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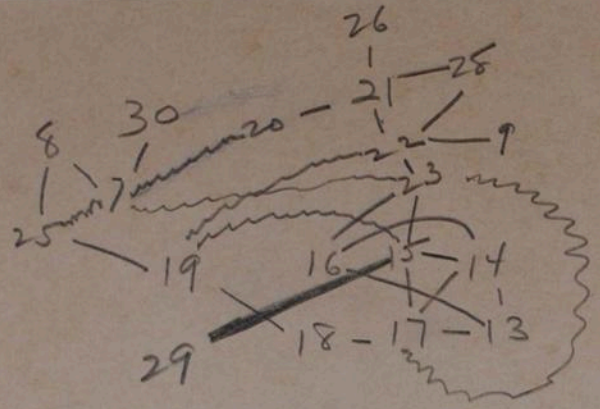
Hunt Institute was dedicated in 1961 as the Rachel McMasters Miller Hunt Botanical Library, an international center for bibliographical research and service in the interests of botany and horticulture, as well as a center for the study of all aspects of the history of the plant sciences. By 1971 the Library's activities had so diversified that the name was changed to Hunt Institute for Botanical Documentation. Growth in collections and research projects led to the establishment of four programmatic departments: Archives, Art, Bibliography and the Library.



all internal connections for L=12 shown as wavy line
big solid line for R set (member changing composition of cluster)

July 18, 1969

Mr. Wm. Stearn
British Museum (Natural History)
Cromwell Road
London, S. W. 7
England

Dear Mr. Stearn:

I return herewith your copy of the proposed manuscript on Oplonia, your diagrams, and our replies to your questions. Hopefully, the replies are meaningful. We are pleased to see the study come to fruition, and look forward to seeing the work in print.

I believe that all of the problems you posed have been answered, but if not, feel free to ask for further clarification.

I wonder if I may ask a favor from you in return? We have recently requested that the Taximetrics Laboratory be accepted by the University as a separate administrative unit. One problem involved in acceptance by the university is that they need evidence from those not immediately a part of this group of researchers to indicate the value of the group. If you feel free to write to Dr. Thurston E. Manning, Vice President for Academic affairs, University of Colorado, Boulder, 80302, I would be very grateful. Perhaps some explanation could be given of the emergence of this type of activity just at this time, and the slow process by which such methods as ours are accepted by the community of biologists. It takes considerable time for new procedures to be accepted in an old and well-established discipline, and we feel that we need more time to stay together as a group (including botanists, mathematicians and programmers) to assure that the procedures do become sufficiently well accepted. Thank you for whatever you can do in this connection.

Sincerely,

David J. Rogers
Professor of Biology.

Telegrams: Nathismus, Southkens, London
Telephone: KENsington 6323

BRITISH MUSEUM (NATURAL HISTORY)
Cromwell Road
London, S.W.7

WTS/CJT

Professor David J. Rogers,
Department of Biology,
University of Colorado,
Boulder, Col. 80302,
U. S. A.

Dear Professor Rogers,

After years during which my attention has been diverted to far too many other matters, I have returned to preparing for publication my work on Oplonia, which I am now anxious to get printed fairly soon, as other people wish to use its conclusions, and I have accordingly made time to examine your computer print-out and diagrams in association with the specimens.

The result has made me regret that such a method was not available, or at any rate known to me, about 1960; it would have provided a short-cut to the same grouping of specimens as I reached slowly and laboriously by other means. My confidence in the potential utility of these partly mechanical methods as aids in practical taxonomy has thus again been confirmed. I propose, therefore, to say a little about this, primarily to help others with a similar problem but also to thank you for your co-operation, in my revision of Oplonia.

The suggested text in the chapter on methodology is enclosed. I will be grateful for your comments and also additions, if you think any desirable. I also enclose a sketch of the illustrative diagrams of stage 12, as well as the relevant print-out and diagram.

Under separate cover I have sent you a copy of my recent publication on Columnea and Alloplectus.

Trusting all goes well with you,

Yours sincerely,

William Stearn

Dr. W. T. Stearn

Enclosures

P.S. During the upheavals and moves consequent on alterations of the herbarium etc. some of your letters seem to have become mislaid if not lost. Hence the following queries relating to your diagram What does the red enclosing line signify? What do the wavy lines connecting 19 and 15, 19 and 22 signify? Why is the line connecting 15 and 29 extra thick? Why are 11, 27 and 12 joined as a triangle but 6, 4 and 5 as a straight line? Should any thing on your model be included in my simple outline? Can connecting lines on diagram be made nearly equal?

Stern

It has been some years since we have done the sub-graphs of Oplonia. In the meantime we have improved the program to give the taxonomist more information than at the time we ran your data and a few other changes to make the print-out easier for the taxonomist to scan. In your copy of the computer print-out for L = 12, our memory of the 17, 23 / 7, 23/ etc. 15, 19* 19, 22* is that the slashes referred to internal connections made at C (12) = .81481 and the * referred to internal connections made after C (12) = .81481 (but before C (13) which we think was likely .80769--but we can't be sure without the print-out). We frequently diagrammed to show a distinction between the two types of internal connections. Your copy of (L 12) shows the wavy lines restricted to internal connections after .81481. The moat here is not large so the distinction between the two types of internal connections is not likely to be significant so the diagram in black and white should look like the following:

The red enclosing line (A)

In regard to your data it was just a convention adapted to indicate that each specimen contained within the enclosing red line had at least three connections to other specimens contained within the red line. We do not think it is pertinent in your study. Twelve out of a possible 21 connections have been made for the specimens enclosed within the red line.

The wavy black lines (B)

A convention to indicate internal connections that have formed at a particular level (stage in your terminology).

The extra thick line.

We use a thick red line to indicate the connection between the specimens that

that results in the formation of a new cluster at a particular level. All thick red lines are between specimens that are R sets R (12) = (15, 29) in cluster 7.

Why are 11, 27, 12 joined as a triangle, etc.?

By level 12, specimens 11, 27, and 12 have been previously joined by R sets or internal connections and it is convenient to show it as a triangle for ease in reading. However, 11 - 27 - 12 is the same as $11 \overset{27}{\diagup\diagdown} 12$.

In cluster 6 - 4 - 5, specimens 6 and 5 are not similar enough to be connected at level 12. Incidentally this linear type of connection sometimes indicate geographical or ecological clines.

Should anything on your "moat" be included in my simple outline?

Taxonomically "moat" is significant as you note in your reference to no. 35 grandiflora without using the word "moat." The moat is the amount of by which the closest non-member of a cluster fails to qualify for membership in the respective cluster. It is an indication of how distinct a cluster is.

Can connecting lines on diagram be made mostly equal?

The length of the lines have no significance. They are made long or short arbitrarily to fit them in some space such as a piece of paper conveniantly.

The purpose of the aforementioned conventions is only so that the taxonomist can see at a glance what changes are taking place from level to level. The red, of course, is distinctive as against the black of ordinary pencil and wavy or thick lines informs one on the type of change: new specimen, two clusters join, internal connections within clusters, etc. One can look at each level as a motion picture frame and progressivley scan along and see the effect of lowering the similarity criterion.

Since you are only showing one level in the paper, these conventions may not be pertinent. I would insert at top of figure L = 2 C(2) = .81481

and below under the title "Single Member Clusters (10) the appropriate specimen numbers.

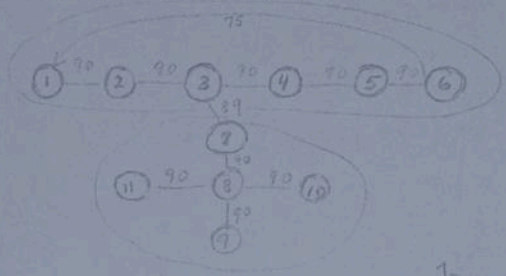
On the top of the page of "First draft of diagram for publication," you have inserted (2) in the list of specimens that have not been classified. The print-out has informed you for L = 12 that 9 specimens were unclassified (unclustered objects (9). Specimen 2 was not included because the program has already checked for identically coded specimens and in this instance specimens 1 and 2 were identical, and the program has selected the lower numbered specimens for classification purposes. The information that these two specimens were found to be coded identically is to be found after the list given of the main input data when the object # and character states are printed.

When one has many characters and character states and/or a large number of spscimens being classified, it is of taxonomic interest to know of any duplicate specimens. We remove the duplicate from the study in order to reduce the number of specimens to be subgraphed and remove redundancy. However, it is correct to include specimen 2 in your list of single number clusters as it will not be classified until specimen 1 is placed. On the other hand, specimen 12 should not be in the list as it has already been placed in cluster 11 at some previous level.

Note that the connection been T 7 (O.t. tetrasticha) and S 21 (O. spinosa) is through T 20 a specimen missing 9 pieces of information. If the missing information is taxonomically critical, the connection shown between the two taxa may not be valid.

Page 1 at X

Third paragraph down--9th line. This sentence is usually true but not necessarily true. We would leave it out. When in practice one is dealing with clines or highly variable taxa, the extremes may be more dissimilar than the median specimens or taxa to sibling or closely related taxa. Without over-laboring the 2-dimensional limitations of the paper, look at the diagram below:



7 is closer to 1, 2, 3, 4, 5, 6, than 6 is to 1, but properly is associated with a different cluster (taxa).

Page 2 bottom

Taximetric similarity-graph-clustering program*

*This study was run on a Control Data 1604 at New York. The Taximetrics Laboratory under the direction of Dr. D. J. Rogers was located at the New York Botanical Garden. The laboratory is now at the University of Colorado, Boulder, Colorado. The programs are operative on ~~IBM 7044 and 7090 and C.D.C. 6400, 7000 series, 360(75), and C.D.C. 6000 series.~~ IBM 7000 series + 360/75 + CDC 6400.

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GRAPH BUILDING OPLONIA 8=3-65

L = 12          C( 12) = .81481          R( 12) = ( 15, 29)- CLUSTER    7
*                        .85185                                  3    2
   4,  5,  6,
                         .81481                                 171   34
*
   7,  8,  9, 13, 14
  15, 16, 17, 18, 19
  20, 21, 22, 23, 25
  26, 28, 29, 30,
  17, 23/  7, 23/  7, 25/  7, 20/ 15, 19* 19, 22*
NEXT PAIR TO JOIN (  9, 10), MOAT = .00712
                         .00888                                  3    3
*
  11, 12, 27,

UNCLUSTERED OBJECTS (  9)
   1   3  10  24  31  32  33  34  35
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· Extract from W. T. Stearn: Survey of the Tropical American Genera Oplonia and Psilanthele (Bull. Brit. Mus. (Nat. Hist.), Bot.) cited. (Tmc 1964)

The major difficulty of classifying apparently rather uniform biological material, wherein most distinctions lie in a diversity of minute characters neither simultaneously observable nor easily correlated, is to put the specimens into small relatively homogeneous groups which can later on be joined into larger groups as defining attributes become evident. Obviously then the study of such material would be eased by use of an efficient computer-aided method of assembling the specimens into successively united groups (clusters) characterised at first by high overall resemblance between the members of each group, this closeness of resemblance between all members of a group progressively becoming less as more groups become united.

Availability of computers and exercise of mathematical ingenuity have now led to the creation of possible numerical methods bewildering in their number and claims (cf Johnson, 1968, for comment and extensive bibliography). Assessment of their respective merits for a given task must depend upon practical experience. They need to be tested by application to group upon group.

The following observations relate to a method of cluster analysis based on graph theory, to which Professor David P. Rogers drew my attention in 1964, after the present study, mostly done in 1961-62, had been virtually completed. This has since been expounded mathematically by Estabrook (1966) and applied by Wirth, Estabrook & Rogers (1966) to Orchidaceae subtribe Oncidiinae, and by Irwin & Rogers (1967) to Cassia sect. Apoucouita. It groups objects into clusters defined by similarity of their members with stage by stage reduction in the degree of similarity necessary for objects to be placed in the same cluster. At all stages the objects within a given cluster agree more closely with each other than they do with objects in other clusters. Hitherto unclustered objects are progressively admitted into clusters through linkage by resemblance to objects already in the cluster. Thus small clusters become linked to larger clusters; as a cluster enlarges through incorporation of other clusters, so the amount of similarity between all members of the resulting cluster lessens at each stage until ultimately the objects all come together into one large cluster. The computer print-out records the process as a series of stages. It is for the taxonomist to decide which of the intermediate stages, when there exist several or many clusters of specimens, has the most relevance to his needs.

Please see accompanying letter — this statement not true. I suggest omission. To fully explain would

The first task, as in other taxonometric procedures, consists of listing all the available characters and their attributes differing from specimen to specimen; these are then tabulated for each specimen being studied. Comparison by the computer pairs the specimens according to their mutual similarity. This stage, the first partition, divides the material into the basic classes. The principles governing procedure, as stated by Estabrook (1966) are:

(1) a biological classification for a collection of objects is a series of partitions for this collection, classes under later collections consisting wholly of classes under earlier partitions (e.g. genera consist wholly of species, species consist of individuals);

(2) for any given partition in this series, two similar objects should not be placed in different classes;

(3) the classes of a given partition should be isolated from each other, i.e. there should be some phenotypic discontinuity between members of different classes.

As at a given degree (level) of similarity

During the passage, by union of clusters resembling one another, from the original clusters (disjoint partitions) pass into the ultimate single cluster (conjoint partition), the greater the overall resemblance between specimens the earlier will be the stage at which they are linked; conversely, the greater their divergence the later will be their linkage. Part of the task of preparing a taxonomic revision of a group has always been a search for such resemblances and divergences, followed by hierarchic ranking of the subgroups detected. A machine technique quickly displaying these relations can thus significantly lessen the labour of research; it may even indicate correlations of characters which otherwise would not have been perceived. Hence it seemed worthwhile, as a guide for future procedure in dealing with groups like Colonia, to test this computer-aided hierarchical clustering technique based on graph theory by applying it to an assemblage of specimens of Colonia.

The characters, 26 in all, of 35 specimens representing the geographical and morphological extremes of the group as well as numerous intermediate states were accordingly tabulated by me and then computed (using Taximetric Similarity & Graph-Theoretic + program on CDC 1604 computer at New York-)

Please see suggested footnote in accompanying letter.

by Rogers, who converted the computer print-out into a series of diagrams (subgraphs), each representing one partition of 21 stages (levels) of clustering. These specimens (to which the scientific name now adopted has been added) were as follows:

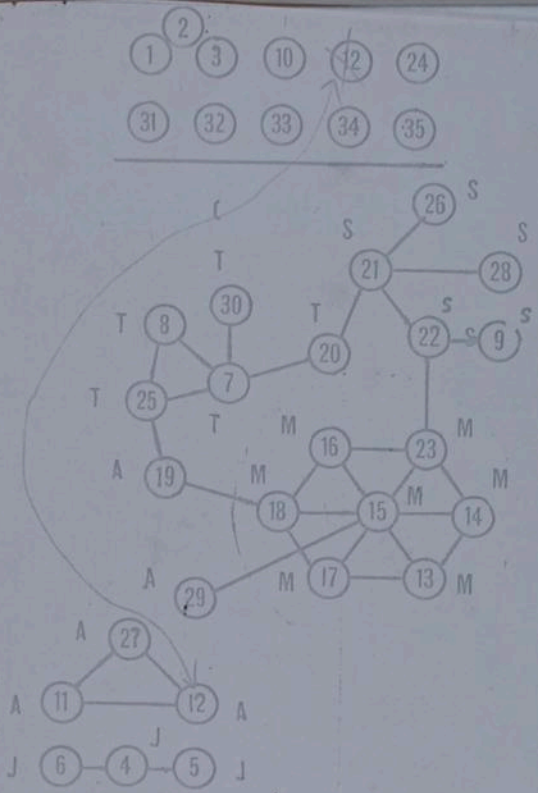
1.	Britton 2877;	Jamaica;	O. acicularis.
2.	Stearn 550;	Jamaica;	O. acicularis.
3.	Britton 2894;	Jamaica;	O. acicularis.
4.	Proctor 8433;	Jamaica;	O. jamaicensis.
5.	Stearn 454;	Jamaica;	O. jamaicensis.
6.	Harris 2968;	Jamaica;	O. jamaicensis (isotype).
7.	Proctor 16430;	Cuba;	O. tetrasticha tetrasticha.
8.	Leon 2326;	Cuba;	O. tetrasticha tetrasticha.
9.	Curtiss 133;	Bahamas;	O. spinosa.
10.	Robertson 26;	Virgin Islands;	O. spinosa.
11.	Stearn 726;	Jamaica;	O. armata minor.
12.	Proctor 21407;	Jamaica;	O. armata armata.
13.	Box 757;	Antigua;	O. microphylla.
14.	Howard 10916;	St. Vincent;	O. microphylla.
15.	Araque-Molina A & Barkley 223448;	Jamaica;	O. microphylla.
16.	Proctor 9971;	Jamaica;	O. microphylla.
17.	Stearn 830;	Jamaica;	O. microphylla.
18.	Norman 100;	Jamaica;	O. armata minor.
19.	Stearn 863;	Jamaica;	O. armata minor.
20.	Ekman 15042;	Cuba;	O. tetrasticha tetrasticha.
21.	Marie-Victorin, Clemente & Alain 21625;	Cuba;	O. spinosa.
22.	Leonard & Leonard 13674;	Hispaniola;	O. spinosa.
23.	Valeur 724;	Hispaniola;	O. microphylla.
24.	Ekman 16534;	Cuba;	O. nannophylla (type).
25.	Clemente 5657;	Cuba;	O. tetrasticha polycea.
26.	Buch 1851;	Hispaniola;	O. spinosa.
27.	Proctor 10236;	Jamaica;	O. armata armata.

28.	Schomburgk 107;	Hispaniola;	O. spinosa.
29.	Stearn 486;	Jamaica;	O. armata armata.
30.	Wright 3067;	Cuba;	O. tetrasticha tetrasticha (isotypa).
31.	Clemente 5014;	Cuba;	O. tetrasticha polyacea.
32.	Stearn 455;	Jamaica;	O. armata armata.
33.	Proctor 8830;	Turks & Caicos Islands	O. spinosa.
34.	Stearn 498;	Jamaica;	O. acicularis.
35.	Ule 6493;	Peru;	O. grandiflora (isotype).

Study of Rogers's series of diagrams (subgraphs) in association with the specimens themselves revealed particularly the utility of the middle stages (levels) of clustering as an aid to perceiving and distinguishing the main components of the group. Fig. , for example, represents the clustering reached at stage 12. The first partition (stage 1) made according to a very high degree of resemblance brought together the almost identical Jamaican specimens (Nos. 15, 16, 17) now referred to O. microphylla; later stages placed Jamaican specimens (Nos. 11, 12) now referred to O. armata in one cluster, Lesser Antillean specimens (Nos. 13, 14) referred to O. microphylla in another, Cuban specimens (Nos. 7, 8) referred to O. tetrasticha and Jamaican specimens (Nos. 4, 5) referred to O. jamaicensis in yet others. By stage 12, the grouping and linking have gone far enough to make a significant arrangement of most of the specimens. Thus Nos. 13, 14, 15, 16, 17 and 23 when put side by side can be seen to have in common very small leaves and short ascending spines and constitute a taxon for which the earliest epithet is microphylla; Nos. 7, 8, 18, 20, 25 and 30, all from Cuba, with their long straight horizontal spines form another group, for which the epithet is tetrasticha; Nos. 9, 21, 22, 26, and 28 with their mostly curved horizontal or deflexed spines likewise form a group, to be called spinosa; Nos. 4, 5 and 6, all from Jamaica, with large leaves and many flowers represent the easily distinguishable jamaicensis. Among the specimens unclustered at this stage, No. 24 (nannophylla), Nos. 1, 2, 3 and 34 (acicularis) and 35 (grandiflora) strike the eye as well distinct from the others, while Nos. 32 (armata), 10 spinosa 31, 29 and 33 (spinosa) show resemblance to some specimens already clustered. The last specimen to enter was No. 35 (grandiflora), from Peru, which accords

with its morphological and geographical distinctness. The logical coherence of this grouping ~~caused~~ made me regret that the technique used had not been available much earlier; ~~for consistency~~ it would have provided a means of grouping fairly quickly the specimens into the taxa ultimately adopted and thereby saved without so much time-consuming search for correlations. The computer run dealing with this material took 3 minutes 47 seconds*, an infinitesimal amount of time compared with that of ascertaining and tabulating data and that of expressing and considering the results. The method commends itself for its graphic portrayal of classification as a stage by stage process and corresponds closely enough in its working to the mental acts of a working taxonomist to be able to serve as a time-saving substitute for some of them. Thus in dealing with a large confused group it is convenient to pick out various types and use these as focal points to which specimens can be referred by resemblance, thereby creating assemblages from which concepts of taxa can take shape and definitions be formulated. This computer method creates such assemblages in the same typological manner and so prepares the way for defining their circumscription and ascertaining the characters by which they can be distinguished.

*. Please note that with present improvements in the programme, and with a much larger computer, we could run the same data in less than one minute, and at the same time get more different types of print-out.



Intermediate stage (level 12 in 1-22 sequence) in cluster analysis of Oplonia specimens by graph theory method of Wirth, Estabrook & Rogers ; A = specimens classified as A armata, J as jamaicensis, S as spinosa, T as tetrasticha. M as microphylla and it specimens 1, 3, 10, 12, 24, 31, 32, 33, 34, 35 above ~~to be clustered~~ later stages of clustering.

(First draft of diagram for publication)

- Taxonomy Laboratory

October 26, 1965

Dr. William T. Stearn
Department of Botany
British Museum (Natural History)
Cromwell Road, London S.W. 7

Dear Dr. Stearn,

We are sending to you by surface mail the following:

1. A copy of the computer printout of Oplonia.
   a. Similarity ratios
   b. Clustering
2. A copy of a manuscript (now in press) which explains our computer method.
3. A mimeographed paper "How to Read the Printout".
4. A large piece of brown "butcher's paper" with a series of subgraphs -- our own method of pictorializing the printout.
5. A computer-derived, computer-printed "skyline" graph of the results.
6. A copy of our interpretation of your characters and attributes.

We are not returning the original data sheets, thinking that you have your own copy of these. If you did not keep these data sheets, we can send them later if desirable. Because of the quantity of the material we are sending this by surface mail. You may be very much shocked by the weight of paper returned to you. We are sending these various documents because they are critical to the understanding of exactly what the computer has done and why it was done.

The actual output from the computer does not give you decisions already made concerning your taxa -- it is not intended to do so. You, as the taxonomist, the specialist, the knowledgeable person, must make the decisions as to what you will select as taxa. In spite of these admonitions, however, I think that you will probably find that the printout gives you some good ideas about how you may decide what your taxa are.

It must be understood that the suggestions that the computer makes are based directly on the information given. Nothing really new is added. In setting up your data for the computer, we have used our judgments where it is possible, but we cannot add information where it is missing, nor can we interpret several places on the coding sheets where the coding was doubtful. As is typical in taxonomy, several of the specimens were missing data, one of them missing up to nine characters. In those cases where much information is missing the specimens may not be as accurately placed as they might be. We might point out as well, that this study has the smallest number of characters we have ever tried; and when information is missing, it must be recognized that this has a direct effect on the positioning of the specimen in the graphs. We had considerable doubts about coding in the geographic factors as information about the plants. Adding geography as a character may have had some undesirable influence on the results.

Looking at the graphs (the brown paper), one gets an overall view of major systems represented by the various specimens. It seems in this study four major "systems" are operating. Three of these are Caribbean and one is Peruvian. Note that the Peruvian specimen, No. 35, does not join until the very last level, Level 21. At a very high level, Level 2, specimens No. 11 and 12, and joined at Level 7 by No. 27, stay apart completely until we get to Level 18 where No. 11 is joined to specimen No. 18. Specimens No. 4 and 5 at Level 5, joined by No. 6 at Level 9, stay separate for a very long time, and they too do not join onto the largest cluster until we get to Level 16 where, through specimen No. 6, this cluster joins specimen No. 27.

The meaning of this activity, i.e. what you want to do about decisions on the sub-generic or generic levels is obviously something that you can decide best with the specimens in front of you. It has been our practice to take all of the specimens that the graph represents and look at them as they are put together, or suggested that they be put together, by the graphs. There are also other kinds of hints that you can find at a lower level than the generic or sub-generic divisions. Some of interest to us, for example, concern specimens No. 15, 16 and 17, O. microphylla of Jamaica, composed of similar individuals but these differ very little from the Antigua and St. Vincent specimens (specimens No. 13 and 14). Is this an effect of coding in geographic data?

Minor specimens 18 and 19 are quite similar, and if they are not a sibling species, they might represent a variety of microphylla. Specimen 11 of minor should be examined closely -- it seems to be an aberrant specimen from the graphs, because it joined with a specimen of armata (Specimen No. 12) at a relatively high level (Level 3) at a similarity rating of .96; and in turn, it serves as a node to relate the armata cluster (12) to minor (specimens 18 and 19) at a much lower level, 18, with a similarity of .75. Armata specimen No. 32 also relates to minor specimen 18. This specimen should be similarly studied carefully, as a suggestion; Is minor (No. 11) a hybrid between microphylla and armata?

Specimen No. 25 (polyece) is as equally related to minor (specimen 19) as to tetrasticha (No. 8). On the basis of two specimens of polyece (31 and 25) the species is variable.

Spinosa, whether from Cuba (21), from Hispaniola (22, 26, 28), the Bahamas (33), or the Virgins (10), group among themselves but indicate some variation. Specimen 20, microphylla (with nine characters missing) should be appraised. It probably relates to 21, spinosa, because of missing information.

There are many more facets of information that one might derive here. I merely started you out with these in order that you can see the type of reading that might be done. Care must be used when appraising the sub-graphs, particularly with poor specimens. Specimens that lack information are being tested only on their information present. The amount of information present is also being weighted by the amount of missing information. Notice that at Level 11 specimen 20, which lacks nine pieces of information, is operating (acting as an articulation point) between specimens 21 and 7. Specimen 24 is another poor specimen. Another piece of information that you may wish to take into account is that the coding has weighted the characters for spines and hairs. Those specimens without spines and hairs may be indicated as more distant than we would intuitively place them. We might also point out that the characters concerned with whether the apex of the leaf is emarginate or mucronate should be consolidated into one character.

In closing, let me say that we are probably burdening you with a great deal of work for essentially a very small taxonomic problem. We do feel, however, that if you are willing, or have the opportunity and time, to really digest the operations as we outlined them, you will gain a tremendous insight into the groups of organisms under study. If you have this one project well understood, then it is likely that you will have a better opportunity when really complicated and large studies begin. We hope you will consider other cooperative studies -- our objective is to provide assistance.

Sincerely yours,

David J. Rogers
Professor of Botany

DJR/ec

BRITISH MUSEUM (NATURAL HISTORY)
Cromwell Road, LONDON S.W.7
Telegrams: Nathismus London
Telephone: KENsington 6323

Department of Botany.

Our reference: WTS/DBA
Your reference:

1st October 1965.

Professor D. J. Rogers,
Department of Botany and Plant Pathology,
Colorado State University,
Fort Collins,
Colorado 8052,
U.S.A.

Dear Professor Rogers,

It has rested uneasily on my conscience for some time that I had not replied to your enquiries regarding Oplonia. The reason is simply, but regrettably, that, having so much else on hand, I had to put all the specimens and notes on Oplonia aside for the time being and I have not yet got back to considering them. I hope, however, to do this in the near future. I shall thus be most interested to see the results of your work, particularly as I ought before long to prepare for publication my revision of the genus and return the borrowed specimens to their owners.

I am trying to push on with The Flora of Jamaica despite continued interruption and much side-tracking. This year I have been up to my eyes in proofs. A long paper on Grisebach's Flora of the British West Indian Islands has appeared in the Journal of the Arnold Arboretum and my Masters Memorial Lectures on the origin and later development of cultivated plants in the Journal of the Royal Horticultural Society. I have passed the last proofs of my Botanical Latin, which runs to 558 pages, my biography and bibliography of Adrian Hardy Haworth and my edition of William Turner's Libellus, and have completed three long-standing papers now in the press and have almost completed three others, and have given some lectures in addition to ordinary administrative work and numerous enquires, so I hope you will be considerate enough to attribute the delay in dealing with Oplonia simply to such diversions and not to deliberate discourtesy or lack of interest.

If I should take up a suggested visiting professorship in the U.S.A. in 1967 may be I could visit you and see firsthand the work in progress at your institution.

Yours sincerely,

William T. Stearn

W. T. Stearn.

BRITISH MUSEUM (NATURAL HISTORY)
DEPARTMENT OF BOTANY
Cromwell Road, LONDON S.W.7
Telegrams: Nathismus, Southkens, London S.W.7
Telephone: KENsington 6323

Your ref:DJR:MDF 8th September 1964.

WTS/DBA

Dr. David J. Rogers,
New York Botanical Garden,
Bronx Park,
New York 58,
New York,
U.S.A.

details of Oplonia specimens under reference

Dear Dr. Rogers,

Under separate cover by registered post I have sent you 35 sheets giving numbers as listed here, and I will naturally be very pleased to see what you make of this and of the details given in my monograph of Epimedium and Vancouveria.

The specimens of Manihot have been sent to the New York Botanical Garden on loan.

I was very pleased to have the opportunity of meeting you both here and in Edinburgh. As a systematist I welcome your approach to the problems presented by genera such as the above.

Yours sincerely,

William T. Stearn

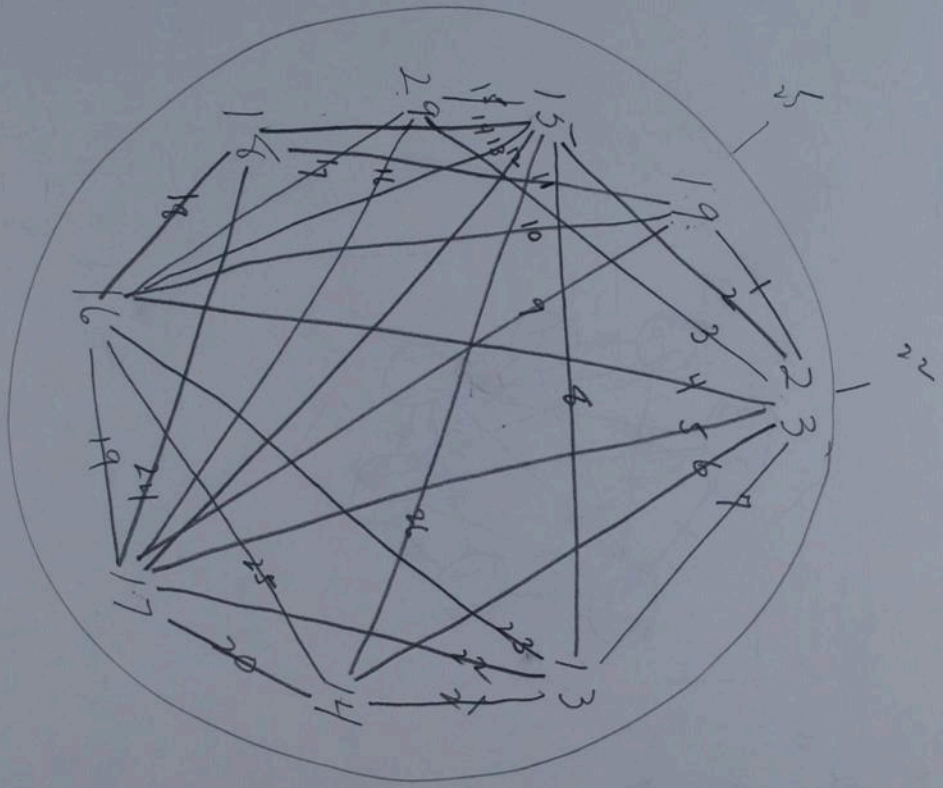
W.T. Stearn.

OPUNTIA SPECIMENS

1.	Britton	2877	(Jamaica)
2.	Stearn	550	Jamaica
3.	Britton	2894	Jamaica
4.	Proctor	8433	Jamaica
5.	Stearn	454	Jamaica
6.	Harris	2968	Jamaica
7.	Proctor	16430	Cuba
8.	Leon	2326	Cuba
9.	Curtiss	133	Bahamas
10.	Robertson	26	Virgin Islands
11.	Stearn	726	Jamaica
12.	Proctor	21407	Jamaica
13.	Box	757	Antigua
14.	Howard	10916	St.Vincent
15.	Araque-Molina & Barkley	22J448	Jamaica
16.	Proctor	9971	Jamaica
17.	Stearn	830	Jamaica
18.	Norman	100	Jamaica
19.	Stearn	863	Jamaica
20.	Ekman	15042	Cuba
21	Marie-Victorin, Clément & Alain	21625	Cuba
22.	Leonard & Leonard	13674	Hispaniola
23.	Valeur	724	Hispaniola
24.	Ekman	16534	Cuba
25.	Clemente	5657	Cuba
26.	Busch	1851	Hispaniola
27.	Proctor	10236	Jamaica
28.	Schomburgk	107	Hispaniola
29.	Stearn	486	Jamaica
30.	Wright	3067	Cuba
31.	Clemente	5014	Cuba
32.	Stearn	455	Jamaica
33.	Proctor	8830	Bahamas (South Caicos)

OPTONIA INDEX

Araque-Molina & Barkley	227448	Jamaica	=	15
Britton	2877	Jamaica	=	1
Britton	2894	Jamaica	=	3
Box	757	Antigua	=	13
Buch	1851	Hispaniola	=	26
Clemente	5014	Cuba	=	31
Clemente	5657	Cuba	=	25
Curtiss	133 - 2 sheets	Bahamas	=	9
Ekman	15042	Cuba	=	20
Ekman	16534	Cuba	=	24
Harris	2968	Jamaica	=	6
Howard	10916	St.Vincent	=	14
Leon	2326	Cuba	=	8
Leonard & Leonard	13674	Hispaniola	=	22
Marie-Victorin, Clément, Alain	21625	Cuba	=	21
Norman	100	Jamaica	=	18
Proctor	8433	Jamaica	=	4
Proctor	8830	Bahamas	=	33
Proctor	9971	Jamaica	=	16
Proctor	10236	Jamaica	=	27
Proctor	16430 - 12 sheets	Cuba	=	7
Proctor	21407	Jamaica	=	12
Robertson	26	Virgin Islands	=	10
Schomburgk	107	Hispaniola	=	28
Stearn	454	Jamaica	=	5
Stearn	455	Jamaica	=	32
Stearn	486	Jamaica	=	29
Stearn	498	Jamaica	=	34
Stearn	550	Jamaica	=	2
Stearn	726 - 2 sheets	Jamaica	=	11
Stearn	830	Jamaica	=	17
Stearn	863	Jamaica	=	19
Ule	6493	Peru	=	35
Valeur	724	Hispaniola	=	23
Wright	3067	Cuba	=	30



Thatcher
Wooley

16=6
18=3
23=3
15=6

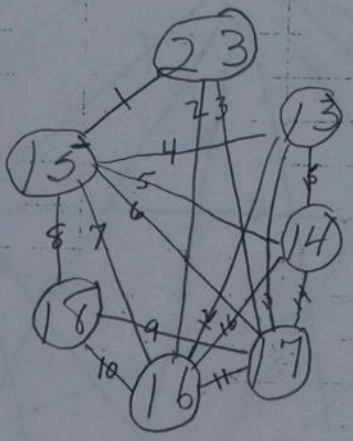
redcircle
17-29
13-23
14-23
17-19

9

72
36

16
6
22

28



OPLONIA DATA STEARN

I.	GEOGRAPHY	1.	Jamaica
		2	Cuba
		3	Hispaniola
		4	Bahamas
		5	Virgin Islands
		6	Antigua
		7	St. Vincent
		8	Peru
II.	HABIT	1	tall or erect
		2	low or spreading
III.	INTERNODES	1	less than 5 mm.
		2	more than 5 mm.
IV.	HAIRS	1	present
		2	absent
V.	HAIRS	1	short
		2	long
		3	not logical (hairs absent)
VI.	HAIRS	1	2 sides
		2	4 sides
		3	not logical (hairs absent)
VII.	SPINES	1	present
		2	absent
VIII.	SPINES	1	up to 12 mm.
		2	less than 12 mm.
		3	not logical(spines absent)
IX.	SPINES	1	fine
		2	stout
		3	not logical(spines absent)
X.	SPINES	1	curved
		2	straight
		3	not logical(spines absent)
		4	varisble(curved, deflexed or straight)
XI.	SPINES	1	ascending
		2	horizontal
		3	not logical(no spines)
		4	varisble(ascending& horizontal)
		5	not logical(curved or deflexed)

XII. LEAF LENGTH	1	3 - 10 cm.
	2	less than 2.5 cm.
	3	less than 12 cm.
XIII. LEAF BREADTH	1	more than 1.8 cm.
	2	6 - 18 mm.
	3	less than 6 mm.
XIV. LEAF BROADEST	1	above middle
	2	at middle
	3	below middle
XV. LEAF BASE	1	cuneate
	2	rounded
XVI. LEAF APEX	1	acute
	2	obtuse
XVII. LEAF	1	emarginate
	2	not emarginate
XVIII. LEAF	1	mucronate
	2	not mucronate
XIX. FLOWER NO.	1	1 or 2
	2	several
XX. PEDICEL	1	equalling or shorter than calyx
	2	longer than calyx
XXI. PEDICAL SURFACE	1	glandular
	2	glabrous
XXII. CALYX LENGTH	1	less than or equal to 3.5 mm.
	2	greater than 3.5 mm.
XXIII. SEGMENTS	1	subulate
	2	linear
XXIV. COROLLA COLOR	1	red
	2	white
	3	blue or violet
XXV. COROLLA SURFACE	1	glabrous
	2	pubescent

XXVI. COROLLA TUBE LENGTH	1	less than or equal to 4.5 mm.
	2	more than 4.5 mm.
XXVII. STAMENS	1	anthers equalling filaments
	2	shorter than filaments
	3	longer than filaments

OPLONIA DATA FOR DR D. J. ROGERS

With the compliments of

WILLIAM T. STEARN

Department of Botany
British Museum (Natural History)
Cromwell Road
London, S.W.7, England

Sept. 27, 1965

Dr. William T. Stearn
Department of Botany
British Museum (Natural History)
Cromwell Road
London, S. W. 7, England

Dear Dr. Stearn:

We have at last run your data on Oplonia that you were kind enough to give us last year. The results are, we think, quite interesting, and we would like to have your comments on them.

We hesitate to send them, however, since we have not heard from you since you sánt the original data. I wrote two letters subsequent to receipt of the original data, but had no reply. Both of those letters contained questions to problems we thought best answered by you. In the absence of any reply, we took the liberty of deciding how to answer the questions ourselves, and have run the data with our new program.

If you are still interested, we will supply the results with a set of explanations which will allow better interpretation of the results. We are anxious to continue this work with you as we think that these results show several interesting factors not shown by any of our other test runs.

Will you please note that we have moved our operations from New York. Our move was dictated by the better opportunity to pursue our work in a bigger institution, one with its own computer center. We also have the opportunity to teach courses in quantitative taxonomy here, one that we did not have in New York.

I will be glad to hear from you.

Sincerely yours,

David J. Rogers
Professor of Botany

October 26, 1964

Dr. William T. Stearn
British Museum (Natural History)
Department of Botany
Cromwell Road
London, S.W. 7, England

Dear Dr. Stearn:

On September 24, 1964, we sent you a listing of attributes and characteristics broken down according to our system with several comments requesting your interpretation and re-organization if you so desired.

I wonder whether you have received this letter or not. If not, we can send you another copy of the re-worked information for your perusal.

Sincerely yours

David J. Rogers
Curator of Quantitative Taxonomy

DJR:MDF

September 24, 1964

Dr. William T. Stearn
British Museum (Natural History)
Department of Botany
Cromwell Road
London, S.W. 7, England

Dear Dr. Stearn:

Your Oplonia data arrived in good order. We began the process of coding and include herewith a copy as we think the coding would go, but we wish to have your okay before we use this format for processing. There are two places that require your specific attention.

One, we decided to include the distributional information as one of the characteristics. You can see that I have put this on at the beginning of the coding. If this is not wanted, please strike and let me know.

The second problem is connected with the character, Calix Length. You will see some crudely pencilled in graphing of the distribution of the calix lengths. You will also see that I have subjectively divided the calix length into five coded states on the bottom and into two coded states above. Rather than to use our judgment as to which of these codings it is best to use, we would rather have your decision which may or may not coincide with either proposed coding. I merely provided you with this rough graph to show you how I would have gone about the matter of dividing the calix length into attributes. If neither of these fit but some other device does, then please let me know. I have left in the coding space for five attributes, but this does not confine us to five; we could add more if it were your desire. Let me point out that the more attributes for this characteristic, the more differentiation will be achieved; the more condensation into smaller numbers of attributes the more clustering will be achieved. Again, you will be in a better position to choose which of these two is required.

When you have made a decision on these two characteristics--the geography and the calix length--we will then proceed to punch cards and proceed with computation. The numbering system for the attributes is explained in the enclosed reprint.

Sincerely yours

David J. Rogers
Curator of Quantitative Taxonomy

DJR:MDF
Enclosures

OPLONIA DATA STEARN

I. Geography	101	Jamaica	
	102	Cuba	
	103	Hispaniola	
	104	Bahamas	
	105	Virgin Islands	
	106	Antigua	
	107	St. Vincent	
	108	Peru	
II. Habit	109	tall or erect	
	110	low or spreading	
III. Internodes	111	less than 5 mm.	
	112	more than 5 mm.	
IV. Hairs	113	present	
	114	absent	
V. Hairs	115	short	
	116	long	
VI. Hairs	117	2 sides	
	118	4 sides	
VII. Spines	119	present	
	120	absent	
VIII. Spines	121	up to 12 mm.	
	122	less than 12 mm.	
IX. Spines	123	fine	
	124	stout	
X. Spines	125	curved or deflexed	
	126	straight	
XI. Spines	127	ascending	
	128	horizontal	
XII. Leaf length	129	3-10 cm.	
	130	less than 2.5 cm.	
	131	less than 12 m.	please check attribute 131. Is it m, mm, or cm?
XIII. Leaf breadth	132	more than 1.8 cm.	
	133	6-18 mm.	
	134	less than 6 mm.	
XIV. Leaf broadest	135	above middle	
	136	at middle	
	137	below middle	
XV. Leaf base	138	cuneate	
	139	rounded	

XVI. Leaf apex	140	acute	
	141	obtuse	
XVII. Leaf _____	142	emarginate	
	143	not emarginate	
XVIII. Leaf _____	144	mucronate	
	145	not mucronate	
XIX. Flower No.	146	1 or 2	
	147	several	
XX. Pedicel	148	equalling or shorter than calyx	
	149	longer than calyx	
XXI. Pedical Surface	150	glandular	
	151	glabrous	
XXII. Calyx length	152	less than or equal to 3.5 mm.	or less than or equal to 6.5 mm.
	153	4 - 5.5 mm.	or greater than or equal to 7.0 mm.
	154	6.0 - 6.5 mm.	
	155	7.0 - 9.0 mm.	
	156	greater than or equal to 9.5 mm.	
XXIII. Segments	157	subulate	
	158	linear	
XXIV. Corolla color	159	red	
	160	white	
	161	blue or violet	
XXV. Corolla surface	162	glabrous	
	163	pubescent	
XXVI. Corolla tube length	164	less than or equal to 4.5 mm.	
	165	more than 4.5 mm.	
XXVII. Stamens	166	anthers equalling filaments	
	167	shorter than filaments	
	168	longer than filaments	

- Taxonomy Laboratory

May 23, 1966

Dr. William T. Stearn
Department of Botany
British Museum (Natural History)
Cromwell Road
London, S.W. 7, England

Dear Dr. Stearn:

Since some time has passed since we returned the results of our computer analysis of Oplonia, I wonder if you have any comments to make upon this subject?

Sincerely yours,

David J. Rogers
Professor of Botany

DJR:ch

BRITISH MUSEUM (NATURAL HISTORY),
Cromwell Road,
London, S.W.7.
Telegrams: NATHISMUS, LONDON, S.W.7.

WTS/DEA

Department of Botany.

18th November 1965.

Professor David J. Rogers,
Taxonomy Laboratory,
Department of Botany,
Colorado State University,
Fort Collins,
Colorado,
U.S.A.

Dear Professor Rogers,

Thank you for both your letter of 26th October 1965 and the impressive bundle of data relating to Oplonia which came today by registered post. At the moment all I have done has been to glance through this. I look forward in the near future to examining it along with the specimens concerned. Meanwhile I thank you very much indeed for your thought and time you have expended on this.

Yours sincerely,

William T. Stearn

W. T. Stearn.

(1)

Oplonia Ref.

Coll. BRITTON No. 2877

			JAMAICA BAHAMAS	CUBA	HISPANIOLA	
(2)	A	1) Habit		tall or erect	low or spreading	
(2)	A	2) Internodes		less than 5mm. long	more than 5mm. long	
(1)	A	3) Hairs		present	absent	
(1)	A	4)		short	long	
(1)	A	5)		on two sides	on four sides	
(1)	A	6) Spines		present	absent	
(1)	A	7) length		up to 12mm.	less than 12mm.	
(1)	A	8) thickness		fine	stout	
(2)	A	9) poise		Curved or deflexed	straight	
(1)	A	10)		ascending	horizontal	
		Leaves				
(2)	Q	11) length (max.)		3-10cm.	less than 2.5cm.	less than 12m. 0 1 2
(2)	Q	12) breadth(max)		more than 1.8cm.	6-18mm.	less than 6mm. 0 1 2
(3)	A	13) broadest		above middle	at middle	below middle 0 1 2
(2)	A	14) base		cuneate	rounded	
(1)	A	15) apex		acute	obtuse	
(2)	A	16)		emarginate	not emarginate	
(1)	A	17)		mucronate	not mucronate	
(1)	A	18) Flowers		1 or 2	several	
(1)	A	19) Pedicel		equalling or shorter than calyx	longer than calyx	
(2)	A	20)		glandular	glabrous	
		Calyx				
(1)	Q	21) length		(3.5mm		
(1)	A	22) segments		subulate	linear	
(2)	A	23) Corolla		red	white	blue or violet
(1)	A	24)		glabrous	pubescent	
(2)	Q	25) tube		to 4.5mm. long	more than 4.5mm. long. (6.5mm)	
(3)	A	26) Stamens		anthers equalling filaments	shorter than filaments	longer than filaments

[Bull's Trade: acc: volcano; N.Y. 62]

(2)

Oplonia Ref.

Coll. STEARN No. ~~BBS/E~~ 550

		JAMAICA BAHAMAS	CUBA	HISPANIOLA
(2)	1) Habit		tall or erect	low or spreading
(2)	2) Internodes		less than 5mm. long	more than 5mm. long
(1)	3) Hairs		present	absent
(1)	4)		short	long
(1)	5)		on two sides	on four sides
(1)	6) Spines		present	absent
(1)	7) length		up to 12mm.	less than 12mm.
(1)	8) thickness		fine	stout
(2)	9) poise		Curved or deflexed	straight
(1)	10)		ascending	horizontal
	Leaves			
(2)	11) length (max.)		3-10cm.	less than 2.5cm.
(2)	12) breadth(max)		less than 12m.	more than 1.8cm.
(3)	13) broadest		6-18mm.	less than 6mm.
			~~below middle~~	
			at middle	
			below middle	
(2)	14) base		cuneate	rounded
(1)	15) apex		acute	obtuse
(2)	16)		emarginate	
			not emarginate	
(1)	17)		mucronate	
			not mucronate	
(1)	18) Flowers		1 or 2	several
(1)	19) Pedicel		equalling or shorter than calyx	
			longer than calyx	
(2)	20)		glandular	glabrous
	Calyx			
(1)	21) length		2.5 mm. long	
(1)	22) segments		subulate	linear
(2)	23) Corolla		red	white
			blue or violet	
(1)	24)		glabrous	pubescent
(2)	25) tube		to 4.5mm. long	5.5 mm long
			more than 4.5mm. long.	
(3)	26) Stamens		anthers equalling filaments	
			shorter than filaments	
			anthers larger than filaments	

Portland : acicularis BM 58

BM.

(3)

Oplonia Ref.

Coll. E.G. BRITTON No. 2894

		JAMAICA BAHAMAS	CUBA	HISPANIOLA
(2) 1)	Habit		tall or erect	low or spreading
(2) 2)	Internodes		less than 5mm. long	more than 5mm. long
(1) 3)	Hairs		present	absent
(1) 4)			short	long
(2) 5)			on two sides	on four sides
(1) 6)	Spines		present	absent
(2) 7)	length		up to 12mm.	less than 12mm.
(1) 8)	thickness		fine	stout
(2) 9)	poise		Curved or deflexed	straight
(1) 10)			ascending	horizontal
	Leaves			
(3) 11)	length (max.)		3-10cm.	less than 2.5cm.
(2) 12)	breadth(max)		less than 12m.	more than 1.8cm. 6-18mm. less than 6mm.
(3) 13)	broadest		above middle	at middle below middle
(2) 14)	base		cuneate	rounded
(2) 15)	apex		acute	obtuse
(2) 16)			emarginate	not emarginate
(1) 17)			mucronate	not mucronate
(1) 18)	Flowers		1 or 2	several
(2) 19)	Pedicel		equalling or shorter than calyx	longer than calyx
(2) 20)			glandular	glabrous
	Calyx			
(1) 21)	length		2 mm. long	
(1) 22)	segments		subulate	linear
(2) 23)	Corolla		red	white
			blue or violet	
(1) 24)			glabrous	pubescent
(1) 25)	tube		to 4.5mm. long	more than 4.5mm. long.
(3) 26)	Stamens		anthers equalling filaments	shorter than filaments

4 mm. long

anthers longer than filaments

11

Westmorland : acicularis. NY 62

NY!

14 4

(4)

Oplonia Ref.

Coll. PROCTOR No. 8433

		JAMAICA BAHAMAS	CUBA	HISPANIOLA
(1) 1)	Habit		tall or erect	low or spreading
(2) 2)	Internodes		less than 5mm. long	more than 5mm. long
(2) 3)	Hairs		present	absent
nl (3) 4)			short	long
nl (3) 5)			on two sides	on four sides
(2) 6)	Spines		present	absent
nl (3) 7)	length		up to 12mm.	less than 12mm.
nl (3) 8)	thickness		fine	stout
nl (3) 9)	poise		Curved or deflexed	straight
nl (3) 10)			ascending	horizontal
	Leaves			
(1) 11)	length (max.)		3-10cm.	less than 2.5cm.
(1) 12)	breadth(max)		less than 12m.	more than 1.8cm.
			6-18mm.	less than 6mm.
(2) 13)	broadest		below middle	at middle
			below middle	
(1) 14)	base		cuneate	rounded
(2) 15)	apex		acute	obtuse
(2) 16)			emarginate	not emarginate
(1) 17)			mucronate	not mucronate
(2) 18)	Flowers		1 or 2	several
(2) 19)	Pedicel		equalling or shorter than calyx	longer than calyx
(2) 20)			glandular	glabrous
	Calyx			
(2) 21)	length		5 mm. long	
(1) 22)	segments		subulate	linear
(3) 23)	Corolla		red	white
			blue or violet	
(2) 24)			glabrous	pubescent
(2) 25)	tube		to 4.5mm. long	more than 4.5mm. long. 10 mm long
(2) 26)	Stamens		anthers equalling filaments	shorter than filaments

Clarendon: Peckham Woods 10 March 1954

jamaicensis

(5)

Oplonia Ref.

Coll. STEARN No. 454

		JAMAICA BAHAMAS	CUBA	HISPANIOLA
(1)	1) Habit		tall or erect	low or spreading
(2)	2) Internodes		less than 5mm. long	more than 5mm. long
(2)	3) Hairs		present	absent
nl (3)	4)		short	long
nl (3)	5)		on two sides	on four sides
(2)	6) Spines		present	absent
nl (3)	7) length		up to 12mm.	less than 12mm.
nl (3)	8) thickness		fine	stout
nl (3)	9) poise		Curved or deflexed	straight
nl (3)	10)		ascending	horizontal
	Leaves			
(1)	11) length (max.)		3-10cm.	less than 2.5cm.
(1)	12) breadth (max)		less than 12m.	more than 1.8cm.
(2)	13) broadest		6-18mm.	less than 6mm.
(1)	14) base		below middle	at middle
(2)	15) apex		cuneate	rounded
(2)	16)		acute	obtuse
(1)	17)		emarginate	not emarginate
			mucronate	not mucronate
(2)	18) Flowers		1 or 2	several
(2)	19) Pedicel		equalling or shorter than calyx	longer than calyx
(1)	20)		glandular	glabrous
	Calyx			
(2)	21) length		4 mm	
(1)	22) segments		subulate	linear
(3)	23) Corolla		red	white
			blue or violet	
(1)	24)		glabrous	pubescent
(2)	25) tube		to 4.5mm. long	more than 4.5mm. long.
(2)	26) Stamens		anthers equalling filaments	shorter than filaments

10 mls

Jamaicalis White Rocks BM

BM

(6)

Oplonia Ref.

Coll. HARRIS No. 2968

JAMAICA / BAHAMAS | CUBA | HISPANIOLA

(1) 1) Habit — tall or erect | low or spreading

(2) 2) Internodes — less than 5mm. long | more than 5mm. long

(1) 3) Hairs — present | absent
(1) 4) short | long
(2) 5) on two sides | on four sides

(2) 6) Spines — present | absent
nl (3) 7) length — up to 12mm. | less than 12mm.
nl (3) 8) thickness — fine | stout
nl (3) 9) poise — Curved or deflexed | straight
nl (3) 10) ascending | horizontal

Leaves
(1) 11) length (max.) — 3-10cm. | less than 2.5cm.
(1) 12) breadth (max) — less than 12m. | more than 1.8cm. | 6-18mm. | less than 6mm.
(2) 13) broadest — below middle | at middle | below middle
(1) 14) base — cuneate | rounded
(2) 15) apex — acute | obtuse
(1) 16) emarginate | not emarginate
(1) 17) mucronate | not mucronate

(2) 18) Flowers — 1 or 2 | several
(2) 19) Pedicel — equalling or shorter than calyx | longer than calyx
(1) 20) glandular | glabrous

Calyx
(2) 21) length — 4.5 mm.
(1) 22) segments — subulate | linear

(3) 23) Corolla — red | white | blue or violet
(2) 24) glabrous | pubescent
(2) 25) tube to 4.5mm. long | more than 4.5mm. long. 10mm lg.
(2) 26) Stamens — anthers equalling filaments | shorter than filaments

Lecto Type Psilanthele jamaicensis Linear
St Cath Mt Diablo 11 8 1905

20,37

(7)

Oplonia Ref.

Coll. PROCTOR No. 16430

		JAMAICA BAHAMAS	CUBA	HISPANIOLA
(1) 1)	Habit		tall or erect	low or spreading
(2) 2)	Internodes		less than 5mm. long	more than 5mm. long
(1) 3)	Hairs		present	absent
(1) 4)			short	long
(2) 5)			on two sides	on four sides
(1) 6)	Spines		present	absent
(1) 7)	length		up to 12mm.	less than 12mm.
(2) 8)	thickness		fine	stout
(2) 9)	poise		Curved or deflexed	straight
(2) 10)			ascending	horizontal
	Leaves			
(3) 11)	length (max.)		3-10cm.	less than 2.5cm.
(3) 12)	breadth(max)		less than 12m.	more than 1.8cm.
			6-18mm.	less than 6mm.
HSF 13)	broadest		below middle	at middle
			below middle	
(1) 14)	base		cuneate	rounded
(2) 15)	apex		acute	obtuse
(2) 16)			emarginate	not emarginate
(2) 17)			mucronate	not mucronate
(1) 18)	Flowers		1 or 2	several
(2) 19)	Pedicel		equalling or shorter than calyx	longer than calyx
(2) 20)			glandular	glabrous
	Calyx			
HSF 21)	length			
(1) 22)	segments		subulate	linear
(3) 23)	Corolla		red	white
			blue or violet	
(2) 24)			glabrous	pubescent
(2) 25)	tube		to 4.5mm. long	more than 4.5mm. long. 8 mm. long.
(2) 26)	Stamens		anthers equalling filaments	shorter than filaments

[Las Villas: tetrasticha; IJ.]

(8) (14)

Oplonia Ref.

Coll. LEON No. 2326

		JAMAICA BAHAMAS	CUBA	HISPANIOLA
(1) 1)	Habit		tall or erect	low or spreading
(2) 2)	Internodes		less than 5mm. long	more than 5mm. long
(1) 3)	Hairs		present	absent
(1) 4)			short	long
(2) 5)			on two sides	on four sides
(1) 6)	Spines		present	absent
(1) 7)	length		up to 12mm.	less than 12mm.
(2) 8)	thickness		fine	stout
(2) 9)	poise		Curved or deflexed	straight
(2) 10)			ascending	horizontal
	Leaves			
(3) 11)	length (max.)		3-10cm.	less than 2.5cm.
(3) 12)	breadth(max)		less than 12m.	more than 1.8cm. 6-18mm. less than 6mm.
(1) 13)	broadest		~~above~~ middle	at middle below middle
(1) 14)	base		cuneate	rounded
(2) 15)	apex		acute	obtuse
(2) 16)			emarginate	not emarginate
(2) 17)			mucronate	not mucronate
(1) 18)	Flowers		1 or 2	several
(2) 19)	Pedicel		equalling or shorter than calyx	longer than calyx
(2) 20)			glandular	glabrous
	Calyx			
(1) 21)	length		3.5mm long	
(1) 22)	segments		subulate	linear
HBF (0) 23)	Corolla		red	white
			blue or violet	
(1) 24)			glabrous	pubescent
(2) 25)	tube		to 4.5mm. long	more than 4.5mm. long. 8mm long
HBF (0) 26)	Stamens		anthers equalling filaments	shorter than filaments

Habana. June 1912.

tetrasticha.

(9)

Oplonia Ref.

Coll. CURTISS No. 133

		JAMAICA BAHAMAS	CUBA	HISPANIOLA
(1) 1)	Habit		tall or erect	low or spreading
(2) 2)	Internodes		less than 5mm. long	more than 5mm. long
(1) 3)	Hairs		present	absent
(1) 4)			short	long
(2) 5)			on two sides	on four sides
(1) 6)	Spines		present	absent
(2) 7)	length		up to 12mm.	less than 12mm.
(2) 8)	thickness		fine	stout
(1) 9)	poise		Curved or deflexed	straight
? (0) 10)			ascending	horizontal
	Leaves			
(3) 11)	length (max.)		3-10cm.	less than 2.5cm.
(3) 12)	breadth(max)		less than 12m.	more than 1.8cm.
			6-18mm.	less than 6mm.
(3) 13)	broadest		below middle	at middle
			below middle	
(2) 14)	base		cuneate	rounded
(2) 15)	apex		acute	obtuse
(2) 16)			emarginate	not emarginate
(2) 17)			mucronate	not mucronate
(1) 18)	Flowers		1 or 2	several
(2) 19)	Pedicel		equalling or shorter than calyx	longer than calyx
(2) 20)			glandular	glabrous
	Calyx			
(1) 21)	length		2 mm.	
(1) 22)	segments		subulate	linear
(3) 23)	Corolla		red	white
			blue or violet	
(1) 24)			glabrous	pubescent
(2) 25)	tube		to 4.5mm. long	more than 4.5mm. long. 8 mm.
(2) 26)	Stamens		anthers equalling filaments	shorter than filaments

[Nassau: spinosa; BM]

(10)

Oplonia Ref.

Coll. W.B. Robertson No. 26

JAMAICA CUBA HISPANIOLA
BAHAMAS VIRGIN ISLANDS

(1) 1) Habit — tall or erect / low or spreading

(2) 2) Internodes — less than 5mm. long / more than 5mm. long

(1) 3) Hairs — present / absent
(1) 4) — short / long
(2) 5) — on two sides / on four sides

(1) 6) Spines — present / absent
(2) 7) length — up to 12mm. / less than 12mm.
(2) 8) thickness — fine / stout
(4) 9) poise — Curved or deflexed / straight
(4) 10) — ascending / horizontal

Leaves
(3) 11) length (max.) — 3-10cm. / less than 2.5cm. / less than 12m.
(2) 12) breadth(max) — more than 1.8cm. / 6-18mm. / less than 6mm.
(3) 13) broadest — above middle / at middle / below middle
(2) 14) base — cuneate / rounded
(2) 15) apex — acute / obtuse
(2) 16) — emarginate / not emarginate
(2) 17) — mucronate / not mucronate

(1) 18) Flowers — 1 or 2 / several
(2) 19) Pedicel — equalling or shorter than calyx / longer than calyx
(2) 20) — glandular / glabrous

Calyx
(1) 21) length — 3 mm.
(1) 22) segments — subulate / linear

(3) 23) Corolla — red / white / blue or violet
? (0) 24) — glabrous / pubescent
((2) 25) tube — to 4.5mm. long / more than 4.5mm. long. 8 mm long
(2) 26) Stamens — anthers equalling filaments / shorter than filaments

Code 4 variable

This puzzl specimen has
1) Spines straight ab
2) " " hor
3) " curved de
on different sh may be it shal be treated as 3 entries.

St. John : Virgin Isl. 7 Mar. 1957

Spinosa

11

(11)

Oplonia

Ref.

Coll. STEARN

No. 726

		JAMAICA BAHAMAS	CUBA	HISPANIOLA
(1) 1)	Habit		tall or erect	low or spreading
(2) 2)	Internodes		less than 5mm. long more than 5mm. long	
(1) 3)	Hairs		present	absent
(1) 4)			short	long
(2) 5)			on two sides on four sides	
(2) 6)	Spines		present	absent
nr (3) 7)	length		up to 12mm. less than 12mm.	
nr (3) 8)	thickness		fine	stout
nr (3) 9)	poise		Curved or deflexed straight	
nr (3) 10)			ascending	horizontal
	Leaves			
(2) 11)	length (max.)		3-10cm. less than 2.5cm.	
(2) 12)	breadth(max)		less than 12m. more than 1.8cm. 6-18mm. less than 6mm.	
(1) 13)	broadest		above middle at middle below middle	
(1) 14)	base		cuneate	rounded
(2) 15)	apex		acute	obtuse
(1) 16)			emarginate	
(2) 17)			not emarginate mucronate not mucronate	
(1) 18)	Flowers		1 or 2	several
(2) 19)	Pedicel		equalling or shorter than calyx longer than calyx	
(1) 20)			glandular	glabrous
	Calyx			
(1) 21)	length		3.5 mm	
(1) 22)	segments		subulate	linear
(2) 23)	Corolla		red	white
			blue or violet	
(1) 24)			glabrous	pubescent
(2) 25)	tube		to 4.5mm. long more than 4.5mm. long.	10mm.
(2) 26)	Stamens		anthers equalling filaments shorter than filaments	

[St. Ann: miner; BM]

12

(12)

(21)

Oplonia

Ref.

Coll. PROCTOR

No. 21407

		JAMAICA BAHAMAS	CUBA	HISPANIOLA
(1) 1)	Habit	tall or erect		low or spreading
(2) 2)	Internodes	less than 5mm. long		more than 5mm. long
(1) 3)	Hairs	present		absent
(1) 4)		short		long
(2) 5)		on two sides		on four sides
(2) 6)	Spines	present		absent
nl (3) 7)	length	up to 12mm.		less than 12mm.
nl (3) 8)	thickness	fine		stout
nl (3) 9)	poise	Curved or deflexed	straight	
nl (3) 10)		ascending		horizontal
	Leaves			
(2) 11)	length (max.)	3-10cm.		less than 2.5cm.
(2) 12)	breadth(max)	less than 12m.		more than 1.8cm.
		6-18mm.		less than 6mm.
(1) 13)	broadest	~~below~~ middle		at middle below middle
(1) 14)	base	cuneate		rounded
(2) 15)	apex	acute		obtuse
(1) 16)		emarginate		not emarginate
(2) 17)		mucronate		not mucronate
(1) 18)	Flowers	1 or 2		several
(2) 19)	Pedicel	equalling or shorter than calyx		longer than calyx
(2) 20)		glandular		glabrous
	Calyx			
(1) 21)	length	3 mm		
(1) 22)	segments	subulate		linear
(1) 23)	Corolla	red	blue or violet	white
(1) 24)		glabrous		pubescent
(2) 25)	tube	to 4.5mm. long	more than 4.5mm. long.	6 mm lg.
(2) 26)	Stamens	anthers equalling filaments		shorter than filaments

Trelawny armata armata Bot

13 4

(13)

Oplonia Ref.

Coll. BOX No. 757

JAMAICA CUBA HISPANIOLA
BAHAMAS ANTIGUA

(1) 1) Habit tall or erect / low or spreading

(2) 2) Internodes less than 5mm. long / more than 5mm. long

(1) 3) Hairs present / absent
(2) 4) short / long
(1) 5) on two sides / on four sides

(1) 6) Spines present / absent
(2) 7) length up to 12mm. / less than 12mm.
(1) 8) thickness fine / stout
(2) 9) poise Curved or deflexed / straight
(1) 10) ascending / horizontal

Leaves
(3) 11) length (max.) 3-10cm. / less than 2.5cm. / less than 12m.
(3) 12) breadth(max) more than 1.8cm. / 6-18mm. / less than 6mm.
(1) 13) broadest above middle / at middle / below middle
(1) 14) base cuneate / rounded
(2) 15) apex acute / obtuse
(1) 16) emarginate / not emarginate
(1) 17) mucronate / not mucronate

(1) 18) Flowers 1 or 2 / several
(2) 19) Pedicel equalling or shorter than calyx / longer than calyx
(2) 20) glandular / glabrous

Calyx
(1) 21) length 2.5 mm. long
(1) 22) segments subulate / linear

(1) 23) Corolla red / white / blue or violet
(2) 24) glabrous / pubescent
(2) 25) tube to 4.5mm. long / more than 4.5mm. long. 6 mm. long
(2) 26) Stamens anthers equalling filaments / shorter than filaments

microphylla.

5

14 (12)

(14)

Oplonia Ref.

Coll. HOWARD No. 10916

JAMAICA CUBA HISPANIOLA
BAHAMAS ST. VINCENT

(1) 1) Habit — tall or erect / low or spreading

(2) 2) Internodes — less than 5mm. long / more than 5mm. long

(1) 3) Hairs — present / absent
(2) 4) short / long
(1) 5) on two sides / on four sides

(1) 6) Spines — present / absent
(2) 7) length — up to 12mm. / less than 12mm.
(1) 8) thickness — fine / stout
(2) 9) poise — Curved or deflexed / straight
(1) 10) ascending / horizontal

Leaves
(3) 11) length (max.) 3-10cm. / less than 2.5cm. / less than 12m.
(3) 12) breadth(max) more than 1.8cm. / 6-18mm. / less than 6mm.
(1) 13) broadest above middle / at middle / below middle
(1) 14) base — cuneate / rounded
(2) 15) apex — acute / obtuse
(2) 16) emarginate
(1) 17) not emarginate / mucronate / not mucronate

(1) 18) Flowers — 1 or 2 / several
(2) 19) Pedicel — equalling or shorter than calyx / longer than calyx
? — 20) glandular / glabrous

Calyx
(1) 21) length 3 mm or
(1) 22) segments — subulate / linear

(3) 23) Corolla — red / white / blue or violet
(2) 24) glabrous / pubescent
(2) 25) tube to 4.5mm. long / more than 4.5mm. long. 6 m.
(2) 26) Stamens — anthers equalling filaments / shorter than filaments

microphylla 13/4 BM

15

Oplonia Ref.

Coll. ARAQUE-MOLINA & BARKLEY No. 22 J 448

JAMAICA CUBA HISPANIOLA
BAHAMAS

(1) 1) Habit — tall or erect / low or spreading

(2) 2) Internodes — less than 5mm. long / more than 5mm. long

(1) 3) Hairs — present / absent
(2) 4) short / long
(2) 5) on two sides / on four sides

(1) 6) Spines — present / absent
(2) 7) length — up to 12mm. / less than 12mm.
(1) 8) thickness — fine / stout
(2) 9) poise — Curved or deflexed / straight
(1) 10) ascending / horizontal

Leaves
(3) 11) length (max.) 3-10cm. / less than 2.5cm.
(3) 12) breadth(max) less than 12m. / more than 1.8cm. / 6-18mm. / less than 6mm.
(1) 13) broadest above middle / at middle / below middle
(1) 14) base cuneate / rounded
(2) 15) apex acute / obtuse
(1) 16) emarginate / not emarginate
(2) 17) mucronate / not mucronate

(1) 18) Flowers — 1 or 2 / several
(2) 19) Pedicel — equalling or shorter than calyx / longer than calyx
(2) 20) glandular / glabrous

Calyx
(1) 21) length — 3 mm long
(1) 22) segments — subulate / linear

(3) 23) Corolla — red / white / blue or violet
(2) 24) glabrous / pubescent
(2) 25) tube to 4.5mm. long / more than 4.5mm. long. 8 mm
(2) 26) Stamens — anthers equalling filaments / shorter than filaments

microphylla

St. Thomas: Yallahs BM

microphylla BM BM

(18)

(16)

Oplonia Ref.

Coll. PROCTOR No. 9971

	JAMAICA BAHAMAS	CUBA	HISPANIOLA
(1) 1) Habit		tall or erect	low or spreading
(2) 2) Internodes		less than 5mm. long	more than 5mm. long
(1) 3) Hairs		present	absent
(2) 4)		short	long
(2) 5)		on two sides	on four sides
(1) 6) Spines		present	absent
(2) 7) length		up to 12mm.	less than 12mm.
(1) 8) thickness		fine	stout
(2) 9) poise		Curved or deflexed	straight
(1) 10)		ascending	horizontal
Leaves			
(3) 11) length (max.)		3-10cm.	less than 2.5cm.
(3) 12) breadth (max)		less than 12m.	more than 1.8cm.
		6-18mm.	less than 6mm.
(1) 13) broadest		~~base~~ middle	at middle
			below middle
(1) 14) base		cuneate	rounded
? HF 15) apex		acute	obtuse
(1) 16)		emarginate	not emarginate
(2) 17)		mucronate	not mucronate
(1) 18) Flowers		1 or 2	several
(2) 19) Pedicel		equalling or shorter than calyx	longer than calyx
(2) 20)		glandular	glabrous
Calyx			
(1) 21) length		2.5 mm. long	
(1) 22) segments		subulate	linear
(3) 23) Corolla		red	white
		blue or violet	
(2) 24)		glabrous	pubescent
(4) 25) tube		to 4.5mm. long	more than 4.5mm. long. 6 mm lg
(2) 26) Stamens		anthers equalling filaments	shorter than filaments

St. Catherine microphylla 85 26

26

17

(31)

Oplonia (17) Ref.

Coll. STEARN No. 830

		JAMAICA BAHAMAS	CUBA	HISPANIOLA
(1) 1)	Habit		tall or erect	low or spreading
(2) 2)	Internodes		less than 5mm. long	more than 5mm. long
(1) 3)	Hairs		present	absent
(2) 4)			short	long
(2) 5)			on two sides	on four sides
(1) 6)	Spines		present	absent
(2) 7)	length		up to 12mm.	less than 12mm.
(1) 8)	thickness		fine	stout
(2) 9)	poise		Curved or deflexed	straight
(1) 10)			ascending	horizontal
	Leaves			
(3) 11)	length (max.)		3-10cm.	less than 2.5cm.
(3) 12)	breadth(max)		less than 12m.	more than 1.8cm. 6-18mm. less than 6mm.
(1) 13)	broadest		~~above~~ middle	at middle below middle
(1) 14)	base		cuneate	rounded
(2) 15)	apex		acute	obtuse
(1) 16)			emarginate	not emarginate
? 1 of F up in (2) — 17)			mucronate	not mucronate
(1) 18)	Flowers		1 or 2	several
(2) 19)	Pedicel		equalling or shorter than calyx	longer than calyx
(2) 20)			glandular	glabrous
(1)	Calyx			
21)	length		3 mm. long	
? HSF (2) 22)	segments		subulate	linear
(3) 23)	Corolla		red	white blue or violet
(2) 24)			glabrous	pubescent
(2) 25)	tube		to 4.5mm. long	more than 4.5mm. long. 8 mm. long.
(2) 26)	Stamens		anthers equalling filaments	shorter than filaments

Kingston & St Andrew.

microphylla

RH

(18)

Oplonia Ref.

Coll. NORMAN No. 100

	JAMAICA BAHAMAS	CUBA	HISPANIOLA
(1) 1)	Habit	tall or erect	low or spreading
(2) 2)	Internodes	less than 5mm. long	more than 5mm. long
(1) 3)	Hairs	present	absent
(1) 4)		short	long
(2) 5)		on two sides	on four sides
(1) 6)	Spines	present	absent
(2) 7)	length	up to 12mm.	less than 12mm.
(1) 8)	thickness	fine	stout
(2) 9)	poise	Curved or deflexed	straight
(1) 10)		ascending	horizontal
	Leaves		
? HSE (0) 11)	length (max.)	3-10cm.	less than 2.5cm.
? HS (0) 12)	breadth (max)	less than 12m.	more than 1.8cm.
		6-18mm.	less than 6mm.
(3) 13)	broadest	~~below~~ middle	at middle
			below middle
(1) 14)	base	cuneate	rounded
(2) 15)	apex	acute	obtuse
(1) 16)		emarginate	not emarginate
(2) 17)		mucronate	not mucronate
(1) 18)	Flowers	1 or 2	several
(2) 19)	Pedicel	equalling or shorter than calyx	longer than calyx
? HSE (0) 20)		glandular	glabrous
	Calyx		
(1) 21)	length	3 mm.	
(1) 22)	segments	subulate	linear
(3) 23)	Corolla	red	white
		blue or violet	
(1) 24)		glabrous	pubescent
(2) 25)	tube	to 4.5mm. long	more than 4.5mm. long.
(2) 26)	Stamens	anthers equalling filaments	shorter than filaments

8 mm

Montego Bay minor minor

(19)

Oplonia Ref.

Coll. STEARN No. 863

		JAMAICA BAHAMAS	CUBA	HISPANIOLA
(1) 1)	Habit		tall or erect	low or spreading
(2) 2)	Internodes		less than 5mm. long	more than 5mm. long
(1) 3)	Hairs		present	absent
(1) 4)			short	long
(2) 5)			on two sides	on four sides
(1) 6)	Spines		present	absent
(2) 7)	length		up to 12mm.	less than 12mm.
(1) 8)	thickness		fine	stout
(2) 9)	poise		Curved or deflexed	straight
(1) 10)			ascending	horizontal
	Leaves			
(3) 11)	length (max.)		3-10cm.	less than 2.5cm.
(1) 12)	breadth(max)		less than 12m.	more than 1.8cm.
			6-18mm.	less than 6mm.
(2) 13)	broadest		~~below~~ middle	at middle
				below middle
(1) 14)	base		cuneate	rounded
(2) 15)	apex		acute	obtuse
(2) 16)			emarginate	not emarginate
(2) 17)			mucronate	not mucronate
(1) 18)	Flowers		1 or 2	several
(2) 19)	Pedicel		equalling or shorter than calyx	longer than calyx
(2) 20)			glandular	glabrous
	Calyx			
(1) 21)	length		3 mm	
(1) 22)	segments		subulate	linear
(3) 23)	Corolla		red	white
			blue or violet	
(1) 24)			glabrous	pubescent
(2) 25)	tube		to 4.5mm. long	more than 4.5mm. long. 9 mm.
(2) 26)	Stamens		anthers equalling filaments	shorter than filaments

St. Elizabeth minor.

(20)

Oplonia Ref.

Coll. EKMAN No. 15042

	JAMAICA BAHAMAS	CUBA	HISPANIOLA
(1) 1) Habit		tall or erect	low or spreading
(2) 2) Internodes		less than 5mm. long	more than 5mm. long
(1) 3) Hairs		present	absent
(1) 4)		short	long
(1) 5)		on two sides	on four sides
(1) 6) Spines		present	absent
(2) 7) length		up to 12mm.	less than 12mm.
(1) 8) thickness		fine	stout
(2) 9) poise		Curved or deflexed	straight
(2) 10)		ascending	horizontal
Leaves			
(3) 11) length (max.)		3-10cm.	less than 2.5cm.
(3) 12) breadth (max)		less than 12m.	more than 1.8cm.
		6-18mm.	less than 6mm.
(2) 13) broadest		above middle	at middle
		below middle	
(1) 14) base		cuneate	rounded
(2) 15) apex		acute	obtuse
(2) 16)		emarginate	
(2) 17)		not emarginate	mucronate
		not mucronate	
(0) 18) Flowers		1 or 2	several
(0) 19) Pedicel		equalling or shorter than calyx	longer than calyx
(0) 20)		glandular	glabrous
Calyx			
(0) 21) length			
(0) 22) segments		subulate	linear
(0) 23) Corolla		red	white
		blue or violet	
(0) 24)		glabrous	pubescent
(0) 25) tube		to 4.5mm. long	more than 4.5mm. long.
(0) 26) Stamens		anthers equalling filaments	shorter than filaments

Oriente: Sierra de Nipe S. BM

microphylla

(21)

Oplonia Ref.

Coll. Marie-Victorin clément & Alain No. 21625

		JAMAICA BAHAMAS	CUBA	HISPANIOLA
(1) 1)	Habit		tall or erect	low or spreading
(2) 2)	Internodes		less than 5mm. long	more than 5mm. long
(1) 3)	Hairs		present	absent
(1) 4)			short	long
(1) 5)			on two sides	on four sides
(1) 6)	Spines		present	absent
(2) 7)	length		up to 12mm.	less than 12mm.
(1) 8)	thickness		fine	stout
(1) 9)	poise		Curved or deflexed	straight
(0) 10)			ascending	horizontal
	Leaves			
(3) 11)	length (max.)		3-10cm.	less than 2.5cm.
(3) 12)	breadth(max)		less than 12m.	more than 1.8cm.
			6-18mm.	less than 6mm.
(2) 13)	broadest		below middle	at middle
			below middle	
(1) 14)	base		cuneate	rounded
(2) 15)	apex		acute	obtuse
(1) 16)			emarginate	not emarginate
(1) 17)			mucronate	not mucronate
(1) 18)	Flowers		1 or 2	several
(2) 19)	Pedicel		equalling or shorter than calyx	longer than calyx
20)			glandular	glabrous
	Calyx			
(2) 21)	length		4 mm. lg.	
(1) 22)	segments		subulate	linear
(0) 23)	Corolla		red	white
			blue or violet	
(1) 24)			glabrous	pubescent
(2) 25)	tube	to 4.5mm. long	more than 4.5mm. long.	8 mm. lg.
(2) 26)	Stamens		anthers equalling filaments	shorter than filaments

Oriente: Moa, r. to Yagrumaje Montreal.
Spinosa
April 1943

(22)

Oplonia Ref.

Coll. E.C. Leonard & C.A. Leonard No. 13674

		JAMAICA BAHAMAS	CUBA	HISPANIOLA
(1) 1)	Habit	tall or erect		low or spreading
(2) 2)	Internodes	less than 5mm. long		more than 5mm. long
(1) 3)	Hairs	present		absent
(1) 4)		short		long
(2) 5)		on two sides		on four sides
(1) 6)	Spines	present		absent
(2) 7)	length	up to 12mm.		less than 12mm.
(1) 8)	thickness	fine		stout
(1) 9)	poise	Curved or deflexed	straight	
HBF (0) 10)		ascending		horizontal
	Leaves			
(3) 11)	length (max.)	3-10cm.		less than 2.5cm.
(3) 12)	breadth(max)	less than 12m.		more than 1.8cm.
		6-18mm.		less than 6mm.
(1) 13)	broadest	~~below~~ middle	at middle	below middle
(1) 14)	base	cuneate		rounded
(2) 15)	apex	acute		obtuse
(2) 16)		emarginate		not emarginate
(2) 17)		mucronate		not mucronate
(1) 18)	Flowers	1 or 2		several
(2) 19)	Pedicel	equalling or shorter than calyx		longer than calyx
(2) 20)		glandular		glabrous
	Calyx			
(1) 21)	length	3.5 mm lg		
(1) 22)	segments	subulate		linear
(3) 23)	Corolla	red		white
(1) 24)		blue or violet		
(1) 25)	tube	glabrous		pubescent
(2) 26)		to 4.5mm. long	more than 4.5mm. long.	7 mm lg
	Stamens	anthers equalling filaments		shorter than filaments

Spinosus Jean Rabel

23

Oplonia Ref.

Coll. VALEUR No. 724

		JAMAICA BAHAMAS	CUBA	HISPANIOLA
(1) 1)	Habit		tall or erect	low or spreading
(2) 2)	Internodes		less than 5mm. long	more than 5mm. long
(1) 3)	Hairs		present	absent
(1) 4)			short	long
(2) 5)			on two sides	on four sides
(1) 6)	Spines		present	absent
(2) 7)	length		up to 12mm.	less than 12mm.
(1) 8)	thickness		fine	stout
(2) 9)	poise		Curved or deflexed	straight
(1) 10)			ascending	horizontal
	Leaves			
(3) 11)	length (max.)		3-10cm.	less than 2.5cm.
(3) 12)	breadth(max)		less than 12m.	more than 1.8cm.
			6-18mm.	less than 6mm.
(1) 13)	broadest		below middle	at middle
			below middle	
(1) 14)	base		cuneate	rounded
(2) 15)	apex		acute	obtuse
(2) 16)			emarginate	not emarginate
(2) 17)			mucronate	not mucronate
(1) 18)	Flowers		1 or 2	several
(2) 19)	Pedicel		equalling or shorter than calyx	longer than calyx
(2) 20)			glandular	glabrous
	Calyx			
(1) 21)	length		4 mm long	
(1) 22)	segments		subulate	linear
(3) 23)	Corolla		red	white
			blue or violet	
(2) 24)			glabrous	pubescent
(1) 25)	tube		to 4.5mm. long	more than 4.5mm. long.
? HSE(0) 26)	Stamens		anthers equalling filaments	shorter than filaments

5mlg.

microphylla

BM

BM

Oplonia (24) Ref.

Coll. EKMAN No. 16534

		JAMAICA BAHAMAS	CUBA	HISPANIOLA
(2) 1)	Habit		tall or erect	low or spreading
(1) 2)	Internodes		less than 5mm. long	more than 5mm. long
(1) 3)	Hairs		present	absent
(1) 4)			short	long
(1) 5)			on two sides	on four sides
(1) 6)	Spines		present	absent
(2) 7)	length		up to 12mm.	less than 12mm.
(1) 8)	thickness		fine	stout
(2) 9)	poise		Curved or deflexed	straight
(1) 10)			ascending	horizontal
	Leaves			
(3) 11)	length (max.)		3-10cm.	less than 2.5cm.
(3) 12)	breadth(max)		less than 12m.	more than 1.8cm.
			6-18mm.	less than 6mm.
(1) 13)	broadest		~~above~~ middle	at middle
			below middle	
(1) 14)	base		cuneate	rounded
(2) 15)	apex		acute	obtuse
(2) 16)			emarginate	not emarginate
(2) 17)			mucronate	not mucronate
18)	Flowers		1 or 2	several
19)	Pedicel		equalling or shorter than calyx	longer than calyx
20)			glandular	glabrous
	Calyx			
21)	length			
22)	segments		subulate	linear
23)	Corolla		red	white
			blue or violet	
24)			glabrous	pubescent
25)	tube	to 4.5mm. long	more than 4.5mm. long.	
26)	Stamens		anthers equalling filaments	shorter than filaments

HBF

S!

Type coll. Anthacanthus nanophyllus Urban

S!

(25)

Oplonia Ref.

Coll. CLEMENTE No. 5657

		JAMAICA BAHAMAS	CUBA	HISPANIOLA
(1) 1)	Habit		tall or erect	low or spreading
(2) 2)	Internodes		less than 5mm. long	more than 5mm. long
(1) 3)	Hairs		present	absent
(1) 4)			short	long
(2) 5)			on two sides	on four sides
(1) 6)	Spines		present	absent
(1) 7)	length		up to 12mm.	less than 12mm.
(2) 8)	thickness		fine	stout
(2) 9)	poise		Curved or deflexed	straight
(1) 10)			ascending	horizontal
	Leaves			
(3) 11)	length (max.)		3-10cm.	less than 2.5cm.
(2) 12)	breadth(max)		less than 12m.	more than 1.8cm.
(2) 13)	broadest		6-18mm.	less than 6mm.
(1) 14)	base		below middle	at middle
(2) 15)	apex		cuneate	rounded
(2) 16)			acute	obtuse
(2) 17)			emarginate	not emarginate
			mucronate	not mucronate
(2) 18)	Flowers		1 or 2	several
(2) 19)	Pedicel		equalling or shorter than calyx	longer than calyx
(2) 20)			glandular	glabrous
	Calyx			
(1) 21)	length		~~2-5mm.~~ 3 mm. Pg	
(1) 22)	segments		subulate	linear
1948 (0) 23)	Corolla		red	white
			blue or violet	
(1) 24)			glabrous	pubescent
(2) 25)	tube		to 4.5mm. long	more than 4.5mm. long.
(2) 26)	Stamens		anthers equalling filaments	shorter than filaments

9 mon.

polyera oct 1947 LS

Oplonia (26) Ref. V

Coll. BUCH No. 1851

		JAMAICA BAHAMAS	CUBA	HISPANIOLA
(1) 1)	Habit		tall or erect	low or spreading
(2) 2)	Internodes		less than 5mm. long	more than 5mm. long
(1) 3)	Hairs		present	absent
(1) 4)			short	long
(1) 5)			on two sides	on four sides
(1) 6)	Spines		present	absent
(2) 7)	length		up to 12mm.	less than 12mm.
(1) 8)	thickness		fine	stout
(1) 9)	poise		Curved or deflexed	straight
nl (5) 10)			ascending	horizontal
	Leaves			
(2) 11)	length (max.)		3-10cm.	less than 2.5cm.
(2) 12)	breadth(max)		less than 12m.	more than 1.8cm.
			6-18mm.	less than 6mm.
(2) 13)	broadest		below middle	at middle
(1) 14)	base		cuneate	rounded
(2) 15)	apex		acute	obtuse
(2) 16)			emarginate	not emarginate
(2) 17)			mucronate	not mucronate
(2) 18)	Flowers		1 or 2	several
(2) 19)	Pedicel		equalling or shorter than calyx	longer than calyx
(2) 20)			glandular	glabrous
	Calyx			
(2) 21)	length		5mm 0g.	
(1) 22)	segments		subulate	linear
(3) 23)	Corolla		red	white
			blue or violet	
(1) 24)			glabrous	pubescent
(2) 25)	tube		to 4.5mm. long	more than 4.5mm. long.
(2) 26)	Stamens		anthers equalling filaments	shorter than filaments

tube partially destroyed by insects - est 5mm. lo

IJ. 12

Isotype Spinosa. Port-au-Prince.

I.J

27

27

Oplonia Ref.

Coll. PROCTOR No. 10236

		JAMAICA BAHAMAS	CUBA	HISPANIOLA
(1) 1)	Habit		tall or erect	low or spreading
(2) 2)	Internodes		less than 5mm. long	more than 5mm. long
(1) 3)	Hairs		present	absent
(1) 4)			short	long
(2) 5)			on two sides	on four sides
(2) 6)	Spines		present	absent
nl (3) 7)	length		up to 12mm.	less than 12mm.
nl (3) 8)	thickness		fine	stout
nl (3) 9)	poise		Curved or deflexed	straight
nl (3) 10)			ascending	horizontal
	Leaves			
(2) 11)	length (max.)		3-10cm.	less than 2.5cm.
(2) 12)	breadth (max)		less than 12m.	more than 1.8cm.
			6-18mm.	less than 6mm.
(1) 13)	broadest		~~above~~ middle	at middle
				below middle
(1) 14)	base		cuneate	rounded
(2) 15)	apex		acute	obtuse
(1) 16)			emarginate	not emarginate
(2) 17)			mucronate	not mucronate
(2) 18)	Flowers		1 or 2	several
(2) 19)	Pedicel		equalling or shorter than calyx	longer than calyx
(1) 20)			glandular	glabrous
	Calyx		3 mm lg	
(1) 21)	length			
(1) 22)	segments		subulate	linear
(1) 23)	Corolla		red	white
			blue or violet	
(2) 24)			glabrous	pubescent
(2) 25)	tube		to 4.5mm. long	more than 4.5mm. long. 8 mm. lng
(2) 26)	Stamens		anthers equalling filaments	shorter than filaments

Clarendon: armata armata

40

(24)

(28)

Oplonia Ref.

Coll. SCHOMBURGK No. 107

	JAMAICA BAHAMAS	CUBA	HISPANIOLA
(1) 1) Habit		tall or erect	low or spreading
(2) 2) Internodes		less than 5mm. long	more than 5mm. long
(1) 3) Hairs		present	absent
(2) 4)		short	long
(2) 5)		on two sides	on four sides
(1) 6) Spines		present	absent
(2) 7) length		up to 12mm.	less than 12mm.
(1) 8) thickness		fine	stout
(1) 9) poise		Curved or deflexed	straight
HSF ~~x~~ (5) 10)		ascending	horizontal
Leaves			
(3) 11) length (max.)		3-10cm.	less than 2.5cm.
(3) 12) breadth (max)		less than 12m.	more than 1.8cm.
		6-18mm.	less than 6mm.
(2) 13) broadest		~~above~~ middle	at middle
			below middle
(1) 14) base		cuneate	rounded
(2) 15) apex		acute	obtuse
(2) 16)		emarginate	not emarginate
(2) 17)		mucronate	not mucronate
(1) 18) Flowers		1 or 2	several
(1) 19) Pedicel		equalling or shorter than calyx	longer than calyx
(2) 20)		glandular	glabrous
Calyx			
(2) 21) length		4 mm long	
(1) 22) segments		subulate	linear
HF (6) 23) Corolla		red	white
		blue or violet	
(1) 24)		glabrous	pubescent
(2) 25) tube		to 4.5mm. long	more than 4.5mm. long. 7 mm long
(2) 26) Stamens		anthers equalling filaments	shorter than filaments ?

Spinosa

BM

BM.

(29)

Oplonia Ref.

Coll. STEARN No. 486

	JAMAICA BAHAMAS	CUBA	HISPANIOLA
(1) 1)	Habit	tall or erect	low or spreading
(2) 2)	Internodes	less than 5mm. long	more than 5mm. long
(1) 3)	Hairs	present	absent
(1) 4)		short	long
(1) 5)		on two sides	on four sides
(1) 6)	Spines	present	absent
(2) 7)	length	up to 12mm.	less than 12mm.
(1) 8)	thickness	fine	stout
(2) 9)	poise	Curved or deflexed	straight
(1) 10)		ascending	horizontal
	Leaves		
(2) 11)	length (max.)	3-10cm.	less than 2.5cm.
(3) 12)	breadth(max)	less than 12m.	more than 1.8cm.
		6-18mm.	less than 6mm.
(1) 13)	broadest	above middle	at middle
		below middle	
(1) 14)	base	cuneate	rounded
(2) 15)	apex	acute	obtuse
(1) 16)		emarginate	not emarginate
(2) 17)		mucronate	not mucronate
(1) 18)	Flowers	1 or 2	several
(2) 19)	Pedicel	equalling or shorter than calyx	longer than calyx
(2) 20)		glandular	glabrous
	Calyx		
(2) 21)	length	4 mm. long	
(1) 22)	segments	subulate	linear
(1) 23)	Corolla	red	white
		blue or violet	
(2) 24)		glabrous	pubescent
(2) 25)	tube	to 4.5mm. long	more than 4.5mm. long. 8 mm long
(2) 26)	Stamens	anthers equalling filaments	shorter than filaments

St. Thomas: arm.29 armat. BM!

Oplonia (30) Ref.

Coll. WRIGHT No. 3067

		JAMAICA BAHAMAS	CUBA	HISPANIOLA
(1) 1)	Habit		tall or erect	low or spreading
(2) 2)	Internodes		less than 5mm. long	more than 5mm. long
(1) 3)	Hairs		present	absent
(2) 4)			short	long
(2) 5)			on two sides	on four sides
(1) 6)	Spines		present	absent
(1) 7)	length		up to 12mm.	less than 12mm.
(2) 8)	thickness		fine	stout
(2) 9)	poise		Curved or deflexed	straight
(2) 10)			ascending	horizontal
	Leaves			
(3) 11)	length (max.)		3-10cm.	less than 2.5cm.
(3) 12)	breadth(max)		less than 12m.	more than 1.8cm.
			6-18mm.	less than 6mm.
(1) 13)	broadest		~~above~~ middle	at middle
				below middle
(1) 14)	base		cuneate	rounded
(2) 15)	apex		acute	obtuse
(2) 16)			emarginate	
(1) 17)			not emarginate	mucronate
				not mucronate
(1) 18)	Flowers		1 or 2	several
(1) 19)	Pedicel		equalling or shorter than calyx	longer than calyx
(2) 20)			glandular	glabrous
	Calyx			
(1) 21)	length		2 mm. long	
(1) 22)	segments		subulate	linear
(3) 23)	Corolla		red	white
			blue or violet	
(2) 24)			glabrous	pubescent
(1) 25)	tube		to 4.5mm. long	more than 4.5mm. long.
(2) 26)	Stamens		anthers equalling filaments	shorter than filaments ?

4.5 mm la

Type - coll. Anthacanthus tetrastichus BM! S!

(31)

Oplonia Ref.

Coll. CLEMENTE No. 5014

	JAMAICA BAHAMAS	CUBA	HISPANIOLA
1) Habit		tall or erect	low or spreading
2) Internodes		less than 5mm. long	more than 5mm. long
3) Hairs		present	absent
4)		short	long
5)		on two sides	on four sides
6) Spines		present	absent
7) length		up to 12mm.	less than 12mm.
8) thickness		fine	stout
9) poise		Curved or deflexed	straight
10)		ascending	horizontal
Leaves			
11) length (max.)		3-10cm.	less than 2.5cm.
		less than 12m.	
12) breadth(max)		more than 1.8cm.	6-18mm.
		less than 6mm.	
13) broadest		below middle	at middle
		below middle	
14) base		cuneate	rounded
15) apex		acute	obtuse
16)		emarginate	not emarginate
17)		mucronate	not mucronate
18) Flowers		1 or 2	several
19) Pedicel		equalling or shorter than calyx	longer than calyx
20)		glandular	glabrous
Calyx			
21) length		4mm. long	
22) segments		subulate	linear
23) Corolla		red	white
		blue or violet	
24)		glabrous	pubescent
25) tube		to 4.5mm. long	more than 4.5mm. long. 7mm lg.
26) Stamens		anthers equalling filaments	shorter than filaments

polyecp

Oriente: Santiago de Cuba May 1946.

(32)

Oplonia Ref.

Coll. STEARN No. 455

JAMAICA BAHAMAS | CUBA | HISPANIOLA

1) Habit: tall or erect | low or spreading

2) Internodes: less than 5mm. long | more than 5mm. long

3) Hairs: present | absent
4) short | long
5) on two sides | on four sides

6) Spines: present | absent
7) length: up to 12mm. | less than 12mm.
8) thickness: fine | stout
9) poise: Curved or deflexed | straight
10) ascending | horizontal

Leaves
11) length (max.) 3-10cm. | less than 2.5cm. | less than 12m.
12) breadth(max) more than 1.8cm. | 6-18mm. | less than 6mm.
13) broadest ~~above~~ middle | at middle | below middle
14) base: cuneate | rounded
15) apex: acute | obtuse
16) emarginate | not emarginate
17) mucronate | not mucronate

18) Flowers: 1 or 2 | several
19) Pedicel: equalling or shorter than calyx | longer than calyx
20) glandular | glabrous

Calyx
21) length 2.5 mms
22) segments: subulate | linear

23) Corolla: red | white | blue or violet
24) glabrous | pubescent
25) tube to 4.5mm. long | more than 4.5mm. long. 8 mms
26) Stamens: anthers equalling filaments | shorter than filaments

St. James: armata ssp. armata BM 43 BM

(22)

(33)

Oplonia Ref.

Coll. PROCTOR No. 8830

JAMAICA CUBA HISPANIOLA
BAHAMAS (South Cairos)

1) Habit — tall or erect / low or spreading

2) Internodes — less than 5mm. long / more than 5mm. long

3) Hairs — present / absent
4) short / long
5) on two sides / on four sides

6) Spines — present / absent
7) length — up to 12mm. / less than 12mm.
8) thickness — fine / stout
9) poise — Curved or deflexed / straight
10) (ascending horizontal)

Leaves
11) length (max.) 3-10cm. / less than 2.5cm. / less than 12m.
12) breadth(max) more than 1.8cm. / 6-18mm. / less than 6mm.
13) broadest — below middle / at middle / below middle
14) base — cuneate / rounded
15) apex — acute / obtuse
16) emarginate / not emarginate
17) mucronate / not mucronate

18) Flowers — 1 or 2 / several
19) Pedicel — equalling or shorter than calyx / longer than calyx
20) (glandular glabrous)

Calyx
21) length 3 mm.
22) segments — subulate / linear

23) Corolla — red / white / blue or violet
24) (glabrous pubescent)
25) tube to 4.5mm. long / more than 4.5mm. long. 8 mm.
26) Stamens — anthers equalling filaments / shorter than filaments

Spinosa. Cockburn Harbour.

34

(34)

Oplonia Ref.

Coll. STEARN No. ~~330~~ 498

	JAMAICA BAHAMAS	CUBA	HISPANIOLA
1) Habit		tall or erect	low or spreading
2) Internodes		less than 5mm. long	more than 5mm. long
3) Hairs		present	absent
4)		short	long
5)		on two sides	on four sides
6) Spines		present	absent
7) length		up to 12mm.	less than 12mm.
8) thickness		fine	stout
9) poise		Curved or deflexed	straight
10)		ascending	horizontal
Leaves			
11) length (max.)		3-10cm.	less than 2.5cm.
12) breadth(max)		less than 12m.	more than 1.8cm.
		6-18mm.	less than 6mm.
13) broadest		below middle	at middle
		below middle	
14) base		cuneate	rounded
15) apex		acute	obtuse
16)		emarginate	not emarginate
17)		mucronate	not mucronate
18) Flowers		1 or 2	several
19) Pedicel		equalling or shorter than calyx	longer than calyx
20)		glandular	glabrous
Calyx			
21) length		2.2 mm. long	
22) segments		subulate	linear
23) Corolla		red	white
		blue or violet	
24)		glabrous	pubescent
25) tube		to 4.5mm. long	5 mm long
		more than 4.5mm. long.	
26) Stamens		anthers equalling filaments	?
		shorter than filaments	

St. Thomas : arcuatus BM

BM 32

(35)

Oplonia Ref.

Coll. ULE No. 6493

JAMAICA CUBA HISPANIOLA
BAHAMAS PERU

(1) 1) Habit tall or erect / low or spreading

(2) 2) Internodes less than 5mm. long / more than 5mm. long

(1) 3) Hairs present / absent
(2) 4) short / long
(2) 5) on two sides / on four sides

(2) 6) Spines present / absent
(3) 7) length up to 12mm. / less than 12mm.
(3) 8) thickness fine / stout
(3) 9) poise Curved or deflexed / straight
(3) 10) ascending / horizontal

Leaves
11) length (max.) 3-10cm. / less than 2.5cm. / less than 12m.
12) breadth(max) more than 1.8cm. / 6-18mm. / less than 6mm.
13) broadest ~~above~~ middle / at middle / below middle
14) base cuneate / rounded
15) apex acute / obtuse
16) emarginate / not emarginate
17) mucronate / not mucronate

18) Flowers 1 or 2 / several
19) Pedicel equalling or shorter than calyx / longer than calyx
20) glandular / glabrous

Calyx
21) length 5 mm
22) segments subulate / linear

23) Corolla red / white / blue or violet
24) glabrous / pubescent
25) tube to 4.5mm. long / more than 4.5mm. long. 2.5mm. long
26) Stamens anthers equalling filaments / shorter than filaments

K!

Type-coll. Psychotria grandiflora K!

Henry Marie – Oplonia

GENERAL CODING WORKSHEET

PROGRAM

CODED BY

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
1	1	2	2	1	1	1	1	1	2	1	2		2	3	2	1	2	1	1	1	2	1	1	2	1	2	3							
2	1	2	2	1	1	1	1	1	2	1	2		2	3	2	1	2	1	1	1	2	1	1	2	1	2	3							
3	1	2	2	1	1	2	1	2	1	2	1	3	2	3	2	2	2	1	1	2	2	1	1	2	1	1	3							
4	1	1	2	2	3	2	2	3	3	3	3	1	1	2	1	2	2	1	2	2	2	2	1	3	2	2	2							
5	1	1	2	2	3	3	2	3	3	3	3	1	1	2	1	2	2	1	2	2	2	2	1	3	1	2	2							
6	1	1	2	1	1	2	2	3	3	3	3	1	1	2	1	2	1	1	2	2	1	2	1	3	2	2	2							
7	2	1	2	1	1	2	1	1	2	2	2	3	3		1	2	2	2	1	2	2		1	3	2	2	2							
8	2	1	2	1	1	2	1	1	2	2	2	3	3	1	1	2	2	2	1	2	2	1	1		1	2								
9	4	1	2	1	1	2	1	2	2	1	5	3	3	2	2	2	2	2	1	2	2	1	1	3	1	2	2							
10	5	1	2	1	1	2	1	2	2	4	4	3	2	3	2	2	2	1	2	2	1	1	1	3		2	2							
11	1	1	2	1	1	2	2	3	3	3	3		2	1	1	2	1	2	2	2	1	1	1	3	1	2	2							
12	1	1	2	1	1	2	2	3	3	3	3		2	1	1	2	1	2	2	2	1	2	1	1	1	1	2	2						
13	6	1	2	1	2	1	1	2	1	2	1	3	1	1	2	2	1	1	2	2	1	1	1		2	2	2							
14	7	1	2	1	2	1	1	2	1	2	1	3	3	1	1	2	2	1	1	2		1	1	3	2	2	2							
15	1	1	2	1	2	2	1	2	1	2	1	3	3	1	1	2	1	2	1	2	2	1	1	3	2	2	2							
16	1	1	2	1	2	2	1	2	1	2	1	3	3	1	1		1	2	1	2	2	1	1	3	2	2	2							
17	1	1	2	1	2	2	1	2	1	2	1	3	3	1	1	2	1		1	2	2	1			3	2	2	2						
18	1	1	2	1	1	2	1	2	1	2	1			3	1	2	1	2	1	2		1	1	3	1	2	2							
19	1	1	2	1	1	2	1	2	1	2	1	3	2	2	1	2	2	2	1	2	2	1	1	3	1	2	2							
20	2	1	2	1	1	1	1	2	1	2	2	3	3	2	1	2	2	2																
21	2	1	2	1	1	1	1	2	1	1	5	3	3	2	1	2	2	2	1	2		2	1		1	2	2							
22	3	1	2	1	1	2	1	2	1	1	5	3	3	1	1	2	2	2	1	2	2	1	1	3	1	2	2							
23	3	1	2	1	1	2	1	2	1	2	1	3	3	1	1	2	2	2	1	2	2	2	1	3	2	2								
24	2	2	1	1	1	1	1	2	1	2	1	3	3	1	1	2	2	2																
25	2	1	2	1	1	2	1	1	2	2	1	3	2	2	1	2	2	2	2	2	2	1	1		1	2	2							
26	3	1	2	1	1	1	1	2	1	1	5	2	2	2	1	2	2	2	2	2	2	2	1	3	1	2	2							
27	1	1	2	1	1	2	2	3	3	3	3	2	2	1	1	2	1	2	2	2	2	1	1	1	1	2	2	2						
28	3	1	2	1	2	2	1	2	1	1	5	3	3	2	1	2	2	2	1	1	2	2	1		1	2	2							
29	1	1	2	1	1	1	1	2	1	2	1	2	3	1	1	2	1	2	1	2	2	2	1	1	2	2	2							
30	2	1	2	1	2	2	1	1	2	2	2	3	3	1	1	2	2	1	1	1	2	1	1	3	2	1	2							
31	2	1	2	1	1	2	1	1	2	2	2	3	3	2	3	2	2	2	1	2		2	1		1	2	2							
32	1	1	2	1	1	2	1	2	1	2	1	2	2	3	2	2	1	2	2	1	1	1	1		1	2	2	2						
33	4	2	1	1	1	2	1	2	1	1	5	3	3	2	1	2	2	1	2	2		1	1	3		2	2							
34	1	2	2	1	1	1	1	1	1	2	1	3	3	2	1	2	1	1	1	2	2	1	1	2	1	2	1							
35	8	1	2	1	2	2	2	3	3	3	3	1	1	3	1	1	2	2	2	2	2	2	2	2	2	1	1							

OPLONIA DATA STEARN

I.	GEOGRAPHY	1.	Jamaica
		2	Cuba
		3	Hispaniola
		4	Bahamas
		5	Virgin Islands
		6	Antigua
		7	St. Vincent
		8	Peru
II.	HABIT	1	tall or erect
		2	low or spreading
III.	INTERNODES	1	less than 5 mm.
		2	more than 5 mm.
IV.	HAIRS	1	present
		2	absent
V.	HAIRS	1	short
		2	long
		3	not logical (hairs absent)
VI.	HAIRS	1	2 sides
		2	4 sides
		3	not logical (hairs absent)
VII.	SPINES	1	present
		2	absent
VIII.	SPINES	1	up to 12 mm.
		2	less than 12 mm.
		3	not logical(spines absent)
IX.	SPINES	1	fine
		2	stout
		3	not logical(spines absent)
X.	SPINES	1	curved
		2	straight
		3	not logical(spines absent)
		4	variable(curved, deflexed or straight)
XI.	SPINES	1	ascending
		2	horizontal
		3	not logical(no spines)
		4	variable(ascending& horizontal)
		5	not logical(curved or deflexed)

XII.	LEAF LENGTH	1	3 - 10 cm.
		2	less than 2.5 cm.
		3	less than 12 cm.
XIII.	LEAF BREADTH	1	more than 1.8 cm.
		2	6 - 18 mm.
		3	less than 6 mm.
XIV.	LEAF BROADEST	1	above middle
		2	at middle
		3	below middle
XV.	LEAF BASE	1	cuneate
		2	rounded
XVI.	LEAF APEX	1	acute
		2	obtuse
XVII.	LEAF	1	emarginate
		2	not emarginate
XVIII.	LEAF	1	mucronate
		2	not mucronate
XIX.	FLOWER NO.	1	1 or 2
		2	several
XX.	PEDICEL	1	equalling or shorter than calyx
		2	longer than calyx
XXI.	PEDICAL SURFACE	1	glandular
		2	glabrous
XXII.	CALYX LENGTH	1	less than or equal to 3.5 mm.
		2	greater than 3.5 mm.
XXIII.	SEGMENTS	1	subulate
		2	linear
XXIV.	COROLLA COLOR	1	red
		2	white
		3	blue or violet
XXV.	COROLLA SURFACE	1	glabrous
		2	pubescent

XXVI. COROLLA TUBE LENGTH	1	less than or equal to 4.5 mm.
	2	more than 4.5 mm.
XXVII. STAMENS	1	anthers equalling filaments
	2	shorter than filaments
	3	longer than filaments

$$
\begin{array}{r}
0\,3\,8\,4\,6 \\
\tfrac{1}{26} \; 26 \,\overline{)\,1\,000000} \\
78 \\
\hline
220 \\
208 \\
\hline
120 \\
104 \\
\hline
160 \\
156 \\
\hline
\end{array}
$$

Sarkar, P.K. Man. St Bidwell 6/65
Numerical Taxonomy of Soils

(88) picked up at Garden
(83) received at Dept SF Collins
5 missing

(23) – 8+5+1

(19) – 4+5+1

(18) – 6+0+1

(14) – 4+0+0

(15) – 7+2+0

(29) – 6+0+0

(17) – 8+1+0

(16) – 8+1+0

(13) 6+0+0

---

21 5+1+0

22 3+0+1

26 3+0+0

28 4+1+0

7 4+3+2

8 4+1+1

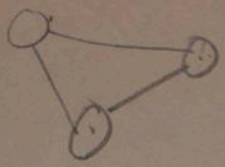
25 3+1+1

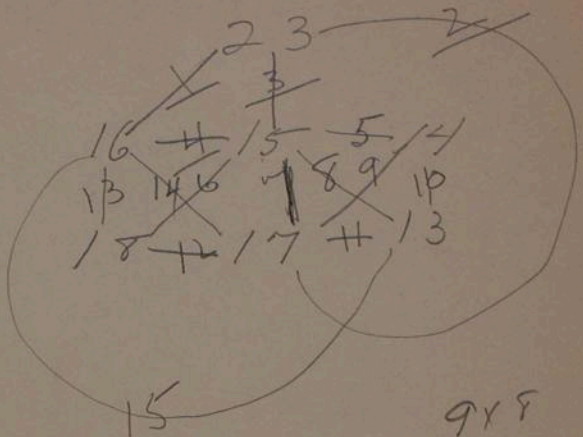
20 4+2+0

22 3+3+0

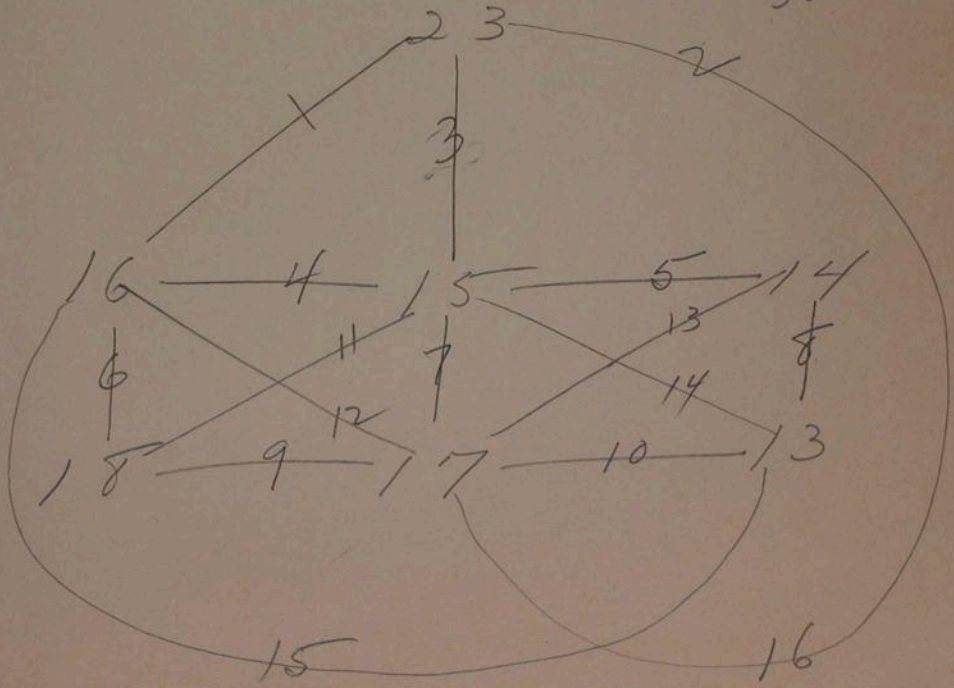
9 3+0+2

Summary of L 17 = .76





9 x 8
72
36



1 2 3 4 5 6 7 8 9 10 11? 12 13 14 15 16 17

33 4, 2, 1, 1, 1, 2, 1, 2, 1, 1, 0, 3, 3, 2, 1, 2, 2

18 19 20 21 22 23 24 25 26 27

1, 2, 2, 0, 1, 1, 3, 0, 2, 2

Check on Curved ordef.
sts.
+ Ask + horiz. for me

3 below
2

We have 5 no log out of 25 char.

Now obj agrees on 15

$\frac{15}{20} = 75$ bad, means each char carries more weight nevertheless - only char judged on,

adj We have 5 no log out of 25 char.

obj agrees on 15

$\frac{15}{25} = \frac{3}{5} = 60$

bad as means 10 disagree

Make agree with whatever spec compared to has

$\frac{22}{25} = 80\%$ neutral

Then only disagrees on 1 char - the char of dif.

The increase in value occurring in not coding N.L. may put the proper value on the remaining char. as that is all upon which to classify them.

(1)

Under the first division (total study - gaps) (35) Psilanthele grandiflora of Peru is separated from the rest of the study

(35) P. grandiflora or subgroup comes into (4) + (5) P. jamaicensis which joined up at level 9 (.85185) with (6), the lectotype of P. jamaicensis. (4) & (5) joined at L5 (92592).

The above division would separate the S. Amer. species of P. silanthele from the Carib. species of Psilanthele. It would align the Carib Psilanthele with Oplonia

However, (4), (5) + (6) remain separate

33

1
II

17	33		17
1	102	1	102
II	110		109
3	111		112
4	113	2	113
5	115		116
6	118	3	118
7	119	4	119
8	122	5	122
9	123	6	123
10	125		126
11	~~~		127
12	131	7	131
13	134	8	134
14	136		135
15	138	9	138
16	141	10	141
17	143		142
18	144		~~~
19	147		146
20	149	11	149
21	~~~		151
22	152	12	152
23	157		~~~
24	161	13	161
25	~~~		163
26	165	14	165
27	167	15	167

15 / 22)150000 = 6811
132
180
176
40
22
180
176
40

27
5
22

15 / 23)151000 = 651
138
120
115
50
23

Obj 1 agrees in 20 char. out of 25
+ hairs 80% agreement.
+ spines
with Obj with 25 Same 15

Obj 2 agrees in 15 char out of 25
with Obj with 20 - hairs
- spines
These Obj are not compared on 5 char
so $\frac{15}{20} = 75\%$ Same 15

We now put nl's
$\frac{20}{25} = 80$

Comp. between Obj 1+2

$\frac{15}{25} = 60$

Suppose we add 5 agreements
when Obj are nl in comps nl objs
Suppose we add 5 agr when Obj 1
is ~~nl~~ Comp with nl Obj 2, ~~is~~

13 65
20 13.00
1.20
10

Calyx length

acic	3.5
acic	2.5
acic	2.
jam	5
jam	4
jam.	4, 5
leit	—
leit	3.5
spin	2.
spin	3.
mic	3, 5
arm	3.
mic	2, 5
mic	3.
mic	3.
mic	2, 5
mic	3.
mic	3.
mic	3.
mic	—
spin	4
spin	3, 5
mic	4
ram	—
poly	3.
spin	5.
arm	3.
spin	4
arm	4
[illegible]	2
poly	4

acic 2.2
psil 5.

19
33

1 ✓
2 ✓
3 ✓
4 ✓
5 ✓
6 ✓
7 2-
8 2-
9 ✓
10 1-
11 ✓
12 ✓
13 1-
14 1-
15 ✓
16 1-
17 2-
18 3-
19 ✓
20 9-
21 2-
22 1✓
23 9- -1
24 1- -9
25 ✓ -1
26 ✓ ✓
27 1- ✓
28 ✓ -1
29 ✓ ✓
30 3- ✓
31 1- -3
32 2- -1
33 -2
34 ✓ ✓

total study

1	1.000000	.03704	.04	bee. mis inf.
2	.96296	.00296	.00	
3	.96000	.00348	.00	
4	.95652	.02060	.02	
5	.92592	.00926	.01	
6	.91666	.02778	.03	(5) — 6 sets
7	.88888	.01388	.01	
8	.87500	.01315	.01	
9	.85185	.00470	.01	
10	.84615	.00615	.01	
11	.84000	.02519	.03	(5) — 3 sets
12	.81481	.00612	.01	
13	.80769	.01603	.01	
14	.79166	.00906	.01	
15	.78260	.00483	.01	
16	.77777	.01777	.02	
17	.76000	.01000	.01	
18	.75000	.00926	.01	
19	.74074	.03241	.03	(17) — 2 sets
20	.70833	.10574	.11	
21	.59259			

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