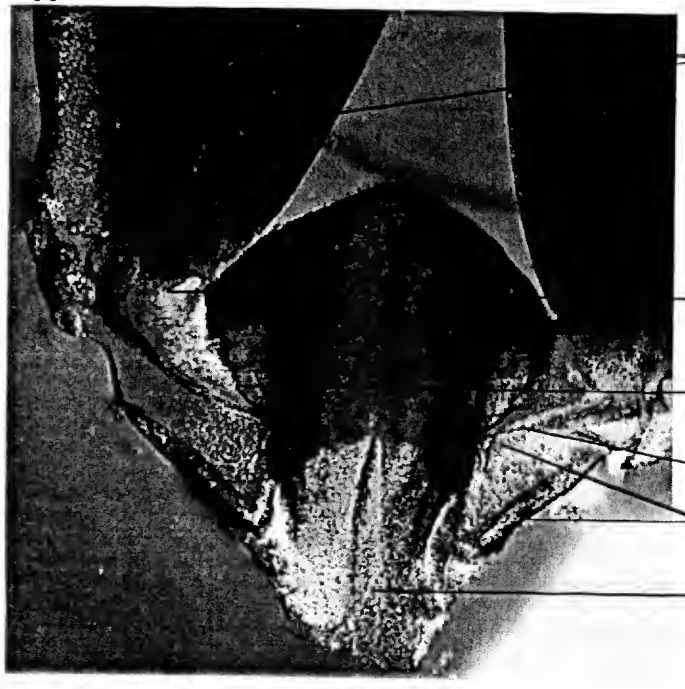
Cavity (tube) entrance.

Extent of outward development of under surface.

Bottom of upper surface.

Magnified approximately 65 X.

Upper Surface View ↓



Pollinia.

Caudicle.

Translator and Caudicle entering tube in side of retinaculum.

Caudicle arm.

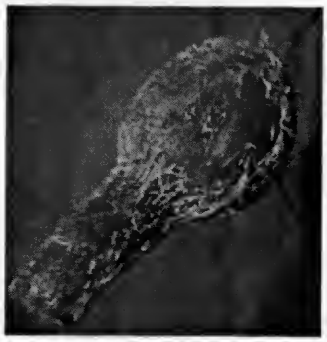
Translator.

Upper surface of retinaculum, outer apical area.

Magnifier approximately 65 X.

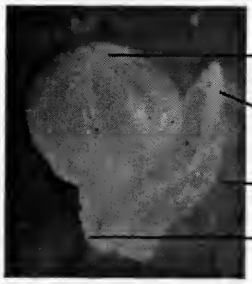
Pollinarium Development Stages

Stage 1: Hoya kerrii Craib.



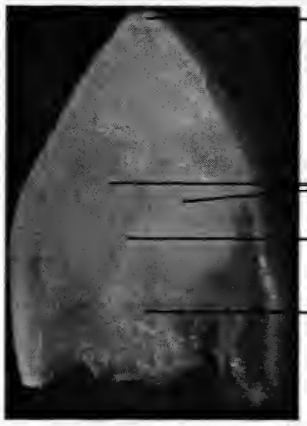
In the very early flower bud stage, prior to any secretion of retinacular structure, the two pollen masses are present in the anther envelopes. At this is time they are not yellow but rather pale cream colored. The anther and stylar table are structurally visible. At this stage no coronal development is visible.

Tight bud stage, 0.34 cm. long x 0.23 cm. widest.



Outer surface of anthers with calyx and corolla pealed back.
Corolla loosened from bud.
Sepal of calyx pealed back from bud.
Pedicel.

Same bud as above approximately 16X magnification.



Anther inner apex, proximal surface.

Pollinia within anther sacks (envelopes).

Side where germinal mouth (sterile edge) forms.

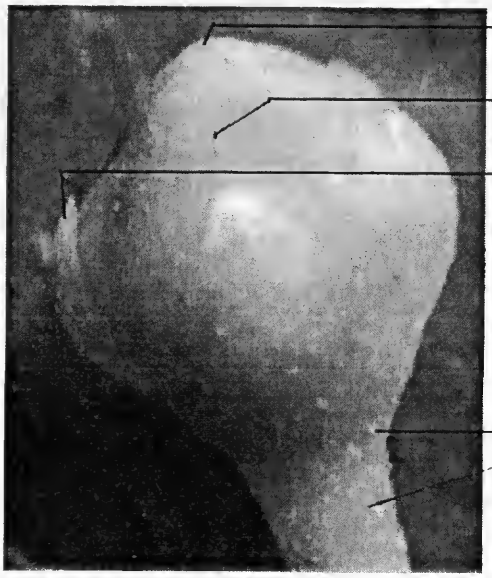
Area of attachment to the edge of the stylar table.

Stage 2:

The first visible presence of a retinaculum begins just as the bud begins to swell and the apex of the corolla begins to protrude above the calyx. The upper surface of the retinaculum is secreted first and at this early stage is only present as two thin slivers of darkened tissue connected at the inner end. The translators and caudicle are not present. The pollinia have further enlarged and have become pale yellow in color. In addition the crown has begun to develop (although still colorless).

Anther magnified approximately 16X, with calyx and corolla removed or pealed back. Stained to enhance detail.

Stage 3: Parts shown are from *H. kerrii* Craib.



Bud apex.

Corolla lobes still fused.

Sepal (calyx) apex.

Pedicel.

Bud magnified approximately 35X
0.38 cm. tall x 0.45 cm. diameter.

Anther apex.
Corolla.
Pollinium.
Apex of inner coronal lobe.
Retinaculum shown in bottom photo.
Anther appendage.
Outer coronal lobe just beginning development.
Calyx

Pedicel

Bud as above with sepals and corolla removed and one anther removed exposing pollinium and retinaculum.

Anther (wing) with two pollinia still enclosed in envelopes (sacks).

Pollinium (two).

Measurements: base 0.09 cm; height 0.13 cm.

By the time the bud swells to where the calyx reaches approximately half way to the bud apex the retinaculum appears as shown in this photomicrograph magnified approximately 16X. Here the translators are developing but not fully formed. The caudicle is just starting to develop (the bulbous end that eventually envelopes the lower end of the pollinia). In addition the retinacular lower surface has not been fully secreted by the fused stigmas.

Stage 4: At the time the flower is beginning to open the pollinia are released from the anther envelopes and adhere to the gelatinous sticky caudicle. The caudicle in turn is supported by the triangular translator arm which lies in the groove where the anther adheres to the edge of the stylar table.

Terminology

Excerpts From Historical Usages of Terms Pertaining to Hoya Pollinarium

Over time, various terms have been used for the different parts of the male reproductive structures. See my labeled photo page 9 of the parts involved.

The oldest reference I have is Vahl's 1810 use of the term "***corpusculi***" for the secreted central holder. Vahl applied this term in the description of the species Sperlingia verticillata, now determined to be *Hoya verticillata* (Vahl) G. Don. I would assume on the basis of priority alone, this term would be the most appropriate to use, however priority does not necessarily apply in such cases. I had preferred and used the term "***retinaculum***", much used by Schlechter, and others. This latter term was also used by Blume in Rumphia IV 1848.

In regard to the pollen which is in coherent masses the designation "***massae pollinis***" was applied in 1811:84 in Anton's Hortus Kewensis and repeated by many subsequent authors (in Latin or English) up to the present time. The secreted connection of the pollen masses and the corpusculum has gone by various names. It was King and Gamble in 1901:559 (Flora of the Malay Penn.) who said "attached by caudicles of various shapes". In reality the pollinia are attached at their base by a sticky, usually clear gelatinous mass, best termed a "***caudicle***". It must be noted this structure may be fused to the underlying structure and barely visible. This structure is supported in many cases by a more rigid wedge shaped structure that I have labeled a translator or translator arm (not originated by me). It is the upper slightly concave surface that supports the caudicle in most cases.

The term translators appears in Perkins (Fragmantia Fl. Philipp.) by Schlechter & Warburg. It is repeatedly used in many German descriptions i.e. Wettstein, Schumann & Lauterbach et al.

Confusion as to what is refereed to by the use of "***pollinia***" for the structure enclosing the pollen but also used for the whole male structure is unfortunate. Forster and Liddle have used the term "***pollinarium***" for the whole structure 1990 in A checklist for the Genus Hoya R. Br. (Asclepiadaceae) in Papuasia. As far as I can determine this term was used by Lynch 1977 for descriptions in the Genus Asclepias.

The following is an attempt to put into dated sequence the use of the various terms in regards hoya:

1810 "Germinia duo sub centro *corpusculi*" 114 **Vahl**: in Gkrivter af Naturhistorie-Gelskabet.

1811 " *Massae Pollinis...*" 84 in **Aiton**'s Hortus Kewensis.

1825 " *Massae pollinis* ....." 1062 **Blume**: in Bijdagen tot de Flora van Nederlandsche Indie.

1837 "*pollen masses* fixed by the base, ..." 125 and "*pollen masses* erect, fixed by the base to the back of the *corpuscles*" 128 in **G. Don** General Sys. of Gardening and Botany.

1844 "*Massae pollinis* erectae, approximatae, ad *corpusculi* dorsum basi affixae" 663 et al, and " saepius *margine pellucidae*" 634 in **Decandolle**, Prodramus Sys, Veg..

1848 " Massae pollinis..." 310 in Fleur des Serres. VI

1848 "*Pollinia* basi affixa" and "*Retinacula* minutissima .....*pollinia* ..... basi affixa" et al 50 and *Retinacula* emarginaturis stigmatis.....*Pollinia* clavata .....cornibus *retinaculi* affixa." 51 **Blume**: in Rumphia IV.

1852 " *Pollinia* basi affixa....." 64 **Walpers:** in Annales Botanices Systematicae.

1865 "*Massae pollinis* ..." 159 **Muller:** in Fragmenta Phytographiae.

1883 "*pollen- masses* 2 to each anther,.." 319 **Bailey**: in Synopsis of the Queensland Flora.

1883 "*pollen-masses* various ....." 52 **Hooker**: in Flora of British India.

1895 " *pollen masses* ...." 162 **Trimen:** in Handbook of the Flora of Ceylon.

1901 "*pollen-masses* 1 in each anther call, erect, waxy, usually flattened, often thickened on the outer margin, attached by *caudicles* of various shapes, ...to the horny hard *pollen carriers*." 559 et al **King & Gamble:** in Jour. of the Royal Asiatic Soc., Bengal Branch. A lot of attention has been given in their species descriptions to variations in the *caudicles* e.g. conical "pollen carriers" and "cup-like caudicles."

1902 "*pollen masses* waxy" 320 **Collett & Hemsley** in Flora Simlensis.

1903 "*Pollinia* basi affixa ....." 478 et all in Plantae Hochrutineranae.

1904 "*polliniis* compressis oblique oblongis, *translatoribus* prebrevibus diatis, *retinaculo* ..." 131 et al and "caudicululis ..." 133 **Schlechter & Warburg:** in Fragmentia Florae Philippines.

1905 " *polliniis* oblique oblongis, *translatoribus* brevibus, *retinaculo* rhomboideo...." 362 et al **Schumann & Lauterbach:** in Nachtrage Zur Flora der Deutschen Schutzgebieten.

1911 "*Pollinien. Translatoren* mit klemmkorpern." 450 **Wetstein:** in Handbook Sys. Botanik.

1912 " *masses polliniques* oblongues, attachees par des *caudicules* en coupe a un *retinacule* ..." 9 et al **LeConte:** in Flore Gen. De L Indo-chine.

1912 "*pollen-masses* 1 in each cell." 380 **Merrill:** in A Flora of Manila.

1920 " *polliniums* solitary.." **Fyson**: in Flora of the Nilgiri & Pulney Hill Tops.

1922 " *Pollinia* 1 in each cell, ..." 561 **Haines:** in Botany of Bihar & Orissa.

1923 " *pollen* in waxy masses" 208 **Parkinson:** in A Flora of the Andaman Islands.

1923 " *pollen masses* erect .....attached by distince *caudicles* to the horny *pollen carriers*" 848 **Gamble:** in Flora of the Presidency of Madras.

1923 " *Pollinia* single, waxy with short thick *caudicles*." 394 **Ridley:** in Flora of The Malay Penn..

1956 " *pollen masses.... corpuscula* cornea ..." 462 **Henry:** in Journal Bombay Natural History Society 75.

1960 "*Pollinia* erect from dark horny *corpuscula....*" **Pham-Huong:** Flora du Vietnam.

1965 " *pollinia* solitary ...." 751 **Ohwi:** in Flora of Japan.

1965 " *pollinium* solitary in each anther cell, erect, often pellucid-margined on one side" 266 **Backer** in Flora of Java.

1973 "*pollen -masses.....*" 50 in **Huber:** A Revised Handbook of the Flora of Ceylon.

1974 " *polliniis* in quoque loculo solitariis..... *caudiculis* erectis brevissimis, *retinaculo* oblongo,....." 126 **Tsang & Li:** in Acta phytotaxinomica 12 #1.

1976 " *Pollinia* erect from dark horny *corpuscula*, 2 anther, waxy without pellucid margins." 449 **Saldanho & Nicholson**: in Flora of Hassan Dist. Karnataka India.

1978 " *Twin-Pollinia*" ..... "both *pollinia* and *caudicles* are winged with *caudicle* wings being very broad" 475 and "*pollen masses* known as *pollinia*: .... by secretions of the stigma which produce the *caudicle* and *corpuscule*" **Rintz:** in Malay Nature Journal.

1984 " *pollinia* ..... marginem pellucida...., *caudiculis* brevibus..., *retinacula* elliptico..." 119 **Li:** in Bull. of Botanical Research IV.

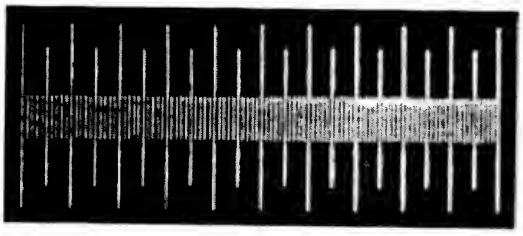
1990 "large *pollinarium*: 5 **Forster & Liddle:** A Checklist for the Genus Hoya R. Br. (Asclepiadaceae) in Papuasia.

1992 "*pollen in pollinia.*" 596 in Royal Hort. Soc. Dictionary of Gardening 2.

1992 "*Pollinarium* 1.3-1.4 mm long , 1.2-1.3 mm wide; *pollinia* oblong, 1.12-1.15 mm long, 0.35-0.42 mm wide, with *pellucid germination mouth* on outer edge; *corpusculum* ovate, 0.8-0.9 mm long, 0.55-0.58 mm wide; *caudicles* 0.30-0.35 mm long, ..." 629 et al **Forster & Liddle:** in Austrobaileya 3(4): 627-641.

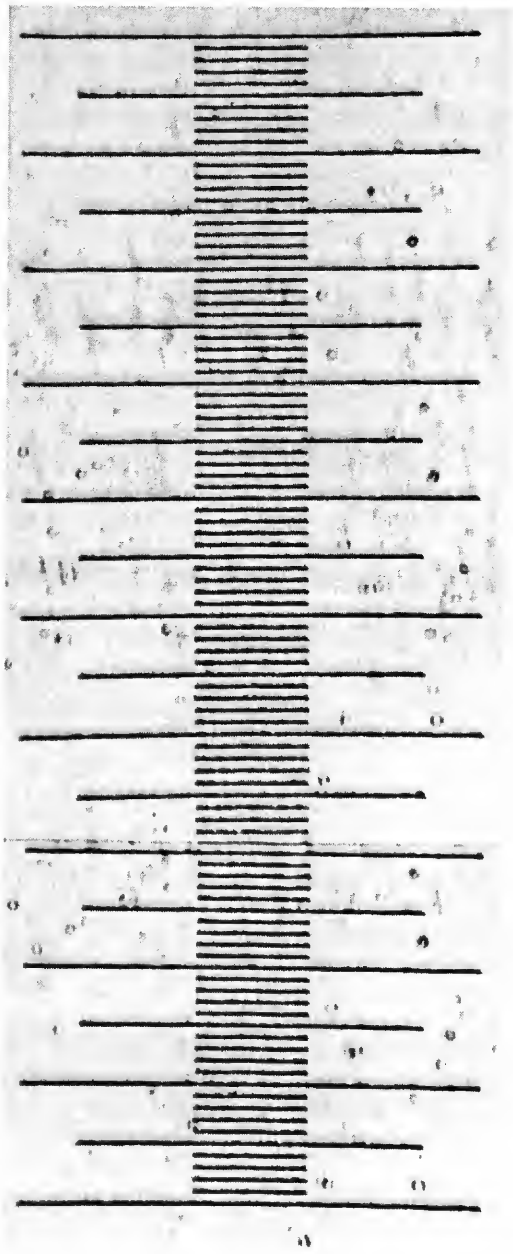
Measuring Gauge

100 micron (1 mm.) scale imbedded in slide.



Magnified 65 times.

The above type magnified scale, and the one on the following page, were used in measuring the pollinaria features in this study. The scale is one millimeter long, divided into 100 segments, on a microscope slide covered with a cover slip. Measurements can be made direct at the time of viewing, or of the enlarged photos.

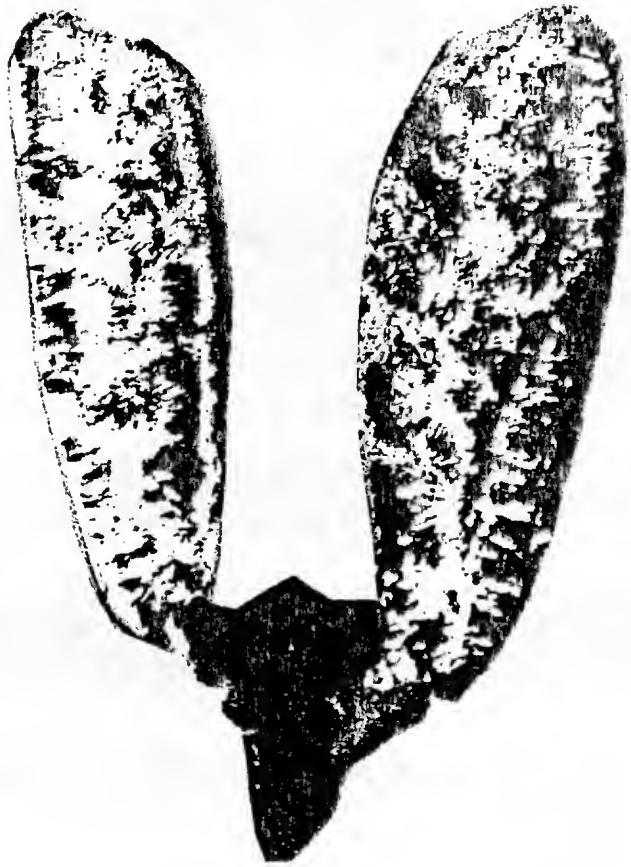


One millimeter scale magnified approximately 160 times.

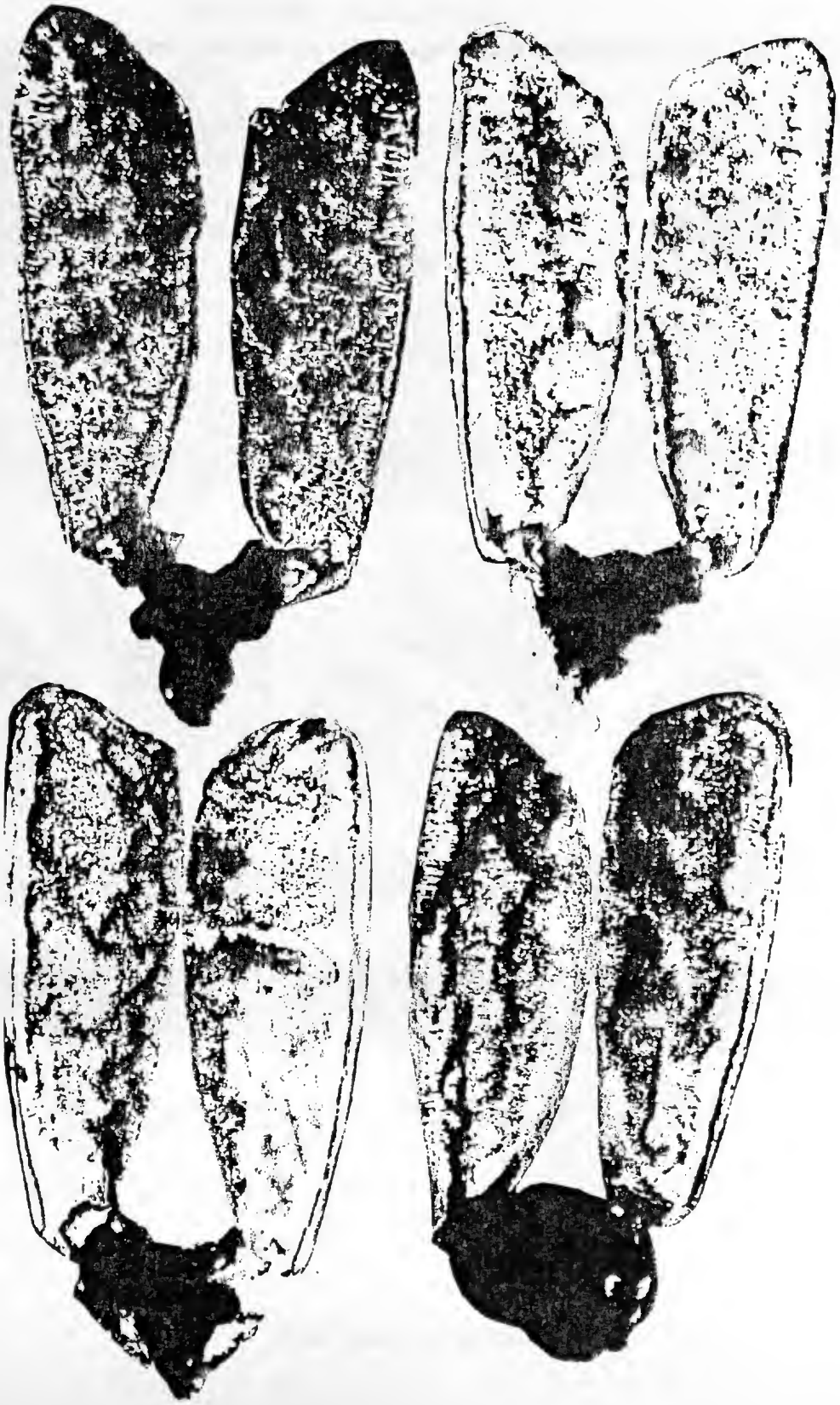
Hoya kerrii Craib 1911

The five pollinarium from one flower.

	Length (Pollinium)			Width		
#	Right	Left	Difference	Right	Left	Difference
1	0.57 mm.	0.57 mm.	0.00 mm.	0.19 mm.	0.19 mm.	0.00 mm.
2	0.58 mm.	0.59 mm.	0.01 mm.	0.19 mm.	0.19 mm.	0.00 mm.
3	0.56 mm.	0.56 mm.	0.00 mm.	0.19 mm.	0.19 mm.	0.00 mm.
4	0.57 mm.	0.59 mm.	0.02 mm.	0.19 mm.	0.19 mm.	0.00 mm.
5	0.59 mm.	0.55 mm.	0.04 mm.	0.20 mm.	0.16 mm.	0.04 mm.

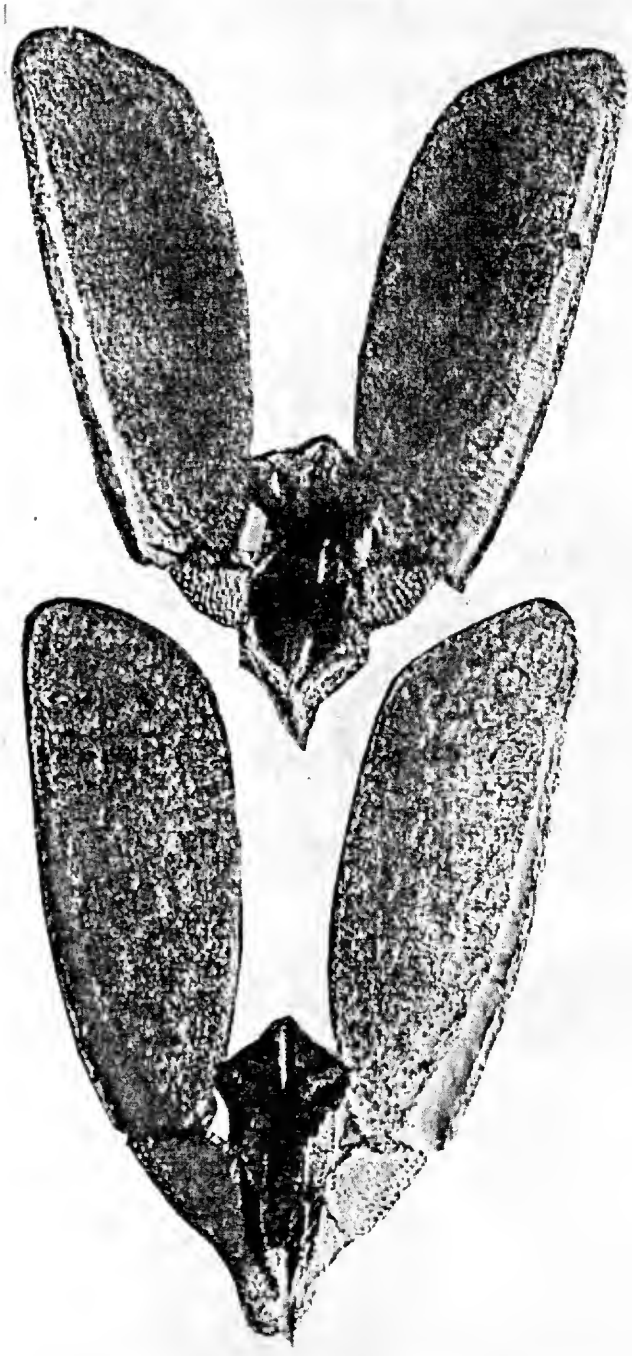


All pollinium here magnified approximately 160X. Above is pollinium #5. On the following page arranger left to right top to bottom is #1, #2, #3 and #4. There is as to be expected some slight differences in development of the various parts giving rise to different measurements. In addition differences in focal depth and positioning of parts after removal from the flower also may contribute to some differences.



Comparison of Pollinaria

***Hoya merrillii* Schltr., flowerings of five (5) different years at Fresno, Calif..**



1990 flowering.

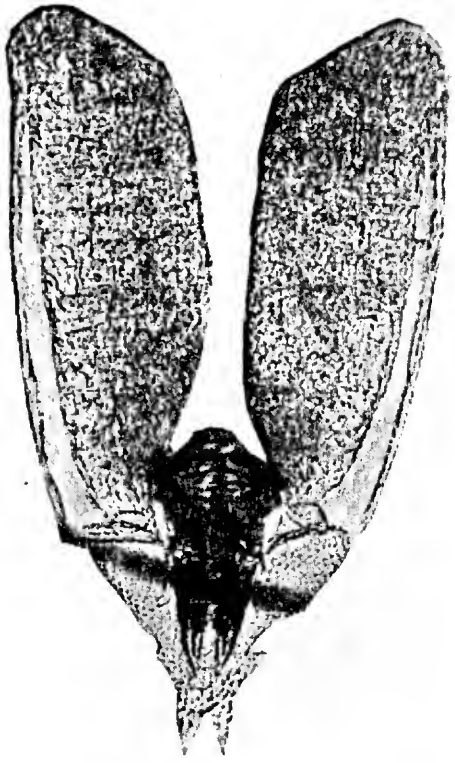
1991 flowering

Pollinaria magnified approximately 160X.

1992 flowering.

1993 flowering.

Pollinaria magnified approximately 160X.



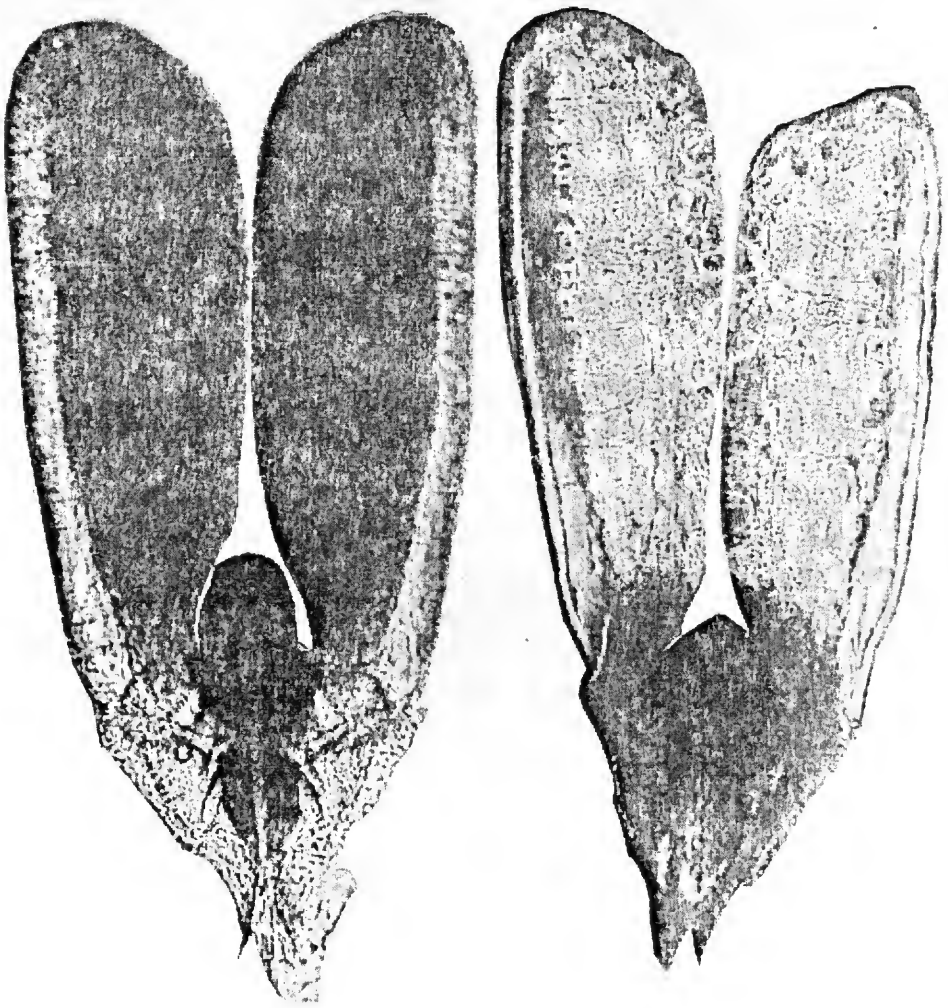
1994 flowering.

Pollinarium magnified approximately 160X.

There appears to be slight variations in the pollinarium of one clone flowered in different years. Some variation in photos results from the focal plane selected. The thickest structure, the retinaculum, gives the most difficulty since the head may rise above the plane of the pollinia. This difference gives rise to photos that appear different but are actually views of different depths on the same object. I was surprised at minimal variation when the results of this study was completed and assembled. There is always variation in the amount of undifferentiated material clinging to the outer apical area of the retinaculum and sometimes along the translators.

Comparison of Pollinaria

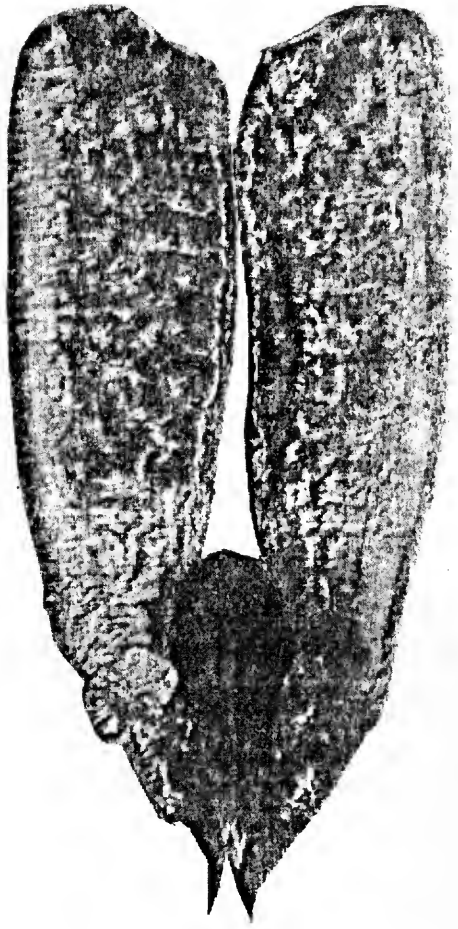
Hoya sp. 80-03, flowered at three (3) different locations.



Flowered at Kaaawa, Hawaii

Flowered at Fresno, Calif..

Pollinaria magnified approximately 160X.



Flowered in Central Point, Oregon.

Magnified approximately 160X.

The pollinia flowered at different locations show slight variation, but are recognizable as from the same species. The right pollinia on the Fresno flowering appears shorter but is the result of being skewed slightly toward the outer apex. As with flowerings of different years most variation shown here is the result of focal plane choice. It actually takes a number of photos to determine precisely any variations involved.

Scanned Photos of Pollinarium

On the following pages I present my present data base of microscopic photos of Hoya pollinarium compiled from various sources as mentioned in the "Acknowledgment" section. I have attempted to present these in some rational order, but this I find difficult. In the majority of cases the taxa is presented with magnifications of about 160 times (160X) normal size. Since not all photos were made at this magnification it was necessary to present some at the smaller magnification of 65 times (65X) normal size. I have included some taxa in both magnifications so that a reference size can be observed.

As stated in Materials and Methods the most disconcerting problem that has arisen, is viewing (and thus photographing) the retinaculum. This structure has thickness (depth of field) which makes it most difficult to present a photo or composite to represent the structure in its entirety. This is especially true as magnifications become larger where details are revealed in the other structures of the pollinarium, and measurements are thus more precise.

Note: see index page 257 for alphabetical listing of species pollinarium.

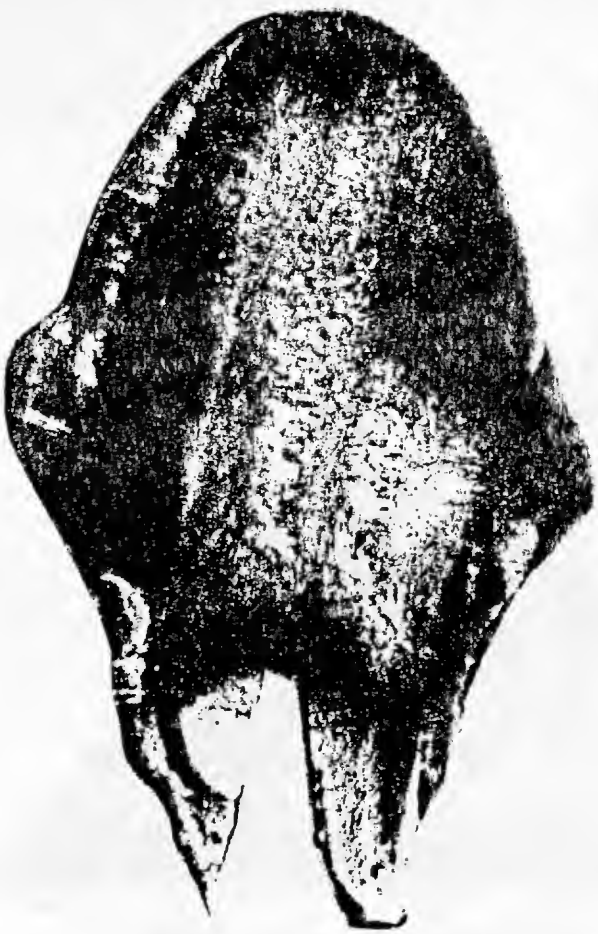
Section Rudimentalia Kloppenburg

The following two Hoya species have very short rudimentary sterile edges (germinal mouths) on the outer edge of the pollinium. Dr. Rintz felt that *Hoya mitrata* Kerr did not have a sterile edge. (His term for this edge was "winged"). I have examined two clones of this species and have observed on close examination that both had a short edge present. As a result I have concluded that Dr. Rintz just overlooked this edge, possible due to viewing the pollinarium at too low a magnification. At any rate the rudimentary edge is visible in both of the two species presented here. These are *Hoya darwinii* Loher and *Hoya mitrata* Kerr.

In many species the inner end of this sterile edge (the edge furthermost from the caudicle) seems to flow into the pollinium margine, whereas the edge nearest the caudicle often ends in an abrupt manner, extending above the pollinium apparent margine. In both the above species the sterile margine is raised above the margine and both ends end abruptly.

This seems to be a transitional type between those species without a pellucid edge and those species with a more developed edge.

Hoya darwinii Loher 1910
Flowered in Hawaii via TG.

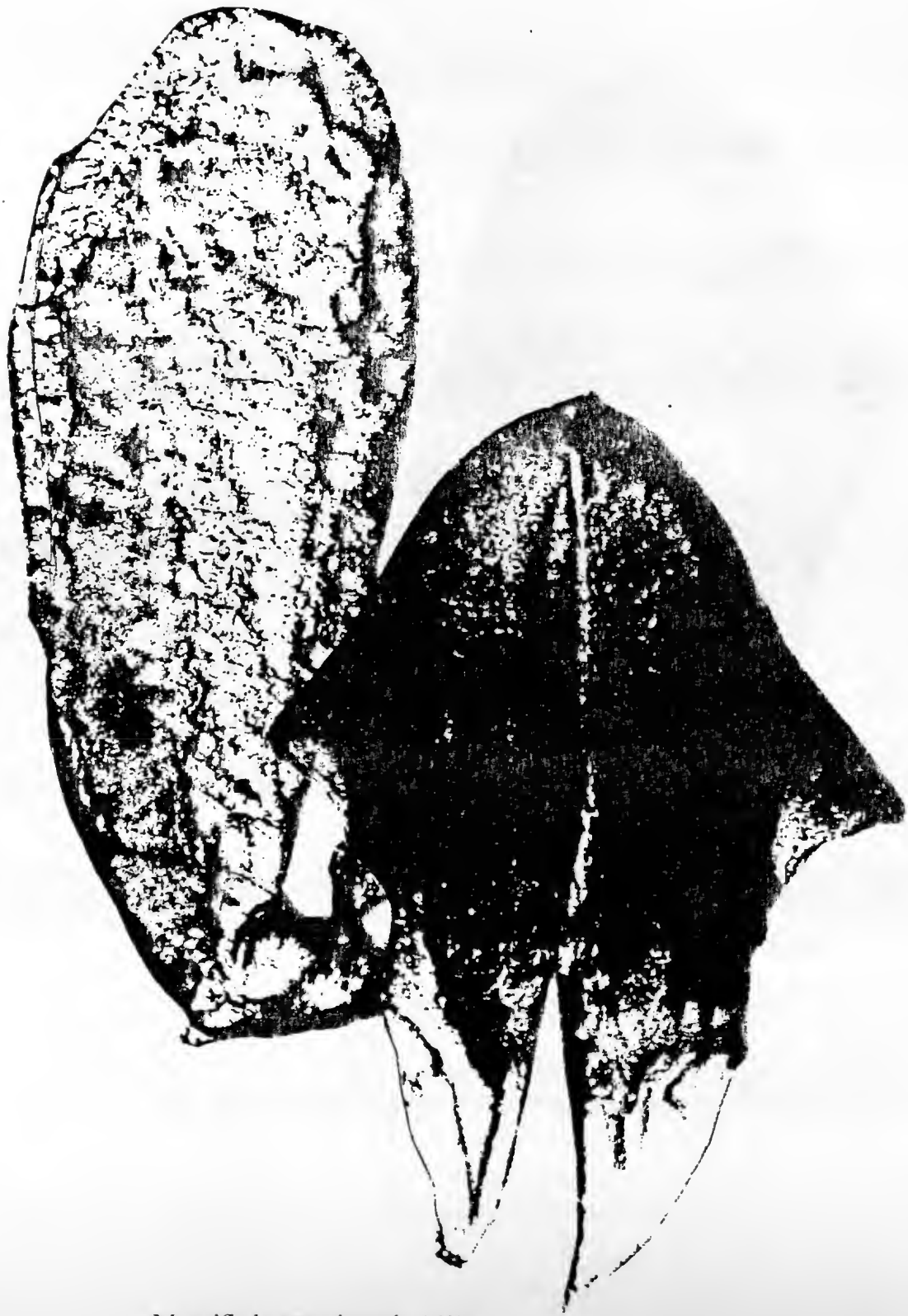


Magnified approximately 160X.

Magnified approx. 65X.

Pollinium: length 0.92 mm.; widest 0.44 mm..
Retinaculum: length 0.57 mm.; shoulder 0.50 mm.; extensions 0.21 mm..

Hoya mitrata kerr 1940
via CT, Thailand.



Magnified approximately 160X.

Hoya mitrata Kerr 1940
Flower from CT, Thailand.

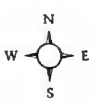
Magnified approximately 65 X

Pollinium length 1.06 mm.; widest 0.44 mm.
Retinaculum length 0.80 mm.; shoulder 0.68 mm.; waist 0.30 mm.; hip 0.35 mm.; ext. 0.13 mm.
Translators 0.30 mm.; depth 0.06 mm.
Caudicle linear ?

Other Large Pollinarium

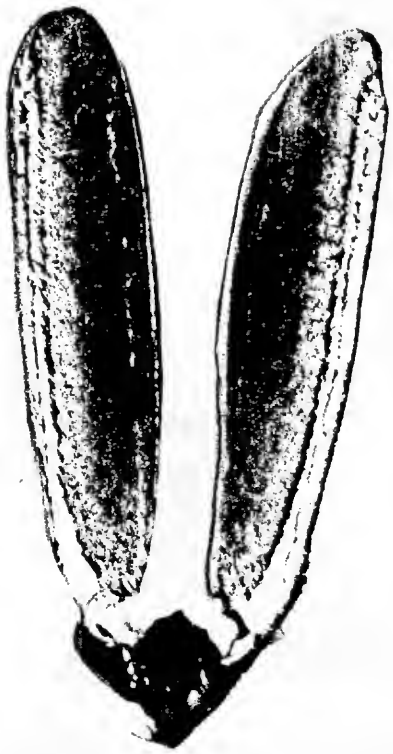
In my data files there are several other taxa with very large pollinarium. These have pollinia that measure close to 1 mm. in length, i.e. greater or slightly less. The longest pollinium I have so far photographed is *Hoya multiflora* Blume. The largest (most mass) has been *Hoya albiflora* Zipp. ex Blume. The others are *Hoya lobbii* Hooker f., *Hoya elliptica* Hooker f., *Hoya imperialis* Lindley, *Hoya coriacea* Blume, *Hoya pruinosa* Miquel (see the pollinarium of this species under the Section Acanthostemma grouping) and *Hoya guppyi* Oliver (an Section Eriostemma Schlechter species).

The species with large pollinaria are not confined to one area but seem to be geographically widely distributed. The two prior species, *Hoya darwinii* Loher is from the Philippines, *Hoya mitrata* is centered around Thailand where *Hoya lobbii* Hooker f. and *Hoya obtusifolia* Wight are also found. *Hoya elliptica* Hooker f. is found here and also further south. Thus there is some concentration in the Thailand area of these species with very large pollinarium. *Hoya albiflora* is centered in Java and *Hoya guppyi* Oliver is from the Solomon Islands. *Hoya multiflora* Blume has a very wide distribution. *Hoya imperialis* Lindley is reported by Dr. Rintz from (Malaya) Jahore, Malaka, Perak and Selangor. The Type species is supposedly from Sarawak ? Borneo and Dr. Merrill's specimen is from Tawao. It has recently (1994) been found to be endemic also to the island of Palawan. *Hoya coriacea* Blume likewise in 1994 was found on this island. It has been reported from Java, Sumatra, Borneo and the Malay Peninsula. It differs in distribution also in not being confined to coastal areas. *Hoya pruinosa* Miquel (syn. Hoya curtisii K & G) is a very small leafed plant with a very long pollinium. This species is also endemic to the island of Palawan, New Guinea and if the synonymy is correct, to Malaya. As can be readily deduced, size does not confer uniformity and all these pollinium are different and distinct.



Hoya multiflora Blume 1823

Flowered at Fresno CA from silvered leaf clone labeled "True".



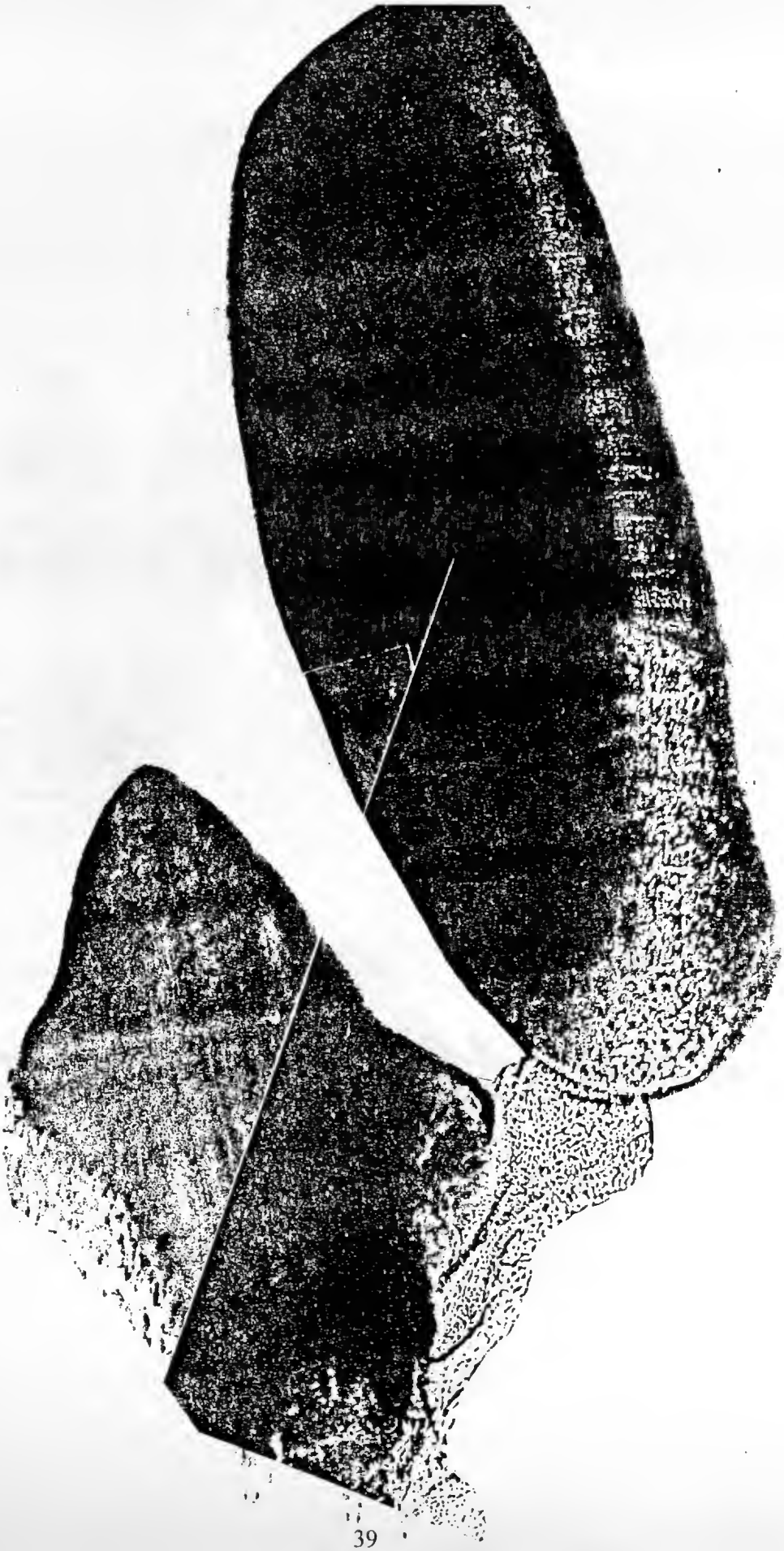
Pollinium		
	length:	1.27 mm.
	widest:	0.28 mm.
Retinaculum		
	length:	0.20 mm.
	shoulder:	0.19 m.
	waist:	0.07 mm.
	hip:	0.12 mm.
	ext.:	0.07 mm.
Translators		
	length:	0.22 mm.
	depth:	0.03 mm.
Caudicle		
	bulb. diam.:	0.10 mm.

Magnified approximately 65X

Hoya albiflora Zipp. ex Blume 1848
Flower via AW.

Magnified approximately 160X
This is one of the largest of all Hoya pollinarium, here only the retinaculum is shown. On the following page is a composite with one pollinium at 160X magnification. Note that the caudicle has surface granulations, whereas in most cases it is clear. The translators top broad surface is fairly discernible in this picture.

Pollinium length: 1.22 mm.; widest: 0.45 mm. (not shown here).
Retinaculum length: 0.61 mm.; shoulder: 0.50 mm.; waist: 0.22 mm.; hip: 0.22 mm.; extensions: 0.18 mm..
Translators length: 0.25 mm.; depth: 0.04 mm..
Caudicle bulb diameter: 0.09 mm.



Hoya lobbii Hooker f. 1883
via CT, Thailand.

Pollinium
length: 1.05 mm.
widest: 0.34 mm.
Retinaculum
length: 0.46 mm.
shoulder: 0.40 mm.
waist: 0.28 mm.
hip: 0.30 mm.
ext.: 0.10 mm.
Translators
length: 0.33 mm.
depth: 0.09 mm.
Caudicle
bulb. diam.: large

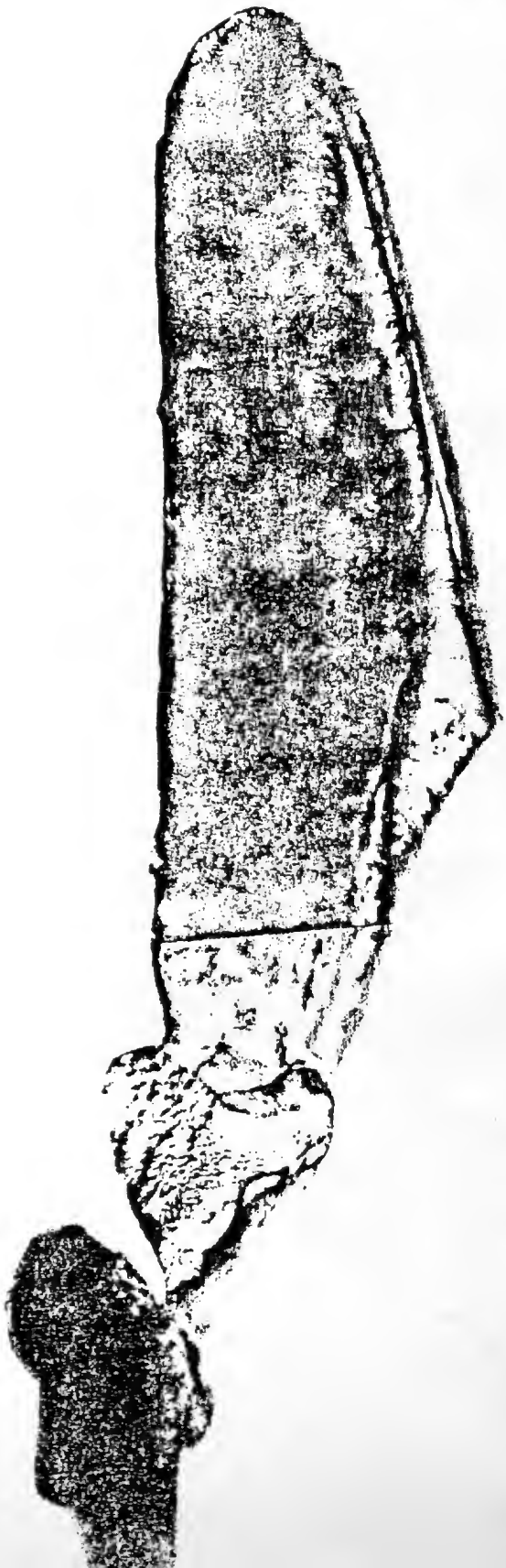
Magnified Approx.
160 X

Hoya obtusifolia Wight 1834
Preserved flower from CT, Thailand.

Pollinium	
length:	1.06 mm.
widest:	0.32 mm.
Retinaculum	
length:	0.31 mm.
shoulder:	0.16 mm.
waist:	0.07 mm.
hip:	0.15 mm.
ext.:	0.10 mm.
Translators	
length:	0.20 mm.
depth:	0.06 mm.
Caudicle	
bulb. diam.:	0.14 mm.

Magnified approximately 65X.

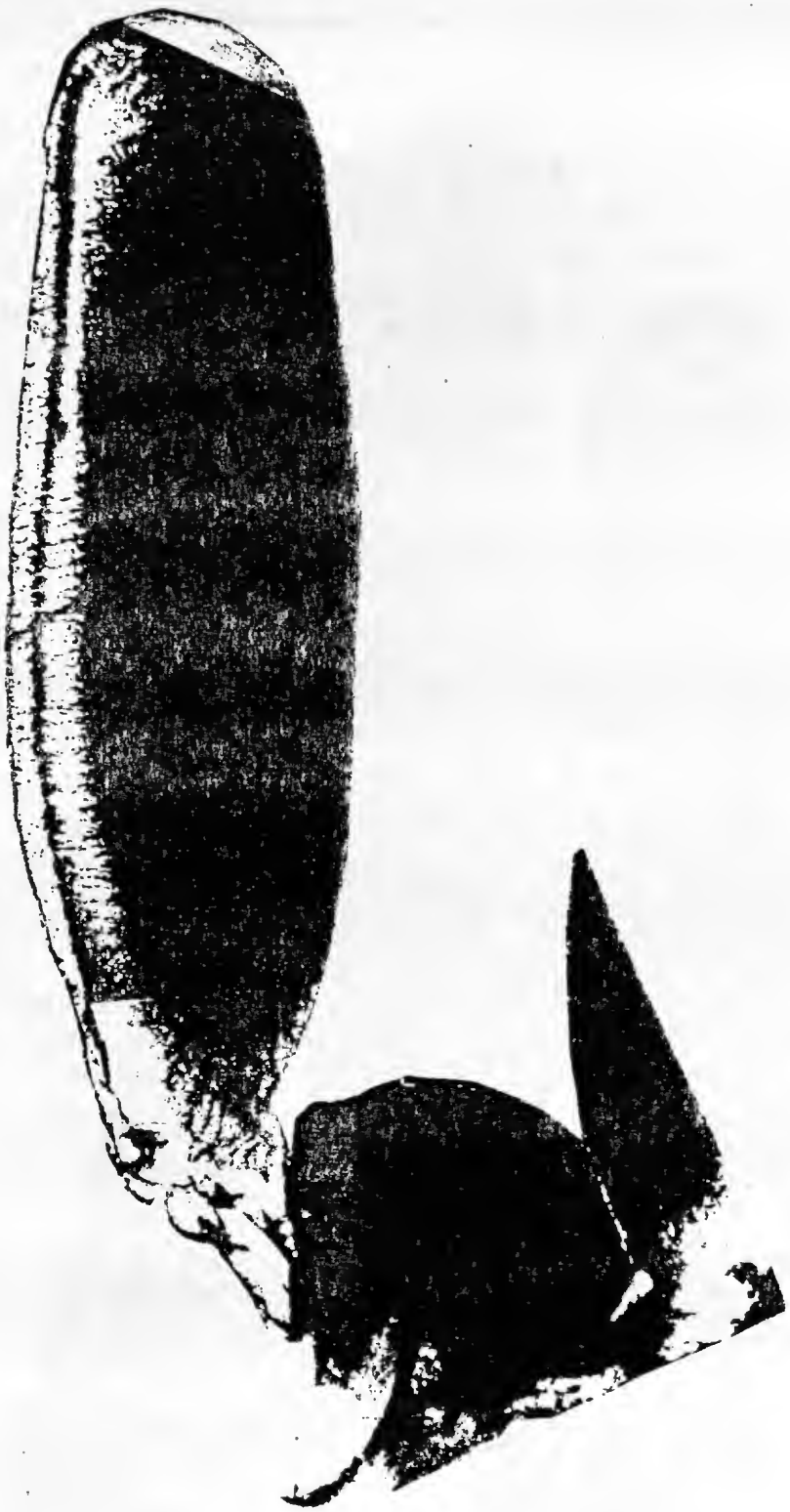
Hoya elliptica Hooker f. 1883
via CT, Thailand.



Pollinium
length: 1.07 mm.
widest: 0.34 mm.
Retinaculum
length:
shoulder:
waist:
hip:
ext.:
Translators
length: 0.32 mm.
depth: 0.04 mm.
Caudicle
bulb. diam.: oval ca. 0.15 mm.

Caudicle opaque.

Magnified approximately 160X.

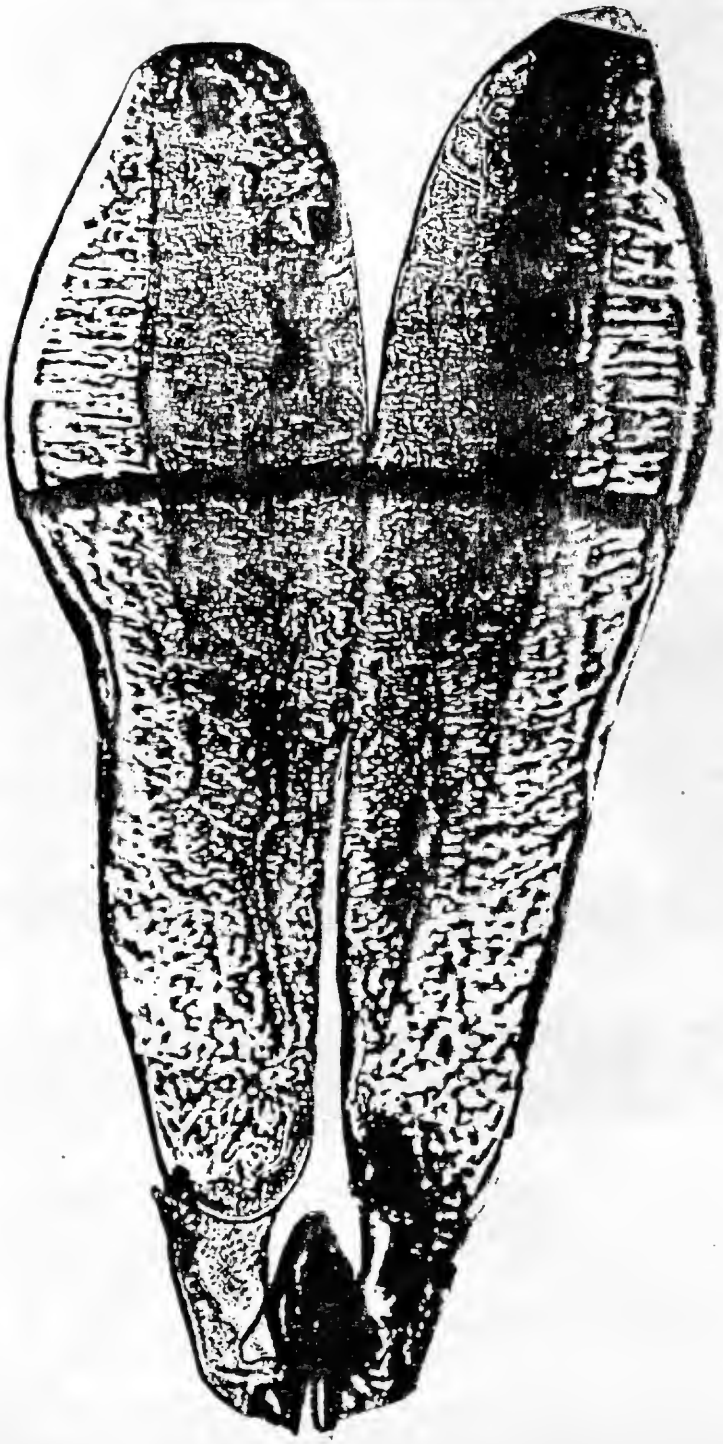


Hoya imperialis
Lindley 1846
Flower from clone at Sebang, Palawan via TG.

Pollinarium
length: 1.02 mm.
widest: 0.30 mm.
Retinaculum
length: 0.29 mm.
shoulder: 0.32 mm.
waist: 0.17 mm.
hip:
ext.: 0.10 mm.
Translators
length: 0.22 mm.
depth: 0.04 mm.
Caudicle
bulb diam.: 0.13 mm.

Magnified aprox. 160X

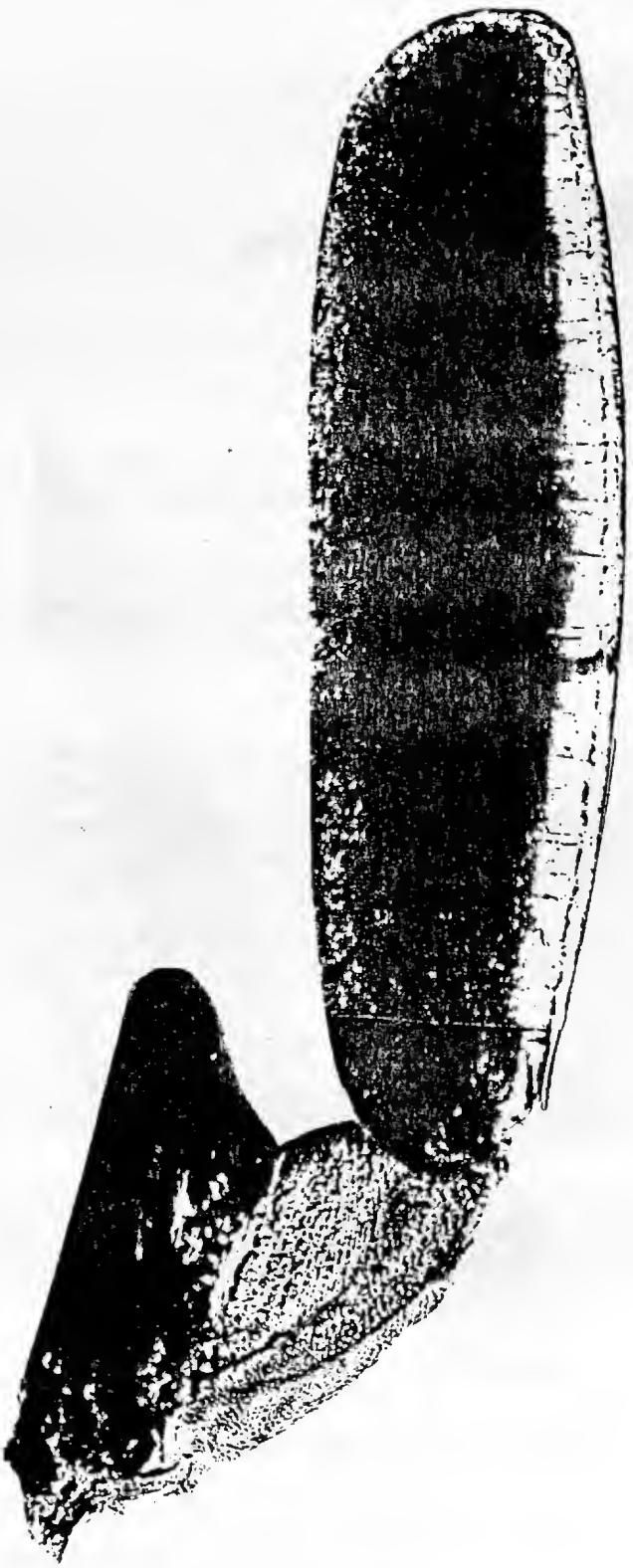
Hoya pruinosa Miquel 1856
Flower via TG. Syn. *H. curtisii* K & G.
Section Acanthostemma Subsection Angusticarinatae.



Pollinarium
length: 0.97 mm.
widest: 0.28 mm.
Retinaculum
length: 0.09 mm.
shoulder: 0.09 mm.
waist: 0.06 mm.
hip: 0.04 mm.
ext.: 0.09 mm.
Translators
length: 0.20 mm.
depth: 0.03 mm.
Caudicle
bulb diam.: 0.08 mm.

Magnified approximately 160X

Hoya coriacea Blume 1826. Flower from AW 8/92



Pollinarium

length:	0.99 mm.
widest:	0.27 mm.

Retinaculum

length:	0.46 mm.
shoulder: ?	0.30 mm.
waist:	0.14 mm.
hip:	0.16 mm.
ext.:	0.09 mm.

Translators

length:	0.37 mm.
depth:	0.03 mm.

Caudicle

bulb diam.:	0.16 mm.

Magnified Approximately 160X

Polliniaria Grouped Around 0.75 mm. Long

Pollinarium with pollinia lengths centered around 0.75 mm. long are numerous. In this arbitrary group I have placed species with pollinium 0.80 mm. long to 0.70 mm. long. Here we find *Hoya tompsonii* Hooker, Hoya sp. CI #3, *Hoya arnottiana* Wight, Hoya sp. 297 ex India, Hoya species BSI #1 (subcalva ?), *Hoya loyceandrewsiae* Green, *Hoya apiculata* Scheff. ?, *Hoya bella* Hooker, *Hoya serpens* Hooker, *Hoya greenii* Kloppenburg, Hoya sp. CAHUP 41932 and *Hoya nicholsoniae* Muller (IML 39).

Following these in length (with pollinium 0.69 mm. to 0.51 mm. long are the following in descending length: *Hoya ischnopus* Schlechter, *Hoya vitensis* Turrell, Hoya cult. Minibella, Hoya cult. shephardell, USDA 354238, Borneo 80-03, *Hoya shephardii* Short ex Hooker, Hoya sp. Tau Is. Samoa, Hoya sp. Sabah Malaya, Hoya sp. PNG #4, *Hoya limonica* S. Moore, Hoya sp. labeled laurifolia, Hoya sp. PNH 5658, Hoya sp. ABG #12, *Hoya cominsii* Hemsley, Hoya sp. Sulawesi (1994), Hoya sp. DAV 819, *Hoya vitellinia* Blume, Hoya sp. Samoa Dbl. (two corollas 10 lobes), *Hoya neoebudica* Guillaumin, *Hoya benguetensis* Schlechter, Hoya sp. Nagtabon, Palawan 1995, *Hoya erythrina* Rintz, *Hoya mucronulata* Warburg and Hoya sp. Bau.

A group of species closely related to *Hoya verticillata* (Vahl) G. Don also have pollinia in this length grouping and are presented separately on pages 114-126.

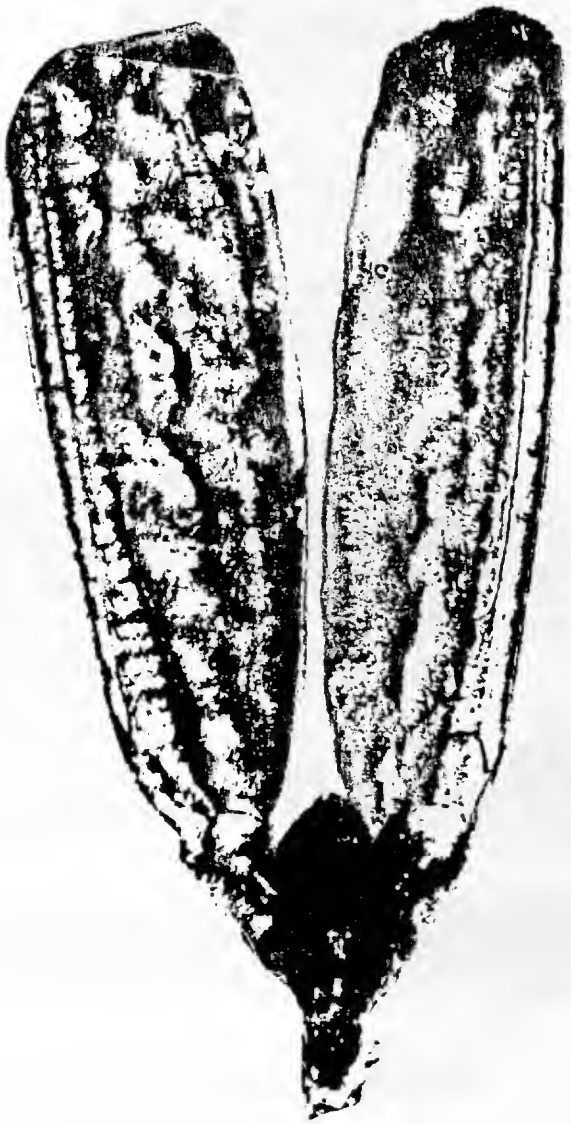
Hoya thompsonii Hooker f. 1883
Flower via CT from Thailand.

Magnified approximately 160 X

Pollinium length: 0.80 mm; widest: 0.25 mm..
Retinaculum length: 0.29 mm.; shoulder: 0.18 mm.; waist: 0.07 mm.; hip: 0.13 mm.; extensions: 0.03 mm..
Translators length: 0.18 mm.; depth: 0.02 mm..
Caudicle bulb diameter: 0.06 mm.

Hoya sp. CI #3

Grown and flowered in Fresno CA.



Pollinium	
length:	0.80 mm.
widest:	0.23 mm.
Retinaculum	
length:	0.16 mm.
shoulder:	0.12 mm.
waist:	0.10 mm.
hip:	0.14 mm.
ext.:	0.04 mm.
Translators	
length:	0.12 mm.
depth:	0.02 mm.
Caudicle	
bulb. diam.:	0.06 mm.

Magnified approximately 160X.

Hoya arnottiana Wight 1834

Flower from AW.

Pollinium		
	length:	0.79 mm.
	widest:	0.31 mm.
Retinaculum		
	length:	0.20 mm.
	shoulder:	0.19 mm.
	waist:	0.13 mm.
	hip:	0.14 mm.
	ext.:	0.05 mm.
Translators		
	length:	0.13 mm.
	depth:	0.02 mm.
Caudicle		
	bulb. diam.:	0.08 mm.

Magnified approximately 160X.

Hoya sp. 297 ex India

Pollinium

length:	0.77 mm.
widest:	0.24 mm.

Retinaculum

length:	0.27 mm.
shoulder:	0.15 mm.
waist:	0.06 mm.
hip:	0.14 mm.
ext.:	0.05 mm.

Translators

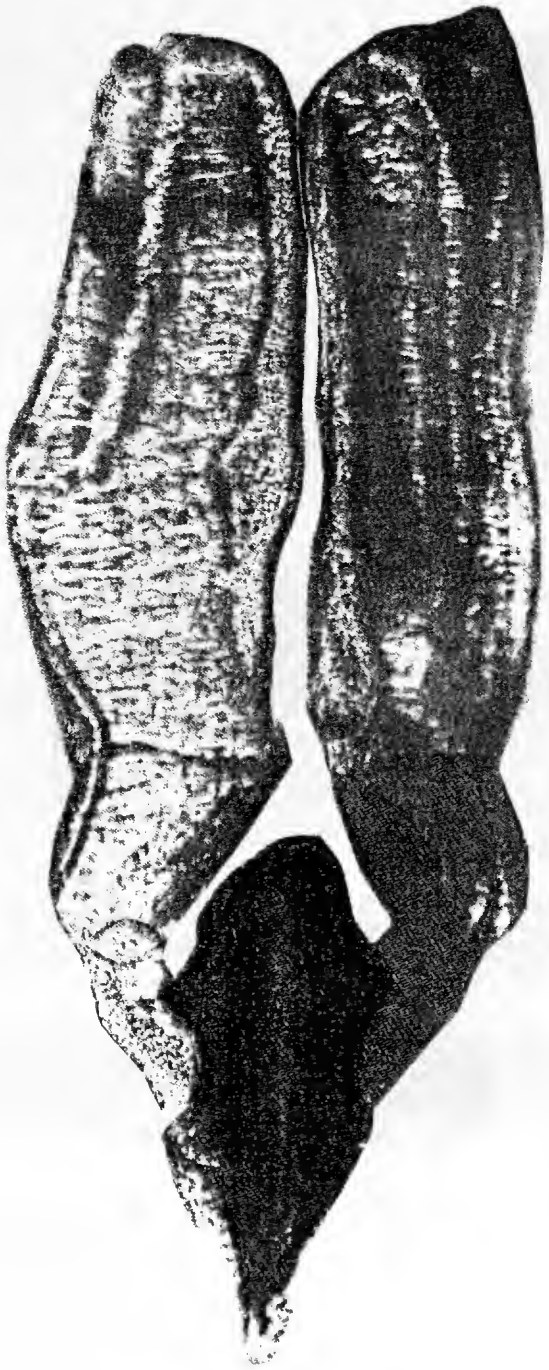
length:	0.14 mm.
depth:	0.03 mm.

Caudicle

bulb. diam.:	?

Magnified approximately 65X.

Hoya sp. BSI #1
via AW.



Pollinium
- length: 0.77 mm.
- widest: 0.20 mm.

Retinaculum
- length: 0.33 mm.
- shoulder: 0.19 mm.
- waist: 0.11 mm.
- hip: 0.16 mm.
- ext.: 0.06 mm.

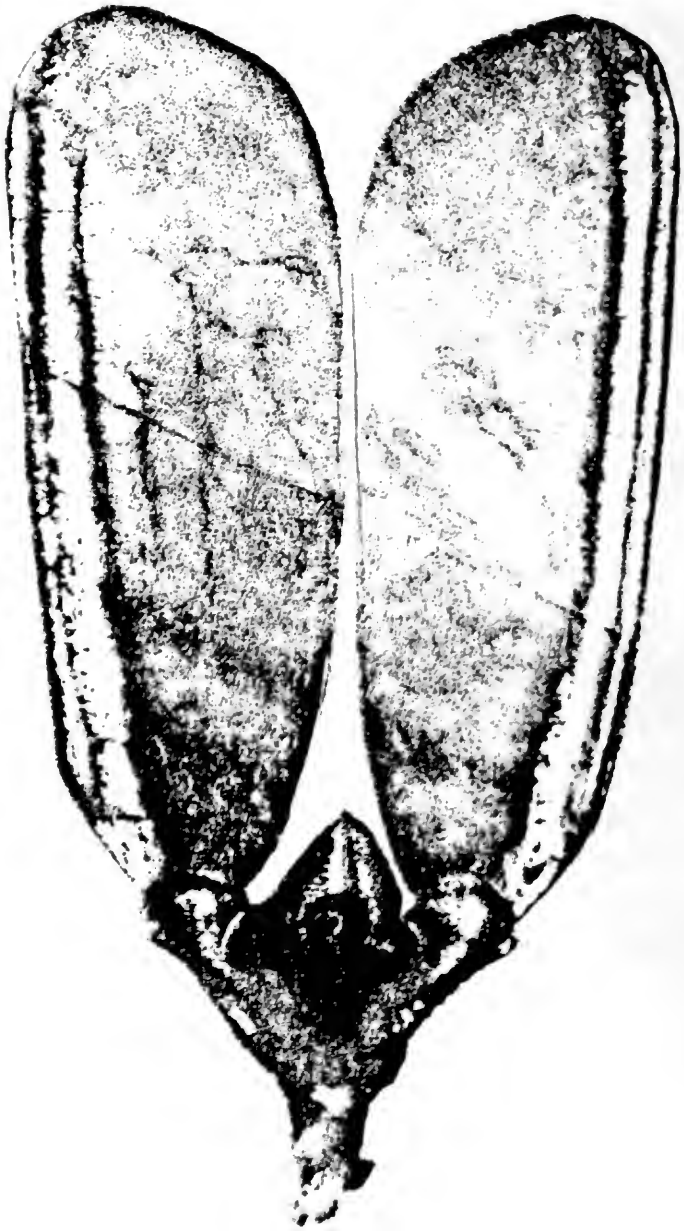
Translators
- length: 0.16 mm.
- depth: 0.02 mm.

Caudicle
- bulb. diam.: 0.05 mm.

Note: reason for the folding and twisting of the pollinia sides could be due to it's thickness, possible sensitivity to heat from the light source or other reasons.

Magnified approximately 160X.

Hoya loyceandrewsiae Green 1995
Grown and flowered at fresno CA USA.

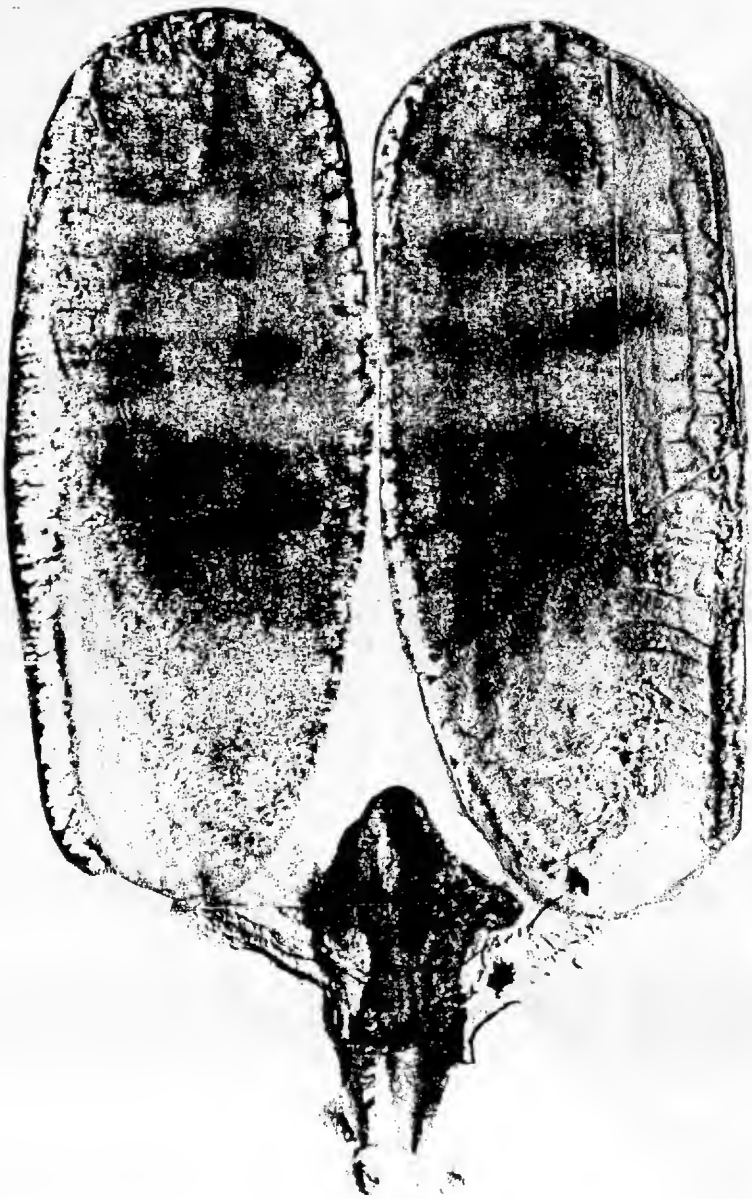


Pollinium
length: 0.775 mm.
widest: 0.280 mm.
Retinaculum
length: 0.240 mm.
shoulder: 0.18 mm.
waist: ca. 0.120 mm.
hip: 0.130 mm.
ext.: ca. 0.070 mm.
Translators
length: 0.160 mm.
depth: 0.020 mm.
Caudicle
bulb diam.: 0.060 mm.

Magnified approximately 160X.

Hoya apiculata Scheff. 1896

Flower via TG.



Pollinium
length: 0.751 mm.
widest: 0.316 mm.
Retinaculum
length: 0.225 mm.
shoulder: 0.190 mm.
waist: 0.080 mm.
hip: 0.100 mm.
ext.: 0.100 mm.
Translators
length: 0.182 mm.
depth: 0.030 mm.
Caudicle
appears to be linear

Note: labeled as above but most likely not this species.

Magnified approximately 160X.

Hoya bella Hooker 1848

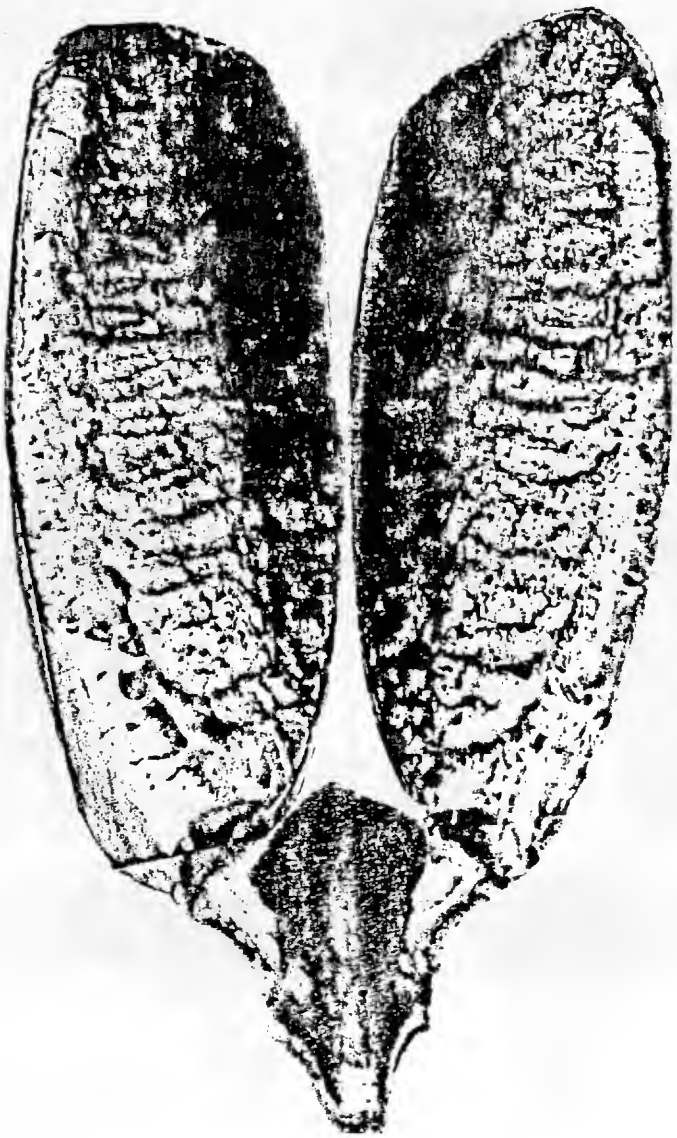
From San Francisco Flower Mart via David Jones.

Pollinium	
length:	0.75 mm.
widest:	0.20 mm.
Retinaculum	
length:	0.28 mm.
shoulder:	0.08 mm.
waist:	0.06 mm.
hip:	0.09 mm.
ext.:	0.04 mm.
Translators	
length:	0.28 mm.
depth:	0.05 mm.
Caudicle	
bulb. diam.:	0.10 mm.

Magnified approximately 160X.

Hoya serpens Hooker f. 1883

Pollinarium from flower via AW.



Pollinium

length: 0.750 mm.
widest: 0.290 mm.

Retinaculum

length: 0.240 mm.
shoulder: 0.170 mm.
waist: 0.118 mm.
hip: 0.150 mm.
ext.: 0.060 mm.

Translators

length: 0.120 mm.
depth: 0.020 mm.

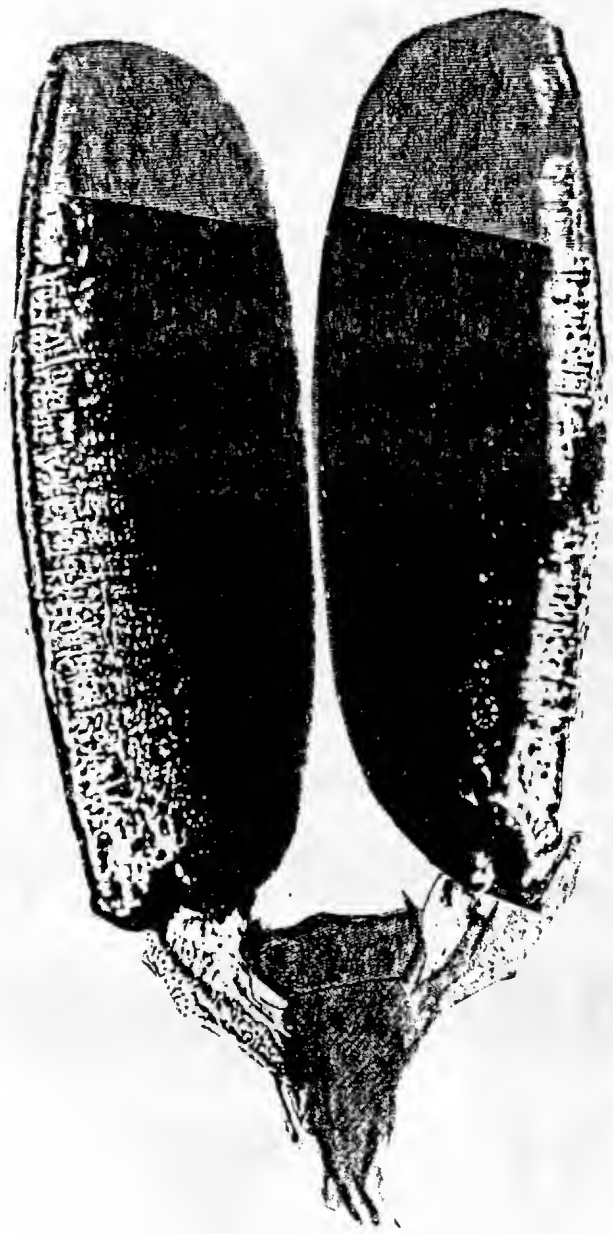
Caudicle

bulb diam.: 0.070 mm.

Magnified approximately 160X

Hoya greenii Kloppenburg 1995

Type clone collected by Ted Green on MT. Apo, Mindanao, Philippines
Flowered at Kaaawa, Hawaii USA via TG.



Pollinium	
length:	0.72 mm.
widest:	0.24 mm.
Retinaculum	
length:	0.23 mm.
shoulder:	0.14 mm.
waist:	0.09 mm.
hip:	0.11 mm.
ext.:	0.05 mm.
Translators	
length:	0.16 mm.
depth:	0.03 mm.
Caudicle	
bulb. diam.:	0.06 mm.

Note: the unusual horns on the head of the retinaculum.

Magnified approximately 160X.

Hoya sp. 41932 CAHUP
Collector Prof. Juan Pancho
El Nido, Palawan, Philippines

Pollinium		
	length:	0.70 mm.
	widest:	0.22 mm.
Retinaculum		
	length:	0.25 mm.
	shoulder:	0.18 mm.
	waist:	0.08 mm.
	hip:	0.14 mm.
	ext.:	0.04 mm.
Translators		
	length:	0.11 mm.
	depth:	0.02 mm.
Caudicle		
	bulb. diam.:	0.08 mm.

Magnified approximately 160X.

Hoya nicholsoniae Muller 1866
Flower from clone IML #39 via AW.

Magnified approximately 160X.

Pollinium length: 0.700 mm.; widest: 0.295 mm.
Retinaculum length: 0.230 mm.; shoulder: 0.170 mm.; waist: 0.120 mm.; hip: 0.170 mm.; ext.: 0.045 mm.
Translators length: 0.08 mm.; depth: 0.03 mm
Caudicle bulb diam. ca. 0.08 mm.

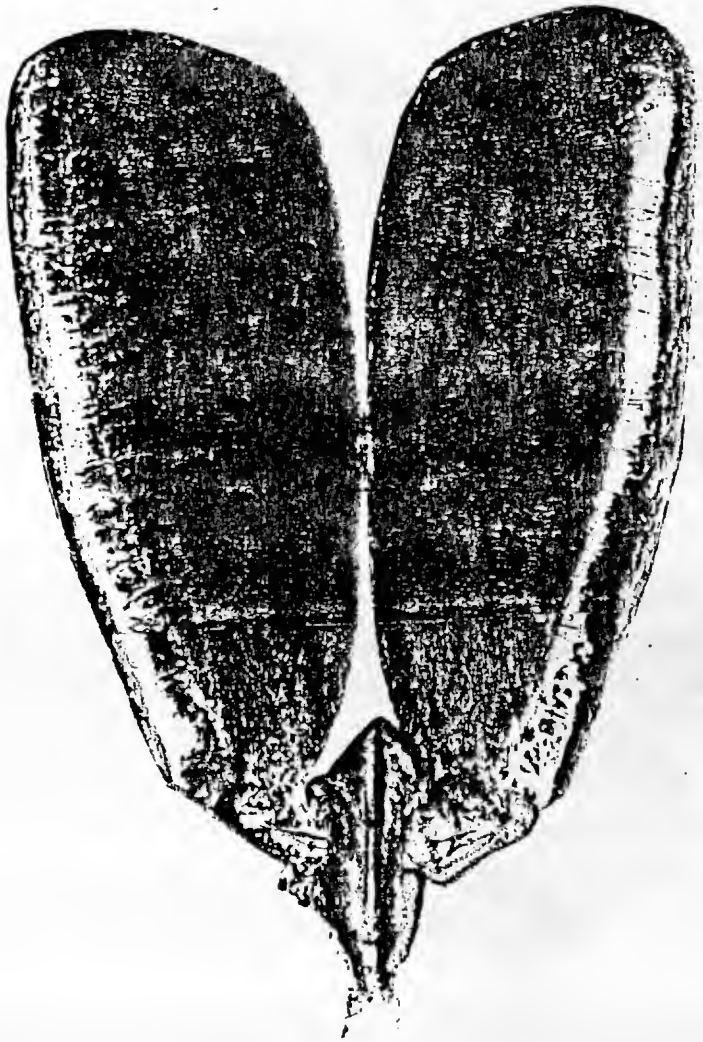
Hoya ischnopus Schlechter 1894
Flower via AW.

Magnified approximately 160X.

Pollinium length: 0.69 mm; widest: 0.27 mm.
Retinaculum length: 0.24 mm.; shoulder: 0.11 mm.; waist: 0.60 mm.; hip: 0.10 mm. extensions: 0.04 mm.
Translators length: 0.11 mm; depth: 0.02 mm.
Caudicle bulb diameter: 0.06 mm.

Hoya ischnopus Schlechter 1913

Flower from TG , clone flowered in Hawaii.



Pollinium	
length:	0.68 mm.
widest:	0.26 mm.
Retinaculum	
length:	0.18 mm.
shoulder:	0.10 mm.
waist:	0.06 mm.
hip:	0.09 mm.
ext.:	0.02 mm.
Translators	
length:	0.12 mm.
depth:	0.02 mm.
Caudicle	
bulb. diam.:	0.06 mm.

Magnified approximately 160X

Hoya vitensis Turrill 1915
(UC) #20732

Magnified approximately 160X.

Pollinium

length:	0.67 mm.
widest:	0.28 mm.

Retinaculum

length:	0.25 mm.
shoulder:	0.13 mm.
waist: ca.	0.07 mm.
hip:	0.09 mm.
ext.:	0.04 mm.

Translators

length:	0.16 mm.
depth:	0.03 mm.

Caudicle

bulb. diam.:ca. 0.10 mm.

Hoya cult. Minibella

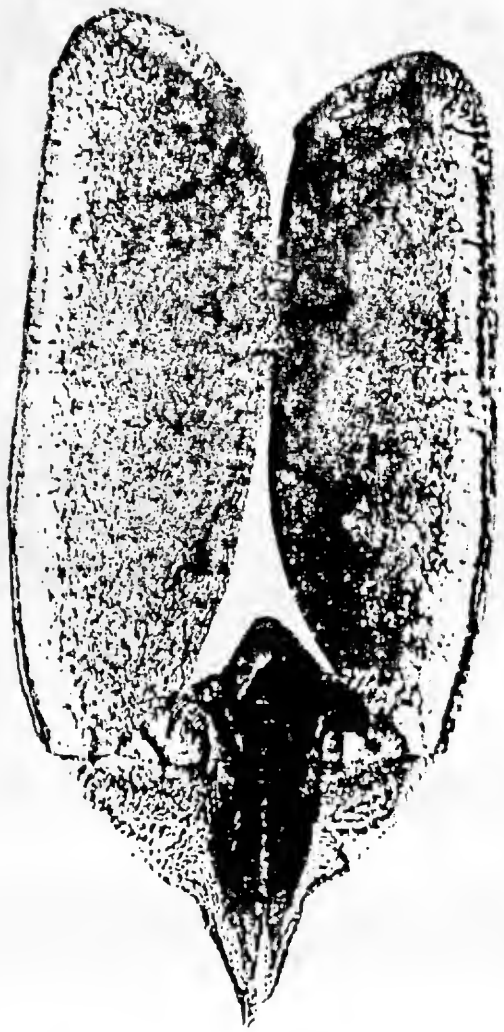
Grown and flowered at Fresno CA.

Pollinium		
	length:	0.66 mm.
	widest:	0.24 mm.
Retinaculum		
	length:	0.32 mm.
	shoulder:	0.18 mm.
	waist:	0.09 mm.
	hip:	0.18 mm.
	ext.:	0.06 mm.
Translators		
	length:	0.14 mm.
	depth:	0.04 mm.
Caudicle		
	bulb. diam.:	0.08 mm.

Magnified approximately 160X.

Hoya sp. shephardell

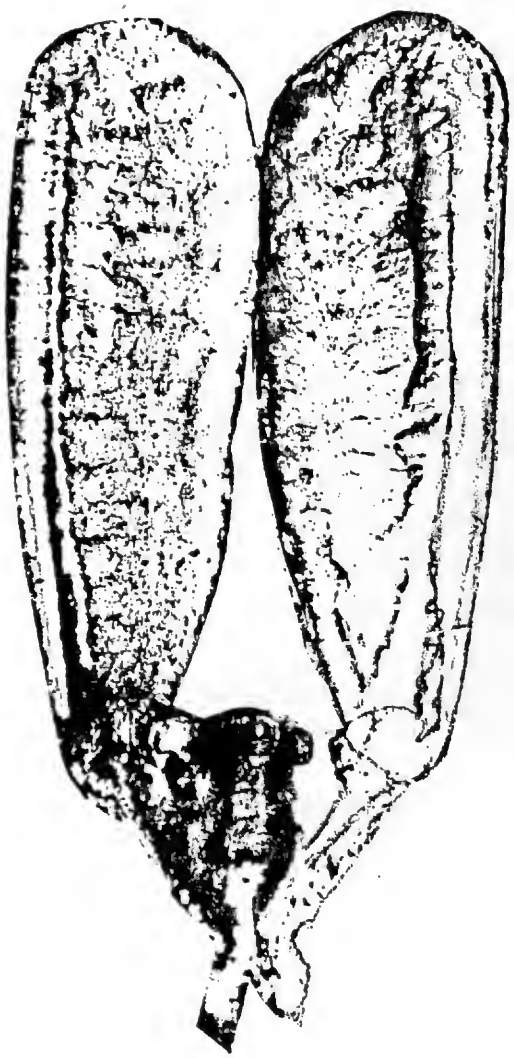
Grown and flowered in Fresno CA.



Pollinium		
	length:	0.65 mm.
	widest:	0.21 mm.
Retinaculum		
	length:	0.24 mm.
	shoulder:	0.15 mm.
	waist:	0.08 mm.
	hip:	0.10 mm.
	ext.:	0.06 mm.
Translators		
	length:	0.14 mm.
	depth:	0.02 mm.
Caudicle		
	bulb. diam.:	0.06 mm.

Magnified approximately 160X.

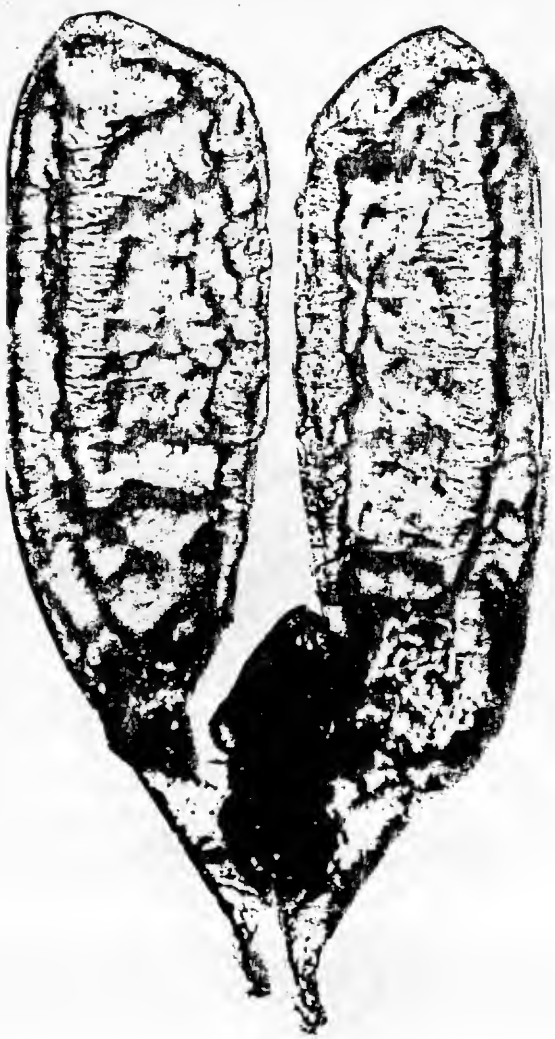
Hoya sp. 80-03 Borneo
Flower via MM.



Pollinium	
length:	0.65 mm.
widest:	0.21 mm.
Retinaculum	
length:	0.14 mm.
shoulder:	0.14 mm.
waist:	0.08 mm.
hip:	0.12 mm.
ext.:	0.04 mm.
Translators	
length:	0.12 mm.
depth:	0.03 mm.
Caudicle	
bulb. diam.:	0.07 mm.

Magnified approximately 160X.

Hoya shepherdii Short ex Hooker 1861
Flowered at Fresno CA.

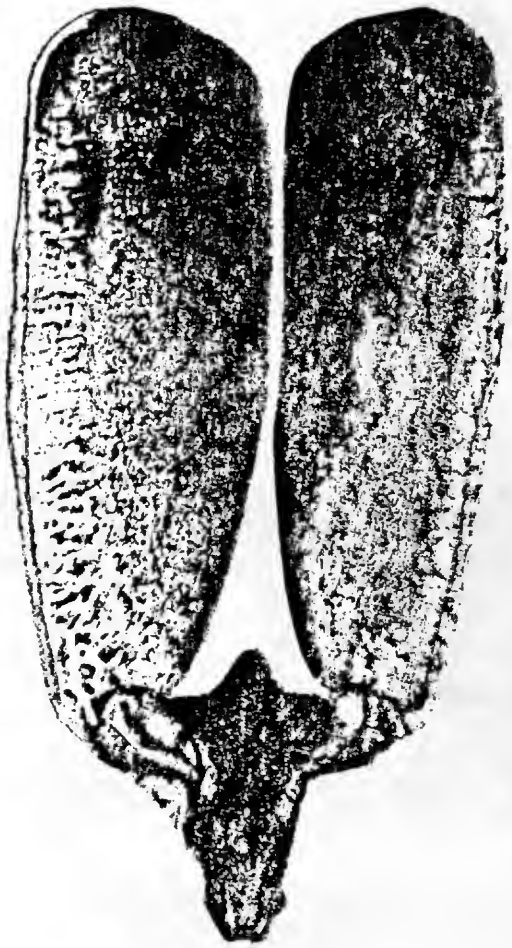


Pollinium		
	length:	0.640 mm.
	widest:	0.225 mm.
Retinaculum		
	length:	0.240 mm.
	shoulder:	0.150 mm.
	waist:	0.080 mm.
	hip:	0.110 mm.
	ext.:	0.040 mm.
Translators		
	length:	0.120 mm.
	depth:	0.020 mm.
Caudicle		
	bulb diam:	0.030 mm.

Magnified approximately 160X.

Hoya sp. Tau Is., Samoa

Flower via TG, collector Art Whistler.

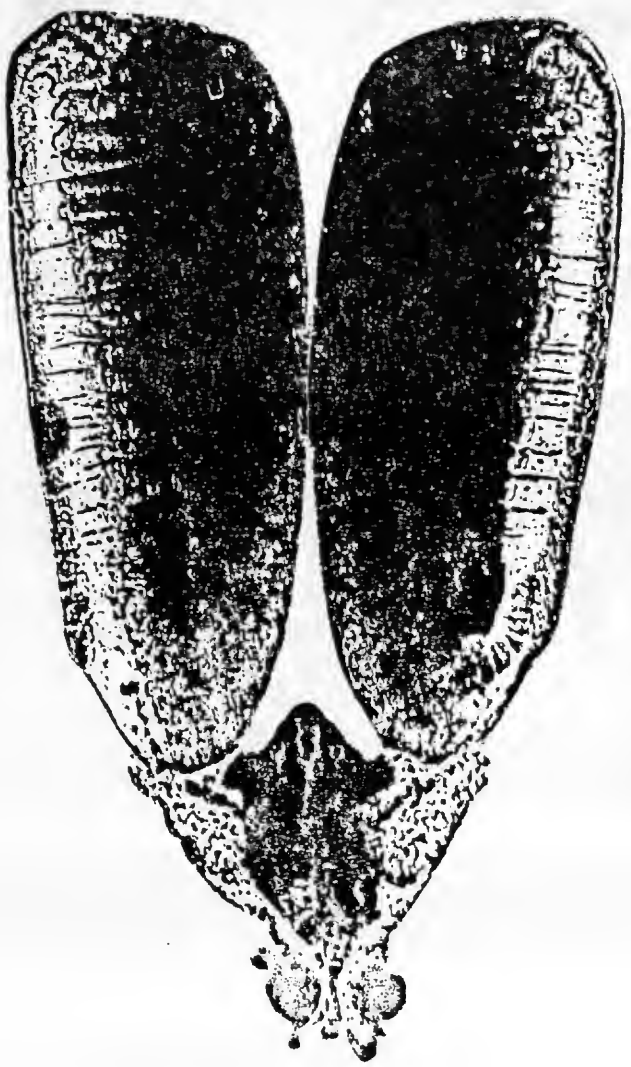


Pollinium	
length:	0.630 mm.
widest:	0.200 mm.
Retinaculum	
length:	0.206 mm.
shoulder:	0.140 mm.
waist:	0.060 mm.
hip:	0.080 mm.
ext.:	0.020 mm.
Translators	
length:	0.120 mm.
depth:	0.020 mm.
Caudicle	
bulb diam.:	0.060 mm.

Magnified approximately 160X.

Hoya sp. USDA 354238

Grown and flowered in Fresno CA.



Pollinium

length:	0.655 mm.
widest:	0.260 mm.

Retinaculum

length:	0.180 mm.
shoulder:	0.150 mm.
waist:	0.110 mm.
hip:	0.120 mm.
ext.:	0.050 mm.

Translators

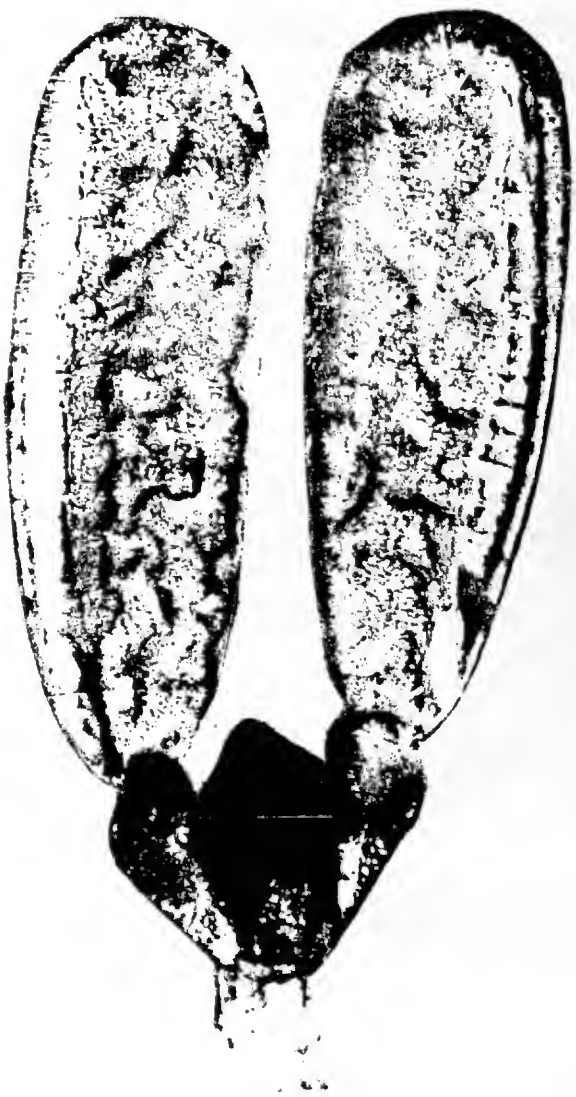
length:	0.150 mm.
depth:	0.040 mm.

Caudicle

bulb. diam.:	?

Magnified approximately 160X.

Hoya sp. Sabah, Malaysia
Flower via AW (66).

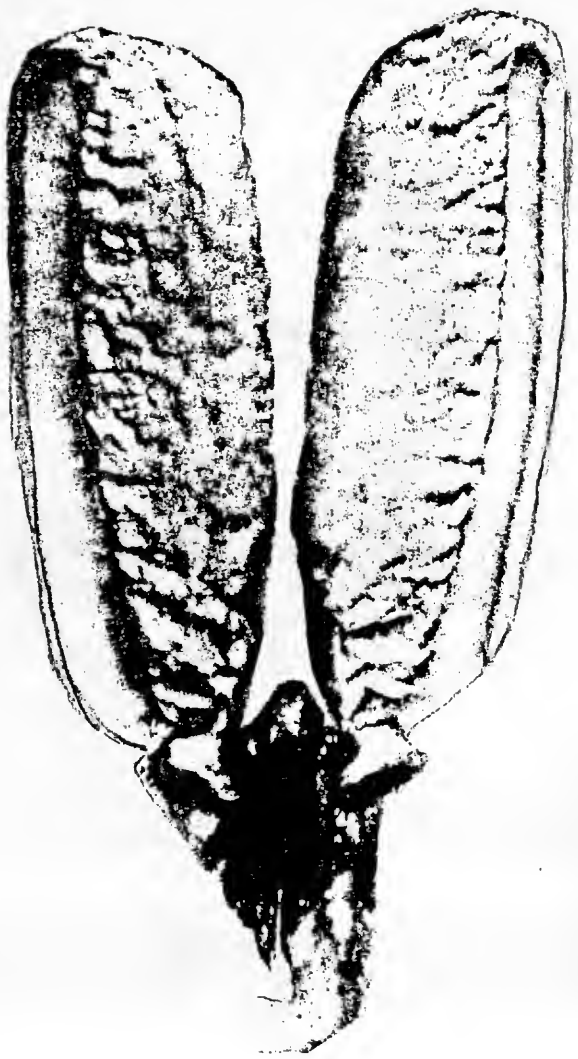


Pollinium	
length:	0.63 mm.
widest:	0.23 mm.
Retinaculum	
length:	0.21 mm.
shoulder:	0.15 mm.
waist:	0.10 mm.
hip:	0.10 mm.
ext.:	?
Translators	
length:	0.18 mm.
depth:	0.04 mm.
Caudicle	
bulb. diam.:	0.10 mm.

Magnified approximately 160X

Hoya limonica S. Moore 1921

Flower via AW.



Pollinium	
length:	0.620 mm.
widest:	0.225 mm.
Retinaculum	
length:	0.180 mm.
shoulder:	0.128 mm.
waist:	0.090 mm.
Hip:	0.130 mm.
ext.:	0.050 mm.
Translators	
length:	0.100 mm.
depth:	0.030 mm.
Caudicle	
bulb diam.:	0.050 mm.

Magnified approximately 160X.

Hoya sp. PNG #4

Pollinarium flower via AW.

Pollinium	
length:	0.62 mm.
widest:	0.21 mm.
Retinaculum	
length:	0.18 mm.
shoulder:	0.09 mm.
waist:	0.04 mm.
hip:	0.07 mm.
ext.:	0.05 mm.
Translators	
length:	0.10 mm.
depth:	0.03 mm.
Caudicle	
bulb. diam.:	?

Magnified approximately 160 X

Hoya laurifolia Decaisne 1883

Pollinarium from flower via MM.

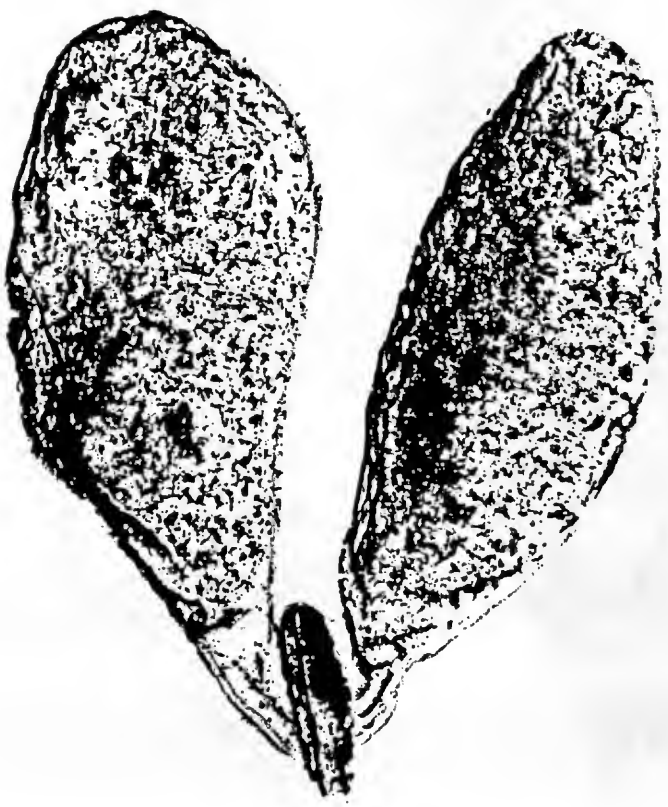
Pollinium	
length:	0.59 mm.
widest:	0.20 mm.
Retinaculum	
length:	0.18 mm.
shoulder:	0.12 mm.
waist:	0.08 mm.
hip:	0.08 mm.
Translators	
length:	0.10 mm.
depth:	0.02 mm.
Caudicle	
bulb diam.:	0.07 mm.

Note: species name is not correct. Sold under this name in commerce.

Magnified approximately 160X

Hoya sp. PNH 5658

Catanduanes, Virac Brig., Ketangang, Philippines



Pollinium
length: 0.58 mm.
widest: 0.26 mm.
Retinaculum
length: 0.16 mm.
shoulder:
waist:
hip:
ext.: 0.03 mm.
Translators
length: 0.10 mm.
depth: 0.20 mm.
Caudicle
bulb. diam.:

Magnified approximately 160X.

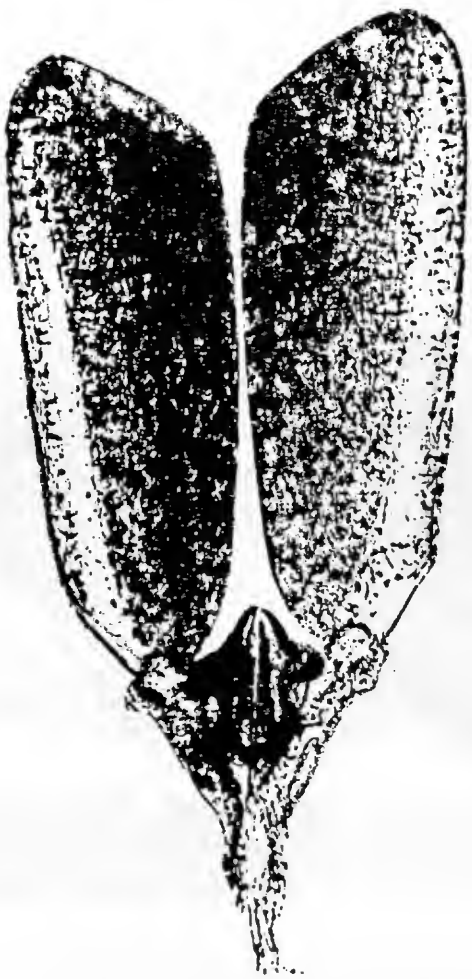
Hoya sp. ABG #12 NG
Flowered in Fresno CA.

Pollinium
length: 0.575 mm.
widest: 0.215 mm.
Retinaculum
length: 0.220 mm.
shoulder: 0.120 mm.
waist: 0.070 mm.
hip: 0.114 mm.
ext.: 0.070 mm.
Translators
length: 0.100 mm.
depth: 0.040 mm.
Caudicle
bulb. diam.: 0.055 mm.

Note: This pollinium is similar to that of H. sp. USDA 354238 but somewhat smaller.

Magnified approximately 160X

Hoya cominsii Hemsley 1890
Flower from clone IML 457 via AW.



Magnified approximately 160 X

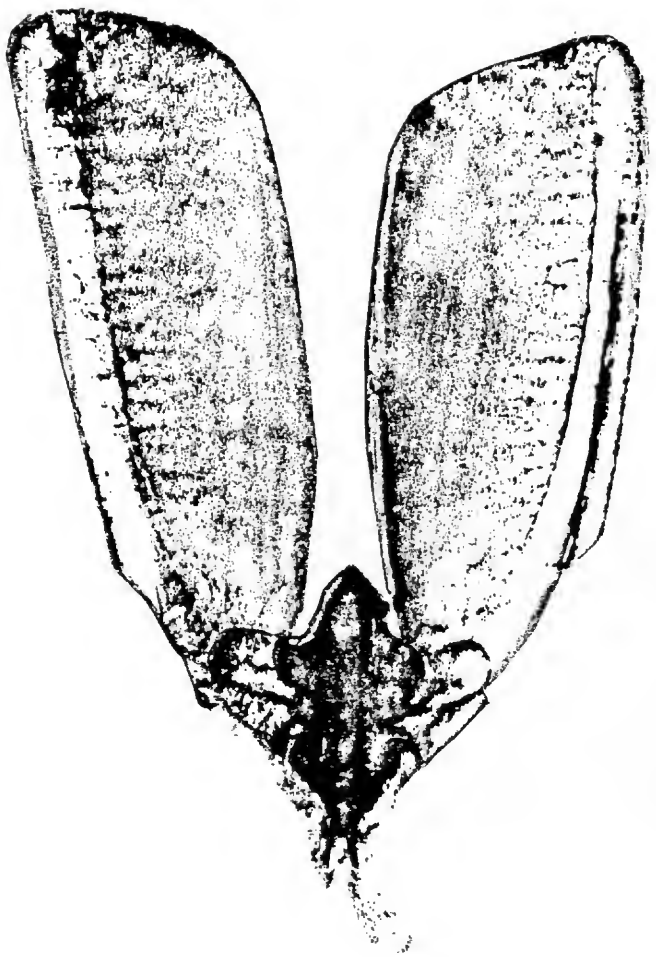
Pollinium	
length:	0.540 mm.
widest:	0.190 mm.
Retinaculum	
length:	0.128 mm.
shoulder:	0.124 mm.
waist:	0.070 mm.
hip:	0.080 mm.
ext.:	0.030 mm.
Translators	
length:	0.100 mm.
depth:	0.022 mm.
Caudicle	
bulb diam.:	0.140 mm.

Hoya sp. Sulawesi med. flower
Collected 1994.

Pollinium
length: 0.57 mm.
widest: 0.23 mm.
Retinaculum
length: 0.20 mm.
shoulder: 0.13 mm.
waist: 0.08 mm.
hip: 0.11 mm.
ext.: 0.13 mm.
Translators
length: 0.06 mm.
depth:
Caudicle
bulb. diam.:

Magnified Approximately 160X.

Hoya sp. DAV 819
Flower via AW.

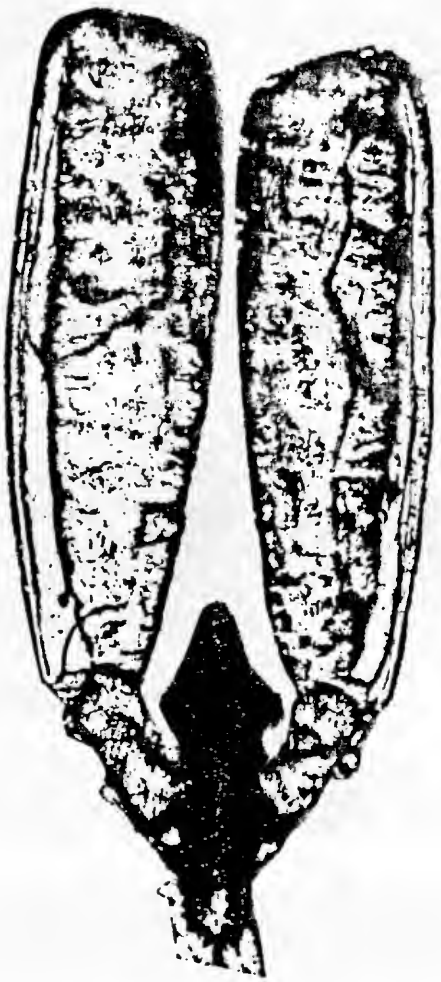


Pollinium
length: 0.56-.58 mm.
widest: 0.21 mm.
Retinaculum
length: 0.23 mm.
shoulder: 0.13 mm.
waist: 0.08 mm.
hip:* 0.11 mm.
ext.: 0.05 mm.
Translators
length: 0.08 mm.
Caudicle
bulb diam.: 0.02 mm.
Note: this is supposed to be H. cominsii, I believe this is correct. See page 74.

Magnified approximately 160X

Hoya vitellinia Blume 1849

Flower from clone labeled H. sp. fuscomarginata .

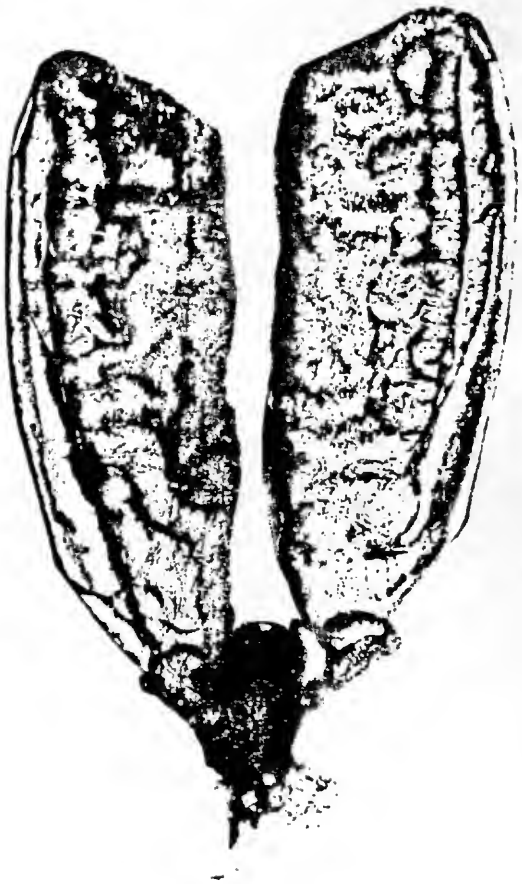


Magnified approximately 160X

Pollinium	
length:	0.56 mm.
widest:	0.18 mm.
Retinaculum	
length:	0.24 mm.
shoulder:	0.10 mm.
waist:	0.06 mm.
hip:	0.10 mm.
ext.:	0.03 mm.
Translators	
length:	0.10 mm.
depth:	0.05 mm.
Caudicle	
bulb diam.:	0.06 mm.

Hoya sp. Samoa double

Flower from MM, clone collected on road to Lake Lanatoo, W. Samoa 1988.



Pollinium		
	length:	0.56 mm.
	widest:	0.22 mm.
Retinaculum		
	length:	0.17 mm.
	shoulder:	0.10 mm.
	waist:	?
	hip:	0.08 mm.
	ext.:	0.03 mm.
Translators		
	length:	0.12 mm.
	depth:	0.02 mm.
Caudicle		
	bulb. diam.:	0.06 mm.

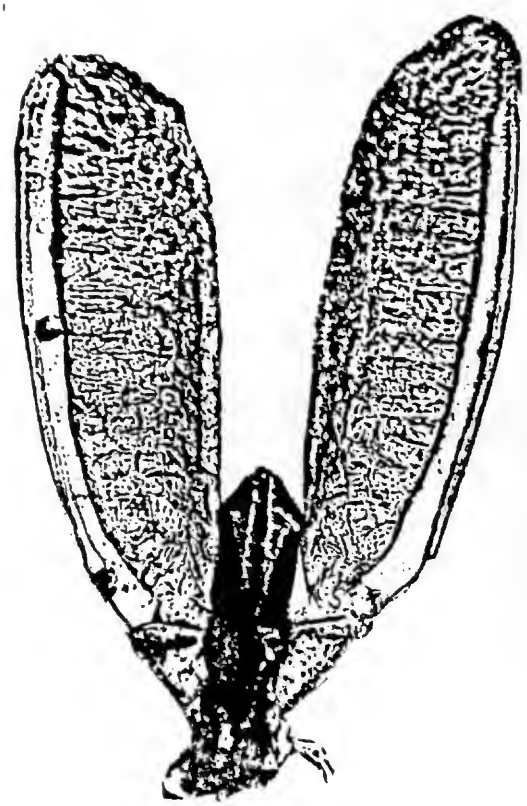
Magnified approximately 160X.

Hoya neoebudica Guillauman
Clone from Espiritu Santo, Vanuatu.

Pollinarium
length: 0.560 mm.
widest: 0.170 mm.
Retinaculum
length: 0.160 mm.
shoulder: 0.120 mm.
waist: 0.066 mm.
hip: 0.100 mm.
ext.: 0.070 mm.
Translators
length: 0.110 mm.
depth: 0.030 mm.
Caudicle
bulb diam.: ca. 0.070 mm.

Magnified approximately 160X.

Hoya benguetensis Schlechter 1906
(UC) 14997 Loher 15 May 1909 ?
Rizal, Luzon, Philippines.



Pollinium
length: 0.54 mm.
widest: 0.18 mm.
Retinaculum
length: 0.23 mm.
shoulder: 0.08 mm.
waist: 0.06 mm.
hip: 0.07 mm.
ext.: 0.05 mm.
Translators
length: 0.10 mm.
depth: 0.03 mm.
Caudicle
bulb. diam.: 0.07 mm.

Translators and caudicle complex.

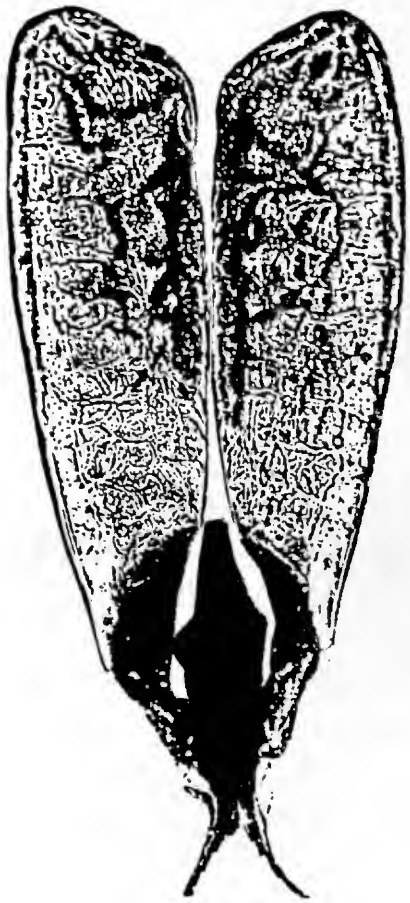
Magnified approximately 160X.

Hoya sp. Nagtabon, Palawan 1995
Flower in Vitro, Yellow.

Pollinarium	
length:	0.53 mm.
widest:	0.18 mm.
Retinaculum	
length:	0.23 mm.
shoulder:	0.08 mm.
waist:	0.07 mm.
hip:	0.10 mm.
ext.:	0.03 mm.
Translators	
length:	0.12 mm.
depth:	0.03 mm.
Caudicle	
bulb diam.:	0.07 mm.

Magnified approximately 160X

Hoya erythrina Rintz 1978
Flower from AW, Central Point OR, USA.



Pollinarium	
length:	0.52 mm.
widest:	0.17 mm.
Retinaculum	
length:	0.24 mm.
shoulder:	0.09 mm.
waist:	0.06 mm.
hip:	0.08 m.
ext.:	0.05 mm.
Translators	
length:	0.11 mm.
depth:	0.02 mm.
Caudicle	
bulb diam.:	0.05 mm.

Magnified approximately 160X

Hoya mucronulata Warburg 1907

Pollinarium from (UC) 18239.

Pollinarium

length:	0.510 mm.
widest:	0.220 mm.

Retinaculum

length:	0.290 mm.
shoulder:	0.210 mm.
waist:	0.110 mm.
hip:	0.138 mm.
ext.:	0.080 mm.

Translators

length:	0.160 mm.
depth:	0.030 mm.

Caudicle

linear sessile ?

Note: pollinium pushed down on caudicle & translator (foreshortened).

Magnified approximately 160X

Section Acanthostemma (Bl) Kloppenburg Pollinaria

The pollinarium of the hoya species in this section vary widely in pollinia length and other structural features. Many are very individualistic and easily recognized (distinctive). All have very well formed translator arms and very noticeable comma shaped caudicles.

This section is divided into two subsections at the present time, based on the formation of the bilobed coronal extensions. Two more subdivisions might be in order. The species *Hoya pruinosa* Miquel is in the grouping "Other Large Pollinarium" this species has a crown very similar to *Hoya waymaniae* Kloppenburg and both have unusually long pollinium.

Hoya waymaniae Kloppenburg
Flower from MM Type clone.

Pollinium	
length:	0.48 mm.
widest:	0.12 mm.
Retinaculum	
length:	0.09 mm.
shoulder:	0.07 mm.
waist:	?
hip:	0.07 mm.
ext.:	0.03 mm.
Translators	
length:	0.25 mm.
depth:	0.04 mm.
Caudicle	
linear:	0.05 mm.

Magnified approximately 160X.

Hoya diptera Seemann 1861

Pollinarium from flower via AW.

Pollinium

length:	0.320 mm.
widest:	0.162 mm.

Retinaculum

length:	0.134 mm.
shoulder:	0.060 mm.
widest	0.050 mm.
hip:	0.070 mm.
ext.:	0.040 mm.

Translators

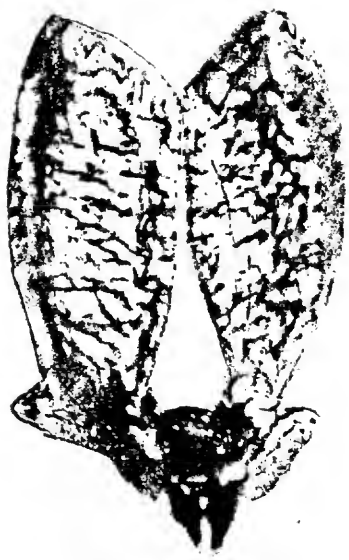
length:	0.140 mm.
depth:	0.050 mm.

Caudicle

bulb diam.:	0.090 mm.

Magnified approximately 160X.

Hoya parviflora Wight 1834
As H. minnima, flower from AW.



Magnified approximately 160X

Pollinarium	
length:	0.35 mm.
widest:	0.14 mm.
Retinaculum	
length:	0.10 mm.
shoulder:	0.08 mm.
waist:	0.04 mm.
hip:	0.07 mm.
ext.:	0.03 mm.
Translators	
length:	0.10 mm.
depth:	0.03 mm.
Caudicle	
bulb diam.:	0.06 mm.

Hoya nummularioides Constantin 1912

Flowers from "red" & "pink" (inner coronal colored) clones, Thailand.

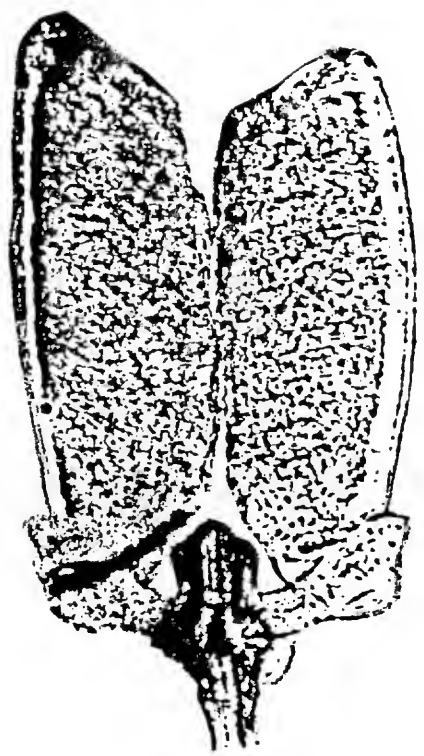
	red clone	pink clone
Pollinium		
length:	0.380 mm.	0.340 mm.
widest:	0.120 mm.	0.120 mm.
Retinaculum		
length:	0.140 mm.	0.145 mm.
shoulder:	0.080 mm.	0.090 mm.
waist:	0.050 mm.	0.060 mm
hip:	0.070 mm.	0.080 mm.
ext.:	0.050 mm.	0.050 mm.
Translators		
length:	0.155 mm.	0.010 mm.
depth:	0.020 mm.	0.020 mm.
Caudicle		
bulb diam.:	0.070 mm.	0.050 mm.

Red clone magnified approximately 160X

Comments: I assume these are from the same species, since the major features are very similar. The translators are a little shorter on the Pink clone and there are other minor (hundredths of a millimeter) differences. Overall the plant, foliage, flowering period and growth habits are very similar.

Pink clone magnified approximately 160X

Hoya sp. NH #1 (Vanuatu).
Flower from AW.



Pollinium		
	length:	0.445 mm.
	widest:	0.170 mm.
Retinaculum		
	length:	0.120 mm.
	shoulder:	0.120 mm.
	waist:	0.060 mm.
	hip:	0.100 mm.
	ext.:	0.080 mm.
Translators		
	length:	0.018 mm.
	depth:	0.060 mm.
Caudicle		
	bulb diam:	0.070 mm.

Magnified approximately 160X.

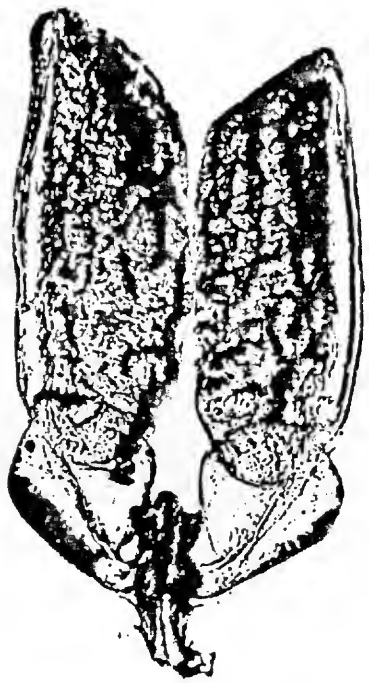
Hoya Sp. revoluta as per TG.
Flowered in Hawaii

Pollinium		
	length:	0.450 mm.
	widest:	0.149 mm.
Retinaculum		
	length:	0.110 mm.
	shoulder:	0.059 mm.
	waist:	0.050 mm.
	hip:	0.078 mm.
	ext.:	0.040 mm.
Translators		
	length:	0.120 mm.
	depth:	0.080 mm.
Caudicle		
	bulb. diam.:	0.050 mm.

Magnified approximately 160X

Hoya incurvula Schlechter 1916

Pollinarium from flower of Sulawesi, Indonesia 1994.



Pollinarium		
	length:	0.390 mm.
	widest:	0.140 mm.
Retinaculum		
	length:	0.090 mm.
	shoulder:	0.061 mm.
	waist:	0.032 mm.
	hip:	0.059 mm.
	ext.:	0.060 mm.
Translators		
	length:	0.149 mm.
	depth:	0.055 mm.
Caudicle		
	bulb diam.:	0.125 mm.

Magnified approximately 160X.

Hoya sp. IPPS 1779

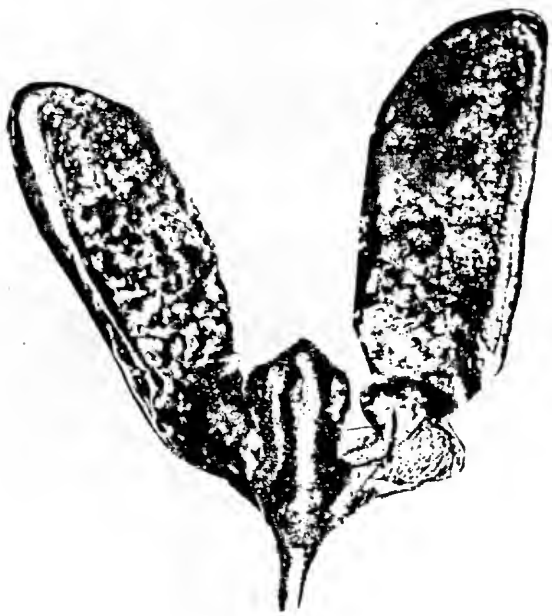
Flower from TG , plant from Sumatra
as H. incurvula.

Pollinium	
length:	0.250 mm
widest:	0.085 mm.
Retinaculum	
length:	0.060 mm.
shoulder:	0.050 mm.
waist:	0.030 mm.
hip:	0.040 mm.
ext.:	0.035 mm.
Translators	
length:	0.010 mm.
depth:	0.040 mm.
Caudicle	
bulb. diam.:	0.066 mm.

Magnified approximately 160X.

Hoya tsangii Burton 1991

Pollinarium from Type Elmer #13372
collected from Cabadbaran, 1000' elevation Mt. Bulusan
Sorsegon Prov. Luzon, Philippines (1916).

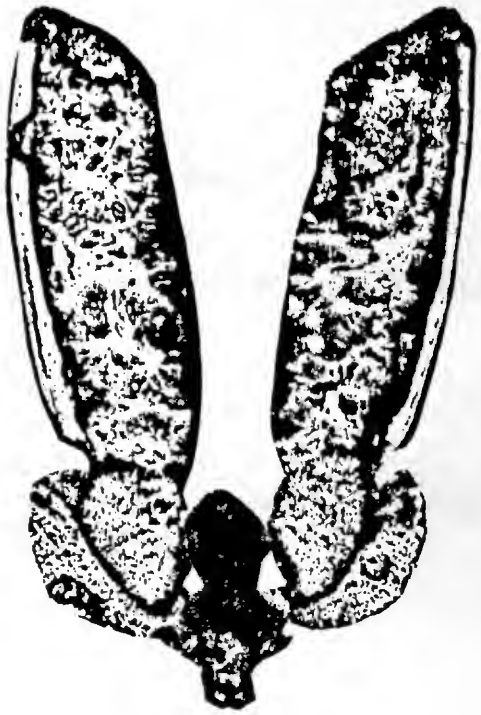


Pollinium		
	length:	0.340 mm.
	widest:	0.130 mm.
Retinaculum		
	length:	0.180 mm.
	shoulder:	0.099 mm.
	waist:	0.065 mm.
	hip:	0.090 mm.
	ext.:	0.060 mm.
Translators		
	length:	0.130 mm.
	depth:	0.053 mm.
Caudicle		
	diam.:	0.060 mm.

Magnified approximately 160X.

Hoya kentiana Burton 1991

Pollinarium from clone Perpich 428 via TG.



Pollinarium

length: 0.450 mm.
widest: 0.148 mm.

Retinaculum

length: 0.150 mm.
shoulder: 0.080 mm.
waist: 0.050 mm.
hip: 0.098 mm.
ext.: 0.037 mm.

Translators

length: 0.205 mm.
depth: 0.053 mm.

Caudicle

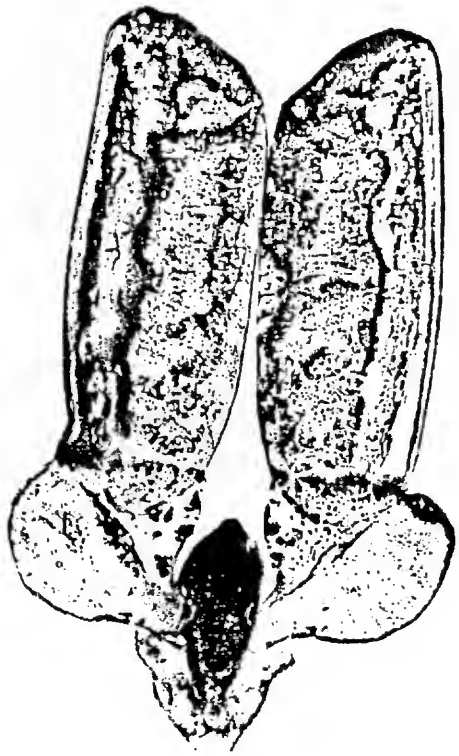
bulb diam.:0.129-0.139 mm.

Magnified approximately 160X

Comments: The clone sold by Green Plant Research is slightly different in the extension of the inner coronal lobes, however the pollinarium are the same. At one time I felt this clone Prepich 428 was the same as the type for H. tsangii Burton but comparison of pollinaria prove them to be distinct. There is a large difference in the pollinia lengths. See the pollinarium of H. tsangii and also H. sp. DS-1, formerly sold as H. tsangii, but most likely H. burtoniae.

Hoya burtoniae Kloppenburg 1990

Pollinarium from clone #81084.



Pollinium	
length:	0.430 mm.
width:	0.150 mm.
Retinaculum	
length:	0.140 mm.
shoulder:	0.070 mm.
waist:	0.050 mm.
hips:	0.040 mm.
Translators	
length:	0.189 mm.
depth:	0.088 mm.
Caudicle	
diam.:	0.080 mm.

Magnified approximately 160X

Hoya wayetii Kloppenburg 1993

Type clone #90148 flowered in Fresno CA USA.

Pollinium	
length:	0.488 mm.
widest:	0.150 mm.
Retinaculum	
length:	0.120 mm.
shoulder:	0.041 mm.
waist:	0.038 mm.
hip:	0.050 mm.
ext.:	0.040 mm.
Translators	
length:	0.188 mm.
depth:	0.070 mm.
Caudicle	
bulb diam.:	0.132 mm.

Magnified approximately 160X.

Hoya pseudolittoralis Norman 1937

Flower from clone via AW purchased as H. gracilipis.

Magnified approximately 160X

Pollinium		
	length:	0.350 mm
	widest:	0.140 mm.
Retinaculum		
	length:	0.110 mm.
	shoulder:	0.076 mm.
	waist:	0.058 mm.
	hip:	0.080 mm.
	ext.:	0.050 mm.
Translators		
	length:	0.120 mm
	depth:	0.060 mm.
Caudicle		
	bulb diam.:	0.080 mm.

Hoya micrantha Hooker f. 1883

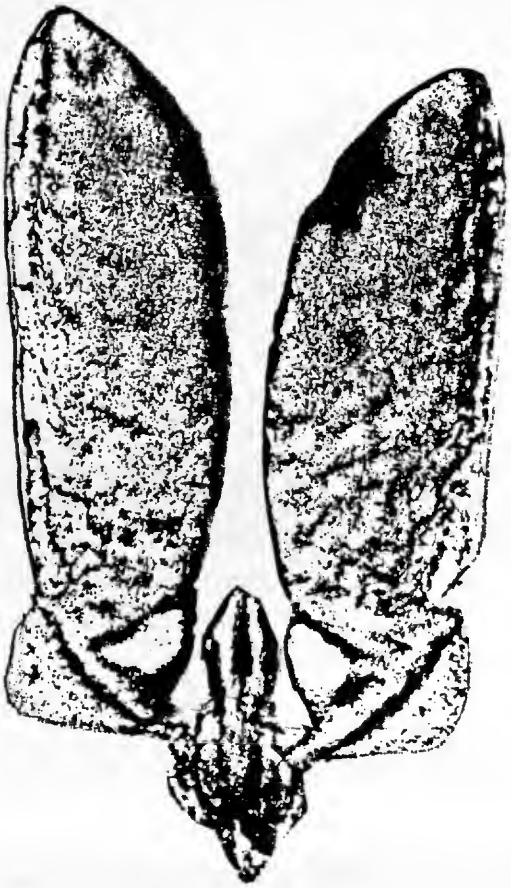
Pollinia from flower supplied by AW.

Pollinium	
length:	0.438 mm.
widest:	0.140 mm.
Retinaculum	
length:	0.090 mm.
shoulder:	0.075 mm.
waist:	0.620 mm
hip:	0.042 mm.
ext.:	0.060 mm.
Translators	
length:	0.140 mm.
depth:	0.080 mm.
Caudicle	
bulb diam.:	0.100 mm.

Magnified approximately 160X.

Hoya plicata King & Gamble 1908

Pollinarium from clone #81036 collected at Ulu Kali, Malaya.



Pollinarium	
length:	0.550 mm.
widest:	0.190 mm.
Retinaculum	
length:	0.200 mm.
shoulder:	0.072 mm.
waist:	0.050 mm.
hip:	0.080 mm.
ext.:	0.050 mm.
Translators	
length:	0.190 mm.
depth:	0.100 mm.
Caudicle	
diam.:	0.100 mm.

Magnified approximately 160X.

Hoya inconspicua Hemsley 1894

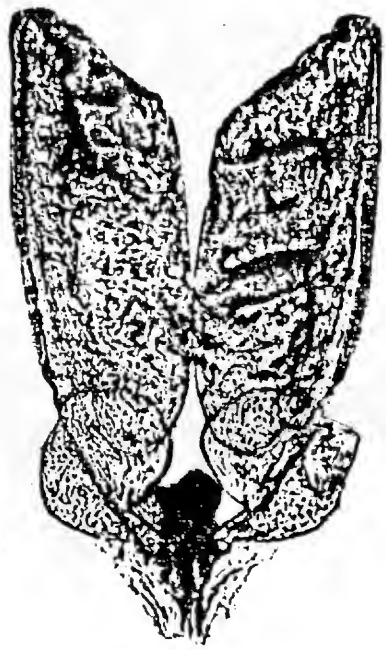
Source, clone personally collected from Honiara botanical garden, Guadalcanal, Solomon Is. 1988.

Pollinium		
	length:	0.400 mm.
	widest:	0.147 mm.
Retinaculum		
	length:	0.110 mm.
	shoulder:	0.050 mm.
	waist:	0.040 mm.
	hip:	0.060 mm.
	ext.:	0.050 mm.
Translators		
	length:	0.160 mm.
	depth:	0.039 mm.
Caudicle		
	bulb diam.:	0.090 mm.

Magnified approximately 160X.

Hoya littoralis Schlechter 1905

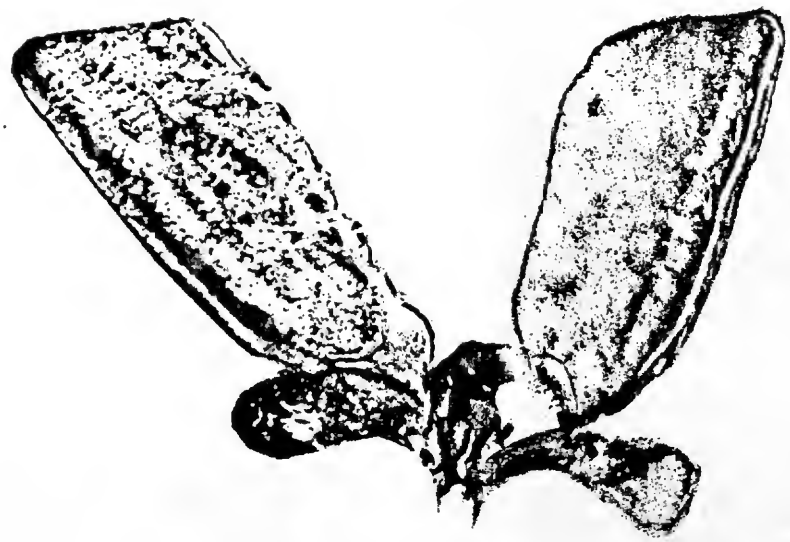
Pollinarium from specimen IML 708 collected
by G. Hardy on Moa Is., Torres Str. 25 Nov. 1986 via TG.



Pollinarium		
	length:	0.385 mm
	widest:	0.150 mm.
Retinaculum		
	length:	0.150 mm.
	shoulder:	0.060 mm.
	waist:	0.042 mm.
	hip:	0.060 mm.
	ext.:	0.045 mm.
Translators		
	length:	0.140 mm.
	depth:	0.500 mm.
Caudicle		
	bulb diam.:	0.100 mm.

Magnified approximately 160X.

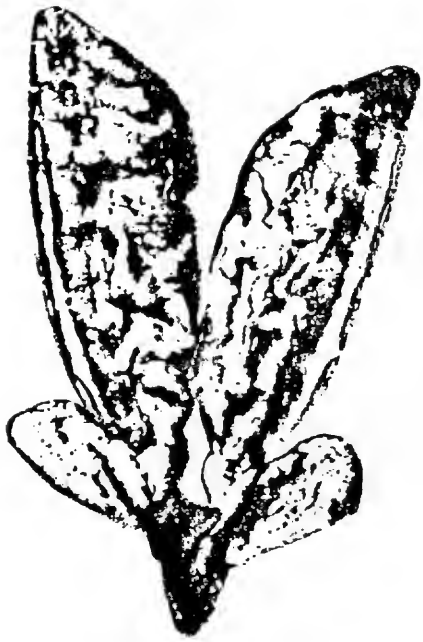
Hoya rizaliana Kloppenburg 1991
Pollinarium from Type clone (UC) Loher s.n.
Montalban, Luzon, Philippines 1909.



Magnified approximately 160X.

Pollinium	
length:	0.390 mm.
widest:	0.115 mm.
Retinaculum	
length:	0.130 mm.
shoulder:	0.070 mm.
waist:	0.035 mm.
hip:	0.040 mm.
ext.:	0.030 mm.
Translators	
length:	0.212 mm.
depth:	0.082 mm.
Caudicle	
diam.:	0.100 mm.

Hoya loheri Kloppenburg 1991
Grown and flowered in Fresno CA USA.



Pollinia		
	length:	0.370 mm.
	widest:	0.132 mm.
Retinaculum		
	length:	0.120 mm.
	shoulder:	0.070 mm.
	waist:	0.030 mm.
	hip:	0.046 mm.
	ext.:	0.015 mm.
Translators		
	length:	0.150 mm.
	depth:	0.080 mm.
Caudicle		
	diam.:	0.060 mm.

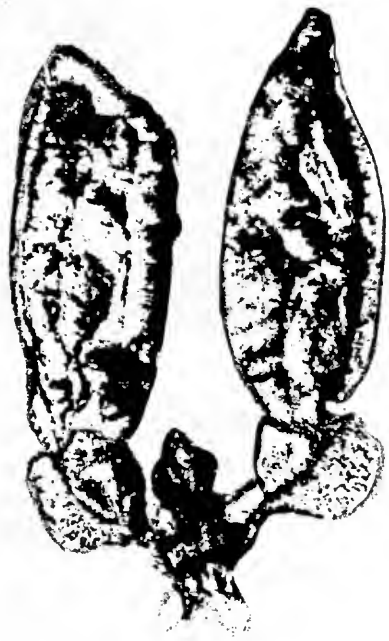
Magnified approximately 160X.

Hoya loheri Kloppenburg 1991
Grown and flowered in Fresno CA USA.

Pollinia	
length:	0.370 mm.
widest:	0.132 mm.
Retinaculum	
length:	0.120 mm.
shoulder:	0.070 mm.
waist:	0.030 mm.
hip:	0.046 mm.
ext.:	0.015 mm.
Translators	
length:	0.150 mm.
depth:	0.080 mm.
Caudicle	
diam.:	0.060 mm.

Magnified approximately 160X.

Hoya poolei White & Francis 1928
Flowered and grown at Fresno CA.



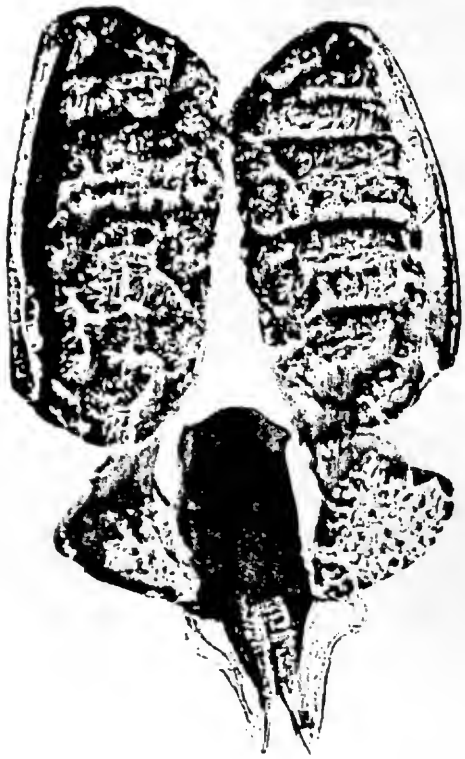
Pollinium	
length:	0.36 mm.
widest:	0.14 mm.
Retinaculum	
length:	0.13 mm.
shoulder:	0.06 mm.
waist:	0.04 mm.
hip:	0.08 mm.
ext.:	0.04 mm.
Translators	
length:	0.14 mm.
depth:	0.06 mm.
Caudicle	
bulb. diam.:	0.09 mm.

Note: the true identity not understood, This clone came from Peter Tsang collected in the Iron Range Australia.

Magnified approximately 160X.

Hoya davidcummingii Kloppenburg 1995

Type material (BISH) #9



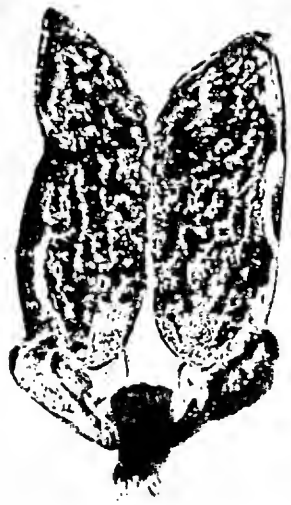
Pollinium	
length:	0.135 mm.
widest:	0.152 mm.
Retinaculum	
length:	0.235 mm.
shoulder:	0.100 mm.
waist:	0.090 mm.
hips:	0.100 mm
ext.:	0.650 mm.
Translators	
length:	0.146 mm
depth:	0.090 mm.
Caudicle	
diam.:	0.070 mm.

Magnified approximately 160X

Comments: This species was collected by David Cumming 1.5 Km. from the lake Bulusan turn off towards the lake, at the forest edge, when comming from Irosin, Sorsegon Prov. Luzon, Philippines. Elevation here is about 500'. This specimen was labeled DMC #3232. The flower providing the pollinarium is from the type clone.

Hoya gracilis Schlechter 1908

Pollinarium from flower of clone Philip. 3.



Pollinarium	
length:	0.318 mm.
widest:	0.110 mm.
Retinaculum	
length:	0.080 mm.
shoulder:	0.054 mm.
waist:	0.039 mm.
hip:	0.050 mm.
ext.:	0.020 mm.
Translators	
length:	0.110 mm.
depth:	0.050 mm.
Caudicle	
bulb diam.:	0.060 mm.

Magnified approximately 160X.

Hoya ruscifolia Decaisne 1844

Flower from clone IML 120 from Zamboanga Philippines
via Peter Tsang.

Magnified approximately 160X.

	top figure	bottom figure
Pollinium		**Hoya bilobata**
length:	0.19 mm.	0.19 mm.
widest	0.08 mm.	0.08 mm.
Retinaculum		
length:	0.08 mm.	0.05 mm.
shoulder:	0.6 mm.	0.06 mm.
waist:	0.03 mm.	0.04 mm.
hip:	0.04 mm.	0.04 mm.
ext.:	0.03 mm.	0.03 mm.
Translators		
length:	0.08 mm.	0.08 mm.
depth:	0.04 mm.	0.03 mm.
Caudicle		
bulb diam.:	0.03 mm.	0.04 mm.

Magnified approximately. 160X.

From green leafed clone collected
in the Philippines in 1981

Hoya bilobata Schlechter 1908 ?
Grown and flowered in Fresno CA USA.

Magnified approximately 160X
red edged leaf clone

	top clone	bottom clone
Pollinium		
length:	0.220 mm.	0.190 mm.
widest:	0.090 mm.	0.080 mm.
Retinaculum		
length:	0.070 mm.	0.080 mm.
shoulder:	0.060 mm.	0.055 mm.
waist:	0.040 mm.	0.040 mm.
ext.:	0.030 mm.	0.030 mm.
Translators		
length:	0.080 mm.	0.080 mm.
depth:	0.030 mm.	0.030 mm.
Caudicle		
bulb diam:	0.035 mm.	0.032 mm.

Clone IML 228 affinis H. bilobata Schltr..

Magnified approximately 160X

.

Hoya bilobata Schlechter 1908

1. Flower from clone "Ben Hardy"
2. Flower from clone "Ted Green"

Magnified approximately 160X.

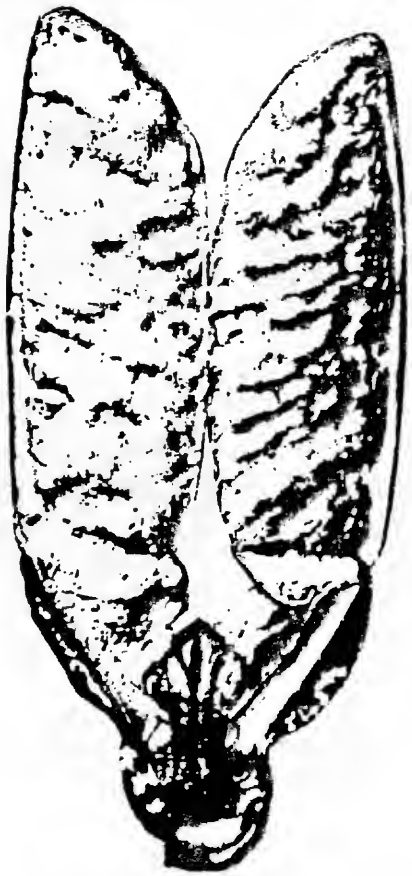
	1. top figure	2. bottom figure
Pollinium		
length:	0.190 mm.	0.215 mm.
widest:	0.090 mm.	0.080 mm.
Retinaculum		
Length:	0.090 mm.	0.057 mm.
Shoulder:	0.047 mm.	0.050 mm.
waist:	0.030 mm.	0.030 mm.
hip:	0.050 mm.	0.040 mm.
ext.:	?	0.030 mm.
Translators		
length:	0.080 mm.	0.100 mm.
depth:	0.035 mm.	0.040 mm.
Caudicle		
bulb diam.:	0.040 mm.	0.040 mm.

Magnified approximately 160X.

Hoya rumphii Blume 1826

From TG via Jerry Williams.

This plant does not fit Type description.

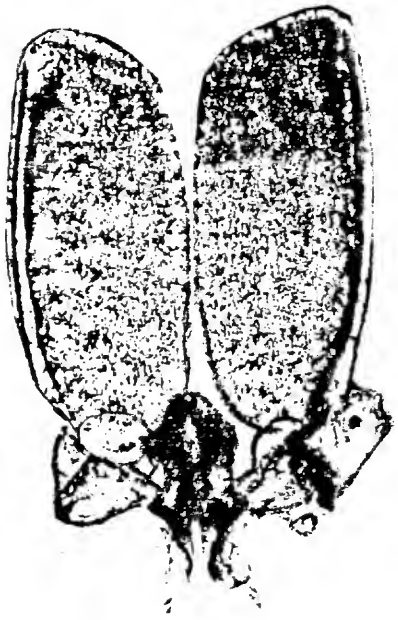


Pollinium	
length:	0.500 mm.
widest:	0.165 mm.
Retinaculum	
length:	0.160 mm.
shoulder:	0.080 mm.
waist:	0.480 mm.
hip:	0.052 mm.
ext.:	0.050 mm.
Translators	
length:	0.170 mm.
depth:	0.030 mm.
Caudicle	
bulb. diam.:	0.070 mm.

Note: complex translators.

Magnified approximately 160X

Hoya eitapensis Schlechter 1909
Flowered in Fresno CA.



Pollinium	
length:	0.350 mm.
widest:	0.150 mm.
Retinaculum	
length:	0.100 mm.
shoulder:	0.085 mm.
waist:	0.060 mm.
hip:	0.086 mm.
extensions:	0.052 mm.
Translator	
length:	0.090 mm.
end width:	0.060 mm.
Caudicle	
bulb diam.:	0.050 mm.

Magnified approximately 160X.

Hoya sp. 577

Flower from AW.

Pollinium

length:	0.55 mm.
widest:	0.20 mm.

Retinaculum

length:	0.16 mm.
shoulder:	0.08 mm.
waist:	0.05 mm.
hip:	0.09 mm.
ext.:	0.04 mm.

Translators

length:	0.14 mm.
depth:	0.05 mm.

Caudicle

bulb. diam.:	0.09 mm.

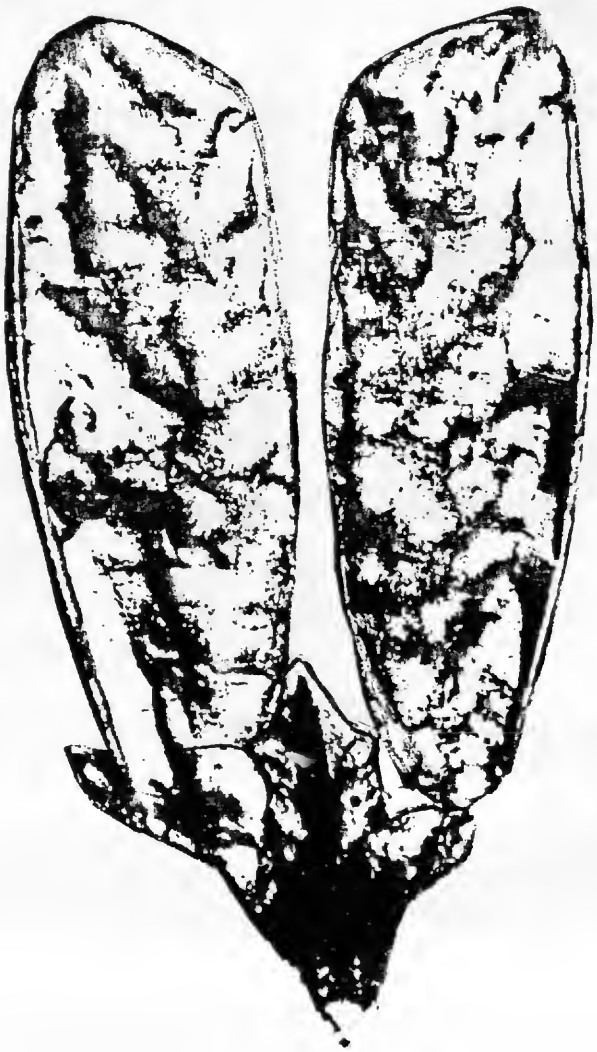
Note: check this designation with H. plicata on page 111, I believe they are the same species.

Magnified approximately 160X

Hoya verticillata (Vahl) G. Gon Pollinaria

This species in it's wide distribution and variability rivals the *Hoya australis* R. Brown ex Trail complex. Like the later the flower characteristics (baring color to some extent) are similar but with widely different foliage types. We have many species or clones, depending on your viewpoint. Under this name have been included the following species: *Hoya acuta* Haworth, *Hoya albens* Miller ex Stroud. *Hoya angustifolia* Trail, *Hoya globiflora* Ridley, *Hoya hookeriana* Wight, *Hoya lanceolata* Lindley, *Hoya nicobarica* R. Brown, *Hoya parasitica* Wight, *Hoya pottsii* Trail, *Hoya pallida* Lindley and *Hoya ridleyi* King & Gamble. A determined "Lumper" might also include *Hoya cinnamomifolia* Hooker, *Hoya purpureofusca* Hooker, *Hoya rigida* Kerr, *Hoya citrina* Ridley, *Hoya subquintuplinervis* Miquel and *Hoya obscurinervia* Merrill. It is hoped the presentation here of some of the Pollinarium might give weight to one view or another.

Hoya verticillata (Vahl) G. Don 1837
Seedling via MM, Hawaii.
Flowered in Fresno CA, USA

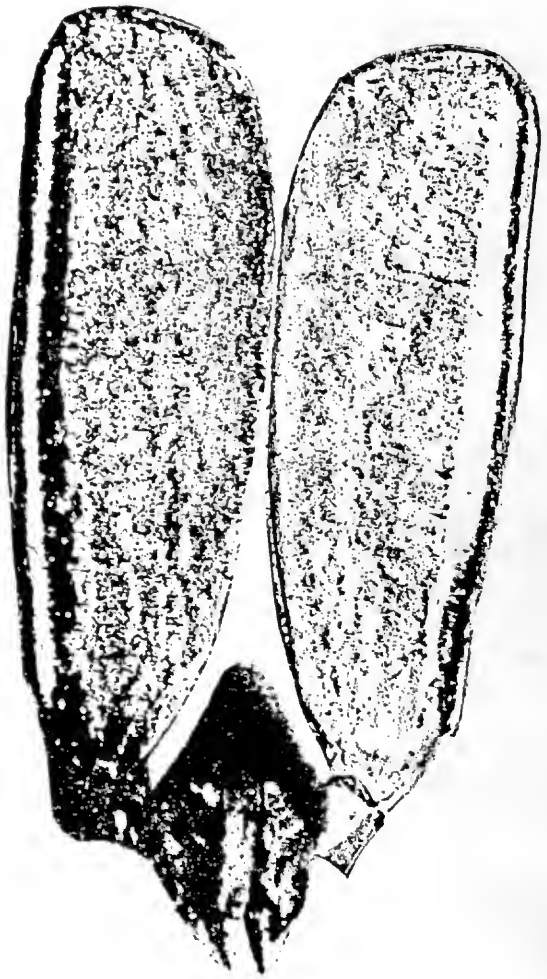


Pollinarium	
length:	0.68 mm.
widest:	0.24 mm.
Retinaculum	
length:	0.29 mm.
shoulder:	0.11 mm.
waist:	0.08 mm.
hip:	0.13 mm.
ext.:	0.06 mm.
Translators	
length:	0.07 mm.
depth:	0.03 mm.
Caudicle	
bulb diam.:	0.07 mm.

Magnified approximately 160X

Hoya verticillata (Vahl) Don 1837

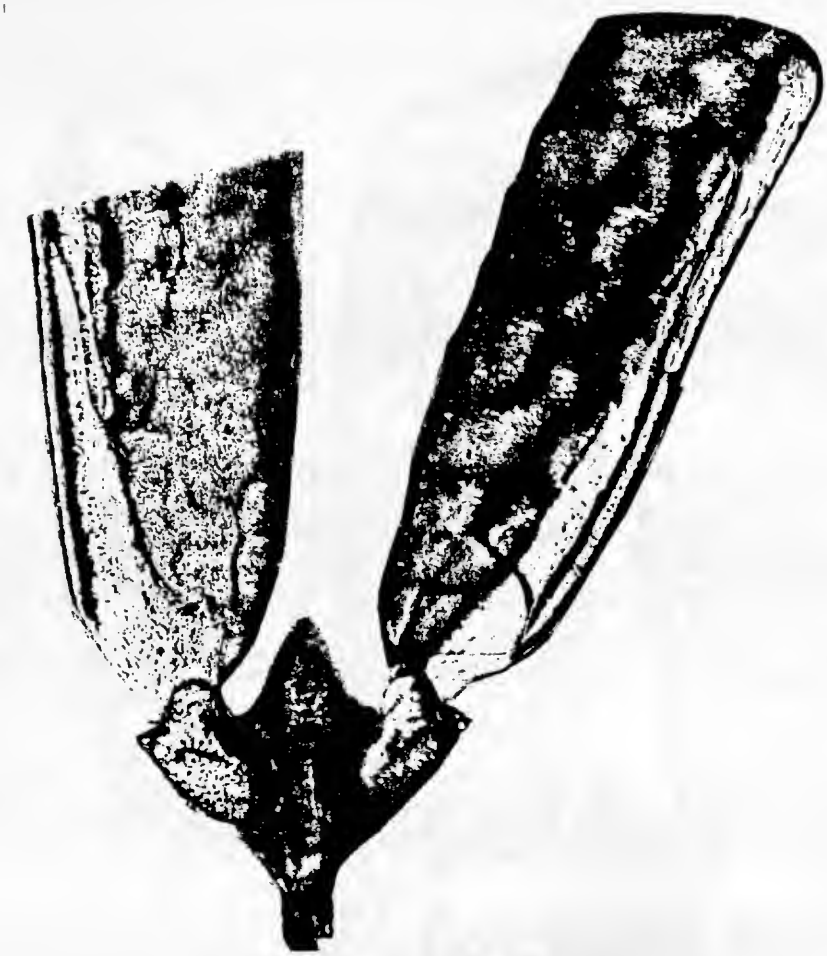
Clone from CT, Thailand, foliage looks like H. finlaysonii.



Pollinium		
	length:	0.67 mm.
	widest:	0.23 mm.
Retinaculum		
	length:	0.22 mm.
	shoulder:	0.16 mm.
	waist:	0.10 mm.
	hip:	0.12 mm.
	ext.:	0.05 mm.
Translators		
	length:	0.12 mm.
	depth:	0.02 mm.
Caudicle		
	bulb. diam.:	0.04 mm.

Magnified approximately 160X.

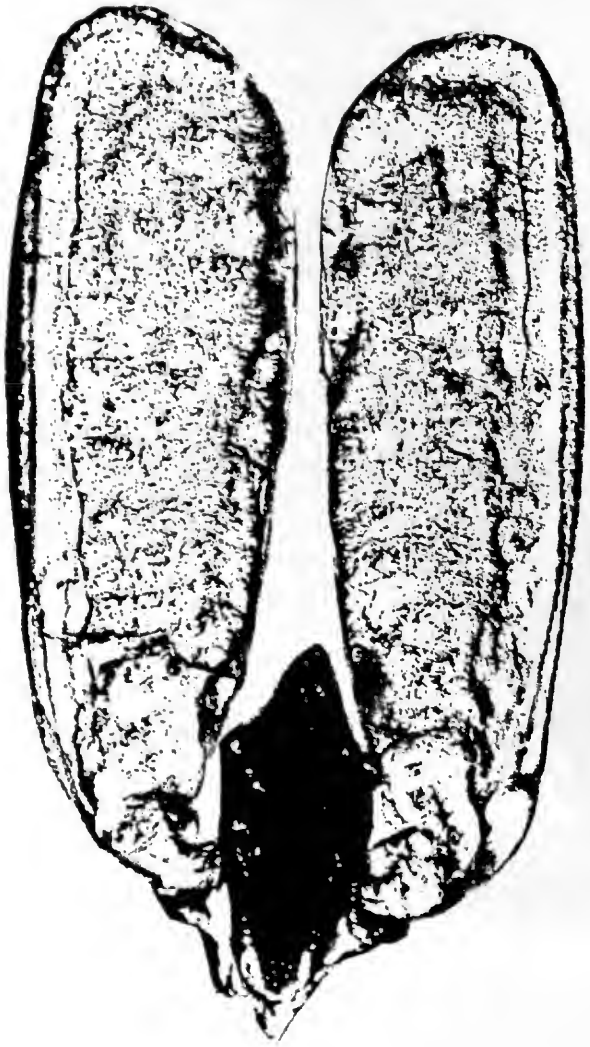
Hoya verticillata (Vahl) G. Don 1837
Flower from clone H. acuta var. green.
Flowered in Fresno CA..



Magnified approximately 160X

Pollinium length: 0.650 mm.; widest: 0.210 mm.
Retinaculum length: 0.250 mm.; shoulder: 0.151 mm.; waist: 0.090 mm.; hip: 0.138 mm.; ext.: 0.050 mm.
Translators length: 0.115 mm.; depth: 0.050 mm.
Caudicle bulb diam.: 0.125 mm.

Hoya sp. Bangkok 4

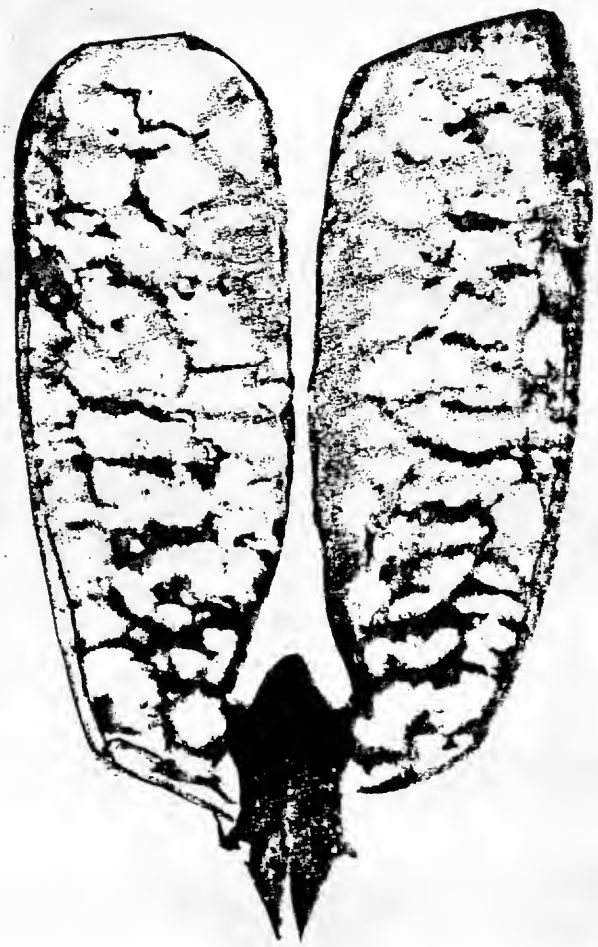


Pollinium	
length:	0.74 mm.
widest:	0.25 mm.
Retinaculum	
length:	0.30 mm.
shoulder:	0.14 mm.
waist:	0.11 mm.
hip:	0.12 mm.
ext.:	?
Translators	
length:	0.24 mm.
depth:	0.03 mm.
Caudicle	
bulb. diam.:	0.12 mm.

Magnifies approximately 160X.

Hoya rigida Kerr 1939

Pollinaria from flower supplied by CT, Thailand.



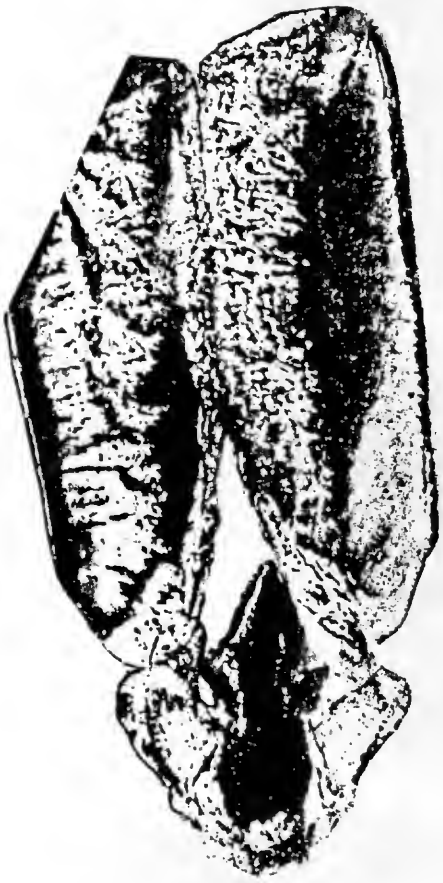
Pollinium		
	length:	0.625 mm.
	widest:	0.250 mm.
Retinaculum		
	length:	0.180 mm.
	shoulder:	0.130 mm.
	waist:	0.080 mm.
	hip:	0.120 mm.
	ext.:	0.070 mm.
Translators		
	length:	0.130 mm.
	depth:	0.020 mm.
Caudicle		
	bulb diam.:	0.060 mm.

Magnified approximately 160X.

Hoya citrina Ridley 1922

Grown and flowered in Fresno CA

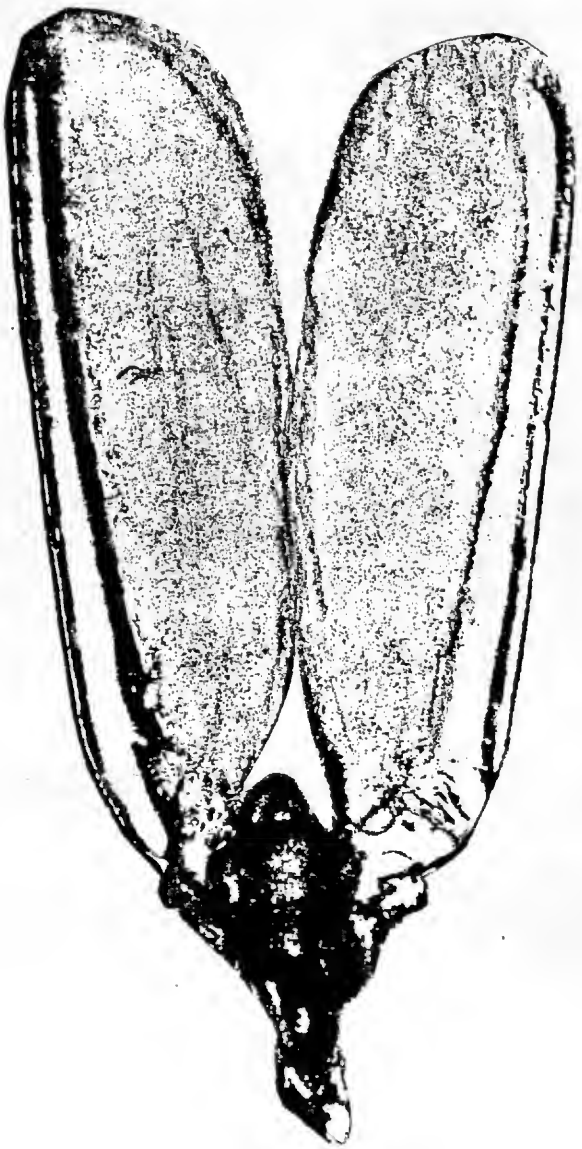
from clone collected by Dr. Chin in Central Malaya.



Pollinium		
	length:	0.56 mm.
	widest:	0.18 mm.
Retinaculum		
	length:	0.23 mm.
	shoulder:	0.12 mm.
	waist:	0.08 mm.
	hip:	0.10 mm.
	ext.:	0.05 mm.
Translators		
	length:	0.13 mm.
	depth:	0.06 mm.
Caudicle		
	bulb. diam.:	0.08 mm.

Magnified approximately 160X.

Hoya sp. Thailand
via CT, Bangkok.



Pollinium

length:	0.76 mm.
widest:	0.23 mm.

Retinaculum

length:	0.20 mm.
shoulder:	0.15 mm.
waist:	0.15 mm.
hip:	0.08 mm.
ext.:	0.07 mm.

Translators

length:	0.09 mm.
depth:	0.02 mm.

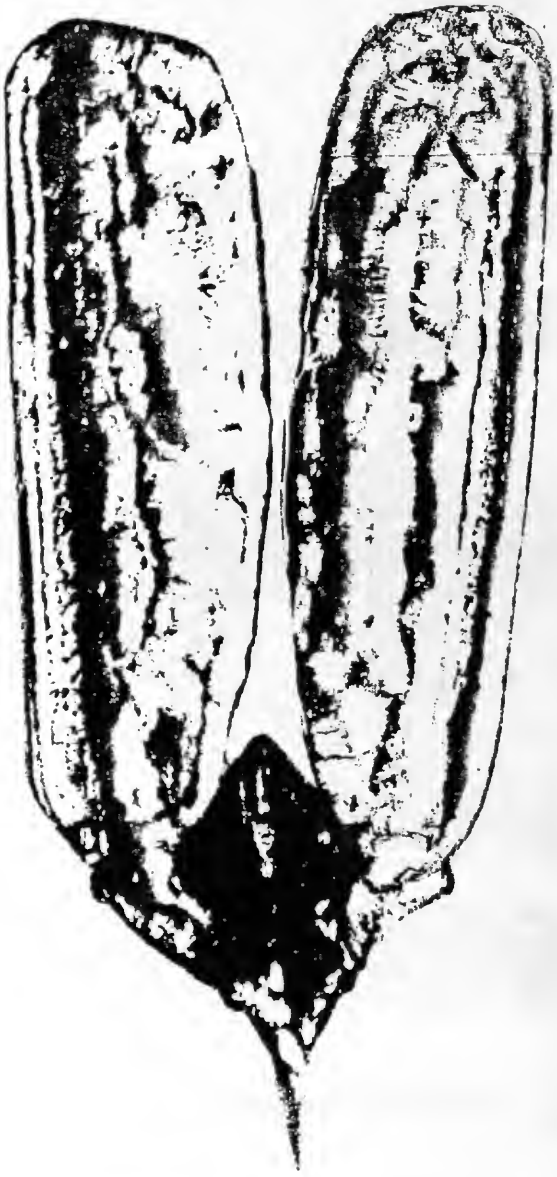
Caudicle

bulb. diam.:	0.06 mm.

Magnified approximately 160X.

Hoya subquintuplinervis Miquel 1869

Flower from clone purchased as H. sp. Chieng Mai.

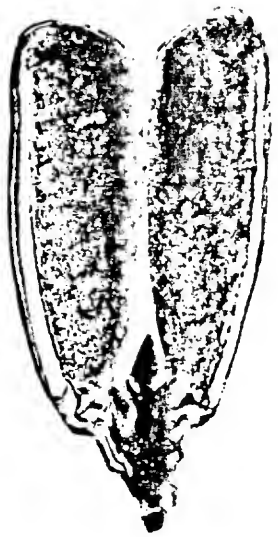


Pollinium	
length:	0.740 mm.
widest:	0.220 mm.
Retinaculum	
length:	0.195 mm.
shoulder:	0.170 mm.
waist:	0.120 mm.
hip:	0.138 mm.
ext.:	0.080 mm.
Translators	
length:	0.115 mm.
depth:	0.040 mm.
Caudicle	
bulb diam.:	0.050 mm.

Magnified approximately 160X.

Hoya pachyclada Kerr 1939

Flower from clone 574 flowered in Fresno CA..



Pollinium	
length:	0.75 mm.
widest:	0.28 mm.
Retinaculum	
length:	0.35 m.
shoulder:	0.15 mm.
waist:	0.07 mm.
hip:	0.13 mm.
ext.:	0.06 mm.
Translators	
length:	0.21 mm.
depth:	0.02 mm.
Caudicle	
bulb. diam.:	0.10 mm.

Magnified approximately 65X.

Hoya cinnamomifolia Hooker 1848

Flower via AW.

Pollinium

length:	0.70 mm.
widest:	0.30 mm.

Retinaculum

length:	0.29 mm.
shoulder:	0.22 mm.
waist:	0.10 mm.
hip:	0.15 mm.
ext.:	0.05 mm.

Translators

length:	0.18 mm.
depth:	0.04 mm.

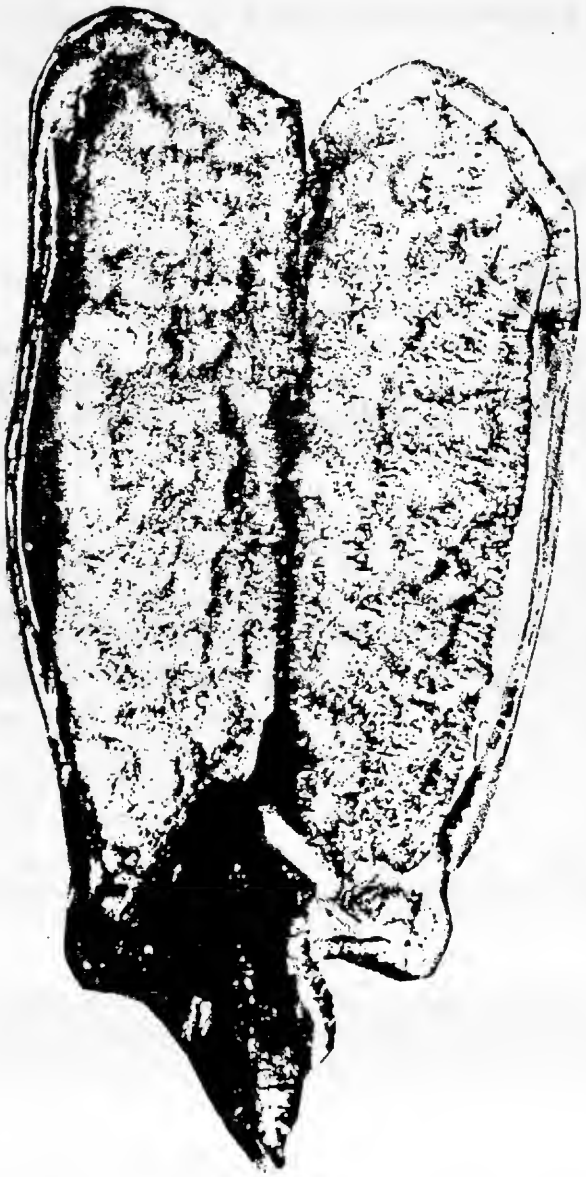
Caudicle

bulb. diam.:	0.08 mm.

Magnified approximately 160X.

Hoya purpureofusca Hooker 1849

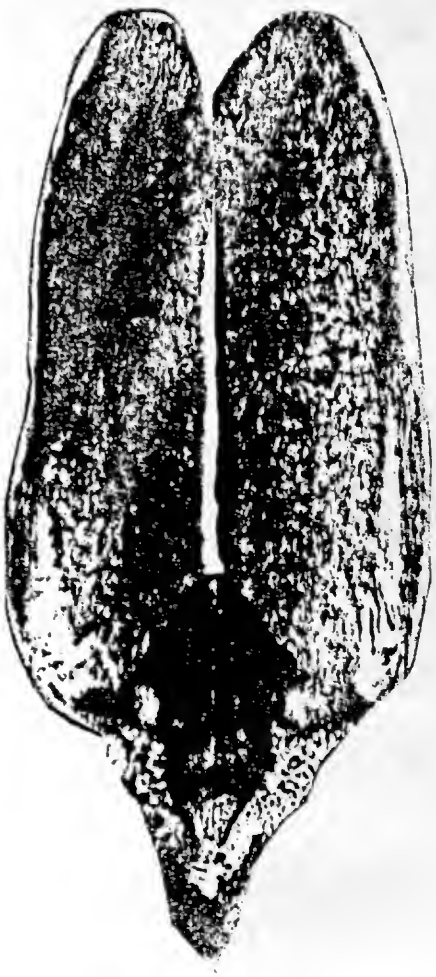
Flower from clone flowered at Fresno CA.



Pollinium	
length:	0.73 mm.
widest:	0.25 mm.
Retinaculum	
length:	0.30 mm.
shoulder:	0.17 mm.
waist:	0.07 mm.
hip:	0.11 mm.
ext.:	0.04 mm.
Translators	
length:	0.20 mm.
depth:	0.025 mm.
Caudicle	
bulb diam.:	?

Magnified approximately 160X.

Hoya sp. India #3



Pollinium

length:	0.61 mm.
widest:	0.18 mm.

Retinaculum

length:	0.20 mm.
shoulder:	0.15 mm.
widest:	0.08 mm.
hip:	0.10 mm.
ext.:	0.04 mm.

Translators

length: ca.	0.10 mm.
depth:	0.02 mm.

Caudicle

bulb diam.: ?	0.05 mm.

Magnified approximately 160X.

The Carnosa Complex Pollinarium

Hoyas of the Section Hoya include, among others, *Hoya carnosa* R. Brown, *Hoya motoskei* Teijsmann & Binn. and *Hoya fungii* Merrill. There are many color variations in the carnosa group and I have here shown the variation present in the pollinaria. Either these species are highly variable (namely Hoya carnosa) or there are more species involved. An in-depth study of the clones now in commerce and herbarium sheets would be a valuable addition to our knowledge and understanding of this group.

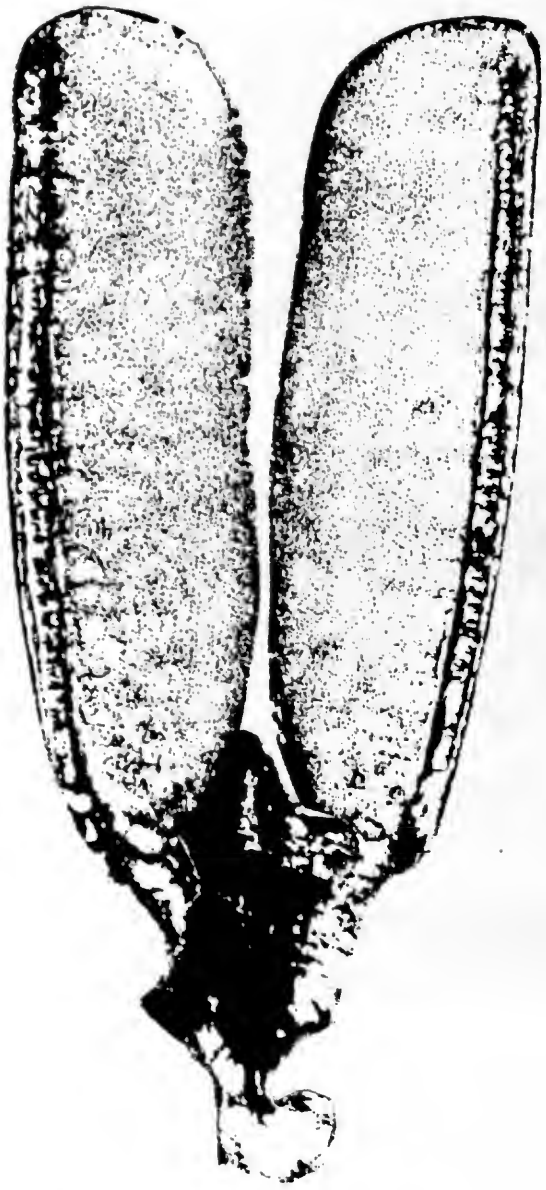
The author of *Hoya intermedia* A. C. Smith has said his species was believed to be an escape in the Fiji Islands and was *Hoya carnosa* R. Brown. The leaf shape of type clone does not seem to me to be typical of *Hoya carnosa* R. Brown species. In addition the pollinarium and retinaculum of Smith's species is smaller. The pollinarium seem to more nearly fit *Hoya verticillata* (Vahl) G. Don.

One clone with rather large glossy foliage and large globose flower clusters is shown here. Its flowers are slightly larger than the typical *H. carnosa* R. Br. flowers. This species is labeled "DD's Big One". The pollinium of this clone is nearly 1 mm. long and could be included with the large pollinia group, however I placed it here since the flowers are so similar to *H. carnosa* R. Br..

Within species called by this name there are clones with both spatulate and dentate inner corona lobes. This indicates that there is more than a single species or at least a cline with wide variability present.

Hoya carnosa R. Brown 1802

Seedling clone D124, flowered in Fresno CA.

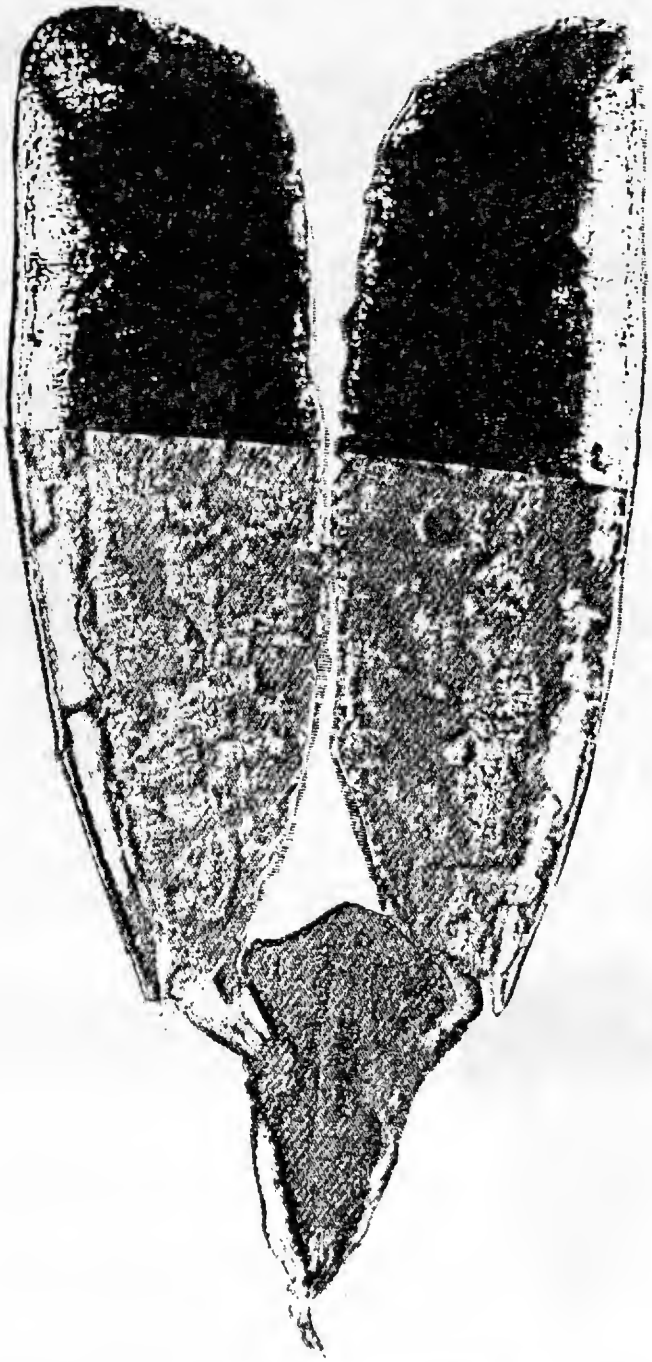


Pollinium	
length:	0.75 mm.
widest:	0.22 mm.
Retinaculum	
length:	0.28 mm.
shoulder:	0.16 mm.
waist:	0.10 mm.
hip:	0.12 mm.
ext.:	0.03 mm.
Translators	
length:	0.10 mm.
depth:	0.04 mm.
Caudicle	
bulb. diam.:	0.07 mm.

Magnified approximately 160X.

Hoya carnosa R. Brown 1802

Pale (white) flower Fresno CA 1995.



Pollinium

length:	0.82 mm.
widest:	0.25 mm.

Retinaculum

length:	0.28 mm.
shoulder:	0.18 mm.
waist:	0.05 mm.
hip:	0.10 mm.
ext.:	0.03 mm.

Translators

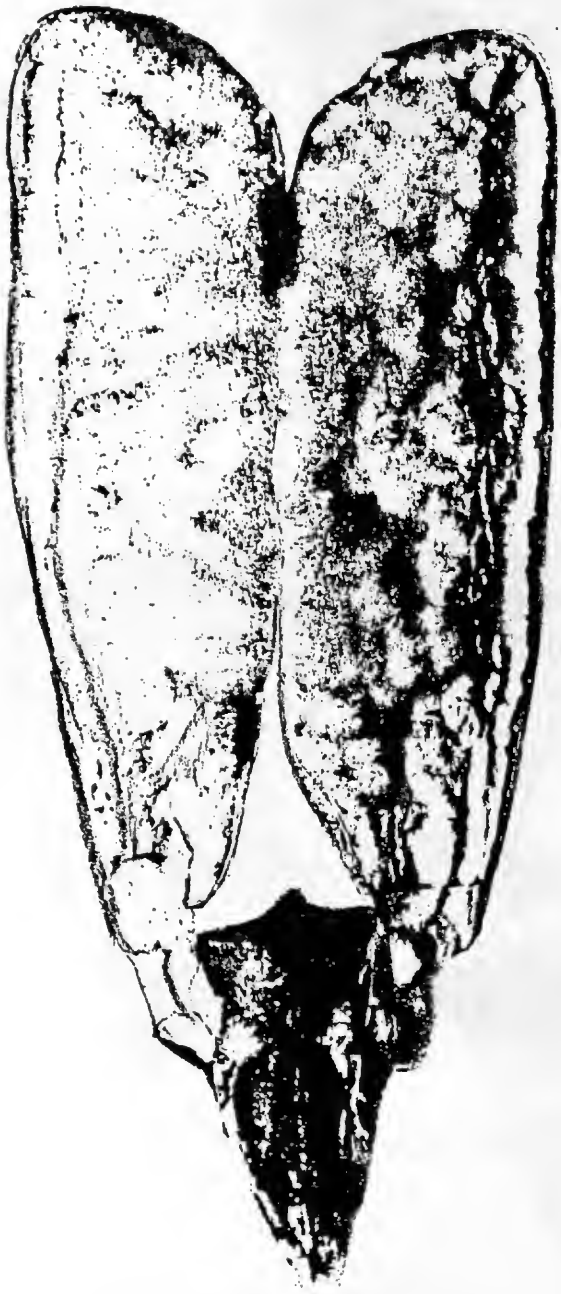
length:	0.13 mm.
depth:	0.02 mm.

Caudicle

bulb. diam.:	0.04 mm.

Magnified approximately 160X.

Hoya motoskei Teijsmann & Binnend. 1852
Flowered at Fresno CA. USA
IML 50 'Thailand White'

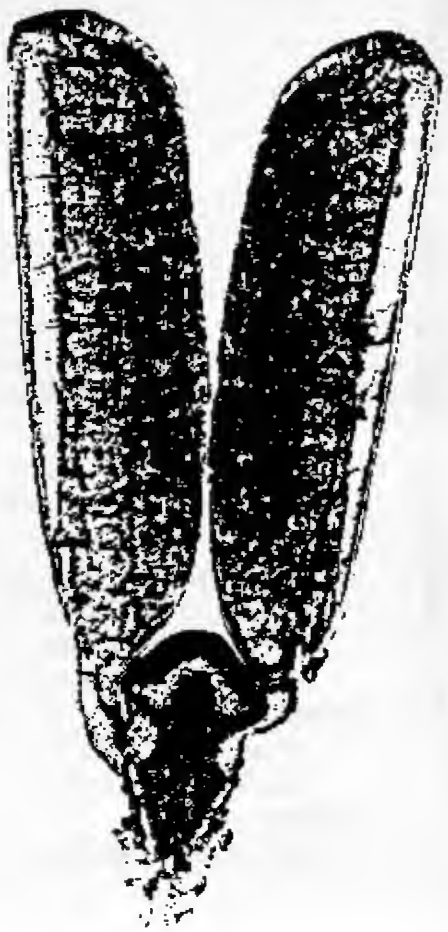


Pollinium
length: 0.80 mm.
widest: 0.25 mm.
Retinaculum
length: 0.27 mm.
shoulder: 0.18 mm.
waist: 0.08 mm.
hip: 0.10 mm.
ext.: 0.05 mm.
Translators
length: 0.12 mm.
depth: 0.04 mm.
Caudicle
bulb. diam.: 0.08 mm.

Magnified approximately 160X.

Hoya fungii Merrill 1934

Pollinarium from flowering at Fresno CA.

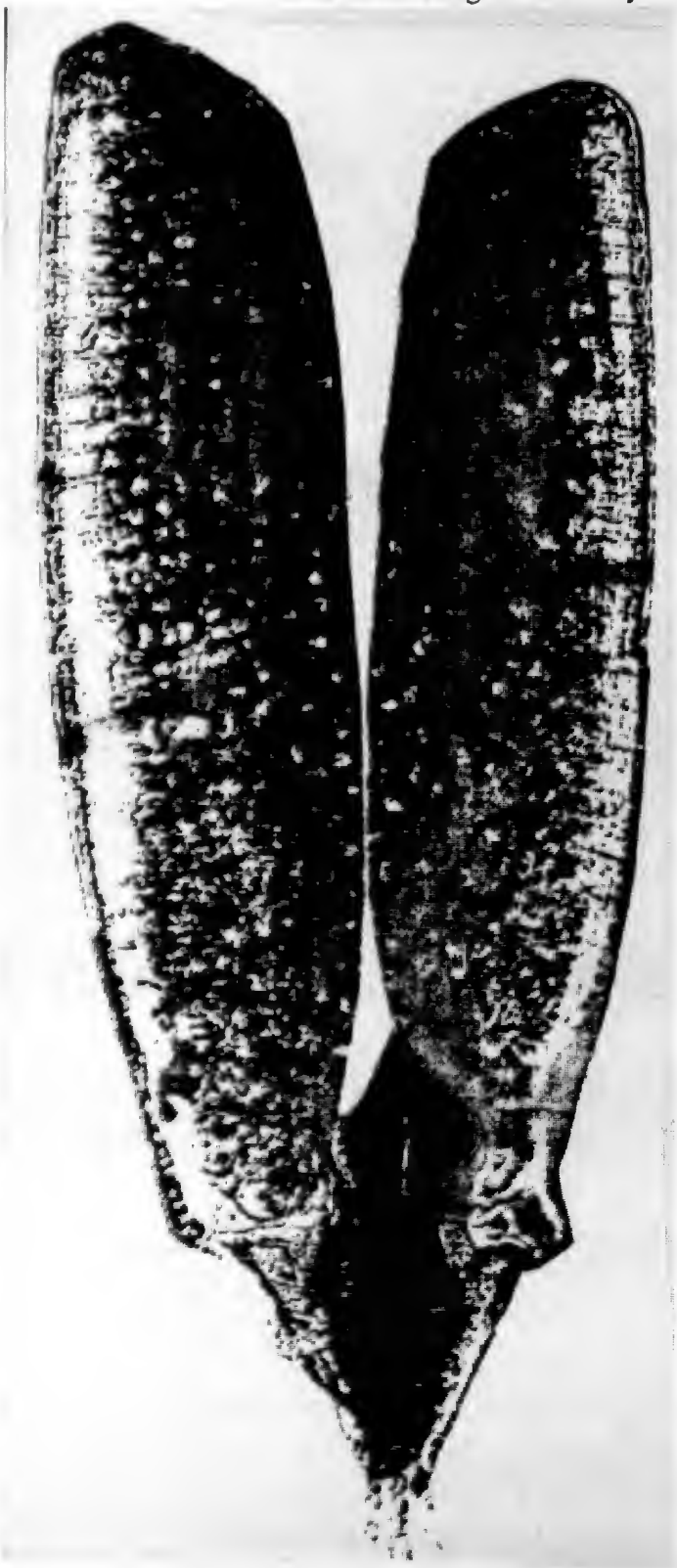


Pollinium	
length:	0.74 mm.
widest:	0.20 mm.
Retinaculum	
length:	0.26 mm.
shoulder:	0.17 mm.
waist:	0.08 mm.
hip:	0.12 mm.
ext.:	0.08 mm.
Translators	
length:	0.12 mm.
depth:	0.04 mm.
Caudicle	
bulb diam.:	0.06 mm.

Magnified approximately 160 X

Hoya carnosa R. Brown 1802

Clone D.D.'s Big One via Jerry Williams.



Pollinium

length:	0.99 mm.
widest:	0.24 mm.

Retinaculum

length:	0.33 mm.
shoulder:	0.13 mm.
waist:	0.07 mm.
hip:	0.12 mm.
ext.:	0.03 mm.

Translators

length:	0.16 mm.
depth:	0.02 mm.

Caudicle

bulb. diam.:	0.09 mm.

Magnified approximately 160 X

Section Otostemma (Bl.) Miquel Species

The Section Otostemma (Blume) Miquel hoyas are few in number. This section of hoyas does not have a channel on the underside of the coronal scale. They possess a skirt like the annulus on some mushrooms. The pollinarium have well developed prominent translator arms and readily visible caudicles. The whole structure is similar to pollinaria from species in the Section Acanthostemma (Blume) Kloppenburg. The retinaculum tend to be slightly proportionally smaller and the translators more linear in the later section. The pollinarium of *Hoya lacunosa* Blume the TYPE species for this section is show along with one of its varieties. In addition two clones of *Hoya obscura* Elmer ex Burton are represented here. There appears to be several undescribed and unnamed species in Borneo. I have presented two of these latter clones on the following pages.

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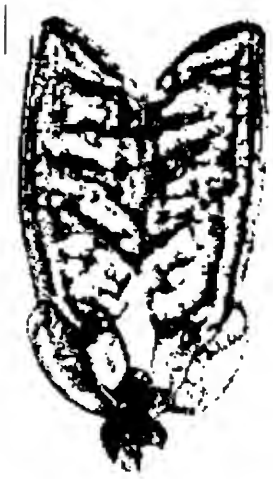
Hoya lacunosa Blume 1826
Flower form blooming at Fresno CA.

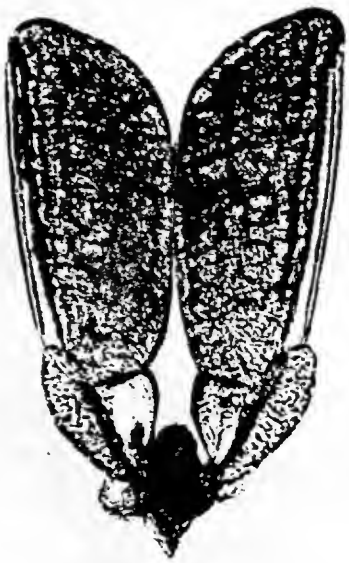


Pollinium	
length:	0.370 mm.
widest:	0.140 mm.
Retinaculum	
length:	0.098 mm.
shoulder:	0.060 mm.
waist:	0.030 mm.
hip:	0.050 mm.
ext.:	0.024 mm.
Translators	
length:	0.165 mm
depth:	0.050 mm.
Caudicle	
bulb diam.:	0.040 mm.

Magnified approximately 160 X

Hoya lacunosa Blume 1826

Pollinarium from flower of clone labeled var. pallida.



Magnified approximately 160 X

Pollinarium		
	length:	0.355 mm.
	widest:	0.143 mm.
Retinaculum		
	length:	0.092 mm.
	shoulder: ca.	0.050 mm.
	waist: ca.	0.042 mm.
	ext.:	0.030 mm.
Translators		
	length:	0.160 mm.
	depth:	0.340 mm.
Caudicle		
	bulb diam.:	0.050 mm.

Hoya obscura Elmer ex Burton 1986
Flower from clone via Peter Tsang 1979,
flowered in Fresno CA.

Pollinium	
length:	0.41 mm.
widest:	0.14 mm.
Retinaculum	
length:	0.13 mm.
shoulder:	0.06 mm.
waist:	0.03 mm.
hip:	0.06 mm.
ext.:	0.02 mm.
Translators	
length:	0.16 mm.
depth:	0.03 mm.
Caudicle	
bulb diam:	0.06 mm.

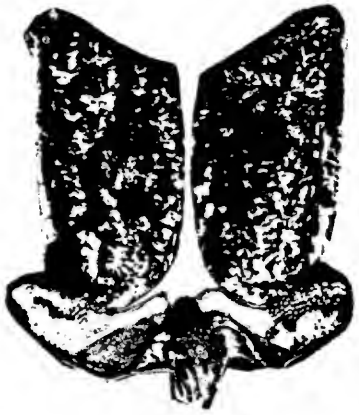
Magnified approximately 160 X

Hoya obscura Elmer ex Burtion 1986
var. longipedunculata.
Flowered at Fresno CA.

Magnified approximately 160X

Pollinarium	
length:	0.26 mm.
widest:	0.07 mm.
Retinaculum	
length:	0.11 mm.
shoulder:	0.04 mm.
waist:	0.03 mm.
hip:	0.05 mm.
ext.:	0.02 mm.
Translators	
length:	0.16 mm.
depth:	0.02 mm.
Caudicle	
bulb diam.:	0.04 mm.

Hoya sp. F484 Kuching, Borneo
Pollinium from flowering at Fresno CA.



Magnified approximately 160 X

Pollinarium

length:	0.260 mm.
widest:	0.142 mm.

Retinaculum

length:	0.070 mm.
shoulder:	0.040 mm.
waist:	0.030 mm.
hip:	0.050 mm.
ext.:	0.030 mm.

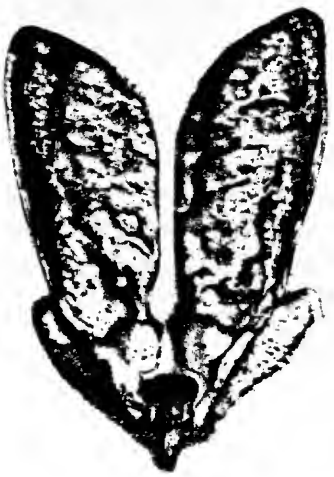
Translators

length:	0.140 mm.
depth:	0.036 mm.

Caudicle

bulb diam.: ca.	0.03 0mm.

Hoya sp. IML 232 Kuching Sarawak, Borneo
Collector Peter Tsang; flower via AW.



Magnified approximately 160 X

Pollinium		
	length:	0.290 mm.
	widest:	0.124 mm.
Retinaculum		
	length:	0.060 mm.
	shoulder:	0.156 mm.
	waist:	0.022 mm.
	hip:	0.040 mm.
	ext.:	0.025 mm.
Translators		
	length:	0.168 mm.
	depth:	0.040 mm.
Caudicle		
	bulb diam.:	0.070 mm.

Section Amblyostemma Kloppenburg Species

All the species we have that belong in this section are very strong growers (vigorous plants). Most are extremely good bloomers, the exception seems to be with the subspecies fraterna. *Hoya meliflua ssp. fraterna* Green. The pollinaria presented here from the species *Hoya diversifolia* Blume, *Hoya excavata* Teijsmann & Binnendijk, *Hoya Kerrii* Craib. *Hoya meliflua* Blanco ex Merrill and *Hoya obovata* Decaisne. *Hoya elnidicus* Kloppenburg is also included here since it has been said to be synonymous with *Hoya diversifolia* Blume. I have collected a number of flowers (1995) on Palawan, Philippines and should be able to make a correct determination soon.

Hoya diversifolia Blume 1826

Flower from specimen collected at Bogor, Indonesia in 1981.

Pollinium length: 0.690 mm.; widest: 0.225 mm.
Retinaculum length: 0.250 mm.; shoulder: 0.140 mm.; waist: 0.120 mm.; hip: 0.135 mm.; extensions: 0.070 mm.
Translators length: 0.130 mm.; depth: 0.030 mm.
Caudicle bulb diameter: ca. 0.080 mm..

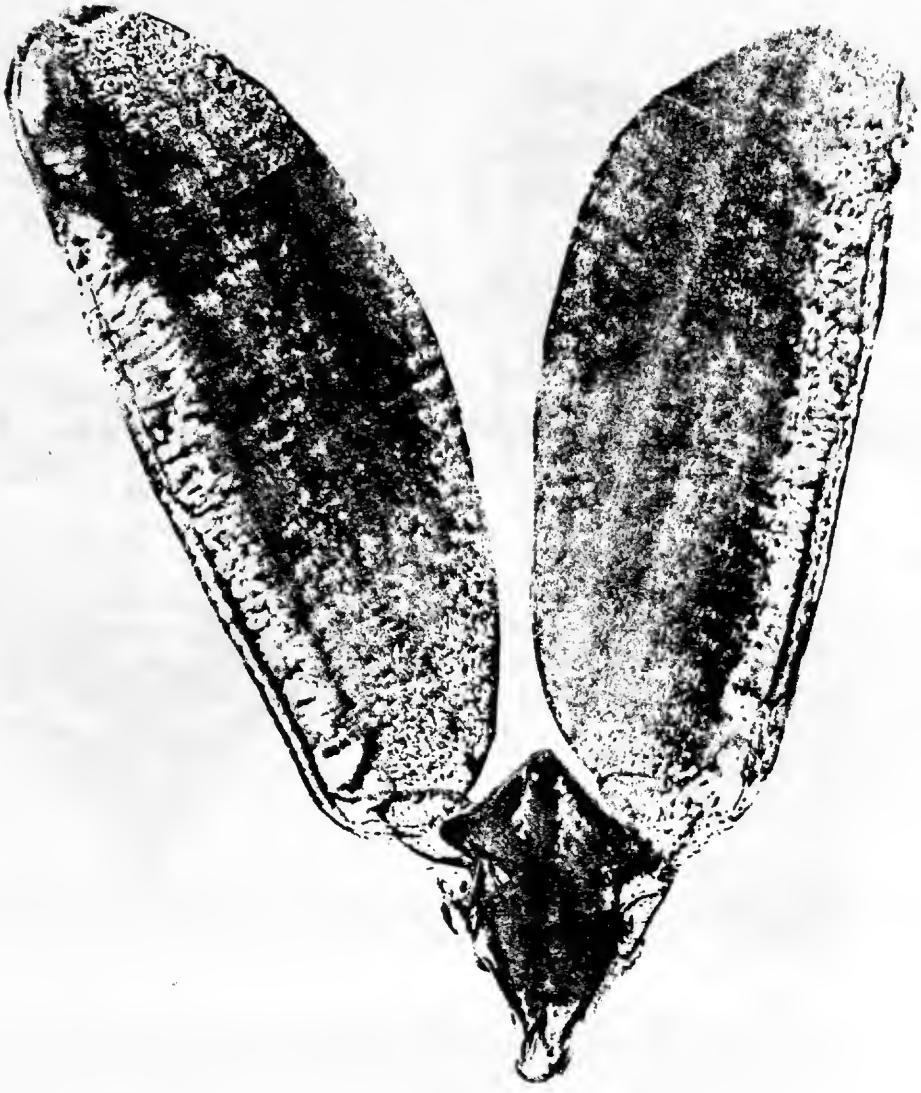
Magnified approximately 160 X

Hoya diversifolia Blume 1826
Flower form clone collected in Central Malaya 1981.
Flowered in Fresno CA.

Pollinium
length: 0.563 mm,
widest: 0.230 mm.
Retinaculum
length: 0.230 mm.
shoulder: 0.140 m.
waist: 0.140 mm.
hip: 0.120 mm.
ext.: 0.030 mm.
Translators
length: 0.130 mm.
depth: ?
Caudicle
bulb diam.: 0.080 mm. ?

Magnified approximately 160 X

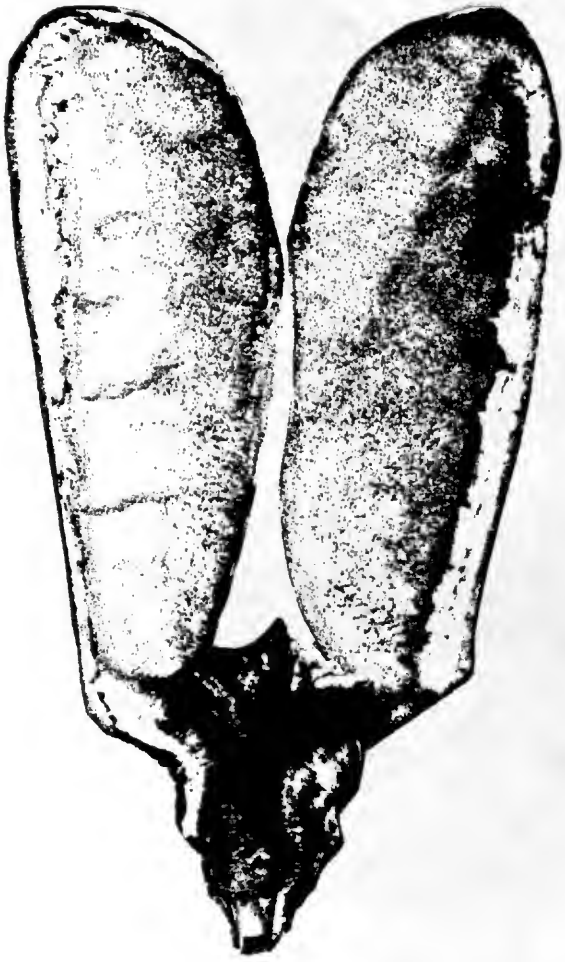
Hoya excavata Teijamann & Binnendijk 1863
Pollinarium from flower via TG.



Magnified approximately 160 X

Pollinium length: 0.79 mm.; widest: 0.28 mm.
Retinaculum length: 0.23 mm.; shoulder: 0.20 mm.; waist: 0.08 mm.; hip: 0.12 mm.; ext.: ca. 0.06 mm.
Translators length: 0.150 mm.; depth: 0.018 mm.
Caudicle bulb diameter: 0.04 mm..

Hoya kerrii Craib 1911
Flower from clone of "Thailand White"
source Sakdi Sir Nsry. Bangkok, Thailand.



Pollinium		
	length:	0.59 mm.
	widest:	0.24 mm.
Retinaculum		
	length:	0.25 mm.
	shoulder:	0.17 mm.
	waist:	0.06 mm.
	hip:	0.08 mm.
	ext.:	0.04 mm.
Translators		
	length: ca.	0.16 mm.
	depth:	0.04 mm.
Caudicle		
	bulb diam:	?

Magnified approximately 160 X

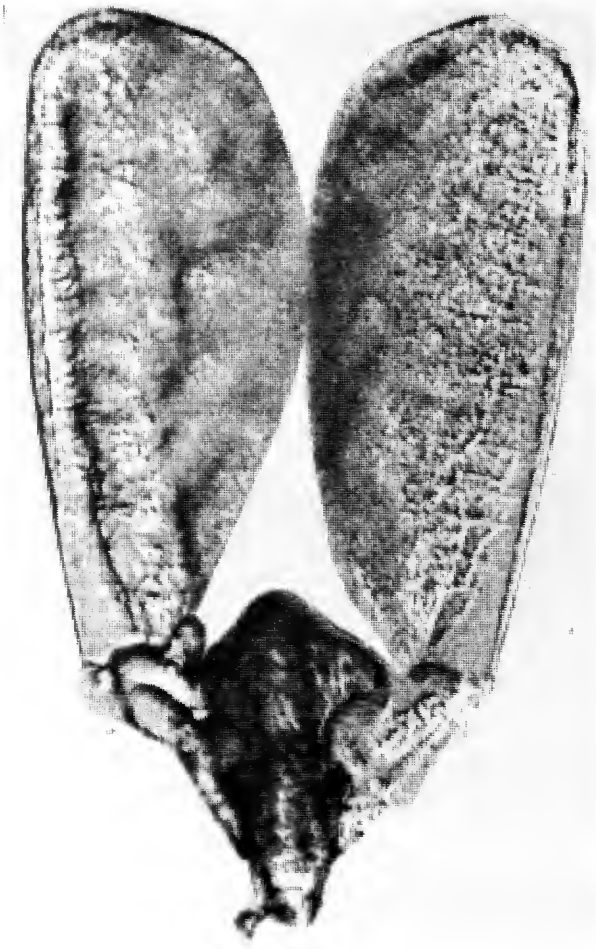
Hoya kerrii Craib 1911

Flower from clone via Marin Cactus Patch.

Pollinium	
length:	0.580 mm.
widest:	0.240 mm.
Retinaculum	
length:	0.200 mm.
shoulder:	0.155 mm.
waist:	0.060 mm.
hip:	0.100 mm.
ext.:	0.040 mm.
Translators	
length:	0.160 mm.
depth:	0.030 mm.
Caudicle	
bulb diam.:	0.070 mm.

Magnified approximately 160 X

Hoya kerrii Craib 1911
Flower from clone "Hairy kerrii".



Magnified approximately 160 X

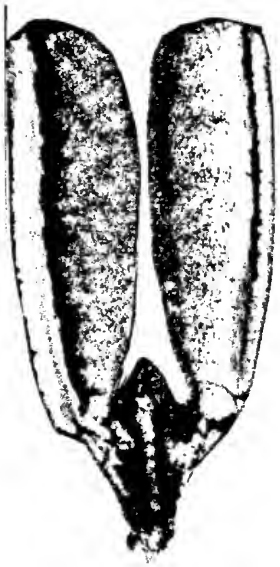
Pollinium	
length:	0.570 mm.
widest:	0.245 mm.
Retinaculum	
length:	0.260 mm.
shoulder:	0.170 mm.
waist:	0.080 mm.
hip:	0.118 mm.
ext.:	0.030 mm.
Translators	
length:	0.170 mm.
depth:	0.040 mm.
Caudicle	
bulb diam.:	0.070 mm.

Hoya meliflua Blanco ex Merrill 1837
Flower from ssp.fraterna via AW.

Pollinium
length: 0.890 mm.
widest: 0.270 mm.
Retinaculum
length: 0.335 mm.
shoulder: 0.220 mm.
waist: 0.060 mm.
hip: 0.100 mm.
ext.: 0.100 mm.
Translators
length: 0.200 mm.
depth: 0.030 mm.
Caudicle
bulb diam.: 0.050 mm.

Magnified approximately 160 X

Hoya meliflua ssp. fraterna Green 1995
Flowered from clone in So. CA.



Pollinium		
	length:	0.87 mm.
	widest:	0.27 mm.
Retinaculum		
	length:	0.37 mm.
	shoulder:	0.19 mm.
	waist:	0.08 mm.
	hip:	0.17 mm.
	ext.:	0.06 mm.
Translators		
	length:	0.13 mm.
	depth:	0.04 mm.
Caudicle		
	bulb. diam.:	0.08 mm.

Magnified approximately 65 X

Hoya obovata Decaisne 1844
Flowered at Fresno CA..

Pollinium
length: 0.60 mm.
widest: 0.24 mm.
Retinaculum
length: 0.27 mm.
shoulder: 0.17 mm.
waist: 0.08 mm.
hip: 0.09 m.
ext.: 0.04 mm.
Translators
length: 0.17 mm.
depth: 0.02 mm.
Caudicle
bulb. diam.: ?

Magnified approximately 65 X

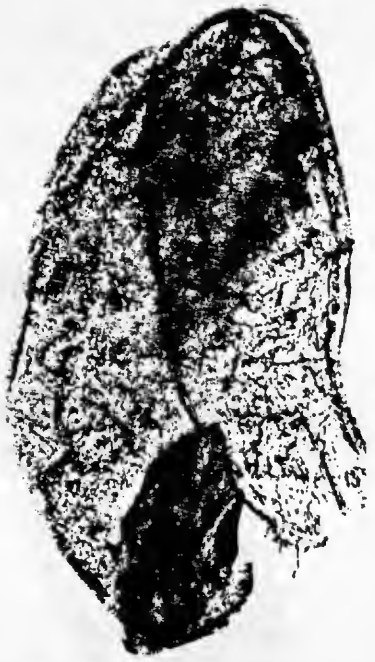
Some controversial Species

In the Philippines there is a very widespread and prevalent group of Hoyas with reflexed corollas, cream with bronze red tipped corona lobes. The group includes *Hoya incrassata* Warburg, *Hoya crassicaulis* (Elmer) Kloppenburg. Although the foliage of this group is similar, there are differences and a wide range of variability. In addition the coronal lobes show about four distinct forms. The pollinarium are also variable as shown on the following pages. The type of *Hoya crassicaulis* (Elmer) Kloppenburg, Elmer's #14440 is shown first so the reader can see the differences from this TYPE material, and others presented. Especially note the lengths of the various retinacula.

The hybrid ? cross by Michael Myashiro in Hawaii of *Hoya meridithii* Green *x* *Hoya crassicaulis* (Elmer) Klopp. has the characteristic conformation of the *H. crassicaulis* type. I have scanned in the pollinarium from *Hoya crasssicaulis* (Elmer) Kloppenburg and *Hoya incrassata* Warburg for a comparison. The overall size is different as well as a major difference in the retinaculum.

Following this is the (1) pod parent *Hoya meridithii* Green 1989. (2) The pollinarium from the TYPE material of *Hoya vitellenioides* Bakhuizen van den Brink. (3) a pollinarium from a clone IPPS 7020. All three specimens have rather long retinaculum and are undoubtedly closely related but only the latter one matches the TYPE material in the form and shape of the pollinia. In all fairness to this comparison I believe all other taxonomic traits should also be taken into considered in making correct identifications.

Hoya crassicaulis Elmer ex Kloppenburg
Flower from Type specimen Elmer #14440
Mt Bulusan, Sorsogon, Luzon, Philippines



Magnified approximately 160 X

	top subject	bottom subject
Pollinium		
length:	0.480 mm.	0.432 mm.
widest:	0.180 mm.	0.160 mm.
Retinaculum		
length:	0.210 mm.	0.180 mm.
shoulder:	0.090 mm.	0.100 mm.
waist:	0.058 mm.	0.060 mm.
hip:	0.080 mm.	0.100 mm.
ext.:	?	?
Translators		
length:	?	?
depth:	?	?
Caudicle		
bulb diam.:	?	?

Magnified approximately 160 X

Note: This grouping points out one of the difficulties with working with herbarium material. This material was soaked in 'Kew Solution' to make it more pliable to manipulation. In spite of this the retinaculum tended to remain curved and thus difficult to get precise measurements. Overall the relationships of relative size and shape of parts can be recognized.

Hoya crassicaulis Elmer ex Kloppenburg
Flower from clone with outer coronal lobes turned up.

Magnified approximately 160 X

Pollinium

length:	0.490 mm.
widest:	0.178 mm.

Retinaculum

length:	0.200 mm.
shoulder:	0.089 mm.
waist:	0.050 mm.
hip:	0.090 mm.
ext.:	0.030 mm.

Translators

length:	0.140 mm.
depth:	0.050 mm.

Caudicle

bulb diam.: ?

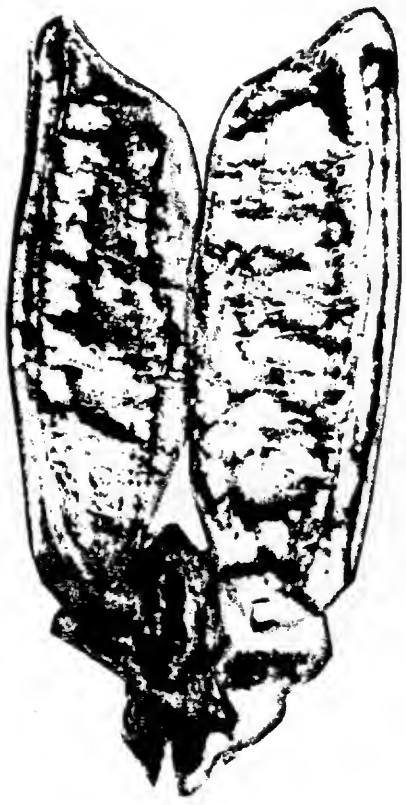
Hoya crassicaulis Elmer ex Kloppenburg

Flowered in Fresno CA from clone collected by Prof. Juan Pancho on Mt. Banahao, Luzon, Philippines.

Magnified approximately 160 X

Pollinium		
	length:	0.47 mm.
	widest:	0.14 mm.
Retinaculum		
	length:	0.15 mm.
	shoulder:	0.14 mm.
	waist:	0.08 mm.
	hip:	0.10 mm.
	ext.:	0.07 mm.
Translators		
	length:	0.09 mm.
	depth:	0.02 mm.
Caudicle		
	bulb diam.:	0.04 mm.

Hoya crassicaulis Elmer ex Kloppenburg
Flowered in Fresno CA from clone #89053 DH.

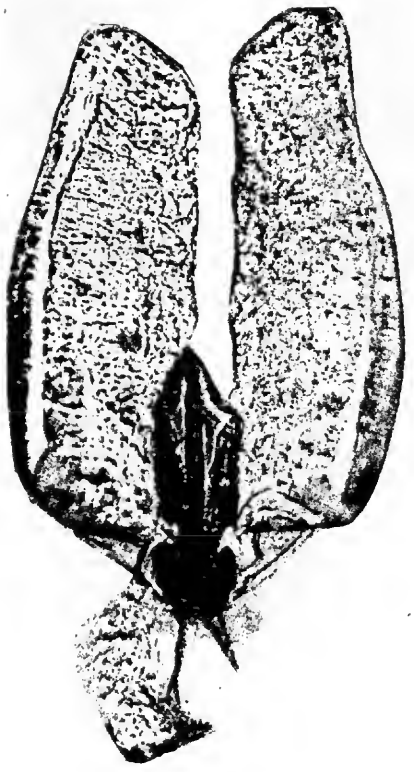


Magnified approximately 160 X

Pollinium		
	length:	0.53 mm.
	widest:	0.15 mm.
Retinaculum		
	length:	0.19 mm.
	shoulder:	0.08 mm.
	waist:	0.06 mm.
	hip:	0.09 mm.
	ext.:	0.05 mm.
Translators		
	length:	0.19 mm.
	depth:	0.02 mm.
Caudicle		
	bulb diam.:	0.05 mm.

Hoya crassicaulis Elmer ex Kloppenburg 1995

Pollinarium from Edano 46116 (1925) Capiz Panay, Pasol River, Philippines.



Magnified approximately 160 X

Pollinium	
length:	0.450 mm.
widest:	0.144 mm.
Retinaculum	
length:	0.220 mm.
shoulder:	0.080 mm.
waist:	0.060 mm
hip:	0.080 mm.
ext.:	0.050 mm.
Translators	
length:	0.090 mm.
depth:	0.010 mm.
Caudicle	
bulb depth:	0.0430 mm.

Hoya crassicaulis Elmer ex Kloppenburg
Flowered in Fresno CA from clone sent by Peter Tsang 1980.

Pollinium
length: 0.480 mm.
widest: 0.190 mm.
Retinaculum
length: 0.230 mm.
shoulder: 0.090 mm.
waist: 0.550 mm.
hip: 0.090 mm.
ext.: 0.035 mm.
Translators
length: 0.090 mm.
depth: 0.010 mm.
Caudicle
bulb diam.:0.080 mm.

Magnified approximately 160 X

Hoya incrassata Warburg 1904
Flower from clone #90143 flowered in Fresno CA.

Pollinium	
length:	0.49 mm
widest:	0.14 mm.
Retinaculum	
length:	0.17 mm.
shoulder:	0.08 mm,
waist:	0.05 mm
hip:	0.08 mm.
ext.:	0.04 mm.
Translators	
length:	0.09 mm.
depth:	0.02 mm.
Caudicle	
bulb diam.:	0.04 mm.

Magnified approximately 160 X

Comparison

Hoya crassicaulis vs. Hoya incrassata

On the left is Hoya crassicaulis.

On the right is Hoya incrassata.

This is a magnification of approximately 65X.

The pollinarium of Hoya is slightly larger overall than Hoya incrassata. The major difference here is the size of the retinaculum, that of Hoya crassicaulis being much longer. The two clones shown here are #900355 (Hoya crassicaulis) and # 900143 (hoya incrassata).

Hoya meredithii x crassicaulis

Grown and flowered in Fresno CA
from hybrid seedlings via MM.

Pollinium

length:	0.63 mm.
widest:	0.23 mm.

Retinaculum

length:	0.23 mm.
shoulder:	0.13 mm.
waist:	0.08 mm.
hip:	0.11 mm.
ext.:	0.08 mm.

Translators

length:	0.15 mm.
depth:	0.04 mm.

Caudicle

bulb. diam.:	0.07 mm.

Magnified approximately 65 X

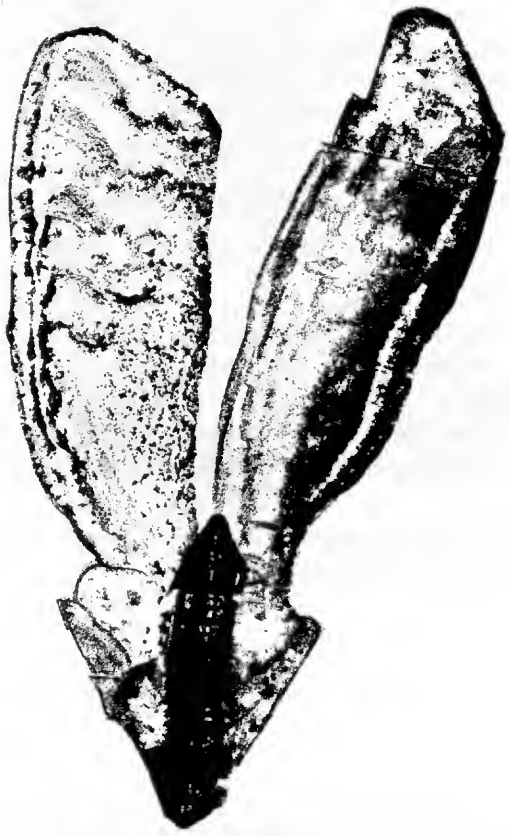
Hoya meredithii Green 1989
Flower from clone 80-05 via TG.

Magnified approximately 160 X

Pollinium	
length:	0.490 mm.
depth:	0.168 mm.
Retinaculum	
length:	0.235 mm.
shoulder:	0.080 mm.
waist:	0.060 mm.
hip:	0.065 mm.
ext.:	0.020 mm.
Translators	
length:	0.120 mm.
depth:	0.045 mm.
Caudicle	
bulb diam.:	0.070 mm.

Hoya vitellinioides Brink f. 1950

Pollinarium from Type flower via CB from (BO).



Pollinium		
	length:	0.500 mm.
	widest:	0.180 mm.
Retinaculum		
	length:	0.260 mm.
	shoulder:	0.070 mm.
	waist:	0.056 mm.
	hip:	0.060 mm.
	ext.: ca.	0.010 mm.
Translators		
	length:	0.140 mm.
	depth:	0.030 mm.
Caudicle		
	bulb diam.:	0.060 mm.

Magnified approximately 160 X

Hoya sp. IPPS 7020

via TG, possibly H. vitellinoides Brink f. 1950

Magnified approximately 160 X

Pollinium

length:	0.580 mm.
widest:	0.196 mm.

Retinaculum

length:	0.250 mm.
shoulder:	0.120 mm.
waist:	0.070 mm.
hip:	0.080 mm.
ext.:	0.080 mm.

Translators

length:	0.130 mm.
depth:	0.020 mm.

Caudicle

bulb. diam.:	0.040 mm.

possibly opaque granulate

Note: there is a secondary bulge above the waist, rather pronounced.

Hoya elnidicus Kloppenburg 1991

Flower from Type clone CAHUP 41931, El Nido, Palawan, Philippines.

Magnified approximately 160 X

Pollinium		
	length:	0.520 mm.
	widest:	0.195 mm.
Retinaculum		
	length:	0.180 mm.
	shoulder:	0.120 mm.
	waist:	0.070 mm.
	hip:	0.090 mm.
	ext.:	0.030 mm.
Translators		
	length: ca.	0.100 mm.
	depth:	0.020 mm.
Caudicle		
	bulb diam.:	0.050 mm.

Comments: this species has been incorrectly placed into synonym with H. diversifolia Blume. Compare to see the pollinaria differences.

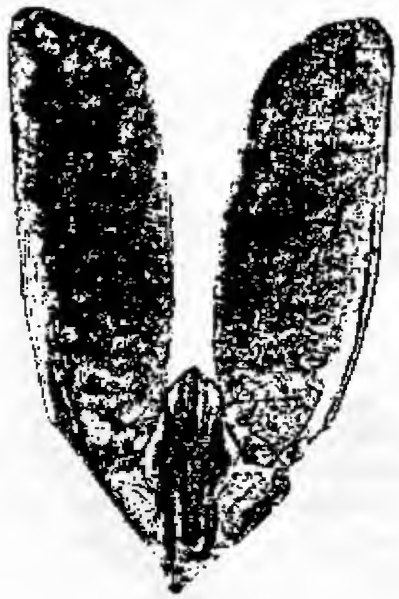
Philippine Broad Leafed Species

The following group of pollinaria are from hoyas of the Philippines which have palmately veined leaves and yellow flowers or in the case of *Hoya cardiophylla* Merrill, pinnate and also broad. Their leaf size and shape vary as well as the size of their flowers and their coronal structures are different. They are, *Hoya macgregorii* Schlechter, *Hoya merrillii* Schlechter, *Hoya pentaphlebia* Merrill and *Hoya quinquinervia* Warburg.

Species of this group are misidentified on many herbarium sheets. Even the species in commerce have for years been mislabeled. It is hoped we will eventually get all properly labeled.

ॐ

Hoya cardiophylla Merrill 1920
Flowered at Fresno CA from clone #910301 DH.
cupped coronal lobes.

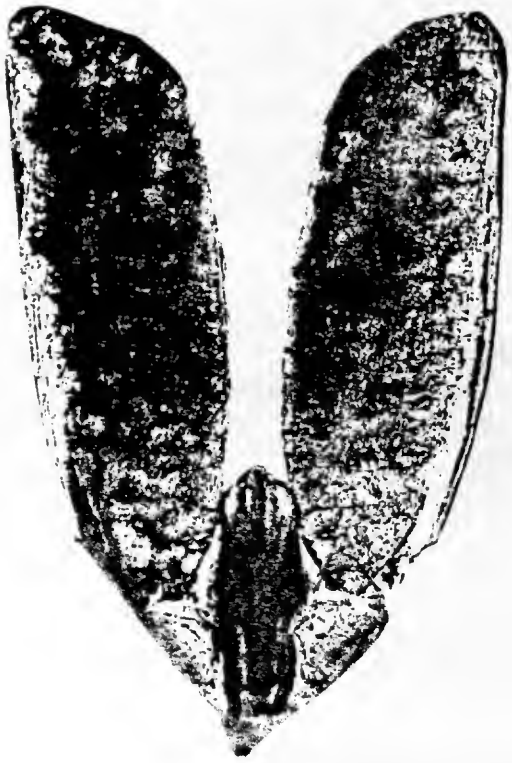


Pollinium		
	length:	0.450 mm.
	widest:	0.140 mm.
Retinaculum		
	length:	0.175 mm.
	shoulder:	0.070 mm.
	waist:	0.050 mm.
	hip:	0.078 mm.
	ext.:	0.080 mm.
Translators		
	length:	0.100 mm.
	depth:	0.040 mm.
Caudicle		
	bulb diam.:	0.060 mm.

Magnified approximately 160 X

Hoya cardiophylla Merrill 1920

Flower from clone 910302 via DH, flowered in Fresno CA.



Magnified approximately 160 X

Pollinium		
	length:	0.520 mm.
	widest:	0.180 mm.
Retinaculum		
	length:	0.200 mm.
	shoulder:	0.070 mm.
	waist:	0.060 mm.
	hip:	0.090 mm.
	ext.:	0.020 mm.
Translators		
	length:	0.110 mm.
	depth:	0.045 mm.
Caudicle		
	bulb. diam.:	0.080 mm.

Hoya macgregorii Schlechter 1906

Clone PNH 15541, Edano 1952, Mt. Katanglad, Samar, Philippines

Pollinium

length:	0.34 mm.
widest:	0.14 mm.

Retinaculum

length:	0.16 mm.
shoulder:	0.10 mm.
waist:	0.07 mm.
hip:	0.08 mm.
ext.:	0.04 mm.

Translators

length:	0.08 mm.
depth:	0.01 mm.

Caudicle

bulb. diam.:

Magnified approximately 160 X

Hoya sp. Hernaez (CAHUP) 5297
UP Landgrant, Quezon (near Nursery) Luzon, Philippines
as H. macgregorii.

Pollinium
length: 0.50 mm.
widest: 0.22 mm.
Retinaculum
length: 0.18 mm.
shoulder: 0.13 mm.
waist: 0.07 mm.
hip: 0.09 mm.
ext.: 0.03 mm.
Translators
length: 0.10 mm.
depth: 0.02 mm.
Caudicle
bulb. diam.: 0.05 mm.

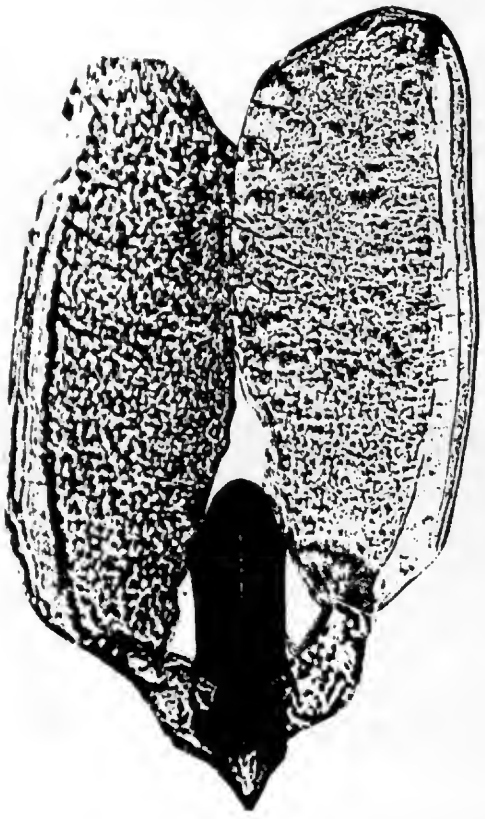
Magnified approximately 160 X

Hoya sp. IML 850 affinis H. macgregorii
Collected by DMC, #1713
Grown and flowered in Fresno CA.

Pollinium		
	length:	0.31 mm.
	widest:	0.17 mm.
Retinaculum		
	length:	0.18 mm.
	shoulder:	0.11 mm.
	waist:	0.08 mm.
	hip:	0.11 mm.
	ext.:	?
Translators		
	length:	0.09 mm.
	depth:	0.03 mm.
Caudicle		
	bulb. diam.:	?

Magnified approximately 160X

Hoya sp. (UC) Here 1013 Coleon
Labeled H. quinquinervia.

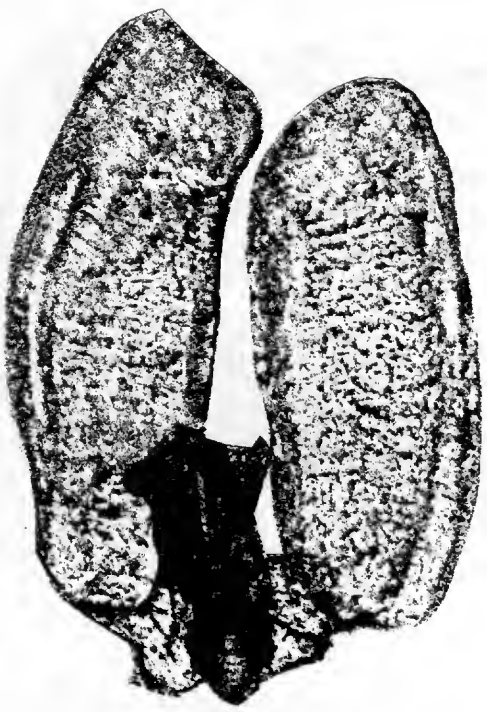


Pollinium
length: 0.52 mm
widest: 0.22 mm.
Retinaculum
length: 0.24 mm.
shoulder: 0.09 mm.
waist: 0.07 mm.
hip: 0.09 mm.
ext.: 0.04 mm.
Translators
length: 0.12 mm.
depth: 0.04 mm.
Caudicle
bulb. diam.: 0.08 mm.
Double hip (upper) 0.10 mm.

Magnified approximately 160X

Note: I believe this clone is *Hoya cardiophylla* Merrill based on a comparison of the pollinaria.

Hoya sp. Edano (PNH) 14203 1951
Victoria Mts. Palawan, Philippines.



Pollinium		
	length:	0.48 mm.
	widest:	0.20 mm.
Retinaculum		
	length:	0.18 mm.
	shoulder:	0.13 mm.
	waist:	0.05 mm.
	hip:	0.08 mm.
	ext.:	0.04 mm.
Translators		
	length:	0.06 mm.
	depth:	0.02 mm.
Caudicle		
	bulb. diam.:	0.06 mm.

Magnified approximately 160 X

Hoya merrillii Schlechter 1904

Flowered in Fresno CA from clone 'Cebu' via Prof. Juan Pancho.

Pollinium

length:	0.51 mm.
widest:	0.18 mm.

Retinaculum

length:	0.22 mm.
shoulder:	0.11 mm.
waist:	0.08 mm.
hip:	0.11 mm.
ext.:	0.04 mm.

Translators

length:	0.12 mm.
depth:	0.06 mm.

Caudicle

bulb diam.:	0.04 mm.

Magnified approximately 160 X

Hoya merrillii Schlechter ? 1904
Clone 930107 DH, flowered at Fresno CA, USA.

Pollinium		
	length:	0.43 mm.
	widest:	0.16 mm.
Retinaculum		
	length:	0.13 mm.
	shoulder:	0.08 mm.
	waist:	0.04 mm.
	hip:	0.06 mm.
	ext.:	0.04 mm.
Translators		
	length:	0.10 mm.
	depth:	0.02 mm.
Caudicle		
	bulb. diam.:	0.05 mm.

Magnified approximately 160X

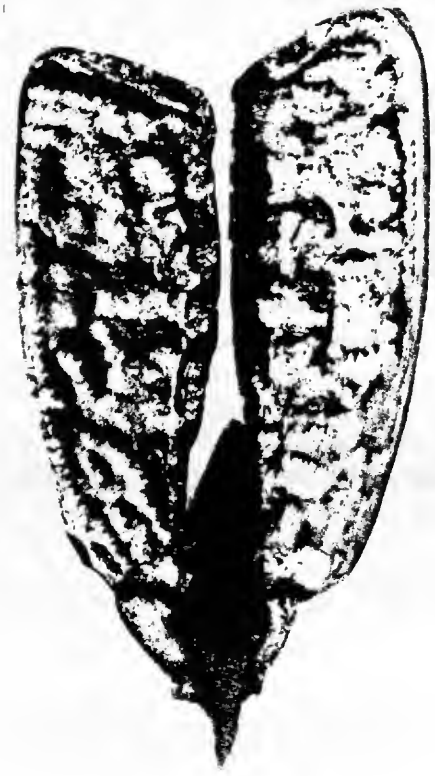
Note: the reason for the ? in the heading is to indicate that I feel this clone is most likely to be *H. quinquinervia* Warburg.

Hoya pentaphlebia Merrill 1918
Flower from PNH #10085, Gaerlan & Sagcal 1992
Birad-dali, Languyan, Tawi-tawi, Philippines.

Pollinium		
	length:	0.444 mm.
	widest:	0.150 mm.
Retinaculum		
	length:	0.190 mm.
	shoulder:	0.160 mm.
	waist:	0.100 mm.
	hip:	0.120 mm.
	ext.:	0.060 mm.
Translators		
	length:	0.110 mm.
	depth:	0.020 mm.
Caudicle		
	bulb. diam.:	linear 0.100 mm. long

Magnified approximately 100 X

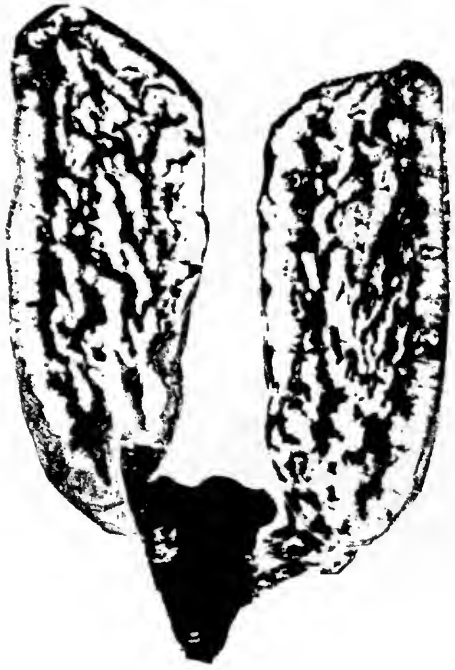
Hoya pentaphlebia Merrill 1918
Flower from clone blooming at Fresno CA.



Pollinium		
	length:	0.510 mm.
	widest:	0.180 mm.
Retinaculum		
	length:	0.230 mm.
	shoulder:	0.090 mm.
	waist:	0.060 mm.
	hip:	0.090 mm.
	ext.:	0.020 mm.
Translators		
	length:	0.090 mm.
	depth:	0.025 mm.
Caudicle		
	bulb diam.:	0.048 mm.

Magnified approximately 160 X

Hoya quinquinervia Warburg 1904
Grown and flowered in Fresno CA from clone 81100 JP.



Pollinium		
	length:	0.420 mm.
	widest:	0.160 mm.
Retinaculum		
	length:	0.132 mm.
	shoulder:	0.100 mm.
	waist:	0.060 mm.
	hip:	0.080 mm.
	ext.:	0.020 mm.
Translators		
	length:	0.090 mm.
	depth:	0.020 mm.
Caudicle		
	bulb. diam.:	0.050 mm.

Magnified approximately 160 X

Short Full Ovate Pollinaria

In this grouping I have placed *Hoya mindorensis* Schlechter and what I consider its synonym *Hoya erythrostemma* Kerr (that is providing the clone in the trade under this name is correct). The foliage, flowers and pollinarium are nearly identical (except for color). Both species have unusually short rounded retinacula. Grouped here are also a number of pollinarium from Philippine Herbarium sheets. In addition I have included pollinarium from *Hoya bordenii* Schlechter, *Hoya solaniflora* Schlechter (TYPE material), *Hoya filiformis* Richinger, *Hoya pauciflora* Wight, and *Hoya uncinata* Teijsmann & Binn.. Although the pollinia are somewhat uniform the retinacula vary considerably.

It appears to me that Ramos & Edano #49328, Grether & Wagner Jr. #3949 and Loher s.n. (1915) are the same species.

Hoya bordenii Schlechter 1906

Clone UC 15829, 1916 Irosin, Sorsegon, Luzon Philippines.

Magnified approximately 160 X

Pollinium

length:	0.40 mm.
widest:	0.24 mm.

Retinaculum

length:	0.16 mm.
shoulder:	0.12 mm.
waist:	0.07 mm.
hip:	0.08 mm.
ext.:	

Translators

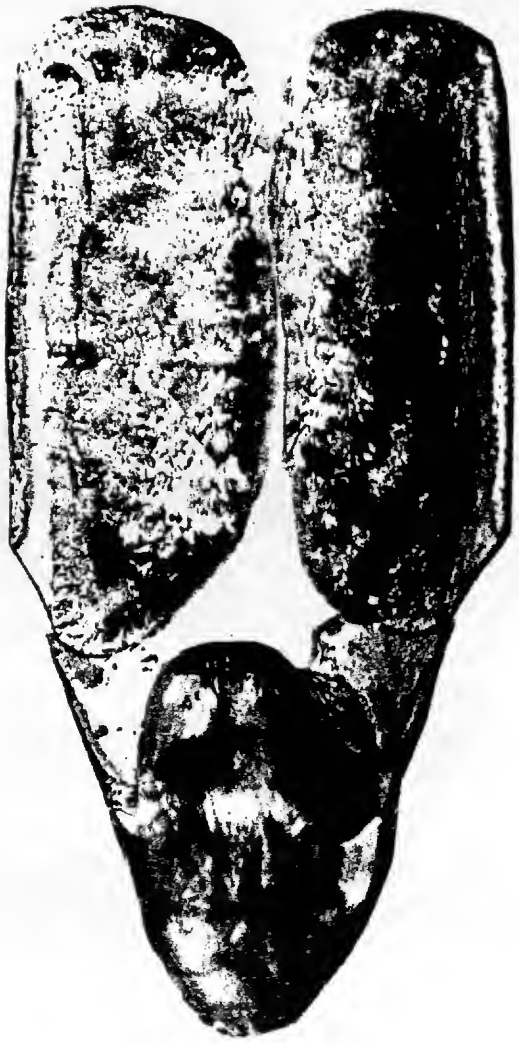
length:	0.11 mm.
depth:	0.03 mm.

Caudicle

bulb. diam.:	0.05 mm.

Hoya erythrostemma Kerr 1939

Flower via MM.



Pollinium		
	length:	0.568 mm.
	widest:	0.230 mm.
Retinaculum		
	length: ?	0.300 mm.
	shoulder:	0.220 mm.
	waist:	0.140 mm.
	hip:	0.165 mm.
	ext.:	?
Translators		
	length:	0.190 mm.
	depth:	0.020 mm.
Caudicle		
	bulb. diam.:	0.080 mm.

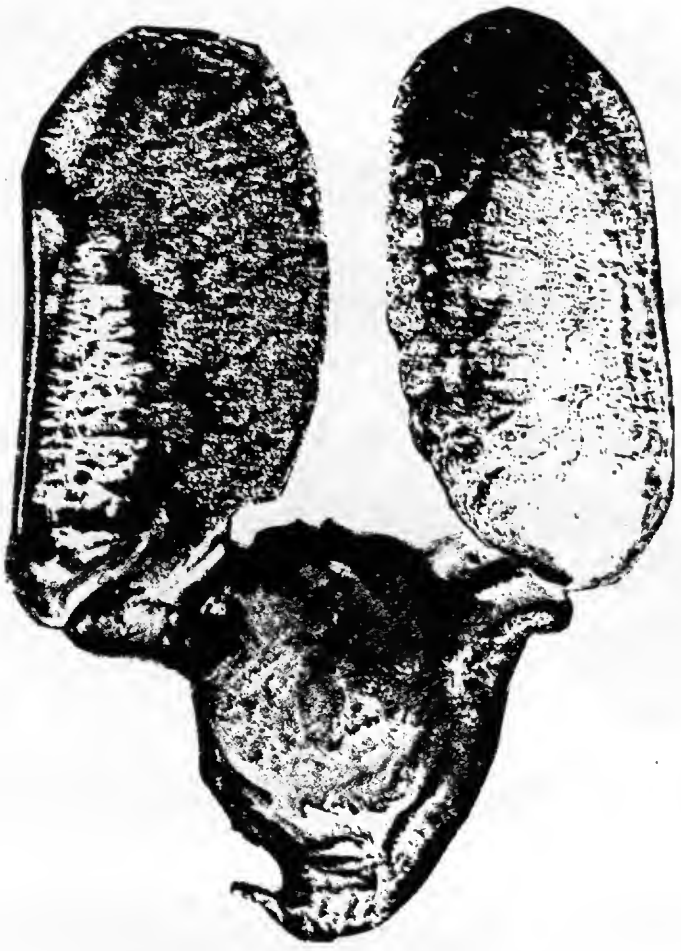
Magnified approximately 160 X

Hoya filiformis Reichinger 1908
Flower via AW.

Pollinium
length: 0.46 mm.
widest: 0.21 mm.
Retinaculum
length: 0.25 mm.
shoulder: 0.16 mm.
waist: 0.10 mm.
hip: 0.13 mm.
ext.: 0.03 mm.
Translators
length:
depth:
Caudicle
bulb. diam.:

Magnified approximately 160 X

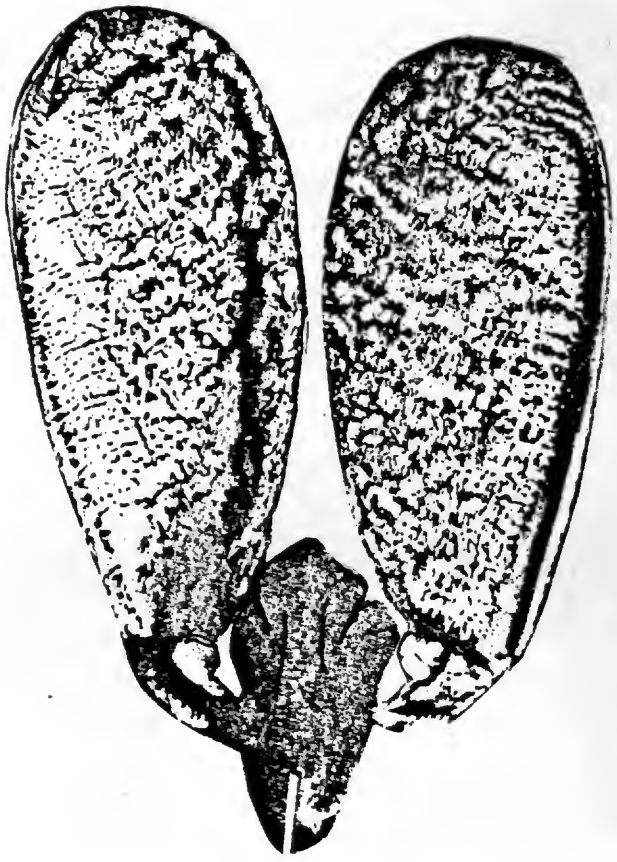
Hoya mindorensis Schlechter 1906
Flower from Diffun, Querino Prov. Luzon Philippines
via Maximo Wayett.



Pollinium
length: 0.52 mm.
widest: 0.24-.27 mm.
Retinaculum
length: 0.30 mm.
shoulder: 0.22 mm.
waist: 0.17 mm.
hip: 0.22 mm.
ext.: 0.08 mm. ?
Translators
length: 0.15 mm.
depth: 0.05 mm.
Caudicle
appears to be linear, ca. 0.05 mm. thick.

Magnified approximately 160 X

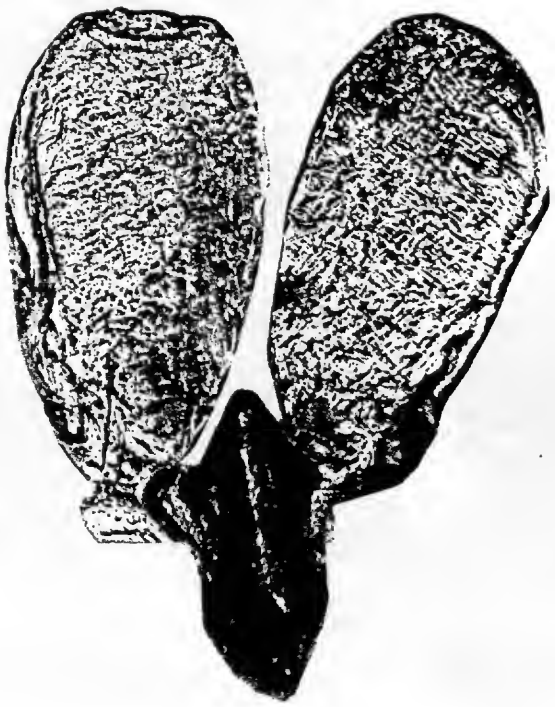
Hoya pauciflora Wight 1848
Flower for pollinarium from Jerry Williams.



Pollinarium	
length:	0.55 mm.
widest:	0.26 mm.
Retinaculum	
length:	0.20 mm.
shoulder:	0.15 mm.
waist:	0.10 mm.
hip:	0.12 mm.
ext.:	0.07 mm.
Translators	
length:	0.12 mm.
depth:	0.03 mm.
Caudicle	
bulb diam.:	0.04 mm.

Magnified approximately 160 X

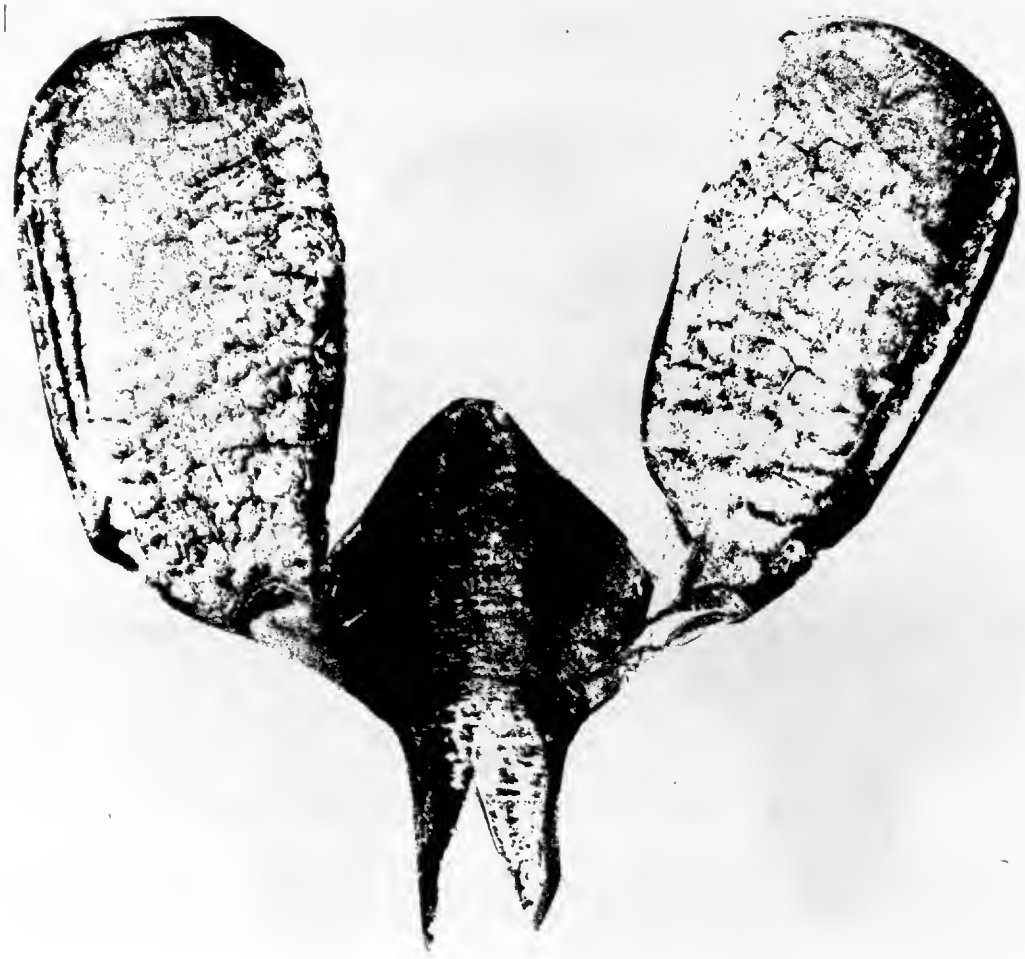
Hoya solaniflora Schlechter 1913
Flower from **Type** #18124.



Pollinium	
length:	0.39 mm.
widest:	0.23 mm.
Retinaculum	
length:	0.24 mm.
shoulder:	0.13 mm.
waist:	0.08 mm.
hip:	0.11 mm.
ext.:	0.03 mm.
Translators	
length:	0.12 mm.
depth:	0.05 mm.
Caudicle	
bulb. diam.:	0.06 mm.

Magnified approximately 160 X

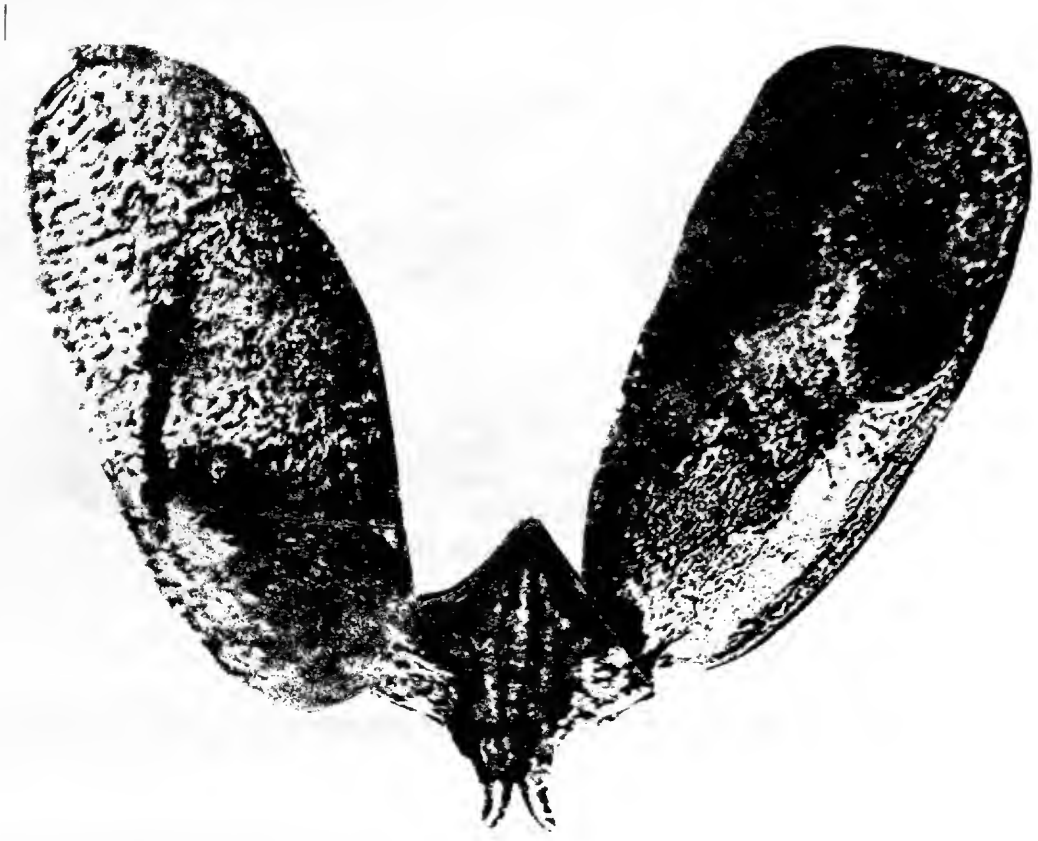
Hoya uncinata Teijsmann & Binn. 1863



Magnified approximately 160 X

Pollinium length: 0.51 mm; widest: 0.28 mm.
Retinaculum length: 0.32 mm.; shoulder: 0.30 mm; waist: 0.16 mm.; hip: 0.17 mm.
ext.: 0.16 mm.
Translators length: 0.16 mm.; depth: 0.04 mm.
Caudicle linear ?

Hoya sp. Loher s.n. (UC) 1915
Caraballo, Mt. Nueve, Luzon Philippines.



Magnified approximately 160 X

Pollinium length 0.555 mm.; widest 0.240 mm.
Retinaculum length 0.210 mm.; shoulder 0.170 mm.; waist 0.090 mm.; hip 0.10 mm.; ext. 0.06 mm.
Translators 0.100 mm.; depth 0.030 mm.
Caudicle ?

Hoya sp. PNH 181
Mt. Mahawae, Tomohon, Celebes 1200 m.
Flower cream flushed pink.

Pollinium		
	length:	0.24 mm.
	widest:	0.10 mm.
Retinaculum		
	length:	0.21 mm.
	shoulder:	0.13 mm.
	waist:	0.09 mm.
	hip:	0.10 mm.
	ext.:	?
Translators		
	length:	0.07 mm.
	depth:	0.10 mm.
Caudicle		
	bulb. diam.:	0.04 mm.

Magnifies approximately 160X.

Note: This pollinium looks like that of *Hoya laurifolia* Decaisne.

Hoya sp. Edano (PNH) 349 1947
Baucungan, Puerto Princesa, Palawan, Philippines.

Pollinium		
	length:	0.40 mm.
	widest:	0.20 mm.
Retinaculum		
	length:	0.21 mm.
	shoulder:	0.15 mm.
	waist:	0.07 mm.
	hip:	0.09 mm.
	ext.:	0.03 mm.
Translators		
	length:	0.10 mm.
	depth:	0.02 mm.
Caudicle		
	bulb. diam.:	0.05 mm.

Magnified approximately 160 X

Hoya sp. Grether & Wagner Jr. #3949
Collected at Pitilu Lagoon, Los Negros, Philippines 1945.

Magnified approximately 160 X

Pollinium length: 0.55 mm.; widest: 0.25 mm.
Retinaculum length 0.25 mm.; shoulder 0.16 mm.; waist 0.10 mm.; hip 0.12 mm.; ext. 0.02 mm.
Translators length 0.16 mm.; depth 0.03 mm.
Caudicle 0.03 mm.

Hoya sp. Edano (PNH) 15642 1952
Mt. Capotoan, Samar, Philippines.

Magnified approximately 160 X

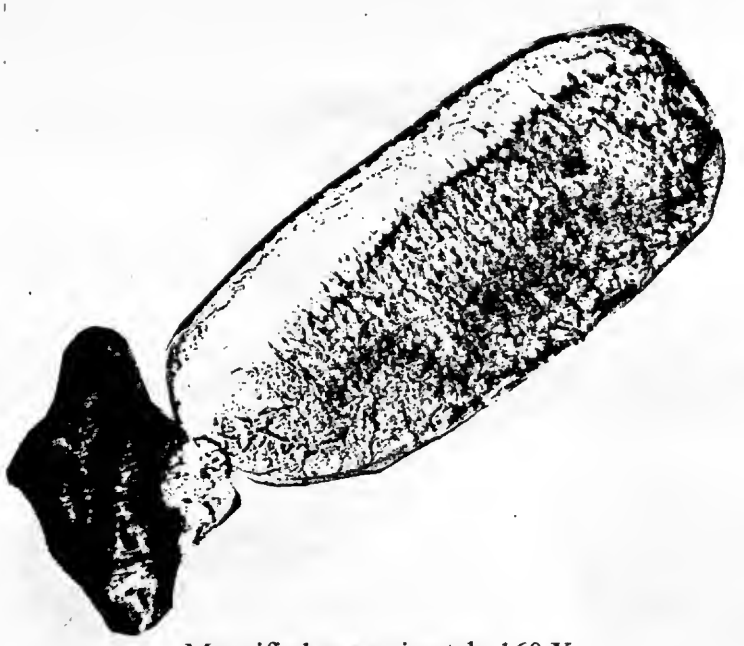
Pollinium	
length:	0.41 mm.
widest:	0.16 mm.
Retinaculum	
length:	0.16 mm.
shoulder:	0.11 mm.
waist:	0.06 mm.
hip:	0.11 mm.
ext.:	0.03 mm.
Translators	
length:	?
depth:	?
Caudicle	
bulb. diam.:	?

Hoya sp. PNH 39370 Quisimbing 1957
From Mona's Garden, Manila, Philippines.

Pollinium		
	length:	0.37 mm.
	widest:	0.16 mm.
Retinaculum		
	length:	ca. 0.12 mm.
	shoulder:	0.11 mm.
	waist:	0.06 mm.
	hip:	0.10 mm.
	ext.:	0.02 mm.
Translators		
	length:	0.11 mm.
	depth:	0.01 mm.
Caudicle		
	bulb. diam.:	0.06 mm.

Magnified approximately 160 X

Hoya sp. Ramos & Edano (UC) 49328
1927 at Mati, Davao, Mindoro.

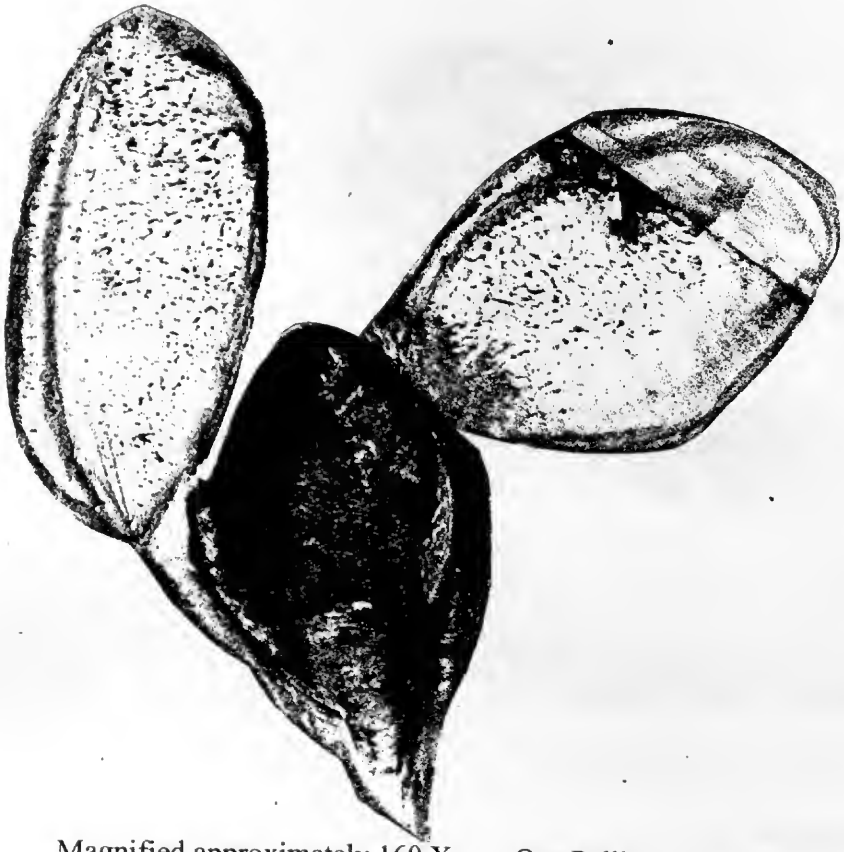


Magnified approximately 160 X

Note: pollinium twisted inward on its axis.

Pollinium	
length:	0.55 mm.
widest:	0.24 mm.
Retinaculum	
length:	0.23 mm.
shoulder:	0.17 mm.
waist:	0.08 mm.
hip:	0.12 mm.
ext.:	0.04 mm.
Translators	
length:	0.07 mm.
depth:	0.02 mm.
Caudicle	
bulb. diam.:	0.05 mm.

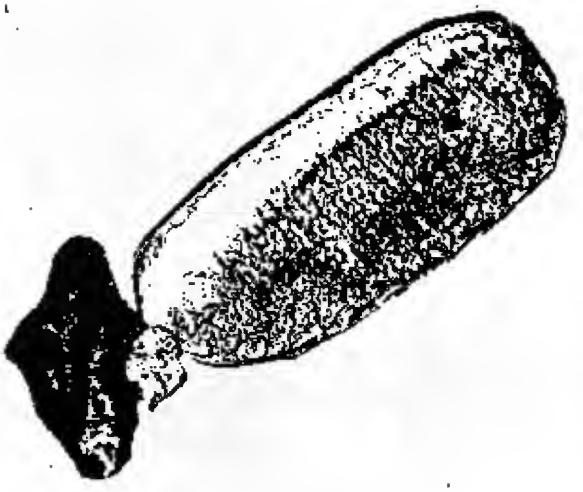
Hoya sp. Ramos & Edano (UC) 45730
Casiguran, Tayabas Prov., Luzon, Philippines
20 June 1925.



Magnified approximately 160 X. One Pollinium has turned on its axis.

Pollinium	
length:	0.470 mm.
widest:	0.220 mm.
Retinaculum	
length:	0.39 mm.
shoulder:	0.265 mm.
waist:	0.110 mm.
hip:	0.120 mm.
ext.:	0.070 mm.
Translators	
length:	0.120 mm.
depth:	0.030 mm.
Caudicle	
bulb. diam.:	?

Hoya sp. Ramos & Edano 1927 (UC) 49395
Labeled Hoya fischeriana Warburg
Mt. Mayo, Mindanao, Philippines.



Pollinium
length: 0.06 mm.;
widest: 0.26 mm.
Retinaculum length: 0.23 mm.;
shoulder: 0.15 mm.;
waist: 0.08 mm.
hip: 0.17 mm.;
ext.: 0.04 mm.
Translators length: 0.18 mm.;
depth: 0.03 mm.
Caudicle bulb. diam.: 0.09 mm.

Magnified approximately 160 X

Hoya odorata and Associated Species

In this group there is a wide divergence in Pollinarium types and sizes. There is definitely more than one species involved here. Note the size, shape and configuration of the various pollinarium parts presented here. One discrepancy I have noted is that the two sheets of Elmer #18041 collected on Mt. Makiling, Los Banos Laguna, Philippines from PNH and UC are not the same. The PNH sheet seems to be of another species.

This is an interesting group of mostly terrestrial species which form bushes rather than being vines or pendant in growth habit. Although these species do not have the growth habit nor foliage approaching the Hoya australis R. Brown complex their pollinia are similar in having an outward extension of the pellucid margine as it nears the caudicle attachment area. Both also have an expanded adjacent vacuole in this area.

ॐ

Hoya odorata Schlechter 1906
Flower from Loher 13176 (UC) 1913

Magnified approximately 160 X

Pollinium
length:0.620 mm.
widest:0.210 mm.
Retinaculum
length: ca. 0.287 mm.

Note: the other measurements are not determinable. Here the retinaculum is lying sideways so most details are not showing.

Hoya odorata Schlechter 1906

Flower from Salvosa 29638 (UC) 1924, Polillo Is., Philippines

Magnified approximately 160 X

Pollinium length: 0.73 mm.; widest: 0.25 mm.
Retinaculum length: 0.380 mm; shoulder: 0.148 mm.; waist: 0.120 mm.; hip: 0.170 mm.; ext.: 0.020 mm.
Translators length: 0.14 mm.; depth: 0.05 mm.
Caudicle bulb diam.: 0.10 mm.

Hoya odorata Schlechter 1906
Flower from Loher s.n. 1916 (UC) 14519

Note: I believe the retinaculum here has twisted on its axis.

Magnified Approximately 160 X

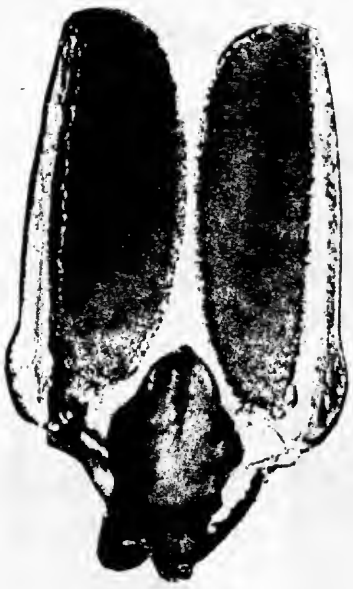
Pollinium length: 0.72 mm; widest: 0.30 mm.
Retinaculum length: 0.33 mm; shoulder: 0.25 mm.; waist: 0.23 mm.; hip: 0.34 mm.; ext.: 0.06 mm.
Translators length: 0.14 mm.; depth: 0.05 mm.; **Caudicle** bulb diam.: 0.10 mm.

Hoya odorata Schlechter 1906
Elmer (UC) 18041: 1917
Mt. Miquiling, Laguna, Luzon Philippines.

Pollinium	
length:	0.90 mm.
widest:	0.26 mm.
Retinaculum	
length:	0.41 mm.
shoulder:	0.13 mm.
waist:	?
hip:	0.16 mm.
ext.:	0.05 mm.
Translators	
length:	0.12 mm.
depth:	0.04 mm.
Caudicle	
bulb. diam.:	0.07 mm.

Magnified approximately 65 X

Hoya odorata Schlechter 1906
Clone via TG flowered in Hawaii.



Magnified approximately 65 X

Pollinium		
	length:	0.89 mm.
	widest:	0.32 mm.
Retinaculum		
	length:	0.45 mm.
	shoulder:	0.30 mm.
	waist:	0.19 mm.
	hip:	0.20 mm.
	ext.:	0.09 mm.
Translators		
	length:	0.30 mm.
	depth:	0.03 mm.
Caudicle		
	bulb. diam.:	0.12 mm.

Hoya odorata Schlechter 1906

Flower via TG from Batangas, collected by Prof. J. Pancho.

Pollinium

length:	0.950 mm.
widest:	0.350 mm.

Retinaculum

length:	0.400 mm.
shoulder:	0.300 mm.
waist:	0.130 mm.
hip:	0.020 mm.
ext.:	0.080 mm.

Translators

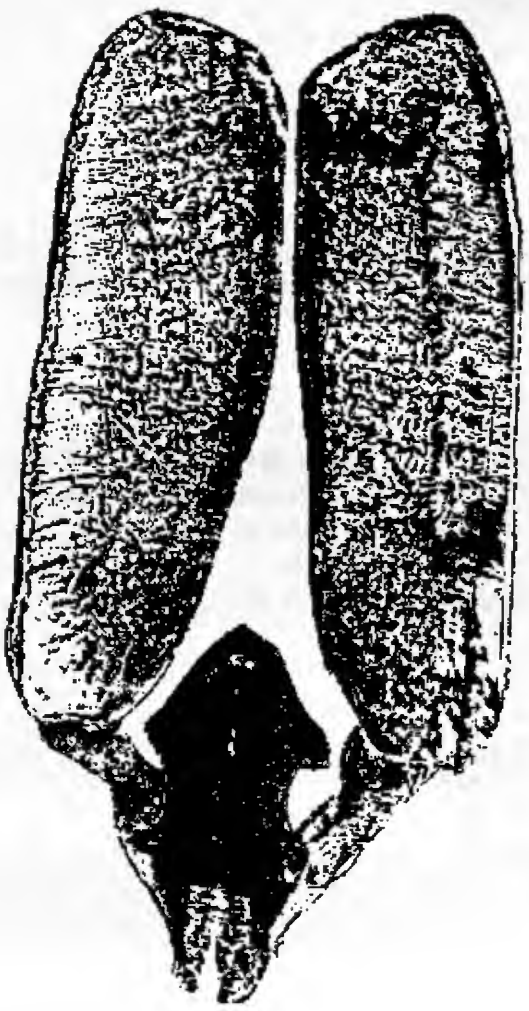
length:	0.170 mm.
depth:	0.040 mm.

Caudicle

bulb diam.:	0.100 mm.

Magnified approximately 65 X

Hoya paziae Kloppenburg 1990
Pollinium form flower via TG
clone 831515.

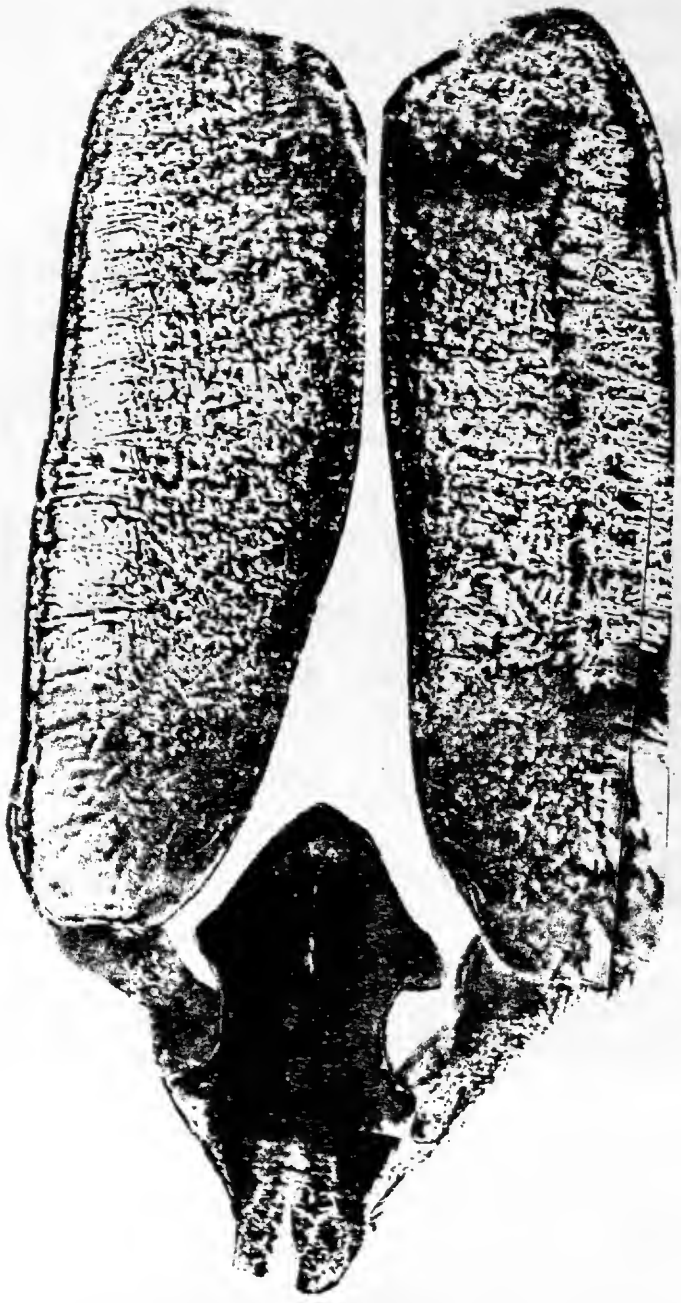


Pollinium
length: 0.750 mm.
widest: 0.250 mm.
Retinaculum
length: 0.300 mm.
shoulder: 0.216 mm.
waist: 0.140 mm.
hip: 0.200 mm.
ext.: 0.100 mm.
Translators
length: 0.170 mm.
depth: 0.050 mm.
Caudicle
bulb. diam.: 0.080 mm.

Magnified approximately 160X.

View from the back side (retinaculum turned over) focused on short extension.

Hoya paziae Kloppenburg 1990
Flower from TG, Hawaii.



Pollinium
length: 0.750 mm.
widest: 0.250 mm.
Retinaculum
length: 0.300 mm.
shoulder: 0.216 mm.
waist: 0.140 mm.
hip: 0.200 mm.
ext.: 0.100 mm.
Translators
length: 0.170 mm.
depth: 0.050 mm.
Caudicle
bulb. diam.: 0.080 mm.

Magnified approximately 160 X

The Hoya australis Complex

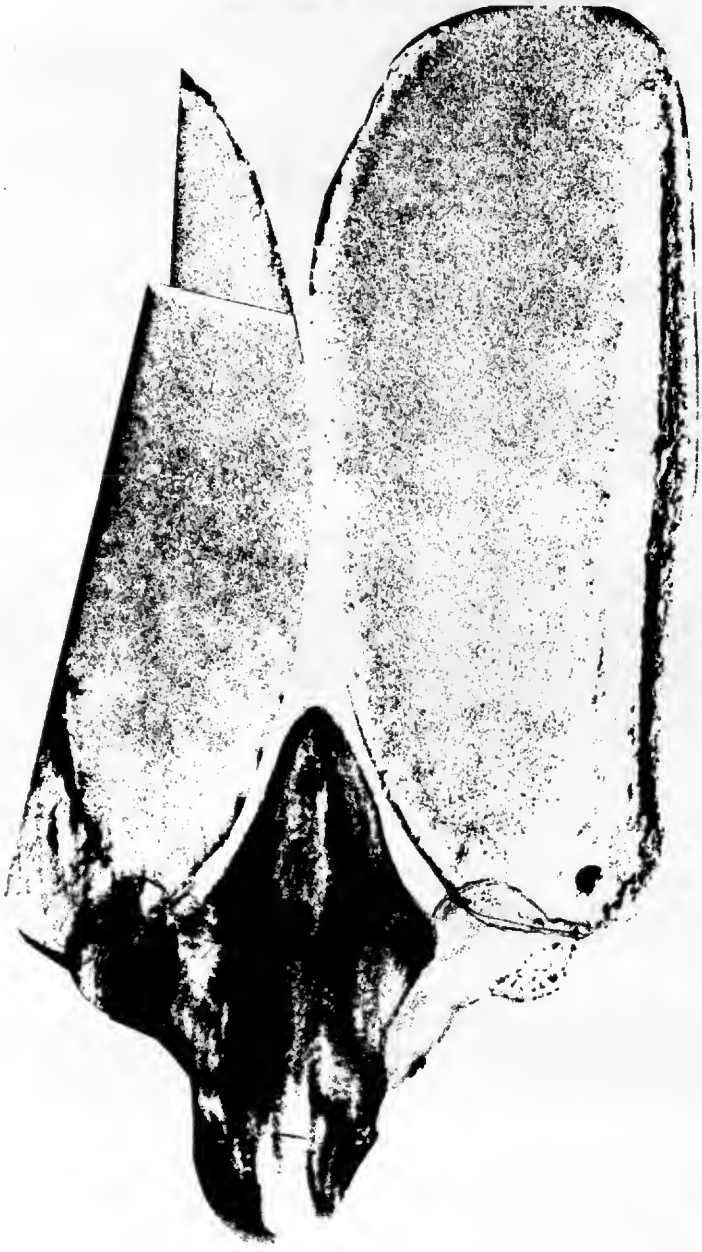
Here again I wish I had more representatives form this group to study, plentiful I am sure in Australia, but shy to bloom for me. At about the time they want to bloom for me it is time to move then into the greenhouse to escape the cold weather.

The clones that I have been able to study all have rather large pollinarium with pollinia lengths of 0.73 - 0.77 mm. All seem to have a distinctive shoulder of the sterile edge on the outer pollinia apical region with an accompanying large vacuole just inward. This feature make them fairly easy to recognize. There is some variation in the translators and caudicle arrangement.

I hope that I can add to this group as time goes on as I am sure that the details of this group are important.

ॐ

Hoya australis R. Brown ex Traill 1830
Flower from clone IML 6 as ssp. australis Forster & Liddle.

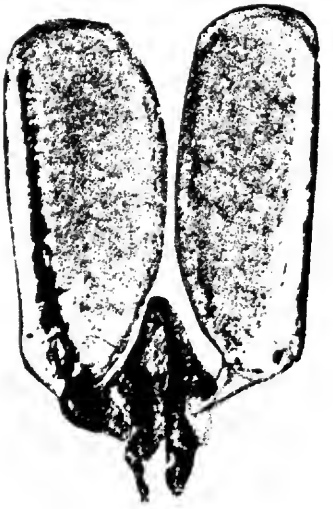


Pollinium
length:
0.080 mm.
widest:
0.345 mm.
Retinaculum
length:
0.3800 mm.
shoulder:
0.22 mm.
waist:
0.140 mm.
hip:
0.150 mm.
ext.:
0.090 mm.
Translators
length:
0.200 mm.
depth:
0.070 mm.
Caudicle
bulb diam.:
0.090 mm.

Note: one pollinia partially shown.

Magnified approximately 160 X

Hoya australis R. Brown **ssp. australis** 1991
Flowered and grown in Fresno CA from clone IML 6.



Pollinium		
	length:	0.83 mm.
	widest:	0.35 mm.
Retinaculum		
	length:	0.32 mm
	shoulder:	0.24 mm.
	waist:	0.10 mm.
	hip:	0.15 mm.
	ext.:	0.12 mm.
Translators		
	length:	0.22 mm.
	depth:	0.03 mm.
Caudicle		
	bulb. diam.:	0.12 mm.

Magnified approximately 65 X

Hoya australis ssp. rupicola (Hill) Forster & Liddle
Flowered at Fresno CA. clone from Peter Tsang

Pollinium
length: 0.74 mm.
widest: 0.28 mm.
Retinaculum
length: 0.33 mm.
shoulder: 0.21 mm.
waist: 0.12 mm.
hip: 0.15 mm.
ext.: 0.03 mm.
Translators
length: 0.14 mm.
depth: 0.06 mm.
Caudicle
bulb. diam.: 0.10 mm.

Magnified approximately 160 X

Hoya australis subsp. orimicola Forster & Liddle 1991
Grown and flowered in Fresno CA from clone via PT.

Pollinium		
	length:	0.730 mm.
	widest:	0.265 mm.
Retinaculum		
	length:	0.270 mm.
	shoulder:	0.180 mm.
	waist:	0.150 mm.
	hip:	0.100 mm,
	ext.:	0.130 mm.
Translators		
	length:	0.120 mm.
	depth:	0.030 mm.
Caudicle		
	bulb. diam.:	0.090 mm.

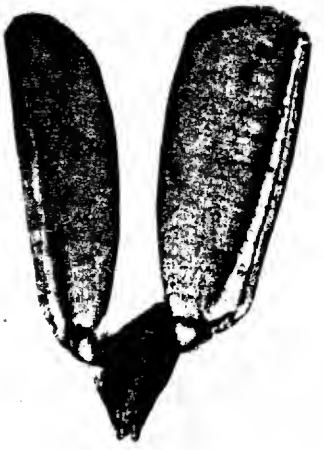
Magnified approximately 160 X

Hoya sp. Sulawesi (affinis H. australis)
Collected on Balasika Is., Tamori Bay 1994.

Pollinium		
	length:	0.75 mm.
	widest:	0.25 mm.
Retinaculum		
	length:	0.27 mm.
	shoulder:	0.18 mm.
	waist:	0.10 mm.
	hip:	0.12 mm.
	ext.:	0.15 mm.
Translators		
	length:	0.17 mm.
	depth:	0.03 mm.
Caudicle		
	bulb. diam.:	0.10 mm.

Magnified approximately 160 X

Hoya naumanii Schlechter 1908
Flower from AW.



0.06 mm.

Magnified approximately 65 X

Pollinium
length: 0.72 mm.
widest: 0.28 mm.
Retinaculum
length: 0.28 mm.
shoulder: 0.22 mm.
waist: 0.10 mm.
hip: 0.14 mm.
ext.: 0.05 mm.
Translators
length: 0.14 mm.
depth: 0.02 mm.
Caudicle

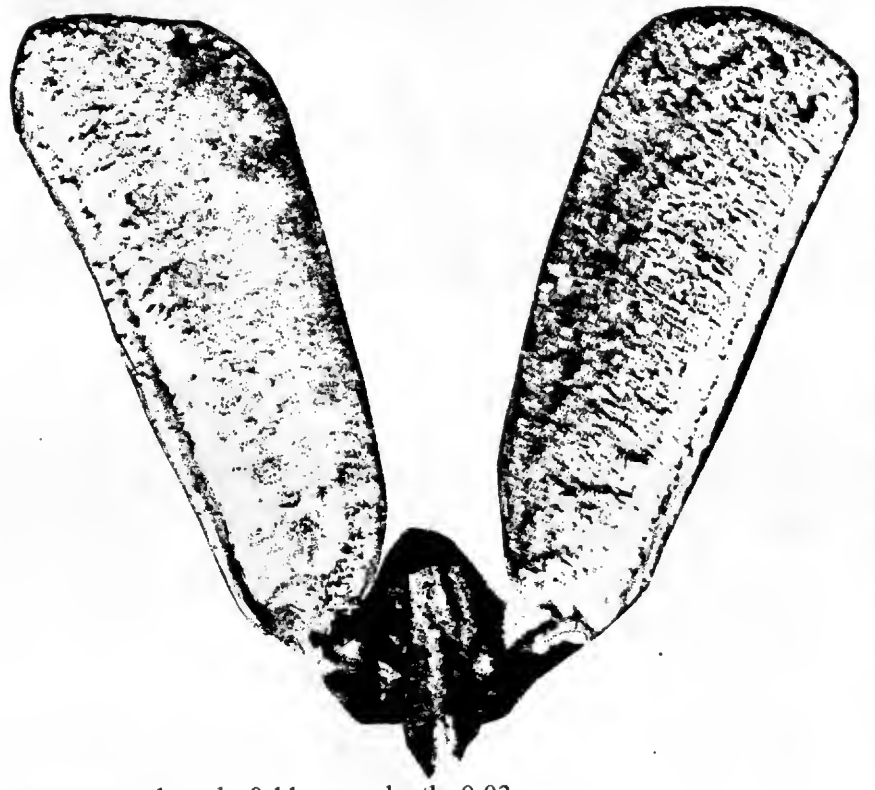
bulb. diam.:

Hoya cummingiana & Related Species

The pollinarium of *Hoya glamcoiana* Kloppenburg is presented here along with *Hoya cumingiana* Decaisne since it is reported they are synonymous. Also shown is pollinarium from the species in commerce sold as *Hoya densifolia* Turcz.. In these three pollinaria you can see the differences and any similarities Additional clones are presented although not of the quality I would like to have available at this time.

ॐ

Hoya golamcoiana Kloppenburg 1991
Flower from Type (CAHUP) 41930.



Magnified approximately 160 X

Pollinium length: 0.58 mm.; widest: 0.21 mm.
Retinaculum length: 0.16 mm.; shoulder: 0.15 mm.; waist: 0.06 mm.; hip: 0.10 mm. ext.: 0.05 mm.

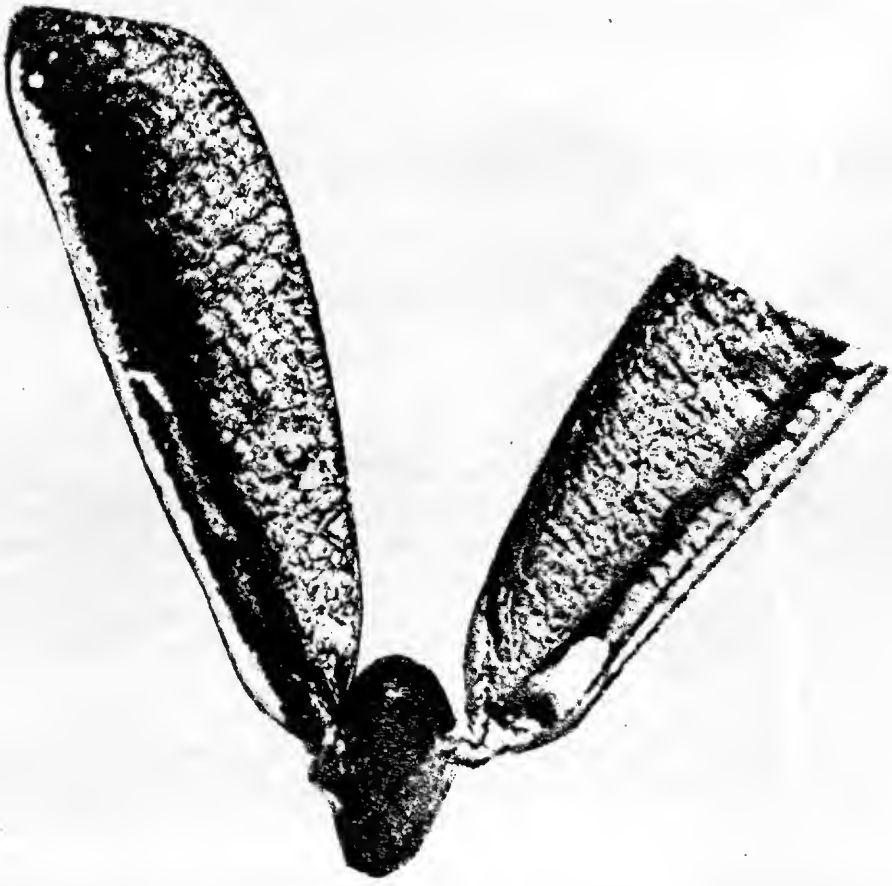
Translators length: 0.11 mm.; depth: 0.03 mm.
Caudicle bulb diam.: 0.06 mm.

Hoya cumingiana Decaisne 1844
Grown and flowered in Fresno CA.

Magnified approximately 160 X

Pollinium length 0.690 mm; widest 0.272 mm.
Retinaculum length 0.253 mm; shoulder 0.150 mm.; waist 0.068 mm.; hip 0.090 mm.; ext. 0.030 mm.
Translators length 0.100 mm.; depth 0.250 mm.
Caudicle bulb diameter 0.050 mm.

Hoya cumingiana (Decaisne) 1844 var. densifolia
Pollinarium from flower via TG.



Magnified approximately 160 X

Pollinium length: 0.71 mm.; widest: 0.20 mm.
Retinaculum length: 0.18 mm.; shoulder: 0.11 mm.; waist: 0.05 mm.; hip: mm.; ext.: 0.03 mm.
Translators length: 0.08 mm.; depth: 0.01 mm.
Caudicle bulb. diam.: 0.06 mm.

Hoya cumingiana Decaisne 1844
Flower from clone (densifolia) Mt. Mayon, Legazpi, Philippines 1995.

Pollinarium	
length:	0.72 mm.
widest:	0.19 mm.
Retinaculum	
length:	0.17 mm.
shoulder:	0.14 mm.
waist:	0.09 mm.
hip:	0.10 mm.
ext.:	0.04 mm.
Translators	
length:	0.08 mm.
depth:	0.02 mm.
Caudicle	
bulb diam.:	0.06 mm.

Magnified approximately 160X.

Pollinaria of the Section Peltostemma Schlechter

Species of this group of hoyas have circular convex leaves with their margines closely clasped to tree trunks. With one leaf per node tending to be imbricate (overlapping the apical margine of the leaf below). The growth habit alone and with flowers with exceptionally long anthers, protruding from the flower center, separates this group from all other sections.

Hoya imbricata Decaisne and its forms are fairly widespread and numerous in various islands of the Philippines. Shown here is a pollinium from the species *Hoya imbricata forma basisubcordata* Koorders (Dr. Merrill quoted it as variety basisubcordata). In this form the pollinium is nearly twice the size of the Celebes (Sulawesi) species collected there in 1994. In addition the pollinia of the Philippine species are larger, relative more linear with rounded inner apices. All of the cordate types I have examined have the cleft situated at the leaf base. On the island of Palawan I have observed several leaf colors, thought to be clonal variation. All seemed to be of the forma typica i.e. without basal clefts. One clone of a fallen Mango tree had exceptionally large green mottled leaves with the upper outer edges spread out on the tree trunks (glabrous and large), maybe the *Hoya pseudomaxima* Koorders.

A second pollinarium from the 1995 Palawan species is presented and also the species with green mottled leaves with deep green markings from the 1994 Sulawesi collection is shown. The clone from Maximo Wayet seems to be different from all of the others and I have not resolved this discrepancy.

ॐ

Hoya imbricata Decaisne 1844
Flower from TG, Hawaii.
Solid green leafed clone from the Philippines.

Pollinarium	
length:	0.68 mm.
widest:	0.23 mm.
Retinaculum	
length:	0.25 mm.
shoulder:	0.16 mm.
waist:	0.10 mm.
hip:	0.12 mm.
ext.:	0.11 mm.
Translators	
length:	0.24 mm.
depth:	0.02 mm.
Caudicle	
bulb diam.:	?

Magnified approximately 160X.

Note: The retinaculum of this clone has 2 side shelves both ends of which end abruptly (they are not tapered into the main structure. The outer extension has a flared shelf. The head inner end is dentate, more so than with any other observed species.

Hoya imbricata Decaisne 1844
Flower from TG, Hawaii
Mottled leaf clone from Palawan, Philippines.

Pollinarium	
length:	0.43 mm.
widest:	0.16 mm.
Retinaculum	
length:	0.13 mm.
shoulder:	0.07 mm.
waist:	0.05 mm.
hip:	0.07 mm.
ext.:	0.03 mm.
Translators	
length:	0.22 mm.
depth:	variable
Caudicle	
bulb diam.:	0.07 mm.

Magnified approximately 160X.

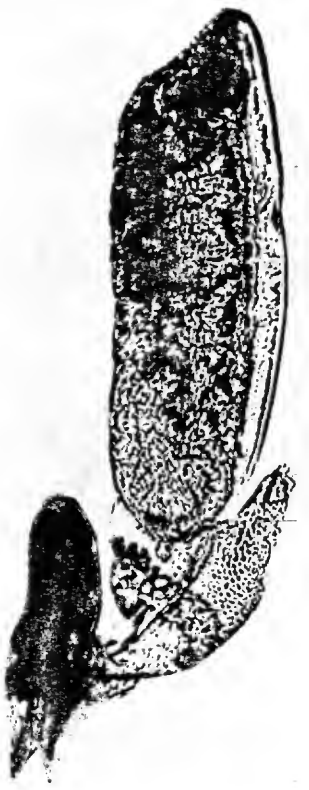
Hoya imbricata Decaisne 1844

Flower from forma basisubcordata Koorders via Maximo Wayett
Baguio, Luzon, Philippines.

Magnified approximately 65X

Pollinium	
length:	0.930 mm.
widest:	0.250 mm.
Retinaculum	
length:	0.220 mm.
shoulder:	0.180 mm.
waist:	0.060 mm.
hip:	0.125 mm.
ext.:	0.050 mm.
Translators	
length:	0.187 mm.
depth:	0.090 mm.
Caudicle	
bulb diam.:	0.110 mm.

Hoya maxima Teijsmann & Binnendkijk 1863
Pollinarium from flower collected in Central Sulawesi 1994.



Magnified approximately 160 X

Pollinarium		
	length:	0.480 mm.
	widest:	0.160 mm.
Retinaculum		
	length:	0.190 mm.
	shoulder:	0.180 mm.
	waist:	0.050 mm.
	hip:	0.090 mm.
	ext.:	0.070 mm.
Translator		
	length:	0.262 mm.
	depth:	0.060 mm.
Caudicle		
	bulb diam.:	0.080 mm.

More Species & Unidentified

Here I have placed some name species in alphabetical order. In addition are pollinarium from herbarium sheets. The later I am still working on to determine proper identification. A couple like the Pollinarium from *Hoya heuschkeliana* and *Hoya Scortechinii* are strikingly different. The numbered material should be keyed to known species with careful comparisons and additional study. I have many more of the latter that could be added and possibly will at a later date.

Hoya chunii P. T. Li, 1984
Flower from AW, clone PNG #6
Schlechter's H. reticulata 1913.

Pollinium		
	length:	0.40 mm.
	widest:	0.17 mm.
Retinaculum		
	length:	0.11 mm.
	shoulder:	0.08 mm.
	waist:	0.04 mm.
	hip:	0.07 mm.
	ext.:	0.03 mm.
Translators		
	length:	0.08 mm.
	depth:	0.02 mm.
Caudicle		
	bulb. diam.:	0.03 mm.

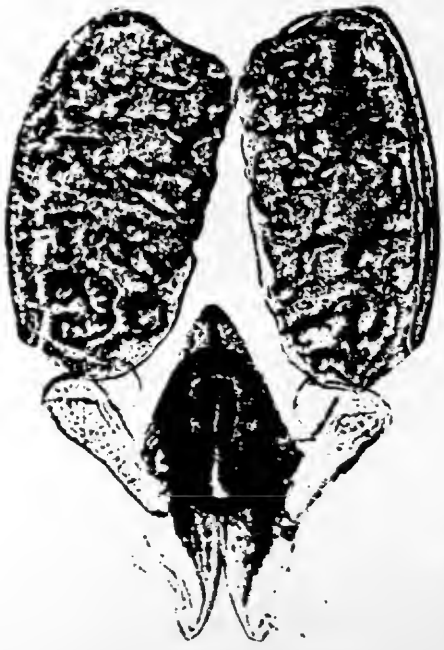
Magnified approximately 160 X

Hoya heuschkeliana Kloppenburg 1989

Pollinarium from Type clone (CAHUP) collected by Professor Juan V. Pancho at the north portion of Lake Bulusan Sorsegon Prov., Luzon, Philippines

Magnified approximately 160 X

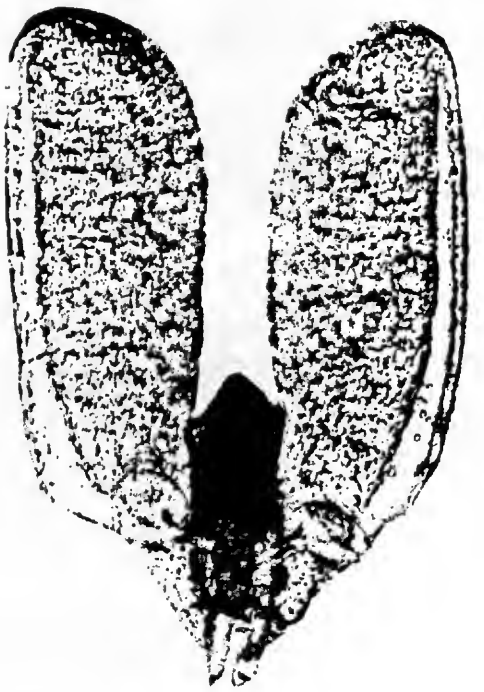
Pollinium	
length:	0.300 mm.
widest:	0.150 mm.
Retinaculum	
length:	0.150 mm.
shoulder:	0.150 mm.
waist:	0.125 mm.
hip:	0.130 mm.
ext.:	0.130 mm.
Translators	
length:	0.120 mm.
depth:	0.050 mm.
Caudicle	
bulb diam.:	0.050 mm



Pollinarium	
length:	0.300 mm.
widest:	0.160 mm.
Retinaculum	
length:	0.170 mm.
shoulder:	0.110 mm.
waist:	0.120 mm.
hip:	0.100 mm.
ext.:	0.011 mm.
Translators	
length:	0.130 mm.
depth:	0.050 mm.
Caudicle	
bulb diam.:	0.050 mm.

This is the yellow flower form of this species which opens campanulate, and thus shows some genetic difference. Same magnification.

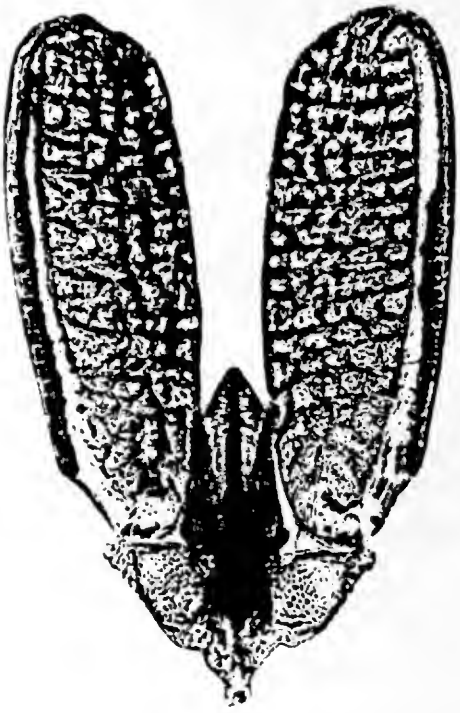
Hoya palawanica Kloppenburg 1990
Pollinarium from flower of PNH 8979, (1948) R. B. Fox
N. E. Polillo, Karlagan, Luzon Philippines.



Magnified approximately 160 X

Pollinium	
length:	0.460 mm.
widest:	0.183 mm.
Retinaculum	
length:	0.220 mm.
shoulder:	0.093 mm.
waist:	0.070 mm.
hip:	0.080 mm.
ext.:	0.060 mm.
Translators	
length:	0.120 mm.
depth:	0.020 mm.
Caudicle	
bulb diam.:	0.060 mm.

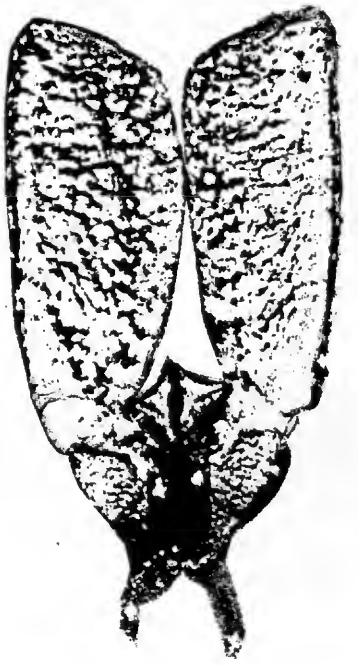
Hoya phylura Schwartz 1931
Flower via TG fresh.



Pollinium
length: 0.47 mm.
widest: 0.16 mm.
Retinaculum
length: 0.22 mm.
shoulder: 0.07 mm.
waist: 0.05 mm.
hip: * 0.06 mm.
ext.: 0.02 mm.
Translators
length: 0.11 mm.
depth: 0.05 mm.
Caudicle
bulb. diam.: 0.05 mm.
* Double hip present, lower; 0.098 mm. very broad.

Magnified approximately 160 X

Hoya polystachya Blume 1849
Grown and flowered in Fresno CA
from clone via Java, Indonesia.



Pollinium	
length:	0.335 mm.
widest:	0.160 mm.
Retinaculum	
length:	0.190 mm.
shoulder:	0.090 mm.
waist:	0.050 mm.
hip:	0.065 mm.
ext.:	0.020 mm.
Translators	
length:	0.100 mm.
depth:	0.050 mm.
Caudicle	
bulb. diam.:	0.060 mm.

Magnified approximately 160 X

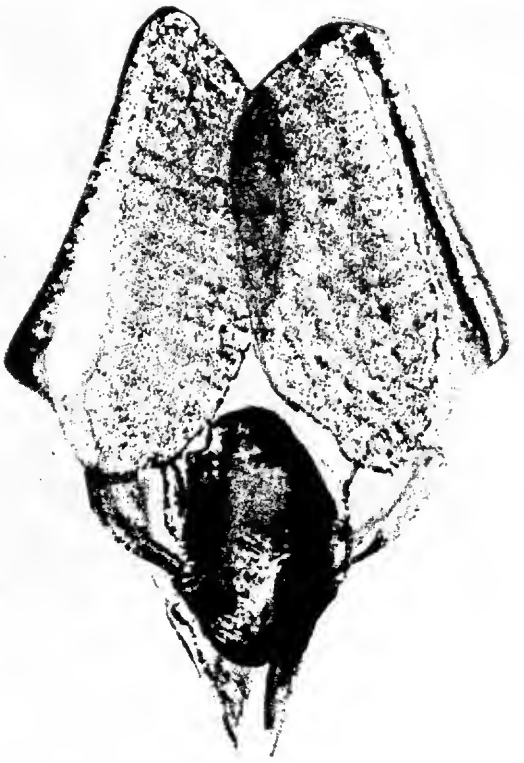
Hoya rhodostella Ridley 1923

#1545 **Topotype**, H.S. Yates, Sumatra, Forest Brostagi.

Magnified approximately 160X

Pollinium	
length:	0.61 mm.
widest:	0.81 mm.
Retinaculum	
length:	0.12 mm.
shoulder:	0.08 mm.
waist:	0.06 mm.
hip:	0.09 mm.
ext.:	0.04 mm.
Translators	
length:	0.13 mm.
depth:	0.02 mm.
Caudicle	
bulb diam.:	0.08 mm.

Hoya scortechinii King & Gamble 1908
Pollinarium from flower via TG.



Pollinium		
	length:	0.400 mm.
	widest:	0.210 mm.
Retinaculum		
	length:	0.226 mm.
	shoulder:	0.130 mm.
	waist:	0.100 mm.
	hip:	0.130 mm.
	ext.:	0.060 mm.
Translators		
	length:	0.130 mm.
	depth:	0.180 mm.
Caudicle		
	diam:	0.050 mm.

Magnified approximately 160 X

Hoya pubicalyx Merrill 1918
Flowered in Fresno CA clone from DH.

Pollinarium	
length:	0.81 mm.
widest:	0.23 mm.
Retinaculum	
length:	0.27 mm.
shoulder:	0.22 mm.
waist:	0.09 mm.
hip:	0.10 mm.
ext.:	0.08 mm.
Translators	
length:	0.15 mm.
depth:	0.02 mm.
Caudicle	
bulb diam.:	0.11 mm.

Magnified approximately 160X.

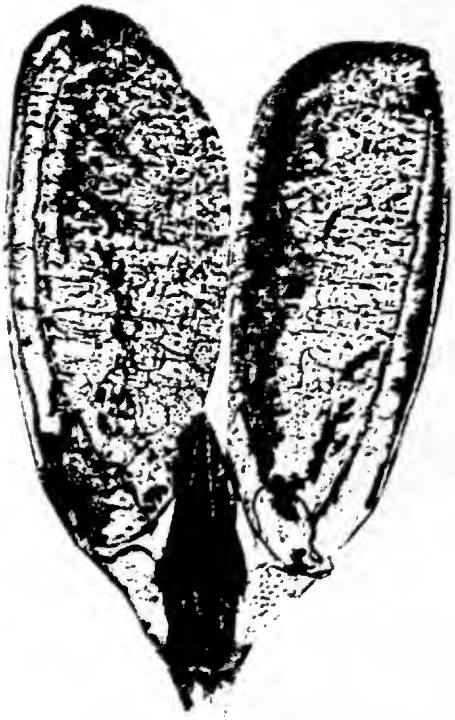
Hoya sp. (CAHUP) #9136 J.R. Velasco 1954
Sugask Is., Palawan.

Pollinium		
	length:	0.460 mm.
	widest:	0.175 mm.
Retinaculum		
	length:	0.170 mm.
	shoulder:	0.080 mm.
	waist:	0.030 mm.
	hip:	0.080 mm.
	ext.:	0.035 mm.
Translators		
	length:	0.120 mm.
	depth:	0.020 mm.
Caudicle		
	bulb. diam.:	0.040 mm.

Magnified approximately 160X.

Note: possibly from the Section Cathetostemma (Bl.) Miquel, although it appears to have pellucid edges. The drawing of the pollinarium in Mus. Bot. L-B. 1:60: t 14 of *Centrostemma laurifolium* Blume is very similar to this one.

Hoya sp. Hybrid #1 via Michael Myashiro
Flowered at Fresno CA..



Pollinium		
	length:	0.45 mm.
	widest:	0.18 mm.
Retinaculum		
	length:	0.20 mm.
	shoulder:	0.05 mm.
	waist:	0.04 mm.
	hip:	0.07 mm.
	ext.:	0.03 mm.
Translators		
	length:	0.09 mm.
	depth:	0.04 mm.
Caudicle		
	bulb. diam.:	0.05 mm.

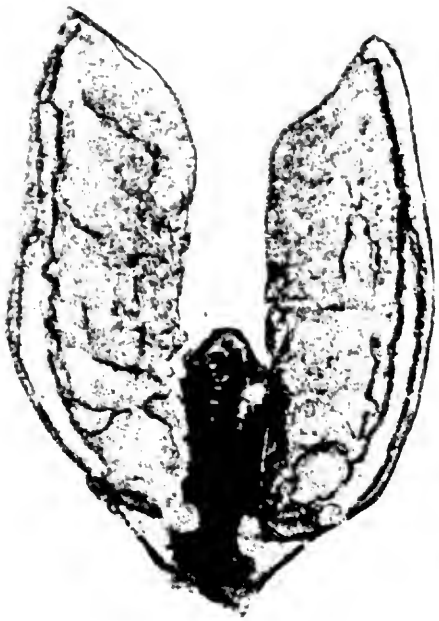
Magnified approximately 160 X

Hoya sp. PNH 4936 Gaerlan & Fuentes
Panay, Antique Prov., Mt. Midia-as, Culasi Hargod, Tubid
Philippines.

Pollinium		
	length:	0.400 mm.
	widest:	0.138 mm.
Retinaculum		
	length:	0.110 mm
	shoulder:	0.070 mm.
	waist:	0.050 mm.
	hip:	0.060 mm.
	ext.:	0.040 mm.
Translators		
	length:	0.016 mm.
	depth:	0.040 mm.
Caudicle		
	bulb. diam.:	0.070 mm.

Magnified approximately 160 X

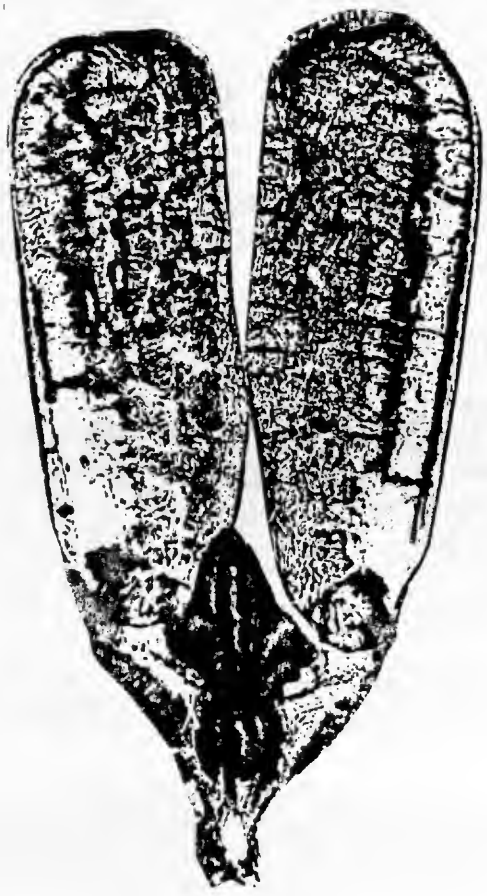
Hoya sp. Edano (PNH) 11859
Antiloa River, Ormac, Leyte 1950.



Pollinium
length: 0.440 mm.
widest: 0.145 mm.
Retinaculum
length: 0.210 mm.
shoulder: 0.090 mm.
waist: 0.030 mm.
hip: 0.080 mm.
ext.: 0.020 mm.
Translators
length: 0.090 mm.
depth: 0.025 mm.
Caudicle
bulb. diam.: 0.04 ? mm.
*second hip: 0.070 mm.

Magnified approximately 160 X

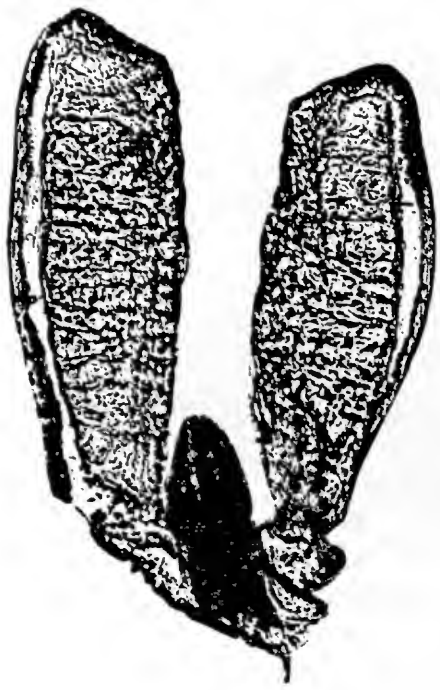
Hoya sp. USDA 354241
Grown and flowered at Fresno CA.



Magnified approximately 165 X

Pollinium	
length:	0.420 mm.
widest:	0.180 mm.
Retinaculum	
length:	0.210 mm.
shoulder:	0.117 mm.
waist:	0.067 mm.
hip:	0.080 mm.
ext.:	0.070 mm.
Translators	
length:	0.110 mm.
depth:	0.050 mm.
Caudicle	
bulb. diam.:	0.070 mm.

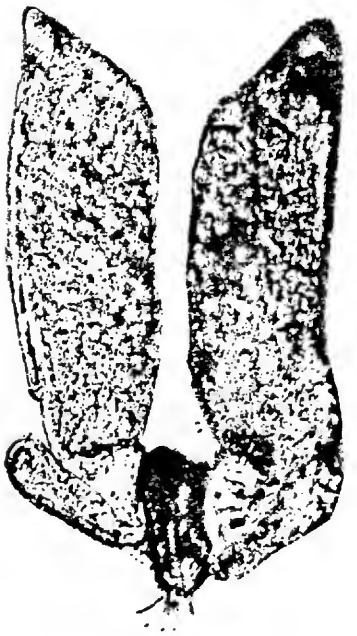
Hoya sp. PNH 4854
Gaerlan, Sagcal & Fernando 10/10/91
Dinagat, Mindanao, Philippines.



Pollinium		
	length:	0.41 mm.
	widest:	0.16 mm.
Retinaculum		
	length:	0.18 mm.
	shoulder:	0.08 mm.
	waist:	0.05 mm.
	hip:	0.06 mm.
	ext.:	0.04 mm.
Translators		
	length:	0.10 mm.
	depth:	0.02 mm.
Caudicle		
	bulb. diam.:	0.08 mm.

Magnified approximately 160 X

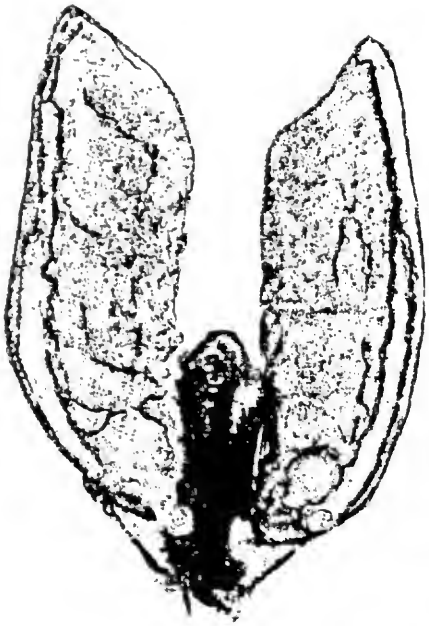
Hoya sp. PNH 4936 Gaerlan & Fuentes
Panay, Antique Prov., Mt. Midia-as, Culasi Hargod, Tubid
Philippines.



Pollinium		
	length:	0.400 mm.
	widest:	0.138 mm.
Retinaculum		
	length:	0.110 mm
	shoulder:	0.070 mm.
	waist:	0.050 mm.
	hip:	0.060 mm.
	ext.:	0.040 mm.
Translators		
	length:	0.016 mm.
	depth:	0.040 mm.
Caudicle		
	bulb. diam.:	0.070 mm.

Magnified approximately 160X.

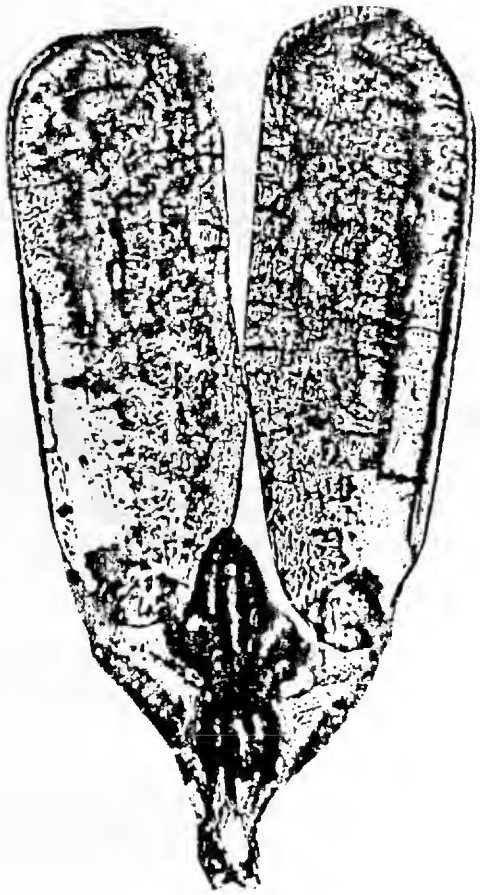
Hoya sp. Edano (PNH) 11859
Antiloa River, Ormac, Leyte 1950.



Pollinium
length: 0.440 mm.
widest: 0.145 mm.
Retinaculum
length: 0.210 mm.
shoulder: 0.090 mm.
waist: 0.030 mm.
hip: 0.080 mm.
ext.: 0.020 mm.
Translators
length: 0.090 mm.
depth: 0.025 mm.
Caudicle
bulb. diam.: 0.04 ? mm.
*second hip: 0.070 mm.

Magnified approximately 160X.

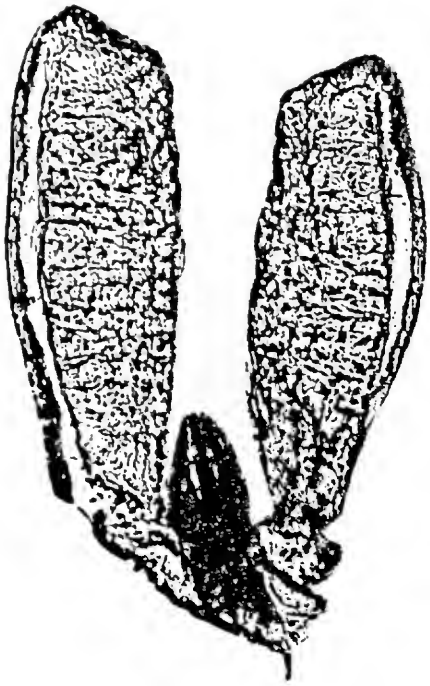
Hoya sp. USDA 354241
Grown and flowered at Fresno CA.



Pollinium		
	length:	0.420 mm.
	widest:	0.180 mm.
Retinaculum		
	length:	0.210 mm.
	shoulder:	0.117 mm.
	waist:	0.067 mm.
	hip:	0.080 mm.
	ext.:	0.070 mm.
Translators		
	length:	0.110 mm.
	depth:	0.050 mm.
Caudicle		
	bulb. diam.:	0.070 mm.

Magnified approximately 160X.

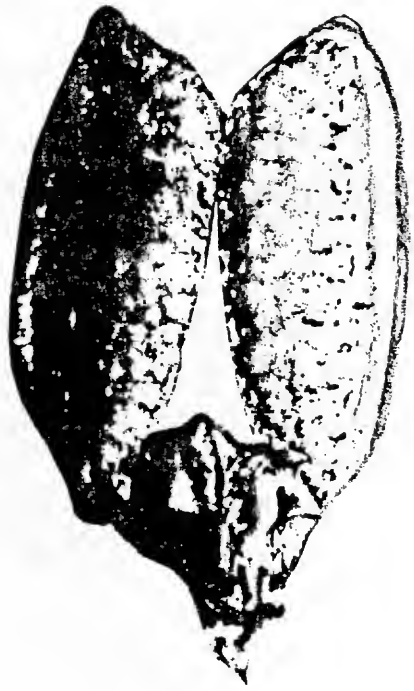
Hoya sp. PNH 4854
Gaerlan, Sagcal & Fernando 10/10/91
Dinagat, Mindanao, Philippines.



Pollinium		
	length:	0.41 mm.
	widest:	0.16 mm.
Retinaculum		
	length:	0.18 mm.
	shoulder:	0.08 mm.
	waist:	0.05 mm.
	hip:	0.06 mm.
	ext.:	0.04 mm.
Translators		
	length:	0.10 mm.
	depth:	0.02 mm.
Caudicle		
	bulb. diam.:	0.08 mm.

Magnified approximately 160 X

Hoya sp. Wayet (CAHUP) 5271: 1990.
Baguio Villiage, Querino, Luzon Philippines.

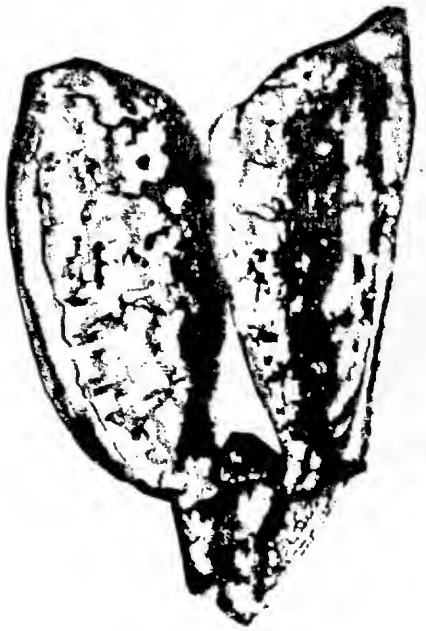


Pollinium		
	length:	0.41 mm.
	widest:	0.17 mm.
Retinaculum		
	length:	0.17 mm.
	shoulder:	0.15 mm.
	waist:	0.05 mm.
	hip:	0.08 mm.
	ext.:	0.02 mm.
Translators		
	length:	0.08 mm.
	depth:	0.02 mm.
Caudicle		
	bulb. diam.:	0.06 mm.

Magnified approximately 160X.

Hoya sp. CAHUP 5269

M. Wayet 1989 Baguio Village, Diffuin, Qurino, Luzon, Philippines
Fl. white or pale yellow, pubescent recurved corolla.



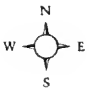
Pollinium	
length:	0.38 mm.
widest:	0.15 mm.
Retinaculum	
length:	0.11 mm.
shoulder:	0.07 mm.
waist:	0.04 mm.
hip:	
ext.:	
Translators	
length:	0.08 mm.
depth:	0.01 mm.
Caudicle	
bulb. diam.:	0.04 mm.

Magnified approximately 160X.

The Section Eriostemma Schlechter Species

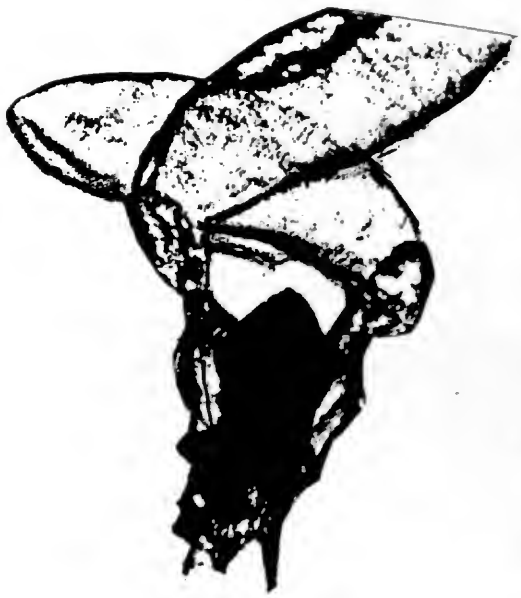
In this section the hoya species have pollinium that do not have a pellucid germinal edge. In addition the translators and caudicle are closely structured (maybe fused would be a better description) into a curled twisted ribbon like structure. Most species have beautiful large fleshy flowers. Since I have been unable to flower these species in Fresno California I am entirely indebted for flowers to work with, mainly from Ted Green in Hawaii.

Many of the species have very large pollinarium. I have presented most of these at 65X because of the large size. Those at 160X are by necessity composites of more than one photograph.



Hoya guppyi Oliver 1892

Flower via TG from clone collected on W. Tulagi, Solomon Is..



Pollinium	
length:	0.99 mm.
widest:	0.33 mm.
Retinaculum	
length:	0.52 mm.
shoulder:	0.27 mm.
waist:	0.11 mm.
hip:	0.15 m.
ext.:	0.13 mm.
Translators	
length:	0.35 mm.
depth:	0.06 mm.
Caudicle	
bulb. diam.:	0.20 mm.

Magnified approximately 65X.

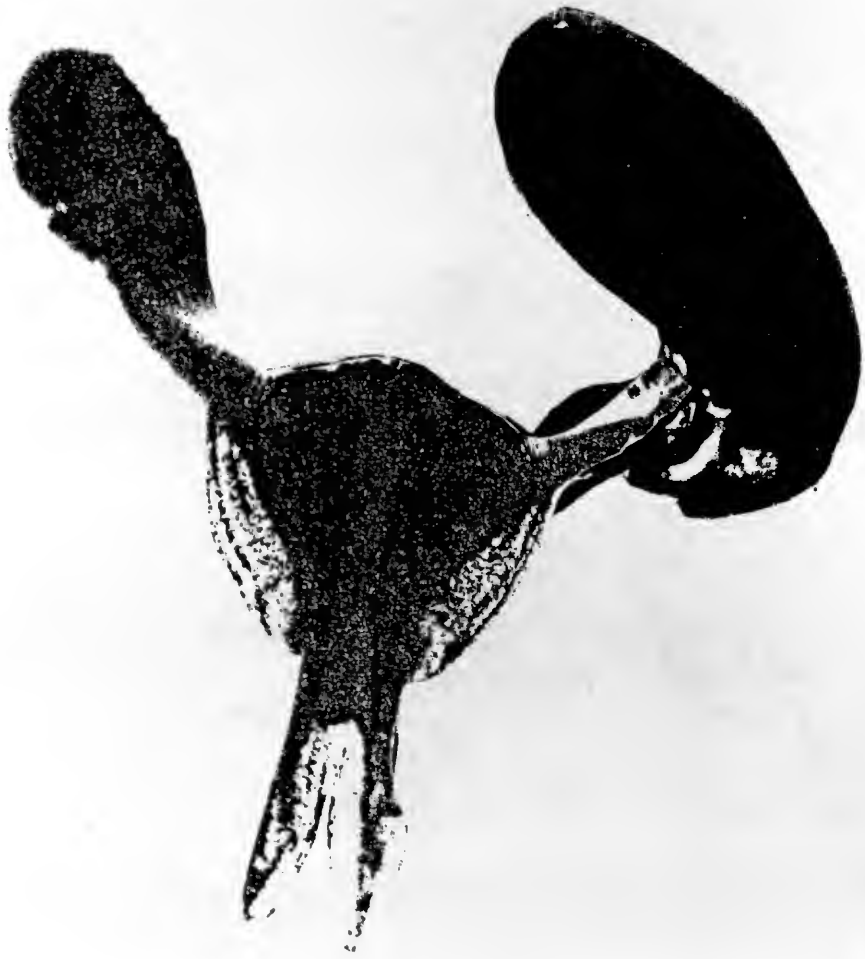
Hoya guppyi Oliver 1892

Flower form dark form clone via TG.

Pollinium	
length:	0.920 mm.
widest:	0.350 mm.
Retinaculum	
length:	0.550 mm.
shoulder:	0.330 mm.
waist:	0.206 mm.
hip:	0.290 mm.
ext.:	0.020 mm.
Translators	
length:	0.550 mm.
depth:	0.080 mm.
Caudicle	
fused depth:	0.050 mm.

Magnified approximately 65X.

Hoya sp. Borneo
Large flowered H. coronaria type clone
Flower via TG., Hawaii.



Magnified approximately 65X.

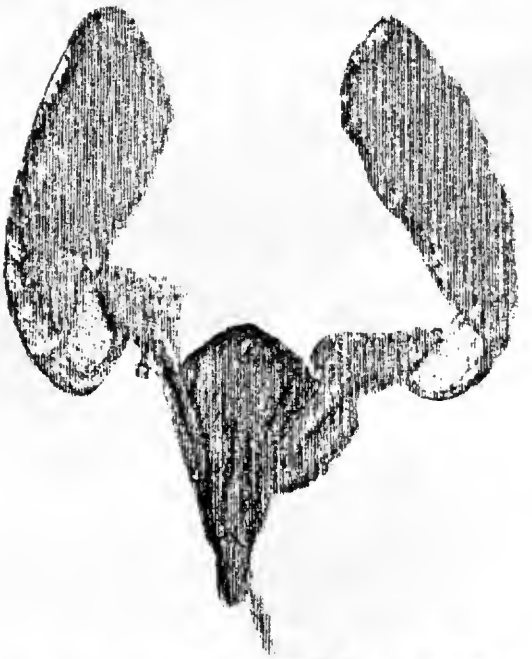
Pollinium length: 1.00 mm.; widest: 0.50 mm.
Retinaculum length: 0.75 mm.; shoulder: 0.65 mm.; waist: 0.28 mm.; hip: 0.30 mm.; extensions: 0.56 mm..
Translators: length: 1.05 mm.; width: 0.05 mm..

Note: Left pollinium deformed. This flower is much larger than the Hoya coronaria Mulu Bot. Gdn. clone and yet polonium is shorter, as are some of the other measurements.

Hoya sp. PNH 29467

Collected by Hinty & Lelan at Walo, Commder Bay

1968 W. New Britain, flower dull red; greenish toward center.



Pollinium

length:	0.73 mm.
widest:	0.27 mm.

Retinaculum

length:	0.47 mm.
shoulder:	0.30 mm.
waist:	0.14 mm.
hip:	0.16 mm.
ext.:	0.08 mm.

Translators

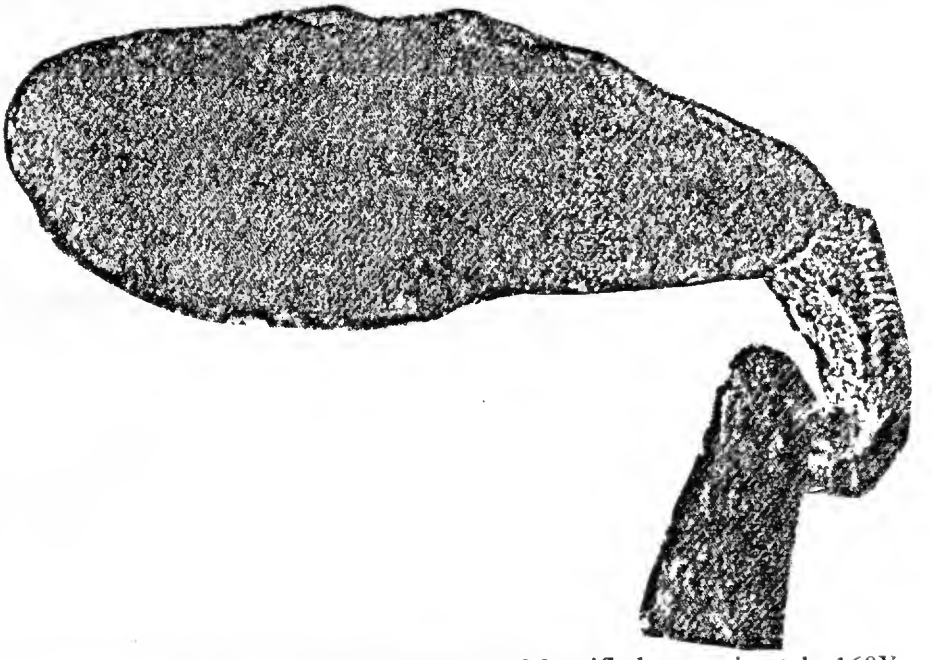
length:	0.70 mm.
depth:	0.04 mm.

Caudicle

bulb. diam.:	0.10 mm.

linearly fused.

Magnified approximately 65 X



Pollinium and translators turned sideways. Magnified approximately 160X.

Hoya coronaria Blume 1825
Flower from clone via TG
Mulu National Park, Sarawak, Borneo 4/12/92.

Magnified approximately 65X.

Pollinarium length: 1.24 mm.; widest: 0.47 mm.
Retinaculum length: 0.77 mm.; shoulder: 0.65 mm.; waist: 0.30 mm.; ext.: 0.25 mm.
Translators length: 1.30 mm.; depth: 0.05 mm. ?

Note: I feel the measurements made at around 160X are more accurate than at this magnification. I have found the measurements made at 65X tend to be slightly larger than at 160X.

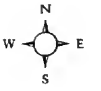
Hoya sp. Small Flower Borneo
Collected and flowered by TG. Hawaii.
Flower similar to H. coronaria but smaller.

Magnified approximately 65X.

Pollinium length: 0.98 mm.; widest: 0.43 mm.
Retinaculum length: 0.55 mm.; shoulder: 0.48 mm.; waist: 0.24 mm.; ext.: 0.25 mm.
Translators length: 1.40 mm.; depth: 0.06 mm.

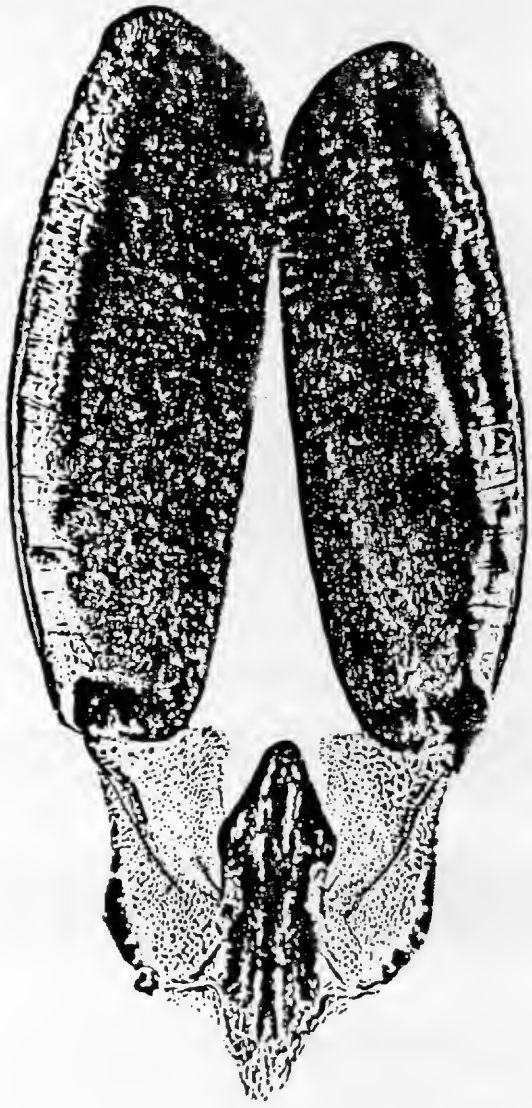
Pollinaria of the Section Physostelam (Wight) Blume

The flowers of this section are beautiful. There is no lack beauty carried over into the pollinaria of this group. I'm sure most will agree when viewing the following page. Presented here are pollinium from the following species at present only one, more in revised issues: *Hoya campanulata* Blume.



Hoya campanulata Blume 1826

Flowered in Hawaii via TG.



Magnified approximately 160 X

Pollinium	
length:	0.610 mm.
widest:	0.205 mm.
Retinaculum	
length:	0.180 mm.
shoulder:	0.100 mm.
waist:	0.050 mm.
hip:	0.080 mm.
ext.:	0.060 mm.
Translators	
length:	0.170 mm.
depth:	0.070 mm.
Caudicle	
bulb. diam.:	0.11 mm.

Note: Translator and caudicle both with opaque surfaces or inclusions. Both are triangular in flat dimension and very pronounced.

Glossary of Terms Associated with the Pollinarium

angle — an·gle (ăng′gel). L. *angulus*, angle or corner. (e.g. inner angle). **angled. angularis.**

anthesis — an·the·sis (ăn-thē′-sís). Gr. *anthesis,* the full bloom of a plant, the time when the flowers are open.

anther — an·ther (ăn′ther). Gr. *anthos,* a flower, in hoya a fused thin triangular part adnate to the coronal scale above and the stylar material below: bearing (holding) the pollinia.

apex — a·pekx (ā′-pĕx). L. *apex,* the tip (plural **apices)** top, highest or end point of a structure.

bilateral — bi·lat·er·al (bī-lăt′er-al). L. *latis*, side. On opposite sides; of two sides.

bisymmetrical— bi·sym·met·ri·cal (bī-sĭ-mĕt′rĭ-kal). The two sides mirror images; alike on two sides of a center line.

anterior — an·te·ri·or (ăn-tîr′ē-er). L. *ante,* prefix meaning before, in front of , (an organ part or placement).

aperture — ap·er·ture (ăp′er-cher). L. *apertura,* an opening. A hole in the wall through which the pollen tube can emerge. A pour for allowing fluids to enter the pollinium in hoya. **aperturate.**

apical — ap·ik·al (ap′ik-al). Pertaining to the apex. At or near the end of the tip.

appendage — ap·pend·age (e-pĕn′dĭj). L. *appendo*, to hang. An additional part or character.

ascending — as·cend (a-sĕnd′). L. *ad; sendo*, to climb. Rising or climbing upward.

attached — at·tach (a-tăch′). L. *attacctus*, touching. Connected to.

back — back (băk). Fr. *bac,* a boat. The dorsal side, the side away from the axis.

basal — bas·al (bā′sal). Gr. *basis,* bottom, base. At the base of a structure. **base.**

basifixed — bay·see·fikst (bā′-si-fikst). Attached at the bottom. e.g. pollinia attached to the caudicle in hoya.

beneath — be·neath (bĭ-nēth′). A. Sax. *beneoth,* below. Under, on the ventral side

bifid — bi·fid (bi′-fĭd) L. *findo,* to split. Divided into 2 parts.

bilobate — bi·lob·ate (bī-lōb-āt). Gr. *lobos*, lobe., With two lobes, divided into two. **bifid. bipartite. bilobed. bilobes.**

bisymmetrical— bi·sym·met·ri·cal (bī-sĭ-mĕt′rĭ-kal). The two sides mirror images; alike on two sides of a center line.

blunt — blunt (blŭnt). Dan. *blande,* a dull knife. A rounded apex (end). Obtuse, muticous.

bulbose — bulb·ous (bŭl′-bōs). L. *bulbus*, onion. Inflated, looking like a onion (bulb).

calyx — ca·lyx (kā′lĭks, kăl′ĭks) *n.*, *pl.* ca·lyx·es or ca·ly·ces (kā′lĭ-sēz′, kăl′ĭ-).The sepals of a flower considered as a group.

carriers — kar·ri·er (kăr′ē-er). The transportors, conveyors, relating to the pollinia holders or pockets.

caudicle — kaw·di·sil (kô′-di-sil). L. *cauddex*, tree stem. The clear adhesive attachment of a pollinarium attached to the central retinaculum and to which the base of the pollinia adheres, supported by the translator arm. **caudicles.**

circa (ca.) — cir·ca (sûr′ka). L. *circa*, about, almost, approximately, near to. Used in botanical works.

cline — klin (klinē). L. *cline,* ecological term. A group of plants with a continuous range of variation, with no breaks. **clinal variation.**

clone — clone (klōn). L. *clone,* branch. Genetically identical plants. Plants propagated from one individual asexually.

cm. — Abreviation for L. *centemetrum*, centimeter. A metric length measurment equal to 0.3937 inches.

column — col·umn (kŏl′em). L. *collum,* neck. The neck-like structure in the flower center formed by the fusion of filaments and style. **gynostegium columnar.**

connivent — con·niv·vent (kon-nīv′ent). L. *conniveo,* to wink at. Having the parts arching over another at the apex, (inner lobe of corona over the anther apex and the latter over the staminal crown).

conspecific — con·spe·cif·ic (kŏn′spĭ-sĭf′ĭk). L. *con,* together; *species,* a kind. Belonging to the same species, said of two taxa.

concave — con·cave (kŏn-kāv′, kŏn′kāv′). L. *concavus,* cupped. Cupped or hollowed out.

corolla — co·rol·la (ko-rŏl′a, -rō′la). L. *corona,* a crown. All the petals collectively, united in hoya.

corona — co·ro·na (ko-rō′na). L. *corona,* a crown. The whorl of flower parts just inwardly from the corolla in hoya divided into inner and outer parts, a radiating fleshy center of the flower, very prominent, visually and taxonomically.

coronal — co·ro·nal (ko-rō′nal). L. *corona,* a crown. Pertaining to the corona, the crown. **coronal processes. coronal lobes.**

corpuscle — cor·pus·cle (kôr′-pŭs′al). L. *corpus,* a body. Another term for the central portion of the pollinarium, in hoya secreted by the fused stigmas. see **retinaculum.**

corpusculum — cor·pus·q·lum (kôr′pus-q-lum). L. *corpus,* a body. A little body, a collection.

correlation — cor·e·la·shun (kŏr-ē-lā′-shŭn). L. *con*, with; *relatum*, brought back. The reciprocal influence of one organ on another.

cuttings — cut·ting (kŭt′ĭng). Of Celtic origin. A portion of a stem cut for propogation. (usually with one or more nodes).

descending — de·scend (dĭ-sĕnd′). L. *de; sendo,* to turn down. Bent or pointed downward.

diam. — Abbreviation for L. *diameter*, distance across (circle), from one side to the other.

diverse — di·vurs (dī-vûrs). L. *diversus*, different. Different, distinct. Abbreviated.**div.**

dorsal — dor·sal (dôr′sal). L. *dorsum*, back. The side away from the axis.

dyed — dye (dī). A. Sax. *deagan,* dye, *color.* With color added; tinted; stained.

edge — edge (ĕj). See **margine**. A. Sax. *ecg.* edge.The border, extremity of a surface.

elevated — el·e·vate (ĕl′e-vāt′). L. *e; levo,* raised from. Raised from the surrounding surface.

elongate — e·lon·gate (ĭ-lông′gāt′, ĭ-lŏng′-). L. *e; longus*, long. Much lengthened. **elongated.**

exudate — ex·ude (ĭg-zo͞od′, ĭk-so͞od′). L. *exudo*, to sweat out. Release of liquid as attractant; to enhance pollen germination etc..

flattened — flat·ten (flăt′n). G. *flach*, flat. Made flat., **applanate** horizontally; **complanate** in any direction; **depressed** from above; **compressed** laterally. **flat.**

flower — flow·er (flou′er). L. *flos*, flower. The reproductive structure in higher plants, consisting of sterile outer parts, calyx, corolla and sexual parts, stamens and carpels.

fused — fuse (fyo͞oz). L. *fusum*, to melt. To grow together, becoming inseparable, combining.

germination — ger·mi·nate (jûr′ma-nāt′). L. *germinatio*, a sprouting. Sprouting of the seed; the emergence of pollen tubes from the pollinia in hoya.

germ — germ (jûrm). L. *germen*, a bud. The origin of anything; the embryo.

germinal — ger·mi·al (jûr′ma-āl′). L. *germen*, a bud. A place of origin (germination).

gland — gland (glănd). L. *glans*, an acorn. dim. *glandula*, a gland. A swelling of a surface, dry or secreting, single cells or secretory structures. **glandular.**

globose — glo·bos (glō-bōs). L. *globus*, a ball. Round, globular. **globular.**

glossary — glos·sa·ry (glô′se-rē, glŏs′a-). Gr. *glossa*, attic; *glotta*, tongue. Dictionary of special terms used in a branch of science or art; here hoya words or terms.

gelatenous — ge·lat′i·nus Fr. gelatine, (L. gelo) to congeal. Resemblng gelatine, viscous.

glutinous — glu·ti·nous (glo͞ot′n-as). L. *gluten*, glue. A sticky exudate.

herbarium — her·bar·i·um (hûr-bâr′ē-em, ûr-). L. *herbarium,* herbarium. The systematic arrangement of dried, mounted plants; the building housing preserved plant specimens. **herb.** abbreviation.

hoya — hoi·a (hoi′a). A genus of the Asclepiadaceae family; wax plants, named for Tomas Hoy.

IML — A prefix for designating hoyas of the Liddle nursery in Mareba, Australia standing for Iris Marie Liddle.

inner-angle — The inner appical area, the one nearest the axis. The inner lobe of the hoya coronal scale

inside — in·side (ĭn-sīd′, ĭn′sīd′). L. *insideo*, to sit in. To be within.

label — la·bel (lā′bel). Gr. *labe,* a handle. A marker , tag, identification, classification.

margine — mar·gin (mär′jĭn). L. *marginis*, edge. Referring to the edge of something **marginal. marrgins. marginalis.**

masses — mass (măs). L. *massa*, a lump, mass. A large group.

membranaceous — mem·bra·na′shus (měm-bar-nā′shus). L. *membrana*, the skin, parchment.Transparent, thin and pliable.

micron — mi·kron (mī′krŏn′). Gr. *mikros,* small. Measurement, 0.000001 meter. (µm.).

minute — mi·nute (mī-nōōt′, -nyōōt′, mĭ-). L. *minutus,* small. Very small in size. **minutely. minutus.**

mm. — L. *millimetrum*. Abbreviation for (measurement) 1000th of a meter.

oblique — o·blique (ō-blēk′, a-blēk′). L. *obliquus*, slanting sideways. Asymmetrical; cut off on one side, e.g. the outer apex of many pollinia.

oblong — ob·long (ŏb′lông′, -lŏng′). L. *oblongus*, somewhat long. Elliptical with obtuse ends. **oblongatus.**

obovate — ob·o·vate (ŏb′-ōvāt′). L. *ovum*, an egg. Shaped like an egg in outline, attached at the narrow end. **obovately.**

obovoid — ob·o·void (ob′-ōvoid′). L. *ob*, against; *ovatus*, egg-shapped. A solid form, (egg-shaped) attached at the narrow end.

obscure — ob·scure (ob′-skyōōr, ab-). L. *obscurus*, dusky. Not readily visible.

obtuse — ob·tuse (ŏb-tōōs′). L. *obtusus*, blunt. With the apex blunt or rounded.

opaque — o·paque (ō-pāk′). L. *opacus,* dark. Not transparent; in colors meaning saturated.

pedicel — ped·i·cel (pĕd′ĭ-sel, -sĕl′). L. *pedicellus*, a little foot. The supporting stem of each single flower. **pedicelled. pedicels. pedicellate.**

pellucid — pel·lu·cid (pe-lōō′sĭd). L. *pellucidus*, transparent. Clear, translucent. e.g. the outer sterile edge of a pollinia.

pentamerous — pen·tam·er·us (pĕn-tăm′-ĕr-ŭs). Gr. *pente*, five; *meros,* five parts. With five members. Five members in each whorl.

pollen — pol·len (pŏl′en). L. *pollens*, powerful. The male gametophyte. **pollen tube. pollination.**

pollinarium — pol·len·ar·i·um (pŏl′en-ār-ĭum). L. *-aria*, suffix added to a noun "a thing like". Two pollen masses (pollinium) from adjacent anther lobes (pockets) connected by translator arms and

caudicles attached to a central bisymetrical retinaculum. Plural **pollinaria**.

pollinium — pol·len·ium (pŏl′en-ĭum). L. *pollinis*, afine powder. A mass of pollen from one anther cavity. One unit. Plural **pollinia**

pore — pore (pôr, pōr). Gr. *poros*, an opening. A small opening. **porose. porous.**

proximal — prox·i·mal (prŏk′si-mal). L. *proximus*, nearest. Nearest to the axis. **proximate**.

raised — raised (rāzd). L. *elivatus*, elevated. To be higher than the surrounding or near structure.

receptive — re·cep·tive (rĭ-sĕp′tĭv). L. *receptivus*, a drawing back. Ready to receive.

retinaculum — re·tin·a·q·lum (re-tik-ā′-q-lum). L. *retinaculum*, that which holds back or binds a band, holdfast, or tether, halter. A horny structure secreted by the channel on top of the fused stigmas, to which the pollinia are attached by translators and/or caudicles. **retinacular.**

rigid — rig·id (rĭj′ĭd). L. *rigidus*, fixed. Stiff, hard, inflexable.

rudimentary — ru·di·men·ta·ry (rōō′da-mĕn′ta-rē, -mĕn′trē). L. *rudimentum*, a first attempt. Just beginning development.

sac — sak (săk). L. *saccus*, a pouch. A pouch like holder open on one side or end. **saccate. saccule.**

secrete — se·crete (sĭ-krēt′). L. *secreta*, a seperation. To discharge, give forth. **secreted. secretion.**

sepal — se·pal (sē′pal). L. *sepalum* a rhyming analogue to "petal ". One leaf of the outer floral envelope (calyx).

sexual — sex·u·al (sĕk′shōō-al). L. *sexulus*, pertaining to sex. Propogation products of an organism; type involving both male and female parts.

short — short (shôrt). A. Sax. *sceort*, short. Of little length, brief, little.

species — spe·cies (spē′shēz, -sēz). L. *species*, a particular kind. A basic unit of classification, a group of closely related individuals. The concept can be narrow (with little variation) or broad (allowing much variability). With no clear cut definition, taxonomically speaking.

specimen — spec·i·men (spĕs′e-man). L. *specimen*, an example.

sect. — L. *sectio*, section. Abbreviation. A group of closely related species placed below subgenus and above series. **section.**

ssp. — L. *sub; species*, a lower kind. A rank below a species. Abbreviation.

staminal — sta·mi·nal (stā′me-nĭt, -nāl′, stăm′a-). L. *stamen*, a thread. Referring to the stamens. **staminate. stamina** (pl.). **staminoid. stamineous.**

stigma — stig·ma (stĭg′ma). L. *stigma* , a spot. The receptive region of the style. In hoya a cup like moist area below the retinaculum, the recurved fused (2) end of the style.

stigmatic — stig·ma·tik (stĭg′ma-tik). L. *stigma* , a spot. Relating to the stigma.

styler — styl·er (stīl-er). Gr. *stylos*, a style, stake. The stalk connecting the ovary to the stigma. In hoya this tissue forms a central dome descending outward to the five pairs of fused stigmas, which results in a pentamerous table. **style**.

subsection.— sub·sek·shun (sŭb-sĕk′-shŭn). A taxonomic rank just below Section. **subsectio.**

support — sup·port (sa-pôrt′, -pōrt′). L. *sustino*. To uphold , to bear; the underlying structure. **supporting.**

surface — sur·face (sûr′fas). L. *pagina*. The outside, exterior surface.

suture — su·ture (sōō′cher). L. *sutura*, a seam. A line of union of two parts.

symmetrical — sym·met·ri·cal (sĭ-mĕt′rĭ-kal). Gr. *syn (sym)*, together; *metron*, a measure. Where a plane can be drawn in which the halves are mirror images.

taxonomy — tax·on·o·my (tăk-sŏn′e-mē). Gr. *taxo*, to arrange. Systematics; the science of botanical (or other organism) classification.

template — tem·plate (tĕm′plĭt). Fr. *temple,* a mechanical appliance. A guide for the formationof a structure. e.g. the template for the retinaculum.

texture — tex·ture (tĕks′cher). L. *textura.* The grain or structure of a surface.

translator — trans·la·tor (trăns-lā′tar, trănz-, trăns′lā′ter, trănz′-). L. *trans*, across. The arm like structure of a pollinarium connecting the central point (corpusculum or retinaculum) to the pollinia or actually supporting the sticky translucent caudicle. The caudicle and translator are fused in some hoya pollinarium.

translucent — trans·lu·cent (trăns-lōō′sent, trănz-). L. *trans; lux*, to transport light. Allows for the passage of light.

transparent — trans·par·ent (trăns-păr′ent, -păr′-). L. *trans, parens*, to appear across. Clear, as to be seen through.

triangular — tri·an·gu·lar (trī-ăng′gye-lar). L. *triangulum*. With three sides but often used to describe the Hoya corolla and sepal lobes with fixed bases. **triangularis.**

truncate — trun·cate (trŭng′kāt′). L. *truncatus*, mutilated. Ending abruptly, as if cut off.

tube — tube (tōōb, tyōōb). L. *tubus*, a hollow cylinder. The hollow cylinder of the corolla.

turgid — tur·gid (tūr′jĭd). L. *turgreo*, to swell. Full of fluid. Swollen.

twisted — twist (twĭst). A. Sax. *twist,* a cord. Bent, winding, contorted. see convolute.

vacuole — vac·u·ole (văk′yōō-ōl′). L. *vacuus,* empty. An empty space; a cavity in the protoplasm. e.g. between the pollen and the pellucid (germinal area) in hoya pollinia.

viscid — vis·cid (vĭs′ĭd). L. *viscum,* mistletoe sap. With a sticky secretion.

viscose — vis·cose (vĭs′kōs′). L. *viscosus*, sticky. Semi-fluid, thick. viscous.

yellow — yel·o (yel′ō). A. Sax. *geolo,* yellow. A color term, like sunlight. Yellowish

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208 sp. Sualawesi #941135 Tomeri Bay, aust. type flow.
75 sp. Sulawesi Med Fl. 1994
66 sp. Tau Samoa TG
120 sp. Thailand CT
170 sp. UC 1013 Coleon
185 sp. UC 1915 Mt. Neueva
188 sp. UC 3949 Grether Pitilu Negros
192 sp. UC 45730 Ramos & Edeno
191 sp. UC 49328 Ramos & Edano Mati Davao
193 sp. UC 49395
67 sp. USDA 354238 F
237 sp. USDA 354241 F
122 subquintuplinervis Miquel F
47 thompsonii Hooker f. CT
93 **tsangii Burton Elmer 13372**
184 uncinata Teij. & Binn. TG
115 verticillata (Vahl) Don F
117 verticillata as acuta green F
116 verticillata CT
77 vitellinia Blume F
161 **vitellinioides Brink L (BO)** via Burton
61 vitensis Turrill UC 20732
96 **wayetii Kloppenburg F**
85 **waymaniae Klopp MM**

Note: **Type** material in bold print.
Source indicated by initials see acknowledgments for key.