SMITHSONIAN MISCELLANEOUS COLLECTIONS
VOLUME 69, NUMBER 2

THE MOSSES COLLECTED BY THE SMITHSONIAN AFRICAN EXPEDITION 1909-10

(With Two Plates)

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(Publication 2494)

CITY OF WASHINGTON
PUBLISHED BY THE SMITHSONIAN INSTITUTION
JULY 26, 1918

The Lord Baltimore Press
BALTIMORE, MD., U. S. A.

THE MOSSES COLLECTED BY THE SMITHSONIAN AFRICAN EXPEDITION, 1909-10

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(With Two Plates)

The mosses collected by Dr. Edgar A. Mearns, during the Smithsonian African Expedition, consisted of eighty-three numbers, of which naturally several were duplicates, the actual number of species represented being forty-eight. As would be expected in the tropical region of Africa, the bulk of them were at high altitudes, only seven numbers being below 2,000 meters, five of these at 1,350 meters, the remaining two at 1,950 meters. Of the rest the largest proportion (between 65 and 70) came from the "giant heath zone" of Mt. Kenia, at about 3,630 meters, five from 4,200 meters, above that zone, and three or four from the "bamboo zone," at about 3,000 meters. Only eight species were in fruit.

A considerable number of the mosses are identical with species already decribed from Kilimanjaro, Ruwenzori, and Kenia itself; quite an appreciable proportion, however, are of especial interest either as being hitherto unknown, or—and these are perhaps the most interesting—as belonging to species already known, but from a very widely distant geographical area.

A connection between the mosses of the higher zones of the equatorial mountains of Africa and those of the palæarctic region of Europe and North America has been recognized for some time. Mitten,[1] in describing the mosses collected on Kilimanjaro by Bishop Hannington and by H. H. Johnston, refers specimens to the northern species, *Bryum roseum, B. alpinum,* and *Thuidium tamariscinum* (in addition to two or three almost cosmopolitan species); of these the two former at least occur also in temperate South Africa.

C. Müller, who has described the greater number of the species collected on Kilimanjaro, fully recognizes the close relationship between the genera of mosses of the higher zones of that mountain and those of the European alpine regions, but his theory of phytogeography does not admit an actual identity of species between two so widely separated areas, except—and that very rarely—in a few admittedly cosmopolitan types. In the conspectus he has given of

[1] Journ. Linn. Soc. Bot. **27**: 298.

the mosses of Kilimanjaro, therefore (4),[1] the relationship between these regions is masked by the creation of new species in the case of several mosses which nearly all bryologists would refer to corresponding palæarctic species. Thus, as Brotherus has pointed out, *Funaria kilimanscharica* C. M. is only one of the forms of *F. hygrometrica* Sibth.; *Polytrichum pungens* C. M. is to be referred to *P. commune* L.; *P. nano-globulus* C. M. to *P. piliferum* Schreb.; *Mnium kilimandscharicum* C. M. is *M. rostratum* Schrad.; and *Grimmia calyculata* C. M. is *G. ovata* Web. & Mohr. The greater number of these species, however, are more or less cosmopolitan, and their occurrence in Central Africa does not imply any special connection between the flora of that area and that of the palæarctic region, except in the case of *Grimmia ovata,* which is, otherwise, almost confined to that region, but reaches as far south as Ceylon in the Asiatic, and Guatemala in the American continent. *Brynm alpinum* Huds., which also occurs on Kilimanjaro, has a similar range, but somewhat more restricted; it also is found in South Africa (*B. afro-alpinum* Rehm. is certainly, and *B. Wilmsii* C. M. in all probability, the same thing).

Brotherus has also recorded *Campylopus polytrichoides* De Not. from the volcano region (1), but this is a warm-temperate zone species, its range being west and south Europe, Madeira, the East African Islands, and Brazil. He records also *Tetraplodon bryoides* Lindb. from Ruwenzori (1) between 3,000 and 4,000 meters, and this is of special interest, as its known range was almost confined to the alpine-arctic zone of Europe, Asia, and North America, except for an isolated station in New Guinea; *Pohlia elongata* Hedw., of nearly the same but slightly less alpine distribution; *Pogonatum aloides* (Hedw.) P. Beauv., with a somewhat similar range to *Grimmia ovata,* from 2,900 meters on Ruwenzori; *Hylocomium proliferum* (L.) Lindb., from 3,600 meters on Karisimbi in the volcano region, known from Europe, Asia, and North America, the Azores and Canaries, Algeria, and Tunis; and its var. *alpinum* Schlieph., from 3,800 meters on Ruwenzori, previously known only from the higher Alps of Europe; *Oxyrrhynchium rusciforme* (Neck.) Warnst., a native of temperate Europe and Asia, North America, the Canaries, and Algeria.

It will be seen that the presence of these species in the alpine zones of the equatorial mountains of Africa scarcely marks a definite connection with the palæarctic region, except in the case of *Tetraplodon*

[1] See Bibliography at end of present paper.

bryoides, Hylocomium proliferum var. *alpinum,* and perhaps *Grimmia ovata* and *Pohlia elongata;* the remaining species having too wide a range for their presence here to establish such a connection, though they would lend support to it were it well established.

It is therefore of the highest interest to find this connection immensely strengthened by certain of the species in this collection, which have hitherto not been known from the African continent. It will be well to give these in tabulated form together with their distribution as hitherto known.

Species	Distribution
Blindia acuta (Huds.) Bry. Eur.	Alpine and arctic Europe and North America; Caucasus; Central Asia.
Aulacomnium turgidum Schwaegr.	Higher Alps of Europe; Arctic regions; mountains of North America and Japan.
Neckera complanata (L.) Huebn.	Temperate regions of Europe and western Asia, and eastern North America.
Calliergon sarmentosum var. *subflavum* Ferg.	(Of type) Alpine-arctic regions of Europe, Asia, and North America; Fuegia; South Georgia; Alps of New Zealand.

Moreover, the plant described below as *Hygroamblystegium procerum* sp. nov. is extremely near to and possibly should be considered a subspecies of *H. filicinum,* the range of which is northern and alpine Europe, Asia, and North America, and New Zealand; and *Calliergon Keniae* sp. nov. belongs to a genus the representatives of which are exclusively confined to the arctic and cold-temperate regions, and almost entirely to those of the northern hemisphere.

The above listed species are so distinctively plants of a comparatively limited area of the alpine-arctic districts of the palæarctic region, that (taken with the two or three species referred to above) they can hardly be explained, I think, without postulating a bridge, at some time or other, between the two areas.

Engler (8) has discussed at some length the problem of the presence of representatives—either identical or as racial forms—of arctic-alpine plants at high elevations on the mountains of Central Africa, citing especially certain grasses and flowering plants (*e. g., Luzula spicata, Anthoxanthum odoratum, Koeleria cristata, Subularia aquatica*). His general conclusion is in favor of what may be termed a fortuitous transport, rather than a definite migration. He holds that there has been no continuous continental connection at any time, such as would provide the conditions necessary for a migration of plants of the colder European regions across northern or north-

eastern Africa to the mountains of Abyssinia and thence to the Central African ranges; but that there may have been a pluvial epoch (I suppose in interglacial or postglacial times) when the zones suitable to these plants were much more nearly approximated than now; *i. e.,* the alpine-arctic European plants would have descended to much lower levels and reached a much more southerly limit in Europe than now, while at the same time the conditions in North Africa would be such that similar and therefore favorable climatic conditions would occur at much lower altitudes than at present, and that the seeds of the plants in question (most of them being small-seeded plants) were transported either by strong northerly winds or by the agency of birds, or both.

I cannot quite think this theory fully adequate to explain the *data* of this question of distribution, especially in view of the additional facts evinced by the mosses dealt with in the present case. If the occurrence of these alpine-arctic seed-plants is due to what I have termed fortuitous transport, *i. e.,* there was no general migration in a southerly direction, but owing to the fact that similar conditions prevailed simultaneously in southerly Europe and the highlands of north-eastern Africa, at no very great distance away, aided by a pluvial epoch, extending over the regions concerned, seeds of these plants happening to be transported found a congenial resting place, thence retreating farther south to higher altitudes as warmer and more xerophytic conditions ensued—if this is the full explanation, it appears to me that we might ask why did not the corresponding interchange from south to north occur at the same time? Why do we not find in the present European alpine-arctic flora isolated instances of Central African genera, transported at the same time from there to here? One does not see why there should not have been *southerly* wind-currents adequate for transport equally with *northerly* ones; indeed, anything like a continuous or prevailing northerly wind would seem to presuppose a counter-current, possibly at somewhat higher levels, from a southerly direction. And if the means of transport was, or was aided by, migratory birds, they should in their return journeys have been equal carriers of a certain number of representatives of the African flora to the European lands.

On general grounds, therefore, I should have thought that Engler's solution of the problem in some measure failed to satisfy the conditions, inasmuch as it would seem to give all the requirements necessary for a counter-exchange of southerly plants to Europe, which does not appear to have taken place. And I venture to think that

this view is considerably strengthened by the mosses of the present collection. To begin with, it may be postulated with practical certainty that the species I have noted above were not transmitted in the spore state, but in the gametophytic stage. For of the four species newly recorded as common to both regions, *Calliergon sarmentosum* and *Aulacomnium turgidum* are dioicous and extremely rare fruiters in the palæarctic region, while *Neckera complanata* also is dioicous and infrequent in fruit, though not so rare as the above two. For *Aulacomnium turgidum* Limpricht (2) cites only three fruiting localities in Central Europe, Hagen states that it is only found sterile in northern Norway, and the same is the case in Great Britain, while in North America the fruit is described as "rare," and I have seen no localities given. *Calliergon sarmentosum* is also, except in the most northerly arctic regions, extremely rare in fruit.

And these four species do not exhaust the contribution of the present collection to the common flora. For of the new species described, *Hygroamblystegium procerum,* while striking and distinct in habit, is structurally identical with the palæarctic *H. filicinum* and would without doubt, I think, if it had been found within the recognized range of that species, have been described as a variety or subspecies at most. And *Calliergon Keniae,* while scarcely, I think, to be placed under *C. sarmentosum,* is undoubtedly nearest to and a derivative from either that plant or *C. stramineum* (Dicks.); and the small genus to which these belong is one of the most markedly alpine-arctic types, reaching the southern part of the north temperate zone only under extreme alpine conditions, with a similar but still more restricted distribution in the southern hemisphere, and having no representative in the African flora. And again, *Philonotis speirophylla* sp. nov., while a clearly marked species, is undoubtedly near to and almost certainly a derivative from the northern, alpine-arctic *P. seriata* Mitt. These three related species are also dioicous, fruiting extremely rarely, *H. filicinum* indeed probably never fruiting in any form such as is at all likely to have given off the plant in question.

Here again, therefore, we are confronted with the problem as to why, under the theory of a fortuitous transport, north to south, from like conditions to like, a counter-exchange from south to north should not have occurred, and we do not find isolated species of African alpine genera among the alpine mosses of Europe; while in addition the further question arises as to why, postulating aerial transport by wind or by bird carriers, and failing a land connection,

should just those species have been chosen out which, being sterile plants, present special difficulties to such modes of transport, when so many fertile species must have been present, the spores of which would have been transmitted infinitely more readily?

And it may be again pointed out that most of the mosses involved are markedly species of the colder, more boreal conditions of the palæarctic region. Now if we have to postulate a very discontinuous area at the migratory period, so that the transported plants had to pass over numerous and considerable gaps of lower, warmer, and drier land before reaching a suitable "pied-à-terre," it seems reasonable to suppose that the species that would survive would be rather those of the lower and more southerly type, those in fact more capable of enduring subxerophytic conditions, whereas it would be difficult to select—short of actual aquatic species—any more pronouncedly hygrophytic mosses than most of those in question, while *Tetraplodon bryoides* and *Hylocomium proliferum* var. *alpinum* though less distinctly hygrophytic are exclusively alpine, and the former at least would be quite unable to resist anything like xerophytic conditions. True, it might be argued that species of a less pronounced hygrophytic nature may have been transported under such conditions and may have been since crowded out, by the returning African flora, from the lower altitudes of the African mountains as the present climatic conditions supervened; but to maintain this contention would (since it implies the transport of a large number of plants by fortuitous means) be still more to strengthen my position that we should all the more expect under these circumstances to see the remains in Europe of a counter-exchange of species from south to north.

I cannot help concluding, therefore, that a more continuous land area under colder and more hygrophytic conditions than Engler admits is postulated by the known facts, and that the practically total absence of any counter-exchange from Africa to Europe presupposes something much more definite in the way of a southerly *migration* than has hitherto been recognized, difficult as it may be to trace the land connection that would have provided the necessary bridge of transit.

It is possible that the working out of the flowering plants of the expedition may throw further light on this problem of geographical distribution; but it is one in which to an unusual extent the lower plants such as the Bryineae may be expected to prove the best witnesses, and it is much to be hoped that further exploration will be

carried on in the higher altitudes of the Central African ranges, and especially among the cryptogamic flora of those altitudes, for it is there that the data necessary for the solution of the problem will most likely be found.

The following species are described here for the first time: *Sphagnum Keniae, Hymenostylium crassinervium, Leptodontiopsis elata, Rhacomitrium defoliatum, Bryum plano-marginatum, Philonotis speirophylla, Breutelia stricticaulis, Polytrichum Keniae, Hygroamblystegium procerum, Calliergon Keniae, Isopterygium sericifolium, Rhynchostegiella Keniae.* The types of these are in the United States National Herbarium, duplicate types being in my own collection.

My thanks are due to Dr. Brotherus and to Mons. Thériot for assistance in the identification of certain of the species, and to the authorities of the British Museum and Kew collections for the opportunity of comparing specimens in these herbaria.

In the following list I have followed the order of Brotherus (Engler & Prantl, Pflanzenfamilien, Musci).

To save repetition I have used the following terms for the two collecting localities which occur most frequently:

"Loc. 3,630 meters." Western slopes of Mt. Kenia, along the trail from West Kenia Forest Station to summit, at about 3,630 meters, in the "giant heath zone," Sept. 21-27, 1909.

"Loc. 4,200 meters." Western upper slopes of Mt. Kenia, above the "giant heath zone," along the trail from West Kenia Forest Station to summit, at about 4,200 meters elevation, Sept. 25-27, 1909.

It may be possible to gain some idea of the prevailing species on Mt. Kenia from the number of gatherings made of some of them. Judged in this way the most frequent mosses would be: *Campylopus stramineus* (Mitt.) Jaeg., 13 gatherings; *Tortula Cavalli* Negri, 9 gatherings; *Bartramia ruvenzorensis* Broth., 5 gatherings; *Grimmia ovata* Web. & Mohr, 5 gatherings. None of the others are represented by more than three gatherings each.

SPHAGNACEAE

SPHAGNUM KENIAE Dixon, sp. nov.

(Plate 1, fig. 1)

§ Subsecunda. Caules breviusculi, ut videtur laxe caespitosi, flavovirides, infra pallide fuscescentes, habitu *S. mollusci* Bruch. Rami *perbreves,* raro 1 cm. longi, plerumque multo minus, *obtusi,* dense conferti.

Folia caulina *2 mm. longa,* late ovato-oblonga, apice in mucronem brevissimum latum convoluta, explicata tamen late rotundata obtusa dentibus nonnullis parvis coronata, limbo *angusto, 2-3-seriato, apud basin parum dilatato* circumdata. Cellulae hyalinae superiores (usque ad 2/3 folii longitudinem) fibrosae, raro bipartitae. Pori *magni,* dorsales *numerosissimi, ventrales paucissimi vel nulli.*

Folia ramea *minima,* circa 1 mm. longa, lenissime secunda, ovata, *brevissime obtusiuscule acuta,* apice 3-4-denticulata, limbo *perangusto,* 1-2-seriato, *denticulato.* Pori dorsales numerosi, ventrales perpauci. Cellulae chlorophyllosae peranguste ellipticae seu trapezoideae, *ventrales, superficie liberi,* cellulae hyalinae dorso perconvexae, prominentes.

Hab.: Loc. 3,630 meters, Nos. 1560 (type), 1561, 1563.

The very slender habit, resembling that of *S. molluscum,* the short branching, and the position of the chlorophyllose cells, on the ventral surface of the leaf, separate this species from most or all of the African species of the *Subsecunda* section. It appears to be nearest to *S. gracilescens* Hampe from southern Brazil; it is in fact very close to that species, which has the chlorophyllose cells in the same position, the short branches, etc. The coloring is quite different, however, the branching there is laxer, as is also the foliation, and the stem leaves are rather smaller, viz., 1-1.5 mm., according to Warnstorf. In view of the widely separated geographical areas these differences must be held sufficient to keep the two apart.

Sphagnum Davidii Warnst., from Ruwenzori, is a much more robust plant, with longer branches, chlorophyllose cells central, smaller stem leaves, more acute branch leaves, etc. *S. ruwenzorense* Negri differs in the same direction, and is larger in all its parts.

SPHAGNUM PAPPEANUM C. M.

Loc. 3,630 meters, No. 1562.

SPHAGNUM RUGEGENSE Warnst. var. GRACILESCENS Warnst.

Hab.: Bamboo zone, western slopes of Mt. Kenia, along the trail from West Kenia Forest Station to summit, at about 3,000 meters, No. 1727.

I have not seen the original plant (collected by Mildbraed on the Deutsch Zentral-Afrika Expedition, in the Rugege-Wald, in mountain bogs at 1,900 meters); but I have compared the present material with Warnstorf's description and figure in the Sphagnaceae (6), with which it agrees in habit and in every particular except in one

minor point regarding the pores. These are remarkable among the section *Cuspidata,* being very numerous on both surfaces, especially the dorsal, where they are arranged in chain form along the commissures as in many of the *Subsecunda,* but are much larger; on the ventral surface they are also numerous, but somewhat less so, and are smaller, while here and there occur very minute pores in the angle of the cell or on its face. Warnstorf describes the pores of the ventral surface as "beringt," those of the dorsal surface as "schwach beringten," while in the present plant the dorsal ones are decidedly more strongly ringed than those on the ventral surface. In every other particular the plant agrees exactly with the var. *gracilescens* as described.

ANDREAEACEAE

ANDREAEA KILIMANDSCHARICA Par.

Andreaea striata C. M., not *A. striata* Mitt.

Loc. 3,630 meters, Nos. 1584, 1588. No. 1588 is in fruit, and the few capsules show a rather remarkable peculiarity. It will be recollected that Hooker f. and Wilson divided Andreaea into two subgenera, separating *A. Wilsoni* (as Acroschisma) from all the remaining species (Eu-Andreaea), on the ground of the capsule, which, instead of splitting to the base or nearly so into four to six valves, splits only about one-fourth the length, the lower part of the capsule remaining entire, shortly cylindric. Wilson placed also in Acroschisma another species, *A. densifolia* Mitt., from the Himalayas, but Brotherus includes it in Eu-Andreaea. According to Roth,[1] Mitten's specimens show a capsule narrowly elliptic to almost cylindric and split into valves from the middle or from two-thirds its length upwards, so that it remains a question as to which subgenus should claim it. The Mt. Kenia plant (No. 1588) shows a few capsules quite normal, one or two entire to about the middle, and one or two entire to about two-thirds the length, only the upper one-fourth or one-third split into valves (cf. *pl. 1, fig. 5, a, a'*). The species, it can hardly be doubted, is a Eu-Andreaea, and the peculiarity of the capsule form an abnormality; it is possible that this may be the case with *A. densifolia* Mitt. The three species, it may be remarked, are not in other respects nearly related to one another.

[1] Die aussereuropäischen Laubmoose, Band 1, p. 21.

DICRANACEAE

DISTICHIUM KILIMANDJARICUM C. M.

Loc. 3,630 meters, No. 1547. I have no doubt that this is C. Müller's species, of which I have not seen specimens. The only slight discrepancy is that C. Müller describes the subula as papillose near the apex, while in this the greater part of the fine filiform subula is roughened; finely and regularly tuberculate would perhaps describe it best. The stems are exceedingly delicate and slender, the leaves distant, with a very long filiform subula which is very flexuose and curled when dry.

BLINDIA ACUTA (Huds.) Bry. eur., forma PROLIXA

Loc. 3,630 meters, No. 1593b. Accompanying *Rhacomitrium defoliatum* sp. nov., and *Calliergon sarmentosum* var. *subflavum*. It is a very elongate, sterile form, with distant, long and narrow leaves having long subulate points, but I cannot find any structural difference from our northern species; it has somewhat the habit of certain of the forms of the var. *trichodes*, but the leaves do not narrow so abruptly from the base to the subula as in that.

New to Africa. Distribution: Northern and alpine Europe; Caucasus; Central Asia; boreal parts of North America.

CAMPYLOPUS STRAMINEUS (Mitt.) Jaeg.

Campylopus substramineus Broth. Wissensch. Ergebn. der Deutsch. Zentral-Afrika Exped., 1907-8, Bd. II, Botanik, 139. 1914.
Campylopus sericeus Negri, Annali di Bot. 7: 162. 1908.

Loc. 3,630 meters, Nos. 1359, 1544, 1548, 1549, 1553, 1558, 1565, 1577, 1578, 1594, 1598. Loc. 4,200 meters, Nos. 1655, 1659.

Evidently one of the common mosses in and above the "giant heath zone," and extremely variable in height, density, and length of leaf, while apparently always retaining a certain general habit and the straw to golden color from which it derives its name. Brotherus (1) describes *C. substramineus* sp. nov. as "praecedenti [*i. e., C. stramineus*] valde affinis, sed foliis duplo vel triplo longioribus diversa." In going through the above numbers I recognized at once that some of them must come under this plant, the long, silky leaves giving a very different appearance to the plant; but it soon became evident that it was going to be very difficult to draw the line between the two, in fact a regular gradation occurred from plants with leaves only about 3-4 mm. long to others where they are 7 mm. long at least; the longer leaf being usually, but by no means always,

correlated with a taller, laxer habit of growth. Moreover, one single gathering (No. 1594) showed forms ranging from the shortest-leaved state to one with very long if not quite the longest leaves.

It occurred to me to examine Mitten's type from the Cameroons, collected by Mann, at Kew, and to my surprise I found both these forms represented there. Mann's specimens are on three sheets, two of them the short-leaved form, the third consisting of two fine fruiting tufts with silky, elongate leaves up to 7 mm. at least. As the fruiting plant, this last would probably have to be considered the type. In any case it is clear that there is no room for a new species, nor do I think any of the forms sufficiently marked or constant to be given varietal rank.

From the description I am strongly inclined to think that *C. sericeus* Negri, from Ruwenzori, is the long-leaved form of this species (the locality is very close to that where *C. substramineus* Broth. was collected), and this in spite of the fact that the author describes it as exhibiting stereids in the dorsal band of the nerve. Brotherus, quite rightly I believe, places *C. stramineus* in the section Pseudocampylopus, the nerve generally, and in the lower part no doubt constantly, showing a median row of guide cells and a dorsal row of subequal moderately lax cells, but no stereids. On cutting sections of the upper part of the leaves, however, I have found here and there a small number of decided stereid cells, intermixed with the dorsal, and I am therefore of the opinion that their presence in *C. sericeus* Negri does not entirely preclude its identity with *C. stramineus*.

CAMPYLOPUS PROCERUS (C. M.) Par.

Hab.: Bamboo zone, western slopes of Mt. Kenia, along the trail from West Kenia Forest Station to summit, at about 3,000 meters elevation, No. 1729. A slightly denser form with leaves a little closer than the original from Kilimanjaro, with which, however, it agrees otherwise.

CAMPYLOPUS JOANNIS-MEYERI (C. M.) Par.

Loc. 4,200 meters, No. 1658. I have not been able to see an original specimen, but from the description I have no doubt that this is the same as the plant from Kilimanjaro. It is in one respect a remarkable species: the nerve section betrays no sign of stereids; it consists of a ventral row of very large empty cells, a row of much smaller guide cells, and a single row of subequal and very similar dorsal cells; the cells of both these layers become somewhat substereid in the

upper part of the leaf, but there is no stereid band. The species must therefore be placed in section Pseudocampylopus; it is the only *hair-pointed* species at present known there.

POTTIACEAE

HYMENOSTYLIUM CRASSINERVIUM Broth. & Dixon, sp. nov.

(Plate 1, fig. 2)

Stirps pro genere robusta, caespites densiusculos elatos usque ad 5 cm. altos, olivaceos, intra flavescentes formans, caulibus submollibus flexuosis interdum ramulosis interrupte foliosis, hic illic *propagulis rhizoideis substrictis simplicibus elongatis robustis* (ad 1 cm. longis 70-80 μ latis) rubris, nunc laevibus nunc papillosis parce vestitis. Caulis sectione sine fasciculo centrali, reti interno laxiusculo tenerrimo, externo e cellulis 2-3 seriebus stereideis vel substereideis rufo-fuscis composito.

Folia 1.5-2 mm. longa, madida *squarrosa vel recurva,* sicca leniter crispata, e basi paullo latiore *perbrevi* anguste ligulata, breviter nec anguste acuminata, acuta, concavo-carinata, marginibus vel omnino planis vel uno latere ad infimam basin brevissime angustissime recurvo, superne saepe valde *irregulariter minute sinuosis,* nullo modo denticulatis. Costa valida, basin versus ad 75 μ lata, in summo apice evanescens, dorso laevis vel hic illic minute scaberula, fuscescens. Cellulae superiores *subquadratae, pellucidae,* foliis junioribus chlorophyllosae, 8-11 μ latae, tenerrime papillosae, parietibus firmis, vix incrassatis, basilares breviter rectangulares (2-4×1), pellucidae, parietibus firmis.

Cetera nulla.

Forma robusta. Omnino robustior, ubique sordide olivacea, inferne haud flavescens.

Hab.: Vicinity of Thika, alt. about 1,350 meters, September 6 and 7, 1909, Nos. 1143 (type), 1144.

I submitted this plant, being uncertain of its position, to Dr. Brotherus, who kindly wrote that in his judgment the stem and leaf-sections indicated a Hymenostylium (rather than a Trichostomum).

No. 1144 consists entirely of the robust form, which is perhaps worthy of a varietal name; it is larger in all its parts, with the stems darker rather than paler below, the leaves larger, denser, and the whole plant more rigid. The leaves and stems vary, however, in density or otherwise of arrangement; both forms also occur in No. 1143, where there are a few somewhat intermediate stems, so that it is perhaps not more than an incidental form; the leaf structure presents no difference.

The irregularity of the leaf margin, while not very conspicuous and not always present, is of an unusual nature, consisting sometimes of slight sinuosities or indentations, sometimes of slight protuberances, quite without system, as if the leaf had been badly cut out with scissors; it is not due in any way to erosion.

LEPTODONTIUM PUMILUM (C. M.) Broth.

Loc. 4,200 meters, No. 1660. A small plant, with rather close, appressed foliage when dry, which agrees well with C. Müller's description. There is a peculiarity about the basal areolation, however, which the author does not mention, but which may well have escaped attention. The basal juxta-costal cells are rather widely rectangular, and pellucid, extending to about half the width of the lamina; the marginal row consists also of pellucid, short, quadrate cells; and between this and the juxta-costal ones there lies a band of narrower, linear-rectangular, bright golden-yellow cells (cf. *pl. 1, fig. 6*).

LEPTODONTIUM JOANNIS-MEYERI C. M.

Loc. 3,630 meters, No. 1546. I have not been able to see a specimen of the original, from Kilimanjaro, but I have no doubt this is C. Müller's plant. From the leaf structure it appears to me probable that the fruiting characters when known may show this to be a Leptodontiopsis.

LEPTODONTIOPSIS ELATA Dixon, sp. nov.

(Plate 1, fig. 3)

L. fragilifoliae Broth. affinis, sed *multo elatior,* 10-12 cm. alta, foliis *haud vel minime fragilibus,* plerumque ad summam apicem *integris,* rarissime denticulatis, siccis flexuoso-crispatis *haud appressis,* flavo-aurantiacis. Fructus caret.

Hab.: Loc. 3,630 meters, No. 1557.

A fine species, clearly—though sterile—allied to Brotherus' plant from Karisimbi in the volcano region and from Ruwenzori, but differing sufficiently, I think, in the characters italicized to be kept distinct. Brotherus figures his species as having the extreme apex of the leaf crowned with a few subpellucid denticulations; these occur occasionally, but very rarely, in the present plant, where the leaf usually ends in a quite entire, fine, subpellucid point. The basal cells are—as in *L. fragilifolia*—linear, highly incrassate, and with the walls porose.

TORTULA ERUBESCENS (C. M.) Broth. in Engl. & Prantl, Pflanzenfam. I[3]: 434. 1902

Barbula erubescens C. M. Nuov. Giorn. Bot. Ital. **4**: 14. 1872.
Barbula Hildebrandti C. M. Linnaea **40**: 294. 1876.
Barbula Leikipiae C. M. Flora **73**: 480. 1890.
Barbula meruensis C. M. Flora *loc. cit.*
Barbula exesa C. M. Hedwigia **38**: 103. 1899.
Barbula oranica C. M. Hedwigia *loc. cit.*

Loc. 3,630 meters, No. 1583. This species is marked by the extreme fragility of the lamina of the leaf, which is carried to such an extreme that the whole of the leaves on a stem will frequently have almost disappeared with the exception of the midrib, and it is often difficult to find a leaf intact or even nearly so. The plants in the above synonymy were described as separate species, chiefly on the ground of their geographical position. One or two characters noted by C. Müller as apparently constituting distinctions are quite valueless. These are: A certain diversity in the size of the upper cells, the direction of the leaves when moist, whether erect-patent or somewhat recurved; the outline of the leaf, the degree of recurving of the margin, and the smoothness or roughness of the nerve at the back near the apex. Nearly all these characters show an equal degree of variation, within the limits of a single species, in allied European species of Syntrichia, and I should have been inclined to doubt, *a priori,* their validity. Apart from this, I have examined specimens of most of them, including the originals of *B. erubescens* and *B. Hildebrandti,* specimens of *B. meruensis* determined by Brotherus, and South African plants corresponding no doubt to one or both of the two species cited last in the synonymy. In all of these I find the above characters eminently variable. *B. Hildebrandti,* for example, has on the same specimen, and sometimes on the same stem, leaves varying from erect-patent to patent and slightly recurved, the apex broadly rounded or only subobtuse, the nerve rough at the back above or quite smooth. Similar variations occur in the other characters mentioned above, in some at least of these plants, and I have no question at all that they all belong to one rather remarkable and not on the whole very variable type. The nerve is excurrent in a very short red mucro, which may be either stout and obtuse or tipped with a very short, fine, paler point or apiculus.

TORTULA CAVALLI Negri, Annal. di Bot. 7: 164. 1908

Loc. 3,630 meters, Nos. 1358 (c. fr.), 1542 (c. fr.), 1572 (c. fr.), 1545 (c. fr.), 1566 (c. fr.), 1579, 1596, 1597. Loc. 4,200 meters, No. 1656 (c. fr.).

Negri's description and figure, though drawn from sterile plants, leave no doubt in my mind that this is the same species. Brotherus has already recorded the fruiting plant from Ruwenzori (1). Nos. 1579, 1596, and 1597 are, I believe, the male plant, though I have not been able actually to find antheridia, owing perhaps to the season at which they were gathered. These agree exactly with Negri's description, and are very marked by the erect, almost appressed leaves when moist, these usually very concave and therefore appearing pointed, and with the nerve only very shortly excurrent, so as to form a scarcely cuspidate point. They are, however, rather broadly oblong-spatulate when flattened out, and though leaves occur as narrow as that figured by Negri (5a), *table 1, fig. 8,* I should not consider this the most typical form.

The fruiting plant, however, presents some differences. It is usually more luxuriant, with larger leaves, more flexuose and twisted when dry, many of them, especially the conal ones, bearing a rather long, smoothish, hyaline hair-point. The seta is rather short for the size of the plant, about 1 cm. long, twisted strongly in the negative direction;[1] the capsule is about 3 mm. long without, 4.5 mm. with the lid, usually rather elliptic-cylindric than quite cylindric, and often slightly curved; the peristome tube appears to be about half the length of the whole. The perichaetial leaves are well differentiated, very long, gradually tapering to a long, colored arista, the whole reaching frequently to one-third the height of the seta.

The more robust plants reach a height of 10 cm., but the plants are often very short, dense, and compact. They sometimes occur on charred wood.

GRIMMIACEAE

GRIMMIA OVATA Web. & Mohr

Grimmia calyculata C. M. Flora **73**: 484. 1890.

Loc. 3,630 meters, Nos. 1552, 1582, 1585, 1586, 1589; all c. fr. Somewhat varying in size and in length of capsule and lid. *Grimmia calyculata* C. M. is without doubt founded on one of the smaller forms of this.[2]

[1] I use the term "*positive*" for a spiral that twists in the direction in which the hands of a watch move, *negative* for the reverse direction.

[2] C. Müller describes *Grimmia calyculata* n. sp. twice over, in Flora, 1888, p. 414, and again, Flora, 1890, p. 484. It is by no means clear whether he intends to describe two species or whether they are actually identical; in any case the second is *G. ovata* Web. & Mohr.

RHACOMITRIUM DEFOLIATUM Dixon, sp. nov.

(Plate 1, fig. 4)

Stirps *praelonga, prolixa,* caulibus 15 cm. aequantibus vel superantibus, *iter iterumque divisis, rigidiusculis, saepe a basi usque fere ad apicem denudatis,* vel costis foliorum vetustorum solum praeditis. Folia perrigida, *sicca madidaque horride erecto-patentia, plerumque rufo-aurantiaca,* 2.5-3 mm. longa, e basi brevi ovata lanceolata, sensim acutata, apice subacuta vel subobtusa, mutica, valde carinato-concava, uno margine leniter recurvo; costa *valida,* apud basin 70-95 μ lata, plano-convexa, sectione (in medio folio) tres cellularum series exhibens, quarum ventrales circa quattuor magnae, mediae paucae (3-4) atque dorsales numerosae multo minores. Cellulae folii basilares perangustae, *alares bene evolutae, magnae, subpellucidae,* superiores *subquadratae, isodiametricae,* omnes sinuosae, 4-5 seriebus marginalibus ab apice usque fere ad basin *bistratosae, limbum bene notatum incrassatum* instruentes. Cetera nulla.

Hab.: Loc. 3,630 meters, Nos. 1593 (type), 1339. Evidently more or less submerged, or subject to aquatic action, probably in mountain torrent or waterfall.

A very distinct species, allied perhaps to *R. protensum* A. Br., but very distinct in the color, smaller leaves, thickened margins, well-developed auricles, etc. *Rhacomitrium alare* (Broth.) Par. differs entirely in the texture, weak nerve, elongate upper cells, etc.

The leaf margin often appears papillose, through the erosion of the outermost cell walls.

RHACOMITRIUM ALARE (Broth.) Par.

Loc. 3,630 meters, No. 1555, c. fr. The fruiting plant has not, I believe, been recorded. The sporophytic characters are of some interest, the two innermost perichaetial leaves being wide, very obtuse, and convolute, so as to form a tubular sheath around the base of the seta; the seta is yellow (brown when old), 1 cm. long; capsule elliptic-cylindric, castaneous when old. Peristome not seen.

The leaf apex varies greatly, being nearly always obtuse and quite hairless, while other leaves on the same stem will be acute with a short piliform hyaline point.

RHACOMITRIUM DURUM (C. M.) Par.

Loc. 3,630 meters, No. 1556, c. fr. This species also, I believe, has not been recorded hitherto in fruit. It was originally described from the Cameroons, but is recorded by Brotherus (1) from Central

Africa, in the volcano region at heights of 3,200 meters and 4,000 meters. The sporophytic characters are identical with those of *R. alare,* including the unusual character of the perichaetial leaves. In fact the plants are extremely closely allied to one another, though the long hyaline points of the present species give it a very different appearance. The difference between the two is practically that—and only that—which exists between the European *R. heterostichum* (Hedw.) Brid. and *R. affine* (Schleich.) Lindb.

ORTHOTRICHACEAE

AMPHIDIUM CYATHICARPUM (Mont.) Broth.

Zygodon kilimandscharicus C. M. Flora **73**: 482. 1890.

Loc. 3,630 meters, No. 1580c. In very low, soft, dense tufts with *Isopterygium sericifolium* sp. nov., etc. I have found ♂ flowers aggregated towards the apex of the short stems, but have not seen ♀ flowers or fruit. C. Müller in describing his *Z. kilimandscharicus* writes "An *Oncophorus* (*Rhabdoweisia*) *cyathicarpus* Mitt. in Journ. Linn. Soc. 1886?" There is no doubt at all that the identification is correct, and equally there is none that Mitten is correct in referring the African plant to the species described by Montagne from Chile, which is distributed throughout a great part of the South Temperate zone and the mountainous parts of the subtropical zone. C. Müller does not suggest any difference in his specimens from these unless it be the leaves denticulate throughout their length; but this character is no more marked in the African than in the South American plant, while the same rather remarkable variability in this character appears in both. The leaves may be absolutely entire from base to apex; they may be—on the same tuft or even sometimes on the same stem—slightly sinuate-denticulate either at apex or for a greater or less part of their length; or they may be minutely and distantly but quite sharply and distinctly denticulate from apex to just above the basal part. All these forms of toothing—or its absence—may occur even on the leaves from a single stem. *Zygodon kilimandscharicus* must certainly fall into the synonymy of *Amphidium cyathicarpum.*

SPLACHNACEAE

TETRAPLODON BRYOIDES (Zoeg.) Lindb.

Tetraplodon mnioides (Sw.) Bry. eur.

Loc. 3,630 meters, No. 1587, c. fr. In short, extremely dense tufts, with numerous capsules, which are only slightly exserted above the leaves of the tuft. The leaves are highly concave, and I should be

inclined to refer it to var. *cavifolius* Berggr. (7). It is the form recorded by Brotherus (1) from similar altitudes on Ruwenzori.

BRYACEAE

POHLIA AFRO-CRUDA (C. M.) Broth.

Loc. 3,630 meters, No. 1580b. In small quantity among *Isoptergynum sericifolium* sp. nov. Its near resemblance to the northern *P. cruda* (L.) quite justifies the name, but it appears to be well distinct; the leaves are distant, and the apex is usually half-twisted. It is a beautiful plant, highly glossy, and often very deep red in color.

POHLIA sp.

Loc. 3,630 meters, No. 1568b, c. fr. With *Bartramia ruwenzorensis* Broth. A few plants with immature and over-ripe capsules occurred mixed up with the Bartramia, but in too small quantity to permit of identification. It is just possible that it may be the fertile plant of *P. afro-cruda*, but I doubt it, as the leaves are much smaller, less glossy, less sharply toothed, less narrowed at base, and more densely arranged. It is a paroicous species, with the perichaetial leaves all small, short, erect, shortly pointed, faintly nerved, and subentire.

BRYUM (PSEUDOTRIQUETRA) PLANO-MARGINATUM Dixon, sp. nov.

Habitu formarum laxiorum *B. ventricosi* Dicks.; caules circa 5-6 cm. alti, infra radiculosi. Folia *sat laxe disposita, costa et alis valde decurrentibus,* siccitate contracta subtorta, ovato-lanceolata, acuta, apice subdenticulata; areolatio *B. ventricosi*, cellulis ad marginem seriebus pluribus linearibus subincrassatis, limbum perdistinctum per totam longitudinem instruentibus; costa basi purpurea, sat valida, *percurrens vel brevissime excurrens;* folia vix concava, *marginibus planis.* Cetera ignota.

Hab.: Vicinity of Thika, British East Africa, alt. about 1,350 meters, Sept. 6 and 7, 1909, No. 1146.

If it were not for the plane margin (very rarely a leaf shows the *slightest* recurving on one side at the extreme base) this might be referred to *B. ventricosum* Dicks. or to *B. bimum* Schreb., but the character appears to be quite sufficient to separate it. *B. minutirete* C. M. is described as with leaves obtusely rounded at apex, entire, with nerve vanishing below apex. It may conceivably, however, be only a form or state of this plant.

RHODOBRYUM SPATHULOSIFOLIUM (C. M.) Broth.

Loc. 3,630 meters, No. 1400, c. fr. From camp on Mt. Kenia (2,550 meters) at lower border of bamboo zone, westward to the Kasorongai River (1,950 meters), Oct. 17-19, 1909, No. 1885, c. fr.

AULACOMNIACEAE

AULACOMNIUM TURGIDUM (Wahl.) Schwaegr. var. PAPILLOSUM Dixon, var. nov.

Lumen cujusque cellulae superioris papilla magna centrali praeditum.

Loc. 3,630 meters, Nos. 1592 (type), 1595. The papillae vary a good deal, being sometimes wanting (especially in No. 1595), or existing as low mamillae only, but on most stems they are well developed. In other respects the plant is normal *A. turgidum*. In No. 1595, however, the stems show a very great variability in robustness, sometimes being exceedingly slender. This species is new to the African continent.

BARTRAMIACEAE

BARTRAMIA RUVENZORENSIS Broth.

Loc. 3,630 meters, Nos. 1568, 1574, 1581, 1590; all c. fr.

Brotherus in describing this species says that the nerve is distinct from the lamina to the leaf apex; I find it very ill defined above, however. Also, he describes the capsule as erect, but in the "Musci" he places the species under the heading "Kaps. geneigt." This appears to me the more accurate view, as the capsules are generally at least very slightly oblique.

Negri (5a) has some pertinent notes on this species. The original plant described was a bright green (*caespites viridissimi*); but, as Negri points out, the color may be yellowish. Both colors occur in this collection. He also arrives at the same conclusion as the above with regard to the inclination of the capsule.

PHILONOTIS SPEIROPHYLLA Dixon, sp. nov.

(Plate 2, fig. 7)

P. seriatae Mitt. affinis, sed gracilior, foliis *fere e basi ad apicem sensim attenuatis, nec infra ovatis, minus concavis, haud plicatis* anguste acuminatis, costa paullo minus valida, breviter tantum excurrente, dorso *laeviuscula,* marginibus *omnino planis,* per totam longitudinem tenuiter denticulatis. Fructus ignotus.

Hab.: Vicinity of Thika, British East Africa, alt. about 1,350 meters, Sept. 6-7, 1909, No. 1139.

Certainly near *P. seriata;* but the leaves gradually tapering from a somewhat hastate base, and therefore triangular in outline, scarcely concave, not plicate, the margins quite plane and closely and finely denticulate, with single, not geminate teeth, and the nerve only lightly and distantly roughened at back, are good distinguishing characters.

BREUTELIA SUBGNAPHALEA (C. M.) var. DENSIRAMEA Negri

Loc. 3,630 meters, Nos. 1571, 1576. A fine variety, with the branching very regularly and closely pinnate. The stems are sometimes densely tomentose above, but more often are quite free from tomentum.

Breutelia subgnaphalea is exceedingly near to *B. diffracta* Mitt., from West Africa. Vegetatively, indeed, I can find no difference. The fruit of *B. diffracta,* however, has an erect or only flexuose seta of above a centimeter in length, whereas that of *B. subgnaphalea* is described as short and recurved; the only capsule I have seen is on so short a seta that it is entirely concealed by the capsule, in the Kew specimen. C. Müller does not describe the peristome, and I am not aware whether it is present, or absent as in *B. diffracta.*

BREUTELIA AURONITENS Negri

Loc. 3,630 meters, Nos. 1543, 1567. A very beautiful plant, with tall, robust, densely foliate stems 15 to 20 cm. in length, of a bright golden yellow. No. 1567 is the ♂ plant, and has the leaves abruptly reflexed, whereas the normal form has them widely patent only. No. 1543 is in two forms, one having the reflexed leaves as in 1567, though not certainly a ♂ plant. This gives the stems a very different appearance, and I supposed at first that two species were involved, but it is clearly only a dimorphic form of the plant. Is the deflexion of the leaves by any chance a secondary sexual (♂) character? The same variation occurs, according to Brotherus, in *B. Stuhlmanni* Broth. This fact suggests the doubt whether the two species are actually distinct. Both were found first on Ruwenzori; they are similar in most characters, but differ in that *B. Stuhlmanni* has the stems tomentose above, a less robust habit, and a rather shorter leaf-base; but in view of the variation as to tomentum in *B. subgnaphalea* described above, and taking into account the rather remarkable dimorphism of leaf-direction occurring in both plants, there appears to be some ground for suspicion as to whether they are actually distinct.

BREUTELIA STRICTICAULIS Dixon, sp. nov.

(Plate 2, fig. 8)

Habitu *B. subgnaphaleae* (C. M.) sed *caulibus plerumque perstrictis,* subsimplicibus vel breviter distanter parce ramosis, 15 cm. altis vel ultra, stramineis, infra fuscis, hic illic usque ad apicem tomentosis. Folia 4-5 mm. longa, e basi brevi pluriplicata erecta *raptim deflexa,* hinc sensim attenuata, *breviuscule acute acuminata, siccitate* parum contracta, leniter plicata. Costa sat angusta, in cuspidem rigidiusculam subflexuosam dentatam excurrens. Folii *margines omnino plani,* inferne denticulati, superne *dentibus tenuibus angustissimis argute ciliolati.* Cellulae basilares angustissime lineares, laeves, *marginales haud vel vix latiores,* superiores lineares, unaquaque papilla alta in angulo inferiore instructa, *marginales 2-3 seriebus omnino laeves,* limbum paullo pellucidiorem instruentes.

Bracteae perigoniales internae obtusae vel subobtusae, evanidinerviae, basi pulchre aurantiacae.

Cetera ignota.

Hab.: Loc. 3,630 meters, No. 1541.

In many respects like *B. subgnaphalea* (C. M.), but more rigid and with certain structural differences of some importance. The leaves in that species taper very gradually to a very acute apex, with a longer, more flexuose filiform point, formed by the excurrent nerve; here they narrow rather rapidly and shortly, with a shorter, more rigid point. The upper denticulation in that is much finer with short, scarcely at all ciliolate teeth, and the border of smooth cells is almost or quite wanting. (Cf. *pl. 2, figs. 8c, 9c.*)

POLYTRICHACEAE

POLYTRICHUM KENIAE Dixon, sp. nov.

(Plate 2, fig. 10)

Robustum: caules ad 25 cm. alti vel ultra, infra cum foliis squamiformibus castaneis appressis subobtusis mucronatis teretes, nullo modo radiculosi, superne dense foliosi; folia madida patentia, sicca magis erecta, *rigidiuscula,* interdum appressa, inde frondem subteretem sistentia, *1-1.5 cm. longa,* e basi nitidiuscula aurantiaca vaginante decurrente *praelonga 1/3 folii longitudinem aequante vel superante,* in laminam lanceolatam sensim acuminatam producta, apice dorso-spinoso, marginibus (parte basilari excepta) *argute, spinose, sat distanter grosse dentatis.* Cellulae superiores valde incrassatae, subquadratae, lumine 7-12 μ lato, inferiores lineares, angustissimae, parietibus valde tenuibus. Lamellae 30-40, apice in-

tegro nec crenulato, e cellularum seriebus 5-6 quarum *apicalis* (sectione) *multo major, ovata, subconica, papillosa.* Cetera nulla.

Hab.: Loc. 3,630 meters, Nos. 1564 (type), 1550.

In the absence of fruit the exact position of this fine species must remain dubious, but the character of the apical cell of the lamellae removes it far from *P. commune,* of which it has somewhat the habit, but with much denser, more rigid leaves. The rather distant, spinose teeth of the leaf margin, quite without the small intermediate teeth found in some species, are also a marked character. The leaf base is remarkably long.

No. 1550 has shorter, more densely foliate stems. No. 1564 is associated with Sphagnum, and is probably a paludal plant.

HEDWIGIACEAE

RHACOCARPUS HUMBOLDTII (Hook.) Lindb.

Loc. 3,630 meters, Nos. 1540, 1551, 1559. Gathered in quantity, and in large, dense masses. It is evidently one of the dominant mosses of the district.

LEUCODONTACEAE

ANTITRICHIA KILIMANDSCHARICA Broth.

Loc. 3,630 meters, No. 1569. Among grass.

PTEROGONIUM ORNITHOPODIOIDES (Huds.) Lindb.

Loc. 3,630 meters, No. 1575. A robust dendroid form, with the branches nearly all attenuated to an extremely long decurved filiform flagellum, which is itself frequently branched near the tip. This gives the plant a very individual appearance, but structurally it agrees quite well with the normal form.

NECKERACEAE

PILOTRICHELLA PROFUSICAULIS (C. M.) Par.

Loc. 3,630 meters, No. 1307. Original specimens, in Herb. Bescherelle, at the British Museum, leg. Meyer, agree quite well; the apical points of the leaves vary somewhat considerably in length, and are usually longer in No. 1307 than in Meyer's specimens, but are quite equalled by some of these, and there is no constancy as to the character in individual plants. The yellowish, golden, or ruddy color, and the rather stout, obtuse branches are notable features of this species.

PAPILLARIA AFRICANA (C. M.) Jaeg.

Vicinity of Lake Naivasha, British East Africa, from lake level (1,860 meters) to 1,950 meters elevation, July 17-Aug. 15, 1909, No. 934.

NECKERA COMPLANATA (L.) Huebn. var. MAXIMA Dixon, var. nov.

Caules praelongi, ad 15 cm., molles.

Hab.: Bamboo zone, western slopes of Mt. Kenia, along the trail from West Kenia Forest Station to summit, at about 3,000 meters alt., No. 1728.

Except in the very elongate stems I find no difference from the European plant. It is known from the Canaries and Algeria, but is new to Central Africa.

PINNATELLA ENGLERI Broth.

Vicinity of Thika, British East Africa, alt. about 1,350 meters, No. 1145.

THAMNIUM HILDEBRANDTII (C. M.) Besch.

Vicinity of Lake Naivasha, British East Africa, from lake-level (1,860 meters) to 1,950 meters elevation, No. 877. Vicinity of Thika, alt. about 1,350 meters, No. 1141.

HYPNACEAE

HYGROAMBLYSTEGIUM PROCERUM Dixon, sp. nov.

(Plate 2, fig. 11)

Perrobustum; caules 20 cm. longi et ultra, inferne plus minusve denudati, *haud radiculosi,* superne *conferte regulariter eleganter pinnati, ramis subaequalibus pro more robustis, 1-1.25 cm. longis, frondem pectinatam ad 2 cm. latam* pulchre aurantiacam vel olivaceam sistentibus. Paraphyllia numerosa. Folia *H. filicini,* caulina magna, 1.5 mm. longa, deltoideo-ovata, ramea angustiora, ovato-lanceolata, omnia *tenerrime indistincte denticulata vel subintegra;* costa valida, percurrens vel plerumque in cuspidem robustam excurrens. Dioicum videtur. Fructus caret.

Hab.: Vicinity of Thika, British East Africa, alt. about 1,350 meters, Sept. 6 and 7, 1909, No. 1140. Probably growing on wet rocks in or near a stream. A few stems were found mixed with No. 1139 (*Philonotis speirophylla*).

This fine plant may be considered a subspecies of *H. filicinum* (L.) Loeske; structurally it is indeed almost identical, but I have

seen no form of that species at all approaching this in size, or in the very regular, elegantly pectinate, robust branching; the stems also are quite free from radicles.

CALLIERGON KENIAE Dixon, sp. nov.

(Plate 2, fig. 12)

Gracile, *stramineum* vel *rufo-flavidum;* caules circa 5-6 cm. alti, haud cuspidati, *molles*, flexuosi, subsimplices, interdum valde tenelli. Folia sat laxe disposita, erecta, *nitida, parva,* 1.5-2 mm. longa, late ovato-oblonga, perconcava, *apice subcucullato, plerumque breviter late apiculato,* marginibus planis integerrimis. Costa *angusta,* ad basin usque ad 50 μ saepius circa 35-40 μ lata, longe infra apicem, saepe quidem apud 2/3 folii longitudinem desinens. Cellulae superiores *breviuscule lineares* subflexuosae, circa 150-200 μ longae, 5-6 μ latae, supra sensim abbreviatae, apud apicem multo breviores latioresque; basin versus laxiores saepe pulchre aurantiacae, rectangulares, ad angulos perlaxae, tenuiores, subvesiculosae, alas decurrentes majusculas formantes. Cetera ignota. Dioicum videtur.

Hab.: Loc. 3,630 meters, No. 1592b. With *Aulacomnium turgidum* var. *papillosum.*

The affinity of this species is no doubt with *C. stramineum,* of which it has the weak nerve and the areolation, but it differs in the color and habit, and the leaf apex, and is a more slender plant altogether. It is a much more delicate plant with smaller leaves than the following, which has branched stems, much more crowded, somewhat spreading, scarcely glossy leaves, a stouter nerve, and much more incrassate cells.

CALLIERGON SARMENTOSUM (Wahl.) Kindb. var. SUBFLAVUM Ferg.

Loc. 3,630 meters, No. 1339b. A few stems mixed with *Rhacomitrium defoliatum.* It agrees exactly with the Scotch plant, named as above by Ferguson, but is probably only a slight form or state of a pale color, having a weaker habit and more spreading leaves.

STEREODON CUPRESSIFORMIS (L.) Brid.

Loc. 3,630 meters, Nos. 1554, 1570.

No. 1554 is a rather robust form, apparently growing more or less prostrate on the ground, and with something the habit of var. *ericetorum* Bry. eur., but browner and more rigid.

No. 1570 is a very marked form, and worthy of a varietal name, but I hesitate to describe it as new from a doubt whether it be not

S. Hochnelii (C. M.). The description of that plant (which I have not been able to see) seems to agree fairly well with this, but C. Müller describes the leaves as *very narrow,* which does not apply here. I do not feel justified therefore in referring No. 1570 to *S. Hochnelii*—which I have no doubt is but a variety of *S. cupressiformis;* on the other hand I have a shrewd suspicion that it is really C. Müller's plant. It is a very soft, prolix form, pale dull green with very long flexuose stems having very few distant irregular branches, slender, but not extremely so, and particularly marked in having the leaves not at all falcate, but straight, suberect or slightly spreading, and generally homomallous. It might perhaps be placed under var. *resupinatus* (Wils.) Schimp., but I have not seen any form of that variety at all approaching this in habit.

ISOPTERYGIUM SERICIFOLIUM Dixon, sp. nov.

(Plate 2, fig. 14)

Autoicum. Dense caespitosum; caules valde intricati, irregulariter ramosi, pergraciles, condensati, *caespites depressos sericeos* instruentes. Rami inaequales, 1-2 cm. longi, *complanati,* parcissime ramulosi, cum foliis vix ultra 1 mm. lati, saepe subflagelliformes, *pallide straminei, valde sericei, nitidi, molles.* Folia 1 mm. longa, concava, e basi parum angustiore oblongo-lanceolata, superne *cito in acumen tenue subfiliforme flexuosum breviusculum* attenuata; marginibus planis *integerrimis.* Costa *gemella,* cruribus brevibus sed plerumque bene notatis, inaequalibus, angustissimis. Areolatio densissima, e cellulis *angustissime linearibus,* valde prosenchymaticis, *infra parum latioribus* instructa, alaribus *nullis.*

Flores masculi et feminei immaturi, apud ramorum basin siti. Cetera ignota.

Hab.: Loc. 3,630 meters, No. 1580.

Belonging to the group of which the nearest continental African allies are *Isopterygium plumigerum* (C. M.) Broth. and *I. conangium* (C. M.) Broth.; but it is quite distinct from these. *Isopterygium plumigerum* is not unlike it in aspect, but has quite different foliation, the leaves being more distichous and widely spreading, while here they point forward in a marked degree, their axis making only a small angle with the stem, while the apex is still more incurved. Most of the other allied species have the leaves also more or less markedly denticulate. *Isopterygium subleptoblastum* C. M. resembles it in leaf form and areolation, but is of a green color, and the leaves are nerveless.

PLEUROPUS SERICEUS (Hornsch.) Broth.

Loc. 3,630 meters, No. 1591. In small quantity, sterile.

BRACHYTHECIUM IMPLICATUM (Hornsch.) Jaeg.

Loc. 3,630 meters, No. 1599. On twigs, etc.

RHYNCHOSTEGIELLA KENIAE Dixon, sp. nov.

(Plate 2, fig. 13)

Caules valde intricati, elongati, mollissimi, tenerrimi, 5 cm. longi vel ultra, vage subpinnatim ramosi, iter iterumque ramulosi, ramulis saepius gracillimis flagelliformibus; rami complanati, flavo-virides, subnitidi. Folia *caulina et ramea distiche complanata, patentia,* 2 mm. longa, vix concava, *sicca saepe plicato-striatula,* e basi *amplexicauli valde constricta subdecurrente anguste lanceolata, argute stricte acuminata,* marginibus per totam longitudinem tenuiter, superne argutius denticulatis, planis, ad infimam basin tantum angustissime brevissime reflexis; costa *angusta,* ad 1/2-2/3 folii longitudinem evanescens. Folia ramulina multo minora, minus complanata, brevius acuminata, sicca haud striata. Cellulae superiores longiuscule lineares, flexuosae, basin versus paullo latiores, parietibus subincrassatis, subporosis, ad insertionem una serie magnae, subvesiculosae, ellipticae; alares *numerosae, parvae, opacae,* irregulariter subquadratae vel breviter rectangulares, *alas minimas inconspicuas* formantes. Cetera ignota. Dioica videtur.

Hab.: Loc. 3,630 meters, No. 1573.

Forming large, thin, very soft mats several inches across, of interlacing stems repeatedly branched, the branches often very delicate and subflagelliform. In absence of fruit the generic position is doubtful; the stems and primary branches are rather robust for Rhynchostegiella and suggest Rhynchostegium, but the small auricles of minute cells obscure with chlorophyll strongly indicate Rhynchostegiella. This is the opinion of Mons. Thériot, to whom I submitted a specimen, and he points out a resemblance to the leaves of *R. hawaiica* (C. M.). It is a much larger plant than *R. Holstii* Broth. from Usambara and Belgian Congo and of quite different habit. The leaves are sharply and narrowly, but not at all delicately, somewhat rigidly acuminate.

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EXPLANATION OF PLATES

PLATE 1

FIG. 1. *Sphagnum Keniae.* *a,* Stem leaf, × 20, with upper cell, dorsal view, × 200. *a'*, branch leaf, × 20; *f,* transverse section of branch leaf, × 200.

FIG. 2. *Hymenostylium crassinervium.* *a,* Stem, nat. size; *a'*, do. of forma *robusta; b,* leaf, × 20; *c,* apex of leaf, × 50; *d,* upper marginal cells, × 200; *e,* basal cells, × 200.

FIG. 3. *Leptodontiopsis elata.* *a,* Stem, nat. size; *b,* leaf, × 20; *c,* apex of leaf, × 50; *d,* upper cells, × 200; *e,* basal cells, × 200.

FIG. 4. *Rhacomitrium defoliatum.* *b,* Leaf, × 20; *d,* upper cells, × 200; *c,* alar cells, × 200; *f,* nerve section, × 100.

FIG. 5. *Andreaea kilimandscharica.* *a, a'*, Capsules, × 5.

FIG. 6. *Leptodontium pumilum.* Basal areolation; *a,* pellucid, *d,* orange cells.

PLATE 2

FIG. 7. *Philonotis speirophylla.* *b,* Leaves, × 20.

FIG. 8. *Breutelia stricticaulis.* *b,* Leaf, × 10; *c,* apex of leaf, × 50.

FIG. 9. *Breutelia subgnaphalea.* *c,* Apex of leaf, × 50.

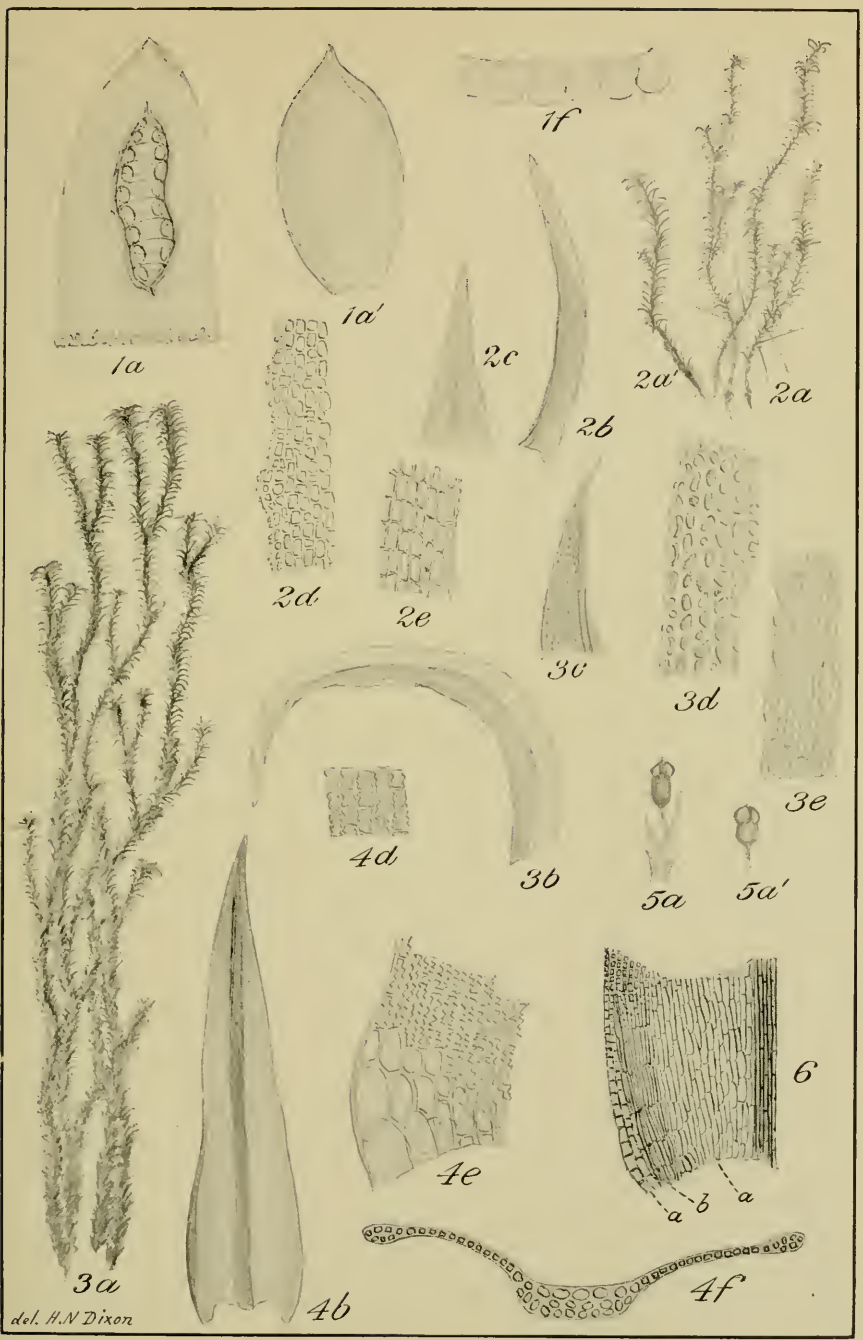
FIG. 10. *Polytrichum Keniae.* *b,* Leaf, × 4; *f,* marginal cells, × 50; *g,* transverse section of lamellae, × 200.

FIG. 11. *Hygroamblystegium procerum.* *a,* Part of stem, nat. size; *b,* stem leaf, × 20.

FIG. 12. *Calliergon Keniae.* *a,* Stem, nat. size; *b,* leaf, × 20; *c,* apex of leaf, × 20; *e,* basal cells, × 50.

FIG. 13. *Rhynchostegiella Keniae.* *a,* Stem, nat. size; *b,* stem leaf, × 20; *c,* apex of leaf, × 50; *e,* alar cells, × 200.

FIG. 14. *Isopterygium sericifolium.* *a,* Upper part of branch, × 4; *b,* leaf, × 20; *c,* apex of leaf, × 50; *e,* basal cells, × 200.



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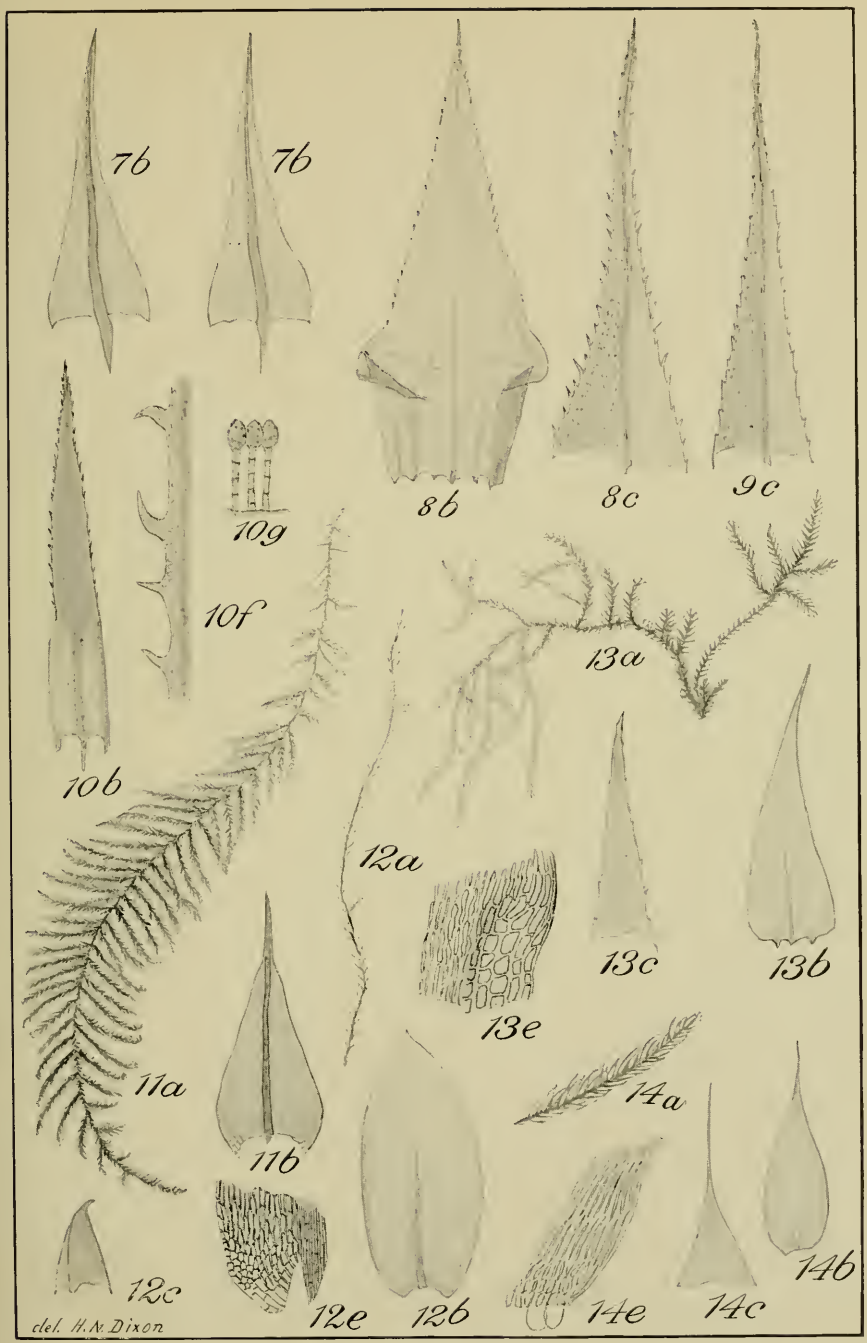

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