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Tributes to Harold E. Moore, Jr.

Hal Moore: A Scientific Contribution

I first met Hal Moore when he was working in London at the Royal Botanic Gardens, Kew in the summer of 1956, a place I also was visiting at the time, on my first leave from West Africa. We had corresponded previously because I had already initiated studies on the systematic anatomy of palms as a student at Kew, prior to working on the family in Singapore and Ghana. Hal was eager to learn how my observations on the distribution of anatomical characters in palms correlated with his developing ideas about the systematics of the family. This was an early indication of Hal's appreciation that systematics should be broadly based. He later was to incorporate information from many other disciplines into the superstructure he was building and I was only one of a number of young scientists whom Hal encouraged in their particular field of specialization.

At Kew an instant rapport was established, not merely because we had much common ground to cover in our discussion, but also because his open spirit and free presentation of his thoughts made the communality of our interests quite clear. David Bates (*Principes*, Jan. 1982) has already indicated how this was a general response that Hal drew from a diversity of acquaintances from all walks of life and I am sure many other readers will be able to identify with these sentiments when they recall their first meeting with Hal.

Our conversations were not restricted to palms and frequently were quite philosophical. We discussed at one stage the intellectual satisfaction of scientific research and the process of discovery which it involved, a satisfaction which was more than adequate compensation for the

frequent lack of monetary reward. At one point he spread his fingers on the table before him and said with a twinkle in his eye "Yes, I have no diamonds on my fingers, but the diamonds in my mind's eye are far more valuable."

This continuing frankness and enthusiasm had the infective consequence that I subsequently scarcely ever published a scientific paper on palms without first sending this to Hal for his evaluation. Sometimes this got me into trouble because he did not always agree with my conclusions or even observations, but even if his criticisms were penetrating they were also well reasoned and fair, just the thing to make those diamonds in the mind's eye sparkle. In addition if he could be won over to your point of view he became as staunch an advocate as he had been a critic and if I lost some battles, I also won a few too and I treasure those victories as triumphs of rationality.

Our meeting in London that year was very influential to my own career. Hal mentioned that Fairchild Tropical Garden was looking for a scientist who was interested in the development of their research program and that it would be particularly appropriate for somebody working on palms to be involved. Subsequently I visited the United States, with Hal as my primary contact; we drove from Ithaca to Miami where I had the chance to see at first hand the splendid opportunities for research on tropical plants that the Garden's rich collections offered. It did not take much deliberation to make up my mind and I was established at Fairchild late in 1960—as soon as my existing commitments and the U.S. Immigration Service allowed. During those early days Hal continued to be a frequent visitor; we worked together on a number of problems



1. Harold E. Moore, Jr. at Fairchild Tropical Garden, July 1973. Photo by G. R. Proctor.

and a steady stream of his students were drawn as best we could into the developing program. I think neither Hal nor the Garden's administration could have had a clear idea of how the program would develop but history suggests that they got it right because the Garden's research activities have gone from strength to strength and become quite diversified so that an international reputation has been established quite out of proportion to the number of people involved and the size of the facility. His direct influence was very strong.

My own professional development depended much on the opportunities that Hal had effectively laid before me, opportunities which could scarcely be equalled elsewhere. Further advancement took me away from the environment which first nurtured me in the United States, but the initial debt is obvious. This, I am sure, documents just one example of the way Hal's generous and positive friendship was individually beneficial, the ultimate out-

come was that scientific endeavor was facilitated. But these are personal recollections; I would like to go on to exemplify Hal's scientific contribution by putting his work on the systematics of palms in a historical context in a way which has obvious relevance to readers of *Principes*, especially as David Bates has eloquently outlined the main features of Hal's scientific achievements.

Palm systematics—a historical overview

Linnaeus knew the palms only from the 12 species he described, but this was sufficient to circumscribe the family and suggest it to be unique and therefore isolated, a fact with which most systematists still concur. A number of monocotyledonous families have some relationships, but modern research tends to set the palms even further apart from them, rather than suggest a particular group with close affinity.

Most significant developments have therefore been concerned with the subdivision of the palm family. The foundation for this was that developed by K. F. P. von Martius in his sumptuous "*Historia Naturalis Palmarum*," published in three volumes over the period 1829–1853. This work was based partly on material assembled by von Martius himself during his own travels in South America, together with information provided by several specialist contributors, notably that of the anatomist Hugo von Mohl. Additional material from other parts of the tropics was either in the form of dried collections or plants cultivated in the great stove houses of Nineteenth-Century Europe. The essential tradition, however, was established that the systematist needed extensive field familiarity with the palms in natural environments if he were to know them well. Martius recognized many major groups of palms whose discreteness is still accepted and he was able to document his subdivision with a wealth of detail which reflected his great familiarity with palms as growing organisms. That tradition has been maintained, by and large, to the present since palms are totally unsuited to herbarium study, consequently the most significant advances have been made by botanists who made many of their own collections.

A process of refinement of the von Martius system was carried out by a number of systematists notably Bentham and Hooker (1883) and Drude (1889). The basis for Hal Moore's own beginnings was perhaps the system provided by the German botanist Burret (1953) and particularly by the great Italian botanist Odoardo Beccari. Beccari made extensive contributions in the form of several large monographs and had field familiarity with palms resulting from his extensive journeys in southeast Asia. He never published his final views in his own lifetime, but a synopsis prepared by R. E. G. Pichi-Sermolli dealing specifically with the arecoid alliance was published in 1955.

This was the legacy which Hal Moore inherited when he began his studies on palms in the early 1950's. It was founded on classical botanical lines and used evidence derived from external morphology in its assessment. Even so the historical basis was broad, because not only features of flowers and fruits but seedling morphology, inflorescence structure and leaf form were incorporated. Von Martius, for example, recognized that palms could be divided into two major categories according to the orientation of the folds of the leaf segments, a seemingly subtle distinction, but one more fundamental than the obvious difference between palmate and pinnate leaves.

Hal Moore built on this foundation in several ways. He broadened the scope for morphological study and showed clearly that the inflorescence *in toto* provided taxonomic features, which were only evident when the whole branch complex was dissected from the crown, and seen at different developmental stages. This dynamic approach characterized much of his morphology; few systematists have emulated him in this respect. He travelled extensively to assemble as much research material of palms as possible. In doing so he probably saw more palm species in natural environments than any previous botanist. He regretted not having seen every genus in nature but he came very close to it. He also established new standards of collecting, following the advice and example of his mentor, L. H. Bailey. He not only selected material for the herbarium with skill and care, but documented information with photographs and extensive field notes. In addition every effort was made to provide material for cytological research, systematic anatomy and, in later years, material for the study of aspects of floral and fruit development. This kind of extension is difficult for the field worker who has not only to find his way to the site, but now has to carry bulky collecting equipment including rather objectionable

fixation fluids and once the task is completed transporting the collections safely back to the ultimate base. Finally arrangements for shipment to the herbarium and laboratory must be made. Anyone who has worked with Hal Moore in the field knows that his physical involvement was total and he always seemed to reserve the most difficult and tedious tasks for himself. Out of this came the full and careful descriptions which characterize his published work, the insights into biological features and assessments of ecological requirements, which could be essential to the successful cultivation of the living material that was frequently brought back. Here Hal's concern was not just for the possible horticultural value of his living collections, but the appreciation that further studies would best be promoted by having living specimens accessible for other workers.

Much of the material he assembled he turned over to his students and associates because he recognized the need for special techniques and approaches if his broadly-based synthesis of palm systematics was to be successful. The summation of this incorporation of new information into the systematics of palms is reflected in his publication "The major groups of palms and their distribution" (*Gentes Herbarum* 11: 27-141, 1973). The synthesis is here preliminary and will be completed in his "Genera Palmarum" by Natalie Uhl and John Dransfield, but was sufficient to show how information from adjacent disciplines of cytology, anatomy, development, geography and paleobotany could be incorporated into the existing grander scheme. The classical morphological details are still included, but displayed with great precision and uniformity. The subdivision of the groups is carried out to a consistently refined degree. The skeletal system of von Martius is now fleshed out with the solid substance of Twentieth Century science.

Nevertheless the caution of the critical scientist is still evident because there are frequent indications of where the gaps in

our knowledge lie and the scope for continued work is continually stressed. The concept of systematics as an "unending synthesis" was very clear in all Hal's research, no systematic work is ever complete and the continual need to examine conclusions in the light of new evidence was always strong in his mind. He had discussed the possibility of doing serological work when these techniques were first developed in relation to systematics, other kinds of chemical systematics interested him, he was always sure that the structure of the pollen still had much to reveal about palm systematics. It was only lack of manpower and available expertise that prevented him from directly adding information from these disciplines to elaborate his systematic studies. But since the synthesis is indeed unending, they surely will find their place in future studies. The quintessence of this caution was that he was still unprepared to recognize his groups as formal categories in the sense of an established hierarchy bound by the rules of precise nomenclature, but his intentions were quite clear in the conspectus that was presented.

Apart from the sheer volume of new evidence that was brought to bear in the development of his new framework for palm systematics, and the diversity of disciplines from which information was drawn, a unique feature of his taxonomic scheme was the strong evolutionary emphasis that was evident in his classification, as in his thinking. The precursory natural grouping of von Martius is here largely transformed into 5 major evolutionary lines within which further degrees of specialization could be recognized. He made a distinction between primitive and advanced characters, and to some extent even groups, which largely reflected his knowledge of current evolutionary ideas. He had strong beliefs about the evolutionary status of palms and considered them an ancient, but not necessarily primitive group. He was able to place his discussion

of the geographical distribution and even ecology of palms in an evolutionary context, and continually lamented the fact that the fossil records of palms was so imperfect and incompletely studied as to give little help in analyzing the phylogeny of palms.

Other systematists had had the concept of phyletic relationships built into their schemes, but nobody had the breadth of knowledge to relate information derived from a study of the flowering plants as a whole to the special example of the palm family. His biological approach, based so clearly on his intimate knowledge of palms in the field, was brought to bear in these evolutionary discussions. He promoted a number of studies on floral biology and was particularly enthusiastic about the possibility of beetle pollination existing in palms, since this is a presumably primitive method of pollen transfer. Continued studies have tended to support his ideas.

The summation of this vigorous scientific life is that we will always see his activities as representing a watershed in our understanding of the palms. Pre-Moore we had a classical botanical concept of the systematics of palms, post-Moore we have a biological and evolutionary classification which will continue to develop. This was biosystematics of a high order in every meaning of the word.

Systematics is foundational to biological understanding but like a firm foundation often lies out of sight and little appreciated. Hal Moore's contribution to the systematics of palms is best measured by some of its practical consequences. It was not just that he was a person to whom horticulturalists could turn for a reliable scientific name; a better indication is the concern expressed when the disease known as lethal yellowing of coconuts reach epidemic proportions in South Florida. At an early meeting where experts discussed the disease, Hal was able to point out the need for a reliable systematic overview as a background to studies on the susceptibility

of palms to the pathogen. Subsequent research was soon to show that the disease transcended systematic boundaries in an alarming way, there were no confines within which the disease might be restrained. The foundation for this conclusion was the systematic framework which generations of palm scientists, culminating in Hal Moore himself, had established.

The current information explosion is all too familiar to active research workers, which in some ways is appropriate, since there are no limits to useful knowledge. Recently I had occasion to survey the scientific literature which relates to palms. Setting a mid-point of 1960, I discovered that more than half the literature on palms ever produced had appeared since 1960. It seems no accident that these last 20 years coincided with Hal Moore's own scientific productivity and it is quite clear that a substantial part of that literature was generated by himself directly or indirectly through his associates. This knowledge is his monument which has absolute permanence so long as men relish those "diamonds which sparkle to the mind's eye."

It seems appropriate that Linnaeus named the palms "Principes:—the princes among plants" for in Hal Moore, one of their foremost students, we had a prince among men.

P. B. TOMLINSON

Harold E. Moore, Jr. A Student's Appreciation

Professor Harold E. Moore, Jr. was known throughout the world as the premier student of the palms. The prominence he achieved in his careful and exhaustive studies of the family will ensure that his name will be remembered and honored by generations of botanists yet to come. Perhaps a more ephemeral aspect of his reputation, particularly since it is

less likely to be noted by future historians of science, was his abilities as a teacher. However, the impact that Hal Moore had on students at Cornell and at other institutions was significant and he contributed to the professional development of many botanists. As an example of the impact that Hal had on students, I would like to offer my own experiences.

My first contact with Hal was through a course he taught on the families of tropical flowering plants. Although not a Cornell student, I saw a circular for the course at the Gray Herbarium, and after receiving an enthusiastic endorsement of both the proposed field course and the instructor from Professor Carroll Wood, I prepared to depart for the course in Costa Rica which was to begin the day after Christmas, 1977.

I was somewhat startled to hear after arriving in San Jose that Hal had been taken seriously ill on the way to Costa Rica and had been hospitalized in the southeastern United States. The other students in the course and I felt somewhat like academic orphans alone in a strange country, but fortunately Gary Hartshorn adopted us for a few days and introduced us to the forest at La Selva. Tom Croat, from the Missouri Botanical Gardens, was pressed into service as a substitute and arrived the next week with several large crates of materials that Hal had prepared for us.

When they were eagerly unpacked the contents of the crates were most revealing of Hal's qualities as a teacher. The first item to be unpacked was a box of large books, one for each of us, that Hal had written especially for the course. Titled simply "Biological Sciences 646," this book which is about the size and weight of an unabridged dictionary, has proved to be a veritable cornucopia of information on tropical plant families. Some of the material Hal had assembled from other sources, but much of the book had been written by Hal alone. There were synopses

of every conceivable family of plants we were likely to encounter in Costa Rica and Panama, numerous line drawings, checklists, vegetative and floral keys, and of course a rather exhaustive treatment of the palms at La Selva and Las Cruces. Although I have been privileged to attend several fine institutions in both the U.S. and Britain I have yet to see any instructor prepare a more carefully designed and exhaustive course syllabus for his students. The value of the book to me has increased with the years and I have carried it with me on travels throughout Central and South America and the Pacific. The second item unpacked was a crate of good quality dissecting scopes—Hal believed in using good equipment for students. Also unpacked were boxes full of film, dissecting tools, and drawing supplies. Although Hal didn't teach the course, his influence was felt throughout it.

My second contact with Hal was through a paper I published in *Principes* on Samoan palms. Hal was helpful and very encouraging—his suggestions on my manuscript were substantial but never discouraging. I have since found from other students that Hal had a well-developed critical ability, and was able to offer criticisms to students in an encouraging rather than discouraging manner, even though his standards for quality of thought and writing were high indeed.

My third, and perhaps most substantial contact with Hal was during a 1980 field trip to Samoa that unfortunately proved to be his last. Having preceded him to Samoa for some studies on *Freycinetia*, I met Hal in Pagopago at the Rainmaker Hotel in March. We both had an interest in the palm genus *Clinostigma*. Although several species had been described from Samoa throughout the years both Hal and I were of the opinion that only one species occurred in the archipelago, particularly on Upolu Island. Art Whistler, a graduate student in Hawaii who also had a lot of field experience in Samoa, also shared our

view, so Hal and I hoped to make the critical collections and observations that would resolve the problem. Although *Clinostigma* had reportedly been collected by the U.S. exploring expedition from Tuutuila Island, no recent collections had been made. However, I remembered seeing in my wanderings past the high village of Aloao, a *Clinostigma* tree and Hal had reports of *Clinostigma* growing in a coconut plantation near the village of Iliili. We started off that morning in a rented car and taking the left turn at Iliili, started to drive towards the ocean. Suddenly we both saw the distinctive crown-shaft of *Clinostigma* mixed in with cultivated coconuts behind a small hut. With me acting as interpreter, Hal asked the old woman who lived in the hut how she came to have *Clinostigma* growing in her garden. The woman, delighted by our visit, immediately invited us into her modest hut for refreshments while she told us the story. I was somewhat nervous at the way Hal might treat her invitation because in the Samoan culture an outright refusal of an invitation to eat is considered an insult, and occasionally expatriates and foreigners inadvertently offend Samoans by not accepting invitations to eat in the somewhat less than sanitary conditions. Hal, however, was very gracious and accepted the warm punch in a cracked and dirty glass as if it had been given him by royalty. The woman was delighted with Hal and although his conversation with her was of necessity channeled through me, I was impressed with the sincerity that Hal communicated to the old woman and her family. After collecting some of the inflorescences, the fruits of which matched the description of *Clinostigma samoense* H. A. Wendl., Hal took a group portrait of the woman and her family, an enlargement of which he mailed to her after his return to Ithaca.

The next day Hal and I started to climb through the cloud forest past the village of Aloao. The day was very foggy with intermittent rain. After traveling through

the forest for about two hours, we found a large single individual of *Clinostigma* aff. *samoense*. We looked about for seedlings but could find only the single tree. This tended to confirm the story of the woman in Iliili who had explained to us that seeds of *Clinostigma* were brought by her father to Tuutuila from Upolu when she was a little girl. Her father had felt the leaves to be superior to coconut leaves for thatching. Since she was 75 years old when we met her, we estimated the introduction to have occurred around 1910 or so. Venturing on past the *Clinostigma* palm in search of perhaps other *Clinostigma* individuals, I contemplated the numerous travels that Hal had made in his career. Hal was known throughout the world to botanists and foresters and had succeeded in seeing all but a few genera of palms in their native habitats, an achievement which I suspect may never again be equalled. As we walked through the traditional Samoan drizzle, I asked Hal if he had ever been lost on any of his field trips. Hal replied that he never had been.

As fate would have it, less than an hour later Hal and I found we were hopelessly lost. The combination of an overcast sky, the dense cloud forest, and my failure to note our compass bearings as we made our way through the forest all combined to produce a rather embarrassing result: on a rather small Pacific island I had succeeded in getting Professor Harold Moore, who had traversed the vast forests of Amazonia and Africa without difficulty, completely lost. Although the situation was not grim, since we were after all on an island, it was alarming since only one side of Tuutuila Island is inhabited. If we descended from the mountains in a direction different from the one in which we came we would certainly be forced to spend a miserable night bivouaced with the rain and legendary Samoan mosquitoes as our only companions. After reluctantly admitting to each other that we were lost we decided to mark a central point from which we would explore transects

along all four points of the compass in the hopes of finding the path back out of the mountains. "Point x," denoted by crossed stems of *Cordyline terminalis*, was duly christened, and we began our first journey of half an hour along one of the four points of the compass, through the now heavy rain. Two hours and three transects later we had still not found the path, when finally Hal yelled that he had found the trail only about 80 meters from point "x."

As we continued our trip into Western Samoa, I continued to be impressed with Hal's knowledge, generosity, and kindness. Each night Hal would patiently answer my numerous questions about the ecology and systematics of palms. He also showed a genuine interest in my own studies of the Pandanaceae and made many useful suggestions on my work. As we traveled about the islands in search of *Clinoostigma* his courtesy and respect for the local people made him very popular. Hal's kindness to me did not prevent him from offering useful criticism of my studies, however. For example, Hal treated somewhat skeptically my report to him that I had seen *Musa acuminata* subsp. *banksii*, a wild diploid banana, in the remote interior of Upolu. Together we made the long hike to Lake Lanoataata, so he could examine the plant. On examining the plant, Hal cheerfully admitted he was wrong, and spent almost an hour in a torrential rain helping me collect seeds to be sent to botanical gardens for cultivation. In general he seemed to combine a highly developed critical ability with a deep sense of humility and a generosity of spirit; individuals possessing all three of these virtues in such a high degree are rare.

On Hal's final night in Samoa we attended a *fiafia* or native celebration hosted by Aggie Grey. At the conclusion I noticed that Hal was somewhat misty-eyed; this was very unusual since he did not tend to be a very emotional person. I asked Hal if something was wrong. He replied that Samoa was very beautiful and he only wished that he could see it again.

Several months after my return to Harvard, I was stunned to receive a call from Natalie Uhl who told me that Hal was in poor health and had been hospitalized. My young family and I traveled that weekend to Ithaca where I visited Hal in the hospital. On entering his room I could tell that he was very seriously ill. Although my concern was with Hal, his concern was with my work. He had me tell him in detail about the progress on my studies on the Pandanaceae. I was very touched that this great scientist, although seriously ill, would take the time to inquire concerning the studies of a rather unnoteworthy graduate student.

The following week I found myself again in Ithaca, but this time the voices in the Cornell chapel, although kind and comforting, seemed to me to be filled with emptiness because Hal was gone. Science had lost a great talent, Cornell had lost a great teacher, and his associates and colleagues had lost a true friend. Even though I had been asked to make a few remarks at the memorial service, I had difficulty controlling my own disconsolate feelings. At the service, however, Natalie Uhl concluded her remarks with a comment I felt most appropriate, particularly for those of us who knew Hal as a teacher: "If Hal were here, his most likely statement to us all would be, 'Go back to work'."

Knowing Hal and his disdain for sentimentality, I suspect he would indeed have said something like that. Hal has laid a most valuable foundation for all of his former students and colleagues to go back to work. His published papers are hallmarks of meticulousness, his reviews demonstrate a high standard of thought and criticism, and the example he set and the generosity he showed for younger botanists will insure that his name and work will be remembered and respected for generations to come.

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