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TABLE OF CONTENTS

NUMBER 1 (June 11, 1965)

NUMBER 2 (October 29, 1965)

NUMBER 3 (December 29, 1965)

NUMBER 4 (December 31, 1965)

NUMBER 5 (March 9, 1966)

NUMBER 6 (April 6, 1966)

NUMBER 7 (September 2, 1966)

NUMBER 8 (December 30, 1966)

NUMBER 9 (April 28, 1967)

NUMBER 10 (July 19, 1967)

INDEX OF ILLUSTRATIONS

INDEX

TO GENERA AND SPECIES

ERRATA

page 27, line 33
for *Castinopsis* read *Castanopsis*

page 81, line 32
for *Fruiticulture* read *Fruitculture*

page 102, line 9
for 1980 read 1930

page 106, line 13
for Apollo read Pollo

page 251, line 1
for **microtantha** read **microtatantha**

page 251, line 2
for **mirotantha** read **microtatantha**

page 258, line 9
for *Camaridium* read *Ornithidium*

page 258, line 12
for **Maxillae** read **Maxillaria**

page 276, line 1
for (Spr. ex Benth. Rudd) read (Spr. ex Benth.) Rudd

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THE 'MUSHROOM MADNESS' OF THE KUMA

BY

ROGER HEIM[1] AND R. GORDON WASSON[2]

FEW have heard of the 'mushroom madness' that strikes at irregular intervals some of the natives of the Wahgi Valley in New Guinea. Even in New Guinea itself those of European race are often not informed about this puzzling behavior. But for us who had long been studying the role of wild mushrooms in primitive cultures, the first intimation of the mushroom madness to reach us, early in 1953, arrested our attention: we seized on it and both from published sources and by private correspondence tried to inform ourselves about it. The more we learned, the more we were baffled. At last circumstances permitted us to visit the Wahgi: in 1963, accompanied by Dr. Marie Reay, anthropologist of the Australian National University, we spent about three weeks on the scene.

Mount Hagen and the Wahgi River are in that portion of New Guinea administered by Australia under mandate from the United Nations. They are in the Western Highlands. The river flows eastward through

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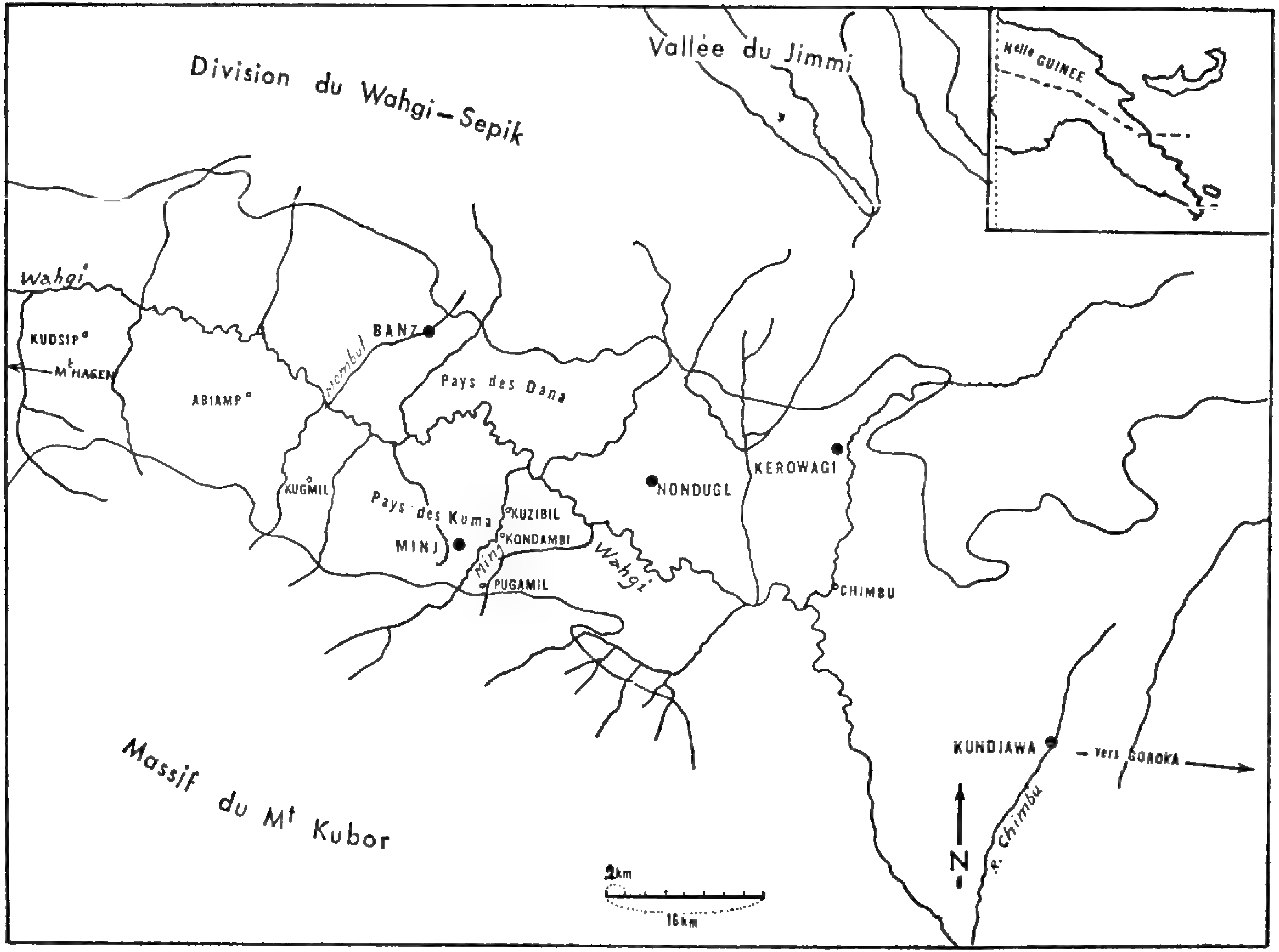
a broad valley the altitude of which above sea-level is about one mile. The length of the valley is some fifty miles, the breadth from eight to 14 miles. The valley is bounded on the west by Mount Hagen, on the east by the Chimbu massif, on the north by the lofty Bismarck range with Mount Wilhelm towering 15,400 feet high, and on the south by Mount Kubor, 14,000 feet high, and its abutments. Lying five or six degrees south of the equator and enjoying an abundant rainfall, it basks in eternal summer. How inviting must have been the prospect, when European eyes first viewed this valley from the ground, with its luxuriant vegetation and its riot of strange wild flowers, hardly more than 30 years ago, in 1933! The Australian party headed by the Leahy brothers that first penetrated this valley could have experienced the awe of discovery that attends the first view of a green and enchanting land—the first view, that is, by persons of the modern world. They found the valley inhabited by a farming population, perhaps some 30,000 in number, ranging in color from deep copper to black, their hair crinkly, normal in stature and of good physique, all speaking the same language with dialectal differences. At least one group of these people called their speech *Yuwi*, by which in their language they meant 'real speech', to distinguish it from all the other languages and dialects. All the languages were unwritten, of course. We know now that the language of the Wahgi is closely related to Medlpa, spoken by the Mount Hagen tribes. Presumably in the not distant past one people speaking a single tongue split up, and in isolation each developed out of the original stock its own language. Their remoter origins are not yet known. The 'mushroom madness' is a feature of both cultures, although it seems to be dying out among the Medlpa speakers.

When the Australians arrived on the scene thirty years

PLATE I



Map of the region visited by Roger Heim and R. G. Wasson in the Western Highlands of Australian New Guinea in August and September 1963.

ago, the Wahgi people were living in the stone age uncontaminated by the modern world. They knew no metals, no cereals. They bred no beasts of burden to help them in their work. Of course they had no wheel, neither wind-mill nor water-wheel. They possessed no grinding-stone, no mortar-and-pestle. They made no pottery, nor did they acquire pottery from others by trade. They knew no alcoholic drink. They spun no yarn, weaved no cloth, wore no clothes. The women wore a cache-sexe of strings, fore and aft, suspended around the hips by a cord. The men wore a double layer of netting in front, suspended from a plaited belt, and behind a bustle of leaves, the stems of the leaves being stuck fast inside the same belt. But it was in the adornment of their own persons that the culture of the Wahgi Valley ran riot. They would rub their bodies in the fat of pigs, until their bodies shone like metal. They would daub their bodies with colored earths, in the case of recent widows a ghastly white from head to foot. They would tattoo themselves in asymmetrical patterns. They would wear plaited arm bands and ankle bands. There was a recognized hierarchy, according to beauty and rarity, of shells and tusks that they wore through the nasal septum, around the neck, or encircling the jaw bone. On ceremonial occasions the men would don the most stupendous head-dresses made up of plumes of rare birds, especially birds of paradise, which are the conspicuous feature of the bird life of New Guinea.

The substance of native life has not changed to this day: the sing-songs and courting practices continue as before, and the exchange of bride and bride-price, and the ceremonial pig-feasting. But the din of the modern world, with its conveniences, is mingling most incongruously with the ancient ways, and change is setting in under the influence of administrative penetration and of the religious schools. Few if any natives of the Wahgi have been taught English. Only the missionaries and Dr. Reay have set out to learn the language of the Wahgi valley, and they are modest in speaking of their attainments. The peoples of the two races meet on common ground in Pidgin, a language that filters out all that is distinctive and most that is of value in both cultures. Only now, at last, since Don and Janet Phillips of the Summer School of Linguistics have taken up residence at Tombil, outside of Minj, is a start being made toward a deeper understanding of the native tongue.

In the first ethnographic document ever published about the Mount Hagen natives, by Father William A. Ross, S.V.D., there is already a reference to the 'mushroom madness'. Written in 1934, the year after the Leahy brothers penetrated into the area on the first patrol, Father Ross's account has this to say: 'The wild mushroom called *nonda* makes the user temporarily insane. He flies into a fit of frenzy. Death is even known to have resulted from its use. It is used before going out to kill another native, or in times of great excitement, anger or sorrow.' Father Ross wrote this statement after he had been in the country only a short time. Inevitably it is inaccurate, but it shows the initial impact on an intelligent observer of a peculiar cultural manifestation, and it served to draw the attention of the learned world to the problem.[1]

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[1] Rev. Wm. Ross: 'Ethnological Notes on Mt. Hagen Tribes', *Anthropos*, 31, 341–363 (351), 1936. In a footnote Father Ross explains that he composed his notes on the basis of ethnographic and linguistic observations of the Rev. Fr. J. Kirschbaum and Dr. Chr. von Fürer-Haimendorf.

Of the following references the first three reflect Father Ross's observations.

(a) Gitlow, Benjamin L.: *Economics of the Mount Hagen Tribes, New Guinea.* Amer. Ethnological Soc., Monograph XII, 1947. (The author repeats what Father Ross says almost verbatim, but forgets to mention his source.)

(b) Vicedom, G.P., and H. Tischner: *Die Mbowamb. Die Kultur der Hagenberg-Stämme in Östlichen Zentral-Neuguinea.* Private English translation by F. E. Rheinstein and E. Klestadt, Vol. 2, 496–7.

(c) Wasson, V.P., and R.G. Wasson: *Mushrooms Russia & History,* Pantheon Books, N.Y., 1957. (The authors cite Gitlow, not knowing that he was quoting Father Ross.)

Up to now the only serious research into the mushroom madness has been that done by an anthropologist:

(d) Reay, Marie: *The Kuma: Freedom and Conformity in the New Guinea Highlands,* Melbourne University Press, 1959, pp. 188–196.

(e) Reay, Marie: '"Mushroom Madness" in the New Guinea Highlands', *Oceania,* Vol. XXXI, No. 2, Dec. 1960; 137–139.

In addition, Roger Heim in his *Champignons Toxiques et Hallucinogènes* (Boubée ed., Paris, 1963, pp. 195–201, 289) summarizes our knowledge of the mushroom madness up to 1962, and poses the various problems presented by this manifestation.

Dr. Rolf Singer, on his part, published a note on a *Russula* that was put forward as a cause of the mushroom madness: 'A *Russula* provoking hysteria in New Guinea', *Mycopath. et Mycol. Applicata,* 9 (4) pp. 275–278, 1958. But, as a result of our latest observations of material, it seems that the Russula used by the Kuma is very similar to, but not identical with, the species sent to Dr. Singer.

We should add that for years the Australian administrators of the Western Highlands have been concerned with the medical and legal aspects of 'mushroom madness'. The relevant correspondence has been concentrated largely in the hands of Dr. Dorothy E. Shaw, Principal Plant Pathologist, Department of Agriculture, Stock and Fisheries, Port Moresby. We are grateful to her and to Mr. Stanley Christian, Research Officer of the Malaria Control School, Kundiawa, for their cordial collaboration. Dr. Shaw's activities have so far led to the publication of a bibliographical note on p. 12 of the Annotated List of References to Plant Pathogens and Miscellaneous Fungi in West New Guinea, Research Bulletin No. 1, 1963, Department of Agriculture, Stock and Fisheries, of which Dr. Shaw is the author.

Thanks to him, for the first time the native word *nonda* entered into the consciousness of anthropologists. It is used in the Wahgi Valley and apparently around Mount Hagen as a general term for all mushrooms. Don Phillips pointed out to us that *nonda*[2] means also 'he will

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[2] Mr. Phillips tell us that the word *nonda* should be written *nonde,*

eat', and *nondo,* 'he can eat', words derived from the stem *non,* 'eat'. He thinks the word used for 'mushroom' is a homonym and unrelated to *non.* We may accept his opinion in the present state of our knowledge of the native language, but if as a result of his further studies he should change his mind, we should (as we were tempted to do in the first place) be presented with proof of an association of ideas that would have considerable ethnomycological meaning. The fact is that the food gathering stage of culture is not far distant in the Wahgi Valley, and many species of mushrooms are still an important source of nourishment for the Kuma, as for other New Guinea ethnic groups such as the Gadsup.[3] Before the introduction of the sweet potato and the taro, it is possible, even probable, that mushrooms played a still more important part in the lives of these primitive peoples. In this tropical land where rain is not lacking, mushrooms are gathered during most of the year, and it would not be surprising if the word expressing the act of eating were applied in a secondary sense to the daily nourishment brought back from the bush and the deep forest.

We remained in the Wahgi from the 27th of August until the middle of September, most of the time in Kondambi, a native village where we were the only outsiders. In the middle 50's Marie Reay had spent 15 months there: she was now returning for the first time. The villagers greeted her with noisy manifestations of affection, and her introduction was invaluable to us. We

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but it seems to us that usage has already expressed its preference for the former. Our stay in New Guinea was too short to satisfy us that we had obtained an accurate method of phonetic transcription of the native names, but we believe that our transcriptions will be recognizable.

[3] *Vide* Heim, Roger: 'Les Champignons alimentaires des Gadsup', *Cahiers du Pacifique,* Paris, fasc. 6, p. 12, June 1964.

took up residence in the house of the Luluai Wamdi.[4] It was an oval hut, its internal dimensions being about 14 feet by 10. The dirt floor was covered with dry grass, the thatched roof was supported by two poles and a cross beam, with many struts running from the central beam to the outer walls. The door was so low that we had to bend double to enter, and there were no windows. The Luluai asked us gently to remove our shoes on entering; he never wore any. Soil was piled up around the house, built of course of wood, sealing it from wind and rain. At night a wood fire was built in a hollow on the floor. As there was no way out for the smoke—the door was always closed—the atmosphere became for us Europeans intolerable, except when we lay close to the ground in our sleeping bags. At intervals during the night we would awaken and see Wamdi stirring the fire. His big, spare, dark frame as he knelt in the smoke over the flaming embers, his prognathous jaw, his contemplative expression, seemed to speak for countless generations of stone-age men, as they tended their fires in rising wisps of smoke, in smoke-filled huts. One or another of his children always slept in our house—his wives had each her own house—, and it was moving to watch silently the gestures of tenderness between father and child. This, including the smell of smoke, was home for the stone-age man.

Heim spent his days receiving deliveries of mushrooms from the villagers, identifying them, describing them in his note-book, painting them, and going out on forays to see where they grew. Wasson, on the other hand,

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[4] 'Luluai' is a government appointed village headman. The term was introduced by the Germans during their occupation of the New Guinea coast before World War I. It is not a word native to Yuwi, the language of the Kuma. All 'Luluais' have lately been superseded by elected Councillors, but the former Luluai usually continues to enjoy his old prestige.

went about the countryside, as far as Mount Hagen, gathering testimony as to the mushroom madness. We saw no signs of mushroom madness during the period of our stay. At the end of our stay and after we left, Marie Reay, who had remained in Minj, assembled information including native names of vital importance for us.

The data that we gathered fell into three parts:

1. The attitude of Europeans toward the mushroom madness.
2. The quite different attitude of the natives.
3. The species of mushrooms held responsible by the natives for the outbursts.

1. *The attitude of the Europeans toward the 'mushroom madness'*.

All the Europeans who have been long in the valley know the recurring outbreaks of mushroom madness, and in varying degrees they are frightened by it. Here for example is a vivid account, in full, that Don and Janet Phillips sent recently to their friends:

> . . . . We had been aware of these wild men of the Wahgi even before we came to settle here, having met up with one of them while doing the survey out here. At that time the thought had crossed our mind, 'Was it demon possession or something else?' But when just the other day yells and screams came from higher up the mountain and then everybody scattered and hid while a young man holding a spear at the ready rushed down the track, these wild men began to become part of our lives. About six of these men rushed around on that first day striking fear into everybody's hearts and causing them to rush for cover. Some actually chased some of the people, intending, so it seemed, to do away with them by the arrows or spears that they held. We were standing by a pig feast when the second one came. We could hear him coming by his queer shouts and whistling. As he came around the corner of the nearby house so everybody fled, but we were determined to find out whether he was just playing, or was he really serious? So we stood our ground, being ready however for anything. Though keeping up his whistling he seemed to notice

us, turned around, and went chasing off in the other direction. Our first encounter seemed to prove that he wasn't serious. A little later the first man came chasing back up the mountain, then turned off the track and went after a man bigger than himself who ran away. (While writing to you I can hear the screams and yells from down the mountain where there is evidently another one of these cases.) As this young fellow came running back up the mountain, I stepped out to meet him. He seemed to be about 17 years of age. I called out to him and walked towards him; however, he didn't seem to notice me and went racing off.

These fits of madness come on when the people begin eating what they call mushrooms, but which to us are more like toadstools. They say that at some unpredictable time their eyes begin to swim, they go deaf and crazy and begin this chasing up and down the mountain. They seem to have an amazing amount of energy, as this proves. Young people as well as men and women are affected, the women dancing around, whistling and singing. The whistling is both in and out with every breath, they also giggle and laugh and let out snorts and loud yells.

After dinner another one came by our house: he was a full-grown man. He seemed to slow up by our house and so I walked over to him calling out to him. Everybody else had fled. As I drew near so he turned to look at me. I've never seen crazy maniacal eyes before, but I'm sure that I saw them then. All of a sudden I got an uneasy feeling in my stomach. I realized that only as I was in the Lord and under His blood was I safe. However, trying not to show my feelings, I went right up to him. My dog Rex, his hair standing on end, growled at my side. Coming up to him I tried to take his spear and bow from him. He struggled a little and his glassy eyes kept swimming around in his head. After a while I let him go and he went off down the mountain, shortly to be followed by another of his kind. All of these men we know personally.

Well, the question remained, 'Is this demon possession or not?' Actually the continual state of tension that these chaps were keeping us in was beginning to get on our nerves, so that we determined not to go out and look at just every wild man that rushed by my house but let things take their normal path. The fit seemed to last only a few hours, then the person concerned recovered and acted normally, that is as far as the men were concerned. The women would be affected with a type of drunkenness that lasted for a couple of days.

Saturday afternoon a patrol officer from Minj, a Christian, came out to see us, and leaving Janet we went up the mountain to do some shooting. (Our game was 'hawks' which were killing all the fowls around here.) We returned at about 5:30 in time for tea. On returning Janet told us that while we were away another six of these men had been tearing around our house, while she remained inside with our two dogs. We let the people know that we were quite annoyed at this and determined in ourselves that we would investigate this matter some more. It was that night as our guest was preparing to depart that we heard the yells of one of these men coming down a nearby mountain track. The path on which he was coming led right by our house, and so by the light of the moon we waited for him — he was covered in a white mud and looked real ghostly. Normally Rex, our dog, won't attack a person, but now he and the other dog realized that something was very wrong, and down the path they went. The yell that this fellow let out when he saw the dogs coming was tremendous, he lifted his spear high in the air and then tried to bring it down on Rex, but missed. He then began to make his way back along the path with the dogs driving him. He went up on the gardens and then after about ten minutes of yelling and groaning with dogs harrassing him, though not biting, he collapsed out of sheer exhaustion. We went up to him and knelt over him and tried to talk to him. He kept up his groaning and snorting and twisting and turning. Well, was he serious? Yes, we believe that he was. Well, what had caused it? We decided that it was a mixture of three things. First, he desired to have attention paid him; secondly, the mushrooms giving a reasonable excuse to cause a scene, he then worked himself up into a passive state and gave himself over to the devil, and in this state he went racing off around the country terrifying everybody. So as we waited beside him there we challenged the evil spirit in the name of the Lord Jesus Christ. Gradually his eyes began to clear, and though he kept up a form of groaning, most of the vehemence had gone out of him. We soon had him on his feet and led him back to our house where quite a large group had gathered. They told this chap off and then we let him go, and he went quietly off down the mountain. He wasn't one of the men from our clan, but had run for miles across the mountains. . . .

At the beginning of April 1963, Frank Porter and Harry Lake, two public officials, were seated at a patrol table in Minj. A crowd of natives were opposite, facing them. Suddenly arrows struck the table top in front of them. The crowd took to their heels. The two officials ran for their lives, in opposite directions, one of them seizing a bicycle that a bewildered native was riding, to hasten his get-away. They swear that the native assailant meant business.

Jeff Broomhead, twelve miles from Mount Hagen down the valley, said that two years ago Manga, a former Luluai, came brandishing a spear. Everyone ran away. When they returned with a gun, the man was normal.

In the Chimbu area the nut of a species of *Pandanus* is also taken, it seems, with identical results. We were told that the nut is not from native trees; traders get it from the Jimi Valley, and the species has not yet been determined. Some white people assume that the pandanus nut ferments before it can have an effect, but we could find not the slightest justification for this facile surmise. In the Banz area a tree known to natives as *kawang* (*Castanopsis acuminatissima* (Bl) Hack & Camus, Fagaceae), yields seed that, when steamed and eaten in quantity, has the same effect as the mushrooms. (This is, incidentally, the tree that many mushrooms grow under, especially the *nonda tuburam.*)

The Rev. W. F. White, head of the Church of the Nazarene at Kudjip, 10 miles from Minj, one day met a man armed with an axe rushing down the path, obviously mad with mushrooms. Mr. White was knocked down, but a native friend came out and attacked the assailant, who fled. Mr. White suffered no injury. Back in 1949 the Rev. Herman Mansur, Lutheran missionary at Banz, returned home to find his wife terror-stricken by the threatening behavior of a mushroom-mad native. Mr. Mansur jumped on his horse and chased the culprit up hill and down dale. He never returned. In February 1963 a local man in Banz chased people with a spade. He was held down by several other natives, escaped, and in the scuffle hit one boy rather hard with the spade. The others, furious, 'worked him over'; then they discovered that he had been fooling all the time. He jerked out of it. As a peace offering they held a pig feast at which they all sat down together.

In September 1963 a man was charged in Minj with arson. He had burnt down two houses and was convicted. His defense was that he was under the influence of mushrooms and therefore not responsible for his behavior. It seemed likely that that was an excuse. In any case the white man's courts do not exonerate a man for offences committed while under the mushroom influence. In fact, 'arson' seems an excessive charge when speaking of the natives: a native dwelling can be built in two days.

We visited Father William A. Ross, S.V.D., of the Catholic Mission of the Holy Trinity at Mount Hagen. He was the first missionary to enter the area, having come in 1934, the year after the initial penetration. (We have already quoted from his report, written at that time.) After our visit he sent us a letter in which he gave his considered opinion that imagination plays a large part in bringing on the effects of the mushrooms, and that large quantities of the mushrooms must in any case be eaten, mixed with other foods. He said that 'mushroom madness' had virtually died out in the Mount Hagen area, though large quantities of the same mushrooms continue to be consumed by the natives. Father John Sheerin, S.V.D., of the Mingende Mission that lies beyond the other end of the valley, when we questioned him, did not know of the mushroom madness, but on inquiring of the natives attached to his mission, discovered that they knew all about it. Whether the Wahgi Valley natives have influenced this area, or whether the phenomenon is indigenous in the Chimbu we do not know. The area of diffusion of 'mushroom madness' has never been defined. It is certain that the madness is known among the Sina-Sina people, ten miles east of Kundiawa on the road to Goroka, where a mushroom causing the outburst is called *kirin*. Our informant is Charles Turner, the local member of the Summer Institute of Linguistics). This carries the limits well beyond where it has previously been reported and into an area of a distinct linguistic family. Many Europeans at the upper end of the Wahgi Valley told us that you could predict the coming of the madness: it always started, they said, at the lower end of the valley, and moved up from clan to clan, about two days to the clan. They did not know what prompted the start and could not predict it.

We will conclude this section of our report with a quotation from a letter received since we left Wahgi Valley, written by the Rev. Rudolf Wenger, whom we will have occasion to mention again. Written on May 22, 1964, in French, its tenor supports our skepticism as to the active role of mushrooms in the 'madness':

> May I tell you about an instance of the madness? It took place one Sunday morning, about 9 o'clock. We had left the church when a native, about 50 years old, suddenly appeared armed with lance and knife. He stopped on the road at the entrance to our compound. He returned to his first position and started to cry in a loud voice: 'Come and tie me up!' Noticing other people, he ran after them. Finally he came back with the two cords in his hands, dropped his arms, and called to me in song, begging me to tie him up with those cords. I came up to him, brought him to the house, and gave him some bananas, which he ate rapidly. I called on Jesus, and about a half hour later he had recovered, hearing and talking as he would do naturally. I observed that when we had prayed, he collapsed immediately, as if he were released or if a power were leaving him. He assured us that he had not eaten mushrooms and that the crisis had come over him suddenly.

2. *The attidude of the natives to 'mushroom madness'.*

Here, as we have already said, Miss Reay is our first and foremost source. We are indebted to her not only for her publications but also for personal communications concerning the Kuma, inhabitants of the Wahgi Valley who live to the south of the river, around Kondambi.

The Kuma employ a special term, *komugl tai*, for the madness caused by the mushrooms. The original meaning of *komugl* is 'ear', but it can also mean deafness, and it also means all kind of madness, either permanent or temporary. An imbecile is *komugl*, the term being explained by the fact that though he may not be deaf, he acts as though he might be. A person who is crazy is also *komugls* for he does not respond normally to what is said to him or in his presence. *Komugl tai* is a specific kind of madness, the one linked with the consumption of certain species of mushrooms.[5] A man is struck with *komugl tai* when his madness is accompanied by shivering. Yet *tai* by itself does not denote shivering. It is the name in Yuwi of the Raggiana, one of the most spectacular of the birds of paradise. Miss Reay has raised with us the question whether *tai* might mean the way the Raggiana shakes his feathers when he takes part in his courtship dance, when he 'displays'. Her suggestion is promising, and in fact it could hold the key to the problem of the pretended madness caused by the mushrooms. Miss Reay gives examples of old women who developed madness, but not the madness caused by mushrooms; they were considered *komugl* but never *komugl tai.*

In fact it is only the men who are afflicted with *komugl tai* through the power of the mushrooms. Women become *ndaadl* from mushrooms, never *komugl tai.* They become delirious and irresponsible, begin to dance and sing, and order their husbands or sons to decorate them with their best feathers. Their men folk do so and give them weapons to hold. The women find at this time their only chance to dance in formation as the men and unmarried girls do. After this kind of quadrille they relax inside their houses while others gather to watch them.

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[5] The term *komugl tai* is also used for the madness that seized the Kuma during the 'cargo cult' of 1949, according to Miss Reay.

The women giggle, flirting with their husbands' clansmen and boasting of real or imaginary sexual adventures. At least one woman's boasting appeared to be genuinely delusional, and several of them seemed to have momentary delusions that they were still unmarried.

Men who are *komugl tai* behave quite differently. They bedeck themselves with their most extraordinary ornaments, seize their arms, and terrorize the community. They attack the men of their own clan and their families; some go to the neighboring communities and there frighten their relatives. They are tense, excited, and afflicted with shivering in the extremities of their fingers. They say they see double and they seem to suffer from intermittent aphasia. Minor injuries are sometimes inflicted but Miss Reay knows of no serious wounds. The men attack fellow clansmen only when spectators are present, so that the attackers are restrained in case of need. Those afflicted with the madness ignore each other and threaten only those who are normal. 'Two men's attempts to set fire to houses belonging to other men of their sub-subclans were promptly thwarted. Women and youths deliberately encouraged the men to be aggressive, emerging from behind houses and trees at a safe distance and withdrawing quickly with excited shrieks and giggles when a madman caught sight of them and lunged forward with spear poised or bow drawn. For people not affected, it is an exciting diversion; for the chief actors, it is a departure from the normal to be joked about in retrospect.' Neither prestige nor stigma accrues to the person affected. The Kuma consider that the heros in this drama are not responsible for their acts.

One subject to attacks of *ndaadl* or *komugl tai* knows when a crisis is coming and can escape by plunging in the near-by river. A woman who had been *ndaadl* before said she was now too old to make an exhibit of herself and so when she felt an attack approaching, she bathed to free herself of the fungal influence.[6]

The mushrooms that are considered the cause of this madness grow all year around. Young and old, men and women, eat them in all seasons, generally mixed with other vegetables. Of the species that may cause the madness, there is only one that is eaten raw, *nonda tuburam*, extremely close to *Tubiporus appendiculatus* of Europe. (Our informants, unlike Miss Reay's, were categorical that *nonda tuburam* never caused 'mushroom madness'.) The madness occurs once or twice a year, without prior ritual. The mushrooms can be roasted or cooked with other vegetables. Different species are often mixed in the same receptacle, which may partly explain the discrepancies in the testimony of the natives as to the species causing the madness.

Although children eat the mushrooms, they are never *komugl tai* or *ndaadl*, but from the age of 17 until 70 certain members of the community are taken by this affliction and they are always the same ones, though not all those subject to it are *komugl tai* at the same time. Miss Reay observes that in 1954 about 30 persons of the Kugika clan were seized by the madness out of 313 that made up the community. To these 30 must be added another eight who were known to be subject to this madness but who on this occasion had escaped its effects.

According to the natives, it is a question of heredity,

[6] Muka, one of our informants, told us he had been subject to repeated crises of madness caused by the mushrooms during his whole adult life, until about two years before, when he had rid himself of the affliction by plunging six times running in a pool of cold water. We spoke with Muka in the house of the Rev. Rudolf Wenger of the Swiss Evangelical Mission. It is not irrelevant to mention that subsequently Muka was elected Counsellor. His 'cure' coincides with his entry into the new order of affairs created by the social and political development in this part of New Guinea.

a person being subject to the madness if one of his parents, or both, were similarly afflicted. But Miss Reay remarked in 1954 that certain individuals were *komugl tai* who ought not to have been. In those cases one said that either the father or mother was subject to the madness without that fact being commonly known, or else that the individuals were pretending. Only one offspring in a susceptible family is susceptible.

After we left the Wahgi Valley in 1963, Miss Reay picked up a remarkable story of which the hero is Tunamp, an adolescent of 16 years, son of Kanant, the woman who had been subject to the madness but who had freed herself by bathing in the river. Tunamp, though only 16, is already subject to attacks of mushroom madness. This came about more or less as follows. Ombun, an aging man closely linked clan-wise with Tunamp, decided he should pass on his 'madness' to Tunamp. Ombun told Tunamp that henceforth he, Tunamp, could go *komugl tai* instead of Ombun himself. Tunamp, remembering what Ombun said, ate the mushrooms in the expectation that he would go *komugl tai.* He ate them with Nggoi, a man about 30 years old, who had frequently experienced the madness, and they both smoked the same cigar together. Nggoi's ability to go *kmogul tai* was communicated to Tunamp by contagion. They both rushed around breaking up bamboo and destroying gardens and fences.

To what Miss Reay says we can add little, though that little may be important. In Banz, which is in Danga country north of the Wahgi, not far from the Kuma but distinguishable from them by dialect and customs, William Meuser, agricultural expert of the Lutheran Mission, presented us to Kondi, Medical Assistant, and Ginga (pronounced as in 'gingham'), the native school teacher. Commenting on the hereditary aspect of the mushroom madness, Konda said that it passed from parent to offspring, but only to one child in the family, usually the eldest, or if not, then the second or third but never the last of a long line of children. He said that mushroom madness is transmitted from parent to offspring,—the *ndaadl* manifestation in women and related behavior in men; but that *kmogul tai* was different: when mushroom madness took someone who did not come by it through heredity, then it assumed the form of *komugl tai,* and the man ran around with an axe, or bow and arrow, or spear, threatening everyone on his path with sudden death.

Ginga added a significant thing: not only are children never subject to mushroom madness, but moreover when the time comes for the madness to strike, *those ordained to succumb to it will succumb whether they eat the mushrooms or not, whether they eat the nut of the* Castanopsis *tree or not.*

Europeans have been living in the Wahgi Valley and around Mount Hagen for 30 years, and all old-timers know many stories that hinge on the 'mushroom madness' of the natives. We find no report of a death caused by these 'madmen', no report of even a serious personal injury. Such serious material damage and minor injuries as have occurred seem to have been accidents due to misunderstandings of Europeans. This absence of serious injury and damage after decades of experience is a startling fact. After all, maniacs do not always miss their aim. We think that one of the keys to the mystery has found its lock opening the door to the explanation.

In summing up the testimony of our European informants, we recall that on five occasions our missionary and his wife met natives in the crisis stage and suffered no injury. On another occasion, when dogs had been let loose against a man in a state of *komugl tai,* he ran away howling and finally collapsed on the trail from fright and fatigue. Frank Porter and one of his colleagues were conversing with a group of natives when the arrows of a madman hit the top of the table, but no one was touched. Jeff Broomhead, Mr. White, and Mrs. Mansur were frightened by natives possessed by this madness, yet none of them was wounded. One day, finally, a person was injured, slightly, in the course of an episode at Banz; but in this case the aggressor admitted that he had been pretending all along, and a feast of pig meat restored peace among all concerned. In the writings of Miss Reay and Stanley Christian,[7] as in those of the missionaries, it is frequently stated that the natives, in certain particular circumstances, have simulated the mushroom madness. These are probably cases where the individuals were actors acting without conviction. A man accused of having set fire to a hut suggests a more interesting situation. If, having eaten the mushrooms, he had been genuinely struck with *komugl tai*, he was not, according to native custom, responsible for his actions, and therefore merited no punishment. According to the white man's law, he was on the contrary responsible and liable to punishment. It is probable that he had done his deed expecting the adults who were looking at him to intervene in time to prevent all damage. It is to be noted that if Europeans were involved, ignorant of the role they were supposed to play in this little drama, that ignorance would relieve them of any responsibility. But if the man was not in a state of *komugl tai*, and if no one was present to stop him in case of need, his guilt becomes positive and his method of defense is only a device, and, by the same token, a deceit. One can see the difficulties

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[7] Letter of Stanley Christian to Dr. Dorothy E. Shaw dated December 10, 1957 included in the compilation forwarded by Dr. Shaw to Roger Heim with her letter of August 20, 1963.

facing the Australian magistrates in handling these cases, where subtle nuances in tribal customs must be taken into account.

Little by little we begin to see clear: Miss Reay discerned the truth when she wrote that the 'mushroom madness' had become institutionalized and that it served as a social catharsis. Is it possible that we are dealing here with a primitive phase in the evolution of the drama, a drama without stage or audience, in which the whole village takes part, the lead roles being assigned by heredity to a few families, one to a family, the other roles falling into place as the simple drama unfolds? There is a tacit understanding on everyone's part to make-believe, the 'madmen' that they are mad, whistling and roaring in maniacal fury, tearing up and down the mountain trails; others including the children running as if for their lives and hiding and peering out and pretending to taunt the maniacs, with a posse of men on hand, in accordance with the prior tacit agreement, to stop the madmen from the consequences of their act. Meanwhile the women who are *ndaadl* dance in formations corresponding to their husband's sub-clans, directly contrary to the rules that govern their behavior in normal times. The women wear their husbands' finery, the best plumes and spears, a startling instance of transvestism in this primitive community. These married women boast of sexual adventures and irregularities in their own past, some of which at least are not true. Have these tales the elements of extempore verse about them? We are not told.

What torpid dolts and killjoys the Europeans must seem to the natives, when they fail to play the game according to the conventional rules! But how are two cultures, separated by millennia and yet co-existing, to communicate with each other?

The fact is that the European cannot judge the whole pattern of native behavior of which the 'mushroom madness' is a culminating point unless he will see that he is in the presence of men and of a civilization intimately associated with Nature. They are a part of Nature just as the animal species are, and the behavior of the fauna actually influences the human behavior. Among the living creatures of the forest, the birds of paradise, by reason of their astonishing dress and also doubtless because of their equally astonishing courtship practices, offer a source of tempting inspiration. Their courtship dances present, as an aspect of the birds' emotional reaction, a shivering phase, the physiological mechanism of which is known, that is particularly spectacular. It is not surprising therefore that the word *tai* is linked with the name of the 'madness', since it is the name of one of the birds of paradise, the Raggiana, that exhibits this kind of agitation in its love-ballet. In our opinion it is not a question of the kinds of mushrooms that this bird eats—such a thing is highly improbable—but the obsessive simulation that the Kuma have achieved, in their own shivering, by observing the birds. The mimetic instinct of the Wahgi natives finds here an exceptional opportunity to introduce into their own theater a dramatic scene from Nature's comedy.

We can readily conceive that this interpretation, to which we will revert later, will meet resistance among the Europeans in contact with the Wahgi Valley natives, whose culture is impregnated with values distinct from our own, but values that are perhaps as defensible and even as solid as ours. Rare must be those missionaries, administrators, travellers, planters, merchants, who are ready for a comprehension so close to realities, who possess the humility, the conscience, the breadth of spirit that is needed in judging these Wahgi Valley natives but that is seldom met with among those of advanced civilization. Perhaps the episode is true that tells of a Catholic priest who faced an oncoming mushroom maniac, raving and whistling and snorting, axe poised in hand, his eyes glassy and not seeing, obviously one possessed of a demon. Hastily making the sign of a cross with his crucifix and ready for instant martyrdom, our priest cried out in a loud voice, in Latin, 'Adjuro te, ut desistas, in nomine Domini Nostri Jesu Christi'—'I adjure thee, stay thy hand, in the name of Our Lord Jesus Christ'. Lo, a miracle was wrought: the wretch lowered his axe and went slinking off down a path to his left, in the direction where souls were traditionally consigned to the eternal fires of hell.

When talking over these things with William Barclay, a perceptive Control Officer, he stressed to us the amount of play-acting that goes on in the lives of the natives. A woman is taken in adultery. Her husband puts on a first-class performance. Every shading of his grievance is fully exploited. But once he receives his compensation, his act ends; from then on it would seem that he could not care less. A native who is party to an action in court plays his role with devasting effect; but in the intervals when the proceedings are suspended he forgets his emotion and talks calmly about the daily round of minutiae. The Kuma are remarkable comedians, as well as gay companions.

3. *The mushrooms responsible for the 'madness'.*

The appropriate Australian authorities have lately made some efforts to identify the mushrooms alleged to cause the madness. Dr. Dorothy E. Shaw, Principal Plant Pathologist, was the focus of these activities. Difficulties in the field, linguistic difficulties in coping with native names, unfamiliarity with the proper methods of handling and shipping mushrooms for subsequent study

—all these factors led to delay and confusion. Miss Shaw made five shipments to the Royal Botanic Gardens at Kew between August 1957 and the end of 1962. Kew was able to identify only one species, and that one with doubt: Derek Reed linked the material under study with *Heimiella retispora* (Pat. & Baker) Boedijn sensu Boedijn, a genus separated off from the Boletellus by Boedijn and named in honor of one of us. There is nothing in the papers published about this species to indicate that it might have psychotropic properties. In 1957, Kew forwarded some of the specimens to Dr. Rolf Singer at Ann Arbor, Michigan, where, following in our steps, he was collaborating at the moment with Dr. Alexander Smith on a study of the hallucinogenic mushrooms of Mexico. He proceeded to describe a new species, *Russula Nondorbingi* Sing., to which he attributed hallucinogenic properties. The collectors who had sent him the inexact indigenous name of *nondorbingi* later proposed to replace it by *nondo bingi*,[8] but Dr. Singer had already published an article on 'A *Russula* Provoking Hysteria in New Guinea' (*Mycopathologia et Mycologia Applicata*, 9, 4: pp. 275–8), and given it the erroneous name.

Here the documentation prior to our inquiries ends. On several occasions we have encountered two Russulas called locally *nonda bingi* and *nonda bingi wam* ('false bingi'). Neither tallies with the description of Dr. Singer, and this is confirmed by the sporal differentiations among the three. The Kuma brought us repeatedly the two kinds, the true and the false *nonda bingi*, the first edible, the second never eaten. But they also brought us on several occasions two species of white Russulas of which one is called *nonda mosh* and the other *nonda mosh wam*, or 'false nonda mosh'. Throughout the Wahgi the former

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[8] *Vide* letters from Stanley Christian to Dr. Shaw dated Dec. 10, 1957, and Oct. 24, 1962.

is used to incite in the women *ndaadl* madness.[9] All of our information leads us to believe that *nonda mosh*, quite different from *R. Nondorbiugi* [sic] Singer, is held responsible for much of the psychic disturbance attributed to mushrooms among the women of the Wahgi. The specific epithet *Nondorbingi* carries no meaning in the Yuwi language.

The description of this Russula, as well as other neighboring ones that we have just mentioned, will appear elsewhere shortly. We shall stress the fact that such confusions stem from difficulties of communication with the natives. Stanley Christian and Dr. Dorothy Shaw deserve nothing but praise for their persistent efforts to identify the mushrooms at the root of the 'madness'. We shall refrain from using the word 'hysteria', as it is quite clear that hysteria does not fit the case.

Until now there have existed two lists of vernacular names for the mushrooms considered by the natives as responsible for the 'madness', one in the article already cited by Marie Reay, published in *Oceania*, the other compiled by Mrs. Danga Goy (born in the Wahgi Valley) and sent by Stanley Christian to Dr. Shaw in his letter dated February 14, 1960.

Names proposed by

	Marie Reay	*Danga Goi*
1.	ngam-ngam	nondo ngamngam
2.	ngamp-kindjkants	nondo napkins gant (or gent)
3.	kermaikip	nondo bolbe
4.	tuadwa	nondo galwans

The descriptive indications accompanying these terms are, mycologically speaking, useless. The first two names

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[9] A recent collection (February 1964) made by Miss Reay permits us to expand our documentation on these Russula species.

in both lists seem to be the same; this means that there are six different names in all.

We now come to our own list of the mushrooms that the natives say may cause 'mushroom madness.' The problems in assembling this list were quite different from our difficulties in Mexico, where the identity of the sacred mushrooms was a secret (albeit shared among many natives), to be ferreted out with patience and delicacy. In Mexico these mushrooms all belonged to three closely related genera of Agaricaceae,—Psilocybe, Stropharia, and Conocybe, of which one—the first—covered most of the species, which reached a dozen in all. The whole subject was instinct with religious feeling and awe. In the Wahgi everyone was ready to be an informant, and it was the abundance of informants that became a danger, the testimony of each witness having to be carefully assayed. In other words, each sought to outdo the others. Thus a man named Wapi, in the home of the Phillipses at Tombil, said that every edible mushroom could cause madness. The others, more selective, offered lists that differed one from another. We shall cite the names of eleven species that appeared (with one exception) in response to many of our inquiries made in the Valley. The notes in quotation marks are from a memorandum of Miss Reay's drawn up in the course of our joint visit in the region of Minj.

1. Nonda ngam-ngam. (No. 1 in above list) 'When four or five fungi come up on one stem both men and women are afflicted with madness after eating it. This is the ordinary mushroom madness, the men aggressive, the women with delusions; common to both sexes are shivering and staring. This mushroom can be cooked in the steampit or in ashes. The leaf of the *kosgagl* shrub (in Pidgin, *mosong kumu*) is cooked with it.'
2. Nonda ngamp kindjkants. (No. 2 in above list.) 'This grows among the pit-pit reeds where the bush has grown after the pigs have been walking about.'

3. Nonda gegwants ngimbigl. (No. 4 in Danga's list). 'Gegwants = left-handed; ngimbigl = penis. The form of the stipe reminds one of the human penis. The Kuma believe the mushroom must be picked with the left hand. If picked with the right hand, the person eating it finds that his tongue stings unbearably, he is apt to faint, and in a little while he goes mad. Men and women are equally affected.' Muka told us in Tsigmel that this was the most powerful kind in provoking mushroom madness.
4. Nonda kermaipip. (No. 3 in Dr. Reay's list.) 'Kermaipip is an edible mushroom that induces madness in both men and women. The first syllable, *ker-*, derives from *kir*, in *ndop kir*, the local method of making fire by pulling a strip of bamboo back and forth around a cleft stick and over some dry waste.'
5. Nonda tua-rua. (No. 4 in Dr. Reay's list.) 'This causes madness at the proper times.'
6. Miru nonda. 'This grows on rotting logs, when it is called *ontr miru*, and on the ground, when it is called *magl miru.*'
7. Nonda obolyei. 'This name is derived from 'obo', bow, in the extended sense of warfare. This is an edible mushroom, black or deep blue in color, growing in the ground. It may make both men and women mad when they eat it. The name is derived from the general word for warfare because of the similarity between the black pigment of the mushroom and the mixture of charcoal and grease that is actually smeared on the skin before entering battle.'
8. Nonda mosh. 'This mushroom is named after *ambugl mosh*, a marriageable girl. Everyone eats it but it affects women only, making them *ndaadl*. Women enjoy eating it, though afterwards they often regret it.'
9. Nonda tuburam. Among all mushrooms this one ranks first for taste. It can be eaten either raw or cooked,—the only one that is eaten raw. 'Eating it afflicts both men and women with madness. It grows near the base of either the kawang tree (*Castinopsis acuminatissima*) or the tomu tree. The mushroom is yellow inside.'
10. Nonda to'kangi. 'An edible mushroom, sometimes white, sometimes yellow. It causes *ndaadl* in women but does not send men *komugl tai*. When a man eats plenty of these he cannot sleep; he walks about at night and is exposed to bush demons. The mushroom has strange effects on men, but afflicts only women with mushroom madness.' The mushroom is preferred when it is still in the egg; it is then called *kaimukum*.
11. Nonda mbogl rongal. *Mbogl* means 'bed'; *rongal* means 'I shall strike.'

Concerning this list we now point out certain discrepancies that one of us (Heim) noted in the course of his inquiries in the village of Kondambi.

To begin with, No. 6—*miru nonda*—seems to be not one but two species, neither of which appears to answer to the description made above: the term *miru* refers to fleshy and woody agarics: a *Flammula* and an *Armillariella* (the latter bearing a synonym *berraip nonda*). The term seems to be a collective. We are not certain of having collected *nonda obolyci*, whose scientific identity escapes us, although we can say that it is a Boletus near to *B. nigerrimus* Heim. The *nonda tuburam*, exceedingly common, is the "cépe" that is most eaten, both raw and cooked, and it plays no role in the madness. Similarly, the *nonda to'kangi* is an excellent Caesar's amanita (in French: *oronge*), a choice dish among the Kuma, without psychotropic action, real or pretended, according to our own experience. As for the *nonda mbogl rongal*, it might be the *nonda mbopukl tongakl* or *tongark*, which is none other than the *Psalliota aurantio-violacea* Heim, an African and New Guinea species, considered very toxic, even lethal. On the other hand we add without hesitation to Miss Reay's new list the name of a *Heimiella* that is of fairly frequent occurrence in the Wahgi, known as *nonda mbolbe*, No. 3 in Danga's list, whose testimony we confirmed at Kondambi. We should add that it is not a question of *Heimiella retispora*, which the investigators of Kew suspected among the specimens sent to them, but of a very different species already described by Heim.

In conclusion here is the list of the seven species linked to the 'madness' that Heim noted and described at Kondambi and later examined and definitively characterized in Paris.[10]

[10] These lines were written when there arrived in Paris a shipment

Our List of Species Acknowledged as Responsible for *komugl tai* and *ndaadl*

	Name	*Action on men:* M *on women:* W	*Scientific Name*
1.	Nonda ngam-ngam	M – W	*Boletus* (*Tubiporus*) *Reayi* Heim
2.	Nonda ngamp-kindj kants	M – W	*Boletus* (*Tubiporus*) *kumaeus* Heim
3.	Nonda gegwants ngimbigl	M – W	*Boletus* (*Tubiporus*) *manicus* Heim
4.	Nonda kermaipip	M – W	*Boletus* (*Tubiporus*) *nigerrimus* Heim
5.	Nonda tua-rua	M – W	*Boletus* (*Tubiporus*) *nigroviolaceus* Heim
6.	Nonda mosh (ambugl mosh	W	*Russula* cf. *delica* Fr.
7.	Nonda mbolbe (mborr'lbé)	M – W	*Heimiella anguiformis* Heim

The definition of the six new species in the above list appeared in the *Revue de Mycologie,* Dec. 15, 1963, Vol. XXVIII, Fasc. 3–4.

Conclusions

1. The manifestations of 'mushroom madness' (or *komugl tai* and *ndaadl* in the native language Yuwi) that have often frightened Europeans in the Wahgi Valley must be viewed as part of a larger event in the life of the native community, and to which every native is a party. This phenomenon extends beyond the Wahgi Valley to neighboring communities, in at least one instance belonging to a distinct linguistic family. We are persuaded that in the behavior of these natives there is room for a most

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of mushrooms from Miss Marie Reay gathered on her recent trip to the Middle of Wahgi at the end of February 1964, and forwarded to us by Miss Dorothy Shaw, along with notes that are highly pertinent. The problem of the species of Rossula in the mosh group is discussed in Heim's descriptive article recently published in *Cahiers du Pacifique,* No. 7 (March 1965).

interesting kind of drama that endangers no one. We are led to this conclusion partly by the fact that in decades of experience we can find no record of a fatality, or even of a serious injury, resulting from these menacing men. In the light of these findings the Europeans may take a more detached view of these manifestations that spring from an ancient culture. Among them may be some who will even study the event in all its aspects, as a remarkable survival into our own times of primitive activity that may well shed light on the origins of institutions in our own society. If it is known that the world takes an interest in the 'mushroom madness', the regard in which it is held by the local Europeans may be considerably enhanced.

2. The mushrooms—or at least most of them—do not seem to cause physiological effects leading to the madness. The cryptogams held responsible for the madness belong to two large categories that include six genera and two orders (or families): Boletales and Asterosporales; or, stated simply, at least six bolets and one russula.

Furthermore, one would have to believe that these mushrooms worked only on certain individuals, chosen by heredity, one to a family; that they brought about different behavior in men and women; that most of the time they caused no disturbance but that at irregular intervals, in a progress up the Wahgi Valley, with a couple of days between the clans, they acquired a pharmacological potency with respect to those individuals and thereupon drove them mad, with consequences known to all; and finally that the visitation could be put off or even permanently exorcised by simply dunking the individual in cold water. This is not mycology but mythology. We found among the Europeans of the Wahgi

PLATE II

Boletus manicus Heim

Valley a singular ignorance of the mushroom world, a lack of curiosity about it, an unwillingness to explore it, even a certain repugnance for the whole subject. The Europeans are mostly of English-speaking stock. They present the perfect syndrome of mycophobia as diagnosed by the Wassons in *Mushrooms Russia & History.*[11]

3. It is natural to seek a parallel between the mushroom madness of the Kuma and the two regions of the world where psychotropic mushrooms are deliberately consumed for their inebriating effect. In the Wahgi Valley there is general agreement that the feats of endurance performed during the attacks of 'madness' by the 'wild men' of the Kuma surpass any normal physical activity. For hours they rush up and down the mountain trails brandishing weapons and shouting at the top of their lungs. In Siberia, among the Koriaki and the Chukchi, similar reports of extreme feats of endurance circulate about the men who have taken *Amanita muscaria.* The erotic aspect of the *ndaadl* condition among the Kuma women also has its parallel in Siberia and perhaps in Mexico. But the deep religious experience of the Mexican Indians who consume the sacred mushrooms has no parallel in the Wahgi Valley, although the shamanistic performances of Siberia provide us with many parallels for the holy communion celebrated at night with mushrooms in the remote valleys of Oaxaca. A detailed comparison of the three areas in their mushroom activities remains to be done, and we propose to give this further study. Whereas the Siberian and Mexican natives use psychotropic mushrooms, in the Wahgi Valley we found none in use, though the natives attributed their extraordinary behavior to mushrooms.

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[11] Pantheon Books, New York, 1957.

4. But if we have crossed the main hurdle of the mushroom madness, there remain three problems we have not solved. Why do the natives suppose, or affect to believe, that mushrooms inspire such frenzies? Why do they attribute this behavior to certain species of mushrooms, and only to those, although there is no agreement among them as to which those species are? Why do we find again here a magic role for the mushroom, such as we have found already in Mexico and such as we read about in Siberia, but in New Guinea without supporting evidence in the mushrooms themselves? To this three-fold question we shall try to respond later, but in any case when research workers such as Miss Marie Reay and the Phillipses will have explored more deeply the recesses of the language spoken in the Wahgi Valley, when others will have listened to the testimony of alert informants, when the area of diffusion of this mushroom manifestation will have been accurately delimited, when finally most of the dialects spoken in this area will have been mastered and comparative studies made, we shall perhaps be able to arrive at assured conclusions. But one certainty seems already safe: during the pre-history of the Wahgi Valley—and this period ended here only 30 years ago—mushrooms played a role not only as food (which they still do) but also cultural and magical, a role that survives to this day. These circumstances lead us to hope that our investigations will be able to advance a few steps in the near future.[12]

Paris and Tokyo
November 1963

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[12] Since this paper was written contributions to the study of the mushroom madness of the Kuma have been published: (1) Roger Heim, Diagnoses latines des espèces de champignons ou *nonda* associés à la folie du *komugl tai* et du *ndaadl*. *Rev. de Mycol.*, XXVIII, pp. 277–283, December 1963; (2) Roger Heim and R. Gordon Was-

ADDENDA

Since writing the foregoing paper we have come across a somewhat older text about a similar madness to which the peoples of New Guinea are subject. We wish to add it to the sources already quoted. It is by a German captain, H. Detzner, in his book, *Moeurs et Coutumes des Papous. Quatre ans chez les Cannibales de Nouvelle Guinée (1914–1918)*, published in French by Payot in 1935. The events of August 1914 took the author by surprise in the course of an exploratory trip through the interior of the German colony in New Guinea, and he remained there under difficult conditions with a small escort during the four years that the war lasted.

This work gives us a rather personal narrative without great precision, but not lacking in interest. It is hard to piece together the itinerary of this officer from his often vague topographical indications. It would seem that he must have approached the valley of the Wahgi, but we are not sure of this and cannot even assert it as a probability. However that may be, this travel book supplies us with the following passage (p. 193) pertinent to our inquiry. The scene is in a Houbé village, near Finschhafen, in a mountainous region near the limits of the Markham Valley, therefore far to the east of the Middle Wahgi. The manifestation of madness is similar to what we know already, although Captain Detzner attributes it apparently to abuse of betel nuts and does not mention mushrooms.

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son, Note préliminaire sur la folie fongique des Kuma. Comptes rendus Ac. des Sciences, 258, pp. 1593–1598, Feb. 3, 1964; (3) Roger Heim, Hier champignons associés à la folie des Kuma. Etude descriptive et iconographie. *Cahiers du Pacifique*, vol. 7, avec 6 pl. col. is 14 pl. phot., fig., mars 1965.

At Kilongo, a Houbé village of average importance numbering about 200 souls, we found the inhabitants prey to a great agitation. Armed men were posted at every fork and crossroad leading into the village, and they were on watch over the environs. Not a woman, not a child, was in the fields, although it was the best moment for planting taro. And yet this village was known among the Houbé for their diligence and progressive spirit. Indeed had they not for a long time realized the absurdity of wars and renounced the pastime of fighting with their neighbors?

'Master, there is a madman in the vicinity. He runs stark naked. He is not one of us. He is a member of the river tribe of Sâng. If we let him act freely, he would kill all our men, women, and children, for he is mad and has completely lost his reason.'

That was the explanation supplied to me by the inhabitants to explain their curious behavior, when I expressed my amazement that they had not come to meet me, as it was their custom to do.

Madness is a frequent phenomenon among the Melanesians and Papous of the Pacific regions. A fine lad, until now calm and inoffensive, is suddenly seized with madness, most often from an abuse of betel, and becomes a menace to everyone. Armed with an axe or other dangerous tool, he flees his home, reaches first the nearest forest, then takes to running across the fields and through villages, and this he does for days on end, seized with veritable fury, attacking and killing every human being he meets. Persuaded that the poor fellow is possessed and urged on by the spirit of a dead relative, the superstitious natives do not dare to disarm him. Although the sentiment of pity is unknown to them, they do no more than prevent the incursion of the madman into their village. They do not try to overpower him. The access of madness does not last long. At the end of a certain time the madman becomes calm again, returns home, and resumes peacefully his work and habitual chores.

Wishing to prevent a tragedy, I ordered the victim to be seized and bound, and to be brought before me. But my orders could not be executed, for he disappeared from the neighborhood of Kilongko as quickly as he had appeared. Other neighboring villages saw him run through the fields, possessed by a veritable fury, still others reported rumors of him, but he himself was nowhere to be found.

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IDENTIFICATION OF THE POLLEN OF MAIZE, TEOSINTE AND TRIPSACUM BY PHASE CONTRAST MICROSCOPY

BY

HENRY IRWIN AND ELSO S. BARGHOORN

IN early studies, Firbas (1937) measured the long axis of grass pollen grains from domestic and wild types in Europe and established 35μ as a division between the two, those larger being considered domestic. Subsequent studies, both in Europe and America, often showed this dividing line to be invalid.

In an effort to distinguish between the pollen of maize, teosinte and *Tripsacum*, Barghoorn, Wolfe, and Clisby (1954), investigated the pore-axis relationship in these grasses. A ratio of 5.7 or greater appeared to separate maize from the other two. Measurement of the pore included the annulus. However, this ratio has been criticized by Kurtz, Tucker, and Liverman (1960), who demonstrated that, under certain conditions, the pore-axis ratio of maize dropped well below 5.7. Their choice of a peculiar type of maize, Bikini out-crossed, probably prejudiced their findings. Further work suggesting that the pore-axis ratio is sometimes invalid as a distinguishing criterion was carried out by James Langham and Donald Whitehead of Williams College. They also investigated simple axis measurements, summarized in Text Figure

1.* A further complication of measurement results from size changes induced by various sedimentary environments and various preparatory techniques (Anderson, 1960).

The exine itself, except for the pore, consists of an endexine, an ektexine tegillum supported by columellae, and simple spinules projecting from this tegillum and corresponding in arrangement to the columellae. With ordinary light microscopy, this exine appears smooth, while, with phase-contrast, the spinules appear as a pattern of dark dots. Using phase-contrast microscopy, Grohne (1957) investigated the pollen of "wild" and cereal type grasses in Europe and suggested that discrimination between the two was possible on the basis of certain phase changes in this exine pattern (see also Erdtman and Praglowski, 1959).

An explanation of these phase changes was offered by Rowley (1960). He found that grasses of the "wild type" have three levels of phase retardation. The lowest is that resulting from depressions between the spinules. These depressions form an incised reticulum that may have one to several spinule per lacuna. This reticulum under phase appears as a dark network. The two other regions of phase retardation are the level ektexine surface (non-incised interspine regions) and the spinules themselves. Grasses of the cultivated type have only two areas of phase retardation, the level ektexine, and that of the surmounting spinules. Rowley's investigations were aided by the use of an electron microscope.

The present paper presents results of observations of the exine, using phase-contrast light, in the New World plants maize, teosinte, and *Tripsacum*. The latter two

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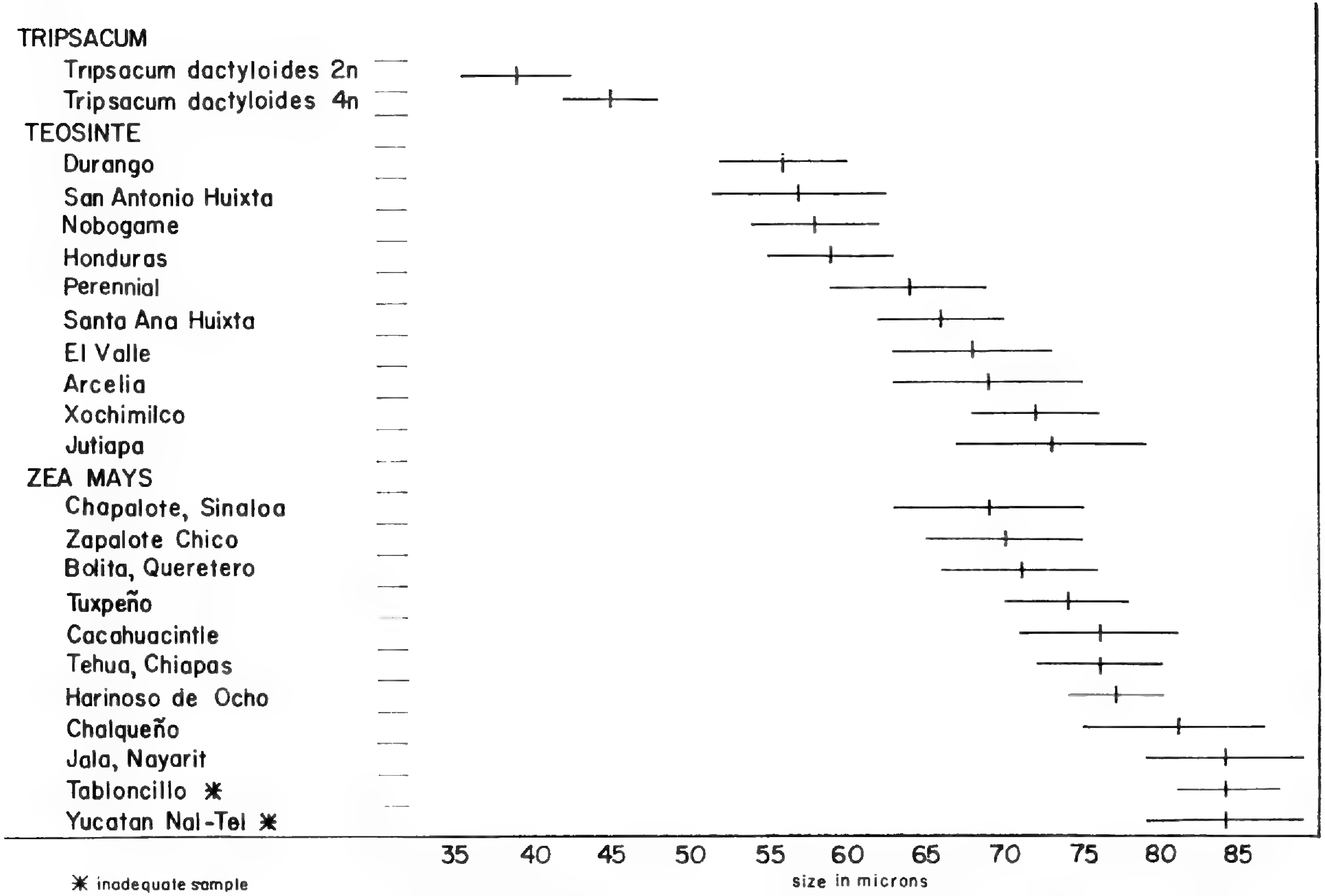
* The data presented in this figure were drawn from the measurements of James Langham and Professor Donald Whitehead. Used by permission of Dr. Whitehead.

TEXT FIGURE 1



DISTRIBUTION OF POLLEN SIZE OF TRIPSACUM, TEOSINTE, & MAIZE are the only New World grasses so far investigated which cannot be distinguished from maize by a simple measurement i.e. $>45\mu$ for the long axis, and $>5.7\mu$ for the pore-axis ratio.

We believe that *Tripsacum* conforms to Rowley's first type in possessing three levels of phase retardation; maize to the second type. Teosinte in some varieties appears to have a faintly incised reticulum and hence is intermediate in this optical characteristic.

In this study, pollen grains were prepared from a number of races of maize, teosinte, and two genotypes of *Tripsacum*. A list of these is found in Table I. In all cases, several anthers, selected from more than one tassel and more than one plant if specimens were available, were utilized in order to avoid the influence of an unusual genetic constitution in a single anther or single plant. All available varieties of teosinte in the Botanical Museum of Harvard University were examined. An attempt was made to choose examples from a number of groups of maize from diverse geographic sources. A maize-*Tripsacum* hybrid (WMT maize × *T. dactyloides*) and two varieties of maize bearing one or more known teosinte chromosomes were studied. In addition, several grains from the fossil record were examined.

All preparations were made by the use of standard acetolysis treatment, followed by bleaching, and the grains were mounted in glycerine jelly. Photographs were taken with a Zeiss Opton W microscope, employing phase objectives on both 35 mm. and 4″×5″ high contrast film (Microfile and Contrast Process Pan). The 2″×2″ photographs in Plates III–VII were made on 4″×5″ negatives.

As these photographs indicate, *Tripsacum* can be distinguished from maize and teosinte by use of phase optics. In *Tripsacum*, the spinules are distributed irregu-

TABLE I POLLEN TYPES STUDIED

Zea mays	*Tripsacum*	*Teosinte*	*Hybrid and Inbred Strains*
Ancient Indigenous*	T. dactyloides 2n	San Antonio Huixta	Maize-*Tripsacum* hybrid
Nal Tel	T. dactyloides 4n	Perennial	Minnesota A158 with
Chapalote, Sinaloa		Nobogame	Florida teosinte chromosome
Pre-Columbian Exotic*		El Valle	1, 3, 4, 9; and
Harinoso de Ocho		Jutiapa	3, 4, & 9
Cacahuacintle		Durango	Texas 4R3 with
Pre-historic Mestizos*		Chalco	Florida teosinte chromosome
Tehua, Chiapas		Arcelia	4, 3, & 9
Jala, Nayarit		Honduras	Nobogame teosinte chromosome
Tuxpeño		Xochimilco	3 & 4, 3
Conico		Santa Ana Huixta	New teosinte chromosome
Zapalote Chico			4 & 9
Modern Incipient*			
Chalqueño			
Bolita			
Other Races			
Huesillo			
Puno			
Confite Morocho			
Texas 4R3			
Strawberry Popcorn			
Longfellow Flint			
Minnesota A158			

* Classification according to Wellhausen *et al.*, 1952.

larly on the ektexine. Dark areas embracing several spinules can be seen, no doubt due to phase retardation of an incised reticulum, as suggested by Rowley (1960). Our sample of a maize-*Tripsacum* hybrid exhibits this pattern.

In a large number of the races of maize, the spinules are located very regularly, i.e., the spacing between each spinule being almost equal. With most varieties of teosinte, the spacing of spinules appears less regular, and in some they are rather closely aggregated, appearing as clumps.

The spinules of maize appear to produce more phase change than those of teosinte. The spinules appear stronger and darker. In teosinte, at the level of the spinules, only small areas can be brought into sharp focus. In addition, within an area so focussed, there are numerous slightly obscured or darkened regions. These may be due to one or more of the following factors: 1) teosinte may have a faintly incised reticulum; 2) the exine of most varieties of teosinte may be thinner and more easily deformed (thus thrown out of focus); 3) the spinules or columellae of maize may be slightly longer than those of teosinte.

Fossil grass grains were studied in preparation of sediment samples from the Bellas Artes core in Mexico City. On the basis of the pore-axis ratio, Barghoorn, Wolfe, and Clisby (1954) identified certain grains from the lower reaches of this core as maize. The precise age of these sediments is not known, but it is beyond reasonable doubt that they antedate man's entrance into the New World. We re-examined grass pollen grains from the Bellas Artes sediments which, on the basis of size measurements, appeared to be either maize, teosinte, or *Tripsacum*. Then, using the optical criteria described earlier in this paper, some of the grains were identified as maize, others as *Tripsacum.* None of the intermediate or teosinte type have so far been located. This lends support to the thesis that wild maize existed in the Valley of Mexico during late Pleistocene time (Mangelsdorf 1958).

In addition, our investigations have led to the following conclusions.

1. Observations on the general similarity of maize and teosinte pollen supports the thesis that teosinte is a race of maize derived from hybridization with *Tripsacum* (Mangelsdorf and Reeves 1939).

2. The more primitive races of maize (Puno, Chapalote, etc.) show the strongest, most regular pattern.

3. Inbred maize strains, Minnesota A158, and Texas 4R3, have a regular strong pattern, while the introduction of teosinte germ plasm causes them to lose the strength and regularity of the pattern, Plate VI.

4. Fossil maize from Bat Cave, New Mexico, shows a well defined, strong and regular pattern. This maize pollen dates from about 5000 years ago.

5. Several grass pollen grains, with size measurements in the *Zea* range were isolated from sediments from Lake Petenxil in Guatemala. Those were present in the lowest sample of a series of cores taken for Harvard University by Dr. George Cowgill (now of Brandeis University). This core was radiocarbon dated by the Humble Oil geochemical laboratory at 3,950 ± 130 years ago. The strength and regularity of the exine pattern suggest that these grains are maize. Present archaeological knowledge indicates that maize may have been grown in Guatemala at this date. The grains, however, could represent possibly wild maize types at that time still extant in the Lake Petenxil area.

6. In areas where teosinte does not grow wild (north of Mexico, for instance), it should prove relatively easy to establish the presence of maize in the pollen record. In these same areas, there is no present evidence of wild maize in the archaeological or palynological record. Therefore, where maize pollen is present in these areas, we can presume that the plant was cultivated. How early this occurs in the United States and where it occurs are important archaeological problems as yet unsolved.

In conclusion, in identifying gramineous pollen as maize, size measurements of large grains should first be made. Those grains which fall in the maize-*Tripsacum* range should then be examined by means of phase-contrast optics. Positive discrimination can then be made between *Zea* (maize and teosinte) and *Tripsacum*. Following certain observations outlined in this paper, maize grains can be separated from teosinte with reasonable reliability. In certain geographic areas, such as the United States, grains in the *Zea* size range with *Zea* pattern may be presumed to be maize.

ACKNOWLEDGMENTS

The authors are indebted to the following individuals for aid in the project: Professor P. C. Mangelsdorf; Professor W. C. Galinat, University of Massachusetts, for much help, criticism and for providing access to the resources of the Botanical Museum of Harvard University; Professor Donald R. Whitehead, Williams College, for critical evaluation and for the data presented in Text Figure 1. Both Professor Galinat and Professor Mangelsdorf have read the manuscript and offered suggestions, while the latter has been particularly helpful in describing the relative evolutionary position of the various races of maize and teosinte studied.

ABSTRACT

Pollen of the Gramineae are spheroidal in shape and monoporate. The pore is surrounded by a thickened area, the annulus. Size characteristics, both of total pollen diameter and the relation of this diameter to the pore width have been used in the past to separate the pollen of maize from teosinte and *Tripsacum.* Use of measurement alone causes several difficulties, the most important being that large numbers of grains are necessary for positive identification. Morphological characteristics of the exine, studied under phase-contrast light, give more conclusive discrimination even when dealing with few grains. Maize and teosinte can easily be separated from *Tripsacum.* Primitive maize and primitive teosinte can also be separated. When dealing with hybrid races of maize of teosinte, discrimination appears to depend largely on how much germ plasm each plant has absorbed from the other. Thus, the pollen of teosinte Chalco, that grows commonly around maize fields in Mexico and frequently crosses with maize, is very difficult to tell from that of a very tripsacoid maize like Huesillo. That this pollen morphology is genetically controlled is supported by observations on pollen of derivatives of maize-teosinte hybrids. Suggestions for dealing with apparent maize pollen in the archaeological record are made.

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EXPLANATIONS OF PHOTOGRAPHS IN PLATES III–VII

All photographs were taken through a phase-contrast microscope system.

The 1″×1″ photographs are at a magnification of 1550.

The 2″×2″ photographs are at a magnification of 4500; they are not enlargement of the smaller ones, but are of different grains, except for the fossil specimens.

EXPLANATION OF THE ILLUSTRATION

PLATE III

A. *Tripsacum dactyloides* 2n (Kansas clone)
B. Maize (Nal Tel)
C. Teosinte (San Antonio Huixta)
D. Maize-Tripsacum hybrid (WMT maize × *Tripsacum dactyloides*)

Explanation

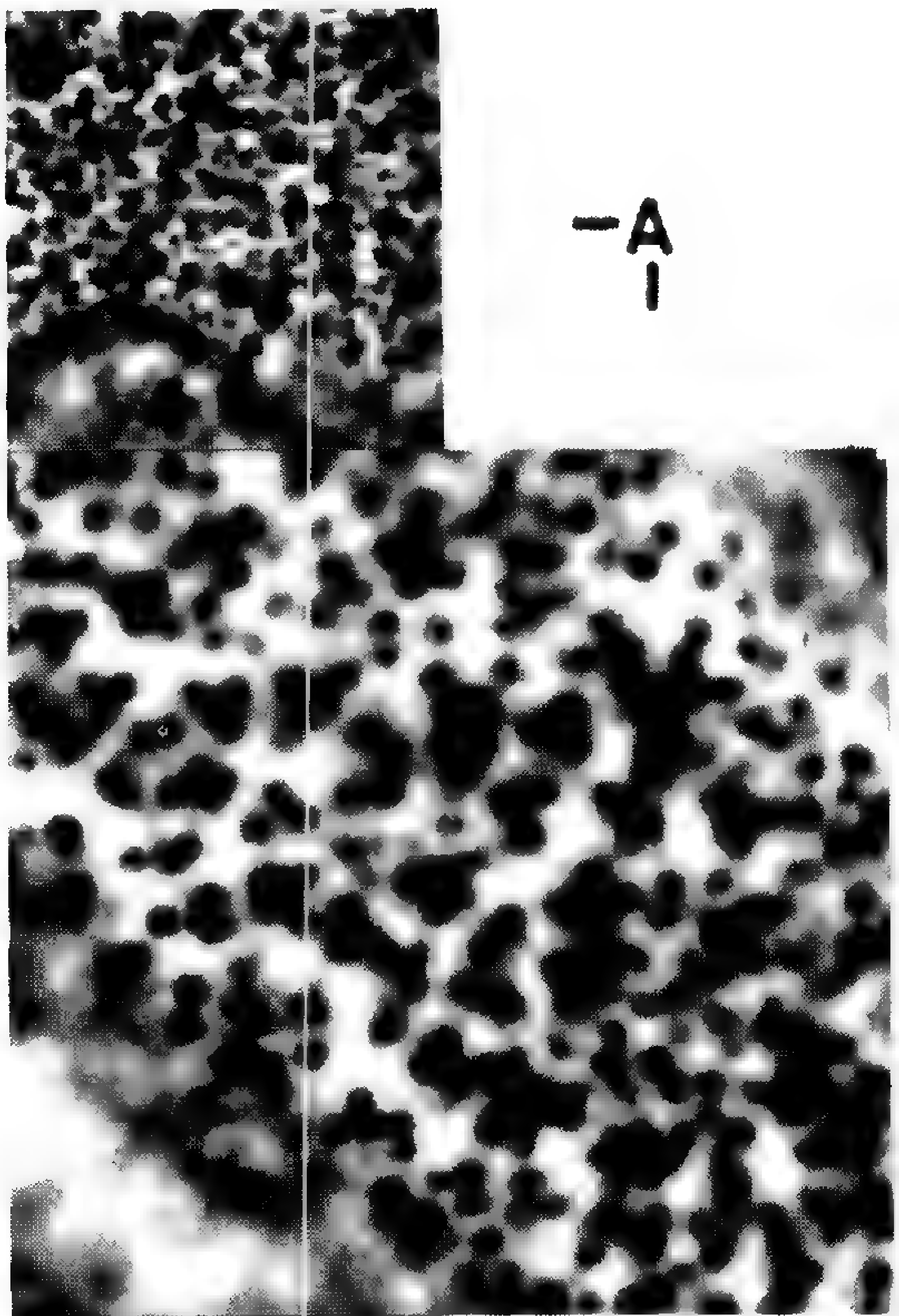
A. These two photographs show a typical "wild" exine pattern, as described by Rowley. The spinules appear clumped and are often visually merged together. In the small photograph, a faintly incised reticulum can be discerned (seen as a greyish network).

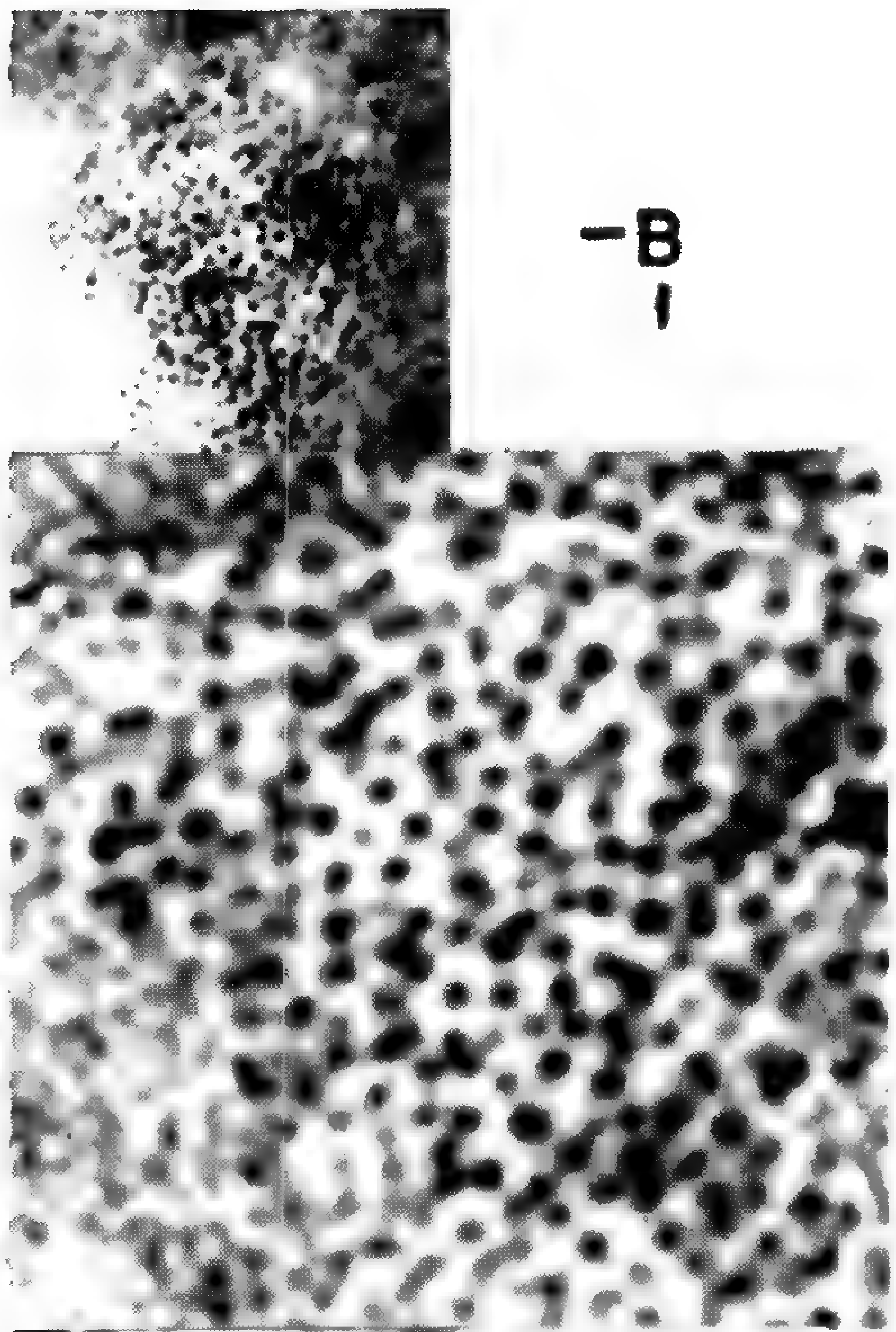
B. Typical pure maize pattern. The spinules are evenly distributed. There are only two levels of phase retardation — the spinules themselves (dark) and the ektexine surface (light).

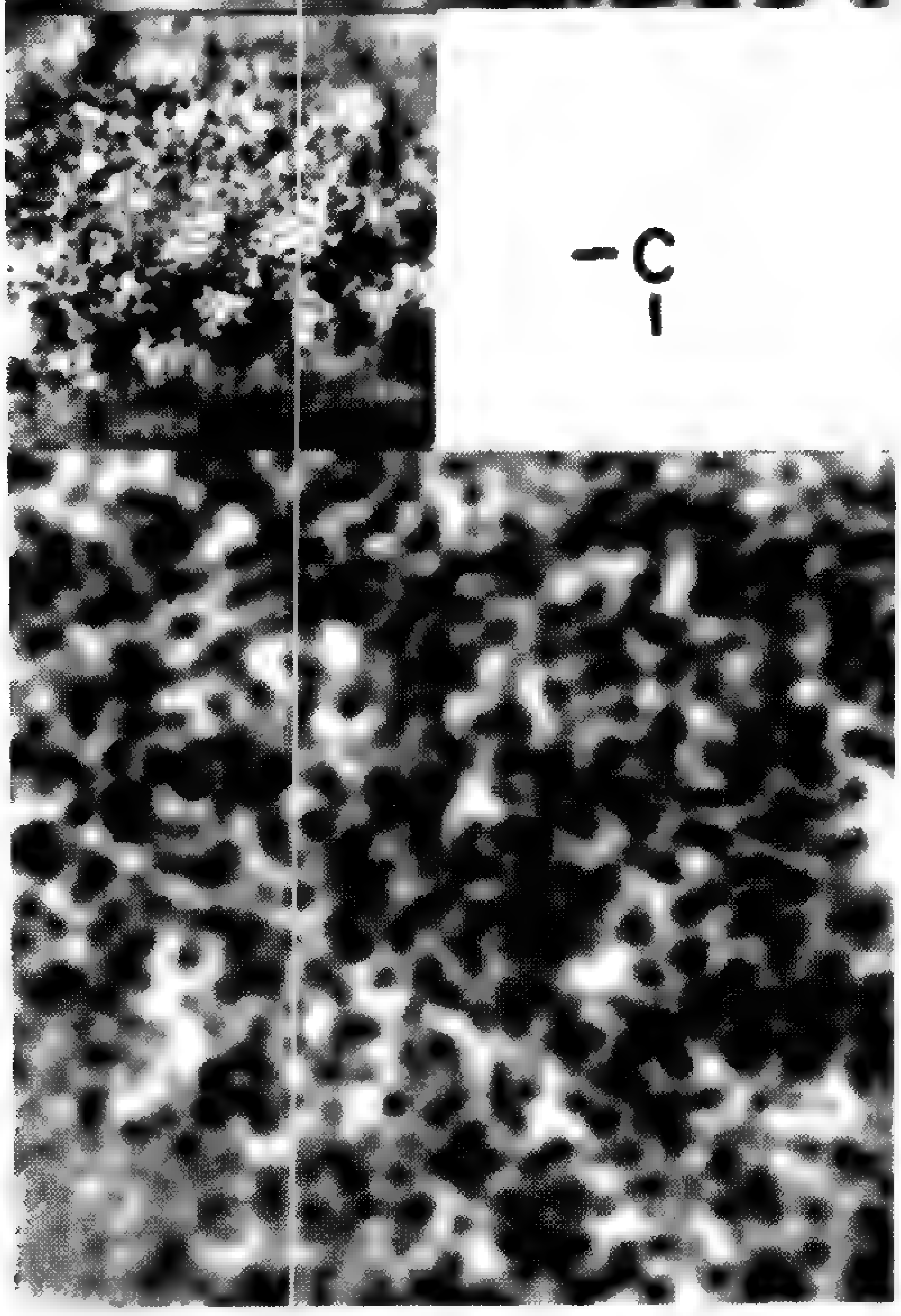
C. Typical primitive teosinte pattern. In the small photograph, the spinules appear clumped, with patches of light and dark areas visible. The large photograph shows the spinules to be rather evenly distributed, but adjacent spinules often appear connected, so that it is difficult to isolate individuals.

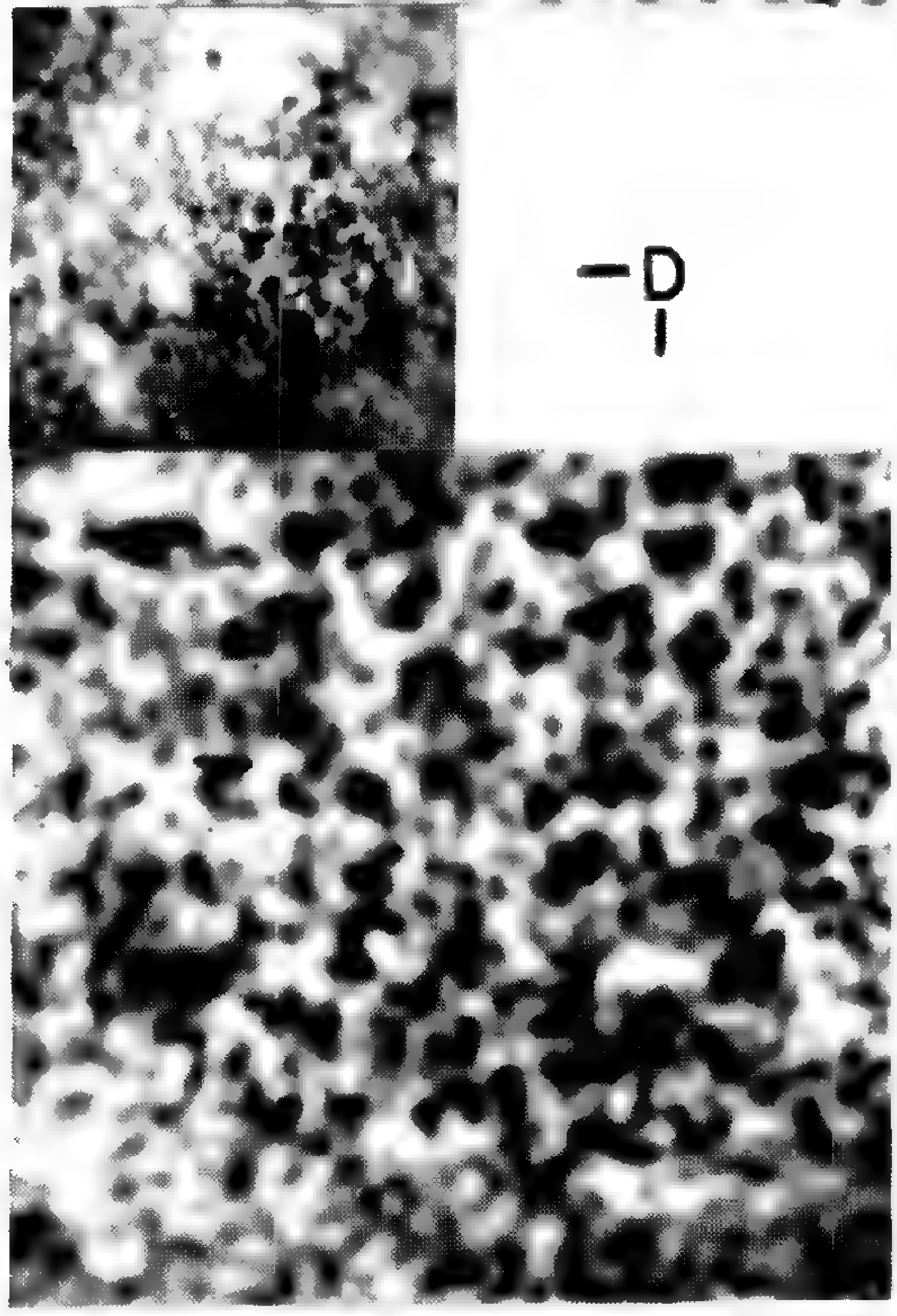
D. In this hybrid, some features of both maize and *Tripsacum* are apparent. The spinules are unevenly distributed and clumped, leaving lacunae larger than those associated with either maize or teosinte, but less pronounced than those of *Tripsacum*.

PLATE III









EXPLANATION OF THE ILLUSTRATION

PLATE IV

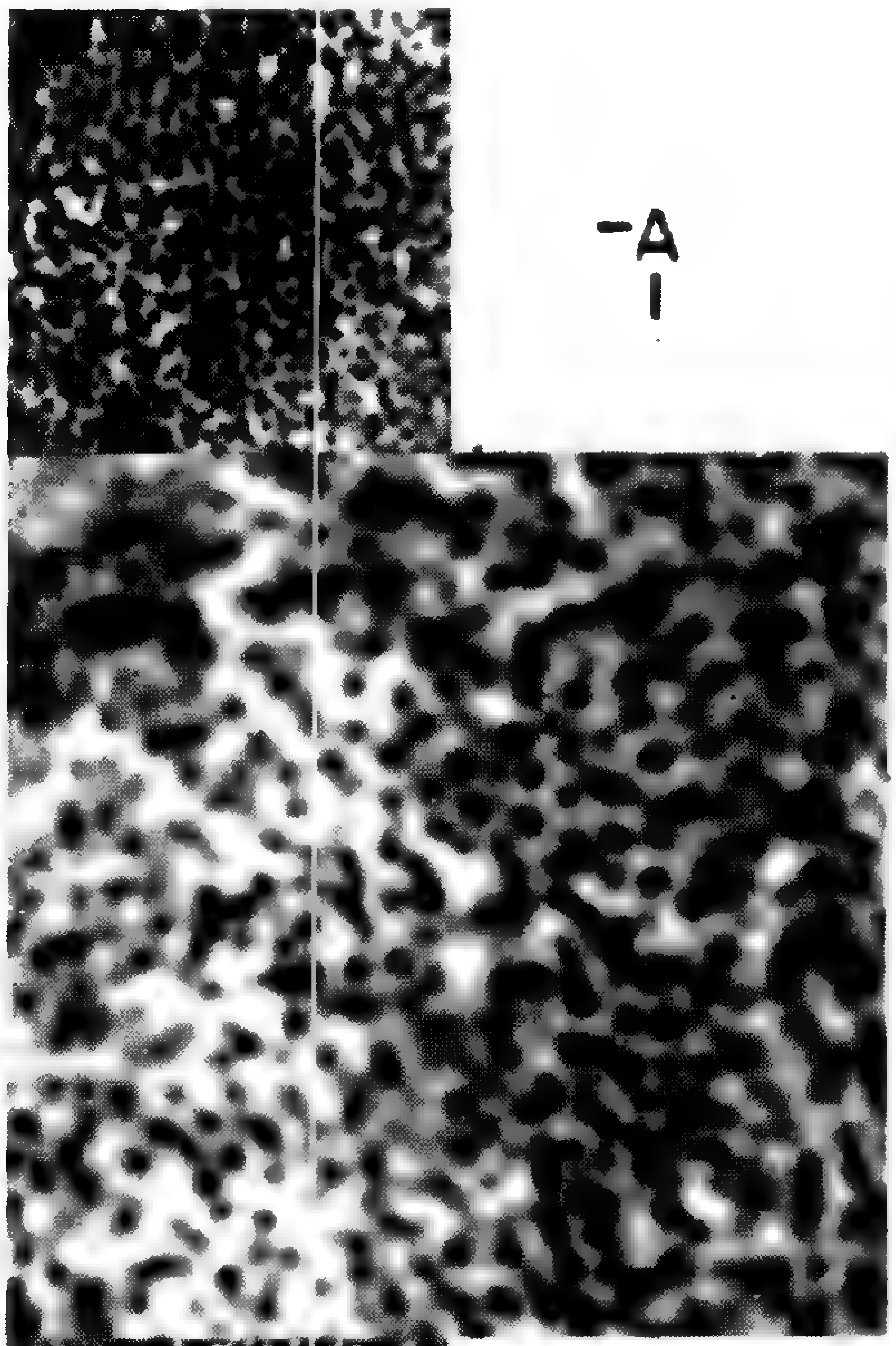
A. Maize (Chapalote, Sinaloa)
B. Maize (Confite Morocho)
C. Teosinte (Chalco)
D. Teosinte (El Valle)

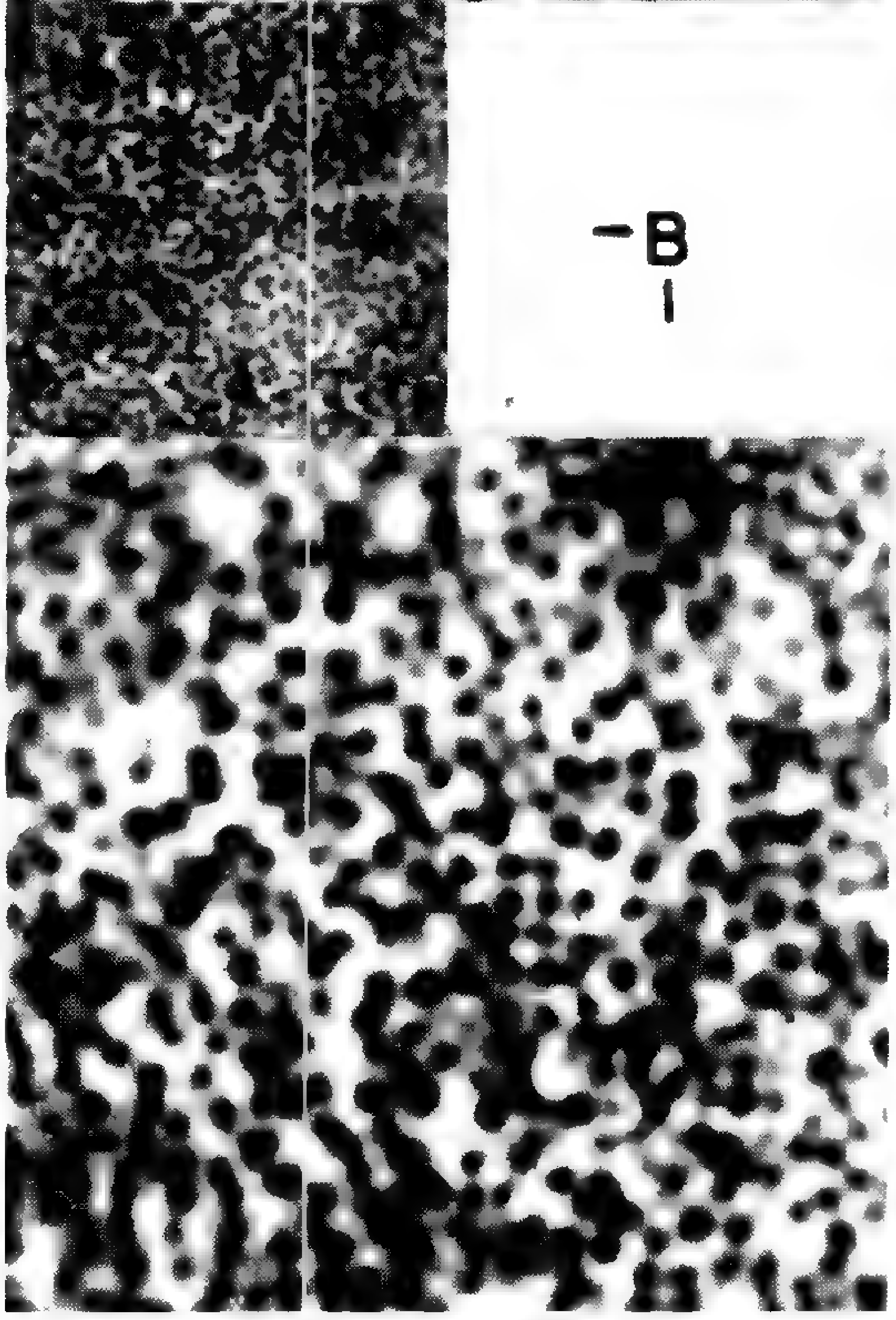
Explanation

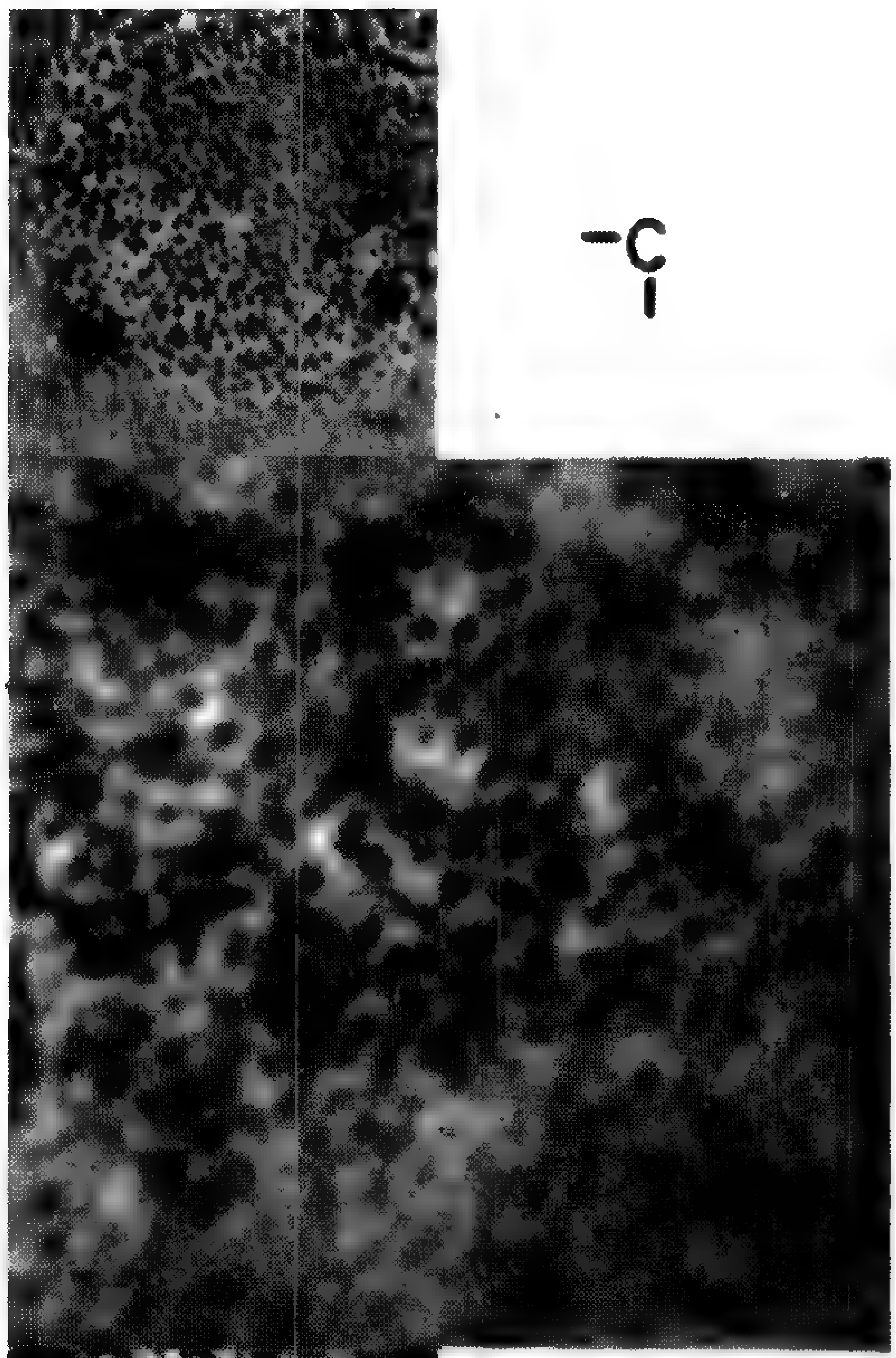
Both A and B show relatively pure maize patterns. In comparing these photographs with those of two teosinte races on the right, a second feature of maize-teosinte exine difference can be seen. The spinules of the maize grains are darker and thus more distinct. This suggests the spinules (and supporting columellae) of the maize-type exine are longer, causing more phase retardation than those of teosinte. One practical result is that larger areas of the exine of maize can be brought into sharp focus (with grains of the same size). Corresponding photographs were taken and printed under virtually identical conditions.

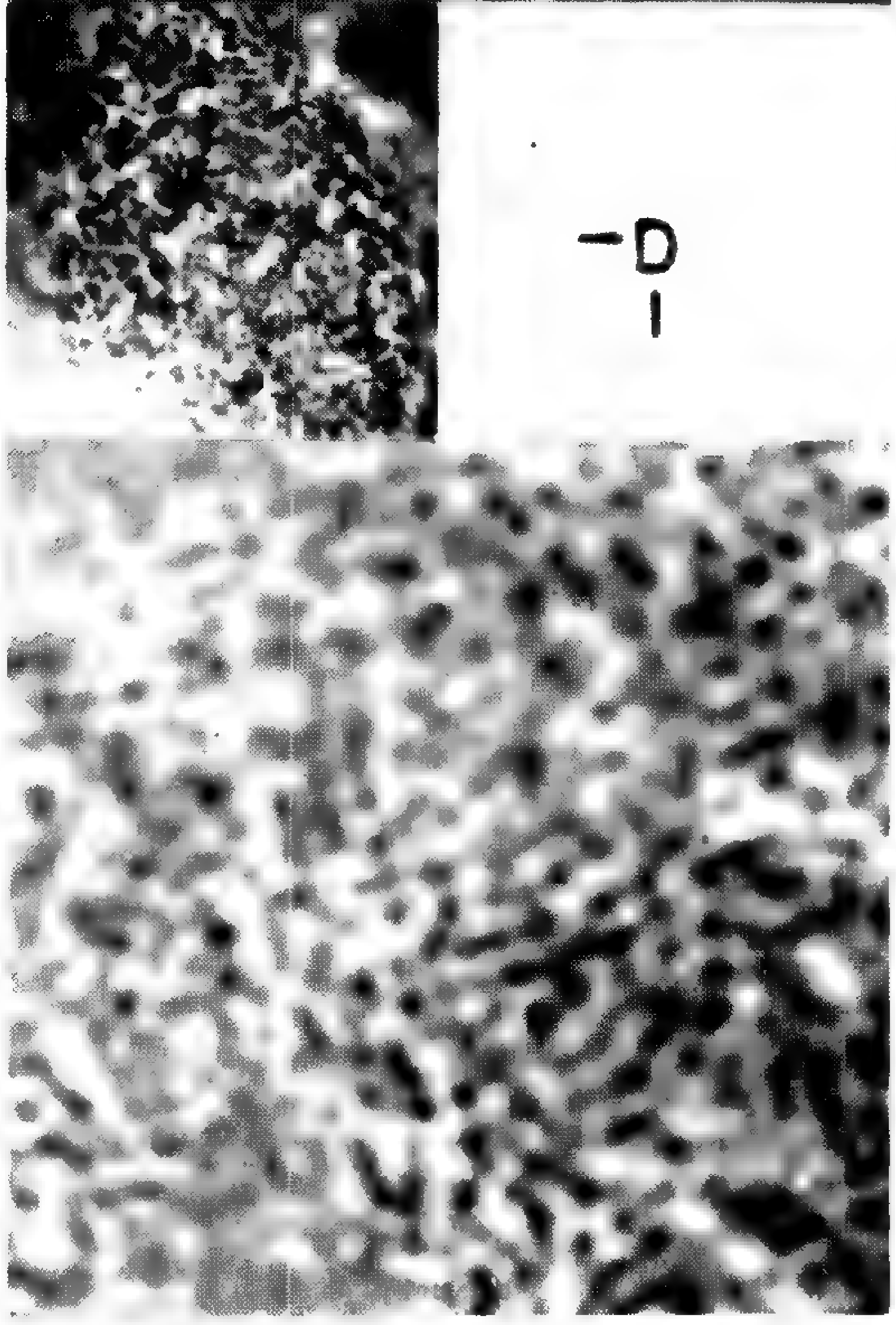
C and D differ in significant ways. D is a primitive teosinte (that is, with little maize contamination). C is a teosinte with a high amount of maize germ plasm. The only observable difference between the latter and typical maize is the amount of phase retardation of the spinules, discussed above. Teosinte Chalco is also one of the most maize-like of modern teosintes in other aspects of plant morphology.

PLATE IV









EXPLANATION OF THE ILLUSTRATION

PLATE V

A. Teosinte (Xochimilco)
B. Maize (Puno)
C. Teosinte (Jutiapa)
D. Maize (Huesillo)

Explanation

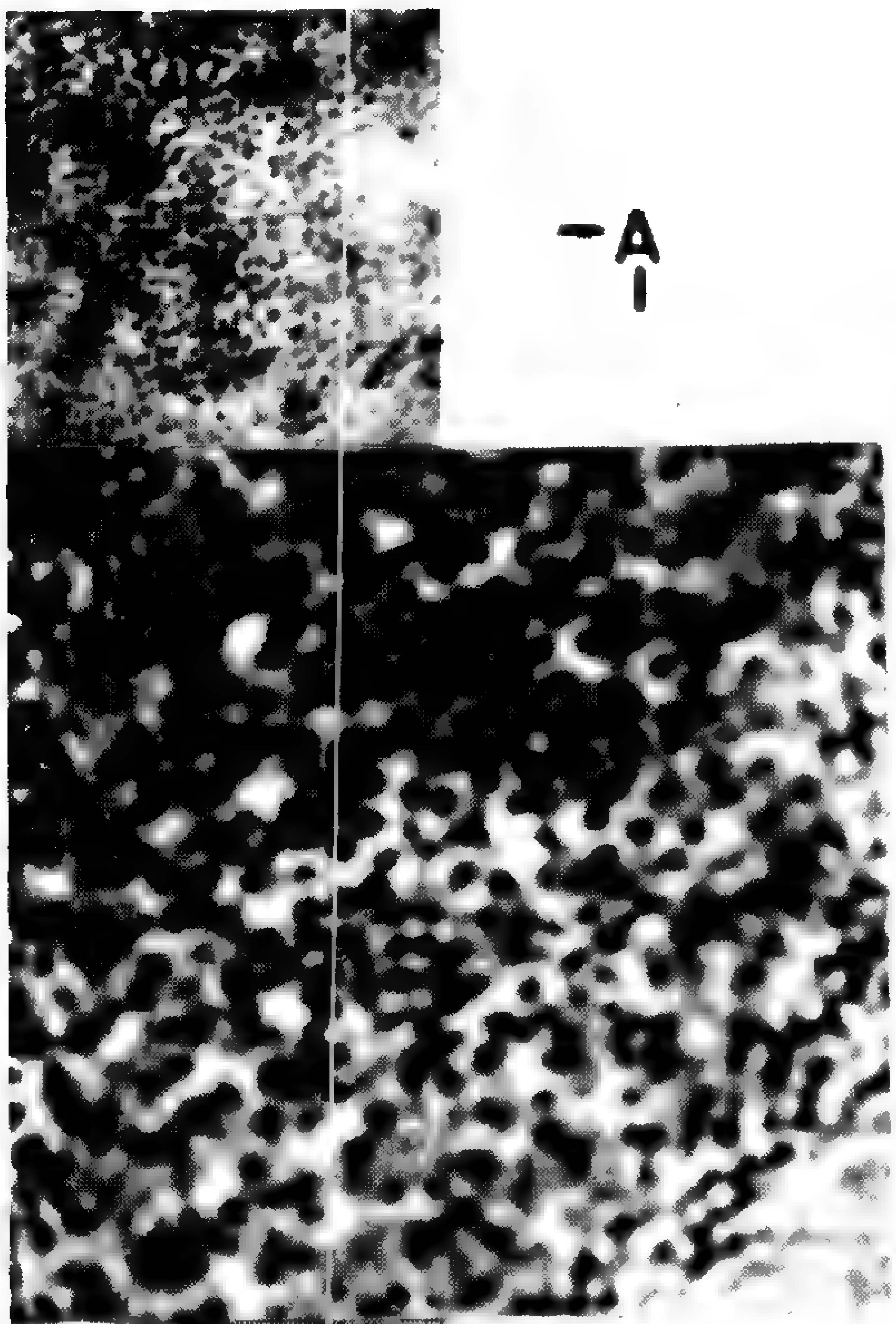
A. Another Mexican teosinte, showing considerable maize influence, according to genetic studies. The exine pattern is rather regular, the phase retardation rather strong.

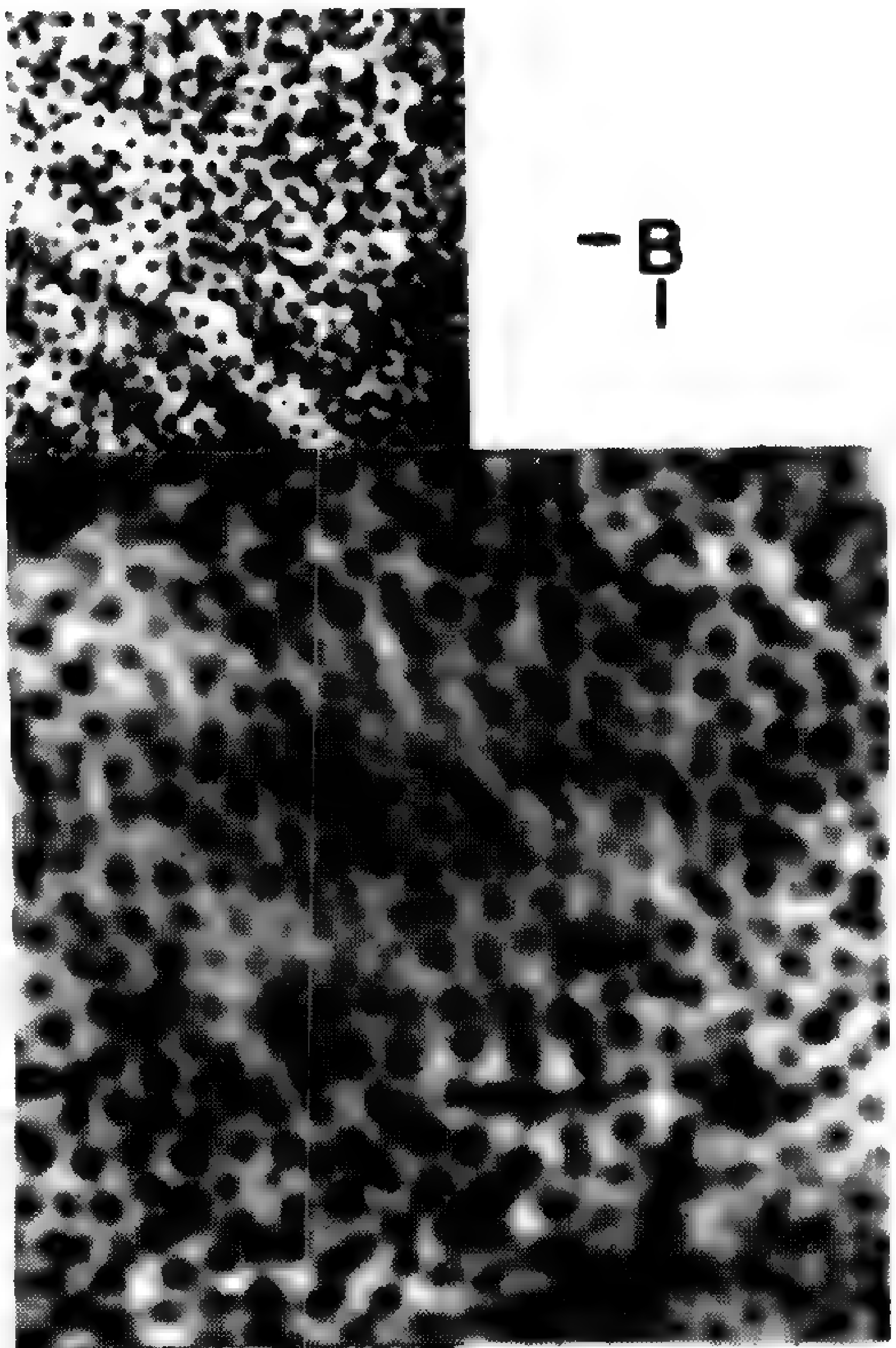
B. Probably the most nearly pure maize. The spinule distribution is very regular (most clearly shown in the large photograph), and the phase retardation of the spinules pronounced (seen best in the small illustration).

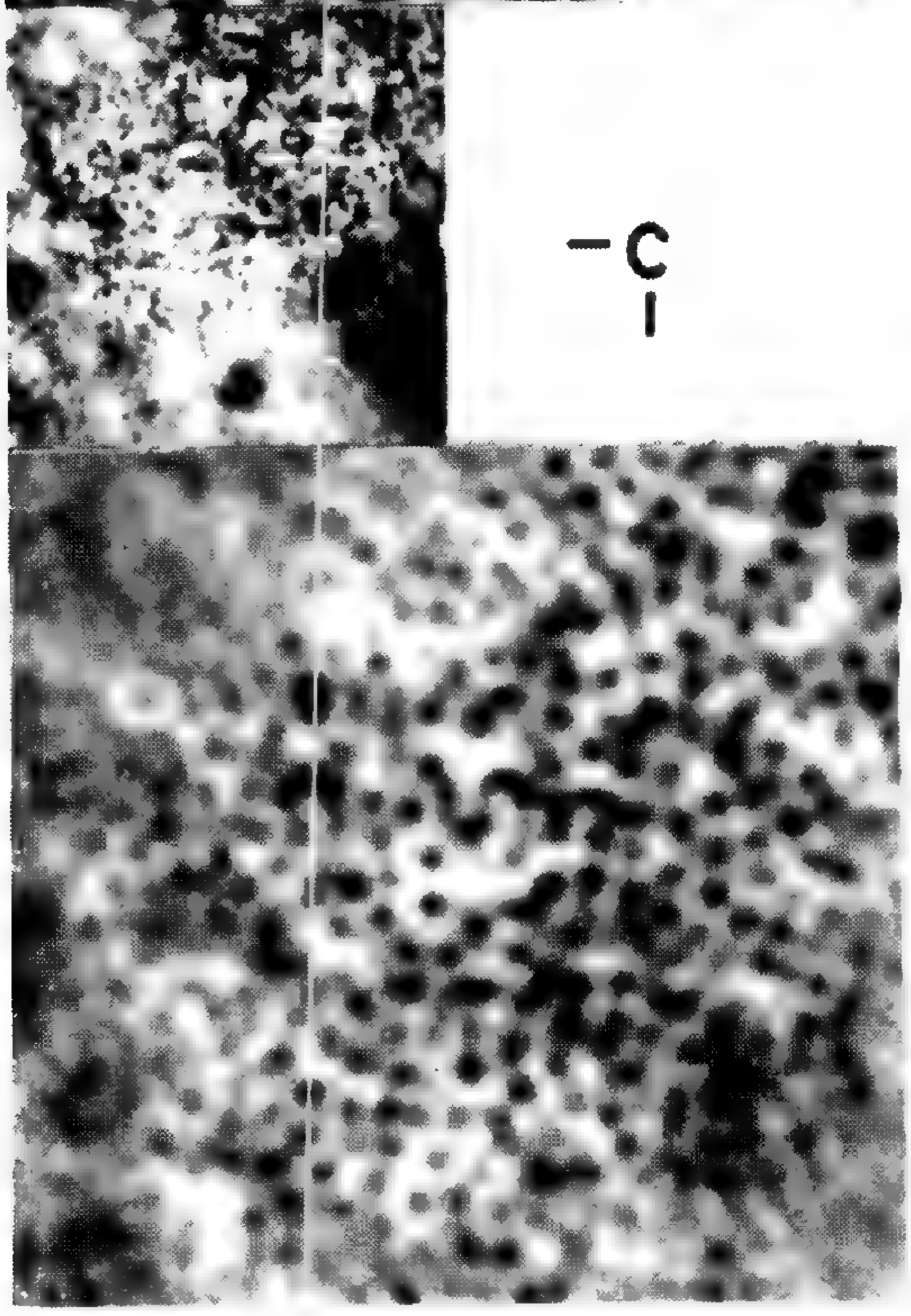
C. Primitive teosinte, showing the same characteristics as El Valle teosinte shown in Plate IV (D).

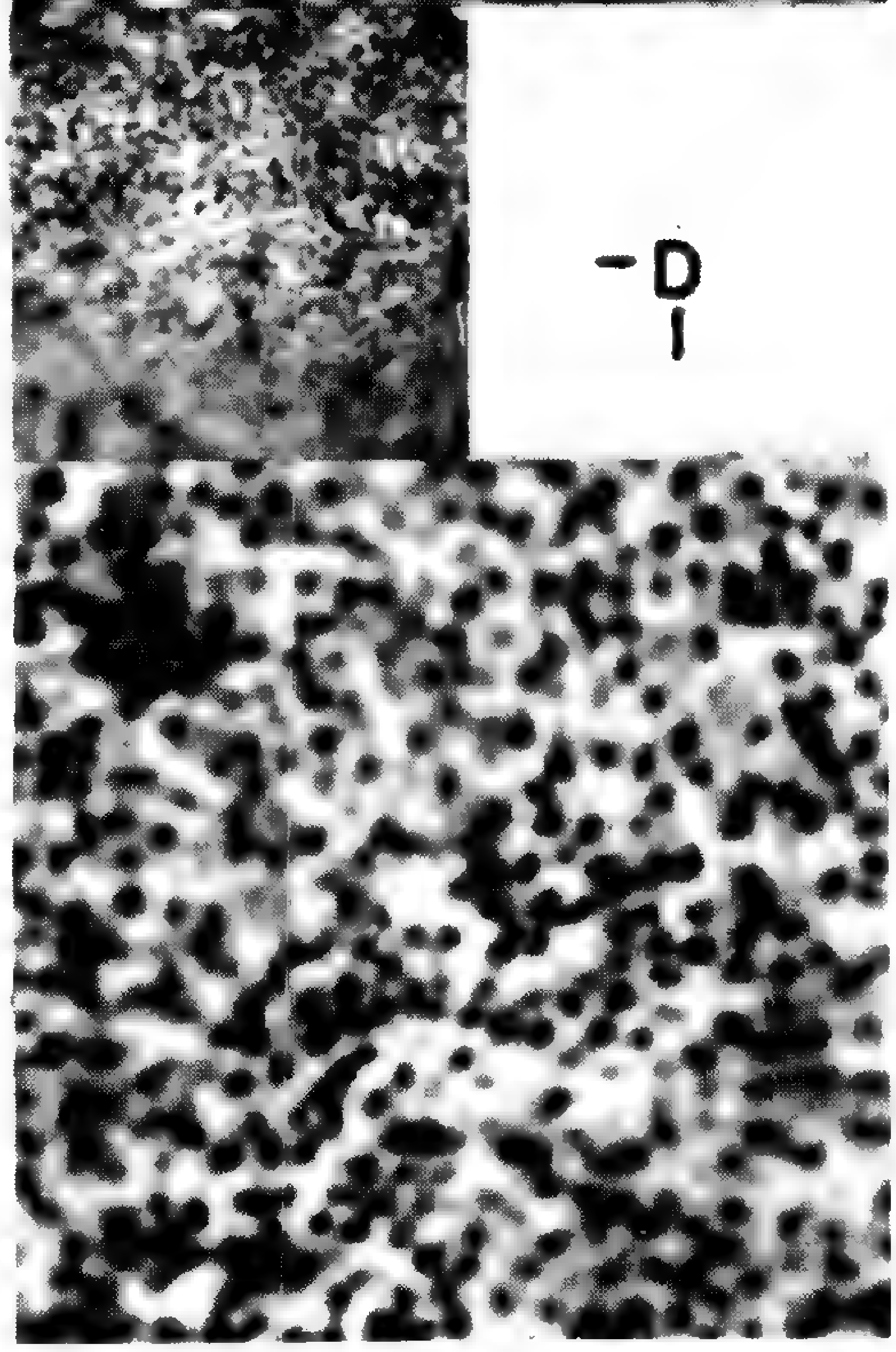
D. A tripsacoid maize showing a pattern similar to maize-like teosintes (as teosinte Chalco, Plate IV, C). The spinules are pale and frequently clumped.

PLATE V









EXPLANATION OF THE ILLUSTRATION

PLATE VI

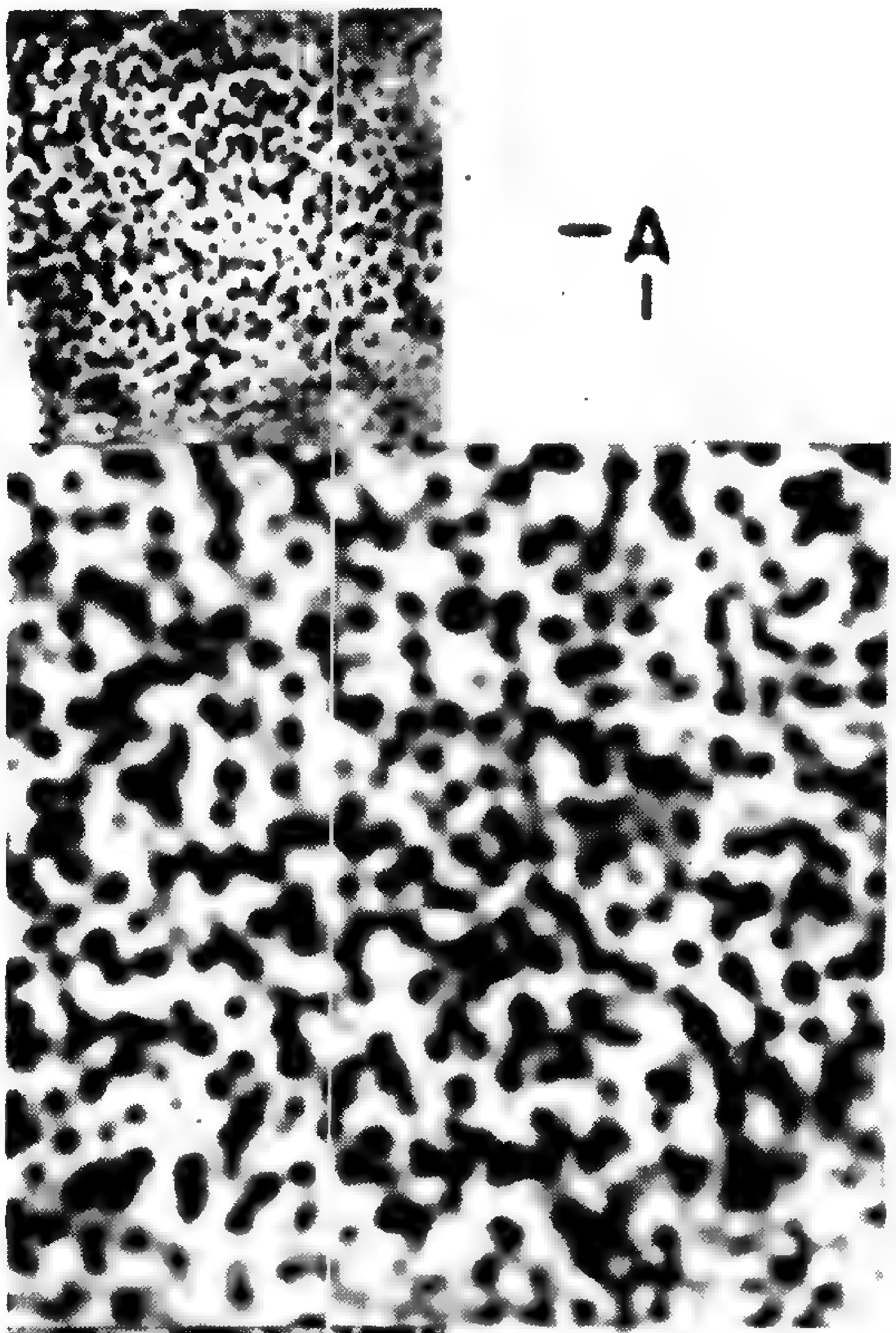
Evidences of genetic influences.

A. Maize (Minnesota A158-inbred)
B. Maize (Minnesota A158 with chromosome 1 of Florida teosinte)
C. Maize (Minnesota A158 with chromosome 3 of Florida teosinte)
D1. Maize (Texas 4R3-inbred)
D2. Maize (Texas 4R3 with chromosomes 3 and 4 of Nobogame teosinte)

Explanation

B shows no pronounced changes from A except for some increased clumping. Greater changes are shown between C and A, in the direction of teosinte: lacunae are more distinct and the contrast is poorer. D1 is an inbred maize. D2 shows a teosinte pattern in clumping of the spinules.

PLATE VI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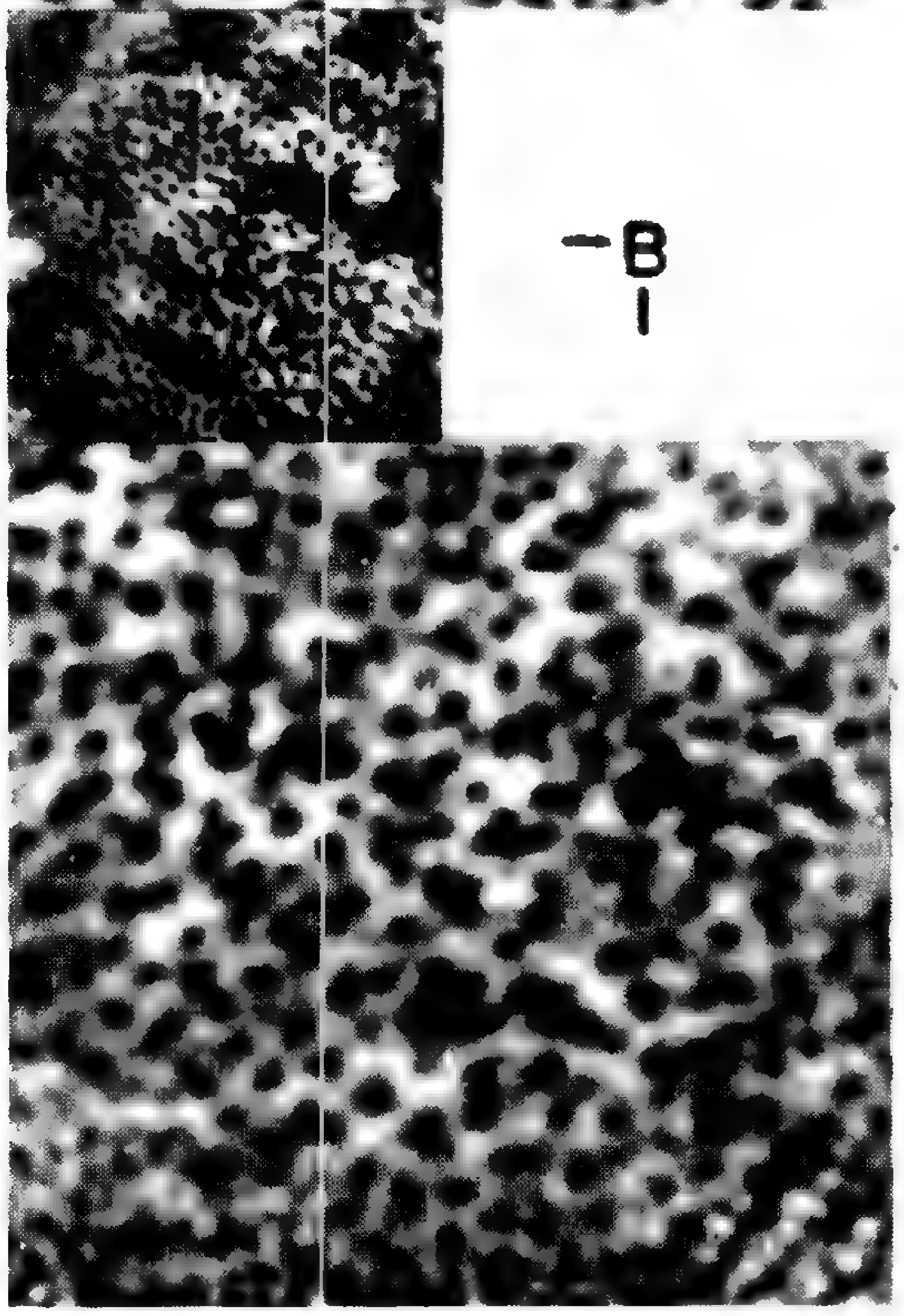
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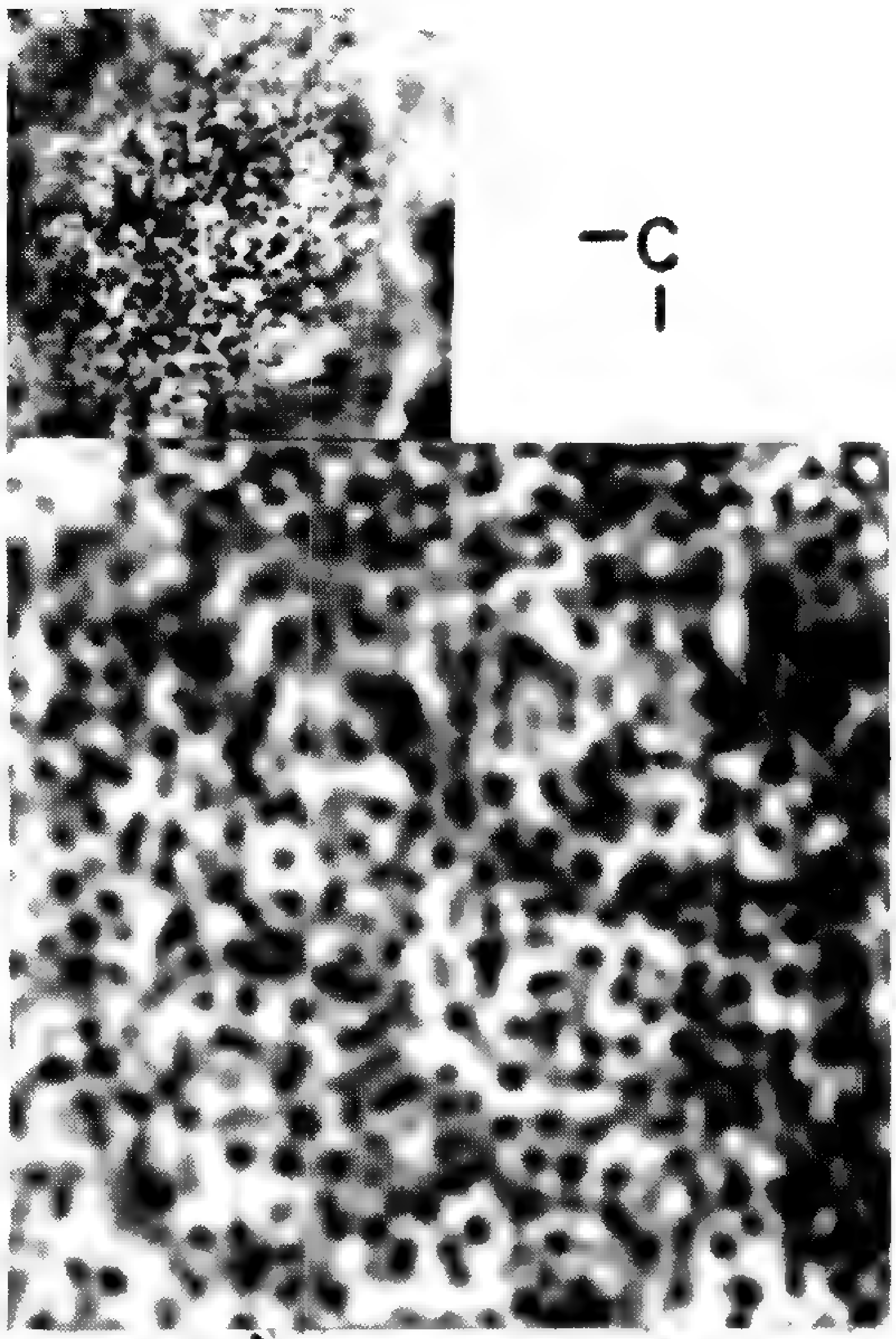
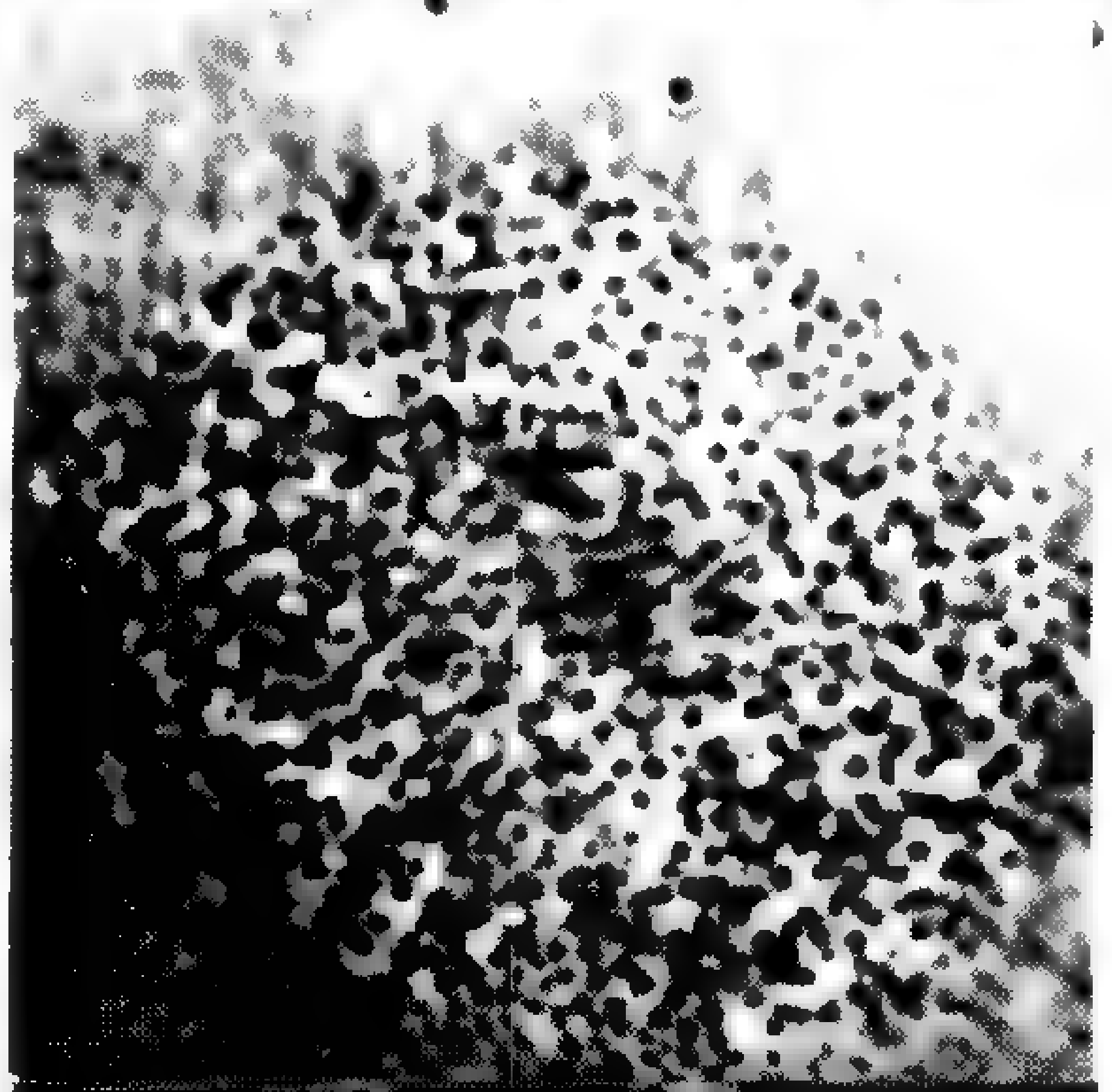
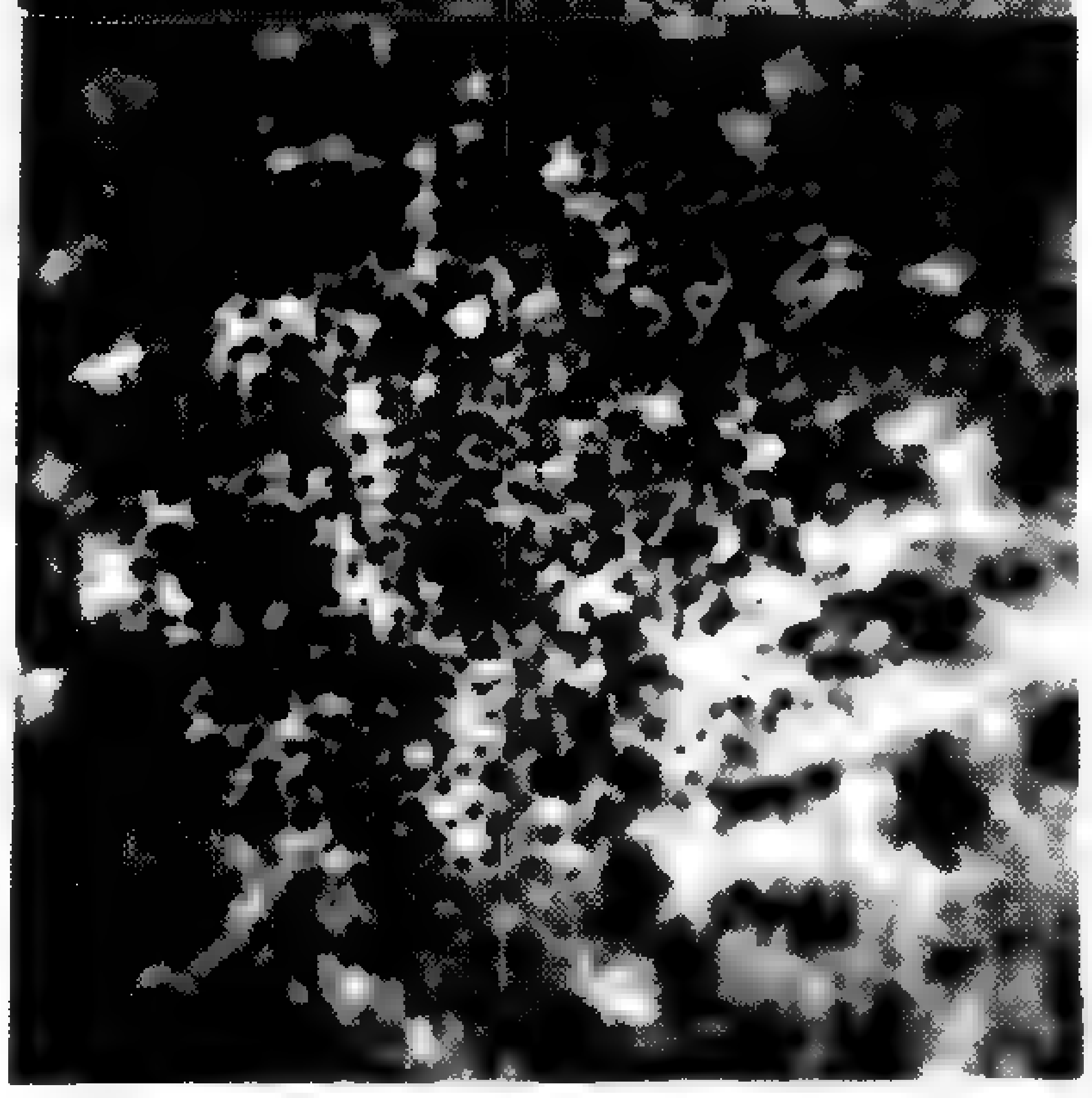

—C


—D_1


—D_2

EXPLANATION OF THE ILLUSTRATION

Plate VII

A. Fossil "*Tripsacum*" (Mexico City Belles Artes Core, depth 74 meters)

B. Fossil "maize" (Mexico City Belles Artes Core, depth 70 meters)

C. Fossil "maize" (New Mexico, Bat Cave, level VI, age ca. 5000 years ago

D. Fossil "maize" (Guatemala, Lake Petenxil, age 3950 ± years ago.

Explanation

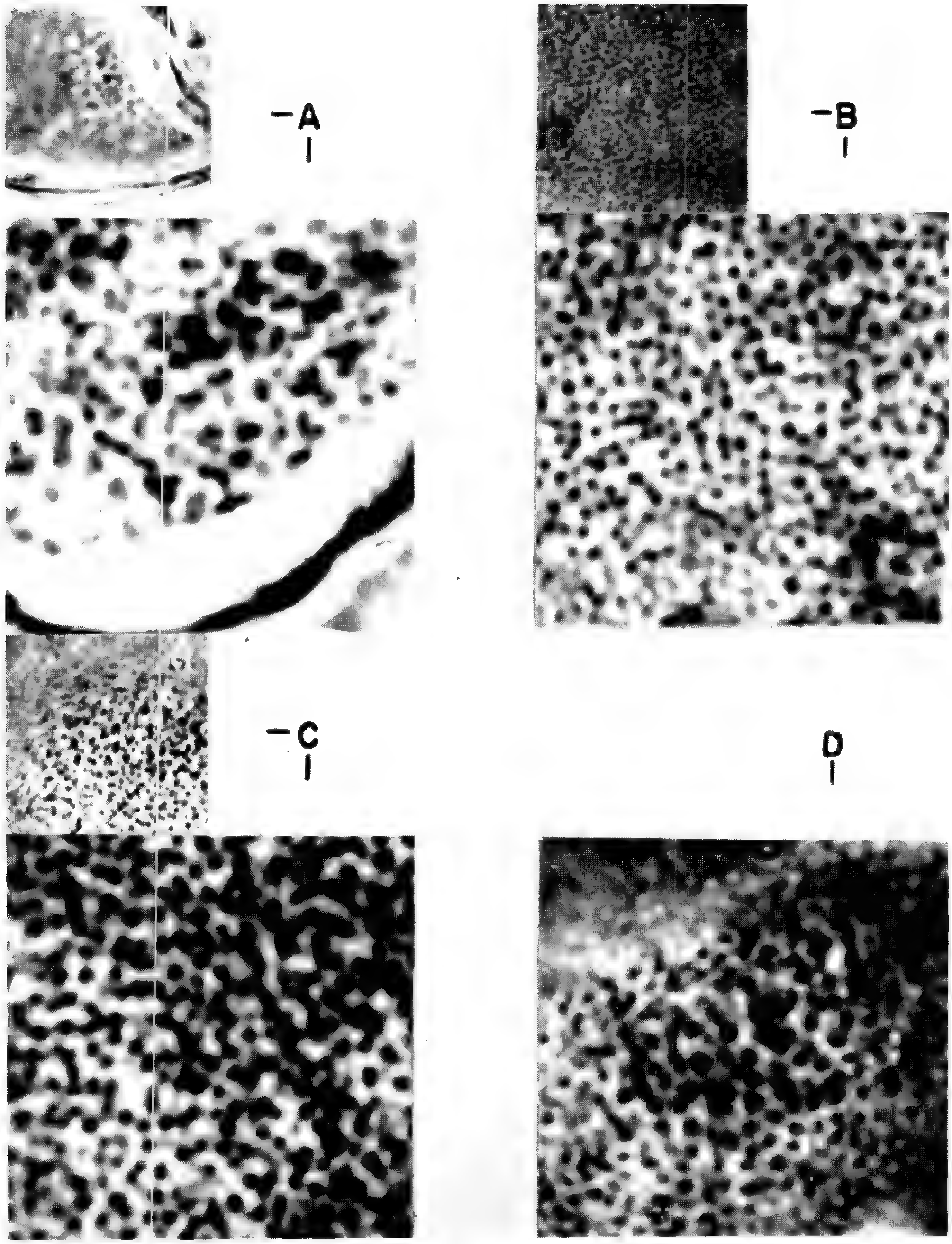
A. Compare with *Tripsacum dactyloides*, Plate III (A).

B. Primitive maize pattern, compare with Nal Tel (a relatively pure type), Plate III (B). Both specimens A and B are in slightly eroded condition due to post-depositional processes.

C. The specimen had a maize pattern with good contrast, but with some clumping of spinules.

D. The specimen is like C, but with slightly greater clumping.

PLATE VII



ETHNOBOTANICAL NOTES ON SIMABA IN CENTRAL BRAZIL

BY

JOAN B. TURNER

DURING the course of ethnographic studies among the Northern Cayapó (Gê) Indians of central Brazil, some new information was discovered concerning the uses of a species of Simaba of the Simarubaceae.

The specific identification of the plant cannot be made until more complete botanical material is collected. The plant in question is an inhabitant of the open grassland country commonly referred to as *campo cerrado* in central Brazil. It is a xerophytic shrub characteristic of this type of vegetation. It has thick, broad leaves and roots which extend to ground water many meters below a hard surface of lateritic soil.

The Simaba samples were collected from the campo cerrado area close to the Cayapó villages of Gorotire on the Rio Fresco, a tributary of the Xingú, and Kubenkranken on the Riozinho, a tributary of the Fresco, both in the state of Pará. In September, at the end of each dry season, this area is often unintentionally burned over by Cayapó who set fires to clear the old vegetation from their slashed garden-plots in the surrounding forest. The Simaba, with its extensive root system, is adapted to survive the annual fires and the poor quality of the lateritic soil.

Despite our inability to offer a specific determination of the plant at the present time, we feel that the data set forth below are sufficiently interesting and the certainty of the generic identification firm enough to warrant publishing these ethnobotanical notes.

The ethnographic literature on the Gê Indians of central Brazil contains several references to the use of plants as contraceptives (Nimuendajú 1939, 1942; Banner 1961; Dreyfus 1963). Two of these groups, the Sherente (Nimuendajú 1942: 37) are reported to take substances orally to prevent pregnancy. Dreyfus, who spent five and a half months with the Cayapó where Banner also worked and where we conducted twelve months of field research in 1962–63, found only "external" contraceptive techniques in practice. The native term which Banner recorded for those plants believed by the Cayapó to prevent conception is identical to that published by Dreyfus (1963: 53), and confirmed by our own work. It is *mẽ-kra-ket-djà*, which translates literally as "the child-not thing." Since neither of the authors identified the plants botanically, all the information that we have from their published reports is that the leaf, root, or vine of certain plants are chewed or made into a brew which must be drunk or rubbed over the body of a woman who wishes to avoid pregnancy.

I collected specimens of two plants to which the Indians attribute contraceptive properties. One of these, an orchid, *Rodriguezia secunda*, is used only externally. To produce the desired effects, the pseudobulb is crushed and rubbed over the woman's body. It is not known universally to the Cayapó but is the private lore of a shaman, or curer, who may demand an exhorbitant fee for his knowledge and services. The preferred payment today is in civilized goods: beads, blankets, knives, and other hardware.

PLATE VIII

Simaba sp., Rio Fresco, Pará, Brazil.

The general term for orchid in Cayapó is *pĩ-aria*, "the plant which grows on wood," thus distinguishing orchids from other blossoming plants (*pi-djô-rara*). As a contraceptive agent, *Rodriguezia secunda* is known also as a *mẽ-kra-ket-djà*.

The other plant, the Simaba, is more widely known to the Cayapó as a contraceptive agent. It is taken orally. Several informants, both men and women, have reported its efficacy. Although I have never seen it done, shavings from the root of the Simaba plant are infused in hot water, like a "tea", which is given to women to drink and to rub over their bodies.

The effects of this remedy are said to be anti-menstrual as well as contraceptive. In recognition of its multiple properties, Cayapó designate the Simaba by several names. *Mẽ-kra-ket-djà* refers to the contraceptive aspect, whereas *kukrut-kanê*, or "tapir sickness-medicine" (*kanê* is a word which can mean a sickness as well as its cure) denotes its anti-menstrual character. The Cayapó do not look upon menstruation as a normal organic function but rather as a disease. As one woman explained, after soliciting medicine from me, "A long time ago the tapir pierced my liver and now I bleed every month." In fact, menstruation does seem to be quite irregular, for many women pass months without a period. I was told that, if a woman takes the root infusion at the onset of her menstrual period, her bleeding will stop by sundown of the following day, and she will not conceive for one month, calculated by the waning and waxing of the moon.

Cayapó know the Simaba also as a fish poisoning agent, *tep-kanê* ("fish medicine"). The root is beaten into the water to stun, not kill, the fish which come floating to the surface where they may be shot easily by Cayapó using bow and arrow, or simply caught up by hand. Simaba is one of several kinds of fish poison; the most common of these is *timbó* (*Lonchocarpus* sp.). Nimuendajú, in a brief discussion of contraceptives and abortifacients used by Apinayé women, mentioned the successful use of "the root of a plant called *teb-gande* (fish medicine)," but only for abortion (1939: 98).

Yet a fourth name given to this Simaba is *tchuru-tchuru*. It is also the Cayapó name for a very large green grasshopper. I have no translation for *tchuru-tchuru*, which may simply be imitative of the grasshopper's song, nor can I offer any reason why both plant and insect share the same name unless, as is sometimes true of Cayapó terminology, the particular species of grasshopper is known to prefer a diet of the Simaba.

I wish to thank Dr. Richard Evans Schultes and Dr. Arthur Cronquist for assistance in botanical aspects of this work. A voucher specimen of the Simaba is preserved in the Economic Herbarium of Oakes Ames in the Botanical Museum of Harvard University.

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BACCAUREA AND ITS USES*

BY
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INTRODUCTION

> I don't know any better way to become acquainted with a new tree than to grow it where you can see it every day. You cannot learn so very much through reading and, while you may get a faint idea of it by seeing its photograph, still, the texture of its leaves, the odor of its flowers, the taste of its fruits — which after all are very important characters — cannot be conveyed to you except in a very general way by the printed word or by the halftone.
>
> (David Fairchild)

IN the Old World tropics there is one little known group of plants that has been of economic importance to the natives since early times. It comprises several species of the euphorbiaceous genus *Baccaurea.*

The words *buah rambai* (the rambai fruit) in the Malay Peninsula and *buah kapundung* (the kapundung fruit) in Java are common names when the season for those fruits is about to begin. In the market place (where it is called *pasar*), in the streets and in many other places, we may see bunches of fresh, shining, green or yellowish brown, appetizing fruits being sold in abundance (Plate IX). Since the price is low, most people can buy and enjoy them. These bunches are from 20 to 30 cm. long, and sometimes may attain even 60 cm. The individual fruits are globose, about 3 to 4 cm. long and 2 to 3 cm. in

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*A term paper for "Plants and Human Affairs," Harvard University, Spring term of 1963.

diameter and have a smooth rind. Inside, there are from three to one (sometimes more) green seeds enclosed in a fleshy, white or pink, edible juicy aril. There is considerable variation among the wild fruits, but generally they are sour; those of the cultivated trees, however, are sweet and very palatable.

The *rambai* and *kapundung* are obtained from different species of ***Baccaurea***, a large genus of evergreen trees occurring from India to the Pacific, but chiefly in Western Malesia. There are more than 60 species of the genus which have been legitimately published; at least 20 have edible fruit, but most of these are found only wild. So far, no more than four species have been recorded as under cultivation, including the *rambai* and *kapundung*. In this paper, the name *rambai*, if it is used without qualifications, always refers to ***Baccaurea Motleyana***, and *kapundung* to ***Baccaurea racemosa***.

The *rambai* fruit has gained increasing popularity in Malaya, and today it is one of the principal fruits. Olds (1933) places it among the "ten most popular fruits in Malaya." Nevertheless, very few experiments have been carried on, either in Malaya or in Java, to improve its quality.

The ripe fruits are eaten usually raw, but they are also suitable for cooking and may be fermented and made into liquor. On occasions of wedding ceremonies, certain races of the Malay Peninsula consume large quantities of this fermented beverage (Skeat & Blagden, 1906). In Kalimantan (Borneo), there is another species of ***Baccaurea***, the *tampoi* (***B. Griffithii***) which is also used to make a kind of liquor called *tuak tampoi* (*tuak* means alcoholic beverage) (Burkill, 1935).

THE GENUS BACCAUREA *Loureiro*
(Latin: *bacca*=berry; *aurea*=golden)

The members of the genus are mostly small to large sized trees, often with buttresses, usually with a dense crown; branchlets often sympodial. The leaves are simple, arranged spirally along the branchlets, but mostly crowded near the apex, and generally with long petioles with a rather distinct swelling at both ends; the leaf venation is penninerved, the margin of the leaves entire or slightly sinuous, sometimes crenate-serrulate. At the base of the petiole, where it merges into the branchlet, two intrapetiolar stipules are present, but they are caducous and observable only when young. The inflorescences are long, slender, more or less drooping, unbranched spikes or racemes, borne in groups along the branches or on the trunk, in some species in the leaf axils. Staminate and pistillate flowers are borne in separate inflorescences; the male and female inflorescences are found usually on different trees. The flowers are very small, without petals, but with usually yellowish green sepals. The staminate flowers, much smaller and more numerous than the female, have four to five (rarely up to eight), very small, and mostly unequal sepals, arranged imbricately in the buds. A glandular disk is present. The glands are very small, almost obsolete, and arranged interstaminally. The stamens are four to eight in number, with short and free filaments, terminating in four-loculed anthers that dehisce longitudinally. The rudimentary ovary, usually shield-shaped, may be seen distinctly at the centre of the flower. The female flowers bear four to six caducous sepals, generally longer than the ovary and hairy on both the outer and inner surfaces. Unlike the staminate flower, the pistillate has no disk. The ovary usually has two to three locules, very seldom four to five, with a very short style, terminated by bifid, plumose or papillose stigmas. Each ovary cell contains two to three, rarely four to five ovules. The fruit is a berry or a capsule (berry here is a loose term, given to the species with indehiscent fruit), globose to ovoid or obovoid, tipped by tiny, sessile, persistent stigmas. Inside, there are six to one large, oblong green seeds, each surrounded by a juicy or creamy pulp, enclosed in a transparent skin; the pericarp is usually fleshy, but sometimes it is suberized or lignified. The seed consists of a thick and fleshy albumen, an incurved embryo, and large and foliaceous cotyledons.

A species of *Baccaurea* is usually easy to recognize from the strings of small, yellowish green flowers (with a sour, lemon-like scent) which are developed on burs on the old wood (Plate IX); and the strings of fruits on the female trees; together with the spirally arranged leaves. Another characteristic feature of the genus is the thinness of the bark, which is, according to Corner (1952), no thicker than a piece of paper, so that a cut with a pen-knife immediately penetrates the wood.

It is unusual, but pleasing, to see a *Baccaurea* tree, with dense and abundantly flowered strings borne along the branches or on the trunk, sometimes so low that they touch the ground. This peculiar feature has, indeed, long attracted the attention of botanists, and it has been recorded that this character plays a part in native ceremonies. Skeat and Blagden (1906) mention that the pagan races of the Malay Peninsula used the sticks or dibbles made from the saplings of a special hardwood tree called *tamun* (Malayan: *setambun*—a local name for *B. parviflora:* cf. Corner, 1952) in planting rice. In this ceremony, a magician sets out at sunrise for the fields, accompanied by all the men, women, and children who are going to take part in the sowing. Upon arriving at the first available space near the middle of the field, the magician draws a circle around himself with a specially made staff, which, like the other dibbles, is made of *tamun* wood; the planting sticks are then heaped up inside the circle. The whole company sits outside the circle in a wide ring, forming what is called the rice-bin or *kepuh*. In the centre, a *bunglei* plant (a poisonous forest tree which also has a meaning in this ceremony) is planted in the ground, and near it a branch of the *tamun* tree. The sowing, which is led by the magician, follows after this ceremony. The purpose of choosing the *tamun* tree is that the rice, by sympathy, will flower in a dense inflorescence near the ground, as does the *tamun* tree, instead of growing long, rank, and weedy. This interesting ceremony is evidence of the people's familiarity with the *Baccaurea* trees from early times.

The genus *Baccaurea* was first described by Loureiro in 1790, with three species, based on herbarium specimens collected from Indo-China. *B. ramiflora*, one of the three species, has recently been designated by Merrill as the type of the genus; he likewise enlarged the concept of the species (1935) by reducing two other species, *B. cauliflora* and *B. sapida*, to synonymy. In this paper, however, *B. sapida* is retained. In 1866, the first monograph of the genus (Mueller-Argoviensis *in* DC., Prodr.) appeared, in which 33 species are described. Pax, in 1922, in collaboration with Käthe Hoffmann, extended his earlier work (1896) by describing 61 species in the genus, and I am of the opinion that this monograph is still the most complete and the best work on the genus. Actually, the number of legitimately published species at this time is not definite (in the *Wealth of India*, 100 species are mentioned), since during the last three decades new species have been added and taxonomic changes have taken place within the genus. However, an up-to-date monograph has not as yet been written.

Indeed, *Baccaurea* is a very difficult genus to deal with. Joseph Dalton Hooker says: "The species of this genus are most difficult of discrimination, owing to the necessity of having for this purpose flowers of both sexes and also ripe fruit, and because in foliage very different species resemble one another. The male inflorescence appears to me to afford the best sectional characters, but it may have to yield to carpological ones, when the fruits are better known. The male flowers of individual species are very inconstant as to the number and form of sepals, and number of stamens. The disk-glands when present are too minute and, I think, variable as to presence or absence, to afford aid in Indian species; nor do I find the anthers truly extrorse in any, the slits being more or less lateral when not truly introrse."

As mentioned before, while at least 20 species of the genus have edible fruits, only four are known to be in cultivation to any considerable extent. Two other species have been mentioned (*Dict. sci. nat.*, 1816) as being cultivated; the rest are still wild, even though the fruits of some of them are collected and sold in the markets and, in some cases, even surpass in quality those of the cultivated species. Besides being sought for their fruits, the trees yield a good timber, and it has often been recorded that it is used for building houses and boats, for posts, and other light constructions. Other parts of the plant, such as the leaves, the bark, and the roots, have likewise been employed in native medicines, for dyeing and even as vegetables. A brief discussion of these uses will be given at the end of the paper. All the species which thus far have been recorded as of economic value are presented in Table I. The following discussion will be restricted only to the four cultivated species mentioned above.

Before proceeding with the species discussion, however, it may be helpful to consider the vernacular names of the species. In this case, we have a chaotic, though more interesting, situation. As mentioned at the beginning of the paper, the name *rambai* is used here for ***B. Motleyana***, and *kapundung* for ***B.*** *racemosa*. ***Rambai***, widely used in Malaya, refers also to ***B. Motleyana***, while *kapundung* is widely used in Sumatra, Java, and Bali for ***B.*** *racemosa*. Addition of the words *hutan* (forest), *ayam* (hen), *burung* (bird), *daun* (leaf), *kera* (monkey), *batu* (stone or rock), and *padang* (field or pasture) to the word *rambai* will completely alter the species and even genus. Thus, we have *rambai ayam*, which may mean ***B.*** *brevipes*, ***B.*** *Wallichii*, ***Ryparosa*** *fasciculata* (Flacourtiaceae), or *Anisophyllea disticha* (Dipterocarpa-

TABLE I

Species of economic value

Cultivated as a fruit tree	Wild	
	With edible fruits; incl. those which have been recorded to yield good timbers	Yield good timbers
B. dulcis (Tjupa)	B. bracteata	B. javanica
B. Motleyana (Rambai)	B. brevipes	B. Kingii
B. racemosa (Kapundung)	B. dasystachya	B. lanceolata
B. sapida (Pupor or Lutqua)	B. Griffithii	B. Nanihua
	B. macrocarpa	B. reticulata
	B. macrophylla	B. sumatrana
	B. malayana *	B. symplocoides
	B. multiflora	
	B. minor	
	B. parviflora	
	B. polyneura	
	B. pubera	
	B. pyriformis	
	B. ramiflora **	
	B. Scortechinii	
	B. velutina	
	B. Wallichii	
	B. Wrayi	

* Has been recorded in cultivation (c.f. Ridley, Fl. Mal. Penins.)
** Has been recorded in cultivation (c.f. Dict. Sci. Nat.)

ceae), while *rambai pontianak* may mean *Galearia affinis* (Euphorbiaceae), *Symplocos rubiginosa* or *Symplocos rigida* (Symplocaceae), or *Timonius Wallichianus* (Rubiaceae), all of which have no connection whatever with *Baccaurea*. However, this point further indicates that the name *rambai* (*B. Motleyana*) is the most popular and well known, therefore the most reliable one, because it forms the basic word, while the other species are so named because of association with the *rambai* fruit. The name *kapundung*, on the other hand, is more constant and is rarely used in compounds. *Tampoi* is another name, second in popularity in Malaya. Although generally it means *B. Griffithii*, still, we should be careful, because it may also mean *B. malayana* or *B. sapida*. Like *rambai*, *tampoi* is often used in compounds. *B. sapida* in India is known as *leteku*, in South China as *lutqua*, in Burma as *kanazo*, and in Malaya as *pupor*. In this case, it is difficult to ascertain just which name should be used properly, since the wider the distribution of a species, the more varied are its common names. There are still many other names used locally in different places for various species, but it is beyond the scope of this paper to deal with all of them. Readers who are interested should consult references listed in the bibliography (Burkill, 1935; Corner, 1952; De Clerq., 1909; Heyne, 1927; Jack, 1825; Marsden, 1811; Meyer, 1935; Newbold, 1839; Ochse, 1931; Smith *in* Koorders & Valeton, 1910; Watson, 1928). In the discussion of the species that follow, the common names have been simplified by choosing the most widely used ones.

So far, no mention has been made of the family to which the genus belongs. *Baccaurea* is a member of the Euphorbiaceae, a large family of flowering plants, including herbs, shrubs, and trees of the most varied aspects. Members of this family are found in nearly all parts of the world, save only the Arctic and Antarctic regions and a few alpine heights. Economically important members of the family are represented both in the Old and the New World.

THE CULTIVATED SPECIES *

1. **Baccaurea Motleyana** *Muell.-Arg. in* DC., Prodr., 15(2): 461. 1866.

Synonym: *Pierardia Motleyana* Muell.-Arg. *in* Flora. 47: 516. 1854.

Common name: *Rambai.*

Plates IX, X, XI, XII.

A medium-sized tree, up to 25 m. tall, 40 cm. in diameter, with rather low, round, bushy, large-leafed crown, with the trunk generally fluted at the base (Plate XI). The bark is whitish or fawn-brown, finely fissured and scaly with small, thin, oblong pieces. The twigs, petioles, and the undersides of the leaves are velvety. The leaf-blades (Plate XII) are 20–35 cm. long, 8–17 cm. broad, slightly obovate-lanceolate to elliptic, acuminate, basally heart-shaped to obtuse, sometimes retuse, the margin entire to slightly uneven and sinuate; lateral nerves twelve to sixteen pairs. The petioles are 3–10 cm. long, subtended by 6–8 mm. long, lanceolate, acuminate stipules. The male racemes (Plate X) are 13–20 cm. long, clustered in bunches along the branches, with minute yellow flowers borne in fascicles of two to five, with very short pedicels. The four to five sepals are oblong, acute, and tomentose on both surfaces. The disk glands are very small, the stamens four to eight, the rudimentary ovary cylindrical, with a concave apex. The female racemes (Plates IX, X, XII) are 25–60 cm. long, also often borne in clusters, with four- to six-sepaled flowers, about 1 cm.

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* The taxonomic treatment of the following four species has been based upon Pax & Hoffmann, 1922.

in diameter, the ovary pubescent, the styles very short. The fruits, produced in great abundance, are about 2–4 cm. in diameter, buff-colored, with a smooth and thin rind, indehiscent. Within there are three to one green seeds enclosed in a translucent white pulp.

The *rambai* is widely cultivated throughout the Malay Peninsula, Sumatra, Kalimantan (Borneo), Java, and Bali. The species is native to the Malay Peninsula and Sumatra; the dates of its introduction to Java and Bali are uncertain. According to Macmillan (1949), it was introduced to Ceylon in 1883. The *rambai*, besides being planted as a fruit tree, is a favorite ornamental due to its bushy and symmetrical shape, which, when planted in a lawn or garden, offers a bold and pleasing outline. As in the other cultivated species, there is a considerable variation in the quality of the fruit, from rather acid to sweet and very palatable.

2. **Baccaurea racemosa** (*Reinw.*) *Muell.-Arg. in* DC., Prodr., 15(2): 461. 1866.

Synonym: *Coccomelia racemosa* Reinw., Catal. Gew. Buitenzorg: 110. 1823; *Pierardia racemosa* Bl., Bijdr. Fl. Ned.-Indië: 579. 1825.

Common name: *Kapundung.*

Plates IX, X, XI, XIII.

A medium-sized tree, 15–25 m. tall, 25–70 cm. in diameter, with the trunk rather straight, often with buttresses, and its crown dense and irregular (Plate XI). The twigs, petioles, the undersides of the leaves, and outer part of stipules are covered with very short, appressed hairs when young, but they are soon glabrescent or glabrous. The leaf-blades are 7–18.5 cm. long, 3–7.5 cm. broad, ovate-oblong or obovate (Plate XIII), acuminate to obtuse, and basally broadly or narrowly cuneate, the margin quite entire, often provided with many

Plate IX

(Top) *Baccaurea Motleyana* Muell.-Arg. (rambai), heavy with inflorescences of various stages. (Lower left) Kapundung fruits sold at roadside near the gate of the Bogor Botanic Gardens. (Lower right) *Baccaurea racemosa* Muell.-Arg. (kapundung), clusters of racemes on burs on trunk of a male tree.

PLATE X

(Top) A fruiting branch of *Baccaurea dulcis* (Jack) Muell.-Arg. (tjupa). (Lower left) A fruiting branch of *Baccaurea racemosa* Muell.-Arg. (kapundung). (Lower right) *Baccaurea Motleyana* Muell.-Arg. (rambai), the vertical branch belongs to a male tree, the horizontal to a female tree.

PLATE XI

(Left) A male tree of *Baccaurea racemosa* Muell.-Arg., in flower (Bogor Botanic Gardens). (Centre) *Baccaurea Motleyana* Muell.-Arg. (the two foreground trees, both with fluted trunks) (Bogor Botanic Gardens). (Right) A female tree of *Baccaurea dulcis* (Jack) Muell.-Arg. (fluted trunk in the foreground) (Bogor Botanic Gardens).

glands which are distinct at the lower surface; lateral nerves in six to twelve pairs. The petioles are 0.5–4.5 cm. long, shallowly furrowed on the anterior side, subtended by more or less triangular, acute, concave, 3–6 mm. long and ca. 2 mm. broad stipules. The male racemes (Plate IX) are 5–13 cm. long, fascicled along old branches or burs on the trunk, many-flowered, composed of numerous, short, three-flowered cymes, densely hairy; at the base of each cyme there are three bracts, the central one the largest. The individual flowers are very small, about 1–15 mm. in diameter, sepals four to five, unequal, hairy on both surfaces, stamens four to eight, about 1 mm. long, arising from the small cavities at the base of the thick, subangular rudimentary ovary. The female racemes are 10–20 cm. long, solitary or fascicled on old branches, the flowers are rather large, 0.5–0.8 cm. in diameter, sepals mostly five, unequal, incurved for about the upper ¼ their length, puberulous on both surfaces. The three- to four-loculed ovary is puberulous, the stigmas sessile. The fruiting racemes are pendulous, 15–20 cm. long, pedicels 1–1.5 cm. long, the yellowish green individual fruits are 2–2.4 cm. in diameter, indehiscent, three to one-seeded, the seeds enclosed within a translucent white to pink pulp.

This species is widely cultivated in Java as a fruit tree as well as a shade tree in the villages. It is also abundant in Sumatra and Bali, and it has been introduced into Bali. According to Pax & Hoffmann (1922), this species has also been introduced into the Malay Peninsula. There are many vernacular names for the fruit, among which are *kapundung* and *menteng*. However, the former is the more commonly used. In Ochse's ***Fruits and Fruiticulture*** (1931), there is confusion between the common name *rambai* (for ***B.*** *Motleyana*), and *kapundung* (for ***B.*** *racemosa*).

There are two varieties: one with white flesh, the true *menteng;* the other with red flesh, the so-called *bentjoj* (Sudanese); both of these have sour and sweet fruits. The sweet fruits are much in demand in the markets, although they are not yet considered as a table fruit.

The tree thrives only below an altitude of 500 m., but in Java it has been recorded that wild trees can grow in an altitude range of 700–1000 m.

3. **Baccaurea dulcis** (*Jack*) *Muell.-Arg. in* DC., Prodr., 15(2): 460. 1866.

Synonym: *Pierardia dulcis* Jack. *in* Trans. Linn. Soc., 14: 120. 1823.

Common name: *Tjupa.*

Plates X, XI, XIV.

A small to medium-sized tree, 12–15 m. tall, up to 50 cm. in diameter, with a strongly fluted trunk and an irregular crown, the leaves are crowded at the end of the glabrous branches (Plate XI). The leaf-blades are 14–18 cm. long, 8–13 cm. broad, glabrous, obovate to elliptic obovate, rounded with a slightly acuminate apicule, basally cuneate, the margin entire; lateral nerves six to ten pairs. The petioles are 3–4 cm. long, subtended by ovate stipules. This species differs from the former two by being monoecious. The male and female inflorescences are separated from each other by old, naked branches. The male racemes are 6–11 cm. long (Plate XIV), farinaceous-pilose throughout, bearing yellowish, fragrant flowers. The sepals are mostly four, the stamens six, very short, the rudimentary ovary is concave. The female racemes are 5–14 cm. long, bearing four- to five-sepaled flowers. The ovary is three-loculed, with three papillose, almost sessile stigmas. The fruits are larger than those of *B. racemosa,* measuring 3.5–4 cm. in diameter.

The species is cultivated only locally in Sumatra(Lampung and Bangkahulu), and in a few parts of western Java, where it is often confused with *B. racemosa*, the *kapundung* (Heyne, 1927; Ochse, 1931; Smith *in* Koorders & Valeton, 1910). In south Sumatra, it is very common; the fruits are offered for sale in the markets of Palembang. In Sturtevant's *Notes on Edible Plants* (Hedrick, 1919), a confusion occurs between this fruit and the *rambeh*, which is *B. Motleyana*, while Jack (1825), due to lack of information, is of the opinion that the *tjupa* and the *rambeh* are different varieties of *B. dulcis*. Again, in Sturtevant's *Notes*, *B. dulcis* is mentioned as being cultivated in China. This is incorrect: what Royle, from whose book the statement was cited, referred to is *B. sapida*.

4. **Baccaurea sapida** *Muell.-Arg. in* DC., Prodr., 15 (2): 459. 1866.

Synonym: *Pierardia sapida* Roxb., Fl. Ind., 2: 254. 1832.

Common names: *Lutko* or *latka* (India), *lutqua* (China), *kanazo* (Burma), *pupor* (Malaya).

Plate XV.

A medium-sized tree, up to 25 m. tall, young branches densely hairy, later glabrescent. The leaf-blades are 10–20 cm. long, 4–9 cm. broad, glabrous, ovate to ovate-lanceolate, obtuse, tapering to cuneate at the base, the margin subdentate to entire; lateral nerves six to eleven pairs. The petioles are 1.5–8 cm. long, subtended by 6 mm. long, lanceolate, fimbriate stipules. This species is dioecious. The male racemes are 2.5–7.5 cm. long, borne usually on the branches or on the trunk, the female ones are about 14 cm. long, lower on the trunk; both inflorescences are tomentose. The male flowers are fascicled on very short lateral rhachises, the pedicels are ca. 1 mm. long, the unequal sepals are four to five, the stamens four to eight, and the rudimentary ovary is cylindrical. The female flowers are solitary on the rhachis, the pedicels ca. 1 mm. long, the sepals 5–6 mm. long, the hairy ovary is two to three-loculed tipped by papillose, two-lobed, sessile stigmas. The fruits, are 2.5–3 cm. in diameter, glabrous, cream white, ripening yellowish, pinkish buff or bright red, in strings 15–30 cm. long. The seeds are enclosed in a rather opaque, cream-white pulp (Plate XV).

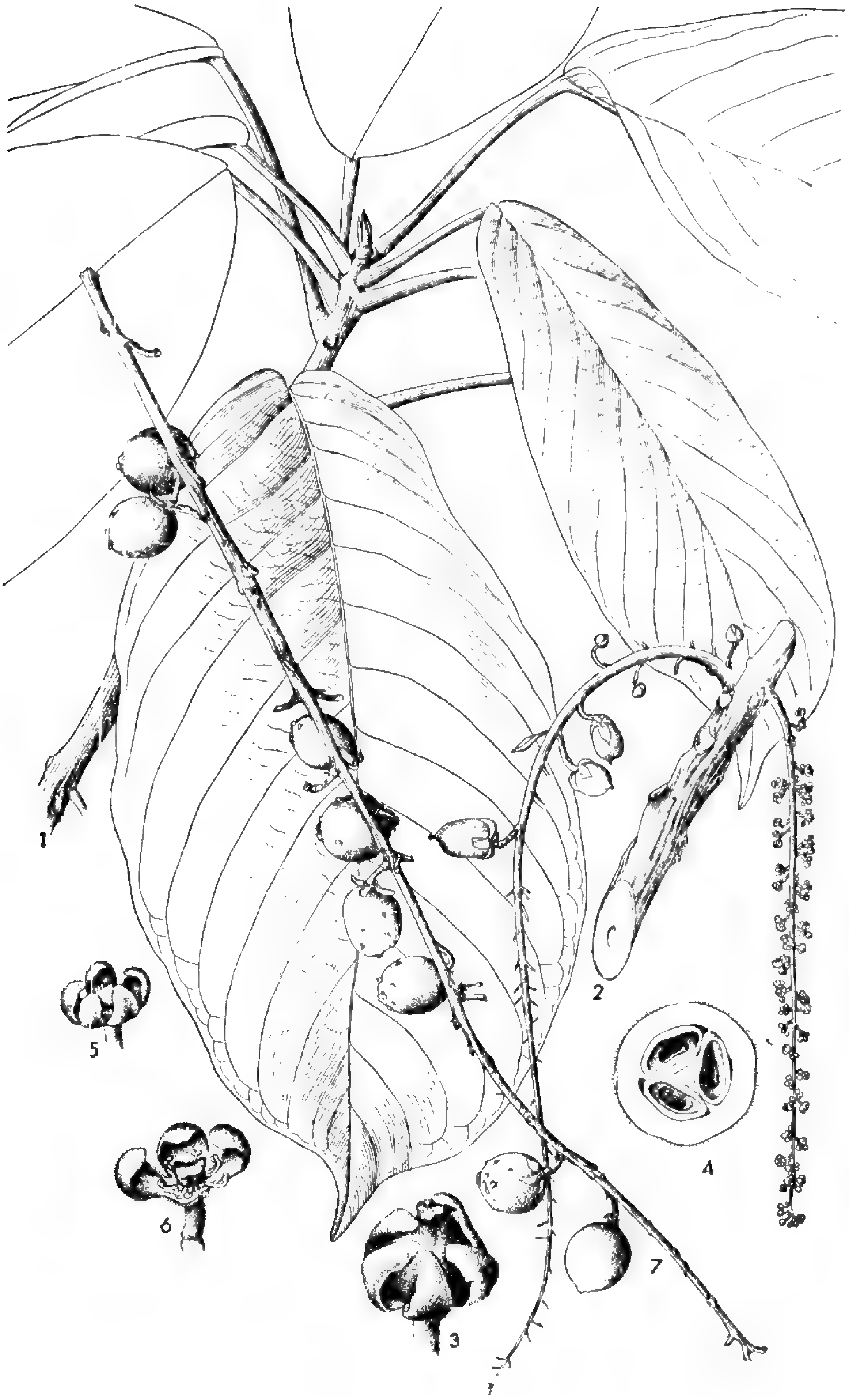
The *kanazo*, referred to *Pierardia sapota* by Pickering (1879), has been known by the Burmese since 1539 B.C., when the country was first inhabited. Mason describes the fruit as "one of the best and most plentiful of the jungle fruits, and the bunches resemble large grapes."

The distribution of this tree is the most extensive of the cultivated species of *Baccaurea*. It occurs wild as well as under cultivation in Nepal, India, Burma, southern China, Indo-China, Thailand, the Andaman Islands, and the Malay Peninsula. In India (Pax, 1922) and in Malaya (Corner, 1952), it is the most commonly cultivated species. Corner reported (1952) that *pupor* seems to be the only kind of *Baccaurea*, other than the ubiquitous *rambai*, that is cultivated in Malaya. In Rangoon, the fruits are plentiful (Watt, 1899). The fruits vary considerably in the color of the rind when ripe, and apparently there are some varieties with yellow fruits and rose-pink pulp around the seeds. The *pupor* is distinguished from the *rambai* by its smaller glabrous leaves which are basally tapering.

ORIGIN AND DISTRIBUTION

There is no serious problem as to the origin and distribution of the species of *Baccaurea*. The area of distribution of the genus extends from India to the Pacific through Ceylon, the Andaman Islands, south China, Indo-China, Burma, Thailand, the Malay Peninsula, the

Plate XII



Baccaurea Motleyana Muell.-Arg. 1, a branch with leaves (2/5×). 2, female inflorescence (2/5×). 3, a female flower, styles dropped off (1 3/5×). 4, a young fruit, cross section (1 1/5×). 5, a male flower (2×). 6, a male flower with two sepals removed. 7, a raceme with fruits. (1–6 drawn from a living specimen at the Bogor Botanic Gardens, label no. III.F.60A; 7 drawn from Enderst's collection, no. 93-EP-758, Sumatra, Palembang).

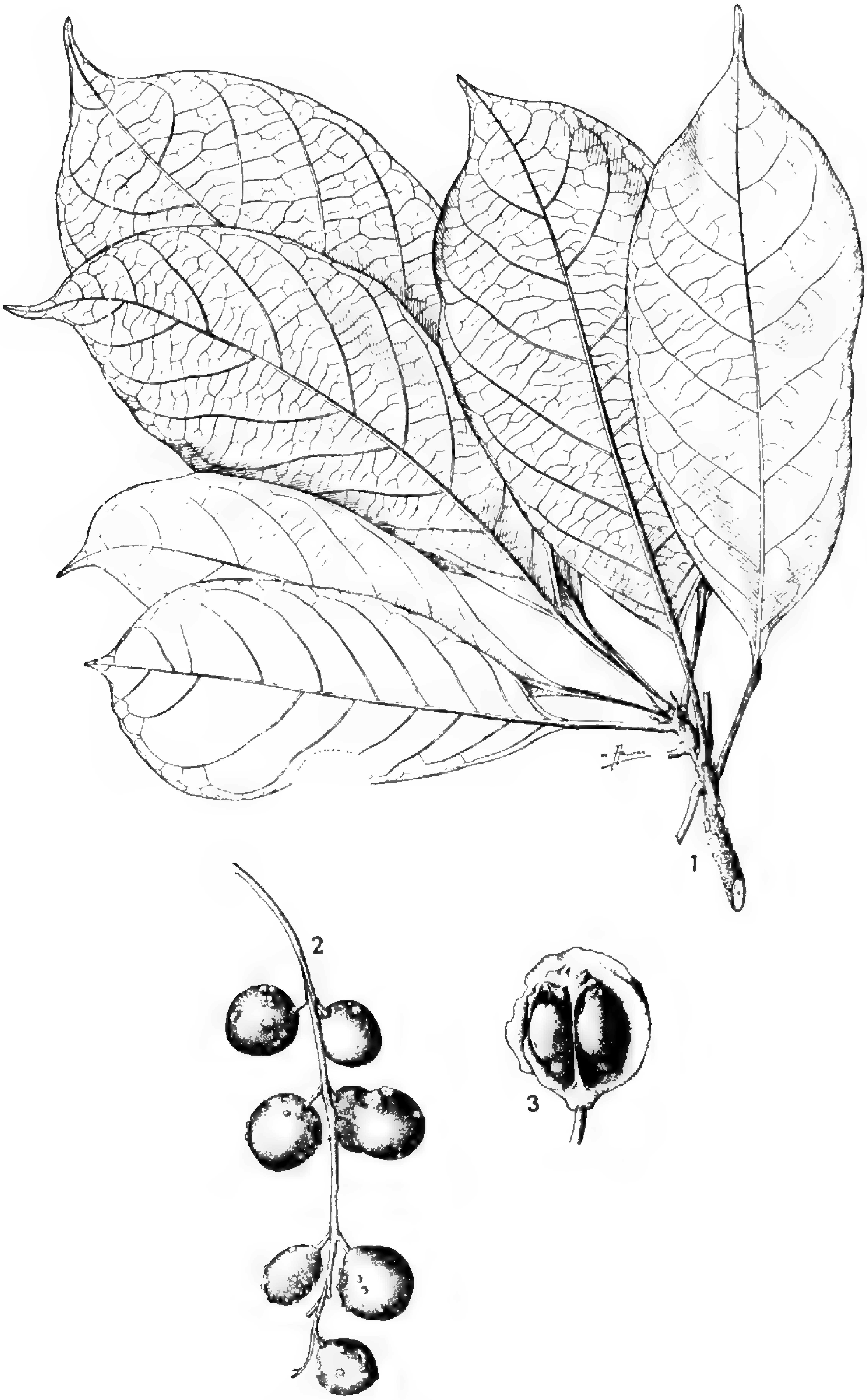
Philippines, Indonesia, New Guinea, Fiji, and Tahiti. The centre of distribution is western Malesia; twenty two species occur in the Malay Peninsula, twenty in Sumatra and adjacent islands, fourteen in Kalimantan (Borneo), five in the Philippines, and five in Java. Thirteen species are endemic to the Malay Peninsula, seven to Sumatra, five to the Philippines, six to Kalimantan, and one to Java.

The cultivated species, which have been mentioned in the preceding pages, also occur in the wild state: *B. Motleyana* — in the lowland forests of the Malay Peninsula; *B. racemosa* — in the forests of Java, Sumatra, and probably Kalimantan; *B. sapida* — in the forests of India, at the base of the Himalayas, in Burma, and in Thailand. According to Charles Pickering (1879), *B. sapida* has been cultivated for a long time, from at least 1000 B.C. Yet, it cannot be regarded as highly domesticated. So far as I know the dates of the first domestication of the other species have not been recorded.

Studies on the variation and cytogenetics of the species of the genus have not been carried on, or at least very little, if anything, has been done in this respect.

When we speak of the distribution of a species, naturally the question always arises — how does it spread? Roughly, but not strictly, the fruits of *Baccaurea* can be differentiated into two types: a capsule, which splits open when dry; and a berry, which does not. In both types, the seeds are enclosed by an aril. Whether this is a "true arillus" or just an "arillode" (a false arillus) is still doubtful. Ridley suggested that the aril in *Baccaurea* is but a modification of the testa. The actual origin of the aril, however, is comparatively unimportant, although it is a point of interest in the evolution of the species. Regardless of whether or not it be a true or a false aril, it plays an important role as the agent of dis-

Plate XIII



Baccaurea racemosa (Reinw.) Muell.-Arg. 1, a branch with leaves (3/7×). 2, a fruiting raceme (3/7×). 3, a fruit, dissected to show the seeds which are still enclosed within an arill (6/7×). (All drawn from Forman 425, Kalimantan, Gunung Sahari.)

persal. In the berry-type species, monkeys, bear-cats (*Arctitis binturong*), squirrels, lemurs and even birds eat the fruits, because they are attracted by the color or the smell (Ridley, 1930: 344, 352, 376; Marsden, 1811 : 101); they pass the seeds through their digestive tracts unharmed. Thus, the seeds are distributed to places far from the mother plants. Bats, the night wanderers, which are common in Indonesia, are undoubtedly very important in dispersing the seeds of *Baccaurea*. In the splitting-type fruit, which is called *jintek-jintek* or "flick-flick"—from the fact that it gives a flicking sound when it splits (Burkill, 1935)—the seeds are thrown out to an appreciable distance, so that the seedlings can grow to maturity without severe competition in obtaining food from the mother plants. Man, of course, is an important agent of plant dispersal, and this is true also for the cultivated species of *Baccaurea*.

Cultivation and Propagation

Generally, no special care nor labor is necessary in cultivating the *rambai* or *kapundung;* the method of planting is still very primitive and is usually of a haphazard nature. In a few instances, new plantings receive some care during the early stages of growth; but, as soon as the plant reaches a mature state and begins flowering and fruiting, it will be left by itself, while at the same time the fruits are continuously picked. Manuring or any other attempt to help the plant grow and yield more fruit is rarely practiced. The same is true in regard to the improvement in quality of the fruit, such as by selection or hybridization, a result, primarily, to lack of knowledge and appreciation.

The *rambai* and *kapundung* are readily raised from seed and grow well in most soils, but the *rambai* prefers alluvial soils near rivers or places where water is readily

PLATE XIV

Baccaurea dulcis (Jack) Muell.-Arg. 1, a branch with leaves (3/7 ×). 2, female inflorescences (3/7 ×). 3, male inflorescences (3/7 ×). 4–6, fruits, in 5 the rind has been removed to expose the seeds which are still enclosed within an aril (all 3/7 ×). (1 and 2 drawn from Dumas s.n., Sumatra, Palembang; 3 drawn from Grashoff 608, Sumatra, Palembang; 4–6 drawn from C.N.A. Voogd 498, Sumatra, Palembang.)

available (Malayan Agric. J., 1935). Seedlings should be set out 8 10 m. apart, so that when the plants mature, the dense crowns are not crowded together.

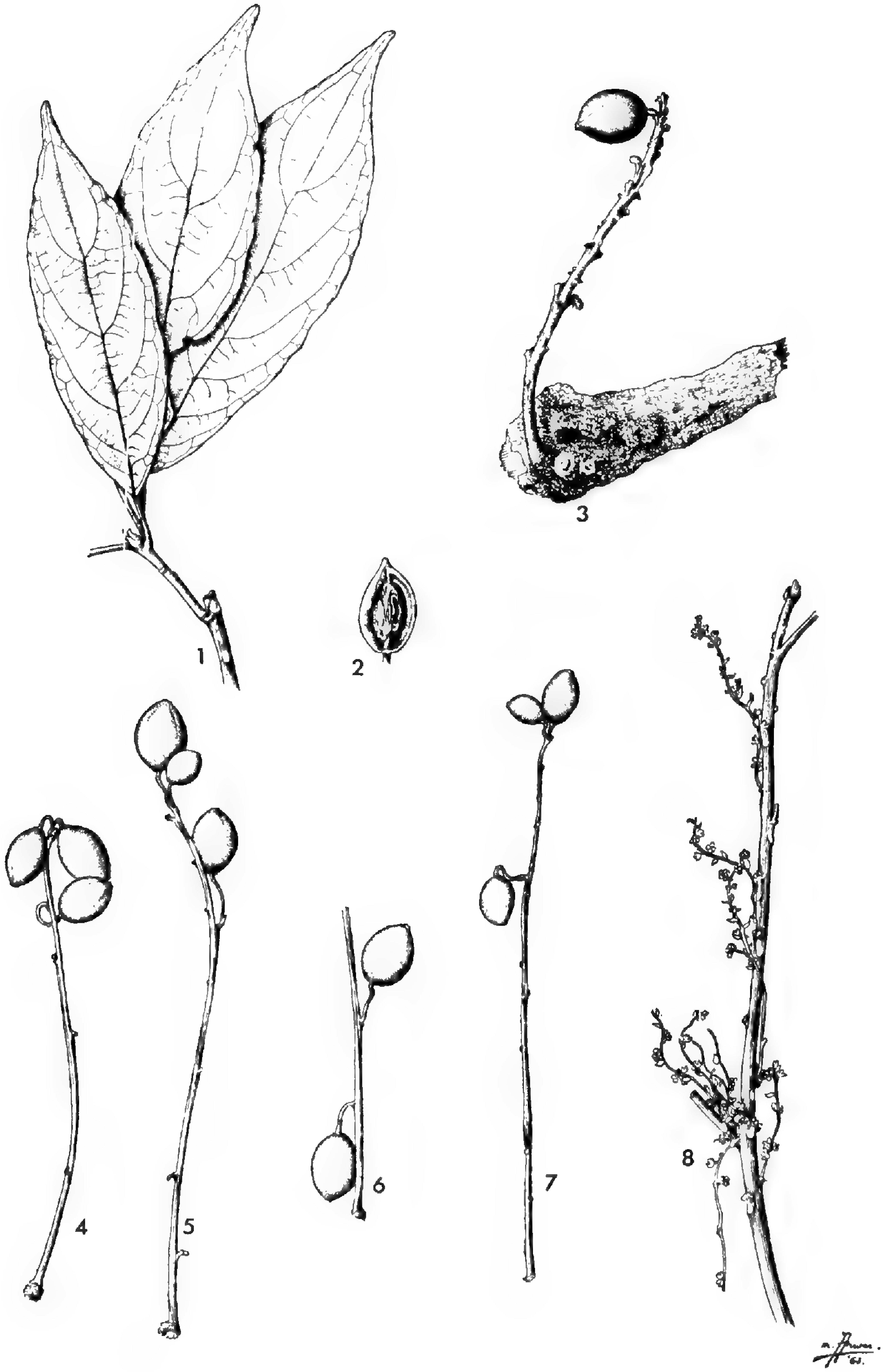
An experiment to propagate the *rambai* and *kapundung* by the "budding method" at the Ragunan Experiment Station, Pasar Minggu, Djakarta, Indonesia, was carried out in 1933. A modification of the Forkert method was used and can be summarized as follows: On the stock plant, a transverse incision is made in the bark as deep as the cambium, after which a flap of the bark, 4 cm. long and 1 cm. wide, is pulled down, either in one piece or else in several small strips. From the strips of the bark torn loose, two-thirds are cut off and the end trimmed. A shield-shaped bud, the scion, with no wood adhering, is then inserted and bound up with raffia.

In the original Forkert method, the bark is not pulled down but is cut loose. This method has also been used, but it proved to be unsatisfactory. In the modified method, there is an advantage, because, if the bark fails to peel properly or tear off in small pieces, it indicates that the cambium is inactive and in an unsuitable condition for budding. Thus, it is possible to ascertain whether the stock is fit or not before commencing further budding operations.

About three weeks after budding, the raffia is removed, and the scion commences to grow. For best results, this budding operation should be carried out during the rainy season.

With this method, attempts have been made to use non-petiolate, one-year-old budwood of ***Baccaurea Motleyana*** as the scion, while fourteen-month-old ***B. Motleyana*** and ***B.*** *racemosa* have been used as the stock. With both stocks, the results were 50% successful. It should then be possible to improve the quality of the fruit. If this method be extended to the villages, where the most

Plate XV



Baccaurea sapida Muell.-Arg. 1, a branch with leaves. 2, a dissected fruit. 3–7, fruiting racemes. 8, male inflorescences. (All 3/7 ×.) (1–3 drawn from M. Nur 11123, Malay Peninsula, Pahang; 4–7 drawn from Pcilane 1271, Indo-China; 8 drawn from L. Pierre 395, collected from the Bogor Botanic Gardens.)

haphazard plantings are carried on, the future of the *rambai* and *kapundung* fruit will be promising.

So far as I am aware, no breeding experiments have been reported. But it is hoped that plant breeders who happen to read this paper may be encouraged to consider the problem and its potentialities, so that, in the near future, we will have *Baccaurea* fruits of a larger size, sweeter and more palatable taste and smaller seeds and that they may be made available with other canned fruits everywhere.

PESTS AND DISEASES

Since the *rambai* and *kapundung* are not yet commercially important, little attention has been directed to a study of the diseases and damages suffered by the plant and its fruits. Consequently, our knowledge of those aspects of the problem is very meagre.

Naturally, like other fruit trees, the *rambai* and *kapundung* are liable to damage from parasitic and epiphytic plants. The former are the more harmful, for they send sucking roots, haustoria, into the vascular system. The most injurious of all the parasites, and the most common in the cultivated areas, are several species of *Loranthus* (Loranthaceae), the centre of distribution of which, coincidentally, is likewise in western Malesia. These parasitic mistletoes seldom kill their host plants outright, but they do considerable damage to the branches on which they grow. The only way to combat them is by cutting off the branches that are badly affected below the part on which the parasites have taken hold. The majority of the epiphytes, such as ferns and certain apocynaceous species, do little damage. The most injurious are *Drymoglossum piloselloides* and *Dischidia nummularia* (Grist, 1936).

Insects, especially caterpillars and scale insects, are often troublesome, though not seriously injurious. Red ants (*kerengga* or *kelangkrang*), *Oecophylla smaragdina* (Grist, l.c.), are probably the greatest pests. They make their nests among the branches by drawing a number of leaves together. The only way to destroy these insects is by burning their nests.

Fungous diseases, which infect the leaves or fruits and other microorganisms living in the roots and which may cause the death of the plants have not as yet been studied.

MARKETING OF RAMBAI AND KAPUNDUNG

The *rambai* and *kapundung* fruits are produced mostly in villages, valleys, and foothills, localities relatively far from the markets. In season, the fruits are produced in great abundance. The *rambai* season in Malaya falls between August and September (Macmillan, 1949); in Java, the *kapundung* season is between January and March (Ochse, 1931). The fruits are collected before they are completely ripe on the tree—that is, when they turn yellowish or brownish. They are picked from the tree in bunches, put into baskets and taken directly by the owner to market for sale. In this case, the price is usually low. But very often the fruits are disposed of at roadside to traveling dealers or sold directly to the customers. Selling the fruits while they are still on the tree, a practice known as *idjon*, as with *durian* (*Durio Zibethinus*), *rambutan* (*Nephelium lappaceum*), and *langsat* (*Lansium domesticum*), is very rarely or never practiced with *rambai* and *kapundung*. Since there is no attempt to increase yield of the fruit, the unit of production is too small to allow good prices to be obtained; but in the case of roadside sales, this factor is sometimes overcome by the owners' arranging to take their produce to a definite place on a particular date, thereby obviating the necessity for a dealer to visit several places before obtaining a sufficient supply to meet his requirements. Marketing facilities of both *rambai* in Malaya and *kapundung* in Java are very poor, and the producer is entirely at the mercy of the buyer.

In Malaya, *rambai* is becoming increasingly popular, as shown by the results of two surveys of fruit production: one by Olds in the Malacca Territory in 1933 (Table II); the other by Jolly in Pahang in 1932 (Table III). The popularity of *rambai* fruit is shown in the two tables. Even so, *rambai* is still far inferior to *rambutan* and *durian*.

TABLE II

The ten commonest fruits in Malacca

Name of Fruit	No. of holdings on which represented
Coconut	153
Rambutan (*Nephelium lappaceum*)	156
Durian (*Durio Zibethinus*)	123
Banana	116
Mangosteen (*Garcinia Mangostana*)	112
Jack fruit	97
Langsat (*Lansium domesticum*)	93
Bachang (*Mangifera* sp.)	82
Rambai (*Baccaurea Motleyana*)	79
Mango	67

NUTRITIONAL VALUE OF THE FRUIT

Although it has been stated that eating *kapundung* in large quantities causes vomiting (Parkinson, 1923) and that the fruit of *pupor* (*Baccaurea sapida*) should be eaten with caution (Parkinson, l.c.), no toxic properties due to alkaloids or similar chemical constituents have been recorded for these fruits. Vomiting caused by eating too much of the fruit is due probably to high acid

TABLE III

Order of Popularity of Fruits as amongst Districts and Percentage of the Total Holdings on which Individual Fruits are Planted.

LIPIS		RAUB		BENTONG		TEMERLOH		KUANTAN		PEKAN	
	%		%		%		%		%		%
Coconut	94	Rambutan	100	Banana	91	Coconut	100	Mango	87	Coconut	96
Langsat	91	Durian	96	Jack Fruit	91	Jack Fruit	78	Rambutan	75	Mango	83
Durian	87	Banana	93	Coconut	83	Rambutan	75	Durian	75	Jack Fruit	76
Rambutan	82	Coconut	89	Rambutan	83	Mango	68	Rambai	75	Rambutan	71
Jack Fruit	78	Langsat	89	Durian	83	Banana	66	Coconut	50	Mangosteen	68
Mangosteen	75	Mangosteen	85	Mango	75	Mata Kuching	56	Mangosteen	37	Banana	68
Bachang	64	Bachang	78	Mangosteen	66	Langsat	53	Jack Fruit	37	Rambai	66
Mata Kuching	64	Mata Kuching	78	Pineapple	66	Durian	50	Bachang	37	Jering	56
Mango	63	Jack Fruit	75	Bachang	66	Bachang	46	Langsat	25	Bachang	53
Pomelo	60	Rambai	71	Jering	66	Mangosteen	41	—		Durian	50
Jering	53	B. Buloh	60	Langsat	58	Rambai	41	—		Pineapple	33
Blimbing Buloh	52	Jering	57	Rambai	58	Pomelo	33	—		Pomelo	31
Rambai	51	Pomelo	50	B. Bulon	50	B. Buloh	33	—		B. Buloh	20
Banana	50	Mango	39	Pomelo	50	Jering	21	—		Langsat	10
Pineapple	25	Pineapple	25	Mata Kuching	33	Pineapple	16	—		Mata Kuching	6

concentration. So far, only *kapundung* fruit has been analyzed chemically. The fruit consists of 5.5 g. of fleshy rind, 12 g. of pulp, and 1.5 g. of seeds. Analysis of the pulp shows that it is composed of: H_2O, 82.32%; protein, 0.36%; raw fibres, 0.21%; raw ashes, 0.48%; carbohydrate, 0%; saccharose, 7.47%.*

OTHER ECONOMIC ASPECTS OF THE GENUS

WOOD

The wood of most species of *Baccaurea* is strong and durable. Various uses of the timber by the natives have been recorded, but it is still commercially neglected. Data in the following discussion have been compiled from Burkill (1935), Heyne (1927), Ridley (1902, 1903), and Smith (*in* Koorders & Valeton, 1910).

1. ***B. bracteata*** (Malay Peninsula, Kalimantan)

Wood very similar to ***B.*** *malayana* (see below), but the transverse bars are finer and the color is darker. Weight 78 lbs. 12 oz. per cubic foot (all weight of the wood that follows is measured in cubic feet).

2. ***B. dasystachya*** (Sumatra)

The timber is used in house construction, for posts and roof beams. The wood is easily worked and durable.

3. ***B. dulcis*** (Sumatra)

The wood is very durable but rarely used for ground construction.

4. ***B. Griffithii*** (Malay Peninsula)

The timber is reported to be strong (Burkill), but no further information is given.

5. ***B. javanica*** (Sumatra, Kalimantan, Java, Sulawesi or Celebes)

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*(Data from: König, J. Chemie der Menschlichen Nahrungs- und Genussmittel, suppl. 2, ed. 4, 2: 380. 1923).

The wood is very strong and durable, and it is used for posts in house construction in Java. In Nusakambangan (an island in the southern part of Central Java), it is used as the principal piles in the harbor. Most of the posts measure between 35–40 m. in length, with a diameter of 55–66 cm. In Palembang (Sumatra) and Minahasa (Sulawesi), the timber is also used for the same purpose. At Menes (Java), it has been reported that the wood is used for carving.

6. ***B. Kingii*** (India, Malay Peninsula)
According to Alvins (quoted by Burkill), the wood is very durable and serviceable for house beams.

7. ***B. lanceolata*** (Malay Peninsula, Sumatra, Kalimantan, Java)
The timber is very durable and is used for house building (Alvins, n.v.; Heyne).

8. ***B. macrophylla*** (Malay Peninsula, Kalimantan)
The wood is very durable and is employed in various ways, such as for house beams, posts, planks, etc., and, due to its toughness, it is often used for the beams of carts.

9. ***B. malayana*** (Sumatra)
A well known fruit tree, 15–20 m. tall. The wood is light brown in color, with tolerably distinct rings and numerous moderate size pores; the rays are mixed between the fine and the broad ones, and there are fine transverse bars running across. Weight 54 lbs. It is a durable wood but is apt to split. It is useful for beams and posts.

10. ***B. Motleyana*** (Malay Peninsula, Kalimantan, Sumatra)
The wood is rather soft and light colored, similar to ash wood, and the rays are thick and the pores large.

The weight is 33 lbs. 12 oz. to 87 lbs. 2 oz. Heyne reports that the timber is used for posts, but it seems to be of poor quality. It is a good fire wood.

11. *B. minor* (Malay Peninsula)
The wood is light, reddish fawn in color; weight 46 lbs.

12. *B. parviflora* (Malay Peninsula, Sumatra, Kalimantan)
Wood compact and hard, often used to make clubs by the Malay. Light fawn or yellow in color, with large and fine rays mixed and connected with very small transverse bars. Weight 23 lbs. Probably of use for work in which box-wood is commonly used (Ridley).

13. *B. polyneura* (Malay Peninsula)
The wood is very durable and good for house posts.

14. *B. racemosa* (Sumatra, Java, Kalimantan ?)
The timber is good for house building, boat and other construction. It is particularly strong, fine and handsome, and it is often used as furniture (Hasskarl, quoted by Heyne). The physical character of the wood has been discussed extensively by Janssonius in his *Mikrographie des Holzes*.

15. *B. reticulata* (Malay Peninsula, Sumatra)
Maingay described the timber as of a dull red color, fairly hard, and stated that it does not split on drying; weight 52 lbs. 6 oz.

16. *B. sapida* (Nepal, India, Indo-China, Burma, Malay Peninsula)
Wood grayish brown, soft, with transverse lines of wood parenchyma very numerous, pores small, in short, radial lines; pith rays moderately broad to broad, the distance between the rays being from one to three times the transverse diameter of the pores. Easily worked and fairly durable.

17. *B. sumatrana* (Sumatra)
Durable to insect attacks, and, therefore, valuable for beams in houses.

18. *B. symplocoides* (Malay Peninsula)
Wood with close grains, light fawn in color, with distinct rings, rays rather distant and broad, pores small and few.

19. *B. Wallichii* (Malay Peninsula)
Trunk 12–20 m. tall; wood red, suitable for beams, because it is durable.

20. *B. Wrayi* (Malay Peninsula)
According to Burkill, the timber is good for house posts.

An extensive study of the wood structure of *Baccaurea* has been carried on by Janssonius (1929, 1934); a summary of the results follows: 1. Most of the wood consists of non-septate libriform fibres with very thick walls and a minute cavity. 2. Metatracheal parenchyma abundant, sometimes as nearly the same mass as the libriform fibres. 3. Vessel perforations in part to exclusively scalariform, often varying within the genus. These characters are very important taxonomically (Janssonius, 1929).

A new and promising prospect has also been brought out by Janssonius' study: that the wood of *B. racemosa* (quite probably also the other species) is suitable for paper pulp. The technical properties of a good pulp wood, i.e., great length of fibre, minimum content of gum and resin, ease of pulping and bleaching, light color—these are well met by *B. racemosa.* The time needed for macerating the wood is also short (one sixth of the time usually required for other woods); the color disappears quickly and completely; and the fibre walls are readily de-lignified. Further details of this process are given in *Tropical Woods*, 18: 1–3, and in *Mikrographie des Holzes.* In

Table IV, a comparison between various species of Euphorbiaceae investigated as to fibre length and time required for maceration relative to that for other woods is presented (from *Tropical Woods*, 18: 1–3).

TABLE IV

Size of Fibers and Relative Time Required for Maceration

Scientific name	Length mm.	Diameter μ	Wall μ	Relative time
Antidesma Bunius	1.5–3.0	25–32 x 28–35	4–5	1/5
Aporosa microcalyx	1.8–2.5	15–28 x 15–25	7–14	1/6
Baccaurea racemosa	2.0–3.3	20–28 x 20–25	9–10	1/6
Bischofia javanica	1.5–2.6	15–45 x 30–45	5–7	1/5
Bridelia minutiflora	1.3–1.7	15–20 x 18–20	3	1/6
Cleistanthus sumatranus	1.4–2.0	10–25 x 15–20	5–7	1/6
Cyclostemon longifolius	2.0–2.7	10–17 x 12–18	6–7	4/10
Glochidion capitatum	1.0–2.0	25–40 x 22–40	3–7	1/25
Glochidion rubrum	1.2–1.7	. . . .	. . .	1/20
Phyllanthus emblica	. . . . .	. . . .	. . .	1/4
Phyllanthus indicus	0.9–1.8	8–18 x 12–20	4	1/20
Putranjiva Roxburghii	2.1–3.2	15–20	8–9	1/10

BARK, LEAVES, ROOTS

The medicinal properties of the genus as part of native medicine have long been recorded. The bark of *rambai* has been mentioned by Skeat (1909) as forming one of the ingredients of the *rempah ratus* (the hundred herbs), a mixture concocted from all kinds of herbs, roots, and spices, and given to mothers after confinement. The ingredients are put into a large vessel of water and left to soak; a portion of the liquor is strained off and given to the patient as a potion every morning. An extract is applied to the patient's waist, and a set of fresh ingredients replaces the old ones. Diarrhea (called *meroyan tahi*) following child-birth is cured by drinking the extract of boiled roots of *setambun*, along with cloves, bruised nutmegs, seven fruits of *chabai* Java (Java long pepper) and *ibu kunyit* (a finger of a fresh turmeric rhizome), while the ground leaves and husked rice is rubbed over the whole body in the night time (Burkill & Haniff, 1930: 400–401). An extract of the leaves of ***B.*** *brevipes* may be used to regulate menstruation (de Clerq, 1909). The pounded bark of the *rambai* tree, sometimes mixed with the leaves of *Adenostemma viscosum* and *Mimusops elengi,* is used to cure "sore eyes" (Burkill & Haniff, 1930: 248). There is also mention of the use of an unidentified species of ***Baccaurea,*** *tambun tahi,* as an elephant medicine, the juice being given internally (Maxwell, 1906). According to Burkill (1935: 278), the leaves of ***B.*** *racemosa* contain an alkaloid.

The dyeing properties of the bark and the leaves have also been reported. The dyers of Pekan (Malay Peninsula) use the bark of ***B.*** *Motleyana*; those of Sulawesi get a yellow color from the bark of ***B.*** *minahassae* (Burkill, 1935); and those of eastern Java employ the bark of ***B.*** *racemosa* for a mauve color (Smith *in* Koorders & Valeton, 1910). As has been mentioned previously, the leaves of ***B.*** *sapida* in northern Benghal and Assam are used for dyeing (green?), while the bark is used as a mordant in dyeing with madder and lac.

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BOTANICAL MUSEUM LEAFLETS
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EARLY ARCHAEOLOGICAL MAIZE FROM VENEZUELA

BY

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DURING the field work season of 1963 in the valley of Quibor, State of Lara, Venezuela, excavation of a site, under the direction of Mario Sanoja O., uncovered several maize cobs at the bottom of a cut. The valley, located in the vicinity of the city of Barquisimeto at an altitude of about 500 meters, is a dry region with a xerophytic vegetation. It has a long archaeological sequence beginning at least 200 B.C. and lasting until post-Conquest times. This area is one of the key points of the Andean Archaeological Project under the auspices of the Universidad de los Andes.

The last aboriginal settlement of the valley, known as the Guadalupe phase, was characterized by mound dwellings associated with polychrome pottery, bone artifacts, and zoological and botanical remains. The most important mound complex is the El Tiestal site designated as L-1. Here mounds are arranged in a more or less circular fashion with a central plaza and two smaller mounds externally placed on an axis corresponding to the diameter of the circle. It was in one of these, designated E-1,

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that a cut was excavated. The first two levels (40 cm.) produced a substantial number of sherds. Below this the clay used to build the mound was almost sterile, except for several thin layers of ash and charcoal containing a few sherds. Below the sterile clay at level 6 (120 cm.), there appeared a thick deposit of ash and charcoal from which seventeen charred maize cobs and a charred mass of ears were recovered. Also present in this layer were sherds, seeds of *Caesalpinia coriaria*, an unidentified palm nut, charred wood, deer, rabbit, bird and snake bones, and a large number of insect larval cells. Beneath the ash deposit was a completely sterile gravel layer of undetermined depth.

TABLE I. Comparison in various ear characteristics of the prehistoric corn from El Tiestal site, Venezuela, with those of the modern race Pollo.

Characteristic	Prehistoric	Apollo*
Diameter mm. ear	22.0	29.3
“ “ cob	13.0	14.3
“ “ rachis	3.0	8.1
Length mm. rachilla	2.0	1.4
“ “ glumes	5.0	3.1
Kernels, length mm.	7.5	8.54
“ width “	6.3	7.94
“ thickness mm.	4.1	4.96
“ row number	8	10

* Data from Roberts *et al.*, 1957.

The maize cobs found at this site may be the oldest prehistoric maize yet found from sites in northern South America. It appears to be an early form of the primitive Colombian popcorn race, Pollo, described by Roberts *et al.* (1957). Especially convincing are the ears which occurred in the charred mass. One of these proved to be quite well preserved and furnished the data on the various dimensions set forth in Table I, where they are compared with the corresponding dimensions of modern Pollo.

In all of its ear characteristics, this specimen is similar to modern Pollo except that it is smaller in most of its parts. It is more primitive than modern Pollo in having a lower kernel-row number, a more slender rachis, and longer rachillae and glumes. As in Pollo, the kernels are rounded.

Table II. Characteristics of cob fragments from El Tiestal site, Venezuela.

Cob No.	Row No.	Diam. Rachis	Length mm.	Kernel Spaces	Kernel Thickness
2	8	6	28	10	2.8
3	8	5	15	6	2.5
5	8	5	22	6	3.7
6	8	4	22	6	3.1
7	10	6	24	8	3.0
8	8	6	17	5	3.4
9	10	5	22	7	3.1
11	8	6	12	4	3.0
12	8	4	17	6	2.8
13	8	5	18	6	3.0
14	8	4	24	6	3.0
15	8	3	15	5	3.0
16	10	5	17	5	3.4
17	8	3	15	5	3.0
18	10	3	9	3	3.0
19	8	—	12	3	4.0
21	10	4	9	3	3.0
Average	8.6	4.6	17.5	5.5	3.2

A photograph of this cob (with its ear cross-section diagram) is shown in Plate XVI.

Measurements were made also on the seventeen cob fragments, and these are set forth in Table II. The length of the fragment divided by the number of spaces once occupied by kernels shows the average amount of space available for the kernels. This is approximately the equivalent of kernel thickness.

The average dimensions of the seventeen fragments are slightly higher than those of the single well preserved ear but, like it, they are lower than those of modern Pollo.

Although the fragments are quite uniform with respect to kernel-row number and space per kernel, they are rather variable in the shape and hairiness of their cupules. This indicates that the plant is not a wild corn: it may represent a corn in an early stage of domestication.

The race Pollo, which occurs on the eastern slopes of the eastern cordillera in the Departments of Cundinamarca and Boyacá in Colombia at elevations of 1600 to 2160 meters, is regarded by Roberts *et al.* as the most primitive race of maize in Colombia. It has the smallest plants and shortest ears and one of the most limited distributions of any of the Colombian races. It has all of the aspects of a relict race. These authors also point out that Pollo may be related to the primitive popcorn race of Peru, Confite Morocho, which is also a maize cultivated at high altitudes (cf. Grobman *et al.*, 1961). If so, Pollo may represent the earliest introduction of maize from Peru into Colombia and from there to Venezuela.

Grant *et al.* (1963) in "Races of Maize in Venezuela" report the occurrence of Pollo at altitudes of 1300–2400 meters in the states of Tachira, Merida, and Trujillo. It is most abundant in Tachira adjacent to the general region where it occurs in Colombia. These authors call attention to the resemblance of Pollo to several highland races of Guatemala, especially Serrano and Nal-Tel Tierra Alta (Wellhausen *et al.*, 1957). Nal-Tel in turn is apparently a direct descendant of the prehistoric wild corn found in the caves of Tehuacán (cf. Mangelsdorf *et al.*, 1964).

PLATE XVI

Charred cob from El Tiestal site, Venezuela, with its ear cross-section diagram. Actual size.

A third possibility is that Pollo represents the domesticated form of a wild maize which once grew in Colombia and Venezuela. As the result of their genetic studies of the tunicate locus in maize, Mangelsdorf and Galinat (1964) have concluded that there were once at least two races of wild maize in Mexico. There may well have been additional wild races elsewhere in America, of which one was the ancestor of Pollo.

The archaeological specimens from the El Tiestal site do not distinguish between the three above possibilities: (1) an early introduction of the race Confite Morocho from Peru, (2) an early introduction of the race, Nal-Tel from middle America, (3) an independent domestication of an indigenous wild corn. They show only that there was cultivation of maize in Venezuela at an earlier date than had previously been reported.

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THE PSYCHOTROPIC *BANISTERIOPSIS* AMONG THE SIBUNDOY OF COLOMBIA

BY

MELVIN L. BRISTOL

I

THE malpighiaceous psychotropic drugs of northwestern Amazonia have long fascinated numerous native peoples of that region, but it was not until about a century ago that their existence became more widely known. Villavicencio (*44*) wrote of the Záparo in eastern Ecuador, in 1858, saying, "They take a vine called *Aya huasca* (death or soul vine) from which they make a light decoction and the Indian drinks it . . . and in a few moments it begins to produce the strangest phenomena". Spruce (*41*) collected botanical specimens in 1852–53 of large forest lianas in the Río Uaupés drainage in Brazil which were used by the Tukano to alter consciousness during festive communal dances. He named the lianas as a new species of the genus *Banisteria* of the Malpighiaceae; Morton (*24*) transferred them to an allied genus, and today they are known as *Banisteriopsis Caapi* (Spruce ex Griseb.) Mort.

During the century following the early discoveries, many other travellers in the Amazon basin recorded their experiences and observations of the hallucinogens variously known as *caapi* (e.g., *capí; 10*), *yagé*, *ayahuasca*, etc., but the literature that accumulated was extremely scattered, often fragmentary, and not always reliable. In 1957, Schultes (*38*) published a thorough and detailed review of the botanical aspects of this chaotic literature and presented, for the first time, a clear view of our knowledge of the identity of the malpighiaceous psychotropic drugs of the northwest Amazon. Rios (*35*) has compiled a review of ethnographic, linguistic, botanical and chemical aspects of *ayahuasca*. Today, as our knowledge rapidly increases, many new problems arise.

II

Schultes (*38*) concluded that the drugs are, "made basically from the same or closely related plants of the Malpighiaceae", that is, ***Banisteriopsis Caapi*** (Spruce ex Griseb.) Mort. (syn.: ***B.*** *quitensis* (Ndz.) Mort.; *8*), ***B. inebrians*** Mort., ***B. Rusbyana*** (Ndz.) Mort. and ***Tet-****trapterys methystica* R. E. Schultes. Several other plants have been reliably reported as occasional admixtures with *Banisteriopsis*(*38,39*): *Alternanthera Lehmannii* Hieron. (Amaranthaceae), *Banisteria longialata* Ruíz ex Ndz. (Malpighiaceae), and *Datura* sp. (Solanaceae). Other species which may be involved are *Malouetia Tamaquarina* A. DC. (Apocynaceae) and *Mascagnia psilophylla* (Juss.) Griseb. var. *antifebrilis* (Ruíz & Pav.) Ndz. (Malpighiaceae).

Siqueira-Jaccoud (*40*) mentions that another malpighiaceous, harmine-containing liana, *Cabi paraensis* Ducke, is used in the same way as its close relative, *Banisteriopsis Caapi*, near the mouth of the Amazon, although Ducke (*9*) had denied any narcotic use of the plant. Ríos (*35*) believed the *ayahuasca* of the Ucayali River in Peru to be the same species, but did not mention herbarium material to support his belief.

Herbarium collections of *Banisteriopsis muricata* (Cav.) Cuatr. giving the vernacular names *aya-huasca*

(*Herrera 672*, *Woytkowski 5588*) and *agahuasca* (*Woytkowski 5332*) suggest that this species may one day be shown to be an ingredient of the drug *ayahuasca* in Peru.

III

Fischer (*12*) isolated an alkaloid from *yagé* which Elger (*11*) showed to be harmine, long known from the seeds of a Near Eastern perennial shrub, ***Peganum Harmala*** L., of the Zygophyllaceae. Chen and Chen (*7*) confirmed the presence of harmine in ***Banisteriopsis Caapi***, and O'Connell and Lynn (*26*) isolated it from stems of ***B. inebrians***. Hochstein and Paradies (*16*) demonstrated the presence of two other β-carboline derivatives, harmaline and *d*-tetrahydroharmine, as well as harmine, in ***B. Caapi*** stems. However, O'Connell and Lynn (*26*) had reported the absence of harmaline in the stems of ***B. inebrians***.

Harmine has been found also in the Amazonian malpighiaceous lianas *Cabi paraensis* (*23*) and *paricá* (*3*), the latter containing harmaline and tetrahydroharmine as well. *Paricá* is the name employed by the Tukano for the hallucinogenic snuffs that they prepare from myristicaceous trees of the genus *Virola* (*37a*) and, reportedly, from malpighiaceous lianas as well (*3*), although herbarium specimens to support this interesting report are apparently lacking. The snuff called *epená* by the Surára, also of northwestern Brazil, contains harmine and tetrahydroharmine (*2a*). Other harman alkaloids have been found in seven plant genera in six families (*4*).

Hochstein and Paradies (*16*) isolated N,N-dimethyltryptamine from leaves said to be employed in Peru along with ***B. Caapi*** in preparing a narcotic beverage. In the absence of herbarium specimens, the common name had suggested *Prestonia amazonica* as the identity of the leaves, but Schultes and Raffauf (*39*) have shown this identification to be in error. On the other hand, the addition of leaves of *Banisteriopsis Rusbyana* to the bark and wood of *B. Caapi* is a well known practice (*38*), and this species ranges from Colombia to Bolivia, including the region in Peru from which Hochstein and Paradies obtained their materials. It is wholly possible, then, that this indole analogue of serotonin is present in *B. Rusbyana.* Dimethyltryptamine is known to have psychotropic action in man (*37*).

N,N-dimethyltryptamine has been isolated also from the seeds of the mimosoid legumes *Anadenanthera peregrina* (L.) Speg. (syn.: *Piptadenia peregrina* L.; *2*) and *A. colubrina* var. *Cebil* (Griseb.) v. Reis (syn.: *P. macrocarpa* Benth.; *2*), from which the narcotic snuff *cohoba*, *vilca* or *yopo* is prepared over a wide area in South America (*13, 34*). Pachter *et al.* (*27*) recovered the same tryptamine from another related legume, *Mimosa hostilis* Benth., used by the Pancurú of northeastern Brazil to prepare their psychotropic drink, *vinho de Jurumena.* Holmstedt (*17*) finds this alkaloid, as well as two of its analogues, in *epená*, an intoxicating snuff used by the Waica in northwestern Brazil. The wood anatomy of this drug source indicates a species of *Virola* (Myristicaceae).

IV

Recent biochemical and pharmacological studies of the harmala alkaloids bring us toward an understanding of *Banisteriopsis* intoxication. Udenfriend *et al.* (*42*) showed harmaline to be one of the most potent, but reversible, inhibitors of monoamine oxidase (MAO) activity, and Pletscher *et al.* (*31*) extended this finding to the other methoxy-harmanes, harmine and tetrahydroharmine, using murine brain *in vivo.* Harmaline's inhibition of MAO in rat brain was seen to last for from twelve to sixteen hours, while that of harmine disappeared in about eight hours (*18*). The enzyme MAO functions in the breakdown of serotonin, a biologically highly active substance found in various tissues, including the central nervous system; and in the breakdown of norepinephrine, a possible neurohumor of the central nervous system and known neurotransmitter in the sympathetic nervous system (*22*). Antidepressant drugs known to inhibit MAO have produced a variety of systemic and psychotomimetic effects, but there is little agreement about the mechanism underlying these actions (*15*).

Pletscher *et al.* (*32*) and Zirkle and Kaiser (*46*) have recently prepared extensive reviews on monoamine oxidase inhibitors. Harmine and harmaline cause hypotension and bradycardia when administered intravenously, but prevent or reverse the hypotensive and sedative effects of reserpine. Small dosages of harmine can slightly increase blood pressure. Although harmine blocks or depresses ganglionic and myoneural transmission, it stimulates intestinal contractions in intact animals. Both harmine and harmaline promote uterine contractions.

Antihelmintic action on parasitic ascarid worms by harmine and harmaline has been observed, and various harman derivatives are also active against Protozoa (trypanosomes, amoebae) *in vitro* (*32*).

V

The psychotropic effects of the malpighiaceous drugs are many and varied, and depend upon the species employed, upon the method of preparing the drugs, upon the social and physical environment in which they are taken, and upon the age, health, personality, expectations and mental state of those who take them. I do not intend here to summarize these effects, but attention is called to the report of Pennes and Hoch (*29*) on the effects of harmine on thirty-two schizophrenic subjects. They wrote, "Diffuse alterations usually occurred in many realms—autonomic, motor, perceptual, emotional, intellectual, and behavioral." Some of the effects of harmine were:

> nausea and vomiting; slow, coarse, spontaneous tremor of the extremities of an 'extrapyramidal' appearance; humming and buzzing noises (no voices); 'waviness' of the environment; 'sinking' sensations of the body; subjective sense of body vibration; and subject numbness, accompanied by objective evidence of reduced sensitivity to light touch and pinprick.

Bradycardia and hypotension were very marked. They observed a "semidelirioid or confusional state", with drowsiness and some amnesia, accompanied by a shallow euphoria and visual hallucinations.

Gershon and Lang (*14*) suggest that "The chief central effects of [harmine] are an anxiety type response in normal man and an activation of psychotic processes in schizophrenic subjects. This distinction is of the utmost theoretical importance in that [harmine] may fall into a very special group of psychotomimetic agents."

Naranjo (*25*) experimented with harmaline on thirty-two Chilean subjects, nearly all of whom found it hallucinogenic. Visions of serpents, tigers and birds, and of negroes, and experiences of flying, of death, and especially an acute awareness of a human soul separated from its body, were common themes.

Experiments with rats have shown harmaline to nullify a conditioned avoidance-escape behavioral reflex (*21*).

VI

The following account presents some of the details concerning the preparation and use of ***Banisteriopsis*** by Sibundoy medicine-men in diagnosing and treating somatic disease and in discovering therapeutic agents. The rich variety of hallucinations experienced by natives during intoxication will be reported elsewhere. No attempt is made here to discuss the drug's implications for psychosomatic therapy, for the treatment or investigation of mental disorders or for psychedelic use.

The Sibundoy are one of the few native peoples of highland South America known to employ *Banisteriopsis.* The tribe inhabits the northeast side of a small basin lying at 2200 meters elevation and isolated on the eastern side of the Andean Cordillera in southern Colombia. At present, they share the basin, or the Valle de Sibundoy, with some 3500–4000 Santiagueño Indians and about 9000 *blancos* of predominantly Spanish ancestry. In 1961, the Sibundoy numbered about 2180, having increased very rapidly during the present century. The bilingual Sibundoy have been schooled by Catholic missionaries, but, excepting the exigencies of the new religion, they adhere to their traditional cultural patterns. While their cultural origins remain enigmatic, their agricultural practices exclude them entirely from the cultural context of highland southern Colombia. It is likely that they were once a tropical forest people, but they may have ascended to the Valley of Sibundoy in the remote past (*5*, *6*). Pérez de Quesada found them well established there in 1542 (*1*).

Apart from Uscátegui's (*43*) belief that "Yagé, coca and tobacco are doubtlessly present as imported curiosities in the bundles of magic-elements of Sibundoy medicine-men, but none of these narcotics is used widely by the Kamsá people", there has been no mention of the Sibundoy use of *yagé.* (Coca and tobacco—excepting occasional commercial cigarettes—are absent among the Sibundoy.) Rocha's account (*36*) in a Bogotá newspaper (the original of which I have not seen) erroneously equates the Mocoa and Ingano with the "Sebondoy", and seems to be confined to the use of *yagé* in the Putumayo lowlands, thus excluding the Sibundoy (cf. *33*). Yepes (*45*) discussed the use of *yagé* by the neighboring, Inga-speaking Santiagueño in his published interview with a travelling medicine-man in Popayan.

VII

The Sibundoy call the drug *biaxíi* * in their native language Kamsá, but frequently use the widespread *yagé* as well. Table I lists and explains all those words used by the Sibundoy to designate the drug or its compo-

TABLE I

Terms employed by the Sibundoy for the drug and its source plants.

Term	Etymology	Ref.	Application
Amarón wáska	Spanish *amarrón* 'boa constrictor', from *amarrar* 'to tie'; and Quechua *wáskha* 'cord' [hence 'liana'].	(*6*) (*20*)	*B.Caapi*
Ambiwáska	Quechua *hánpi* 'medicine' and *wáskha* 'liana'.	(*20*)	*B.Caapi*, drug
Ayawáska	Quechua *áya* 'cadaver' and *wáskha* 'liana'.	(*20*)	*B.Caapi*, drug
Biáxa	Kamsá: sometimes 'climbing plant', but usually restricted to this use. (Related to *yaxé*?).	(*6*)	*B.Caapi*
Biaxíi	Kamsá: from *biáxa*.	(*19*)	drug
Bičémia	Kamsá: 'climbing plant'.		*B.Caapi*
Čagrupə́ngə	Quechua *cháhra* 'planted area, garden'; and *p'ánkka* 'corn shuck', hence 'leaf'.	(*20*) (*28*)	*B.Rusbyana*
Remedio, El remedio	Spanish: 'remedy'.		drug
Sačawáska	Quechua *sách'a* 'shrub, tree' [hence 'woodland']; and *wáskha* 'liana'.	(*20*) (*28*)	*B.Caapi*, drug
Yaxé	Tukano *yahi* 'sorcerer, sorcerer's plant'.	(*33*)	*B.Caapi*, drug

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* The notation of Kamsá conforms with Juajibioy (*19*) who follows the Institut d'Ethnologie and the Societé de Linguistique of Paris. An English approximation of *biaxíi* is byah-*hee*-ee.

nents. The presence of non-Kamsá names among the Sibundoy is occasioned by their frequent acquisition of plant materials through natives speaking one of the Quechuan languages. Sometimes the drug is accorded a position of preeminence with the Spanish epithet *el remedio* ('*the* remedy'), a term employed even when speaking Kamsá. The names *sačawáska* 'woodland liana' and *čagrupə́ngə* 'garden leaf' imply that ***B. Caapi*** is considered wild, while ***B. Rusbyana*** is thought of as domesticated, or at least ruderal. As yet, however, we have no botanical evidence to support such an interpretation. A Siona Indian in the nearby lowlands says, "The plant is cultivated and lasts forever." (*21a*). He seems to refer to the liana the bark of which is employed, ***B. Caapi.*** The widespread term *ayawáska*, or *ayahuasca*, seems especially pertinent in regard to Naranjo's finding (*25*) that many of his harmaline-treated subjects in Chile experienced feelings of death and of the separation of soul and body.

VIII

The botanical identities of the crude drugs *biáxa* and *čagrupə́ngə*, from which *biaxü* is prepared, are based upon seven sterile and three partly fertile specimens from the adjacent eastern lowlands, whence the Sibundoy obtain the plant materials. ***Bristol*** *759* (*biáxa*) from the garden of Salvador Chindoy in the Valley of Sibundoy represents ***Banisteriopsis Caapi*** (Spruce ex Griseb.) Mort. Chindoy planted it there from a cutting that he obtained near Mocoa about ten years ago, but he will be unable to use it for *biaxü* for years to come because it grows slowly in the cool climate of the high valley. ***Bristol*** *325-A7* (*čagrupə́ngə*) consists of four leaves of ***B. Rusbyana*** (Ndz.) Mort. brought by the same medicine-man from the same area.

Bristol 759 is equivalent to the five sterile specimens of *B. Caapi* from the Mocoa-Umbría region of the eastern lowlands, but it likewise resembles *Klug 1964*, the type of *B. inebrians* Mort., also from Umbría. *Bristol 325-A7* is similar to two sterile and two semi-fertile collections of *B. Rusbyana* from the same region.

Specimens examined from the region where the Sibundoy collect materials for preparing biaxíi.

Banisteriopsis Caapi (*Spruce ex Griseb.*) *Mort.*

Colombia. Comisaría del Putumayo: Valle de Sibundoy, alt. 2200 m., 1.5 km. s. Sibundoy.—Twining, woody, 3 m. "Biaj". Narcotic. Planted as cutting brought from near Mocoa. Bark to be used for hallucinogen, "biajíi". Indian garden, very infreq. [sterile]. 13-IV-1963, *Bristol 759* (ECON). Región de Mocoa, alt. 550–800 m., camino viejo Mocoa-Pepino.—[sterile]. 28-VIII-1963, *Chindoy* 256a* (ECON).—"Bichemia" ('bejuco'), "Amarrón huasca" ('bejuco de boa'). Enredadero 5–6 m.; flor morada. [sterile]. 28-VIII-1963, *Chindoy 279* (ECON, GH, US). Riberas del río Rumiyacu, entre las poblaciones de El Pepino y Mocoa, alt. ca. 600 m.—Nombre vernáculo "Yajé". Bejuco trepador de unos 7 m. Tallos cilíndricos. Cultivado por los indios Inganos en campo abierto y poco sombreado. [sterile]. 28-VII-1960, *Fernández-Pérez & Schultes 5704* (ECON). Umbría, alt. 325 m.—"Yagé" vine. Forest clearing. [sterile]. I/II-1931, *Klug 1934* (A, GH). Alta cuenca del Río Uchupayaco, al suroeste de Puerto Limón.—"Yajé". Narcotic. Liana. [sterile]. 27/28-II-1942, *Schultes 3346* (ECON).

Banisteriopsis inebrians *Mort.*

Colombia. Comisaría del Putumayo: Umbría, alt. 325 m.—"Yagé del monte". Strong narcotic. Indians make a brew of this and have "visions". From root to tip, more than 30 meters long. It takes 6 men to drag the lower half when cut. I estimate that this weighs more than 500 kg. Forest. [fruiting]. I/II-1931, *Klug 1964* (Type; A, ECON, GH).

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* Pedro Juajibioy Chindoy, brother of the ethnographer and linguist Alberto Juajibioy Chindoy; not related to the medicine-man Salvador Chindoy.

Klug 1964 may be the only fertile collection extant of this species (*8*).

Banisteriopsis Rusbyana (*Ndz.*) *Mort.*

Colombia. Comisaría del Putumayo: (Valle de Sibundoy).—Obtained from Salvador Chindoy, a Sibundoy who collected these near Mocoa, alt. 550–800 m. "Chagrupanga". Narcotic. For preparing the hallucinogen "biajíi". [4 leaves]. *Bristol 325-A7* (ECON). Región de Mocoa, alt. 550–800 m.—"Amarrón chagrupanga". [sterile]. 28-VIII-1963, *Chindoy 280a* (ECON).—"Chagropanga". 2.5 m. Se dice que no tiene flor. [sterile]. 28-VIII-1963, *Chindoy 281* (ECON, US). Umbría, alt. 325 m.—"Chagropanga" "oco yagé". Vine. Forest. [stem, leaves, 1 perianth]. I/II-1931, *Klug 1971* (A, GH).

IX

The Sibundoy avail themselves of *biaxíi* in two ways. First: they may purchase a bottle of prepared *biaxíi* from a Sibundoy or Santiagueño medicine-man in the Valley of Sibundoy. Several natives of the valley who know where to gather the plant materials in the eastern lowlands and how to prepare the drug engage in this commerce. They sell it by the liter for five to ten pesos. Second: in cases of severe or prolonged illness, one of these medicine-men (*tat̪mbwá, biaxíi pormayá*) is paid, usually in kind or in labor, to diagnose the disease (*s̬okán*) while intoxicated with *biaxíi.* On these occasions, members of the patient's family and one or more friends of the medicine-man may also take the drink. Thus, while the uses of *biaxíi* by medicine-men to diagnose disease and "to study medicine" are considered the more important by the Sibundoy and are the central subject of this report, a majority of the men and many of the women have also taken *biaxíi* several times in their lives and for other purposes.

Biaxíi intoxication is sought for a variety of reasons outside of the medical sphere. A Sibundoy separated from his family while travelling may take it to relieve his loneliness and, as he says, transport himself to their midst. Or he may be anxious to know who is gossiping about him during his absence. The location of a lost object, he believes, can be revealed by intoxication. It would appear that anxiety states can be better defined, or even resolved, with *biaxíi*. Of great importance is its use *para conocer*, 'to perceive, to experience, to know through familiarity, to learn', the native's way of expressing in Spanish the drug's ability to "expand consciousness", especially in the visual realm. In this connection, and perhaps in other ways as well, *biaxíi* helps the Sibundoy "to learn how to live".

Therapeutically, the Sibundoy medicine-man employs *biaxíi* for its unfailing purgative action, perhaps due to harmine's ability to increase intestinal motility (*32*). As an emetic, the drug is notorious. These secondary actions, while deliberately prescribed at times, also affirm the medicine-man's control over the body, for the drug is taken usually by the patient undergoing diagnosis as well. A strong purge is always assumed to be beneficial, a reasonable assumption in an environment where intestinal parasites are common. The antiparasitic actions of the harmala alkaloids have already been noted (*32*). Regardless of the ensuing diagnosis, the patient justifiably feels that some improvement has been attained.

X

We now proceed to an examination of my observations on the preparation of *biaxíi* and its use in diagnosing disease and in "studying medicine" by a Sibundoy medicine-man and close friend, Salvador Chindoy. I have been able to discuss the utilization and especially the intoxication from *biaxíi* with many Sibundoy, but rather than present a composite and generalized picture of its use, it seems preferable to recount a specific instance, the one I observed most fully.

PLATE XVII

The small hut (*biaxii wabwanái támbo*) hidden in a secluded garden area where Salvador Chindoy prepares *biaxii*. A meter stick indicates its size. The roofing is made from fronds of the very common palm, *botsacšá* (*Prestoea* sp.), seen at the upper right and in Plate XVIII. A bunch of dried cornstalks suggests a wall.

On this occasion, Chindoy prepared the drug with the bark of ***Banisteriopsis Caapi*** (or possibly ***B. inebrians***) and the leaves of ***B. Rusbyana*** that he had recently gathered in the Mocoa region of the adjacent eastern lowlands.

The preparation of *biaxíi* is reserved to a small hut, *biaxíi wabwanái támbo*, (*biaxíi* 'cooking shelter'), which women are expected never to approach (see Plate XVII). It is believed that, should a pregnant woman come too near the hut, thunder and lightning will appear, and both the woman and the medicine-man will be killed instantly. Among other things, this taboo serves to prevent women's learning how to prepare *biaxíi* and thus intoxicate themselves when their husbands are travelling. While women can and do take *biaxíi*, they must never do so in the absence of their husbands. Furthermore, harmine and harmaline promote uterine contractions (*32*) and may cause abortion. If the women are aware of this possibility, the taboo discourages their using *biaxíi* as an abortifacient without the consent of their husbands. Whether or not pregnant women ever take *biaxíi* for any purpose was not ascertained.

The details of preparing *biaxíi* vary somewhat, especially between the ideal and the actual practice. Chindoy explained the procedure as follows:

> Beginning in the morning, boil forty liters of water, add a pile of bark scrapings to the boiling water, and stuff the pot full of *čagrupə́ngə* leaves. At noon, throw out both the scrapings and the leaves and add the same amounts of fresh scrapings and leaves, continuing to boil for another three or four hours. Again remove the scrapings and leaves, but this time, add only twelve pairs of *čagrupə́ngə* (24 leaves), boiling them for two additional hours. When they are taken out, the pot is cooled and the *biaxíi* readied for use.

As I had the opportunity to observe the complete preparation of *biaxíi* by Chindoy, it seems worthwhile to record his actual procedures here.

> Late in the afternoon the *biaxíi wabwanayá* (*biaxíi* 'cook') started

PLATE XVIII

A Sibundoy medicine-man, Salvador Chindoy, demonstrating the adornments he uses while practicing medicine under the influence of the psychotropic drug *biaxií*. (See text.)

a fire in the *biaxíi* cooking hut, about fifty meters from the house in a secluded spot. A cauldron with several liters of water was set to boil, and twenty-four *čagrupə́ngə* leaves were added. This was left and he returned to the house to chat with his family and eat a light supper.

About 7:00 P.M., Chindoy returned to the hut with several enormous leaf blades of *síkse tomakéño* (*Colocasia esculenta* Schott) and two liters of *biaxíi* remaining from a previous occasion. Behind the hut, he dug up 'four pairs' (eight sections about 4 × 25 cm.) of the *biáxa* liana. These had been buried for three weeks, to keep them fresher, he said. The sections were carefully scraped to remove all dirt from the bark, an operation which took twenty-five minutes. During this time, the fire subsided, but, when the cleaning was finished, he revived it to continue the boiling for about forty-five minutes.

Now the medicine-man began scraping the bark from the sections of liana with a knife. This tiring process lasted about half an hour, during which time six sections were scraped down to the wood. He decided that it would be too much work to scrape the bark from the remaining two, and further decided against mashing up the wood as he had previously intended. About one and a half liters of scrapings from the liana were accumulated.

A flat stone was placed on the *Colocasia* leaves, and the bark scrapings were pounded on this with a smaller round stone, collected on the leaves and dumped into a large enamel bowl. The scrapings appeared to be reduced to one liter in volume.

The two bottles of previously prepared *biaxíi* were then shaken, producing a froth in the bottles. Their contents, about one and a half liters, were emptied into the bowl of fresh bark scrapings, and about one-half of the simmering *čagrupə́ngə* infusion (one liter) was also added to the bowl. Chindoy washed his hands and proceeded to knead, rub and squeeze the scrapings in the bowl for several minutes. Then the scrapings were thrown into the cauldron of *čagrupə́ngə* leaves and the cauldron taken off the fire. The liquid in the bowl, consisting of previously prepared *biaxíi* (1.5 liters) and an infusion of *čagrupə́ngə* leaves (1 liter) in which about 1 liter of mashed *biáxa* bark scrapings had been kneaded and squeezed, was ready for consumption as soon as cooled.

In brief, the ingredients of *biaxíi* were:

1. 24 leaves of ***B. Rusbyana.***
2. Bark from a stem of ***B. Caapi*** (or possibly ***B. inebrians***) about 1.5 meters long and 4 cm. in diameter.
3. 1.5 liters of previously prepared *biaxíi.*

The leaves were boiled in several liters of water, but only half of the resulting infusion, or one liter, was used on this occasion. This simmering infusion was added to the cold drink previously prepared, and the sap and small particles from the shredded and pounded bark completed the luke-warm mixture.

The two bottles of *biaxíi* left from another occasion could have been taken alone, but Chindoy advised that "it is better to refine the *biaxíi*". He said the *čhagrupɔ́ngə* leaves had to be included, "in order to see pictures", for the *biáxa* bark alone is not hallucinogenic. The remaining liter of *čagrupɔ́ngə* infusion, the squeezed bark scrapings, the wood of the six sections already scraped, as well as the two untouched sections, were saved to prepare more *biaxíi* at a later date. If all these materials are, in fact, used in making the next *biaxíi*, its preparation will conform neither to the stated ideal, nor to the procedure just described. Presumably, some *biaxíi* left over from the present batch would serve as the basis for the next.

Although women are never allowed in or near the hut, once the preparation is complete, the *biaxíi* can be taken to the house, for "the women can no longer harm it".

XI

It was then about 8:30 P.M., and Chindoy's wife and the three visitors had gone to bed on reed mats on the floor in the main room. The medicine-man arranged his blankets on the raised wooden bed, and I slept on the floor on a mat. It is common for friends of the medicine-man to spend the night at his house at such opportunities to take *biaxíi*, and I was not in an awkward atmosphere. The drink was to be taken around midnight.

The stated purpose of taking *biaxíi* on this occasion was twofold. First: a young couple with an ailing infant wanted to have its disease diagnosed and cured. The child was said to be thirteen months old, but it was obviously stunted. Several native remedies had been tried by the parents to no avail during the past few months. Second: Chindoy wanted to examine some branches of a peculiar *boracĕra* (*Datura candida*(Pers.) Saff.) closely resembling several of the more important medicinal plants known to him. I had located the small tree in the garden of an older, well known Sibundoy along a much frequented trail, but it had never been seen by Chindoy who rarely had occasion to travel that section of the trail. As he had said that it would be very unwise for him to inspect the other man's tree, I had brought several branches from it. Intoxicated with *biaxíi*, he would "examine" the branches to determine whether the plant was "poison or remedy, and, if not a poison, what it would be good for and how it should be used".

The medicine-man, the young couple and I awoke at about 1:30 A.M. The medicine-man adorned himself for the ceremonial preparation of the *biaxíi* with a necklace of large puma canine-teeth, a great many small-beaded necklaces of several colors, two longer necklaces of palm fruit rattles, a chain necklace with a crucifix, two long, tightly wound wrist cords, two red parrot tail feathers in his pierced ear lobes, and a narrow crown with erect, red and blue parrot tail feathers at the rear and a long train of green parrot tail feathers and black-yellow-red toucan tails hanging behind (see Plate XVIII). Excepting for the multicolored porcelain bead necklaces, all these adornments are used by Chindoy exclusively for practicing medicine while influenced by *biaxíi*. He acquired all but the beads and crucifix in the eastern lowlands among the Mocoa and Ingano who fashioned them from locally available materials and who use them for similar purposes.

Chindoy sat on a stool facing the large enamel bowl of *biaxíi* and the wall; the young woman and child remained on their mat on the floor; and the young man and I sat on stools around the now dead fire.

A ceremony was performed over the bowl of *biaxíi* before any was taken. The medicine-man alternately chanted, hummed and whistled a tune of three or four staccato notes for about ten minutes. The chanting was solely of the syllables *bia-xí-bia-xí-bia-xí-i-bia-xí-bia-xí-i* . . . . There was no pause in the chanting, humming and whistling. This was accompanied by rattling a brush, *bačnxnaišá* (*báčna* 'priest', *xnaišá* ?), made of dried leaves known as *wa-íra-činga* or *pičánga*. This is a "broom to sweep away *bákna bíŋjia* or *malaire*", an airborne disease-causing spirit. The oblong-lanceolate leaves are from a low, unidentified grass of the eastern lowlands.

After the initial ceremony over the large bowl of *biaxíi* was complete, Chindoy put some of the drug into a *biaxíi* *f*^{u}*tmán kwaštém*, or *medida*, a 'measure' of about 150 cc. This *kwaštém* ('little bowl') is a small, very hard bowl, made probably from a small-fruited variety of the calabash tree, *Crescentia Cujete* L. With the measure of *biaxíi* held in the hand, the chanting and humming was repeated. He dipped a crucifix from one of his necklaces into the drink and then crossed himself with it. He completed the ceremony by repeating the sign of the cross over the measure of *biaxíi*.

He drank the *biaxíi* quickly, spitting and shaking his head because of the disagreeable bitterness. He followed it with half a jigger (20–25 cc.) of *aguardiente* ('whiskey') to wash his mouth, but then he swallowed it, too. With similar ceremony, the medicine-man offered me a measure of *biaxíi* which I drank quickly and followed with the more pleasant taste of a few drops of rum which he had advised me to bring for this purpose. A third measure was given to the young father of the sick infant, and half as much was given also to its mother in a small glass bowl.

After considerable spitting on the dirt floor, Chindoy vomited lightly over the bench next to the wall, beside the head of his sleeping wife. Suddenly, the young man leaped from his stool and vomited lustily across the floor, to everyone's amusement; outside the door, he continued retching for several minutes. About forty-five minutes after taking the drug, no one had noticed any psychic effects, and the three men present each took another half measure. Shortly thereafter, nausea overcame me, and I was obliged to withdraw and vomit up the infusion.

Before long, Chindoy announced, "The *čúma* ('narcosis') has seized me", but instead of sharing any feelings and insights, and perhaps because the drug made him drowsy, he retired quickly to bed. He had seemed to take no notice of either the ailing child or the unknown *boračéra* branches. With no signs of inebriation, the rest of us soon followed suit.

All of the Sibundoy agree that to "see things" most people must take *biaxíi* on several occasions and that neophytes rarely succeed. Chindoy, who takes *biaxíi* every few weeks and sometimes more often, invariably has visions and says that he "learns" something each time. My own failure to respond to *biaxíi* was not unusual; indeed, it was anticipated by Chindoy. But I remembered also the abbreviated procedures in preparing the drink and wondered if a longer boiling of larger quantities of leaves and bark would have been more likely to produce psychic effects.

Juajibioy (pers. comm.) informs me that sometimes the participants bathe in the nearest stream the following dawn and then are ritually fumigated with *kopál* (resin from ***Hymenaea Courbaril*** L.; *30*) to expel *malaire.*

We arose leisurely at about 6:00 A.M. and rolled up our sleeping mats. I felt nothing unusual. Presently, I asked the medicine-man, "Did you see anything last night?" and he gave three answers.

First: he had seen that my parents in the United States were disturbed over my long absence (fifteen months) and were anxious for me to return home. They felt that I was being very irresponsible in neglecting them for so long. Second: he informed us that nothing could be done to save the stunted child. Some time ago *microbios* had entered the body between the toes and had crept up through the legs into the torso and now suffused the whole body except for the heart. As soon as they reached the heart—he repeated this—the infant would die. Third: the unusual Datura was identified as *salamán boračéra*, a small tree cultivated by Chindoy and used for various medicinal and occasionally narcotic purposes. He would plant the cuttings in his garden, he said, and use the leaves as he does those of the *salamán boračéra.*

Here ends this instance of the use of *biaxú* by the Sibundoy, but several comments on its results may be worthwhile.

XII

The observation of my parents' anxiety over my long absence may imply that Chindoy was disturbed, even during normal consciousness, by what he sensed as careless irresponsibility on my part. Certainly among the Sibundoy, filial responsibilities are greater than in American society. It appears likely that valuable insight on Sibundoy cultural values could be gained from an analysis of the content of natives' psychic experiences during *biaxú* intoxication.

Of greater interest is the medicine-man's finding that nothing could save his patient from approaching death, for ten days later the child died. With this event, the predictive value of *biaxíi* intoxication was dramatically confirmed for all those Sibundoy involved. Regardless of whether the *biaxíi* actually contained psychotropic methoxy-harmanes that might somehow facilitate prognosis, several occurrences of this sequence—intoxication, prediction of an event, realization of the event—might be sufficient to establish the general use of the drug for prognostication. We may postulate that such a stimulus-response-reward phenomenon occurred repeatedly among not only the Sibundoy, but especially among tribes of the western Amazon long ago when the use of ***Banisteriopsis*** was in its initial and experimental stages.

The final observation of the medicine-man on the identity of an unusual plant was as unexpected as it was illuminating. Chindoy's identification of the leaves as those of *salamán boračéra* was manifestly incorrect, as he conceded at a later date when comparing leaves of the two plants. The misidentification is all the more surprising in view of Chindoy's exceptional interest in the medicinal and narcotic uses of the *Datura candida* clones and in the fact that he cultivates all of them in his garden, unlike any other Sibundoy contacted. The plant in question was a variant of the *amarón boračéra* growing beside Chindoy's house, but for which he knows no use.

In this determination through ***Banisteriopsis*** intoxication of the medicinal uses of a previously unknown plant, we see a most interesting mechanism for the expansion of the Sibundoy *materia medica*. Not only are new plant drugs thus introduced, but there can be little certainty that the use of new drugs will be restricted to situations for which drugs are already available. Through chance, operating within the superstitious nature of Sibundoy beliefs, it is entirely possible that a new drug would become associated with disease symptoms previously untreatable. This role of narcosis in expanding the native pharmacopoeia neither leads to the conclusion that most of the Sibundoy drugs were discovered in this way, nor does it suggest that any drugs so discovered are likely to have less therapeutic value than drugs discovered in other ways by other primitive peoples. Nevertheless, it would seem that a substantial increase in the number of medicinal plants available to a culture implies at least a slight increase in that small number which are therapeutically effective. The use of *Banisteriopsis* by Sibundoy medicine-men, not only as an emetic and purge, but even more generally to investigate medicine and disease, may be seen as leading ultimately to an improvement of tribal health.

XIII

I gratefully acknowledge several suggestions from I. M. Cooke, Claudio Naranjo and R. E. Schultes which have improved the foregoing presentation. The ethnographer and linguist, Alberto Juajibioy, a Kamsá speaking Sibundoy, has contributed to the native terminology reported.

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NATURAL AND ARTIFICIAL HYBRID GENERIC NAMES OF ORCHIDS

1887–1965

BY
Leslie A. Garay and Herman R. Sweet

This compendium of orchid hybrid generic names from 1887 through 1965 is prepared to further the stabilization of orchid hybrid generic names through correct nomenclature.

It may safely be said that no other plant family possesses such a large number of hybrids, both natural and artificial, as the *Orchidaceae.* Since the time that Dominy flowered his first artificial cross — *Calanthe Dominyi* — in 1856, the number of man-made hybrids now well exceeds that of the described species. Shortly after this date, it was recognized that in the orchid family crosses between species of different genera often resulted in fertile offspring, a phenomenon that necessitated a change in nomenclatorial procedures.

In 1887, Rolfe, in the Journal of the Linnean Society, proposed that the precedent established by Masters in 1872 (The Gardeners' Chronicle, p. 358, 1872) should be followed. Accordingly, hybrid generic names are compounded from those of parent genera. In following this principle, Rolfe established the first seven bigeneric hybrid names: **Phaiocalanthe** (*Phaius* × *Calanthe*), **Laeliocattleya** (*Laelia* × *Cattleya*), **Sophrocattleya**

(*Sophronitis* × *Cattleya*), **Zygocolax** (*Zygopetalum* × *Colax*), **Anoectomaria** (*Anoectochilus* × *Haemaria*), **Macomaria** (*Macodes* × *Haemaria*) and **Dossinimaria** (*Dossinia* × *Haemaria*). He again employed this same principle in "The Orchid Stud-Book", published in 1909, in which names of trigeneric origin are also included.

In 1910, during the International Horticultural Congress in Bruxelles, much attention was paid to the problem of orchid hybrid nomenclature. It was resolved that bi- and trigeneric names were to be compounded from the parental generic names, while quadrigeneric names were to be named for some person distinguished in either botany or horticulture, and that the suffix "-ara" be attached to the name of the person so honored. Furthermore, it was resolved that "-ara" ending may be applied also to trigeneric hybrids. Examples given were **ADAMARA** (*Brassavola* × *Laelia* × *Cattleya* × *Epidendrum*) and **LINNEARA** (*Diacrium* × *Cattleya* × *Brassavola* × *Laelia*).

Due to the increased numbers of hybrids, F. Sander published, in 1901, his first "Sander's Orchid Guide", in which all species as well as natural and artificial hybrids known in cultivation up to that date were listed. This book was superceded in 1915 by Sander and Sons' "Orchid Hybrids", which has seen several revised editions as well as supplementary volumes. Following Sander's publication, lists of new orchid hybrids were issued periodically in "The Gardners' Chronicle" until 1922, but since that date such lists have been printed monthly in "The Orchid Review".

The registration of new hybrids was first privately undertaken by Sander's Company, and in 1960, during the Third World Orchid Conference, this responsibility was transferred to the Royal Horticultural Society.

One of the major shortcomings of all of these publications, with the exception of "The Orchid Stud-Book", is that they are merely compilations of names without any reference to the places of publication. Moreover, since the inception of hybrid registration, the registration authorities have neglected to catalog the hybrids published in various botanical and horticultural journals. These deficiencies precipitated the publication of synonyms and homonyms.

In addition to these problems, the nomenclature of orchid hybrids has been, and to a great extent, still is confused by practices that run contrary to the rules and regulations of both the International Code of Botanical Nomenclature and the International Code of Nomenclature of Cultivated Plants. This statement does not mean that orchidists and orchidologists willfully engage in practices that are contrary to the Codes, but rather that neither of the Codes has taken into consideration the practices established in the past hundred years of orchid hybridization. Recently, however, significant steps have been taken to accomodate the nomenclatorial problems of orchid hybrids within the framework of the existing Codes.

The 1961 edition of the Horticultural Code makes allowances for the special application of collective names of orchids of hybrid origin, since the registration of orchid hybrids takes place at the *grex* level and not at the cultivar level, as in other plant families. The current Horticultural Code, however, has no provisions for *grex* registration. More significant is the decision reached at the Tenth International Botanical Congress in Edinburgh in 1964. The Committee for Hybrids of the Nomenclatorial Section completely redrafted the wording of Articles 40, H.3 and H.4 of the Botanical Code. These reworded articles embody the following new principles: "that (1) 'generic names' of hybrid genera should be regarded as condensed formulae and should be validly published by an accompanying statement of their parentage, without any Latin diagnosis or other description, and (2) that as a consequence, such 'generic names' should be applicable only to the plants which are accepted taxonomically as derived from the parent genera named." (From the Report of the Committee for Hybrids, p. 2.)

To clarify the meaning and because of the application of these new principles to hybrid generic names of orchids, we are quoting here the full text of Article 40, as presented to the Committee, voted on and accepted by the Nomenclatorial Section on July 30, 1964. Examples are omitted.

"Article 40.— For purposes of valid publication, the name of a hybrid group of generic, subgeneric or sectional rank, which is a condensed formula or equivalent to a condensed formula (see H.3 and H.4), must be published with a statement of the names of the parent genera, subgenera, or sections respectively, but a Latin diagnosis or other description is not necessary. . . .

"For purposes of valid publication, names of hybrids of specific or lower rank with Latin epithets are subject to the same rules as are those of non-hybrid taxa of the same rank. . . .

"For purposes of priority, names and epithets in Latin form given to hybrids are subject to the same rules as are those of non-hybrid taxa of corresponding rank. . . ."

Notwithstanding the rather unorthodox wording of this article (it represents a new biological phenomenon in proposing hybridization solely among names) it validates the several hundreds of orchid hybrid generic names which up to the present time, have had no legal status under the Codes due to a lack of any kind of description. This is a relief, since it has occasionally been the practice, especially by the Royal Horticultural Society, to establish and to publish hybrid generic names prior to actual registration of hybrid epithets. We find, for example, the names **Colmanara** (*Miltonia* × *Odontoglossum* × *Oncidium*) and **Miltonidium** (*Miltonia* × *Oncidium*) proposed in "The Gardeners' Chronicle" in 1936; however, the first hybrids, **Miltonidium** Aristocrat and **Colmanara** Sir Jeremiah, were not registered and published until 1940 and 1963 respectively.

Although Article 40 shows clearly the necessity of the strict observance of priority, priority has not always been followed. As a matter of fact, the current hybrid list is plagued with inconsistencies. For example, both **Doritaenopsis** (*Doritis* × *Phalaenopsis*) and **Vandaenopsis** (*Vanda* × *Phalaenopsis*), published in 1935, have been accepted by the registration authorities, but **Vandachostylis** (*Vanda* × *Rhynchostylis*), which appears in the same publication, is ignored. In 1958, *Vanda* × *Rhynchostylis* was published again, but this time with a new hybrid generic name of **Rhynchovanda.**

Finally, we must call attention to another deficiency and inconsistency in the current horticultural practices, i.e., the lack of application of the results of research in orchid taxonomy. Quite possibly many hybridizers are not aware of the amount of research and effort made by taxonomists to establish the correct identity of the species employed in their hybridizing programs. This failure is responsible, to some extent, for the current confusion in the nomenclature of hybrid orchids. Yet, we believe, that nomenclatorial aspects should receive at least as much attention as do current cultural techniques, such as potting media and meristem culture.

To remedy these deficiencies, we have searched the world's botanical and horticultural literature for known hybrid generic names of orchids, together with the original places of publication. We have updated the taxonomy of the hybrid generic names, and, where necessary, new hybrid generic names have been proposed. For example, when the hybrid **Trichovanda** Ulaula was first published, its parentage was given as *Trichoglottis brachiata* × *Vanda Sanderiana.* Thus, **Trichovanda** is a condensed formula, made from the names *Trichoglottis* and *Vanda.* The correct name, however, for *Vanda Sanderiana,* according to Holttum, is *Euanthe Sanderiana.* Since **Antheglottis** is the condensed formula for *Euanthe* × *Trichoglottis,* the hybrid **Trichovanda** Ulaula becomes **Antheglottis** Ulaula.

For convenience, we are presenting here a list of nomenclatorial changes incorporated in this compendium of hybrid generic names. The column on the left represents those names which are currently used in horticultural literature, while the column on the right gives their correct botanical equivalents.

Agaisia lepida = *Otostylis alba*
Angraecum falcatum = *Neofinetia falcata*
Angraecum sesquipedale = *Macroplectrum sesquipedale*
Arachnis Clarkei = *Esmeralda Clarkei*
Arachnis Sulingi = *Armodorum Sulingi*
Chondrorhyncha discolor = *Cochleanthes discolor*
Cochlioda sanguinea = *Symphyglossum sanguineum*
Cymbidium elegans = *Cyperorchis elegans*
Habenaria Susannae = *Pecteilis Susannae*
Haemaria discolor = *Ludisia discolor*
Lycaste Skinneri = *Lycaste virginalis*
Phaius Humblotii = *Gastrorchis Humblotii*
Phaius simulans = *Gastrorchis simulans*
Phaius tuberculosus = *Gastrorchis tuberculosa*
Phalaenopsis Denevei = *Paraphalaenopsis Denevei*
Phalaenopsis Laycocki = *Paraphalaenopsis Laycocki*
Phalaenopsis serpentilingua = *Paraphalaenopsis serpentilingua*
Renanthera histrionica = *Renantherella histrionica*
Rhyncholaelia Digbyana = *Brassavola Digbyana*

Rhyncholaelia glauca = *Brassavola glauca*
Saccolabium giganteum = *Rhynchostylis gigantea*
Sophronitis violacea = *Sophronitella violacea*
Stauropsis fasciata = *Trichoglottis fasciata*
Vanda Sanderiana = *Euanthe Sanderiana*
Zygopetalum Jorisianum = *Mendoncella Jorisiana*
Zygopetalum rostratum = *Mendadenium labiosum*

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PART I

List of hybrid generic names

Aceraherminium in Camus, Ic. Orch. Europ. 2: 366, 1929
Aceras × *Herminium*
1st. hybr.: unnamed
Parentage: *Aceras anthropophora* × *Herminium monorchis*
Syn.: **Aceras-Herminium** in Gremli, Neue Beitr. 3: 35, 1883

Aceras-Herminium in Gremli, Neue Beitr. 3: 35, 1883
Observation: See **Aceraherminium**

Adaglossum in Orch. Rev. 21: 298, 1913
Ada × *Odontoglossum*
1st hybr.: *A.* Juno
Parentage: *Ada aurantiaca* × *Odontoglossum Edwardii*

Adamara in Bull. Roy. Soc. Bot. Belg. 47: 402, 1911
Brassavola × *Cattleya* × *Laelia* × *Epidendrum*
1st hybr.: *A.* Fuchsia (as **Yamadara** Fuchsia)
Parentage: **Brassolaeliocattleya** Eudetta × *Epidendrum Mariae*
Syn.: **Yamadara** in Orch. Rev. 68: 404, 1960

Adioda in Orch. Rev. 19: 258, 1911
Ada × *Cochlioda*
1st hybr.: *A.* St. Fuscien
Parentage: *Ada aurantiaca* × *Cochlioda Noezliana*

Aeridachnis in The Orch. Journ. 3: 165, 1954
Aerides × *Arachnis*
1st hybr.: *A.* Bogor
Parentage: *Arachnis Hookeriana* × *Aerides odoratum*
Ill.: in The Orch. Journ. 3: 166, f. 2, 1954

Aeridanthe nom. hybr. gen. nov.
Aerides × *Euanthe*
1st hybr.: *A.* Tsuruko Iwasaki (as **Aeridovanda** Tsuruko Iwasaki)
Parentage: *Aerides Lawrenciae* × *Euanthe Sanderiana*

Aeridofinetia in Orch. Rev. 69: 267, 1961
Aerides × *Neofinetia*
1st hybr.: *A.* Pink Pearl
Parentage: *Aerides Jarckianum* × *Neofinetia falcata*

Aeridoglossum in Orch. Rev. 71: September, 1963
Aerides × *Ascoglossum*
1st hybr.: *A.* Peach Blossom
Parentage: *Aerides Lawrenciae* × *Ascoglossum calopterum*

Aeridolabium in Orch. Rev. 67: 329, 1959
Aerides × *Saccolabium*
1st hybr.: not yet reported
Observation: For the hybrid **Aeridolabium** Springtime see **Aeridostylis.**

Aeridopsis in Orch. Rev. 46: 200, 1938
Aerides × *Phalaenopsis*
1st hybr.: *A.* Shinjiku
Parentage: *Aerides japonicum* × *Phalaenopsis* Leda

Aeridostylis in Hawkes, Orchids 242, 1961
Aerides × *Rhynchostylis*
1st hybr.: *A.* Springtime (as **Aeridolabium** Springtime)
Parentage: *Aerides Lawrenciae* × *Rhynchostylis gigantea*
Ill.: in Na Pua Okika o Hawaii Nei 9: 92, 1959
Syn.: **Rhynchorides** in Orch. Rev. 70: October, 1962

Aeridovanda in Gard. Chron. ser. 3, 63: 93, 1918
Aerides × *Vanda*
1st hybr.: *A.* Mundyi
Parentage: *Aerides vandarum* × *Vanda teres*
Ill.: in Gard. Chron. ser. 3, 63: 93, f. 43, 1918
Observation: For the hybrid **Aeridovanda** Elizabeth Young see **Vandantherides.**

Syn.: **Aerovanda** in Sander, List Orch. Hybr. Add. 319, 1949–51
Aeriovanda in Gartenfl. 86: 252, 1937

Aeriovanda in Gartenfl. 86: 252, 1937
Observation: See **Aeridovanda.**

Aerovanda in Sander, List. Orch. Hybr. Add. 319, 1949–51
Observation: See **Aeridovanda.**

Aliceara in Orch. Rev. 72: July, 1964
Brassia × *Oncidium* × *Miltonia*
1st hybr.: *A.* Pacesetter
Parentage: **Brassidium** Coronet × **Miltonidium** Lustre
Ill.: in Orch. Rev. 73: 332, f. 123, 1965

Amesara nom. hybr. gen. nov.
Renanthera × *Vanda* × *Euanthe*
1st hybr.: *A.* Donald McIntyre (as **Renantanda** Donald McIntyre)
Parentage: **Vandanthe** Clara Shipman Fisher × *Renanthera Storiei*
Ill.: in Amer. Orch. Soc. Bull. 25: 257, 1956

Anacamptiplatanthera in Fourn., Brev. Bot. 512, 1927
Anacamptis × *Platanthera*
1st hybr.: *A. Payoti*
Parentage: *Anacamptis pyramidalis* × *Platanthera bifolia*

Anacamptorchis in Journ. Bot. Fr. 6: 113, 1892
Anacamptis × *Orchis*
1st hybr.: *A. Duquesnei* (as *Aceras Duquesnei,* 1851)
Parentage: *Anacamptis pyramidalis* × *Orchis palustris*
Ill.: in Reichenb. Fl. Germ. et Helv. 13–14: t. 162, f. II, 1, 4, 1851
Syn.: **Orchidanacamptis** in Guétrot, Pl. Hybr. Fr. II, 51, 1926

Angulocaste in Rev. Hort. Belg. 32: 172, 1906
Anguloa × *Lycaste*
1st hybr.: *A.* Bièvreana
Parentage: *Lycaste virginalis* × *Anguloa Rueckeri*
Ill.: in La Tribune Hortic. 2: t. 57, 1907

Anoectogoodyera in Gard. Chron. ser. 3, 1: 646, 1887
Anoectochilus × *Goodyera*
1st hybr.: not yet reported

Anoectomaria in Journ. Linn. Soc. Bot. 24: 170, 1887
Observation: See **Ludochilus** including the hybrid **Anoectomaria** *Dominyi. Haemaria* is a synonym of *Ludisia.*

Antheglottis nom. hybr. gen. nov.
Euanthe × *Trichoglottis*
1st hybr.: *A.* Ulaula (as **Trichovanda** Ulaula)
Parentage: *Trichoglottis brachiata* × *Euanthe Sanderiana*
Ill.: in Amer. Orch. Soc. Bull. 34: 927, f., 1965

Antheranthe nom. hybr. gen. nov.
Renanthera × *Euanthe*
1st hybr.: *A.* Titan (as **Renantanda** Titan)
Parentage: *Renanthera Imshootiana* × *Euanthe Sanderiana*
Ill.: in Orch. Rev. 43: 105, f., 1935

Arachnoglottis in Orch. Rev. 66: 86, 1958
Observation: See **Trichachnis** including the hybrid **Arachnoglottis** Brown Bars.

Arachnopsis in Anggrek Boelan 1: 83, 1939
Arachnis × *Phalaenopsis*
1st hybr.: *A. Rosea*
Parentage: *Phalaenopsis Schilleriana* × *Arachnis Maingayi*
Ill.: in Anggrek Boelan 1: 82, 1939
Observation: For the hybrid **Arachnopsis** Eric Holttum see **Pararachnis.**

Aranda in Orchideen 4: 70, 1937
Arachnis × *Vanda*
1st hybr.: *A.* Jacoba Louisa
Parentage: *Arachnis Maingayi* × *Vanda* Miss Joaquim
Ill.: in Orchideen 4: 71, f., 1937
Syn.: **Vandachnanthe** in Anggrek Boelan 1: 67, 1939
Vandarachnis in Orchideen 6: 107, 1939

Arandanthe in Malay. Orch. Rev. 5: 13, 1957
Arachnis × *Vanda* × *Euanthe*
1st hybr.: *A.* Wendy Scott
Parentage: *Arachnis Hookeriana* × *Vandanthe Rothschildiana*
Ill.: in Malay. Orch. Rev. 5: 13, f., 1957

Aranthera in Malay. Orch. Rev. 2: 109, 1936
Arachnis × *Renanthera*
1st hybr.: *A.* Mohamed Haniff
Parentage: *Arachnis Hookeriana* × *Renanthera coccinea*
Ill.: in Malay. Orch. Rev. 2: 108, 1936
Observation: For the hybrid **Aranthera** Star Orange see **Renaradorum.**

Arizara in Orch. Rev. 73: October, 1965
Epidendrum × *Domingoa* × *Cattleya*
1st hybr.: *A.* Luis
Parentage: **Epigoa** Olivine × *Cattleya guttata*

Armodachnis in Na Pua Okika o Hawaii Nei 7: 154, 1957
Armodorum × *Arachnis*
1st hybr.: *A.* Catherine (as *Arachnis* Catherine)
Parentage: *Armodorum Sulingi* × *Arachnis Hookeriana var. luteola*
Ill.: in Henders. & Addis., Malay. Orch. Hybr. 53, 1956

Ascocenda in Orch. Rev. 57: 172, 1949
Ascocentrum × *Vanda*
1st hybr.: *A.* Portia Doolittle
Parentage: *Ascocentrum curvifolium* × *Vanda lamellata*
Observation: For the hybrid **Ascocenda** Meda Arnold see **Schlechterara.**

Ascofinetia in Orch. Rev. 69: 32, 1961
Ascocentrum × *Neofinetia*
1st hybr.: *A.* Twinkle
Parentage: *Neofinetia falcata* × *Ascocentrum miniatum*
Ill.: in Amer. Orch. Soc. Bull. 32: 455, f., 1963

Ascorella nom. hybr. gen. nov.
Ascocentrum × *Renantherella*
1st hybr.: *A. Curvionica* (as **Renancentrum** *Curvionica*)
Parentage: *Renantherella histrionica* × *Ascocentrum curvifolium*

Aspasium in Orch. Rev. 66: 161, 1958
Observation: See **Oncidasia** including the hybrid **Aspasium** Regal.

Aspoglossum in Orch. Rev. 70: September, 1962
Aspasia × *Odontoglossum*
1st hybr.: *A.* Nuuanu
Parentage: *Aspasia principissa* × *Odontoglossum cordatum*

Athertonara in Orch. Rev. 56: 26, 1948
Observation: See **Renanopsis** including the hybrid **Athertonara** Lena Rowold.

Bardendrum in Orch. Rev. 70: September, 1962
Barkeria × *Epidendram*
1st hybr.: *B.* Elvena
Parentage: *Barkeria Lindleyana* × *Epidendrum Schomburgkii*
Syn.: **Barkidendrum** in Amer. Orch. Soc. Bull. 31: 667, 1962

Barkidendrum in Amer. Orch. Soc. Bull. 31: 667, 1962
Observation: See **Bardendrum.**

Barlaceras in Riviera Scientif. 11: 62, 1924
Barlia × *Aceras*
1st hybr.: *B. Terraccianoi*
Parentage: *Aceras anthropophora* × *Barlia longibracteata*

Beaumontara in Orch. Rev. 69: 198, 1961
Observation: See **Recchara** including the hybrid **Beaumontara** Herb.

Benthamara nom. hybr. gen. nov.
Arachnis × *Paraphalaenopsis* × *Euanthe*
1st hybr.: *B.* Manoa (as **Trevorara** Manoa)
Parentage: **Pararachnis** Eric Holttum × *Euanthe Sanderiana*

Bolleo-Chondrorhyncha in Gard. Chron. ser. 3, 32: 243, 1902
Observation: See **Chondrobollea.**

Bradriguezia in Bull. Pac. Orch. Soc. Hawaii 14: 85, 1957
Rodriguezia × *Brassia*
1st hybr.: *B.* Angellitos (as **Rodrassia** Angellitos)
Parentage: *Brassia Gireoudiana* × *Rodriguezia venusta*
Syn.: **Rodrassia** in Orch. Rev. 68: 404, 1960

Brapasia in Bull. Pac. Orch. Soc. Hawaii 14: 85, 1957
Aspasia × *Brassia*
1st hybr.: *B.* Panama
Parentage: *Aspasia principissa* × *Brassia longissima*

Brassidium in Orch. Rev. 56: 186, 1948
Brassia × *Oncidium*
1st hybr.: *B.* Coronet
Parentage: *Oncidium anthocrene* × *Brassia brachiata*

Brassocatlaelia in Gard. Chron. ser. 3, 21: 438, 1897
Observation: See **Brassolaeliocattleya.**

Brassocattleya in Gard. Chron. ser. 3, 5: 438, 1889
Brassavola × *Cattleya*
1st hybr.: *B. Lindleyana* (as *Cattleya Lindleyana*, 1857)
Parentage: *Brassavola tuberculata* × *Cattleya intermedia*
Ill.: in Bot. Mag. 90: t. 5449, 1864
Syn.: **Brassoleya** in Hansen, Orch. Hybr. 81, 1895
Correvonia in Jardin 240, 1898
Cattleyovola in Proc. 3rd World Orch. Conf. 323, 1960

Brasso-Cattleya-Laelia in Gard. Chron. ser. 3, 41: 259, 1907
Observation: See **Brassolaeliocattleya.**

Brassodiacrium in Orchid World 6: 62, 1915
Brassavola × *Diacrium*
1st hybr.: *B. Colmaniae*
Parentage: *Diacrium bicornutum* × *Brassavola nodosa*

Brassoepidendrum in Gard. Chron. ser. 3, 40: 298, 1906
Brassavola × *Epidendrum*
1st hybr.: *B. Stamfordiense*
Parentage: *Brassavola glauca* × *Epidendrum Parkinsonianum*
Syn.: **Epivola** in Orch. Rev. 16: 83, 1908
Epibrassavola in Roanele Manor Coll. Orch. 38, 1926

Brassolaelia in Orch. Rev. 10: 85, 1902
Brassavola × *Laelia*
1st hybr.: *B. Veitchii* (as *Laelia Digbyano-purpurata*)
Parentage: *Laelia purpurata* × *Brassavola Digbyana*
Ill.: in Gartenw. 16: 415, f., 1912
Syn.: **Brassavolaelia** in Proc. 3rd World Orch. Conf. 325, 1960
Laeliavola in Proc. 3rd World Orch. Conf. 325, 1960

Brassolaeliocattleya in Gard. Chron. ser. 3, 40: 201, 1906
Brassavola × *Laelia* × *Cattleya*
1st hybr.: *B. Lawrencei* (as **Brassocatlaelia** *Lindleyano-elegans*)
Parentage: **Brassocattleya** *Lindleyana* × **Laeliocattleya** *elegans*
Syn.: **Brassocatlaelia** in Gard. Chron. ser. 3, 21: 438, 1897
Laelio-Brasso-Cattleya in Gard. Chron. ser. 3, 39: 254, 1906
Brasso-Cattleya-Laelia in Gard. Chron. ser. 3, 41: 259, 1907

Brassoleya in Hansen, Orch. Hybr. 81, 1895
Observation: See **Brassocattleya.**

Brassonotis in Orch. Rev. 70: December, 1962
Observation: See **Sophrovola** including the hybrid **Brassonotis** Edna.

Brassophronitis in Die Orchidee 5: 41, 1954
Observation: See **Sophrovola** including the hybrid **Brassophronitis** Waipuna.

Brassosophrolaeliocattleya in Bol. Circ. Paul. Orch. 1: 191, 1944
Observation: See **Potinara.**

Brassotonia in Orch. Rev. 68: 223, 1960
Brassavola × *Broughtonia*
1st hybr.: *B.* John H. Miller
Parentage: *Brassovola nodosa* × *Broughtonia sanguinea*

Brassovolaelia in Proc. 3rd World Orch. Conf. 325, 1960
Observation: See **Brassolaelia.**

Bratonia in Bull. Pac. Orch. Soc. Hawaii 14: 85, 1957
Miltonia × *Brassia*
1st hybr.: *B.* Premier (as **Miltassia** Premier)
Parentage: *Miltonia spectabilis* × *Brassia caudata*
Ill.: in Amer. Orch. Soc. Bull. 30: 480, f., 1961
Syn.: **Miltassia** in Orch. Rev. 66: 255, 1958

Broughtopsis in Bull. Pac. Orch. Soc. Hawaii 14: 85, 1957
Broughtonia × *Laeliopsis*
1st hybr.: *B.* Kingston (as **Lioponia** Kingston)
Parentage: *Broughtonia sanguinea* × *Laeliopsis domingensis*
Ill.: in Amer. Orch. Soc. Bull. 32: 198, f., 1963
Syn.: **Lioponia** in Orch. Rev. 67: 259, 1959

Burrageara in Gard. Chron. ser. 3, 81: 309, 1927
Cochlioda × *Miltonia* × *Odontoglossum* × *Oncidium*
1st hybr.: *B.* Windsor
Parentage: **Odontonia** *Firminii* × **Oncidioda** *Cooksoniae*
Ill.: in Orch. Rev. 35: 179, f., 1927

Calanthidio-preptanthe in Kerchov, Le Liv. Orch. 465, 1894
Observation: See *Calanthe.*

Calanthophaius in Plauszew., Orch. Pl. Serr. t. 11, 1899
Observation: See **Phaiocalanthe.**

Carrara nom. hybr. gen. nov.
Vanda × *Euanthe* × *Ascocentrum* × *Rhynchostylis*
1st hybr.: *C.* Blue Fairy (as **Vascostylis** Blue Fairy)
Parentage: **Schlechterara** Meda Arnold × *Rhynchostylis coelestis*

Catlaelia in Hansen, Orch. Hybr. 85, 1895
Observation: See **Laeliocattleya.**

Catlaenitis in Hansen, Orch. Hybr. 100, 1895
Observation: See **Sophrolaeliocattleya.**

Cattleyodendrum in Chron. Orch. 1: 115, 1898
Observation: See **Epicattleya.**

Cattleyovola in Proc. 3rd World Orch. Conf. 323, 1960
Observation: See **Brassocattleya.**

Cattleytonia in Orch. Rev. 67: 69, 1959.
Cattleya × *Broughtonia*
1st hybr.: *C.* Rosy Jewel (as **Cattleytonia** Rosy Gem)
Parentage: *Broughtonia sanguinea* × *Cattleya Bowringiana*
Ill.: in Amer. Orch. Soc. Bull. 31: 351, f., 1962

Cephalepipactis in Camus, Monogr. Orch. Europ. 424, 1908
Observation: See **Cephalopactis.**

Cephalopactis in Asch. & Grebn., Syn. 3: 883, 1907
Cephalanthera × *Epipactis*
1st hybr.: *C. speciosa* (as *Epipactis speciosa*, 1889)
Parentage: *Cephalanthera alba* × *Epipactis rubiginosa*
Ill.: in Oesterr. Bot. Zeitschr. 39: t. 3, 1889
Syn.: **Cephalepipactis** in Camus, Monogr. Orch. Europ. 424, 1908

Charlesworthara in Orch. Rev. 27: 143, 1919 (as **Charlesworthiara**)
Cochlioda × *Miltonia* × *Oncidium*
1st hybr.: *C.* Alpha
Parentage: **Miltonioda** Ajax × **Oncidioda** *Cooksoniae*

Chondrobollea in Orch. Rev. 10: 347, 1902
Chondrorhyncha × *Bollea*
1st hybr.: *C. Froebeliana*
Parentage: *Bollea coelestis* × *Chondrorhyncha Chestertonii*
Syn.: **Bolleo-Chondrorhyncha** in Gard. Chron. ser. 3, 32: 243, 1902

Chondropetalum in Orch. Rev. 16: 56, 1908
Observation: See **Zygorhyncha** including the hybrid **Chondropetalum** *Fletcheri*. This name is preempted by *Chondropetalum* Rttb., 1773.

Cirrhophyllum in Orch. Rev. 73: January, 1965
Cirrhopetalum × *Bulbophyllum*
1st hybr.: *C. Mariae*
Parentage: *Cirrhopetalum picturatum* × *Bulbophyllum Dearei*
Observation: This hybrid is very similar if not identical with *Cirrhopetalum lasiochilum.*

Cochleatorea in Orch. Rev. 73: May, 1965
Observation: See **Pescoranthes** including the hybrid **Cochleatorea** Sunnybank.

Coeloglossgymnadenia in Rep. Bot. Exch. Cl. Brit. Isl. 8: 698, 1928
Observation: See **Gymnaglossum.**

Coeloglosshabenaria in Rep. Bot. Exch. Cl. Brit. Isl. 8: 698, 1928
Observation: See **Gymnaglossum.**

Coeloglossogymnadenia in Camus, Ic. Orch. Europ. 2: 377, 1929
Observation: See **Gymnaglossum.**

Coeloglossorchis in Guétrot, Pl. Hybr. Fr. II: 57, 1926
Observation: See **Orchicoeloglossum.**

Cogniauxara nom. hybr. gen. nov.
Renanthera × *Vanda* × *Euanthe* × *Arachnis*
1st hybr.: *C.* Bintang Timor (as **Holttumara** Bintang Timor)
Parentage: **Amesara** Palolo × *Arachnis Hookeriana*

Colmanara in Gard. Chron. ser. 3, 94: 33, 1936
Miltonia × *Odontoglossum* × *Oncidium*
1st hybr.: *C.* Sir Jeremiah (in Orch. Rev. 71: November, 1963)
Parentage: *Odontoglossum bictoniense* × **Miltonidium** Lee Hirsch
Syn.: **Hatcherara** in Gard. Chron. ser. 3, 94: 33, 1936

Correvonia in Jardin 240, 1898
Observation: See **Brassocattleya.**

Cycnodes in Orch. Rev. 69: 402, 1961
Cycnoches × *Mormodes*
1st hybr.: *C.* L. Sherman Adams
Parentage: *Cycnoches chlorochilon* × *Mormodes Wendlandi*

Cyperocymbidium in Orch. Rev. 72: 420, 1964
Cyperorchis × *Cymbidium*
1st hybr.: *C. Gammieanum* (as *Cymbidium Gammieanum*)
Parentage: *Cyperorchis elegans* × *Cymbidium longifolium*
Ill.: in Ann. Roy. Bot. Gard. Calcutta 5: t. 257, 1895

Cysepedium in Hansen, Orch. Hybr. 187, 1895
Cypripedium × *Selenipedium*
1st hybr.: not yet reported
Observation: For the hybrid **Cysepedium** *Corndeanei* see **Phragmipaphium.**
Syn.: **Selenocypripedium** in Journ. Hort. Soc. Fr. ser. 4, 13: 706, 1912

Dactylitella in Watsonia 6: 132, 1965
Dactylorhiza × *Nigritella*

1st hybr.: *D. Tourensis* (as **Nigrorchis** *Tourensis*)
Parentage: *Nigritella nigra* × *Dactylorhiza maculata*
Ill.: in Journ. Bot. 63: t. 573, I, a, b, 1925

Dactylocamptis in Watsonia 6: 132, 1965
Dactylorhiza × *Anacamptis*
1st hybr. *D. Weberi* (as **Anacamptorchis** *Weberi*)
Parentage: *Anacamptis pyramidalis* × *Dactylorhiza maculata*

Dactylodenia nom. hybr. gen. nov.
Dactylorhiza × *Gymnadenia*
1st hybr.: *D. Heinzeliana* (as **Orchigymnadenia** *Heinzeliana*)
Parentage; *Dactylorhiza maculata* × *Gymnadenia conopea*
Ill.: in Camus, Ic. Orch. Europ. t. 126, f. 1–3, 1928

Dactyloglossum in Watsonia 6: 132, 1965
Dactylorhiza × *Coeloglossum*
1st hybr.: *D. Erdingeri* (as *Platanthera Erdingeri*)
Parentage: *Coeloglossum viride* × *Dactylorhiza sambucina*
Ill.: in Verh. Zool.-Bot. Gesellsch. Wien 15: t. 4, f. 4–9, 1865

Dekensara in Orch. Rev. 63: 107, 1955
Brassavola × *Cattleya* × *Schomburgkia*
1st hybr.: *D.* Flandria
Parentage: **Brassocattleya** Helena × *Schomburgkia undulata*

Dendrocattleya in Schultes & Pease, Gen. Name Orch. 329, 1963
Dendrobium × *Cattleya*
1st hybr.: unnamed
Parentage: *Cattleya Bowringiana* × *Dendrobium Phalaenopsis*
Ill.: in Amer. Orch. Soc. Bull. 29: 30, 1960

Diabroughtonia in Orch. Rev. 64: 209, 1956
Diacrium × *Broughtonia*
1st hybr.: *D.* Alice Hart
Parentage: *Broughtonia sanguinea* × *Diacrium bicornutum*

Diacatlaelia in Orch. Rev. 18: 110, 1910
Observation: See **Dialaeliocattleya.**

Diacattleya in The Garden 72: 95, 1908
Diacrium × *Cattleya*
1st hybr.: *D. Colmaniae*
Parentage: *Cattleya intermedia* × *Diacrium bicornutum*
Ill.: in Gard. Chron. ser. 3, 43: 114, f. 45, 1908
Syn.: **Diacrocattleya** in Gard. Chron. ser. 3, 43: 108, 1908

Diacrocattleya in Gard. Chron. ser. 3, 43: 108, 1908
Observation: See **Diacattleya.**

Dialaelia in Gard. Chron. ser. 3, 37: 174, 1905
Diacrium × *Laelia*
1st hyb.: *D. Veitchii*
Parentage: *Diacrium bicornutum* × *Laelia cinnabarina*
Ill.: in Orch. Rev. 20: 361, f. 50, 1912

Dialaeliocattleya in Orch. World 6: 61, 1915
Diacrium × *Laelia* × *Cattleya*
1st hybr.: *D.* Gatton Rose
Parentage: *Diacrium bicornutum* × *Laeliocattleya Cappei*
Syn.: **Diacatlaelia** in Orch. Rev. 18: 110, 1910

Diaschomburgkia in Bull. Pac. Orch. Soc. Hawaii 14: 84, 1957
Diacrium × *Schomburgkia*
1st hybr.: *D.* Ipo
Parentage: *Schomburgkia tibicinis* × *Diacrium bicornutum*
Syn.: **Schombodiacrium** in Orch. Rev. 66: 137, 1958

Domindendrum in Bull. Pac. Orch. Soc. Hawaii 14: 85, 1957
Observation: See **Epigoa.**

Domindesmia in Orch. Rev. 72: November, 1964
Domingoa × *Hexadesmia*
1st hybr.: *D.* Little Gem
Parentage: *Domingoa hymenodes* × *Hexadesmia pulchella*

Domintonia in Bull. Pac. Orch. Soc. Hawaii 14: 85, 1957
Domingoa × *Broughtonia*
1st hybr.: not yet reported

Domliopsis in Orch. Rev. 73: August, 1965
Domingoa × *Laeliopsis*
1st hybr.: *D.* Lavender Mist
Parentage: *Domingoa hymenodes* × *Laeliopsis domingensis*

Doritaenopsis in Arch. Mus. Nat. Paris ser. 6, 12, pt. 2: 613, 1935
Doritis × *Phalaenopsis*
1st hybr.: *D.* Asahi (as *Phalaenopsis* Asahi)
Parentage: *Phalaenopsis Lindeni* × *Doritis pulcherrima*
Syn.: **Doritopsis** in Rev. Circ. Paul. Orch. 7: 218, 1950

Doritopsis in Rev. Circ. Paul. Orch. 7: 218, 1950
Observation: See **Doritaenopsis.**

Dossinimaria in Journ. Linn. Soc. Bot. 24: 170, 1887
Observation: See **Dossisia** including the hybrid **Dossinimaria** *Dominyi.*
Haemaria is a synonym of *Ludisia.*

Dossisia nom. hybr. gen. nov.
Dossinia × *Ludisia*
1st hybr.: *D. Dominyi* (as *Anoectochilus Dominyi,* 1861)
Parentage: *Dossinia marmorata* × *Ludisia discolor*
Syn.: **Dossinimaria** in Journ. Linn. Soc. Bot. 24: 170, 1887

Ellanthera in Orch. Rev. 71: 137, 1963
Renanthera × *Renantherella*
1st hybr. *E. Histrimona* (as *Renanthera Histrimona*)
Parentage: *Renantherella histrionica* × *Renanthera monachica*

Epibrassavola in Roanele Manor Coll. Orch. 38, 1926
Observation: See **Brassoepidendrum.**

Epibroughtonia in Bull. Pac. Orch. Soc. Hawaii 14: 85, 1957
Epidendrum × *Broughtonia*
1st hybr.: *E.* Lilac (as **Epitonia** Lilac)
Parentage: *Epidendrum cochleatum* × *Broughtonia sanguinea*
Syn.: **Epitonia** in Orch. Rev. 68: 371, 1960

Epicattleya in Gard. Chron. ser. 3, 5: 491, 1889
Epidendrum × *Cattleya*
1st hybr.: *E. matutina*
Parentage: *Cattleya Bowringiana* × *Epidendrum ibaguense*
Ill.: in Gard. Chron. ser. 3, 21: 233, f. 77, 1897
Syn.: **Epileya** in Hansen, Orch. Hybr. 203, 1895
Cattleyodendrum in Chron. Orch. 1: 115, 1898

Epidiacrium in Orch. Rev. 16: 82, 1908
Epidendrum × *Diacrium*
1st hybr.: *E. gattonense* (in Rolfe, Stud-book 268, 1909)
Parentage: *Diacrium bicornutum* × *Epidendrum ibaguense*

Epidrobium in Hansen, Orch. Hybr. 203, 1895
Epidendrum × *Dendrobium*
1st hybr.: not yet reported

Epigoa in Orch. Rev. 65: 137, 1957
Epidendrum × *Domingoa*
1st hybr.: *E.* Olivine
Parentage: *Domingoa hymenodes* × *Epidendrum Mariae*
Ill.: in Na Pua Okika o Hawaii Nei 7: 148, 1957

Syn.: **Domindendrum** in Bull. Pac. Orch. Soc. Hawaii 14: 85, 1957

Epilaelia in Gard. Chron. ser. 3, 16: 605, 1894
Epidendrum × *Laelia*
1st hybr.: *E. Hardyana*
Parentage: *Epidendrum ciliare* × *Laelia anceps*
Ill.: in Gard. Chron. ser. 3, 16: 629, f. 80, 1894
Syn.: **Laeliodendrum** in Journ. Hort. Soc. Fr. ser. 3, 19: 602, 1897

Epileya in Hansen, Orch. Hybr. 203, 1895
Observation: See **Epicattleya.**

Epilaeliocattleya in Orch. Rev. 68: 193, 1960
Epidendrum × *Laelia* × *Cattleya*
1st hybr.: *E.* Mint
Parentage: **Laeliocattleya** Kahili Kea × *Epidendrum Mariae*

Epilaeliopsis in Orch. Rev. 67: 405, 1959 (as **Epilaelopsis**)
Observation: See **Epilopsis** including the hybrid **Epilaeliopsis** Ariza-Julia.

Epilopsis in Bull. Pac. Orch. Soc. Hawaii 14: 85, 1957
Epidendrum × *Laeliopsis*
1st hybr.: *E.* Ariza-Julia (as **Epilaelia** Ariza-Julia)
Parentage: *Laeliopsis domingensis* × *Epidendrum Eggersii*
Syn.: **Epilaeliopsis** in Orch. Rev. 67: 405, 1959 (as **Epilaelopsis**)

Epiphaius in Hansen, Orch. Hybr. Suppl. II, 322, 1897
Epidendrum × *Phaius*
1st hybr.: not yet reported

Epiphronitella in Hawkes, Orchids 244, 1961
Epidendrum × *Sophronitella*
1st hybr.: *E. Orpeti* (as **Epiphronitis** *Orpeti*)
Parentage: *Epidendrum O'Brienianum* × *Sophronitella violacea*
Ill.: in Amer. Gard. 22: 331, f. 71 (III), 1901

Epiphronitis in Gard. Chron. ser. 3, 7: 799, 1890
Epidendrum × *Sophronitis*
1st hybr.: *E. Veitchii*
Parentage: *Epidendrum ibaguense* × *Sophronitis grandiflora*
Ill.: in Amer. Orch. Soc. Bull. 28: 601, f., 1959

Epitonia in Orch. Rev. 68: 371, 1960
Observation: See **Epibroughtonia** including the hybrid **Epitonia** Lilac.

Epivola in Orch. Rev. 16: 83, 1908
Observation: See **Brassoepidendrum.**

Esmeranda in Vacherot, Les Orchidées 150, 1954
Esmeralda × *Vanda*
1st hybr.: *E.* Würzburg
Parentage: *Esmeralda Clarkei* × *Vanda coerulea*

Eurachnis in Bok Choon, List Malay. Orch. Hybr. III, 1960
Euanthe × *Arachnis*
1st hybr.: *E.* Helen Gagan (as **Aranda** Helen Gagan, 1957)
Parentage: *Arachnis* Maggie Oei × *Euanthe Sanderiana*

Fujiwarara in Orch. Rev. 71: April, 1963
Brassavola × *Cattleya* × *Laeliopsis*
1st hybr.: *F.* Frolic (as **Tenranara** Frolic)
Parentage: **Brassocattleya** Kinipopo × *Laeliopsis domingensis*
Syn.: **Tenranara** in Orch. Rev. 70: December, 1962

Gastrocalanthe in The Orch. Journ. 1: 245, 1952
Gastrorchis × *Calanthe*
1st hybr.: *G. Berryana* (as **Phaiocalanthe** *Berryana*)
Parentage: *Calanthe masuca* × *Gastrorchis Humblotii*

Gastrophaius in The Orch. Journ. 1: 245, 1952
Gastrorchis × *Phaius*
1st hybr.: *G. Cooksoni* (as *Phaius Cooksoni*)
Parentage: *Gastrorchis tuberculosa* × *Phaius Wallichii*
Ill.: in Gard. Chron. ser. 3, 7: 389, f. 57, 1890

Grammatocymbidium in Hawkes, Orchids 244, 1961
Grammatophyllum × *Cymbidium*
1st hybr.: not yet reported

Gymnabicchia in Camus, Monogr. Orch. Europ. 315, 1908
Observation: See **Gymnorchis.**

Gymnacamptis in Roy. Hort. Soc. Dict. 2: 938, 1951
Observation: See **Gymnanacamptis.**

Gymnadeniorchis in Hawkes, Encycl. Cult. Orch. 340, 1965
Observation: See **Orchigymnadenia.**

Gymnaglossum in Orch. Rev. 27: 171, 1919
Gymnadenia × *Coeloglossum*
1st hybr.: *G. Jacksonii* (as **Gymnplatanthera** *Jacksonii*, 1911
Parentage: *Gymnadenia conopea* × *Coeloglossum viride*

Ill.: in Fedde Rep. Sonderbeih. A. 5: t. 444, f. 1–2b, 1939
Syn.: **Coeloglossgymnadenia** in Rep. Bot. Exch. Cl. Brit. Isl. 8: 698, 1928
Coeloglosshabenaria in Rep. Bot. Exch. Cl. Brit. Isl. 8: 698, 1928
Coeloglossogymnadenia in Camus, Ic. Orch. Europ. 2: 377, 1929

Gymnanacamptis in Aschers. & Graebn., Syn. 3: 854, 1907
Gymnadenia × *Anacamptis*
1st hybr.: *G. anacamptis* (as *Gymnadenia anacamptis*, 1868)
Parentage: *Anacamptis pyramidalis* × *Gymnadenia conopea*
Ill.: in Fedde Rep. Sonderbeih. A. 3: t. 167, f. 7–9, 1939
Syn.: **Gymnacamptis** in Roy. Hort. Soc. Dict. 2: 938, 1951

Gymnaplatanthera in Roy. Hort. Soc. Dict. 2: 939, 1951
Observation: See **Gymnplatanthera.**

Gymnigritella in Journ. Bot. Fr. 6: 484, 1892
Gymnadenia × *Nigritella*
1st hybr.: *G. suaveolens* (as *Orchis suaveolens*, 1787)
Parentage: *Nigritella nigra* × *Gymnadenia conopea*
Ill.: in Camus, Ic. Orch. Europ. t. 89, f. 1–3, 1921

Gymnorchis in Dostál, Fl. Czechosl. (Květena ČSR) ed. 2, 2101, 1950
Leucorchis × *Gymnadenia*
1st hybr.: *G. Schweinfurthii* (as *Gymnadenia Schweinfurthii*, 1865)
Parentage: *Gymnadenia conopea* × *Leucorchis albida*
Ill.: in Verh. Zool.-Bot. Gesellsch. Wien 15: t. 5, f. 15–16, 1865
Syn.: **Gymnabicchia** in Camus, Monogr. Orch. Europ. 315, 1908
Leucadenia in Fedde Rep. 16: 290, 1920, not *Leucadenia* Klotzsch, 1864

Gymnplatanthera in Camus, Monogr. Orch. Europ. 337, 1908
Gymnadenia × *Platanthera*
1st hybr.: *G. Chodati* (as *Gymnadenia Chodati*)
Parentage: *Gymnadenia conopea* × *Platanthera bifolia*
Ill.: in Fedde Rep. Sonderbeih. A. 5: t. 434, f. 1, 1939
Syn.: **Gymnaplatanthera** in Roy. Hort. Soc. Dict. 2: 939, 1951

Habenari-orchis in Ann. Bot. 6: 325, 1892
Observation: See **Orchicoeloglossum.**

Haemari-anoectochilus in Kerchov, Le Liv. Orch. 468, 1894
Observation: See **Ludochilus.**

Haemari-macodes in Kerchov, Le Liv. Orch. 468, 1894
Observation: See **Macodisia.**

Hartara in Orch. Rev. 73: August, 1965
Sophronitis × *Laelia* × *Broughtonia*
1st hybr.: *H.* George
Parentage: **Sophrolaelia** Valda × *Broughtonia sanguinea*
Ill.: in Amer. Orch. Soc. Bull. 34: 878, 1965

Hatcherara in Gard. Chron. ser. 3, 94: 33, 1936
Observation: See **Colmanara.**

Hawaiiara in Orch. Rev. 67: 405, 1959
Renanthera × *Vandopsis* × *Vanda*
1st hybr.: *H.* Sunglow
Parentage: **Renanopsis** Lena Rowold × *Vanda spathulata*
Observation: For the hybrid **Hawaiiara** Copper Coin see **Lindleyara.**

Hermibicchia in Camus, Monogr. Orch. Europ. 312, 1908
Observation: See **Leucerminium.**

Herminiorchis in Fourn., Quatre Fl. Fr. 201, 1935
Observation: See **Leucerminium.**

Holttumara in Malay. Orch. Rev. 5: 75, 1958
Arachnis × *Vanda* × *Renanthera*
1st hybr.: *H.* Cochineal
Parentage: **Aranda** Hilda Galistan × *Renanthera coccinea*
Ill.: in Malay. Orch. Rev. 5: 75, f., 1958
Observation: For the hybrid **Holttumara** Bintang Timor see **Cogniauxara.**
Syn.: **Renanda** in Orch. Rev. 69: 63, 1961

Hookerara in Orch. Rev. 71: October, 1963
Diacrium × *Cattleya* × *Brassavola*
1st hybr.: *H.* Fragrance
Parentage: **Diacattleya** Chastity × *Brassavola Digbyana*

Iwanagara in Orch. Rev. 68: 223, 1960
Observation: See **Linneara** including the hybrid **Iwanagara** Frontier.

Kirchara in Orch. Rev. 67: 33, 1959
Epidendrum × *Sophronitis* × *Laelia* × *Cattleya*
1st hybr.: *K.* Topaz
Parentage: **Sophrolaeliocattleya** Firefly × *Epidendrum Mariae*
Ill.: in Amer. Orch. Soc. Bull. 29: 434, f., 1960

Kraenzlinara nom. hybr. gen. nov.
Trichoglottis × *Vanda* × *Euanthe*
1st hybr.: *K.* Richard Emery (as **Trichovanda** Richard Emery)
Parentage: *Trichoglottis brachiata* × **Vandanthe** *Rothschildiana*
Ill.: in Amer. Orch. Soc. Bull. 34: No. 8, Cover, 1965

Laelio-Brasso-Cattleya in Gard. Chron. ser. 3, 39: 254, 1906
Observation: See **Brassolaeliocattleya.**

Laeliocattkeria in Orch. Rev. 73: October, 1965
Laelia × *Cattleya* × *Barkeria*
1st hybr.: *L.* Serendipity
Parentage: **Laeliocattleya** Ibbie × *Barkeria Lindleyana*

Laeliocattleya in Journ. Linn. Soc. Bot. 24: 168, 1887
Laelia × *Cattleya*
1st hybr.: *L. elegans* (as *Cattleya elegans*, 1848)
Parentage: *Cattleya Leopoldii* × *Laelia purpurata*
Ill.: in Bot. Mag. 79: t. 4700, 1853
Syn.: **Catlaelia** in Hansen, Orch. Hybr. 85, 1895

Laeliodendrum in Journ. Hort. Soc. Fr. ser. 3, 19: 602, 1897
Observation: See **Epilaelia.**

Laeliovola in Proc. 3rd World Orch. Conf. 325, 1960
Observation: See **Brassolaelia.**

Laelonia in Orch. Rev. 65: 231, 1957
Laelia × *Broughtonia*
1st hybr.: *L.* Ruby
Parentage: *Broughtonia sanguinea* × *Laelia autumnalis*
Observation: For the hybrid **Laelonia** Federation see **Laeopsis.**

Laeopsis in Bull. Pac. Orch. Soc. Hawaii 14: 85, 1957
Laelia × *Laeliopsis*
1st hybr.: *L.* Federation (as **Laelonia** Federation)
Parentage: *Laelia rubescens* × *Laelopsis domingensis*
Syn.: **Liaopsis** in Orch. Rev. 67: 147, 1959
Opsilaelia in Hawkes, Orchids 244, 1961

Leptolaelia in Gard. Chron. 3, 31: 280, 1902
Leptotes × *Laelia*
1st hybr.: *L. Veitchii*
Parentage: *Leptotes bicolor* × *Laelia cinnabarina*
Ill.: in Gard. Chron. ser. 3, 33: 50, f. 23, 1903

Leucadenia in Fedde Rep. 16: 290, 1920
Observation: Not *Leucadenia* Klotzsch, 1864. See **Gymnorchis.**

Leucerminium in Gartenfl. 85: 253, 1936
Leucorchis × *Herminium*
1st hybr.: *L. Aschersonianum* (as *Gymnadenia Aschersoniana*, 1888)
Parentage: *Leucorchis albida* × *Herminium monorchis*
Syn. **Hermibicchia** in Camus, Monogr. Orch. Europ. 312, 1908
Herminiorchis in Fourn., Quatre Fl. Fr. 201, 1935

Leucotella in Fedde Rep. 16: 272, 1920
Leucorchis × *Nigritella*
1st hybr.: *L. micrantha* (as *Nigritella micrantha*)
Parentage: *Nigritella nigra* × *Leucorchis albida*
Ill.: in Verh. Zool.- Bot. Gesellsch. Wien 15: t. 6, f. 1, 1865
Syn.: **Nigribicchia** in Camus, Monogr. Orch. Europ. 360, 1908

Liaopsis in Orch. Rev. 67: 147, 1959
Observation: See **Laeopsis** including the hybrid **Liaopsis** Federation.

Limara in Orch. Rev. 68: 403, 1960
Renanthera × *Vandopsis* × *Arachnis*
1st hybr.: *L.* Lim Lean Teng
Parentage: **Renanopsis** Lena Rowold × *Arachnis* Maggie Oei

Limatopreptanthe in Kerchov, Le Liv. Orch. 471, 1894
Observation: See *Calanthe.*

Lindleyara nom. hybr. gen. nov.
Renanthera × *Vandopsis* × *Vanda* × *Euanthe*
1st hybr.: *L.* Copper Coin (as **Hawaiiara** Copper Coin)
Parentage: **Vandanthe** Ellen Noa × **Renanopsis** Lena Rowold

Linneara in Bull. Soc. Roy. Bot. Belg. 47: 402, 1911
Diacrium × *Laelia* × *Brassavola* × *Cattleya*
1st hybr.: *L.* Frontier (as **Iwanagara** Frontier)
Parentage: **Diacattleya** Chastity × **Brassolaeliocattleya** Hodaco
Ill.: in Amer. Orch. Soc. Bull. 32: 451, f., 1963
Syn.: **Iwanagara** in Orch. Rev. 68: 223, 1960

Lioponia in Orch. Rev. 67: 259, 1959
Observation: See **Broughtopsis** including the hybrid **Lioponia** Kingston.

Loroglorchis in Journ. Bot. Fr. 6: 110, 1892
Loroglossum × *Orchis*
1st hybr.: *L. Lacasei*

Parentage: *Orchis simia* × *Loroglossum hircinum*
Observation: This hybrid may be identical with **Orchiaceras** *spuria*.
Syn.: **Orchimantoglossum** in Aschers. & Graebn., Syn. 3: 799, 1907

Lowara in Orch. Rev. 20: 360, 1912 (as **Lowiara**)
Brassavola × *Laelia* × *Sophronitis*
1st hybr.: *L. insignis*
Parentage: *Sophronitis grandiflora* × *Brassolaelia* Helen

Ludochilus nom. hybr. gen. nov.
Anoectochilus × *Ludisia*
1st hybr.: *L. Dominyi* (as *Anoectochilus Dominyi*)
Parentage: *Anoectochilus Roxburghii* × *Ludisia discolor*
Observation: *Haemaria* is a synonym of *Ludisia*.
Syn.: **Anoectomaria** in Journ. Linn. Soc. Bot. 24: 170, 1887
Haemari-anoectochilus in Kerchov, Le Liv. Orch. 468, 1894

Luisanda in Orch. Rev. 60: 180, 1952
Luisia × *Vanda*
1st hybr.: *L.* Uniwai
Parentage: *Luisia teretifolia* × *Vanda Hookeriana*
Ill.: in Na Pua Okika o Hawaii Nei 2: No. 3, Cover, 1953

Lycastenaria in Colman, Hybr. Orch. 80, 1933
Lycaste × *Bifrenaria*
1st hybr.: *L.* Darius (as *Lyfrenaria* Darius, 1954)
Parentage: *Bifrenaria Harrisoniae* × *Lycaste virginalis* var. *hellemense*
Ill.: in Gard. Chron. ser. 3, 136: 5, f. 3, 1954
Syn.: **Lyfrenaria** in Gard. Chron. ser. 3, 135: 175, 1954
Lycasteria in Orch. Rev. 62: 92, 1954

Lycasteria in Orch. Rev. 62: 92, 1954
Observation: See **Lycastenaria** including the hybrid **Lycasteria** Darius.

Lyfrenaria in Gard. Chron. ser. 3, 135: 175, 1954
Observation: See **Lycastenaria** including the hybrid **Lyfrenaria** Darius.

Lyonara in Orch. Rev. 56: 94, 1948
Observation: See **Trichovanda.** For the hybrid **Lyonara** Ulaula see **Antheglottis.**

Lyonara in Orch. Rev. 67: 405, 1959
Observation: See **Schombolaeliocattleya** including the hybrid **Lyonara** Fiesta.

Macodisia nom. hybr. gen. nov.
Macodes × *Ludisia*
1st hybr.: *M. Veitchii* (as *Goodyera Veitchii*)
Parentage: *Macodes Petola* × *Ludisia discolor*
Observation: *Haemaria* is a synonym of *Ludisia*.
Syn.: **Macomaria** in Journ. Linn. Soc. Bot. 24: 170, 1887
Haemari-macodes in Kerchov, Le Liv. Orch. 468, 1894

Macomaria in Journn. Linn. Soc. Bot. 24: 170, 1887
Observation: See **Macodisia** including the hybrid **Macomaria** *Veitchii*.

Macrangraecum in Cost., La Vie des Orch. 180, 1917
Macroplectum × *Angraecum*
1st hybr.: *M. Veitchii* (as *Angraecum Veitchii*)
Parentage: *Macroplectrum sesquipedale* × *Angraecum superbum*
Ill.: in Gard. Chron. ser. 3, 25: 35, f. 10, 1899
Observation: *Macroplectrum* is a synonym of *Angraecum*. If the two genera are kept separate, **Macrangraecum** should be used.

Milpasia in Orch. Rev, 67: 33, 1959
Observation: See **Miltonpasia** including the hybrid **Milpasia** *Candissa*.

Milpilia in Orch. Rev. 69: 33, 1961
Observation: See **Miltonpilia** including the hybrid **Milpilia** Magic.

Miltassia in Orch. Rev. 66: 255, 1958
Observation: See **Bratonia** including the hybrid **Miltassia** Premier.

Miltoglossum in Tribune Hortic. 5: 241, 1910
Observation: See **Odontonia.**

Miltoncidium in Amer. Orch. Soc. Bull. 25: 186, 1956
Observation: See **Miltonidium.**

Miltonguezia in Bull. Pac. Orch. Soc. Hawaii 14: 85, 1957
Rodriguezia × *Miltonia*
1st hybr.: *M.* Freckles (as **Rodritonia** Freckles, 1959)
Parentage: *Miltonia Bluntii* × *Rodriguezia secunda*
Syn.: **Rodritonia** in Orch. Rev. 67: 33, 1959

Miltonidium in Gard. Chron. ser. 3, 94: 33, 1936
Miltonia × *Oncidium*
1st hybr.: *M.* Aristocrat (in Orch. Rev. 48: 56, 1940)
Parentage: *Miltonia Schroederiana* × *Oncidium leucochilum*
Ill.: in Curtis, Orchids 218, t., 1950
Syn.: **Miltoncidium** in Amer. Orch. Soc. Bull. 25: 186, 1956

Miltonioda in Orch. Rev. 17: 57, 1909
Miltonia × *Cochlioda*
1st hybr.: *M. Lindenii*
Parentage: *Cochlioda vulcanica* × *Miltonia Phalaenopsis*

Miltoniopsis in Orchidophile 9: 145, t., 1889
Observation: See *Miltonia.*

Miltonpasia in Bull. Pac. Orch. Soc. Hawaii 14: 85, 1957
Miltonia × *Aspasia*
1st hybr.: *M. Candissa* (as **Milpasia** *Candissa*)
Parentage: *Aspasia principissa* × *Miltonia candida*
Syn.: **Milpasia** in Orch. Rev. 67: 33, 1959

Miltonpilia in Bull. Pac. Orch. Soc. Hawaii 14; 85, 1957
Miltonia × *Trichopilia*
1st hybr.: *M.* Magic (as **Milpilia** Magic)
Parentage: *Miltonia spectabilis* × *Trichopilia suavis*
Ill.: in Orch. Rev. 69: 261, f. 76, 1961
Syn.: **Milpilia** in Orch. Rev. 69: 33, 1961

Moirara in Orch. Rev. 71: June, 1963
Vanda × *Renanthera* × *Phalaenopsis*
1st hybr.: *M.* Sunbeam (in Orch. Rev. 71: August, 1963)
Parentage: **Renantanda** Gold Nugget × *Phalaenopsis* Doris
Observation: For the hybrid **Moirara** Sunshine see **Paravandanthera.**

Nakamotoara in Orch. Rev. 72: August, 1964
Neofinetia × *Ascocentrum* × *Vanda*
1st hybr.: *N.* Blanc (in Orch. Rev. 73: March, 1965)
Parentage: **Ascocenda** Charm × *Neofinetia falcata*
Observation: For the hybrid **Nakamotoara** Wendy see **Smithara.**

Neostylis in Orch. Rev. 73: August, 1965
Neofinetia × *Rhynchostylis*
1st hybr.: *N.* Dainty
Parentage: *Neofinetia falcata* × *Rhynchostylis retusa*

Nigribicchia in Camus, Monogr. Orch. Europ. 360, 1908
Observation: See **Leucotella.**

Nigrorchis in Journ. Bot. 63: 313, 1925
Nigritella × *Orchis*
1st hybr.: not yet reported
Observation: For the hybrid **Nigrorchis** *Tourensis* see **Dactylitella.**

Odontioda in Gard. Chron. ser. 3, 35: 360, 1904
Odontoglossum × *Cochlioda*
1st hybr.: *O. Vuylstekeae*
Parentage: *Cochlioda Noezliana* × *Odontoglossum Pescatorei*
Ill.: in Orch. Rev. 12: 209, f. 34, 1904

Odontiodonia in Orch. World 1: 84, 1911
Observation: See **Vuylstekeara.**

Odontobrassia in Gartenfl. 84: 121, 1935
Odontoglossum × *Brassia*
1st hybr.: *O.* Alice
Parentage: *Brassia brachiata* × *Odontoglossum* Tagus
Ill.: Die Orchidee 5: 43, t., 1954

Odontocidium in Gard. Chron. ser. 3, 50: 343, 1911
Odontoglossum × *Oncidium*
1st hybr.: *O. Fowlerianum*
Parentage: *Odontoglossum cirrhosum* × *Oncidium Forbesii*

Odontonia in Gard. Chron. ser. 3, 37: 398, 1905
Odontoglossum × *Miltonia*
1st hybr.: *O. Lairesseae*
Parentage: *Miltonia Warscewiczii* × *Odontoglossum crispum*
Ill.: in Orch. Rev. 13: 217, f. 47, 1905
Syn.: **Miltoglossum** in Tribune Hortic. 5: 241, 1910

Odopetalum in Hansen, Orch. Hybr. 227, 1895
Odontoglossum × *Zygopetalum*
1st hybr.: *O. heathii* (in Hansen, Orch. Hybr. Suppl. II, 329, 1897)
Parentage: *Zygopetalum Mackayi* × *Odontoglossum* sp.
Observation: This is a very doubtful hybrid.

Oncidarettia in Bull. Pac. Orch. Soc. Hawaii 14: 85, 1957 (as **Oncidaretia.**)
Oncidium × *Comparettia*
1st hybr.: *O.* Valentine (as **Oncidettia** Valentine)
Parentage: *Oncidium altissimum* × *Comparettia falcata*
Syn.: **Oncidettia** in Orch. Rev. 71: June, 1963

Oncidasia in Bull. Pac. Orch. Soc. Hawaii 14: 85, 1957
Aspasia × *Oncidium*
1st hybr.: *O.* Regal (as **Aspasium** Regal)
Parentage: *Aspasia epidendroides* × *Oncidium Wydleri*
Syn.: **Aspasium** in Orch. Rev. 66: 161, 1958

Oncidesa in Orch. Rev. 72: December, 1964
Oncidium × *Gomesa*
1st hybr.: *O.* America
Parentage: *Oncidium triquetrum* × *Gomesa recurva*

Oncidettia in Orch. Rev. 71: June, 1963
Observation: See **Oncidarettia** including the hybrid **Oncidettia** Valentine.

Oncidguezia in Bull. Pac. Orch. Soc. Hawaii 14: 85, 1957
Observation: See **Rodricidium.**

Oncidioda in Orch. Rev. 18: 266, 1910
Oncidium × *Cochlioda*
1st hybr.: *O. Charlesworthii*
Parentage: *Cochlioda Noezliana* × *Oncidium incurvum*
Ill.: in Orch. World 1: 8, 1910

Opsilaelia in Hawkes, Orchids 244, 1961
Observation: See **Laeopsis.**

Opsisanda in Orch. Rev. 57: 24, 1949
Vanda × *Vandopsis*
1st hybr.: *O.* Colombo
Parentage: *Vanda Dearei* × *Vandopsis lissochiloides*
Ill.: in Bot. Gaz. 125: 135, f. 12 & 17, 1964
Observation: For the hybrid **Opsisanda** Helen Miyamoto see **Opsisanthe**.
For the hybrid **Opsisanda** Kimo Cardus see **Reichenbachara.**
Syn.: **Tanakara** in Orch. Rev. 55: 120, 1947 (not **Tanakara,** 1952)
Vandopsisvanda in Rev. Circ. Paul Orch. 7: 219, 1950

Opsisanthe in Schultes & Pease, Gen. Names Orch. 330, 1963
Vandopsis × *Euanthe*
1st hybr.: *O.* Helen Miyamoto (as **Opsisanda** Helen Miyamoto)
Parentage: *Vandopsis lissochiloides* × *Euanthe Sanderiana*
Ill.: in Amer. Orch. Soc. Bull. 29: 927, 1960

Orchiaceras in Journ. Bot. Fr. 6: 107, 1892
Orchis × *Aceras*
1st hybr.: *O. Bergoni*
Parentage: *Orchis simia* × *Aceras anthropophora*
Ill.: in Camus, Ic. Orch. Europ. t. 17, f. 13–16, 1921

Orchicoeloglossum in Aschers. & Graebn., Syn. 3: 849, 1907
Orchis × *Coeloglossum*

1st hybr.: not yet reported

Observation: For the hybrid **Orchicoeloglossum** *Erdingeri* see **Dactyloglossum.**

Syn.: **Habenari-orchis** in Ann. Bot. Fr. 6: 325, 1892
Coeloglossorchis in Guétrot, Pl. Hybr. Fr. II, 57, 1926

Orchidactyla in Watsonia 6: 133, 1965
Dactylorhiza × *Orchis*
1st hybr.: *O. Schulzei* (as *Orchis Schulzei*, 1882)
Parentage: *Orchis coriophora* × *Dactylorhiza latifolia*
Ill.: in Camus, Ic. Orch. Europ. t. 56, f. 5–9, 1921

Orchidanacamptis in Guétrot, Pl. Hybr. Fr. II, 51, 1926
Observation: See **Anacamptorchis.**

Orchigymnadenia in Journ. Bot. Fr. 6: 477, 1892
Orchis × *Gymnadenia*
1st hybr.: *O. Evequei* (as *Orchis Evequei*, 1905)
Parentage: *Gymnadenia odoratissima* × *Orchis laxiflora*
Ill.: in Camus, Ic. Orch. Europ. t. 86, f. 1–2, 1921
Syn.: **Gymnadeniorchis** in Hawkes, Encycl. Cult. Orch. 340, 1965

Orchimantoglossum in Aschers. & Graebn., Syn. 3: 799, 1907
Observation: See **Loroglorchis.**

Orchiplatanthera in Journ. Bot. Fr. 6: 474, 1892
Orchis × *Platanthera*
1st hybr.: not yet reported
Observation: For the hybrid **Orchiplatanthera** *Chevallieriana* see **Rhizanthera.**

Orchiserapias in Journ. Bot. Fr. 6: 31, 1892
Orchis × *Serapias*
1st hybr.: *O. triloba* (as *Serapias triloba*)
Parentage: *Orchis ensifolia* × *Serapias cordigera*
Ill.: in Reichenb., Fl. Germ. et Helv. 13–14: t. 86, 1851

Papilionanda in Schultes & Pease, Gen. Names Orch. 330, 1963
Papilionanthe × *Vanda*
1st hybr.: *P.* Miss Joaquim (as *Vanda* Miss Joaquim)
Parentage: *Vanda Hookeriana* × *Papilionanthe teres*
Ill.: in Henders. & Addis., Malay. Orch. Hybr. 107, 1956
Observation: *Papilionanthe* is a synonym of *Vanda*. If the two genera are kept separate, **Papilionanda** should be used.

Parandachnis nom. hybr. gen. nov.
Arachnis × *Paraphalaenopsis* × *Vanda*

1st hybr.: *P.* Hong Trevor (as **Trevorara** Hong Trevor)
Parentage: **Pararachnis** Eric Holttum × *Vanda Dearei*
Ill.: in Amer. Orch. Soc. Bull. 35: 33, f., 1966

Parandanthe nom. hybr. gen. nov.
Euanthe × *Vanda* × *Paraphalaenopsis*
1st hybr.: *P.* Pang Nyuk Yin (as **Vandaenopsis** Pang Nyuk Yin)
Parentage: **Vandanthe** Ellen Noa × *Paraphalaenopsis Denevei*
Ill.: in Malay. Orch. Rev. 7: 10, f., 1964

Paranthe nom. hybr. gen. nov.
Euanthe × *Paraphalaenopsis*
1st hybr.: *P. Jawaii* (as **Vandaenopsis** *Jawaii*)
Parentage: *Euanthe Sanderiana* × *Paraphalaenopsis Denevei*
Ill.: in De Orchidee 9: 21, 1940

Paranthera nom. hybr. gen. nov.
Arachnis × *Paraphalaenopsis* × *Renanthera*
1st hybr.: *P.* Ahmad Zahab (as **Sappanara** Ahmad Zahab)
Parentage: **Pararachnis** Eric Holttum × *Renanthera Storiei*

Pararachnis in Orquidea 25: 215, 1963
Arachnis × *Paraphalaenopsis*
1st hybr.: *P.* Eric Holttum (as **Arachnopsis** Eric Holttum)
Parentage: *Arachnis* Maggie Oei × *Paraphalaenopsis Denevei*
Ill.: in Malay. Orch. Rev. 4: 41, f. 1, 1950

Pararenanthera in Orquidea 25: 215, 1963
Renanthera × *Paraphalaenopsis*
1st hybr.: *P.* Firefly (as **Renanthopsis** Firefly)
Parentage: *Paraphalaenopsis Denevei* × *Renanthera Storiei*
Ill.: in Malay. Orch. Rev. 4: 44, f. 2, 1950

Paravanda in Orquidea 25: 215, 1963
Vanda × *Paraphalaenopsis*
1st hybr.: *P. Bogoriana* (as **Vandaenopsis** *Bogoriana*, 1939)
Parentage: *Paraphalaenopsis Denevei* × *Vanda coerulea*
Ill.: in De Orchidee 8: 171, f., 1939

Paravandanthera nom. hybr. gen. nov.
Vanda × *Renanthera* × *Paraphalaenopsis*
1st hybr.: *P.* Sunshine (as **Moirara** Sunshine, 1963)
Parentage: **Renantanda** Gold Nugget × *Paraphalaenopsis Denevei*
Ill.: in Orch. Rev. 71: 339, f. 170, 1963

Pectabenaria in Hawkes, Orchids 244, 1961
Pecteilis × *Habenaria*
1st hybr.: *P.* Original (as *Habenaria* Original)
Parentage: *Habenaria militaris* × *Pecteilis Susannae*

Pescarhyncha in Orch. Rev. 69: 33, 1961
Pescatoria × *Chondrorhyncha*
1st hybr.: not yet reported
Observation: For the hybrid **Pescarhyncha** Painted Lady see **Pescoranthes.**

Pescatobollea in Orch. Rev. 10: 347, 1902
Pescatoria × *Bollea*
1st hybr.: *P. bella* (as *Pescatoria bella*)
Parentage: *Pescatoria Klabochorum* × *Bollea coelestis*
Ill.: in Orch. Rev. 13: 329, f. 68, 1905

Pescoranthes in Orch. Rev. 69: 403, 1961
Pescatoria × *Cochleanthes*
1st hybr.: *P.* Painted Lady (as **Pescarhyncha** Painted Lady)
Parentage: *Pescatoria cerina* × *Cochleanthes discolor*
Syn.: **Cochleatorea** in Orch. Rev. 73: May, 1965

Phabletia in Hansen, Orch. Hybr. Suppl. II, 330, 1897
Phaius × *Bletia*
1st hybr.: not yet reported

Phaiocalanthe in Journ. Linn. Soc. Bot. 24: 168, 1887
Phaius × *Calanthe*
1st hybr.: *P. irrorata* (as *Phaius irroratus*)
Parentage: *Phaius grandifolius* × *Calanthe vestita*
Ill.: in Flor. Mag. t. 426, 1869
Syn.: **Phaiopreptanthe** in Kerchov, Le Liv. Orch. 485, 1894
Phaiolimatopreptanthe in Kerchov, Le Liv. Orch. 485, 1894
Phalanthe in Hansen, Orch. Hybr. 233, 1895
Calanthophaius in Plauszew., Orch. Pl. Serr. t. 11, 1899

Phaiocymbidium in Gard. Chron. ser. 3, 31: 219, 1902
Phaius × *Cymbidium*
1st hybr.: *P. Chardwarense*
Parentage: *Cymbidium giganteum* × *Phaius Wallichii*
Ill.: in Amer. Orch. Soc. Bull. 32: 215, 1963
Observation: This is a very doubtful hybrid.

Phaiolimatopreptanthe in Kerchov, Le Liv. Orch. 485, 1894
Observation: See **Phaiocalanthe.**

Phaiopreptanthe in Kerchov, Le Liv. Orch. 485, 1894
Observation: See **Phaiocalanthe.**

Phalaerianda in Orch. Rev. 59: 124, 1951
Aerides × *Vanda* × *Phalaenopsis*
1st hybr.: *P.* Honolulu
Parentage: **Aeridovanda** Ruth × *Phalaenopsis Schilleriana*
Ill.: in The Orch. Journ. 1: 66, f. 55, 1952
Syn.: **Tanakara** in Orch. Rev. 60: 13, 1952 (as **Tanakaria**)

Phalandopsis in Orch. Rev. 68: 224, 1960
Phalaenopsis × *Vandopsis*
1st hybr.: *P.* Star of Hawaii
Parentage: *Vandopsis Warocqueana* × *Phalaenopsis* Grace Palm
Ill.: in Na Pua Okika o Hawaii Nei 10: No. 2, Cover, 1960

Phalaenetia in Orch. Rev. 72: July, 1964 (as **Phalanetia**)
Phalaenopsis × *Neofinetia*
1st hybr.: *P. Pacifica*
Parentage: *Neofinetia falcata* × *Phalaenopsis* Chieftain

Phalanthe in Hansen, Orch. Hybr. 233, 1895
Observation: See **Phaiocalanthe.**

Phragmipaphiopedilum in Hawkes, Orchids 244, 1961
Observation: See **Phragmipaphium.**

Phragmipaphium in Gartenfl. 85: 253, 1936
Phragmipedium × *Paphiopedilum*
1st hybr.: *P. Corndeanii* (as **Cysepedium** *Corndeanii* in Hansen, Orch. Hybr. 189, 1895)
Parentage: *Phragmipedium Sedeni* × *Paphiopedilum gigas*
Syn.: **Phragmipaphiopedilum** in Hawkes, Orchids 244, 1961

Potinara in Gard. Chron. ser. 3, 71: 98, 1922
Brassavola × *Cattleya* × *Laelia* × *Sophronitis*
1st hybr.: *P. Juliettae*
Parentage: **Brassocattleya** Ena × **Sophrolaeliocattleya** Marathon
Syn.: **Brassosophrolaeliocattleya** in Bol. Circ. Paul. Orch. 1: 191, 1944

Recchara in Rev. Circ. Paul. Orch. 7: 165, 1950 (as **Recchiara**)
Brassavola × *Laelia* × *Cattleya* × *Schomburgkia*
1st hybr.: *R.* Amelia
Parentage: **Brassolaelia** Brasil × **Schombocattleya** *crispo-Loddigesii*
Syn.: **Beaumontara** in Orch. Rev. 69: 198, 1961

Reichenbachara nom. hybr. gen. nov.
Vanda × *Euanthe* × *Vandopsis*
1st hybr.: *R.* Kimo Cardus (as **Opsisanda** Kimo Cardus)
Parentage: **Vandanthe** *Burgeffii* × *Vandopsis lissochiloides*
Ill.: in Amer. Orch. Soc. Bull. 21: 445, f., 1952

Renades in Orch. Rev. 63: 108, 1955
Renanthera × *Aerides*
1st hybr.: *R.* Kaiulani
Parentage: *Renanthera monachica* × *Aerides Fieldingii*

Renaglottis in Bull. Pac. Orch. Soc. Hawaii 14: 85, 1957
Renanthera × *Trichoglottis*
1st hybr.: not yet reported

Renancentrum in Orch. Rev. 70: September, 1962
Renanthera × *Ascocentrum*
1st hybr.: not yet reported
Observation: For the hybrid **Renancentrum** *Curvionica* see **Ascorella.**

Renanda in Orch. Rev. 69: 63, 1961
Observation: See **Holttumara** including the hybrid **Renanda** Ruby Star.

Renanetia in Orch. Rev. 70: September, 1962
Renanthera × *Neofinetia*
1st hybr.: *R.* Bali
Parentage: *Renanthera* Brookie Chandler × *Neofinetia falcata*

Renanopsis in Orch. Rev. 57: 24, 1949
Renanthera × *Vandopsis*
1st hybr.: *R.* Lena Rowold (as **Athertonara** Lena Rowold)
Parentage: *Renanthera Storiei* × *Vandopsis lissochiloides*
Ill.: in Amer. Orch. Soc. Bull. 25: 256, f., 1956
Syn.: **Athertonara** in Orch. Rev. 56: 26, 1948
Renopsis in Malay. Orch. Rev. 4: 36, 1949

Renanstylis in Orch. Rev. 68: 224, 1960
Renanthera × *Rhynchostylis*
1st hybr.: *R.* Jo Ann
Parentage: *Renanthera* Brookie Chandler × *Rhynchostylis retusa*
Syn.: **Rhynchanthera** in Hawkes, Encycl. Cult. Orch. 529, 1965

Renantanda in Bull. Soc. Hort. Fr. ser. 6, 2: 92, 1935
Renanthera × *Vanda*
1st hybr.: *R. Sanderi*

Parentage: *Renanthera Imshootiana* × *Vanda suavis*
Ill.: in Curtis, Orchids 224, t., 1950
Observation: For the hybrid **Renantanda** Titan see **Antheranthe.**
Syn.: **Renantheranda** in Malay. Orch. Rev. 2: 139, 1938
Vandathera in De Orchidee 8: 159, 1939

Renantheranda in Malay. Orch. Rev. 2: 139, 1938
Observation: See **Renantanda.**

Renanthoglossum in Orch. Rev. 71: September, 1963
Renanthera × *Ascoglossum*
1st hybr.: *R.* Red Delight
Parentage: *Renanthera Storiei* × *Ascoglossum calopterum*

Renanthopsis in Bull. Soc. Hort. Fr. ser. 5, 4: 342, 1935
Renanthera × *Phalaenopsis*
1st hybr.: *R.* Premier
Parentage: *Renanthera Imschootiana* × *Phalaenopsis Sanderiana*
Observation: For the hybrid **Renanthopsis** Firefly see **Pararenanthera.**

Renaradorum nom. hybr. gen. nov.
Renanthera × *Arachnis* × *Armodorum*
1st hybr.: *R.* Star Orange (as **Aranthera** Star Orange)
Parentage: **Armodachnis** Catherine × *Renanthera coccinea*
Ill.: in Malay. Orch. Rev. 5: 10, f., 1957

Renopsis in Malay. Orch. Rev. 4: 36, 1949
Observation: See **Renanopsis.**

Rhizanthera in Watsonia 6: 133, 1965
Dactylorhiza × *Platanthera*
1st hybr.: *R. Chevallieriana* (as *Orchis Chevallieriana*, 1891)
Parentage: *Dactylorhiza maculata* var. *elodes* × *Platanthera bifolia*
Ill.: in Camus, Ic. Orch. Europ. t. 86, f. 3–5, 1921

Rhynchanthera in Hawkes, Encycl. Cult. Orch. 529, 1965
Observation: See **Renanstylis.**

Rhynchocentrum in Orch. Rev. 71: April, 1963
Rhynchostylis × *Ascocentrum*
1st hybr.: *R.* Sagarik
Parentage: *Rhynchostylis coelestis* × *Ascocentrum curvifolium*

Rhynchonopsis in Orch. Rev. 73: November, 1965
Rhynchostylis × *Phalaenopsis*
1st hybr.: *R.* Winona Jordan

Parentage: *Rhynchostylis gigantea* × *Phalaenopsis* Doris

Rhynchorides in Orch. Rev. 70: October, 1962 (as **Rhynchorades**)
Observation: See **Aeridostylis** including the hybrid **Rhynchorides** Springtime.

Rhynchovanda in Orch. Rev. 66: 231, 1958
Observation: See **Vandachostylis** including the hybrid **Rhynchovanda** Fantasy. For the hybrid **Rhynchovanda** Blue Angel see **Rhynchovandanthe.**

Rhynchovandanthe nom. hybr. gen. nov.
Rhynchostylis × *Vanda* × *Euanthe*
1st hybr.: *R.* Blue Angel (as **Rhynchovanda** Blue Angel)
Parentage: **Vandanthe** *Rothschildiana* × *Rhynchostylis coelestis*
Ill.: in. Amer. Orch. Soc. Bull. 32: 843, f., 1963

Rhynchovola in Proc. 3rd World Orch. Conf. 326, 1960
Rhyncholaelia × *Brassavola*
1st hybr.: *R.* David Sander (as *Brassavola* David Sander)
Parentage: *Brassavola cucullata* × *Rhyncholaelia Digbyana*
Observation: The genera *Rhyncholaelia* and *Brassavola* are not separable.

Ridleyara in Malay. Orch. Rev. 5: 2, 1957
Arachnis × *Vanda* × *Trichoglottis*
1st hybr.: *R.* Fascad
Parentage: **Aranda** Eileen Addison × *Trichoglottis fasciata*
Ill.: in Malay. Orch. Rev. 5: 2, f., 1957

Rodrassia in Orch. Rev. 68: 404, 1960
Observation: See **Bradriguezia** including the hybrid **Rodrassia** Angellitos.

Rodrettia in Orch. Rev. 66: 231, 1958
Rodriguezia × *Comparettia*
1st hybr.: *R.* Hawaii
Parentage: *Comparettia falcata* × *Rodriguezia secunda*
Ill.: in Amer. Orch. Soc. Bull. 28: 883, f., 1959

Rodricidium in Orch. Rev. 65: 89, 1957
Rodriguezia × *Oncidium*
1st hybr.: *R.* Twyla
Parentage: *Oncidium tetrapetalum* × *Rodriguezia secunda*
Syn.: **Oncidguezia** in Bull. Pac. Orch. Soc. Hawaii 14: 85, 1957

Rodridenia in Orch. Rev. 70: April, 1962
Rodriguezia × *Macradenia*
1st hybr.: *R.* Red Gem
Parentage: *Rodriguezia secunda* × *Macradenia brassavolae*
Ill.: in Amer. Orch. Soc. Bull. 31: 357, 1962

Rodritonia in Orch. Rev. 67: 33, 1959
Observation: See **Miltonguezia** including the hybrid **Rodritonia** Freckles.

Rolfeara in Orch. Rev. 27: 3, 1919
Brassavola × *Cattleya* × *Sophronitis*
1st hybr.: *R. rubescens*
Parentage: **Sophrocattleya** *Blackii* × **Brassocattleya** Mrs. J. Leemann

Saccanthera in Orch. Rev. 69: 269, 1961
Renanthera × *Saccolabium*
1st hybr.: not yet reported
Observation: For the hybrid **Saccanthera** Queen Emma see **Renanstylis.**

Saccovanda in Orch. Rev. 67: 330, 1959
Observation: See **Sanda.** For the hybrid **Saccovanda** Dawn see **Vandachostylis.**

Sanda in Sander, List. Orch. Hybr. Add. III, x, 1955
Saccolabium × *Vanda*
1st hybr.: not yet reported
Syn.: **Saccovanda** in Orch. Rev. 67: 330, 1959

Sanderara in Orch. Rev. 45: 257, 1937
Brassia × *Cochlioda* × *Odontoglossum*
1st hybr.: *S.* Alpha
Parentage: *Brassia Lawrenceana* × **Odontioda** Grenadier
Ill.: in Orch. Rev. 59: 27, f., 1951

Sappanara in Orch. Rev. 73: June, 1965
Arachnis × *Phalaenopsis* × *Renanthera*
1st hybr.: not yet reported
Observation: For the hybrid **Sappanara** Ahmad Zahab see **Paranthera.**

Sarcothera in Orch. Rev. 62: 92, 1954
Sarcochilus × *Renanthera*
1st hybr.: *S.* Kona
Parentage: *Sarcochilus pallidus* × *Renanthera monachica*

Schlechterara nom. hybr. gen. nov.
Vanda × *Euanthe* × *Ascocentrum*
1st hybr.: *S.* Meda Arnold (as **Ascocenda** Meda Arnold)
Parentage: *Ascocentrum curvifolium* × **Vandanthe** *Rothschildiana*

Schombavola in Orch. Rev. 72: January, 1964
Observation: See **Schombobrassavola** including the hybrid **Schombavola** Purple Star.

Schombletia in Hansen, Orch. Hybr. 234, 1895
Schomburgkia × *Bletia*
1st hybr.: not yet reported

Schombobrassavola in Bull. Pac. Orch. Soc. Hawaii 14: 85, 1957
Schomburgkia × *Brassavola*
1st hybr.: *S.* Purple Star (as **Schombavola** Purple Star)
Parentage: *Schomburgkia* Kalihi × *Brassavola glauca*
Syn.: **Schombavola** in Orch. Rev. 72: January, 1964

Schombocattleya in Orch. Rev. 13: 245, 1905
Schomburgkia × *Cattleya*
1st hybr.: *S. spiralis*
Parentage: *Cattleyae Mossiae* × *Schomburgkia tibicinis*
Ill.: in Orch. Rev. 13: 245, f. 61, 1905
Syn.: **Schomburgkio-Cattleya** in Journ. Hort. Soc. Fr. ser. 4, 4: 534, 1903
Schomcattleya in Gard. Chron. ser. 3, 38: 53, 1905

Schombodiacrium in Orch. Rev. 66: 137, 1958
Observation: See **Diaschomburgkia** including the hybrid **Schombodiacrium** Ipo.

Schomboepidendrum in Orch. Rev. 65: 90, 1957
Schomburgkia × *Epidendrum*
1st hybr.: *S.* Crispa-Glow
Parentage: *Schomburgkia crispa* × *Epidendrum* Orange Glow

Schombolaelia in Orch. Rev. 21: 254, 1913
Schomburgkia × *Laelia*
1st hybr.: *S. Tibibrosa*
Parentage: *Laelia tenebrosa* × *Schomburgkia tibicinis*

Schombolaeliocattleya in Roy. Hort. Soc. Dict. Gard. 4: 1905, 1951
Schomburgkia × *Laelia* × *Cattleya*
1st hybr.: *S.* Fiesta (as **Lyonara** Fiesta)
Parentage: **Laeliocattleya** Issy × *Schomburgkia Thomsoniana*
Syn.: **Lyonara** in Orch. Rev. 67: 405, 1959

Schombonia in Orch. Rev. 70: January, 1962
Observation: See **Schombotonia** including the hybrid **Schombonia** Firefly.

Schombotonia in Bull. Pac. Orch. Soc. Hawaii 14: 85, 1957
Schomburgkia × *Broughtonia*
1st hybr.: *S.* Firefly (as **Schombonia** Firefly)
Parentage: *Schomburgkia Thomsoniana* × *Broughtonia sanguinea*
Syn.: **Schombonia** in Orch. Rev. 70: January, 1962

Schomburgkio-Cattleya in Journ. Hort. Soc. Fr. ser. 4, 4: 534, 1903
Observation: See **Schombocattleya.**

Schomcattleya in Gard. Chron. ser. 3, 38: 53, 1905
Observation: See **Schombocattleya.**

Selenocypripedium in Journ. Hort. Soc. Fr. ser. 4, 13: 706, 1912
Observation: See **Cysepedium.** For the hybrids **Selenocypripedium** *Malhouitri* and **Selenocypripedium** Confusion see **Phragmipaphium.**

Serapicamptis in Journ. Bot. 59: 57, 1921
Serapias × *Anacamptis*
1st hybr.: *S. Forbesii*
Parentage: *Serapias lingua* × *Anacamptis pyramidalis*
Ill.: in Journ. Bot. 59: 57, t., 1921

Shipmanara in Orch. Rev. 71: April, 1963
Schomburgkia × *Diacrium* × *Broughtonia*
1st hybr.: *S.* Pink Angel
Parentage: **Diaschomburgkia** Ipo × **Diabroughtonia** Alice Hart

Smithara nom. hybr. gen. nov.
Ascocentrum × *Euanthe* × *Neofinetia* × *Vanda*
1st hybr.: *S.* Wendy (as **Nakamotoara** Wendy)
Parentage: *Neofinetia falcata* × **Schlechterara** Meda Arnold

Sobraleya in Hansen, Orch. Hybr. 242, 1895
Sobralia × *Cattleya*
1st hybr.: not yet reported

Sophrobroughtonia in Bull. Pac. Orch. Soc. Hawaii 14: 85, 1957
Sophronitis × *Broughtonia*
1st hybr.: not yet reported

Sophrocatlaelia in Orch. Rev. 8: 354, 1900
Observation: See **Soprolaeliocattleya.**

Sophrocattleya in Journ. Linn. Soc. Bot. 24: 169, 1887
Sophronitis × *Cattleya*

1st hybr.: *S. Batemaniana* (as *Laelia Batemaniana*)
Parentage: *Sophronitis grandiflora* × *Cattleya intermedia*
Ill.: in Veitch, Man. Orch. Pl. pt. 2: 93, f., 1887
Syn.: **Sophroleya** in Hansen, Orch. Hybr. 242, 1895

Sophrolaelia in Orch. Rev. 2: 333, 1894
Sophronitis × *Laelia*
1st hybr.: *S. laeta*
Parentage: *Laelia pumila var. Dayana* × *Sophronitis grandiflora*
Ill.: in Gard. Chron. ser. 3, 16: 477, f. 63, 1894

Sophrolaeliocattleya in Journ. Roy. Hort. Soc. 21: 468, 1897
Sophronitis × *Laelia* × *Cattleya*
1st hybr.: *S. Veitchii*
Parentage: *Sophronitis grandiflora* × *Laeliocattleya elegans* (*Schilleriana*)
Ill.: in Journ. Roy. Hort. Soc. 21: 461, f. 107, 1897
Syn.: **Catlaenitis** in Hansen, Orch. Hybr. 100, 1895
Sophrocatlaelia in Orch. Rev. 8: 354, 1900

Sophroleya in Hansen, Orch. Hybr. 242, 1895
Observation: See **Sophrocattleya.**

Sophrovola in Hansen, Orch. Hybr. 243, 1895
Brassavola × *Sophronitis*
1st hybr.: *S.* Edna (as **Brassonotis** Edna, 1962)
Parentage: *Sophronitis coccinea* × *Brassavola nodosa*
Syn.: **Brassophronitis** in Die Orchidee 5: 41, 1954
Brassonotis in Orch. Rev. 70: December, 1962

Spathophaius in Hawkes, Orchids 245, 1961
Spathoglottis × *Phaius*
1st hybr.: not yet reported

Staurachnis in Orch. Rev. 58: 65, 1950
Observation: See **Trichachnis** including the hybrid **Staurachnis** N. Sorapure

Stauranda in The Orch. Journ. 1: 300, 1952
Observation: See **Trichovanda.** For the hybrid **Stauranda** Ulaula see **Antheglottis.**

Symphodontioda in Hawkes, Encycl. Cult. Orch. 457, 1965
Symphyglossum × *Odontoglossum* × *Cochlioda*
1st hybr.: *S.* Hermione (as **Odontioda** Hermione, 1910)
Parentage: **Symphodontoglossum** *heatonensis* × *Cochlioda vulcanica*

Symphodontoglossum in Hawkes, Encycl. Cult. Orch. 457, 1965
Symphyglossum × *Odontoglossum*

1st hybr.: *S. heatonensis* (as **Odontioda** *heatonensis*, 1906)
Parentage: *Symphyglossum sanguineum* × *Odontoglossum cirrhosum*
Ill.: in Bot. Mag. 133: t. 8133, 1907

Symphodontonia nom. hybr. gen. nov.
Symphyglossum × *Odontoglossum* × *Miltonia*
1st hybr.: *S.* Felicia (as **Vuylstekeara** Felicia, 1921)
Parentage: *Miltonia Warscewiczii* × **Symphodontoglossum (Odontioda)** Felicia
Observation: **Symphodontonia** Felicia is the only hybrid known.

Symphyglossonia in Hawkes, Encycl. Cult. Orch. 457, 1965
Symphyglossum × *Miltonia*
1st hybr.: *S.* Pink Pearl (as **Miltonioda** Pink Pearl)
Parentage: *Miltonia* St. Andre × *Symphyglossum sanguineum*

Tanakara in Orch. Rev. 55: 120, 1947
Observation: See **Opsisanda** including the hybrid **Tanakara** Colombo.

Tanakara in Orch. Rev. 60: 13, 1952 (as **Tanakaria**)
Observation: See **Phalaerianda** including the hybrid **Tanakara** Honolulu.

Tenranara in Orch. Rev. 70: December, 1962
Observation: See **Fujiwarara** including the hybrid **Tenranara Frolic.**

Tetralaelia in Gard. Chron. ser. 3, 31: 280, 1902 (as **Tetralaenia**)
Tetramicra × *Laelia*
1st hybr.: not yet reported

Tetraliopsis in Orch. Rev. 73: July, 1965
Tetramicra × *Laeliopsis*
1st hybr.: *T.* Candystripe
Parentage: *Tetramicra canaliculata* × *Laeliopsis domingensis*

Tetratonia in Orch. Rev. 73: August, 1965
Tetramicra × *Broughtonia*
1st hybr.: *T.* Dark Prince
Parentage: *Tetramicra canaliculata* × *Broughtonia sanguinea*

Trevorara in Orch. Rev. 71: March, 1963
Arachnis × *Phalaenopsis* × *Vanda*
1st hybr.: *T.* Inggraini (in Orch. Rev. 72: June, 1964)
Parentage: *Vanda tricolor* × **Arachnopsis** Rosea
Observation: For the hybrid **Trevorara** Hong Trevor see **Parandachnis.** For the hybrid **Trevorara** Manoa see **Benthamara.**

Trichachnis in Na Pua Okika o Hawaii Nei 7: 154, 1957
Trichoglottis × *Arachnis*
1st hybr.: *T.* N. Sorapure (as **Staurachnis** N. Sorapure)
Parentage: *Arachnis flos-aeris* × *Trichoglottis fasciata*
Syn.: **Staurachnis** in Orch. Rev. 58: 65, 1950
Arachnoglottis in Orch. Rev. 66: 86, 1958

Trichocidium in Orch. Rev. 63: 155, 1955
Trichocentrum × *Oncidium*
1st hybr.: *T.* Elvena
Parentage: *Oncidium Lanceanum* × *Trichocentrum albopurpureum*
Ill.: in Amer. Orch. Soc. Bull. 33: 596, f., 1964

Trichopasia in Bull. Pac. Orch. Soc. Hawaii 14: 85, 1957
Trichopilia × *Aspasia*
1st hybr.: not yet reported

Trichovanda in Orch. Rev. 57: 24, 1949
Trichoglottis × *Vanda*
1st hybr.: *T.* Bonfire
Parentage: *Vanda Herziana* × *Trichoglottis brachiata*
Observation: For the hybrid **Trichovanda** Ulaula see **Antheglottis.**
For the hybrid **Trichovanda** Richard Emery see **Kraenzlinara.**
Syn.: **Lyonara** in Orch. Rev. 56: 94, 1948
Stauranda in The Orchid Journ. 1: 300, 1952

Vancampe in Bull. Pac. Orch. Soc. Hawaii 14: 85, 1957
Vanda × *Acampe*
1st hybr.: *V.* Beans
Parentage: *Vanda* Frank Scudder × *Acampe longifolia*

Vandachnanthe in Anggrek Boelan 1: 67, 1939
Observation: See **Aranda.**

Vandachnis in Orch. Rev. 57: 66, 1949
Vandopsis × *Arachnis*
1st hybr.: *V.* Premier
Parentage: *Arachnis flos-aeris* × *Vandopsis lissochiloides*
Ill.: in Henders. & Addis., Malay. Orch. Hybr. 124, 1956

Vandachostylis in Arch. Mus. Hist. Nat. Paris ser. 6, 12 pt. 2: 608, 1935 (as **Vandacostylis**)
Vanda × *Rhynchostylis*
1st hybr.: *V. Bernardii*
Parentage: *Vanda teres* × *Rhynchostylis retusa*

Ill.: in Arch. Mus. Hist. Nat. Paris ser. 6, 12 pt. 2: 608, t., 1935
Syn.: **Rhynchovanda** in Orch. Rev. 66: 231, 1958

Vandaecum in Orch. Rev. 68: 224, 1960
Vanda × *Angraecum*
1st hybr.: not yet reported
Observation: For the hybrid **Vandaecum** Premier see **Vandofinetia.**

Vandaenopsis in Arch. Mus. Nat. Paris ser. 6, 12 pt. 2: 607, 1935
Vanda × *Phalaenopsis*
1st hybr.: *V. ferrierensis* (as × **Vandopsis** *ferrierensis*)
Parentage: *Vanda suavis* × *Phalaenopsis Rimestadiana*
Observation: For the hybrid **Vandaenopsis** Pang Nyuk Yin see **Parandanthe.** For the hybrid **Vandaenopsis** *Jawaii* see **Paranthe.** For the hybrid **Vandaenopsis** *Bogoriana* see **Paravanda.**
Syn.: **Vandaeopsis** in Gartenfl. 86: 252, 1937
Vandanopsis in De Orchidee 8: 186, 1939

Vandaeopsis in Gartenfl. 86: 252, 1937
Observation: See **Vandaenopsis.**

Vandanopsis in De Orchidee 8: 186, 1939
Observation: See **Vandaenopsis.**

Vandanthe in Orchis 13: 52, 1919
Vanda × *Euanthe*
1st hybr.: *V. Tatzeri*
Parentage: *Vanda tricolor* × *Euanthe Sanderiana*
Ill.: in Orchis 13: 52, f. 7, 1919

Vandathera in De Orchidee 8: 159, 1939
Observation: See **Renantanda.**

Vandantherides nom. hybr. gen. nov.
Vanda × *Euanthe* × *Aerides*
1st hybr.: *V.* Elizabeth Young (as **Aeridovanda** Elizabeth Young)
Parentage: **Aeridovanda** Dickie Yawata × *Euanthe Sanderiana*

Vandarachnis in Orchideen 6: 107, 1939
Observation: See **Aranda.**

Vandofinetia in Orch. Rev. 68: 404, 1960
Neofinetia × *Vanda*
1st hybr.: *V.* Premier (as **Vandaecum** Premier)
Parentage: *Neofinetia falcata* × *Vanda lamellata*

Vandopsides in Orch. Rev. 66: 231, 1958
Vandopsis × *Aerides*

1st hybr.: *V.* Apple Blossom
Parentage: *Aerides Lawrenciae* × *Vandopsis lissochiloides*

Vandopsisvanda in Rev. Circ. Paul. Orch. 7: 219, 1950
Observation: See **Opsisanda.**

Vandoritis in Orch. Rev. 73: August, 1965
Vanda × *Doritis*
1st hybr.: *V.* Malaysia
Parentage: *Vanda* Lanikea × *Doritis pulcherrima*

Vascostylis in Orch. Rev. 72: January, 1964
Vanda × *Ascocentrum* × *Rhynchostylis*
1st hybr : not yet reported
Observation: For the hybrid **Vascostylis** Blue Fairy see **Carrara.**

Vaughnara in Orch. Rev. 73: March, 1965
Brassavola × *Cattleya* × *Epidendrum*
1st hybr.: *V.* Sparklet
Parentage: **Brassocattleya** *Cliftonii* × *Epidendrum vitellinum*

Vuylstekeara in Orch. Rev. 19: 60, 1911
Cochlioda × *Miltonia* × *Odontoglossum*
1st hybr.: *V. insignis*
Parentage: *Miltonia vexillaria* × **Odontioda** *Vuylstekeae*
Ill.: in Rev. Hort. Belg. 36: 150, f., 1910
Syn.: **Odontiodonia** in Orch. World 1: 84, 1911

Warneara in Orch. Rev. 72: July, 1964
Oncidium × *Rodriguezia* × *Comparettia*
1st hybr.: *W.* Robert
Parentage: *Oncidium* Agnes Ann × **Rodrettia** Hawaii

Wilsonara in Gard. Chron. ser. 3, 59: 315, 1916
Cochlioda × *Odontoglossum* × *Oncidium*
1st hybr.: *W. insignis*
Parentage: *Odontoglossum illustrissimum* × **Oncidioda** *Charlesworthii*
Ill.: in Orch. World 6: 203, f., 1916

Yamadara in Orch. Rev. 68: 404, 1960
Observation: See **Adamara** including the hybrid **Yamadara** Fuchsia.

Zygobatemania in Semain Hortic. 3: 76, 1899
Zygopetalum × *Batemannia*
1st hybr.: *Z. Mastersii*
Parentage: *Zygopetalum crinitum* × *Batemannia Colleyi*
Ill.: in Lindenia 14: t. 657, 1899

Zygocaste in Orch. Rev. 54: 41, 1946
Zygopetalum × *Lycaste*
1st hybr.: Z. Van Belle
Parentage: *Lycaste virginalis* × *Zygopetalum Mackayi*

Zygocella nom. hybr. gen. nov.
Zygopetalum × *Mendoncella*
1st hybr.: *Z. Max-Jorisii* (as *Zygopetalum Max-Jorisii*)
Parentage: *Zygopetalum maxillare* × *Mendoncella Jorisiana*

Zygocidium in Hansen, Orch. Hybr. 244, 1895
Zygopetalum × *Oncidium*
1st hybr.: not yet reported

Zygocolax in Gard. Chron. ser. 3, 1: 756, 1887
Zygopetalum × *Colax*
1st hybr.: *Z. leopardinus* (as *Zygopetalum leopardinum*)
Parentage: *Colax jugosus* × *Zygopetalum maxillare*
Ill.: in Gard. Mag. 43: 121, f., 1900
Syn.: **Zygolax** in Hansen, Orch. Hybr. 244, 1895

Zygodendrum in Hansen, Orch. Hybr. 244, 1895
Zygopetalum × *Epidendrum*
1st hybr.: not yet reported

Zygolax in Hansen, Orch. Hybr. 244, 1895
Observation: See **Zygocolax.**

Zygomena in Die Natuerl. Pflanzenfam. Erg.-heft II, 92, 1908
Zygopetalum × *Menadenium*
1st hybr.: *Z. Roeblingiana* (as *Zygopetalum Roeblingianum*)
Parentage: *Zygopetalum maxillare* × *Menadenium labiosum*
Ill.: in Gard. Chron. ser. 3, 34: 227, f. 93, 1903

Zygonisia in Gard. Chron. ser. 3, 31: 443, 1902
Zygopetalum × *Aganisia*
1st hybr.: not yet reported
Observation: For the hybrids **Zygonisia** *Rolfeana* and **Zygonisia** *Sanderi* see **Zygostylis.**

Zygorhyncha in Gartenfl. 85: 254, 1936
Zygopetalum × *Chondrorhyncha*
1st hybr.: *Z. Fletcheri* (as **Chondropetalum** *Fletcheri*)
Parentage: *Zygopetalum Mackayi* × *Chondrorhyncha Chestertonii*
Ill.: in Gard. Chron. ser. 3, 45: 9, f. 12, 1909
Observation: This is a very doubtful hybrid.

Syn.: **Chondropetalum** in Orch. Rev. 16: 56, 1908, not Rttb. 1773

Zygostylis nom. hybr. gen. nov.
Zygopetalum × *Otostylis*
1st hybr.: *Z. Rolfeana* (as **Zygonisia** *Rolfeana*)
Parentage: *Zygopetalum maxillare* × *Otostylis alba*
Ill.: in Gard. Chron. ser. 3, 32: 30, f. 11, 1902

PART II

Parentage index to hybrid generic names

Parent Genera	*Hybrid Genus*
Acampe × Vanda	= Vancampe
Aceras × Barlia	= Barlaceras
Aceras × Herminium	= Aceraherminium
Aceras × Orchis	= Orchiaceras
Ada × Cochlioda	= Adioda
Ada × Odontoglossum	= Adaglossum
Aerides × Arachnis	= Aeridachnis
Aerides × Ascoglossum	= Aeridoglossum
Aerides × Euanthe	= Aeridanthe
Aerides × Euanthe × Vanda	= Vandantherides
Aerides × Neofinetia	= Aeridofinetia
Aerides × Phalaenopsis	= Aeridopsis
Aerides × Phalaenopsis × Vanda	= Phalaerianda
Aerides × Renanthera	= Renades
Aerides × Rhynchostylis	= Aeridostylis
Aerides × Saccolabium	= Aeridolabium
Aerides × Vanda	= Aeridovanda
Aerides × Vanda × Euanthe	= Vandantherides
Aerides × Vanda × Phalaenopsis	= Phalaerianda
Aerides × Vandopsis	= Vandopsides
Aganisia × Zygopetalum	= Zygonisia
Anacamptis × Dactylorhiza	= Dactylocamptis
Anacamptis × Gymnadenia	= Gymnanacamptis
Anacamptis × Orchis	= Anacamptorchis
Anacamptis × Platanthera	= Anacamptiplatanthera
Anacamptis × Serapias	= Serapicamptis

Angraecum × Macroplectrum = Macrangraecum
Angraecum × Vanda = Vandaecum

Anguloa × Lycaste = Angulocaste

Anoectochilus × Goodyera = Anoectogoodyera
Anoectochilus × Ludisia = Ludochilus

Arachnis × Aerides = Aeridachnis
Arachnis × Armodorum = Armodachnis
Arachnis × Armodorum × Renanthera = Renaradorum
Arachnis × Euanthe = Eurachnis
Arachnis × Euanthe × Paraphalaenopsis = Benthamara
Arachnis × Euanthe × Renanthera × Vanda = Cogniauxara
Arachnis × Euanthe × Vanda = Arandanthe
Arachnis × Euanthe × Vanda × Renanthera = Cogniauxara
Arachnis × Paraphalaenopsis = Pararachnis
Arachnis × Paraphalaenopsis × Euanthe = Benthamara
Arachnis × Paraphalaenopsis × Renanthera = Paranthera
Arachnis × Paraphalaenopsis × Vanda = Parandachnis
Arachnis × Phalaenopsis = Arachnopsis
Arachnis × Phalaenopsis × Renanthera = Sappanara
Arachnis × Phalaenopsis × Vanda = Trevorara
Arachnis × Renanthera = Aranthera
Arachnis × Renanthera × Armodorum = Renaradorum
Arachnis × Renanthera × Euanthe × Vanda = Cogniauxara
Arachnis × Renanthera × Paraphalaenopsis = Paranthera
Arachnis × Renanthera × Phalaenopsis = Sapanara
Arachnis × Renanthera × Vanda = Holttumara
Arachnis × Renanthera × Vanda × Euanthe = Cogniauxara
Arachnis × Renanthera × Vandopsis = Limara
Arachnis × Trichoglottis = Trichachnis
Arachnis × Trichoglottis × Vanda = Ridleyara
Arachnis × Vanda = Aranda
Arachnis × Vanda × Euanthe = Arandanthe
Arachnis × Vanda × Euanthe × Renanthera = Cogniauxara
Arachnis × Vanda × Paraphalaenopsis = Parandachnis
Arachnis × Vanda × Phalaenopsis = Trevorara
Arachnis × Vanda × Renanthera = Holttumara
Arachnis × Vanda × Renanthera × Euanthe = Cogniauxara
Arachnis × Vanda × Trichoglottis = Ridleyara
Arachnis × Vandopsis = Vandachnis
Arachnis × Vandopsis × Renanthera = Limara

Armodorum × Arachnis = Armodachnis
Armodorum × Arachnis × Renanthera = Renaradorum
Armodorum × Renanthera × Arachnis = Renaradorum

Ascocentrum × Euanthe × Neofinetia = Smithara
Ascocentrum × Euanthe × Rhynchostylis × Vanda = Carrara
Ascocentrum × Euanthe × Vanda = Schlechterara
Ascocentrum × Euanthe × Vanda × Rhynchostylis = Carrara
Ascocentrum × Neofinetia = Ascofinetia
Ascocentrum × Neofinetia × Euanthe = Smithara
Ascocentrum × Neofinetia × Vanda = Nakamotoara
Ascocentrum × Renanthera = Renancentrum
Ascocentrum × Renantherella = Ascorella
Ascocentrum × Rhynchostylis = Rhynchocentrum
Ascocentrum × Rhynchostylis × Euanthe × Vanda = Carrara
Ascocentrum × Rhynchostylis × Vanda = Vascostylis
Ascocentrum × Rhynchostylis × Vanda × Euanthe = Carrara
Ascocentrum × Vanda = Ascocenda
Ascocentrum × Vanda × Euanthe = Schlechterara
Ascocentrum × Vanda × Euanthe × Rhynchostylis = Carrara
Ascocentrum × Vanda × Neofinetia = Nakamotoara
Ascocentrum × Vanda × Rhynchostylis = Vascostylis
Ascocentrum × Vanda × Rhynchostylis × Euanthe = Carrara

Ascoglossum × Aerides = Aeridoglossum
Ascoglossum × Renanthera = Renanthoglossum

Aspasia × Brassia = Brapasia
Aspasia × Miltonia = Miltonpasia
Aspasia × Odontoglossum = Aspoglossum
Aspasia × Oncidium = Oncidasia
Aspasia × Trichopilia = Trichopasia

Barkeria × Epidendrum = Bardendrum
Barkeria × Laelia × Cattleya = Laeliocattkeria

Barlia × Aceras = Barlaceras

Batemannia × Zygopetalum = Zygobatemania

Bifrenaria × Lycaste = Lycastenaria

Bletia × Phaius = Phabletia
Bletia × Schomburgkia = Schombletia

Bollea × Chondrorhyncha = Chondrobollea
Bollea × Pescatoria = Pescatobollea

Brassavola × Broughtonia = Brassotonia
Brassavola × Cattleya = Brassocattleya
Brassavola × Cattleya × Diacrium = Hookerara
Brassavola × Cattleya × Diacrium × Laelia = Linneara
Brassavola × Cattleya × Epidendrum = Vaughnara
Brassavola × Cattleya × Epidendrum × Laelia = Adamara
Brassavola × Cattleya × Laelia = Brassolaeliocattleya
Brassavola × Cattleya × Laelia × Diacrium = Linneara
Brassavola × Cattleya × Laelia × Epidendrum = Adamara
Brassavola × Cattleya × Laelia × Schomburgkia = Recchara
Brassavola × Cattleya × Laelia × Sophronitis = Potinara
Brassavola × Cattleya × Laeliopsis = Fujiwarara
Brassavola × Cattleya × Schomburgkia = Dekensara
Brassavola × Cattleya × Schomburgkia × Laelia = Recchara
Brassavola × Cattleya × Sophronitis = Rolfeara
Brassavola × Cattleya × Sophronitis × Laelia = Potinara
Brassavola × Diacrium = Brassodiacrium
Brassavola × Diacrium × Cattleya = Hookerara
Brassavola × Diacrium × Cattleya × Laelia = Linneara
Brassavola × Diacrium × Laelia × Cattleya = Linneara
Brassavola × Epidendrum = Brassoepidendrum
Brassavola × Epidendrum × Cattleya = Vaughnara
Brassavola × Epidendrum × Cattleya × Laelia = Adamara
Brassavola × Epidendrum × Laelia × Cattleya = Adamara
Brassavola × Laelia = Brassolaelia
Brassavola × Laelia × Cattleya = Brassolaeliocattleya
Brassavola × Laelia × Cattleya × Diacrium = Linneara
Brassavola × Laelia × Cattleya × Epidendrum = Adamara
Brassavola × Laelia × Cattleya × Schomburgkia = Recchara
Brassavola × Laelia × Cattleya × Sophronitis = Potinara
Brassavola × Laelia × Diacrium × Cattleya = Linneara
Brassavola × Laelia × Epidendrum × Cattleya = Adamara
Brassavola × Laelia × Schomburgkia × Cattleya = Recchara
Brassavola × Laelia × Sophronitis = Lowara
Brassavola × Laelia × Sophronitis × Cattleya = Potinara
Brassavola × Laeliopsis × Cattleya = Fujiwarara
Brassavola × Rhyncholaelia = Rhynchovola

Brassavola × Schomburgkia = Schombobrassavola
Brassavola × Schomburgkia × Cattleya = Dekensara
Brassavola × Schomburgkia × Cattleya × Laelia = Recchara
Brassavola × Schomburgkia × Laelia × Cattleya = Recchara
Brassavola × Sophronitis = Sophrovola
Brassavola × Sophronitis × Cattleya = Rolfeara
Brassavola × Sophronitis × Cattleya × Laelia = Potinara
Brassavola × Sophronitis × Laelia = Lowara
Brassavola × Sophronitis × Laelia × Cattleya = Potinara

Brassia × Aspasia = Brapasia
Brassia × Cochlioda × Odontoglossum = Sanderara
Brassia × Miltonia = Bratonia
Brassia × Miltonia × Oncidium = Aliceara
Brassia × Odontoglossum = Odontobrassia
Brassia × Odontoglossum × Cochlioda = Sanderara
Brassia × Oncidium = Brassidium
Brassia × Oncidium × Miltonia = Aliceara
Brassia × Rodriguezia = Bradriguezia

Broughtonia × Brassavola = Brassotonia
Broughtonia × Cattleya = Cattleytonia
Broughtonia × Diacrium = Diabroughtonia
Broughtonia × Diacrium × Schomburgkia = Shipmanara
Broughtonia × Domingoa = Domintonia
Broughtonia × Epidendrum = Epibroughtonia
Broughtonia × Laelia = Laelonia
Broughtonia × Laelia × Sophronitis = Hartara
Broughtonia × Laeliopsis = Broughtopsis
Broughtonia × Schomburgkia = Schombotonia
Broughtonia × Schomburgkia × Diacrium = Shipmanara
Broughtonia × Sophronitis = Sophrobroughtonia
Broughtonia × Sophronitis × Laelia = Hartara
Broughtonia × Tetramicra = Tetratonia

Bulbophyllum × Cirrhopetalum = Cirrhophyllum

Calanthe × Gastrorchis = Gastrocalanthe
Calanthe × Limatodes = Calanthe
Calanthe × Limatodes × Phaius = Phaiocalanthe
Calanthe × Phaius = Phaiocalanthe

Calanthe × Phaius × Limatodes = Phaiocalanthe
Calanthidium × Preptanthe = Calanthe

Cattleya × Barkeria × Laelia = Laeliocattkeria
Cattleya × Brassavola = Brassocattleya
Cattleya × Brassavola × Diacrium = Hookerara
Cattleya × Brassavola × Diacrium × Laelia = Linneara
Cattleya × Brassavola × Epidendrum = Vaughnara
Cattleya × Brassavola × Epidendrum × Laelia = Adamara
Cattleya × Brassavola × Laelia = Brassolaeliocattleya
Cattleya × Brassavola × Laelia × Diacrium = Linneara
Cattleya × Brassavola × Laelia × Epidendrum = Adamara
Cattleya × Brassavola × Laelia × Schomburgkia = Recchara
Cattleya × Brassavola × Laelia × Sophronitis = Potinara
Cattleya × Brassavola × Laeliopsis = Fujiwarara
Cattleya × Brassavola × Schomburgkia = Dekensara
Cattleya × Brassavola × Schomburgkia × Laelia = Recchara
Cattleya × Brassavola × Sophronitis = Rolfeara
Cattleya × Brassavola × Sophronitis × Laelia = Potinara
Cattleya × Broughtonia = Cattleytonia
Cattleya × Dendrobium = Dendrocattleya
Cattleya × Diacrium = Diacattleya
Cattleya × Diacrium × Brassavola = Hookerara
Cattleya × Diacrium × Brassavola × Laelia = Linneara
Cattleya × Diacrium × Laelia = Dialaeliocattleya
Cattleya × Diacrium × Laelia × Brassavola = Linneara
Cattleya × Domingoa × Epidendrum = Arizara
Cattleya × Epidendrum = Epicattleya
Cattleya × Epidendrum × Brassavola = Vaughnara
Cattleya × Epidendrum × Brassavola × Laelia = Adamara
Cattleya × Epidendrum × Domingoa = Arizara
Cattleya × Epidendrum × Laelia = Epilaeliocattleya
Cattleya × Epidendrum × Laelia × Brassavola = Adamara
Cattleya × Epidendrum × Laelia × Sophronitis = Kirchara
Cattleya × Epidendrum × Sophronitis × Laelia = Kirchara
Cattleya × Laelia = Laeliocattleya
Cattleya × Laelia × Barkeria = Laeliocattkeria
Cattleya × Laelia × Brassavola = Brassolaeliocattleya
Cattleya × Laelia × Brassavola × Diacrium = Linneara
Cattleya × Laelia × Brassavola × Epidendrum = Adamara

Cattleya × Laelia × Brassavola × Schomburgkia = Recchara
Cattleya × Laelia × Brassavola × Sophronitis = Potinara
Cattleya × Laelia × Diacrium = Dialaeliocattleya
Cattleya × Laelia × Diacrium × Brassavola = Linneara
Cattleya × Laelia × Epidendrum = Epilaeliocattleya
Cattleya × Laelia × Epidendrum × Brassavola = Adamara
Cattleya × Laelia × Epidendrum × Sophronitis = Kirchara
Cattleya × Laelia × Schomburgkia = Schombolaeliocattleya
Cattleya × Laelia × Schomburgkia × Brassavola = Recchara
Cattleya × Laelia × Sophronitis = Sophrolaeliocattleya
Cattleya × Laelia × Sophronitis × Brassavola = Potinara
Cattleya × Laelia × Sophronitis × Epidendrum = Kirchara
Cattleya × Laeliopsis × Brassavola = Fujiwarara
Cattleya × Schomburgkia = Schombocattleya
Cattleya × Schomburgkia × Brassavola = Dekensara
Cattleya × Schomburgkia × Brassavola × Laelia = Recchara
Cattleya × Schomburgkia × Laelia = Schombolaeliocattleya
Cattleya × Schomburgkia × Laelia × Brassavola = Recchara
Cattleya × Sobralia = Sobraleya
Cattleya × Sophronitis = Sophrocattleya
Cattleya × Sophronitis × Brassavola = Rolfeara
Cattleya × Sophronitis × Brassavola × Laelia = Potinara
Cattleya × Sophronitis × Epidendrum × Laelia = Kirchara
Cattleya × Sophronitis × Laelia = Sophrolaeliocattleya
Cattleya × Sophronitis × Laelia × Brassavola = Potinara
Cattleya × Sophronitis × Laelia × Epidendrum = Kirchara

Cephalanthera × Epipactis = Cephalopactis

Chondrorhyncha × Bollea = Chondrobollea
Chondrorhyncha × Pescatoria = Pescarhyncha
Chondrorhyncha × Zygopetalum = Zygorhyncha

Cirrhopetalum × Bulbophyllum = Cirrhophyllum

Cochleanthes × Pescatoria = Pescoranthes

Cochlioda × Ada = Adioda
Cochlioda × Brassia × Odontoglossum = Sanderara
Cochlioda × Miltonia = Miltonioda
Cochlioda × Miltonia × Odontoglossum = Vuylstekeara

Cochlioda × Miltonia × Odontoglossum × Oncidium = Burrageara
Cochlioda × Miltonia × Oncidium = Charlesworthara
Cochlioda × Miltonia × Oncidium × Odontoglossum = Burrageara
Cochlioda × Odontoglossum = Odontioda
Cochlioda × Odontoglossum × Brassia = Sanderara
Cochlioda × Odontoglossum × Miltonia = Vuylstekeara
Cochlioda × Odontoglossum × Miltonia × Oncidium = Burrageara
Cochlioda × Odontoglossum × Oncidium = Wilsonara
Cochlioda × Odontoglossum × Oncidium × Miltonia = Burrageara
Cochlioda × Odontoglossum × Symphyglossum = Symphodontioda
Cochlioda × Oncidium = Oncidioda
Cochlioda × Oncidium × Miltonia = Charlesworthara
Cochlioda × Oncidium × Miltonia × Odontoglossum = Burrageara
Cochlioda × Oncidium × Odontoglossum = Wilsonara
Cochlioda × Oncidium × Odontoglossum × Miltonia = Burrageara
Cochlioda × Symphyglossum × Odontoglossum = Symphodontioda

Coeloglossum × Dactylorhiza = Dactyloglossum
Coeloglossum × Gymnadenia = Gymnaglossum
Coeloglossum × Orchis = Orchicoeloglossum

Colax × Zygopetalum = Zygocolax

Comparettia × Oncidium = Oncidarettia
Comparettia × Oncidium × Rodriguezia = Warneara
Comparettia × Rodriguezia = Rodrettia
Comparettia × Rodriguezia × Oncidium = Warneara

Cycnoches × Mormodes = Cycnodes

Cymbidium × Cyperorchis = Cyperocymbidium
Cymbidium × Grammatophyllum = Grammatocymbidium
Cymbidium × Phaius = Phaiocymbidium

Cyperorchis × Cymbidium = Cyperorcymbidium

Cypripedium × Selenipedium = Cysepedium

Dactylorhiza × Anacamptis = Dactylocamptis
Dactylorhiza × Coeloglossum = Dactyloglossum
Dactylorhiza × Gymadenia = Dactylodenia
Dactylorhiza × Nigritella = Dactylitella
Dactylorhiza × Orchis = Orchidactyla

Dactylorhiza × Platanthera = Rhizanthera

Dendrobium × Cattleya = Dendrocattleya
Dendrobium × Epidendrum = Epidrobium

Diacrium × Brassavola = Brassodiacrium
Diacrium × Brassavola × Cattleya = Hookerara
Diacrium × Brassavola × Cattleya × Laelia = Linneara
Diacrium × Brassavola × Laelia × Cattleya = Linneara
Diacrium × Broughtonia = Diabroughtonia
Diacrium × Broughtonia × Schomburgkia = Shipmanara
Diacrium × Cattleya = Diacattleya
Diacrium × Cattleya × Brassavola = Hookerara
Diacrium × Cattleya × Brassavola × Laelia = Linneara
Diacrium × Cattleya × Laelia = Dialaeliocattleya
Diacrium × Cattleya × Laelia × Brassavola = Linneara
Diacrium × Epidendrum = Epidiacrium
Diacrium × Laelia = Dialaelia
Diacrium × Laelia × Brassavola × Cattleya = Linneara
Diacrium × Laelia × Cattleya = Dialaeliocattleya
Diacrium × Laelia × Cattleya × Brassavola = Linneara
Diacrium × Schomburgkia = Diaschomburgkia
Diacrium × Schomburgkia × Broughtonia = Shipmanara

Domingoa × Broughtonia = Domintonia
Domingoa × Cattleya × Epidendrum = Arizara
Domingoa × Epidendrum = Epigoa
Domingoa × Epidendrum × Cattleya = Arizara
Domingoa × Hexadesmia = Domindesmia
Domingoa × Laeliopsis = Domliopsis

Doritis × Phalaenopsis = Doritaenopsis
Doritis × Vanda = Vandoritis

Dossinia × Ludisia = Dossisia

Epidendrum × Barkeria = Bardendrum
Epidendrum × Brassavola = Brassoepidendrum
Epidendrum × Brassavola × Cattleya = Vaughnara
Epidendrum × Brassavola × Cattleya × Laelia = Adamara
Epidendrum × Brassavola × Laelia × Cattleya = Adamara
Epidendrum × Broughtonia = Epibroughtonia
Epidendrum × Cattleya = Epicattleya
Epidendrum × Cattleya × Brassavola = Vaughnara

Epidendrum × Cattleya × Brassavola × Laelia = Adamara
Epidendrum × Cattleya × Domingoa = Arizara
Epidendrum × Cattleya × Laelia = Epilaeliocattleya
Epidendrum × Cattleya × Laelia × Brassavola = Adamara
Epidendrum × Cattleya × Laelia × Sophronitis = Kirchara
Epidendrum × Cattleya × Sophronitis × Laelia = Kirchara
Epidendrum × Dendrobium = Epidrobium
Epidendrum × Diacrium = Epidiacrium
Epidendrum × Domingoa = Epigoa
Epidendrum × Domingoa × Cattleya = Arizara
Epidendrum × Laelia = Epilaelia
Epidendrum × Laelia × Brassavola × Cattleya = Adamara
Epidendrum × Laelia × Cattleya = Epilaeliocattleya
Epidendrum × Laelia × Cattleya × Brassavola = Adamara
Epidendrum × Laelia × Cattleya × Sophronitis = Kirchara
Epidendrum × Laelia × Sophronitis × Cattleya = Kirchara
Epidendrum × Laeliopsis = Epilopsis
Epidendrum × Phaius = Epiphaius
Epidendrum × Schomburgkia = Schomboepidendrum
Epidendrum × Sophronitella = Epiphronitella
Epidendrum × Sophronitis = Epiphronitis
Epidendrum × Sophronitis × Cattleya × Laelia = Kirchara
Epidendrum × Sophronitis × Laelia × Cattleya = Kirchara
Epidendrum × Zygopetalum = Zygodendrum

Epipactis × Cephalanthera = Cephalopactis

Esmeralda × Vanda = Esmeranda

Euanthe × Aerides = Aeridanthe
Euanthe × Aerides × Vanda = Vandantherides
Euanthe × Arachnis = Eurachnis
Euanthe × Arachnis × Paraphalaenopsis = Benthamara
Euanthe × Arachnis × Renanthera × Vanda = Cogniauxara
Euanthe × Arachnis × Vanda = Arandanthe
Euanthe × Arachnis × Vanda × Renanthera = Cogniauxara
Euanthe × Ascocentrum × Neofinetia = Smithara
Euanthe × Ascocentrum × Rhynchostylis × Vanda = Carrara
Euanthe × Ascocentrum × Vanda = Schlechterara
Euanthe × Ascocentrum × Vanda × Rhynchostylis = Carrara
Euanthe × Neofinetia × Ascocentrum = Smithara
Euanthe × Paraphalaenopsis = Paranthe

Euanthe × Paraphalaenopsis × Arachnis = Benthamara
Euanthe × Paraphalaenopsis × Vanda = Parandanthe
Euanthe × Renanthera = Antheranthe
Euanthe × Renanthera × Arachnis × Vanda = Cogniauxara
Euanthe × Renanthera × Vanda = Amesara
Euanthe × Renanthera × Vanda × Arachnis = Cogniauxara
Euanthe × Renanthera × Vanda × Vandopsis = Lindleyara
Euanthe × Renanthera × Vandopsis × Vanda = Lindleyara
Euanthe × Rhynchostylis × Ascocentrum × Vanda = Carrara
Euanthe × Rhynchostylis × Vanda = Rhynchovandanthe
Euanthe × Rhynchostylis × Vanda × Ascocentrum = Carrara
Euanthe × Trichoglottis = Antheglottis
Euanthe × Trichoglottis × Vanda = Kraenzlinara
Euanthe × Vanda = Vandanthe
Euanthe × Vanda × Aerides = Vandantherides
Euanthe × Vanda × Arachnis = Arandanthe
Euanthe × Vanda × Arachnis × Renanthera = Cogniauxara
Euanthe × Vanda × Ascocentrum = Schlechterara
Euanthe × Vanda × Ascocentrum × Rhynchostylis = Carrara
Euanthe × Vanda × Paraphalaenopsis = Parandanthe
Euanthe × Vanda × Renanthera = Amesara
Euanthe × Vanda × Renanthera × Arachnis = Cogniauxara
Euanthe × Vanda × Renanthera × Vandopsis = Lindleyara
Euanthe × Vanda × Rhynchostylis = Rhynchovandanthe
Euanthe × Vanda × Rhynchostylis × Ascocentrum = Carrara
Euanthe × Vanda × Trichoglottis = Kraenzlinara
Euanthe × Vanda × Vandopsis = Reichenbachara
Euanthe × Vanda × Vandopsis × Renanthera = Lindleyara
Euanthe × Vandopsis × Renanthera × Vanda = Lindleyara
Euanthe × Vandopsis × Vanda = Reichenbachara
Euanthe × Vandopsis × Vanda × Renanthera = Lindleyara

Gastrorchis × Calanthe = Gastrocalanthe
Gastrorchis × Phaius = Gastrophaius

Gomesa × Oncidium = Oncidesa

Goodyera × Anoectochilus = Anoectogoodyera

Grammatophyllum × Cymbidium = Grammatocymbidium

Gymnadenia × Anacamptis = Gymnanacamptis

Gymnadenia × Coeloglossum = Gymnaglossum
Gymnadenia × Dactylorhiza = Dactylodenia
Gymnadenia × Leucorchis = Gymnorchis
Gymnadenia × Nigritella = Gymnigritella
Gymnadenia × Orchis = Orchigymnadenia
Gymnadenia × Platanthera = Gymnplatanthera

Habenaria × Pecteilis = Pectabenaria

Herminium × Aceras = Aceraherminium
Herminium × Leucorchis = Leucerminium

Hexadesmia × Domingoa = Domindesmia

Laelia × Barkeria × Cattleya = Laeliocattkeria
Laelia × Brassavola = Brassolaelia
Laelia × Brassavola × Cattleya = Brassolaeliocattleya
Laelia × Brassavola × Cattleya × Diacrium = Linneara
Laelia × Brassavola × Cattleya × Epidendrum = Adamara
Laelia × Brassavola × Cattleya × Schomburgkia = Recchara
Laelia × Brassavola × Cattleya × Sophronitis = Potinara
Laelia × Brassavola × Diacrium × Cattleya = Linneara
Laelia × Brassavola × Epidendrum × Cattleya = Adamara
Laelia × Brassavola × Schomburgkia × Cattleya = Recchara
Laelia × Brassavola × Sophronitis = Lowara
Laelia × Brassavola × Sophronitis × Cattleya = Potinara
Laelia × Broughtonia = Laelonia
Laelia × Broughtonia × Sophronitis = Hartara
Laelia × Cattleya = Laeliocattleya
Laelia × Cattleya × Barkeria = Laeliocattkeria
Laelia × Cattleya × Brassavola = Brassolaeliocattleya
Laelia × Cattleya × Brassavola × Diacrium = Linneara
Laelia × Cattleya × Brassavola × Epidendrum = Adamara
Laelia × Cattleya × Brassavola × Schomburgkia = Recchara
Laelia × Cattleya × Brassavola × Sophronitis = Potinara
Laelia × Cattleya × Diacrium = Dialaeliocattleya
Laelia × Cattleya × Diacrium × Brassavola = Linneara
Laelia × Cattleya × Epidendrum = Epilaeliocattleya
Laelia × Cattleya × Epidendrum × Brassavola = Adamara
Laelia × Cattleya × Epidendrum × Sophronitis = Kirchara
Laelia × Cattleya × Schomburgkia = Schombolaeliocattleya

Laelia × Cattleya × Schomburgkia × Brassavola = Recchara
Laelia × Cattleya × Sophronitis = Sophrolaeliocattleya
Laelia × Cattleya × Sophronitis × Brassavola = Potinara
Laelia × Cattleya × Sophronitis × Epidendrum = Kirchara
Laelia × Diacrium = Dialaelia
Laelia × Diacrium × Brassavola × Cattleya = Linneara
Laelia × Diacrium × Cattleya = Dialaeliocattleya
Laelia × Diacrium × Cattleya × Brassavola = Linneara
Laelia × Epidendrum = Epilaelia
Laelia × Epidendrum × Brassavola × Cattleya = Adamara
Laelia × Epidendrum × Cattleya = Epilaeliocattleya
Laelia × Epidendrum × Cattleya × Brassavola = Adamara
Laelia × Epidendrum × Cattleya × Sophronitis = Kirchara
Laelia × Laeliopsis = Laeopsis
Laelia × Leptotes = Leptolaelia
Laelia × Schomburgkia = Schombolaelia
Laelia × Schomburgkia × Brassavola × Cattleya = Recchara
Laelia × Schomburgkia × Cattleya = Schombolaeliocattleya
Laelia × Schomburgkia × Cattleya × Brassavola = Recchara
Laelia × Sophronitis = Sophrolaelia
Laelia × Sophronitis × Brassavola = Lowara
Laelia × Sophronitis × Brassavola × Cattleya = Potinara
Laelia × Sophronitis × Broughtonia = Hartara
Laelia × Sophronitis × Cattleya = Sophrolaeliocattleya
Laelia × Sophronitis × Cattleya × Brassavola = Potinara
Laelia × Sophronitis × Cattleya × Epidendrum = Kirchara
Laelia × Sophronitis × Epidendrum × Cattleya = Kirchara
Laelia × Tetramicra = Tetralaelia

Laeliopsis × Brassavola × Cattleya = Fujiwarara
Laeliopsis × Broughtonia = Broughtopsis
Laeliopsis × Cattleya × Brassavola = Fujiwarara
Laeliopsis × Domingoa = Domliopsis
Laeliopsis × Epidendrum = Epilopsis
Laeliopsis × Laelia = Laeopsis
Laeliopsis × Tetramicra = Tetraliopsis

Leptotes × Laelia = Leptolaelia

Leucorchis × Gymnadenia = Gymnorchis

Leucorchis × Herminium = Leucerminium
Leucorchis × Nigritella = Leucotella

Limatodes × Calanthe = Calanthe
Limatodes × Calanthe × Phaius = Phaiocalanthe
Limatodes × Phaius × Calanthe = Phaiocalanthe
Limatodes × Preptanthe = Calanthe

Loroglossum × Orchis = Loroglorchis

Ludisia × Anoectochilus = Ludochilus
Ludisia × Dossinia = Dossisia
Ludisia × Macodes = Macodisia

Luisia × Vanda = Luisanda

Lycaste × Anguloa = Angulocaste
Lycaste × Bifrenaria = Lycastenaria
Lycaste × Zygopetalum = Zygocaste

Macodes × Ludisia = Macodisia

Macradenia × Rodriguezia = Rodridenia

Macroplectrum × Angraecum = Macrangraecum

Menadenium × Zygopetalum = Zygomena

Mendoncella × Zygopetalum = Zygocella

Miltonia × Aspasia = Miltonpasia
Miltonia × Brassia = Bratonia
Miltonia × Brassia × Oncidium = Aliceara
Miltonia × Cochlioda = Miltonioda
Miltonia × Cochlioda × Odontoglossum = Vuylstekeara
Miltonia × Cochlioda × Odontoglossum × Oncidium = Burrageara
Miltonia × Cochlioda × Oncidium = Charlesworthara
Miltonia × Cochlioda × Oncidium × Odontoglossum = Burrageara
Miltonia × Odontoglossum = Odontonia
Miltonia × Odontoglossum × Cochlioda = Vuylstekeara
Miltonia × Odontoglossum × Cochlioda × Oncidium = Burrageara
Miltonia × Odontoglossum × Oncidium = Colmanara
Miltonia × Odontoglossum × Oncidium × Cochlioda = Burrageara
Miltonia × Odontoglossum × Symphyglossum = Symphodontonia
Miltonia × Oncidium = Miltonidium
Miltonia × Oncidium × Brassia = Aliceara

Miltonia × Oncidium × Cochlioda = Charlesworthara
Miltonia × Oncidium × Cochlioda × Odontoglossum = Burrageara
Miltonia × Oncidium × Odontoglossum = Colmanara
Miltonia × Oncidium × Odontoglossum × Cochlioda = Burrageara
Miltonia × Rodriguezia = Miltonguezia
Miltonia × Symphyglossum = Symphyglossonia
Miltonia × Symphyglossum × Odontoglossum = Symphodontonia
Miltonia × Trichopilia = Miltonpilia

Mormodes × Cycnoches = Cycnodes

Neofinetia × Aerides = Aeridofinetia
Neofinetia × Ascocentrum = Ascofinetia
Neofinetia × Ascocentrum × Euanthe = Smithara
Neofinetia × Ascocentrum × Vanda = Nakamotoara
Neofinetia × Euanthe × Ascocentrum = Smithara
Neofinetia × Phalaenopsis = Phalaenetia
Neofinetia × Renanthera = Renanetia
Neofinetia × Rhynchostylis = Neostylis
Neofinetia × Vanda = Vandofinetia
Neofinetia × Vanda × Ascocentrum = Nakamotoara

Nigritella × Dactylorhiza = Dactylitella
Nigritella × Gymnadenia = Gymnigritella
Nigritella × Leucorchis = Leucotella
Nigritella × Orchis = Nigrorchis

Odontoglossum × Ada = Adaglossum
Odontoglossum × Aspasia = Aspoglossum
Odontoglossum × Brassia = Odontobrassia
Odontoglossum × Brassia × Cochlioda = Sanderara
Odontoglossum × Cochlioda = Odontioda
Odontoglossum × Cochlioda × Brassia = Sanderara
Odontoglossum × Cochlioda × Miltonia = Vuylstekeara
Odontoglossum × Cochlioda × Miltonia × Oncidium = Burrageara
Odontoglossum × Cochlioda × Oncidium = Wilsonara
Odontoglossum × Cochlioda × Oncidium × Miltonia = Burrageara
Odontoglossum × Cochlioda × Symphyglossum = Symphodontioda
Odontoglossum × Miltonia = Odontonia
Odontoglossum × Miltonia × Cochlioda = Vuylstekeara
Odontoglossum × Miltonia × Cochlioda × Oncidium = Burrageara
Odontoglossum × Miltonia × Oncidium = Colmanara
Odontoglossum × Miltonia × Oncidium × Cochlioda = Burrageara

Odontoglossum × Miltonia × Symphyglossum = Symphodontonia
Odontoglossum × Oncidium = Odontocidium
Odontoglossum × Oncidium × Cochlioda = Wilsonara
Odontoglossum × Oncidium × Cochlioda × Miltonia = Burrageara
Odontoglossum × Oncidium × Miltonia = Colmanara
Odontoglossum × Oncidium × Miltonia × Cochlioda = Burrageara
Odontoglossum × Symphyglossum = Symphodontoglossum
Odontoglossum × Symphyglossum × Cochlioda = Symphodontioda
Odontoglossum × Symphyglossum × Miltonia = Symphodontonia
Odontoglossum × Zygopetalum = Odopetalum

Oncidium × Aspasia = Oncidasia
Oncidium × Brassia = Brassidium
Oncidium × Brassia × Miltonia = Aliceara
Oncidium × Cochlioda = Oncidioda
Oncidium × Cochlioda × Miltonia = Charlesworthara
Oncidium × Cochlioda × Miltonia × Odontoglossum = Burrageara
Oncidium × Cochlioda × Odontoglossum = Wilsonara
Oncidium × Cochlioda × Odontoglossum × Miltonia = Burrageara
Oncidium × Comparettia = Oncidarettia
Oncidium × Comparettia × Rodriguezia = Warneara
Oncidium × Gomesa = Oncidesa
Oncidium × Miltonia = Miltonidium
Oncidium × Miltonia × Brassia = Aliceara
Oncidium × Miltonia × Cochlioda = Charlesworthara
Oncidium × Miltonia × Cochlioda × Odontoglossum = Burrageara
Oncidium × Miltonia × Odontoglossum = Colmanara
Oncidium × Miltonia × Odontoglossum × Cochlioda = Burrageara
Oncidium × Odontoglossum = Odontocidium
Oncidium × Odontoglossum × Cochlioda = Wilsonara
Oncidium × Odontoglossum × Cochlioda × Miltonia = Burrageara
Oncidium × Odontoglossum × Miltonia = Colmanara
Oncidium × Odontoglossum × Miltonia × Cochlioda = Burrageara
Oncidium × Rodriguezia = Rodricidium
Oncidium × Rodriguezia × Comparettia = Warneara
Oncidium × Trichocentrum = Trichocidium
Oncidium × Zygopetalum = Zygocidium

Orchis × Aceras = Orchiaceras
Orchis × Anacamptis = Anacamptorchis

Orchis × Coeloglossum = Orchicoeloglossum
Orchis × Dactylorhiza = Orchidactyla
Orchis × Gymnadenia = Orchigymnadenia
Orchis × Loroglossum = Loroglorchis
Orchis × Nigritella = Nigrorchis
Orchis × Platanthera = Orchiplatanthera
Orchis × Serapias = Orchiserapias

Otostylis × Zygopetalum = Zygostylis

Paphiopedilum × Phragmipedium = Phragmipaphium

Papilionanthe × Vanda = Papilionanda

Paraphalaenopsis × Arachnis = Pararachnis
Paraphalaenopsis × Arachnis × Euanthe = Benthamara
Paraphalaenopsis × Arachnis × Renanthera = Paranthera
Paraphalaenopsis × Arachnis × Vanda = Parandachnis
Paraphalaenopsis × Euanthe = Paranthe
Paraphalaenopsis × Euanthe × Arachnis = Benthamara
Paraphalaenopsis × Euanthe × Vanda = Parandanthe
Paraphalaenopsis × Renanthera = Pararenanthera
Paraphalaenopsis × Renanthera × Arachnis = Paranthera
Paraphalaenopsis × Renanthera × Vanda = Paravandanthera
Paraphalaenopsis × Vanda = Paravanda
Paraphalaenopsis × Vanda × Arachnis = Parandachnis
Paraphalaenopsis × Vanda × Euanthe = Parandanthe
Paraphalaenopsis × Vanda × Renanthera = Paravandanthera

Pecteilis × Habenaria = Pectabenaria

Pescatoria × Bollea = Pescatobollea
Pescatoria × Chondrorhyncha = Pescarhyncha
Pescatoria × Cochleanthes = Pescoranthes

Phaius × Bletia = Phabletia
Phaius × Calanthe = Phaiocalanthe
Phaius × Calanthe × Limatodes = Phaiocalanthe
Phaius × Cymbidium = Phaiocymbidium
Phaius × Epidendrum = Epiphaius
Phaius × Gastrorchis = Gastrophaius

Phaius × Limatodes × Calanthe = Phaiocalanthe
Phaius × Spathoglottis = Spathophaius

Phalaenopsis × Aerides = Aeridopsis
Phalaenopsis × Aerides × Vanda = Phalaerianda
Phalaenopsis × Arachnis = Arachnopsis
Phalaenopsis × Arachnis × Renanthera = Sappanara
Phalaenopsis × Arachnis × Vanda = Trevorara
Phalaenopsis × Doritis = Doritaenopsis
Phalaenopsis × Neofinetia = Phalaenetia
Phalaenopsis × Renanthera = Renanthopsis
Phalaenopsis × Renanthera × Arachnis = Sappanara
Phalaenopsis × Renanthera × Vanda = Moirara
Phalaenopsis × Rhynchostylis = Rhynchonopsis
Phalaenopsis × Vanda = Vandaenopsis
Phalaenopsis × Vanda × Aerides = Phalaerianda
Phalaenopsis × Vanda × Arachnis = Trevorara
Phalaenopsis × Vanda × Renanthera = Moirara
Phalaenopsis × Vandopsis = Phalandopsis

Phragmipedium × Paphiopedilum = Phragmipaphium

Platanthera × Anacamptis = Anacamptiplatanthera
Platanthera × Dactylorhiza = Rhizanthera
Platanthera × Gymnadenia = Gymplatanthera
Platanthera × Orchis = Orchiplatanthera

Preptanthe × Calanthidium = Calanthe
Preptanthe × Limatodes = Calanthe

Renanthera × Aerides = Renades
Renanthera × Arachnis = Aranthera
Renanthera × Arachnis × Armodorum = Renaradorum
Renanthera × Arachnis × Euanthe × Vanda = Cogniauxara
Renanthera × Arachnis × Paraphalaenopsis = Paranthera
Renanthera × Arachnis × Phalaenopsis = Sappanara
Renanthera × Arachnis × Vanda = Holttumara
Renanthera × Arachnis × Vanda × Euanthe = Cogniauxara
Renanthera × Arachnis × Vandopsis = Limara
Renanthera × Armodorum × Arachnis = Renaradorum
Renanthera × Ascocentrum = Renancentrum
Renanthera × Ascoglossum = Renanthoglossum
Renanthera × Euanthe = Antheranthe

Renanthera × Euanthe × Arachnis × Vanda = Cogniauxara
Renanthera × Euanthe × Vanda = Amesara
Renanthera × Euanthe × Vanda × Arachnis = Cogniauxara
Renanthera × Euanthe × Vanda × Vandopsis = Lindleyara
Renanthera × Euanthe × Vandopsis × Vanda = Lindleyara
Renanthera × Neofinetia = Renanetia
Renanthera × Paraphalaenopsis = Pararenanthera
Renanthera × Paraphalaenopsis × Arachnis = Paranthera
Renanthera × Paraphalaenopsis × Vanda = Paravandanthera
Renanthera × Phalaenopsis = Renanthopsis
Renanthera × Phalaenopsis × Arachnis = Sappanara
Renanthera × Phalaenopsis × Vanda = Moirara
Renanthera × Renantherella = Ellanthera
Renanthera × Rhynchostylis = Renanstylis
Renanthera × Saccolabium = Saccanthera
Renanthera × Sarcochilus = Sarcothera
Renanthera × Trichoglottis = Renaglottis
Renanthera × Vanda = Renantanda
Renanthera × Vanda × Arachnis = Holttumara
Renanthera × Vanda × Arachnis × Euanthe = Cogniauxara
Renanthera × Vanda × Euanthe = Amesara
Renanthera × Vanda × Euanthe × Arachnis = Cogniauxara
Renanthera × Vanda × Euanthe × Vandopsis = Lindleyara
Renanthera × Vanda × Paraphalaenopsis = Paravandanthera
Renanthera × Vanda × Phalaenopsis = Moirara
Renanthera × Vanda × Vandopsis = Hawaiiara
Renanthera × Vanda × Vandopsis × Euanthe = Lindleyara
Renanthera × Vandopsis = Renanopsis
Renanthera × Vandopsis × Arachnis = Limara
Renanthera × Vandopsis × Euanthe × Vanda = Lindleyara
Renanthera × Vandopsis × Vanda = Hawaiiara
Renanthera × Vandopsis × Vanda × Euanthe = Lindleyara

Renantherella × Ascocentrum = Ascorella
Renantherella × Renanthera = Ellanthera

Rhyncholaelia × Brassavola = Rhynchovola

Rhynchostylis × Aerides = Aeridostylis
Rhynchostylis × Ascocentrum = Rhynchocentrum
Rhynchostylis × Ascocentrum × Euanthe × Vanda = Carrara
Rhynchostylis × Ascocentrum × Vanda = Vascostylis

Rhynchostylis × Ascocentrum × Vanda × Euanthe = Carrara
Rhynchostylis × Euanthe × Ascocentrum × Vanda = Carrara
Rhynchostylis × Euanthe × Vanda = Rhynchovandanthe
Rhynchostylis × Euanthe × Vanda × Ascocentrum = Carrara
Rhynchostylis × Neofinetia = Neostylis
Rhynchostylis × Phalaenopsis = Rhynchonopsis
Rhynchostylis × Renanthera = Renanstylis
Rhynchostylis × Vanda = Vandachostylis
Rhynchostylis × Vanda × Ascocentrum = Vascostylis
Rhynchostylis × Vanda × Ascocentrum × Euanthe = Carrara
Rhynchostylis × Vanda × Euanthe = Rhynchovandanthe
Rhynchostylis × Vanda × Euanthe × Ascocentrum = Carrara

Rodriguezia × Brassia = Bradriguezia
Rodriguezia × Comparettia = Rodrettia
Rodriguezia × Comparettia × Oncidium = Warneara
Rodriguezia × Macradenia = Rodridenia
Rodriguezia × Miltonia = Miltonguezia
Rodriguezia × Oncidium = Rodricidium
Rodriguezia × Oncidium × Comparettia = Warneara

Saccolabium × Aerides = Aeridolabium
Saccolabium × Renanthera = Saccanthera
Saccolabium × Vanda = Sanda

Sarcochilus × Renanthera = Sarcothera

Schomburgkia × Bletia = Schombletia
Schomburgkia × Brassavola = Schombobrassavola
Schomburgkia × Brassavola × Cattleya = Dekensara
Schomburgkia × Brassavola × Cattleya × Laelia = Recchara
Schomburgkia × Brassavola × Laelia × Cattleya = Recchara
Schomburgkia × Broughtonia = Schombotonia
Schomburgkia × Broughtonia × Diacrium = Shipmanara
Schomburgkia × Cattleya = Schombocattleya
Schomburgkia × Cattleya × Brassavola = Dekensara
Schomburgkia × Cattleya × Brassavola × Laelia = Recchara
Schomburgkia × Cattleya × Laelia = Schombolaeliocattleya
Schomburgkia × Cattleya × Laelia × Brassavola = Recchara
Schomburgkia × Diacrium = Diaschomburgkia

Schomburgkia × Diacrium × Broughtonia = Shipmanara
Schomburgkia × Epidendrum = Schomboepidendrum

Schomburgkia × Laelia = Schombolaelia
Schomburgkia × Laelia × Brassavola × Cattleya = Recchara
Schomburgkia × Laelia × Cattleya = Schombolaeliocattleya

Schomburgkia × Laelia × Cattleya × Brassavola = Recchara

Selenipedium × Cypripedium = Cysepedium

Serapias × Anacamptis = Serapicamptis
Serapias × Orchis = Orchiserapias

Sobralia × Cattleya = Sobraleya

Sophronitella × Epidendrum = Epiphronitella

Sophronitis × Brassavola = Sophrovola
Sophronitis × Brassavola × Cattleya = Rolfeara
Sophronitis × Brassavola × Cattleya × Laelia = Potinara
Sophronitis × Brassavola × Laelia = Lowara
Sophronitis × Brassavola × Laelia × Cattleya = Potinara
Sophronitis × Broughtonia = Sophrobroughtonia

Sophronitis × Broughtonia × Laelia = Hartara
Sophronitis × Cattleya = Sophrocattleya
Sophronitis × Cattleya × Brassavola = Rolfeara
Sophronitis × Cattleya × Brassavola × Laelia = Potinara
Sophronitis × Cattleya × Epidendrum × Laelia = Kirchara
Sophronitis × Cattleya × Laelia = Sophrolaeliocattleya

Sophronitis × Cattleya × Laelia × Brassavola = Potinara
Sophronitis × Cattleya × Laelia × Epidendrum = Kirchara
Sophronitis × Epidendrum = Epiphronitis
Sophronitis × Epidendrum × Cattleya × Laelia = Kirchara
Sophronitis × Epidendrum × Laelia × Cattleya = Kirchara
Sophronitis × Laelia = Sophrolaelia
Sophronitis × Laelia × Brassavola = Lowara
Sophronitis × Laelia × Brassavola × Cattleya = Potinara
Sophronitis × Laelia × Broughtonia = Hartara
Sophronitis × Laelia × Cattleya = Sophrolaeliocattleya

Sophronitis × Laelia × Cattleya × Brassavola = Potinara
Sophronitis × Laelia × Cattleya × Epidendrum = Kirchara

Sophronitis × Laelia × Epidendrum × Cattleya = Kirchara

Spathoglottis × Phaius = Spathophaius

Symphyglossum × Cochlioda × Odontoglossum = Symphodontioda
Symphyglossum × Miltonia = Symphyglossonia
Symphyglossum × Miltonia × Odontoglossum = Symphodontonia
Symphyglossum × Odontoglossum = Symphodontoglossum
Symphyglossum × Odontoglossum × Cochlioda = Symphodontioda
Symphyglossum × Odontoglossum × Miltonia = Symphodontonia

Tetramicra × Broughtonia = Tetratonia
Tetramicra × Laelia = Tetralaelia
Tetramicra × Laeliopsis = Tetraliopsis

Trichocentrum × Oncidium = Trichocidium

Trichoglottis × Arachnis = Trichachnis
Trichoglottis × Arachnis × Vanda = Ridleyara
Trichoglottis × Euanthe = Antheglottis
Trichoglottis × Euanthe × Vanda = Kraenzlinara
Trichoglottis × Renanthera = Renaglottis
Trichoglottis × Vanda = Trichovanda
Trichoglottis × Vanda × Arachnis = Ridleyara
Trichoglottis × Vanda × Euanthe = Kraenzlinara

Trichopilia × Aspasia = Trichopasia
Trichopilia × Miltonia = Miltonpilia

Vanda × Acampe = Vancampe
Vanda × Aerides = Aeridovanda
Vanda × Aerides × Euanthe = Vandantherides
Vanda × Aerides × Phalaenopsis = Phalaerianda
Vanda × Angraecum = Vandaecum
Vanda × Arachnis = Aranda
Vanda × Arachnis × Euanthe = Arandanthe
Vanda × Arachnis × Euanthe × Renanthera = Cogniauxara
Vanda × Arachnis × Paraphalaenopsis = Parandachnis
Vanda × Arachnis × Phalaenopsis = Trevorara
Vanda × Arachnis × Renanthera = Holttumara
Vanda × Arachnis × Renanthera × Euanthe = Cogniauxara
Vanda × Arachnis × Trichoglottis = Ridleyara
Vanda × Ascocentrum = Ascocenda
Vanda × Ascocentrum × Euanthe = Schlechterara

Vanda × Ascocentrum × Euanthe × Rhynchostylis = Carrara
Vanda × Ascocentrum × Neofinetia = Nakamotoara
Vanda × Ascocentrum × Rhynchostylis = Vascostylis
Vanda × Ascocentrum × Rhynchostylis × Euanthe = Carrara
Vanda × Doritis = Vandoritis
Vanda × Esmeralda = Esmeranda
Vanda × Euanthe = Vandanthe
Vanda × Euanthe × Aerides = Vandantherides
Vanda × Euanthe × Arachnis = Arandanthe
Vanda × Euanthe × Arachnis × Renanthera = Cogniauxara
Vanda × Euanthe × Ascocentrum = Schlechterara
Vanda × Euanthe × Ascocentrum × Rhynchostylis = Carrara
Vanda × Euanthe × Paraphalaenopsis = Parandanthe
Vanda × Euanthe × Renanthera = Amesara
Vanda × Euanthe × Renanthera × Arachnis = Cogniauxara
Vanda × Euanthe × Renanthera × Vandopsis = Lindleyara
Vanda × Euanthe × Rhynchostylis = Rhynchovandanthe
Vanda × Euanthe × Rhynchostylis × Ascocentrum = Carrara
Vanda × Euanthe × Trichoglottis = Kraenzlinara
Vanda × Euanthe × Vandopsis = Reichenbachara
Vanda × Euanthe × Vandopsis × Renanthera = Lindleyara
Vanda × Luisia = Luisanda
Vanda × Neofinetia = Vandofinetia
Vanda × Neofinetia × Ascocentrum = Nakamotoara
Vanda × Papilionanthe = Papilionanda
Vanda × Paraphalaenopsis = Paravanda
Vanda × Paraphalaenopsis × Arachnis = Parandachnis
Vanda × Paraphalaenopsis × Euanthe = Parandanthe
Vanda × Paraphalaenopsis × Renanthera = Paravandanthera
Vanda × Phalaenopsis = Vandaenopsis
Vanda × Phalaenopsis × Aerides = Phalaerianda
Vanda × Phalaenopsis × Arachnis = Trevorara
Vanda × Phalaenopsis × Renanthera = Moirara
Vanda × Renanthera = Renantanda
Vanda × Renanthera × Arachnis = Holttumara
Vanda × Renanthera × Arachnis × Euanthe = Cogniauxara
Vanda × Renanthera × Euanthe = Amesara
Vanda × Renanthera × Euanthe × Arachnis = Cogniauxara
Vanda × Renanthera × Euanthe × Vandopsis = Lindleyara
Vanda × Renanthera × Paraphalaenopsis = Paravandanthera

Vanda × Renanthera × Phalaenopsis	= Moirara
Vanda × Renanthera × Vandopsis	= Hawaiiara
Vanda × Renanthera × Vandopsis × Euanthe	= Lindleyara
Vanda × Rhynchostylis	= Vandachostylis
Vanda × Rhynchostylis × Ascocentrum	= Vascostylis
Vanda × Rhynchostylis × Ascocentrum × Euanthe	= Carrara
Vanda × Rhynchostylis × Euanthe	= Rhynchovandanthe
Vanda × Rhynchostylis × Euanthe × Ascocentrum	= Carrara
Vanda × Saccolabium	= Sanda
Vanda × Trichoglottis	= Trichovanda
Vanda × Trichoglottis × Arachnis	= Ridleyara
Vanda × Trichoglottis × Euanthe	= Kraenzlinara
Vanda × Vandopsis	= Opsisanda
Vanda × Vandopsis × Euanthe	= Reichenbachara
Vanda × Vandopsis × Euanthe × Renanthera	= Lindleyara
Vanda × Vandopsis × Renanthera	= Hawaiiara
Vanda × Vandopsis × Renanthera × Euanthe	= Lindleyara

Vandopsis × Aerides	= Vandopsides
Vandopsis × Arachnis	= Vandachnis
Vandopsis × Arachnis × Renanthera	= Limara
Vandopsis × Euanthe × Renanthera × Vanda	= Lindleyara
Vandopsis × Euanthe × Vanda	= Reichenbachara
Vandopsis × Euanthe × Vanda × Renanthera	= Lindleyara
Vandopsis × Phalaenopsis	= Vandaenopsis
Vandopsis × Renanthera	= Renanopsis
Vandopsis × Renanthera × Arachnis	= Limara
Vandopsis × Renanthera × Euanthe × Vanda	= Lindleyara
Vandopsis × Renanthera × Vanda	= Hawaiiara
Vandopsis × Renanthera × Vanda × Euanthe	= Lindleyara
Vandopsis × Vanda	= Opsisanda
Vandopsis × Vanda × Euanthe	= Reichenbachara
Vandopsis × Vanda × Euanthe × Renanthera	= Lindleyara
Vandopsis × Vanda × Renanthera	= Hawaiiara
Vandopsis × Vanda × Renanthera × Euanthe	= Lindleyara

Zygopetalum × Aganisia	= Zygonisia
Zygopetalum × Batemannia	= Zygobatemania
Zygopetalum × Chondrorhyncha	= Zygorhyncha
Zygopetalum × Colax	= Zygocolax
Zygopetalum × Epidendrum	= Zygodendrum

Zygopetalum × Lycaste = Zygocaste
Zygopetalum × Menadenium = Zygomena
Zygopetalum × Mendoncella = Zygocella
Zygopetalum × Odontoglossum = Odopetalum
Zygopetalum × Oncidium = Zygocidium
Zygopetalum × Otostylis = Zygostylis

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BOSTON POLLEN SURVEY — 1965 PRELIMINARY REPORT

BY

ARTURO CORSO[1] AND MANUEL LOPEZ[2]

THIS is a preliminary report of the Pollen Survey carried out in the Greater Boston area during the pollen season of 1965.

The survey was conducted by the authors, with the cooperation of the Allergy Unit at the Massachusetts General Hospital and the Botanical Museum of Harvard University. Support for this research was received from the Milton Fund of Harvard University and United States Public Health Service Grant No. AI–026–3807.

Methods

Nine stations were established in locations forming a semi-circle around Boston. No. 1 in Arlington: Mrs. Marsh Williams; No. 2 in Melrose: Dr. Richard Evans Schultes; No. 3 in Newton: Dr. William Franklin; No. 4 in Boxford: Dr. J. W. Fowler; No. 5 in Brookline: Dr. Arturo Corso; No. 6 in Westwood: Mrs. Edith Bloom; No. 7 in Brockton; Mrs. Donna Dickson; No. 8 in Cambridge: Dr. Manuel Lopez; No. 9

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in Lincoln: Dr. F. C. Lowell. This was first located on Blue Hill (Milton), but because of technical problems, it was moved to Lincoln on May 5. We gratefully acknowledge the assistance of those who manned the various stations and Mr. Morgan's willingness to allow us to place a gravitational and an automatic rotoslide sampler on the premises of Drumlin Farm in Lincoln. We are also indebted to Dr. John Noxon and the staff of the Blue Hill Observatory for their helpful assistance.

Conventional gravitational samplers approved by the Pollen Committee of the American Academy of Allergy were used in all the stations. These consist of two parallel planes 9 inches in diameter, 3 inches apart and held with three struts. One inch above the center of the lower plane there is a slide holder into which the slide fits firmly. The supporting rod of the apparatus, 30 inches long, rises from a tripod base (1). We used wood instead of steel in the construction of the samplers. Regular microscope slides impregnated with silicon grease were employed. With occasional exceptions, slides were changed daily between 7 and 9 A.M.

In two stations, Cambridge and Lincoln, we used the Intermittent Rotoslide sampler[3] developed by Dr. Eugene Ogden. "This sampler is designed to take pollen sampler representative of the average pollen concentration over a 24-hour period by automatically operating periodically for short periods of time. Pollen is collected on the edges of two microscope slides inserted in metal holders which are rotated by a small electric motor. The leading edge of each slide protrudes from its holder and is oriented so its face is always at right angles to the direction of motion. The timing mechanism is designed to take a one minute sample in every twelve minutes, giving a total sampling time of two hours in every 24.

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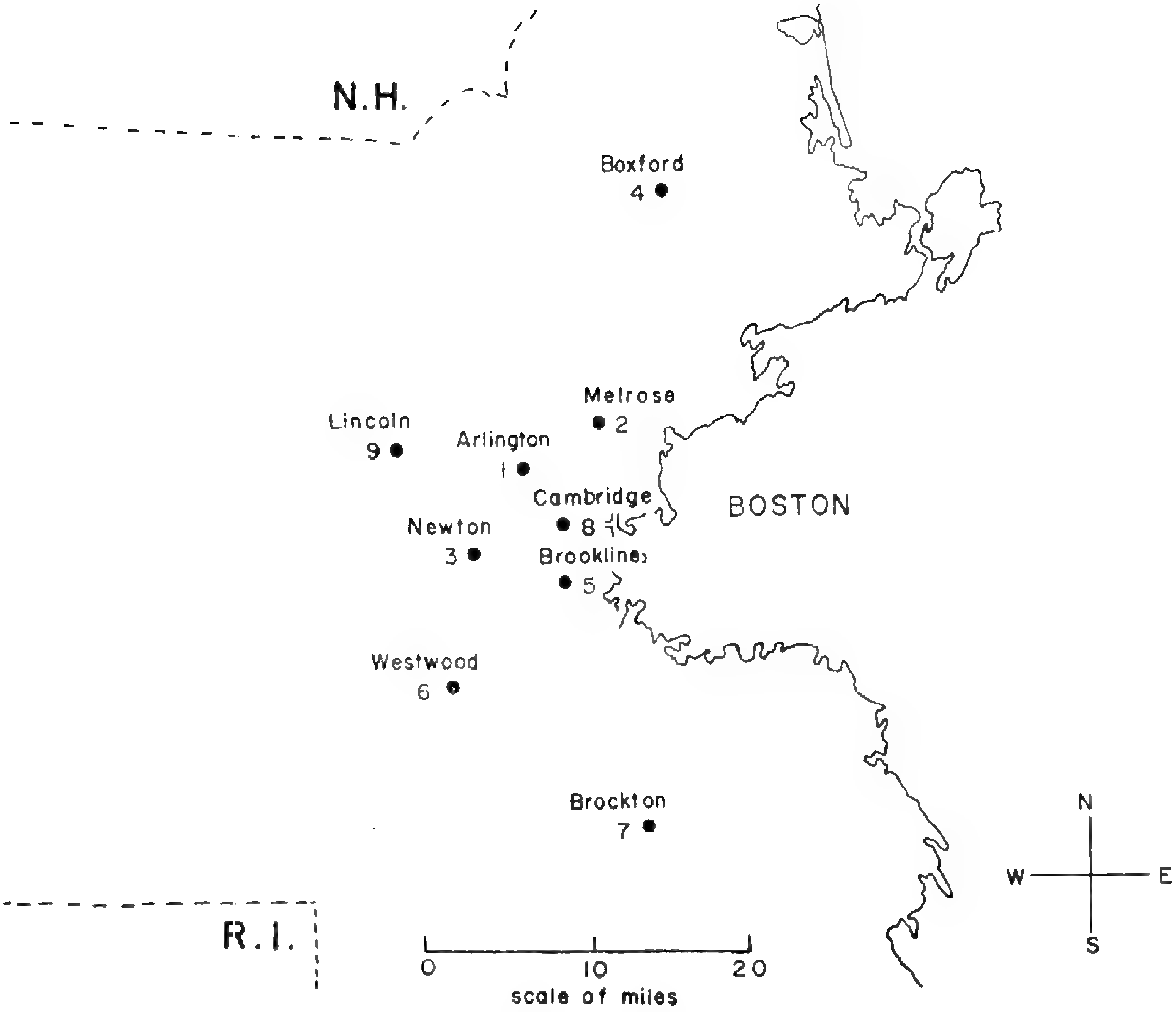
[3] Two samplers were kindly supplied by Dr. Ogden.

PLATE XIX



Map showing location of the nine stations in the Boston area.

A cylindrical shield prevents impaction of pollen on the sample surface while the slides are not rotating. When the slides are in motion the shield is pulled down so they are exposed to normal air flow. When rotation ceases, the shield is pulled up to shelter them from the wind"(2).

The slides from the gravitational samplers were stained and mounted with methyl green in jelly. Such slides can be stored for a long time without deterioration. The rotosampler slides were placed in special holders and stained with methyl green. There is no satisfactory method for preserving the rotosampler slides after reading, a disadvantage when there are difficulties in identification.

Identification was carried out in the Paleobotanical Laboratory of the Botanical Museum, Harvard University, directed by Professor Elso S. Barghoorn. We had previously obtained experience in pollen identification from two year's study of the flora of the Sabana de Bogotá in Colombia, South America. During a four-month period before initiating the survey, we became familiar with the flora of Boston by studying the pollen collections of the laboratory and our own collection prepared from herbarium specimens. During the season, we had the cooperation of Mr. Richard Eaton, Phanerogamic Curator of the New England Botanical Club Herbarium, who gave us helpful information as well as specimens of the different native plants in flower.

Zeitz microscopes were used with the 10× objective. On occasion, it was necessary to use 40× or oil immersion. Each of us took four stations, and the remaining one was rotated every two months. One square cm. of each slide was studied, and the pollen grains were identified and counted. When a particular grain was difficult to identify, the place was marked with a microlocater for further study. About 95% of the pollen grains were identified.

Results

In this report, we present the principal pollen seasons as revealed by the gravitational sampler for the nine stations. The results of the rotoslide and comparison of the two methods will be the subject of another report.

Identification of pollen derived from different species within a genus was not attempted. In the case of *Betula*-type, pollen grains so identified may have included other members of the Betulaceae and the closely similar pollen from *Myrica*. Likewise, discrimination of pollen from the different genera of the Gramineae was not attempted.

The seasonal patterns accorded with expectations. At the beginning of the tree season in April, *Ulmus* is the more important with an average of 118 grains per square cm. during the peak of the season. Other early trees are *Juniperus* and *Populus*, with *Acer* following later in April. May is dominated by *Betula*-type, with an average of 130 grains per square cm. during the peak, and *Quercus* in the second part of May, with an average peak of 209 grains. *Carya* and *Pinus* appear later in May. The Gramineae season starts at the end of May and continues to the end of July. As is shown in the table and figures, the trees produced greater concentrations of pollen than do the grasses and *Ambrosia*, which pollinates from the middle of August to the end of September.

It was interesting to observe the wide variations in the daily pollen counts from station to station. There are many local factors (such as location of the sampler, local flora and wind direction) which presumably account for these variations. For this reason, reports of daily pollen counts based on one station equipped with a gravitational sampler only are of little value from a quantitative standpoint. As indicated below, however, the average of several stations scattered over a wide area can give a useful indication of the intensity of the different pollen seasons.

The results of the pollen counts during the *Ambrosia* season by both methods, gravitation and rotoslide, were compared for station No. 9. There was a clear difference in the daily counts. The rotoslide appeared to be more efficient, especially when the pollen concentration was low. When the results of the rotoslide were compared with the average of all nine stations, the daily variations were similar, and there was little difference in the counts obtained by the two methods. Further studies with the other pollen seasons are necessary; but, in any case, these results seem to confirm the general impression that a single station equipped with the gravitational method cannot give reliable quantitative information.

TABLE I

POLLEN SEASONS *

	Onset	*Main part of the season*	*Peak (Grains/cm.^{2})*	*End*
ACER	April 21	April 24–29	April 25; (33)**	May 6
ALNUS	April 27	April 29–May 1	April 30; (6)	May 5
BETULA	May 1	May 8–11	May 9; (130)	May 25
CARYA	May 22	May 25–30	May 26; (15)	June 10
GRAMINEAE	May 24	June 4–July 10	June 9; (24)	July 30
JUNIPERUS	April 12	April 21–30	April 22; (54)	May 4
PINUS	May 20	June 5–13	June 8; (133)	July 3
POPULUS	April 14	April 28–May 4	April 30; (17)	May 6
QUERCUS	April 30	May 11–30	May 15; (209)	May 30
AMBROSIA	August 15	August 25–Sept. 4	August 28; (16)	Sept. 25
SALIX	May 2	May 2–8	May 3; (22)	May 20
ULMUS	April 14	April 15–25	April 22; (118)	May 6

*Average for all nine stations.

**Numbers in parenthesis indicate pollen count at peak of season.

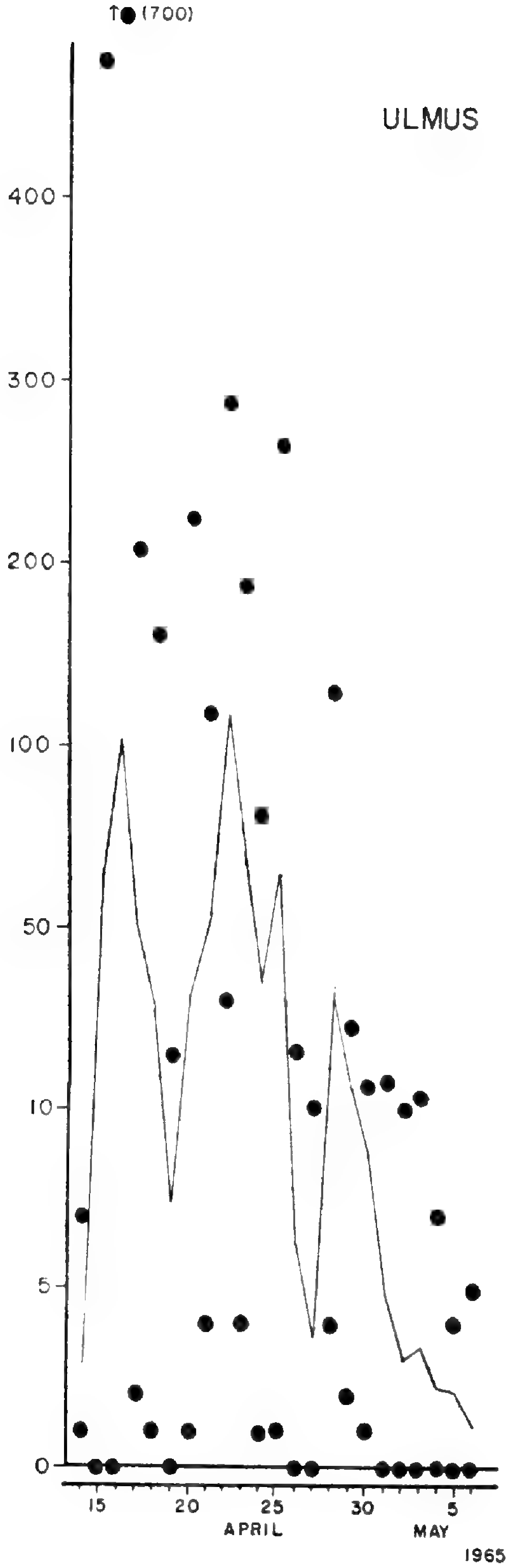
Legend: Onset of season defined as the earliest date on which the average pollen count attained was 2 grains/cm^2. End of season defined as the last date on which the average pollen count was 2 grains/cm^2.

REFERENCES

1. Durham: Volumetric Incidence of Atmospheric Allergens. Journal of Allergy, pp. 80–81, March 1946.

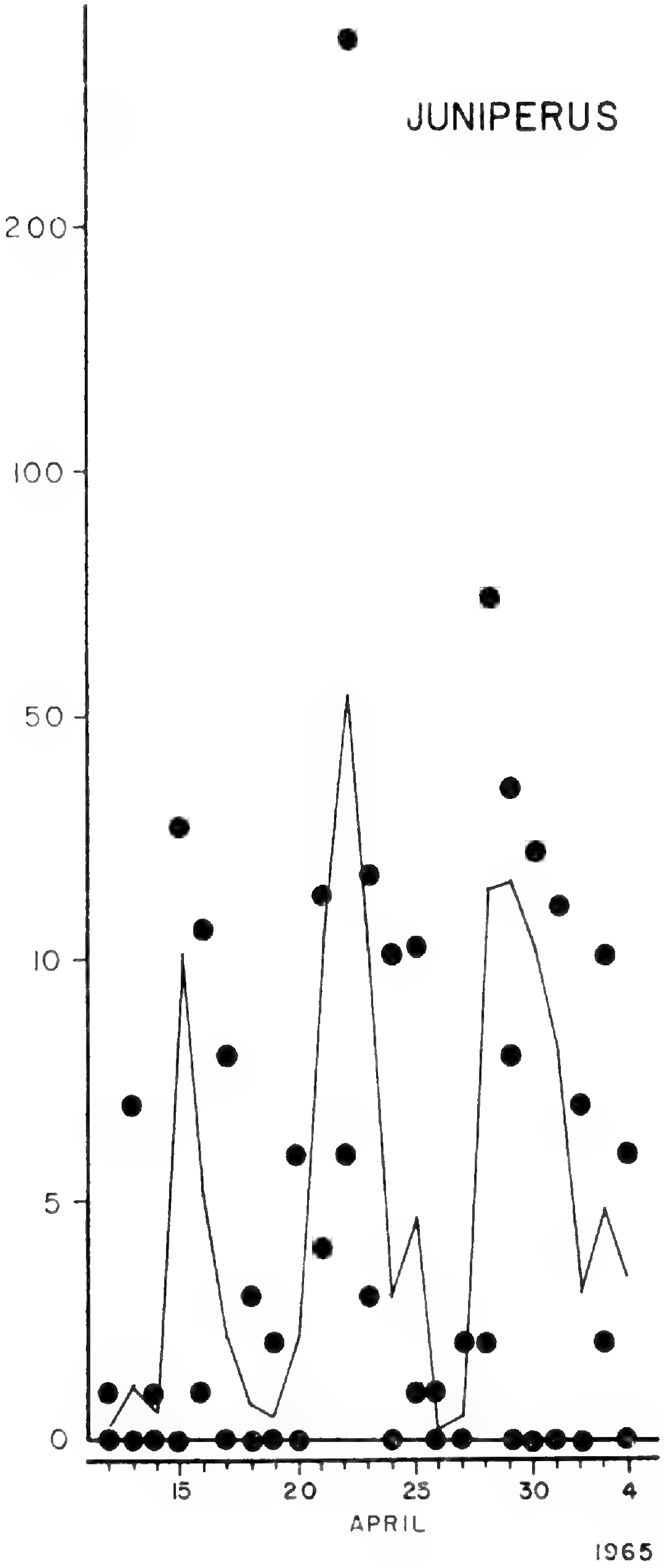
2. Ogden *et al*: Construction and Use of the Intermittent Rotoslide Pollen Sampler. Separate distributed by the Pollen and Mold Committee, American Academy of Allergy, Milwaukee, Wisconsin.

Plate XX



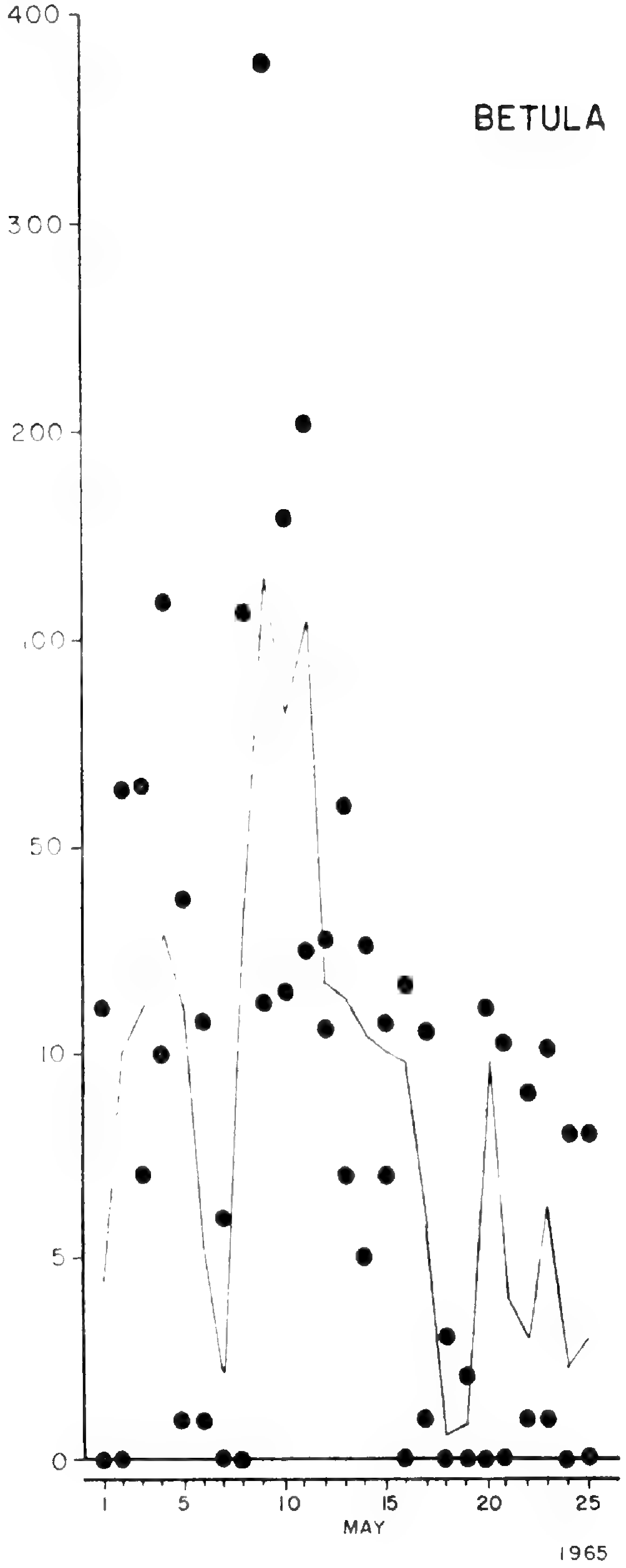
Note that scale is expanded in the lower range. The line indicates the average pollen count for all stations on each day. The points lying above the line indicate the highest observed count on that day and those below the line, the lowest.

PLATE XXI



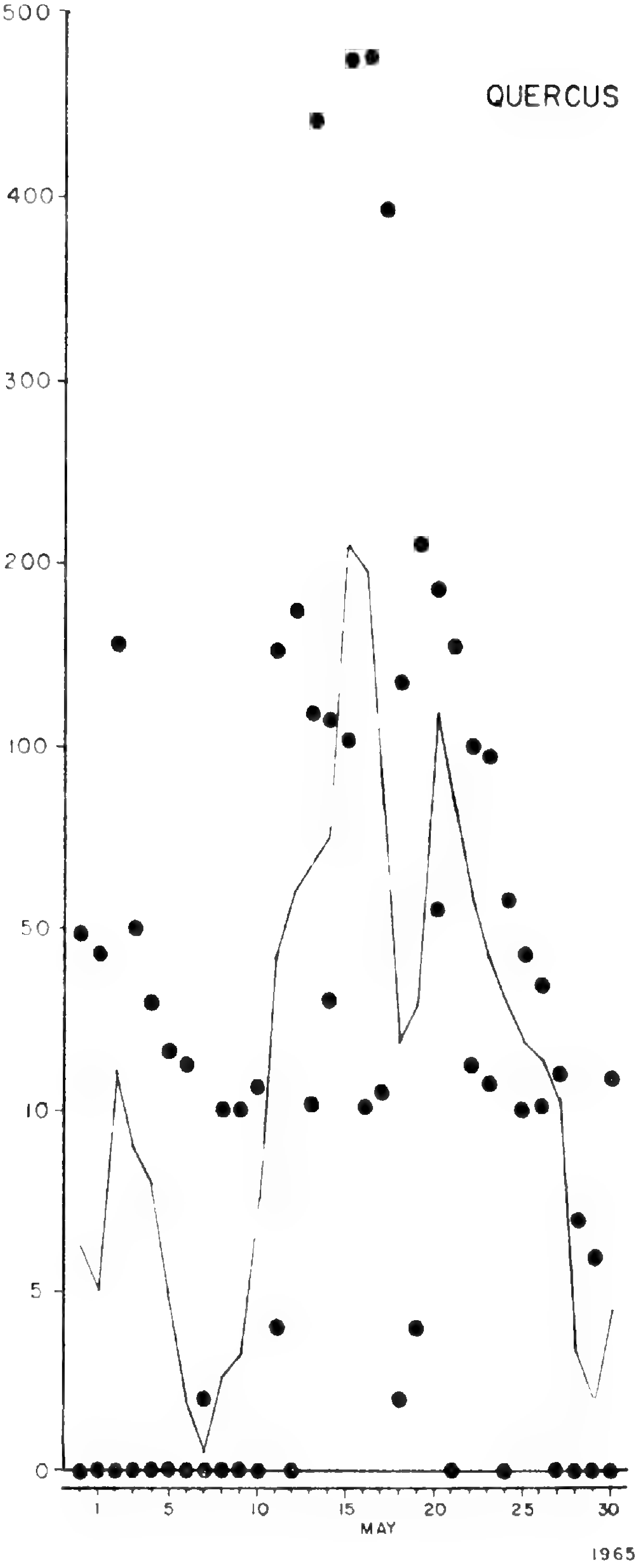
See legend, Plate XX

Plate XXII



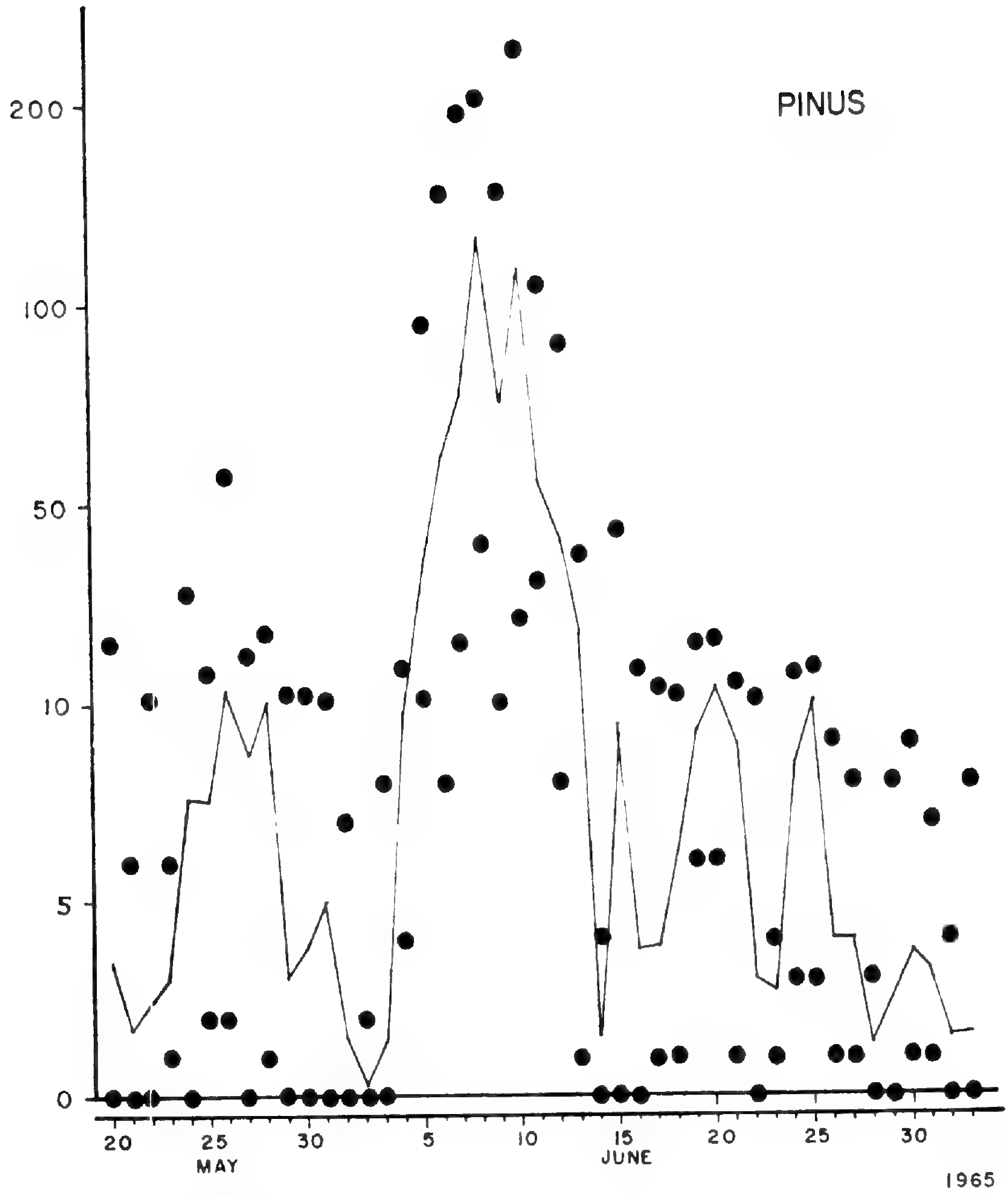
See legend, Plate XX

PLATE XXIII



See legend, Plate XX

Plate XXIV



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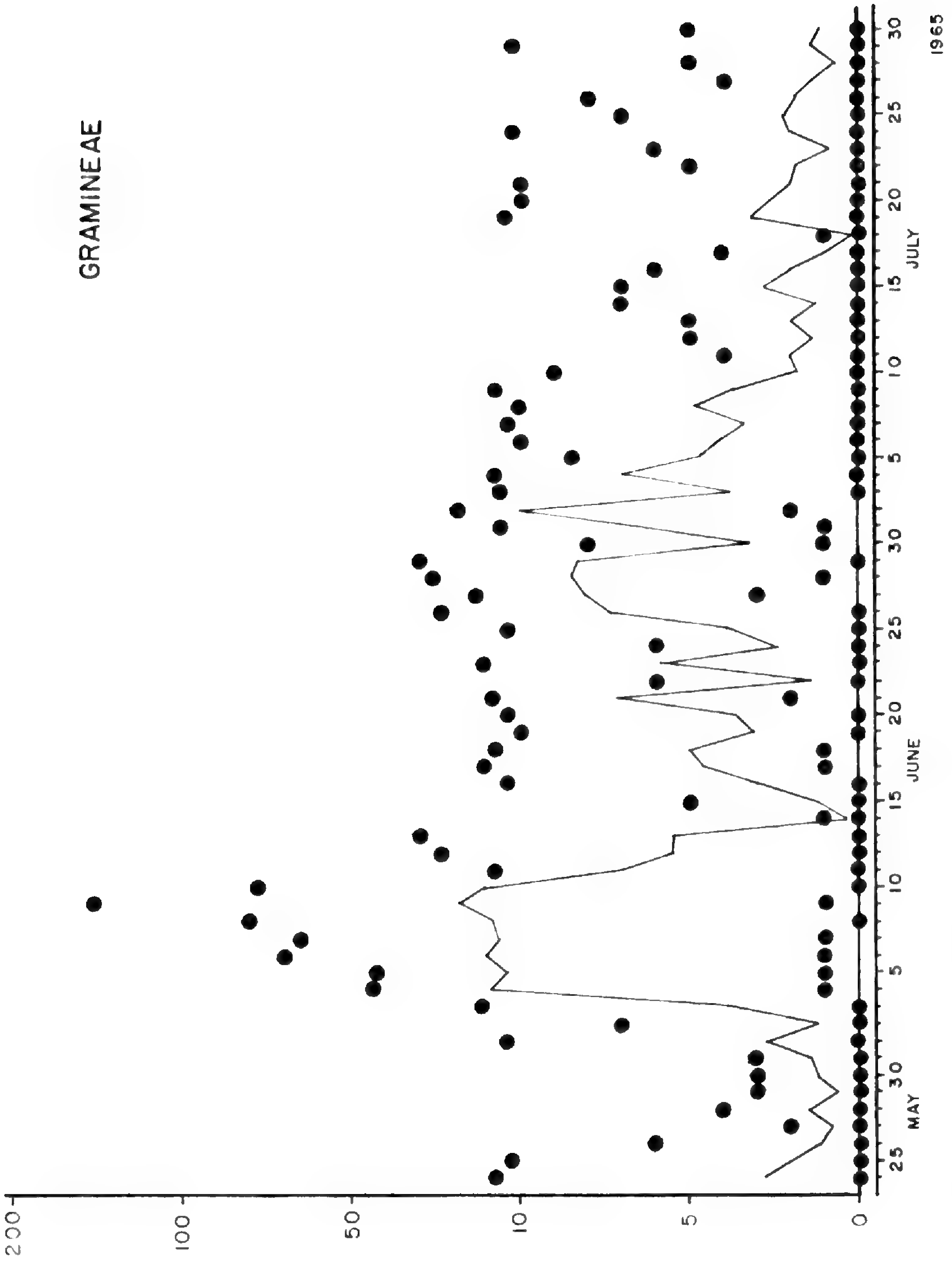
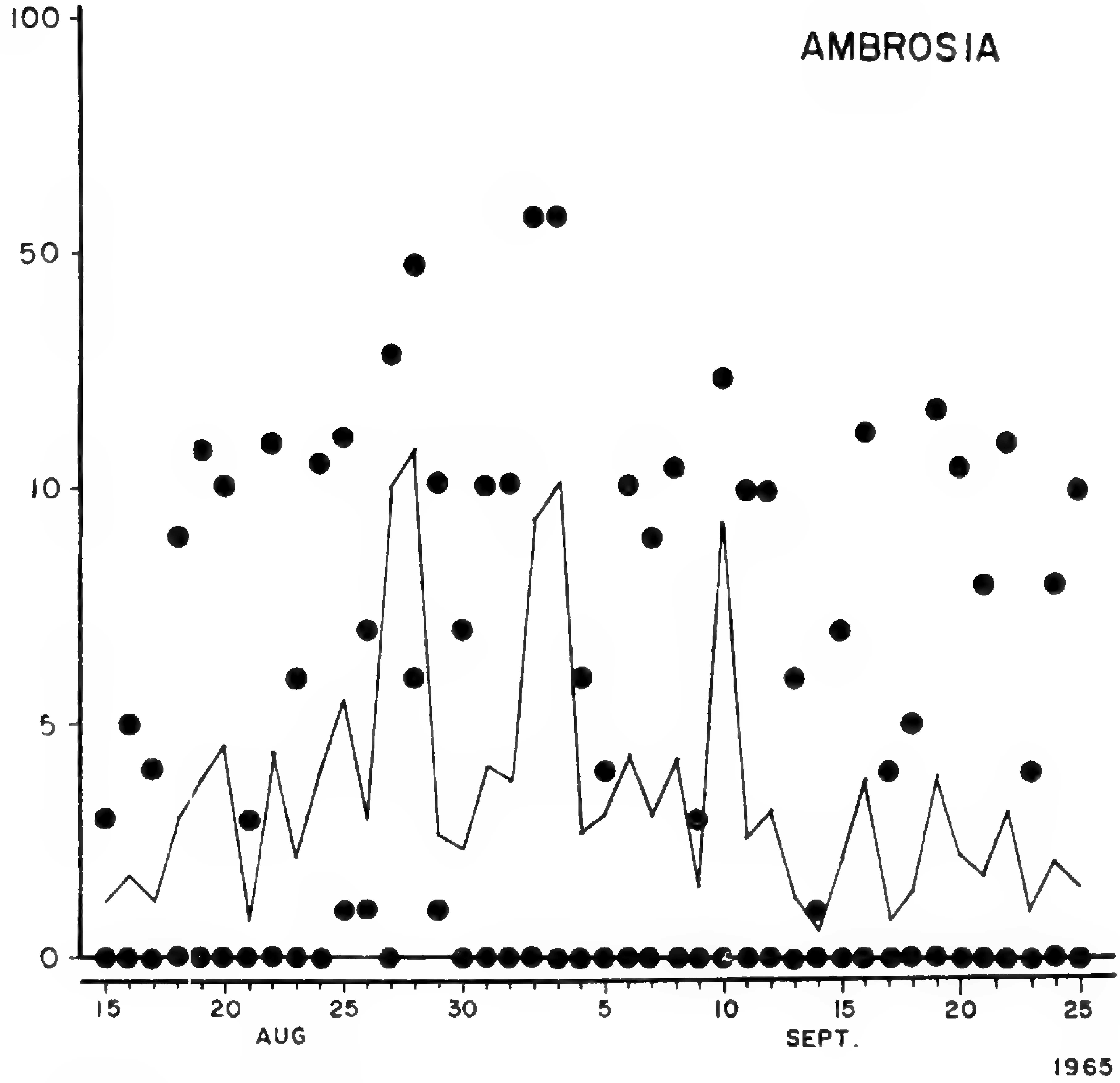


See legend, Plate XX

PLATE XXVI



See legend, Plate XX

BOTANICAL MUSEUM LEAFLETS
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NOTES ON THE SPECIES OF TREE DATURAS

BY

MELVIN L. BRISTOL*

THE great variability of the arborescent Daturas, *Datura* sect. *Brugmansia* Pers., has led to the proposal of about two dozen specific names. In 1895, Lagerheim (9) ably monographed seven Ecuadorean Brugmansias, four of which he proposed as new. Safford's synopsis of the genus in 1921 (11) treated 14 arborescent species, including three new concepts and two new names for older ones. Danert's recent discussion (5) of sectional characters in *Datura* and the possible conspecificity of several arborescent species includes a key to six cultivated tree Daturas. DeWolf (6) has followed Safford in reviewing five species among the North American cultivated tree Daturas. The newest concept, established in 1959, is *D. vulcanicola* A. S. Barclay (2).

It is the aim of the present notes to suggest that excessive attention has been devoted to characters of infraspecific variability in the recognition of the 15 species currently accepted in *Datura* sect. *Brugmansia*. A key to the principal species is given, together with the more important synonyms of each. For a complete list of specific

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names published before 1921, but not treated by Safford at that time, see Sachet (10) and Fosberg (7). Collections of several species are very limited or absent in a number of our larger herbaria (A, COL, GH, NY, US).

Of the numerous collections of conspicuous and highly attractive tree Daturas in these herbaria, nearly all are referable to three taxa: *D. candida* (Pers.) Saff., *D. suaveolens* H. & B. ex Willd. and *D. sanguinea* R. & P. DeWolf (6) and the herbarium determinations of A. S. Barclay in 1959 are in agreement here. Each of the remaining collections most frequently displays a unique combination of characters, and several such collections have been selected for the typification of new species. In 1955, Schultes (12) described as *Methysticodendron Amesianum* what I believe to be a greatly modified tree Datura from the Valley of Sibundoy in southern Colombia.

It is interesting to note that, in 1891, Wettstein's summary (15) of the Solanaceae for Engler and Prantl's *Die Natürlichen Pflanzenfamilien* cited only three arborescent Daturas, although several more had been described by that time. He cited *D. sanguinea*, *D. suaveolens* and *D. arborea*, the last very probably referring to plants identified here as *D. candida*, and thus he anticipated by more than half a century the growing realization (3, 5, 6) that the principal species of tree Daturas are few in number.

The very extensive work of Blakeslee and his associates (1) with the herbaceous Daturas demonstrated a great range of variability and the spontaneous appearance of many unusual characteristics. Of the 541 gene mutations encountered, 72 appeared following heating, wounding and ageing, or spontaneously in nature. Recessive genes controlling leaf shape, flower size, shape and color, and fruit form are among those uncovered. It is entirely possible that many of these single recessive genes affecting taxonomically significant characters are present also in the tree Daturas. In Colombia, I have observed unusual tree Daturas which resemble the striking effects produced in herbaceous species by the single recessive genes "equisetum", "tricarpel" and "quercina" (*Bristol 1112, 1162, 566;* GH).

Many writers have noticed the frequency with which the tree Daturas are associated with human habitations, but the extent of this association and its implications have not been fully understood. I have seen no indication in herbaria nor during 13 months of field work in southern Colombia and northern Ecuador that any tree Datura was not associated with human activity; and Schultes (pers. comm.), in his many years of familiarity with northwestern South America, has never seen a tree Datura that he could say was truly wild. The northern Andes, however, is the centre of variability and probable area of origin of this group. In the same region, there is a conspicuous absence of seedling tree Daturas, although Schultes once observed abundant seedlings of *D. vulcanicola.* The reason for the usual failure of seeds to regenerate colonies is obscure, but it may relate to the normal indehiscence of fruits; if given normal care in a greenhouse, seeds of *D. candida* and *D. sanguinea* produce healthy seedlings. Throughout the northern Andes, it is customary for man to propagate tree Daturas by large cuttings. As no other mode of reproduction appears to be operative, and since they are nowhere encountered as an element of natural vegetation, it appears that the tree Daturas have achieved their present, highly ornamental form under domestication and thus should be considered as cultigens.

If we reflect upon this occurrence of highly attractive, medicinally and narcotically useful plants possessing great variability in a practically exclusive association with man, it seems entirely likely that much of the observable variation in the group has resulted from man's preferential maintenance of conspicuously different forms. The size of the flowers, among the largest of all flowering plants, facilitates, both for the native and for the botanist, the detection of differences that often go unnoticed in flowers of smaller size. Because of the paucity of seedlings, implying ineffective sexual reproduction, we cannot yet confidently infer whether the numerous cultivars have arisen primarily through hybridization and gene recombination or through the appearance of mutations as bud sports or chimeras. In any case, most of our attempts to delimit species amidst these circumstances have been unwarranted.

The characters used by Safford (11) to distinguish species are not always unique to the entities that he attempts to separate. For example, in studying a large population of *D. candida* in the Valley of Sibundoy in Andean southern Colombia, I noted the presence of both spathe-like and several-pointed calyces (as in *D. sauveolens*), of rounded, as well as emarginate, corolla margins (as in *D. arborea* and *D. cornigera*) and of corollas varying from under 20 to over 32 cms. in length. Seeds of four of the five species illustrated by Lagerheim (9), though apparently distinctive, can be seen in a single fruit of *D. candida*.

It is hoped that controlled hybridization experiments and more intensive observation of natural populations will eventually contribute to a better understanding of the great variability in the tree Daturas.

Key to principal species of *Datura* sect. *Brugmansia* Pers. (cf. Plate XXVII).

A. Leaves angular to repand, apex acute to obtuse; flowers mostly red (rarely yellow), 17–25 cm., their corolla teeth not exceeding 2 cm.; anthers 1.2–1.8 cm.; fruit ovoid to oblong-elliptic; seeds rounded, verruculose. . . . . *D. sanguinea*

AA. Leaves entire (rarely coarsely dentate), apex acute to acuminate; flowers white (rarely yellow or slightly reddish), 17–45 cm., their corolla teeth much exceeding 2 cm.; anthers 2.5–4 cm.; fruit elongate; seeds angular or irregularly ridged.

B. Calyx 1.5–3 cm. broad, usually 1–3-toothed; flowers rarely exceeding 30 cm., the slender basal part of the corolla tube not visible or reaching only the calyx tip; corolla teeth 4–9 cm.; anthers distinct; fruit oblong-cylindric to fusiform; seeds with a greatly thickened suberose testa. . . *D. candida*

BB. Calyx 2–4 cm. broad, usually 3–5-toothed; flowers often exceeding 30 cm., the slender basal part of the corolla tube conspicuously exceeding the calyx, corolla teeth 2–5 cm.; anthers connivent; fruit fusiform (rare); seeds lacking a thick suberose testa. . . . . *D. suaveolens*

1. **Datura sanguinea** *Ruíz & Pavón* Fl. Peruv. 2: 15. 1799.

Brugmansia bicolor Persoon Syn. Pl. 1: 216. 1805; Lindley Bot. Reg. 20: pl. 1739. 1834.

B. sanguinea D. Don in Sweet Brit. Fl. Gard. II. 3: pl. 272. 1835; Lagerheim Bot. Jahrb. Engl. 20: 662. 1895.

Small trees, 2–5 meters in height; leaves soft-pubescent, the lower repand to angular, the upper usually entire; flowers 17–25 cm. long, the corolla with a short-toothed, recurved to strongly reflexed (rarely erect) limb, the tube typically green within the calyx, yellow at the middle, and red or orange-red (rarely yellow-orange or bronze) toward the limb, the ribs yellow; anthers 1.2–1.8 cm., beneath an obtuse stigma; fruit ovoid (rarely oblong-elliptic), calyx persistent or caducous, the base rounded to acute (rarely acuminate) and mucronate, in cross-section usually bilaterally flattened, or 4–5-sided to nearly round with 2 or 4 longitudinal sulci; seeds verruculose and lacking a greatly thickened testa. n=12 (*Bristol 1114;* GH).

These are a common sight about towns and habitations in many areas of highland Colombia and Ecuador, but they are not seen at middle and lower elevations.

SPECIMENS EXAMINED:

UNITED STATES: *Walther 542.* COLOMBIA: *Bristol 419, 653, 715, 1114, 1345, 1354, 1419, 1420, 1446; Chindoy 198; Cuatrecasas 13644; Fosberg 20562; Foster & Foster 1945; García-B. 7847; Holton 548; Idrobo 2223, 2239; Overton 0-56-106; Schultes 6591A, 7078, 7103; Schultes & Villarreal 7522g, 7538, 7556, 7689, 7893A, 8031, 8040, 8041; Soejarto 204.* ECUADOR: *Bristol 1374, 1375, 1377, 1378, 1379, 1380, 1383; Hitchcock 20939; Rimbach 1, 7, 63; Rose & Rose 22344.* PERU: *Hartweg 815; Kanehira 224; Metcalf 30493; West 3692.* BOLIVIA: *Bang 1942; Brooke 6177.*

There are several color-forms (9), of which one has already received formal recognition.

A. Exposed part of corolla entirely yellow . . . . 'Flava'

AA. Exposed part of corolla entirely red, or green at the middle and red toward the limb . . . . 'Sangre'

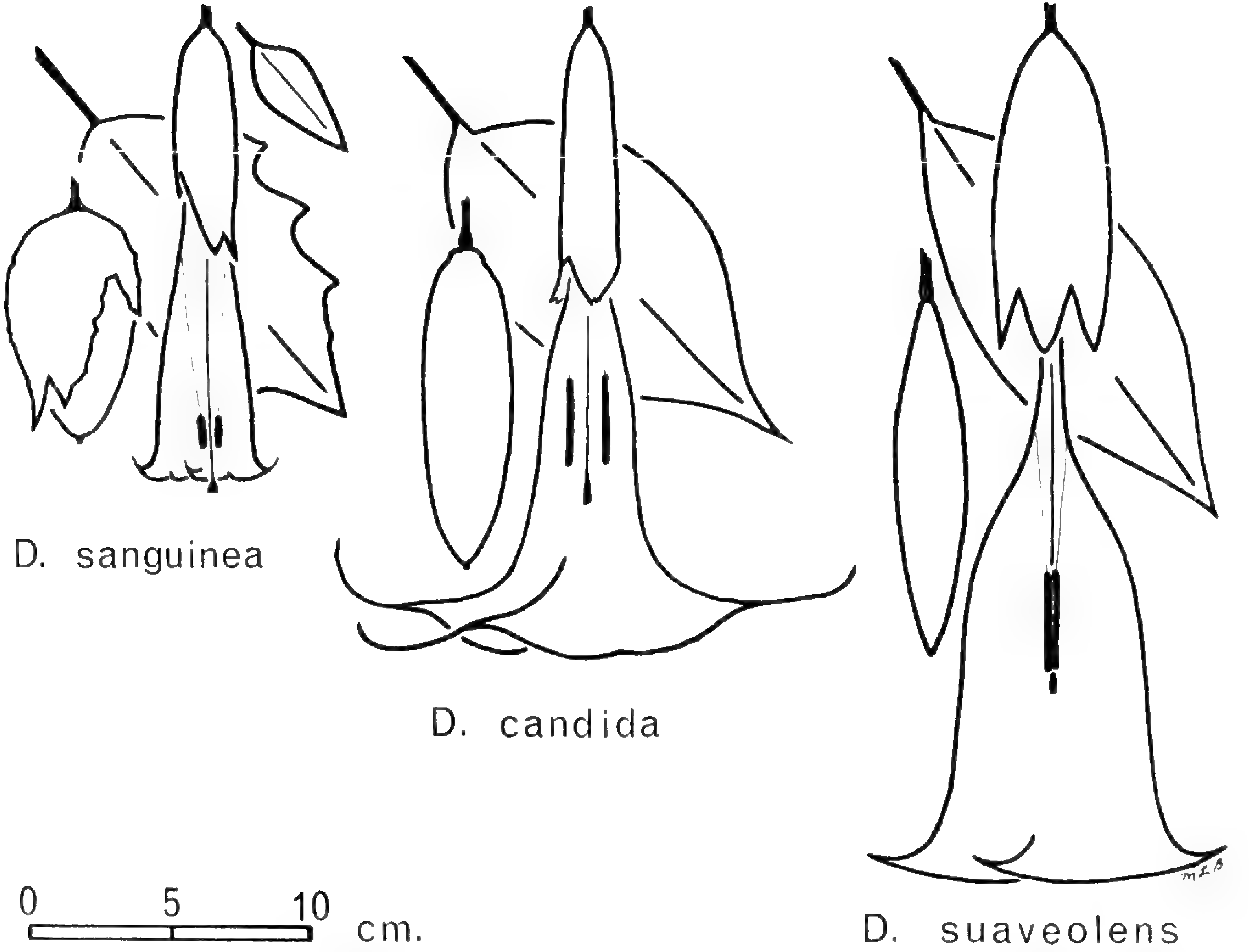
1a. cv. Flava.

Datura sanguinea β flava Dunal in DC. Prod. 13: 545. 1852.

D. Rosei Safford Journ. Wash. Acad. Sci. 11: 188. 1921.

D. sanguinea 'Flava', with brilliant yellow flowers, is cultivated in the highlands of central Ecuador and southern Colombia. Safford's species differs from *D. sanguinea* only in its angular, densely tomentose upper leaves and in its orange or saffron-yellow corolla, the color placing

Plate XXVII



Datura sanguinea : *Bristol 1373* (GH), Ecuador, Carchi, alt. 2900 m. D. candida : *Bristol 1255* (GH) flower and leaf, *Bristol 1098* (GH) fruit; Colombia, Putumayo, alt. 2200 m. D. suaveolens : *Heller 4486* (GH) flower and leaf, Puerto Rico, near sea level; fruit *fide* Safford (11), Brazil, Minas Gerais.

it with cv. Flava. The calyx of *D. Rosei* does not terminate in a single horn-like point as once emphasized (6).

SPECIMENS EXAMINED:

COLOMBIA: *Bristol 1800.* ECUADOR: *Rose, Pachano & Rose 22965* (TYPE *D. Rosei;* US).

1b. cv. Sangre, n. cv.

D. sanguinea 'Sangre', with a deep red corolla entirely devoid of yellow, is cultivated at several places in the highlands of southern Colombia and northern Ecuador.

SPECIMENS EXAMINED:

COLOMBIA: *Bristol 652, 1307, 1309.* ECUADOR: *Bristol 1372, 1373, 1381, 1382, 1795.*

2. **Datura candida** (*Pers.*) *Safford* Journ. Wash. Acad. Sci. 11: 182. 1921.

Brugmansia candida Persoon Syn. Pl. 1: 216. 1805.

Datura arborea Ruíz & Pavón Fl. Peruv. 2: 15. pl. 128. 1799; non *D. arborea* L.

D. aurea Lagerheim Gartenfl. 42: 33. 1893; Safford *ibid.* 186. 1921.

B. aurea Lagerheim Bot. Jahrb. Engl. 20: 664. 1895.

B. arborea Lagerheim *ibid.* 663. 1895.

D. affinis Safford *ibid.* 186. 1921.

D. Pittieri Safford *ibid.* 187. 1921.

This variable species is the most common of the white flowered tree Daturas in Andean South America. A small tree, 3–5 meters in height; leaves glabrous or minutely pubescent, ovate or oblong-elliptic, entire or coarsely dentate; calyx 1.5–3 cm. broad, 1–4-toothed; the slender basal part of the white corolla wholly enclosed by the calyx, the limb flaring broadly with long (4–9 cm.) recurved teeth; anthers distinct; fruit oblong-cylindric to fusiform and lacking a persistent calyx; seeds

PLATE XXVIII

Datura candida (Pers.) Saff. (*D. aurea* Lagerh.). Near Zipaquirá, Colombia. *Photograph by* R. E. SCHULTES angular, with a greatly thickened, suberose testa. n=12 (*Bristol 1193, 1255;* GH).

Both the calyx and corolla are variable in length, but the corolla rarely measures less than 20 cm. or more than 30 cm. long. Fruiting is very infrequent, and this supports the contentions of Joshi (8) and Barclay (3) that the tree Daturas, the populations of which often consist of a single clone, are self incompatible. Despite the illustration by Ruíz and Pavón (reproduced by DeWolf, 6) upon which Persoon based his description, a persistent calyx is rarely seen either in the field or in the herbarium.

D. candida has been spread through much of Latin America and elsewhere from the northern Andes, where it thrives in the warm days and cool nights between 1500 and 2500 meters elevation.

D. affinis Saff. is based on the description of *Brugmansia arborea* (L.) Lagerh. of which *D. arborea* L. is the basionym. Lagerheim noted its good agreement with Pavón's specimens labelled "D. arborea Fl. Per." (Ruíz and Pavón's *D. arborea* L.), *e.g.*, *D. candida* (Pers.) Saff. In proposing *D. affinis*, Safford relied upon the glabrous peduncle and the 2-5-toothed calyx to separate the concept from *D. candida*. The white corolla is short, as in *D. aurea*, and Safford observed that *D. affinis* is "very closely allied" to this species.

D. aurea Lagerh. differs from *D. candida* only in its longer calyx and shorter corolla which remains yellow after emerging. As with *D. affinis*, the fruit and seeds are those of *D. candida*.

D. Pittieri Saff. is easily referable to *D. candida* in spite of the short corolla and anthers which chiefly distinguish it.

SPECIMENS EXAMINED:

MEXICO: *Botteri 1090; Greenman 131; Muller 265; Pringle 6321, 13126; Rose 3243; Seaton 94; Seler 56; Schultes & Reko 455.* GUATE-

Plate XXIX

(Left) *Datura sanguinea* R. & P. Above Zipaquirá, Colombia. *Photograph by* R. E. Schultes

(Right) *Datura sanguinea* R. & P. Below Páramo de Chisacá, Cundinamarca, Colombia. *Photograph by* D. Soejarto mala: *King 3295; Skutch 1754; J.D.Smith 1878; von Turckheim 2246.* El Salvador: *Calderón 1819; Fassett 28307; Standley 19332.* Costa Rica: *Heiser 3583.* Cuba: *van Hermann 407, 2647.* Hispaniola: *Augusto 413.* Bahamas: *Curtiss 194.* Bermuda: *Collins 441.* Colombia: *André 2093; Bristol 345, 458, 564, 566, 567, 751, 775, 887, 889, 890, 999, 1080, 1098, 1109, 1110, 1111, 1117, 1121, 1122, 1162, 1189, 1192, 1193, 1194, 1213, 1246, 1255, 1264, 1266, 1267, 1268, 1297, 1299, 1304, 1305, 1311, 1333, 1346, 1347, 1348, 1356, 1388, 1431, 1432, 1433, 1434, 1435, 1438, 1439, 1447, 1448; Chindoy 190; Cuatrecasas 11463, 13636, 19429; Cuatrecasas, Schultes & E. Smith 12599; Fosberg 20568; García-B. 4640; Holton 546, 547; Killip 8265; Killip & Hazen 9563; Killip & Smith 15408, 16678, 18315; Lawrance 120; Pennell & Killip 8066; Pittier 1305* (Type: *D. Pittieri;* US): *Schultes 3207, 7083; Schultes & Villarreal 5212, 7638, 7809, 7917; H. H. Smith 1157; Soejarto 278; Toro 24, 649, 750.* Peru: *Macbride 4061; Wurdack 1785.* Bolivia: *Steinbach 8433.* Argentina: *Venturi 8495.* Venezuela: *Aristeguieta 2416.* Congo: *Tejeune 315.* Hawaii: *Degener 7366, 7367.*

3. **Datura suaveolens** *Humboldt & Bonpland ex Willdenow* Enum. Hort. Berol. 227. 1809.

D. suaveolens β macrocalyx Sendtner in Martius Fl. Bras. 10: 161. 1846.

D. Gardneri Hooker Curt. Bot. Mag. sub pl. 4252. 1846.

A small tree, 2–5 meters in height; leaves glabrous or minutely pubescent, ovate to narrowly elliptic and entire; calyx broad (2–4 cm.), 3–5-toothed; the slender basal part of the white corolla usually exceeding the calyx, the broader distal part of the limb not abruptly flaring or recurved, the teeth 2–5 cm. long; anthers connivent; fruit fusiform (rarely seen); seeds irregularly angular, lacking the greatly thickened suberose testa of the previous species.

D. suaveolens is confined largely to tropical and subtropical climates; in the northern Andes, it is not grown above 1200 meters elevation. This species has been much more widely introduced than either *D. sanguinea* or *D. candida.*

Danert's suggestion (5) that *D. suaveolens* and *D. candida* may be conspecific deserves further consideration and, especially, experimentation. However, the association in *D. suaveolens* of several characters rarely seen in *D. candida* and the relatively very few intermediate specimens known, imply, at least for the present, that both concepts are of species status.

SPECIMENS EXAMINED:

United States: *Small, DeWinkeler & Mosier 11158.* Nicaragua: *Grant 1121.* Costa Rica: *Allen 709.* Panama: *Hayes 101.* Cuba: *Clemente 2502; Hamilton 68; van Hermann 406, 622, 841; Howard 6552; Jack 4792, 7452, 8679; Salvoza 648; Shafer 7751; Wright 1641.* Jamaica: *Britton 175, 3544; Harris 9599; Proctor 20815.* Hispaniola: *Ekman 7212; Holdridge 1045; Leonard 3885, 7567, 9232a; Leonard & Leonard 14512; Nash 754; Valeur 361.* Puerto Rico: *Britton & Britton 7318, 10126; Britton, Cowell & Brown 4536; Britton, Steves & Hess 2408; Garber 66; Heller 4486; Johnston 929; Otero 426; Urban 337, 4258.* Guadeloupe: *Duss 2598.* Dominica: *Eggers 622.* Martinique: *Duss 1924.* St. Vincents: *H.H. & G.W. Smith 983.* Colombia: *Schultes 6535.* Ecuador: *Fuller 110; von Hagen 103; Schultes 3472.* Peru: *Killip & Smith 26355; Klug 3477.* Bolivia: *Williams 593.* Paraguay: *Hassler 4371, 12413; Jorgensen 7371.* Venezuela: *Allart 330; Aristeguieta 1594; Fendler 1014; Pittier 10422.* Brazil: *Dusen 10209; Gardner 560; Martius 106; Mexia 4412, 5341; L. B. Smith, Reitz & Klein 7242; White 1098.* Gold Coast: *Vigne 1090.* Tanganyika: *Goodwin 31.* India: *Biskam 2292; Erlanson 5497; Kingdon-Ward 17900; Koelz 1745, 4547; U. Singh 149.* Burma: *Dickason 9156.* China: *Chun 40029; Metcalf 7647; Taam 1903.* New Hebrides: *Kajewski 175.* New Caledonia: *Franc 2349; Guillaumin 8515.* Fiji: *A.C. Smith 4499.*

DOUBTFUL SPECIES AND HYBRIDS

D. vulcanicola A.S. Barclay in Bot. Mus. Leafl. Harvard Univ. 18: 260 (1959), closely related to *D. sanguinea* R. & P., is distinguished by its cernuous flowers with light red throat, yellow mouth and red nerves, and by its warty, almost woody, fruit with smooth seeds. n = 12. Schultes (pers. comm.) observed abundant seedlings of this at the type locality; possibly the population can be regarded as an incipient species still confined to a single locality in southern Colombia.

COLOMBIA: *Barclay & Schultes 147* (TYPE), *149*, *177*; *Pennell 7093*; *Pérez-Arbeláez & Cuatrecasas 5960*; *von Sneidern 1898*.

D. dolichocarpa (Lagerh.) Safford in Journ. Wash. Acad. Sci. 11: 186 (1921), based upon two collections by Sodiro from Ecuador, is distinguished chiefly by its very long (31 cm.), terete fruit. It resembles *D. suaveolens* in the very long corolla, stamens and pistil, but the short calyx, long corolla teeth and free anthers relate it to *D. candida*. *Bristol 1387* (GH), from one of Sodiro's two collecting localities (Santo Domingo de los Colorados), has a fruit intermediate in size (16.5 cm.) and shape between this species and *D. candida*, but an extremely long corolla (44.3 cm.) and calyx (23 cm.) much exceeding those of *D. dolichocarpa* which are, respectively, 35 cm. and 13 cm. The calyces of this collection have conspicuous horn-like apices, as in *D. cornigera* Hooker.

D. longifolia (Lagerh.) Safford *ibid.* 186 (1921) is closely allied to *D. dolichocarpa*, but the single Ecuadorean collection by Sodiro is described as having very long, linear-oblong and sinuate-repand leaves, thus approaching those of *Methysticodendron Amesianum* R.E. Schultes, a striking clone discussed below. The style is also unusually long.

D. versicolor (Lagerh.) Safford *ibid.* 183 (1921) also closely resembles *D. dolichocarpa* but has a pointed calyx, ultimately reddish corolla, shorter stamens and pistil, a very long aristate fruit, and thicker, verrucose seeds.

Four of the tree Datura concepts are best interpreted as hybrids, three of them between *D. candida* and *D. sanguinea*.

D. arborea Linnaeus Sp. Pl. 1: 179 (1753), the first to be described, is rarely seen. While its affinity is with

D. candida, the shorter corolla and corolla teeth, and especially the ovoid fruit, are indicative of hybridization involving *D. sanguinea.* Danert (5) has not questioned the validity of *D. arborea* and has suggested that *D. candida*, *D. affinis*, and even *D. suaveolens* may be synonymous with the Linnaean species.

D. cornigera Hooker in Curt. Bot. Mag. pl. 4252 (1846); Lagerheim in Bot. Jahrb. Engl. 20: 663 (1895) is also similar to *D. candida*, but it differs in the very short corolla, in the more emarginate corolla lobes, in the capitate stigma, and especially in the calyx which tapers to a long subulate point. Though such a calyx is very rarely seen in the tree Daturas, several collections show intermediates between it and that of *D. candida* (*Bristol 738, 1213, 1387;* GH). The ovoid fruit, recorded by Lagerheim (*loc. cit.*), the size and form of the corolla, and the capitate stigma are all characters associated with *D. sanguinea.*

D. rubella Safford *ibid.* 185 (1921), with acuminately tipped leaves and a spathe-like, caudate-acuminate calyx again suggests hybridization between *D. candida* and *D. sanguinea*, though the red corolla (13–14 cm.) and the pistil and stamens are much shorter even than in *D. sanguinea.*

SPECIMEN EXAMINED:

ECUADOR: *Rose, Pachano & Rose 22828* (TYPE; US).

D. mollis Safford *ibid.* 183 (1921) resembles *D. candida* but for the much longer calyx, stamens and pistil and its light pink corolla.

SPECIMEN EXAMINED:

ECUADOR: *Rose & Rose 23418* (TYPE; US).

A uniquely attractive hybrid in highland central Peru (*Ochoa 601;* NY) has a very small (13 cm.) white flower combining the characters of *D. candida* and *D. sanguinea.* Another (*Augusto 413;* NY), from Hispaniola, appears intermediate between *D. candida* and *D. suaveolens*, but it has yellow flowers. Both hybrids have the unusual horn-like calyx appendage of *D. cornigera.*

Methysticodendron Amesianum R.E. Schultes in Bot. Mus. Leafl. Harvard Univ. 17: 2 (1955) undoubtedly belongs with the white-flowered species of tree Daturas. It differs from *D. candida* and *D. suaveolens* in its narrow linear-ligulate leaves with undulate margins, in the distally inflated calyx, the deeply divided, or adesmic, corolla having long spatulate lobes; it is, furthermore, monstrously different in the distally contorted filaments, in the variable number of incompletely coherent styles exceeded by the stamens, and in the often three-locular ovary with one or more variably developed appendages homologous with the styles. n = 12.

Barclay (3) determined the chromosome number as 2n = 24, and the haploid complement is now verified as n = 12 (*Bristol 477, 764, 888, 1112, 1400*) as in all tree Daturas which have been examined.

Intensive study of *M. Amesianum* at the type locality in southernmost Colombia suggests the existence of not more than thirty-five trees, all in cultivation (4). Most of these were found to bear flowers with both two- and three-celled ovaries, as in a local cultivar of *D. candida*[1] confirming the earlier observations of Theilkuhl (14). Despite constant observation during thirteen months, no fruit was seen. Schultes recalled his lost collections of fruit as "unarmed, smooth, indehiscent and fusiform, about six inches in length and in shape very like the fruit of *Datura suaveolens*" (12). The fruit size, shape and variable number of locules imply a relationship with a cultivar

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[1] An account of the unique Datura cultivars grown by the Sibundoy Indians is in preparation.

of *D. candida* which is also unique to the same locality.

Other observers of *M. Amesianum* have associated it with the tree Daturas. Theilkuhl (14) related it to the other diseased and curiously malformed Datura clones in the Valley of Sibundoy, while Barclay (3) suggested it could be, "the result of the action of a single pleiotropic gene mutation . . . . a monstrosity of some *Datura* species of subg. *Brugmansia* . . . ." Van Steenis (13) in discussing genotypic variability at the infraspecific level, cited *M. Amesianum* as, "a remarkable case of adesmy, a tendency which is recorded from various Solanaceae."

SPECIMENS EXAMINED:

COLOMBIA: *Bristol 477, 764, 888, 1112, 1391, 1400; Fernández 2641; Fosberg 20406; Idrobo 2221; Mora 1023; Olday 639; Schultes 3256; Schultes & Cabrera 20079* (TYPE; GH); *Villarreal 68.*

Abnormalities suggestive of *M. Amesianum* have appeared in several species of *Datura*. Barclay (3) noted the deeply divided, spatulate-lobed corollas occurring in *D. inoxia* Miller (*Davidson 1659;* GH) and in *D. ferox* L. (*Venturi 328;* A). The most extreme modification is the highly adesmic "equisetum" form of *D. Stramonium* L. (*Moldenke & Moldenke 11814;* NY). This single recessive gene (1) causes nearly filiform leaves and both the calyx and corolla are divided almost to the base, the corolla appearing merely as filiform segments. In addition to the five stamens, there are at least six staminodia. Another *D. Stramonium* mutant, "quercina", also has a divided corolla and modified leaves and fruits (1). A collection (*Romero-C. 5364;* COL) from the Pacific coast of southernmost Colombia is similar to *M. Amesianum* but differs in the long-lanceolate leaves (as in *D. longifolia*), in the extension of the calyx tip into five distinct, long (7.5 cm.) subulate apices, and in the short (14 cm.)

corolla which barely exceeds the calyx. Neither the gynoecium nor any fruit of this curiosity has been examined.

Extra perianth whorls occur in both the tree and the herbaceous Daturas. Specimens of *D. candida* with double corollas are known from Bermuda (*Collins 441;* NY), Mexico (*Schultes & Reko 455;* ECON, GH), Costa Rica (*Heiser 3583;* IND), Chile (*Cameron s.n.;* US), Argentina (*Venturi 8495;* A) and the Philippines (*Sulit s.n.;* GH). A double-corollate form from California (*Wight 1661;* US) represents apparently a hybrid between *D. candida* and *D. sanguinea.* In the double forms, the inner corolla may be either longer, shorter or equal in length to the outer. A form with a cluster of numerous spatulate staminodia is represented by Model 290 in the Ware Collection of Glass Flowers at the Harvard Botanical Museum.

In addition to these conspicuous anomalies and to those described in the "species" discussed above, there are many collections representing additional variability in the tree Daturas. Among the variations are very long, ochraceous flowers (*Bristol 1297;* GH), S-curved styles (*Bristol 1314;* GH) and variously erose leaves (*García-B. 4640*, US; *Idrobo 2224*, COL; *Bristol 1268*, ECON) in *D. candida*, and pink flowers (*Bristol 1445;* GH) in *D. sanguinea.* Several trees at Santo Domingo de los Colorados, Ecuador, have brick red, as well as white, flowers which reach or exceed one-half meter in length (*Bristol 1734, 1736;* ECON).

As our knowledge of the tree Daturas increases, it is certain that more novel, perhaps striking and highly attractive cultivars will be found. We can hope that many more of the tree Datura cultivars will become established outside of the northern Andes, for the abundance of their huge, colorful and fragrant flowers deserves a much wider appreciation. The origin of the group and the circumstances favorable to the development of its great diversity in exclusive association with man pose intriguing, and as yet unanswerable, questions to students of plant domestication and evolution, genetics, ethnobotany and archaeology.

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STUDIES IN AMERICAN ORCHIDS VI

BY

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DURING the summer of 1964, I visited Europe and studied the orchid material of the Lindley Herbarium at Kew Gardens, England, and of the Reichenbach Herbarium at the Natural History Museum, Vienna, Austria. The taxonomic decisions presented in this paper are the result of the research carried out at these places. To my colleagues Dr. Victor S. Summerhayes, Kew Gardens, and Dr. Karl Rechinger, Natural History Museum, I wish to express my sincere thanks for their kind cooperation during my visit. This study and the travel to Europe was made possible by a Grant-in-Aid for Research, GB 1858, issued by the National Science Foundation which is likewise gratefully acknowledged.

Sobralia D'Orbignyana *Reichb.f.* in Xenia Orch. 2: 179, 1873.

Sobralia semperflorens Krzl. in Viert. Nat. Gesellsch. Zurich 6: 428, 1915.

Chloraea sobraloides Krzl. in Notizbl. Bot. Mus. Berlin 7: 447, 1921.

Sobralia Kalbreyeri Schltr. in Notizbl. Bot. Mus. Berlin 7: 531, 1921.

Sobralia parviflora L.O.Wms. in Lilloa 3: 475, 1938.

Both *Sobralia semperflorens* and *Sobralia parviflora* are based on *Bang 2290* from Bolivia. When Williams described his *S. parviflora*, he also cited specimens from Colombia. These Colombian specimens apparently represent Kraenzlin's concept of *S. Kalbreyeri*. My examination of these materials confirms my belief in their identity with *S. D'Orbignyana*, of which I have also studied the type in the Vienna Herbarium.

Spiranthes coccinea *Garay nom. nov.*

Basionym: *Stenorhynchus cernuus* Lindl. in Ann. Mag. Nat. Hist. 15: 386, 1845, not *Spiranthes cernua* (L.) L.C.Rich.

This striking and locally uncommon species is known from Colombia and Ecuador. It is closely related to the Peruvian *Spiranthes corymbosa* Krzl.

Erythrodes serripetala *Garay sp. nov.*

Terrestre, usque ad 40 cm. alta; rhizomate prorepenti; foliis tenuibus, anguste ovatis, acutis, basi in vaginam transeuntibus, vaginis inclusis usque ad 8 cm. longis, 1.7 cm. latis; inflorescentia erecta, paululo arcuata, laxiflora, usque ad 30 cm. longa; bracteis lineari-lanceolatis, acuminatis, 1.5–2 cm. longis; floribus inversis; sepalo postico ovato, obtuso, uninervo, 5 mm. longo, 2 mm. lato; sepalis lateralibus paululo obliquis, ovatis, obtusis, uninervis, 6 mm. longis, 2 mm. latis; petalis anguste oblanceolatis, acutis, margine exteriore serrulatis, uninervis, 5 mm. longis, 1 mm. latis; labello bipartito, partitione basilari cymbiformi, partitione antica elliptico-subrotunda, acuta; toto labello 4 mm. longo, 1.5 mm. lato; calcare clavato-cylindrico, 5 mm. longo.

Without proper locality and collector. TYPE in Herbarium of the Natural History Museum, Vienna (*Reichenbach 37739*) (W).

This new species, probably of Andean origin, is easily distinguished from other members of the genus by its serrate petals.

Platystele microtantha (*Schltr.*) *Garay comb. nov.*

Basionym: *Pleurothallis mirotantha* Schltr. in Fedde Rep. 3: 276, 1907.

Synonym: *Pleurothallis perparva* Standl. & L.O.Wms. in Ceiba 3: 193, 1953.

This miniature species until now has been known only from Costa Rica. A collection by *F.C. Lehman s.n.*, from the vicinity of Buenaventura in Colombia, extends its range to the mainland of South America.

Platystele misera (*Lindl.*) *Garay comb. nov.*

Basionym: *Pleurothallis misera* Lindl., Folia Orch. Pleurothallis 36, 1859.

Synonym: *Humboldtia misera* O.Ktze., Rev. Gen. Pl. pt. 2: 668, 1891.

This species, formerly known only from Peru, is now represented in the Orchid Herbarium of Oakes Ames by several collections from Colombia.

Scaphosepalum carpophorum (*Krzl.*) *Garay comb. nov.*

Basionym: *Masdevallia carpophora* Krzl. in Fedde Rep. 17: 427, 1921.

Synonym: *Scaphosepalum Endresianum* Krzl. in Fedde Rep. 17: 435, 1921.

An examination of the types of both, *Masdevallia carpophora* and *Scaphosepalum Endresianum* indicates that they are conspecific. Both types were collected by Endres in Costa Rica.

Porroglossum amethystinum (*Rchb.f.*) *Garay comb. nov.*

Basionym: *Masdevallia amethystina* Rchb.f. in Otia Bot. Hamb. 1: 14, 1878.

Synonym: *Porroglossum colombianum* Schltr. in Fedde Rep. Beih. 7: 83, 1920.

Scaphosepalum amethystinum Schltr. in Fedde Rep. Beih. 8: 119, 1921.

This rare Ecuadorian species has been collected only twice since the original collection was made by Jameson in 1857. *Porroglossum colombianum*, as illustrated by Schlechter, is identical with *P. amethystinum*, of which I have studied the type.

Porroglossum Xipheres (*Rchb.f.*) *Garay comb. nov.*
Basionym: *Masdevallia Xipheres* Rchb. f. in Linnaea 41: 12, 1876.
Synonym: *Scaphosepalum Xipheres* Schltr. in Fedde Rep. Beih. 7: 220, 1920.

When Reichenbach described *Masdevallia Xipheres*, he assigned it to the section "Echidna". This section now comprises the genus *Porroglossum*. *Porroglossum Xipheres* is very similar to *P. amethystinum* in general appearance, but its hirsute peduncle and *Restrepia*-like petals easily differentiate the two species from one another.

Pleurothallis hypnicola *Lindl.* in Bot. Reg. 28: Misc. p. 75, 1842.

Lepanthes Wawreana Barb. Rodr., Gen. et Sp. Orch. Nov. 2: 46, 1882.

Humboldtia hypnicola O. Ktze., Rev. Gen. Pl. pt. 2: 667, 1891.

Pleurothallis cuneifolia Cogn. in Mart. Fl. Bras. 3, pt. 4: 441, 1906.

An examination of the type of *Pleurothallis hypnicola* in the Lindley Herbarium indicates that *P. cuneifolia* is merely a form with luxuriant growth of that species.

Pleurothallis parva *Rolfe* in Kew Bull. 33, 1895.
Pleurothallis sonderanoides Hoehne in Arch. Inst. Biol. S. Paulo 2: 30, 1929.

I have studied the type of *Pleurothallis parva* in the Kew Herbarium and have found it to represent the well-known ***P.** sonderanoides.*

Restrepia nittiorhyncha (*Lindl.*) *Garay comb. nov.*

Basionym: *Pleurothallis nittiorhyncha* Lindl. Folia. Orch. Pleuroth. 20, 1859.

Synonym: *Restrepia Schlimii* Rchb. f. in Linnaea 41: 45, 1876.

Examination of the type specimens of both *Pleurothallis nittiorhyncha* and *Restrepia Schlimii* fail to reveal any differences between them either in vegetative appearance or in general floral morphology. Most probably both types came from the same collection, since they were collected by Schlim at Ocaña.

Octomeria chloidophylla (*Rchb.f.*) *Garay comb. nov.*

Basionym: *Pleurothallis chloidophylla* Rchb. f. in Linnaea 22: 830, 1849.

Synonym: *Humboldtia chloidophylla* O. Ktze. Rev. Gen. Pl. pt. 2: 667, 1891.
Octomeria Dusenii Schltr. in Notizbl. Bot. Gart. Berlin 7: 324, 1919.

An examination of the type of *Pleurothallis chloidophylla* revealed eight pollinia in the anther. *Octomeria Dusenii*, of which I have seen ample material, is conspecific with *O. chloidophylla.*

Octomeria sagittata (*Rchb.f.*) *Garay comb. nov.*

Basionym: *Pleurothallis sagittata* Rchb. f. in Wawra, Bot. Reise Maxim. Bras. 150, 1866.

Synonym: *Octomeria Juergensii* Schltr. in Fedde Rep. Beih. 35: 64, 1925.

It is unfortunate that Reichenbach chose a rather badly shrivelled flower upon which to describe and illustrate this species. On examination of the type of *Pleurothallis sagittata*, I found eight pollinia, a character ascribed to the genus *Octomeria*. Moreover, the lip is not sagittate, as shown on the illustration prepared by Reichenbach, but merely short-clawed, as commonly observed in *Octomeria Juergensii* Schltr.

Epidendrum roseum *Gerard* in Portef. Hort. 2: 66, t., 1848.

Epidendrum Jenischianum Rchb.f. in Fl. des Serres 9: 98, 1853.

A comparison of the type of *Epidendrum Jenischianum* with that of the published plate of *E. roseum* convinces me that the two are conspecific. Both concepts are based on plants collected in Bahia, Brazil.

Epidendrum sculptum *Rchb.f.* in Bonpl. 2: 89, 1854.

Epidendrum sculptum var. *linearifolium* Rchb.f. in Linnaea 41: 131, 1877.

Epidendrum florijugum Barb. Rodr. Gen. et Sp. Orch. Nov. 1: 57, 1877.

Epidendrum colonense Ames, Sched. Orch. 1: 14, 1922.

Epidendrum sculptum var. *Arevaloi* Schltr. in Fedde Rep. Beih. 27: 74, 1924.

Huebneria yauaperyensis auct. non Schltr. in Hoehne, Icon. Orch. Brasil. t. 99, 1949.

This rare species has recently been noted from Colombia. *Epidendrum florijugum* is noted here for the first time as a new synonym. A copy of Barbosa Rodrigues' original drawing of *E. florijugum* (as published by Cogniaux in Martius' *Flora Brasiliensis*) has recently been re-published by Hawkes as *Huebneria yauaperyensis* in his "Encyclopaedia of Cultivated Orchids".

Reichenbachanthus emarginatus *Garay nom. nov.*

Basionym: *Hexisea reflexa* Reichb.f. in Linnaea 41: 131, 1877, not *Reichenbachanthus reflexus* (Lindl.) Brade.

Synonym: *Fractiunguis reflexa* Schltr. in An. Mem. Inst. Butan. 1, pt. 4: 56, 1922.

A critical examination of the type of *Hexisea reflexa* Rchb.f. has shown it to be quite dissimilar in its floral morphology to *Scaphyglottis reflexa* Lindl. These two species have been confused with one another, due to the apparent similarity in their vegetative structures and size of the flowers. They were treated by me as one in *Venezuelan Orchids* under the name of *Reichenbachanthus reflexus* (Lindl.) Brade.

Scaphyglottis bicornis (*Lindl.*) *Garay comb. nov.*

Basionym: *Hexadesmia bicornis* Lindl. in Bot. Reg. 30: Misc. p. 41, 1841.

Synonym: *Scaphyglottis ruberrima* var. *aurea* Rchb.f. in Linnaea 22: 856, 1849.
Tetragamestus aureus Rchb.f. in Bonpl. 2: 22, 1854.
Scaphyglottis genychila Schltr. in Fedde Rep. Beih. 7: 122, 1920.
Scaphyglottis aurea Foldats in Acta Biol. Venez. 2: 381, 1959.
Hexisea aurea Dressler in Taxon 13: 246, 1964.

An examination of the type of *Hexadesmia bicornis* in the Lindley Herbarium confirms Reichenbach's contention that his *Tetragamestus aureus* may be conspecific with it. I have examined a series of specimens from Venezuela and Colombia, and in each instance I found only four pollinia in the anthers. The lip is somewhat sigmoid, a character which alone does not warrant the inclusion of this species in the genus *Hexisea*, as proposed by Dressler.

Teuscheria Wageneri (*Rchb.f.*) *Garay comb. nov.*

Basionym: *Bifrenaria Wageneri* Rchb.f. in Bonpl. 2: 17, 1854.

Synonym: *Teuscheria venezuelana* Garay in Rhodora 61: 39, 1959.

Recently, I had the opportunity to examine the type specimen in the Reichenbach Herbarium of the poorly described *Bifrenaria Wageneri*. This examination convinces me that my *Teuscheria venezuelana* is identical in every respect with Reichenbach's type.

Chondrorhyncha flaveola (*Linden & Rchb.f.*) *Garay comb. nov.*

Basionym: *Zygopetalum flaveolum* Linden & Rchb.f. in Walp. Ann. Bot. Syst. 6: 662, 1863.

Synonym: *Stenia fimbriata* Linden & Rchb.f. in Gard. Chron. 1313, 1868.
Chondrorhyncha fimbriata Rchb.f. in Saund. Ref. Bot. 2: t. 107, 1878.
Kefersteinia flaveola Schltr. in Fedde Rep. Beih. 7: 266, 1920.

It is rather unfortunate that the type of *Zygopetalum flaveolum* consists only of a colored drawing, which was prepared by Mr. Schlim in the field. Yet this drawing is so carefully executed that it leaves no doubt as to its identity with *Chondrorhyncha fimbriata*, a species that still grows in the vicinity of Ocaña, where Schlim collected it over one hundred years ago.

Cochleanthes picta (*Rchb.f.*) *Garay comb. nov.*

Basionym: *Warscewiczella picta* Rchb.f. in Gard. Chron. n.s. 20: 8, 1883.

At the time when Schultes and I published our paper on *Cochleanthes*, *Warscewiczella picta* was, unfortunately, overlooked. This distinctive Costa Rican species is quite rare in collections.

Pescatoria euglossa *Rchb.f.* in Gard. Chron. n.s. 6: 808, 1876.

Zygopetalum euglossum Rchb.f. in Gard. Chron. n.s. 6: 808, 1876.

Zygopetalum Roezlii var. *euglossum* Rchb.f. in Otia Bot. Hamb. 1: 8, 1878.

Bollea Schroederiana Sander in Gard. Chron. ser. 3, 17: 497, 1895.

Pescatoria Schroederiana Rolfe in Orch. Rev. 8: 68, 1900.

Rolfe had noted as early as 1900 that *Bollea Schroederiana* is referable to the genus *Pescatoria*. Recently, I had an opportunity to compare *Pescatoria Schroederiana* with *P. euglossa*, and I found the two to be conspecific.

Maxillaria carinulata *Rchb.f.* in Linnaea 41: 6, 1876.

Camaridium lamprochlamys Schltr. in Fedde Rep. Beih. 7: 177, 1920.

The record of the type of *Camaridium lamprochlamys* in the Orchid Herbarium of Oakes Ames agrees in every respect with the type of *Maxillaria carinulata*, which I studied in the Reichenbach Herbarium. *Maxillaria carinulata*, according to the notes made by Reichenbach on the herbarium sheet, was collected by Roezl in Medellín, Colombia.

Maxillaria nubigena (*Rchb.f.*) *C. Schweinf.* in Bot. Mus. Leafl. Harv. Univ. 11: 282, 1945.

Basionym: *Ornithidium nubigenum* Rchb.f. in Walp. Ann. Bot. Syst. 6: 488, 1863.

Synonym: *Ornithidium compactum* Schltr. in Fedde Rep. Beih. 7: 177, 1920.
Pachyphyllum pamplonense Krzl. in Pflanzenr. IV. 50, Heft 83: 27, 1923.

An examination of the type of *Pachyphyllum pamplonense* in the herbarium of the Natural History Museum, Vienna, shows clearly that Kraenzlin based his concept on a tracing of the type specimen of *Ornithidium nubigenum.*

The record of the type of *Camaridium compactum* Schltr. in the Orchid Herbarium of Oakes Ames likewise has been found to be identical with *Maxillaria nubigena.*

Maxillae Caucae *Garay nom. nov.*

Basionym: *Maxillaria parvula* Schltr. in Fedde Rep. Beih. 27: 176, 1924 not *Max. parvula* Hook. 1827.

This rather common species is a close relative of *Maxillaria variabilis* Batem. *Maxillaria parvula* Schltr. is a later homonym—hence the new name.

Maxillaria parviflora (*Poepp. & Endl.*) *Garay comb. nov.*

Basionym: *Scaphyglottis parviflora* Poepp. & Endl. Nov. Gen. ac Sp. 1: 58, 1836.
Synonym: *Ornithidium parviflorum* Rchb. f. in Bonpl. 2: 19, 1854.
Maxillaria ignea Hort. ex Rchb. f. in Bonpl. 2: 19, 1854.
Maxillaria exigua Regel in Ind. Hort. Sem. Petrop. 21, 1855.
Sophronitis ochroleuca Hort. ex Regel in Ind. Hort. Sem. Petrop. 21, 1855.
Maxillaria surinamensis Focke ex Rchb. f. in Walp. Ann. Bot. Syst. 6: 492, 1863.
Ornithidium chloroleucum Barb. Rodr. Gen. et Sp. Orch. Nov. 2: 208, 1881.

Ornithidium virescens Schltr. in Fedde Rep. Beih. 27: 102, 1924.

Maxillaria purpurea var. *parviflora* C. Schweinf. in Bot. Mus. Leafl. Harv. Univ. 11: 285, 1945.

Pseudomaxillaria chloroleuca Hoehne in Arqu. Bot. Estad. Sao Paulo n.s. form. maior 2 pt. 4: 72, 1947.

An examination of the type of *Scaphyglottis parviflora* in the Herbarium of the Natural History Museum, Vienna, has revealed only a single leaf for each pseudobulb (not two, as depicted by Poeppig) and three lobes to the lip. A good illustration of this species is found in Martius' *Flora Brasiliensis,* vol. 3, pt. 6: t. 25, f. 1, 1904, under the name of *Ornithidium chloroleucum.* This species has always lateral inflorescences, a character which automatically excludes it from the genus *Scaphyglottis.*

Maxillaria ramosa *Ruiz & Pav.* Syst. Veg. 1: 226, 1798.

Dendrobium ramosum Pers. Syn. Pl. 2: 524, 1807.

Scaphyglottis pendula Poepp. & Endl. Nov. Gen. ac Sp. 1: 58, 1836.

Scaphyglottis Tafallae Rchb.f. in Linnaea 22; 855, 1849.

Ornithidium Tafallae Rchb.f. in Bonpl. 2: 18, 1854.

Ornithidium pendulum Cogn. in Mart. Fl. Bras. 3, pt. 6: 92, 1904.

Ornithidium dichotomum Schltr. in Fedde Rep. Beih. 7: 178, 1920.

Maxillaria pendula C. Schweinf. in Bot. Mus. Leafl. Harv. Univ. 11: 285, 1945.

Maxillaria Tafallae C. Schweinf. in Bot. Mus. Leafl. Harv. Univ. 11: 288, 1945.

In the Delessert Herbarium, Geneva, there is a specimen collected by Pavón. The label attached to the specimen in Pavón's handwriting reads: "Orchis ramosa, Fl. P. & C. no. 16, Chicoplaya, 97". A second label attached to this specimen shows in Reichenbach's hand writing "Ornithidium ramosum Rchb.". Fragments of this collection are in the Reichenbach herbarium, and upon these fragments *Scaphyglottis Tafallae* Rchb.f. was established in 1849.

A comparison of these materials with the rather scanty original description of *Maxillaria ramosa* indicates that the material in the Delessert Herbarium represents most probably the actual holotype. This assumption is strengthened by the coincidence of the specific name "ramosa" as well as "Fl. P. & C. no. 16" on the label with the actual data published in "Flora of Peru & Chile" where *Maxillaria ramosa* is no. 16 in the enumeration of species.

Moreover, my study of the type of *Scaphyglottis pendula* confirms Reichenbach's observation (cf. Bonpl. 2: 18, 1854) that this species is inseparable from *Scaphyglottis Tafallae* Rchb.f.

Maxillaria ruberrima (*Lindl.*) *Garay comb. nov.*

Basionym: *Scaphyglottis ruberrima* Lindl. Orch. Linden. 22, 1846.

Synonym: *Ornithidium ruberrimum* Rchb.f. in Walp. Ann. Bot. Syst. 6: 489, 1863.

This apparently rare species from the Venezuelan Andes has not hitherto been transferred to the genus *Maxillaria*. The genus *Maxillaria*, as understood today, includes the genera *Ornithidium* and *Camaridium*.

Maxillaria speciosa *Rchb.f.* in Gard. Chron. n.s. 6: 196, 1876.

Maxillaria scurrilis Hort. ex Rolfe in Orch. Rev. 8: 234, 1900.

After having studied the type of *Maxillaria speciosa* in the Reichenbach Herbarium, I am convinced that the horticulturally well-known *Maxillaria scurrilis* is identical with that species. *Maxillaria speciosa* was originally collected in Colombia by Klaboch; a recent collection by *Asplund 17411* establishes its occurrence in Chiriboga, Prov. Pichincha, Ecuador.

Plectrophora alata (*Rolfe*) *Garay comb. nov.*
Basionym: *Trichocentrum alatum* Rolfe in Kew Bull. 197, 1898.

The type specimen of *Trichocentrum alatum* in the Kew Herbarium shows clearly that the spur of the flower is formed by the lateral sepals and not by the lip as described by Rolfe, hence a transfer to the genus *Plectrophora* is necessary. I have examined material of this species from Colombia and Panama.

Capanemia superflua (*Rchb.f.*) *Garay comb. nov.*
Basionym: *Oncidium superfluum* Rchb.f. in Walp. Ann. Bot. Syst. 6: 721, 1863.
Synonym: *Capanemia uliginosa* Barb. Rodr. Gen. et Sp. Orch. Nov. 1: 137, 1877.
Rodriguezia anomala Rolfe in Gard. Chron. ser. 3, 9: 728, 1891.
Rodriguezia uliginosa Cogn. in Mart. Fl. Bras. 3, pt. 6: 169, 1904.

The holotype of *Oncidium superfluum* is in the Kew Herbarium. On the type sheet, there is an annotation by Rolfe indicating that he considers it to be referable to *Rodriguezia anomala*. Cogniaux in Martius' *Flora Brasiliensis* united *Rodriguezia anomala* with *Capanemia uliginosa*. Since we are dealing with only one species under different names, the above combination is proposed, in accord with the rule of priority.

Sigmatostalix graminea (*Poepp. & Endl.*) *Rchb.f.* in Bot. Zeit. 10: 769, 1852.

Basionym: *Specklinia graminea* Poepp. & Endl. Nov. Gen. ac Sp. 1: 51, 1836.

Synonym: *Sigmatostalix peruviana* Rolfe in Kew Bull. 371, 1910.

Sigmatostalix pusilla Schltr. in Fedde Rep. 10: 392, 1912.

Sigmatostalix bicornuta Rolfe in Kew Bull. 342, 1913.

Petalocentrum pusillum Schltr. in Fedde Rep. 15: 145, 1918.

Petalocentrum angustifolium Schltr. in Fedde Rep. 15: 145, 1918.

Petalocentrum bicornutum Schltr. in Fedde Rep. Beih. 9; 179, 1921.

Unfortunately, until recently we have had no clear understanding of the floral morphology of *Sigmatostalix graminea*, although it is the type of the genus. The original illustration of this species by Poeppig is very misleading, especially for floral details. As a matter of fact, they maybe called the product of pure imagination. Reichenbach in *Xenia Orchidacea* published new details for *Sigmatostalix graminea*, which he claimed to have based on examinination of the original material. If the claim be correct, then Reichenbach must have examined some poorly preserved flowers. In 1964, I studied Poeppig's original material and made careful dissections. These dissections revealed a hitherto unknown feature of this species, namely a small, tooth-like projection on the external side of the petals. This very character was employed by Schlechter in establishing *Petalocentrum* as a distinct genus beside *Sigmatostalix*. Consequently, the genus *Petalocentrum* is untenable. A correct illustration of *Sigmatostalix graminea* is to be found in *Fedde*

Repertorium Specierum Novarum Beihefte 58: t. 59, nr. 234 under *Petalocentrum angustifolium* Schltr.

Zygostates Bradei (*Schltr.*) *Garay comb. nov.*

Basionym: *Dipteranthus Bradei* Schltr. in Anex. Mem. Inst. Butan. Soc. Bot. 1, pt. 4: 65, 1922.

Synonym: *Zygostates rotundiglossa* Pabst in An. XIV Congr. Soc. Bot. Bras. 21, 1963.

Recently, I saw a specimen of this species in the Reichenbach Herbarium with an unpublished name under *Zygostates*. The material was collected by Fritz Mueller in Santa Catarina. *Zygostates rotundiglossa* is in no way separable from this species.

Ornithocephalus stenoglottis *Rchb.f.* in Flora 69: 551, 1886.

Ornithocephalus longilabris Schltr. in Fedde Rep. Beih. 9: 114, 1921.

When Reichenbach described *Ornithocephalus stenoglottis*, he recorded neither the country of origin nor the name and number of the collector. The type specimen in the Reichenbach Herbarium, however, shows *F. C. Lehmann 3370.* Both Schlechter and Schweinfurth assign this species to Peru, but I am sure it is of Colombian origin, for Lehmann collected in South America only in Colombia and in neighboring parts of Ecuador.

Sphyrastylis Escobariana *Garay sp. nov.*

Epiphytica, ascendenti, usque ad 10 cm. alta; radicibus leviter flexuosis, glabris; caulibus abbreviatis, vaginis foliorum omnino obtectis, 2 cm. longis; foliis ensiformibus, imbricatis, cum vaginis articulatis, 5 cm. longis, 0.5 cm. latis; inflorescentiis lateralibus, muriculato-hispidulis, usque ad basin floriferis, multifloris, 9–10 cm. longis; bracteis ovato-lanceolatis, acutis, ovariis pedicellatis plus duplo longioribus, 0.5–0.6 cm. longis: floribus satis carnosis, apertis, viridi-flavis; sepalis inter se simillimis, oblongo-obovatis, apice obtusis, dorsaliter cristato-carinatis, 3.5 mm. longis, 2 mm. latis; sepalis lateralibus paululo obliquis; petalis suborbicularibus apice rotundatis, margine irregulariter denticulatis, dorsaliter a basi usque ad medium cristato-carinatis, 4 mm. longis, 3.5 mm. latis; labello porrecto, oblongo-ligulato, apice rotundato, basi callo bipartito in medio excavato ornato, 5 mm. longo, 1.5 mm. lato: columna humili, 2 mm. alta; rostello valde evoluto, 2 mm. longo; ovario pedicellato 3 mm. longo.

COLOMBIA: Departamento de Antioquia; Heliconia. 1800 m. alt. Coll. *Gilberto Escobar R. no. 104.* TYPE! TYPE in the Orchid Herbarium of Oakes Ames.

This new species differs from *Sphyrastylis Hoppii* Schltr. in being much smaller vegetatively and in having a dissimilar lip. It is named in honor of my good friend, Sr. Gilberto Escobar R., who, through his collecting, has contributed much to our knowledge of the orchid flora of Colombia.

Sphyrastylis cryptantha (*C. Schweinf. & P. H. Allen*) *Garay comb. nov.*

Basionym: *Oakes-Amesia cryptantha* C. Schweinf. & P. H. Allen in Bot. Mus. Leafl. Harvard Univ. 13; 134, 1948.

An examination of the type of *Oakes-Amesia cryptantha* convinces me that it is referable to the earlier described genus *Sphyrastylis.* With this transfer, the known geographical distribution of the genus *Sphyrastylis* includes Colombia and Panama.

DE PLANTIS TOXICARIIS E MUNDO NOVO TROPICALE COMMENTATIONES I

BY

RICHARD EVANS SCHULTES

As our phytogeographical and ethnobotanical knowledge of the New World tropics increases, additional information on the wealth of toxic plants in the flora of this area is brought to light. Only a small fraction of the hundreds of poisonous species already known has been subjected to chemical and pharmacological study. In addition to those species that have long been recognized as toxic, there are many still to be found—a number of them in families never considered as possessing chemical constituents with marked biological activity.

It would seem that one of the best methods of stimulating concentrated and thorough study of the toxic plants of the New World tropics might be to make available little known or hitherto unreported information on species that are recognized as definite poisons or which, for one reason or another, are suspected of being poisonous. I have, consequently, decided to begin a series of articles with this purpose in mind. They will form part of more extensive investigations into the poisonous plants of the New World tropics which I have been carrying out since 1941 and which is currently being supported by a grant from the National Institutes of Health (No. LM-GM 00071-01).

The sources of the information in this series of articles will be varied. Many of the data will be culled from my own ethnobotanical field notes, especially from those gathered in northwestern South America from 1941 to the present time. A wealth of mostly unpublished reports from labels on herbarium specimens has accrued as a result of a search through the more than two million sheets in the Harvard University Herbaria carried out under the direction of Dr. Siri von Reis Altschul of the Botanical Museum of Harvard University and supported by grants from Smith, Kline & French Company, by Eli Lilly Company and (mainly) by the National Institutes of Health (von Reis, S. "Herbaria: sources of medicinal folklore" Econ. Bot. 16 (1962) 283–287). Still more data are occasionally found in old or rare books and manuscripts, and information of this kind is often overlooked, if indeed it is even available to research workers. It is hoped that a combination of these and possibly other sources of information may materially advance our understanding of the frontier that still exists for intensive and extensive studies of the toxic plants of the tropical parts of the Western Hemisphere.

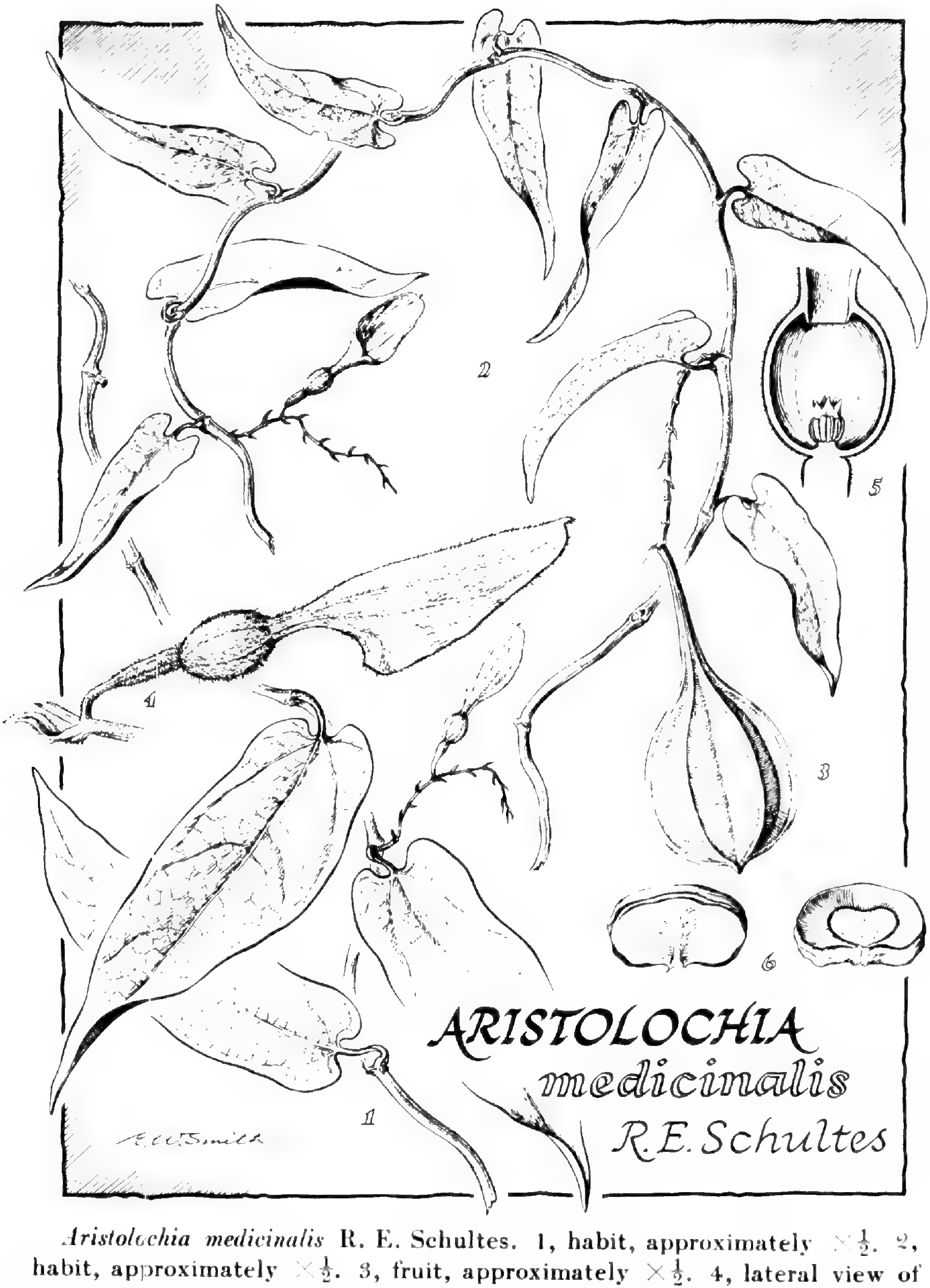
While I realize that investigations of toxic plants amongst the cryptogams, especially the fungi, is almost untouched for the American tropics, I must restrict my studies to the spermatophytes. It is to be hoped that one day soon a study of the rich and virgin field of toxic cryptogams of the New World tropics will be adequately undertaken.

ARISTOLOCHIACEAE

Aristolochia medicinalis *R. E. Schultes sp. nov.*

Frutex scandens, extensus. Caulis volubilis; rami volubiles, teretes, inconspicue striolati, fusco-brunneo, cum cortice tenui, minutissime puberulente. Folia exstipulata, chartacea, oblonga, apice acuminata, basi valde cordata, petiolata (petiolo robusto, plus minusve

PLATE XXX



Aristolochia medicinalis R. E. Schultes. 1, habit, approximately × ½. 2, habit, approximately × ½. 3, fruit, approximately × ½. 4, lateral view of flower, × 2. 5, longitudinal section of bulbous basal portion of perianth, showing genitalia, × 3. 6, seeds, × 1½. *Drawn by* ELMER W. SMITH

1.5 cm. longo, minutissime pulverulente), nervis lateralibus quattuor vel quinque supra glaberrima, vivo nitida et atroviridia, siccitate stramineo-viridia, nervis non conspicue elevatis, subtus pallide viridia, nervis omnibus prominenter elevatis, statu juvenile minutissime fuscotomentulosa, sine petiolo usque ad 12 cm. longa, 4.5 cm. lata. Flores in racemis laxis, multifloribus et axillaribus, plus minusve 4 cm. longis, pedunculo minutissime pulverulente, gracile. Perianthii pars basalis ovoidea-dilatata, plus minusve 10 mm. longa, 6 mm. in diametro, intus glabra, extus pilis longis appressis subdense obtecta: tubus asymmetricus obconicus, usque ad 10 mm. longus, basi 4 mm. sed apice plus minusve 12 mm. diametriens, intus glabrus, extus subdense pilosus, in faucis ore conspicue inciso; limbus oblongo-lanceolatus vel ovalis, apice truncatus sed mucronatus vel prominenter apiculatus, 20 mm. longus, usque ad 12 mm. latus, intus glabrus, extus pilosus. Columna genitalis plus minusve 3 mm. longa, breviter stipitata, per 0.5 mm. sex divisa, lobis pseudostylinis triangularibus, acutis. Stamina sex columnae adnata, antheris linearibus, quattuor 0.8 mm. longis, cetera 1.2 mm. longis, longitudinaliter dehiscentibus. Capsula ellipsoido-ovoidea, costis conspicuis, basi longe attenuata, apice breviter mucronata, plusminusve 9 cm. longa, 4 cm. in diametro; semina obovoideo-orbicularia, apice truncata, parte centrale valde cordiforme, 0.8 mm. longa, 1.3 mm. lata.

Colombia: Comisaría del Vaupés, Río Kuduyarí (tributary of Río Vaupés). Alt. about 700–800 ft. "Vine. Fruit pendent, green. Flowers brownish purple, striped with yellow-green." October 16, 1952, *Richard Evans Schultes & Isidoro Cabrera 17856* (Type in Herb. Gray).

Aristolochia medicinalis, which falls into Hoehne's section *Exstipulatae*, seems to correspond vegetatively rather closely with *A. melastoma* Manso., but the inflorescence of the former has many more flowers than that of the latter. It is florally perhaps closer to *Aristolochia acutifolia* Duchtr. *Aristolochia medicinalis* would appear to be somewhat intermediate between these two species. The former species is distributed in southern Brazil; the latter comes from the eastern Amazon south to Ceará.

The flowers of *Aristolochia medicinalis* have externally a longer, appressed indumentum differing from the short, erect hairs of *A. acutifolia;* the apicule of the perianth in the former is larger and more obtuse than that of the latter. There is a significant difference also in the structure of the seeds of the two species; the central part of the seed of *Aristolochia medicinalis* is much smaller and much less deeply cordate than the corresponding heart-shaped area in the seed of *A. acutifolia*, and the whole seed is wider in relation to its height. An interesting floral character of *Aristolochia medicinalis* is the difference in size of the stamens: four shorter and two longer.

The plant is an extensive vine not uncommon on the overhanging vegetation, where the river bank is not subject to deep annual flooding.

This new species is pointed out by the Kubeo Indians of the Río Kuduyarí, who know the plant as *da-koo-to-me*, as both toxic and medicinal. The astringent root is dried and pulverized to prepare a very bitter and pungent infusion given to natives who suffer periodic attacks that would seem to be epileptic in nature. Care must be taken not to employ this infusion too frequently nor in doses too large since, according to native medicine men, it may cause permanent insanity and, sometimes, muscular paralysis.

LEGUMINOSAE

Ormosia *Jackson*

One of the most interesting groups of toxic legumes is the genus Ormosia, a tropical genus of Middle and

South America and southeastern Asia, comprising about 100 species of shrubs and trees.

It is usually the seed that is reputed to be toxic, although the bark is not without suspicion in some species. The seeds of most, if not all, species are probably poisonous to some degree. Normally brightly colored, red and black, the beans are often used in making ornamental necklaces by peoples in primitive societies. The technical name of the genus has, in fact, been derived from a Greek word for *necklace*.

Alkaloids have reputedly been isolated from the seeds of at least nine species (Willaman, J.J. and B.G. Schubert "Alkaloid-bearing plants and their contained alkaloids" U.S.D.A. Techn. Bull. No. 1234 (1961) 120–121). These have been named ormosine, ormosanine, ormosinine and panamine; and N-methylcytisine has been reported from one species. Ormosinine is stated to be morphine-like in physiological action (Henry, T. A. "The plant alkaloids" ed. 4 (1949) 776), while panamine has been found to possess hypotensive properties when applied to dogs. In her outstanding monograph of the American species of this genus, Rudd (Rudd, V.E. "The American species of *Ormosia* (Leguminosae)" Contrib. U.S. Nat. Herb. 32 (1965) 279–384) reviews the sparse chemical and pharmacological literature on Ormosia and points out that "the plant names used [in this literature] are not necessarily true taxonomic synonyms, and it is not always possible to know what material the chemist had at hand".

The seeds of some of the species have been employed therapeutically in folk-medicine. The collection *Steyermark 61330* reports that, in eastern Venezuela, seeds of *Ormosia monosperma*, known locally as "pionía montañera" are cooked and made into a drink "for pains of the heart" and that the "cooked seed placed in water

[is] given to children to put around the neck for sore throat''.

I have found several species of *Ormosia* avoided or employed as poisons or medicines in the northwest Amazon, while several other species were not regarded as toxic or of economic value. The collections of interest are enumerated below. Those for which no information relative to biological activity could be elicited from native informants are: *Ormosia discolor* Spr. ex Benth. (Río Apaporis, Colombia: *Schultes et Cabrera 12952*) and *O. Williamsii* Rudd (Río Negro, Colombia: *Schultes et López 9888*).

All of the collections cited have been annotated by Rudd and are included in her monograph, with the single exception of the new variety described below.

Ormosia amazonica *Ducke* var. **venenifera** *R. E. Schultes var. nov.*

Arbor rivularis, 60–70 ped. alta, trunco columnare usque ad 2 ped. in diametro, fulvo-nigro cum cortice crasso. Rami sparse adpresso-tomentosi, ramulis densissime chryso- vel fulvo-tomentosis. Stipulae parvae, strictae, triangulares, usque ad 3 mm. longae. Folia 7- ad 11-foliolata, axibus petiolisque usque ad 40–50 cm. longis, albido-sericeis, petiolulis similibus, plus minusve 5 mm. longis, foliolis plerumque 6–11 cm. distantibus, coriaceis, usualiter obovatis, acuminatis vel saepe obtusis, basi rotundatis vel late subcuneatis, 9–25 cm. longis, 5–10 cm. latis, laeviter marginatis, supra glabris subnitidisque, infra densissime minuteque albido-velutinis, venis prominenter elevatis secundariis quindecim ad viginti, 9–14 mm. distantibus. Inflorescentiae maxime densissimeque floribunda, usque ad 30–40 cm. in diametro, axibus dense chryso- vel albido-velutinis, bracteis elongatis, ligulatis, usque ad 7 mm. longis, basi 1–2 mm.

latis, bracteolis parvis, linearibus. Flores formosi fragrantesque, ad 28 mm. longi; calyx dense fulvo-velutinus, 10 mm. longus, tubo 4–5 mm. diametro, laciniis 5 mm. longis; petala purpurea, glabra, vexillo stipitato-orbiculare, 17 mm. longo, 13–14 mm. lato, lateralibus vel alis 18 mm. longis, 5–6 mm. latis; carina minore; staminibus alternate subaequalibus, 12 mm. longis; ovario elongato-ovoideo, pubescente, 9 mm. longo, 2–3 mm. lato. Fructus dehiscentes, extus rugosi, sublignosi, nigro-fulvi, 3–5 cm. longi, 2–3 cm. lati, valvis ad 2 mm. crassis. Semina 1 vel 2, bicolora, coccinea sed $\frac{1}{4}$ pro parte nigro-maculata, 12–13 mm. longa, 10 mm. lata, 6–7 mm. crassa, hilo 3 mm. longo.

COLOMBIA: Comisaría del Amazonas, mouth of Río Loretoyacu, Trapecio Amazónico. Alt. 100 m. "Common name: *chocho*. Height 55 feet. Calyx brown. Petals white and lavender. Stamens white. Flowers with odour of citronella, strong. Bark smooth, grey-brown. Seeds highly alkaloidal; leaves, twigs only slightly so." September 13–15. *Richard Evans Schultes, Robert F. Raffauf & Doel Soejarto 24107*. (TYPE in Herb. Gray; DUPLICATE TYPES in Econ. Herb.; Herb. Nac. Col.; U.S. Nat. Herb.).

Same locality. "N.v. *cairuro*. Arbol de 12 m. Semillas rojo y negro. Alcaloides—muy positivo en las semillas; corteza negativa para alcaloides." October 10, 1961. *J. M. Idrobo 4732*.

Same locality. "Arbol de unos 20 m. de alto. Inflorescencias de color café. Prueba de alcaloides++". August 21, 1964. *A. Fernandez-Perez 6882*.

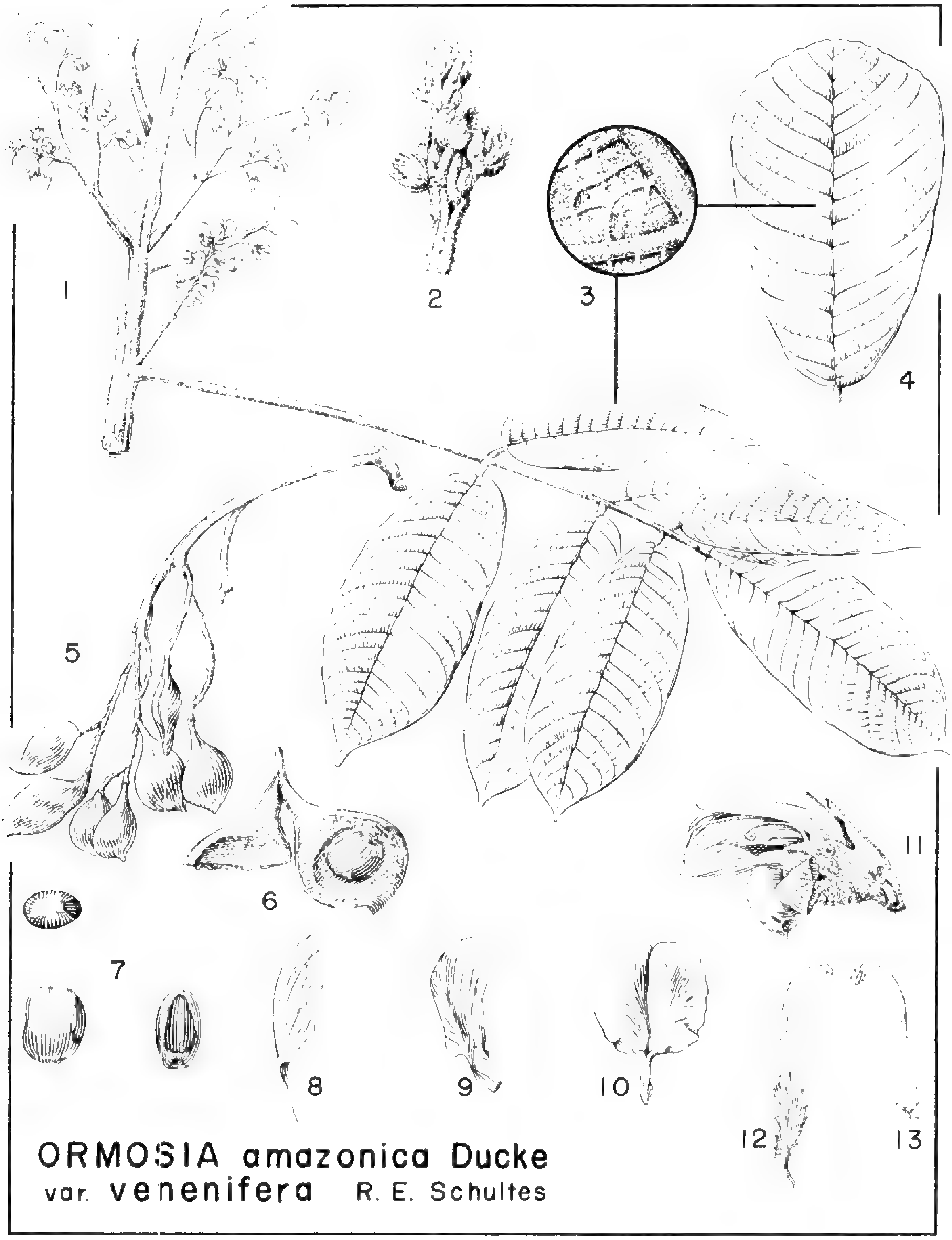
This variety may represent a western variant of *Ormosia amazonica*. The species itself is distributed in the central part of the Amazon. There are several minor differences in the size of flowers and floral parts, the shape of the base of the leaves, the general texture of the leaves and the density of leaf-indumentum and in habit of the plant, and these would seem to justify its recognition as a distinct subspecific concept.

All three of the collections cited above were made from the same tree which has been under surveillance

PLATE XXXI

(Left) Photograph of the tree from which the type of *Ormosia amazonica* Ducke var. *venenifera* R.E. Schultes was taken. Río Loretoyacu, Amazonas, Colombia. (Right) Flowering branch from the same tree.

Photographs by RICHARD EVANS SCHULTES



Ormosia amazonica Ducke var. *venenifera* R. E. Schultes. 1, flowering branch, approximately $\times\frac{1}{2}$. 2, buds, approximately $\times\frac{2}{3}$. 3, detail of nether surface of leaf, approximately $\times 2\frac{2}{3}$. 4, leaflet, showing variation in shape, approximately $\times\frac{3}{8}$. 5, fruiting branch of inflorescence, approximately $\times\frac{1}{4}$. 6, open pod with seed, approximately $\times\frac{1}{2}$. 7, seed, approximately $\times\frac{3}{4}$. 8–13, flower and floral parts, approximately $\times 1\frac{1}{2}$.

Drawn by JOSHUA B. CLARK

and study for a number of years, especially since it has shown such highly positive alkaloidal spot test reactions for the seeds. The seeds are recognized by the inhabitants of the area as being toxic.

Ormosia coccinea (*Aubl.*) *Jackson* var. **subsimplex** (*Spr. ex Benth.*) *Rudd* in Contrib. U.S. Nat. Herb. 35 (1965) 328.

This tree, with attractive, shiny, deep red pods, is rather abundant in Amazonian Colombia (Rudd, loc. cit.), usually in association with the flora of savannahs in the vicinity of the remnant quartzitic mountains of the Guiana-Venezuela land-mass.

The seeds are considered by the Witotos of eastern Colombia to be highly poisonous when ingested, but these Indians do not seem to employ them for any specific purpose. The tree is called *ee-tö'-a* in Witoto.

COLOMBIA: Comisaría del Amazonas, Río Karaparaná, near El Encanto. Alt. about 150 m. "Tall tree up to 20 m. Basal diameter 10 m. Pods deep red. Bark smooth, mottled brown and grey. Wood soft, yellowish." May 22–28, 1942. *R.E. Schultes 3833.*

Ormosia isthmensis *Standley* in Field Mus. Nat. Hist., Bot. Ser. 17 (1937) 264.

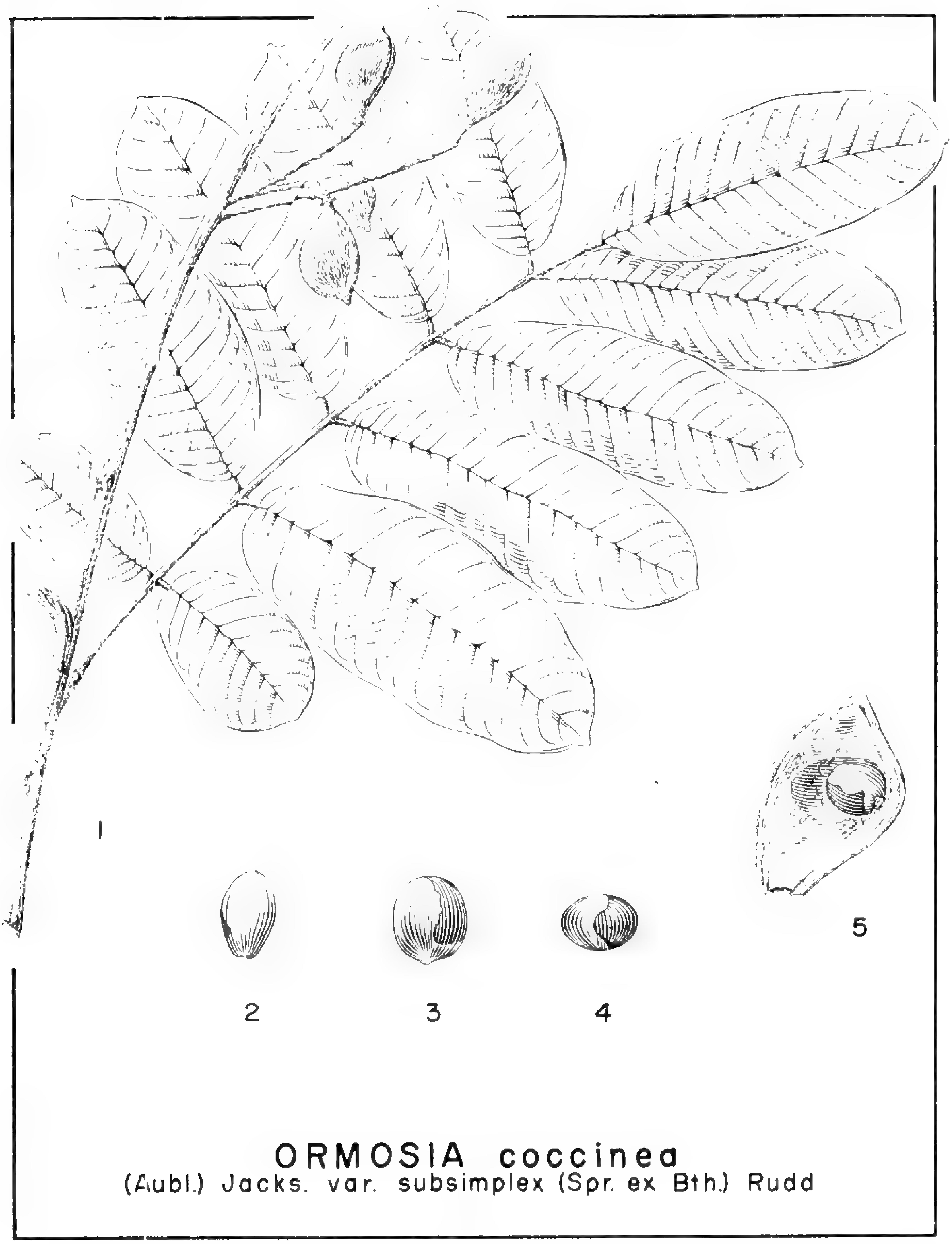
MEXICO: Oaxaca, District of Choapam, San Juan Lalana. Alt. 550 m. May 8, 1939, *Schultes & Reko 822.*

The wood of this very tall and conspicuous tree is employed in Oaxaca for a number of purposes where strength and durability is required (Schultes in Bot. Mus. Leafl. Harvard Univ. 9 (1941) 176), but no use is known for the seeds which the Chinantec Indians, who call the tree *mu-sa*, consider to be strongly poisonous.

Ormosia lignivalvis *Rudd* in Contrib. U.S. Nat. Herb. 32 (1965) 331.

Known from French Guiana, British Guiana, Venezuela, and the central part of the Brazilian Amazon,

PLATE XXXIII



Ormosia coccinea (Aubl.) Jackson var. *subsimplex* (Spr. ex Benth.) Rudd. 1, fruiting branch with leaf, slightly larger than × $\frac{1}{3}$. 2, 3, 4, views of seed, approximately × 1. 5, open pod, approximately × $\frac{2}{3}$.

Drawn by JOSHUA B. CLARK

Ormosia lignivalvis is here first recorded for the Colombian flora. A very lofty tree with a beautiful cylindrical trunk two feet in diameter and a light reddish brown bark, it is known as "cocho" by Colombian settlers of the Amazon who employ a strong infusion of the bark for washing sores with pus. The same informants consider the black and scarlet seeds to be poisonous.

COLOMBIA: Comisaría del Caquetá, Río Apaporis, Cerro Castillo. Quartzite base. Alt. 350–1000 feet above forest floor, 1250–1900 feet above sea level. "Huge tree, cylindrical, diam. 2 ft., 100 ft. tall. Bark light reddish brown, smooth, wood white, not hard. Seeds black and scarlet. Bark infusion for washing sores with pus, *Cocho*". July 27, 1943. *R.E. Schultes 5731.*

Ormosia macrophylla *Bentham* in Ann. Wien. Mus. 2 (1838) 88.

A small but beautiful tree of the central and northwestern Amazon, *Ormosia macrophylla* is valued by the Tawaino Indians of the Río Kananarí of Amazonian Colombia as one of the ingredients in a curare prepared reputedly from the bark of a *Strychnos*, the bark of *Vochysia ferruginea* Mart., the crushed stems and leaves of an aroid (possibly a *Philodendron*) and the bark of *Ormosia macrophylla*. I did not witness the preparation of this curare, but several independent informants agreed on the ingredients of the preparation.

The tree is known as "peonía" amongst the civilized settlers of the Río Vaupés. In Tawaino, it is called *ma-hö'-kĕ.*

COLOMBIA: Comisaría del Vaupés, Río Kananarí, Cerro Isibukurí. "Small tree. Flowers brown." October 29, 1951. *R.E. Schultes & I. Cabrera 14533.*—Comisaría del Vaupés, Río Vaupés, Raudal de Yuruparí. Quartzite base. November, 1953. *R.E. Schultes et I. Cabrera 19747.*

ERICACEAE

Pernettya prostrata (*Cav.*) *Sleumer*

Several varieties of *Pernettya prostrata* in Andean

South America are known to possess poisonous properties that effect both man and domesticated animals. The following notes, apparently unpublished, are documented by plant collections preserved in the Gray Herbarium of Harvard University.

Pernettya prostrata (*Cav.*) *Sleumer* var. **Pentlandii** (*DC.*) *Sleumer* Notizbl. 12 (1935) 290.

BOLIVIA: Province of Chapare, Cochabamba. Alt. 3,000 m. "Frucht . . . soll, wenn reichlich genossen, Schwindel verursachen." March 5, 1929. *J. Steinbach 9514.*

Province of Chapare, Cochabamba. Alt. 3,200 m. "Die Frucht hat eine einschläfernde Eigenschaft. Eine zahmer Affe, welcher die Beeren meiner zum einlegen bestimten [sic] Pflanzen genascht hatte, wurde total betrunken." March 10, 1929. *J. Steinbach 9583.*

These two references indicate that the ripened fruit of this low shrub of the Bolivian highlands is narcotic and toxic: in the one case, dizziness was caused when ingested by human beings; in the other case, a donkey showed signs of intoxication after eating dried fruits. The vernacular name of this plant in Cochabamba is given as *macha-macha.*

Pernettya prostrata (*Cav.*) *Sleumer* var. **purpurea** (*D.Don*) *Sleumer* Notizbl. 12 (1935) 290.

COLOMBIA: Department of Nariño. Alt. 3,000 m. ". . . fruit . . . are poisonous; adults become violently ill, children dying from eating the berries." August 17, 1938. *Y. Mexia 7642.*

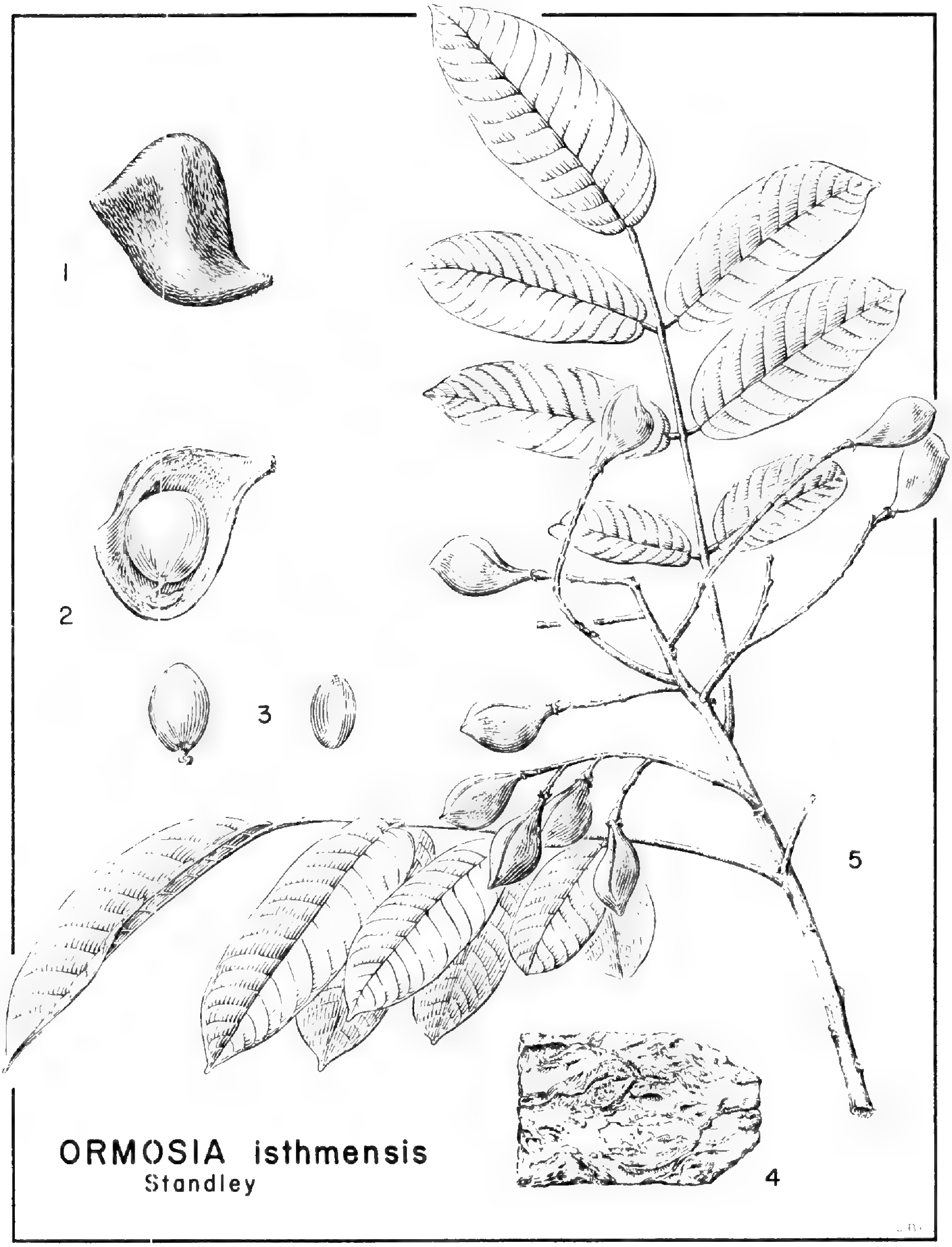
The common name in southern Colombia of this shrub is *moridera.* Accidental poisoning, especially amongst children, is reported as not uncommon in Colombia from the fruit of *Pernettya prostrata,* including undoubtedly this variety which is abundantly represented in the *páramo* vegetation. (Pérez-Arbeláez: *Plantas útiles de Colombia* (1947) 415).

Vaccinium floribundum *HBK.* var. **ramosissimum** (*D. Don.*) *Sleumer* Notizbl. 13 (1936) 131.

Bolivia; Province of Sacaba, Cochabamba, Inachaca. Alt. 2,800 m. "Dicen que las frutas comiendo muchos embriagan." October 14, 1921. *J. Steinbach 5895.*

This abundant highland shrub, locally known in Cochabamba as *macha-macha,* has fruits which intoxicate apparently in the same way as those of the related genus *Pernettya.*

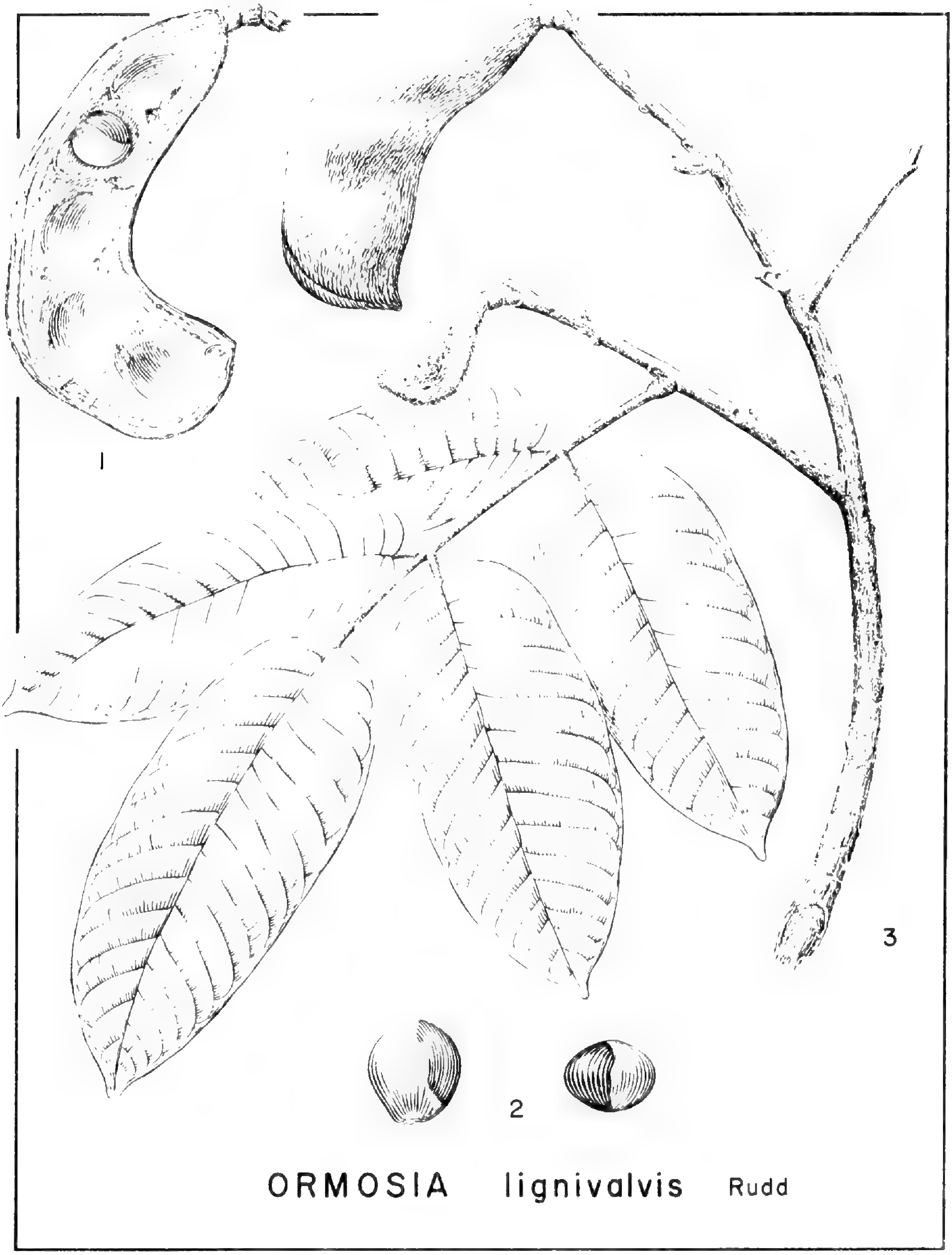
PLATE XXXIV



Ormosia isthmensis Standley. 1, pod, ×1. 2, open pod with contained seed, ×1. 3, views of seed, approximately ×1. 4, detail of bark, ×1. 5, fruiting branch with leaves, slightly larger than ×$\frac{1}{3}$.

Drawn by JOSHUA B. CLARK

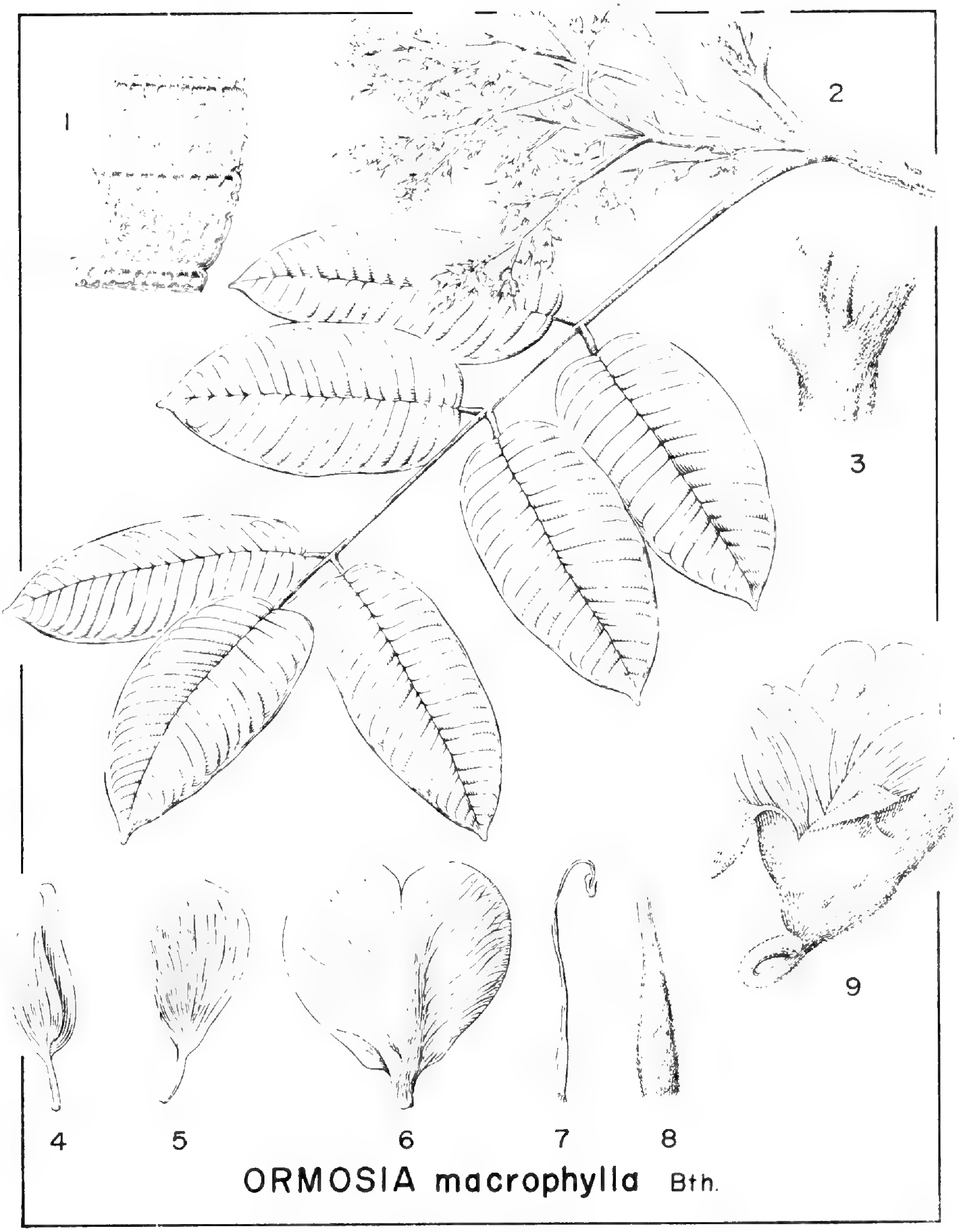
PLATE XXXV



Ormosia lignivalvis Rudd. 1, opened pod, approximately ×½. 2, seeds, approximately ×1. 3, fruiting branch with leaf, approximately ×½.

Drawn by JOSHUA B. CLARK

PLATE XXXVI



Ormosia macrophylla Bentham. 1, detail of nether surface of leaflet, ×4. 2, flowering branch with leaf, approximately ×$\frac{1}{4}$. 3, detail of twig, approximately ×1. 4, 5, 6, 7, 8, floral parts, approximately ×2; flower, approximately ×2. *Drawn by* JOSHUA B. CLARK

PLATE XXXVII

Pernettya prostrata (Cav.) Sleumer. 1, habit, approximately × 1. 2, branch, × 2. 3, outline of leaf, × 5. *Drawn by* JOHN STANWELL-FLETCHER

TRIPSACUM IN PERU

BY

ALEXANDER GROBMAN[1]

EXCEPT for a single, verbal report[2] that Asplund identified *Tripsacum* near Tingo María, Department of Huánuco, and considered it an escape from cultivation, no other literature references (including Weberbauer (1) and MacBride (2)) give any indication that *Tripsacum* might be native to Peru.

The identification of races of tripsacoid maize on the eastern slopes of the Andes and in the Amazon basin of Peru had suggested the probable occurrence of *Tripsacum* sympatric with maize and might explain the introgression of tripsacoid characters into maize in these areas (3).

Cutler and Anderson (4) presented evidence of widespread distribution of *Tripsacum* in the Amazon basin. They considered all of the South American specimens that they studied as belonging to *Tripsacum australe.* I have found *Tripsacum* growing wild twice in the Huallaga valley region of north-central Peru (July 4, 1963). The first collection was made at Puerto Rico, formerly called Juanjuicillo, on a river bank on the east side of the

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[1] Formerly Director of Research, Division of Experimentation, Servicio de Investigación y Promoción Agraria, Lima, Perú.

[2] Kindly supplied by Dr. Ramon Ferreyra, Director of Museo de Historia Natural, Javier Prado, Universidad Nacional Mayor de San Marcos, Lima.

Río Huallaga. There were two separate clumps of plants, rooted about one and one half to two meters above the water level, at that time. The plants had green stalks; the leaves were of medium width; and the plants were in full bloom. Travelling northwards by motor boat, I could not find any other clumps of *Tripsacum*, even though I scanned both sides of the river at normal cruising speed. Further explorations of Huallaga affluents were not carried out, except in the lower Río Mayo section. On the Mayo, near its confluence with the Huallaga, abundant masses of plants which resembled *Tripsacum* were found on high river banks. Collections were made for transplanting. These plants had red stalks, hairy sheaths and narrow leaves. No herbarium specimens of this colony were preserved, and since the plants had not developed inflorescences, no positive identification was possible.

A third and large mass of *Tripsacum* with fully developed inflorescences was found along the road between the Tarapoto and Granja Porvenir, a livestock farm operated by SIPA (a dependency of the Peruvian Ministry of Agriculture). These plants had sun-red leaf sheaths, and they were rather hairy and had rather narrow leaves.

Live plants from all three sites were planted at the Granja Porvenir near Tarapoto, but unfortunately the plants that survived transplanting were destroyed during construction work.

It was possible for me to collect herbarium material in full bloom again in 1964 along the road from Granja Porvenir to Tarapoto. These were compared at the Botanical Museum of Harvard University with herbarium specimens of *Tripsacum australe* collected by Cutler. I carried out this comparison in the winter of 1965, and the assistance of Dr. Paul C. Mangelsdorf, Director of the Museum, in this study is gratefully acknowledged. From the comparison of several morphological characters — including leaf blades, sheaths, and inflorescences — I concluded that the Tripsacum growing in the Porvenir-Tarapoto locality of the Huallaga valley fall well within the range of variation of *Tripsacum australe.*

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MANGROVE POLLEN AT THE DEPOSITIONAL SITE OF OLIGO-MIOCENE AMBER FROM CHIAPAS, MEXICO[1]

BY
Jean H. Langenheim, Betty L. Hackner and Alexandra Bartlett[2]

Amber from the New World tropics has been reported to occur in Mexico, Colombia, Brazil, Argentina, Haiti and the Dominican Republic (Langenheim, 1964). Neither the amber itself nor the environment of its deposition in any of these localities, however, has previously been studied in detail.

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[1] Grateful acknowledgment is expressed to Prof. J. Wyatt Durham and Prof. E. S. Barghoorn for continued interest and help with the project as well as criticism of the manuscript. The critical comments of Prof. A. O. Dahl and Dr. Lucy Cranwell Smith are also appreciated. The investigation was supported in part by National Science Foundation grants GB 1312 and 2397, and the Radcliffe Institute for Independent Study.

[2] The senior author was a Research Associate in the Botanical Museum, now at the University of California at Santa Cruz. Miss Hackner, now at the University of Pennsylvania, investigated the mangrove and associated fossil pollen in the Chiapas amber-bearing sediments for a Senior Thesis at Radcliffe College under the supervision of Dr. Langenheim. Miss Hackner gratefully acknowledges support of this study by an National Science Foundation Undergraduate Research Participation grant. Dr. Bartlett, Harvard University, made a special study of modern *Rhizophora* and other tropical pollen in connection with this project and with her present studies of Late and Post-Glacial history of Gatun Basin, Panama. She wishes to express appreciation to the American Chemical Society, PRF Grant 947-A-2, for assistance in this study.

The classic concept of amber has been derived from the extensive deposits along the shores of the Baltic Sea which have been rather intensively studied for over a century. This Baltic amber is known to have been produced in forests with a high proportion of subtropical to tropical floral and faunal elements (Czeczott, 1960; Schubert, 1958; 1961). Yet most comparative observations of resin-producing trees and the manner in which they produced large quantities of resin that could be deposited in the sedimentary record were restricted to cool temperate conditions around the Baltic Coast. Much emphasis was placed on the necessity for an extensive forest of trees producing resin excessively in response to diseased and physiological imbalance in order to accumulate the incredible deposits that occur along the Baltic coast (Conwentz, 1890). Little attention was given to the fact that tropical trees can produce large quantities of resin under apparently natural forest conditions and that environments of deposition occur there that can favor large accumulations of resin. Unfortunately, it has been impossible to study the primary environment of deposition of the Baltic amber, because it is thought to be secondarily deposited (Czeczott, 1960).

Amber from the Simojovel region, Chiapas, Mexico, is one of the occurrences in the New World tropics that provides sufficiently abundant material for detailed investigation. Entomologists from the University of California at Berkeley became aware of the presence of numerous insects in this amber and initiated a collecting and study program in 1953 (Hurd and Smith, 1957). Although the occurrence of this amber has been recorded since at least 1891, the extent of the deposits and potential biological significance of the material had not been known. The inaccessibility of this area in the southernmost state of Mexico and the possessive attitudes of the natives there toward the amber probably also contributed to lack of previous recognition. Invertebrate paleontologists at Berkeley since 1956 and stratigraphers at the University of Illinois since 1961 have been studying the geology of the amber-bearing beds in the Simojovel region in order to establish the age of deposition of the amber as a context for evolutionary studies of the included fossils. Various phases of botanical investigations of the amber and of the beds containing it were begun in 1962 at Harvard University and extended to include chemical aspects in 1963. Thus, the study of the Chiapas amber has been approached from the standpoint of coordinating data from several disciplines that may shed light on mid-Tertiary ecosystems in southern Mexico. It has, furthermore, provided an opportunity to understand more fully the natural production of large quantities of resin and sites that favor its accumulation and subsequent deposition in sediments under tropical conditions.

Pollen analysis of the Chiapas amber-bearing beds is of particular interest in any attempt to determine some of the vegetational and general environmental conditions that could have existed at or near the site of deposition of the amber. Study of 12 samples from amber-bearing strata in various localities indicates that the primary depositional environment of the amber was dominated by mangrove vegetation comprised of several species of *Rhizophora*. Although numerous other microspore types occur in these sediments, this report will be restricted essentially to a discussion of *Rhizophora*, with brief mention of associated pollen types which were strikingly abundant or otherwise significant to an understanding of the ecology of vegetation at or near the depositional sites of the Chiapas amber. The record of occurrence of *Rhizophora* pollen in these strata contributes also to our knowledge of the distribution and ecology of mangrove vegetation during the mid-Tertiary in southern North America.

BOTANICAL SOURCE OF THE AMBER

In contrast to the classical view that amber is derived from pines or, at least, pines and other conifers, it has been demonstrated on the basis of several lines of collateral evidence that the source of most of the Chiapas amber is the leguminous genus *Hymenaea* (Langenheim and Beck, 1965; Langenheim, 1966). This genus has the center of its distribution today in the Amazon Basin. Of the 20 species commonly recognized (Record and Hess, 1943), only one species,[3] *Hymenaea Courbaril* L., has a wide distribution. It occurs throughout northern South America (Brazil, Bolivia, Colombia, Ecuador, Venezuela, the Guianas), along the Pacific slopes throughout Central America to central Mexico, and on most of the islands of the West Indies. Prof. Faustino Miranda (per. comm., 1964) identified a *Hymenaea* leaflet in the amber which resembles both *H. Courbaril* and *H. intermedia* Ducke, the latter today restricted to the Amazon region. On the basis of diagnostic glandular morphology, the leaflet probably more closely resembles present-day populations of *H. Courbaril* than *H. intermedia.* Likewise, similarities in the infrared spectra of most of the Chiapas amber and of resin of modern populations of *H. Courbaril* make it appear that the amber was produced possibly by an ancestral population of *H. Courbaril.*

Although ecological data are scarce throughout its wide range of distribution, the senior author has observed *Hymenaea Courbaril* to be an important member

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[3] Some taxonomists also recognize *Hymenaea candolleana* HBK. as occurring in Central America. Most workers, in Mexico at least (F. Miranda, per. comm. 1964), think that *H. candolleana* is at best a variety of *H. Courbaril* and does not warrant specific designation.

of humid evergreen or of seasonally dry semi-deciduous forest types on the Pacific slopes in Central America. It is common along coastal plains and rivers, and grows also on beaches and sandy ridges that interdigitate with lagoons. *Hymenaea Courbaril* varies in the amount of resin produced under natural forest conditions at various sites. It appears to produce larger quantities where conditions favor a more rapid growth rate. Resin may accumulate in the soil around the base of the tree in large amounts (Noriega, 1918; Record and Hess, 1943) and from there can easily be transported into either marine or brackish-water sites in or near which mangroves frequently predominate.

GEOLOGICAL OCCURRENCE OF THE AMBER

The Simojovel Area is located in central Chiapas in the Central Mesa region and parts of the Tabasco Coastal Plain. The amber is collected primarily from rocks exposed in landslides (Plate XXXVIII), although some outcrops of beds containing amber occur along river banks and in road cuts.

Although geological investigations of the amber-bearing beds were begun in 1956, little detailed stratigraphic information has yet been published. Licari (1960), in a preliminary study of the region, described the largely Oligocene Simojovel Group as consisting of approximately 6550 feet of well-bedded marine calcareous sandstones and mudstones with some intercalated lignitic seams. It is underlain by Eocene sandstones, shales and conglomerates and overlain by Miocene sandstones and shales. The upper portion of the Simojovel Group, including a distinctive limestone member, is characterized by the presence of the marine gastropod genus *Orthaulax*, indicative of late Oligocene to earliest Miocene age. Amber has been found in the "*Orthaulax* zone" and in the lowermost part of the overlying sandstones and shales.

The geologic history inferred for the Simojovel Group suggests deposition of sediments, derived from the ancestral Sierra Madre to the south, under warm, generally shallow-marine conditions. Occasional shoreline oscillations led to deposition in terrestrial, estuarine and brackish environments.

Description of Samples for Pollen Analysis

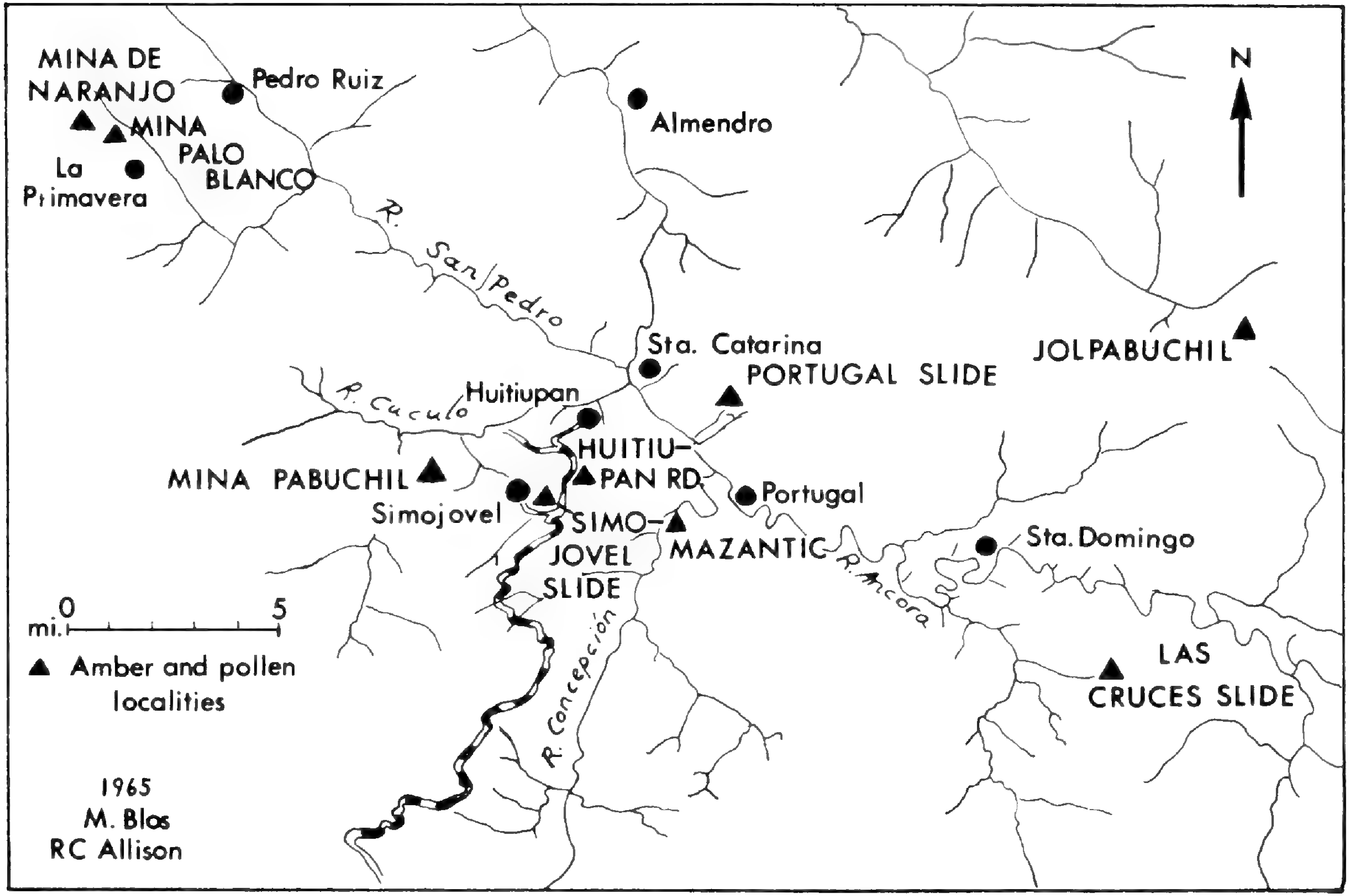
The samples analysed for pollen were collected by J. Wyatt Durham and Jean H. Langenheim from beds in which the amber occurred or from immediately adjacent beds (Plate XXXVIII). In general, the amber from these deposits does not appear to be reworked; hence it may be possible to determine some of the vegetational conditions at or near the depositional site. Location of sites from which samples were studied are indicated in Plate XXXIX. Lithologic description of the 12 samples is presented in the Appendix. Most of the samples were either calcareous siltstones or silty shales, three of the latter being glauconitic. There was some variation in coarseness and in color. One sample was a calcareous sandstone. Several samples were associated with lignitic bands or at least had carbonaceous streaks.

All of the samples are from the upper portion of the Simojovel Group and of latest Oligocene or earliest Miocene age (Durham *in lit.*, 1964). Samples from Simojovel, Mazantic, Pabuchil, Huitiupan, Portugal and Las Cruces (I–VII) are believed to be of approximately the same age (Durham, pers. comm. 1965). Durham also indicated that stratigraphic control on Sample XII from Jolpabuchil has not been established. R. C. Allison (*in lit.* to Durham) considers the invertebrate fauna from Mina Palo Blanco and Mina de Naranjo to indicate an

Plate XXXVIII

(Top) Las Cruces landslide showing alternation of marine siltstones and sandstones with some intercalated brackish water sediments. (Bottom) Amber deposited in lignitic bed among marine sandstones, Simojovel landslide.

PLATE XXXIX



Location of sites where pollen samples were collected in association with amber, Simojovel Area, Mexico.

age similar to that of Simojovel, Portugal and Jolpabuchil. Thus, available information suggests that the present samples represent a geologically short time interval.

DETERMINATION OF RHIZOPHORA POLLEN

Preparation Procedures

The pollen samples were prepared by techniques modified from various standard sources (Faegri and Iversen, 1964; USGS Prep. Proc., 1960; Brown, 1960) in a manner found suitable in the treatment of sediments of this type in other investigations at the Paleobotanical Laboratories of the Botanical Museum of Harvard University. Samples were first disaggregated by soaking in distilled water and by gentle grinding in a mortar with a pestle. The major portion of calcareous material was removed with 10% HCl; then lignin was removed by bleaching in acidified 7% $NaClO_2$. Larger quartz grains and other heavy minerals were removed by heavy-liquid separation in a solution of $ZnBr_2$ in 10% HCl at a specific gravity of 2.2. Finer silicious material was dissolved by overnight soaking of the sample in concentrated HF, followed by washing in HCl to minimize silica gel formation. The samples were acetolysed to remove remaining cellulose, and mounted in glycerin jelly.

The fossil pollen types were identified by comparison with modern pollen in the Harvard Pollen Collection. Additional modern samples prepared for this study were treated by standard methods used for this collection: i.e., treatment in hot 10% KOH followed by acetolysis and mounting in glycerin jelly.

Modern Rhizophora pollen

The genus *Rhizophora* was monographed by Salvoza in 1936, and was reviewed by Hou in 1960. Salvoza recognized *R. Mangle* L. and *R. samoensis* (Hochr.)

Salvoza as separate species, mainly on the basis of their geographical separation into two groups living respectively on the east and west coasts of America, and because of a difference in length of style. Salvoza also recognized *R. brevistyla* Salvoza on the Pacific coast as a species distinct from *R. Harrisonii* Leechm. on the east coast of America, chiefly on the basis of a difference in flower and flower-bud size and difference in stylar length. Hou does not think that the difference between the two groups in each pair is sufficient to warrant specific designation. He recognizes only three American species: *R. Mangle* L., *R. Harrisonii* Leechm., and *R. racemosa* G. F. W. Meyer. Of these, only *R. racemosa* has not yet been found on the Pacific coast of the Americas, the other two occurring on both coasts.

Pollen of the various New World species of *Rhizophora* had previously not been studied in detail. Van der Hammen (1963; pers. comm., 1965) has expressed the opinion that pollen of the three species of *Rhizophora* occurring today in British Guiana can be distinguished morphologically, but he does not separate them in his data. Muller (1959) observes that pollen of the *Rhizophora*-type shows "rather strong variation in size and in the appearance of pores." He attributes this variation, however, to difference in preservation rather than to morphological distinction of value in separation of the species.

Observations of modern *Rhizophora* pollen by the authors have led them to concur with van der Hammen that the species of *Rhizophora* can be separated in some cases by morphological characters, and an attempt to do so will be made in this paper.

The following description of pollen of several species of modern *Rhizophora* is presented after study of the *Rhizophora* pollen available from specimens in the Harvard University Herbaria and from the Harvard Pollen Collection. All size measurements are of the greatest dimension.

Rhizophora L.[4] Grains from 11 to 30 μ in size, varying in shape from subprolate to spheroidal to suboblate. Polar view circular to triangular in grains with gaping colpi. Tricolporate; ectexinous colpi crossed by colpi transversales or elongated into a colpus aequatorialis. Colpi transversales costate to varying degrees at edges. Exine less than 1 to ca. 2.5 μ thick. Ectexine generally thinner than endexine except sometimes at poles. Ectexine varies from smooth with very indistinct pattern to scabrate with distinct columellae.

1. *R. Mangle* L.: Grains 11–28 μ, spheroidal to subprolate; circular to triangular in polar view. Shape generally well-defined and very regular, ranging from circular to oval with a slight equatorial bulge in equatorial view. Costae transversales well developed. Small grains psilate; exines of large grains scabrate with distinct columellae forming regular patterning in surface view. Colpi transversales of medium width. Plate XL, fig. 3.

2. *R. samoensis* Salv.: Grains 14–28 μ, subprolate; nearly rhomboidal in equatorial view; grains mostly well formed, regular in shape. Costae colpi and costae transversales very narrow. Ectexinous colpi constricted at junction with colpus transversalis. Columellae not so distinct as in *R. Mangle;* ectexine psilate to very finely scabrate. Ectexine heavier at poles.

3. *R. racemosa* G. F. W. Meyer: Grains 15–26 μ in breadth, typically oblate-spheroidal to suboblate; colpi transversales very narrow, often ragged. Grains tend to crumple more than do those of *R. Mangle* L. Ectexine psilate and appearing almost structureless in most grains. Surface pattern indistinct. Plate XL, figs. 1 and 7.

4. *R. Harrisonii* Leechm.: This description does not

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[4] Terminology from Erdtman (1952) and Faegri and Iversen (1964).

include the *R. brevistyla*-type, as none were recognized in this fossil assemblage. Pollen 12–24 μ. Grains are generally ill-formed, tending to crumple easily. Shape, size, and sculpturing very variable.

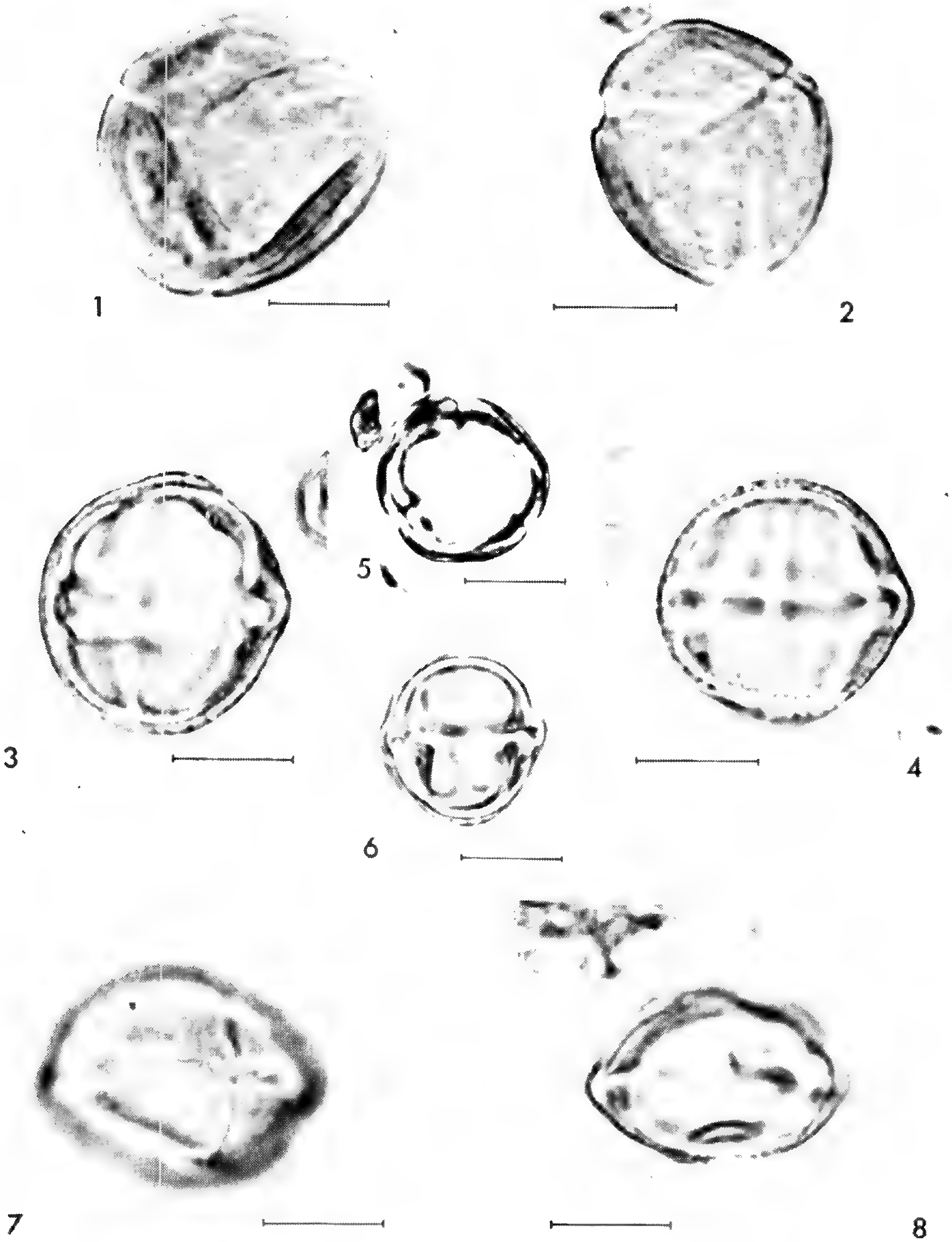
Although pollen of all of these species of *Rhizophora* is quite similar and pollen of each species shows morphological variation, the species can be separated to some extent. Pollen of *R. Mangle* is quite distinct from that of all the other species except some grains of *R. samoensis.* Typical, well-formed pollen of *R. samoensis* is also distinct from that of the other species, with the exception of some grains which, as stated above, may be confused with those of *R. Mangle.* Crumpled grains of *R. samoensis* are similar to some grains of *R. Harrisonii.*

Pollen of *R. racemosa* is distinctive in being oblate-spheroidal, and thus cannot be mistaken for pollen of any of the other types, except for that of some grains of *R. Harrisonii.* Modern pollen of *R. Harrisonii* has not been abundantly available. In order to determine whether the pollen of *R. Harrisonii* is distinctive and clearly distinguishable from the other species, much more flowering material is needed. In addition, further taxonomic work is needed on the entire genus to determine if the presently disputed species boundaries can be more clearly defined. Until such work is completed, it will remain somewhat hazardous to make species determinations of fossil *Rhizophora* grains on a statistical basis.

Fossil Rhizophora Pollen

On the basis of morphology as described above, the fossil *Rhizophora* pollen has been divided into two maior groups which reflect not only the pollen morphology but also the division of the species of *Rhizophora* into two groups occupying somewhat different habitats. The first is composed of typical *R. Mangle*-type and *R. samoensis*-

Plate XL



Modern and fossil *Rhizophora* pollen types. 1, *Rhizophora racemosa*, modern; polar view. 2, *Rhizophora racemosa*-type; fossil, Simojovel; polar view. 3, *Rhizophora Mangle*, modern; equatorial view. 4, *Rhizophora Mangle*-type; fossil, Simojovel; equatorial view. 5, *Rhizophora* sp.; fossil, Simojovel; polar view. 6, *Rhizophora Mangle*-type; fossil, Mina Palo Blanco; equatorial view. 7, *Rhizophora racemosa*, modern; equatorial view. 8, *Rhizophora racemosa*-type; fossil, Simojovel; equatorial view. The scale on each figure is 10μ.

type pollen, and will be designated as *R. Mangle*-type.[5] The second consists of pollen of *R. racemosa*-type and *R. Harrisonii*-type and will be designated as *Rhizophora*-spp. In this group are included fossil *Rhizophora* grains present in very small quantities in several of the fossil samples which resemble those of *R. Harrisonii* but which are not completely distinct from somewhat crumpled grains of *R. samoensis*. Since these grains occur consistently together with high percentages of *R. racemosa*-type and *R. Harrisonii*-type, and decrease in percentage as *R. Mangle*-type increases, their affinity is probably with the former group. The category "*Rhizophora* affinity uncertain" was established to include grains which, due to poor preservation or unfavorable orientation, could not be placed with certainty in one of the major categories.

It is not proposed in this study to attempt a rigorous statistical treatment of the observed *Rhizophora* pollen nor to identify minor components of this pollen flora. An initial investigation of the slides indicated that a count of 200 grains per sample was sufficient to suggest the major outlines of the vegetation and the relative frequencies of the most abundant pollen types. For this purpose, slides were scanned at 300×. Final determinations were made at higher magnifications. The first 200 identifiable pollen grains were recorded. Record was kept also of the relative percentages of pollen and fungal spores in each sample. Data concerning the relative abundances of different *Rhizophora* pollen types and of

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[5] Nomenclature of the fossil pollen follows the principles outlined by Zagwijn (1960). As summarized by Muller (1964, p. 35), these may be stated as follows: "If a fossil pollen type has been assigned to a given natural taxon, this expresses the author's confidence in a high degree of probability for the identification. If, however, the word "-type" is added this means that the pollen type is known to occur also in a related taxon of the same rank."

fungal spores compared with total pollen, are summarized in Table I. The significance of these percentages is discussed in a following section.

THE ECOLOGY OF MODERN MANGROVE AND ASSOCIATED VEGETATION

The term "mangrove" is applied both to the physiognomically similar but taxonomically diverse group of salt-tolerant semi-aquatic woody plants that grows along silted shorelines and in brackish water throughout the tropics and to any member of this vegetation. The New World mangrove association includes four major genera: *Rhizophora*, *Avicennia*, *Laguncularia* and *Conocarpus*. Of these, only *Rhizophora* and *Avicennia* have more than one species. An additional minor component of mangrove vegetation on the west coast of Central and South America is *Pelliciera rhizophorae* Pl. & Tr. Some workers would also include as "mangroves" plants with a limited salt tolerance that occur in swamps behind the "true mangroves", e.g., *Cassipourea* (Cuatrecasas, 1958).

The ecology of New World mangroves has been studied by Chapman (1939), Cuatrecasas (1958) and others. Lindeman (1953) has given a complete description of the vegetation types of coastal Surinam, including the mangrove, which is extended by Muller (1959) and van der Hammen (1963) to the north coasts of Venezuela and British Guiana. Cuatrecasas (1958) has described the situation along the coasts of Colombia and Ecuador. Only brief descriptions of mangrove vegetation are available for Mexico and Central America.

Studies of recent pollen sedimentation by Muller (1959, 1964), van der Hammen (1963) and Spackman, *et al.* (1964) indicate that, among the mangroves, only species of *Rhizophora* and *Avicennia* are likely to be represented in the pollen record to any great extent. Thus,

Table I. Relative abundance of *Rhizophora* pollen types and fungal spores.
Explanation: np – not present; p – present in negligible amounts.

Sample Number and Locality	% $\frac{\text{Rhizophora}}{\text{total pollen}}$	% $\frac{\text{R. Mangle-type}}{\text{total Rhizophora}}$	% $\frac{\text{Rhizophora spp.}}{\text{total Rhizophora}}$	% $\frac{\text{Rhiz. aff. uncertain}}{\text{total Rhizophora}}$	% $\frac{\text{fungal spores}}{\text{total pollen}}$
I Simojovel	90	p	85	15	10
II Mazantic	66	p	40	60	10
III Pabuchil	45	20	40	40	111
IV Huitiupan	45	15	50	35	62
V Portugal #1	30	np	95	p	100
VI Portugal #2	40	np	75	25	37
VII Las Cruces	p	np	np	p	np
VIII Palo Blanco #1	50	np	35	65	16
IX Palo Blanco #2	75	5	35	40	38
X Naranjo #1	6	np	20	80	14
XI Naranjo #2	16	np	20	80	54
XII Jolpabuchil	p	np	np	p	np

any palynological interpretation of mangrove vegetation rests likewise primarily upon reconstruction of conditions indicated by these two genera, and particularly by *Rhizophora*, the most abundant pollen source. More studies on present-day pollen sedimetation are needed before anything other than very general ecological conclusions may be reached. However, the various species of *Rhizophora* do provide significant, although considerably limited, ecological data. The abundant incorporation of *Rhizophora* pollen into sediments is a result, in part, of the manner in which the pollen is released. Rhizophoras produce a large amount of small light pollen which is released into the bud before anthesis and much of which is retained by the hairy petals and is not blown away or carried by insects when the bud opens. Both the anthers and the petals fall from the trees into the water within two or three days after the bud opens, carrying the pollen directly into the water (Guppy, 1906).

Rhizophoras are well adapted to growth in regions of extreme tides, because of the ability of the viviparous seedlings to root rapidly and to withstand inundation. Under these tidal conditions, it forms broad bands along the western coast of South America. Where tides are of low amplitude, for example along the north coast of South America, *Rhizophora* may be scarce or absent along the coast.

Rhizophora Mangle (red mangrove), the most widespread species, is a pioneer which establishes itself successfully on unconsolidated silt if its seedlings are left unflooded for as little as 48 hours. It appears to be the most salt-tolerant of the New World mangroves, occurring both on the open sea shore (if protected from extreme wave action) and in areas where salt concentrations in the soil are abnormally high due to periodic flooding and evaporation (Guppy, 1906; Savory, 1953; Jonker, 1959). Its luxuriant growth in such areas as southern Florida, however, indicates that it does not always require this high salinity. Here, the usual species found in more brackish water are absent.

Rhizophora Harrisonii, the second most widespread of the species, is characteristic of brackish estuaries and rivers in West Africa, on both the east and west sides of the South American continent and on the west coast of lower Central America. The tree forms great expanses of tall forest bordering the rivers in Surinam (Jonker, 1959).

Rhizophora racemosa is more restricted, the species having never been found on the west coast of the Americas. *R. racemosa* is considered the least salt-tolerant of the Rhizophoras, and it is found far up tidal rivers, growing together with *R. Harrisonii* and beyond the range of that species into nearly fresh water. Both Savory (1953) and Jonker (1959) consider it the least salt-tolerant of the *Rhizophora* species.

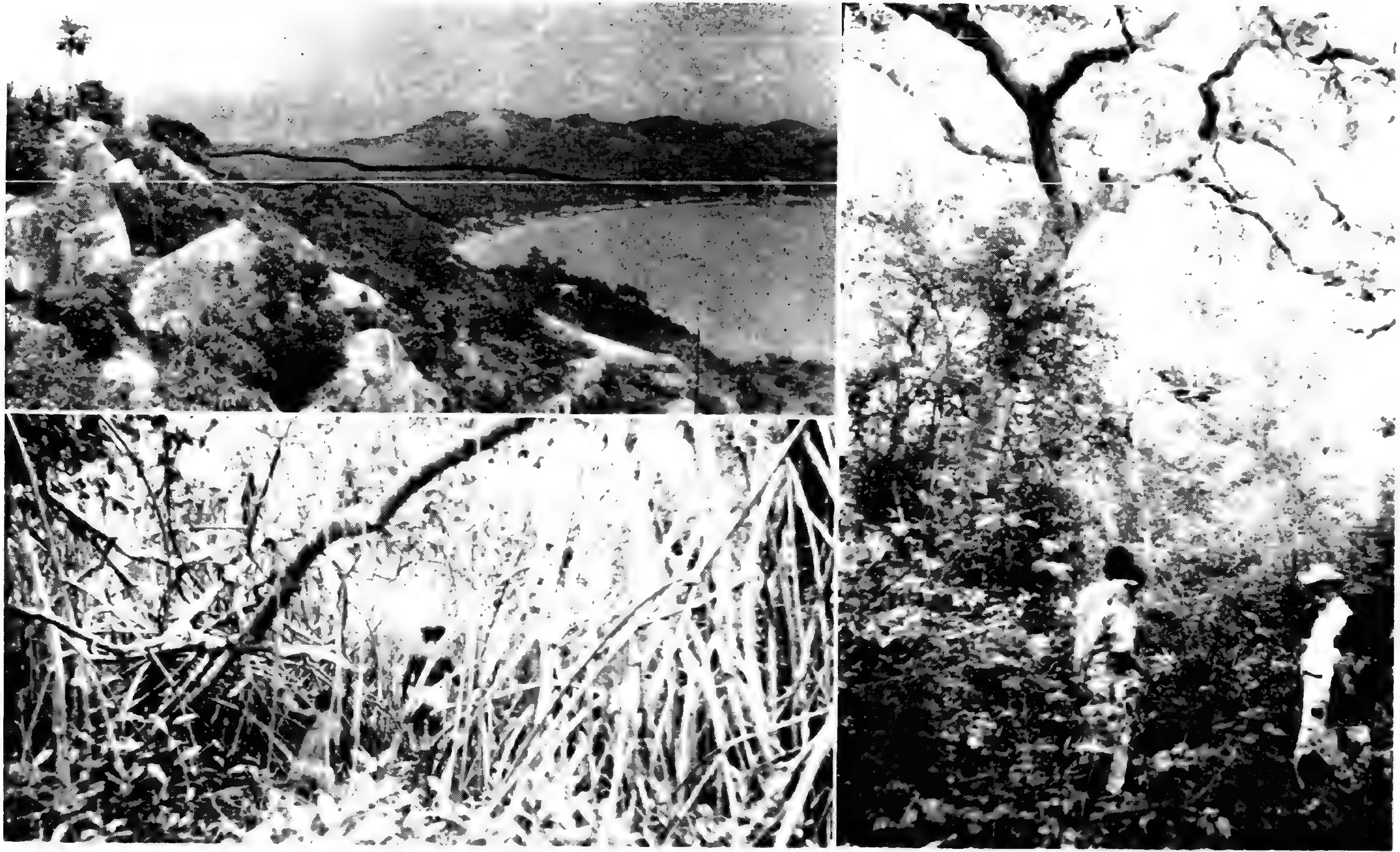
The species occurring on higher ground within or near the mangrove and in fresh-water swamps behind or upstream from the mangroves vary from region to region. In the coastal regions of Surinam, Venezuela and British Guiana, where *Avicennia* is the dominant mangrove, the region behind the mangrove belt is a complex mosaic of vegetation types controlled by local soil and water conditions. Especially important is the mixed swamp forest (including *Pachira* (*Bombax*) *aquatica* and *Pterocarpus officinalis*) which may form extensive stands behind the mangroves. There also are often palm swamps; herbaceous swamps, often dominated over great expanses by ferns (e.g., *Acrostichum aureum*); as well as special vegetation types on sandy beach ridges and high natural levees. This pattern is very different from that described by Cuatrecasas and others for the west coast of South

America. Here, behind the *Rhizophora* zone, the backswamp vegetation is usually a mixed swamp forest type which forms a gradual transition to rain forest. In Mexico and some other areas of Central America, where hills come down to the shore, such a transition belt is usually narrow or absent.

As previously noted, *Hymenaea Courbaril* today frequently occurs in habitats closely associated with mangroves along the Pacific coast of Central America. This has been observed by the senior author along the Guerrero coast in Mexico and along the Osa Peninsula in Costa Rica. Lindeman (1953) also has reported *H. Courbaril* as occurring in Surinam on low sand ridges near the mangroves.

The most significant present-day situation observed by the senior author that might represent possible site conditions like one of those in which the Chiapas amber could have been deposited occurs around Puerto Márques Bay, Guerrero, Mexico. Here, *H. Courbaril* is one of the dominant trees in a Tall-Medium Subdeciduous forest-type (Miranda and Hernández-X, 1963) on the hills sloping either to the ocean or to bays (Plate XLI). *Hymenaea* occurs along rivers that enter the lagoons and also on sandy ridges that interdigitate into the lagoon (Plate XLI). These lagoons are fringed primarily by *R. Mangle* and on higher ground by *Laguncularia racemosa* (Plate XLI). *Hymenaea* also may be found on dune and beach ridge vegetation along the coast in Guerrero and Oaxaca. Around Puerto Márquez Bay, it is easy to visualize how resin from *H. Courbaril* would be deposited into the lagoon with fringing mangroves. A single severe flooding could wash away resin collected in the soil, and the stilt roots of *Rhizophora* offer an excellent mechanism to "trap" the resin. Also, resin may easily be transported down rivers that enter the bays and

PLATE XLI



(Top, left) Puerto Márquez Bay, Guerrero, Mexico, with *Hymenaea Courbaril* as one of the dominant trees in hillside vegetation. Mangrove vegetation along lagoons is outlined. *Hymenaea* also occurs on sandy ridges extending into the lagoons. (Right) *Hymenaea Courbaril* L. on sandy ridges about 200 yards from lagoonal mangrove swamp shown in top, left. (Bottom, left) Typical *Rhizophora Mangle* stilt roots occurring in Puerto Márquez mangrove swamp with *Hymenaea Courbaril* on adjacent sand ridge.

lagoons, for it was frequently observed that soil around the bases of streamside *Hymenaea*, where resin often accumulates, has been washed away, exposing the roots. In general, it has been observed that present-day habitats of *H. Courbaril* offer a number of possibilities for resin to be deposited in a site dominated by mangrove vegetation.

Interpretation of Rhizophora Pollen Data from Amber-bearing Sediments

Muller (1959) studied the pollen of mangrove and associated vegetation in sediments of the Orinoco delta and the Gulf of Paria near Trinidad. He was also able to define palynological provinces in these sediments on the basis of pollen composition and abundance. He has shown that the major factor influencing pollen deposition there is water transportation. He further points out that pollen studies may be of use in facies determination and reconstruction of ancient basins of sedimentation. Van der Hammen (1963) extends Muller's observations and concludes the following in regard to deposition of mangrove pollen in British Guiana (pp. 140–141):

1) "In a Mangrove forest the percentage of *Rhizophora* + *Avicennia* may be between 45 and 95%. If the Mangrove forest forms only a narrow fringe, the sediment tends to have lower percentage, as for instance 30."

2) "Mud deposited in front of the coast-line, may have percentages of *Rhizophora* + *Avicennia* pollen of 30–50%. Further offshore the percentage of *Rhizophora* pollen increases and may be up to 70% or more."

3) "Swamp forests immediately behind the Mangrove forest may have 45-10% (or less) and Swamp forests farther inland may have 10-0% *Rhizophora* pollen in the sediment."

4) "Heavy pollen grains. . . rarely are found in sediments in front of the coastline in any appreciable percentage. Lighter pollen grains are carried seawards more easily and may be sedimented at considerable distance from the shore."

5) "The Fungi spore content is in general highest in the swamp and forest area behind the coast-line and ranges between 10 and 100% of the pollen sum, although both higher and lower values may occur (0–500%). In the Mangrove belt the percentages are usually relatively low, ordinarily varying between 3 and 10%. In a zone in front of the coast percentages are generally low (1–3%), and spores of this type are not found farther offshore."

Although Muller's and van der Hammen's conclusions cannot necessarily be assumed to represent conditions along the Central American coasts, they provide a tentative framework for interpretation of the Chiapas sediments. Pertinent palynological data from these sediments are summarized in Table I. The relationship of *Rhizophora* pollen to total pollen content of the sediments is represented by "percent *Rhizophora* pollen." "Total *Rhizophora*" constitutes the sum of all *Rhizophora* types as well as those with uncertain affinities. In an attempt to gain more detailed ecological information from the total *Rhizophora* category, it was divided into three groups. The *R. Mangle*-type which, as established by ecological studies of modern mangroves, represents pollen of the species occupying a more saline habitat; *Rhizophora* spp. (*R. racemosa*-type and *R. Harrisonii*-type) which represents pollen of the species living in less saline (brackish and fresh) habitats; and *Rhizophora* with uncertain affinities. The percentage relationship of each of the first two groups to the total *Rhizophora* pollen, therefore, gives a possible indication of a more saline or more brackish environment. However, this conclusion must remain tentative, until statistical analyses are undertaken of *Rhizophora* pollen presently being deposited in various types of marine and brackish environments, to show whether the relative percentages of the two types of pollen actually reflect the two vegetational groups. The percentage of fungal spores to total pollen is considered by van der Hammen to represent a possible index of "landinwards" conditions. Since the identification of individual grains as belonging to the *Rhizophora Mangle*-type or *Rhizophora* spp.-type may not always be certain, a few grains in each sample may have been misidentified. Therefore, percentages given in Table I are approximate.

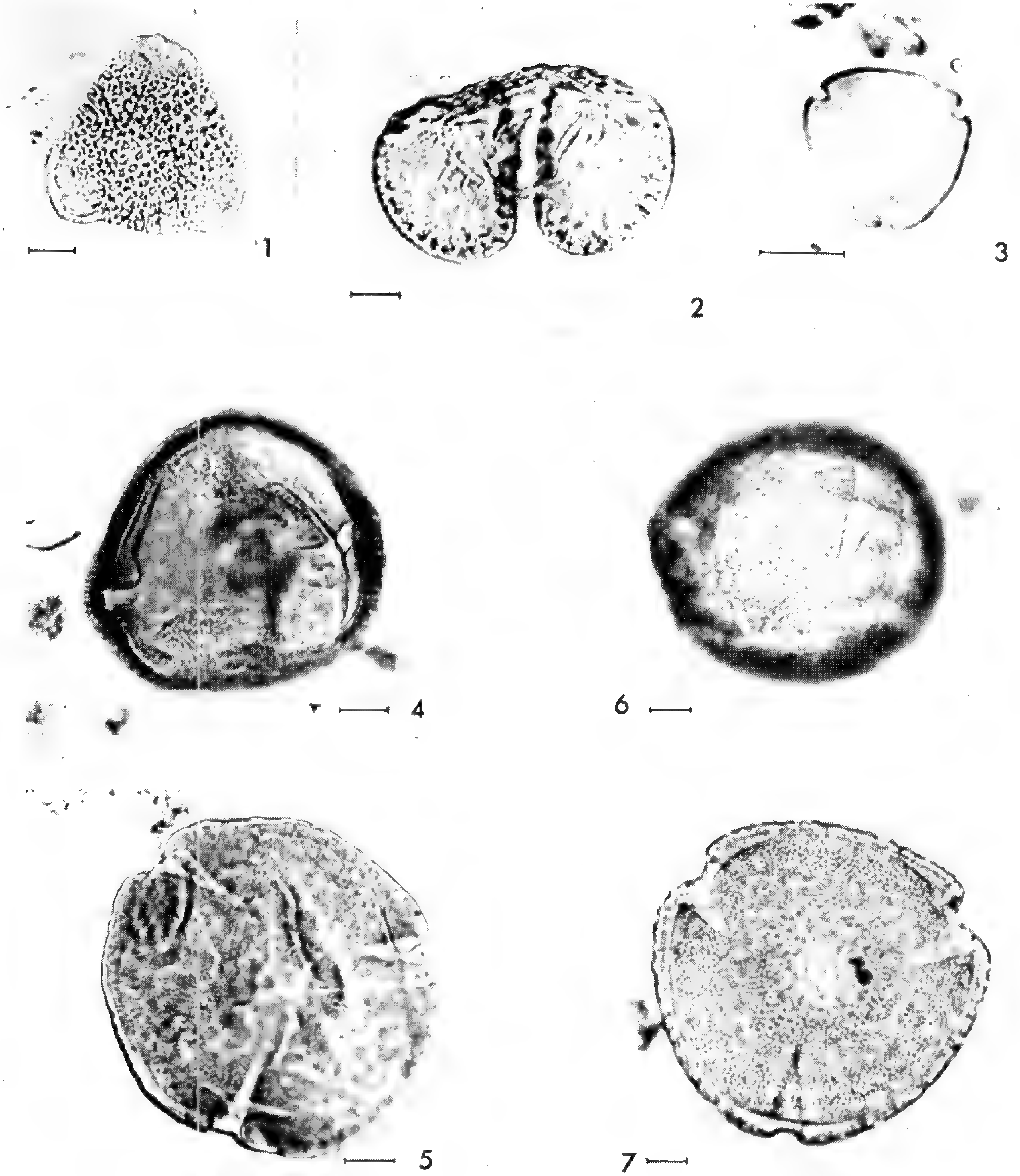
Sample I from Simojovel appears from several lines of evidence to represent deposition at the actual site of a mangrove swamp. The sample is lignitic in nature, and mangroves today are known to be active peat formers (Chapman, 1939; Spackman *et al.*, 1964). The total content of *Rhizophora* pollen is very high (90%); associated pollen is large and heavy, and would not be expected to be carried far from its source plant. The fungal spore content is very low. The extremely high percentage of *Rhizophora* pollen also suggests that the source area was not a narrow fringing mangrove but an extensive forest. *Rhizophora Mangle*-type is present (Plate XL, fig. 4), but in negligible percentages, suggesting that the mangrove forest here was composed largely of individuals belonging to the *Rhizophora* spp. division (Plate XL, figs. 2 and 8) and grew perhaps under brackish conditions. The occurrence in this sample of pollen very closely resembling that of *Pelliciera rhizophorae* (Plate XLII, figs. 4–7), a highly specialized member of the Theaceae, is very interesting. Since the range of this monotypic genus today is restricted to mangrove swamps along the Pacific coast from Costa Rica south to western Colombia

(Johnston, 1949), its presence in this sample suggests a wider distribution in the past.

Sample II, Mazantic, is very closely related to that from Simojovel (I) in lithology. Approximately 66% of the grains are recognizable as *Rhizophora*. Although poor preservation of the sample made division of the grains into the two major *Rhizophora* categories difficult and somewhat uncertain, a large proportion of the grains could be assigned to the *Rhizophora* spp. group. *R. Mangle*-type was present only in very low percentages; the same is true for fungal spores. From the general similarity of the two sediments, it is suggested that the samples from Simojovel and Mazantic represent a similar habitat.

Samples III and IV, from Pabuchil and Huitiupan, although somewhat different lithologically, appear to be comparable palynologically. In both, nearly half of the pollen (45%) encountered is of the *Rhizophora* type. Of this, a comparatively large percentage (20%) is definitely *R. Mangle*-type. The category *Rhizophora* affinity uncertain here includes a number of grains referable probably to *R. Mangle*-type, seen in polar view. Such grains were placed in this category, since it is often difficult to distinguish modern *R. Mangle* in this orientation from other species. In both samples, fungal spores are abundant with respect to the total pollen. Other microfossils include pollen very closely resembling that of *Engelhardtia* (Plate XLII, fig. 3), a very low percentage of pollen of the *Pelliciera*-type, and a few Hystrichosphaerids in the Huitiupan sample. The two are similar in the percentages of unidentified tricolporate and monocolpate pollen; marine shells occur in both samples. These samples represent probably similar habitats. By van der Hammen's criteria, the relatively high fungal spore content suggests that the site was very near the coastline,

PLATE XLII



Miscellaneous fossil pollen types associated with *Rhizophora*. 1, *Pachira*-type: fossil, Portugal. 2, *Podocarpus* sp., fossil, Pabuchil. 3, *Englehardtia* sp., fossil, Pabuchil. 4, *Pelliciera*-type; fossil, Simojovel; equatorial view. 5, *Pelliciera*-type; fossil, Simojovel; polar view. 6, *Pelliciera rhizophorae;* modern. 7, *Pelliciera rhizophorae;* modern. The scale on each figure is 10μ.

just behind, or perhaps just offshore; the presence of large, heavy grains also supports this. The relatively high percentage of mangrove pollen suggests that a mixed *Rhizophora* swamp was present in the vicinity. The higher percentage of *R. Mangle*-type pollen and the marine shells may indicate more coastal conditions than those suggested by samples I and II.

The two samples from Portugal (V and VI) are similar in lithology and in the presence of moderate percentages of *Rhizophora* pollen which is referable to the *Rhizophora* spp. division. The majority of the pollen is made up of various unidentified tricolpate and monocolpate pollen. Small quantities (3–7%) of *Engelhardtia*-type grain occur. Sample VI contains several interesting non-rhizophoroid grains, among them large planar tetrads comparable to those of the Annonaceae and a grain of *Pachira aquatica* Aubl., a member of the Bombacaceae today characteristic of fresh-water swamp regions behind the mangrove as well as of streamsides. On the basis of these non-rhizophoroid grains, these samples would appear to represent a somewhat less brackish facies than any of the above and suggest deposition in a swamp forest adjacent to mangroves. However, the presence of marine fossils in the same samples casts some doubt on this interpretation.

Pollen in Sample VII, a coarse-grained siltstone from the Las Cruces slide, was infrequent and poorly preserved. Those grains encountered appeared to be *Rhizophora*, perhaps of the *Rhizophora* spp.-type. A relatively large piece of amber, however, from Las Cruces has oysters embedded in the surface, indicating that the resin was still soft when it entered the marine environment. This suggests either that the trees producing the resin were growing along the shore or that the resin was transported only a short distance before the shells were caught in it.

The two samples from Palo Blanco (VIII and IX) are generally similar. Sample VIII is from the bed immediately underlying that of Sample IX and appears to contain no *R. Mangle*-type, and though there is much uncertainty about the affinity of many individual grains due to poor preservation, it is improbable that a significant number *R. Mangle*-type have been overlooked. *Engelhardtia*-type makes up 22% of the total recognizable pollen. The genus *Engelhardtia* today is restricted to the highland areas of Mexico and Central America (Miranda and Sharp, 1950), and to southeast Asia, where it is common in the hills of coastal regions (S. Hu, pers. comm., 1965). The abundance of grains of this type in the Chiapas sediments (and in other early Tertiary sediments, cf. Traverse, *Engelhardtia Spackmanii*) suggests either that the grain represents an extinct line with pollen very similar to the modern *Engelhardtia*, or that the genus has changed both its range and ecological preference in the New World since the Oligo-Miocene. Sample IX contains a small percentage of unmistakable *Rhizophora Mangle*-type pollen and a number of *Rhizophora* affinity uncertain grains which belong probably to *R. Mangle* and also 7% *Engelhardtia*. The matrix of both samples contained glauconite and marine fossils. The high percentage of *Rhizophora* pollen and the presence of fungal spores suggest deposition in the vicinity of mangrove vegetation. There is some carbonized material which might result from re-deposition of older material, as is known to occur in levee deposits in the Orinoco delta (Muller, 1959). However, percentages of *Rhizophora* and other small, light pollen are known to increase also in sediments quite distant from shore. Most of the grains encountered in these sediments are in the 20–40 μ size range and indicate possibly an offshore depositional environment.

The samples from Mina de Naranjo (X and XI) are presumed to be roughly the same age as in the Mina Palo Blanco sediments. Samples X and XI are similar in the relatively low percentages of *Rhizophora* pollen present and in their poor preservation. Only a few grains in each sediment could be confidently placed in one of the two major divisions. The remainder were placed with those of uncertain affinity, but most grains belong probably to the *Rhizophora* spp. group. In Sample X, fungal spores were present in low percentages, and the majority of the pollen were unidentified tricolpate and monocolpate types. There were 7% fern spores. Pollen of *Podocarpus* (Plate XLII, fig. 2) occurs infrequently in these sediments. *Podocarpus* is the only conifer present, other than a few poorly preserved grains probably of *Pinus*. Sample XI contained a somewhat larger percentage of *Rhizophora* pollen, including a number of *Rhizophora* spp.-type grains, and a considerably larger percentage of fungal spores. The percentage of *Engelhardtia*-type decreased to 3%, and the number of fern spores remained high (7%). The depositional environment of these samples is not suggested on the basis of their pollen content. The low percentages of *Rhizophora* might be interpreted as indicative of deltaic deposits such as those investigated by Muller (1959, Pica E), or of foreshore deposits. The generally moderate to high percentages of fungal spores in these sediments and the Palo Blanco samples above, according to the ideas of van der Hammen (1963), seem higher than those which would be expected in an offshore environment; many more data from modern depositional environments, however, are needed here. Amber from these deposits does have impressions of marine gastropods, which again suggests that the resin-producing trees were close to the shore so that the resin was deposited in the water (or on the strand line with the shells) before it hardened.

Sample XII, from Jolpabuchil, contained relatively small amounts of poorly preserved pollen and great quantities of carbonized debris, which might perhaps have been re-deposited material. Recognizable tracheids of the sort described by Muller (1959) as re-deposited from Eocene sediments in Venezuela were frequently encountered. Pollen grains included some *Rhizophora* of uncertain affinity. The presence of marine fossils indicates probably an offshore environment.

Summary and Conclusions

Pollen from 12 rock samples from Chiapas, Mexico, either from strata containing amber or immediately adjacent to them, were studied. These samples do not vary greatly in lithology, ranging from calcareous siltstone or silty shale to calcareous sandstone. They are all from strata considered to be latest Oligocene or earliest Miocene in age and represent apparently a relatively small interval of geological time. The palynological data indicate development of mangrove vegetation of considerable complexity at or close to the site of deposition of the amber. The most important elements of the vegetation from the standpoint of the pollen record were members of the genus *Rhizophora*, in all probability representing several species of different ecological preferences. Although only one other genus known to be a member of the New World mangrove association today (i.e., *Pelliciera*) was encountered, the possible presence of others is not precluded. As studies by Muller (1959), van der Hammen (1963) and Spackman *et al.* (1964) have indicated, other mangroves such as *Laguncularia* and *Conocarpus* may be present, but only *Rhizophora* and *Avicennia* pollen commonly occur in abundance in recent sediments. Until more careful studies of the delimitation of different mangrove species and their pollen are made, and investigation of pollen sedimentation on the Central American coasts is carried out, all paleoecological conclusions regarding the Chiapas mangrove association must be tentative.

Despite the fact that it is not possible from presently available data to reconstruct the vegetation types at or close to the depositional site of the amber, certain environmental conditions are strongly suggested. It appears that, at certain sites, the beds from which the samples came were deposited under brackish conditions with a predominance of *Rhizophora* (Simojovel and Mazantic); in others, in a more coastal, saline mixed *Rhizophora* vegetation (Pabuchil and Huitiupan); in somewhat less brackish conditions, suggesting deposition in or near a backswamp forest adjacent to *Rhizophora* (Portugal); or possibly in foreshore conditions in the vicinity of mangroves (Mina Palo Blanco and Mina de Naranjo). These data likewise support the geological evidence that deposition of the amber-bearing beds took place, in general, along a coastline of a shallow, tropical sea with occasional shoreline fluctuations. Evidence that the amber was produced by possible ancestral populations of *Hymenaea Courbaril* also receives corroboration, as this species today commonly occurs in habitats in which the resin produced could easily enter mangrove deposits. Likewise, the significant absence of *Pinus* in the amber-bearing beds, except for a rare, eroded specimen, seems to support a source tree other than pine. Since pine produces such large quantities of pollen that get widely distributed by wind, its scarcity tends to indicate that pines were probably not present within this vicinity.

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APPENDIX

Following is a brief lithologic description of the samples studied. Locality numbers in parentheses with "B" and "D" prefixes refer to materials on loan to the Botanical Museum of Harvard University from collections of the University of California Museum of Paleontology. Locality numbers with "Pl" prefixes are in the Harvard University Paleobotanical collections.

Sample I (D-621) was collected from the landslide on the east side of the village of Simojovel. It is a brownish to reddish, coarse-grained siltstone, including fine seams of lignitic material.

Sample II (Pl-32) was collected upstream from Mazantic from a 5-10 foot lignitic bed containing amber.

Sample III (Pl-7) was collected from Pabuchil (Rancho Alegre) slide two miles northwest of Simojovel. It is a sandy, dark-grey calcareous silt stone from an amber-bearing interval with marine fossils.

Sample IV (Pl-8) was collected at an outcrop along the road to Huitiupan. It is a leached calcareous sandstone with carbonaceous sandstone with carbonaceous streaks and contained fairly abundant amber.

Sample V (B-4178) was collected at the Portugal (also known as Santa Catarina) slide on the north side of the Rió Ancora valley. It is a greyish-brown siltstone containing marine fossils from a bed immediately below the amber-bearing strata.

Sample VI (B-4177) also was collected at Portugal slide from a blue silty clay 100 feet in the section above Sample V and 4–5 feet above a thin lignitic zone.

Sample VII (Pl-33) was collected at the Las Cruces slide about 15 miles southeast of Simojovel. It is a brownish, coarse-grained siltstone with some lignitic material, from a 4–8 foot lignitic interval immediately above beds containing amber.

Sample VIII (D-614) was collected from a marine glauconitic sandy shale at Mina Palo Blanco, Finca La Primavera on the San Pedro River northwest of Simojovel.

Sample IX (D-615) was collected from a marine black silty-shale at Mina Palo Blanco from the bed immediately above the previous sample.

Sample X (B-8106) is a marine glauconitic silty-shale collected at Mina de Naranjo, Finca La Primavera.

Sample XI (B-8105) is a marine glauconitic silty-shale collected at Mina de Naranjo.

Sample XII (B-4180) was collected at Jolpabuchil. It is a greyish-black carbonaceous siltstone with marine fossils.